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CLINICAL CASE - TEST YOURSELF | Interventional

Haemodynamically unstable patient with chest trauma

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PART A

A 47-year-old male patient presented to our hospital Accident and Emergency (A&E) department after involvement in a side impact motor vehicle accident. Notes from paramedics and witnesses described that the speed of the motorbike was around 50 km/h, and the patient was unconscious for a moment and later started speaking incoherently. The patient presented in A&E haemodynamically unstable, with a pulse rate of 110 beats/min, blood pressure of 80/50 mm Hg, and oxygen saturation of 92% on room air. He was confused and failed to respond to the questions from hospital staff. Clinically, the patient suffered from head and abdominal injuries, as well as a right lower limb fracture. Laboratory examinations were also performed and showed: HGB: 8.7 mg/dl, HCT: 26.3 mg/dl, CKMB: 1,88I U/L and CK: 3,274 IU/L. A multiphase CT angiography (CTA) and an aortography were performed immediately (**Fig. 1-6**).

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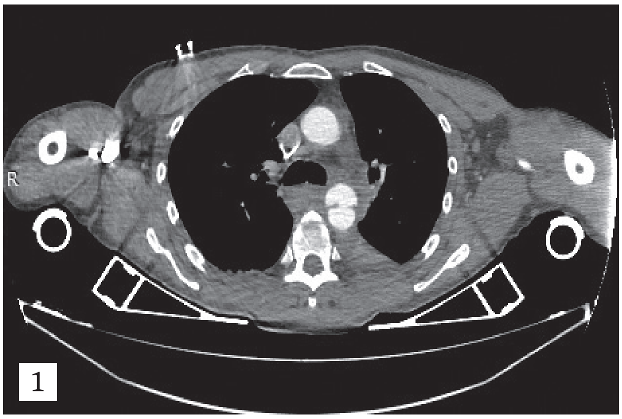
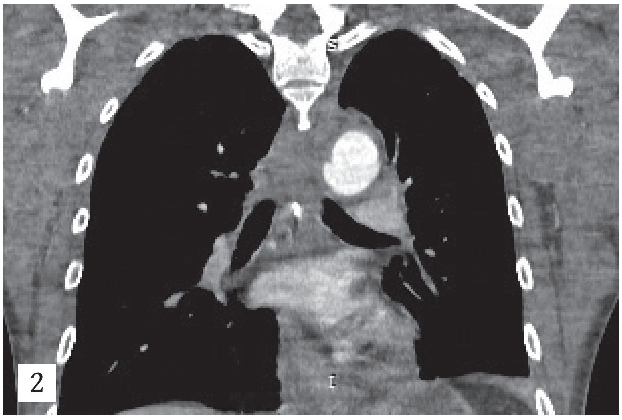
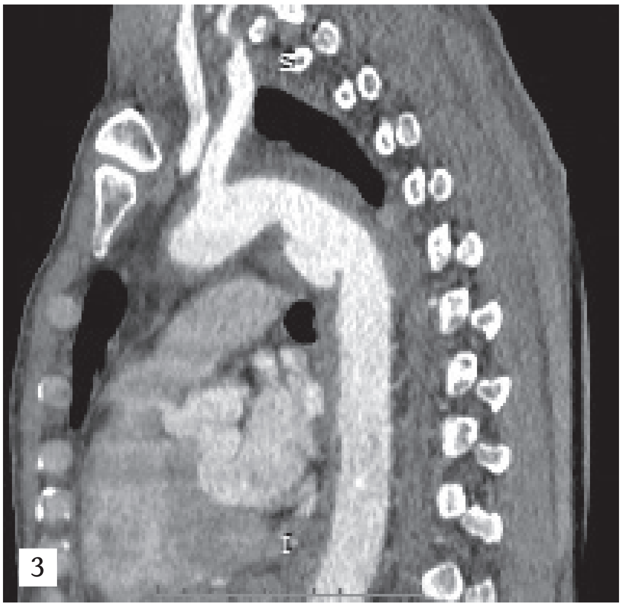






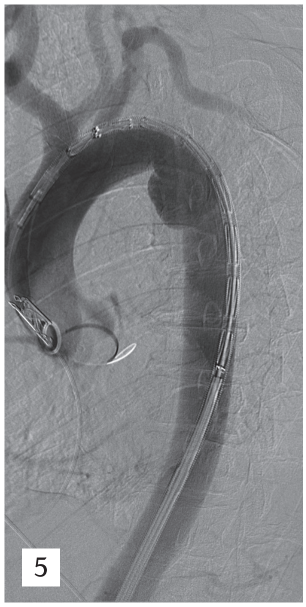


Fig. 1. *Axial CT Angiography image*
Fig. 2. *Coronal CT Angiography image*
Fig. 3. *Sagittal CT Angiography image*
Fig. 4. *Digital subtraction image*
Fig. 5. *Digital subtraction image*
Fig. 6. *Digital subtraction image*

PART B

Diagnosis: Traumatic Rupture of the Thoracic Aorta

Traumatic rupture of the thoracic aorta due to blunt chest trauma leads to immediate death in 75-90% of cases and accounts for up to 18% of deaths in motor vehicle accidents. Approximately 15-20% of the victims reach the hospital alive [1]. In some patients who survive transportation to the hospital, the rupture is contained by the adventitia or mediastinal structures, as in the reported patient. These patients usually sustain secondary aortic rupture within 24 hours [2].

Clinical features to suggest the presence of traumatic rupture of the thoracic aorta include hypotension, haemodynamic instability, upper extremity hypertension, bilateral lower extremity pulse deficit, and initial chest tube output greater than 750 mL of blood. Patients with blunt aortic injury were also found to have greater incidence of other significant injuries, with one retrospective study reporting 31% with concomitant major head injury and 29% with major abdominal injury [3]. Given that in some patients clinical features are unreliable, the injury mechanisms should already raise suspicion of blunt thoracic aorta injury. High-energy blunt trauma involving rapid deceleration is at risk. Motor vehicle crashes accounted for 74% of blunt aortic injury in one study [4]. However, abnormal chest radiograph findings, especially widening of the mediastinum, should prompt advanced chest imaging. Nevertheless, even in the absence of chest radiograph findings, a suspicion of blunt aortic injury based on the trauma mechanism and clinical features should similarly prompt chest imaging. Current technology favours a CT scan as gold standard modality, as opposed to transoesophageal echocardiogram or aortography [5].

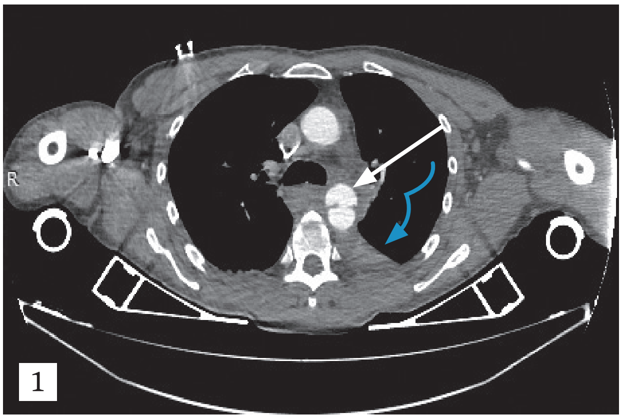
The type of aortic injury is a critical factor determining the timing of intervention. Patients with free aortic rupture or large periaortic haematoma should be treated as emergency cases. For all other conditions, intervention may be delayed for up to 24 hours to allow for patient stabilisation and the best possible conditions for aortic intervention [6].

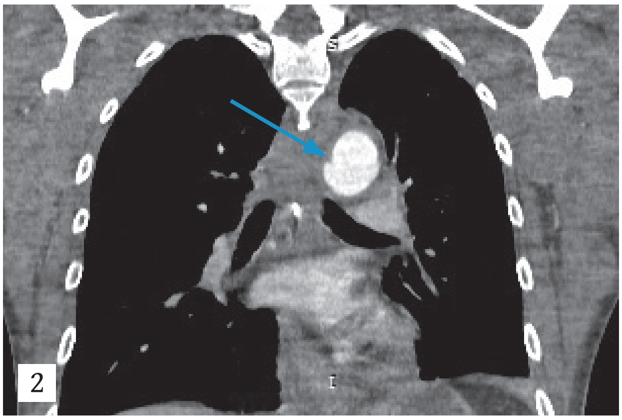
Available data indicate that Thoracic Endovascular Aneurysm Repair (TEVAR) should be the preferred treatment option in thoracic aortic injury (TAI). Open surgical repair of a TAI at the classic isthmus location requires exposure of the aorta via a left fourth interspace thoracotomy, as well as selective right lung ventilation. The aorta is clamped proximal to the origin of the left subclavian artery and distal to the injured segment. A meta-analysis of this technique reported mortality and paraplegia rates of 16-31% and 5-19%, respectively [7]. However, most systematic reviews suggested an advantage of TEVAR in terms of survival as well as a decreased incidence of paraplegia, when compared to open surgery. Endoleak rates of up to 5.2% and stent collapse rate of 2.5%, with mortality rate of 12.9% associated with the latter complication have been reported for TEVAR [8]. Challenges of endovascular repair of traumatic aortic injury include potential aortic growth in young trauma victims, technical issues related to femoral artery access, limitation in utilising aortic endograft cuffs in treating descending aortic injury, procedure-related complications due to device deployment, haemodynamic and anatomical features related to the aorta, endograft collapse due to significant endograft oversize, postoperative spinal cord ischaemia (SCI) after Adamkiewic artery coverage and left subclavian artery coverage in patients with rupture close to left subclavian artery ostium [9].

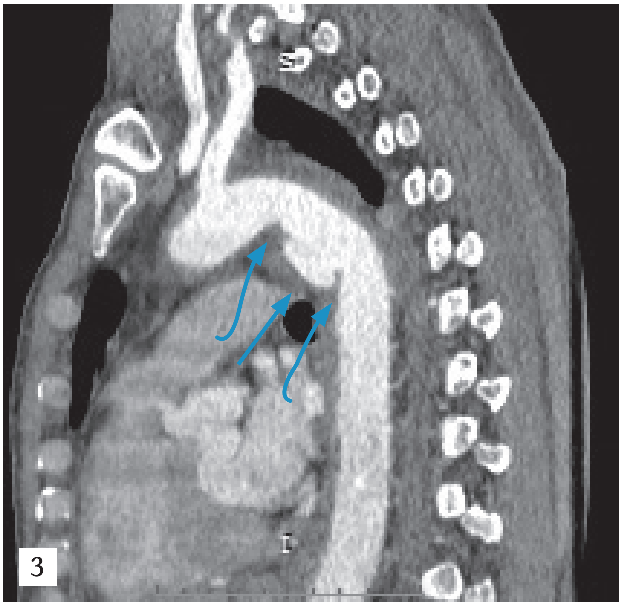
In our patient, imaging investigation included CT Angiography of thoracic-abdominal aorta (**Fig. 1-3**), contrast enhanced CT of upper and lower abdomen and plain X-Rays of upper and lower extremities. After CT the patient was transferred to the Interventional Radiology Unit, where cardiothoracic surgeons proceeded to surgical exposure of the right femoral artery, followed by interventional radiologists proceeding in implantation of a stent graft and repair of the thoracic aorta (**Fig. 4-6**).

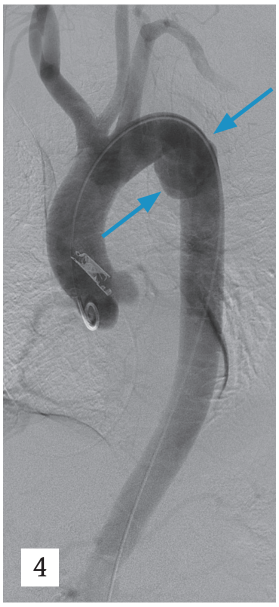
CT is currently considered the standard imaging modality for follow-up in patients who benefit from TEVAR after the endovascular repair. However, given the frequent young age of patients with traumatic aortic injury, concerns arise with regards to cumulative exposure to radiation and iodinated contrast media injection. For these reasons MRI is the best alternative for surveillance when magnetic resonance-compatible stent grafts are employed [10]. **R**

Conflict of interest:
The authors declared no conflicts of interest.









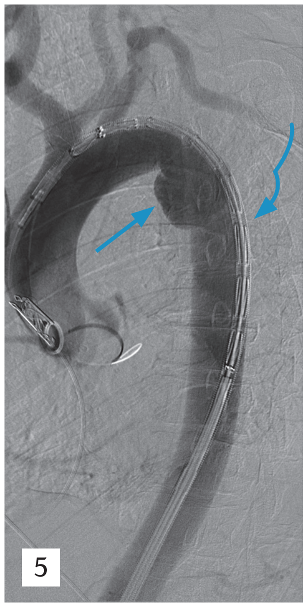


Fig. 1. *Axial CT image shows mediastinal haematoma, irregularity of the aortic lumen (white arrow) and a small amount of haemorrhagic pleural effusion (curved arrow)*

Fig. 2. *Coronal CT Angiography image shows irregularity of the aortic lumen and medial haematoma (arrow)*

Fig. 3. *Sagittal CT Angiography image illustrates the descending aorta transection (curved arrows) and the large pseudoaneurysm (arrow)*

Fig. 4. *Digital subtraction image in the left anterior oblique projection showing circumferential transection of the proximal descending thoracic aorta with a large pseudoaneurysm (arrows)*

Fig. 5. *Digital subtraction image. Stent graft in position prior to the stent placement. Please note the pseudoaneurysm of the proximal descending aorta (arrow) and the stent graft in final position (curved arrows)*

Fig. 6. *Digital substraction image following stent graft placement. An endograft (Zenith Alpha 28mm-155mm, Cook Medical) was placed distal to the left subclavian artery and the pseudoauneurysm was excluded from the circulation*

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