Technical Note

A Technique for a More Accurate Acromioclavicular Joint Reduction in Arthroscopic Coracoclavicular Stabilization of Acromioclavicular Joint Dislocation

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Abstract: Loss of reduction is the most common complication following acromioclavicular dislocations treatment, with literature showing greater postoperative coracoclavicular distances associated with worse clinical results. We present a surgical gesture that aims to help surgeons achieve and secure an anatomic acromioclavicular reduction during coracoclavicular fixation. This technique has the possibility to improve radiological and functional results of acromioclavicular dislocation treatment.

Introduction

Acromioclavicular (AC) dislocations represent up to 12% of all shoulder injuries[1] and, although no gold standard treatment has been established, there is currently a tendency toward an arthroscopic approach, which has been demonstrated to be extremely safe and reliable.[1,2] However, despite significant evolution in fixation materials and techniques, postoperative loss of reduction is a concern, affecting up to 28% of operated patients.[3]

The objective of this technical note is to describe a technique that ensures accurate reduction of the AC joint and minimizes loss of reduction following coracoclavicular (CC) arthroscopic fixation.

Surgical Technique

The surgical technique is demonstrated in Video 1.

With the patient in the beach chair position, under general anesthesia with an interscalene block, the C-arm is draped and positioned closely to the surgical field, entering from the contralateral side. The arm of the patient is draped and secured by a mechanical arm (Trimano, Arthrex, Munich, Germany) (Fig 1).

After marking the anatomical landmarks on the skin, the AC joint is identified using an intramuscular needle under an image intensifier (Table 1). A 3-cm skin incision is made over the clavicle shaft and centered between the AC joint and the projection of the coracoid. (Fig 2). Careful dissection is performed, and the frequently elongated or torn deltotrapezial fascia is identified, and if needed, opened and secluded, until the clavicle surface is reached. Any cicatricial tissue, fibrosis, meniscus remnants, or interposed capsule is cleared from the AC joint (Fig. 2, Table 1). The Trimano is then repositioned in order to force a vertical upward migration of the arm, and consequently of the acromion, to facilitate AC joint reduction.

The AC joint is anatomically reduced in both coronal and sagittal plane under direct view, with the help of a bone graft impactor. At this stage, while reduction is

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Fig 1. Initial operating room setting. Patient in beach chair position with the arm marked and draped, with the image intensifier positioned on the opposite side.

maintained, a K-wire is introduced percutaneously from the acromion, directed medially and superiorly through the distal clavicle, under direct AC visualization and radiograph control (Fig 3 and Video 1). Care should be taken not to advance the K-wire excessively, as doing so would interfere with the clavicle bone tunnel placement and subsequent fixation system.

Final joint reduction is confirmed under direct visualization and also strict antero-posterior AC radiograph view (Fig 4). The surgeon should aim for stable and anatomic reduction of the AC joint. If reduction of quality of fixation is in doubt, this step is repeated, and the K-wire is repositioned (Table 1).

After ensuring anatomical reduction of the AC joint with secure and correct positioning of the K-wire, we proceed with the arthroscopic procedure. Using a 30° arthroscope, the joint is inspected through the posterior portal after which an antero-inferior (AI) portal is created, and the rotator interval is released (Fig 5). Although maintaining the camera in the posterior portal, an antero-lateral (AL) portal is created in order to allow coracoid exposure, taking care not to damage the coraco-acromial ligament.

After adequate coracoid exposure, the posterior portal is abandoned, and the AI and AL portals are used as both visualization and as work portals (Table 2). Complete exposure of the inferior and lateral part of the coracoid is then performed (Fig 6).

Once the subcoracoid space is cleared of debris, the 10-mm PassPort Button cannula (Arthrex, Munich, Germany) is inserted through the AI portal. The camera is passed through this portal, and the bone tunnel guide, introduced by the AL portal, is centered at the coracoid base. Using a 2.4-mm cannulated drill bit, the coracoclavicular tunnel is drilled by the assistant through the clavicular incision, under arthroscopic visualization (Fig 7).

The camera is then placed in the AL portal, while the assistant removes the drill bit trocar and introduces a SutureLasso (Arthrex), which is retrieved from the AI portal. After that, the drill bit should then be carefully removed not to damage the SutureLasso, which will serve as a shuttle (Fig 8).

Table 1. Pearls and Pitfalls

Technique Pearls and Pitfalls
• Identify the acromioclavicular (AC) joint using an intramuscular needle under image intensifier, as this will be helpful in programming the skin incision.
• Identify and protect the torn deltotrapezial fascia. Any cicatricial tissue, fibrosis, meniscus remnants or interposed capsule must be cleared from the acromioclavicular (AC) join to facilitate joint reduction.
• Perform acromioclavicular joint reduction reduction under direct vision. While reduction is maintained, a K-wire is introduced percutaneously. Care should be taken not to advance the K-wire too medially. The K-wire should be well centered at the acromion and clavicle shaft as to ensure adequate fixation.
• Remove the bone graft impactor and evaluate the achieved reduction and fixation quality. Undercorrection or instability of the K-wire should be corrected at this point.
• After the surgeon retrieved the SutureLasso, the assistant should very carefully and gently removed the drill bit, as not to damage the SutureLasso.

AC, acromioclavicular.

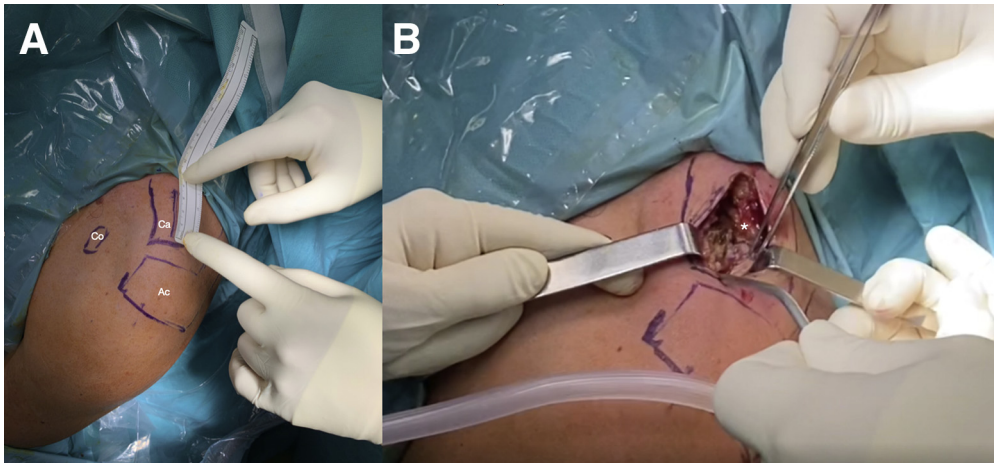

Fig 2. Mini-open access over the acromioclavicular (AC) joint and lateral clavicle (A), used to remove fibroses, and ensure anatomical reduction (B). Ac, acromion; Ca, clavicle; Co, coracoid.

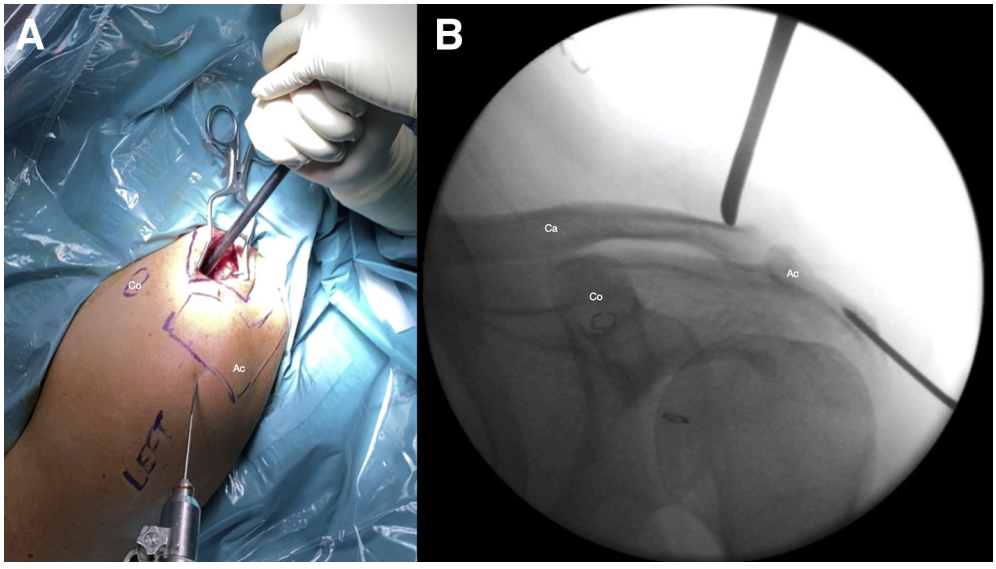

Fig 3. The acromioclavicular (AC) joint is reduced with a bone graft impactor (A) and a K-wire is introduced percutaneously from the acromion through the lateral clavicle under radiograph control (B). Ac, acromion; Ca, clavicle; Co, coracoid.

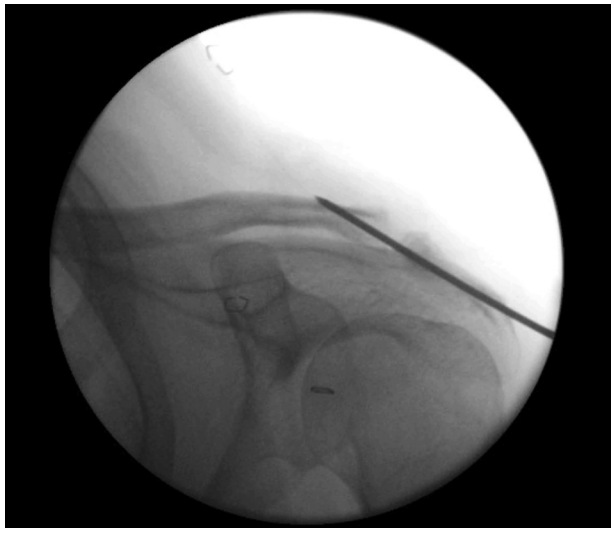

Fig 4. Intraoperative radiograph showing anatomic reduction of the acromioclavicular (AC) joint and correct positioning of the K-wire laterally to desire the coracoclavicular tunnel.

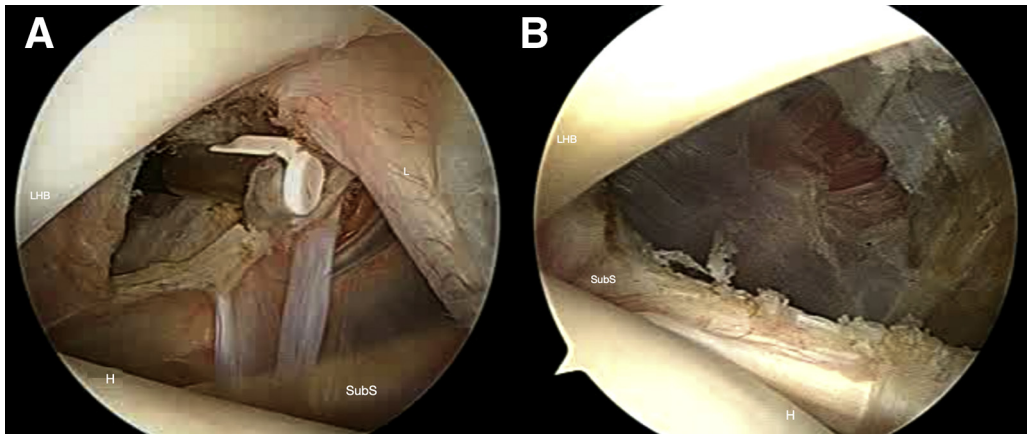

Fig 5. Using the posterior portal for visualization, the surgeon should debride the rotator interval with electrocautery (A). (B) Final aspect of the debrided rotator interval. H, humerus; L, labrum; LHB, long head of the biceps; SubS, subscapularis.

One FiberTape and one TigerTape Loops (Arthrex) are assembled on the Dog Bone Button (Arthrex), and both free loop ends are passed through the SutureLasso loop. The assistant pulls the SutureLasso through the clavicle end, pulling the Dog Bone into the subcoracoid space. This step can be facilitated if the surgeon uses a KingFisher retriever (Arthrex) to assist with Dog Bone passage, positioning it under the coracoid (Fig 9).

Both FiberTape and TigerTape ends are cut, and the second Dog Bone Button is assembled and slid until it sits over the clavicle, at which stage it is locked with alternated half knots (Fig 10).

A new radiograph control confirms the maintenance of AC anatomical reduction after the K-wire is removed (Fig 11). The deltotrapezial fascia and periosteum should be carefully closed, and care should be taken to exactly oppose the sectioned platysma layers (Fig 12, Video 1).

Patient aftercare includes a 4-week period of immobilization in an arm sling, allowing elbow and wrist range of motion. At 4 weeks postoperatively, supervised rehabilitation is initiated. Return to contact sports activities is allowed approximately at 6 months postoperatively.

Discussion

Loss of reduction is the most common complication in AC dislocations treatment,[3,4] and although most of these patients remain asymptomatic, literature has shown that greater postoperative CC distances are associated with worse functional scores.[3-5]

The aim of this additional step in the standard surgical procedure is to achieve anatomical and stable fixation at the initial phase of the procedure. With the mini-open approach, we hope to consistently obtain anatomic AC joint reduction. This also ensures a correct and centered entry point for clavicle drilling and adequate closure of the deltotrapezial fascia (Table 3).

Securing early and provisional anatomic reduction with a K wire avoids the forceful and unstable stabilization achieved by the reduction maneuver, while drilling and proceeding with CC fixation, which could possibly result in nonanatomical reduction and inappropriate bone tunnel location. This surgical step will also allow secure tensioning of the CC fixation device.

The skin incision that we used permits the repair of the deltotrapezial fascia at the end of the procedure, which is not performed as an exclusively percutaneous and/or arthroscopic treatment. Besides that, interposition of the deltotrapezial fascia in the acromioclavicular joint previous to reduction is avoided, and the risk of incomplete acromioclavicular joint reduction, particularly in grade V dislocations, is

Table 2. Arthroscopy Portals Used During the Procedure

Portal	Description of the Arthroscopic Portals
Posterior Portal	2 cm medial and inferior to the posterolateral angle of the acromion, at the soft spot
Antero-lateral (AL) Portal	1-2 cm below the anterolateral acromion angle in line with the anterior border of the clavicle. Generally, using a needle outside-in technique in order to prevent rotator cuff damage
Antero-inferior (AI) Portal	1 cm inferior and lateral to the coracoid, using an outside-in technique to allow direct access to the inferior and lateral part of the coracoid process.

AL, antero-lateral portal; AI, antero-inferior portal.

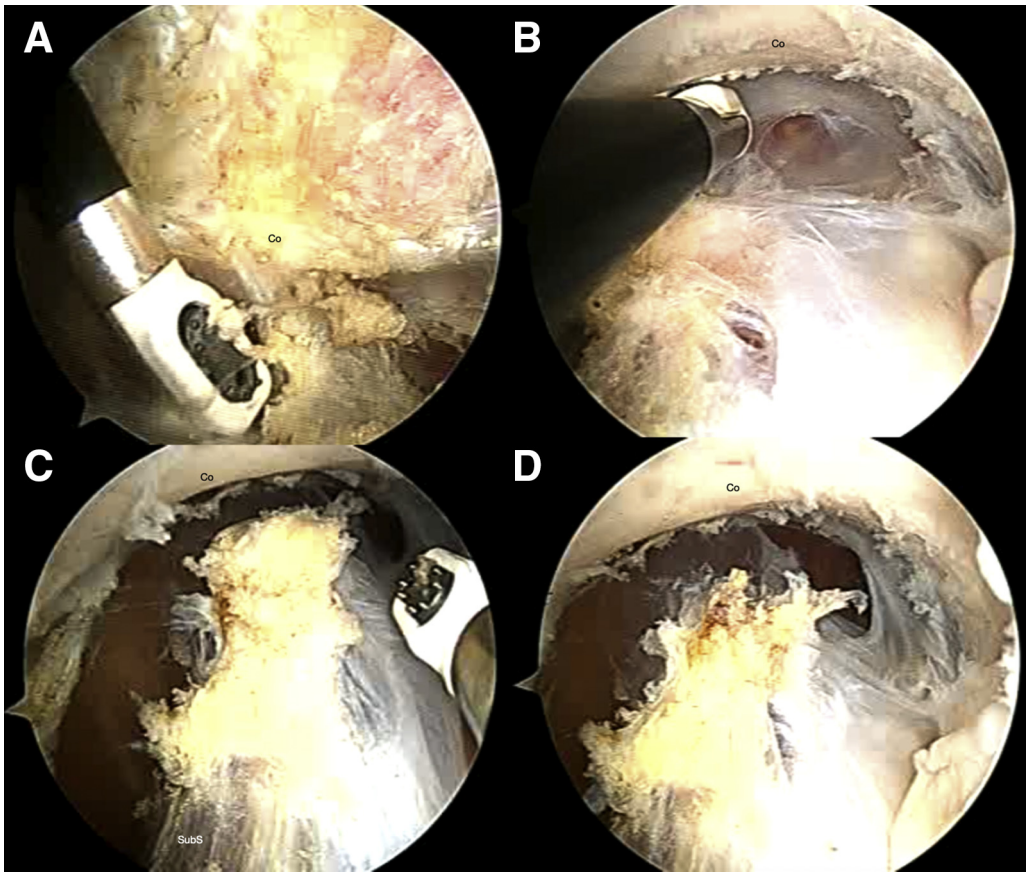

Fig 6. Using the AL portal for visualization, the surgeon proceeds with debridement of the coracoid. Exposure of the coracoid tip (A), knee (B), and base (C) are crucial. (D) Final aspect of the subcoracoid space. Co, coracoid, SubS, subscapularis.

minimized (Table 3).[6] The importance of this structure to AC stabilization has been described previously, and its incorrect closure is one of the most commons pitfalls in AC surgery.[6-8]

This fascia is an important AC static and dynamic stabilizer, contributing to AC reduction strength, and presenting a synergetic effect in AC joint reduction with the AC ligaments and deltoid and trapezoid muscles.[6,7] Besides, it also has an important role in local blood supply.[8]

This approach does not interfere with the rest of the arthroscopic surgical procedure, which is mandatory to ensure a proper position of the device at the coracoid and treat associated injuries related to the AC dislocation. It is also helpful when a complementary procedure is necessary for AC horizontal stabilization.

However, this technique also has some pitfalls (Table 3). Concerns regarding AC joint degenerative changes can arise from the transarticular drilling of the K-wire. These degenerative changes are described in the context of the kinematic changes, secondary to the initial trauma or AC ligaments and capsule rupture. This instability will compromise AC joint congruency, making it more prone to arthritic changes. Notwithstanding, considering that the K-wire has only a 2-mm diameter and is used solely as a provisional stabilizer, we believe that the benefits (greater stability during the procedure, nonforceful reduction of the AC joint and guaranteed anatomic reduction at final fixation) clearly outweigh the possible risks. Hardware complications such as K-wire breakage or inadvertent perforation of medial neurovascular structures are theoretical risks that, nevertheless, did not occur in any of our cases. Appropriate thickness (at least 2 mm) and manipulation of the K-wire must be considered to avoid these risks.

With this technique, we hope to achieve better and more consistent AC joint reduction and, consequently, improve our clinical results for this group of patients, who are traditionally young and physically active.

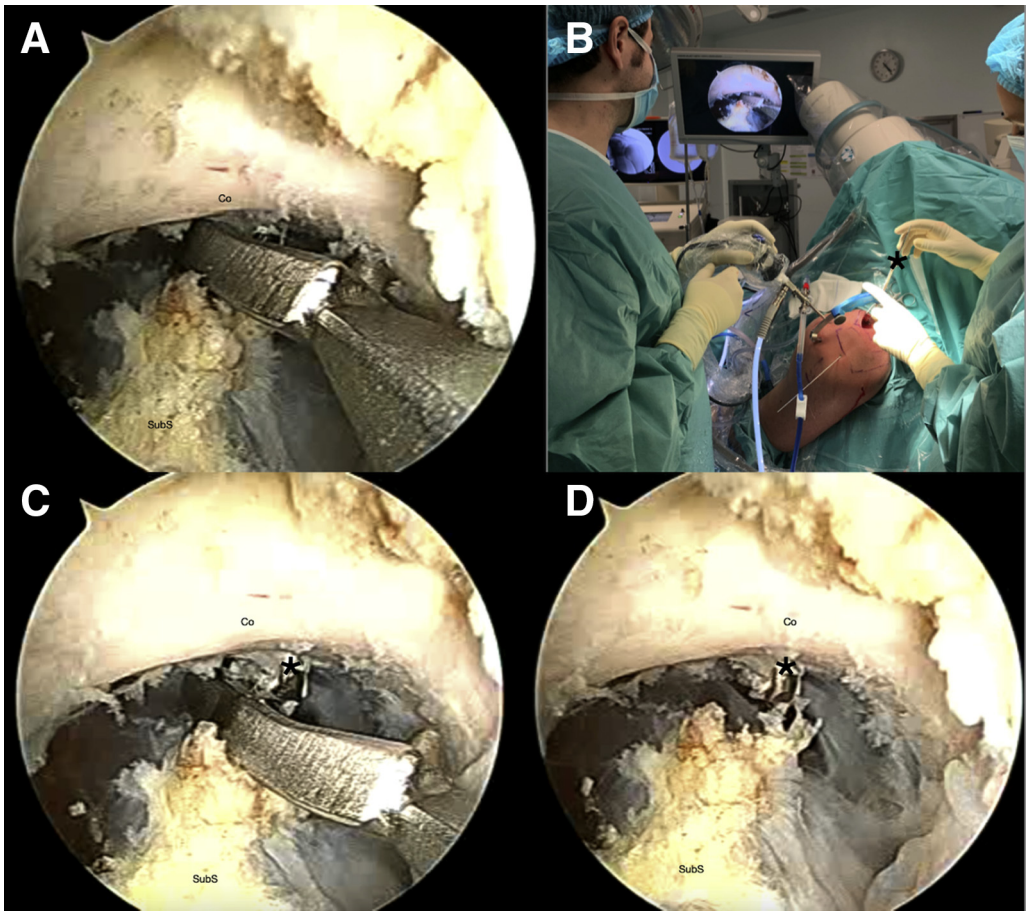

Fig 7. Location of the coracoclavicular drill guide at the coracoid base (A), using the anterolateral and anteroinferior portals for work and visualization, respectively. Under arthroscopic control, the assistant drills the clavicle and coracoid through the clavicle incision (B). (C and D) Final position of the drill bit. Co, coracoid, SubS, subscapularis. * denotes the drill bit.

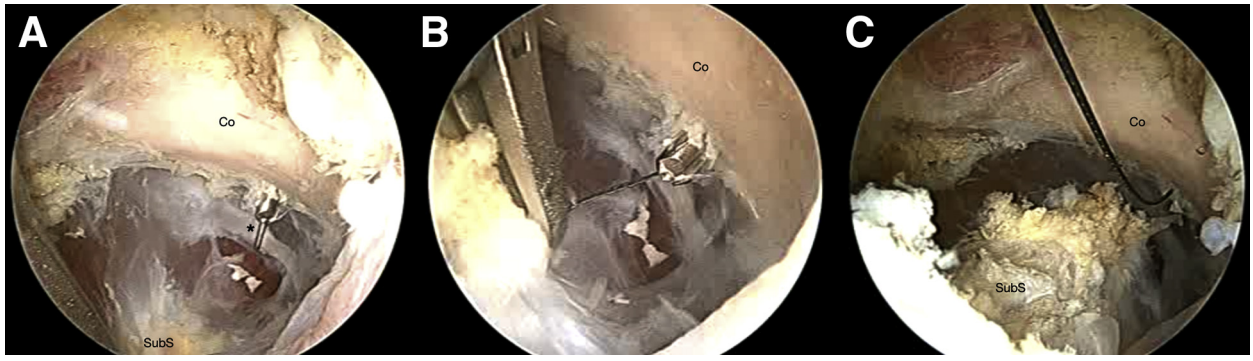

Fig 8. (A) After the assistant removes the drill bit trocar, a SutureLasso is passed through the cannulated drill. The surgeon then retrieves the SutureLasso through the antero-inferior portal (B), and after that, the drill bit can be removed (C). Co, coracoid; SubS, subscapularis. * denotes SutureLasso.

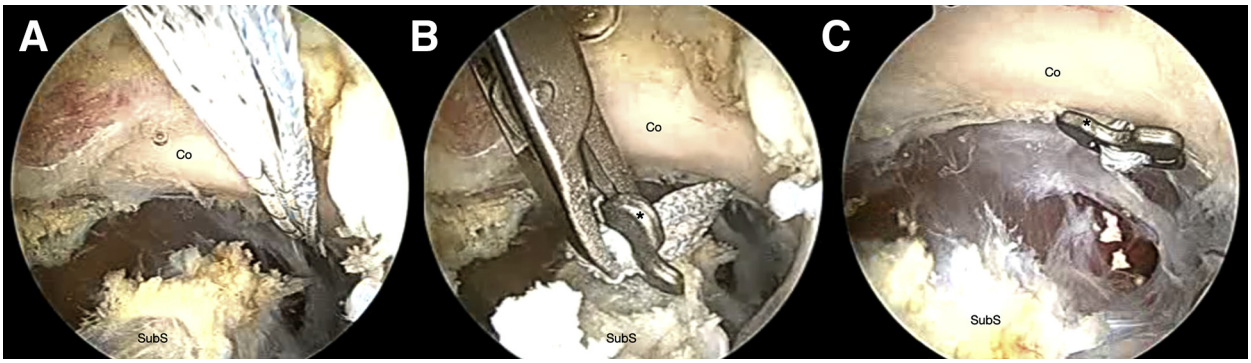

Fig 9. (A) The assistant pulls the SutureLasso through the clavicle incision, pulling the Dog Bone Button construct into the shoulder joint. The surgeon uses a King Fisher grasp to help with button positioning (B and C). Co, coracoid, SubS, subscapularis. * denotes Dog Bone Button.

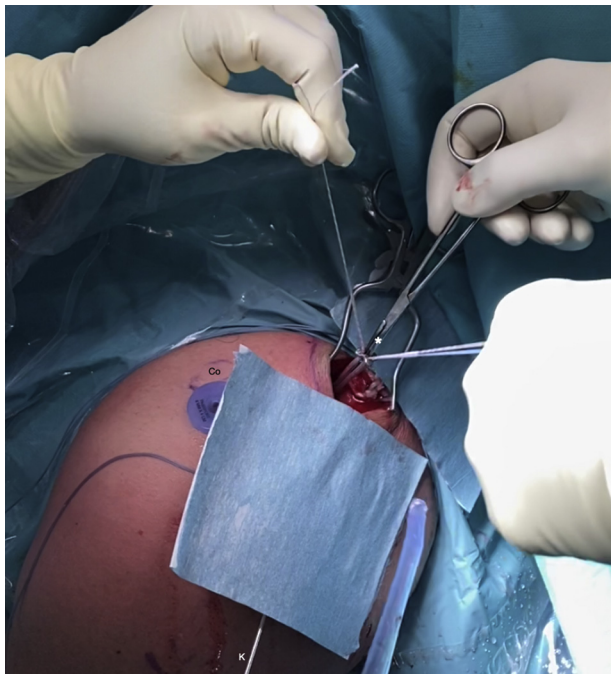

Fig 10. Extra-articular assembly of the Bog Bone Button over the clavicle. Co, coracoid. * denotes Dog Bone Button.

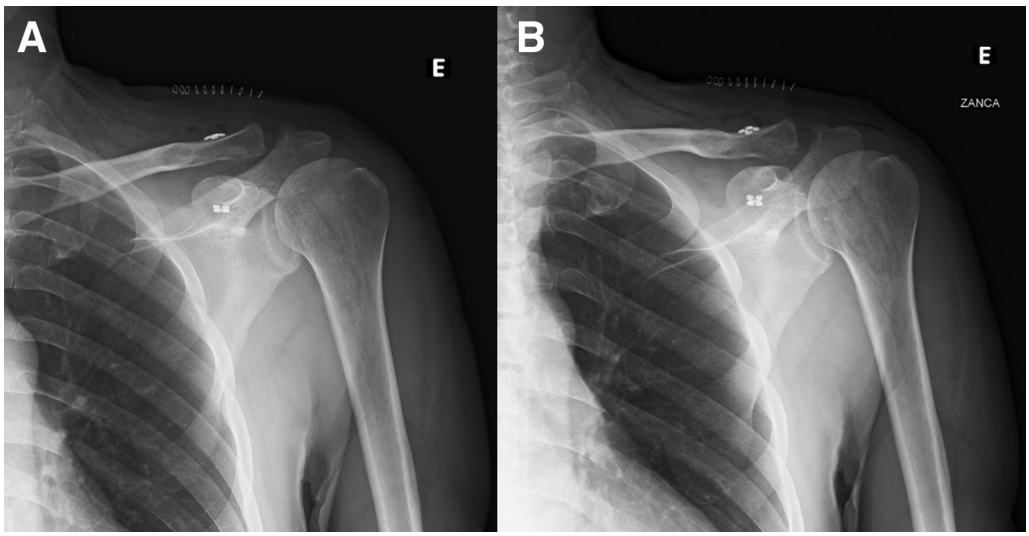

Fig 11. Final intraoperative radiograph confirms the maintenance of acromioclavicular (AC) anatomical reduction. (A) antero-posterior and (B) Zanca views.

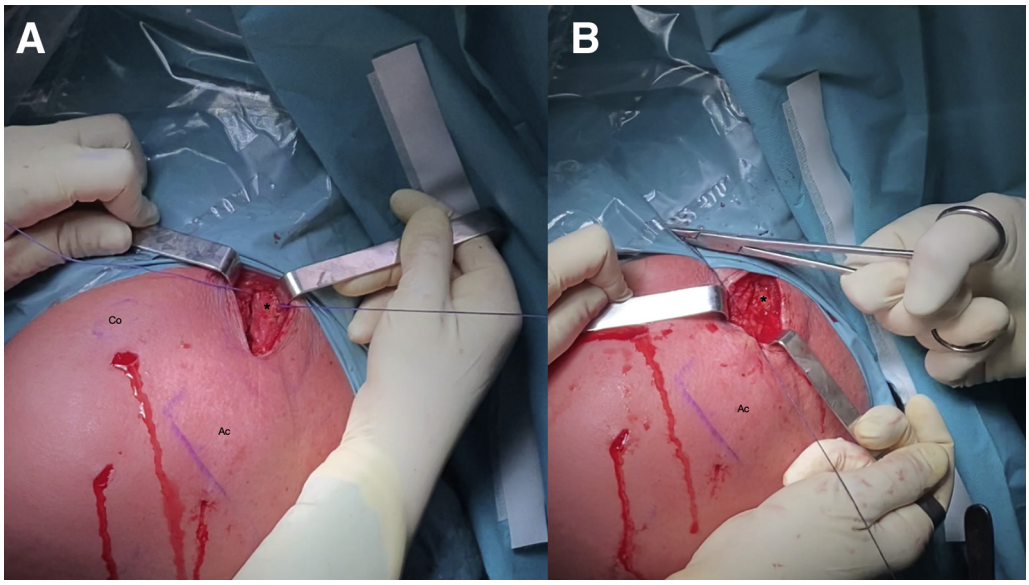

Fig 12. The deltotrapezial fascia should be carefully closed (A). (B) Deltotrapezial fascia closure using a baseball-stitch technique. Co, coracoid; Ac, acromion. * denotes deltotrapezial fascia.

Table 3. Advantages and Disadvantages

Technique Advantages and Disadvantages	
Advantages	Disadvantages
• Clean the AC joint of debris, capsule, menisci, or interposed deltotrapezial fascia, resulting in consistent AC joint anatomic reduction. • Allows the repair of the deltotrapezial fascia, which is an important AC joint stabilizer. This incision can also be used if an additional procedure of horizontal stabilization is needed. • Incision over the clavicle will also facilitate CC drilling, ensuring a more centered entry point. • Achieve anatomical and stable fixation at the initial phase of the procedure, ensuring anatomic reduction of the AC joint and making CC drill safer. • Secure tensioning of the CC fixation device.	• Risk of AC joint degenerative changes from the transarticular drilling of the K-wire. • 3 cm skin incision when compared in percutaneous procedure • Risk of K-wire breakage during the procedure

AC, acromioclavicular; CC, coracoclavicular.

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