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Arthroscopic-assisted removal of broken distal hook fragment that migrated to the acromion in a patient who underwent hook plate fixation due to acromioclavicular joint dislocation: a case report and literature review

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Acromioclavicular joint (ACJ) dislocations are common injuries of the shoulder girdle and often occur after direct trauma to the acromion while the arm is in adduction.² The Rockwood classification is used to categorize ACJ dislocations, describing them as type I through type VI according to the degree of dislocation.²²

Many different methods are used in the treatment of ACJ dislocations. One of these is hook plate (HP) fixation, which is an effective and frequently preferred method that provides natural healing of the coracoclavicular ligaments in the treatment of both ACJ dislocations and distal clavicle fractures.^{8,19,24} During HP fixation, the hook is passed through the ACJ and placed posterior to the acromion in the subacromial space, and then the plate body is fixed by placing screws in the distal clavicle.^{5,10} Thus, the acromion and clavicle are brought into line and the ligaments are healed in the appropriate length. However, although it provides important advantages such as stable fixation and early mobilization, important complications related to HP fixation have been reported, including subacromial impingement syndrome (SIS), acromial osteolysis, and rotator cuff damage.^{6,13} For these reasons, some authors recommend removing the HP as soon as possible to avoid complications after ACJ healing is completed.^{13,16,18} After removing the screws placed on the clavicle while removing the HP, the plate can be removed obliquely without damaging the ACJ.

In this case report, the arthroscopic-assisted removal of a distal hook fragment that was broken and migrated to the acromion in a

patient who had previously undergone HP fixation due to ACJ dislocation, without causing disruption in the ACJ and deltoid origin, is described.

Case report

A 26-year-old male patient was admitted to a different hospital in June 2017 with severe shoulder pain after falling on his right shoulder during an epileptic seizure. The patient, who is a teacher, is right-hand dominant and plays basketball twice a week as a sports activity. When a detailed history was taken from the patient, it was learned that he had no comorbidities other than epilepsy. After an examination of this patient, Rockwood type V ACJ dislocation was detected in his right shoulder. The patient underwent open reduction and internal fixation with HP under general anesthesia the next day (Fig. 1, A and B). He was discharged on the first postoperative day as his general condition was good. In the meantime, the patient, who did not undergo regular follow-up at that first hospital, continued his daily activities.

The patient was admitted to our clinic in August 2023 with increasing pain and joint range of motion (ROM) limitation in the right shoulder, particularly with overhead activities. It was learned that he had lifted a heavy object about 3 days ago and then severe pain started in his shoulder. The patient stated that he had limited ROM in his right shoulder before lifting a heavy object, but had no pain. During the examination of the patient, a transverse incision scar of approximately 8 cm in length was observed on the right clavicle and ACJ. The patient had tenderness and swelling around the ACJ. When passive joint ROM was evaluated, 110° forward flexion, 90° abduction, 30° external rotation with the arm in

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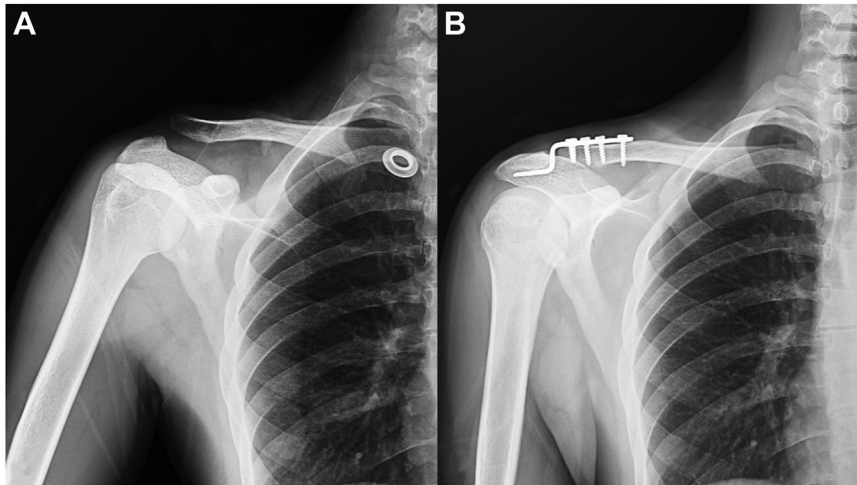


Figure 1 (A) Rockwood type V ACJ dislocation seen on the shoulder AP radiograph of the patient, who applied to a different hospital 6 years ago. (B) Immediate postoperative radiograph of the patient, who had undergone HP fixation. ACJ, acromioclavicular joint; AP, anteroposterior.

adduction, 70° external rotation with the arm in abduction, and internal rotation at the T10 level were obtained. This patient, who experienced severe pain, especially during forward flexion and abduction, reported a visual analog scale (VAS) pain score of 8 (range: 0-10). The Neer sign and Hawkins-Kennedy test were positive and the patient was diagnosed with SIS.^{9,17} In shoulder anteroposterior and Zanca view radiographs, it was seen that the patient's ACJ was healed but the previously placed HP was broken at joint level.²⁸ Shoulder computed tomography (CT) was performed to determine the location of the broken fragment, and from the coronal and sagittal CT sections, it was understood that osteolysis had developed in the acromion and the broken fragment had migrated superiorly (Fig. 2, A-D). After these evaluations, implant removal was planned for the patient; it was decided that the proximal part of the plate and the screws would be removed with open surgery and the distal hook fragment of the plate would be removed with an arthroscopic-assisted procedure to avoid causing ACJ disruption.

Shoulder arthroscopy was performed with the patient in the beach chair position under general anesthesia. The patient's passive shoulder ROM also was limited under general anesthesia. A posterior portal was used for viewing, and lateral and anterolateral portals were used for working. Diagnostic arthroscopy revealed that the ACJ was healed and the rotator cuff was intact. However, there was severe inflammation and thickening in the subacromial bursa. Arthroscopic subacromial bursectomy was performed to provide the visualization. The location of the HP was then sought; it appeared that fibrotic tissues had formed in the posterior region of the acromion and that the HP could be located within these fibrotic tissues. Later, when that same area was examined with an arthroscopy probe, metal was found in the fibrotic tissues and the location of the HP was determined. The fibrotic tissues were debrided with an arthroscopic radiofrequency probe and the inferior part of the broken plate sitting on the acromion was explored. After adequate débridement, the distal hook fragment fell to the subacromial region from where it had migrated and it was then removed with the help of surgical forceps (Fig. 3, A-F). In subsequent imaging, it was observed that the distal hook fragment had migrated significantly superiorly and caused osteolysis in the acromion (Fig. 4). The arthroscopy procedure was subsequently completed and open surgery was begun. New bone formation was seen around the proximal part of the plate. After the screws were removed, the plate was removed with the help of an elevator and

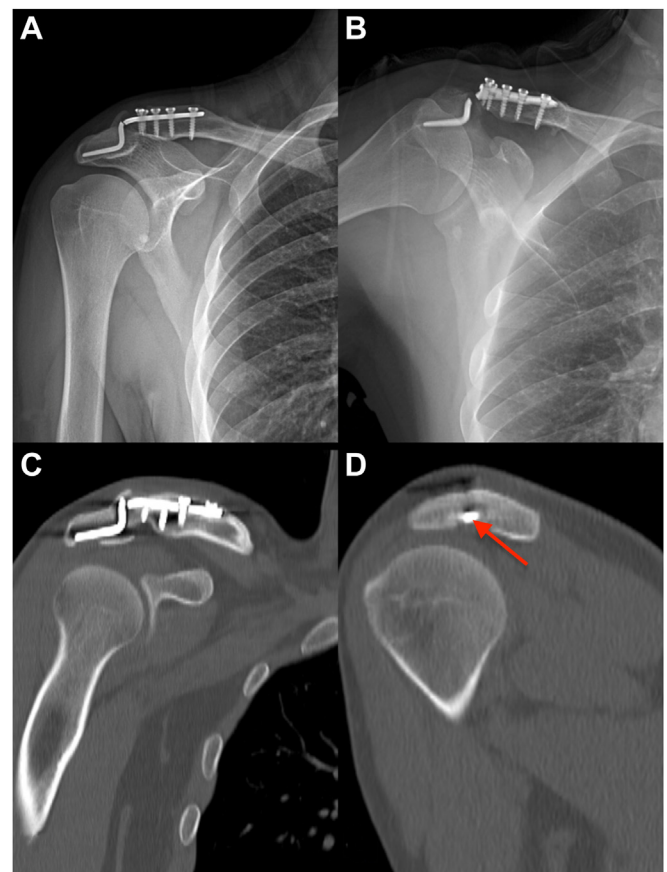


Figure 2 Broken HP is seen in the shoulder (A) AP and (B) Zanca view radiographs of the patient, who applied to our clinic due to shoulder pain. In the patient's shoulder CT (C) coronal and (D) sagittal sections, the distal hook fragment is shown with a — and has migrated superiorly within the acromion. HP, hook plate; CT, computed tomography; AP, anteroposterior.

the operation was terminated (Fig. 5, A–D). The HP used for fixation was short plate and had a posterior hook offset.²⁵

The patient underwent immediate postoperative ACJ examination and shoulder anteroposterior radiography, and it was determined that the joint was in a reduced position and there was no

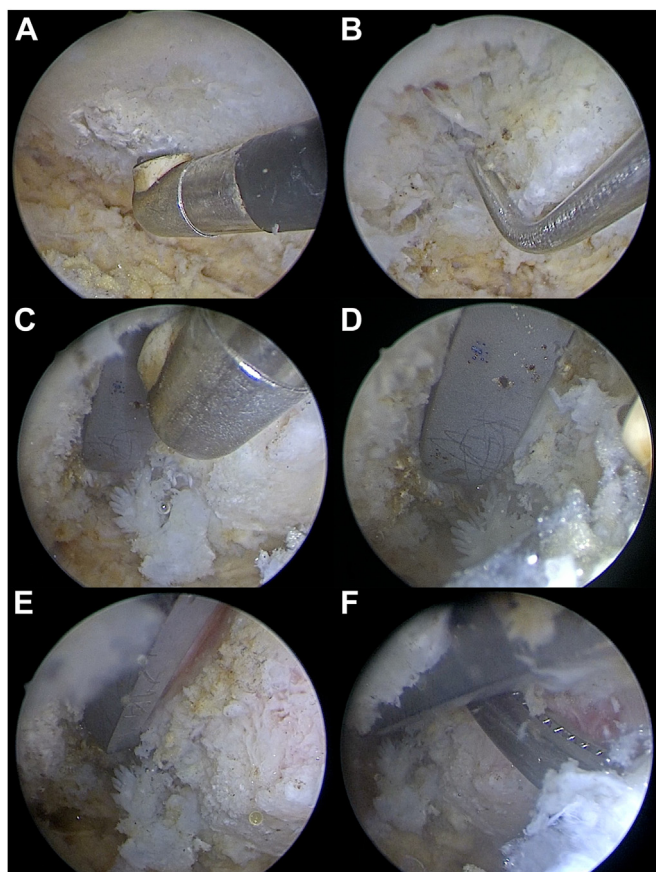


Figure 3 Arthroscopic-assisted removal of the distal hook fragment. (A) The area with fibrotic tissue was detected with the arthroscopic radiofrequency probe. (B) When this area was examined with the arthroscopy probe, it was felt that there was metal inside. (C and D) Fibrotic tissues were debrided with the arthroscopic radiofrequency probe and the distal hook fragment was completely explored. (E and F) After débridement, it was seen that the distal hook fragment was separated from the groove where it had migrated, and it was captured and removed with the help of surgical forceps.

instability (Fig. 6). His general condition was good on the first postoperative day and he was discharged. Rehabilitation started immediately. The patient was followed regularly and, at the second postoperative month, passive ROM of 170° forward flexion, 150° abduction, 45° external rotation with the arm in adduction, 90° external rotation with the arm in abduction, and internal rotation at the T8 level were measured. The pain VAS score was 2 during forward flexion and abduction.

Discussion

Different techniques such as HP fixation, open or arthroscopic-assisted coracoclavicular ligament reconstruction, and the use of suspensory loop fixation devices (open or arthroscopic, TightRope [Arthrex, Inc., Naples, FL, USA] or EndoButton [Smith & Nephew, Andover, MA, USA] fixation) have been described in the treatment of ACJ dislocations.⁴ In a study conducted by Liu et al,¹⁴ 57 patients with Rockwood type V ACJ dislocation fixed with HP were followed for approximately 46 months, and significant increases in functional scores and patient satisfaction were reported. According to a systematic review by Arirachakaran et al,¹ although suspensory loop fixation provides better functional scores and less postoperative shoulder pain than HP, it has higher complication rates. In another study, it was reported that clinical results were similar between patients treated with HP and TightRope, and

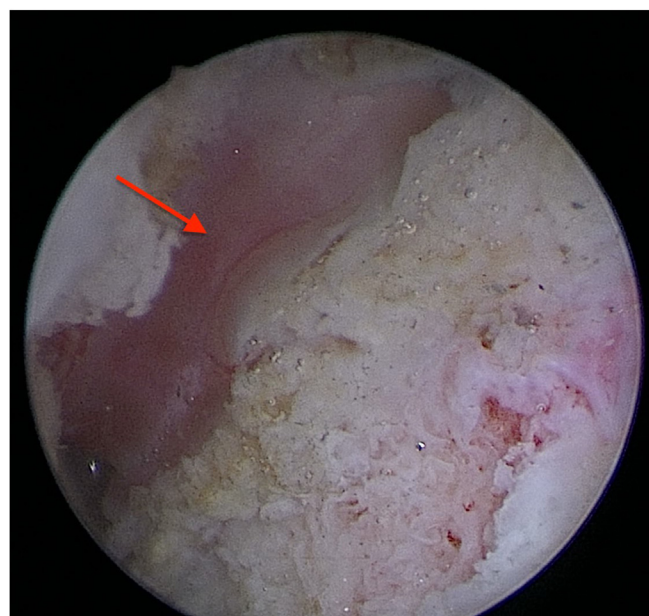


Figure 4 Acromial osteolysis caused by the distal hook fragment migrating superiorly is shown with a ←.

postoperative pain decreased after implant removal in the HP group.² According to a meta-analysis conducted by Pan et al,²⁰ similar functional results were found between the HP and TightRope techniques, but significantly higher postoperative pain was detected in the HP group. The case that we present had a similarly high VAS score before implant removal.

Although good functional results have been reported in the treatment of ACJ dislocations with HP, some implant-related complications are significant. In a cadaver study conducted by Vajapey et al,²³ it was shown that HP used in the treatment of ACJ dislocation provides mechanical power at the supraphysiological level and causes rotator cuff impingement in forward flexion/abduction. According to another study, the most common complication of HP fixation after ACJ dislocation was reported to be SIS.¹⁸ In the dynamic sonography study conducted by Lin et al,¹³ the most common complication after HP fixation was observed to be SIS. In the current case, increasing pain, especially during overhead activities, and a positive Neer sign and Hawkins-Kennedy test led to the diagnosis of SIS.

One of the most serious complications after HP fixation is subacromial erosion.⁶ In the study conducted by Yoon et al,²⁷ it was emphasized that the tip of the HP made pinpoint contact with the lower face of the acromion and that this contact caused acromial osteolysis. Kim et al¹² performed postoperative CT measurements for 35 patients who underwent HP fixation due to acute ACJ dislocation and found that subacromial erosion of approximately 50% of the acromial thickness had occurred. Similarly, in another study, it was found that subacromial erosion developed in 24% of patients followed after HP fixation.²⁶ In the present case, the development of acromial osteolysis after arthroscopic-assisted implant removal was confirmed by arthroscopic imaging.

Shoulder arthroscopy procedures provide direct visualization of the ACJ, allowing for anatomical reduction of the joint.⁷ Approximately 15% of high-grade ACJ injuries are accompanied by intra-articular lesions, providing the opportunity to diagnose and treat these lesions.²¹ On the other hand, arthroscopic-assisted implant removal has become increasingly popular recently. Bhatia³

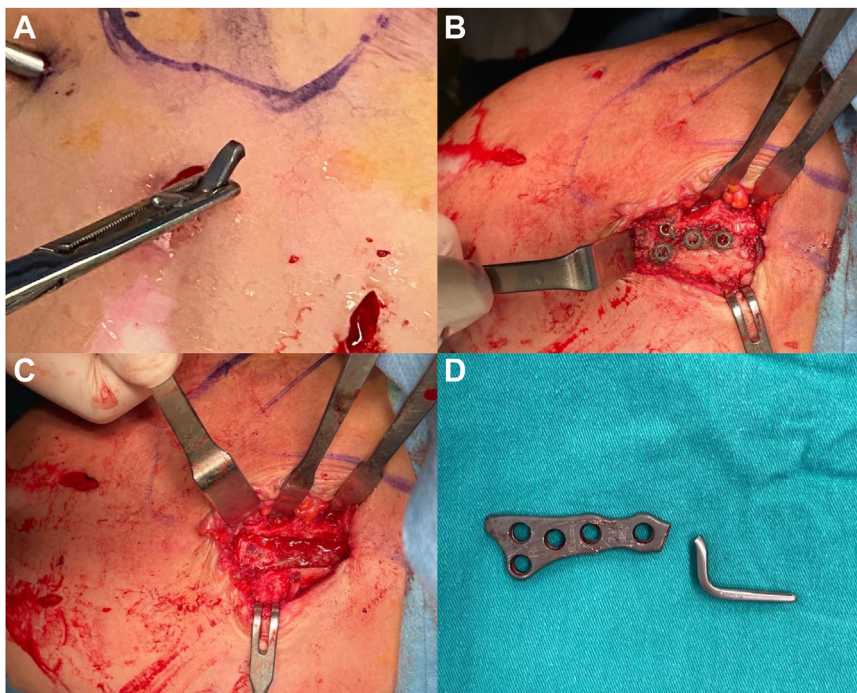


Figure 5 (A) Removal of the distal hook fragment from the subacromial space with the help of surgical forceps. (B) Exploration of screws after open surgery to remove the proximal fragment of HP. (C) Intact clavicle seen after removal of screws and HP. (D) Image of removed HP fragments. HP, hook plate.



Figure 6 Immediate postoperative radiograph taken after implant removal shows complete recovery of the patient's ACJ. ACJ, acromioclavicular joint.

reported that arthroscopic removal of the proximal humeral plate is a cosmetic method, and shoulder stiffness is also treated with arthroscopic adhesiolysis. Maqdes et al¹⁵ removed the proximal humeral plate arthroscopically for 11 patients and stated that this was a feasible method. In another study, arthroscopy in the second stage of treatment for patients who underwent plate fixation due to

proximal humerus fracture was defined as a valuable revision tool for both implant removal and the diagnosis and treatment of intra-articular pathologies.¹¹ In the case we present, arthroscopic removal of the distal hook fragment of the HP protected the ACJ and deltoid origin from disruption. In addition, arthroscopic adhesiolysis and subacromial bursectomy were performed in the subacromial space in the same session, contributing to increased joint ROM, because arthroscopic débridement of adhesions in the subacromial space and removal of HP causing SIS contributed to the relief of the subacromial space and therefore to the increase in joint ROM.

Arthroscopic-assisted HP removal in this case also has some risks. The change in the anatomical structure of the shoulder joint in a patient who has previously undergone surgery makes the arthroscopy procedure difficult. Fibrotic tissues that form in the subacromial space secondary to healing are another situation that will challenge the surgeon during arthroscopic visualization. Performing arthroscopy by experienced surgeons in patients who have previously undergone surgery provides more successful outcomes.

Conclusion

Although HP application provides rigid fixation in cases of ACJ injuries, it is a treatment open to many complications. Failure to remove the implant in the early period may cause complications such as shoulder pain, SIS, and acromial osteolysis. After the plate breaks, implant removal becomes more complicated. Although arthroscopic-assisted implant removal is becoming increasingly popular, arthroscopic HP removal has not been previously reported. Arthroscopic-assisted removal of the distal hook fragment of the HP makes our case unique.

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