

Successful Treatment of a Recalcitrant Pleural Effusion with Rib Fracture Fixation

Benjamin C. Taylor, MD · Bruce G. French, MD

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Abstract Pulmonary complications of rib fractures typically occur in the immediate postinjury period, as a result of the forces causing the injury or subsequent rib fracture displacement. Pneumothorax, hemothorax, pulmonary contusions, or parenchymal lacerations are frequently seen with significant chest wall trauma. Hemopneumothorax is typically treated with tube thoracostomy, and full resolution of the pleural injury is expected; continued pleural fluid accumulation despite these measures is unanticipated, rare, and quite problematic. We report a case of hemorrhagic pleural effusion after rib fractures that were recurrent despite several tube thoracostomies and computed tomography-guided aspirations. The patient subsequently underwent operative fixation of her rib fractures, with successful resolution of her symptomatic pleural effusion.

Keywords rib fracture · flail chest · pleural effusion · rib fixation · chest wall injury

Introduction

Rib fractures are typically the result of blunt force trauma and can be associated with significant pulmonary dysfunction and even increased mortality rates [3]. Although long-term disability has been reported with nonoperative management of rib fractures [2] morbidity is generally seen upon initial presentation, with little currently reported on delayed complications of rib fractures. Prolonged thoracic weakness,

impaired respiratory function, and chronic pain have been noted at long-term evaluation of patients who underwent conservative treatment of flail chest and/or multiple rib fractures [2].

We present what we believe to be the first case of rib fixation as a successful treatment method for recalcitrant pulmonary effusion associated with rib fractures. This case is also very unique in the delayed fashion of the pulmonary effusion, as only four cases of delayed pulmonary effusion as result of rib fractures have been reported in the literature thus far [4, 7]. Prompt patient recovery was seen, and we believe that this technique should be added to a surgeon's armamentarium in treating a similar thoracic injury.

Case Report

A 90-year-old female was presented to the emergency room after a nonsyncopal slip and fall in her bathroom with complaints of right chest pain. She was diagnosed with right posterolateral 6th, 7th, and 8th rib fractures as well as a small pneumothorax (Fig. 1). No paradoxical motion with respiration of the involved area was seen on clinical examination. A chest tube was placed uneventfully, and the pneumothorax resolved without issue; the chest tube was removed 4 days later without recurrence of the pneumothorax. She was discharged home the following day, as her pain was controlled, she had no respiratory difficulties, and did not require supplementary oxygen.

The patient was then readmitted to the hospital 1 week later, as she developed increasing shortness of breath and a large right-sided pleural effusion (Fig. 2). A repeat tube thoracostomy was performed, with an initial large decrease in effusion (450 ml of serosanguinous

B. C. Taylor MD (✉) · B. G. French MD
Department of Orthopaedic Surgery,
Grant Medical Center,
285 East State Street, Suite 500, Columbus, OH 43215, USA
e-mail: drbentaylor@gmail.com

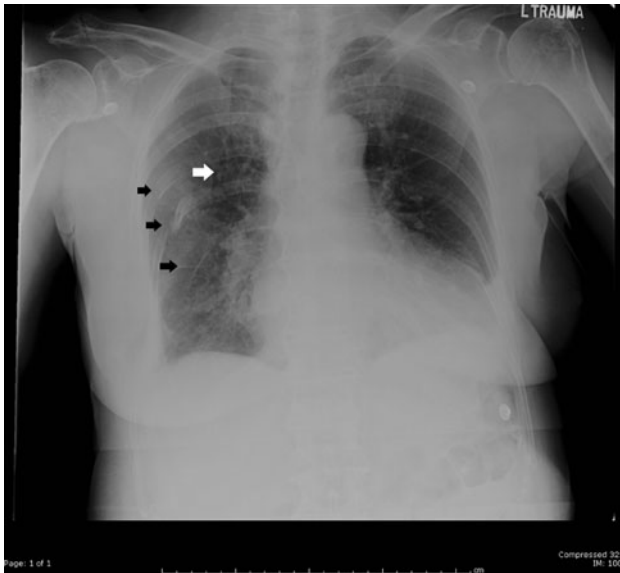


Fig. 1. Initial posteroanterior chest radiograph showing right-sided posterolateral rib fractures and a small apical pneumothorax. The white arrow points to the edge of the collapsed lung, while the black arrows point to the displaced rib fractures

appearing fluid). However, due to the persistence of the effusion, interventional radiology was consulted 2 days later, and they performed an ultrasound-guided tube thoracostomy. Again, an initial improvement in the effusion was seen, but 6 days later, the effusion had reaccumulated, and an additional computed-tomography guided

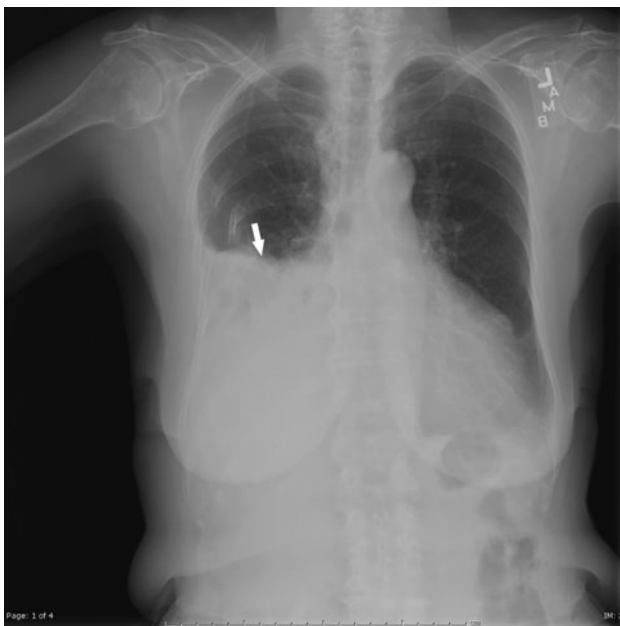


Fig. 2. Repeat chest radiograph revealing a new, large right-sided pleural effusion and the posterolateral rib fractures. The arrow points to the new pleural effusion

tube thoracostomy was performed by the interventional radiology team. She continued to have complaints of dyspnea and was requiring increasing levels of supplemental oxygen as well as increased levels of narcotics for chest wall pain.

Given the significant displacement of her rib fractures and recalcitrant effusions (Fig. 3), the decision was made to pursue operative stabilization of her rib fractures. She underwent open reduction and internal fixation of the right-sided rib fractures 1 month after her initial injury. She was placed in a lateral decubitus position, and a limited posterolateral approach to these ribs was performed. The procedure was performed by a fellowship-trained orthopedic trauma surgeon as well as a fellowship-trained general trauma surgeon; the approach was performed by the general surgeon, while reduction and fixation were performed by the orthopedic surgeon. The fractures of ribs 6 and 7 found to be completely mobile intraoperatively, and were reduced manually with use of small Hohmann-style retractors. The fractures were stabilized using Synthes (West Chester, PA) MatrixRIB locking titanium plates with at least three bicortical locking screws per fracture segment (Fig. 4). The fracture of the 8th rib did not require fixation, as it was not significantly displaced, had an appropriate amount of callus, and was not found to be mobile. Postoperatively, her pain level decreased significantly, and her pulmonary status improved in an expedient fashion, allowing her chest tube to be removed 4 days after surgery. She was discharged home 6 days after surgery and did not require any supplemental oxygen. Final follow-up at 16 months postoperatively revealed a symmetric thorax with excellent chest wall respiratory excursion. No further effusion developed, and she is not requiring pain medication or supplemental oxygen. The final chest radiograph revealed a fully inflated and symmetric thorax with successful union of her operatively stabilized rib fractures (Fig. 5).

Discussion

Open reduction and internal fixation for rib fractures is an increasingly established treatment method for flail chest [1]. As compared to nonoperative treatment, patients undergoing rib fixation have been shown to have shorter intensive care unit stays, decreased ventilator requirements, shorter overall hospital length of stays, fewer tracheostomies, less pneumonia, less need for reintubation, and decreased home oxygen supplementation [1, 6, 8]. However, evidence-based treatment algorithms for rib fracture fixation are currently absent, as further large-scale randomized studies are needed to help further delineate true surgical indications.

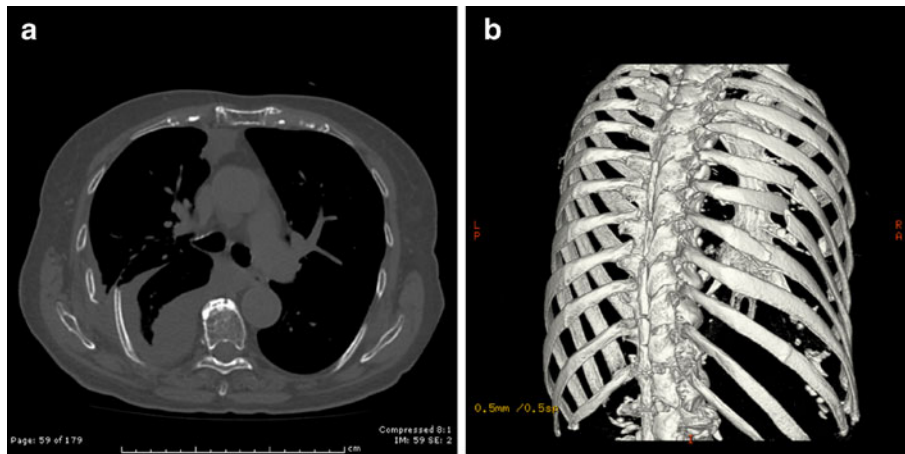


Fig. 3. **A** Axial computed tomography cut showing a large right-sided effusion with significant internal rotation and displacement of the posterior rib fractures. **B** 3-D computed tomography reconstruction depicting the right-sided rib fractures. No true flail segment is seen

This case stresses the importance of continued close follow-up of patients after chest wall trauma and pneumothorax. Persistent pain and morbidity of rib fractures is well-described, but evolution of delayed rib fracture complications are rarely described in the literature. O’Kane et al. [7] reported on a delayed pneumothorax and small effusion after a single rib fracture that was successfully treated using tube thoracostomy. Lu et al. [5] also presented a case series of 16 patients with rib fractures and delayed pneumothorax and concluded that presence of subcutaneous emphysema with rib fractures

should prompt hospitalization and 48 h monitoring to ensure no delayed pneumothorax occurs. In this case, there was no evolution of delayed pneumothorax, but the effusion was refractory to multiple drainage attempts. From intraoperative evaluation, it appeared that the effusion was a result of the mobile fracture ends entering into the pleural cavity and causing a reactive serosanguinous appearing exudative effusion.

We present this case to propose the indication of operative stabilization of the chest wall for recalcitrant effusions caused by rib fractures. We are unaware of any mention of this in the current literature, and believe that this is a valuable tool in treating this, or similar, pathology.



Fig. 4. Intraoperative photograph showing rib reduction and fixation with low-profile titanium-locking plates and screws



Fig. 5. Final chest radiograph showing a fully inflated and symmetric thorax with successful union of her operatively stabilized rib fractures

Disclosures The authors certify that their institution has approved the reporting of this case, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.

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