Technical Note

Arthroscopic Anatomic Glenoid Reconstruction in the Setting of a Failed Latarjet Using Distal Tibial Allograft

Anjaneyulu Purnachandra Tejaswi Ravipati, M.B.B.S., M.S. (Ortho), D.N.B. (Ortho), Malik I. Ali, M.Sc.P.T., and Ivan Ho-Bun Wong, M.D., F.R.C.S.C., M.Ac.M., Dip. Sports Med.

Abstract: Treatment of traumatic anterior glenohumeral dislocation has evolved over the years in terms of surgical approaches and methods of repair. Recurrence of instability following surgical repair remains challenging with conventional methods of open reconstruction. We describe the utilization of arthroscopic anatomic glenoid reconstruction using a distal tibial allograft after a failed Latarjet procedure. Preoperative and operative methodology are described with relevant imaging investigations and a detailed intraoperative arthroscopic technique.

Traumatic anterior glenohumeral dislocation is the most common type of joint dislocation.[1] Many procedures have been described for its treatment including the arthroscopic Bankart repair and Latarjet procedure. Burkhart and DeBeer reported a 67% recurrence rate after soft-tissue repair for patients with considerable bone loss.[2] Following a Latarjet procedure, the same authors reported a recurrence rate of 5% in a series of 102 patients.[3] Generally, recurrence after surgery for anterior instability of the shoulder may be caused by trauma, technical failure, misdiagnosis, as in the case of posterior instability, or patient factors such as hyperlaxity.[1]

The management of a patient with a failed index procedure for glenohumeral dislocation can be challenging, more so after a failed bone-block procedure. Many factors including the cause of failure, preexisting anchors, metal work, scar formation, altered anatomy of the neurovascular structures, and glenohumeral arthritis need to be considered. There have been several techniques described for managing recurrent instability following a failed Latarjet procedure including the Eden-Hybinette procedure using iliac crest autograft[4,5] and anatomic glenoid reconstruction using distal tibia allograft.[6,7] The majority have been open procedures although Giannakos et al.[4] described an all arthroscopic Eden-Hybinette procedure for failed instability surgery.

The role of arthroscopy in visualizing the position of the bone block, in comparison to an open procedure, helps in preventing postoperative complications. Hovelius et al.[8] reported higher recurrence rates when the bone block was placed overly superior or medially on the glenoid neck. A position >1 cm medial to the glenoid rim was associated with an 83% rate of recurrence. Wong and Urquhart[8] described an arthroscopic anatomic glenoid reconstruction technique with a distal tibial allograft (DTA) for the treatment of shoulder instability in the lateral decubitus position. The objective of this Technical Note is to describe the application of the arthroscopic anatomic glenoid reconstruction technique using DTA for the treatment of severe anterior glenoid bone loss in the setting of a failed Latarjet procedure.

Surgical Technique

Preoperative Assessment

A standard physical examination of the shoulder is performed. Instability is assessed using the anterior apprehension, Jobe relocation, sulcus, and load-and-shift tests. Rotator cuff integrity is assessed using the empty-can, drop-arm, lift-off, and resisted internal/external rotation testing. Hypermobility of the shoulder

From the Division of Orthopaedic Surgery (A.P.T.R., I.H-B.W.), Department of Surgery, Faculty of Medicine, and Faculty of Medicine (M.I.A.), Dalhousie University Halifax, Nova Scotia, Halifax, Nova Scotia, Canada.

The authors report that they have no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received July 12, 2019; accepted September 15, 2019.

Address correspondence to: Ivan Ho-Bun Wong, M.D., F.R.C.S.C., M.Ac.M., Dip. Sports Med., Division of Orthopaedic Surgery, Department of Surgery, Faculty of Medicine, Dalhousie University, 5955 Veterans Memorial Lane, Room 2106 VMB, Halifax, Nova Scotia B3H 2E1, Canada. E-mail: iw@drivanwong.com

2212-6287/19883

https://doi.org/10.1016/j.eats.2019.09.019

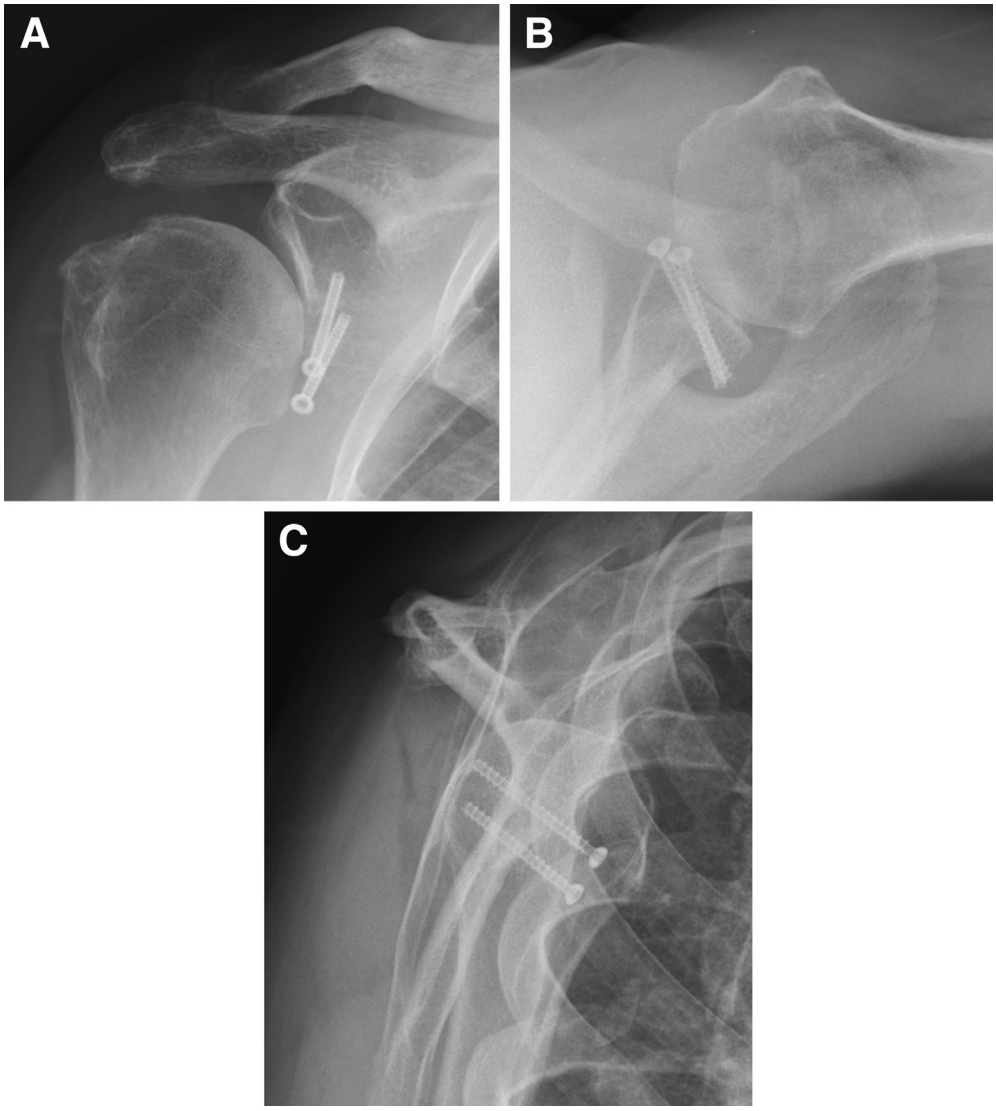

Fig 1. (A) Standard anteroposterior, (B) axillary, and (C) transscapular Y views of the right shoulder. The screw head is seen to be protruding and impinging on the humeral head in the axillary view in panel B.

and other joints is assessed using the Beighton score. Shoulder imaging (Fig 1) consists of anteroposterior, axillary, and trans-scapular Y views, as well as a computed tomography scan with 3-dimensional reconstruction (Fig 2) to assess glenoid bone loss, degree of resorption, nonunion/malunion of the previously placed allograft, and presence of Hill-Sachs lesion.

Surgical indications would include shoulder instability secondary to significant bone loss, a failed previous stabilization procedure for anterior instability involving soft tissue, or a previously failed Latarjet procedure.

Patient Positioning and Operative Room Setup

A bean bag is placed on the operating table under the patient. The patient is rolled into a semilateral position at 30° from vertical (Fig 3). After aseptically prepping the patients' skin and draping, the arm is placed in a pneumatic positioner (Spider 2; Smith & Nephew, Memphis, TN) and abducted 60° in balanced suspension. Skin landmarks including the acromion, scapular spine, clavicle, and acromioclavicular joint are drawn on the patient (Fig 3B).

Evaluation and Debridement

A standard diagnostic arthroscopy according to Snyder's described technique is performed after establishing a standard posterior portal.[9] Anterosuperior and anteroinferior portals are created using an outside-in technique (Fig 4). A biceps tenotomy is recommended in the presence of preexisting biceps pathology. Extensive scarring may be seen around the subscapularis and the rotator interval. Using a thermal probe, rotator interval release is done. The anterosuperior portions of the subscapularis are fully visualized by this release. Through the anteroinferior portal,

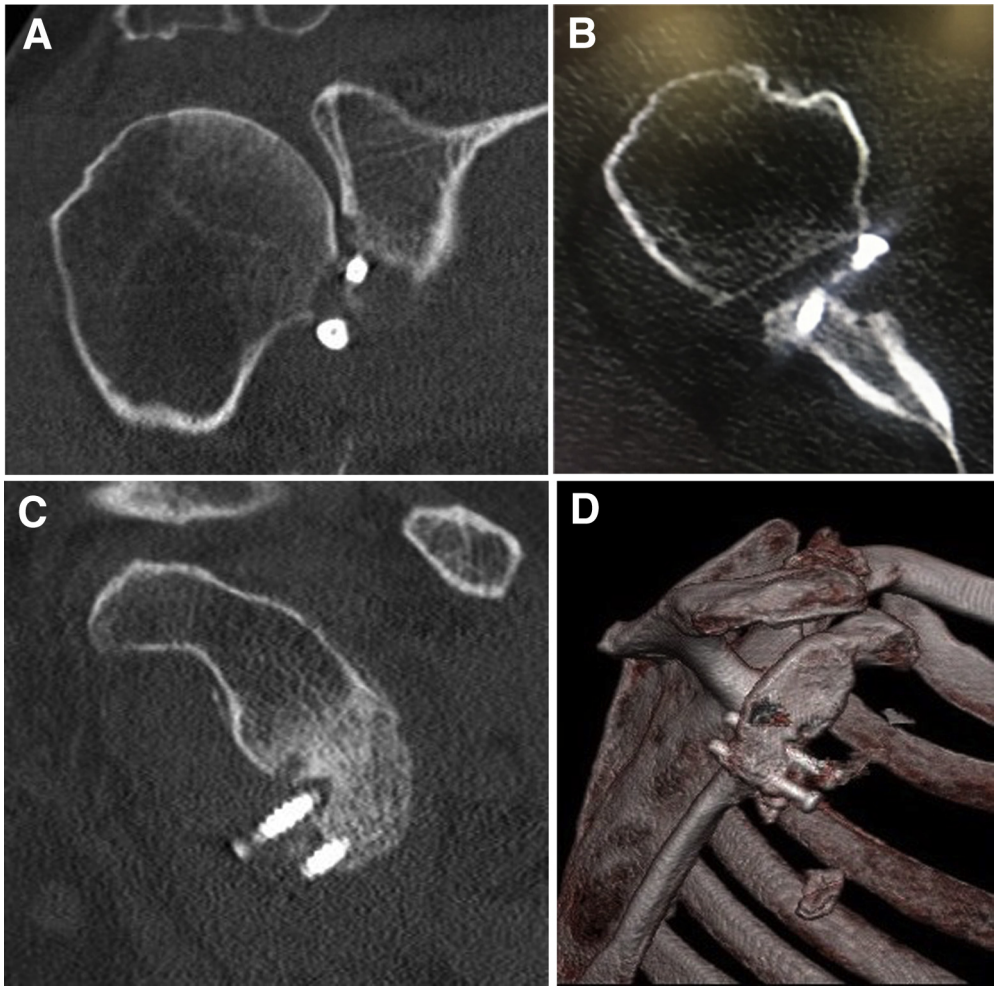

Fig 2. (A-D) Computed tomography scan of the right shoulder. The coracoid graft is completely resorbed. (B) The screws are seen to be intra-articular impinging on the humeral head. (D) Three-dimensional reconstruction shows extensive bone loss in the anteroinferior glenoid.

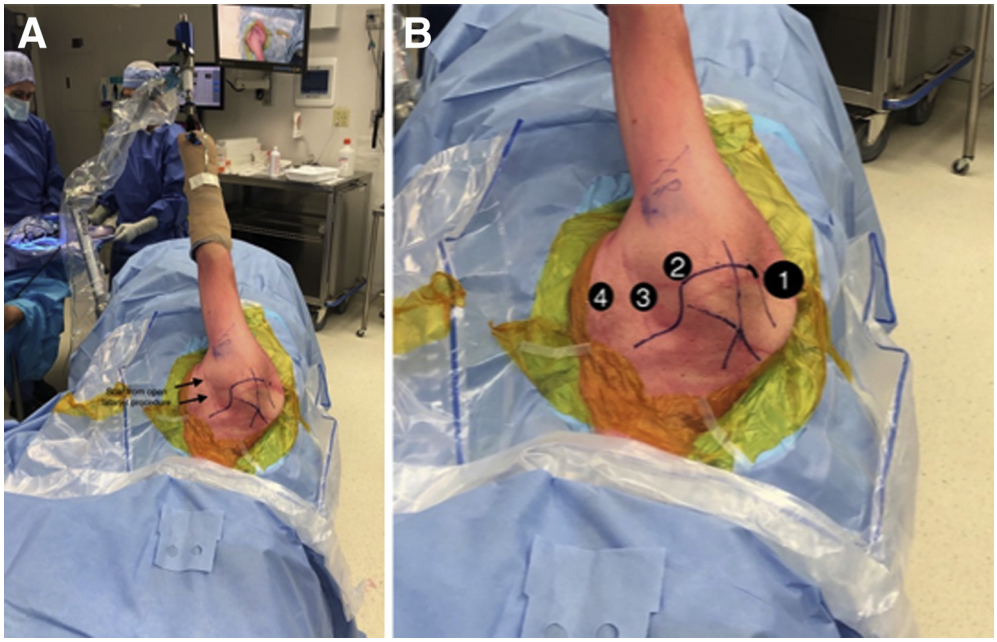

Fig 3. Patient position: semilateral; shoulder: right. Patient positioning in the semilateral position and right arm in 60° of abduction using a pneumatic arm holder. (A) Incision scars from previous Latarjet procedure. (B) Anatomic landmarks and the sites of portal placement: 1, posterior portal; 2, anterosuperior portal; 3, anteroinferior portal; 4, Halifax portal.

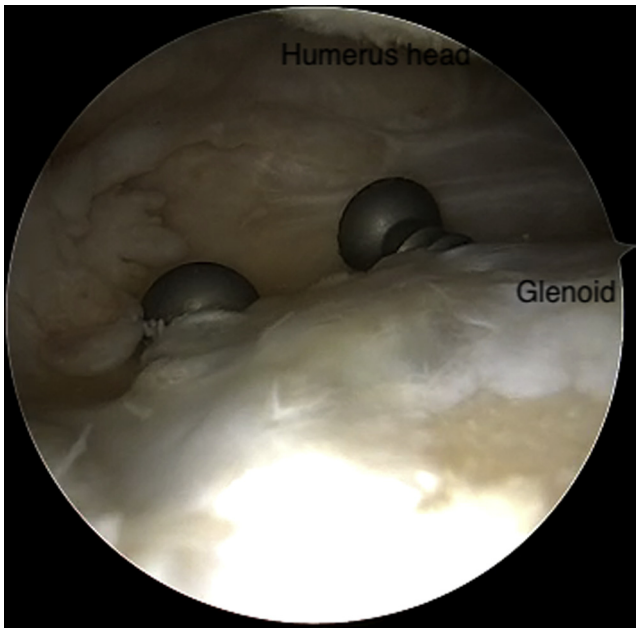

Fig 4. Patient position: semilateral; shoulder: right; viewing portal: posterior. Graft resorption with prominent screws is seen with arthroscope introduction through the posterior portal. Associated cartilage loss is seen on the glenoid face. This image highlights a previously failed Latarjet procedure with recurrent stability.

a labral elevator is used to mobilize the labrum and scar tissue if present. This maneuver helps in exposing previous bone grafts or hardware. The arthroscope is then shifted to the anterosuperior portal and a cannula is placed in the posterior portal to serve as an outflow to maintain a low intra-articular portal pressure.

Through the anteroinferior portal, hardware removal is attempted with a 3.5-mm screw driver; however, because the angle may not be appropriate, an additional far medial portal is created.[10] This portal is created in the usual fashion using an inside-out technique. The switching stick in the posterior portal is advanced parallel to the glenoid, superior to the subscapularis, and as high as possible toward the humeral head under direct visualization. This ensures reduced risk and safety of the neurovascular structures. The switching stick is then advanced through the deltoid, and a skin incision is made over the switching stick. A slotted cannula is placed through this portal, followed by a large channeler, to bluntly dilate the medial portal. This allows for easier hardware removal and passage of the DTA graft at later stages. The screws are removed from the medial portal after direct visualization and access using a 3.5-mm screwdriver. At this point, the anterior glenoid is completely debrided of friable tissue. The anterior

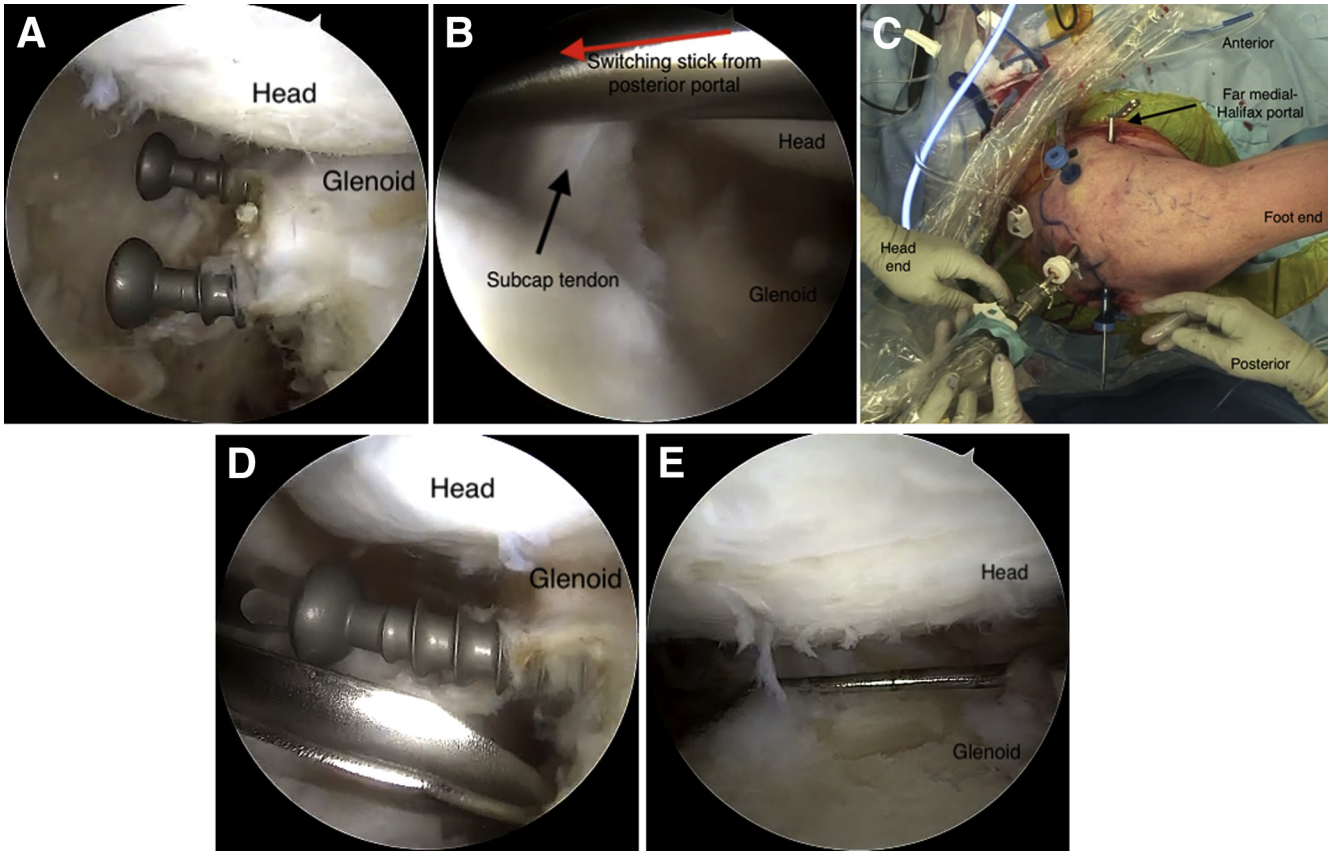

Fig 5. Patient position: semilateral position; shoulder: right; viewing portal: anterosuperior. (A) With the arthroscope in the anterosuperior portal, most of the coracoid graft from the index operation is seen to be resorbed and prominent hardware is visualized. (B, C) A far medial or Halifax portal is created by inside out technique. (D) This portal allows for a better trajectory of hardware removal as the screwdriver is parallel to the glenoid fossa. (E) Once this is done, the anteroposterior diameter of the glenoid is measured using a calibrated probe inserted through the posterior portal.

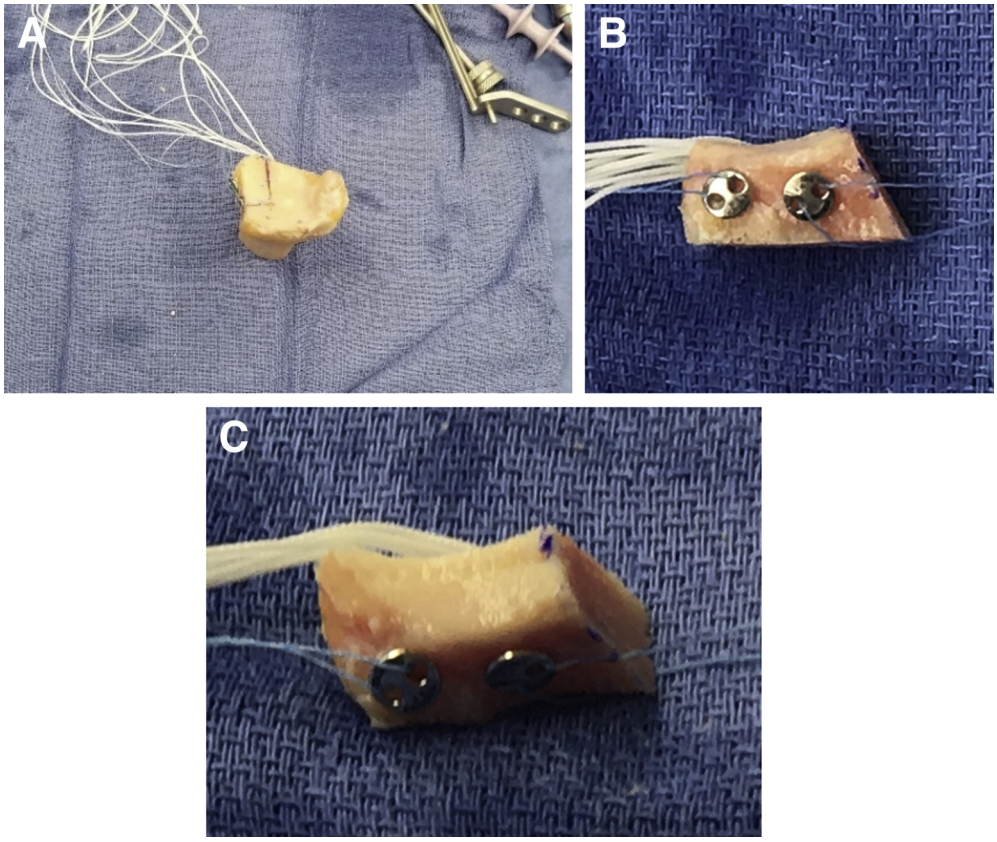

Fig 6. Distal tibia graft preparation: frozen. (A) Usually ipsilateral distal tibia allograft is used. Microsagittal saw is used to prepare the graft as per the measured dimensions. The posterolateral corner tends to have the best contours. (B, C) Using a graft prep tool (Smith and Nephew) 2 holes are drilled 10 mm apart and then loaded with EndoButtons.

glenoid is rasped and decorticated to provide a bleeding surface for promoted healing.

The dimensions of the glenoid is then measured and the graft size estimated using a calibrated probe. The posterior canula is then removed and a metal half pipe is inserted through the posterior portal. This is used as an aid for sliding the hook end of the double glenoid guide on the glenoid surface. Two glenoid guide bullets are percutaneously passed to secure the guide by ratcheting onto the posterior glenoid. Two 2.8-mm sleeved drills are then placed through the bullets to drill parallel holes through the glenoid approximately 10 mm apart. Each drill is to exit 5 mm below the cortical edge of the glenoid face. The bullets and guide are removed, leaving the drills and sleeves.

Distal Tibia Graft Preparation

A fresh-frozen (nonradiated) distal tibial allograft (Capital District Health Authority Regional Tissue Bank, Halifax, Nova Scotia, Canada) is used for the reconstruction. Usually, the tibia of the same side as the shoulder is ordered and used. The graft is prepared as described by Wong and Urquhart.[11] The dimensions of the graft were 15 mm in the anteroposterior plane, 20 mm in the inferosuperior plane, and a width of 15 mm. The graft is then held with a graft prep tool (Smith and Nephew) and 2 holes are drilled 10 mm apart. The created holes correspond to the distance of the cannulated drill sleeves previously placed in the glenoid neck. Using a suture retrieving device, the suture tail ends of the two EndoButton implants (Smith and Nephew) are placed through the drilled holes in the graft. Finally, the graft is thoroughly irrigated with normal saline.

Graft Placement, Tensioning, and Capsulolabral Repair

A double bullet drill guide (Smith & Nephew) is inserted through a posterior portal and the main arm is placed at the desired position on the glenoid fossa (Fig 7A). A small incision is made and the bullet is ratcheted against the posterior glenoid and this stabilizes the guide against the anterior glenoid rim. The 2.8-mm drill and sleeve are drilled through the glenoid from posterior to anterior. Two tunnels are made on either side of the main arm of the drill guide that correspond to the drill holes made in the graft. At this point, the drills are removed and number 1 looped monofilament suture is passed through the 2 sleeves and retrieved anteriorly through the far medial portal. These are used to shuttle the suture tails of the EndoButton-graft construct through the predrilled glenoid holes. Two 1.8-mm all suture anchors (Q-Fix, Smith & Nephew) are then inserted into the anterior glenoid rim after predrilling

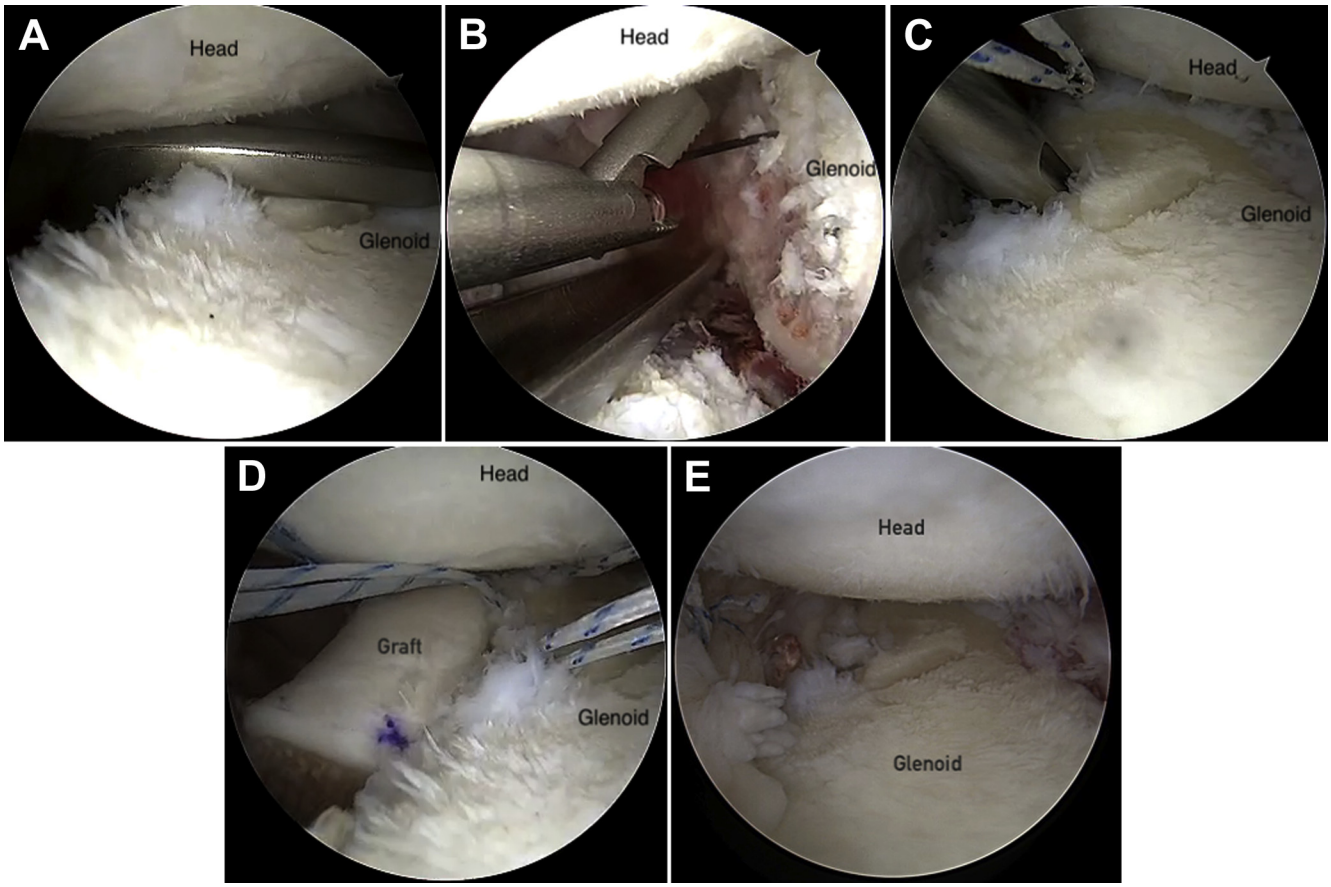

Fig 7. Patient position: semilateral; shoulder: right; viewing portal: anterosuperior portal. (A) A double bullet drill guide (Glenoid Drill Guide, Smith & Nephew) is inserted through a posterior portal and the main arm is placed at the desired position on the glenoid fossa. The 2.8-mm drill and sleeve are drilled through the glenoid from posterior to anterior, creating 2 tunnels on either side of the main arm. (B) The drills are removed and number 1 looped monofilament suture is passed through the 2 sleeves and retrieved anteriorly through the far medial portal. (C) Two 1.8-mm all suture anchors are inserted starting from the inferior border of the glenoid. (D) The distal tibia graft is shuttled inside the joint with aid of the previously passed monofilament sutures and the sutures from each EndoButton implant exit the skin posteriorly. The graft is tensioned over two EndoButtons loaded posteriorly after confirming the desired position. (E) Capsulolabral tissue is repaired in the usual fashion to achieve a stable construct.

Table 1. Steps of Arthroscopic Anterior Glenoid Reconstruction Using Distal Tibial Allograft in a Patient with Failed Latarjet Procedure

1. Place the patient in the 30° semilateral position.
2. Place the arm in a pneumatic arm holder and standard landmarks are drawn (Fig 3).
3. Perform diagnostic arthroscopy through the posterior portal, anterior portal and anterosuperior portals are created.
4. Open the rotator interval.
5. The arthroscope is switched to the anterosuperior portal.
6. Anteroinferior glenoid is debrided and the capsulolabral tissue is elevated to expose the previous screw heads (Fig 5A).
7. Use an inside-out portal for the creation of the medial portal. A switching stick is passed from the posterior portal parallel to the glenoid surface, superior to the subscapularis, and as lateral as possible to exit the skin (Fig 5 B-D).
8. Hardware removal is done through the medial portal.
9. Measure the glenoid (Fig 5E).
10. Distal tibial allograft using the posterolateral corner. The tibia from the same side as the shoulder undergoing surgery and 2 EndoButtons are loaded with the suture tails (Fig 6).
11. The main arm of double bullet drill guide is inserted through the posterior portal and placed at the desired position on glenoid fossa (Fig 7A).
12. Two tunnels are created using 2.8-mm drill and sleeve on either side of the main arm.
13. Monofilament sutures are passed through these tunnels and retrieved through the medial portal (Fig 7B).
14. Two 1.8-mm Q-fix anchors are inserted on the anteroinferior labrum (Fig 7C).
15. The distal tibia graft is shuttled in through the medial portal using the monofilament sutures so that the lead sutures of the graft exit the skin posteriorly (Fig 7D).
16. Two EndoButtons are loaded on the exit sutures posteriorly and the graft tensioned to 100N after confirming adequate position.
17. Reattach the anterior-inferior labral tissue to the native glenoid through the previously placed anchors (Fig 7E).

Table 2. Pearls and Pitfalls of the Surgical Technique

Pearls	Pitfalls
All arthroscopic anatomic glenoid reconstruction	Requires familiarity with the medial anterior portal Halifax portal
Avoids difficult surgical exploration in context of revision surgery after primary Latarjet procedure	New surgical technique that may require operative experience before competence but learning curve has been better than the arthroscopic Latarjet procedure[13]
Avoids further compromise of subscapularis function	Requires cadaveric graft availability
Allows for better positioning of the bone graft flush with the glenoid surface	Associated costs of graft
Allows for repair of the capsulolabral tissue resulting in soft tissue balancing	

taking care not to coalesce with the glenoid tunnels. These anchors will aid in the repair of the capsulolabral tissue after the fixation of the graft. The graft is tilted for insertion into the 10-mm cannula. The graft is advanced by pulling the guidewires out posteriorly. Slight tension is maintained on the sutures throughout this step until the bone block is positioned flush on the anterior neck of the glenoid; each implant's lead suture exits the skin posteriorly. The posterior EndoButtons are loaded onto the suture tails and sequentially tensioned using a suture tensioning device up to 100 N, as per the previously described technique by Taverna et al.[12]

The capsulolabral complex mobilized earlier is repaired over the graft on to the native glenoid using the regular Bankart repair technique. The construct is then viewed from all portals to ensure a glenoid positioned humeral head while taking it through range of motion and an anterior stress test. The arthroscopic portals are closed and the arm is placed in a neutral rotation sling. The steps of this surgical technique have been summarized in Table 1 and the pearls and pitfalls in Table 2.

Discussion

Arthroscopic modes of glenoid reconstruction are an area of continued research. The results of the Eden-Hybinette procedure after failed Latarjet have been mixed and variable in the literature for recurrent shoulder instability. Lunn et al.,[1] in a series of 34 patients with recurrent instability after Latarjet procedures, reported persistent instability/dislocation in 4 patients after revision with modified Eden-Hybinette procedure. On the contrary, Rouxel et al.[5] reported no cases of recurrence after the Eden-Hybinette procedure for the treatment of instability after a failed Latarjet procedure. The main complication appears to be the incidence of postoperative arthritis (as high as 50%) resulting from the absence of articular cartilage in the iliac crest bone block.[5] A previously published systematic review of the complications associated with Bristow/Latarjet procedures showed a 30% complication rate that included coracoid fractures, recurrent instability, bone-block migration, screw migration/breakage/prominence, nonunion, infection, osteolysis, hematoma, osteoarthritis, subscapularis rupture, loss of external rotation, and neurovascular injury.[14]

Arthroscopic anatomic glenoid reconstruction using distal tibial allograft is a newly described surgical technique with a relatively fast learning curve and high rates of desired graft position compared with the arthroscopic Latarjet procedure.[13] This technique has been originally described by Wong and Urquhart in 2015.[11] The arthroscopic procedure allows us to place the graft at the desired location and flush with the adjacent glenoid fossa. The additional medial portal allows for a parallel positioning of the tunnels to the glenoid surface. The safety profile of this portal has been previously established.[10] Further, the capsulolabral repair that is done on top of the graft makes the bone graft extra-articular. The capsulolabral repair, which on its own is a very successful surgical procedure in patients with no or mild glenoid bone loss, further augments the stability that the distal tibia bone graft provides and negates the need for the sling effect of subscapularis. In revision cases, especially after a previous open Latarjet procedure, which makes it difficult to identify the neurovascular planes due to scarring, our technique is not only anatomic in the re-creation of the glenoid surface but also anatomic in the preservation and repair of the capsulolabral complex.

We describe the intraoperative surgical technique including perioperative assessment details and visual illustrations (Video 1).

References

1. Lunn JV, Castellano-Rosa J, Walch G. Recurrent anterior dislocation after the Latarjet procedure: Outcome after revision using a modified Eden-Hybinette operation. *J Shoulder Elb Surg* 2008;17:744-750.
2. 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.
3. Burkhart SS, De Beer JF, Barth JRH, et al. Results of modified Latarjet reconstruction in patients with anteroinferior instability and significant bone loss. *Arthrosc J Arthrosc Relat Surg* 2007;23:1033-1041.

4. Giannakos A, Vezeridis PS, Schwartz DG, Jany R, Lafosse L. All-arthroscopic revision Eden-Hybinette procedure for failed instability surgery: Technique and preliminary results. *Arthrosc J Arthrosc Relat Surg* 2017;33:39-48.
5. Rouxel Y, Rolland E, Saillant G. Postoperative recurrence: results of surgical revisions. *Rev Chir Orthop Reparatrice Appar Mot* 2000;86:137-147 (Suppl 1).
6. Sanchez A, Ferrari MB, Akamefula RA, Frank RM, Sanchez G, Provencher MT. Anatomical glenoid reconstruction using fresh osteochondral distal tibia allograft after failed latarjet procedure. *Arthrosc Tech* 2017;6:e477-e482.
7. Tytherleigh-Strong GM, Morrissey DI. Failed Latarjet procedure treated with a revision bone block stabilization using a suture-button fixation. *J Shoulder Elb Surg* 2017;26:e102-e107.
8. Hovelius L, Sandström B, Olofsson A, Svensson O, Rahme H. The effect of capsular repair, bone block healing, and position on the results of the Bristow-Latarjet procedure (study III): Long-term follow-up in 319 shoulders. *J Shoulder Elb Surg* 2012;21:647-660.
9. Snyder SJ, Bakh MBJ. *SCOI Shoulder Arthroscopy*. 3rd ed. Philadelphia: Wolters Kluwer Health, 2015.
10. Moga I, Konstantinidis G, Wong IH-B. The safety of a far medial arthroscopic portal for anatomic glenoid reconstruction: A cadaveric study. *Orthop J Sport Med* 2018;6. 232596711879540.
11. Wong IH, Urquhart N. Arthroscopic anatomic glenoid reconstruction without subscapularis split. *Arthrosc Tech* 2015;4:e449-e456.
12. Taverna E, D'Ambrosi R, Perfetti C, Garavaglia G. Arthroscopic bone graft procedure for anterior inferior glenohumeral instability. *Arthrosc Tech* 2014;3:e653-e660.
13. Moga I, Konstantinidis G, Coady C, Ghosh S, Wong IH. Arthroscopic anatomic glenoid reconstruction: Analysis of the learning curve. *Orthop J Sports Med* 2018;6. 2325967118807906.
14. 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;22:286-292.