

90-Day Complication Rate After the Latarjet Procedure in a High-Volume Center

John P. Scanlon,* MB BCh, Eoghan T. Hurley,*†‡§|| MB BCh, MCh, Martin S. Davey,*† MB BCh, MCh, Mohamed Gaafar,* FRCSI (Tr & Orth), Leo Pauzenberger,* MD, Cathal J. Moran,*¶ MD, FRCSI (Tr & Orth), and Hannan Mullett,* MCh, FRCSI (Tr & Orth)

Investigation performed at the Sports Surgery Clinic, Dublin, Ireland

Background: The Latarjet procedure is indicated for patients with recurrent anterior shoulder instability, previous failed soft tissue stabilization, glenoid bone loss, or high-risk factors for recurrence, although there is still a concern with the surgical complication rates associated with the Latarjet procedure.

Purpose: To evaluate the 90-day complication rate after the open Latarjet procedure in a high-volume center.

Study Design: Case series; Level of evidence, 4.

Methods: A retrospective review was performed of patients who underwent an open Latarjet procedure at our institution over a 5-year period between January 2015 and December 2019. The complications, readmissions, and reoperations within 90 days were evaluated.

Results: A total of 441 patients with a mean age of 23.0 ± 5.7 years was included; 97.5% of the patients were male. There were 2 intraoperative complications (0.5%): 1 coracoid fracture and 1 anaphylactic reaction to vancomycin. Overall, there were 19 postoperative complications (4.3%) in 18 patients, with 4 (0.9%) readmissions for revision surgery. Hematomas were the most common complication, occurring in 12 patients (2.7%), with 9 (2.0%) requiring a return to the operating theater during their stay for an evacuation. In those who required a readmission for a reoperation, 1 was for a hematoma requiring a washout, 2 were for irrigation and debridement of a surgical site infection, and the third was for a biceps tenodesis in a patient with severe bicipital pain. No patients had recurrence or any postoperative graft complications; additionally, there were no neurovascular complications.

Conclusion: We found that in a high-volume center, the open Latarjet procedure has a low 90-day complication rate with a low revision rate. Hematomas were the most common complication experienced by patients who underwent the Latarjet procedure, while there was no recurrent instability or neurological or hardware complications reported among the 441 patients included in this study.

Keywords: Latarjet; complications; hematoma; readmissions; revision

Rates of anterior instability as high as 3% per year have been reported in at-risk young male patients.^{18,22}

||Address correspondence to Eoghan T. Hurley, MB BCh, MCh, Sports Surgery Clinic, Northwood Ave, Santry, Dublin 9, Ireland (email: eoghanhurley@rcsi.ie).

*Sports Surgery Clinic, Dublin, Ireland.

†Royal College of Surgeons in Ireland, Dublin, Ireland.

‡National University of Ireland Galway, Galway, Ireland.

§New York University Langone Health, New York, New York, USA.

¶Trinity College Dublin, Dublin, Ireland.

Submitted March 26, 2020; accepted July 7, 2020.

The authors declared that they have no conflicts of interest in the authorship and publication of this contribution. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

The American Journal of Sports Medicine

1–5

DOI: 10.1177/0363546520964488

© 2020 The Author(s)

Recurrent anterior shoulder instability is often caused by humeral or glenoid bony defects in addition to soft tissue injuries.^{2,3,14} The Latarjet procedure is indicated in those with previous failed soft tissue stabilization, those with glenoid bone loss, or those with high-risk factors for recurrence. The mechanism of the Latarjet procedure has been described as a “sling” effect of the conjoint tendon acting on the subscapularis and capsule and the “bony effect” of increasing the glenoid surface area.¹⁹ Hurley et al¹² found in a systematic review that, at a minimum of 10 years after the Latarjet procedure, <5% of patients had revisions or recurrent dislocations.

There is a concern with the surgical complication rates associated with the Latarjet procedure. A systematic review by Griesser et al⁸ reported a total complication rate of 30% after the Latarjet procedure, with 75% of these complications occurring within the first year. The most commonly reported complications after the Latarjet procedure include recurrent instability, neurovascular injury,

loss of external rotation, coracoid nonunion, and osteolysis/fracture. Frank et al⁶ reported an overall 90-day complication rate after the Latarjet procedure of 7.5%, with 60% of these complications leading to subsequent surgery. However, the majority of Latarjet procedures are done in institutions performing <10 cases per year. This may be a contributing factor to the high reported complication and reoperation rates, as the volume of shoulder surgeries has been shown to be correlated with outcomes.^{5,23}

Our institution is a high-volume shoulder instability center and performs approximately 100 open Latarjet procedures per year; thus, we thought it was warranted to analyze our complication rates. The purpose of this study was to evaluate the complications and the 90-day complication rate after the Latarjet procedure in a high-volume center. It was hypothesized that the Latarjet procedure would have a low 90-day complication rate when performed in a high-volume center.

METHODS

A retrospective review was performed of patients who underwent an open Latarjet procedure at our institution over a 5-year period between January 2015 and December 2019. The Latarjet procedure was indicated in patients with anterior shoulder instability who were deemed to be at high risk for recurrence, including collision athletes, those with glenoid bone loss, or those with previous failed soft tissue stabilization. The study was approved by the institutional review board. Electronic patient records were reviewed for all complications that occurred within 90 days of surgery. The inclusion criteria of the current study were age between 16 and 60 years at the time of surgery and a minimum 90-day follow-up. Patients with a previous ipsilateral bone-graft procedure were not included in the current study.

Surgical Technique

All patients underwent surgery under general anesthesia and were placed in the beach-chair position. A 4-cm long skin incision was placed in the extension of the axillary fold, starting approximately 4 to 6 cm distal to the tip of the coracoid. After development of the deltopectoral interval, the coracoid and the conjoint tendons were exposed using a Hohmann retractor on the dorsal aspect of the coracoid. The coracoacromial ligament laterally and the pectoralis minor insertion medially were then released off the coracoid. An osteotomy of the coracoid was then performed at the junction between its body and base using a saw angled at 90°, while aiming to harvest a minimum 20-mm long graft. The Hohmann retractor was removed before preparing the coracoid to reduce the tension on the nerves. The donor area at the coracoid base was coagulated and sealed using bone wax. The undersurface of the coracoid was then prepared using a high-speed bur, and the first 2.5-mm drill hole was placed centrally, 5 mm proximal from the coracoid tip. A subscapularis split was

performed at the junction between its middle- and lower-third to expose the capsule, which was then split to allow access to the anterior scapular neck. A Hohmann retractor was carefully placed on the medial scapular neck to allow access to the anterior glenoid. After removal of any remnant osseous fragments and soft tissues, the anterior glenoid was freshened using a high-speed bur. An inferior 2.5-mm drill hole was then placed 5 mm superior to the inferior margin of the defect. After measuring and tapping, the coracoid graft was fixed to the glenoid using a standard 3.5-mm, partially threaded, cancellous screw. A second drill hole and screw were then placed approximately 10 mm superior to finally secure the graft. The graft was then contoured to be flush with the glenoid surface using a high-speed bur. Capsular closure was then performed using 2-3 nonabsorbable stitches. Topical vancomycin was used in the wound to reduce the potential risk of surgical site infections with *Cutibacterium acnes*. The arm was supported in a simple sling for 4 weeks after surgery. All patients were admitted to the hospital on the day of surgery for postoperative overnight monitoring.

Data Collection

Data on patient characteristics and preoperative variables, including age, sex, laterality, and previous shoulder surgeries, were collected. Intraoperative and postoperative complications included recurrence, graft complications, screw complications, wound infections, hematoma, and neurological complications. Additionally, we recorded whether a patient required readmission for a complication or a subsequent procedure within 90 days. Follow-up examinations were performed by the operating surgeon (C.M., H.M.) at 3 and 12 weeks postoperatively.

Statistical Analysis

Statistical analysis was performed using SPSS (version 26; IBM Corp, released 2013). For all continuous and categorical variables, descriptive statistics were calculated. Continuous variables were reported as weighted mean and estimated SD, whereas categorical variables were reported as frequencies with percentages. Categorical variables were analyzed using Fisher exact or chi-square tests. The independent or paired *t* test for normally distributed variables or the nonparametric Mann-Whitney *U* test or Wilcoxon signed rank test for nonnormally distributed variables was performed to compare continuous variables. A value of *P* < .05 was considered statistically significant.

RESULTS

Patient Characteristics

A total of 441 consecutive patients underwent the Latarjet procedure for anterior shoulder instability by 2 fellowship trained surgeons (C.M., H.M.) at a single institution. There were no patients lost to follow-up. The mean age was 23.0

TABLE 1
Patient Characteristics^a

No. of patients	441
Age, y	23.0 ± 5.72
Sex, M/F	430/11
Glenoid bone loss, %	13.4 ± 8.2
Previous ipsilateral shoulder surgery, Y	93

^aValues are presented as n or mean ± SD. F, female; M, male; Y, yes.

± 5.7 years, and 97.5% of the patients were male. The mean surgical time from incision to wound closure was 42.5 minutes. Overall, 93 of the 441 patients (21.1%) had undergone previous ipsilateral shoulder procedures. The patient characteristics are shown in Table 1.

Complications

There were a total of 19 complications in 18 patients within 90 days of surgery, for an overall short-term complication rate of 4.3%. Hematomas were the most common complication, occurring in 12 patients (2.7%); 9 patients (2.0%) required a return to the operating theater during their stay for an evacuation, and 3 patients developed hematomas within the first 3 weeks postoperatively. Of the 19 total complications, 4 patients (0.9%) required a readmission for a reoperation. While 2 patients underwent irrigation and debridement of a surgical site infection, 1 patient underwent evacuation of a hematoma, and 1 patient underwent biceps tenodesis for severe bicipital pain. Four patients (0.9%) had infectious complications, with 1 patient returning to the operating theater for irrigation and debridement during the initial stay for a suspected acute infection and 1 patient requiring readmission for irrigation and debridement. Two patients showed signs of superficial wound infections and were managed nonoperatively. Symptoms resolved in all patients after both surgical and nonsurgical management using concomitant antibiotic treatment. There were 2 intraoperative complications (0.5%): 1 coracoid fracture and 1 anaphylactic reaction to vancomycin. All of the patients who experienced a complication were male. Seven (7.5%) of those with and 11 (0.3%) without a history of previous surgery sustained a complication ($P = .0746$), and 3 (3.2%) patients with and 1 (0.3%) without a history of previous shoulder surgery required readmission ($P = .0309$). All of the complications experienced by patients included in this study resolved later, except for the bicipital pain experienced by the patient who had ongoing bicipital discomfort after a revision biceps tenodesis. The complications are shown in Tables 2 and 3.

DISCUSSION

The most important finding of this study was that the overall 90-day complication rate after the Latarjet procedure

TABLE 2
Summary of Patient Complications^a

90-d complications	18
Readmissions	4
Reoperations	12
Hematoma	12
Infectious complications	4
Hardware/graft complications	1
Recurrent instability	0
Vascular complications	0
Neurological complications	0

^aValues are presented as No.

when performed in a high-volume center was lower than that previously reported. There was no recurrent instability or neurological or hardware complications reported within 90 days of the Latarjet procedure among the 441 patients included in this study.

Our results showed a complication rate of 4.3%, which was lower than that reported by Frank et al,⁶ who found a complication rate of 7.5% within 90 days of the Latarjet procedure. However, 69% of patients in their cohort had undergone previous ipsilateral shoulder surgery compared with 21% in our series, which may explain the slightly higher rate, as our study found a slightly higher rate of complications in those who had undergone previous stabilization. Notably, our study reports the complications in 441 patients who underwent the Latarjet procedure over a 5-year period, whereas Frank et al reported the complications of 133 patients who underwent Latarjet procedures over a 9-year period. Of the complications reported by Frank et al, 60% required subsequent surgery, similar to the 66.7% reported in our series. In the longer-term follow-up, a systematic review by Griesser et al⁸ reported a complication rate of 30% after the Latarjet procedure, with 75% of these complications occurring within the first year. Recurrent instability, neurovascular injury and coracoid fracture, lysis, and nonunion/fibrous union were the most commonly reported complications after the Latarjet procedure, with <1% of patients undergoing the Latarjet procedure experiencing a hematoma that required drainage. Our results showed a lower complication rate than that in previous reports, yet our complication rate was higher than that reported for arthroscopic Bankart repairs of 1.6%, which, in contrast, typically have higher rates of recurrence.²⁴

Hematoma was the most common complication experienced by patients in our series, accounting for approximately two-thirds of the complications reported, which may indicate the difficulty in achieving complete hemostasis in this procedure. In our experience, patients who undergo Latarjet procedures at our center typically have large muscle bulk, which may complicate attempts at finding deep oozing vessels. Additionally, the coracoid donor site may be a source of continual bleeding, although we do apply bone wax to this area.¹⁷ Hematomas are a common complication after open shoulder surgery, and recently several randomized controlled trials have evaluated the use of tranexamic acid (TXA) for shoulder arthroplasty and, more

TABLE 3
Individual Patient Complications^a

Patient	Age, y	Sex, M/F	Previous Shoulder Surgery, Y/N	Complication	Reoperation	Outcome
1	19	M	Y	SSI	Debridement + irrigation	Resolved
2	23	M	N	Hematoma	Washout	Resolved
3	33	M	Y	SSI + bicipital pain	Revision biceps tenodesis	Infection; resolved bicipital pain; ongoing discomfort
4	26	M	Y	Anaphylactic reaction to vancomycin	N/A	Resolved
5	21	M	N	Hematoma	N/A	Resolved
6	23	M	Y	Hematoma	Washout	Resolved
7	21	M	N	Hematoma	Washout	Resolved
8	20	M	N	Hematoma	Washout	Resolved
9	23	M	N	SSI	Debridement + irrigation	Resolved
10	23	M	N	Coracoid fracture	N/A	Resolved
11	21	M	Y	Hematoma	Washout	Resolved
12	25	M	N	Hematoma	N/A	Resolved
13	25	M	N	SSI	N/A	Resolved
14	19	M	N	Hematoma	Washout	Resolved
15	24	M	Y	Hematoma	N/A	Resolved
16	22	M	N	Hematoma	Washout	Resolved
17	20	M	N	Hematoma	Washout	Resolved
18	22	M	Y	Hematoma	Washout	Resolved

^aF, female; M, male; N, no; N/A, not applicable; SSI, surgical site infection; Y, yes.

recently, the Latarjet procedure.^{11,15,16} Our group has performed a randomized controlled trial evaluating the use of TXA compared with a placebo in 100 patients undergoing a Latarjet procedure to reduce the formation of hematomas.¹¹ Overall, TXA significantly reduced hematoma grade and subsequent pain levels, which led to decreased use of opioids. Thus, the use of TXA may ultimately lead to a decrease in clinically significant hematomas requiring an evacuation and has since become routine in our clinical practice. Additionally, even low-grade hematomas may cause increased pain postoperatively, which was shown to be reduced using TXA.¹¹

There were no reported neurological complications in this series. The musculocutaneous nerve is most commonly injured, followed by the axillary, ulnar, radial, and median nerves. Neurological injury is a complication that is reported to occur at a rate as high as 10.4% in patients after the Latarjet procedure.^{6,7,21} Neurological injury after stabilization procedure has been attributed to traction, patient malpositioning, and inadvertent suturing.^{1,10} Delaney et al⁴ found that the risk of neurological injury was greatest during the glenoid exposure and graft insertion stages of the Latarjet procedure. Furthermore, they also found a prolonged total operative time to be a statistically significant predictor of postoperative nerve deficit.⁴ Therefore, we believe that the low number of complications was a result of experience with the procedure, including specific anatomy, which can only be achieved in a high-volume center.

There was 1 case of graft fracture in this series, and graft-related complications, such as fracture, lysis, or failure in union, may all occur after the Latarjet procedure. The reported rate of graft fracture is 1.5%.⁸ The risk of

iatrogenic fracture may be increased by the narrow spacing of drill holes and excessive decortication of the coracoid process, which may weaken the graft.⁹ Screws are the most common method of graft fixation, but hardware complications caused by loosening, prominence in the joint, or screw breakage may lead to pain and neurological injury. Problematic hardware requiring removal is the cause of 35% of unplanned reoperations after the Latarjet procedure.⁸ With the advent of the arthroscopic Latarjet procedure, there has been interest in using suture buttons to fixate the coracoid, as fixation of suture buttons has been shown in other joints to reduce complication rates when compared with those of screw fixation while having a similar biomechanical strength for coracoid bone block fixation.^{13,20,25} In our experience, we have found the use of solid screws to be reliable regarding both intraoperative handling and outcomes in our patient population.

The implementation of the Latarjet procedure as a primary procedure for instability has become more common, particularly in Europe. However, the arthroscopic Bankart repair is still the most commonly performed shoulder stabilization procedure worldwide. The current study demonstrates a high number of Latarjet procedures performed per year and, to our knowledge, represents the highest total number of Latarjet procedures reported in a single series in the literature. Notably, this series demonstrates the highest rate of Latarjet procedures performed as primary stabilization surgeries. We believe the lower complication rate in our series is attributable to the high volume of cases performed, as the volume of shoulder surgeries has been shown to be correlated with outcomes.^{5,23} Three strategies that we believe may be of value in reducing complications are the

use of TXA, use of solid screws, and removal of the Hohmann retractor before coracoid preparation. We believe that the results in our series will mitigate some of the concerns surrounding the Latarjet procedure as well as inform surgeons and patients.

Limitations

This study is a single-center study and is limited by its retrospective nature. The study evaluated complications that occurred within 90 days. Therefore, any late complications that may have occurred outside of this window were not evaluated. The surgical approach used in this study is solely an open approach; therefore, the results of this study are not representative of arthroscopic Latarjet procedures. Patients were assessed by the operating surgeon at follow-up, which may be a source of potential bias. In addition, the cohort in this study was mostly male patients and may not be adequately powered to reflect differences in complications associated with sex.

CONCLUSION

Our study found that the Latarjet procedure has a low 90-day complication rate when performed at a high-volume center. Hematomas were the most common complication experienced by patients who underwent the Latarjet procedure, while there was no recurrent instability or neurological or hardware complications reported among the 441 patients included in this study.

REFERENCES

- Boardman ND III, Cofield RH. Neurologic complications of shoulder surgery. *Clin Orthop Relat Res*. 1999;368:44-53.
- Boileau P, Villaiba 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;88:1755-1763.
- 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;16:677-694.
- Delaney RA, Freehill MT, Janfaza DR, Vlassakov KV, Higgins LD, Warner JJ. Neuromonitoring the Latarjet procedure. *J Shoulder Elbow Surg*. 2014;23(10):1473-1480.
- Ekhtiari S, Horner NS, Bedi A, Ayeni OR, Khan M. The learning curve for the Latarjet procedure: a systematic review. *Orthop J Sports Med*. 2018;6(7):2325967118786930.
- Frank RM, Gregory B, O'Brien M, et al. Ninety-day complications following the Latarjet procedure. *J Shoulder Elbow Surg*. 2019;28(1):88-94.
- Gartsman GM, Waggenspack WN, 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.
- Griesser MJ, Harris JD, McCoy BW, et al. Complications and re-operations after Bristow-Latarjet shoulder stabilization: a systematic review. *J Shoulder Elbow Surg*. 2013;22(2):286-292.
- Gupta A, Delaney R, Petkin K, Lafosse L. Complications of the Latarjet procedure. *Curr Rev Musculoskel Med*. 2015;8(1):59-66.
- Ho E, Cofield RH, Balm MR, Hatstrup SJ, Rowland CM. Neurologic complications of surgery for anterior shoulder instability. *J Shoulder Elbow Surg*. 1999;8:266-270.
- Hurley E, Lim Fat D, Pauzenberger L, Mullett H. Tranexamic acid in the Latarjet procedure—a randomized controlled trial. *JSES Open Access*. 2019;3:235.
- Hurley ET, Lim Fat D, Farrington SK, Mullett H. Open versus arthroscopic Latarjet procedure for anterior shoulder instability: a systematic review and meta-analysis. *Am J Sports Med*. 2019;47(5):1248-1253.
- Hurley ET, Jamal MS, Ali ZS, Montgomery C, Pauzenberger L, Mullett H. Long-term outcomes of the Latarjet procedure for anterior shoulder instability: a systematic review of studies at 10-year follow-up. *J Shoulder Elbow Surg*. 2019;28(2):e33-e39.
- Itoi E, Lee SB, Berglund LJ, Berge LL, An KN. The effect of a glenoid defect on antero-inferior stability of the shoulder after Bankart repair: a cadaveric study. *J Bone Joint Surg Am*. 2000;82:35-46.
- Kirsch JM, Bedi A, Horner N, et al. Tranexamic acid in shoulder arthroplasty. *JBJ Reviews*. 2017;5(9):e3.
- Kuo LT, Hsu WH, Chi CC, Yoo JC. Tranexamic acid in total shoulder arthroplasty and reverse shoulder arthroplasty: a systematic review and meta-analysis. *BMC Musculoskel Disord*. 2018;19(1):60.
- Metais P, Clavert P, Barth J, et al. Preliminary clinical outcomes of Latarjet-Patte coracoid transfer by arthroscopy vs. open surgery: prospective multicenter study of 390 cases. *Orthop Traumatol Surg Res*. 2016;102:271-276.
- Owens BD, Duffey ML, Nelson BJ, DeBerardino TM, Taylor DC, Mountcastle SB. The incidence and characteristics of shoulder instability at the United States Military Academy. *Am J Sports Med*. 2007;35(7):1168-1173.
- Patte D, Debeyre J. Recurrent dislocation of the shoulder. *Encycl Med Chir Paris Technique Chirurgicale Orthopedie*. 1980;44265:44-52.
- Provencher MT, Aman ZS, LaPrade CM, et al. Biomechanical comparison of screw fixation versus a cortical button and self-tensioning suture for the Latarjet procedure. *Orthop J Sports Med*. 2018;6(6):232596711877784.
- 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.
- Waterman B, Owens BD, Tokish JM. Anterior shoulder instability in the military athlete. *Sports Health*. 2016;8(6):514-519.
- Weinheimer KT, Smuin DM, Dhawan A. Patient outcomes as a function of shoulder surgeon volume: a systematic review. *Arthroscopy*. 2017;33(7):1273-1281.
- Williams HLM, Evans JP, Furness ND, Smith CD. It's not all about redislocation: a systematic review of complications after anterior shoulder stabilization surgery. *Am J Sports Med*. 2019;47(13):3277-3283.
- Zhang P, Liang Y, He J, et al. A systematic review of suture-button versus syndesmotomic screw in the treatment of distal tibiofibular syndesmosis injury. *BMC Musculoskel Disord*. 2017;18(1):286.