

# Interesting case of traumatic paediatric chest pain: don't forget the vessels

A male adolescent was a restrained passenger in a high-speed road traffic collision. At the scene he was noted to be hypotensive and received one unit of blood. In the emergency department, he presented with mild chest pain. He had a normal chest examination. A 20 mm Hg blood pressure difference was found between his right and left arms. His CT chest is displayed in [figure 1](#).

## QUESTIONS

1. What is the most likely cause of the CT appearance identified by arrow 'C'?
  - A. Pneumothorax
  - B. Haemothorax
  - C. Empyema
  - D. Pulmonary contusion
2. What does the arrow 'B' show?
  - A. Aortic dissection
  - B. Aortic transection
  - C. Normal anatomy
  - D. Cardiac tamponade
3. How would you manage this patient acutely?
4. When would you decide to organise a CT chest in a trauma patient?

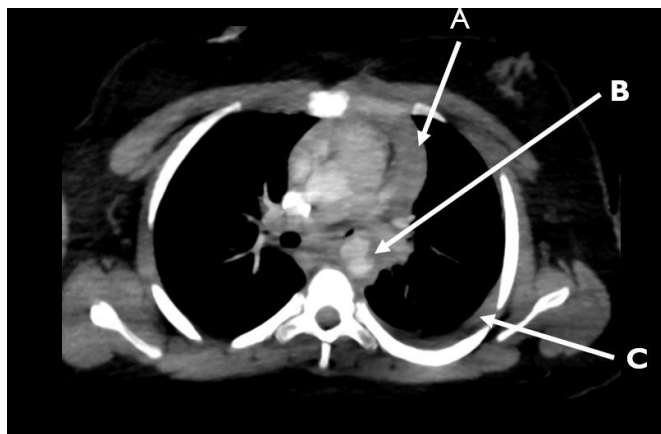
## ANSWERS

### Question 1

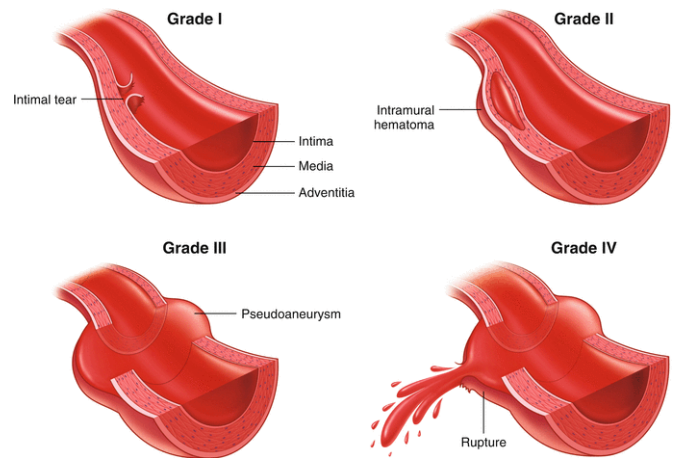
(B) Haemothorax. Arrow 'C' demonstrates fluid within the pleural space; in a trauma setting, blood must be suspected. Air (pneumothorax) appears black on a CT and an empyema (purulent collection) is not in keeping with the clinical case. In trauma, haemothorax occurs from injury to the lungs, heart, chest wall or great vessels.

### Question 2

(B) Aortic transection. Arrow 'B' demonstrates mural irregularity of the aorta with a pseudoaneurysm anteriorly, implying complete disruption of the vessel wall—an aortic transection. This location, the aortic isthmus, is the most common site for this injury.



**Figure 1** CT chest with contrast, axial 3 mm slice taken just below the level of the subclavian artery origin.



**Figure 2** Classification system for traumatic aortic injury. Reproduced from Azzadeh *et al*<sup>1</sup> with permission from Elsevier.

Additional findings labelled as arrow 'A' show a mediastinal haematoma.

In aortic dissection there is an intimal tear allowing blood to pool between vessel layers ([figure 2](#)).<sup>1,2</sup> On CT, dissection is evident as an intimal flap leading to a blood-filled space with a true and false lumen.<sup>3</sup>

A high index of clinical suspicion is required to diagnose aortic injury and should be considered in rapid deceleration mechanisms, patients with signs of a chest injury and/or haemodynamic instability.<sup>4</sup>

### Question 3

Follow the 'C-ABC' approach to trauma with administration of tranexamic acid, volume resuscitation with blood products and activation of the major haemorrhage protocol as required. Avoid hypertension which may exacerbate the aortic injury.<sup>5</sup>

Definitive treatment requires multi-disciplinary team input from general paediatric surgeons, cardiothoracic surgeons, vascular surgeons and interventional radiology. Minor aortic injuries may be managed conservatively with follow-up imaging but more significant vessel injury requires repair (open vs endovascular).<sup>6</sup> In this case, the patient was managed with an open repair by cardiothoracics and made a full recovery.

### Question 4

Imaging in the paediatric population is guided by the as low as reasonably achievable principle, aiming to limit unnecessary radiation exposure. Reassuringly, there is no difference in mortality outcomes when targeted imaging is compared with the 'pan-scan' approach.<sup>7</sup>

The Royal College of Radiology published recommendations specific to paediatric trauma.<sup>8</sup> In thoracic injury, chest X-rays should be performed initially to look for mediastinal enlargement, rib fractures, haemothorax/pneumothorax and diaphragmatic injury. If the patient is stable, with no signs of chest trauma and a normal X-ray, no further imaging is recommended. Conversely, in the patients with chest signs (abnormal examination or observations), abnormal chest X-ray and who are unstable without obvious cause, further imaging of the chest should be considered. Contrast-enhanced CT is the modality of choice.

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#### REFERENCES

- 1 Azizzadeh A, Keyhani K, Miller CC, *et al.* Blunt traumatic aortic injury: initial experience with endovascular repair. *J Vasc Surg* 2009;49:1403–8.
- 2 McMahon MA, Squirrell CA. Multidetector CT of aortic dissection: a pictorial review. *Radiographics* 2010;30:445–60.
- 3 Duran ES, Ahmad F, Elshikh M, *et al.* Computed tomography imaging findings of acute aortic pathologies. *Cureus* 2019;11:e5534-e.
- 4 Karmy-Jones R, Hoffer E, Meissner M, *et al.* Management of traumatic rupture of the thoracic aorta in pediatric patients. *Ann Thorac Surg* 2003;75:1513–7.
- 5 Bansal V, Lee J, Coimbra R. Current diagnosis and management of blunt traumatic rupture of the thoracic aorta. *J Vasc Bras* 2007;6:64–73.
- 6 Chiba K, Abe H, Kitanaka Y, *et al.* Conventional surgical repair of traumatic rupture of the thoracic aorta. *Gen Thorac Cardiovasc Surg* 2014;62:713–9.
- 7 Meltzer JA, Stone ME, Reddy SH, *et al.* Association of whole-body computed tomography with mortality risk in children with blunt trauma. *JAMA Pediatr* 2018;172:542–9.
- 8 The Royal College of Radiologists. *Paediatric trauma protocols*. London: The Royal College of Radiologists, 2014.