Arthroscopically Assisted Treatment of Acute Dislocations of the Acromioclavicular Joint

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Abstract: Arthroscopically assisted treatments for dislocations of the acromioclavicular joint combine the advantages of exact and visually controlled coracoid tunnel placement with the possibility of simultaneous treatment of concomitant injuries. The clinical results of previous arthroscopically assisted techniques have been favorable at midterm and long-term follow-up. The presented surgical technique combines the advantages of arthroscopically positioned coracoclavicular stabilization with an additional suture cord cerclage of the acromioclavicular joint capsule for improved horizontal stability.

Appreciation of the anatomic structures that provide acromioclavicular (AC) joint stability is vital for successful and sustainable treatment. As 1 of the 2 main ligamentous structures that stabilize the AC joint, the coracoclavicular (CC) ligaments primarily prevent the lateral clavicle from dislocating superiorly, whereas the AC ligaments mainly contribute to horizontal stability of the AC joint. The surgical stabilization of these structures should allow the complex 3-dimensional motion pattern of the joint without jeopardizing the construct's stability.[1]

Previous studies showed the biomechanical properties and satisfactory clinical outcomes of suture button devices for the treatment of acute AC joint dislocations.[2-4] With treatment performed in an early stage after the initial injury, the clavicle and acromion are approached in a physiological way to promote healing of the AC and CC ligaments. The further development of fixation devices consisting of 2 "dog-bone" buttons in combination with 2 FiberTapes (Arthrex, Naples, FL) required a tunnel diameter of only 2.4 mm and therefore advanced the safety of previous arthroscopic techniques. The advantages of arthroscopically assisted procedures are the detection and treatment of additional glenohumeral lesions as well as minimal soft-tissue dissection, smaller incisions, and more precise tunnel placement at the coracoid process because it is performed under a direct view.

We have been performing arthroscopic techniques for the treatment of acute AC joint dislocations for more than 10 years. Within this period, we have learned specific lessons and found pearls that allowed further development of our surgical procedure. The surgical technique presented in this article and in Video 1 combines the advantages of arthroscopically positioned CC stabilization with an additional suture cord cerclage of the AC joint capsule for improved horizontal stability (Table 1).[5,6]

Table 1. Surgical Pearls and Pitfalls

Perform glenohumeral arthroscopy to evaluate for possible associated glenohumeral lesions.
Drill the horizontal tunnel for AC cerclage before the AC joint is reduced to allow better manipulation of the distal clavicle.
First reconstruct the AC ligaments to maintain perfect reduction when drilling the CC tunnel.
Tag the deltoid and trapezial fascia to achieve a good repair.
Ensure proper visualization of the posterior base of the coracoid (using an additional anterolateral portal or 70° arthroscope).
Use a 2.4-mm cannulated drill for easy suture passage.
Reduce the clavicle by lifting the arm with an automatic arm holder, and control reduction with fluoroscopic visualization.
Control the anterior and posterior clavicular borders (using Hohmann retractors) to prevent cortical blowout.
Use the index finger to control the position of the aiming device at the clavicle and prevent slippage.

AC, acromioclavicular; CC, coracoclavicular.

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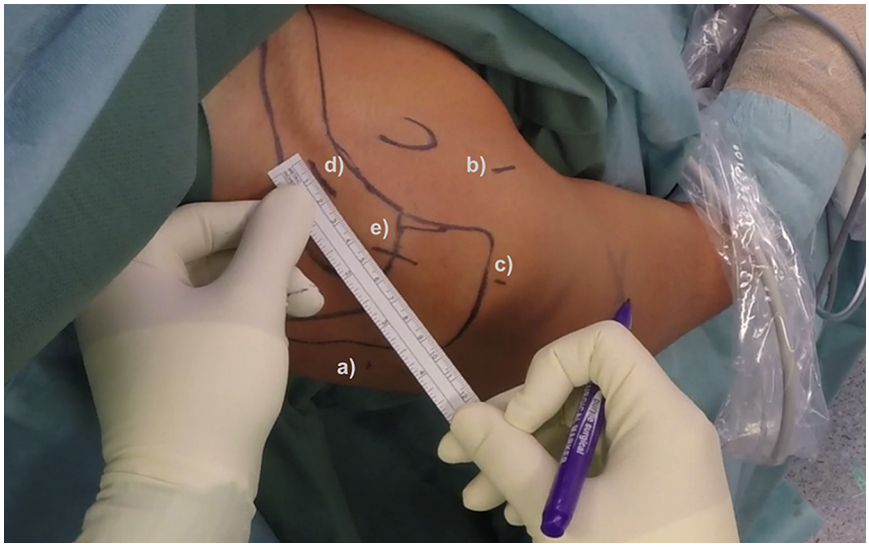

Fig 1. Right shoulder of patient positioned in beach-chair position. Portals and skin incisions are marked preoperatively: standard posterior portal (a), antero working portal (b), lateral portal for better visualization of coracoid base (c), skin incision at the area of the anatomic coracoclavicular ligament insertion for drilling of the coracoclavicular tunnel (d), and skin incision over the acromioclavicular joint (e).

Surgical Technique

The patient is placed in the beach-chair position with special emphasis on sufficient access to the clavicle for placement of the clavicular bone tunnel. Turning the head slightly in the opposite direction and using a mechanical arm holder have been shown to be beneficial. Correct access for intraoperative imaging with the C-arm should be tested, and finally, the anatomic landmarks are identified and marked on the skin (Fig 1).

A 40-mm 30° arthroscope is used within the posterior portal in a standard fashion. Concomitant intra-articular injuries (e.g., SLAP lesions) should be addressed as needed. A deep anterolateral portal is established by an outside-in technique through the rotator interval and parallel to the subscapularis tendon and is secured with a flexible silicone cannula (e.g., 10-mm PassPort Button Cannula [Arthrex]) (Figs 2 and 3). The base and arch of the coracoid undergo skeletonization with an electrothermal ablation device. For an optimal view of the base of the coracoid, the arthroscope is switched to an additional trans-supraspinatus lateral viewing portal directly posterior to the long head of the biceps tendon (Figs 4 and 5). This step is considered crucial to adequately visualize the base of the coracoid and not to place the subsequent drill tunnel through the coracoid tunnel too far anteriorly.

Primarily for suture cord cerclage of the AC joint, a 30-mm skin incision is established over the AC joint in line with and central to the distal clavicle. The fascia is incised in line with the natural demarcation between the trapezius insertion onto the posterior aspect of the clavicle and the deltoid origin on the anterior clavicle. It is carefully mobilized, with elevation of the anterior and posterior flaps subperiosteally as a single layer, which facilitates its later repair. Freeing the clavicle and AC joint of soft tissues that are preventing joint reduction completes the exposure. Next, a 2.4-mm cannulated drill is used to drill a horizontal hole into the lateral clavicle, approximately 10 to 15 mm medial and parallel to the AC joint line in a posterior-to-anterior

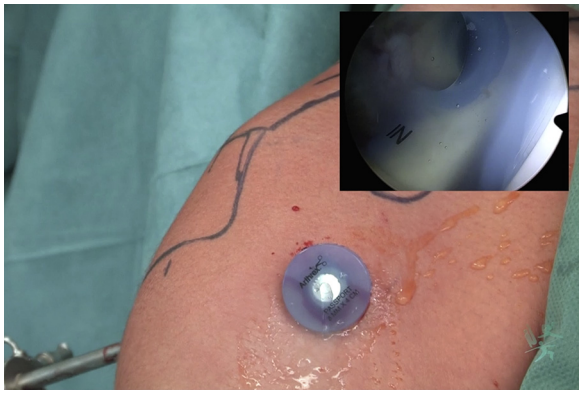

Fig 2. Anterior view of right shoulder with flexible cannula (PassPort) positioned in anterosuperior working portal.

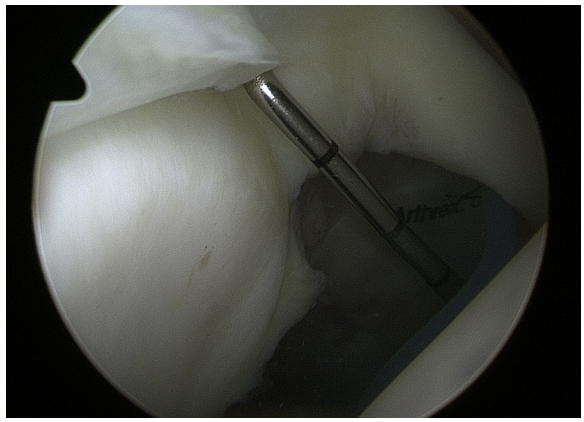

Fig 3. Arthroscopic view through the standard posterior portal showing probe testing of the biceps insertion to evaluate for SLAP lesions.

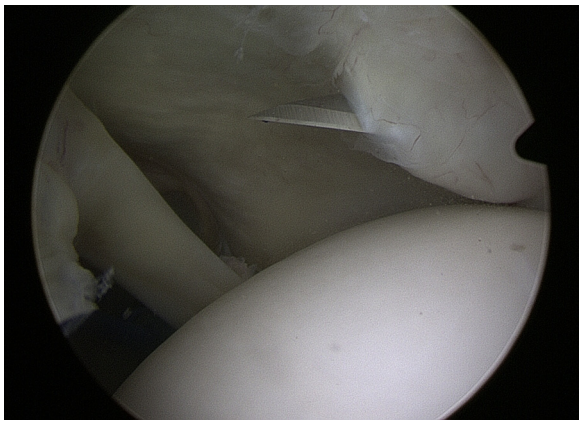

Fig 4. Arthroscopic view through the standard posterior portal showing the application of the second anterolateral portal.

direction (the AC joint is still unreduced and the lateral clavicle is mobile) (Fig 6).

A shuttle suture (SutureLasso; Arthrex) is passed through the cannulated drill, which is removed. By use of the same cannulated drill, a corresponding drill hole is then placed into the acromion, approximately 10 mm lateral to the joint line, starting from the anteroinferior edge to the acromion surface at the posterior border of the AC joint. Again, a shuttle suture is transferred through the drill, and a 1.5-mm polydioxanone cord is then passed through the drill holes in a figure-of-8 configuration (Fig 7). The AC joint is thoroughly reduced by lifting the arm with the help of an automatic arm holder. Correct reduction is checked visually and radiographically. The cord is fixed temporarily, and final tying of the AC polydioxanone cord is performed at the end of the procedure. Maintaining an exact reduction throughout the following steps is essential.

A second skin incision (3 cm) is made beginning 2 cm medial to the lateral border of the clavicle (centrally within the anatomic insertion of the conoid and

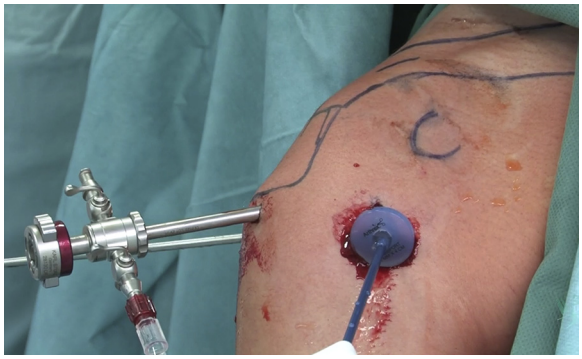

Fig 5. Outside view of a right shoulder from anterior showing the arthroscope positioned in the lateral portal for better visualization of the coracoid base and an electrothermal device placed in the anterolateral working portal.

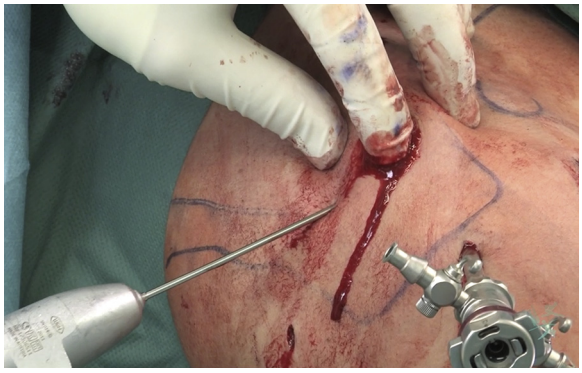

Fig 6. Outside view of right shoulder. A 2.4-mm cannulated drill is used to drill a horizontal hole into the lateral clavicle, approximately 10 to 15 mm medial and parallel to the acromioclavicular joint line in a posterior-to-anterior direction (the acromioclavicular joint is still unreduced and the lateral clavicle is mobile).

trapezoid ligament at the clavicle). The trapezoid fascia is exposed and incised in the same way as described before, which allows exposure of the clavicle with its anterior and posterior cortical margins. For CC tunnel placement, the AC joint drill guide (AC Guide; Arthrex) is inserted through the anterolateral portal (Figs 8 and 9). The 2.4-mm cannulated drill is then used to drill the CC tunnel approximately 35 mm medial to the AC joint, in a transclavicular manner and close to the base of the coracoid process. Because of the oblique drilling direction, the entrance point of the clavicular drill hole should be placed slightly posterior to the midline. To prevent cortical blowout, retractors are placed at the anterior and posterior edges of the clavicle. The correct positioning of the tunnel at the base of the coracoid is verified under

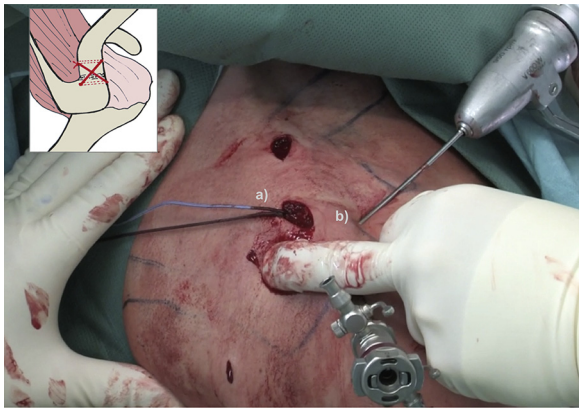

Fig 7. Outside view of right shoulder. A 1.5-mm polydioxanone cord (a) is passed through the medial drill hole. A second drill hole (b) is placed into the acromion, approximately 10 mm lateral to the joint line, starting from the anteroinferior edge to the acromion surface at the posterior border of the acromioclavicular joint. The polydioxanone cord is then passed in a figure-of-8 configuration, as shown in the inset.

Fig 8. Outside view of right shoulder. The acromioclavicular joint drill guide (AC Guide) is inserted through the anterolateral portal. To prevent cortical blowout, retractors are placed at the anterior and posterior edges of the clavicle.

fluoroscopy with a probe. Subsequently, a SutureLasso wire loop is inserted through the cannulated drill bit before it is removed. By use of this shuttle wire, the free strands of 2 high-strength suture tapes (e.g., FiberTape [Arthrex]) are shuttled upward through the coracoid and the clavicle. The loops are threaded in a special titanium button (DogBone; Arthrex), and the button is placed under the coracoid process using a grasper through the deep anterolateral portal (Fig 10). Correct placement of the button under the coracoid is controlled by direct visualization. The 4 strands of the suture tapes are threaded in a second titanium button (DogBone) on top of the clavicle (Fig 11). Again, correct reduction is controlled radiographically. Next, the suture tapes are tightened and secured by alternating knots. The cerclage is then finally fixed by alternating knots.

The deltotrapezial fascia is closed with interrupted sutures attaching the anterior deltoid fascia and the trapezius fascia. The knots are placed on the posterior side of the flap to minimize skin irritation. Finally, the dermal layer is closed in the usual manner.

Postoperatively, the arm is placed in a sling. Motion and activity limitations for the postoperative period are shown in Table 2. Patients are typically allowed to return to full-contact athletics after 5 to 6 months.

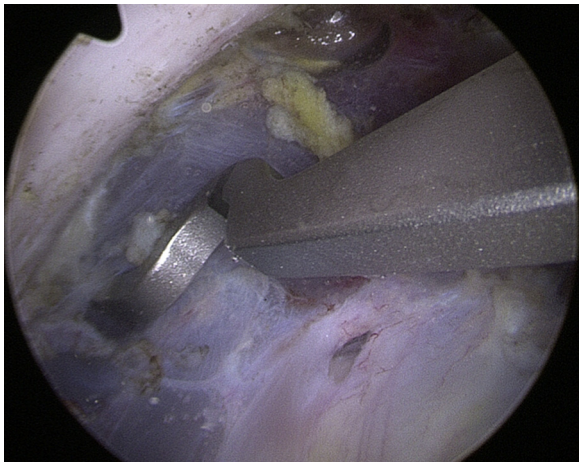

Fig 9. Arthroscopic view of a right shoulder through the anterolateral portal showing the positioned aiming device for arthroscopically controlled drilling of the coracoclavicular tunnel.

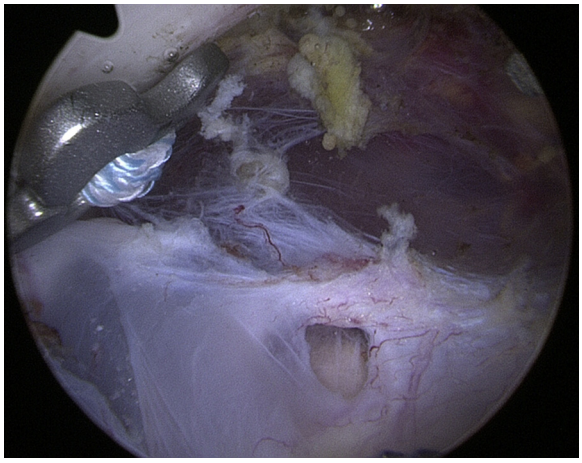

Fig 10. Arthroscopic view of a right shoulder through the anterolateral portal showing the button and tapes correctly positioned at the center of the coracoid base.

Discussion

None of the numerous currently existing procedures for the treatment of AC joint dislocations have been proved to be the overall gold standard.[1] However, the clinical results of previous arthroscopically assisted techniques for AC joint reconstruction have been favorable at midterm and long-term follow-up.[3,7] Because concomitant injuries to the shoulder girdle are frequent, any successful AC joint surgery demands complete and accurate diagnosis of all pathology

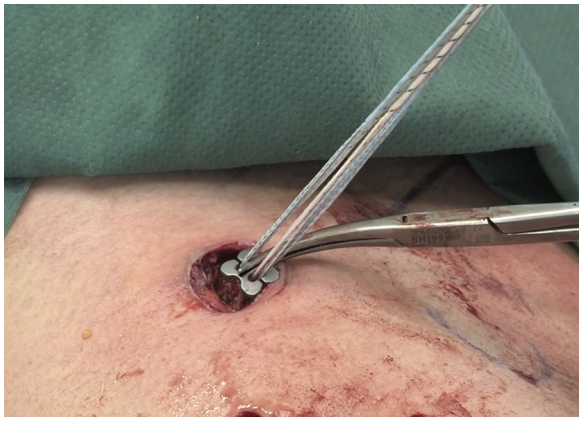

Fig 11. Outside view of right shoulder. The 4 strands of the suture tapes are threaded in a titanium button (DogBone) on top of the clavicle and finally fixed after radiographic control of correct repositioning.

Table 2. Postoperative Motion and Activity Limitations

Time Postoperatively	Permitted Range of Motion and Activity
1-2 wk	Passive abduction/adduction: 30°/0°/0° Passive flexion/extension: 30°/0°/0° Passive IR/ER: 80°/0°/15°
3-4 wk	Passive abduction/adduction: 45°/0°/0° Passive flexion/extension: 45°/0°/0° Passive IR/ER: 80°/0°/30°
5-6 wk	Passive abduction/adduction: 60°/0°/0° Passive flexion/extension: 60°/0°/0° Passive IR/ER: free
7 wk	Free active range of motion

NOTE. Range of motion is reported according to the neutral zero method.

ER, external rotation; IR, internal rotation.

involved, which is possible through the use of such arthroscopic procedures.[8] In addition, surgeons should be aware of the importance of the superior and posterior AC ligaments and should avoid sacrificing their competence in surgical procedures.

To minimize the bone loss related to coracoid tunnel placement, we currently prefer the described technique, which uses a single, small CC drill hole. This allows an arthroscopically controlled and anatomic placement of the coracoid tunnel. We believe that the combination of such refixation of the CC ligaments and the additional cerclage of the AC ligaments provides an optimized vertical and horizontal stability for healing. However, in case of high body mass index or body size combined with high athletic demands, we add a second DogBone construct for CC refixation (placed in the anatomic position of the trapezoid and coronoid ligament).

Multiple questions remain unsolved in finding the optimal treatment for AC joint dislocations. These range from treating the correct patient based on the perfect diagnosis as well as finding the optimal time point and procedure for surgical treatment.[9] Although our early results are encouraging, investigations with long-term follow-up will be necessary to show the value and possible advantages of the described procedure.

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