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Indirect signs of aortic dissection on POC-TTE despite an ADD-RS of 0 and D-dimer < 500 ng/mL: A case report

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ABSTRACT

Aortic dissection (AD) is a “can’t miss” diagnosis for emergency physicians. An algorithm combining the Aortic Dissection Detection Risk Score (ADD-RS) with D-dimer has been proposed as a high-sensitivity clinical decision tool for AD that can determine the need for advanced imaging. Here we present a case of a 48-year-old male who presented to the emergency department (ED) with chest pain and dyspnea. He had an ADD-RS score of 0 and negative D-dimer, which placed him in the low-risk category not requiring further advanced imaging. Despite this, he was found to have a pericardial effusion and dilated aortic root on point-of-care transthoracic echocardiogram (POC-TTE). These findings increased suspicion for AD and prompted the emergency physician to order a computed tomography angiography (CTA), revealing a thoracic AD. The patient successfully underwent surgical repair. This case demonstrates that the ADD-RS + D-dimer algorithm would have erroneously ruled out AD, without the inclusion of indirect findings of AD from the POC-TTE. This highlights the value of using POC-TTE as an adjunct to the ADD-RS + D-dimer algorithm in the diagnostic evaluation of AD and how giving more weight to indirect signs of AD on POC-TTE could potentially increase the sensitivity of the combined ADD-RS + D-dimer + POC-TTE algorithm.

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1. Introduction

Aortic dissection (AD) is a rare but high-mortality disease with varied clinical presentations, making diagnosis in the emergency department (ED) challenging. [1] In this article, the term “aortic dissection” refers to AD, intramural hematoma (IMH), penetrating aortic ulcer (PAU), and aortic rupture collectively. Transesophageal echocardiogram (TEE), magnetic resonance angiography (MRA), and computed tomography angiography (CTA) remain the modalities of choice for diagnosing AD with a sensitivity and specificity of 94–100%. [2] However, TEE and MRA are not readily available in most EDs and given radiation exposure it would be poor clinical practice for all patients with chest pain to undergo CTA to exclude AD. Thus, highly sensitive rule-out strategies are needed.

Most rule-out strategies have focused on point-of-care transthoracic echocardiography (POC-TTE), decision algorithms, or D-dimer levels. POC-TTE can identify AD through direct (i.e. an intimal flap, IMH, and PAU) and indirect signs (i.e. pericardial effusion, aortic regurgitation, dilated aortic root). [2,3] However, POC-TTE alone has insufficient sensitivity to rule out AD. [4] The Aortic Dissection Detection Risk Score (ADD-RS) uses 12 factors to stratify patients into low (ADD-RS = 0),

intermediate (ADD-RS = 1), and high risk (ADD-RS > 1) groups. [5] Yet, as a standalone screening system, the ADD-RS has inadequate sensitivity and moderate inter-rater reliability. [1,6,7] Finally, D-dimer is a promising biomarker using a threshold level of <500 ng/mL to exclude AD; however, it too lacks sensitivity when used alone. [1]

Given these limitations, recent studies have proposed a combined ADD-RS + D-dimer algorithm, yielding sensitivities of 99.6% and 99.9% in two studies. [6,8] In an effort to increase sensitivity further, Nazerian et al. [3] proposed adding POC-TTE to the combined ADD-RS + D-dimer methodology. They outlined a stepwise algorithm to rule out AD: if ADD-RS ≤ 1, then perform a POC-TTE; if no direct signs of AD are present on POC-TTE, the patient is stable, and an alternate diagnosis is more likely, obtain a D-dimer; if D-dimer is negative, rule out AD; however, if any of these steps is not true, then proceed to advanced imaging. The authors concluded that this algorithm yielded a failure rate of 0%. [3]

In our case, indirect signs of AD on POC-TTE aided in diagnosing a clinically significant thoracic AD that would have potentially been missed using these algorithms.

2. Case presentation

A 48-year-old male presented to the ED with 3 days of chest pain. He described his symptoms as gradually increasing, moderate in severity,

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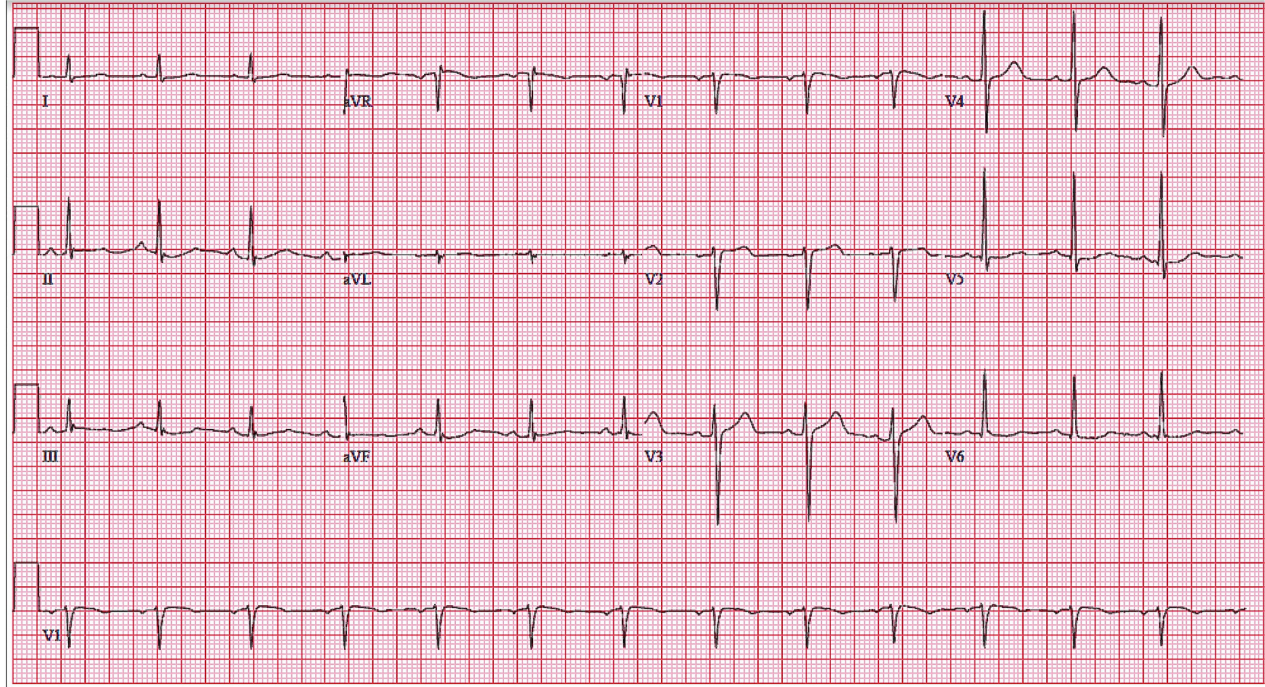


Fig. 1. Electrocardiogram on patient arrival. No significant ST-elevation noted.

non-radiating, and pleuritic. He disclosed tobacco use and trying cocaine on day 2 of his symptoms. He denied any personal or family history of cardiac, thromboembolic, or aortic disease. His vital signs and physical exam were unremarkable. The ADD-RS score was 0. The EKG did not demonstrate ST elevations (Fig. 1). Troponin I was negative (<0.2 ng/mL) and the D-dimer was 415.57 ng/mL FEU (<500 ng/mL FEU). A POC-TTE performed by the ED physician revealed widening of

the proximal aortic root (measured at 4.9 cm) and a small pericardial effusion without tamponade physiology (Fig. 2).

In the setting of chest pain, these POC-TTE findings were interpreted as indirect signs of AD and prompted an immediate CTA. The CTA demonstrated a thoracic “aortic aneurysm [...] measuring up to 5.3 cm” with “suspicion for a small dissection flap at the anterior sinotubular junction” and a small amount of hemorrhage in the pericardial and

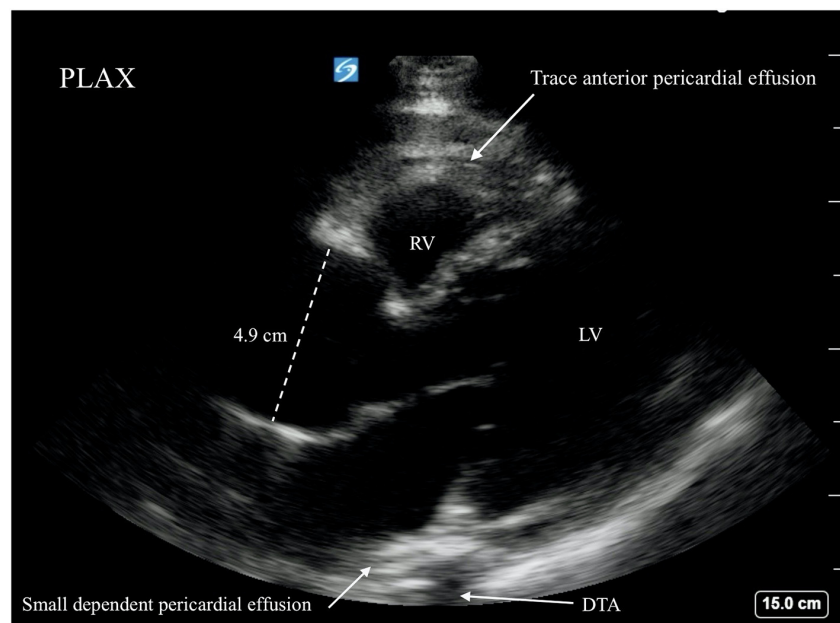


Fig. 2. The cardiac Point-of-care ultrasound image demonstrates a parasternal long axis view using a nonconventional echocardiography image orientation with findings consistent with a small pericardial effusion and aortic root dilation to 4.9 cm. LV = Left Ventricle, RV = Right Ventricle, DTA = Descending Thoracic Aorta, Parasternal Long Axis View = PLAX. *Of note, the image depth could have been extended 1-2 cm to fully capture the DTA.

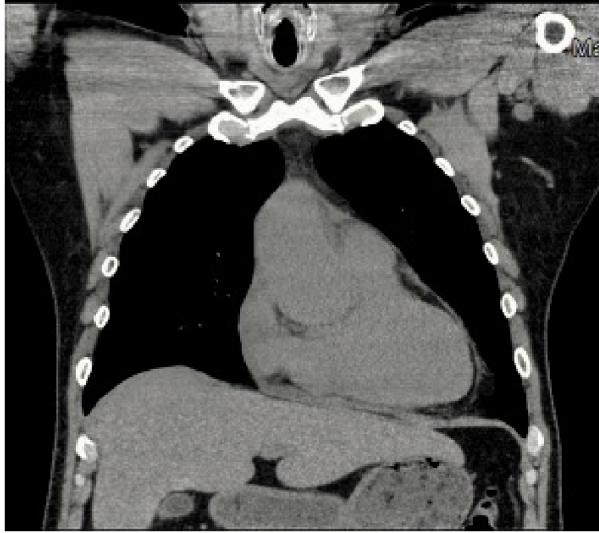


Fig. 3. This Computed Tomography Angiography dissection study displays the aortic aneurysm at the sinus of Valsalva and sinotubular junction as well as hemopericardium.

mediastinal space (Fig. 3). Cardiothoracic surgery was immediately consulted, and the patient was transferred to a referral hospital where he underwent emergent operative repair (Fig. 4). He recovered well and was subsequently discharged.

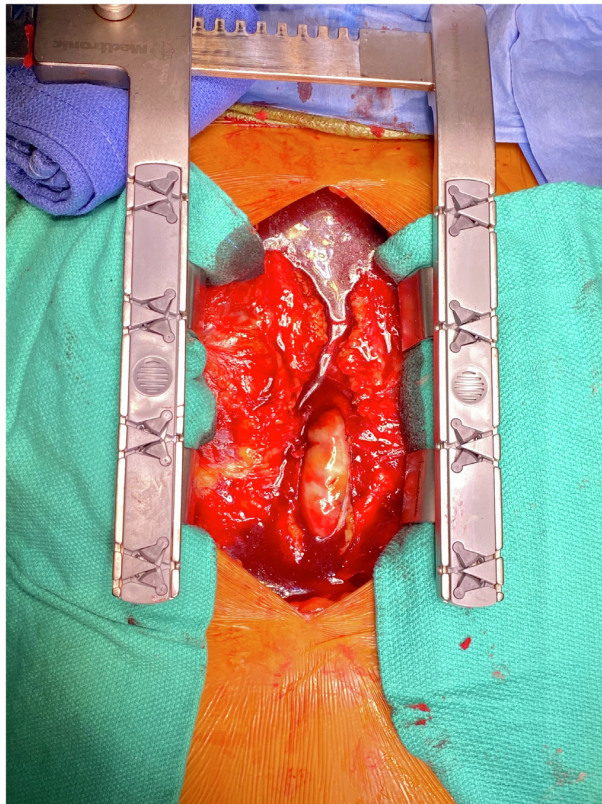


Fig. 4. This is an intra-operative photograph showing a sanguineous pericardial effusion. Per the Cardiothoracic surgeon's report, the patient was found to have a transverse tear in the aortic root just distal to the left main coronary os, comprising 50% the circumference of the aorta and terminating anterior to the right coronary os.

3. Discussion

As our case illustrates, despite its great promise for ruling out AD, the combined ADD-RS + D-dimer algorithm [6,8] does not detect some clinically significant ADs. In the study by Nazerian et al. [8], 8 ADs were reported in patients with a D-dimer <500. A number of patient and dissection characteristics have been associated with low D-dimer levels, including short dissection length, increased time from onset of dissection to evaluation (as D-dimer levels may fall after 24–48 h), thoracic ADs, and young age. [1,9–11] In our case, all the aforementioned factors were present.

Similarly, the ADD-RS + D-dimer + POC-TTE algorithm would not have detected our patient's AD since, in the algorithm, indirect signs of AD on POC-TTE carry less weight than D-dimer and determining the importance of indirect signs is left to the physician. [3] Based on our experience, clinically unexplained indirect signs of AD on POC-TTE should increase suspicion for AD and the need for emergent CTA. These findings should perhaps supersede a negative D-dimer.

4. Conclusion

When combined with the ADD-RS + D-dimer algorithm, direct and indirect signs of AD on POC-TTE can offer valuable information that can change management and patient outcomes in the ED. We believe a revised POC-TTE + ADD-RS + D-dimer algorithm warrants further examination and prospective validation.

Conflict of interest for all involved authors

none.

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none.

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Informed consent

Patient consent obtained for anonymous publication of this work.

IRB

No IRB required for case report per institution guidelines.

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