

Treatment of Failed Latarjet With Arthroscopic Anatomic Glenoid Reconstruction



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Purpose: Various methods have been described for the treatment of anterior shoulder instability with glenoid bone loss. The incidence of recurrent dislocations following surgical intervention is high and, therefore, necessitates a reliable and replicable revision procedure. The purpose of this Technical Note is to describe a method of arthroscopic anatomic glenoid reconstruction using a distal tibial allograft and screw fixation in the setting of a failed Latarjet procedure with significant glenoid bone loss. **Methods:** We describe in detail patient positioning, portal placement, steps of the diagnostic arthroscopy, and graft preparation using imaging and a detailed intraoperative arthroscopic technique. **Level of Evidence:** Level 1, Shoulder; Level 2, Instability.

The Latarjet procedure has been described as having excellent clinical outcomes in the treatment of recurrent anterior shoulder instability, but it remains a procedure that is difficult to revise.¹ A primary open Latarjet procedure requires a high learning curve² because of the proximity of the musculocutaneous and axillary nerves to the subscapularis, which has to be bisected in order to position the coracoid graft appropriately. There are many relevant anatomic landmarks for the Latarjet³ that are important to note so as to avoid palsies and other neurovascular complications. In a revision setting, these landmarks are altered, thereby limiting subsequent surgical options.⁴ There are few techniques describing the revision of a failed Latarjet in the literature; they include the all-arthroscopic Eden-Hybinette procedure⁵ and arthroscopic anatomic glenoid reconstruction.⁶

Variations of the Eden-Hybinette procedure such as suture-button fixation have shown promising outcomes for revising a failed Latarjet procedure.⁷ Additionally, Giannakos and colleagues⁵ developed an all-arthroscopic Eden-Hybinette procedure for failed Latarjet revision but found that 33% of patients experienced poor outcomes resulting from poor graft union. Another study documented 2 accounts of Eden-Hybinette Latarjet revision failure caused by fragmented screws and injury to the ilioinguinal nerve.⁸ All arthroscopic Latarjet procedures have also been shown to be successful in the revision of a primary Latarjet but suffer from requiring a steep learning curve to perform it as well as graft nonunion, weakening of the subscapular muscle and nerve damage.² A novel technique developed by Wong and Urquhart⁶ uses distal tibial allograft (DTA) to reconstruct arthroscopically the anterior rim of the glenoid by employing a far medial portal, the Halifax portal. This arthroscopic anatomic glenoid reconstruction (AAGR) obviates the need for a subscapularis split, circumvents neurovascular structures and preserves the capsulolabral complex.

The objective of this Technical Note is to describe a technique for removing the screws of a failed Latarjet and addressing glenoid bone loss (GBL) while minimizing the risk of damage to neurovascular structures that have been altered by the primary surgery (Video 1). Our aim was to provide a safer and more standardized surgery for addressing hardware complications when reconstructing the glenoid. The surgical procedure is summarized in Table 1, and the pearls and pitfalls of the technique are summarized in Table 2.

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Table 1. Surgical Steps Required to Conduct the Arthroscopic Anatomic Glenoid Reconstruction With a Distal Tibial Allograft in the Setting of a Failed Latarjet Procedure

1. Position patient in a lateral decubitus position at 30°.
2. Place arm in pneumatic arm holder and mark the standard landmarks (Fig. 3).
3. Perform a diagnostic arthroscopy through the posterior portals. Under direct vision, create the anterior and anterosuperior portals.
4. Open the rotator interval using a shaver.
5. Move the arthroscope to the anterosuperior portal.
6. Debride the anteroinferior glenoid using an ablator probe and elevate the capsulolabral tissues using a liberator knife. This exposes the preexisting hardware (Fig. 4A).
7. Hardware is removed from the posterior and anterosuperior portals.
8. The degree of GBL is measured using a graduated probe (Fig. 4E).
9. The DTA is marked and cut from donor tissue; alpha and beta holes are drilled; the holes are tapped, and 2 titanium top-hat washers are inserted. The graft is then loaded onto a double-barrel cannula.
10. The far medial Halifax portal is created by passing a large switching stick from the posterior portal using an inside-out technique. Remain parallel to the glenoid surface, superior to subscapularis, and as lateral as possible to exit skin.
11. Insert 2 half-pipe cannulas through the medial portal, and use a large channel dilator to bluntly dilate the portal hole.
12. Insert the graft through the Halifax portal and use two K-wires to drill through the graft and glenoid fossa.
13. Align the graft using a switching stick to be parallel to the glenoid face (Fig. 6A).
14. Insert 2 34 mm cortical screws from the anterior side over the protruding K-wires. Use a combo screwdriver to tighten the screws through the graft and into the glenoid (Fig. 6B).
15. Reduce the subscapularis tissues back over the glenoid and graft using a switching stick and grasper.
16. Insert 2 1.8 mm double-loaded Q-FIX suture anchors into the anterior glenoid to complete the reattachment of the anterior-inferior labral tissue to the native glenoid (Fig. 6D).

DTA, distal tibial allograft; GBL, glenoid bone loss.

Surgical Technique

Preoperative Assessment

A physical examination of the shoulder is performed to assess instability. Shoulder instability is assessed using the anterior apprehension, Jobe relocation, sulcus, and load-and-shift tests, whereas the integrity of the rotator cuff is gauged by using the empty-can, drop-arm, lift-off, and resisted-rotation tests. Shoulder and

joint hypermobility are measured by a goniometer and assessed using the 9-point Beighton score. Shoulder imaging (Fig 1) consists of anteroposterior and transscapular Y views as well as a computed tomography scan with 3-dimensional reconstruction (Fig 2) to show the nonunion of the graft and the pullout of the screws.

Surgical indications for this procedure are recurrent shoulder instability with significant bone loss and graft nonunion and screw pullout following a previous open Latarjet procedure.

Patient Positioning and Operative Room Setup

To perform this procedure in the lateral decubitus position, a beanbag is placed on the operating table under the patient. The patient is rolled into a lateral position at 30° from vertical and is prepped and draped in the usual aseptic fashion. The right arm is placed in a pneumatic arm holder (Spider 2; Smith & Nephew, Memphis, TN) and is abducted 60° (Video 1). The standard skin landmarks, including the acromioclavicular joint, clavicle, acromion, and scapular spine, are drawn on the patient (Fig 3).

Evaluation and Debridement

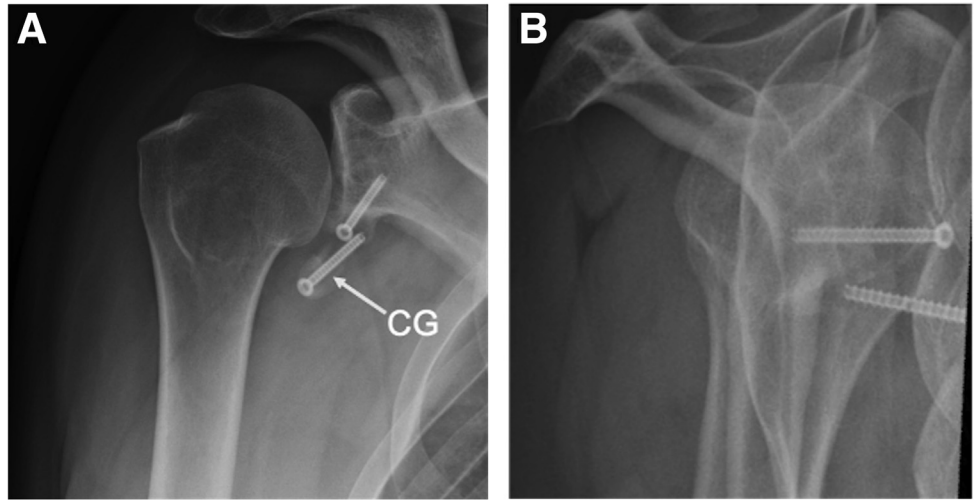
A diagnostic arthroscopy is performed following the establishment of a standard posterior portal.¹⁰ After introducing the posterior portal, the anterosuperior and anteroinferior portals are created using an outside-in technique (Fig 4A). Scarring tissue is typically found surrounding the rotator interval and subscapularis. To address this, a rotator interval excision is performed using an ablator probe, which allows full visualization of the anterosuperior portions of the subscapularis. The labrum and capsular tissues are then mobilized using a labral elevator. By elevating the tissues off of the glenoid fossa, the extent of preexisting hardware and residual graft is more easily visualized (Fig 4B). A cannula is then inserted in the posterior portal to serve as an outflow for maintaining a low intra-articular pressure.

To allow the insertion and fixation of the DTA, existing symptomatic hardware must be removed (Fig 4B). This removal is first attempted through the anteroinferior portal; however, the approach angle does not

Table 2. Pearls and Pitfalls of the Surgical Technique Described

Pearls	Pitfalls
All-arthroscopic procedure that minimizes invasiveness by preserving soft tissue structures	Novel surgical technique that will require operative experience and training
Avoids splitting and compromising subscapularis function	Requires familiarity with the creation of the far medial Halifax portal and the operative planning associated therein
Allows for a custom and flush fit of bone graft within the cavity of glenoid bone loss	Dependent on the availability of frozen cadaveric tibial graft
Provides a mechanical bony augmentation as well as added security from the soft tissue Bankart repair	Cost of distal tibial allograft
Relatively short surgical time and learning curve when compared with similar procedures	

Fig 1. (A) Anteroposterior view showing the nonunited, pulled-off coracoid graft. (B) transscapular Y views of the right shoulder. CG, coracoid graft.



allow screw removal. This issue is remediated by creating a far medial portal called the Halifax portal. The portal is created using an inside-out technique,¹¹ where a large switching stick is passed through the posterior portal, parallel to the glenoid, and advanced superior to the subscapularis (Fig 4B, C, D). This technique ensures that the soft tissue of the subscapularis

muscle is preserved as are the local neurovascular structures. The switching stick is then advanced farther through the deltoid and out the skin. A slotted cannula is then placed into the portal and a large channel dilater is used to dilate the portal bluntly so as to allow the graft to be passed and additional hardware to be removed (Fig 4E). Following hardware removal, an

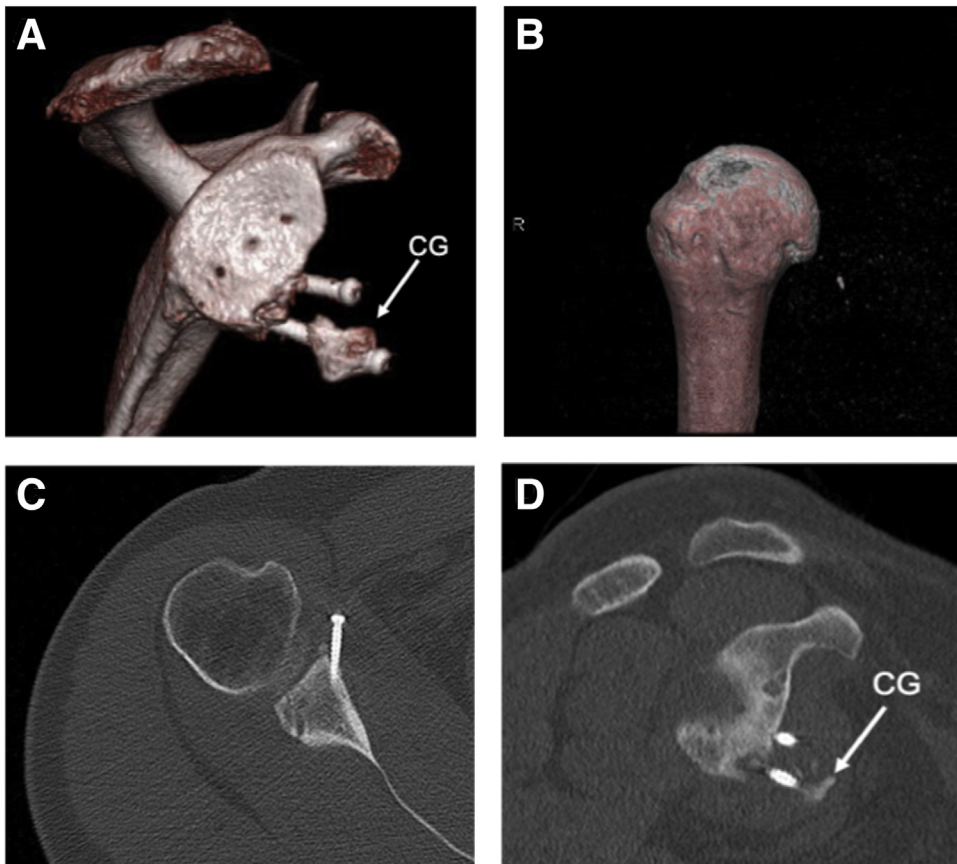


Fig 2. (A-D) Computed tomography scan of the right shoulder. (A) 3-dimensional reconstruction shows the fixation failure and nonunion of the coracoid graft to the glenoid as well as the pullout of the screw. (B) Humeral head showing large Hill-Sachs lesion and screw protrusion (C, D). CG, coracoid graft.



Fig 3. Patient is placed in the lateral decubitus position, and the right arm is secured in a pneumatic arm holder. Standard surgical landmarks are marked with a surgical marker. The sites for portal placement include: 1, posterior portal; 2, anterosuperior portal; 3, anteroinferior portal, 4, far medial portal (Halifax portal).

arthroscopic burr is used to debride the anterior glenoid so as to instigate healthy bleeding bone.

Graft Preparation, Placement and Capsulolabral Repair

A fresh-frozen, nonradiated DTA (Capital District Health Authority Regional Tissue Bank, Halifax, Nova Scotia, Canada) was used for this arthroscopic reconstruction. The graft was measured and cut according to the amount of GBL that was found when using the graduated probe (Fig 4F). The graft was prepared as described by Wong and Urquhart.⁸ The dimensions of the graft were cut to 10mm × 15 mm × 20 mm (Fig 5). Two Kirschner wires (K-wires) are then used with a

guide to drill the alpha and beta holes in the DTA. Once predrilled, a top-hat tap is used to tap the 2 alpha and beta holes, respectively. The 2 top-hat washers are then screwed into the tapped holes, and the DTA is loaded onto a double-barrel cannula with 2 3.5 mm screws. Once the graft is securely fastened to the double-barrel cannula, it is thoroughly irrigated with normal saline to remove all bone dust from the saw.

During the insertion of the graft, the subscapularis is retracted inferiorly using a switching stick from the posterior portal. Two half-pipe cannulas are used to additionally dilate the Halifax portal, which preserves soft tissues as the graft is passed from the outside onto the anterior rim of the glenoid fossa. A large switching

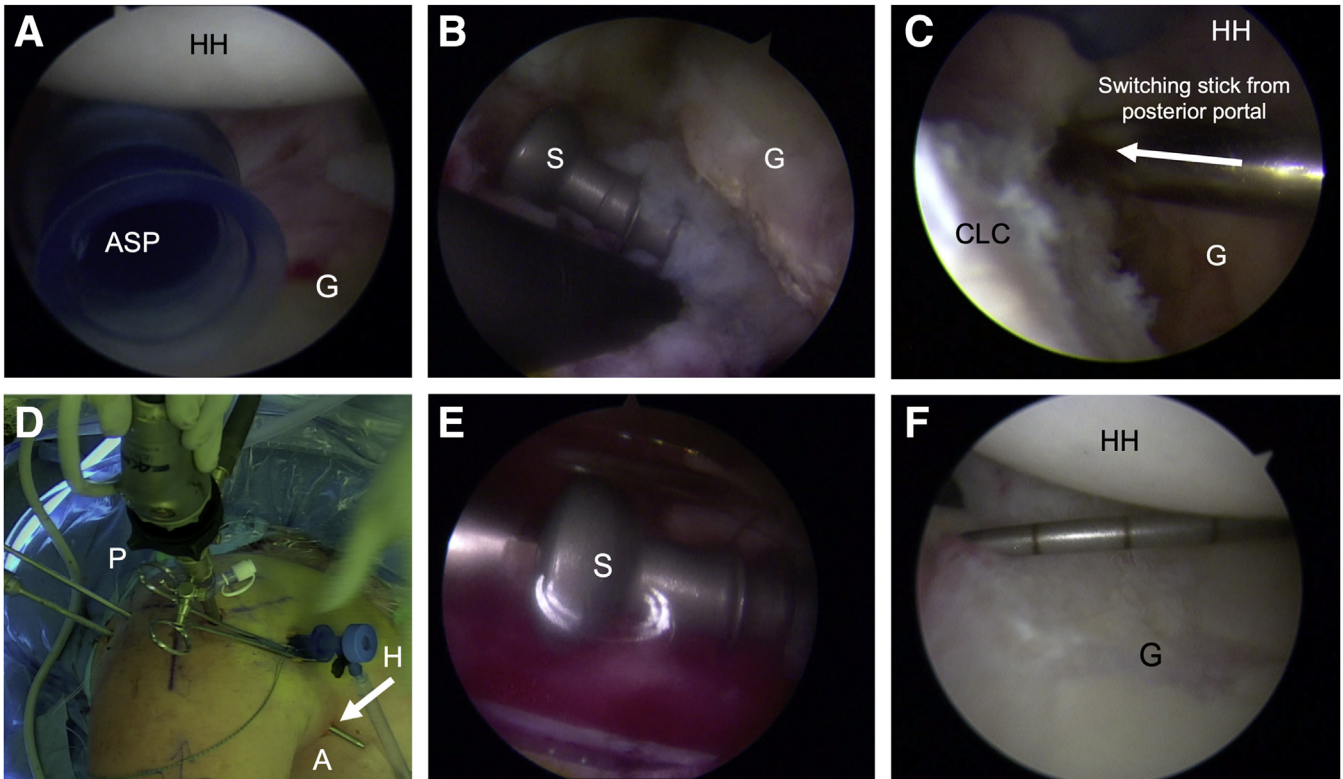


Fig 4. The patient is placed in the lateral decubitus position with the right arm placed in a pneumatic arm hold, viewing from the anterosuperior portal (A-E). A, the creation of the anterosuperior and anteroinferior portals, viewing from the posterior portal. B, the majority of the coracoid graft resorbed, with the screws left protruding. C, D, a far medial portal (Halifax portal) is created using an inside-out technique and a more direct DTA graft insertion. E, The anterosuperior portal allows efficient hardware removal because the screwdriver is parallel to the glenoid fossa. F, A graduated probe is then inserted through the posterior portal to measure the width of the GBL. A, anterior; P, posterior; ASP, anterosuperior portal; CLC, capsulolabral complex; G, glenoid; H, Halifax portal; HH, humeral head; S, screw.

stick is used to align the graft and ensure that it stays level with the glenoid face. Two K-wires are used to drill through the double-barrel cannula. The final position of the graft can be adjusted by alternating removal and redrilling of each of these K-wires until the graft is in the correct position. A calibrated glenoid drill (288241-Glenoid Drill; DePuy Mitek, Raynham, MA) is used to drill through the graft and native glenoid. Two 36 mm-long 4.0 mm cannulated cortical screws (288226 Sterile Latarjet Screw; 34 mm, DePuy Mitek) are inserted over K-wires and used to compress the graft to the native glenoid so the screw tip compresses to the cortex of the distal tibial allograft. The previously elevated subscapularis is then reduced with a switching stick to the native position to cover the front of the graft.

The capsulolabral complex is repaired over the graft and restored to its native position following the standard Bankart-repair technique.⁹ The repair is then viewed through all portals to ensure that the humeral head is centered and stable over the glenoid fossa (Fig 6). This is additionally confirmed by an anterior stress test and a range-of-motion test, respectively.

Discussion

The gold standard of care for cases of anterior shoulder instability with significant GBL has been the open Latarjet procedure. However, this procedure is described as having intraoperative complications, such as graft malpositioning, nerve and vascular injury and a rate of revision surgery reported to be 3.4%.^{10,11} Salvage procedures such as the Eden-Hybinette procedure in the setting of a failed Latarjet have shown promising outcomes but remain challenging; Lunn et al.¹² found that 4 patients in a series of 34 experienced recurrent instability after revision by the Eden-Hybinette procedure. These complications stem largely from the incidence of postoperative arthritis that results from the lack of an articular surface on the iliac crest bone block.¹³ The Eden-Hybinette procedure for revising a failed Latarjet is also technically demanding and incurs increased risk to neurovascular structures. The open Latarjet procedure changes neurovascular anatomy directly by shifting the position of the musculocutaneous nerve in the superior-to-inferior direction while both the musculocutaneous and axillary nerves become medial and inferior to their original

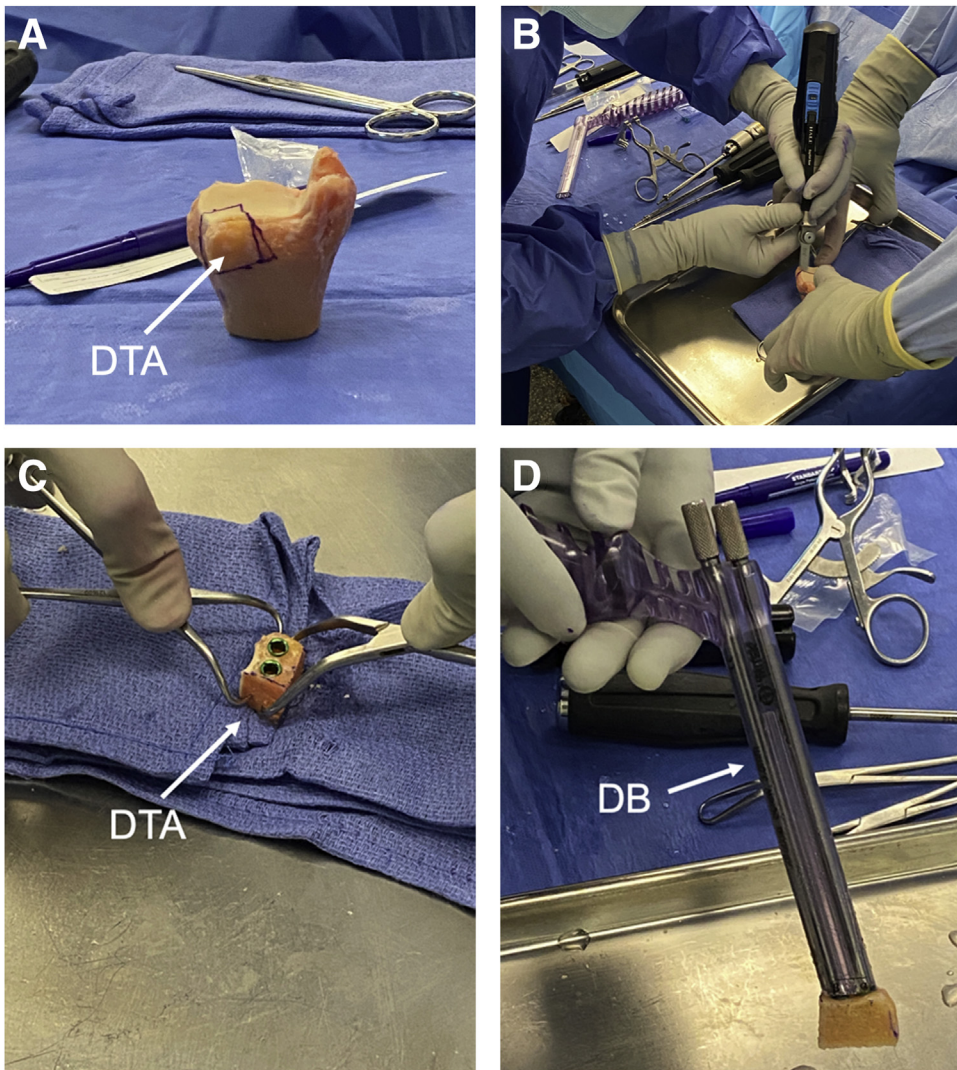


Fig 5. (A-D) Preparation of DTA from frozen donor tissue. A, Operative planning and measurement of GBL influence the measurements of the graft. B, A micro sagittal saw (Hall Micro-power+; ConMed, New York, NY) is used to cut the graft from the distal portion of the tibia. C, Following the cut, the DTA is tapped and 2 titanium top-hat washers are inserted. D, The DTA is loaded onto a double-barrel cannula (DePuy Synthes, Raynham, MA) to be inserted medially through the Halifax Portal. DTA, distal tibial allograft; DB, double-barrel cannula; GBL, glenoid bone loss.

anatomical positions.¹⁴ Therefore, attaining the same exposure during a revision procedure becomes difficult because these nerves have now shifted and become overlapping, and the transferred coracoid may no longer serve as a reference point for avoiding the neurovascular structures medial to the glenoid.¹⁴

The AAGR using a DTA was originally described by Wong and Urquhart in 2015.⁶ It is a novel surgical technique that addresses GBL in cases of anterior shoulder instability. The AAGR technique is reliable and has a faster learning curve and a lower complication rate than the arthroscopic Latarjet,² which allows reproducibility with high fidelity. The arthroscopic nature of the procedure allows the graft to be positioned at the desired location and also ensures that it remains flush with the anterior glenoid surface.¹⁵ Furthermore, the lateral decubitus positioning of the patient allows for increased joint visualization, access to the labrum

and working space for instrumentation.^{16,17} Wong et al.¹⁸ found a 100% graft-union rate and promising short-term clinical outcomes at the 2-year timepoint. The AAGR also minimizes invasiveness by avoiding a split and potential loss of function in the subscapularis by introducing the far medial Halifax portal. Moreover, the DTA contains dense, weight-bearing cortico-cancellous bone and a cartilaginous surface, which is ideal for screw fixation and graft integration.¹⁹

The main advantages of this arthroscopic technique include the preservation and circumventing of an additional subscapularis split and avoidance of neurovascular structures, namely the musculocutaneous and axillary nerves.²⁰ This is facilitated by using the Halifax portal, which preserves the subscapularis.⁶ The AAGR procedure also preserves and repairs the labrum and capsular tissues, which further augments the stability produced by the bone graft. The additional

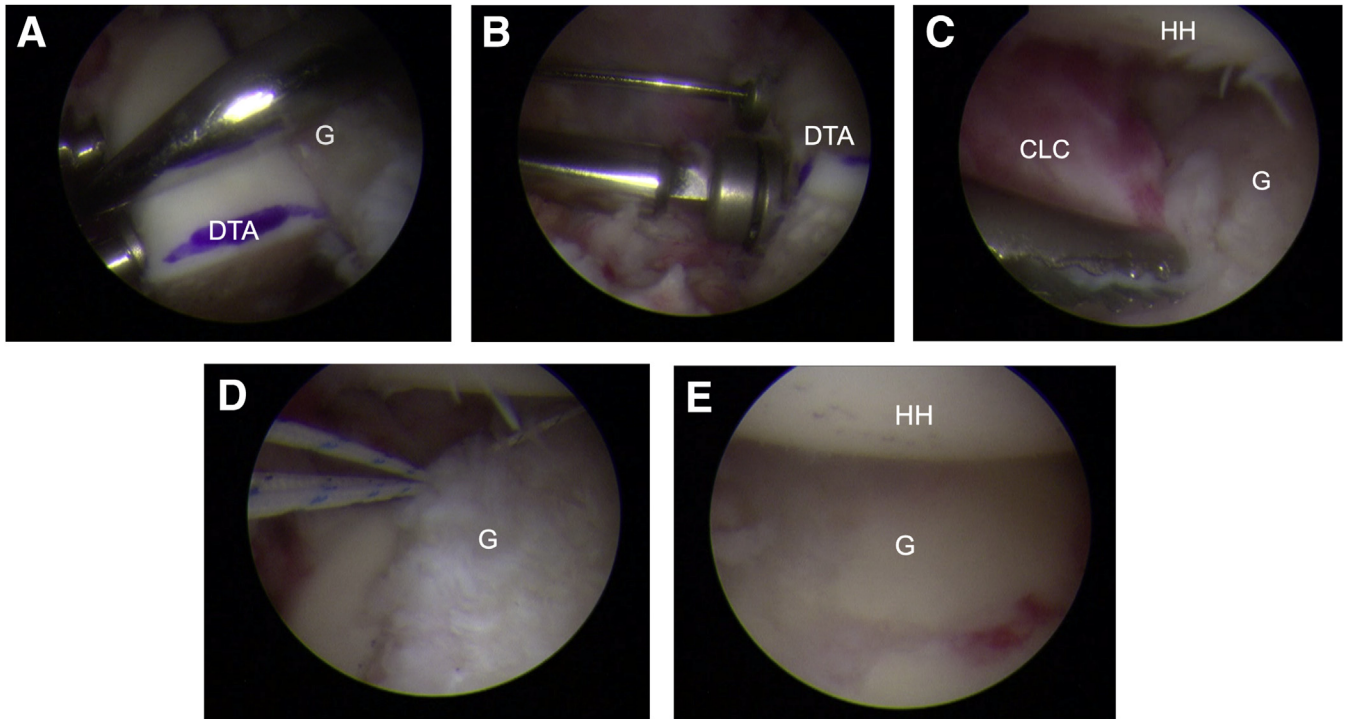


Fig 6. Viewed from the anterosuperior portal, the patient is in a semilateral decubitus position, and the right arm is abducted at 60°. A, Large switching stick is used to position the DTA to be level with the anterior rim of the glenoid fossa. B, Combo screwdriver (Smith & Nephew, Memphis, TN) is tightening the beta 34 mm screw while the guiding K-wire remains in the alpha screw hole. C, The subscapularis (SubScap) is reduced by using a grasper back into the native position over the DTA. D, Two 1.8 mm double-loaded suture anchors (Q-FIX; Smith & Nephew, Memphis, TN) are used to complete the Bankart repair of the labrum. E, The final view shows the centered humeral head over the glenoid fossa following a capsulolabral repair. CLC, capsulolabral complex; DTA, distal tibial allograft; G, glenoid; HH, humeral head.

capsulolabral repair and subsequent shift of the capsulolabral complex restores both the glenoid surface and the soft-tissue anatomy of the shoulder, which makes AAGR using DTA and screw fixation a promising revision technique in the setting of a failed Latarjet

procedure. Additional risks and limitations of the technique are summarized in Table 3.

Table 3. Additional Risks and Limitations of the Arthroscopic Anatomic Glenoid Reconstruction in the Setting of a Failed Latarjet Procedure

Risks	Limitations
There are no additional risks to this technique when compared to an open Latarjet procedure. The risks are mitigated due to the far medial Halifax portal, which allows preservation of the subscapularis during graft insertion.	Reduced soft-tissue quality for the subsequent Bankart repair due to the primary Latarjet procedure Surgeons' skills and training are required to perform this procedure.

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