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A novel method of open reduction and internal fixation of a displaced manubrial fracture using distal clavicle locking plates

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Abstract

A 52-year-old man sustained a sternal fracture after a blunt traumatic chest injury. He was in severe pain in the intensive care unit, which resulted in difficulty breathing and increased analgesic requirement, and a decision was made to stabilize his manubrial fracture. Orthopaedic and thoracic surgeons jointly performed open reduction and internal fixation of the displaced manubrial fracture using 2 distal clavicle locking plates. This resulted in improvement in patient's pain and helped with his subsequent recovery and discharge from the hospital. This case report describes a new, safe and effective method of treating this uncommon injury.

Keywords: Sternal fracture • Open reduction and internal fixation • Distal clavicle locking plate

INTRODUCTION

Sternal fractures occur in 3–8% of blunt chest trauma [1] and are treated conservatively in over 95% of cases [2]. However, unstable fractures can result in flail segments, intractable pain and non-union [1]. The main indications for surgery are to reduce physical deformity and to alleviate pain [3]. Spontaneous ventilation can cause movement of the fragments in an unstable fracture that can result in increasing pain and potentially impair the healing process. This pain can also lead to respiratory difficulty resulting in atelectasis and pneumonia.

A variety of methods for the fixation of sternal and manubrial fractures including T-shaped plates, mandibular plates, cervical plates, various wiring techniques and suturing had been used with no overwhelming consensus [4, 5]. Our paper adds a novel method for fixing displaced manubrial fractures as an alternative to those previously described for use in situations when other methods are not available or suitable. It creates another option for a future, large trial comparing fixation methods.

CASE PRESENTATION

A 52-year-old farmer presented to the local emergency department after a soil bank collapsed on him. He was managed according to the advanced trauma life support principles. On initial assessment, the patient had a patent airway and was haemodynamically stable. His respiratory rate was 23 with O₂

saturations of 99% on 15l of oxygen. His Glasgow Coma Scale score was 15. He was tender bilaterally over the anterior and posterior aspects of the chest wall, with a pain score of 9/10 on visual analogue scale of 0–10.

A computed tomography scan (Fig. 1) showed a fractured manubrium, right and left rib fractures with flail segments, bilateral fractured scapulae, bilateral small pneumothoraces, bibasal lung contusions and consolidation. He was admitted to the intensive care unit for pain relief via a thoracic epidural and to monitor his respiratory function. Bilateral chest drains were inserted the day after his admission on intensive care unit.

The patient was reviewed by orthopaedic and thoracic surgeons, and it was decided that the fracture should be stabilized due to the deformity of the manubrial fracture and pain. His pre-operative pain score was 8/10 on visual analogue scale with a thoracic epidural, oral morphine, intravenous morphine, neofopam, paracetamol and nonsteroidal anti-inflammatory drugs. It was also noted by the intensive care unit physiotherapists that coughing and breathing exacerbated his pain leading to difficulties in performing deep breathing exercises.

His surgery was performed 2 days after his injury by the consultant orthopaedic and thoracic surgeons. Under general anaesthetic in the semi-beach chair position, a curved incision was made over the manubrium and the large manubrial fragments were reduced and stabilized with 2 distal clavicle J plates (Acumed Ltd, Hampshire, UK) under direct vision. The left- and right-sided plates perfectly reduced the fracture after application (Fig. 2A). A chest drain was inserted at the end of the procedure. The length of surgery was 135 min, and the patient was

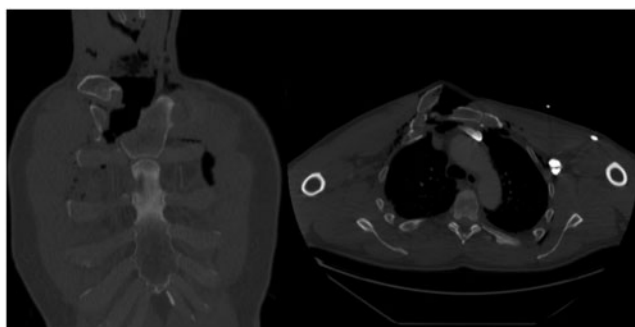


Figure 1: Preoperative computed tomography of sternal fracture.

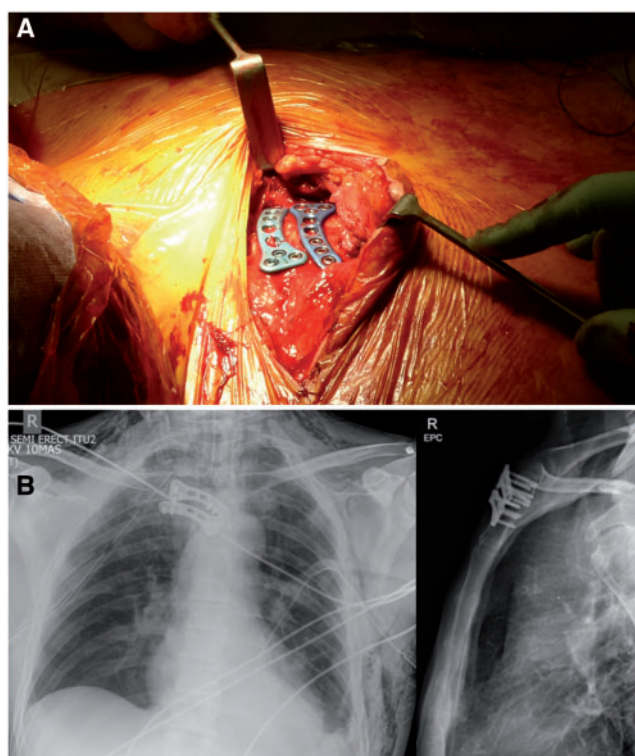


Figure 2: (A) Arrangement of distal clavicular plates. (B) Postoperative X-rays.

successfully extubated postoperatively. He required reintubation and ventilation overnight due to his agitation but was successfully extubated on the first postoperative day. He made a good recovery, and the remainder of his hospital stay was uneventful. His postoperative radiographs were satisfactory (Fig. 2B). His reported pain score was 5/10 on postoperative Day 1 and after pain team review his oral morphine and intravenous morphine were stopped. The physiotherapy team recorded that the patient was able to perform deep breathing exercises. His pain was managed exclusively on oral analgesia by Day 9 post injury. He was discharged from hospital after 12 days postoperative.

This patient was regularly reviewed in thoracic follow-up clinics. He was not on any regular analgesia 9 months after his initial injury so he was discharged from routine care.

DISCUSSION

The scarcity of sternal fractures in day-to-day surgical practice, combined with the high rates of conservative management [2], means that operative fixation is a relatively unexplored area. A difference of opinion has been shown between surgeons of different specialities and in different locations [5] when deciding whether operative fixation is necessary and which approach to use.

Plating has been shown to be biomechanically superior to other methods of fixation [5]. Due to the likely high energy mechanism of fracture, sternal fractures may be associated with underlying mediastinal, tracheal, cardiac and pulmonary injury, so it is important to consider a joint approach of orthopaedic and thoracic surgeons.

The lack of consensus and evidence for one type of fixation over another, coupled with the fracture pattern prompted us to use 2 opposed distal clavicle plates. The low-profile locking plates utilized are precontoured and matched the shape of the manubrium such that a good reduction and stability was obtained. We feel that this novel method of open reduction and internal fixation using distal clavicle locking plates can be utilized in unstable manubrial fracture to improve the pain control and breathing. We recommend a joint procedure between orthopaedic and cardiothoracic surgeons due to the risk of intraoperative cardiovascular injury.

CONCLUSION

Open reduction and internal fixation of displaced sternal fracture can play an important role in the pain management and improvement of respiratory function. This case report details a new, safe and an effective way of achieving this goal with the use of 2 opposed distal clavicle plates in a joint case between orthopaedic and thoracic surgeons.

Conflict of interest: none declared.

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