



# Latarjet Procedure With Coracoclavicular Ligament Augmentation for Traumatic Coracoid Fracture and Recurrent Anterior Glenohumeral Instability in an Elite Contact Athlete

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**Abstract:** Coracoid fractures are relatively uncommon injuries and are typically treated conservatively or with open reduction and internal fixation of displaced fractures. In rare cases, coracoid fractures coincide with glenohumeral instability. Although glenohumeral instability is frequently treated with Bankart procedures, the Latarjet procedure (or transfer of the coracoid process) is used in patients with significant glenoid bone loss, recurrent instability, or prior failed Bankart procedures. However, in some cases, surgeons opt for the Latarjet procedure in patients who are at risk for recurrent instability, such as the elite contact athlete presented in this case. This Technical Note describes the transfer of a previously fractured coracoid fragment to the anterior glenoid rather than reduction of the fracture with concurrent coracoclavicular ligament augmentation to restore anterior shoulder stability.

Coracoid fractures are uncommon injuries typically seen with high-energy mechanisms and traumatic collisions. Treatment of coracoid fractures occurring in isolation typically involves conservative management in nondisplaced or minimally displaced fractures<sup>1</sup> and surgical fixation with open reduction and internal fixation (ORIF) for displaced fractures.<sup>2-4</sup> These fractures, however, more commonly occur in association with other shoulder pathology, usually the superior shoulder

suspensory complex.<sup>5-9</sup> Fractures near the coracoid base/neck can involve disruption of the coracoclavicular ligaments, which may need to be reconstructed.

In rare cases, coracoid fractures have been associated with glenohumeral instability or traumatic dislocations.<sup>10,11</sup> In cases of glenohumeral instability with significant glenoid bone loss, recurrent instability, or prior failed Bankart procedures, transfer of the coracoid process (otherwise known as the Latarjet procedure) has shown to restore glenohumeral stability with reliable clinical outcomes.<sup>12,13</sup> Furthermore, the Latarjet procedure is increasingly being considered as the treatment of choice for contact athletes and military personnel who are at high risk of recurrent instability, even with small amounts of glenoid bone loss.<sup>14-17</sup> The robust bone block and additional soft tissue—stabilizing mechanisms of the “sling effect”<sup>18</sup> provided by the Latarjet allow these athletes to return sports requiring high functional demands of their shoulders.

Because these are rare cases, treatment of concomitant coracoid fractures with associated ligament damage and anterior glenohumeral instability is not well described. In this setting, the authors propose implementing the Latarjet procedure to transfer the fractured coracoid to the anterior glenoid. As such, the fractured coracoid is transferred rather than reduced, improving the biomechanics of the unstable glenohumeral joint and

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additionally providing the sling effect of the conjoint tendon. Furthermore, coracoclavicular ligament repair and augmentation are performed, as these often involve disruption of the superior shoulder suspensory complex. In this Technical Note, we describe reconstruction of the anterior glenoid via Latarjet procedure with concurrent coracoclavicular (CC) ligament augmentation to address recurrent glenohumeral instability and concomitant traumatic coracoid fracture in a contact athlete at the professional level.

## Surgical Procedure

### Patient Positioning and Diagnostic Arthroscopy

Before surgery, diagnostic imaging was obtained including magnetic resonance imaging, 2-dimensional computed tomography with 3-dimensional renderings, and standard shoulder radiographs, anteroposterior (AP)/Grashey/scapular Y/axillary lateral views, along with clavicle AP and Zanca views, which can help with the diagnosis and appreciation of the position of clavicle with respect to the acromion (Figs 1, 2, and 3). The patient is induced with general anesthesia, a regional interscalene catheter, and PECS II single-shot block. The patient is then placed in the beach chair position, prepped, and draped with 2 towels placed under the medial scapula and the arm placed free on a padded Mayo stand. A diagnostic arthroscopy is performed to further assess intraarticular pathology before the open procedure.

### Open Approach

The procedure begins with a 6-cm incision just lateral and inferior at the axilla, similar to a deltopectoral open Bankart approach (Fig 4). Dissection is carefully carried down to the deltopectoral interval using a 15 blade. The cephalic vein is identified and retracted laterally to be protected throughout the procedure. Self-retaining Kolbel retractors are inserted to maintain the interval between the deltoid and pectoralis major. In addition, a Hohmann retractor may be inserted superior to the coracoid to improve visualization.

### Coracoid Preparation

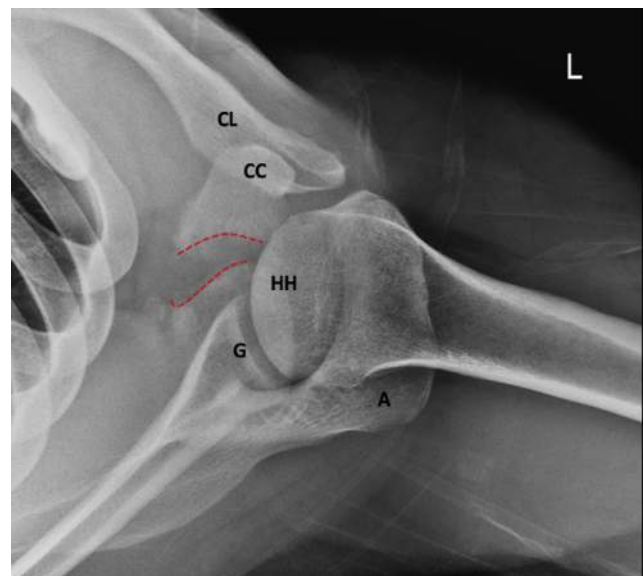
Once the coracoid fracture is located, the base of the fracture is identified, and the coracoid is mobilized. A Darrach retractor is used to gently retract the soft tissue medially and inferiorly to protect neurovascular structures. The coracoacromial ligament is then identified and, if intact, is transected ~1 cm from its insertion on the coracoid process, leaving a cuff of soft tissue on the coracoid for later incorporation into the capsular repair. With the shoulder positioned in adduction and internal rotation, the pectoralis minor tendon can be released from its insertion on the medial aspect of the coracoid process sharply with an elevator. The axillary and

musculocutaneous nerves should be identified and protected with digital palpation throughout the coracoid exposure. The coracoid is then debrided and freed up using a combination of a Cobb retractor, a one-half-inch osteotome, a small sagittal saw, a Kocher forceps, and a rongeur. It is important to release the soft tissue adhesions on the posterior aspect of the conjoint tendon to allow for ease of transfer. The musculocutaneous nerve is also visualized and gently released until it is free of tension all the way to the insertion site at the muscle. The coracoid is prepared in a standard fashion for a traditional Latarjet using a sagittal saw with saline irrigation and decortication of the inferior bony surface (Fig 5). Two 4.0-mm holes are drilled into the coracoid using the Arthrex guide system (Arthrex, Naples, FL), centering to ensure that there is no overhang, even with the suture washers (Fig 6).

### Coracoclavicular Ligament Augmentation

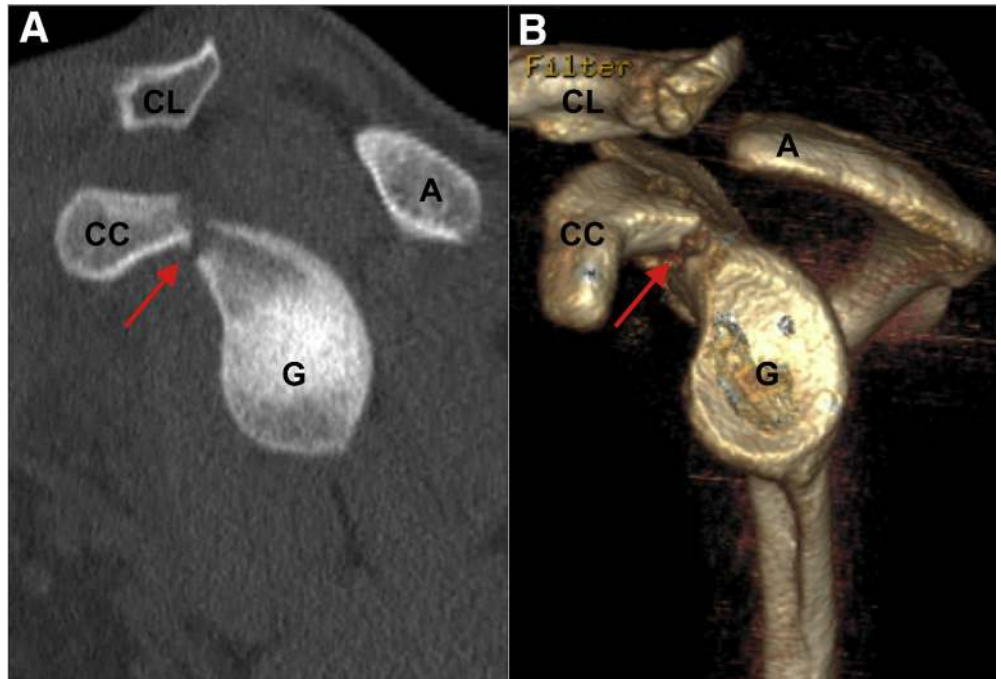
The clavicle should be easily anatomically reduced to the acromion. In some cases, a distal clavicle debridement or excision may need to be performed to allow for anatomic reduction. Two SutureTape and 2 FiberTape sutures (Arthrex) are then passed: one of each through both the conoid and trapezoid ligaments. Additionally, 1 FiberTape may be passed over the top of the clavicle to integrate into the repair of both the conoid and trapezoid ligaments. To do this, the FiberTape is stitched around ligaments, brought over the top of the clavicle, and back down to the ligaments.

Two 4.75-mm holes in the base of the coracoid fracture are then predrilled and dilated with a 5.5-mm tap, making sure to have good bony fixation for the



**Fig 1.** Left shoulder. Preoperative axillary view radiograph demonstrating a severe, semidisplaced coracoid fracture (dotted red line). A, acromion; CC, coracoid; CL, clavicle; G, glenoid; HH, humeral head.

**Fig 2.** Left shoulder. Preoperative 2-dimensional CT in the sagittal plane (A) with 3D renderings in the en face view (B) more clearly demonstrates the exact location and extent of the traumatic coracoid fracture (red arrow). A, acromion; CC, coracoid; CL, clavicle; CT, computed tomography; G, glenoid.

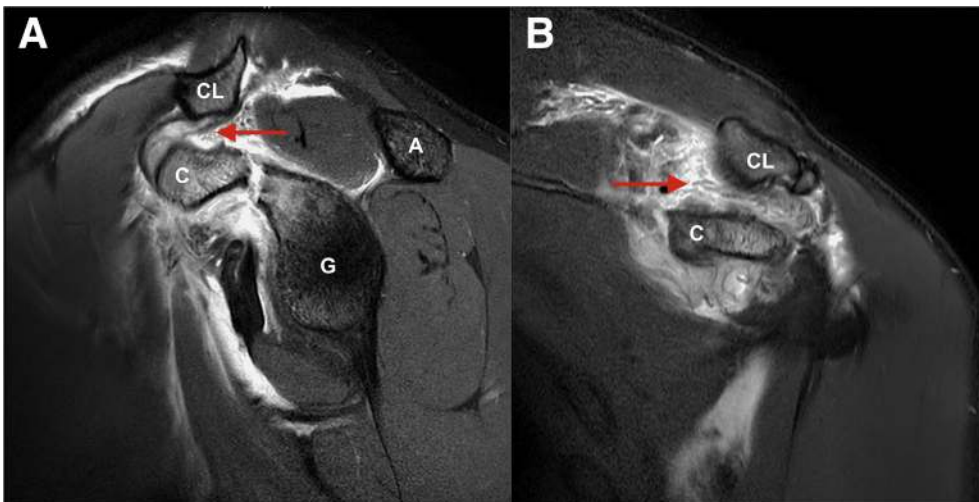


5.5 SwiveLock anchors (Arthrex). The SutureTape and FiberTape are threaded through the SwiveLock anchors. At this time, the coracoid transfer portion of the procedure may be complete, or some may choose to finalize the CC ligament repair and augmentation at this time. A Cobb retractor, a pointed Hohmann retractor, or other instrument is used to place downward pressure on the clavicle while upward pressure is applied to the arm, reducing the clavicle to the acromion. The 2 SwiveLock anchors are then impacted into their previously drilled holes in the base of the coracoid. Just before final impaction and insertion of the anchors, the sutures are maximally tensioned to hold reduction

of the acromioclavicular joint. This should completely restore the anatomy of the CC ligaments in the base of the coracoid and maintain reduction of the acromioclavicular joint. Fluoroscopic images may be obtained to confirm anatomic reduction.

#### Subscapularis Split and Bone Block Fixation

A standard subscapularis split is used, ~28 mm from the upper border and ~22 mm from the inferior border. Using a 15-blade scalpel, the subscapularis is split in line with its fibers carefully down to the capsule, protecting all medial structures. A Cobb elevator or Ray-Tec sponge can be used to separate the subscapularis muscle from



**Fig 3.** Left shoulder. Preoperative MRI in the sagittal (A) and coronal (B) planes demonstrating disruption of the coracoclavicular ligament complex (red arrow). A, acromion; CC, coracoid; CL, clavicle; G, glenoid; MRI, magnetic resonance imaging.

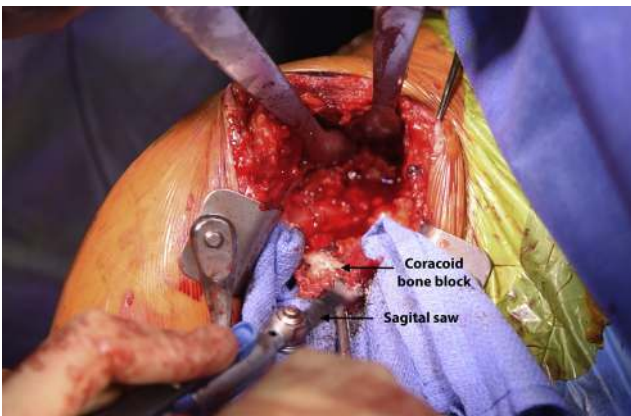




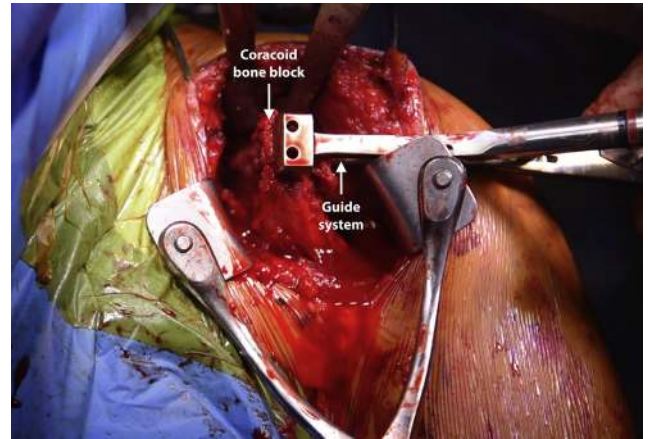
**Fig 4.** Left shoulder, reclined beach chair position. A 6-cm incision is made just lateral and inferior at the axilla, similar to a deltopectoral open Bankart approach.

the underlying capsule. A Gelpi retractor can be placed deep to retract the superior and inferior bellies of the subscapularis, exposing the underlying capsule. The capsule is then incised sharply, performing an L-shaped capsulotomy. A stitch is placed at the apex of the L, which represents the most medial side of the capsule. This can then be pulled out of place so that an anterior glenoid retractor can be used to expose the anterior glenoid.

In preparing the glenoid before final coracoid bone block fixation, a 5.0-mm bur can be used to create a bleeding bony surface on the anterior aspect of the glenoid to promote graft union and healing (Fig 7). Through the predrilled holes of the coracoid, the coracoid is preliminarily affixed to the glenoid with two 0.062-inch Kirschner wires (Fig 8A, B, C). Using a lag technique, a 2.5-mm drill is then advanced in an anterior-to-posterior fashion through the 4.0-mm holes, drilling 2 tunnels and affixing with appropriate-length screws and a suture washer (Fig 9).



**Fig 5.** Left shoulder, reclined beach chair position. The coracoid is prepared in a standard fashion for a traditional Latarjet using a sagittal saw with saline irrigation and decoration of the inferior bony surface.

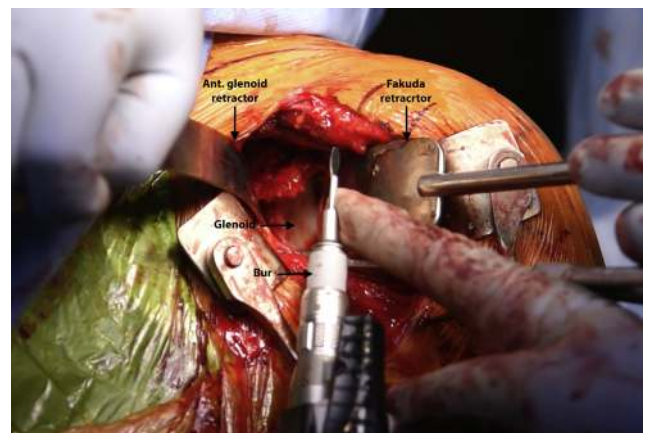


**Fig 6.** Left shoulder, reclined beach chair position. Two 4.0-mm holes are drilled into the coracoid using the Arthrex guide system, centering to ensure that there is no overhang, even with the suture washers.

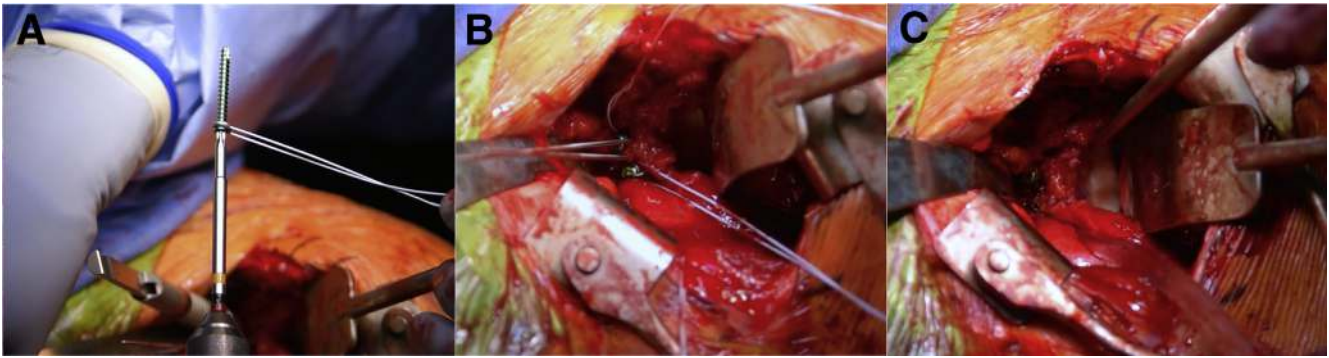
### Capsular and Subscapularis Closure

The capsular closure should be done with suture washers and stitches with a tension slide technique. The coracoacromial ligament is stitched with the arm in 45° of external rotation and 20° of abduction. Suture washers should also be stitched in the capsule and labrum anteriorly.

The remainder of the capsule is closed with SutureTape, taking care to stay superficial. The subscapularis should then be closed with SutureTape in a figure-8 fashion. Before final closure, the CC ligaments and clavicle should be checked to ensure stability. The wound should be copiously irrigated, and the skin and subcutaneous tissue are closed in a layered fashion. The patient is placed in a padded abduction sling before awaking from anesthesia. Advantages, disadvantages, pearls, and pitfalls of the complete surgical technique are summarized in Tables 1 and 2.



**Fig 7.** Left shoulder, reclined beach chair position. In preparing the glenoid before final coracoid bone block fixation, a 5.0-mm bur can be used to create a bleeding bony surface on the anterior aspect of the glenoid to promote graft union and healing.



**Fig 8.** Left shoulder, reclined beach chair position. Appropriate-length screws with suture washers are prepared and are advanced through the predrilled holes of the coracoid bone block (A) that is temporarily held in place by 2 Kirschner wires (B). The K-wires are then removed, and the final glenoid-bone block construct can be easily visualized (C).

### Postoperative Rehabilitation

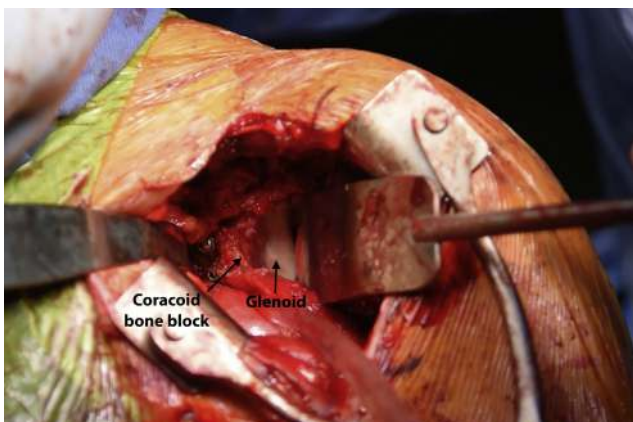
The joint should be immobilized in a sling for ~6 weeks to allow the reconstruction to heal and strengthen before starting movement. During this time, passive motion of the scapular plane is encouraged, and physical therapy is started the day after surgery. The patient should return for a checkup 1 week after surgery for x-rays and evaluation (Fig 10). Between 5.5 and 7 months after surgery, the patient can work on return-to-play activities while continuing to strengthen around the operative site.

### Discussion

This Technical Note highlights multiple bony and soft tissue procedures performed to stabilize the shoulder of a patient presenting with a coracoid fracture, a CC ligament tear, an AC ligament disruption and separation, and anterior glenohumeral instability with appreciable glenoid bone loss (GBL). In this particular case, the fractured coracoid

fragment was used as a bone block for a Latarjet procedure to stabilize the shoulder following recurrent anterior glenohumeral instability and with reattachment of the CC ligaments (conoid and trapezoid) to the neck of the coracoid.

Fractures of the coracoid commonly result from high-energy collision mechanisms and direct, acute trauma.<sup>19-21</sup> However, they are a relatively uncommon injury, presenting in only 2% to 13% of all scapular fracture cases.<sup>19,22,23</sup> A systematic review by Knapik et al.<sup>24</sup> reported on coracoid fractures sustained during sporting activity from 1970 to 2017 and found only 21 published cases in the relevant literature. A variety of treatment algorithms to address coracoid fractures have been well described, with conservative treatment being the most common choice.<sup>3,7,25-27</sup> Operative treatment is typically reserved for Eyres types IV and V coracoid fractures occurring at the base of the coracoid and either the body of the scapula or the glenoid fossa.<sup>7,28</sup>



**Fig 9.** Left shoulder, reclined beach chair position. Using a lag technique, a 2.5-mm drill is advanced in an anterior to posterior fashion through the 4.0-mm holes of the coracoid bone block, drilling 2 tunnels and affixing with appropriate-length screws and a suture washer.

**Table 1.** Advantages and disadvantages

| Advantages   | Disadvantages   |
|--|---|
| Restores anterior shoulder stability with a robust bone graft and the sling effect of the conjoint tendon in a patient that is at high risk for recurrence | Use of fractured coracoid fragment as an autograft and ability to augment coracoclavicular ligaments depend on the location of the fracture in the coracoid |
| Coracoclavicular ligament augmentation restores native anatomy and ligamentous stability without use of reconstruction                                     | Some patients may experience postoperative pain from the screws placed in the coracoid graft and must undergo hardware removal surgery                      |
| Fractured coracoid fragment can be used for bone block transfer rather than open reduction and internal fixation   | Open procedure may lead to greater blood loss compared with arthroscopic procedures   |
| No need for allograft, which helps to lower the cost and the risk of nonunion  | Articulation between the humeral head and the coracoid graft may lead to a greater risk of developing osteoarthritis  |



**Table 2.** Pearls and pitfalls

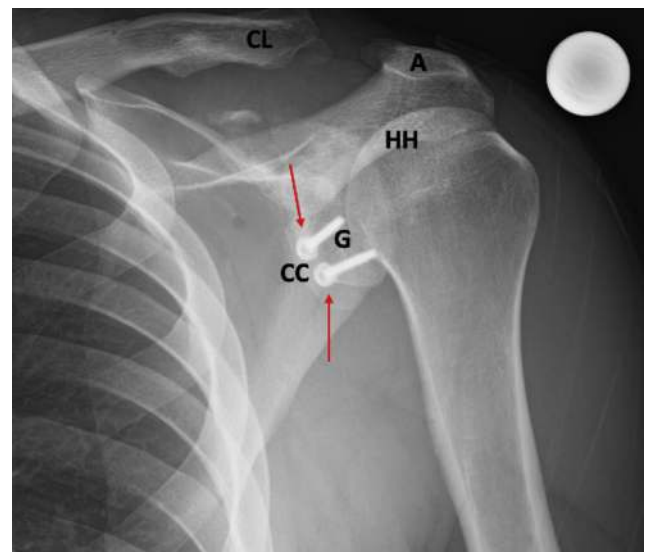
| Pearls  | Pitfalls   |
|---|--|
| In addition to incorporating the coracoacromial ligament stump into the capsular repair, use suture washers for additional capsular repair strength | Failure to perform the capsular repair in 45° of external rotation may increase the risk of postoperative loss of external rotation                              |
| Use fluoroscopic imaging to ensure proper anatomic reduction of the acromioclavicular joint after ligamentous repair                                | Excessive medialization of the coracoid graft may fail to improve anterior instability, whereas excessive lateralization may lead to postoperative complications |

In the present case, the patient was initially treated for a coracoid fracture and a minor anterior subluxation event nonoperatively with a bone stimulator, which resulted in excellent callus and full return to play during the same season. Unfortunately, the patient reported feeling his coracoid “pop up” and his shoulder shift anteriorly while making a tackle ~8 weeks after the completion of nonoperative treatment. Because of the recurrent instability event and complete fracture of the coracoid with damage to the surrounding ligamentous structures, operative intervention was indicated. Although the patient presented to the senior author (M.T.P.) with only 10% to 15% GBL after multiple events of recurrent instability, it was determined that a more robust stabilization with a Latarjet procedure was necessary because of the patient’s increased risk of recurrence as an elite contact athlete.<sup>29-31</sup> Thus, rather than performing a typical ORIF procedure to address the coracoid fracture, the remaining coracoid fragment was used as a stabilizing bone block on the anterior aspect of the glenoid for a Latarjet procedure. It is important to note that although the fractured coracoid fragment was large enough in this patient, it may not be in all patients depending on the size and location of the coracoid fracture.

In this Technical Note, we describe a unique case of AC joint pathology with concomitant CC ligament damage, coracoid fracture, and evidence of recurrent anterior glenohumeral instability. Fractures of the coracoid often present with concurrent AC joint injuries. Previous studies have demonstrated that 55% to 60% of patients presenting with coracoid fractures also suffer from a concurrent ipsilateral AC joint injury.<sup>7,24</sup> Injuries involving coracoid fractures and AC dislocations typically result from a direct blow or fall on the AC joint, which displaces the acromion caudad while the CC ligaments pull on the coracoid and clavicle cephalad.<sup>32,33</sup> Interestingly, although AC joint injuries are common with both coracoid fractures and CC ligament tears, there is a paucity of literature<sup>32,34,35</sup> reporting on the combination of all 3 pathologies and the optimal

treatment methodology to address them. Previous patients with all 3 injuries were treated surgically with ORIF; however, the addition of anterior glenohumeral instability in the current case needed to be considered as part of the operative plan.

Elite-level contact athletes are at high risk of recurrent shoulder instability after a single dislocation or subluxation event.<sup>29-31</sup> Typically, the Latarjet procedure is reserved for those with severe anterior glenohumeral instability and >15% to 25% GBL.<sup>36-38</sup> However, because contact athletes have such a high risk of recurrence, the Latarjet procedure was determined to be the best option for this patient, despite having only 10% to 15% GBL.<sup>16</sup> By transferring the previously fractured coracoid fragment to the anterior glenoid, the surgeon addressed both the coracoid fracture and the anterior glenohumeral instability in a single operation. Furthermore, the Latarjet procedure has proven to be especially efficacious in these high-risk athletes owing to its “triple-blocking” effect.<sup>39</sup> Along with the restoration of the glenoid’s anterior osseous architecture with a robust coracoid autograft, the sling effect provided by the relocated conjoint tendon limits anterior translation of the humeral head when the arm is positioned in abduction and external rotation.<sup>18</sup> Lastly, the attachment of the remaining coracoacromial ligament stump to the medial capsule provides an additional ligament-stabilizing effect. Thus, the Latarjet procedure was chosen for this high-risk patient to prevent future anterior shoulder instability despite not meeting the typical indications for the operation.



**Fig 10.** Left shoulder. Postoperative shoulder anteroposterior radiographs at 1 week demonstrate solid coracoid bone block fixation and proper screw trajectory (red arrows) through the bone block and glenoid. A, acromion; CC, coracoid; CL, clavicle; G, glenoid; HH, humeral head.

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