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Revision anterior glenohumeral instability: is arthroscopic treatment an option?

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Background: The purpose of this study was to determine the short-term outcomes for patients who underwent revision surgery for shoulder instability, including both revision arthroscopic repair and Latarjet.

Methods: This study included patients who underwent revision of a prior arthroscopic labral repair to arthroscopic labral repair or Latarjet at our institution from 2012 to 2017. After collection of preoperative demographic data, preoperative 3-dimensional imaging was reviewed to determine percent glenoid bone loss (%GBL) and to determine whether each shoulder was on-track or off-track. Patients were contacted to obtain postoperative patient-reported outcome metrics including visual analog scale pain, Simple Shoulder Test, American Shoulder and Elbow Surgeons scores, and instability recurrence (full dislocation, subluxation, or subjective apprehension) data at a minimum of 2 years postoperatively.

Results: Of 62 patients who met criteria, 45 patients were able to be contacted. Of them, 21 underwent revision arthroscopy and 24 underwent a Latarjet procedure. In the revision arthroscopy group, 5 of 15 had %GBL >20% and 4 of 21 were contact athletes. In the Latarjet group, 11 of 22 had %GBL >20% and 5 of 24 were contact athletes. Of 21 revision arthroscopy patients, 8 underwent concomitant remplissage. Eight of 21 patients in the revision arthroscopy group and 7 of 21 patients in the Latarjet group reported instability postoperatively. Three of 21 patients in the revision arthroscopy group and 2 of 21 patients in the Latarjet group reported full dislocations postoperatively. Zero patients in the revision arthroscopy group and 1 of 21 patients in the Latarjet group underwent reoperation.

Conclusion: Our results suggest that both revision Latarjet and arthroscopic stabilization can be of benefit in select circumstances. However, in revision settings, postoperative instability symptoms are common with both procedures.

Arthroscopic labral repair is the most commonly performed primary shoulder stabilization procedure for recurrent anterior shoulder instability.[5] Unfortunately, failure rates for primary arthroscopic labral repair have been estimated to be as high as 35% in some series and appear to increase with long-term follow-up.[7,9,10,17,21,23,28] One recent large epidemiologic study estimated that up to 6% of patients undergoing primary arthroscopic stabilization will require additional surgical intervention for instability.[23] Although risk factors for failure of arthroscopic stabilization may include young age, contact and collision athletics, and hyperlaxity, glenoid bone loss has emerged as a central predictor of recurrence.[8,19,22,26,27,32]

The Latarjet procedure has been popularized as an alternative to arthroscopic stabilization in patients with both critical glenoid bone loss, defined as 20%-30% of glenoid surface area in various studies, and subcritical bone loss defined as approximately 13.5%-20% of glenoid surface area.[16,22,27,31,32] For primary shoulder stabilization, Latarjet has demonstrated favorable results when compared with open and arthroscopic labral repair with respect to the maintenance of shoulder stability in long-term studies.[18,34] However, Latarjet is associated with serious complications that are not generally seen in shoulder arthroscopy, such as neurovascular injury and the development of osteoarthritis over the long term.[1,13,15,24,30] Gartsman et al[15] demonstrated a neurologic injury

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This study was performed under the University of Utah Institutional Review Board approved protocol #44662. Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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rate of 3.1% for Latarjet in a retrospective study of 416 shoulders. Allain et al[1] demonstrated an increase in the rate of osteoarthritis from 20% preoperatively to 62% postoperatively in a long-term study of Latarjet outcomes with a mean follow-up of 14 years. In addition, multiple series have reported good outcomes with arthroscopic labral repair even in individuals with critical glenoid bone loss.[25,33] Thus, surgeons must balance the likelihood of successful stabilization with the risk of potentially irreversible and serious complications when choosing a procedure. Many currently available treatment algorithms recommend bony augmentation with a Latarjet procedure over arthroscopic stabilization for primary stabilization procedures in high demand individuals with glenoid bone loss greater than 20%.[27]

In contrast to the abundance of data available for primary procedures, there are minimal data regarding the results of surgical treatment in the setting of instability recurrence after a prior arthroscopic labral repair. Although studies have reported good results for both procedures individually, no study has included both revision Latarjet and revision arthroscopic labral repair for instability recurrence after a prior arthroscopic labral repair performed by the same surgeons and within the same institution.[2-4,6,11,12,20,29] Friedman et al[14] performed a systematic review of revision stabilization procedures that demonstrated nearly identical rates of recurrent instability, which included subjective instability, subluxation, or frank dislocation, between revision arthroscopic stabilization (14.7%) and the Latarjet procedure (14.3%). Flinkkilä and Sirniö[12] also reported results of Latarjet in the revision setting that were not included in the above-mentioned review and reported a rate of recurrent instability, defined as recurrent dislocation or subluxation, of 14%. These rates are substantially higher than the instability recurrence rate for Latarjet in the primary setting and call into question whether this procedure substantially outperforms arthroscopic labral repair in the revision setting. Despite these unclear data, a recent survey of 26 primarily academic shoulder surgeons in the United States demonstrated that Latarjet was the most commonly performed surgery in revision surgery for recurrent anterior instability.[5] A critical gap thus exists within the current literature with regard to revision surgery for instability recurrence after a prior arthroscopic labral repair.

The primary purpose of this study was to determine the short-term outcomes for patients who underwent revision surgery for shoulder instability, including both revision arthroscopic repair and Latarjet. Outcome evaluation included patient-reported shoulder function and pain as well as recurrence of instability including full dislocations, subluxations, or apprehension.

Methods

Patient selection and data collection

This was a retrospective cohort study performed at University of Utah. The operative logs of the University of Utah Orthopaedic Surgery Department were searched for all patients who underwent a surgical procedure between January 1, 2012, and July 1, 2016, using the common procedure terminology codes 29806, 23455, 23466, 23462, 23460, and 23465 to capture all patients who had surgical treatment of glenohumeral instability. This group was further narrowed by chart review to include only those patients who underwent revision surgery for shoulder instability with either arthroscopic stabilization or a Latarjet procedure. Patients were not excluded from the study if they had a prior open stabilization procedure that did not involve glenoid bone grafting in addition to an arthroscopic stabilization procedure. Patients were excluded if they had prior glenoid bone grafting of any kind. Four surgeons performed all surgeries. The choice of procedure performed was made at the discretion of the treating surgeon. All surgeons took into account several factors in their treatment decision including the age of the patient, activity level of the patient, surgical history, traumatic history, hyperlaxity physical examination findings, percent glenoid bone loss, combined glenohumeral bone loss, and goals and desires of the patient with regard to the complication profiles of both procedures. The choice of hyperlaxity testing was made at the discretion of the treating surgeon, and details of hyperlaxity testing were not sufficiently documented across the electronic medical record (EMR) for summary data to be included in the study. Because of assumed differences in indications across surgeons and the retrospective nature of this study, no statistical comparisons were performed comparing groups. During the study period, the surgeons included did not always perform either Latarjet for bone loss above a certain percent or arthroscopy for bone loss below a certain percent.

Baseline data were collected including age at surgery, sex, body mass index, tobacco usage, Charleston Comorbidity Index, American Society of Anesthesiologists score, whether the patient was a contact or collision athlete, number of prior arthroscopic and open instability surgeries, and the length of time from first dislocation to surgery. Contact or collision athlete status was determined by the American Academy of Pediatrics definition, and patients were not further stratified by full contact or limited contact status. Select perioperative and intraoperative data were also collected including patient positioning, number of anchors and sutures used in the procedures, and whether a concomitant remplissage or biceps tenodesis was performed. Preoperative patient-reported outcome scores including the visual analog scale for pain (VAS pain), Simple Shoulder Test (SST), and American Shoulder and Elbow Surgeons shoulder score (ASES shoulder score) were collected from the EMR where available.

Once patients had been identified and pre- and perioperative data had been collected, a mailing containing postoperative outcomes questionnaires was sent to all patients with at least 2 years of follow-up. This mailing contained the VAS pain score, SST, ASES shoulder score, and a questionnaire with questions regarding postrevision shoulder instability. This questionnaire asked the following questions: (1) Since your instability repair surgery, have you had a full shoulder dislocation? If so, how many times? If so, was it self-reduced or reduced in an emergency department? (2) Since your instability repair surgery, do you ever feel your shoulder slips out of place? If so, how often? (3) Since your instability repair surgery, do you have any apprehension when using your shoulder? (4) Since your instability repair surgery, have you had any trauma associated with your shoulder? If yes, did the trauma contribute to any of the above symptoms? (5) Since your instability repair surgery, have you had any additional surgeries on your affected shoulder? If so, what procedure was performed? Using the answers to these questions, postoperative instability was categorized in 2 ways. First, patients were divided based on whether or not they had a shoulder dislocation postoperatively. Second, patients were classified as having any instability if they experienced either a full dislocation, a subluxation, apprehension, or any combination thereof. Patients who did not respond to the mailing were contacted by e-mail and/or phone and asked to complete these items through an internet link sent via e-mail. Only patients who responded to the postoperative questionnaires were included in the final cohort.

Imaging measurements

For patients meeting inclusion and exclusion criteria, computed tomography (CT) and magnetic resonance imaging (MRI) data were collected, if available. These studies were downloaded in Digital

Imaging and Communications in Medicine format and uploaded into OsiriX (Pixmeo Sarl, Bern, Switzerland), a freely available medical imaging viewer. Using OsiriX, all sagittal CT and MRI imaging were reoriented to parasagittal en face views of the glenoid. The plane of the glenoid was defined using the superior pole, the inferior pole, and the most posterior osseous point on the glenoid surface. A single image of the glenoid face was saved following the en face reconstruction. Next, the available axial CT and MRI images of the shoulder were reviewed, and a single axial image from these studies was saved at the point that the Hill-Sachs lesion width was widest. The above imaging was provided to 2 attending orthopedic surgeons with subspecialty training in shoulder and elbow surgery for subsequent imaging measurements. The surgeons were blinded to one another and independently performed measurements of each patient. Using the en face parasagittal image, glenoid width was measured as the diameter of the best-fit circle of the glenoid. Glenoid defect width was measured as the distance from the anterior edge of the best-fit circle to the anterior aspect of the intact glenoid. Glenoid area was approximated by the area of the best-fit circle. Glenoid defect area was calculated digitally as the area of the anterior aspect of the best-fit circle that did not include intact glenoid. On the axial image, the Hill-Sachs defect width was measured from the posterior aspect of the humeral articular surface to the rotator cuff attachment. Linear percent bone loss (defect width/best-fit circle diameter $\times$ 100) and area percent bone loss (defect area/best-fit circle area $\times$ 100) were calculated using the above measurements. Whether the shoulder was considered on-track vs. off-track was determined by multiplying the diameter of the glenoid by 0.83, subtracting glenoid defect width, and then comparing this calculation with the Hill-Sachs defect width. If the resulting number was greater than the Hill-Sachs width, the shoulder was considered to be on-track. Conversely, if the resulting number was less than the Hill-Sachs width, the shoulder was considered to be off-track. In the final analysis, the data from both evaluators were averaged to create composite measurements. Furthermore, we use the term best available data to indicate that values derived from CT were used, if available. If no CT imaging was available, values derived from MRI were included instead, using the same measurement methodologies as above.

Statistical analysis

Statistical analyses were performed in Excel X (Microsoft, Redmond, WA, USA) and SPSS 25 (IBM, Armonk, NY, USA). Descriptive statistics were calculated for both groups. Statistical comparison between baseline statistics for each group was not performed. Patient-reported outcome scores were analyzed for normality using the Shapiro-Wilk test. Matched pairs testing was performed using either a paired-samples *t*-test or a Wilcoxon signed rank test depending on the normality of the sample. Univariate binary logistic regression analysis was performed within each group to assess for associations between recurrent instability postoperatively and the available preoperative risk factors for instability in the data set. To assess reliability across imaging modalities and observers, intraclass correlation coefficients (ICC) were calculated to compare evaluator 1 vs. evaluator 2 for both area and linear glenoid bone loss measurements. ICC values of greater than 0.8 were considered strong agreement and ICC values between 0.6 and 0.8 were considered good agreement. A kappa statistic was calculated to compare evaluator 1 vs. evaluator 2 in the determination of on-track vs. off-track. Kappa values greater than 0.4 were considered acceptable.

Results

Baseline characteristics

Sixty-two patients were identified as meeting the inclusion and exclusion criteria of the study and were contacted for postoperative follow-up. Of those 62 patients, 45 patients returned completed postoperative questionnaires (73% follow-up). Of the patients who completed follow-up, there were 21 patients in the revision arthroscopy group and 24 patients in the Latarjet group. Demographic and perioperative data were available for all patients. Preoperative bone loss data were available for 15 patients in the revision arthroscopy group and 22 patients in the Latarjet group (Table I). All patients in the arthroscopic stabilization group were positioned in the lateral position. All patients in the Latarjet group were positioned in the beach chair position. The average number of anchors used in the arthroscopic stabilization group was 3.95 (range, 2-7). All Latarjet patients had their graft fixed with 2 screws. A total of 10 Latarjet patients had additional anchors placed for labral repair at the time of their Latarjet procedure.

Reliability measures

Agreement was strong between evaluators for both linear and area MRI data and good between evaluators for both linear and area CT data. Agreement on the on-track vs. off-track status of the shoulder between evaluators was acceptable (Table II).

Patient-reported outcomes

Preoperative scores were accessible for 42, 25, and 32 patients for VAS pain, SST, and ASES scores, respectively (Table III). For the revision arthroscopy group, there were statistically significant improvements from preoperatively to postoperatively in VAS pain ($P = .018$) and ASES ($P = .016$). SST was not statistically significant ($P = .051$). For the Latarjet group, there were statistically significant improvements in SST ($P < .001$) and ASES ($P < .001$). The change in VAS pain was not statistically significant ($P = .081$).

Of 45 patients, 41 (20 in the revision arthroscopy group and 21 in the Latarjet group) completed the postoperative instability questionnaire. A total of 40% (8 of 20) of patients in the revision instability group and 33% (7 of 21) of patients in the Latarjet group reported any instability postoperatively. Fifteen percent (3 of 20) of patients in the revision arthroscopy group and 10% (2 of 21) of patients in the Latarjet group reported full dislocations postoperatively. Zero percent of patients in the revision arthroscopy group and 5% (1 of 21) of patients in the Latarjet group underwent reoperation.

Univariate binary logistic regression analysis

Univariate binary logistic regression analysis was performed to interrogate associations between preoperative risk factors for instability and any patient-reported instability on the study outcome questionnaire. Analyzed risk factors included age at surgery, male sex, tobacco use, American Society of Anesthesiologists score, contact athlete status, number of prior arthroscopic surgeries, percentage of glenoid bone loss area, percentage of linear glenoid bone loss, and on-track vs. off-track shoulder. None of the variables analyzed were statistically associated with postoperative instability in either group (Table IV).

Table I
Baseline characteristics and preoperative glenoid bone loss data

	Revision arthroscopy	Latarjet
N	21	24
Age at surgery (yr)	27.3 ± 5.0	26.0 ± 6.6
Duration of follow-up	4.3 ± 1.5	4.7 ± 1.5
Female (%)	38	21
BMI (kg/m^2)	25.6 ± 4.9	26.7 ± 5.9
Tobacco use (%)	24	21
ASA	1.3 ± 0.5	1.3 ± 0.5
Contact athlete (%)	19	21
Number of prior arthroscopic surgeries	1.1 ± 0.3	1.4 ± 0.5
Number of prior open surgeries	0.2 ± 0.4	0.2 ± 0.5
Time from first dislocation to surgery (mo)	100 ± 57.4	30.7 ± 39.8
Biceps tenodesis (%)	0	8
Remplissage (%)	38	0
Best available area glenoid bone loss (%)	16.58 ± 7.3	20.42 ± 6.11
Best available linear glenoid bone loss (%)	18.8 ± 8.3	25.18 ± 6.45
On-track shoulder (%)	64	36
Percentage of patients with glenoid bone loss area >20%	36	50

BMI, body mass index; *ASA*, American Society of Anesthesiologists score.
Continuous data are shown as mean ± standard deviation and discrete data are shown as %.

Discussion

Within our study with short-term follow-up, 14% of the revision arthroscopy group and 10% of the Latarjet group reported full dislocations postoperatively. For these 2 groups individually, these rates are similar to prior studies. In a study of 23 patients, Kim et al[20] reported a 22% recurrence rate after revision arthroscopic labral repair for failed open or arthroscopic labral repair. In a study of 56 patients, Bartl et al[4] reported an 11% recurrence rate after revision arthroscopic labral repair for failed anatomic open or arthroscopic labral repair. In a study of 52 patients, Flinkkilä and Sirniö[12] reported a 14% recurrence rate after Latarjet for a failed arthroscopic stabilization.

Beyond full dislocations, 38% of the revision arthroscopy group and 33% of the Latarjet group reported any instability, which includes dislocations, subluxation events, or subjective apprehension, postoperatively. Few studies have reported the number of patients with any instability. Schmid et al[29] retrospectively reported on 49 shoulders that underwent Latarjet as a revision procedure for recurrent shoulder instability, reporting a 14% subjective instability rate. Our results suggest that future instability studies should query not just full dislocations, but also subluxations and subjective apprehension to fully evaluate instability recurrence, as the current data demonstrate that the results of revision to Latarjet may be worse than previously demonstrated. Given the substantial incidence of postoperative instability after revision to Latarjet demonstrated in this study, patients who suffer instability recurrence after a prior anterior shoulder stabilization procedure will need to be carefully counseled that the Latarjet procedure has a significant rate of recurrent instability in the revision setting, which may not be fully understood, before incurring the more serious risk profile associated with the operation.

Both Latarjet and arthroscopic labral repair significantly improved patient-reported outcomes in the study cohorts. Kim et al[20] reported that VAS pain, SST, University of California Los Angeles shoulder score, and Rowe scores improved significantly and results were rated as good to excellent in 82% of patients after revision arthroscopic labral repair for failed open or arthroscopic labral repair. Bartl et al[4] significant improvements in Rowe, Constant, and SST scores and 86% of shoulders were rated as good to excellent. Flinkkilä and Sirniö[12] reported on 52 patients who underwent Latarjet after failed arthroscopic stabilization demonstrating statistically significant improvements in Western Ontario Shoulder Instability Index, Subjective Shoulder Value, and Oxford scores.

This study has several limitations. First, this is a retrospective study with limited sample size. No a priori algorithm was used to guide treatment and preoperative data were not available on all patients. The study was specifically weakened by this limitation in that the EMR was not sufficiently complete to characterize preoperative factors that drove individual surgeon decision making. Most specifically, information about the initial dislocation mechanism, number of prior dislocations, and preoperative laxity testing was not reliably available. Furthermore, 3-dimensional imaging was not retrospectively available for all patients. Second, as revision procedures are uncommon, the sample size is small. Because of the above limitations, no statistical comparison was performed between groups as even a multivariate analysis cannot overcome these limitations. Third, the data collected in the prospective instability questionnaire were inherently limited. As detailed in the Methods section, patients answered 5 questions regarding their shoulder instability, but more granular data were not available. Thus, we cannot explain how patients who had full dislocations or subjective instability but did not report a reoperation chose to manage their instability symptoms. In addition, time to instability recurrence was a variable that was omitted from the data collection process. Finally, our study presents results from short- to mid-term follow-up. With longer follow-up, the recurrence rate may increase.[34]

Table II
Reliability measures

	ICC	Kappa
CT glenoid bone loss area	0.736	–
CT linear glenoid bone loss	0.733	–
MRI glenoid bone loss area	0.870	–
MRI linear glenoid bone loss	0.867	–
CT on-track	–	0.751
MRI on-track	–	0.471

ICC, intraclass correlation coefficient; *CT*, computed tomography; *MRI*, magnetic resonance imaging.

Table III
Pre- and postoperative patient-reported outcomes data by group

	Revision arthroscopy	Latarjet
Preoperative VAS pain	3.68 ± 2.36	3.52 ± 2.74
Preoperative SST	6.70 ± 3.16	5.40 ± 3.87
Preoperative ASES	55.54 ± 20.98	55.95 ± 21.44
Postoperative VAS pain	2.43 ± 2.38	2.54 ± 2.38
Postoperative SST	9.95 ± 2.67	10.00 ± 2.45
Postoperative ASES	73.98 ± 21.97	77.71 ± 18.22

VAS, visual analog scale; *SST*, simple shoulder test; *ASES*, American Shoulder and Elbow Surgeons score.

Table IV
Univariate binary logistic regression analysis *P*-values for recurrent instability by group

Variable	Revision arthroscopy	Latarjet
Age at surgery	0.739	0.863
Male sex	0.109	0.999
BMI	0.789	0.202
Tobacco use	0.309	0.696
ASA	1.000	0.515
Contact athlete	0.650	0.440
Number of prior arthroscopic surgeries	0.762	0.213
% Glenoid bone loss area	0.736	0.731
% Linear glenoid bone loss	0.590	0.933
On-track shoulder	0.172	0.251

BMI, body mass index; *ASA*, American Society of Anesthesiologists score.

Conclusions

Our results suggest that both revision Latarjet and arthroscopic stabilization can be successful in select circumstances. However, in revision settings, postoperative instability symptoms are common with both procedures.

Disclaimer

Robert T. Burks receives IP royalties from Arthrex; is an unpaid consultant for Arthrex; has stock in KATOR; and is a paid consultant for Mitek.

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