



Two-year results of arthroscopic conjoint tendon transfer procedure for the management of failed anterior stabilization of the shoulder



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Background: Management of failed anterior stabilization is difficult. There are two main options for revision either a revision labral repair which has published high failure rates because of poor quality capsulolabral tissues or a bone block/Latarjet procedure with associated morbidity and complication rates. On this background, the senior author (D.T.) has developed a new procedure to treat this difficult to manage clinical scenario.

Aim: The aim of this study was to evaluate the 2-year results of an arthroscopic conjoint tendon transfer procedure. The procedure has previously been developed to provide a potential solution for active patients with a failed labral repair, subcritical glenoid bone loss, and an on-track Hill-Sachs lesion.

Methods: Consecutive patients who fulfilled the inclusion criteria were prospectively recruited. Inclusion criteria were active patients with recurrent shoulder instability owing to failed labral repair, less than 10% anterior glenoid bone loss, and an on-track Hill Sachs lesion. Patients were fully consented and offered a choice of revision with an arthroscopic labral repair, a Latarjet procedure or the arthroscopic conjoint tendon transfer procedure. Preoperative and postoperative Western Ontario Shoulder Instability Index and Oxford Instability Score were collected.

Results: Eight patients met the inclusion criteria and opted for the conjoint tendon transfer procedure. Mean age was 35 with a male:female ratio of 7:1. No patients had hyperlaxity clinically. At median follow-up of 31 months (range 24–41), there was a significant improvement in both the median Western Ontario Shoulder Instability Index (53.7 to 13.4, $P = .0003$) and Oxford Instability Score (27 to 44.5, $P = .0017$) scores. No patient had a further dislocation, and all were able to resume contact and noncontact sports.

Conclusion: Our results at a minimum of 2-year follow-up demonstrate that the arthroscopic transfer of the conjoint tendon confers clinical stability in patients with a failed primary labral repair who have minimal bone loss.

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Primary arthroscopic anterior stabilization for traumatic instability has up to 17.4% failure rate.¹¹ Revision arthroscopic stabilization can be challenging, with failure rates of up to 27%.¹³ A variety of causes for failure have been identified including failure to address significant bone deficiency and the poor quality of the soft tissues in the revision setting.

Where there is significant bone loss, the use of a coracoid transfer³ or bone block procedure (iliac crest, distal clavicle, distal tibia) has proved successful.¹⁵ Owing to the high rate of failure after revision

arthroscopic stabilization, some surgeons advocate bone augmentation on the glenoid side, irrespective of the degree of bone loss.^{2,28,18} However, Balestro et al¹ found severe coracoid bone block osteolysis with almost complete disappearance of the graft in 8 of 12 patients (66.67%). Di Giacomo et al^{8,7} reported significantly more coracoid bone block resorption in patients with less than 15% glenoid bone loss compared with patients with more than 15% glenoid bone loss.

Biomechanical and cadaveric studies have demonstrated that the conjoint tendon plays an important role in achieving

This work was in keeping with the hospital clinical governance guidance and approved by a local medical council.

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glenohumeral stability after a Latarjet procedure and that this is achieved through a sling effect.¹⁰ We therefore hypothesized that transferring the conjoint tendon on its own without the coracoid could improve shoulder stability through the same sling effect.

The purpose of this study was to report the minimum 2-year follow-up results of the CTT procedure for revision shoulder stabilization. We hypothesized that patients undergoing revision Bankart repair supplemented by a CTT in the absence of significant bone loss would have improvement in functional outcome and a lower failure rate than that reported in the literature for revision arthroscopic stabilization.

Methods

Patient selection

All patients presenting to our unit with recurrent dislocation after a previous labral repair *between January 2015 and June 2017* underwent an magnetic resonance arthrogram to assess the capsulolabral structures and computed tomography (CT) scan axial and coronal CT images of the glenohumeral joint were used to assess the size and location of the Hill-Sachs defect. Reconstructed 3-dimensional CT images of the glenoid with humeral head subtraction were used to assess glenoid bone loss using the unilateral circle (Pico) method²⁰ and the glenoid track was calculated as described by Yamamoto et al.²⁶ All images were reviewed by a consultant radiologist with a specialist interest in musculoskeletal radiology and the senior author.

Our indications for surgery were patients with recurrent shoulder dislocation despite previous stabilization, <10% glenoid bone loss and an “on-track” Hill-Sachs defect as defined by Yamamoto et al.²⁶

Approval was obtained from the local medical advisory committee (minutes October 2014). All patients were given an approved patient information sheet that explained the risks of the procedure and explicitly informed them that the procedure was new with no robust published evidence as to its clinical benefit. All patients were assessed preoperatively, consented, and operated on by the senior author.

Surgical technique

Our unit has previously described the arthroscopic technique of conjoint tendon transfer procedure using a combination of suspensory and interference screw fixation²¹ (Supplementary Video S1).

The operation is performed in the beach-chair position. After a diagnostic arthroscopy, the anterior labrum and glenoid are prepared with removal of all previous suture material. The sutures are passed through the anterior capsulolabral structures, but the labral repair and capsular shift are not completed at this point in the procedure.

The rotator interval is débrided and the glenoid neck exposed. A #2 Fiberwire (Arthrex, Naples, FL, USA) cinch stitch is passed through the conjoint tendon at its coracoid insertion and then the tip of the coracoid (5mm) is osteotomized via an anterior portal. (*The CTT places the bone inside the glenoid as an aid to union and to prevent suture pullout.*)

Under direct vision, a split is made in the subscapularis tendon from outside to in approximately midway between the superior and inferior margins. A 3.2-mm spade tip drill pin is passed from a more medial portal through the split in subscapularis. The tip is positioned on onto the anterior glenoid neck 10 mm medial to the articular surface (allowing 3 mm for the reaming and 7 mm for cartilage and subchondral bone) and

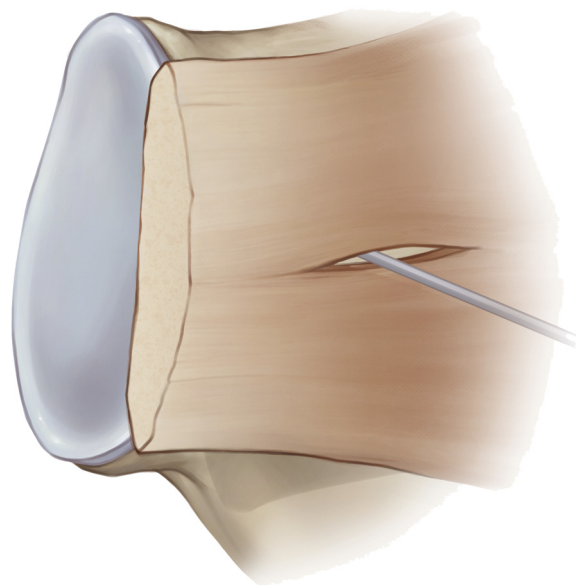


Figure 1 Illustration of the left shoulder demonstrating the 3.2-mm spade tip drill pin being passed through a split in subscapularis.

half way between the lower margin of the coracoid and the inferior margin of the glenoid. It is then drilled to the posterior cortex, angling the pin 5°–10° inferiorly (Fig. 1). The distance from anterior to posterior cortex is measured. A 7-mm-diameter reamer is then passed over the pin to create a 15-mm-deep socket in the anterior glenoid neck (Fig. 2).

The conjoint tendon whipstitch is withdrawn via the medial portal, and a large Pec Button (Arthrex, Naples, FL, USA) is loaded onto the sutures in the “tension slide” fashion. The button is attached to the eyelet of the drill pin using an additional loop suture (Fig. 3). The pin is pushed through the posterior skin and the button pulled through to the posterior glenoid and flipped to rest on the posterior cortex. The tension slide technique is used to draw the graft into the socket (Figs. 4 and 5). Once seated, an interference screw using a 5.5-mm BioComposite SwiveLock anchor (Arthrex, Naples, FL, USA) is used as supplementary fixation.

A knotless labral repair is then completed using 2.9-mm BioComposite PushLock anchors (Arthrex, Naples, FL, USA).

The postoperative rehabilitation protocol was the same for all patients. Patients were protected in a polysling with a body strap for 3 weeks and then began physical therapy. External rotation was limited to neutral for 6 weeks postoperatively. Early rehabilitation focused on gentle passive- and active-assisted range of motion with avoidance of resistance for 6 weeks from surgery. Unrestricted strengthening was gradually promoted at 12 weeks from surgery, with a return to full activity allowed at 6 months.

Prospective demographic data, including age at the time of surgery, gender, hyperlaxity, sports participation, and surgical history of the affected shoulder, were collected. Preoperative Oxford Shoulder Instability Score (OSIS) and Western Ontario Shoulder Instability (WOSI) score (<https://www.orthotoolkit.com/wosi/>) were prospectively collected. Outcome scores were repeated a minimum of 24 months after surgery and further data on sports participation, and shoulder redislocation events were recorded. All complications and any additional interventions were recorded.

The Mann-Whitney U test was used to compare individual preoperative and postoperative values. All statistical analyses were performed with SPSS software (version 22; IBM, Armonk, NY, USA), with significance set at $P \leq .05$.

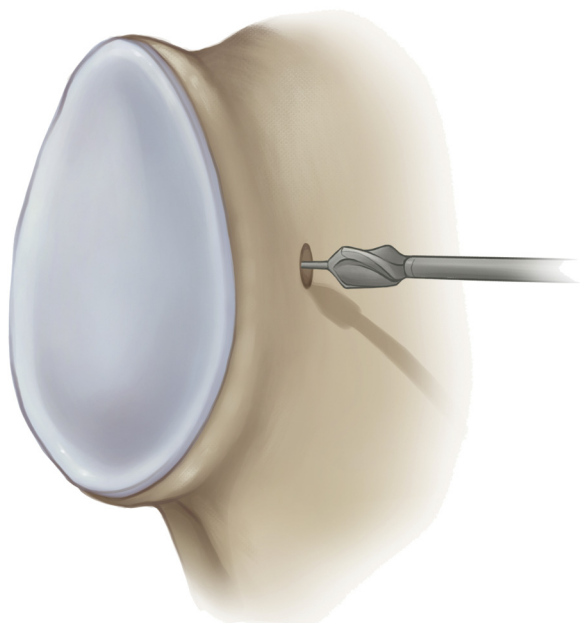


Figure 2 Illustration of the 7-mm reamer being passed over the drill pin to create the socket in the glenoid neck.

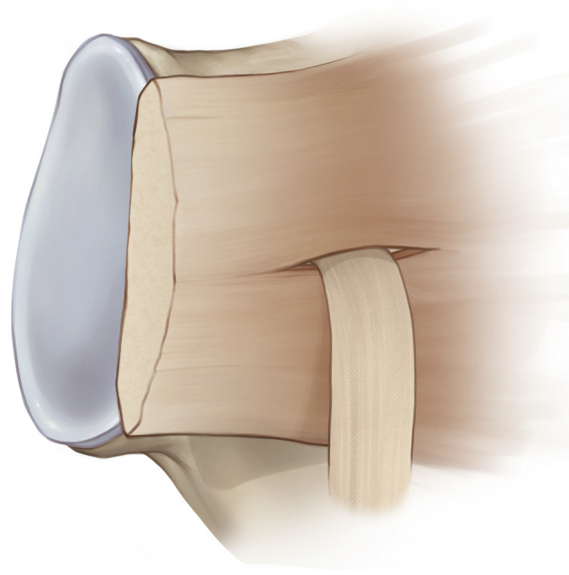


Figure 4 Illustration of the conjoint tendon being inserted into the glenoid neck and passing through the subscapularis split.

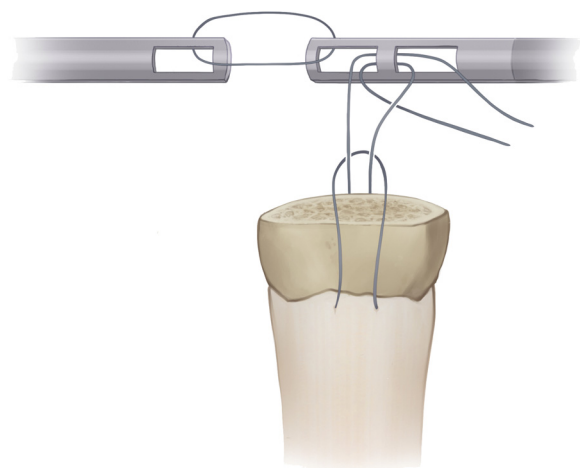


Figure 3 Illustration of the arrangement of sutures to deliver the graft. The Pec Button (right) is attached to the graft using the cinch stitch and a tension slide technique and the drill pin (left).

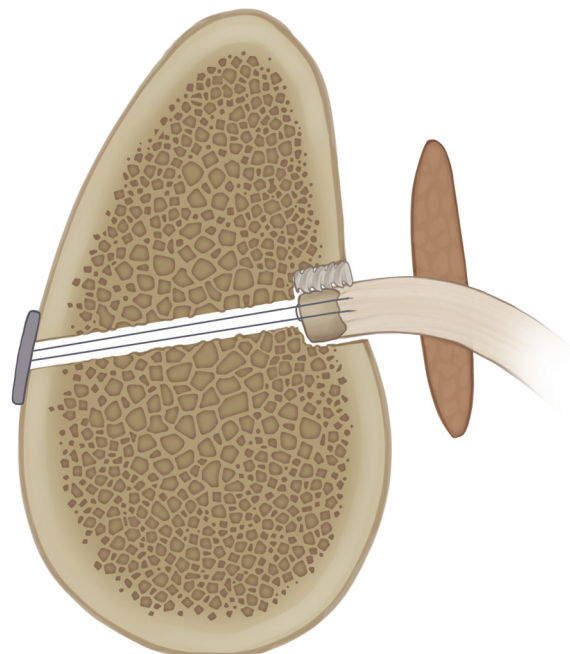


Figure 5 Illustration of a cross section of the glenoid showing the completed tendon transfer with suspensory and supplemental interference screw fixation.

Results

Between January 2015 and June 2017, 8 patients met the inclusion criteria and were consented to undergo the conjoint tendon transfer (CTT) procedure. The median age was 35 (25–48) years, with a male:female ratio of 7:1. No patient had hyperlaxity. All patients had undergone a labral repair previously, and the labrum was found to be return in all cases.

The median operating time was 95 minutes (90–110), and there were no complications.

The median follow-up period after the CTT procedure was 31 months (24–41). At the final follow-up, there was a significant improvement in both the WOSI and the OSIS (Individual changes in

each patient outcome score was used to compute Mann-Whitney U test).

Patient reported outcomes (PRO)

The median preoperative WOSI was 53.7 (22.6–77.8) and the postoperative score was 13.4 (5.6–30.3); this difference was significant ($P = .003$)

Table I
Individual preoperative and postoperative OSIS and WOSI scores.

Patient no	Preoperative WOSI OSIS	Postoperative WOSI OSIS	Score improvement
1	64.6	21.6	43
	15	47	32
2	54.4	19.8	34.7
	32	46	14
3	72.4	5.9	66.5
	12	44	32
4	44.5	15.4	29.1
	29	45	16
5	25.8	11.4	14.4
	38	39	1
6	21.6	9.3	12.3
	37	44	7
7	53	7.2	45.8
	27	47	20
8	65	30.3	34.7
	18	39	21

OSI, Oxford Shoulder Instability Score; WOSI, Western Ontario Shoulder Instability.

The median preoperative OSIS was 27 (10-38) and the postoperative score was 44.5 (39-47). This difference was significant ($P = .017$)

Clinical outcomes

No patient had a further dislocation or subluxation, and all patients returned to their preinjury levels of sport. One patient returned to professional boxing, 1 patient resumed contact sports, and 1 patient took up contact sports subsequent to the CTT procedure (boxing and mixed martial arts).

All patients had a range of external rotation in 90 degrees of abduction within 10 degrees of the contralateral side; none reported feeling that the shoulder had a subjective loss of motion.

One patient suffered an epileptic seizure several months after surgery and injured his shoulder, but he did not redislocate.

Complications

There were no immediate or delayed complications in any of the patients in this cohort.

Table I shows the individual preoperative and postoperative OSIS and WOSI scores.

Table II shows sports participation before injury, after primary surgery, and after CTT procedure.

Discussion

Eleven patients were followed up for a minimum of 2 years after undergoing the CTT procedure. The median WOSI improved by 40.3 and the median OSIS improved by 17.5. Both were significant and both exceeded the minimal clinically important differences (MCID). There were no redislocations and no complications.

Despite the improvement in the understanding of shoulder stability and advancement of arthroscopic surgical techniques, recurrence of instability after soft-tissue revision stabilization surgery remains an issue. Reasons for failed revision soft-tissue stabilization surgery include failure to address significant bone defects, poor-quality soft tissues, as well as technical errors.

There is evidence supporting the use of the conjoint tendon without the coracoid as a stabilizing structure. In a biomechanical study, Yamamoto et al²⁷ found that the conjoint tendon–subscapularis sling effect was responsible for 76% to 77% of

the stabilizing effect conferred by the Latarjet procedure in a cadaveric model. The authors concluded that the sling effect was the primary stabilizing effect at both end-range and midrange arm positions.

Thomas et al²² reported there was no difference between the Bristow procedure and conjoint tendon transfer alone in reducing anteroposterior translation in a simple soft-tissue shoulder instability model with low load and no bony defect.

In a cadaveric model with 25% anterior glenoid bone loss, Panchal et al¹⁷ reported that a conjoint tendon transfer was equivalent to a coracoid transfer procedure in restoring anterior humeral head translation back toward the normal state. The authors reported that a tensioned conjoint tendon transfer exhibited a statistically significant reduction in anterior glenohumeral translation at 60 degrees of abduction similar to what was achieved with a coracoid transfer. A reduction was also observed at 90 degrees of abduction; however, this reduction did not achieve statistical significance.

In a similar study, using a cadaveric model with 20% glenoid bone loss, Kephart et al¹² found that there was no significant difference in anterior humeral head translation between the modified Bristow procedure and transfer of the conjoint tendon alone.

The use of the LHB as a dynamic stabilizer (DAS procedure) has been described.⁵ However, no clinical results have been published, and there are concerns that the sling effect is weaker than that obtained by the conjoint tendon and there is the risk of tendinopathy within the LHB itself.

On the basis of the available evidence, we felt that, in patients with no glenoid bone loss, transfer of the conjoint tendon alone would achieve stability without the potential for graft osteolysis and the complication rate associated with the Latarjet procedure. Our results demonstrate that a conjoint tendon transfer supplementing an arthroscopic revision Bankart repair when there is no significant glenoid bone loss successfully achieves a stable shoulder at 2 to 3-year follow-up. All patients reported a subjective sense of stability and some reported that their shoulders felt more stable after the revision than they did after the primary arthroscopic stabilization. There were no failures. We found statistically significant improvements in our primary outcome measures (both the WOSI and OSI scores) and the observed improvements exceeded the reported minimal clinical important difference for each score (observed improvement in WOSI 35 and MCID 10.5-16.2,^{19,23} observed improvement in OSIS 17 and MCID 6-9^{16,24,25} indicating a clinically significant improvement).

Published literature on the clinical application of the conjoint transfer for stabilizing the shoulder is sparse. In 1951, Boytchev⁴ described a technique using the tip of the coracoid to effect shoulder stability. In this procedure, the conjoint tendon as well as the pectoralis minor was taken with the tip of the coracoid and transferred through the subscapularis and back to the origin on the coracoid where it was secured with a single screw. There is little evidence in the literature on its efficacy, and Dalsgard⁶ reported a 44% recurrence rate.

The CTT procedure differs significantly from that described by Boytchev in that the conjoint tendon alone is inserted into the neck of the glenoid, providing a true sling effect, similar to that obtained in the Latarjet procedure.

Douguilh et al⁹ reported the clinical outcome of the use of the conjoint tendon transfer to restore anterior shoulder stability. This was retrospective series of 10 consecutive patients who underwent conjoined tendon transfer (8 open and 2 arthroscopic) for anterior glenohumeral instability with 25% or greater anterior glenoid bone loss, engaging Hill-Sachs lesion, or absent anterior-inferior labral tissue with anterior capsular tissue that did not readily hold sutures or a combination of these deficiencies. There was recurrent instability in 1 patient. However, as a consequence of the heterogenous

Table II
Individual patients sporting activity before injury, after initial anterior labrum repair, and after conjoint tendon transfer.

Patient no	Sports participation before first injury	Sports participation after primary surgery	Sports participation after conjoint tendon transfer
1	Boxing professional	Boxing, frequent dislocations	Boxing professional
2	Running, swimming, tennis	Running, swimming	Running, swimming, yennis
3	Tennis, hockey, badminton	Hockey	Gym, cycling, running, golf
4	Swimming/Walking	Walking	Swimming, walking
5	Football, badminton	Football	Mixed chi combat, football, badminton
6	Cricket, football	Swimming cycling, running	Swimming, cycling, running
7	Running, weight lifting, boxing, pilates, yoga	Running, weight lifting, boxing, pilates, yoga	Running, weight lifting, boxing, pilates, yoga
8	Gym, running	None	Running, calisthenics

patient population and surgical indications, it is difficult to draw any meaningful conclusions from this study, and we remain concerned about the use soft tissue alone to stabilize the glenohumeral joint where there is bone loss. The CTT does not increase the width of the glenoid nor address a significant Hill-Sachs defect, and as such, we only were able to offer the procedure to patients without significant (<10%) glenoid bone loss and an “on-track” Hill Sachs lesion, assuming a purely soft-tissue defect as being the cause of the instability.

We recognize there are several limitations to the present study. There were only 8 cases, but as the selection criteria for this new procedure were very specific, the study was designed as a pilot. Much of literature on shoulder stabilization procedures is difficult to interpret owing to the heterogeneity in the amount of glenoid bone loss and size of the Hill-Sachs lesion within studies, as well as between studies. Therefore, we defined a clear population subgroup who we felt would benefit from conjoint tendon transfer allowing for clearly defined indications for future comparison purposes. The mean age of the population (35 years) may also have an influence on the outcome. However, as this population represents a cohort who had undergone primary stabilization surgery that had failed and had then been referred to a tertiary center for revision surgery, we feel that is probably representative of the population of patients for whom this procedure was intended. It would not be reasonable to extrapolate these results to a younger population. The follow-up period of 2 years is enough to identify the primary success of the procedure, but it is recognized that the results of instability surgery do tend to decline over time, and it is our intention to follow up these patients in the longer term.

The procedure is safe with no complications in our cohort although there is a potential risk to the suprascapular nerve when drilling through the posterior cortex.¹⁴ This technique directs the pin inferiorly, and there is no need to direct medially as with conventional Latarjet procedures.

Conclusion

Our results at a minimum of 2-year follow-up demonstrate that the arthroscopic transfer of the conjoint tendon confers clinical stability in patients with a failed primary labral repair who have minimal bone loss. The procedure avoids the risks of bone block harvest, resorption or arthritis owing to malposition, as well as avoiding the potential for intra-articular damage with the hardware needed for bone graft fixation.

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Conflicts of Interest: Prof. D Tennent contributed to conceptualization, methodology, software, validation, formal analysis, investigation, data curation, writing - review and editing, visualization, supervision, and project administration. Vishal Patel contributed to formal

analysis, data curation, visualization, and writing - original draft. Resources were obtained from St Georges Hospital. The Radiology Department of St Georges Hospital contributed to validation. Y Pearse and M Arnander contributed to writing - review and editing.

Conflicts of interest: The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jseint.2020.12.009>.

References

- Balestro JC, Young A, Maccioni C, Walch G. Graft osteolysis and recurrent instability after the Latarjet procedure performed with bioabsorbable screw fixation. *J Shoulder Elbow Surg* 2015;24:711-8. <https://doi.org/10.1016/j.jse.2014.07.014>.
- Bessière C, Trojani C, Carles M, Mehta SS, Boileau P. The open latarjet procedure is more reliable in terms of shoulder stability than arthroscopic bankart repair. *Clin Orthop Relat Res* 2014;472:2345-51. <https://doi.org/10.1007/s11999-014-3550-9>.
- Boileau P, Thélou CÉ, Mercier N, Ohl X, Houghton-Clemmey R, Carles M, et al. Arthroscopic Bristow-Latarjet combined with bankart repair restores shoulder stability in patients with glenoid bone loss. *Clin Orthop Relat Res* 2014;472:2413-24. <https://doi.org/10.1007/s11999-014-3691-x>.
- Boytchev B. Treatment of recurrent shoulder instability. *Minerva Orthopeda* 1951;2:377-9.
- Collin P, Lädermann A. Dynamic anterior stabilization using the long head of the biceps for anteroinferior glenohumeral instability. *Arthrosc Tech* 2017;7:e39-44. <https://doi.org/10.1016/j.eats.2017.08.049>.
- Dalsgaard HL, Gøthgen CB, Hoogmartens MJ. The Boytchev procedure for recurrent anterior dislocation of the shoulder. A controversial technique. *Acta Orthop Belg* 2000;66:248-50.
- Di Giacomo G, Costantini A, de Gasperis N. Coracoid graft osteolysis after the Latarjet procedure for anteroinferior shoulder instability: a computed tomography scan study of twenty-six patients. *J Shoulder Elbow Surg* 2011;20:989-95. <https://doi.org/10.1016/j.jse.2010.11.016>.
- Di Giacomo G, de Gasperis N, Costantini A, De Vita A, Beccaglia MA, Pouliart N. Does the presence of glenoid bone loss influence coracoid bone graft osteolysis after the Latarjet procedure? A computed tomography scan study in 2 groups of patients with and without glenoid bone loss. *J Shoulder Elbow Surg* 2014;23:514-8. <https://doi.org/10.1016/j.jse.2013.10.005>.
- Douoguih WA, Goodwin D, Churchill R, Paulus M, Maxwell A. Conjoined tendon transfer for traumatic anterior glenohumeral instability in patients with large bony defects and anterior capsulolabral deficiency. *Arthroscopy* 2018;34:12-20. <https://doi.org/10.1016/j.arthro.2017.06.044>.
- 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>.
- Kennedy MI, Murphy C, Dornan GJ, Moatshe G, Chahla J, LaPrade RF, et al. Variability of reporting recurrence after arthroscopic bankart repair: a call for a standardized study design. *Orthop J Sports Med* 2019;7:2325967119846915. <https://doi.org/10.1177/2325967119846915>.
- Kephart CJ, Abdulian MH, McGarry MH, Tibone JE, Lee TQ. Biomechanical analysis of the modified Bristow procedure for anterior shoulder instability: is the bone block necessary? *J Shoulder Elbow Surg* 2014;23:1792-9. <https://doi.org/10.1016/j.jse.2014.03.003>.
- Krueger D, Kraus N, Pauly S, Chen J, Scheibel M. Subjective and objective outcome after revision arthroscopic stabilization for recurrent anterior

- instability versus initial shoulder stabilization. *Am J Sports Med* 2011;39:71-7. <https://doi.org/10.1177/0363546510379336>.
14. Lödermann A, Denard PJ, Burkhart SS. Injury of the suprascapular nerve during Latarjet procedure: an anatomic study. *Arthroscopy* 2012;28:316-21. <https://doi.org/10.1016/j.arthro.2011.08.307>.
 15. Longo UG, Loppini M, Rizzello G, Ciuffreda M, Maffulli N, Denaro V. Latarjet, Bristow, and Eden-Hybinette procedures for anterior shoulder dislocation: systematic review and quantitative synthesis of the literature. *Arthroscopy* 2014;30:1184-1191. <https://doi.org/10.1016/j.arthro.2014.04.005>.
 16. Moser JS, Barker KL, Doll HA, Carr AJ. Comparison of two patient-based outcome measures for shoulder instability after nonoperative treatment. *J Shoulder Elbow Surg* 2008;17:886-92. <https://doi.org/10.1016/j.jse.2008.05.040>.
 17. Panchal AP, Osbahr DC, Douoguih W, Parks BG. Conjoined tendon transfer vs modified Bristow in a glenoid bone loss model: a biomechanical study. *Orthop J Sports Med* 2013;1(4_Suppl). <https://doi.org/10.1177/2325967113500012>.
 18. Schmid SL, Farshaf M, Catanzaro S, Gerber C. 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. *J Bone Joint Surg Am* 2012;94:e75. <https://doi.org/10.2106/JBJS.K.00380>.
 19. Skare Ø, Liavaag S, Reikerås O, Mowinckel P, Brox JI. Evaluation of Oxford instability shoulder score, Western Ontario shoulder instability index and Euroqol in patients with slap (superior labral anterior posterior) lesions or recurrent anterior dislocations of the shoulder. *BMC Res Notes* 2013;6:273. <https://doi.org/10.1186/1756-0500-6-273>.
 20. Sugaya H, Moriishi J, Dohi M, Kon Y. Tsuchiya A Glenoid rim morphology in recurrent anterior glenohumeral instability. *J Bone Joint Surg Am* 2003;85-A:878-84. <https://doi.org/10.2106/00004623-200305000-00016>.
 21. Tennent D, Colaço H, Arnander M, Pearse E. Arthroscopic conjoint tendon transfer: a technique for revision anterior shoulder stabilization. *Arthrosc Tech* 2016;5:e201-5. <https://doi.org/10.1016/j.eats.2015.11.002>.
 22. Thomas PR, Parks BG, Douoguih WA. Anterior shoulder instability with Bristow procedure versus conjoined tendon transfer alone in a simple soft-tissue model. *Arthroscopy* 2010;26:1189-94. <https://doi.org/10.1016/j.arthro.2010.01.033>.
 23. Van der Linde JA, van Kampen DA, van Beers LW, van Deurzen DFP, Saris DBF, Terwee CB. The responsiveness and minimal important change of the Western Ontario Shoulder Instability Index and Oxford Shoulder Instability Score. *J Orthop Sports Phys Ther* 2017;47:402-10. <https://doi.org/10.2519/jospt.2017.6548>.
 24. van der Linde JA, van Kampen DA, van Beers LW, Van Deurzen DF, Terwee CB, Willems WJ. The Oxford Shoulder Instability Score; validation in Dutch and first-time assessment of its smallest detectable change. *J Orthop Surg Res* 2015;10:146. <https://doi.org/10.1186/s13018-015-0286-5>.
 25. Wylie JD, Beckmann JT, Granger E, Tashjian RZ. Functional outcomes assessment in shoulder surgery. *World J Orthop* 2014;5:623-33. <https://doi.org/10.5312/wjo.v5.i5.623>.
 26. 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>.
 27. Yamamoto N, Muraki T, An KN, Sperling JW, Cofield RH, Itoi E, et al. The stabilizing mechanism of the Latarjet procedure: a cadaveric study. *J Bone Joint Surg Am* 2013;95:1390-7. <https://doi.org/10.2106/JBJS.L.00777>.
 28. Young AA, Maia R, Berhouet J, Walch G. Open Latarjet procedure for management of bone loss in anterior instability of the glenohumeral joint. *J Shoulder Elbow Surg* 2011;20(2_Suppl):S61-9. <https://doi.org/10.1016/j.jse.2010.07.022>.