

Stress-Related Acromion Base Fracture after Clavicular Hook Plate Fixation: A Case Report

Yi-Hsuan Chen¹, Shun-Min Chang^{1,2}, Chao-Tse Chiu², Cheng-Chang Lu^{1,2}

Learning Point of the Article:

Stress-related acromion base fractures represent a rare but important complication following clavicular hook plate fixation.

Abstract

Introduction: Clavicular hook plate fixation is widely used for the surgical management of high-grade acromioclavicular (AC) joint injuries and generally provides reliable clinical outcomes. Nevertheless, implant-related complications involving the acromion have been reported. Stress-related fractures at the base of the acromion following hook plate fixation are extremely rare and remain poorly described in the literature.

Case Report: A 48-year-old woman sustained a high-grade AC joint injury and underwent open reduction and internal fixation with a clavicular hook plate. Two months after surgery, she presented with acute shoulder pain and functional limitation following minor trauma. Imaging studies revealed failure of the hook plate construct associated with a displaced fracture at the base of the acromion, resulting in compromise of the subacromial space. The patient was treated surgically with implant removal, fixation of the acromial fracture using a tension-band technique, and restoration of AC and coracoclavicular stability. Post-operative imaging demonstrated satisfactory reduction, and the patient achieved functional recovery during follow-up.

Conclusion: This case illustrates a rare stress-related fracture of the acromion base following clavicular hook plate fixation, with a fracture pattern distinct from the typical hook plate cut-out mechanism. Awareness of this potential complication and individualized surgical management based on fracture morphology and shoulder girdle stability are essential for achieving favorable outcomes.

Keywords: Acromioclavicular joint, clavicular hook plate, acromion fracture, stress fracture, superior shoulder suspensory complex.

Introduction

Acromioclavicular (AC) joint ligament injuries account for a considerable proportion of traumatic shoulder conditions, representing approximately 9% of all shoulder injuries [1]. High-grade acute AC dislocations are characterized by complete disruption of both the AC and coracoclavicular ligament complexes, resulting in significant joint instability and therefore commonly necessitate operative stabilization [2]. To date, no consensus on an optimal surgical technique has

been reached, and procedure-related complications have been reported [3].

Clavicular hook plate fixation has demonstrated reliable clinical outcomes in unstable AC joint injuries [4,5]. The overall complication rate associated with hook plate fixation was 15.8%, including subacromial impingement, acromial osteolysis, loss of reduction, AC joint osteoarthritis, and periarticular calcification [6]. Transacromial erosion and associated fractures have been reported as complications of

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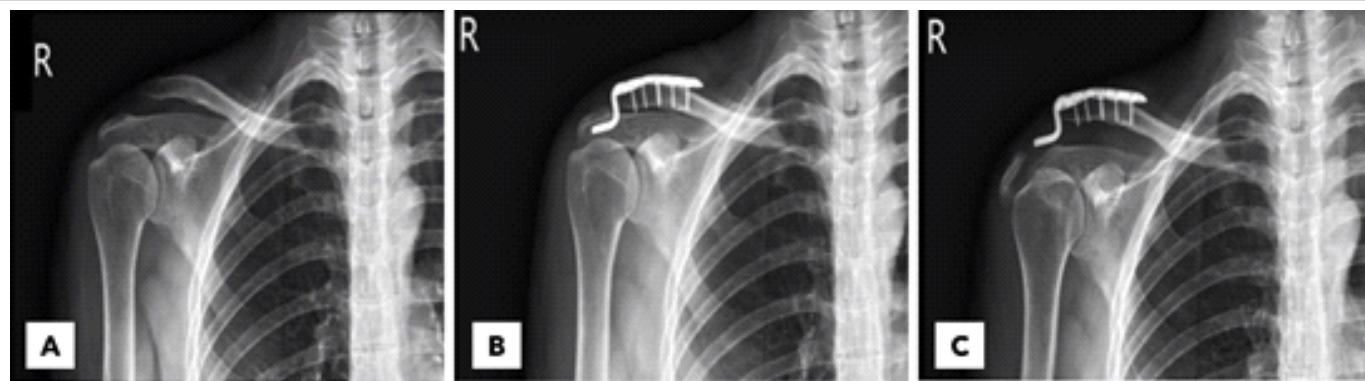


Figure 1: Radiographic evaluation of the right shoulder before and after clavicular hook plate fixation. (a) Anteroposterior radiograph demonstrating a Rockwood Type V acromioclavicular joint dislocation. (b) Post-operative anteroposterior radiograph showing reduction of the acromioclavicular joint after clavicular hook plate fixation. (c) Radiograph obtained 2 months after surgery demonstrating a peri-implant fracture involving the acromion.

hook plate fixation as well [7,8,9]. In this article, we report a rare stress-related fracture at the base of the acromion following hook plate fixation.

Case Report

A 48-year-old woman sustained a right shoulder contusion in a traffic accident, resulting in a Rockwood type V AC joint injury (Fig. 1a). Open reduction and internal fixation of the AC joint was performed using a clavicular hook plate, followed by regular outpatient follow-up and a progressive rehabilitation program (Fig. 1b).

2 months after the index surgery, she presented with painful dysfunction of the right shoulder after a fall onto an outstretched hand. Physical examination revealed localized tenderness over the acromion without evidence of vascular compromise or brachial plexus injury. Plain radiographs demonstrated failure of the hook plate construct associated with a displaced acromial fracture (Fig. 1c). Computed tomography with three-dimensional reconstruction revealed a stress-related fracture

originating from the base of the acromion, with a fragment diastasis of 15 mm and narrowing of the subacromial space, consistent with a Kuhn type III acromion fracture (Fig. 2).

Through a superolateral approach, the hook plate was removed, and osteosynthesis of the acromial fracture was performed using a tension-band wiring technique. The AC joint was stabilized with percutaneous pin fixation, and the coracoclavicular ligament was reconstructed using the coracoacromial ligament augmented with Mersilene tape (Fig. 3). Post-operative radiographs confirmed satisfactory reduction and fixation (Fig. 4).

Postoperatively, the shoulder was immobilized in a sling for 2 weeks, followed by passive range-of-motion exercises for 4 weeks. After removal of the percutaneous AC pins at 6 weeks, active range-of-motion exercises were initiated. At 3 months postoperatively, the patient had regained functional shoulder motion for daily activities, and radiographs demonstrated fracture consolidation (Fig. 5).

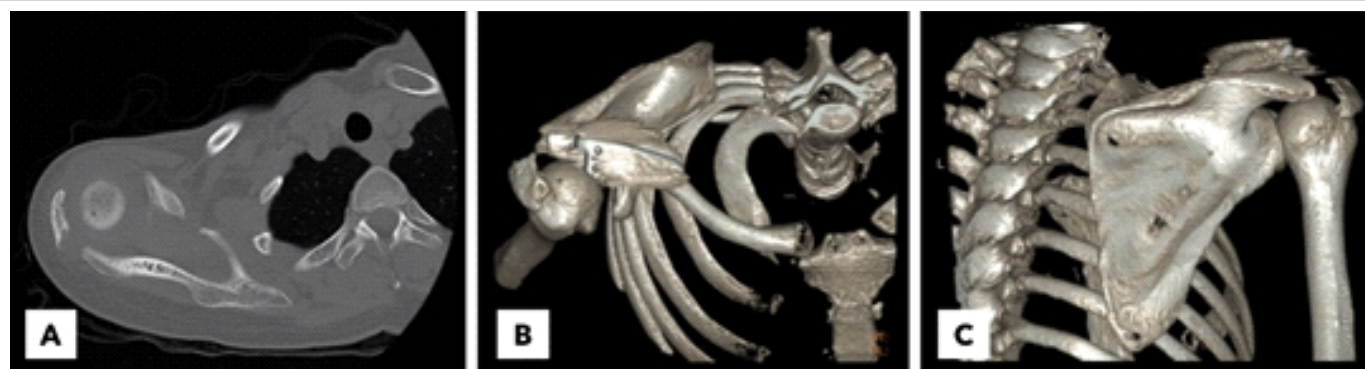


Figure 2: Computed tomography evaluation of the acromial base fracture. (a) Axial computed tomography image demonstrating an intact acromial fracture fragment with 15-mm diastasis. (b) Superior-view three-dimensional computed tomography reconstruction showing a fracture at the base of the acromion. (c) Posterior-view three-dimensional computed tomography reconstruction demonstrating inferior displacement of the acromial fragment with associated subacromial impingement.

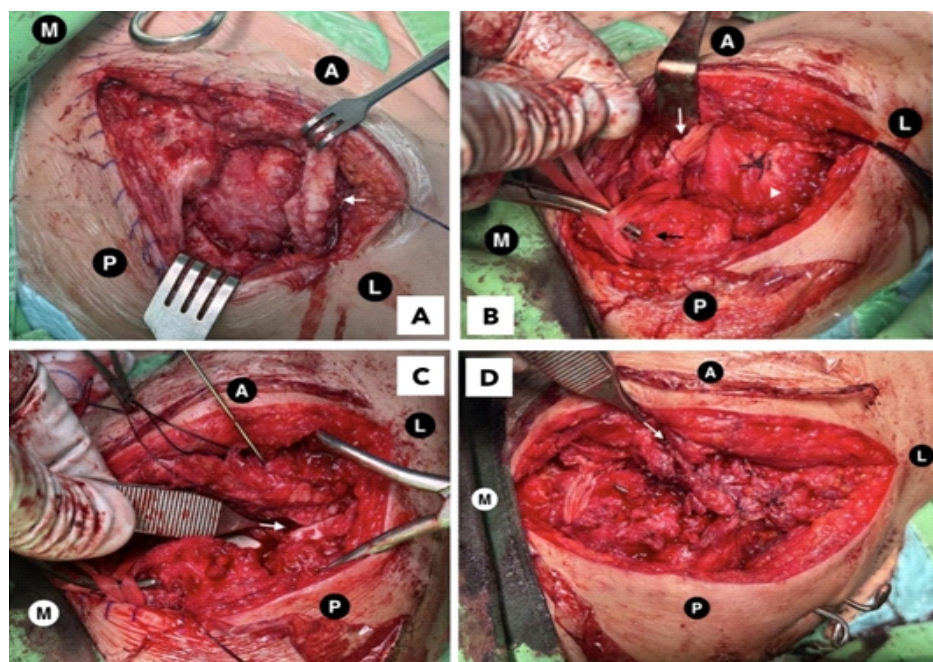


Figure 3: Intraoperative findings and surgical management of the acromial base fracture. Orientation markers (A: Anterior; P: Posterior; M: Medial; L: Lateral) are labeled for spatial reference. (a) Intraoperative photograph obtained through a superolateral approach demonstrating an intact acromial fragment without fragmentation (white arrow). (b) Intraoperative photograph showing the coracoacromial ligament tagged with a stay suture for coracoclavicular ligament reconstruction (white arrow) and two Mersilene tapes passed through the coracoid process for augmentation (black arrows). A partial rotator cuff tear was identified and repaired with sutures (arrowhead). (c) Intraoperative image demonstrating reduction of the acromial fragment with temporary fixation using a 2.0-mm Kirschner wire (white arrow). (d) Intraoperative image showing repair of the acromioclavicular capsule with interrupted sutures following acromioclavicular joint reduction and coracoclavicular ligament reconstruction (white arrow).

described by Goss in 1993, comprises a ring of osseous and ligamentous structures essential for maintaining shoulder biomechanics, including the glenoid fossa, coracoid process, coracoclavicular ligaments, distal clavicle, AC joint, and acromion. Goss conceptualized injuries to the SSSC as a ring disruption, proposing that involvement of two or more components leads to shoulder girdle instability and generally warrants surgical stabilization [12]. However, no definitive treatment guidelines currently exist for injuries of the SSSC, and the optimal management of multiple SSSC disruptions remains controversial [13]. Consequently, treatment should be individualized according to patient age, associated injuries, and biomechanical considerations [14].

With respect to acromial fractures, Kuhn et al. proposed a three-stage classification system based on the degree of displacement: Type I, minimal displacement; Type II, displacement without compromise of the subacromial space; and Type III, displacement

Discussion

Acromial erosion with subsequent hook plate cut-out is an uncommon but recognized complication following clavicular hook plate fixation [7,8,9]. From a surgical perspective, increased hook depth reduces stress on the clavicle and the force transmitted to the acromion, which may help reduce the risk of acromial osteolysis or peri-implant fracture [10]. In addition, clavicular hook plates with different hook angles may induce varying biomechanical effects on the clavicle and acromion. Therefore, careful selection of an appropriate hook plate based on individual patient anatomy is essential [11].

Beyond these previously described complications, even more rarely, we report a stress-related fracture at the base of the acromion with a fracture pattern distinct from the typical hook plate cut-out mechanism, resulting in disruption of multiple components of the superior shoulder suspensory complex (SSSC). The SSSC, first

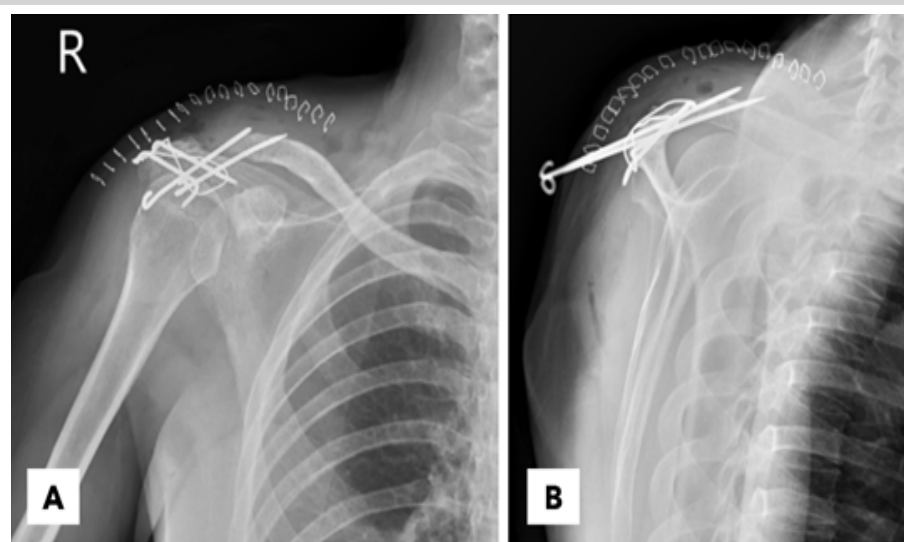


Figure 4: Post-operative radiographic evaluation of the right shoulder. (a) Post-operative anteroposterior radiograph demonstrating satisfactory reduction of the acromioclavicular joint. (b) Post-operative scapular Y-view radiograph confirming maintained alignment of the acromioclavicular joint.



Figure 5: Follow-up radiographic evaluation at three months postoperatively. Anteroposterior radiograph of the right shoulder demonstrating consolidation of the acromial fracture with maintained acromioclavicular joint alignment.

associated with narrowing of the subacromial space. Type III acromial fractures managed non-operatively have been associated with painful restriction of shoulder motion, indicating that early surgical intervention may be warranted [15]. Recent studies have suggested that surgical treatment is indicated in cases of symptomatic non-union, subacromial impingement, displacement >10 mm, open fractures, or disruption of the SSSC [16,17]. Nevertheless, no widely accepted treatment algorithm or fixation strategy for acromial fractures currently exists. Osteosynthesis may be achieved using tension-band wiring, cannulated screws, or plate fixation, largely based on surgeon preference [16,18]. Each fixation method has distinct advantages and limitations. Cannulated screw fixation is minimally invasive and usually does not require implant removal; however, screw placement can be technically challenging due to the thin cortical bone of the acromion and is less suitable for comminuted lateral fractures. Plate fixation, while more invasive, allows accurate fracture reduction and rigid stabilization but has been associated with a higher risk of infection. The tension-band technique provides both static and dynamic compression of fracture

fragments and is less invasive than plate fixation; however, it does not offer the most rigid construct and carries a risk of implant irritation or migration [16,19,20,21]. In the present case, the tension-band technique was selected because the acromial fragment was intact and the fracture pattern was simple.

In conclusion, stress-related fractures of the acromion base represent a rare but important complication following clavicular hook plate fixation and may differ from the typical cut-out-related erosion pattern. Awareness of this injury mechanism is essential for timely diagnosis and appropriate treatment. Surgical management should be individualized based on fracture morphology and stability, and tension-band fixation may be a suitable option in cases with an intact fragment and simple fracture pattern.

Conclusion

Stress-related fractures of the acromion base represent a rare but clinically significant complication following clavicular hook plate fixation for AC joint injuries. This fracture pattern differs from the typical cut-out mechanism and may be associated with disruption of the SSSC, resulting in shoulder girdle instability. Early recognition through appropriate imaging and individualized surgical management based on fracture morphology and stability are essential to achieve favorable clinical and radiographic outcomes.

Clinical Message

Although clavicular hook plate fixation is an effective treatment for high-grade acromioclavicular joint injuries, surgeons should remain vigilant for rare stress-related fractures at the base of the acromion. New-onset or persistent shoulder pain after surgery, even following minor trauma, should prompt thorough imaging evaluation. Treatment should be tailored according to fracture pattern and overall shoulder girdle stability.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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