



Case report

Cardiac injury due to the rapid progress of the dislocation of rib fractures: A rare case that required urgent open reduction and internal rib fixation

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ABSTRACT

Background: Most rib fractures are treated conservatively, but patients with severe trauma may require surgical treatment. We report a rare case of delayed pericardial injury due to a fractured rib stump.

Case presentation: A 61-year-old man fell while riding a bicycle and was transferred to our hospital. A computed tomography (CT) scan showed mild rib fractures on the 4th-6th ribs, and he was hospitalized because of acute pain. A few days later, his respiratory condition had worsened. CT showed that the rib fractures progressed significantly, and the stump was in contact with the heart, so we performed an urgent surgical rib fixation. Operative findings revealed intrathoracic hemorrhage by the pericardial laceration because of the rib stump. The 4th-7th ribs were internally fixed using a screwless titanium metal plate, and he was discharged without complications on the 20th postoperative day.

Conclusion: We experienced a rare case of pericardial injury caused by a rapid dislocation of rib fractures. Urgent surgical treatment was able to prevent a serious complication.

1. Background

Rib fracture, occurring in 10% of blunt trauma patients, is one of the most frequent injuries [1,2]. Severe trauma cases can cause intrathoracic complications, such as in the heart, lungs, spine, and diaphragm, which may require an emergency thoracotomy [3]. On the other hand, most cases of rib fractures are conservatively treated. We present a mild trauma case that required an urgent rib fixation because of an unexpected clinical course.

2. Case presentation

A 61-year-old male man fell while riding a bicycle and was transferred to our hospital. During the initial visit, he experienced left chest pain and did not show unconsciousness or neurological symptoms. His vital signs were also within the normal range. A computed tomography (CT) scan showed fractures in the 4th-6th ribs, but no intrathoracic complications, such as a hemothorax and lung contusion (Fig. 1A). He was hospitalized for pain relief and follow-up.

On the 3rd day of admission, his respiratory condition had worsened, and a chest radiograph showed a left-sided plural effusion and pneumothorax. A subsequent CT scan showed that the ribs fractures progressed significantly, and the stump was in contact with the heart

(Fig. 1B and C). We were concerned about a serious heart injury from the fractured ribs and decided to perform an emergency surgery.

Video-assisted thoracic surgery (VATS) showed that the 4th rib stump was exposed in the thoracic cavity and was in contact with the heart (Fig. 2A). When repairing the fractured rib, hemorrhage due to a pericardial laceration appeared below the stump (Fig. 2B). After hemostasis, it was confirmed that there was no pulmonary fistula, and the 4th-7th ribs were internally fixed using screwless titanium metal plates (KANI, USCI Japan, Tokyo) (Fig. 2C). He recovered well after surgery and was discharged on the 20th postoperative day. The patient had no recurrence of hemothorax during the one-year observation, and the fixed ribs were also preserved.

3. Discussion

Thoracic trauma tends to develop into a fatal condition and requires proper initial treatment. VATS has been well accepted in the management of thoracic emergencies [4]. In our institution, we have decided that the indication for emergency surgical intervention, according to the American College of Surgeons' Committee on Trauma (ATLS) guideline [5], is when excessive drainage volume is confirmed or damage to the bronchial/lung and mediastinal organs is suspected. A rib fracture is one of the more frequent injuries after blunt chest trauma,

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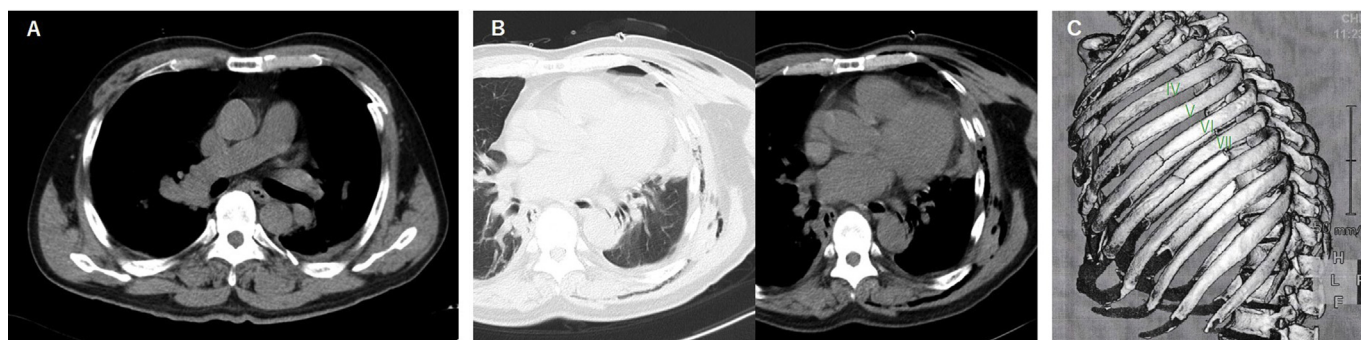


Fig. 1. A: A chest computed tomography (CT) scan showed a mild 4th rib fracture. B: A subsequent CT scan showed a significant dislocation of fractured ribs and hemopneumothorax. C: A 3D reconstruction of the bony thorax showed a rib fracture from the 3rd-7th ribs (4th rib was fractured at two locations).

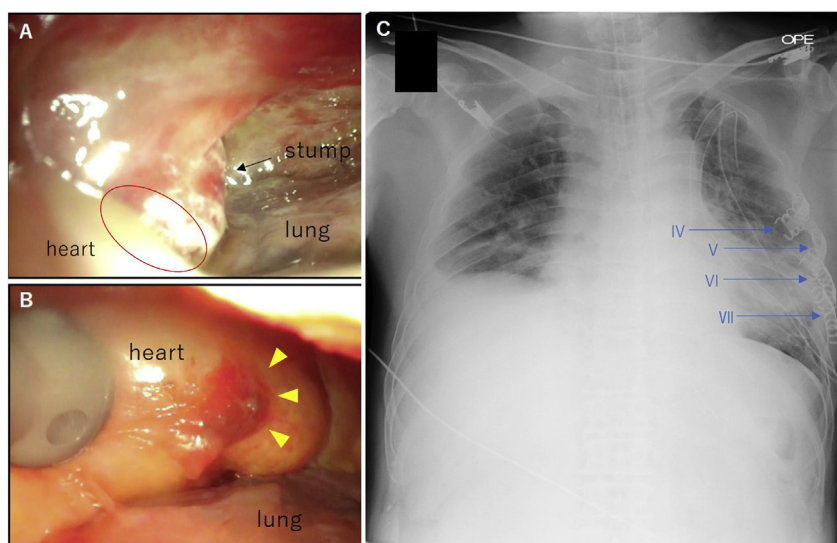


Fig. 2. A: The rib stump of the dislocated 4th rib was exposed in the thoracic cavity and was in direct contact with the heart (red circle). B: There was a pericardial injury just below the broken rib stump (arrow heads). C: A chest radiograph showed that the 4th-7th ribs were fixed by titanium plates.

Indications for surgical internal rib fixation are:

- 1) Chest wall deformity with respiratory failure
- 2) Injury of the heart or large blood vessels (hemorrhage, cardiac tamponade)
- 3) Injury of lungs (hemothorax, pneumothorax)
- 4) Perforation of the diaphragm or chest wall (hemorrhage, hernia)
- 5) Progression of dislocation that may cause intrathoracic complications (unresponsive to conservative treatment)

Fig. 3. Our recommendation for surgical internal rib fixation.

but most of them are managed conservatively, like our case. However, in this case, the dislocation progressed in a few days, and there was concern about a life-threatening cardiac problem, so we performed an urgent rib fixation. The 4th rib, which became unstable because of multiple fractures (Fig. 1C), was pulled by the chest muscle group, and it was thought that the dislocation increased rapidly. In addition, patients with left-anterior chest trauma may require more careful follow-up.

Although traumatic cardiac problems usually occur immediately during the acute phase, cases have been reported where mild myocardial injury and sternum fracture caused delayed cardiac tamponade [6,7]. Late-onset cardiac injury resulting from a rib stump, as we

reported, may be rare.

Open reduction and internal fixation (ORIF) is becoming increasingly more accepted worldwide because of its contribution in reducing mortality in adult patients with a flail chest [8]. However, its treatment effect may be limited in patients with severe, no-flail fracture patterns. Currently, a randomized controlled study is being conducted by the Chest Wall Injury Society [9], and future results are expected. If there is a strong dislocation, even with a few rib fractures, ORIF may be indicated to prevent late-onset mediastinal organ injury [10–12]. We described our recommendation for surgical internal rib fixation in order to reduce the risk of intrathoracic complications (Fig. 3).

4. Conclusion

We experienced a rare case of pericardial injury caused by a rapid dislocation of rib fractures. Urgent surgical treatment was able to prevent a serious complication.

Consent

Informed consent was obtained from the patient's parents for publication and use of images.

Conflicts of interest

The authors have no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.rmcr.2019.100840>.

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