Technical Note

All-Endoscopic Treatment of Acromioclavicular Joint Dislocation: Coracoclavicular Ligament Suture and Acromioclavicular Ligament Desincarceration

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Abstract: Acute acromioclavicular (AC) joint dislocations are common and difficult to manage. The physiopathologic pattern begins with the rupture of the AC ligaments, then the coracoclavicular (CC) ligaments, and with an invasion of the clavicle through the deltotrapezial fascia. Therefore, we tend to perform a true suture of the CC ligaments, along with a release of the AC ligaments from the joint. We thus propose an all-endoscopic CC ligament suture and AC joint release. It starts with glenohumeral exploration enabling a repair of concomitant lesions when necessary. Dissection of the coracoid process is made, along with the lateral border of the conjoint tendon, medially the pectoralis minor tenotomy, and plexus brachial exposition and protection. Superiory the CC ligaments are tagged and exposed. A major difference with others procedure then arises. We dissect the inferior and superior surfaces of the clavicle and the AC joint, although we maintain the continuity between the deltotrapezoid fascia and the AC ligaments. The AC dislocation is reduced under endoscopic control performing a true suture of the CC ligaments by the mean of 2 suture tapes and dog bones. After surgery, a shoulder brace is used for 6 weeks. Physiotherapy then begins.

Acute acromioclavicular (AC) joint dislocations are a common traumatic reason for consultation in shoulder surgeons’ offices, but their management is difficult and controversial.1,2 AC dislocations are mainly caused by a fall on the shoulder stump with the entire upper limb pushed down. This results first in a rupture of the AC ligament, then in a rupture of the coracoclavicular (CC) ligaments, then in the final stage an invasion of the clavicle through the deltotrapezial fascia, as described in the Rockwood classification.

Some authors remain convinced it should never be addressed surgically; however, most agree with conservative treatment in stages I or II of Rockwood and surgical treatment in stages IV, V, and VI.3 Despite the fact that many techniques exist, including arthroscopic techniques, few all-endoscopic techniques with both CC ligament repair and AC ligament release are documented. In 2015, Barth et al.4 recommended addressing both the CC and AC ligaments in to ensure good stabilization in both the vertical and horizontal planes. We present in this note a technique enabling the repair of the CC ligaments without creating any tunnels in the coracoid, by the means of cerclages, the extraction of the clavicle from the deltotrapezoid fascia, release of the AC ligament, and the reduction of the AC dislocation using an all-arthroscopic approach.

Anatomy and Pathology Pattern

This surgery is almost entirely performed out of the glenohumeral joint. It takes place in the anterosuperior and anteroinferior shoulder. It is important to identify correctly and dissect the brachial plexus so as not to damage it during the procedure at the inferior and medial border of the coracoid.

The whole upper limb is attached to the axial skeleton through the clavicle and AC joint. This joint is stabilized by AC ligaments (horizontal plane) and by CC ligaments (vertical plane). Therefore, to obtain a good outcome on the stabilization in both planes, the surgery must address both ligaments in acute AC dislocation, repairing the CC ligaments, and at least extract the...
incarcerated tissue from the AC joint, including the AC ligament. The technique we present enables one to safely perform all of the aforementioned in an all arthroscopic fashion with pearls and pitfalls (Table 1) and advantages and disadvantages (Table 2) discussed.

Surgical Technique (With Video Illustration)
The surgery (Video 1) is performed with the patient under general anesthesia. The patient is placed in the beach chair position with the arm in traction.

Endoscopic Portals
The endoscopic portals are as follows (Fig 1):
- A: posterior soft point.

| Step | Action | Pearls | Pitfalls and Tricks |
|------|--------|--------|---------------------|
| 1    | GH exploration | Use a needle to place the portal under endoscopic control | Associated lesions on labrum or rotator cuff tendons |
| 2    | Coracoid dissection | Release far distally CT Retract the deltoid with a switching stick in the D portal | Bleeding may occur at this stage |
| 3    | Clavicle dissection | retract the anterior deltoid with a switching stick | Adhesions may occur between the Pm and brachial plexus |
| 4    | AC dissection | Maintain the continuity between the deltotrapezoid fascia and the AC ligaments | Anteroposterior instability if AC ligaments severed |
| 5    | Clavicle drill | Locate with K wire the anterior, posterior, and lateral edges of the clavicle | Clavicle fracture if tunnels are poorly located |
| 6    | CC fixation | Use alternatively medial (M) and lateral (E, J) portals for instruments | Nerves and vascular injuries |

Table 2. Advantages and Disadvantages Between Arthroscopic and Open Procedures

| Step | Action | Advantages | Disadvantages |
|------|--------|------------|--------------|
| 1    | GH exploration | Verify associated lesions on labrum or rotator cuff tendons | Risk of injury on brachial plexus during Pectoralis minor tenotomy |
| 2    | Coracoid dissection | Less-invasive coracoid dissection | No suture of deltotrapezoid fascia |
| 3    | Clavicle dissection | Maintain the continuity between the deltrotrapezoid fascia and the AC ligaments | Anteroposterior instability if AC ligaments severed |
| 4    | AC dissection | No pressure loss due to skin incision | Nerves and vascular injuries |
| 5    | Clavicle drill | Protect vessels and nerves with a curette | Clavicle fracture if tunnels are poorly located |
| 6    | CC fixation | Control AC joint reduction | Two drills in clavicle with risk of clavicle fractures |

AC, acromioclavicular; CC, coracoclavicular; CT, conjoint tendon; GH, glenohumeral; Pm, pectoralis minor.
First Step: Glenohumeral Exploration
The surgery is always started through a posterior approach in the glenohumeral joint, enabling exploration and repair of associated lesions (e.g. cuff or labral tears). The rotator interval is opened, then the lateral margin of the conjoint tendon and inferior face of the coracoid are prepared.

Second Step: Coracoid Dissection
Lateral dissection (posterior view, A portal) (Fig 2A): The lateral border of the conjoint tendon and the coracoid is dissected. The coracoacromial (CA) ligament is tagged and either detached from the coracoid or loaded with sutures and prepared for clavicle reinsertion (e.g. transfer of the CA ligament coracoidal insertion to the clavicle). Tip: The lateral border of the conjoint tendon must be released far distally to increase the space around the coracoid and facilitate its further exposition.

Inferior and anterior dissection of the coracoid (lateral view) (Fig 2B): Through a lateral visualization portal (E) and the operative anterior inferior portal I, the exposition of the coracoid is completed, to release the soft tissue from its inferior surface, and to expose its anterior surface along with the insertion of the pectoralis minor (Pm). Tip: a switching stick can be introduced in the D portal and used as a retractor for the deltoid.

Fig 1. Endoscopic portals, left shoulder. (A, posterior soft point; D, lateral portal; E, anterolateral portal; I, anteroinferior portal; J, between I and E; LSC, lateral supraclavicular; M, medial approach; MSC, medial supraclavicular.)
Medial dissection (anterior view) (Fig 2C): The scope is switched to the I portal, and an operative medial (M) portal is created. The Pm is detached (Fig 2C), and care is taken to expose and protect the musculocutaneous (MC) nerve and the brachial plexus (Fig 2D). The upper border of the subscapularis is released, and the medial border of the coracoid is exposed. Tip: before detaching the Pm, it is safer to expose the space between the Pm and the conjoint tendon to visualize the MC nerve and ensure no adhesions between the nerve and the Pm place it at risk.

Superior dissection (anterior view) (Fig 3 A and B): The operative portals are alternatively medial (M) and lateral (D, E, J) according to the ideal position for coracoid and clavicle exposition. The superior surface exposition of the coracoid is completed, and the insertion of the CC ligaments is inspected. Their medial and lateral borders are clearly identified. The inferior face of the clavicle medially and laterally from the CC ligaments is exposed.

**Third Step: Clavicle Dissection**

The anterior, then superior, surface of the clavicle is dissected, and the deltotrapezoid fascia is detached from the clavicle. Progressing from medial to lateral enables one to extract the clavicle, which is incarcerated into the fascia (Fig 3 C and D). Tip: a switching stick is introduced in the D portal and used to elevate the anterior deltoid.

**Fourth Step: AC Dissection**

Moving from medially to laterally, the AC joint is exposed, and the AC ligament dissected and extracted from the AC joint (Fig 3D). Meniscus resection can be

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**Fig 2.** Coracoid and conjoint tendon dissection (left shoulder; a, b: posterior view; c, d: anterior view). (A) Posterior view (scope in soft point) of the rotator interval in the glenohumeral joint. (B) Lateral view (scope in D) of the coracoid process and conjoint tendon. (C) Anterior view (scope in I, instrument in M) of the coracoid process with pectoralis minor tenotomy. (D) Medial dissection of the coracoid process with musculocutaneous nerve dissection (scope in I, instrument in M) (C, coracoid process; MC, musculocutaneous nerve; Pm, pectoralis minor.).
performed at this step if necessary. Tip: care is taken to maintain the continuity between the deltotrapezoid fascia and the AC ligaments to ensure the spontaneous repositioning and healing of the AC ligaments on top of the clavicle.

**Fifth Step: Clavicle Drilling**

Once the clavicle is exposed, with its posterior and anterior edges tagged, drilling of the medial and lateral clavicular tunnels is performed. Two 2.0-mm K wires are used to create the correct path. The drill is a 4.0-mm cannulated one (DePuy Synthes Mitek, Raynham, MA). Tips: the anterior and posterior edges of the clavicle can be located with palpation thanks to the K wires for accurate placement of the tunnels (Fig 4). A curette is used while drilling to prevent the K wires being pushed inferiorly into major vascular or neurologic structures (Fig 5). The lateral tunnel in the clavicle must be at least 1 cm from the lateral edge of the clavicle, and the 2 tunnels are separated by at least 2 cm to prevent clavicle fracture.

**Sixth Step: Coracoclavicular Fixation**

We use a suture passer from DePuy Synthes Mitek (ideal suture grasper 30°, ref. 251721) to pass the shuttle relay sutures in the clavicle tunnels and though the CC ligaments. The shuttle relay sutures are replaced by suture tape (PERMATAPE Suture Blue Braided Flat Suture, 2.5 mm, ref. 223170; DePuy Synthes Mitek) and a not is tight around a Dog Bone (Dog Bone...
Button, ref. AR-2270; Arthrex, Naples, FL) while reducing the coracoclavicular diastasis (Figs 6 and 7).
Tip: the visualization is anterior (I portal). The suture passing device and a magic grasper (Suture Manipulator Grasper, ref. 214626; DePuy Synthes Mitek) are alternatively used in the medial (M) and lateral (E, J) portals. The suture passer is introduced in the medial supraclavicular and lateral supraclavicular portals to retrieve the shuttle relay sutures. The reduction of the clavicle is eased by the action of the switching stick introduced in the D portal, pushing the clavicle downwards against the coracoid. The AC reduction and absence of AC ligament incarceration is controlled with the scope (Fig 8).

Postoperative Care
The healing process requires one to prevent the weight of the upper limb to pull down the scapula. A 6-week immobilization period with a shoulder brace supporting the elbow is mandatory. Physiotherapy begins only then.

Discussion
Many techniques are described to manage acute AC joint dislocations. Most of them are performed arthroscopically. Some require the use of a C-arm and fluoroscopy, complicating the setup of the patient and the operating field. Many involve a mini-open step to extract the clavicle from the deltotrapezoid fascia and the repositioning and suture of the AC ligament.
In our technique, we choose to perform a dissection of the clavicle from the deltotrapezoid fascia and extract all the structures incarcerated endoscopically. An all-arthroscopic procedure limits the risks of infection. It enables a greater exposition of the clavicle, which can sometimes be difficult when performed through a mini-open incision, realized at the end of the procedure, when the shoulder is swollen, or creating a pressure drop.
if performed at the beginning of the surgery. The cerclage with tapes around as opposed to tunnels drilled into the coracoid obviously lowers the risk of coracoid fracture. Of course, this technique presents risks due to the proximity of the brachial plexus during the dissection of the coracoid. The MC nerve must be identified to avoid injury during the tenotomy of the Pm. The classic complications linked to the use of strips under the coracoid can be found, such as the fracture of the coracoid by shearing or fracture of the clavicle at the level of the tunnels.

The complications of recurrent instability are limited by the use of 2 strips allowing the reconstruction of the conoid and trapezoid ligament. Even if the delto-trapezius muscle is not sutured, it is dissected and lifted flush with the peristeum to allow it to heal postoperatively. In addition, an improvement in the technique with reconstruction of the AC ligament by the CA ligament is possible. We simply detach the CA ligament from the lateral edge of the coracoid and fix it to the lateral clavicular hole by a lasso loop. This improves the anteroposterior stability.

Our technique enables a true suture of the CC ligaments, which are loaded with tape and reattached to the lower surface of the clavicle. Their potential healing is thereby improved.

However, we still believe, as shown by Barth et al., that acute AC joint dislocations should be managed within the first 10 days if simple fixation is desired. Beyond this time frame, we favor CC ligament reconstruction with tendon grafts.

**Fig 5.** Medial clavicle tunnel drilling (left shoulder, anterior view). (A-D) Drilling of the medial clavicle with protection of the neurovascular structures, using a curette. Scope in I, K wire is introduced in MSC (medial supra clavicular portal). (CC, coracoclavicular ligament; Cl, clavicle; mCl, medial 2/3 of clavicle; Tz, trapezius.)
Fig 6. Conoid ligament suture (left shoulder, anterior view, scope in I, suture grasper and dog bone in MSC). (A) Passage of the suture under the coracoid process behind conjoint tendon from lateral to medial. (B) Passage of the medial strand of the shuttle relay through the medial clavicle tunnel. (C) Passage of the lateral strand of the shuttle relay through the conoid ligament. (D) Retrieving the lateral strand of the shuttle relay through the medial clavicle Tunnel. (E) Dog Bone application on the medial clavicle tunnel. (F) Suture of the conoid ligament: shuttle relay has been replaced by tape sutures. (C, coracoid process; CC, coracoclavicular ligaments; Cl, clavicle; CT, conjoint tendon; MSC, medial supra clavicular; Pm, pectoralis minor; Tz, trapezius.)
Fig 7. Suture of the trapezoid ligament (left shoulder, anterior view, scope in I, suture grasper alternatively in lateral supraclavicular and M, switching stick in J). (A) Passage of the shuttle relay under the coracoid process behind conjoint tendon, from lateral to medial. (B) Passage of the medial strand of the shuttle relay through the trapezoid ligament. (C) Retrieving the medial strand of the shuttle relay after passing though the trapezoid ligament. (D) Passage of the medial strand of the shuttle relay through the lateral clavicle tunnel. (E) Suture of the trapezoid ligament under the lateral part of the clavicle after the lateral strand of the shuttle relay was passed in the lateral clavicle tunnel, and replaced by a suture tape. (F) Dog Bone application on the lateral clavicle tunnel and reduction with the switching stick. (ACJ, acromioclavicular joint; C, coracoid process; CC, coracoclavicular ligament; Cl, clavicle; CT, conjoint tendon; ICl, lateral clavicle.)
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![Fig 8. Control of the reduction of the ACJ with no incarceration of ACJ ligaments (left shoulder, anterior view, scope in I, switching stick in J). (Ac, acromion; ACJ, acromioclavicular joint; Cl, clavicle.)](image-url)