Technical Note

Arthroscopic Double-Bone Block Cerclage for Bipolar Glenoid Bone Loss

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Abstract: Glenoid bone loss is a risk factor for recurrent glenohumeral instability. Various techniques exist for glenoid bone graft augmentation, mostly relying on metallic hardware fixation. However, few data are available on traumatic instability with bipolar bone loss. We describe an all-arthroscopic double-bone block cerclage technique, using 2 tricortical iliac crest autografts, for bidirectional traumatic glenohumeral instability with bipolar glenoid bone loss.

Glenoid bone loss is a recognized risk factor for recurrent glenohumeral instability after shoulder dislocation, especially if not addressed properly.[1] Several surgical techniques have been described; coracoid (Latarjet) or iliac crest (Eden-Hybinette) bone block transfers are the most popular.[2] Although a variety of other free bone block procedures are available, including various allograft and even equine xenograft procedures,[3,4] most reconstruction techniques rely on fixation with metallic screws, bioabsorbable screws, and EndoButtons (Smith & Nephew, Andover, MA).[5-7] Recently, Hachem et al.[8,9] have proposed a metal-free, all-suture arthroscopic reconstruction technique for treating unidirectional isolated anterior or posterior bone loss. The purpose of this article is to describe our surgical technique for bidirectional traumatic glenohumeral instability with bipolar glenoid bone loss, consisting of all-arthroscopic double-bone block cerclage (Video 1).

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Surgical Technique

The patient undergoes general anesthesia combined with an interscalene block, and intravenous antibiotic prophylaxis is administered. The patient is initially placed in the supine position for bilateral iliac crest graft harvesting. To save time, 2 surgical teams work simultaneously to harvest 2 bone grafts measuring roughly 2.5 cm long × 1.5 cm high × 1 cm wide (Fig 1A). The main surgeon prepares the bone blocks on the back table, while the second surgical team closes and dresses the wounds. The concave side of the graft is identified as the future articular side and marked with ink (Fig 1B). The grafts are then predrilled using a double-barrel 3-mm guide with a 7-mm-offset Arthrex drill guide (Naples, FL) (Fig 2).

The patient is placed in the beach-chair position with the arm in slight traction using a Trimano arm holder (Arthrex). The portals are marked, consisting of posterior, posterolateral, anterolateral, and anterior portals (Fig 3). A complete diagnostic joint workup is carried out through a posterior viewing portal using a 3.5-mm 30° oblique arthroscope, confirming bipolar bone loss on the glenoid and any other associated lesions.

The anterolateral portal is placed using a spinal needle to confirm correct positioning and direction toward anteroinferior, and a solid 8.25 × 7-mm cannula is inserted. The labrum is then mobilized using a rasp and elevated with a traction stitch to allow proper exposure and access to the anterior glenoid, and the anterior glenoid rim is predrilled for future labral repair (Fig 4 A-C). It is important to carry out this step before placing the bone block suture cerclage to avoid damaging it with the drill.

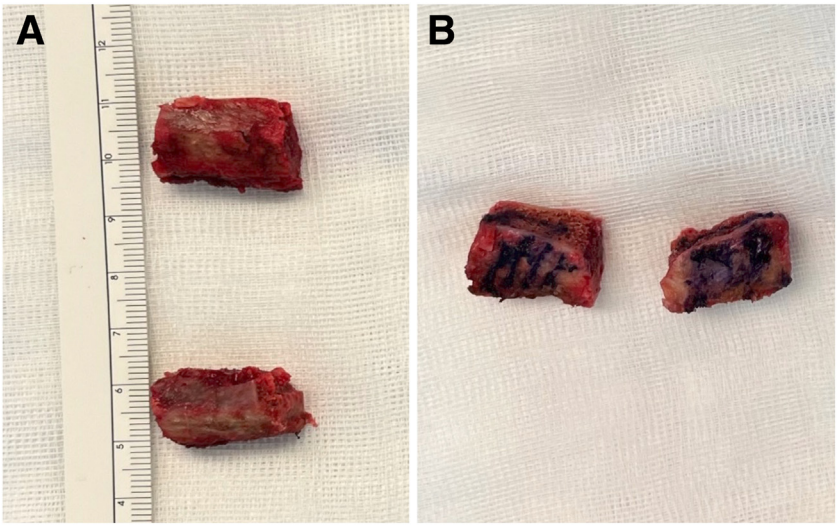

Fig 1. (A) Two iliac crest bone grafts are harvested, roughly measuring 2.5 cm long × 1.5 cm high × 1 cm wide. (B) The most convex side is marked with ink to facilitate further intra-articular visualization.

The arthroscope is now placed through the anterolateral portal and will remain there until the end of the bone block procedure. The anterior glenoid is prepared with a high-speed burr to remove any bony fragments and obtain a flat bleeding bed for the bone graft (Fig 4D). The exact same steps are carried out for the posterior glenoid through the posterolateral working portal; the posterior labrum is mobilized and elevated with a traction stitch, the posterior glenoid surface is burred, and the posterior glenoid rim is predrilled for future labral repair (Fig 5).

Fig 2. Preparation of iliac crest bone block on back table, which is predrilled using a 7-mm offset guide from the identified future articular surface. The asterisk indicates the drill guide.

A new posterior portal is placed using a spinal needle parallel to the glenoid plane with a slightly inferior direction to ensure an equatorial position for the posterior bone block and a subequatorial position for the anterior bone block (Fig 6 A and B). The anterior and posterior portals are widened, and the soft tissues are bluntly spread, with care taken to horizontally split the deep muscle fascia. A finger should be able to be inserted all the way into the joint to make sure sufficient clearance is obtained. The Arthrex TransGlenoid Drill Guide Hook is now inserted, and the glenoid is drilled from posterior to anterior with two 3-mm cannulated drills (Fig 6C). Direct visualization of the exit point is essential to avoid overdrilling into the subscapularis and anterior neurovascular structures (Fig 6D). Two nitinol loops are passed through the cannulated drills and recuperated through the anterior incision, and the drills are then removed.

Two FiberLink sutures (Arthrex) are shuttled through the nitinol wires, the superior one with the loop posterior and the inferior one with the loop anterior (Fig 7). Two FiberTape cerclages (FiberTape and TigerTape sutures; Arthrex) are passed through the posterior bone block (Fig 8A), shuttled through the superior FiberLink from posterior to anterior (Fig 8B), passed through the anterior bone block (Fig 8C), shuttled back through the inferior FiberLink from anterior to posterior, and finally, shuttled through the posterior bone block (Fig 8D). A small Wedged Profile Plate (Arthrex) can be placed posteriorly to protect the posterior bone block when tensioning the cerclages (Fig 8A). If there is concern about bone quality, a second plate can be added anteriorly in the same way. A frame construct incorporating both bone blocks that can be assembled posteriorly should thus be created (Fig 9). The anterior bone block is inserted first through the anterior incision

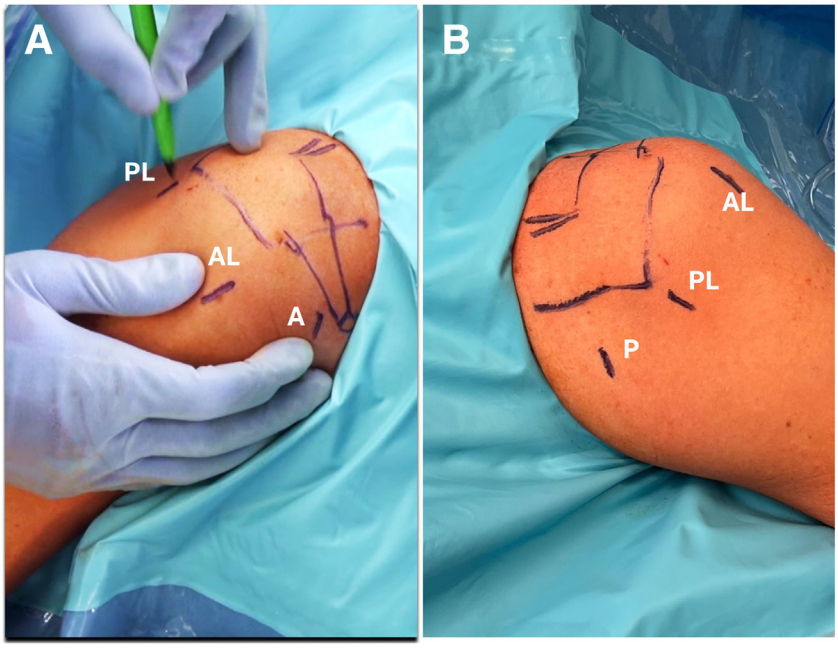

Fig 3. Right shoulder installed in beach-chair position from front (A) and back (B). The arthroscopic portals are marked on the skin. (A, anterior; AL, anterolateral; P, posterior; PL, posterolateral.)

with the help of a clamp and the cerclages to pull it toward the anterior glenoid. A switching stick can be helpful to guide and rotate the graft properly. The posterior bblock and the posterior plate are then inserted through the posterior incision in the same way. Verification of the proper final position of the bone blocks is performed (Fig 10). The 2 FiberTape cerclages are assembled and fed through a Tensiometer

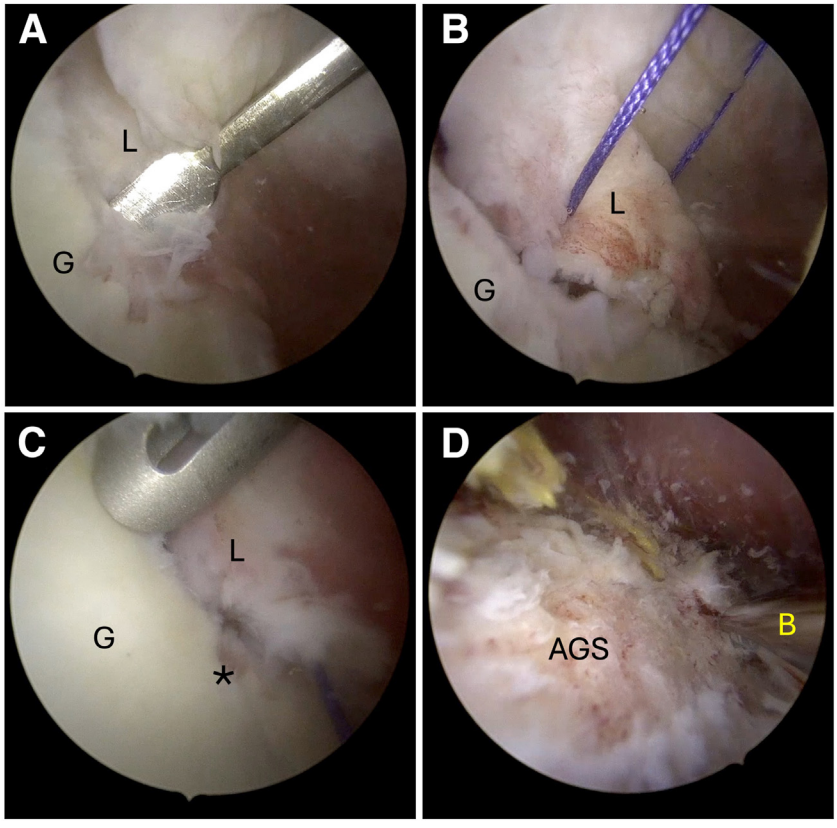

Fig 4. Arthroscopic views of right shoulder through posterior viewing portal in beach-chair position. (A) A rasp is used to mobilize the labrum from the glenoid. (B) A traction stitch is passed into the labrum to mobilize it away from the glenoid. (C) The labrum is freed and pulled away from the glenoid. The asterisk indicates the glenoid drill hole at the 5-o'clock position. (D) The anterior glenoid rim is predrilled for future labral repair and anchor placement. (AGS, anterior glenoid surface; B, burr; G, glenoid; L, labrum.)

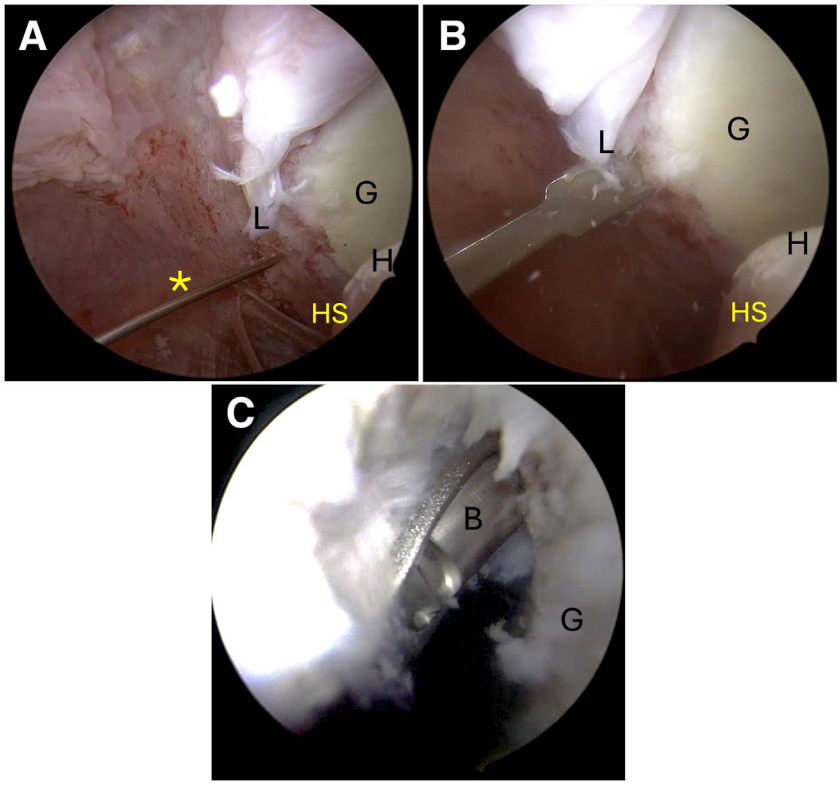

Fig 5. Arthroscopic views of right shoulder through anterolateral viewing portal in beach-chair position. (A) A spinal needle (asterisk) is used to place the posterolateral working portal. (B) The posterior labrum is mobilized with a rasp. (C) The labrum is retracted with a stitch to allow access and burring of the posterior glenoid flat. (B, burr; G, glenoid; H, humerus; HS, Hill-Sachs lesion; L, labrum.)

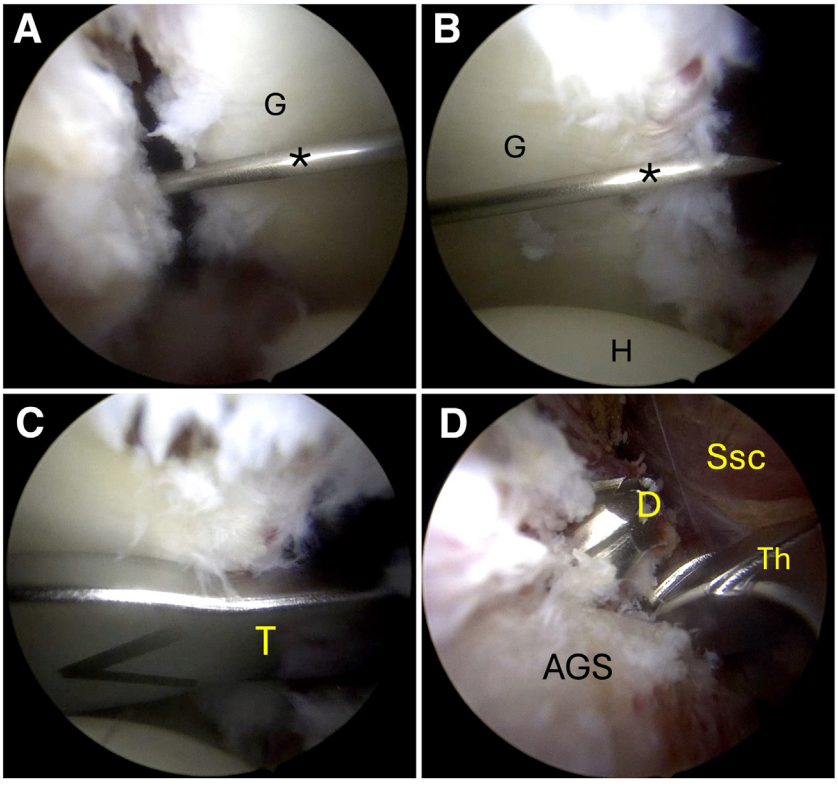

Fig 6. Arthroscopic views of right shoulder through anterolateral viewing portal in beach-chair position. (A, B) A spinal needle (asterisks) is inserted from a posterior-to-anterior direction to create a new posterior portal. This must be strictly parallel to the glenoid with a slightly downward direction. (C) An Arthrex TransGlenoid Guide with 7 mm of offset is inserted through the newly created posterior portal. (D) The glenoid is drilled with two 3-mm cannulated drill bits under direct visualization to avoid over-drilling into the subscapularis seen anteriorly. (AGS, anterior glenoid surface; D, drill bit; G, glenoid; H, humerus; Ssc, subscapularis muscle; T, TransGlenoid Guide; Th, TransGlenoid Guide Hook.)

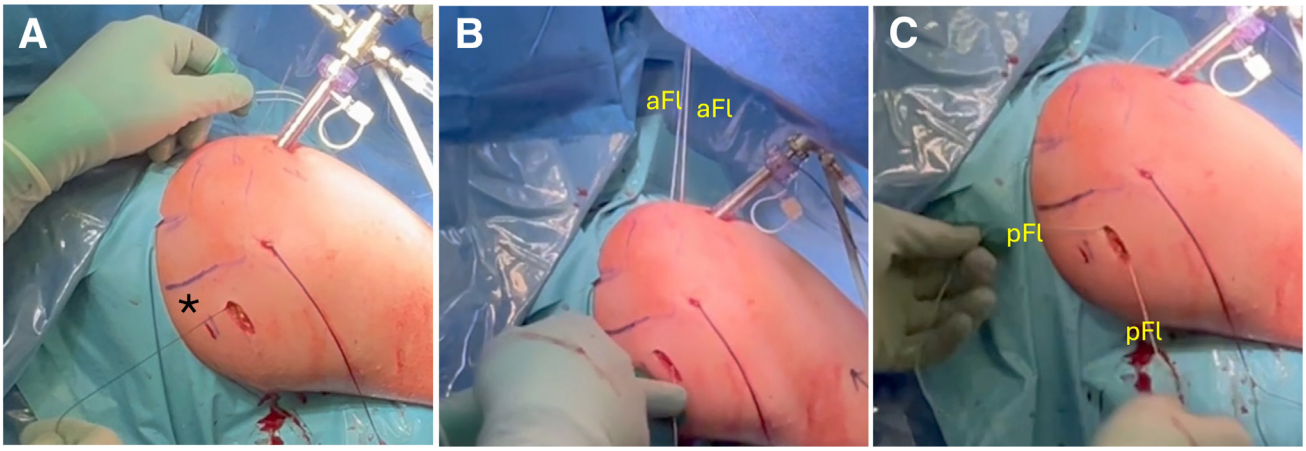

Fig 7. Right shoulder in beach-chair position from back. (A) Nitinol loops (asterisk) have been passed through the subsequently removed cannulated drills and retrieved anteriorly. (B, C) Two FiberLinks are shuttled through the superior and inferior glenoid tunnels. The superior FiberLink loop is kept posteriorly, and the inferior one is kept anteriorly. (aFl, anterior FiberLink limbs through anterior portal; pFl, posterior FiberLink limbs through posterior portal.)

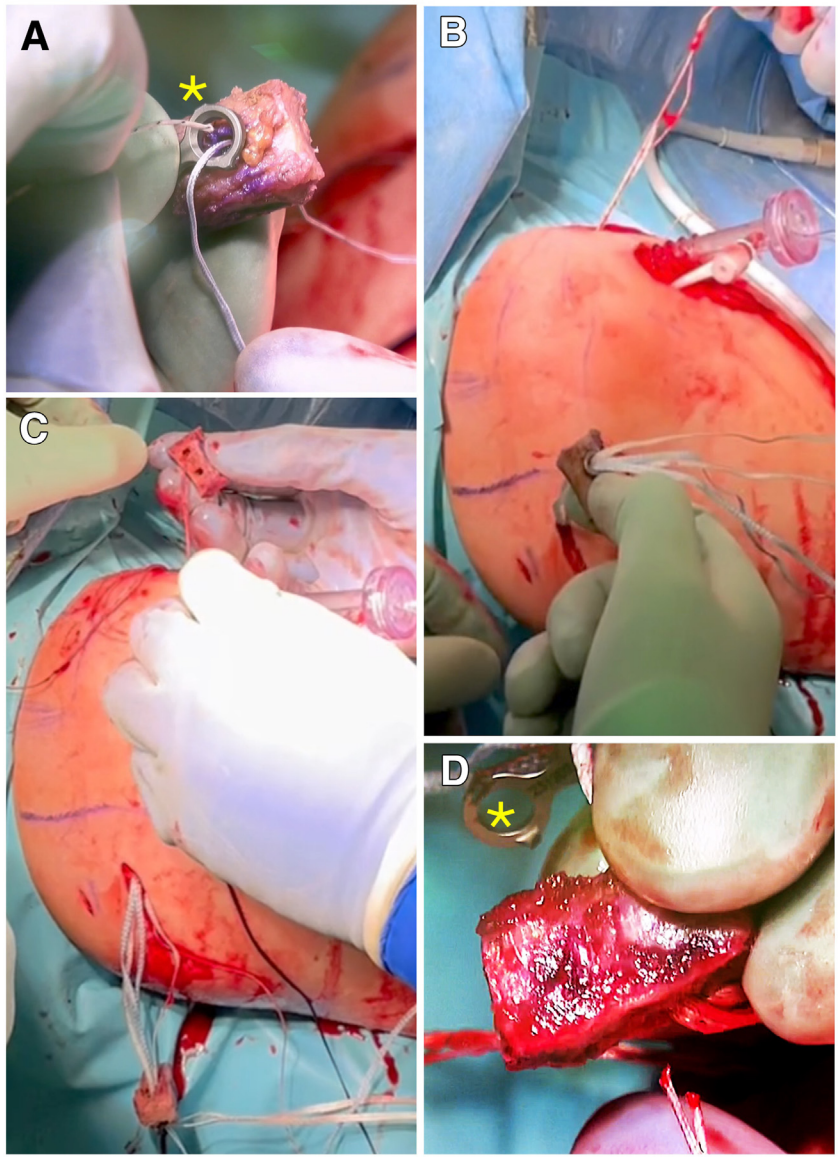

Fig 8. Right shoulder in beach-chair position from back, showing assemblage sequence of double-block cerclage. The 2 FiberTape cerclages are passed through the posterior bone block (A), are shuttled anteriorly and passed through the anterior bone block (B, C), and are shuttled posteriorly and passed back through the posterior bone block (D). The asterisks indicate a low-profile plate used to reinforce the posterior bone block.

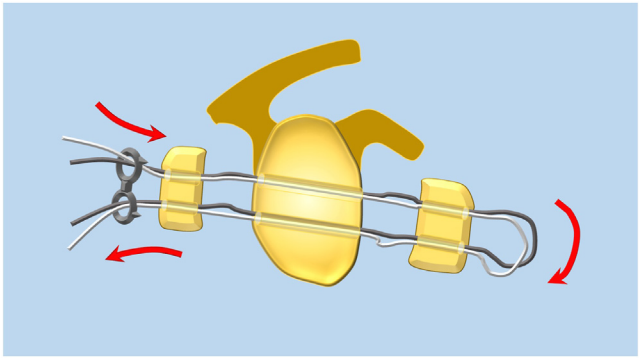

Fig 9. Construct of double-bone block cerclage in right shoulder. A Wedged Profile Plate is used at the back to secure the bone block from the Tensiometer and knots.

(Arthrex), tensioned to 80 N under arthroscopic control, and secured with several knots (Fig 11).

A standard anterior and posterior labral repair with inferior glenohumeral ligament tensioning can now be performed to make the bone blocks extra-articular, using short 2.9-mm PushLock anchors (Arthrex) (Fig 12). The wounds are closed, and the patient's arm is immobilized. Pearls and pitfalls are presented in Table 1, and advantages and disadvantages are presented in Table 2.

Postoperative Management

The shoulder is immobilized in a neutral rotation sling for 4 weeks. The rehabilitation protocol consists of active elbow-wrist mobilization, pendulum shoulder movements, and passive mobilization in the scapular plane for the first 6 weeks. Active mobilization is then allowed, followed by muscle strengthening with elastic bands. Return to sports requiring use of the upper limb is allowed after 3 months, with a return to contact sports after 4 months.

Discussion

We present a technique consisting of arthroscopic all-suture double-bone block cerclage for bidirectional traumatic glenohumeral instability with bipolar glenoid bone loss. Although atraumatic multidirectional instability is well known and managed nonoperatively, traumatic instability with bipolar bone loss is rare and presents a management challenge with scarce literature.

D'Ambrosi et al.[10] performed an arthroscopically assisted Latarjet procedure and open posterior bone block, fixed with malleolar screws, in a patient with recurrent posterior instability and post-traumatic anterior dislocation; at 1-year follow-up, the results were promising. Haeni et al.[11] performed an arthroscopic double-bone block procedure in 7 patients with multidirectional instability. Given the revision rate, with 2 surgical procedures for screw removal and 1 for recurrent dislocation, they proposed this technique as a salvage procedure.

The use of suture material, as described in our technique, eliminates hardware complications related to screws, such as malposition, soft-tissue irritation, anterior neurovascular damage, and hardware crowding.[12-17] Hachem et al.[8,9] have previously published a technique using tricortical iliac crest allograft and autograft with FiberTape cerclage for isolated posterior or anterior instability. In a clinical series of 23 patients with anterior instability, Hachem et al.[18] reported promising functional results; 3 patients had complete graft resorption at last follow-up.

Alternative screw-less fixation systems have also been reported, such as cortical suture buttons or knotless anchors.[5,6,19-21] Neither technique offers a clear advantage, but cerclages theoretically provide a stable frame with evenly spread tension.

Using free bone block graft instead of the coracoid process offers some advantages, such as avoiding subscapularis splitting, which reduces operative time, as well as complexity, and preserves the option to perform future anatomic arthroplasty.[22] The choice of autograft versus allograft remains a topic of debate, with increased but short-term morbidity when harvesting

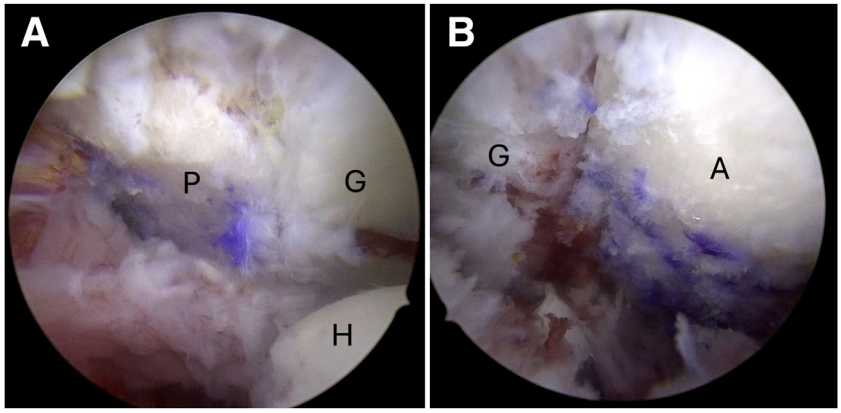

Fig 10. Arthroscopic views of right shoulder through anterolateral portal showing posterior (A) and anterior (B) bone blocks sitting flush with glenoid (G). (A, anterior bone block; H, humerus; P, posterior bone block.)

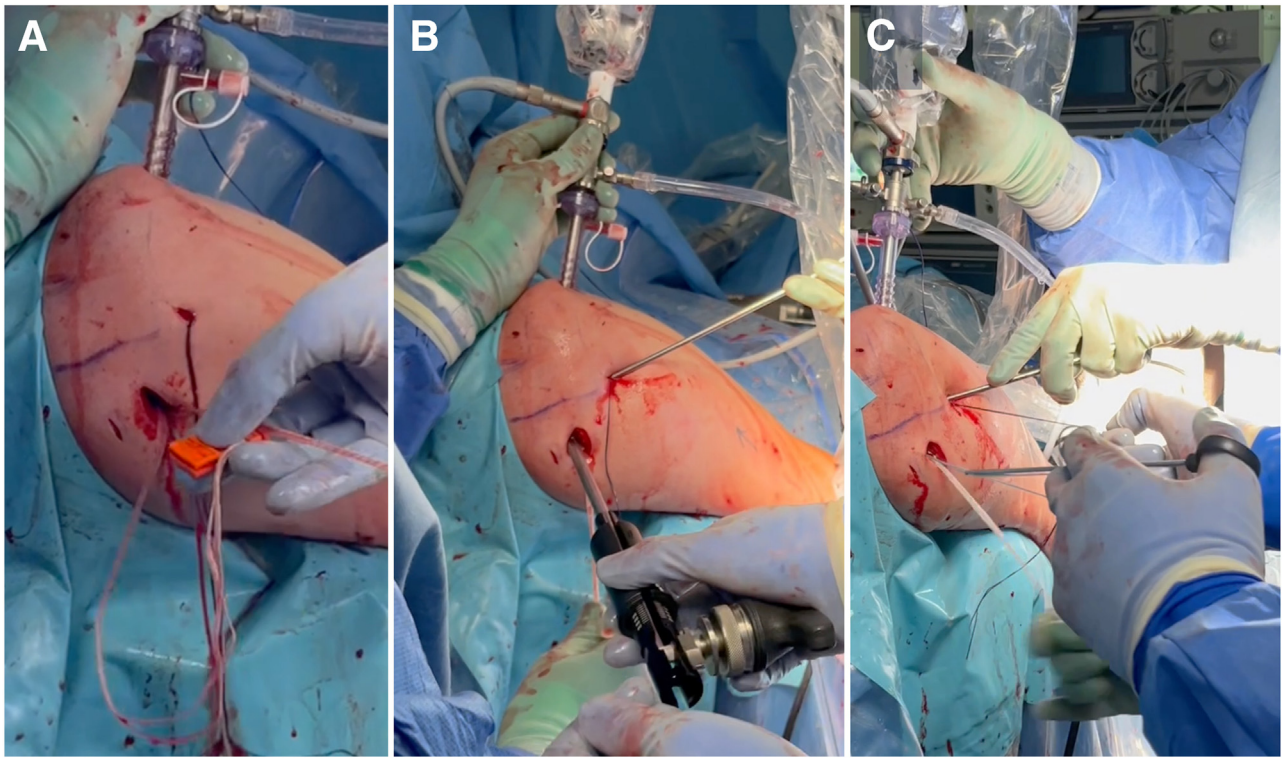

Fig 11. Right shoulder in beach-chair position from back, showing fixation of bone block cerclages. (A) The FiberTape cerclages are assembled and tightened. (B) A Tensiometer is placed against the plate on the posterior bone block and tensioned to 80 N. (C) A few pairs of knots are tied over both FiberTape cerclages.

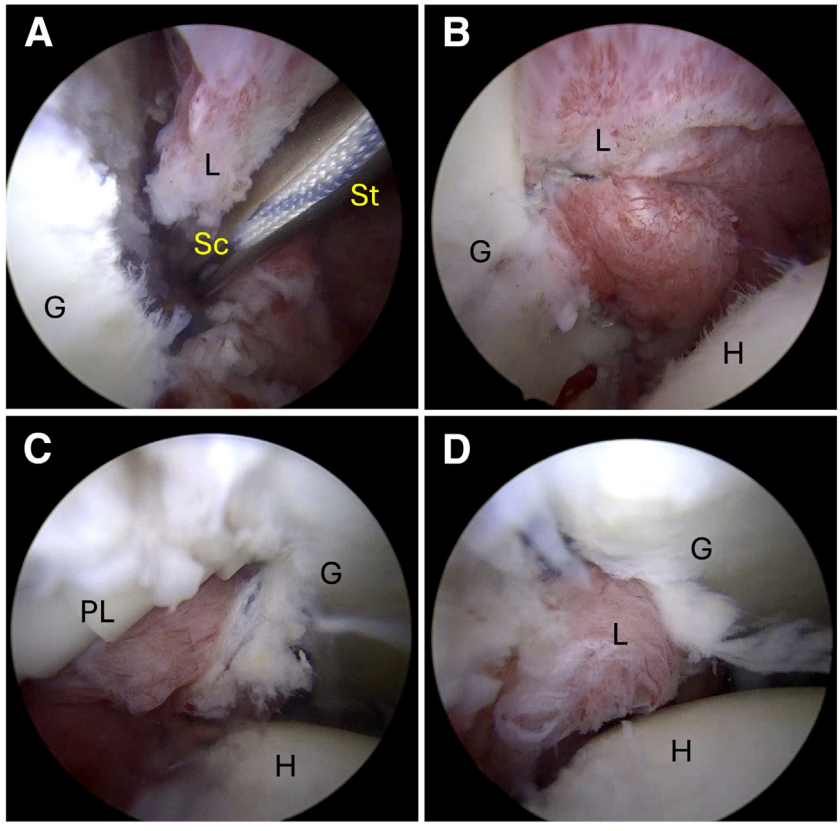

Fig 12. Arthroscopic views of right shoulder in beach-chair position from back, showing final soft-tissue repair. (A, B) The labrum is repaired to the anterior glenoid using the predrilled holes, covering the anterior bone block and making it extra-articular. (C, D) The same procedure is carried out for the posterior labrum. (G, glenoid; H, humerus; L, labrum; PL, PushLock anchor; Sc, Scorpion suture passer [Arthrex]; St, SutureTape [Arthrex].)

Table 1. Pearls and Pitfalls

Pearls
The articular side of the bone blocks should be marked on the most convex side.
The arthroscope should be kept in the anterolateral portal throughout bone block implantation.
The anterior and posterior incisions should be enlarged as late as possible to avoid fluid extravasation.
The surgeon should use a finger to make sure there is a sufficient passage down to the anterior and posterior glenoid.
A posterior low-profile wedged plate should be used to protect the bone block when tensioning the FiberTape knots.
Pitfalls
Improper visualization of the anterior glenoid carries a risk of overdrilling into the subscapularis and neurovascular structures.
Improper labral mobilization away from the glenoid may result in soft-tissue interposition between the bone blocks and the glenoid.
Overtensioning the system may result in bone graft breakage.

Table 2. Advantages and Disadvantages

Advantages
Stable doubled load-spreading frame construct
Safe for neurovascular structures
Preserves subscapularis integrity
No crowding or impingement related to metallic screws
Allows associated soft-tissue procedures (e.g., labral repair or remplissage)
Disadvantages
Technically demanding with a stepwise procedure
Risk of graft breakthrough if overtensioned
Risk of nonunion or resorption, especially if undertensioned

iliac crest bone block. However, autografts offer several advantages: They can be tailored to large defects when using iliac crest,[3,23] they are less expensive, and patients with traumatic instability are usually younger and have better bone quality.[24]

Potential and unique complications may, however, occur from the presented technique, such as cutting through the bone block with the cerclages, particularly if overtensioned, and fibrous union or nonunion. However, a clinical series regarding this technique used in patients with unidirectional instability with bone loss has shown excellent clinical outcomes.[18]

Disclosures

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: M.H. reports employment with Arthrex. All other authors (G.C., A.B., M.Ö., R.B., S.M.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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