

Late Diagnosis of Post-Traumatic Aortic Isthmus Rupture with Airways Compression and Respiratory Distress: The Secret to Survival and Success of Surgical Repair

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Abstract

Case Report

Traumatic rupture of the thoracic aorta is a catastrophic event with high pre-hospital mortality. For patients surviving the initial impact, timely diagnosis is often hindered by concomitant injuries. We report the case of a 17-year-old patient diagnosed 15 days post-trauma with a Grade III aortic isthmus rupture presenting as acute respiratory distress due to tracheobronchial compression. Due to the lack of immediate endovascular options and the severe mass effect, the patient underwent successful open surgical repair under femoro-femoral cardiopulmonary bypass assistance.

Keywords: Traumatic aortic rupture, Tracheobronchial compression, Open surgical repair.

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1. INTRODUCTION

Traumatic rupture of the thoracic aorta remains an extreme surgical emergency with a somber prognosis; pre-hospital mortality is estimated between 70% and 80%. For those surviving long enough to reach the emergency department, the risk remains critical, as nearly one-third succumb within the first 24 hours without specialized management [1]

These injuries typically occur during high-energy trauma, such as high-velocity motor vehicle accidents or falls from significant heights [1]. While the Society for Vascular Surgery [SVS] guidelines recommend early intervention [often within 24 hours], the "ideal timing" strategy remains a subject of debate, particularly in complex clinical scenarios with coexisting life-threatening injuries. The optimal timing for intervention remains ill-defined [2],[3] In cases of unrepaired thoracic transection, the risk of delayed rupture is estimated at 2% to 5%.[2]

Surgical or endovascular aortic intervention is indicated for high-grade [Grade III and IV] blunt traumatic thoracic aortic injuries [BTTAI], assuming the absence of prohibitive comorbidities or life-threatening concomitant trauma[2,4]

In comparison, open surgery carries a hospital mortality rate of 19 %, endovascular repair making it a

viable but statistically less protective alternative in the acute phase. Conversely, non-operative management carries a significantly poorer prognosis, with a mortality rate reaching 46 % [2]. Consequently, between 2007 and 2015, the rate of open surgery decreased from 7.5% to 1.9%, while thoracic endovascular aortic repair [TEVAR] increased from 12.1% to 25.7% [3].

In cases of delayed diagnosis, survival is often attributed to the formation of a pseudoaneurysm contained by the adventitia and the pleura. Although endovascular treatment is currently the gold standard due to its low morbidity.[1].Open surgery remains essential in the presence of compressive symptoms, especially when no other hemorrhagic-risk injuries are present.

We report a case of late-diagnosed post-traumatic aortic isthmus rupture complicated by respiratory distress, presenting a double challenge: the risk of rupture leading to hemorrhagic shock and acute respiratory failure.

2. CASE OBSERVATION

A 17-year-old male with no prior medical history was involved in a high-velocity frontal collision between a car and a motorcycle 15 days prior to admission. Initial impact points were thoracolumbar and cranial, without loss of consciousness. He initially presented with mild hematuria that resolved within 48

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hours, diagnosed as a renal contusion managed conservatively in the urology department.

He subsequently developed progressive dyspnea [advancing from Stage I to Stage III], orthopnea, dysphagia, and dysphonia, without fever or chest pain. A

thoracic CT scan revealed a Grade III aortic isthmus rupture measuring 4.5 x 6 x 6.2 cm, causing significant compression of the aerodigestive axis with a laminated appearance of the trachea and bronchi. The pleural cavity was free of effusion.

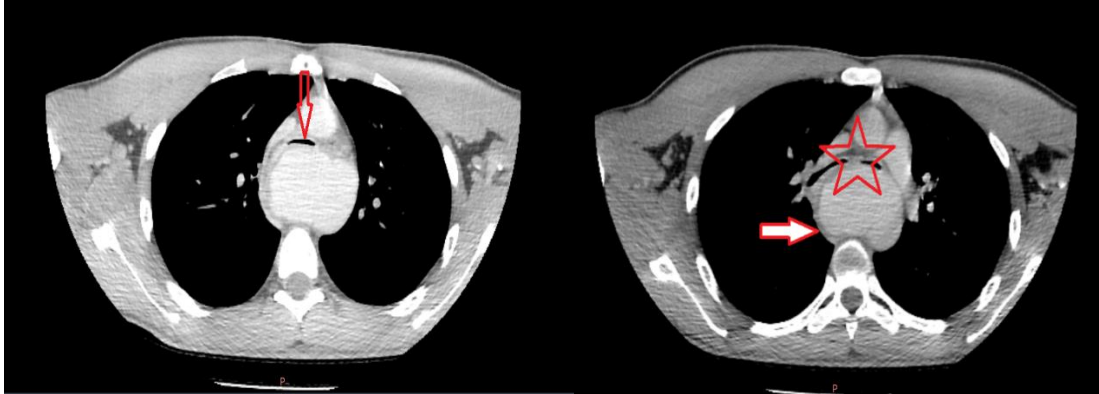


Figure 1 and 2: tracheobronchial compression by thoracic aneurysm

Up on admission, the clinical findings were:

Neurological: Normal.

Hemodynamics: Heart rate 110 bpm; Blood pressure 121/76 mmHg; no blood pressure asymmetry; symmetric peripheral pulses.

Respiratory: SpO₂ 98% [Room Air]; significant dyspnea with audible wheezing.

The clinical course was marked by rapid respiratory distress requiring sedation and orotracheal intubation. However, peak airway pressures reached 40

cmH₂O for two hours, and maximum SpO₂ remained at 85% despite mechanical ventilation [PaO₂ 76 mmHg, PaCO₂ 60 mmHg]. Hypertension developed, requiring a Nicardipine infusion. A rescue maneuver consisting of selective right lung intubation was performed to bypass the tracheal compression zone, successfully restoring SpO₂ to 99% and normalizing blood gases within three hours. Biological tests were unremarkable, with no signs of anemia.

Given the severe mass effect of the aneurysm and the unavailability of an endoprosthesis in the emergency setting, open surgical repair was performed.

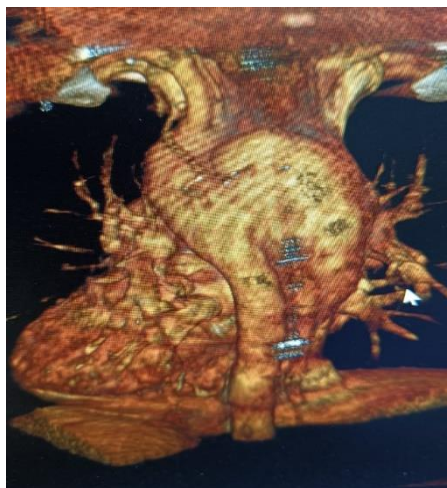


Figure 3: 3D CT scan aortic isthmus rupture

Surgical Management

Access: Left Scarpa approach for femoro-femoral cardiopulmonary bypass [CPB] assistance after anticoagulation [Heparin 3 mg/kg].

Left thoracotomy via the 4th intercostal space. CPB was initiated under moderate hypothermia. Dissection of the

isthmus was laborious due to inflammatory changes from the pseudoaneurysm.

Repair: Control of the distal aortic arch and descending aorta was obtained. After cross-clamping the aneurysmal segment, resection was performed. A 24 mm Dacron

graft was interposed with proximal and distal 4.0 Prolene sutures.

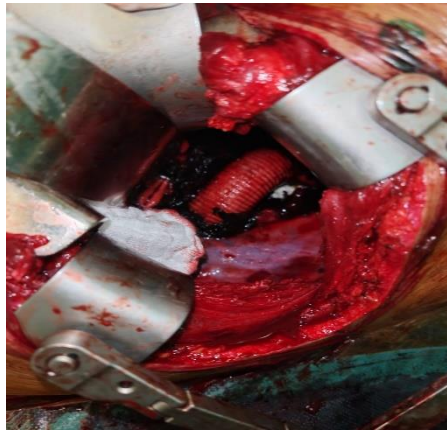


Figure 4: Dacron prosthesis repair CPB time was 225 minutes; aortic clamping time was 29 minutes.

Outcome:

Hemostasis was achieved, and a pleuro-pericardial window was created. The patient remained hemodynamically stable, required minimal inotropic support, and was successfully extubated 5 hours postoperatively. The postoperative course was uneventful.

3. DISCUSSION

Approximately 80% of patients with traumatic aortic rupture die at the scene. This patient's 15-day survival is explained by the formation of a contained pseudoaneurysm, where the adventitia and mediastinal pleura successfully withstood the pressure. These injuries are classified into four grades: intimal tear [I], intramural hematoma [II], pseudoaneurysm [III], and complete rupture [IV]. Pseudoaneurysms [71%] located at the isthmus [71%] are the most common surviving lesions [5].

In this case, the aortic lesion was initially masked by a renal contusion. It is common for aortic injuries to be overshadowed by concomitant cranial or urological trauma. A systematic whole-body CT scan is indispensable in high-velocity trauma, such as motorcycle-to-car collisions, to avoid missing dynamic lesions.

The respiratory symptoms were atypical and secondary to mechanical compression of the trachea and left main bronchus. Optimal blood pressure management is fundamental to prevent rupture before surgery [3]. While most aortic ruptures are treated to prevent fatal hemorrhage, this patient's primary indication at Day 15 was mechanical [Stage III dyspnea and wheezing]. Tracheal and esophageal compression by a pseudoaneurysm is a rare but life-threatening complication [6]. Selective right intubation was a brilliant life-saving maneuver to bypass the tracheal obstruction without increasing wall stress.

Open surgery remains crucial when endovascular logistics are unavailable or to address mass effect. Unlike TEVAR, which reinforces the internal wall, only open surgery with hematoma resection provides immediate relief of the tracheobronchial tree. However, some authors have reported relief of compression through endovascular treatment alone [6].

We utilized femoro-femoral CPB assistance. Grade III ruptures often involve difficult dissections with a high risk of intraoperative rupture. This technique is advantageous for protecting the spinal cord and kidneys during clamping. Regarding the renal contusion at Day 0, the hemorrhagic risk of heparinization at Day 15 was deemed acceptable given the respiratory emergency. CPB allowed for heart decompression and a bloodless field with precise pharmacological control.

Extubation occurred at 5 hours despite a CPB time of 225 minutes. This duration is higher than some reported series [7] due to early initiation of CPB during the difficult dissection of the pseudoaneurysm. This outcome demonstrates that while open surgery is more invasive, it remains a reliable and life-saving option in experienced hands when endovascular techniques are not feasible.

4. CONCLUSION

Open surgery maintains a fundamental role in centers where endovascular options are logistically unavailable or in cases of severe aerodigestive compression, particularly when there are no other active contraindications to anticoagulation.

5. Acknowledgements

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6. Ethics

Informed consent was obtained from the patient's legal guardian for the publication of this case report and accompanying images

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