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Diagnostic Pitfalls in Aortic Dissection: A Case of Misdiagnosed Acute Myocardial Infarction Leading to Emergency Surgical Intervention

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ABSTRACT

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Background: The defining feature of aortic dissection (AD), a life-threatening cardiovascular emergency, is an intimal tear in the aortic wall that creates a false lumen. Early detection remains challenging because symptoms frequently resemble those of other acute cardiovascular conditions despite medical and surgical treatment advances.

Case Presentation: We report the case of a 52-year-old male with newly diagnosed hypertension and diabetes mellitus who initially presented with severe chest pain and was misdiagnosed with acute myocardial infarction. He received thrombolytic therapy and was discharged, only to return days later with recurrent chest pain radiating to the abdomen. Stanford Type A aortic dissection affecting the aortic root and arch was confirmed through diagnostic imaging with echocardiography and computed tomography angiography (CTA). Emergency surgery on the patient involved replacing the aortic root and hemi-arch and repairing the aortic valve along with performing coronary artery bypass grafting.

Conclusion: This case demonstrates the diagnostic complexities of AD when its early symptoms resemble those of acute coronary syndrome. Due to the significant risks of delayed diagnosis, clinicians need to remain alert to the possibility of AD when patients show up with severe, sudden chest pain. Successful patient results depend on prompt imaging and surgical procedures.

KEYWORDS:

Aortic dissection, Stanford Type A, acute coronary syndrome, thrombolysis, cardiovascular emergency, surgical repair.

INTRODUCTION

Aortic dissection (AD) is a life-threatening cardiovascular emergency caused by a tear in the intimal layer of the aortic wall, which leads to the formation of a false lumen【1】. Despite advancements in medical and surgical interventions, diagnosing AD remains challenging due to its diverse clinical presentation. AD is often confused with acute coronary syndrome or pulmonary embolism, which contributes to delays in appropriate management【2】.

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The condition is classified using the Stanford and DeBakey systems based on the location of the dissection. Stanford Type A involves the ascending aorta and requires urgent surgical intervention, whereas Stanford Type B affects the descending aorta and may be managed medically【3】. Modifiable risk factors include hypertension, dyslipidemia, and smoking, while non-modifiable risks encompass genetic predisposition and age【4】.

Early diagnosis is critical, with imaging modalities such as echocardiography, computed tomography angiography (CTA), and magnetic resonance angiography (MRA) playing a key role【5】. Management strategies include blood pressure control and immediate surgical repair in high-risk cases【1】.

This case highlights the challenges in diagnosing AD when presenting symptoms mimic acute myocardial infarction. The

discussion further explores diagnostic pitfalls, risk factors, and best management practices to improve patient outcomes.

CASE REPORT

Patient Presentation

A 52-year-old male with a history of newly diagnosed hypertension and diabetes mellitus presented to a local hospital with severe chest pain. He was initially diagnosed with an anterior wall myocardial infarction and received thrombolytic therapy. The patient was discharged but returned to the hospital days later with recurrent chest pain, prompting further evaluation.

Upon admission, the patient described chest pain persisting for three days, which was mild to moderate in intensity, radiating to the abdomen, and associated with exertional shortness of breath. He had a 15-year history of smoking (20 cigarettes/day).

Physical Examination

On examination, the patient was conscious and afebrile (37°C) with a pulse rate of 100 bpm, respiratory rate of 18 bpm, and blood pressure readings of 140/80 mmHg in the right arm and 137/70 mmHg in the left arm. Oxygen saturation on room air was 99%. His height was 154 cm, and his weight was 57 kg.

Initial Diagnostic Workup

The initial electrocardiogram (ECG) demonstrated normal sinus rhythm with T-wave inversion in leads V4–V6 (**Figure 1**). A chest X-ray revealed a widened mediastinum (**Figure 2**). Laboratory findings were unremarkable except for a mild increase in troponin I (56.1 ng/L).

Imaging and Diagnosis

A transthoracic echocardiogram (TTE) was performed, revealing an intimal flap within the ascending aorta extending to the aortic root, along with aortic dilatation measuring 4.1 cm in maximum diameter and aortic regurgitation (**Figure 3 A-B**). Given these findings, computed tomography angiography (CTA) was conducted, confirming an ascending aortic aneurysm consistent with a Stanford Type A aortic dissection (**Figure 4**).

Based on these diagnostic findings, the patient was diagnosed with acute Stanford Type A aortic dissection.

Surgical Intervention

The patient was immediately transferred to a specialized cardiac surgery center for emergency intervention. Intraoperative findings revealed an extensive aortic dissection involving the aortic root, with severe aortic regurgitation and occlusion of the left anterior descending (LAD) coronary artery. Two intimal tears were identified: one located at the aortic root near the left main ostium and another at the aortic arch adjacent to the left common carotid artery.

The patient underwent replacement of the aortic root and hemi-arch with valve-sparing repair of the aortic valve. A bypass graft to the LAD was also performed (**Figure 4B-C**).

Postoperative Course and Follow-Up

The patient had an uneventful postoperative recovery. He was monitored in the intensive care unit and showed stable hemodynamics without any neurological or cardiac complications. Postoperative echocardiography confirmed the successful repair of the aortic root and arch with no significant residual aortic regurgitation. The patient was discharged in stable condition with recommendations for strict blood pressure control, smoking cessation, and regular cardiovascular follow-up.

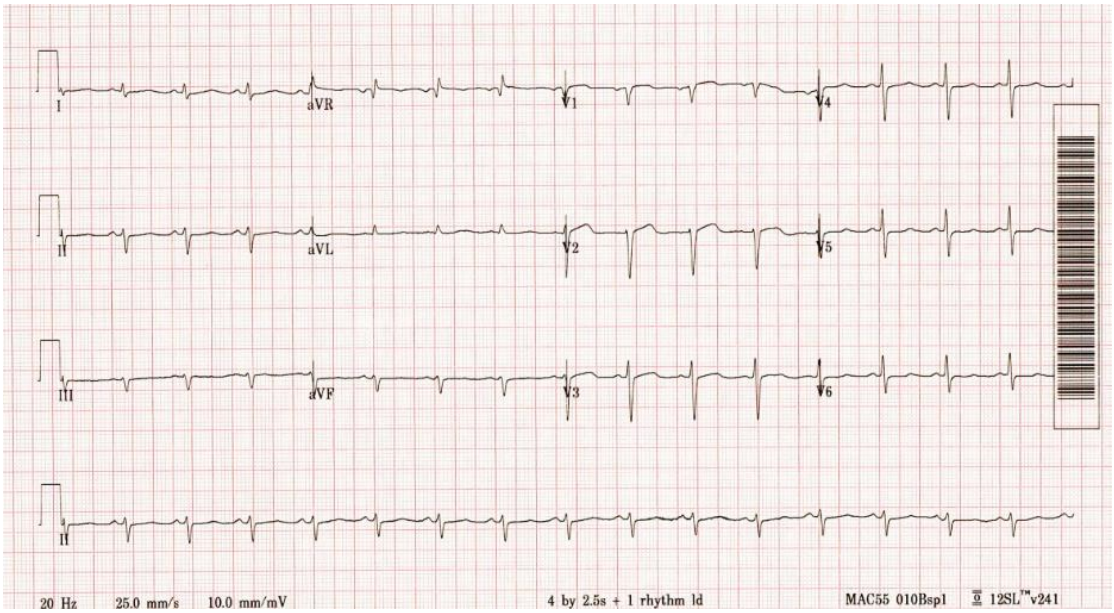


Figure 1: Electrocardiogram (ECG) demonstrating normal sinus rhythm with T-wave inversion in leads V4–V6, an abnormal finding suggestive of myocardial ischemia.

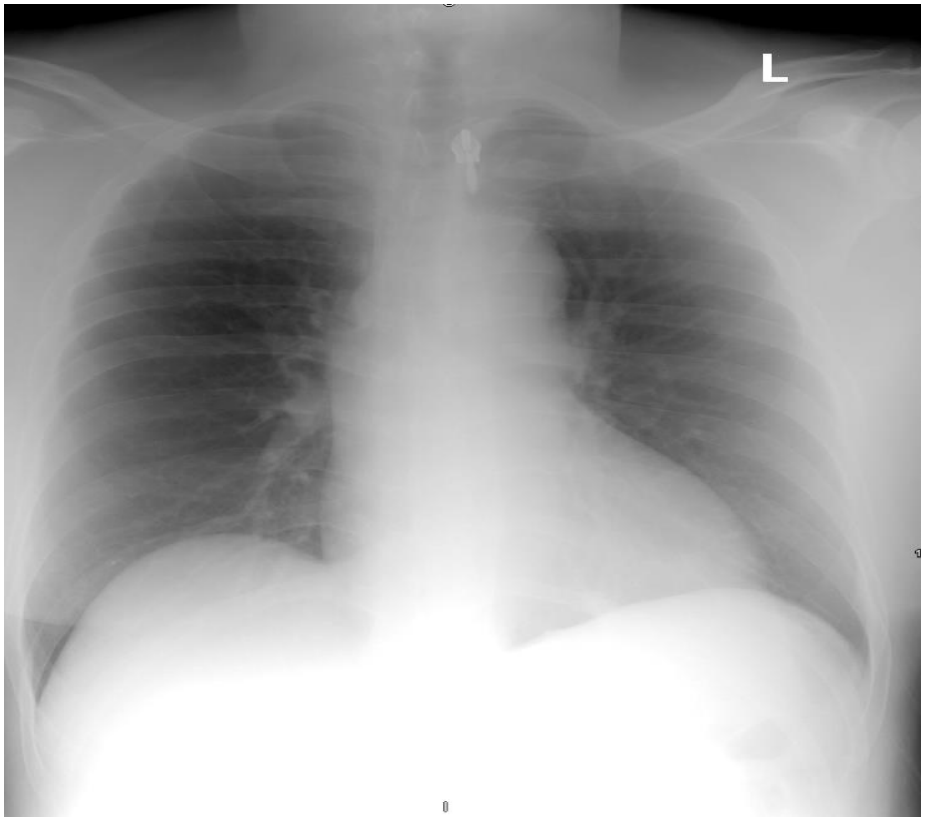


Figure 2: Chest X-ray revealing a widened mediastinum, a characteristic radiographic sign of acute aortic dissection

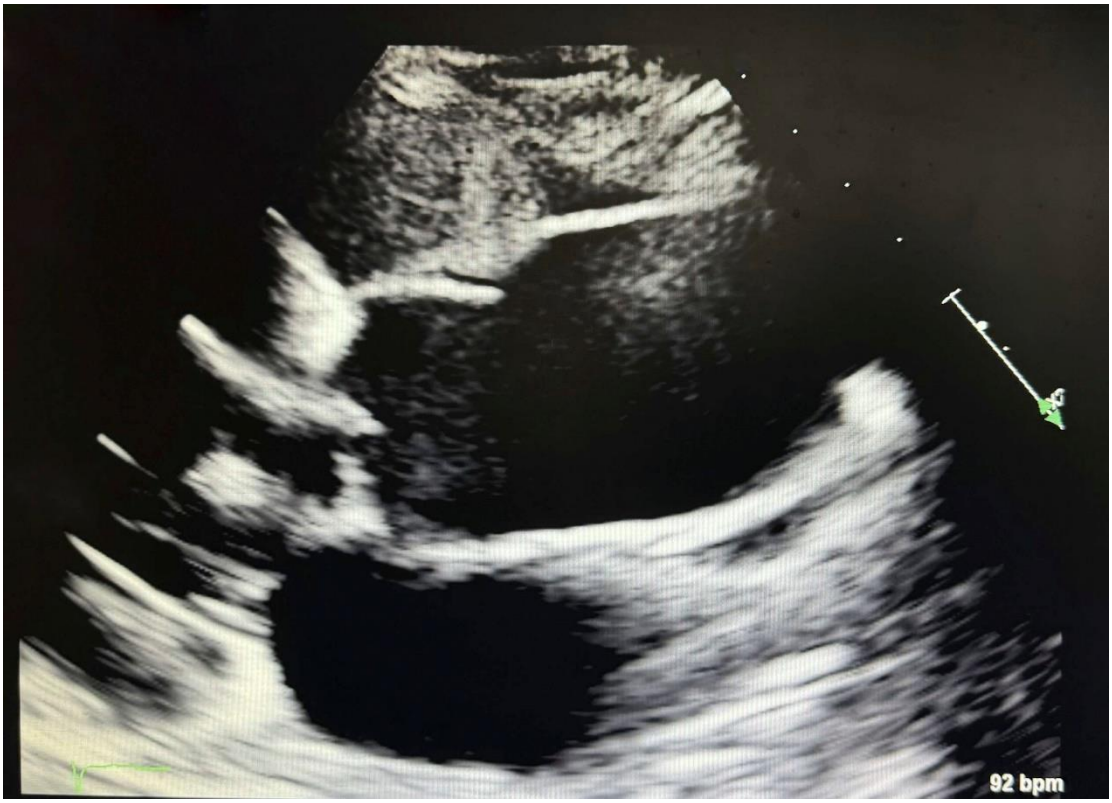


Figure 3A: Transthoracic echocardiogram (TTE) displaying an intimal flap in the ascending aorta with evidence of luminal separation, confirming the presence of an aortic dissection.

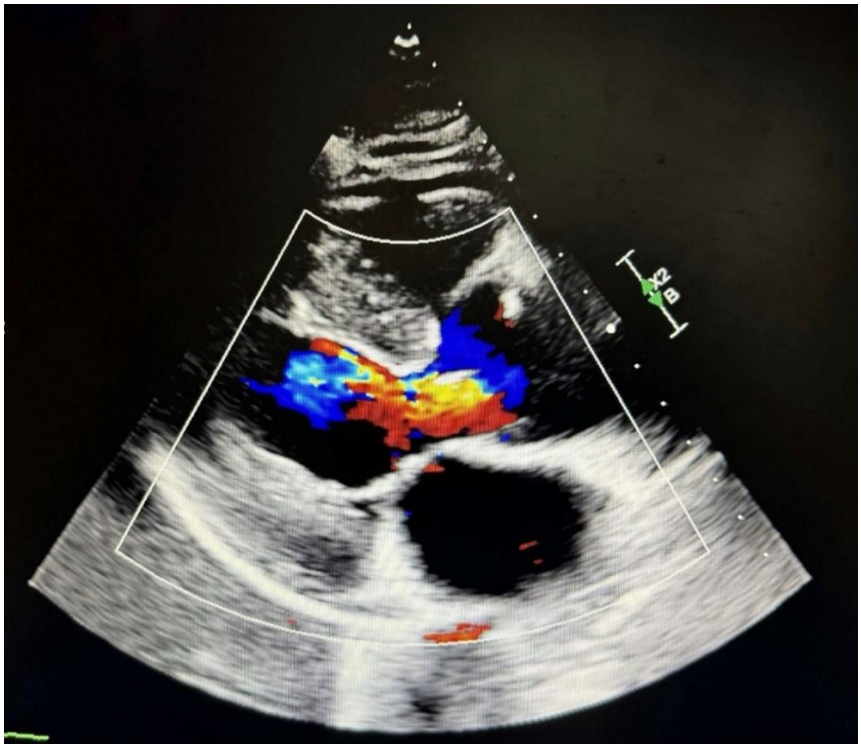
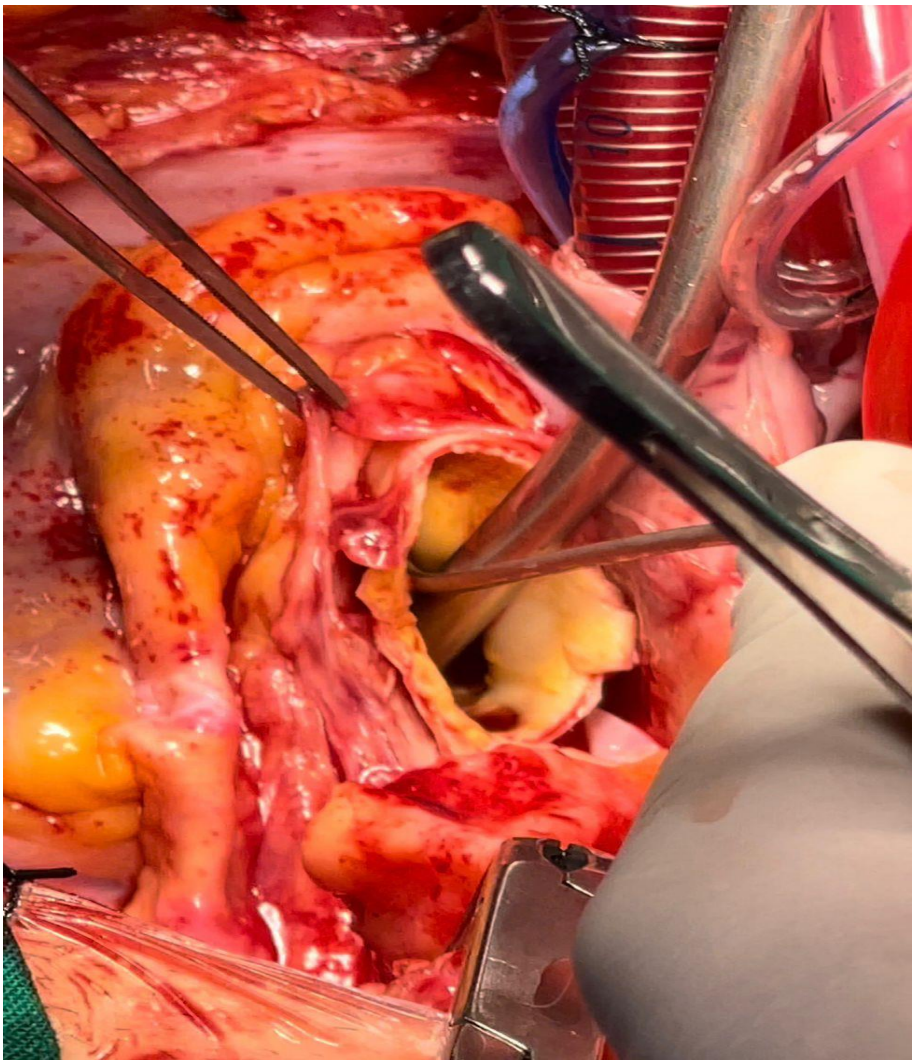


Figure 3B: TTE with color Doppler showing an intimal flap within the ascending aorta.Abnormal turbulent flow in the aortic root, and Aortic Regurgitation.



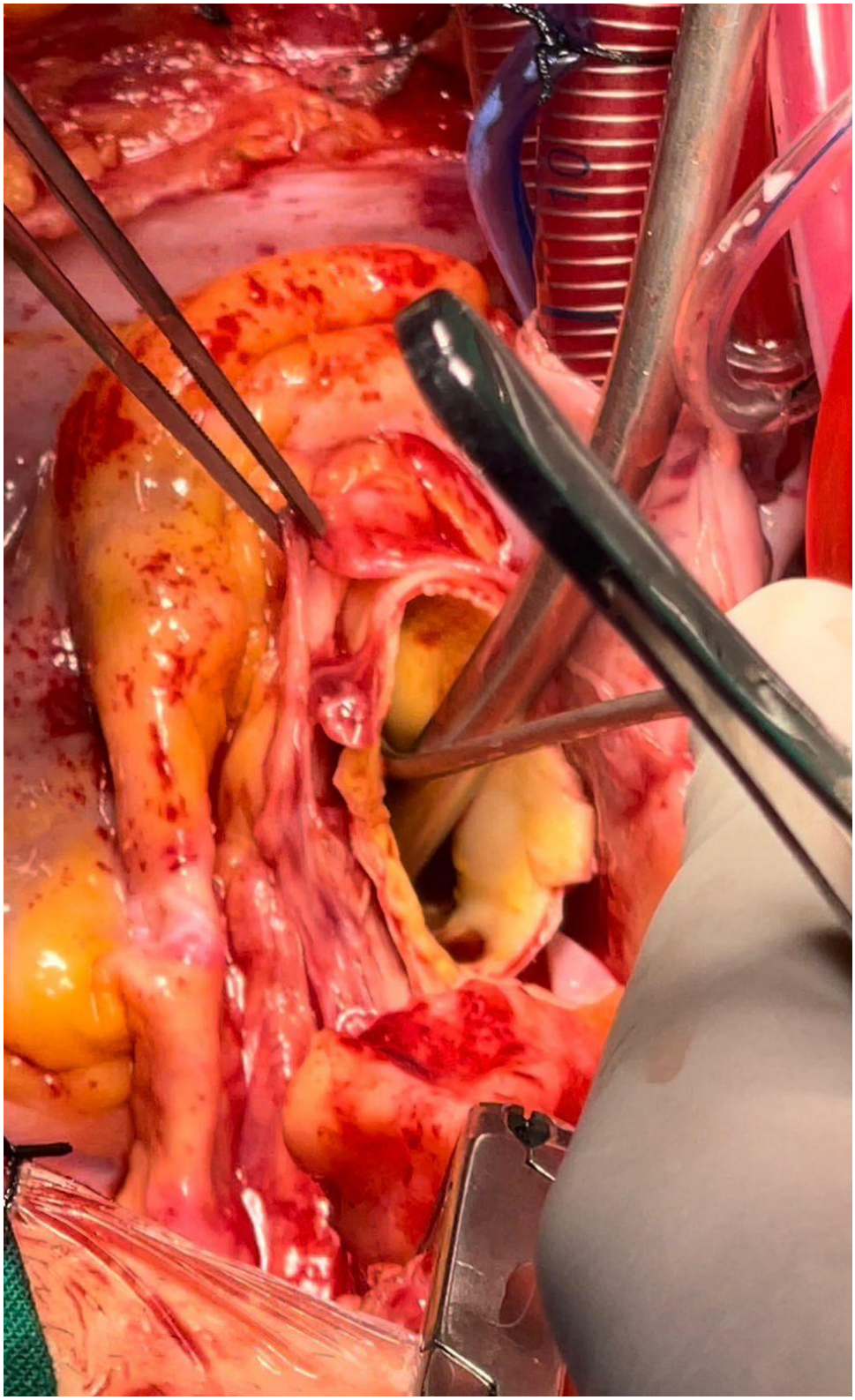


Figure 4B-C: Replacement of the aortic root and hemi-arch with valve-sparing repair of the aortic valve. A bypass graft to the LAD was also performed.

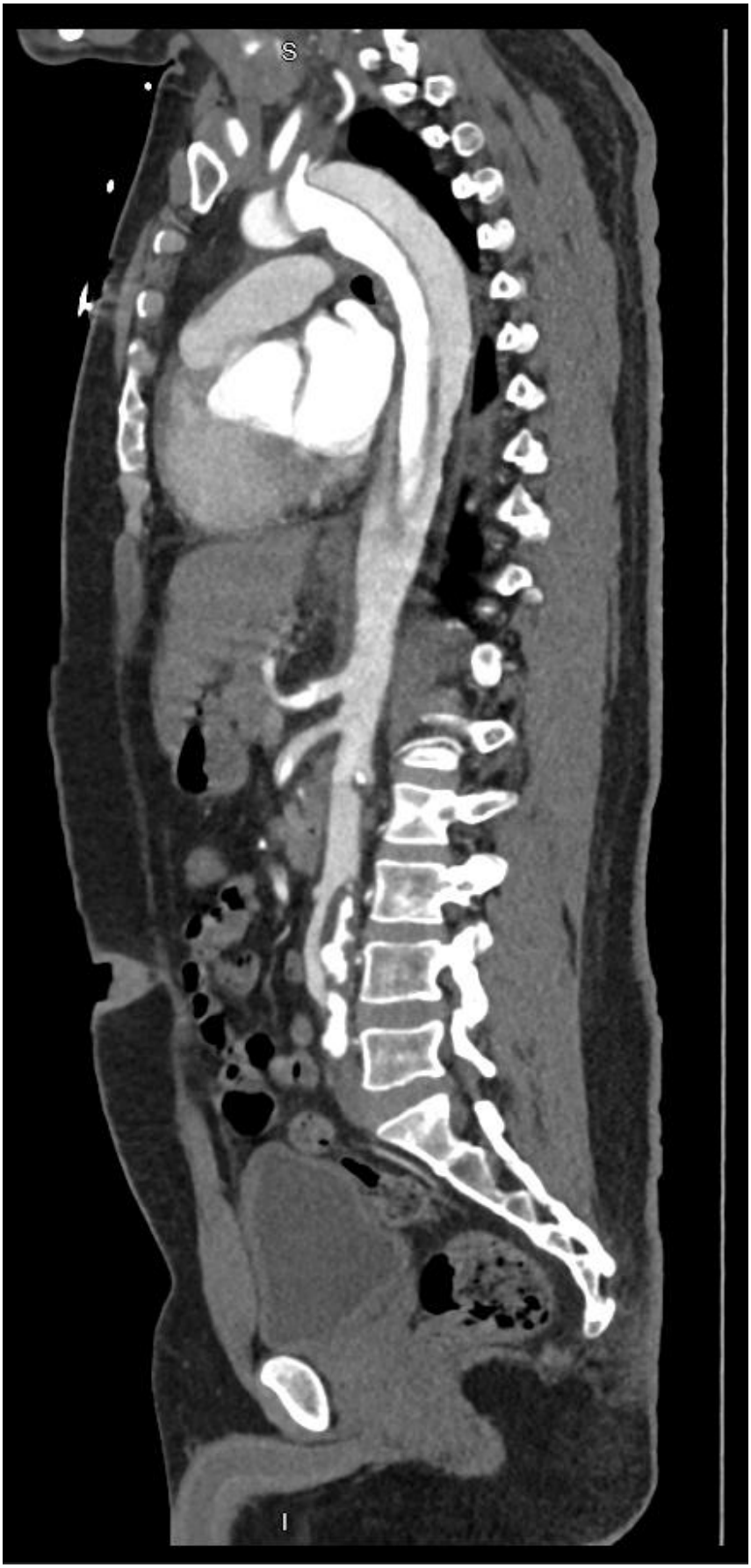


Figure 4: Computed tomography angiography (CTA) confirming an ascending aortic aneurysm consistent with a Stanford Type A aortic dissection.

DISCUSSION

Aortic dissection (AD) remains a rare yet life-threatening cardiovascular emergency with significant morbidity and mortality rates. The presented case underscores the challenges in timely diagnosis and management of AD, particularly when initial symptoms mimic other cardiovascular conditions such as myocardial infarction.

Diagnostic Challenges and Misinterpretation

The patient initially presented with severe chest pain and was diagnosed with an anterior wall myocardial infarction, leading to the administration of thrombolytic therapy. This highlights a well-recognized diagnostic pitfall, as AD symptoms can overlap with acute coronary syndrome. Literature indicates that a substantial proportion of AD cases (15-43%) are misdiagnosed at the initial presentation【3】. The administration of thrombolytic therapy in an undiagnosed aortic dissection can lead to catastrophic bleeding and worsening of the dissection【2】. In this case, the subsequent recurrence of chest pain prompted further investigation, leading to the correct diagnosis. The widened mediastinum on chest X-ray and an intimal flap on echocardiography were crucial in suspecting and confirming AD【3】. Other case studies have reported similar challenges, where initial presentations mimicked pericarditis or pulmonary embolism, further delaying appropriate management【5,6】.

Risk Factors and Pathogenesis

This patient had multiple risk factors contributing to the development of AD, including newly diagnosed hypertension, smoking history, and diabetes mellitus. Hypertension is the most significant modifiable risk factor, leading to chronic stress on the aortic wall and predisposing it to intimal tears【4】. Additionally, smoking has been linked to increased vascular inflammation and degradation of the extracellular matrix, further weakening the aortic wall【4】. The patient's BMI, calculated from a height of 154 cm and weight of 57 kg, does not indicate obesity, which is often associated with additional cardiovascular risk factors. However, other acquired factors such as iatrogenic causes (prior thrombolytic therapy) might have played a role in the progression of the disease【1】. Contrasting reports have documented cases where genetic predisposition played a more significant role, such as in Marfan syndrome or Loeys-Dietz syndrome, leading to early-onset AD in younger patients【7】.

Anatomical Classification and Surgical Management

According to the Stanford classification, this patient had a type A dissection, as the ascending aorta was involved【3】. Type A dissections have a high mortality rate if left untreated, necessitating urgent surgical intervention【2】. The extensive dissection in this case involved the aortic root and extended to the arch, with severe aortic regurgitation and occlusion of the left anterior descending (LAD) coronary artery. Surgical intervention included replacing the aortic root and hemi-arch, repairing the aortic valve, and bypass grafting to the LAD【1】.

Surgical repair remains the gold standard for type A dissections, aiming to prevent complications such as cardiac tamponade, aortic rupture, and end-organ ischemia. The patient's postoperative course was uneventful, which aligns with favorable outcomes when timely surgical intervention is performed【2】. However, in some cases, complications such as cerebrovascular ischemia and renal failure have been reported, further emphasizing the importance of postoperative surveillance【8】.

Clinical Implications and Lessons Learned

This case highlights several key lessons in the diagnosis and management of AD:

1. **Importance of Early and Accurate Diagnosis:** The initial misdiagnosis delayed the correct management approach and could have led to worsened outcomes. A high index of suspicion is necessary when patients present with sudden, severe chest pain, especially when it radiates to the back or abdomen【3】.
2. **Imaging as a Crucial Tool:** Echocardiography and CTA were instrumental in identifying the dissection and determining the extent of involvement, guiding the surgical approach【3】.
3. **Risk Factor Modification:** Given the patient's history of hypertension and smoking, strict blood pressure control and smoking cessation should be emphasized in the post-operative period to prevent future vascular complications【4】.
4. **Multidisciplinary Approach:** The case underscores the importance of collaboration between emergency physicians, cardiologists, radiologists, and cardiothoracic surgeons in ensuring rapid diagnosis and intervention【1】.
5. **Limitations**: This case report has several limitations. Firstly, as a single case study, its findings may not be generalizable to a broader population. Additionally, the initial misdiagnosis and administration of thrombolytic therapy may have influenced disease progression, making it difficult to determine the natural course of the dissection. The short follow-up period limits the ability to assess long-term complications or outcomes. Furthermore, no genetic testing was performed, which may have overlooked hereditary factors contributing to the patient's condition. Retrospective analysis can also introduce recall bias, affecting the accuracy of the initial diagnostic workup. Additionally, we lacked detailed information about the initial diagnostic workup, which led to a misdiagnosis at the referring hospital.

CONCLUSION

Aortic dissection remains a challenging diagnosis due to its overlapping symptoms with other cardiovascular emergencies. This case underscores the importance of maintaining a high level of suspicion, particularly in patients presenting with severe, sudden-onset chest pain. Misdiagnosis can lead to inappropriate interventions, such as thrombolysis, which may worsen the condition. Rapid imaging with echocardiography and computed tomography angiography is crucial for timely and accurate diagnosis. Emergency surgical intervention is vital in Stanford Type A dissections to prevent catastrophic complications; however, diagnosing aortic dissection remains difficult because its symptoms overlap with those of other cardiovascular emergencies. This case emphasizes how critical it is for doctors to be vigilant regarding aortic dissection, especially in patients experiencing sudden chest pain. We must implement several measures to enhance our diagnostic capabilities and support patients effectively. We should establish a risk assessment system, ensure high-risk patients receive advanced scans, and foster improved collaboration among emergency doctors, cardiologists, and cardiac surgeons. Moving forward, we should explore advancements in our diagnostic techniques, create standardized procedures, and conduct long-term follow-ups with patients to provide the best possible care. Increasing awareness about this condition can reduce diagnostic delays and improve survival rates for those facing this life-threatening issue.

Institutional Review Board (IRB) Approval

This case report was conducted in compliance with ethical standards and has received approval from the Institutional Review Board (IRB) of King Abdullah International Medical Research Center (KAIMRC). Written informed consent was obtained from the patient to publish this case report and accompanying images, ensuring adherence to ethical guidelines and patient confidentiality.

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