Technical Note

Arthroscopic Anatomic Glenoid Reconstruction in Lateral Decubitus Position Using Allograft With Nonrigid Fixation

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Abstract: Recurrent shoulder instability is highly associated with glenoid bone loss. Traditionally, bony procedures to address this bone loss have described nonanatomic, coracoid transfer procedures. More recently, anatomic glenoid reconstruction procedures have been described. These were first described as open procedures, and subsequently there have been several arthroscopic procedures described. We provide a description of an arthroscopic anatomic glenoid reconstruction approach with allograft.

The glenohumeral joint has the greatest range of motion of any joint in the body. Accordingly, it is also the most frequently dislocated joint.[1] Its anatomy consists of both bony and soft tissue components that contribute to providing a delicate balance between mobility and stability. Dislocation can result in injury to soft tissue as well as the bony structures that stabilize the glenohumeral joint.[2] Recurrent shoulder instability is a common problem encountered after traumatic dislocation.[3]

Glenoid bone loss can be present after a single shoulder dislocation and is even more common in cases of recurrent instability.[4,5] Soft tissue procedures performed in the presence of significant bone loss have demonstrated unacceptably high recurrence rates.[6,7] Conversely, procedures that address bony pathology have demonstrated excellent results.[8]

Anatomic glenoid reconstruction procedures have been described via open procedures,[9,10] and more recently via arthroscopic techniques.[11,12] We describe an arthroscopic transglenoid suture fixation technique performed in the lateral decubitus position using allograft. In this technique, we place a free suture in the labrum to help with labral manipulation, glenoid visualization, and finally Bankart repair. Several advantages and disadvantages, as well as potential complications associated with the procedure, are listed in Table 1.

Technique

Preoperative Assessment

The patient underwent a thorough preoperative assessment (Table 2).

Patient Positioning

The patient was positioned in the lateral decubitus position using a vacuum bean bag positioner. We allowed the patient to rotate back approximately 30° so that the glenoid surface is parallel to the floor. We placed a bolster to support the scapula. The left arm was placed in a pneumatic limb positioner (Spider 2; Smith & Nephew, Memphis, TN) and abducted 60° (Fig 1A and Video 1).

Portal Placement and Diagnostic Arthroscopy

Bony landmarks (scapular spine, acromion, acromioclavicular joint, clavicle, and coracoid process) were identified and marked on the patient (Fig 1B). Diagnostic arthroscopy was carried out through a standard

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Table 1. Advantages, Disadvantages, and Potential Complications of Arthroscopic Allograft Reconstruction With EndoButton

Advantages:
• Reduced patient morbidity without graft harvest
• Graft available for repeat procedure if needed
• Avoids reoperation for symptomatic hardware/screw removal
• Better able to tailor graft to size/shape of native glenoid
• Potentially shorter surgical time without graft harvest
Disadvantages:
• Cost of allograft
• Availability of allograft
• Technically challenging procedure
Potential complications:
• Graft resorption
• Nonunion
• Recurrent instability

posterior portal. This allowed direct visualization of the bony deficit identified on preoperative imaging. Anteroinferior and anterosuperior portals were created with an outside-in technique under direct visualization from the posterior portal. Cannulas were placed to maintain each portal.

Glenoid Preparation

A suture passer (Spectrum II; ConMed, Utica, NY) was placed through the anteroinferior portal and a traction suture was placed around the anterosuperior labrum using a standard technique (Fig 2). This suture assisted in control and subsequent manipulation of the labrum. It was also used to help secure the Bankart repair at the end of the case. The arthroscope was then placed through the anterosuperior portal. The labrum was controlled with the previously placed suture and the glenoid rim was prepared with instruments placed through the anteroinferior portal. First, any exposed hardware from a prior stabilization surgery was removed. Next, a labral knife was used to free any labral adhesions to the glenoid rim and neck. Soft tissues were further debrided with a shaver. Finally, we debrided and decorticated the anteroinferior rim of the glenoid with a burr (Stonecutter; Smith & Nephew) to give us healthy, bleeding cancellous bone (Fig 3).

Graft Preparation

The graft was prepared from distal tibia allograft. We harvested a section of bone from the posterolateral aspect of the tibial plafond (Fig 4). The measurement of our prepared graft was 20 x 10 x 15-mm (20 mm posterior-anterior, 10 mm lateral-medial, 15 mm distal-proximal). However, this should be tailored based on the defect size as determined on both preoperative imaging, as well as after direct visualization and measurement during the diagnostic part of the procedure. We drilled 2 holes in our allograft 10 mm apart using a 2.8-mm drill. These were parallel to the articular surface of the tibial plafond. Sutures with a round EndoButton (Smith & Nephew) were placed through each hole, which were used to secure the graft to the glenoid.

Transglenoid Tunnel Placement

We drilled transglenoid tunnels for the sutures. A double-barrel bullet drill guide (Double Glenoid Drill Guide; Smith & Nephew) was placed through the posterior portal (Fig 5). The main arm of the guide was passed across the articular surface of the glenoid to hook the anterior glenoid margin at the 3-o'clock position (Fig 6). A small skin incision was made medial to the posterior portal to allow the 2 bullet drill guides to be advanced to the posterior glenoid.

We drilled 2 holes from the posterior glenoid to the anterior glenoid with a 2.8-mm drill, exiting at the site of bone defect. Then, we passed a 2-mm monofilament wire anteriorly through each of these holes (Fig 7). The monofilaments were then retrieved through the anteroinferior portal and taken out through the skin to prepare for graft passage.

Suture Anchor Placement

Suture anchors (double-loaded Q-FIX; Smith & Nephew) were drilled and placed into the native glenoid to prepare for soft tissue repair after our bony reconstruction was complete. Two anchors were placed through the anteroinferior portal, and the suture tails were retrieved through the posterior cannula for suture management.

Graft Passage

The anteroinferior portal was dilated to allow passage of the bone graft (Fig 8). Suture tails from the EndoButton suture in the graft were placed through the monofilaments. The monofilaments were then used to pass the sutures through the transglenoid tunnels and retrieved through the posterior portal. Tensioning these sutures allowed anatomic reduction of the graft. A switching stick placed through the posterior portal was used as a guide to assist in proper placement and to ensure there was no lateralization of the graft (Fig 9).

Table 2. Preoperative Assessment for Shoulder Instability

• Full history and physical examination including history initial dislocation, subsequent dislocations, and treatment to date
• Focused physical examination for instability, including assessment of Beighton score, assessment of rotator cuff, and special tests for instability: apprehension test, relocation test, load and shift test, and assessment of sulcus sign
• Radiographs including anteroposterior glenohumeral joint, scapular Y-view, axillary view, and Bernageau view
• CT with 3-dimensional reconstructions to better assess bone loss
• Consider MRI to assess labral pathology and rotator cuff integrity

CT, computed tomography; MRI, magnetic resonance imaging.

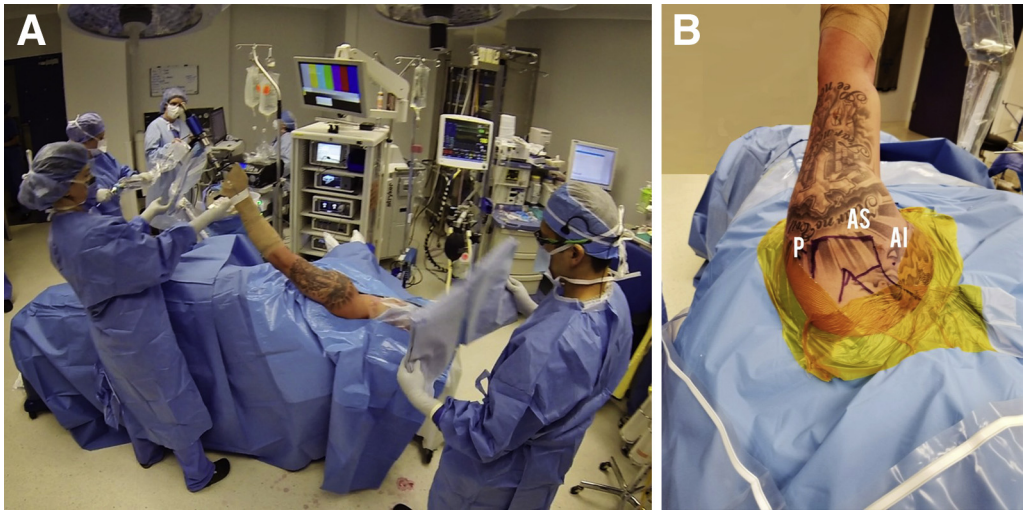

Fig 1. (A) The patient is positioned in the lateral decubitus position (left shoulder). (B) Skin markings for standard shoulder arthroscopy portals (left shoulder). (AI, anteroinferior portal; AS, anterosuperior portal; P, posterior portal.)

An EndoButton was placed posteriorly, and the graft was secured using a Nice knot for each suture.[12] The graft was then compressed with a force of 100 N using a tensioning device and further secured with 3 half-hitch knots (Fig 10).

Bankart Repair

We repaired the labral complex to the native glenoid with our previously placed suture anchors using standard Bankart techniques. A knotless suture anchor (Bioraptor; Smith & Nephew) was also placed in the glenoid to secure the traction suture placed at the beginning of the case. All instruments were removed, and the shoulder was examined to ensure stability.

Postoperative Management

Instructions were given for postoperative rehabilitation (Table 3).

Discussion

This Technical Note provides several pearls/new concepts to add to currently published literature. We describe the placement of a free traction suture in the labrum to provide better control throughout the case, in a manner similar to Kalogrianitis et al.[13] This suture can subsequently be used to augment the Bankart repair at the end of the case. Additionally, this note provides the description of a transglenoid suture technique performed in the lateral decubitus position and also the use of allograft (Table 4).

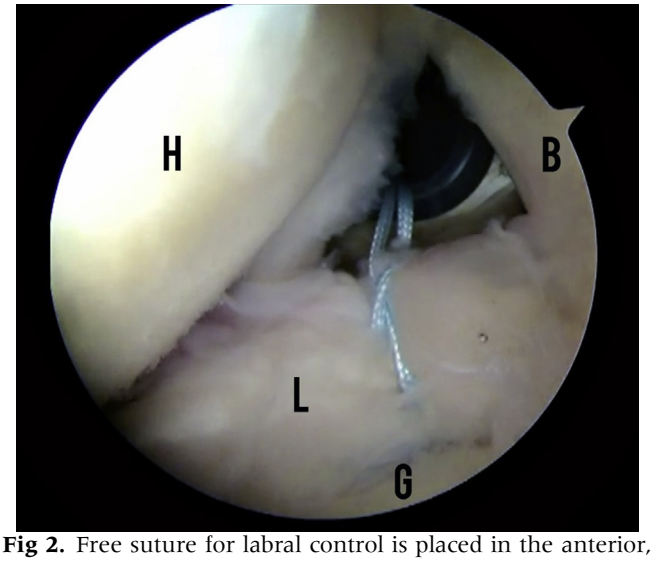

Fig 2. Free suture for labral control is placed in the anterior, superior labrum (left shoulder, as viewed from posterior portal). (B, biceps; G, glenoid; H, humerus; L, labrum.)

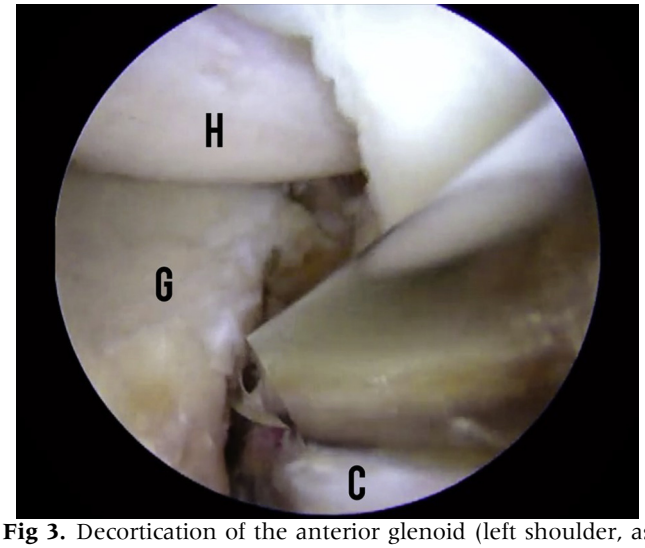

Fig 3. Decortication of the anterior glenoid (left shoulder, as viewed from the anterosuperior portal). (C, capsule; G, glenoid; H, humerus.)

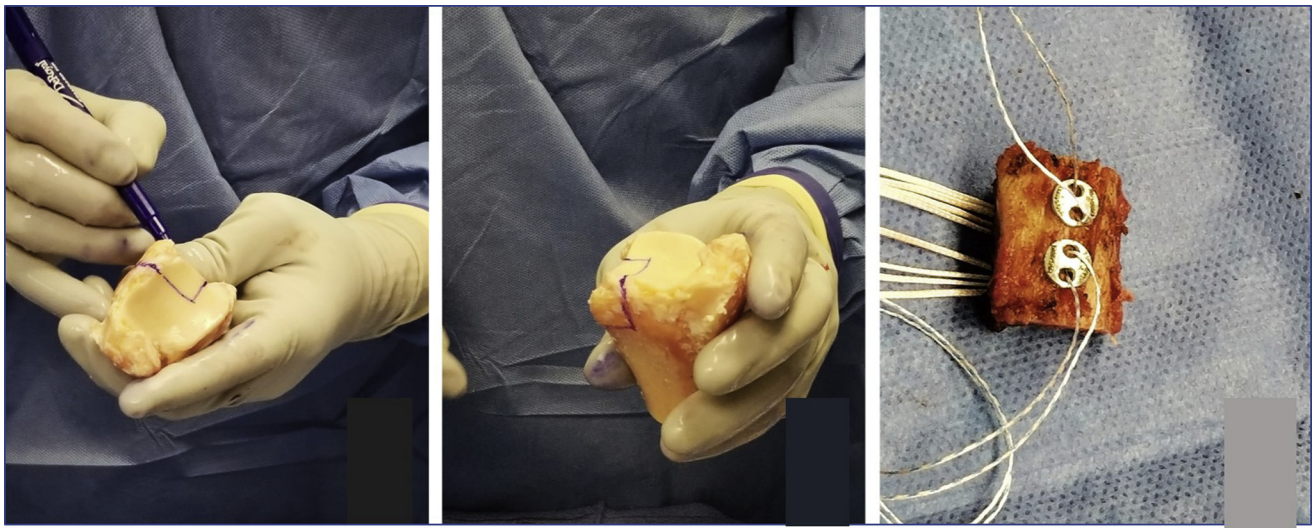

Fig 4. A 20 x 10 x 15-mm graft is prepared from the distal tibia allograft.

Risks and Complications

General risks that have been previously reported for shoulder arthroscopy would apply to this technique as well.[14] There are also several risks specific to this procedure.

Reoperation for hardware removal has been identified as a complication in both coracoid transfer procedures[15-17] and anatomic glenoid reconstruction.[18] Graft resorption is a common occurrence in both of these procedures.[19-24] This may contribute to symptomatic hardware. In light of this, we hypothesize that the nonrigid-fixation EndoButton technique will result in lower rates of symptomatic hardware and reoperation.

As with any bone grafting procedure, there is a risk of nonunion with this procedure. However, there is only 1 study that has reported any cases of nonunion after an arthroscopic anatomic glenoid reconstruction.[18] All other studies that report on union have found 100% union rates,[23-27] which would be consistent with our experience to date.

Recurrent shoulder instability is another possible complication following anatomic glenoid reconstruction. Review of the published literature on

Fig 5. Bullet drill guide is positioned posteriorly (left shoulder).

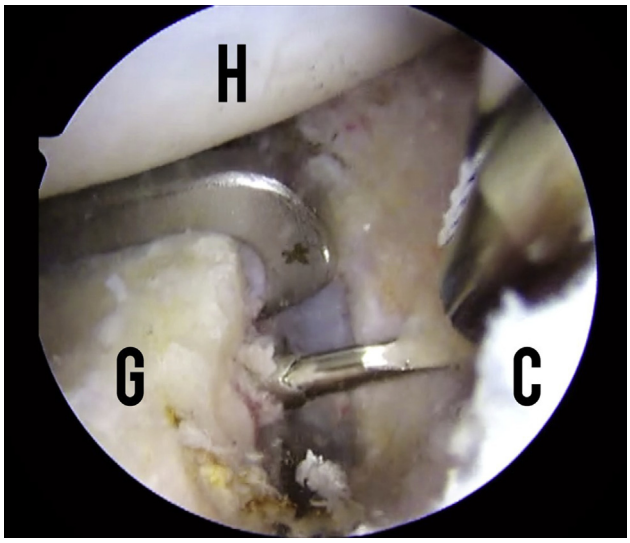

Fig 6. Transglenoid tunnel is drilled (left shoulder, as viewed from the anterosuperior portal). (C, capsule; G, glenoid; H, humerus.)

Fig 8. Passing the bone graft through the anteroinferior portal. (left shoulder, as viewed from above). (AI, anteroinferior portal; AS, anterosuperior portal; P, posterior portal.)

arthroscopic anatomic glenoid reconstruction identifies only a single patient with postoperative dislocation.[26] We have not had any patients experience postoperative instability.

Limitations

There are several limitations of this technique. The use of allograft has advantages, including elimination donor site morbidity,[28] as well as availability for repeat procedures. However, allograft may not be available at all centers, and can add additional cost to the surgery.

This arthroscopic technique is technically challenging, and the learning curve is unknown. Furthermore, it is a new technique and the long-term outcomes are not known. We have had no complications and excellent short-term outcomes as of this

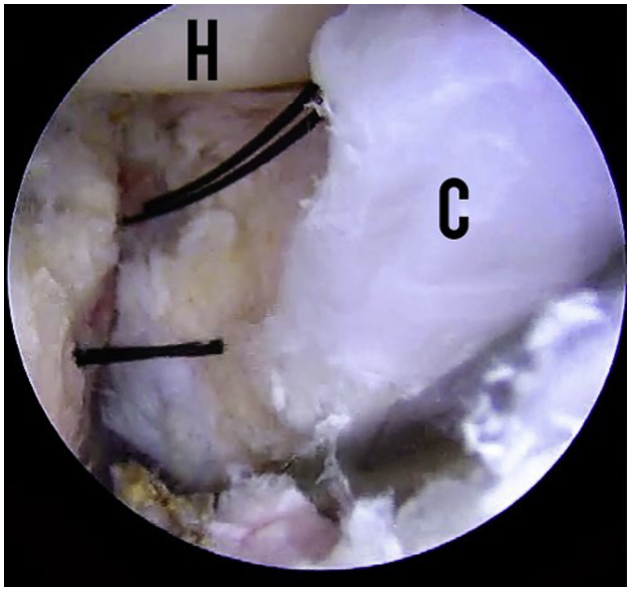

Fig 7. Monofilament is passed through the transglenoid tunnel (left shoulder, as viewed from the anterosuperior portal). (C, capsule; H, humerus.)

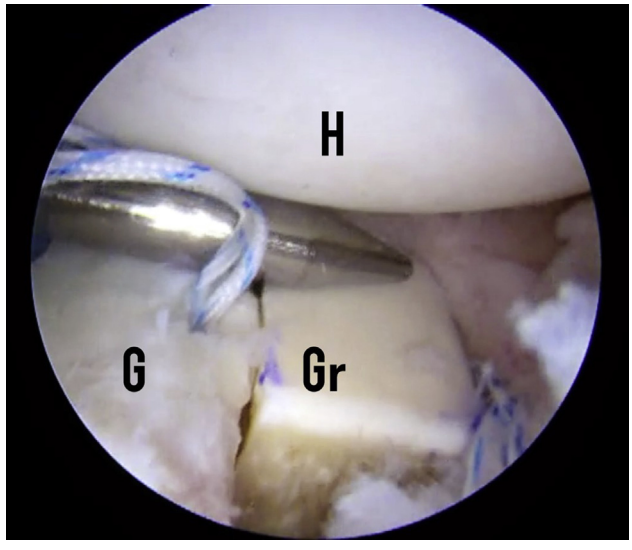

Fig 9. A switching stick is passed from the posterior portal to ensure that the graft is not lateralized (left shoulder, as viewed from the anterosuperior portal). (G, glenoid; Gr, graft; H, humerus.)

Fig 10. A tensioner is used to secure the graft with appropriate force of 100 N. (left shoulder, as viewed from above). The white arrow head indicates the tensioner. (AS, anterosuperior portal; P, posterior portal.)

writing; however, long-term results are not yet available.

Good outcomes have been shown with open procedures for bony augmentation.[9,29] Although arthroscopic procedures for anatomic glenoid reconstruction have only been described in recent years, early results have shown promising outcomes and results comparable to open procedures.[24,26,30]

We feel that this article provides a minimally invasive technique that is expected to provide good results, consistent with prior described techniques. As discussed earlier, the use of nonrigid fixation may even lead to lower rates of reoperation. This technique also preserves the majority of the native anatomy and avoids the placement of screws through the glenoid, which would decrease the complexity of future surgery, if required.

We feel that the described technique may provide better visualization through patient positioning in the lateral decubitus position, as well as labral manipulation with a free suture. We hypothesize that this could result in easier surgery, shorter operative time, more reproducible results, and fewer complications.

Table 3. Postoperative Rehabilitation for Arthroscopic Anatomic Glenoid Reconstruction

- 0-2 weeks: immobilization in sling with ROM exercises for wrist and elbow, with some very early passive shoulder ROM exercises started at initial physiotherapy visit on postoperative day 5
- 2-6 weeks: pendulum and gentle passive ROM exercises
- 6-12 weeks: active ROM, light strengthening, discontinue sling
- 12 weeks: continue ROM and progressive strengthening exercises

ROM, range of motion.

Table 4. Tips and Tricks for Arthroscopic Allograft Reconstruction With EndoButton

- Pass bone graft through dilated anteroinferior portal with heavy grasper.
- Place a free suture in the labrum for manipulation and improved visualization.
- Place suture anchors before graft is stabilized to avoid disrupting sutures to graft with drill.
- Use 2 tensioners simultaneously when securing graft to ensure graft remains well seated.

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