

Case report

Blunt trauma with flail chest and penetrating aortic injury

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Received 28 March 1999; received in revised form 14 June 1999; accepted 22 June 1999

Abstract

Blunt chest trauma with flail chest is common. The mortality attributes initially to the associated pulmonary contusion, massive hemothorax and later to the occurrence of adult respiratory distress syndrome. We report a case of flail chest with segmental fractures near the costovertebral junction and delayed hemothorax attacked 14 h later. The final diagnosis of the penetrating aortic injury by detached rib fragment was appreciated by aortogram. Unfortunately, active aortic hemorrhage made prompt thoracotomy in vain for life salvage. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Flail chest; Aortic injury

1. Introduction

Flail chest is usually caused by blunt forces of either traffic accident or falling down from height. Most mortality and morbidity attribute to the contusion or laceration of the underlying intrathoracic content. Recognition of flail chest as a marker of high kinetic energy absorption should keep highly suspicion of life-threatening thoracic injury in each case. The depressed rib segments impart a squashing injury and penetrating diaphragm hernia, lung perforation or hemopericardium were reported [1], but delayed exsanguinating penetrating aortic injury, as our case, was rarely reported before.

2. Case report

A 65-year-old female patient fell down incidentally from a staircase about 2 m in height. Severe chest pain but no significant dyspnea was recorded in the local hospital referred sheet. Initial CXR revealed multiple rib fractures. Preventive tube thoracostomy to avoid tension pneumothorax during transportation was done and only 200 ml bloody pleural effusion was drained. She was then transferred to our hospital to monitor delayed respiratory insufficiency, 10 h after the accident.

While arriving at our emergency room, the patient was

alert but complained of left chest pain especially aggravated with deep breathing. Physical examinations showed stable vital sign: blood pressure (BP), 122/74 mmHg; pulse rate, 98/min; and respiratory rate, 20/min. Follow up CXR revealed left 4, 5, 6, 7, 8 rib fractures with flailed segments but no significant pulmonary contusion or hemopneumothorax. Unfortunately, 13 h after the accident, sudden BP dropped to 78/43 mm Hg but soon corrected to 110/70 mmHg after lactate Ringer 1000 ml infusion. Emergent computerized tomography (CT) showed the descending aorta surrounded by hematoma and a depressed rib fragment just behind it (Fig. 1). Only an additional 200 cc pleural drainage was noted during CT examination and the patient was kept in vital sign stable after 2 units of whole blood were given.

Aortogram was then arranged to rule out traumatic aortic transection or other active bleeding sources. No isthmus pseudoaneurysm was detected but surprisingly an active bleeder from the descending aorta, about 4 cm below the isthmus, were identified. It was caused by detached rib penetrating injury and the contrast extravasation could be clearly delineated by each cardiac pulsation (Fig. 2). The patient was rushed to the operation room but exsanguinating pleural drainage was noted during transportation. Though chest tube was clamped after 1200 ml blood drained out and aggressive whole blood infusion was given via large bore catheter, circulatory collapse and cardiac standstill were noted even after prompt thoracotomy commenced. She died soon after failed cardiac resuscitation.

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Fig. 1. CT showed descending aorta was surrounded by hematoma and a detached rib fragment was just behind it.

3. Discussion

The strict definition of flail chest is the fracture of at least four consecutive ribs in two or more places; however, the functional definition is an incompetent segment of chest wall large enough to impair the patient's respiration. The major mortality and morbidity of the flail chest is respiratory failure. It can be attributed to the associated pulmonary contusion, paradoxical movement of the chest wall and hypoventilation caused by the intolerable pain from fractures. Our unusual report typified another kind of trauma by flail chest. Because of the proximity of the thoracic cage to the underlying cardiopulmonary system, the stove-in detached rib fragment made a hazard for the underlying intrathoracic viscera. Penetrating cardiopulmonary injury with lung perforation, hemopericardium and frank cardiac perforation were reported before [1,2]. The penetrating onset was usually not on the scene and may postpone hours or even days later after none being concerned of the risks. Because of the vital structural characteristic of intrathoracic visceral, the resulting injuries usually were

dramatic with respiratory distress, massive bleeding, or sudden asystole.

Radiological examination of the flail chest with only plain CXR may sometimes underestimate the severity of the disease, as our case, and make an unfortunate mistake [1,3,4]. Chest roentgenogram confirmed the presence of flail chest, but the true nature of the internal damage may not be fully appreciated until CT performed. CT scan can give more detailed information of the intrathoracic damage and also assess the hemothorax, hemomediastinum, great vessel injury and hemopericardium well. Aortogram remains the golden standard of aortic injury diagnosis, but it should not hamper the prompt surgical intervention if operation is truly indicated. However, with the development of stent grafting as a form of therapy for localized aortic trauma, angiography may allow us to not only to diagnose, but also definitively treat the problem quite quickly and minimally invasive.

The treatment of flail chest remains highly controversial. In the literature convincing arguments can be found to support any therapeutic procedure. Most flail chest could

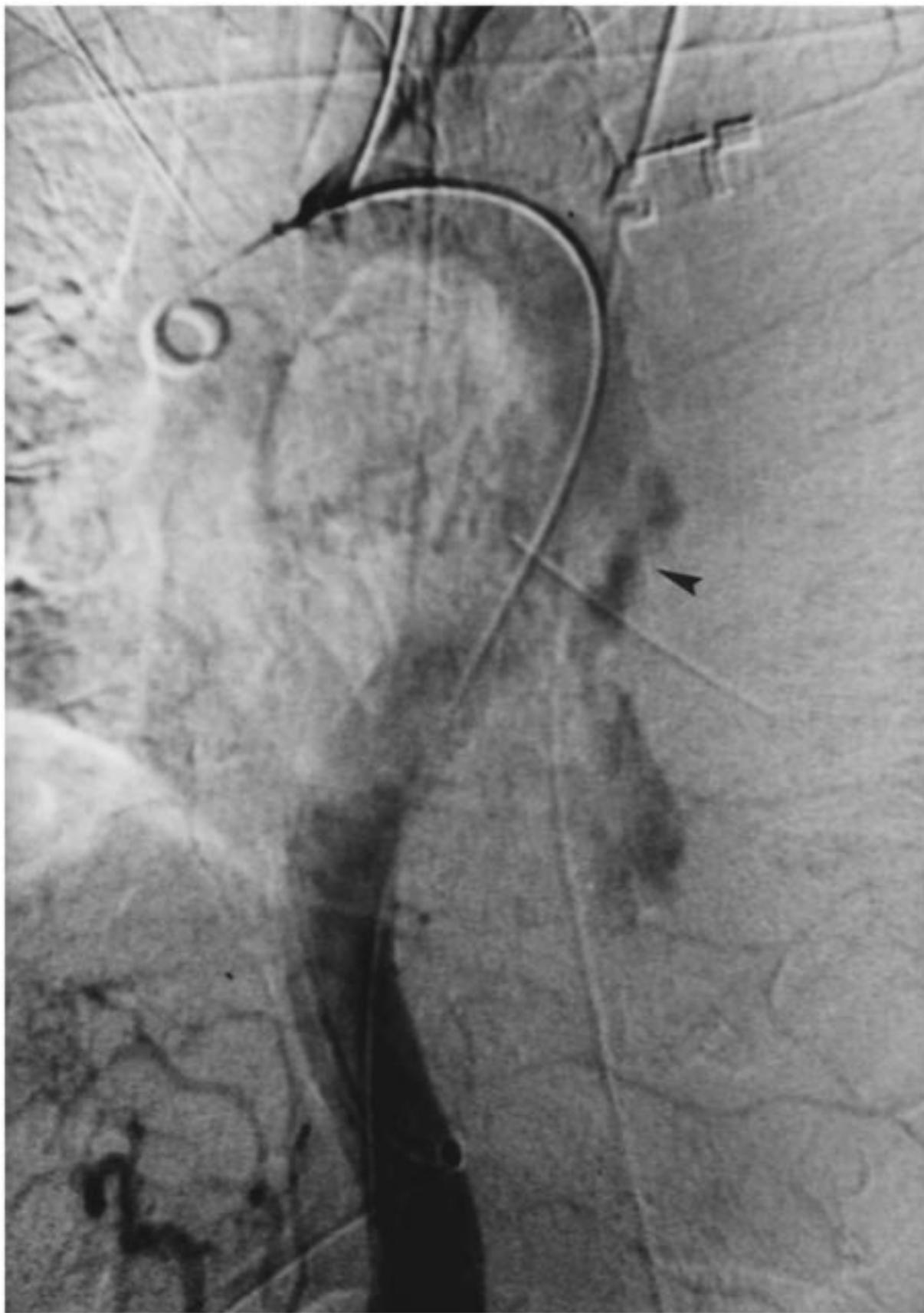


Fig. 2. Aortogram showed the documented extravasation (arrowhead) from the aorta.

be managed with aggressive pulmonary toilet and pain control or with the internal splinting of mechanical ventilation until fibrous stabilization of the chest wall is apparent. The decision to surgically stabilize the chest wall in flail chest was to minimize intubation time and correct the persistent chest wall deformity [5]. However, operation in some, as our case allowed excellent assessment of intrathoracic trauma, removal of endangering rib fragments, repair of visceral lacerations and air leaks, control of bleeding and evacuation of collections.

Blunt chest trauma with flail chest was a significant marker of underlying thoracic injury [6]. Care must be taken to avoid underestimation of the effect of the injury on subsequent cardiopulmonary mechanics [7,8]. Frequent bed transfer and mobilization during CXR, CT and aortogram examinations made our case the ultimately penetrating aortic insult. If we took a more aggressive management after CT scan with surgical exploration rather than arranging aortogram, our patient may have the chance to survive. This was the most important lesson we learned from this case. Flail chest without severe pulmonary contusion or aortic isthmus pseudoaneurysm still could make a dramatic tragedy. Depressed rib fragments of the flail chest especially near the heart or aorta should never be neglected. Preventive tube thoracostomy to close monitor any unusual bleeding and complete bed rest were the initial suggested managements. If CT showed vital structures, such as heart and

aorta, in jeopardized location with detached rib fragment or sudden increase of bloody effusion from chest tube, emergent thoracotomy, even at emergency room, to control the bleeder should always be prepared to avoid sudden cardiopulmonary collapse.

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