

Traumatic Aortic Isthmus Rupture in A Polytrauma Patient Treated by Thoracic Endovascular Repair with Left Subclavian Artery Fenestration: A Case Report

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INTRODUCTION:

Blunt traumatic injury of the thoracic aorta represents a rare but highly lethal condition, most frequently resulting from high-energy deceleration mechanisms such as road traffic accidents. Up to 80% of patients die before reaching hospital care. Among survivors, the aortic isthmus is the most commonly affected segment due to biomechanical stress at the junction between the mobile ascending aorta and the fixed descending thoracic aorta.

Computed tomography angiography (CTA) is the diagnostic modality of choice, allowing rapid identification of aortic lesions and associated injuries in polytrauma patients. Over the past two decades, thoracic endovascular aortic repair (TEVAR) has replaced open surgery as the first-line treatment, offering significantly reduced perioperative mortality and neurological complications.

However, endovascular repair of aortic isthmus injuries often necessitates coverage of the left subclavian artery (LSA), potentially increasing the risk of ischemic complications. Various strategies for LSA preservation have been described. In emergency settings, endovascular fenestration represents a valuable alternative. We report a case illustrating this approach.

PRESENTATION OF CASE

A 23-year-old male with no significant past medical history was admitted to the emergency department following a high-speed motorcycle-car collision. The patient sustained a high-energy blunt trauma involving the head, thorax, abdomen, and left lower limb.

On admission, he was conscious but confused. Airway patency was preserved, respiratory rate was normal, and oxygen saturation was 98% on room air. Cardiovascular assessment revealed tachycardia (110 beats/min) associated with severe hypotension (70/50 mmHg). Initial management included peripheral venous access and immediate fluid resuscitation.

Neurological examination showed isocoric and reactive pupils with no focal motor or sensory deficits. Physical examination identified a scalp laceration, multiple superficial wounds of the lower limbs, and deformity of the left knee consistent with subluxation, which was immobilized.

After initial stabilization, whole-body computed tomography was performed. Thoracic imaging revealed a saccular pseudoaneurysm involving less than 50% of the aortic circumference at the isthmus, consistent with a contained traumatic rupture, associated with a small hemomediastinum and pulmonary contusion. Abdominal CT demonstrated a grade III hepatic laceration, a right perirenal hematoma, and non-displaced fractures of the L3 vertebral body and posterior acetabular wall. No cranial or cervical injuries were identified.

CTA of the thoracoabdominal aorta confirmed a 27-mm saccular pseudoaneurysm of the aortic isthmus, compatible with a subintimal traumatic rupture. Laboratory tests showed anemia (hemoglobin 9.8 g/dL), normal coagulation parameters, and marked hepatic cytolysis.

The patient was admitted to the intensive care unit for strict blood pressure control using intravenous nicardipine under invasive arterial monitoring. A multidisciplinary decision was made to proceed with urgent endovascular repair.

Under general anesthesia, thoracic endovascular aortic repair was performed. Intraoperative angiography confirmed a rupture of the aortic isthmus adjacent to the origin of the left subclavian artery (LSA). A covered thoracic stent graft was deployed with proximal landing at the level of the left common carotid artery. Due to compromised LSA flow on completion angiography, a secondary endovascular fenestration was performed. Balloon predilation followed by deployment of a covered balloon-expandable stent restored LSA patency.

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Final angiography demonstrated complete exclusion of the aortic lesion with preserved flow in all supra-aortic vessels. Postoperative evolution was uneventful. Follow-up CTA at postoperative day 3 showed no endoleak, graft migration, or thrombosis. The patient was discharged on day 7.

DISCUSSION

Blunt traumatic thoracic aortic injury remains a rare but catastrophic consequence of high-energy deceleration trauma, with the aortic isthmus being the most vulnerable segment. Early diagnosis using CTA is essential for survival and treatment planning in polytrauma patients.

Historically, open surgical repair was the standard treatment but was associated with high morbidity and mortality, particularly due to aortic cross-clamping and neurological complications. The advent of TEVAR has dramatically changed management strategies, offering reduced perioperative mortality, lower rates of spinal cord ischemia, and improved outcomes, especially in unstable or polytraumatized patients.

A major challenge in TEVAR for isthmic lesions is the frequent need to cover the LSA to achieve an adequate proximal seal. Although intentional LSA coverage may be tolerated in selected cases, it is associated with an increased risk of upper limb ischemia, vertebrobasilar insufficiency, and spinal cord ischemia, particularly in young patients.

Several strategies have been proposed to preserve LSA perfusion, including surgical bypass, chimney techniques, branched devices, and endovascular fenestration. In emergency trauma settings, surgical revascularization may not be feasible. Secondary endovascular fenestration offers a rapid, minimally invasive solution that preserves LSA flow without significantly prolonging operative time.

In the present case, secondary LSA fenestration achieved satisfactory aortic exclusion and branch preservation, with excellent short-term clinical and radiological outcomes. This approach aligns with current evidence supporting individualized strategies based on patient anatomy, urgency, and available expertise.

CONCLUSION

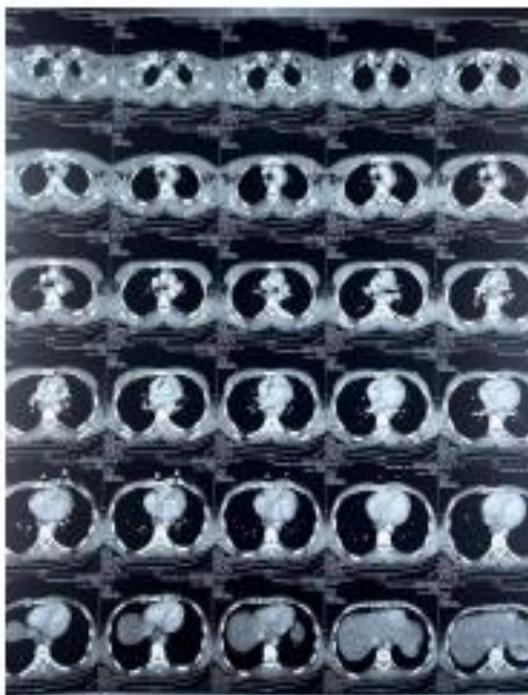
Traumatic rupture of the aortic isthmus is a life-threatening injury requiring rapid diagnosis and treatment. TEVAR represents the current standard of care due to its favorable risk profile. When LSA coverage is unavoidable, endovascular fenestration provides a safe and effective option for branch preservation in emergency trauma settings. This case supports the role of advanced endovascular techniques in optimizing outcomes for young polytrauma patients.

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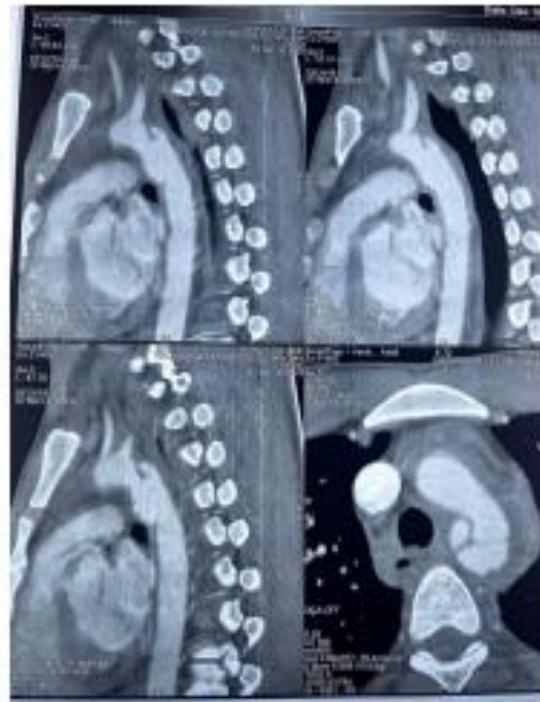
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a. Contrast-enhanced thoracic CT angiography (arterial phase), axial views



b. Thoracic CT angiography with sagittal and axial reconstructions showing a saccular pseudoaneurysm of the aortic isthmus

