

Osseous pinch mechanism in traumatic rupture of aorta and the left main bronchus

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Abstract

We report an unusual case of traumatic aortic rupture and lesion of the left main bronchus after blunt chest trauma in an 8-year-old otherwise healthy boy. The trauma mechanism was severe compression of the thoracic cavity underneath a heavy object without a deceleration component. The visceral lesions were disproportionally severe compared with the surface injury. This case shows the possibility of an osseous pinch after severe compression of the chest and the importance of meticulous examination and monitoring of the patient for complications afterwards.

Keywords

Aorta; Bronchoscopy; Pediatric; Rupture; Blunt trauma.

Case report

History

An 8-year-old boy was transferred to our institution with an aortic rupture after being caught under a tilting soccer goal frame during a match. He had been unconscious for a few moments, but on arrival at the local hospital the boy scored the full 15 points on the Glasgow Coma Scale. A left-sided tension pneumothorax was treated with a chest tube. A computerized tomographic (CT) scan showed bilateral contusions of the lungs, a small residual pneumothorax, a pneumomediastinum and a left-sided mediastinal hematoma with a possible aortic lesion at the level of the aortic isthmus, just distal to the origin of the left subclavian artery in the CT slices (Fig. 1a,b) and in a full reconstruction of the thoracic aorta (Fig. 2). The boy was transferred to our institution for surgery, awake and in a circulatory and respiratory stable condition. Because of the pneumomediastinum and the CT findings, we suspected an oesophageal or bronchial lesion

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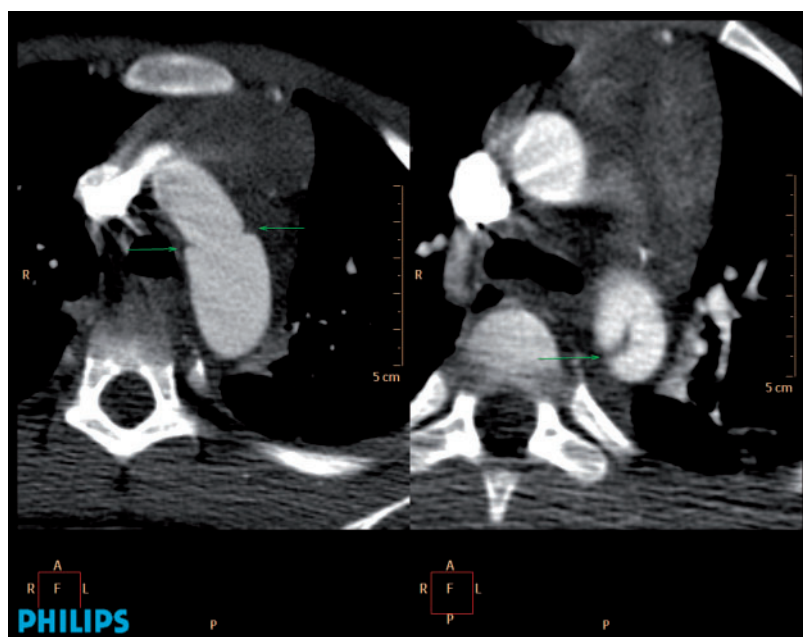


Fig. 1. Chest CT scan showing (a) a 3-cm long aortic injury at the level of the ligamentum arteriosum and (b) the injury in the descending aorta.

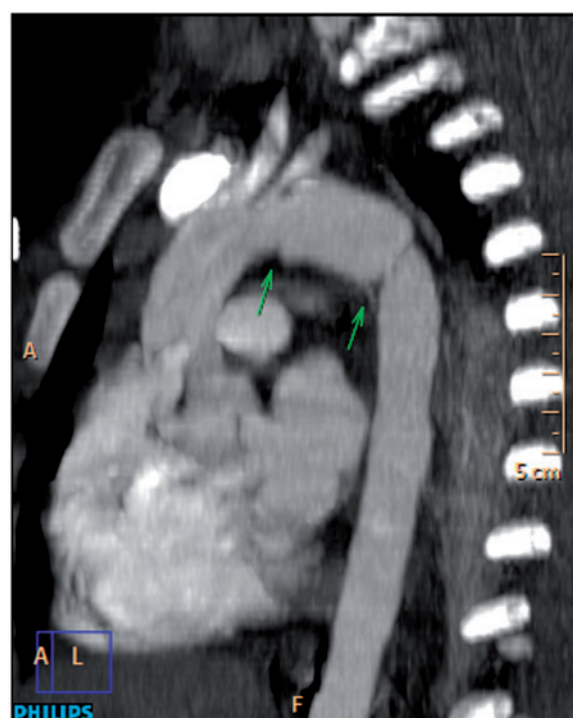


Fig. 2. Reconstruction of the thoracic aorta showing the rupture.

(Fig. 3). Gastroscopy revealed no oesophageal lesion. Bronchoscopy revealed a submucous hematoma in the left main bronchus, but the mucosa was intact.

Surgery

Through a left-sided thoracotomy, the descending aorta and left auricle were cannulated and partial cardiopulmonary bypass (left ventricular assist device) was initiated. An air leak was noticed after mobilization of the aorta and a 3-cm long lesion was discovered in the left main bronchus. This was sutured with 3-0 PDS and covered with a fibrin-coated fleece coverage

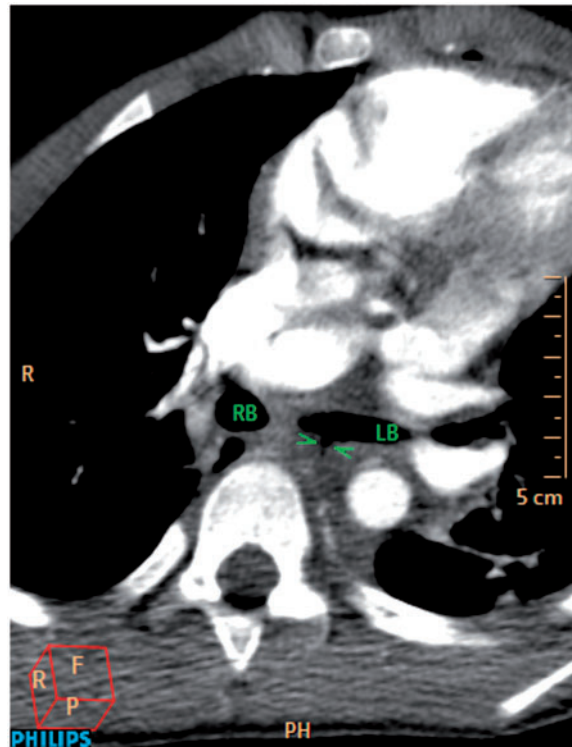


Fig. 3. CT scan of the chest showing an indentation in the left main bronchus suspected to be an incomplete rupture.

(Tachosil®, Nycomed, Linz, Austria). The oesophagus appeared undamaged. The aorta was then clamped distal and proximal to the injury. The rupture involved the intima and media for the whole circumference of the vessel, leaving only the adventitia intact. A 16-mm diameter Goretex® (Goretex®, W.L. Gore & Associates Inc., Flagstaff, AZ) prosthesis was interposed. The patient was extubated on the first postoperative day and transferred back to his local hospital on the fourth postoperative day. At 1-year follow-up he remained well with a normal bronchoscopy and CT scan.

Discussion

Traumatic aortic rupture is usually related to a rapid deceleration injury. Other mechanisms have been proposed, such as a sudden increase in intraabdominal pressure, a water hammer effect that involves simultaneous occlusion of the aorta and a sudden increase in blood pressure, and the osseous pinch effect from entrapment of the aorta between the anterior chest wall and the vertebral column^[1]. The osseous pinch effect seems most likely in our case, where the soccer goal hit the boy directly over the sternum. The chest wall of children is thinner than in adults and there is a higher proportion of cartilage, so the ribs are more elastic and rib fractures are less likely than in adults. However, the underlying heart and lungs are then more vulnerable and injuries are often disproportionately severe compared with the visible surface injury^[2] and compared with the same injury in adults^[3]. Even tracheobronchial rupture is more commonly seen in children than in adults and more often on the right side because of the position of the bronchus just in front of the spine^[4]. The lesion in this case was found at the most central part of the left main bronchus.

Prompt diagnosis can be difficult as symptoms may not appear for several hours and imaging modalities may not be conclusive^[5]. In our case, the combination of CT scanning and bronchoscopy raised a suspicion that was confirmed at operation, but the actual injury was more severe than anticipated, and even the superficial findings were equivocal; the diagnosis of aortic injuries in children after severe compression of the chest requires a high index of suspicion. Osseous pinch caused by compression of the chest wall with concomitant rupture of the aorta and transection of the left bronchus seems to be the most likely mechanism in this case.

Teaching point

High impact chest injury in children may be relatively asymptomatic but may still result in severe organ damage. A knowledge of the mechanism of injury combined with imaging such as CT scanning and bronchoscopy may increase suspicion but still may not be conclusive.

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