Original Article

Surgical Treatment of Acromioclavicular Injuries Using the AO Hook Plate

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Objective: Acromioclavicular (AC) joint dislocations are graded according to the extent of displacement of the clavicle in relation to the acromion. Numerous methods of operative fixation have been described to surgically treat AC and surrounding joint injuries in the hopes of restoring normal joint biomechanics. However, there are failures and complications associated with each fixation approach. In this study, we retrospectively examined 29 patients with Rockwood type III, IV dislocations treated with a clavicle hook plate to evaluate the clinical results.

Methods: Since December 2004, 29 patients in our department were treated with a clavicle hook plate for a Rockwood type III, IV dislocation. The average age of patients was 38 years. There were 21 males and 8 females. The mean follow-up period was 18 months. Plain radiographs of clavicles were used to assess. Functionary recovery of the shoulder joint was assessed using the Constant scoring system.

Results: At a mean follow-up of 18 months (12 to 38 months), all these patients were reporting a satisfactory report. The mean Constant scoring is 95.5 points. All but one returned to full ROM in 6 weeks.

Conclusions: AO clavicle hook-plates are useful fixative implants for AC joint displacement. Static fixation was achieved and physiotherapy can be started immediately after surgery. It is easy to perform this surgery with high successful rate and low complication. The combination of repair the AC joint capsule and hook plate fixation will be more successful. No impingement resulted from the hook of the hook plate.

Key words: hook plate, acromion-clavicle joint, surgical treatment

Introduction

The acromioclavicular (AC) joint is an important component of the suspensory mechanism of the upper limb. The strong sternoclavicular ligaments support the clavicles out, away from the body, like the wings off the body of an airplane.[1] The coracoclavicular (CC) ligament is the prime suspensory ligament of the upper extremity. Injuries to the AC joint complex most frequently occur in the young and athletic population. Disruption of this complex may lead to pain and instability.[2]

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Currently, selected Rockwood type III injuries and most type IV, V, and type VI injuries are treated with operative intervention. There is probably not another joint in the body that has been treated in so many different ways as the acromioclavicular joint in attempts to properly restore it to its natural situation. There are four basic types of procedure[1]: (1) acromioclavicular repair; (2) coracoclavicular repair; (3) distal clavicle excision; (4) dynamic muscle transfers. Techniques include hook plates[3,4] coracoclavicular screws,[5] coracoclavicular ligament reconstructions[6] that simulate the function of the trapezoid and conoid ligaments,[7] acromioclavicular ligament repair,[8,9] coraco-acromial ligament transfers,[10] tension band wire fixation (Fig. 1),[11] and the use of synthetic suture materials.[12] However, there are failures and complications associated with each fixation approach,[4,8,9,11] and thus there has been no universal agreement on the most optimum treatment.

The hook plate was introduced into Taiwan for 10 more years. We have accumulated more than 100 cases of hook plate in our hospital. We find that it is an easy, safe and reliable procedure.

The purpose of this study was to report our clinical results of 29 patients with Rockwood type III, IV dislocation treated with clavicle hook plate.

Materials and Methods

From December 2004 till February 2007, 29 patients in our department were treated with a clavicle hook plate (AO, Synthes, Switzerland) for a Rockwood type III or IV AC dislocation. Their mean age was 38 years (ranging from 19 to 67 years). There were 21 males and 8 females. Road traffic accidents were the most frequent cause. Some were sports injuries. These operations were performed by the orthopedic surgeons in our trauma department.

Surgery was performed under general anesthesia with the patient in beach-chair position. A transverse incision about 6 centimeters was made across the AC joint.

The muscular fascia was dissected to expose the AC joint and the lateral portion of the clavicle. Before insertion the hook part of the hook plate, an insertion point posterior the acromion should be decided. Once the insertion point has been decided, the hook of the hook plate was inserted to the posterior acromion. Sometimes it was hard to reduce the AC joint, so compress the proximal part of the hook plate to the clavicle with screw fixation first. After the first screw has been put in, the rest is the easy part. All we have to do is putting on the rest of the screws to the screw holes. After the hook plate was in the correct position, the AC ligament and capsule sometimes could be sutured. After checking bleeding, the wound was closed layer by layer. Mean hospital stay was

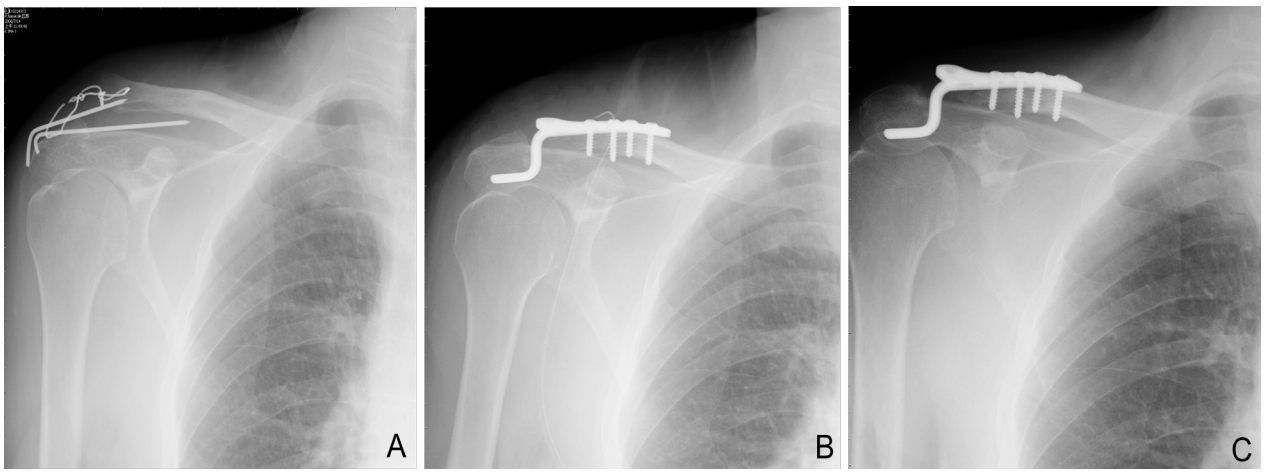

Fig 1. Radiographs of right shoulder of a 67-year-old man with acromioclavicular dislocation showing (A) tension band wire failure and hook plate fixation (B) immediately , and (C) eight months after operation.

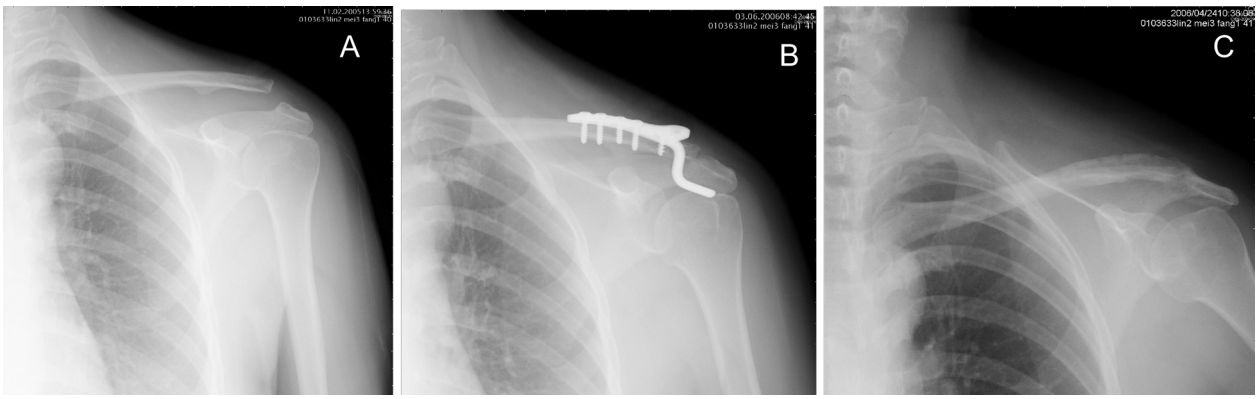

Fig 2. 41-year-old woman with acute acromioclavicular dislocation (A) before operation, and at postoperative four months (B) before, and (C) after remove of hook plate.

3 days. Postoperatively, mobilization of the shoulder was encouraged. No motion limitation only if the patient could tolerate the postoperative pain. Plate removal was suggested for all the patients 3 months after operation, but some of them even with the hook plate for 16 months.

We retrospectively reviewed the clinical and radiographic results of patients. Shoulder symptoms and functions were assessed using the Constant scoring system for therapeutic effects on shoulder disorders. Postoperative conditions were rated in terms of pain, strength of forward abduction, activity of daily life, and ROM. The functional score was determined by the independent orthopedic outpatient clinic nurse.

Because the concern of the hook of the hook plate inducing subacromial impingement and damage the rotator cuff, we performed the

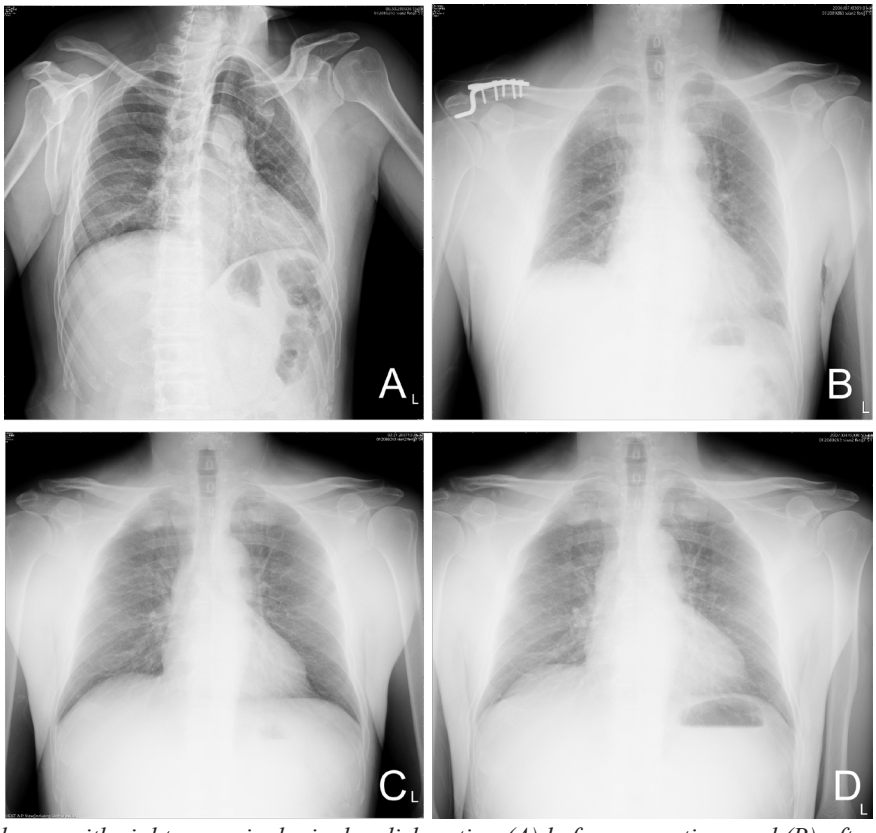

Fig 3. 55-year-old man with right acromioclavicular dislocation (A) before operation, and (B) after hook plate fixation (C) removal of hook plate at postoperative six months , but (D) mild subluxation noted three months after plate removal.

Table1. Criteria for therapeutic effects on shoulder disorders

Criteria	Score
Pain (30 points)	
a. None	30
b. Tenderness or minimal pain in sports or heavy labor	25
c. Minimal pain in activities of daily life	20
d. Moderate and tolerable pain	10
e. Severe pain	5
f. Totally incapacitated because of pain	0
Function (20 pointed)	
a. Total function (10 pointed)	
b. Strength in abduction	5
c. Endurance	5
d. Activities of daily life (10 pointed)	10
Range of motion (30 points)	
Elevation(15 points)	
> 150°	15
> 120°	12
> 90°	9
> 60°	6
> 30°	3
0°	0
External rotation (9 points)	
> 60°	9
> 30°	6
0°	3
> -20°	1
> -20°	0
Internal rotation (6 points)	
a. Above T12 spinous process	6
b. Above L5 spinous process	4
c. Gluteal	2
d. Below gluteal	0
Radiographic evaluation (5 points)	
a. Normal	5
b. Moderate changes or subluxation	3
c. Advanced changes or dislocation	0
Joint stability (15 points)	
a. Normal	15
b. Slight instability or apprehension	10
c. Severe instability or state of subluxation	5
d. Relevant history or state of disloction	0

shoulder arthroscopy on the first case to check the subacromial space.

Results

At a mean follow-up of 18 months (12 to 38 months), all these patients were reporting a satisfactory report. The mean Constant score (maximum score, 100 points) was 95 points (range, 87-100 points) at the final follow-up. All but one returned to full ROM in 6 weeks. One patient had limited elevation. The internal rotation and external rotation were all the same as the normal side. All patients had good joint stability. Three patients had AC joint subluxation after hook plate removal (Fig. 2, Fig. 3).

The result of shoulder arthroscopy: the hook of the plate was inserted under the posterior part of the acromion so we could not find the hook in the anterior subacromion space where the impingement usually happens.

Discussion

Numerous methods of operative fixation of the AC joint are reported in the literature with no clear evidence for the best form of fixation. Use of smooth pins and threaded pins has been associated with hardware migration, which can be associated significant morbidity and possible mortality.[11] The transclavicular coracoid fixation method, described by Bosworth in 1941, has been associated numerous complications include screw pullout, infection, and irritation over the screw head requiring a secondary procedure to remove the screw.[5] Weaver and Dunn introduced the technique of transfer of the coraco-acromial ligament to a modified distal clavicle.[13] However, Weinstein et al[14] reported a loss of reduction of up to 29% of cases, especially in those treated late.

The hook-plate is a relatively new implant that has been in the market only for a few years and not widely used. There are several reports by different authors with varying results.[3,4] In the early reports the incision is longitudinal crossing the clavicle with high complication rates.[4] The early hook plate also is different from nowadays.[4] The one we used is an AO plate. There is a right- or left-sided plate, the design is such that the plate is put on the superior part of the clavicle and the hook passed be-

low the acromion posterior to the acromioclavicular joint, thus not interfering with the joint. This plate has been used in the management of acromioclavicular joint dislocation and distal clavicle fracture. There are several favorable reports described by Baets et al,[15] Faraj et al,[3] and Kashii et al.[16] There is also a biomechanical comparison of different methods of operative fixation of the acromion-clavicle joint recently.[5] The conclusion is that CC screw may provide the most rigid fixation of the AC joint, the hook plate however more closely resembles the native AC joint in allowing physiologic motion of the distal end of the clavicle. The CC sling method does not reproduce the mechanical stiffness of the native AC joint.

The main concern in using hook plate is subacromial impingement,[4] although some authors also report enlargement of the hook hole, ossification of the CC ligament, re-dislocation of the AC joint, and calcification.[3] In our study, we had found the ossification of the CC ligament. No enlargement of the hook hole and no re-dislocation of the AC joint. Three patients had AC joint subluxation after hook plate removal, but the functional score still excellent. We also performed the shoulder arthroscopy to check the sub-acromion space to see if the hook will impinge at the anterior part of subacromion space. Since the hook was inserted at the posterior part of the acromion, actually you couldn't hardily find the hook in the subacromion space under arthroscopy.

In conclusion, the hook plate is a useful device to treat unstable injuries in the acromioclavicular joint. It is easy to perform this surgery with high successful rate and low complication. The combination of repair the AC joint capsule and hook plate fixation will be more successful. No impingement resulted from the hook of the hook plate.

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