

Open Reduction and Internal Fixation of Medial End of Clavicle Fracture Across Bilateral Sternoclavicular Joints

Jia-Fu Zhu¹, Wei-Nan Liu² and Aihua Liu³

¹Department of Orthopaedics, The Affiliated People's Hospital of Fujian University of Traditional Chinese Medicine, Fuzhou, China

²Department of Orthopaedics, The Central Hospital of Enshi Tujia and Miao Autonomous Prefecture, Enshi, China

ABSTRACT

A fracture of the medial end of clavicle is rare and can be easily overlooked clinically. Due to the complex anatomy and problematic internal fixation methods, the conservative treatment has been used in the past. Some patients have shoulder joint dysfunction and symptomatic nonunion after the conservative treatment. Therefore, it has been argued that surgical treatment can improve the clinical prognosis of patients. However, surgical risks are high, and many postoperative complications may occur even after internal fixation. In December 2021, the authors used open reduction and internal fixation (ORIF) across bilateral sternoclavicular joints to treat one case of fracture of the medial end of the left clavicle, which not only had low risk but also met the requirements of elastic fixation of sternoclavicular joint and promoted early functional exercise of the affected shoulder.

Key Words: Medial end of clavicle, Fracture, Internal fixation, Sternoclavicular joint, Elastic fixation.

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INTRODUCTION

Fractures of the medial end of the clavicle are complex, but the incidence rate is low. The conservative treatment and improper surgery may affect patients' functional recovery and prognosis.¹ We treated a patient with a fracture of medial end of the clavicle, a fracture of the thoracic vertebrae T12, and a rib fracture in December 2021. We performed open reduction and internal fixation across the bilateral sternoclavicular joints for the fracture of the medial end of clavicle. The clinical results were satisfactory. The diagnosis and treatment of fractures of the medial end of the clavicle are further discussed.

CASE REPORT

A 58-year man accidentally fell from a height of 2 m. The patient experienced limited mobility and pain in the back and left chest. He underwent an urgent x-ray examination after arriving at the hospital. The x-ray film revealed a compression fracture of the thoracic vertebrae, T12, but no abnormalities were discovered in the left clavicle. A complete CT scan was performed. In addition to a blowout fracture of the thoracic vertebrae, T12, a fracture of the medial end of the left clavicle (Figure 1) and a fracture of the left second rib were detected.



Figure 1: (A) X-ray film taken at the emergency department, no obvious fractures were discovered in the left clavicle. (B) CT scan performed at the emergency department; a fracture of the medial end of the left clavicle was detected.

After further examinations, the patient received a diagnosis of (1) a fracture of the medial end of the left clavicle, (2) a blowout fracture of the thoracic vertebrae, T12, (3) a rib fracture, and (4) multiple contusions. Thereafter, comprehensive preoperative examinations were conducted, and no obvious surgical contraindications were discovered. Under general anaesthesia, open reduction and internal fixation (ORIF) surgery was performed to correct the fractures of the medial end of the left clavicle (Figure 2) and thoracic vertebrae, T12.

In the early postoperative stages, the patient performed passive functional exercises under the guidance of doctors and nurses and active functional exercises in a supine position. On the seventh day after the operation, the patient left the bed by using protection braces, and the left glenohumeral joint could be moved with few limitations (Figure 3). Approximately 2 months after the operation, the x-ray examination revealed the formation of callus at the medial end of the left clavicle and a blurred fracture line. The scores of the Neer Test and the visual

Correspondence to: Dr. Aihua Liu, Department of Orthopaedics, The Central Hospital of Enshi Tujia and Miao Autonomous Prefecture, Enshi, China
E-mail: 610474594@qq.com

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analogue scale were 94 and 1, respectively.

The patient was told to revisit the hospital approximately 3 months after the operation to remove the internal fixation from the clavicle. However, the outpatient appointments were affected by the COVID-19 pandemic. Six months after the operation, the patient experienced discomfort due to plate rupture after strenuous movement and revisited the hospital to remove the internal fixation. The re-examination revealed that the fracture of the medial end of the left clavicle had healed, and the left glenohumeral joint functioned well (Figure 4).



Figure 2: Surgical incisions. Limited incisions were made on both sides of the medial clavicle, and the plate was reached to the opposite side through a skin-sternum tunnel.

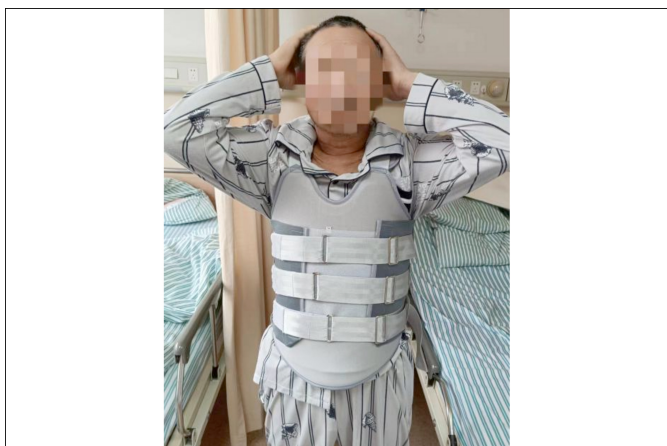


Figure 3: On the seventh day after the operation, the patient left the bed by using protection braces, and the left glenohumeral joint could be moved with few limitations.

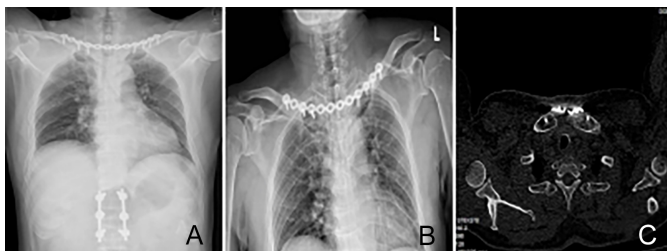


Figure 4: (A) X-ray film taken during the postoperative examination. (B) X-ray film taken approximately 2 months after the operation. Callus has formed at the proximal end of the left clavicle, and the fracture line is blurred. (C) The fracture of the medial end of the left clavicle has healed 6 months after the surgery.

DISCUSSION

A fracture of the medial end of clavicle is a rare clinical occurrence. According to the epidemiological statistics, fractures of the medial end of clavicle, discovered through x-ray examinations, account for approximately 2–3% of all clavicle fractures.² Clinicians may miss the fractures of the medial end of clavicle due to the limitation of x-ray examinations. Better understanding of fractures of the medial end of clavicle and the use of CT scans have led some researchers to believe that the actual incidence of fractures of the medial end of clavicle is much higher than previously reported.³ Salipas *et al.* revealed that the incidence of fractures of the medial end of clavicle may reach 15.4%.⁴ Fracture of the medial end of clavicle is mostly a high-energy injury that often occurs concurrently with rib or scapula fractures. Fractures of the medial end of clavicle may also damage the brachial plexus and subclavian vein and can be a compound injury between the scapula, clavicle, and thoracic vertebrae.⁵ Multiple traumas may also cause fractures of the medial end of clavicle to be overlooked.

The anatomical structure of the medial end of the clavicle is complex. A careless operation can cause serious damage to blood vessels and nerves. Because of the surgery's high risk, the conservative treatment is usually adopted. Nevertheless, some patients may feel uncomfortable with conservative fixation methods such as bandages or slings, which makes continuous reduction difficult. Robinson *et al.* indicated that the incidence of symptomatic nonunion in conservatively-treated fractures of the medial end of clavicle is 8%, and can reach 14–20% in conservatively-treated displaced fractures of the medial end of clavicle.⁶ Consequently, some patients can develop glenohumeral joint dysfunction or deformity.⁷

Surgery not only achieves satisfactory anatomical reduction but also improves the healing rate of the bone. However, no internal fixation methods for fractures of the medial end of clavicle have been developed currently. Various fixation methods such as Kirschner wires, T plates, and inverted distal clavicle plates have been used. Although such methods achieve some clinical effect in small studies, there are still some deficiencies and even internal fixation failures. The function of the glenohumeral joint may be affected by the internal fixation failure.⁸ Besides the internal fixation, the position of the patient, as well as the plate, have an important impact on the success of the operation.⁹

In this study, we performed fixation of the fracture of the medial end of the left clavicle across the bilateral sternoclavicular joints when the patient assumed a supine position. The clinical follow-up results were satisfactory. This method had the following benefits: (1) elastic fixation at the fracture end required less peeling of the periosteum and was conducive to fracture healing. (2) The sternum was not fixed with the locking of the plate, which protected the sternoclavicular joint capsule and the surrounding ligaments. Similar to the use of internal fixation brackets, this method guaranteed slight movement in the sternoclavicular joint, which fulfilled the requirement of elastic fixation at the sternoclavicular joint. (3) The back of the sternum was not exposed, and no drilling was required on the sternum or the medial end of the clavicle, which guaranteed higher safety. (4) The gleno-

humeral joint could move in the early postoperative stages, which prevented stiffness of the glenohumeral joint. (5) The bilateral clavicles were fixed with double cortex, which ensured satisfactory stability. The internal fixation should be removed approximately 3 months after the operation once the fracture heals to reduce implant failure caused by internal fixation fatigue.

Open reduction of the proximal clavicular fracture across bilateral sternoclavicular joints with internal fixation had high surgical safety. It was not only beneficial to the early functional exercise of the affected limb but also reduced the occurrence of symptomatic nonunion. The patient in this study was highly satisfied with the procedure. However, the clavicle on the healthy side was involved, which increased trauma to a certain degree.

PATIENT'S CONSENT:

The patient gave his permission for publishing the data.

COMPETING INTEREST:

The authors declared that they have no competing interests.

AUTHORS' CONTRIBUTION:

JZ: Conception of study design, collection of data, literature review, manuscript writing.

WL: Critical review.

AI: Conception of study design, critical review.

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