

# Stabilization of the anterior flail chest and lung resection in a patient with blunt chest trauma and hepatic injuries

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## CASE PRESENTATION

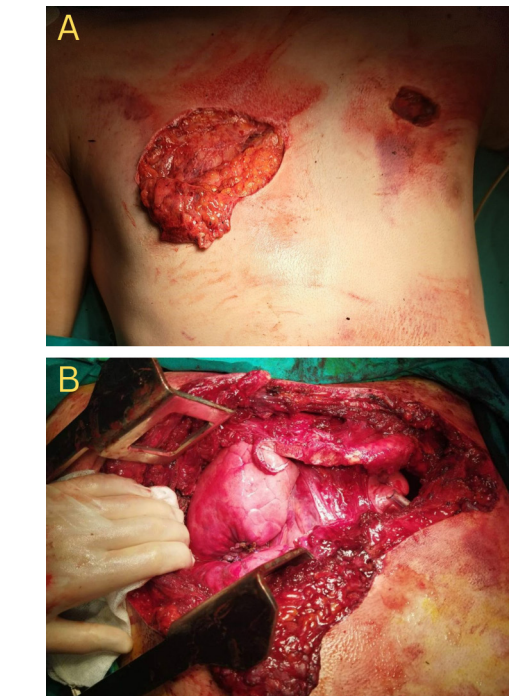
A man in his 20s injured in a tractor rollover in the forest was admitted to our hospital with chest and abdomen injuries. Glasgow Coma Scale score at admission was 15, and he was hemodynamically stable. He suffered from a painful chest and difficulty breathing. There were two penetrating open chest wounds (bilateral open pneumothorax) and clinical signs of anterior flail chest. CT scan was performed, and there were signs of transversal sternal fracture, bilateral multi-fragmental rib and cartilage fractures, bilateral clavicle fractures, and bilateral open traumatic hemopneumothorax. There were also signs of bilateral pulmonary contusion and hepatic lesion with hemoperitoneum ([figure 1](#)).

## WHAT WOULD YOU DO?

1. Bilateral chest drainage, pain management, ventilatory support.
2. Clamshell thoracotomy, bleeding control, chest wall stabilization, liver packing.
3. Resuscitative endovascular balloon occlusion of the aorta (REBOA) first, followed by thoracotomy, then laparotomy.

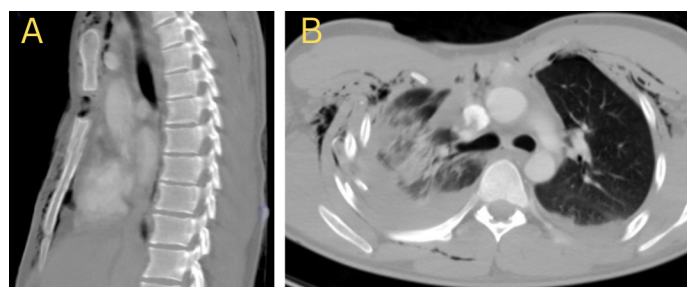
## WHAT WE DID AND WHY?

A clamshell thoracotomy at the level of the transversal sternal fracture was performed. After the skin incision, a growing sternal fracture gap and torn muscles allowed us a fast and excellent approach to both pleural cavities and anterior mediastinum ([figure 2](#)). We noticed both internal thoracic arteries transected, lacerated right upper pulmonary lobe, and hemothorax bilaterally. After ligating internal thoracic arteries, an atypical resection of the S3 segment of the right upper pulmonary lobe was performed. The sternal fracture was stabilized using



**Figure 2** Chest wounds (A) and the clamshell thoracotomy (B).

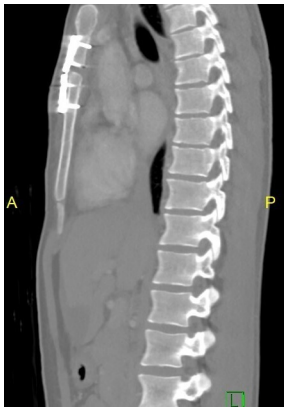
a plate ([figure 3](#)). The rib cartilage was sutured on both sides. Chest drains were placed bilaterally. The hepatic laceration was treated by packing performed through a laparotomy and 3 days after the gauze was removed through the relaparotomy. Blood loss was about 2000 mL. After the surgery, the patient was treated with vasopressors, blood transfusions, antibiotics, and other supportive therapy in the intensive care unit. He was weaned from the mechanical ventilator support 5 days after



**Figure 1** Sagittal (A) and axial (B) CT scans before operation showing transversal sternal fracture, rib and cartilage fractures, traumatic hemopneumothorax, and lung contusions.

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**Figure 3** CT scan of the reduced and plated transversal sternal fracture.

the injury. Due to prolonged pleural infection, the chest drain on the right side was removed after 26 days, and he was discharged 27 days after admission.

## DISCUSSION

Injuries caused by tractor rollover are still common in agriculture and forestry in many parts of the world. High-energy impact in this type of accident often causes complex polytrauma, demanding surgeries to control massive bleeding and stabilization of the flail chest to avoid respiratory failure. An anterior flail chest usually involves anterior portions of upper and middle ribs and sometimes sternum or costal cartilage. The paradoxical motion of parts of the anterior chest wall accompanied by respiratory distress is commonly seen in those instances. Profound pain, hypoventilation, secret retention and atelectasis, respiratory failure, and iatrogenic ventilator-dependent lung injuries could be prevented in some cases by stabilization of fractured bony or cartilage fragments.<sup>1</sup>

In this case, the challenge was what approaches to use for hemorrhage control and what would be the first method applied. The clamshell thoracotomy where the transversal sternal fracture was present offered an optimal approach to both pleural cavities and anterior mediastinum. Stabilizing the parts of the unstable anterior chest wall on the way out was effortless using this approach. By plating and stabilizing the anterior chest wall

the integrity and chest wall biomechanics and respiratory function were partly and sufficiently restored.

In conclusion, although not so widely used, the clamshell thoracotomy could be easily performed in cases with a transverse sternal fracture with a gap when demanding urgent thoracotomy for optimal bleeding control and chest wall stabilization of the anterior flail chest on the way out.

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