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Original Article

Comparision of Clavicle Hook Plate and K-wire with Coracoclavicular Ligament Repair in Treatment of Acromioclavicular Joint Dislocation

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Abstract

Background and objectives: **The most effective method for the surgical treatment of acromioclavicular joint dislocation has not been established. Two commonly used techniques are clavicle hook-plate fixation and K-wire fixation with coracoclavicular ligament repair. We performed a retrospective study to compare these two treatment strategies.**

Materials and methods: **A total of 60 patients were selected for review. Each patient was treated by one of the two methods. Data including operative time, pain score, shoulder score, return to previous work within three months, return to previous activity within six months, and operative complications were collected.**

Results: **Thirty-two patients were treated with clavicle hook plate fixation, and the rest (28) were treated with K-wire fixation and coracoclavicular ligament repair. Clavicle hook-plate fixation was associated with significantly shorter operative time and lower rate of complications ($P < 0.05$). There were no significant differences in postoperative pain, shoulder score, return to previous work within three months, and return to previous activity within six months, between the two groups.**

Conclusion: **The clavicle hook-plate technique is similar in effectiveness to the K-wire fixation with coracoclavicular ligament repair in the treatment of acromioclavicular joint dislocation, but with shorter operative time and fewer complications.**

Keywords: **acromioclavicular joint dislocation, clavicle hook-plate, K-wire fixation, coracoclavicular ligament repair**

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Introduction

The acromioclavicular joint is commonly involved in traumatic injuries that affect the shoulder. Most injuries are related to fall onto the shoulder, and to repetitive use of the shoulder such as in heavy labor and athletics[1]. While conservative treatment is recommended for Rockwood Types I and II acromioclavicular injuries and most fractures of the shaft and the medial part of the clavicle, several different surgical treatments are described for Rockwood Type III acromioclavicular joint dislocations, and the choice of operation is still controversial[2]. The reason for the instability that leads to a relative dislocation of the lateral clavicle is the involvement of the coracoclavicular ligaments. The mechanism of injury is usually direct trauma to the superior aspect of the acromion in relation to the distal end of the clavicle.

One of the more popular surgical methods for treating this injury is K-wire fixation with coracoclavicular ligament repair, but this method involves considerable risk for complications, including loss of reduction, pin migration, and skin ulceration due to pin irritation[3]. A hook plate with an extension under the acromion has been developed to provide more rigid fixation. However, a major concern is subacromial impingement or rotator cuff injury[4].

Previous studies have shown that acromioclavicluar fixation techniques are more successful than coracoclavicular fixation techniques[5]. So far there have been no reports comparing the results of clavicle hook plate and K-wire fixation with coracoclavicular ligament repair for treating acromioclavicular joint dislocation. The purpose of this study was to retrospectively compare between the two techniques in terms of clinical outcomes. Also, the functional recovery and operative complications were examined in detail.

Materials and methods

Between 2008 and 2013, 62 adults who had acromioclavicular joint dislocation were surgically treated at Sawangdandin Crown Prince Hospital. Inclusion criteria for this study were (a) Rockwood Type III dislocation; (b) acute and unilateral dislocation; (c) internal fixation with either a clavicle hook plate or K- wire with coracoclavicular ligament repair; and (d) normal shoulder function before injury. Exclusion criteria included (a) subacromial pathology; (b) concomitant injury to the ipsilateral shoulder girdle; (c) inadequate follow-up; and (d) incomplete data.

The clavicle hook plate used in this study is a pre-contoured, stainless steel, dynamic compression plate with a wider anterolateral end and a lateral extension shaped as a hook which is placed below the acromion. The holes accept 3.5 mm cortical bone screws and 4.0 mm cancellous bone screws. The anterolateral screw holes provide additional options for screw fixation to the lateral metaphyseal part of the clavicle. These plates are available with 3 or 5 holes and the hook depth can vary between 12 mm and 18 mm.

In the clavicle hook-plate fixation technique, an incision was made along the distal clavicle and acromion. The pre-bended hook of the hook-plate was inserted through the incision and the plate was placed and fixed to the lateral clavicle with three cortical screws. Postoperative immobilization was achieved with an arm sling for four to six days, the shoulder range of motion (ROM) was restricted to 90° abduction and anteversion for six weeks under the instruction of a physiotherapist.

In the K-wire fixation with coracoclavicular ligament repair technique, the skin incision was approximately 6 cm in length and made along Langer's skin lines 2 to 3 cm medial to the acromioclavicular joint. The clavicle was delivered into the wound after reflecting the anterior deltoid and trapezius. Two K-wires were inserted. A C-clamp was used to pass sutures under the coracoid from a medial to lateral direction. Two drill holes were placed through the clavicle for passage of sutures. Two suture anchors were placed along the lateral clavicle margin. The sutures were used to reattach the acromioclavicular joint capsule and the delto-trapezial aponeurosis. Postoperative immobilization was as for the hook-plate technique.

Data recorded for all patients included operative time, visual analogue pain score (0, none to 10, severe) on the first postoperative day, whether the patient returned to previous work within three months, whether the patient returned to previous activities within six months, and operative complications.

The patients were evaluated on a weekly basis after surgery. The follow-up radiographic protocol consisted of standardized radiographs that included a

true glenohumeral anteroposterior view (neutral rotation, elbow by the side); these were analyzed for implant migration, acromioclavicular joint pathology (degeneration, instability), and subacromial changes (degeneration, osteolysis). At the follow-up, the shoulder scoring system of Constant and Murley[6] was applied. In this system, both subjective and objective clinical data are included, with a maximum score of 100 points. Pain (15 points), activities of daily living (20 points), range of motion of the shoulders (40 points), and muscle power (25 points) were evaluated. The Student's *t*-test, chi-square test, and Fisher's exact test were used in the comparison of outcomes between the two groups. Two-sided p-values less than 0.05 were considered statistically significant.

Results

There were 60 patients in the present study, with an average age of 28.7 years (range 16 years to 38 years). All were followed up for more than six months after discharge from the hospital. The average follow-up time was 12.8 months (range, six months to 24 months). The 60 patients were divided into two groups, based on the method of treatment. The clavicle hook-plate group included 32 patients and the K-wire with coracoclavicular ligament repair group included 28 patients. The mechanisms of injury and demographic data related to each group are shown in Table 1.

The mean operative time was 51 minutes (range, 48 to 61 minutes) for the clavicle hook plate group and 89 minutes (range, 78 to 95 minutes) for the K-wire with coracoclavicular ligament repair group; this difference was significant. The average pain scores on the first postoperative day were five for the clavicle hook plate group and six for the K-wire with coracoclavicular ligament repair group, which were not significantly different. Details of outcomes are given in Table 2.

In the clavicle hook-plate group, the mean score for the affected shoulder using the scoring system of Constant and Murley was 89 points, and the mean score for the contralateral shoulder was 93 points. In the K-wire with coracoclavicular ligament repair group, the mean score for the affected shoulder was 87 points, and for the contralateral shoulder was 92 points. There were no significant differences in the scores between the two groups (Table 3).

Complications were recorded for each group (Table 4). Five of 32 patients with clavicle hook-plate fixation had complications, whereas 11 of 28 patients with K-wire with coracoclavicular ligament repair had

Table 1 The injury mechanism, preoperative demographic data for both treatment groups

Characteristics	Clavicle hook-plate (n = 32)	K-wire with ligament repair (n = 28)	p-value
Gender (M/F)	26/6	23/5	0.929
Age (years): mean (sd)	27.8 (3.2)	29.1 (2.8)	0.785
Follow-up (months): mean (sd)	12.6 (5.3)	12.9 (6.1)	0.826
Vehicular trauma: number (%)	25 (78)	21 (75)	0.775
Injury time (days): mean (sd)	1.5 (0.4)	1.8 (0.5)	0.684

Table 2 Comparison of outcomes between the two treatment groups

Outcome	Clavicle hook-plate (n = 32)	K-wire with ligament repair (n = 28)	p-value
Operative time (min): mean (sd) [range]	51 (3) [48 min to 61 min]	89 (6) [78 min to 95 min]	< 0.001
Pain score: mean (sd) [range]	5 (1.5) [3 to 8]	6 (1.8) [4 to 9]	0.183

Table 3 Comparison of shoulder scores between the two groups

Shoulder score	Clavicle hook-plate	K-wire with ligament repair	p-value
Affected shoulder: mean (sd) [range]	89 (5) [81 to 100]	87 (6) [72 to 100]	0.487
Contralateral shoulder: mean (sd) [range]	93 (3) [89 to 100]	92 (4) [84 to 100]	0.651
Time to evaluation (months): mean (sd)	6.1 (0.8)	6.7 (1.2)	0.374

Table 4 Comparison of complications between the two treatment groups

Complication	Clavicle hook-plate	K-wire with coracoclavicular ligament repair
Infection	2	3
Loss of reduction	1	2
Malposition	1	3
Broken implant	0	1
Implant irritation	1	2
Total	**5**	**11**

complications; this difference was significant (p = 0.039). All superficial infections were diagnosed clinically at the first follow-up visit, which was seven to ten days after surgery. A one-week regimen of oral antibiotics resolved the infections.

In the clavicle hook-plate group, all but three cases (90.6%) returned to their previous work three months postoperatively. Twenty-six patients (81.3%) could do the same athletic activities six months after surgery. In the K-wire with coracoclavicular ligament repair group, 24 patients (85.7%) returned to their previous work three months postoperatively. Twenty-one patients (75%) could do the same athletic activities six months after surgery. These differences were not statistically significant (p = 0.554 and p = 0.558, respectively).

Discussion

The acromioclavicular (AC) joint is involved in 4% to 8% of joint injuries[7]. In most cases, sports injuries, and especially road traffic injuries, are the main causes of AC joint dislocation. Many different types of operative procedures have been described for treating AC joint dislocations, and even operative versus conservative treatment of Rockwood III lesions is still a topic of discussion[8-12]. Results and complication rates of the countless procedures vary[13]. There are other minimally invasive methods available using tight rope devices, without the need for a second operation to remove metalwork, but long term results for these techniques are not yet available[14]. In our series, K-wire fixation with coracoclavicular ligament repair was used to achieve stability. However, three cases had loss of reduction related to pin migration or broken wire. We think that K-wire fixation without threads has a significant risk of pin migration. In addition, during mobilisation of the shoulder, rotation of the clavicle causes migration of the K-wires. This results in not only pin migration, but also broken wires.

AC joint dislocation treated with hook-plate fixation is a relatively new method. The hook-plate design gives a more stable fixation. In the literature, most studies reported good results with few complications[15-16]. Our results were comparable to those in the literature, and only five complications occurred in our series. However, a few studies mentioned that AC joint dislocation treated with a clavicle hook-plate might develop subacromial impingement or rotator cuff injury if the hook is placed in an inappropriate position. In our series, we found no evidence of subacromial impingement or rotator cuff injury, even though the plate was inserted in the subacromial space.

In the present study, the functional shoulder scores were not significantly different between the clavicle hook-plate and K-wire with coracoclavicular ligament repair groups. However, the clavicle hook-plate group had a slightly higher tendency to return to their previous work within three months after surgery. We determined that the hook-plate gave very stable fixation, with early and wider range of motion of the affected shoulder. Patients treated with this method should be able to return to work and to previous athletic activities in a shorter time.

This study had a few limitations: (a) it was a retrospective study and not randomised, so there was selection bias; and (b) the size of the study was relatively small, thus a few comparisons lacked statistical power.

Conclusion

Both clavicle hook-plate and K-wire with coracoclavicular ligament repair for the treatment of AC joint dislocation could achieve good results. However, internal fixation with a clavicle hook-plate had more advantages, such as shorter operative time and lower rate of complications, than K-wire fixation with coracoclavicular ligament repair.

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