



# A case of thoracic aortic injury caused by multiple rib fractures

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**Abstract:** Thoracic aortic injury is fatal but rare in blunt chest trauma, which usually requires urgent surgical treatment. It is mostly caused by posterior rib fractures. Chest wall stabilization (CWS) has been widely performed in patients with multiple rib fractures all over the world in the past two decades with satisfactory outcomes. However, the surgical treatment of posterior rib fracture within 2–3 cm from transverse process is still a difficult problem for thoracic surgeons. Under this circumstance, rib-transverse process internal fixation method was developed and widely performed for above patients at present. In this article, we presented a case of thoracic aortic injury caused by multiple rib fractures. A 54-year-old female was admitted to our hospital with dyspnea and severe chest pain caused by a falling object. Thoracic aortic injury with multiple rib fractures were diagnosed basing on image date and emergency CWS was performed for this patient. Rib-transverse process internal fixation was not performed in this case since the patients combined with transverse process fracture. We firstly performed transverse process resection combined with CWS for this patient. The results of our study showed this method is safe and feasible for patients with multiple rib fractures combined with transverse process fracture.

**Keywords:** Thoracic aortic injury; chest wall stabilization (CWS); multiple rib fractures

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## Introduction

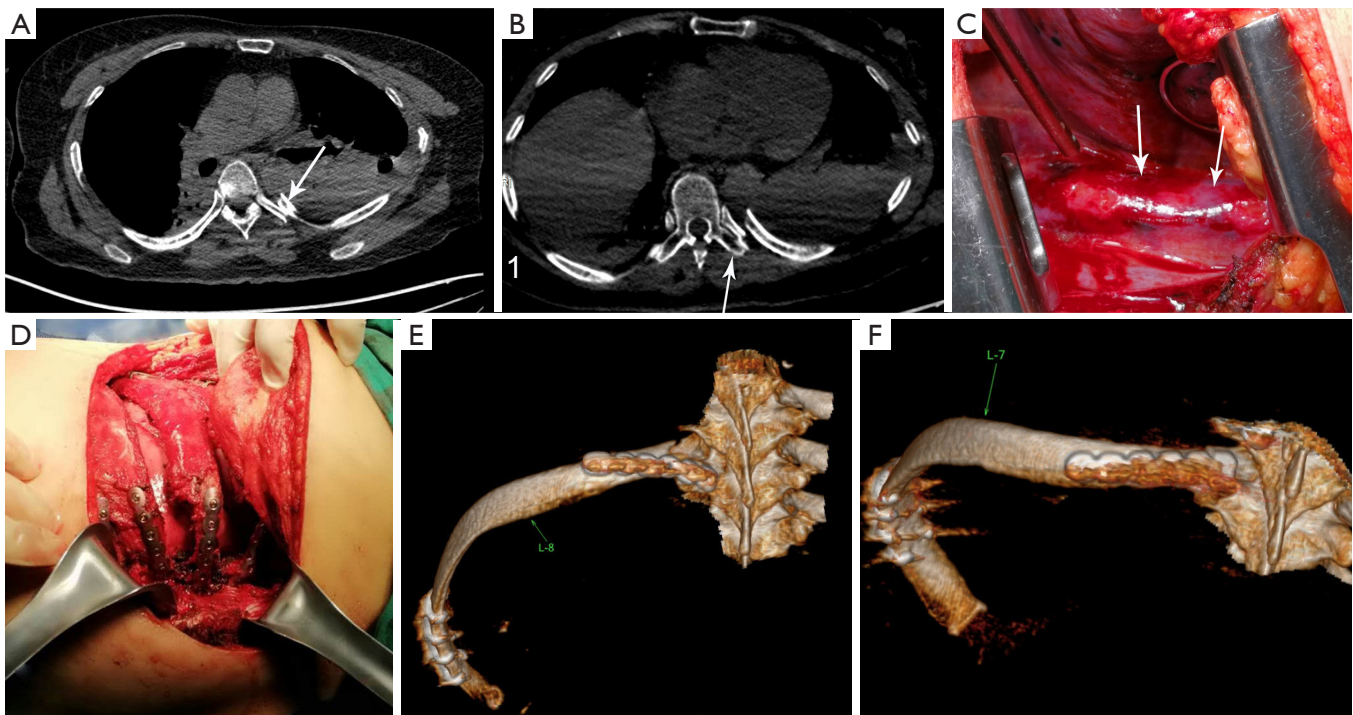
Thoracic aortic injury caused by rib fracture is rare, which usually requires emergency surgery. CWS is now widely performed in patients with multiple rib fractures and has achieved satisfactory results. However, CWS for posterior rib fractures within 2 to 3 cm to transverse process remains a challenge for surgeons due to limited distance for internal fixation of ribs. Rib-transverse process internal fixation is the mostly used method in above situation nowadays, which is not suitable for patients with rib fracture combined with transverse process fracture. Here we reported a case of thoracic aortic injury caused by rib fracture, which was treated with a new operative method with satisfactory results.

We present the following case in accordance with the CARE reporting checklist (available at <http://dx.doi.org/10.21037/acr-20-96>).

## Case presentation

A 54-year-old female was admitted to our hospital with dyspnea and severe chest pain after 24 hours of injury caused by a falling object. No obvious positive sign was detected in physical examination. Chest computed tomography (CT) scan showed bilateral rib fractures, lung contusion and hemopneumothorax, transverse process fracture of T7. The 5th to 8th rib fracture tip was very close to the descending aorta (*Figure 1A,B*). Considering the risk of aorta injury, emergency surgery was performed in this patient.

A left posterolateral incision was made through the 6th intercostal spaces in this case. Exploration revealed 3th to 10th rib fractures in the left side, mostly double fractures. The 5th to 8th rib fractures were located within 3 cm to transverse process while the tips of fractured ribs were punctured into the adventitia of the descending thoracic



**Figure 1** Clinical data of the patient in this case. (A) A chest computed tomography (CT) before operation (arrow: fractured fragment of 7th rib); (B) a chest computed tomography before operation (arrow: transverse process fracture of T7); (C) intraoperative findings (arrows: the adventitia of the descending thoracic aorta was punctured by fractured ribs); (D) surgical procedure: fixation of multiple posterior rib fractures; (E) the CT three-dimensional reconstruction image of the chest wall after operation (transverse process resection combined with chest wall stabilization); (F) the CT three-dimensional reconstruction image of the chest wall after operation (rib-transverse process internal fixation for posterior rib fracture).

aorta (*Figure 1C*). Rib-transverse process internal fixation method was performed for the 5th, 6th, and 8th rib fractures (*Figure 1D,E*). Considering the 7th rib fracture was combined with transverse process fracture, above procedure was not performed. So, we firstly performed transverse process resection to provide sufficient space for CWS and then CWS for the 7th rib fracture (*Figure 1F*). The patient recovered smoothly and was discharged in 14 days after operation. All procedures performed in this study were in accordance with the ethical standards of the institutional and national research committees and with the Helsinki Declaration (as revised in 2013). A written informed consent was obtained from the patient.

## Discussion

In this article, we presented a case of thoracic aorta injury caused by blunt chest trauma. We performed CWS through a totally new method to treat patient with posterior rib

fracture combined with transverse process fracture with satisfactory results.

Thoracic aorta injury caused by blunt chest trauma is rare and very few reports have been reported (1-6). Posterior ribs fracture is the major reason for thoracic aorta injury in patients with chest trauma. It can occur immediately after chest trauma or later. Considering the risk of thoracic aorta injury, surgery is suggested in patients with posterior rib fracture close to aorta. CWS is suggested for patients with multiple rib fracture (7). However, CWS is not widely performed in patients with paraspinal rib fractures within 2 to 3 cm of the transverse process due to insufficient space for internal fixation. Several studies suggested performing rib fragment resection or dulling tip of fractured rib in patients with thoracic aorta injury caused by posterior rib fractures (1,3,4,6). However, one study also showed a case of aorta injury caused by chest wall resection (2). So, there is still risk of secondary injury of aorta after these treatments. Compared with rib fragment resection, rib-transverse

process internal fixation can provide better maintenance of thoracic contour and avoid secondary injury of aorta, which is more widely used in China nowadays. However, rib-transverse process internal fixation was not suitable for patients with rib fractures combined with transverse process fracture due to instability of fixation. Considering the resection of transverse process may able to provide about 2-cm distance for internal fixation of rib, transverse process resection combined with CWS were performed in this case with satisfactory results. Compared with rib-transverse process internal fixation, our new method can better correct thoracic deformity and provide more stable fixation. The patient recovered well and was satisfied with the operation results.

Compared with previous studies (1-6), the degree of aortic injury in this case is the least serious. The major reason for above situation may attribute to the early and effective treatment for this patient. In previous studies (1,3-5), the aortic injury was detected on the 14th, 3th, 11th, and 4th days, which suggested early surgical intervention for rib fracture close to aorta may able to avoid serious aortic injury.

In conclusion, we introduced a new method to treat patient with thoracic aorta injury caused by posterior rib fractured. Transverse process resection combined with CWS for above patients is safe and feasible.

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## Footnote

*Reporting Checklist:* The authors have completed the CARE reporting checklist. Available at <http://dx.doi.org/10.21037/acr-20-96>

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/acr-20-96>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures

performed in this study were in accordance with the ethical standards of the institutional and national research committees and with the Helsinki Declaration (as revised in 2013). A written informed consent was obtained from the patient.

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