JSES International 5 (2021) 175–180

Contents lists available at ScienceDirect

JSES International

journal homepage: www.jsesinternational.org

Clinical and radiographic outcomes after Latarjet using suture-button fixation

Brandon J. Erickson, MD [a,*], Yousef Shishani, MD [b], Stacy Jones, BA [b], Anthony A. Romeo, MD [c], Reuben Gobezie, MD [b]

[a] Rothman Orthopaedic Institute, New York, NY, USA
[b] Cleveland Shoulder Institute, Beachwood, OH, USA
[c] DuPage Medical Group, DuPage, IL USA

A R T I C L E I N F O

Keywords:
Latarjet
suture button
shoulder instability
bone loss
outcome
dislocation

Level of Evidence: Level IV; Case Series; Treatment Study

Background: Latarjet has become a common treatment option for patients with shoulder instability in the setting of bone loss. The coracoid is commonly secured with screws

Methods: All patients who underwent Latarjet with suture-button fixation with minimum 1-year follow-up were eligible for inclusion. Preoperative demographic and clinical outcome data including American Shoulder and Elbow Surgeons (ASES), Single Assessment Numerical Evaluation (SANE), and Visual Analog Scale (VAS) were recorded and compared with postoperative scores. Radiographs were reviewed for signs of nonunion. Complications were recorded.

Results: Overall 21 patients (76% male, average age: 30.4 ± 11.3 years) underwent Latarjet with suture-button fixation. Significant improvements at 1 year were seen in ASES ($P < 0.001$), SANE ($P < 0.001$), and VAS ($P = 0.011$) scores compared with preoperative scores. Of the 21 patients who had reached 1-year follow-up, 17 (81%) reached 2-year follow-up. For the 17 patients who reached 2-year follow-up, there were significant improvements in ASES ($P = 0.001$), SANE ($P = 0.001$), and VAS ($P = 0.005$) scores from preoperative values. When isolating the 17 patients with 2-year follow-up, there were no significant differences between their 1-year and 2-year ASES ($P = 0.73$), SANE ($P = 0.17$), and VAS ($P = 0.37$) scores. Overall, 3 patients (14%) sustained a complication (one redislocation, one with coracoid migration and a fibrous union, and one superior labral tear requiring biceps tenodesis and superior labral repair).

Conclusion: Suture-button fixation of the coracoid during the Latarjet provides encouraging clinical and radiographic outcomes at 1 and 2 years.

Shoulder instability is a common problem affecting patients of all ages and activity levels.[12] While some patients can be managed nonoperatively with physical therapy, there are a significant number of patients who fail conservative treatment and require surgical intervention.[1,17,21] Surgical treatment can be divided into soft tissue and bony procedures. Soft tissue procedures involve an attempt to restore normal anatomy by repairing the labrum, properly tensioning the glenohumeral ligaments, and occasionally adding in a remplissage for increased stability.[8,9] In patients who have failed a prior, arthroscopic Bankart repair, in patients with clinically significant bone loss, or in patients with an off-track lesion, the Latarjet has emerged as a reliable option for restoring shoulder stability and function.[2,11,18,28]

The Latarjet procedure involves transfer of the coracoid to the glenoid to increase the glenoid width and create a potential sling effect of the conjoint tendon as the shoulder is brought into abduction and external rotation.[12-14,19] The Latarjet is commonly performed open, through a saber incision. Some authors have recently introduced an arthroscopic technique with good results following a significant learning curve.[3-5,24] Fixation methods of the coracoid to the glenoid include cannulated or solid cancellous screws, cannulated or solid cortical screws, with or without plate augmentation, and suture-button fixation.[20,23] Recent cadaveric studies have found no significant differences in biomechanical performance among varying fixation constructs.[20,23] However, although the Latarjet is an excellent procedure, it is not without its complications, specifically hardware complications from screw

Institutional Review Board approval was received from Salus IRB (SOS #1).

* Corresponding author: Brandon J. Erickson, MD, Assistant Professor, Department of Orthopaedic Surgery, Sidney Kimmel Medical College of Thomas Jefferson University, Department of Orthopaedic Surgery Zucker School of Medicine, Hofstra University, Rothman Orthopaedic Institute, 176 3rd Ave, New York, NY 10003, USA.
E-mail address: brandon.erickson@rothmanortho.com (B.J. Erickson).

https://doi.org/10.1016/j.jseint.2020.10.009
2666-6383/

placement including the need for subsequent screw removal.[15,10] As such, suture-button fixation may provide an excellent alternative to screw fixation by minimizing hardware complications while maintaining excellent outcomes.[26]

The purpose of this study was to report the clinical and radiographic outcomes and complications after Latarjet with suture-button fixation of the coracoid. The authors hypothesized that patients who underwent Latarjet with suture-button fixation would have significant improvements in clinical outcome scores, no radiographic change in coracoid position over time and no significant hardware complications.

Methods

All patients who underwent Latarjet with suture-button fixation by a single surgeon at a single institution between September 2016 and March 2019 with minimum 1-year follow-up were eligible for inclusion. Patients with less than 1-year follow-up and those who underwent distal tibial allograft were excluded. Institutional review board approval was obtained for this study (IRB SOS #1). All patients had a diagnosis of recurrent shoulder instability with evidence of >10% glenoid bone loss on preoperative computed tomography scan. Preoperative demographic and clinical outcome scores including American Shoulder and Elbow Surgeons (ASES), Single Assessment Numerical Evaluation (SANE), and Visual Analog Scale (VAS) were recorded. These scores were then compared with postoperative ASES, SANE, and VAS scores at 1 year, and in patients who were far enough out, 2-year follow-up. Radiographs were reviewed for signs of nonunion defined as change in position of the suture-button construct or migration of the coracoid bone block compared with initial postoperative radiographs.

Surgical technique

All procedures were performed with a combination regional plus general anesthesia in the modified beach chair position. An examination under anesthesia confirmed significant anterior laxity in all patients before incision. After the examination under anesthesia, the patient was prepped and draped in the usual sterile fashion, and after administration of preoperative antibiotics, a timeout was performed to confirm the correct shoulder in all patients. After the timeout, a skin incision was made and the arthroscope was introduced into the glenohumeral joint. An arthroscopy was performed to confirm and estimate glenoid bone loss based on the technique previously described by Burkhart et al, and to rule out other pathology.[7] The arthroscope was then removed and a saber skin incision was made, approximately 8cm in length, beginning at the coracoid and heading distal. Dissection is taken down through the deltopectoral interval to the coracoid where the conjoint tendon is mobilized from the clavipectoral fascia. The pectoralis minor is released off of the medial border of the coracoid and the coracoacromial ligament is released approximately 1cm from the coracoid to allow this tissue to be used in later closure. Once the coracoid is exposed, a blunt retractor is placed medially to protect the brachial plexus and a pointed Hohmann retractor is placed over the coracoid to improve exposure. A 4-mm drill bit is then used to drill a bicortical hole from superior to inferior in the coracoid for later passage of the BTB TightRope (Arthrex, Naples FL, USA) and large Pec Button (Arthrex) (Fig. 1). This hole is drilled posterior enough to avoid breaking out of the anterior aspect of the coracoid and anterior enough to allow the 90° saw to cut the coracoid without violating the drill hole. Once the hole is drilled and with a blunt retractor placed medially to protect the neurovascular structures, a 90° saw is used to cut the coracoid in a superomedial to inferolateral direction taking great care to avoid the brachial plexus. The cut is finished with a curved osteotome. The soft tissue on the undersurface of the coracoid is gently peeled back without violating the attachment of the conjoint tendon. The saw is used to remove any excess spikes of bone from the coracoid and to establish a bleeding bony surface on the coracoid.

The coracoid is then placed back into the incision for later use. The subscapularis is exposed and is then split at the 50-yard line, in line with its fibers. Care is taken to avoid the capsule underneath. An elevator is used to then elevate the subscapularis off of the underlying capsule and an angled Gelpi retractor is used to open the split in the subscapularis. The capsule is then split horizontally, thereby exposing the glenohumeral joint. An anterior glenoid retractor is placed to expose the glenoid rim and the glenoid is prepared using an osteotome or burr to remove any malunited bone and to create a flat recipient surface for the coracoid at the 2 o'clock to 5 o'clock position (right shoulder). Once the glenoid is prepared, the 4-mm drill is used to create the path for the BTB TightRope (Arthrex) and large Pec Button (Arthrex) in the glenoid, from anterior to posterior, parallel to the articular surface and deep enough to avoid penetrating the articular surface (Fig. 2). After this has been created, the free end of the BTB TightRope (Arthrex) is loaded onto the pec button and, using the inserter, the pec button is passed from anterior to posterior and is flipped on the posterior aspect of the glenoid/scapula (Fig. 3). After this is flipped and securely fixed, the free ends of the suture are passed through the

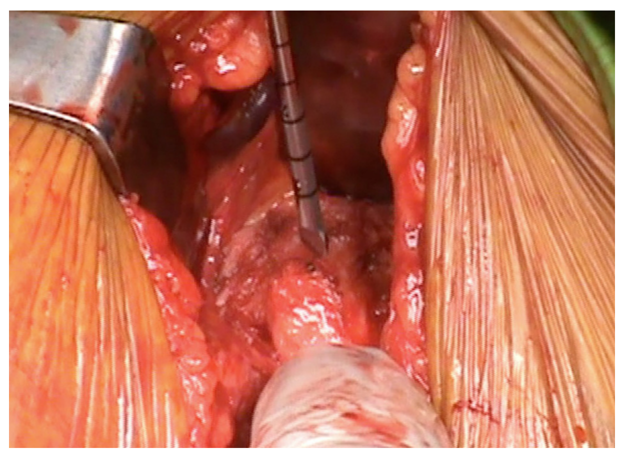

Figure 1 Intraoperative image demonstrating coracoid exposure and drilling the bicortical hole in the coracoid for later BTB TightRope (Arthrex, Naples FL, USA) passage. The surgeon's finger is pointing to the bottom of the coracoid/conjoint tendon.

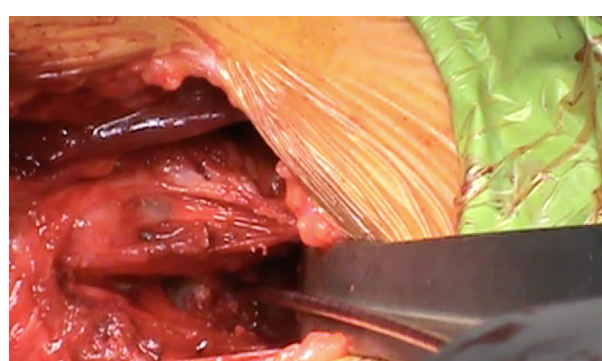

Figure 2 Intraoperative imagine demonstrating creation of the glenoid tunnel for later BTB TightRope (Arthrex, Naples FL, USA) passage. The retractor is on the anterior glenoid neck with the drill going through the glenoid neck where the bone graft will later sit.

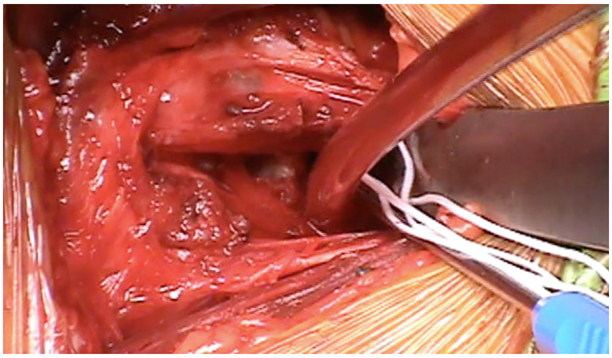

Figure 3 Intraoperative imagine demonstrating passage of the BTB TightRope (Arthrex, Naples FL, USA) through the tunnel in the glenoid using the inserter.

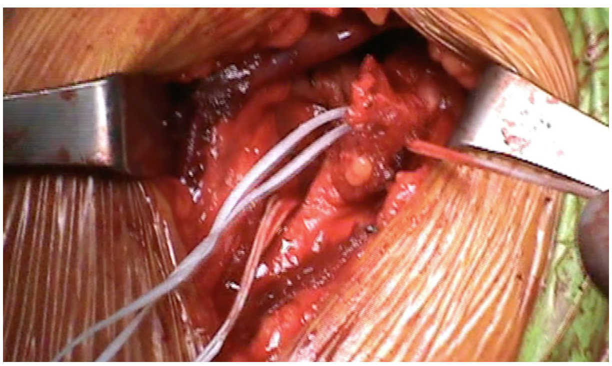

Figure 4 Intraoperative image demonstrating passage of the sutures from the BTB TightRope (Arthrex, Naples FL, USA) through the tunnel in the coracoid.

previously drilled tunnel in the coracoid (Fig. 4), and the coracoid is reduced down to the glenoid. The free sutures are then placed through a TightRope ABS Button and securely tied. This secured the coracoid to the glenoid in appropriate position (Fig. 5). The shoulder is then taken through a range of motion to ensure is moves well and that there is no lateral overhang of the coracoid graft which can lead to accelerated glenohumeral wear. The incision is copiously irrigated and the split in the capsule is closed, taking care to incorporate the coracohumeral ligament. If desired, anchors can be placed in the glenoid at the 6 o'clock and 5:30 position (right shoulder) to perform a capsular shift and make the graft extra-articular. Care must be taken not to overtighten and constrain glenohumeral movement. The split in the subscapularis is repaired and the incision is closed in layered fashion. A waterproof bandage is applied; the patient is placed into a sling for 4 weeks and is discharged home. We use a multimodal approach to postoperative pain control and encourage cryotherapy. We typically see the patients at 2 weeks for a wound check and X-ray (Fig. 6, A and B). We begin therapy at 4 weeks, initially focusing on range of motion, and progress to strengthening around the 3-month mark.

Statistics

For categorical data, tabulated results are shown as averages ± standard deviation. The quantitative data are summarized by the mean and standard deviation. Those quantitative data were first examined for potential non-normality, by examining their histograms and considering their skewness and kurtosis statistics. Owing to the sample size and their apparent non-normality, the main analytical approach toward the quantitative outcome data for

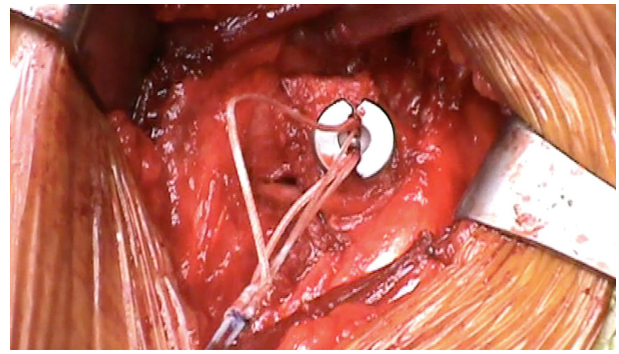

Figure 5 Intraoperative image demonstrating fixation of the TightRope ABS Button (Arthrex, Naples FL, USA) securing the coracoid graft to the glenoid.

patients when comparing between two times (pre vs. one year, one year vs. two years and pre vs. two years) or across all three times was to use nonparametric statistical techniques. When comparing these quantitative data between two time points, the Wilcoxon signed rank test was used. Statistical significance was set at $P < 0.05$.

Results

Overall, 21 patients underwent Latarjet with suture-button fixation with minimum 1-year follow-up. There were 16 men (76%) and 5 (24%) women. Average patient age at the time of surgery was 30.4 ± 11.3 years. Of this cohort of patients, 15 (71%) had a prior arthroscopic Bankart that failed and 4 of these patients had multiple prior surgeries. The average number of previous surgeries in this cohort was 0.9. Overall, 10 patients (48%) had the suture-button Latarjet performed on their dominant shoulder. The average length of follow-up was 29.3 ± 8.9 months. Of the 21 patients who had reached 1-year follow-up, 17 (81%) reached 2-year follow-up. The average glenoid bone loss determined at the time of arthroscopy was 13.3% ± 8.0%.

For the 21 patients who reached one-year follow-up, there were significant improvements in ASES, SANE, and VAS scores from the baseline (Table I). For the 17 patients who reached 2-year follow-up, there were also significant improvements in ASES, SANE, and VAS scores from preoperative values (Table II). Importantly, when isolating the 16 patients with 2-year follow-up, there were no significant differences between their 1-year and 2-year ASES, SANE, and VAS scores (Table III). In the initial postoperative radiographs, there was no evidence of coracoid malposition in any patient. There was no radiographic evidence of change in position of the coracoid bone graft over time in 95% of patients.

There were 3 patients (14%) who sustained a complication. One patient redislocated 4 months after surgery. He was treated conservatively and has not had any more instability episodes. One patient had displacement of the coracoid bone from the glenoid but was clinically asymptomatic and did not require further surgery. One patient sustained a SLAP tear 9 months postoperatively and underwent a biceps tenodesis with concomitant repair of the superior labrum. This patient recovered and has not had any further issues.

Discussion

Latarjet has become a well-regarded treatment option for certain patients with shoulder instability. The authors' hypotheses were confirmed as patients who underwent Latarjet with suture-

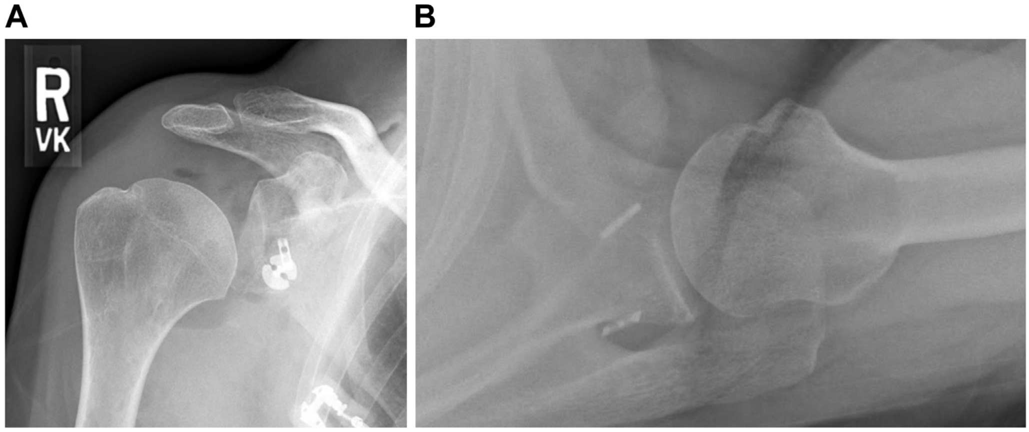

Figure 6 (**A** and **B**), Anteroposterior (**A**) and axillary (**B**) radiograph demonstrating the suture button construct used for fixation of the coracoid during the Latarjet procedure.

Table I
Comparison between preoperative and 1-year postoperative clinical outcome scores for patients who underwent suture button Latarjet

Clinical outcome score	Preoperative	1 year postoperative	*P* value
ASES	57.6 ± 21.0	88.1 ± 11.0	< .001
SANE	31.1 ± 19.3	80.4 ± 14.5	< .001
VAS	3.5 ± 2.7	1.2 ± 1.5	.011

ASES, American Shoulder and Elbow Surgeons; *SANE*, Single Assessment Numerical Evaluation; *VAS*, Visual Analog Scale.

Table II
Comparison between preoperative and 2-year postoperative clinical outcome scores for patients who underwent suture button Latarjet

Clinical outcome score	Preoperative	2 years postoperative	*P* value
ASES	57.6 ± 21.0	88.8 ± 13.2	.001
SANE	31.1 ± 19.3	84.0 ± 13.4	.001
VAS	3.5 ± 2.7	0.9 ± 1.4	.005

ASES, American Shoulder and Elbow Surgeons; *SANE*, Single Assessment Numerical Evaluation; *VAS*, Visual Analog Scale.

Table III
Comparison between 1-year and 2-year postoperative clinical outcome scores for patients who underwent suture button Latarjet

Clinical outcome score	1 year postoperative	2 years postoperative	*P* value
ASES	89.1 ± 11.9	88.8 ± 13.2	.73
SANE	80.9 ± 13.4	84.0 ± 13.4	.17
VAS	1.0 ± 1.3	0.9 ± 1.4	.37

ASES, American Shoulder and Elbow Surgeons; *SANE*, Single Assessment Numerical Evaluation; *VAS*, Visual Analog Scale.

button fixation had significant improvements in clinical outcome scores with no significant hardware complications.

Since Burkhart and De Beer as well as Itoi and Yamamoto described the glenoid track concept, much attention has been paid to bone loss on both the glenoid and humeral side in patients with shoulder instability.[6,27,28] Although there are several factors that play a role in shoulder instability including patient age, degree of sport participation, type of sport played, shoulder hyperlaxity, and others, bone loss has become a well-recognized variable for shoulder instability.[1] It has become well understood that managing patients with off-track lesions and bone loss with an isolated soft tissue procedure increases the patient's risk of failure.[22] As such, the Latarjet has become an effective procedure to treat patients with off-track lesions as well as those with significant glenoid bone loss. Hurley performed a systematic review of 13 studies with a minimum 10-year follow-up to determine the functional outcomes, recurrences rates, and subsequent revision rates after the open Latarjet procedure.[16] The review included 822 patients (82% male) at an average age of 27 years and an average follow-up of 16.6 years. The authors reported good/excellent outcomes in 86.1% of patients and a recurrent instability rate of 8.5% (3.2% of patients had recurrent dislocations) with a revision rate of 3.7%. Interestingly, the most common reason for revision surgery after recurrence was for screw removal.

There are multiple methods of coracoid fixation in the Latarjet procedure including cannulated screws, solid screws, and the suture button. Most studies to date have evaluated screw constructs as this fixation method has been the most commonly described technique in the literature. Shin et al performed a biomechanical study in 35 fresh frozen cadaveric shoulders to compare the initial fixation stability, failure strength, and mode of failure of 5 different screw types (all stainless steel) and fixation methods used in the Latarjet procedure.[23] The authors evaluated partially threaded cannulated 4.0-mm cancellous screws with bicortical fixation, partially threaded cannulated 4.0-mm screws with bicortical fixation, partially threaded solid 4.0-mm cancellous screws with bicortical fixation, partially threaded solid 4.0-mm cancellous screws with unicortical fixation and fully threaded solid 3.5-mm cortical screws with bicortical fixation. All screws were stainless steel. The results demonstrated no significant difference in load to failure, work to failure, or in creep/stiffness among different screw types or fixation methods following cyclic loading. However, as the suture-button construct began to emerge, biomechanical data were needed to compared the suture-button technique with the original screw technique. Provencher et al performed a biomechanical study using 8 matched pairs of cadaveric shoulders to compare the ultimate failure load of the cortical button and self-tensioning suture to metal screws for coracoid graft fixation during the Latarjet.[20] The authors found no significant difference in the mean ultimate load to failure or the mean strain at failure for screw fixation vs. suture-button fixation. The screw fixation group tended to fail at the bone block drill holes, whereas the suture button group tended to fail at the clamp-muscle interface. As such, it appears the suture-button fixation method is biomechanically equivalent to the screw fixation method.

One of the complications that can occur after Latarjet is hardware failure or revision surgery to remove symptomatic hardware, typically screws.[16] The suture-button technique was developed in an effort to mitigate this complication. Boileau et al reported the midterm clinical outcomes, complications, bone-block healing, and positioning in 121 patients after suture-button fixation of the coracoid graft in the arthroscopic Latarjet.[5] At an average follow-up of 26 months, the authors reported no cases of neurologic complications or hardware failure and found the coracoid had properly healed to the scapular neck in 95% of the cases. Importantly, no patients necessitated hardware removal after suture-button fixation. Similarly, Xu et al reported on 102 patients at a mean follow-up of 40 months who underwent suture-button fixation for the Latarjet.[25] The authors reported 100 of the 102 grafts achieved bony union and noted no patient required a reoperation for removal of hardware. The results from the present study are similar as no patients sustained hardware related complications with one patient experiencing a fibrous union. Furthermore, there were significant improvements in all clinical outcome scores for patients included in this study with no differences in outcomes between 1- and 2-year follow-up. This is an important finding as it indicates patients have reached their maximal improvement at 1 year and did not see a decline in their scores the following year.

Limitations

This series of patients is from a single, fellowship-trained surgeon at a single institution and therefore many not be translatable to other populations. This is a short-term follow-up study in a limited number of patients, and as such comments regarding long-term follow-up cannot be made. Computed tomography scans were not used to evaluate healing of the coracoid graft and return to sport scores were not collected. As such, there have been many patients with an asymptomatic fibrous union.

Conclusion

Suture-button fixation of the coracoid during the Latarjet provided encouraging clinical and radiographic outcomes at 1 and 2 years in this study.

Disclaimer

Brandon Erickson is a board or committee member of AAOS and American Orthopaedic Society for Sports Medicine; received research support from Arthrex, Inc, DePuy, A Johnson & Johnson Company, Smith & Nephew, Stryker, and Linvatec; and is a member of the editorial or governing board of PLOS One.

Yousef Shishani and Stacy Jones, their immediate family, and any research foundation with which they are affiliated did not receive any financial payments or other benefits from any commercial entity related to the subject of this article.

Anthony Romeo received other financial or material support from AANA; received research support from Aesculap/B.Braun, is a board or committee member of American Shoulder and Elbow Surgeons; obtained IP royalties, research support, and other financial or material support from and is a paid consultant and paid presenter or speaker of Arthrex, Inc.; is a board or committee member of Atreon Orthopaedics; received research support from OrthoSpace, NuTech, Smith & Nephew, Histogenics, Zimmer, and Medipost; received other financial or material support from MLB; is a member of the editorial or governing board of Orthopedics; is a board or committee member and member of editorial or governing board of Orthopedics Today; is a member of the editorial or governing board of SAGE; received publishing royalties, and financial or material support from Saunders/Mosby-Elsevier; received publishing royalties, financial or material support from and is a member of the editorial or governing board of SLACK Incorporated; and is a member of the editorial or governing board of Wolters Kluwer Health—Lippincott Williams & Wilkins.

Reuben Gobezie received IP royalties and research support from and is a paid consultant and paid presenter or speaker of Arthrex, Inc; Research Committee—American Shoulder & Elbow Society; Closed and Open Program Committee—American Shoulder & Elbow Society; Technology Committee—American Shoulder & Elbow Society; Research Committee—OREF; Research Committee—AANA; Shoulder and Elbow Program Committee—AAOS and is its board or committee member.

References

1. Balg F, Boileau P. The instability severity index score. A simple preoperative score to select patients for arthroscopic or open shoulder stabilisation. J Bone Joint Surg Br 2007;89:1470-7. https://doi.org/10.1302/0301-620X.89B11.18962.
2. Baverel L, Colle PE, Saffarini M, Anthony Odri G, Barth J. Open Latarjet Procedures Produce Better Outcomes in Competitive Athletes Compared With Recreational Athletes: A Clinical Comparative Study of 106 Athletes Aged Under 30 Years. Am J Sports Med 2018;46:1408-15. https://doi.org/10.1177/0363546518759730.
3. 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 Related Res 2014;472:2345-51. https://doi.org/10.1007/s11999-014-3550-9.
4. Bessiere C, Trojani C, Pelegri C, Carles M, Boileau P. Coracoid bone block versus arthroscopic Bankart repair: a comparative paired study with 5-year follow-up. Orthop Traumatol Surg Res 2013;99:123-30. https://doi.org/10.1016/j.otsr.2012.12.010.
5. Boileau P, Saliken D, Gendre P, Seeto BL, d'Ollonne T, Gonzalez JF, et al. Arthroscopic Latarjet: Suture-Button Fixation Is a Safe and Reliable Alternative to Screw Fixation. Arthroscopy 2019;35:1050-61. https://doi.org/10.1016/j.arthro.2018.11.012.
6. 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;16:677-94.
7. Burkhart SS, Debeer JF, Tehrany AM, Parten PM. Quantifying glenoid bone loss arthroscopically in shoulder instability. Arthroscopy 2002;18:488-91. https://doi.org/10.1053/jars.2002.32212.
8. Buza JA 3rd, Iyengar JJ, Anakwenze OA, Ahmad CS, Levine WN. Arthroscopic Hill-Sachs remplissage: a systematic review. J Bone Joint Surg Am 2014;96:549-55. https://doi.org/10.2106/JBJS.L.01760.
9. Degen RM, Giles JW, Johnson JA, Athwal GS. Remplissage versus Latarjet for engaging Hill-Sachs defects without substantial glenoid bone loss: a biomechanical comparison. Clin Orthop Related Res 2014;472:2363-71. https://doi.org/10.1007/s11999-013-3436-2.
10. Domos P, Chelli M, Lunini E, Ascione F, Bercik MJ, Neyton L, et al. Clinical and radiographic outcomes of the open Latarjet procedure in skeletally immature patients. J Shoulder Elbow Surg 2019;29:1206-13. https://doi.org/10.1016/j.jse.2019.09.039.
11. Flinkkila T, Sirnio K. Open Latarjet procedure for failed arthroscopic Bankart repair. Orthop Traumatol Surg Res 2015;101:35-8. https://doi.org/10.1016/j.otsr.2014.11.005.
12. Frank RM, Arciero RA, Erickson BJ, Trenhaile ST, Provencher MT, Verma NN. Shoulder Instability: An American Perspective. Instr Course Lect 2018;67:415-32.
13. Frank RM, Romeo AA, Richardson C, Sumner S, Verma NN, Cole BJ, et al. Outcomes of Latarjet Versus Distal Tibia Allograft for Anterior Shoulder Instability Repair: A Matched Cohort Analysis. Am J Sports Med 2018;46:1030-8. https://doi.org/10.1177/0363546517744203.
14. Giles JW, Boons HW, Elkinson I, Faber KJ, Ferreira LM, Johnson JA, et al. Does the dynamic sling effect of the Latarjet procedure improve shoulder stability? A biomechanical evaluation. J Shoulder Elbow Surg 2013;22:821-7. https://doi.org/10.1016/j.jse.2012.08.002.
15. Horner NS, Moroz PA, Bhullar R, Habib A, Simunovic N, Wong I, et al. Open versus arthroscopic Latarjet procedures for the treatment of shoulder instability: a systematic review of comparative studies. BMC Musculoskelet Disord 2018;19:255. https://doi.org/10.1186/s12891-018-2188-2.
16. 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:e33-9. https://doi.org/10.1016/j.jse.2018.08.028.

17. Jeon YS, Jeong HY, Lee DK, Rhee YG. Borderline Glenoid Bone Defect in Anterior Shoulder Instability: Latarjet Procedure Versus Bankart Repair. Am J Sports Med 2018;46:2170-6. https://doi.org/10.1177/0363546518776978.
18. 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;23:1691-9. https://doi.org/10.1016/j.jse.2014.02.015.
19. Omori Y, Yamamoto N, Koishi H, Futai K, Goto A, Sugamoto K, et al. Measurement of the Glenoid Track In Vivo as Investigated by 3-Dimensional Motion Analysis Using Open MRI. Am J Sports Med 2014;42:1290-5. https://doi.org/10.1177/0363546514527406.
20. Provencher MT, Aman ZS, LaPrade CM, Bernhardson AS, Moatshe G, Storaci HW, et al. Biomechanical Comparison of Screw Fixation Versus a Cortical Button and Self-tensioning Suture for the Latarjet Procedure. Orthop J Sports Med 2018;6:2325967118777842. https://doi.org/10.1177/2325967118777842.
21. Rugg CM, Hettrich CM, Ortiz S, Wolf BR, Group MSI, Zhang AL. Surgical stabilization for first-time shoulder dislocators: a multicenter analysis. J Shoulder Elbow Surg 2018;27:674-85. https://doi.org/10.1016/j.jse.2017.10.041.
22. Shaha JS, Cook JB, Song DJ, Rowles DJ, Bottoni CR, Shaha SH, et al. Redefining "Critical" Bone Loss in Shoulder Instability: Functional Outcomes Worsen With "Subcritical" Bone Loss. Am J Sports Med 2015;43:1719-25. https://doi.org/10.1177/0363546515578250.
23. Shin JJ, Hamamoto JT, Leroux TS, Saccomanno MF, Jain A, Khair MM, et al. Biomechanical Analysis of Latarjet Screw Fixation: Comparison of Screw Types and Fixation Methods. Arthroscopy 2017;33:1646-53. https://doi.org/10.1016/j.arthro.2017.03.030.
24. Valsamis EM, Kany J, Bonnevialle N, Castricini R, Ladermann A, Cunningham G, et al. The arthroscopic Latarjet: a multisurgeon learning curve analysis. J Shoulder Elbow Surg 2020;29:681-8. https://doi.org/10.1016/j.jse.2019.10.022.
25. Xu J, Liu H, Lu W, Deng Z, Zhu W, Peng L, et al. Modified Arthroscopic Latarjet Procedure: Suture-Button Fixation Achieves Excellent Remodeling at 3-Year Follow-up. Am J Sports Med 2020;48:39-47. https://doi.org/10.1177/0363546519887959.
26. Xu J, Liu H, Lu W, Zhu W, Peng L, Ouyang K, et al. Clinical outcomes and radiologic assessment of a modified suture button arthroscopic Latarjet procedure. BMC musculoskelet Disord 2019;20:173. https://doi.org/10.1186/s12891-019-2544-x.
27. Yamamoto N, Itoi E, Abe H, Minagawa H, Seki N, Shimada Y, et al. Contact between the glenoid and the humeral head in abduction, external rotation, and horizontal extension: a new concept of glenoid track. J Shoulder Elbow Surg 2007;16:649-56. https://doi.org/10.1016/j.jse.2006.12.012.
28. Yamamoto N, Kawakami J, Nagamoto H, Shiota Y, Itoi E. The Relationship between the Glenoid Track and the Range of Shoulder Motion: A Cadaver Study. Orthopaed Traumatol Surg Res 2018;104:793-6. https://doi.org/10.1016/j.otsr.2017.12.006.