

Arthroscopic-assisted hook plate fixation for acromioclavicular joint dislocation

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Abstract

Purpose We present a new technique of arthroscopic-assisted AC-hook plate fixation for acromioclavicular joint dislocation with all the advantages of minimally invasive surgery and the possibility to treat concomitant pathologies.

Methods Initially a glenohumeral arthroscopy is performed to address concomitant intra-articular injuries. Under subacromial visualisation the drill hole for the hook of the plate can be exactly positioned in the acromion. The hook plate is put in place under visual control.

Results The initial results ($n=3$) are promising with good to excellent results in the Constant score [90.5 (range 82–100)] in all cases studied. The cross-body test was slightly positive in one case. The median follow-up time after the index procedure was seven months (range five to ten).

Conclusions In conclusion, arthroscopic-assisted reconstruction of acromioclavicular joint separation is feasible and may provide patients with all the benefits of AC-hook fixation with decreased risks related to open surgery. The described technique is recommended for all surgeons familiar with arthroscopic surgery.

Introduction

Arthroscopic joint surgery has evolved dramatically and become an integral part of orthopaedics over the past few decades [1].

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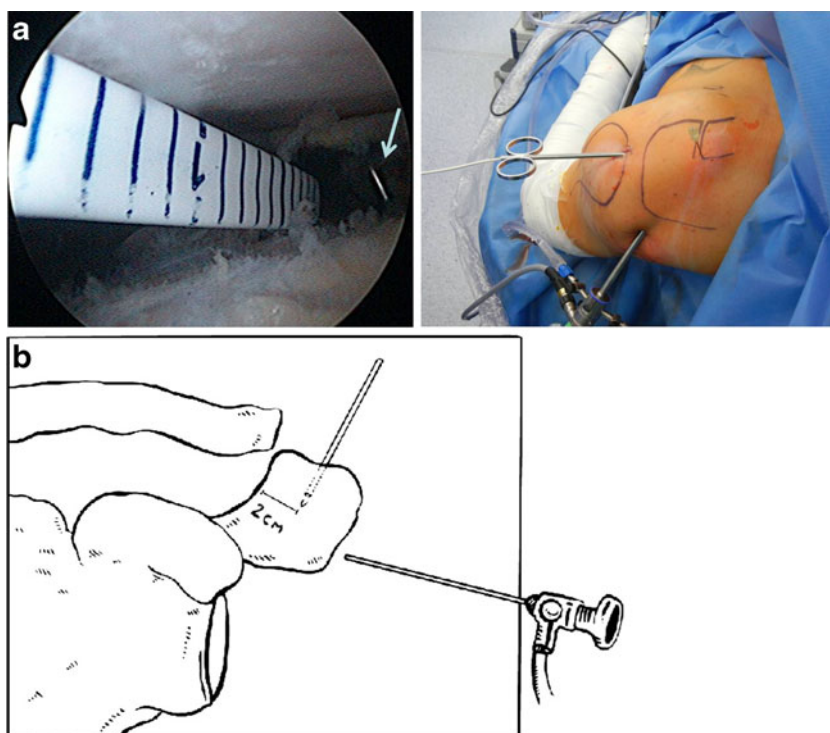
Acromioclavicular joint dislocations are common injuries in orthopaedic surgery and sports medicine [6]. These injuries often occur in athletic, young patients after blunt force to the shoulder [12]. While conservative treatment is the option of choice in Rockwood type I and II injuries, operative treatment is still a matter for discussion for Rockwood type III injuries and is the option of choice for type IV–VI separations [6, 7, 12]. For the reconstruction of the acromioclavicular joint separation, several static and dynamic operative procedures with or without primary ligament replacement have been described [5]. Operative treatment of AC joint dislocation with an AC-hook plate leads to good mid-term results with a low overall complication rate [6]. Open reduction and AC joint reconstruction with a hook plate implant can be an extensive surgical procedure. We present a novel technique of arthroscopic-assisted AC joint reconstruction with a hook plate and report our initial results.

Surgical technique

The indication for this procedure is acute Rockwood III–V injuries. In chronic AC joint separations it is mandatory to ensure preoperatively that full reduction of the clavicle is possible. Under general or regional (interscalene) anaesthesia, the patient is placed in the standard beach-chair position on a radiolucent operating table. Initially two different portals are used for this procedure, namely, the standard posterior soft spot portal and an anterolateral portal just at the anterior corner of the acromion. The operation is started with glenohumeral arthroscopy through a posterior viewing portal and intra-articular lesions are repaired.

After glenohumeral arthroscopy is complete, the instruments are positioned in the subacromial space. Through the anterolateral portal a full radius resector is passed for bursal resection while the subacromial space is distended. In case of bleeding we use a radiofrequency device (VAPR, DePuy Mitek). A subacromial decompression is not routinely

Fig. 1 **a** Arthroscopic anteromedial view in the subacromial space (left shoulder); a needle marks the posterior part of the AC-joint (white arrow). Intraoperative setting with the arthroscope in the posterolateral portal, a linear measuring tool in the anterolateral portal and the needle marks the AC joint. **b** The illustration demonstrates the exact positioning of the drill guide (posteromedial view; left shoulder). The drill hole should be perpendicular to the distal end of the clavicle and 2 cm lateral to the AC joint



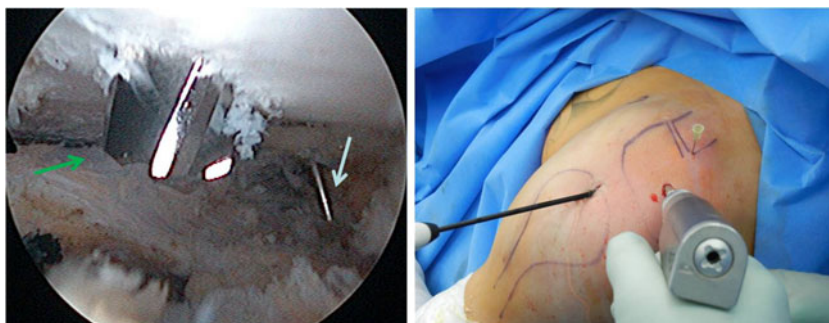
performed as it may lead to a weakened acromion raising the potential risk of a cut-out of the plate's hook. Once the bursal tissue and periosteum of the acromion have been adequately resected to allow identification of the anatomical landmarks, a needle is placed in the dorsal part of the AC-joint (Fig. 1a). A precise positioning of the guide pin is the next step. The drill hole should be in extension of the dorsal clavicle's rim and the distance to the AC joint should be 2 cm, which can be measured by a linear measuring tool (Fig. 1b). The distance from the AC joint to the drill hole is predefined by the design of the hook plate. It is important to have sufficient bone bridges both lateral and dorsal to the reamed tunnel. The guide pin is drilled through the acromion and can be visualised arthroscopically as soon as it appears in the subacromial space (Fig. 2). A drill guide may be helpful to place the guide pin at the undersurface of the acromion in the desired location. A 5-mm incision is made over the acromion close to the guide pin. A 5-mm

cannulated drill (Asnis System, Stryker) is used to create a tunnel through the acromion (Fig. 3). The reamer is left in situ but the inner guide pin is removed. A lasso wire (Arthrex) is passed through the reamer with the loop end down. The lasso is pulled out at the AC joint with a grasper, after making a 5-mm incision over the dorsal rim of the lateral clavicle close to the AC joint (Fig. 4). We do not recommend making the incision initially larger than that before to the plate fixation, as it leads to rapid fluid loss and arthroscopically-limited visibility. The cannulated reamer can now be removed and an Orthocord® suture is pulled out through the acromion and out of the incision by the lasso loop. A hook plate (tifix®-AC-hook-plate, Litos) is knotted to the medial end of the Orthocord® suture (DePuy Mitek) and the hook plate is positioned (Fig. 5). This can be done under steady visual control by arthroscopy (Fig. 6a and b). The incision over the distal part of the clavicle is enlarged to 2.5 cm and the deltoid

Fig. 2 Arthroscopic anteromedial view in the subacromial space (left shoulder); a precise positioning of the guide pin is done under visual control (red arrow). The needle at the AC joint is marked with a white arrow. The drill guide is positioned transcutaneously



Fig. 3 Arthroscopic anteromedial view in the subacromial space (left shoulder); a cannulated drill (Asnis System, Stryker) is used to create a tunnel through the acromion (*green arrow*). The needle at the AC joint is marked with a *white arrow*



insertion over the clavicle is detached partially with a periosteal elevator. After manual reduction of the AC joint the plate is fixed temporarily using a screw through the most medial plate hole. An arthroscopic evaluation is performed focusing on the one hand on the alignment of the AC joint and on the other hand to exclude any impingement between the hook and the rotator cuff. Following this confirmation, the other screws are fixed. The plate position is finally assessed fluoroscopically (Fig. 7). Figure 8 shows findings at the time of discharge two days postoperatively.

Physiotherapy is started immediately with limitation of forward flexion and abduction up to 90° for eight weeks. Initially patients are not allowed to carry any weight with the arm. Eight weeks postoperatively the hardware is removed on an outpatient basis. Free range of motion is allowed after eight weeks without heavy lifting for a total of three months.

Case series

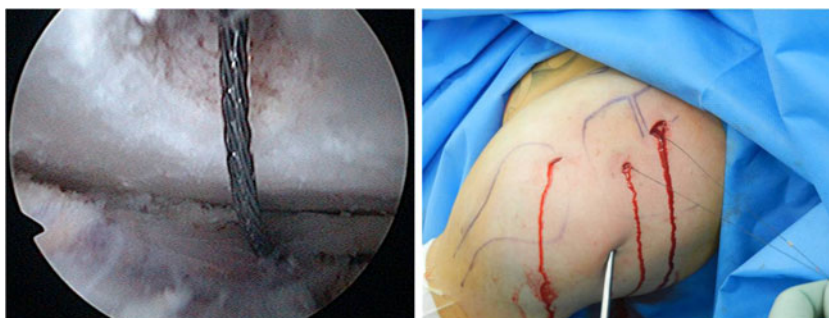
In a series of three cases, arthroscopically assisted AC-hook plate fixation for acromioclavicular joint dislocation was performed as described above. At no point during the procedures did the surgeon feel uncomfortable with proceeding arthroscopically and converted to an open procedure. None cases had any complication associated with the index procedure. During the diagnostic glenohumeral arthroscopic procedure one partial subscapularis lesion was diagnosed. The

lesion was considered as degenerative and more superficial articular-side partial tear; it was left untreated. The median follow-up time after the index procedure was seven months (range five to ten). The Constant score at the time of follow-up was 90.5 (range 82–100). None of the cases studied was limited in their activities of daily living (ADL). The cross-body test was slightly positive in one case. The distance between elbow at the opposite shoulder in maximum adduction was 1 cm (range 0.5–2 cm) longer after the index procedure compared to the contralateral side; a slightly positive cross-body test was linked to the longest distance.

Discussion

Within recent years several arthroscopic techniques for the treatment of AC joint dislocation have been described [5]. Open procedures have considerable morbidity and some high failure rates, but arthroscopic reconstruction techniques are far from being widely accepted [13]. Operative treatment of AC joint dislocation with an AC-hook plate leads to good mid-term results with a low overall complication rate [6]. But open reduction and AC joint reconstruction with a hook plate implant can be an extensive surgical procedure. The most important finding of our study is that arthroscopic-assisted AC-hook plate fixation for acromioclavicular joint dislocation is technically feasible. Addressing the AC separation through an arthroscopically-assisted approach enables one to use smaller incisions with decreased associated risks.

Fig. 4 Arthroscopic anteromedial view in the subacromial space (left shoulder); a lasso wire (Arthrex) is passed through the reamer with the loop end down. The lasso is pulled out at the AC joint with a grasper after a 5-mm incision was made over the dorsal rim of the lateral clavicle close to the AC joint



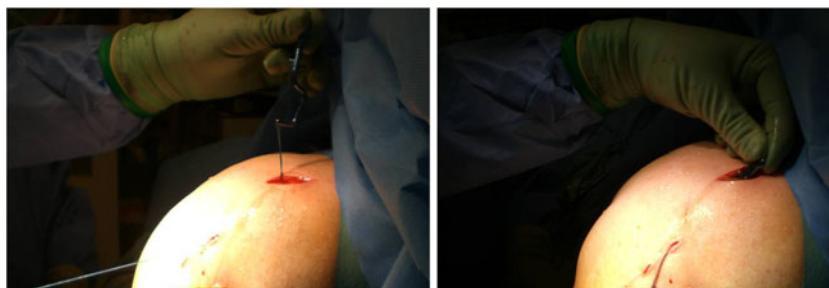


Fig. 5 Intraoperative setting with an anterior view (left shoulder); the cannulated reamer has been removed and an Orthocord® suture was pulled out through the acromion and out of the incision by the lasso

loop. A hook plate (tifix®-AC-hook-plate, Litos) knotted to the medial end of the Orthocord® suture (DePuy Mitek) is positioned

Compared to open surgery, the arthroscopic technique may offer advantages including:

- Minimal soft tissue trauma
- Minimal blood loss
- Complete shoulder inspection and treatment of concomitant intra-articular injuries

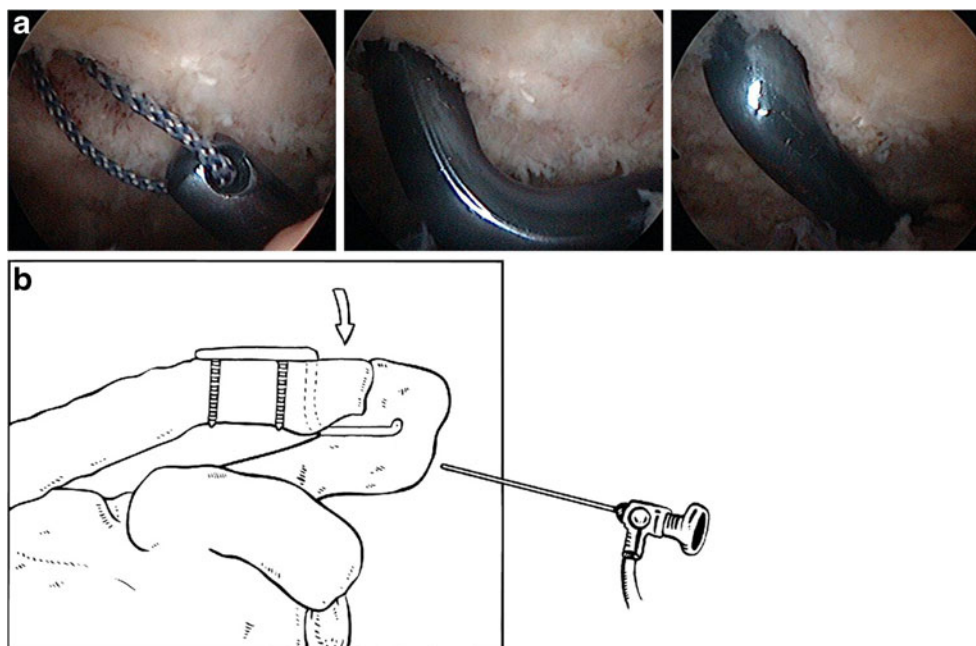
The limits of this technique are seen in patients with gross obesity and in chronic AC separations, which cannot be fully reduced [11].

To the best of our knowledge this is the first report of AC-hook plate fixation for acromioclavicular joint dislocation. Arthroscopically-assisted locking compression plate clavicular hook fixation for unstable fractures of the lateral end of the clavicle was first described in 2009 [8]. Looking at this study in detail, an open reduction and hook plate

fixation was performed with solely an arthroscopy at the end of the operation. An arthroscopy examination was done to exclude an impingement of the hook and rotator cuff in exercises from all directions.

Arthroscopy provides direct visualisation of the AC-joint and may allow a higher accuracy in reduction of the AC separation leading to better clinical outcomes compared to open procedures. Other than this, the need for fluoroscopy and the X-ray time are reduced; it has been our experience that single-shot fluoroscopy at the end of surgery is enough. Direct arthroscopic visualisation of the undersurface of the acromion allows positioning of the transacromial drill hole in exactly the desired location. It has been reported in the literature that the hook needs to be well seated beneath the acromion, posterior to the acromioclavicular joint [3, 4]. Otherwise unhooking of the plate from under the

Fig. 6 a Arthroscopic anteromedial view in the subacromial space (left shoulder); the hook plate is positioned in place under steady visual control by arthroscopy. **b** The illustration shows the hook plate in a correct position with an AC joint with good alignment (anterodorsal view; left shoulder)



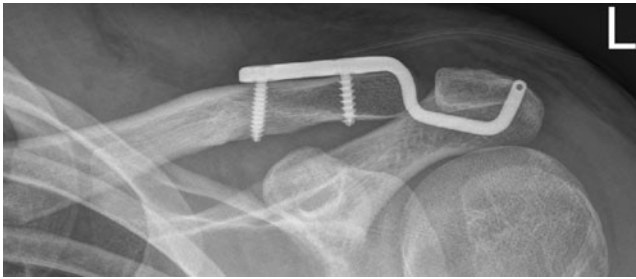


Fig. 7 The plate position is finally assessed fluoroscopically and the end of surgery before wound closure. The AC joint shows good alignment with the hook plate in the correct position

acromion may occur and this is related to incorrect positioning of the drill hole [2].

The arthroscopic-assisted approach provides surgeons with an opportunity to treat concomitant intra-articular pathologies, which otherwise might have been missed. In an earlier series, 15 % of high-grade AC-joint separations were associated with traumatic intra-articular lesions [10]. We are not aware of any study that reported on revisions after failed AC-joint repair due to overlooked intra-articular pathology. However, persistent shoulder pain after an otherwise successful AC-joint repair may be related to concomitant injuries [10].

The presented clinical results at the time of follow-up are in accordance with the literature, reporting good to excellent outcome results in the Constant score after AC-hook plate fixation for acromioclavicular joint dislocation [6]. Factors that influence the clinical outcome are articular congruity, stability of the joint and hook contact with surrounding subacromial structures [2, 3, 9].

There are limitations that need to be acknowledged and addressed regarding this study. One limitation has to do with the extent to which the findings can be generalised beyond the cases studied. Another limitation is the lack of a control group. However, these limitations can be seen as fruitful



Fig. 8 Dorsal view in a left shoulder; findings at the time of discharge two days postoperatively. The incision necessary for plate fixation is marked with a red arrow

avenues for future research under the same theme. A randomised trial is on its way and will elucidate the possible advantages of arthroscopic-assisted AC-hook plate fixation in comparison with open surgery in AC-joint separations.

Conclusion

We conclude that arthroscopically-assisted AC-hook plate fixation in AC-joint separations may be a useful innovation, which offers all advantages of a minimally-invasive surgical procedure to the patient. The described technique is recommended for all surgeons familiar with arthroscopic surgery.

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