Case Report

Double-plate fixation in double clavicle fractures: A case report

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ABSTRACT

Bilateral clavicle fractures are rare; Double clavicle fractures are particularly rare. We report a case of a 23-year-old woman presenting with double fractures (middle and distal end) of the right clavicle and single fracture of the left clavicle after she suffered a road traffic accident. Four days after the injury, the right clavicle was fixed with a reconstruction locking plate and a hook plate, the left clavicle was fixed by a S-shaped locking plate. Bone union was achieved 3 months after surgery. The patient regained full range of shoulder motion with a mild pain in the right acromion 21 months after the operation. To our knowledge, treating double clavicle fractures using double-plate fixation has not been described. Our case shows that double-plate fixation was successful in achieving an excellent long-term outcome.

Introduction

Unilateral clavicle fractures are commonly encountered, however, bilateral clavicle fractures are uncommonly reported in the literature with the incidence being < 0.5% of all the clavicle fractures [1–3]. Furthermore, double clavicle fractures, are particularly rare [4]. To our knowledge, there is no literature about double plates (reconstruction locking plate and hook plate) in treating double (middle and distal end) clavicle fractures. So we report this case and present the management of the fractures and the outcome in this unusual case.

Case presentation

A 23-year-old, right hand-dominant female suffered from a road traffic accident on the highway while sitting in the co-pilot position. She was thrown out of the window. She had a coma and was taken to the emergency room. At the presentation, the patient was conscious and her vital signs were stable. Physical examination revealed swelling, tenderness, and restricted mobility in the bilateral shoulders, apart from some soft tissue lacerations over the scalp and local contusion over the face and right lower limb. Her neurovascular examination was normal. No other complications (i.e., pneumothorax, hemothorax) was presented. The patient was five months postpartum. There were no previous medical comorbidities. The radiographs showed double (middle and distal end) fractures of the right clavicle and middle comminuted fracture of the left clavicle (Fig. 1). CT scan with three-dimensional (3D) reconstruction of the right shoulder demonstrated a displaced transverse mid-shaft clavicle fracture associated with distal clavicle fracture Neer type I [5] (Fig.2). Both upper extremities were immobilized with the arm sling. Four days after the accident, open reduction and internal fixation was performed under general anaesthesia. The patient was placed in the beach chair position and antibiotic prophylaxis was administered. Initially, the mid-shaft fracture of the right clavicle was fixed with an eight-hole reconstruction locking plate anteriorly, then the ipsilateral distal end fracture was fixed with a three-hole hook plate. Subsequently, the
fracture of the left clavicle was fixed using a S-shaped locking plate after reduction. Postoperative X-rays confirmed that the implants were in their appropriate positions and showed a good reduction (Fig. 3).

Post-operatively, the patient was given bilateral arm sling support. The suspenders were removed 4 weeks after the operation, and active exercise for the shoulder joints was initiated. At the 3-month follow-up, bone fusion was complete, but the patient complained of bilateral shoulder pain occasionally, the Visual Analog pain Scale (VAS) of the right side was 6 points, and the left side was 1 point. She complained that there is little difficulty in performing overhead movements (DASH Score of the left and right side: 38.3 and 43.3, respectively). With aggressive stretching exercises, she eventually regained full range of motion (Fig. 4) (DASH Score: 12.5 and 14.1). Bone remodeling was quite well at the 21-month follow-up (Fig. 5). The VAS of the left and right shoulder were 0 point and 1 point, respectively; meanwhile, the patient's Constant-Murley scores are 100 and 91. The physical and mental component summary SF-36 scores were 80 and 88, respectively. She has also returned to preinjury levels of laboring and sporting activities.
Although clavicle fractures represent 2–5% of all fractures in adults and accounting for > 10% in children [6–7], bilateral clavicle fractures are rarely reported in the literature [8–9]. Most clavicle fractures have been managed non-surgically due to the high complication rates of the surgical treatment [10]. But there are evidences in the literature that suggest a high rate of delayed, nonunion or shoulder dysfunction after conservative treatment in clavicle fractures [11–13]. Furthermore, when the shoulder girdle becomes unstable due to the double fractures of the clavicle and to avoid further displacement of the fracture causing related complications (i.e., subclavian artery and brachial plexus injury, pneumothorax, hemothorax), surgical treatment is considered necessary.

Double clavicular fractures are usually associated with high-energy trauma, and we surmise that the mechanism of this injury can be explained by the following sequence of events. The distal clavicle fracture occurred first due to the strong external force directly impacting the distal site. Then the violence continuing forced the mid-shaft of the clavicle and to avoid further displacement of the fracture causing related complications (i.e., subclavian artery and brachial plexus injury, pneumothorax, hemothorax), surgical treatment is considered necessary.

The optimal way of internal fixation for this rarely double clavicle fractures is still not conclusive in the literature. In Nanno M’s report of the double clavicle fractures [14], they fixed the middle clavicular fracture with a 3.5-mm dynamic compression plate and the distal clavicular fracture was fixed with tension band wiring. The patient started to exercise after 3 weeks of immobilisation with a sling and a bandage. At the final follow-up, the fractures’ healing was normal, although the shoulder function remained diminished, owing to the brachial plexus injury and severe soft-tissue damage. In another case [15], Hagino Tet al. treated the mid-clavicle
fracture with an intramedullary 2.5-mm Kirschner wire and the distal clavicle fracture was fixed using a tension band wiring method. Bone fusion was complete 6 months after the operation. Finally, the patient was pain-free and had no restricted motion in the shoulder. In this case, we used a reconstruction locking plate and hook plate in treating the middle and distal end clavicle fractures, respectively. At the final follow-up, the shoulder function was satisfactory, apart from occasionally mild pain in the right acromion. Wu K et al. compared hook plates and Kirschner tension band wiring for unstable lateral clavicle fractures, they found that there is an equivalent rate of complications in the two groups, however, hook plate fixation was associated with statistically better shoulder function than K-wire tension band fixation [16]. In addition, Kiefer H et al. compared the mechanical strengths between K-wires with tension bands and clavicular hook plates, they drew a conclusion that hook plates provided more stability than K-wires [17].

Beytemür Ö et al. successfully treated a clavicle diaphyseal fracture with ipsilateral type 3 acromioclavicular joint dislocation with the combination of reconstruction locking plate and hook plate [18]. The double-plate fixation can provide a correct anatomic reduction, and what's more, it does not require professional knowledge in comparison with some procedures promoted as being “minimally invasive” [19].

Conclusion

We described a rare case of bilateral clavicle fracture with double fractures in the right clavicle. Our results indicate that the combination of reconstruction locking plate and hook plate is a reliable method for the management of double (middle and distal end) clavicle fractures, they also provided excellent clinical and radiographic outcomes.

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