Treatment of fractures of the lateral end clavicle by hook plate

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Aim
To assess the outcomes of management of an unstable fracture of the lateral end of the clavicle with clavicular hook plate.
Patients and methods
A total of 23 patients with displaced fracture lateral end clavicle were treated with clavicular hook plate fixation. The mean age of patients was 38.5 years (range, 28–55 years).
Results
The mean follow-up period was 20 months (range, 28–39 months). The mean fracture healing time was 12 weeks after operation. One (4.2%) patient had nonunion with good alignment without functional disability and was asymptomatic. One patient had a superficial wound infection. One patient had impingement, and his pain was resolved shortly after plate removal. AC joint arthrosis was reported in one patient.
The mean constant score for the affected shoulder was 90 points (87–100), whereas the mean score for the contralateral shoulder was 96 points (92–100). The plate was removed in three (13%) patients only.
Conclusion
Clavicular hooked plate is a good method for management of lateral end clavicle fractures. It can provide stable fixation with a low rate of complications. Removal of the plate is not necessary.

Keywords:
fracture, lateral end of the clavicle, hook plate

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Introduction

Displaced lateral third clavicle fracture is less common than fracture of middle third. It represents 15% of all clavicle fractures [1].

Only one-third of these fractures are displaced (Neer type II) and have a high rate of delayed and nonunion [2].

Surgical management of this fracture is a challenge because of the small bony fragment, the proximity to the AC joint, and soft metaphyseal bone in this area [3].

Many surgical methods have been proposed for treatment of this fracture including Kirschner wire fixation [4], coracoclavicular screw fixation [5], plate fixation, and arthroscopic treatment [6]. None of these is generally regarded as the gold standard treatment [7].

The hook plate system enables early rotational mobility of the shoulder. It has been shown to have a favorable outcome in a number of studies [1,4,8] but also has documented complications such as nonunion, infection, and acromial osteolysis [8–13].

The aim of this study is to assess the outcome of using AO hook plates in treatment of Neer type II distal clavicle fractures. Secondary aim is to answer a question whether clavicle plates should be removed after union of the fracture or not.

Patients and methods

Clavicular hook plate fixation was performed in 23 patients (14 males and nine females) for displaced fracture of lateral end clavicle between February 2011 and June 2013. The study was approved by the institutional ethics committee in the Orthopedic Department of Orthopaedic Surgery, Mansoura, Egypt. The mean age of patients was 38.5 years (range, 28–55 years). The fracture was right sided in 12 patients and left sided in 11. All patients had a Neer type II fracture. Eight were involved in heavy manual labor, 10 were clerical worker, and five were unemployed. The same fixation technique of the clavicle was performed by clavicular hooked plate.

Surgical technique

The surgery was done in beach-chair position under general anesthesia. A standard Thompson incision (length of 6–8 cm), centered on the fracture ends, was made. The fracture site was exposed. The interposed soft tissue between the fracture ends was removed and then the fracture was reduced, and a hooked plate was used to fix it. The torn coracoclavicular ligament was left without repair. The hook of the plate was passed below the acromion and then the shaft of the plate was placed on the superior cortex of the clavicle and held by bone reduction forceps. By using fluoroscopy, we verified the plate position and shoulder motion before definitive fixation. The clavicular hook plate was fixed to the medial fragment of the clavicle with 3.5-mm cortical screws and then the wound was closed.

During the first 3 weeks, the arms were held in a sling. Passive movements were allowed; overhead abduction was prohibited. After that, the patients were encouraged to do active movement. Radiograph was done every 3 weeks, and the constant score was used to assess the shoulder function.

Results

The mean follow-up time was 32 months (range, 28–39 months). The mean fracture healing time was 12 weeks after operation (Fig. 1). One (4.2%) patient had nonunion with good alignment without functional disability and was asymptomatic.

Superficial wound infection was reported in one case and was treated successfully with antibiotics.

Two (8.3%) patients reported pain. One of them was due to impingement, and his pain was resolved after plate removal. The other patient had persistent pain, which was diagnosed as AC joint arthrosis with some degree of limitation of range of movement. All patients but two were back to work and activity before their injury on an average of 4 months (3–6 months) following surgery.

There were no intraoperative complications. No fractures of the acromion were encountered. No acromial osteolysis was noted.

The mean constant score for the affected shoulder was 90 points (87–100), and the mean score for the contralateral shoulder was 96 points (92–100).

The plate was removed in three (13%) patients (one due to impingement and two according to the request of the patient).

Discussion

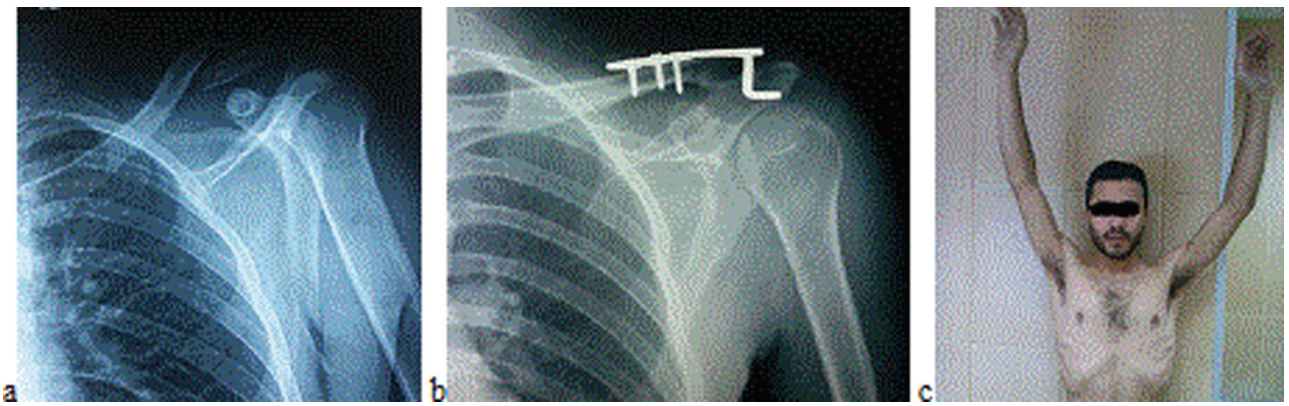
Displaced lateral third clavicle fracture is less common than fracture of the middle third [1]. It represents 15% of all clavicle fractures.

Minimally displaced clavicle fractures can be successfully treated by nonoperative methods; however, surgical treatment is recommended for unstable fracture of the lateral end clavicle (Neer type II) owing to the reported high rate of nonunion [1].

Neer reported that the high incidence of nonunion can be explained by the deforming forces acting on the fracture site, causing continuous motion at the fracture ends with displacement [14,15].

Edwards *et al.* [16] treated type II fractures of the lateral end clavicle in a series of 43 patients with

Figure 1



(a) AP radiographic view of a 33-year-old man with a type II fracture of the left clavicle. (b) Radiographic view taken 3 months postoperatively, showing good reduction and full union. (c) Photograph 3 months postoperatively.

conservative methods. They reported a high incidence of local complications, residual shoulder dysfunction, and nonunion. They recommended open reduction and internal fixation as a method of treatment of such fracture.

Surgical treatment of this unstable fracture can be a challenge because of the bony fragment is small and usually comminuted, the proximity of the fracture to the AC joint, and the soft metaphyseal bone in this part. Many methods have been proposed for treatment of this fracture including K-wire fixation, modified tension band fixation, and Bosworth-type screw fixation [4–6]. These procedures have had significant problems with hardware failure and migration. In addition, plate fixation cannot be used if the distal fragment will not support two or more cortical screws.

We hypothesize that fixation with clavicular hook plate could overcome difficulties of fixation of the small lateral fragment, maintain the mobility of the acromioclavicular joint, and promote early recovery of shoulder function without reconstruction of coracoclavicular ligament.

In a comparative study, Lee *et al.* [17] treated 52 patients with unstable fractures of distal clavicle by open reduction and internal fixation with hook plates or tension band wires. They reported that hooked plate group had fewer complications than the tension band wire (P=0.01). The hooked plate group had one (3.1%) complication related to screw loosening with partial loss of reduction. The tension band group had six (30%) complications consisting of one complete loss of reduction with nonunion, three partial losses of reduction, and two superficial infections.

K-wire migration is a major concern, particularly with osteoporotic bones. Overall, 10–15% of the patients in the available studies using K-wires had implant migration [17–21]. Kona *et al.* [4] treated 13 patients with unstable fracture of the lateral end clavicle using K-wires. They reported eleven unsatisfactory results (six nonunions and five infections). They concluded that K-wire fixation should not be recommended in such fractures.

In the current study, the plate was removed in three. Two of them were according to the request of the patient in spite of absence of any symptoms. Our results coincide with Faraj and Ketzer [22] who used hook plates in ten patients who had acromioclavicular injuries (three fractures). All fractures united, and patients had pain-free function. They did not remove the hook plate in any patient.

In this study, 21 (92.3%) patients were totally pain free. Apart from two patients, all patients treated with this method had the ability to return to their work and previous athletic activities within a short time.

The design of the hook plate gives a stable fixation. In the literature, most researchers reported good results with few complications [5,6,22,23]. Our results were compatible with theirs. Theoretically, the hook plate might develop rotator cuff injury or subacromial impingement. However, on practical basis, we found that it did not produce impingement. This could be explained by the fact the hook of the plate usually occupies the posterior part of the subacromial space away from the site of impingement. Haidar *et al.* [23] reported that the plate does not affect the ACJ provided that it was placed in the appropriate position. The vertical part of the hook should pass behind the ACJ. The joint could be violated if the plate migrates anteriorly but this is almost impossible when secured rigidly on the shaft.

Conclusion

Clavicular hook plate is a good method of fixation of fracture lateral end clavicle. It provides stable fixation with a low rate of complications. Removal of the plate is not necessary.

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Conflicts of interest

There are no conflicts of interest.

References

1 Robinson CM, Cairns DA. Primary nonoperative treatment of displaced lateral fractures of the clavicle. J Bone Joint Surg Am 2004; 86-A:778–782.

2 Robinson CM. Fractures of the clavicle in the adult. Epidemiology and classification. J Bone Joint Surg Br 1998; 80:476–484.

3 Eskola A, Vainionpaa S, Patiala H, Rokkanen P. Outcome of operative treatment in fresh lateral clavicular fracture. Ann Chir Gynaecol 1987; 76:167–169.

4 Kona J, Bosse MJ, Staeheli JW, Rosseau RL. Type II distal clavicle fractures: a retrospective review of surgical treatment. J Orthop Trauma 1990; 4:115–120.

5 Badhe SP, Lawrence TM, Clark DI. Tension band suturing for the treatment of displaced type 2 lateral end clavicle fractures. Arch Orthop Trauma Surg 2007; 127:25–28.

6 Macheras G, Kateros KT, Savvidou OD, Sofianos J, Fawzy EA, Papagelopoulos PJ. Coracoclavicular screw fixation for unstable distal clavicle fractures. Orthopedics 2005; 28:693–696.

7 Checchia SL, Doneux PS, Miyazaki AN, Fregoneze M, Silva LA. Treatment of distal clavicle fractures using an arthroscopic technique. J Shoulder Elbow Surg. 2008; 17:395–398.

8 Kiefer H, Claes L, Burri C, Holzwarth J. The stabilizing effect of various implants on the torn acromioclavicular joint. A biomechanical study. Arch Orthop Trauma Surg 1986; 106:42–46.

9 Tambe AD, Motkur P, Qamar A, Drew S, Turner SM. Fractures of the distal third of the clavicle treated by hook plating [published online ahead of print October 19, 2005]. Int Orthop 2006; 30:7–10.

10 Mizue F, Shirai Y, Ito H. Surgical treatment of comminuted fractures of the distal clavicle using Wolter clavicular plates. J Nippon Med Sch 2000; 67:32–34.

11 Meda PV, Machani B, Sinopidis C, Braithwaite I, Brownson P, Frostick SP. Clavicular hook plate for lateral end fractures: a prospective study. Injury 2006; 37:277–283.

12 Lee YS, Lau MJ, Tseng YC, Chen WC, Kao HY, Wei JD. Comparison of the efficacy of hook plate versus tension band wire in the treatment of unstable fractures of the distal clavicle. Int Orthop 2009; 33:1401–1405.

13 Renger RJ, Roukema GR, Reurings JC, Raams PM, Font J, Verleisdonk EJ. The clavicle hook plate for Neer type II lateral clavicle fractures. J Orthop Trauma 2009; 23:570–574.

14 Neer CS. Fractures of the distal third of the clavicle. Clin Orthop Relat Res 1968; 58:43–50.

15 Neer CS. Fracture of the distal clavicle with detachment of the coracoclavicular ligaments in adults. J Trauma 1963; 3:99–110.

16 Edwards DJ, Kavanagh TG, Flannery MC. Fractures of the distal clavicle: a case for fixation. Injury 1992; 23:44–46.

17 Lee KW, Lee SK, Kim KJ, Kim YI, Kwon WC, Choy WS. Arthroscopic-assisted locking compression plate clavicular hook fixation for unstable fractures of the lateral end of the clavicle: a prospective study. Int Orthop 2010; 34:839–845.

18 Wu K, Chang CH, Yang RS. Comparing hook plates and Kirschner tension band wiring for unstable lateral clavicle fractures. Orthopedics 2011; 34: e718–e723.

19 Flinkkila T, Ristiniemi J, Hyvonen P, Hamalainen M. Surgical treatment of unstable fractures of the distal clavicle. Acta Orthop Scand 2002; 73:50–53.

20 Tsuei YC, Au MK, Chu W. Comparison of clinical results of surgical treatment for unstable distal clavicle fractures by transacromial pins with and without tension band wire. J Chin Med Assoc 2010; 73:638–643.

21 Hsu TL, Hsu SK, Chen HM, Wang ST. Comparison of hook plate and tension band wire in the treatment of distal clavicle fractures. Orthopedics 2010; 33:879.

22 Faraj AA, Ketzer B. The use of a hook-plate in the management of acromioclavicular injuries. Report of ten cases. Acta Orthop Belg 2001; 67:448–451.

23 Haidar SG, Krishnan KM, Deshmukh SC. Hook plate fixation for type II fractures of the lateral end of the clavicle. J Shoulder Elbow Surg 2006; 15:419–423.