

Stabilisation of chronic flail chest: a novel approach of surgical fixation and osteogenesis

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ABSTRACT

A patient with chronic flail chest, severe persistent pain and chest wall deformity was successfully managed with open reduction and internal fixation of the ribs and application of a novel osteogenic protein.

A 74-year-old man sustained multiple rib fractures of the right fourth to ninth ribs that resulted in a flail chest with significant chest wall deformity (fig 1A, 2A). The posterior fractures of the sixth to ninth ribs failed to unite and severe pain persisted for 2 years. The severity of the pain progressed to the point that the patient was unable to brush his teeth with his right hand. He also reported dyspnoea with minimal exertion. The patient was refused surgical treatment elsewhere and came to us for a second opinion.

We performed open reduction and internal fixation of ribs 6, 7, 8 and 9. A right postero-lateral thoracotomy was performed through the seventh intercostal space. Bone ends of the sixth to ninth ribs were freshened and properly aligned. Human recombinant osteogenic protein 1 (OP-1; Stryker Biotech, Hopkinton, Massachusetts, USA) was applied between the edges of the fractured ribs. Internal fixation was performed using 5–7 hole screw plates (Synthes, Switzerland) using cortical and locking screws (Synthes) (fig 1B, 2B). A chest tube was placed and the thoracotomy was closed in a standard fashion. The patient reported immediate and dramatic relief of symptoms. He was discharged home on the third postoperative day and is pain free at 6 months of follow-up.

A significant proportion of patients with chronic flail chest are symptomatic, have abnormal

spirometry¹ and significant long term disability.² Operative stabilisation of an acute flail chest is being increasingly recognised as a valuable approach to avoid prolonged ventilation and pneumonia in selected patients. However, fractures of multiple ribs are notoriously difficult to stabilise because of constant chest wall motion that prevents osteogenic reunion of the fractured ribs. This may result in persistent symptoms despite plating of the fractured ends. There have been only a few reports on flail chest stabilisation for chronic pain and disability.^{3,4} Such stabilisation involved complete resection of pseudoarthroses and bridging of the resulting gap with plates.

The concept of stimulated osteogenesis in the management of non-healed fractures is new. A recent case report described the use of bone morphogenic protein in a patient with a previously failed attempt at internal fixation of a sternal fracture using screw plates.⁵ Herein we described a novel combined approach of surgical fixation and stimulated osteogenesis in a patient with a chronic severe flail chest. Osteogenic protein promotes osteogenesis by induction of cellular differentiation in mesenchymal cells and rapid formation of chondroblasts and osteoblasts at the fracture site. Internal fixation provides stabilisation of flail segment while osteogenic protein facilitates the reunion of the fractures.

Surgical fixation of non-union of multiple rib fractures facilitated by osteogenic protein may become a gold standard in patients with chronic flail chest and a long term disability.

Competing interests: None.

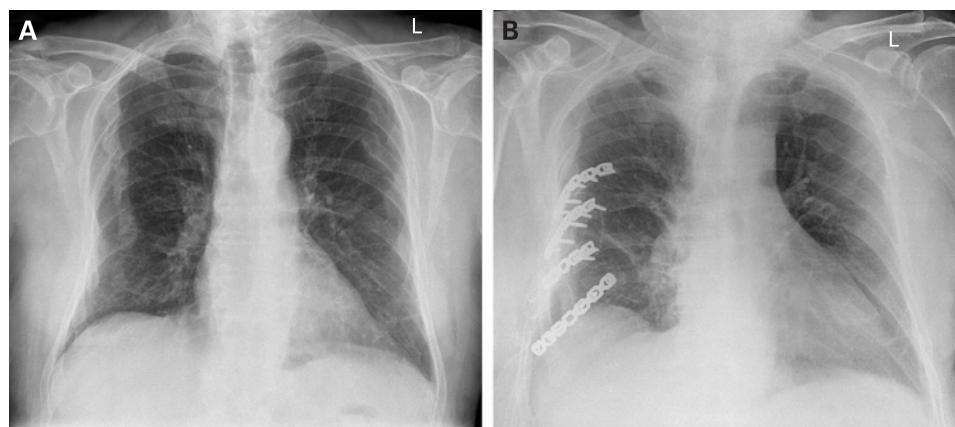
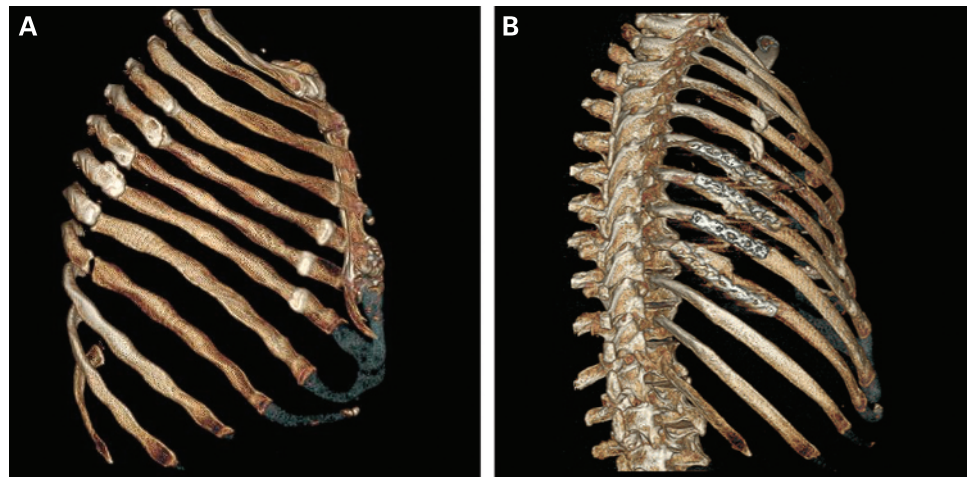


Figure 1 Postero-anterior chest x ray before (A) and after (B) internal fixation of the rib fractures.

Figure 2 CT scan before (A) and after (B) operative stabilisation of the flail chest.



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