

CT Diagnosis of Combined Grade I and Grade IV Traumatic Aortic Ruptures Following Blunt Chest Trauma

Basma Beqqali*, Ola Messaoud, Basma Dghoughi, Zineb Labbi, Joud Boutaleb, Omar El Aoufir, Laila Jroundi and Zaynab Iraqi Houssaini

Emergency Radiology Department, Ibn Sina Hospital, Mohammed V University, Rabat, Morocco

***Corresponding Author:** Basma Beqqali, Emergency Radiology Department, Ibn Sina Hospital, Mohammed V University, Rabat, Morocco.

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Abstract

Traumatic rupture of the aortic isthmus represents one of the most severe vascular injuries following blunt chest trauma. Rapid recognition through imaging is vital for survival. We report the case of a 23-year-old man who sustained a road traffic accident and was found to have a double aortic injury - a grade I intimal tear at the isthmus and a grade IV rupture of the descending thoracic aorta - associated with contrast extravasation and hemomediastinum on CT angiography. This case illustrates the pivotal role of CT imaging in early diagnosis, classification, and management of traumatic aortic lesions.

Keywords: Traumatic Aortic Injury; Aortic Rupture; Isthmus; Hemomediastinum; CT Angiography; Blunt Trauma

Introduction

Traumatic aortic injury (TAI) is a major cause of mortality following high-velocity blunt trauma. The aortic isthmus, just distal to the origin of the left subclavian artery, is the most frequent site of injury due to its position between the mobile arch and the fixed descending aorta [1-3].

Sudden deceleration produces shearing forces that can result in partial or complete disruption of the aortic wall [4,5].

According to the Society for Vascular Surgery (SVS) classification, traumatic aortic lesions are divided into four grades: Grade I: Intimal tear; Grade II: Intramural hematoma; Grade III: Pseudoaneurysm; Grade IV: Rupture with active extravasation [6].

We describe a case combining grade I isthmic tear and grade IV descending rupture, highlighting the importance of recognizing complex aortic injury patterns.

Case Presentation

A 23-year-old man, previously healthy, was admitted after a high-speed motor vehicle accident. He complained of moderate chest pain but remained hemodynamically stable. No neurological or abdominal abnormalities were noted.

Contrast-enhanced chest CT angiography showed a focal intimal discontinuity at the aortic isthmus, consistent with a grade I lesion (intimal tear without external contour deformity) [6].

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Distally, at the descending thoracic aorta, there was a grade IV rupture characterized by active contrast extravasation into the surrounding mediastinal fat and the presence of a hemomediastinum.

No pseudoaneurysm, intramural hematoma, or dissection flap was observed.

These findings established the diagnosis of a double aortic injury: isthmic grade I tear and descending grade IV rupture.

Given the contained nature of the rupture and the patient's stability, an urgent thoracic endovascular aortic repair (TEVAR) was performed after multidisciplinary discussion, with successful exclusion of the lesion.

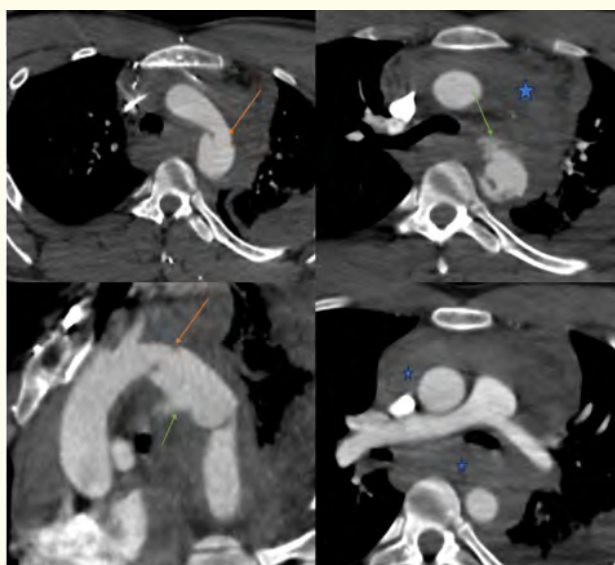


Figure 1: CT angiography showing an aortic isthmic intimal tear (grade I, orange arrow) and a descending thoracic aortic rupture (grade IV, green arrow) with active contrast extravasation and hemomediastinum (blue star).

Discussion

TAI remains a leading cause of death in high-speed collisions, accounting for up to 20% of trauma-related fatalities [4,5].

The aortic isthmus is injured in over 80% of cases due to the abrupt mechanical transition between fixed and mobile segments of the thoracic aorta [3,6].

Classification and mechanism

The SVS classification stratifies lesions by severity [6]:

- Grade I: Intimal tear.
- Grade II: Intramural hematoma.
- Grade III: Pseudoaneurysm.
- Grade IV: Rupture with active extravasation.

Grades I-II may be managed conservatively, while grades III-IV typically require urgent intervention [6,7].

Our case illustrates the coexistence of a minor (grade I) and major (grade IV) lesion, likely representing sequential injury due to deceleration forces acting on two distinct aortic segments.

CT angiography is the diagnostic standard for traumatic aortic injury, with > 95% sensitivity and specificity [8,9].

Key CT features include intimal irregularity, contrast extravasation, periaortic hematoma, and mediastinal hemorrhage.

In this patient, the absence of pseudoaneurysm or intramural hematoma simplified classification: a clean intimal tear at the isthmus and a frank rupture of the descending thoracic aorta with hemomediastinum.

The presence of extravasation without free rupture confirmed a contained grade IV lesion.

Endovascular repair (TEVAR) has become the gold standard for grade III-IV injuries, offering lower mortality and paraplegia rates than open repair [10,11].

Initial management requires blood pressure control using beta-blockers to reduce shear stress.

In this case, TEVAR achieved complete exclusion of the rupture and restoration of aortic integrity, with favorable short-term outcome.

Conclusion

This case demonstrates a double aortic rupture pattern - a grade I isthmic intimal tear and a grade IV descending thoracic rupture - with hemomediastinum but no dissection or intramural hematoma.

CT angiography remains essential for accurate diagnosis and SVS-based classification, which directly influences management.

Prompt endovascular repair provides an excellent prognosis in young trauma patients with contained rupture.

Ethical Approval

No ethical approval was required for this article.

Patient Consent

Written informed consent was obtained from the patient for the anonymized information to be published in this article.

Conflict of Interest

The author(s) declare that they have no conflicts of interest that could have inappropriately influenced them in the writing of this article.

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