

Fixation of comminuted midshaft clavicle fractures with bone fragments separated by soft tissue using a novel double ligature technique

A case report

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Abstract

Rationale: Clavicle fractures are common, and mostly occur in the midshaft. Methods for operative treatment of midshaft clavicle fractures are evolving, as they improve clinical outcomes compared with traditional conservative management. However, fixation of comminuted midshaft clavicle fractures with bone fragments separated by soft tissue remains a challenge.

Patient concerns: Here, we present a case of comminuted midshaft clavicle fracture with a bone fragment separated from the main fracture by soft tissue.

Diagnosis: Left comminuted midshaft clavicle fracture.

Interventions: We treated this patient with a novel double ligature technique using absorbable suturing.

Outcomes: In the past 7 years, we have treated >50 patients with this technique. We have achieved good clinical outcomes with no complications.

Lessons: We recommend widespread use of our novel double ligature technique for treating comminuted midshaft clavicle fractures with bone fragments separated by soft tissue.

Abbreviation: DASH = disabilities of the arm, shoulder and hand.

Keywords: double ligature technique, free bone fragments, midshaft clavicle fractures

1. Introduction

Clavicle fractures account for 2.6% to 4% of all fractures. Most (80%) clavicle fractures occur in the midshaft^[1–4] as a result of direct axial compressive force caused by a fall or a blow to the shoulder. Many clinicians favor conservative treatment of midshaft clavicle fractures, but nonunion or malunion occurs in 60% and 15% of midshaft clavicle fractures after conservative treatment, respectively,^[5] and there may be a 20% to 25% decrease in shoulder function and arm strength.^[6] Consequently, methods for plating midshaft clavicle fractures are evolving.

However, fixation of comminuted midshaft clavicle fractures with bone fragments separated by soft tissue remains a challenge. Fixing comminuted fractures with a plate and screws is difficult as the fragments are small, and the procedure may lead to vascular injury, bone fragment breakage during reduction, fixation failure, or nonunion. To resolve these issues, we devised a novel double ligature technique using absorbable suturing. We have successfully used this procedure in our institution for the last 7 years. Here, we present a case of comminuted midshaft clavicle fracture treated with the double ligature technique.

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1.1. Case presentation

A 36-year-old man who had been involved in a traffic accident was admitted to our hospital 6 hours after the accident with complaints of pain in the left shoulder. On physical examination, the left clavicle was prominent and there were no neurovascular injuries. The patient's medical history was unremarkable, and he had no notable comorbidities. Radiography revealed a left comminuted midshaft clavicle fracture with a bone fragment separated from the main fracture by soft tissue (Fig. 1A).

Emergency surgery involved our novel double ligature technique designed specifically to treat comminuted midshaft clavicle fractures (Fig. 1B). The procedure required 4 steps and no specialized surgical instruments. The length of the clavicle was restored by reducing the main fracture; temporarily, boneholders were used to hold the fracture in position. The anatomical position of the bone fragment was stabilized. A clavicle locking compression plate of adequate length was used to fix the main

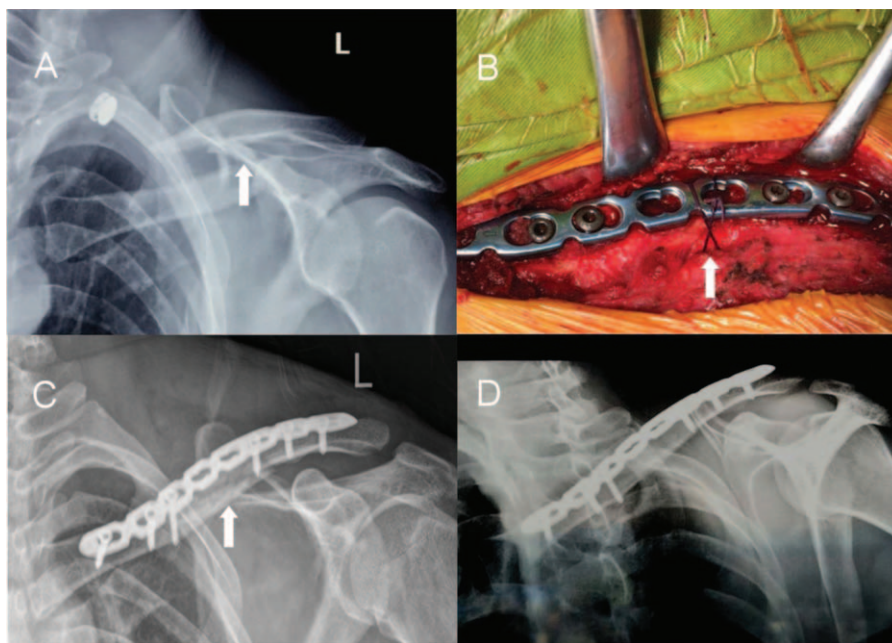


Figure 1. (A) Radiograph showing a comminuted midshaft clavicle fracture with a bone fragment separated by soft tissue. (B) The midshaft clavicle fracture was fixed with a locking compression plate, and the free bone fragment was fixed with absorbable suturing. (C) Radiograph taken postoperatively showing good fracture reduction. (D) At the 1-y follow-up, radiography revealed fracture union with abundant callus formation across the fracture site and absence of a fracture line. Arrows indicate the free bone fragment attached to soft tissue.

fracture. The anatomical position of the bone fragment was fixed using double-stranded absorbable coated VICRYL Plus antibacterial sutures (Fig. 1B). When suturing the bone fragment, the needle was kept close to the bone surface to avoid neurovascular injury.

Postoperative radiographs showed good fracture reduction (Fig. 1C). At the 1-year follow-up, radiography revealed fracture union with abundant callus formation across the fracture site and absence of a fracture line (Fig. 1D). The patient had normal function in the injured shoulder.

2. Discussion

Clavicle fracture is common, accounting for approximately 5% of all fractures in adults.^[7] Clavicle fractures are usually classified according to location. In 1967, Allman divided clavicle fractures into 3 groups: Group I central third fractures; Group II, distal third fractures; and Group III, medial third fractures.^[8] Midshaft clavicle fractures (Group I) constitute the majority of clavicle fractures (69–82%)^[2]; however, optimal treatment of midshaft clavicle fractures remains controversial. Traditionally, midshaft clavicle fractures are treated conservatively, but conservative management is associated with nonunion in 5% to 20% of patients^[9] and malunion leading to loss of shoulder function in many others.^[6] In a multicenter, prospective clinical trial of 132 patients with a displaced midshaft fracture of the clavicle, Altamimi and McKee reported significantly improved Constant Shoulder and Disabilities of the Arm, Shoulder and Hand (DASH) scores at the 1-year follow-up, as well as a significantly shorter time to radiographic union in patients treated with operative fixation compared with those treated nonoperatively.^[10] These data contribute to the growing body of evidence that supports the use of primary plate fixation for midshaft clavicle fractures.

Most midshaft clavicle fractures are comminuted with free bone fragments because they result from trauma caused by direct force. A recent report identified comminution of fracture as an independent predictive factor for nonunion of midshaft clavicle fractures after nonoperative treatment.^[11] Our clinical experience has shown that operative fixation of comminuted midshaft clavicle fractures with bone fragments separated by soft tissue is especially challenging, particularly when the fragments are small. Therefore, we devised a novel double ligature technique that involves plate fixation of the main fracture, stabilization of the anatomical position of the bone fragments, reduction of the fragments, and fixation of the bone fragments with absorbable sutures. At 6 weeks postoperatively, the sutures are absorbed, allowing calluses to form. This method has been used successfully for the last 7 years in our department on >50 patients with no adverse events. All the fractures united well. Based on our clinical experience, the double ligature technique warrants widespread use.

In conclusion, we recommend the use of our novel double ligature technique for treating comminuted midshaft clavicle fractures with bone fragments separated by soft tissue.

3. Consent

The Institutional Review Board of Jilin University approved the publication of this case report, and informed consent has been obtained from the patient.

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