Thoraco-abdominal Aorta Dissection: Look Again Before You Leap

Abdel-Rauf Zeina[1*], Victoria Trachtengerts[1], Sobhi Abadi[2], Jacob Jarchowsky[3], Uri Soimu[1], Alicia Nachtigal[1]

1. Department of Radiology, Hillel Yaffe Medical Center, Hadera, Israel

2. Department of Radiology, Rambam Medical Center, Haifa, Israel

3. Department of Internal Medicine B, Hillel Yaffe Medical Center, Hadera, Israel

1,2,3 Affiliated to Faculty of Medicine, Technion- Israel Institute of Technology, Haifa, Israel

* **Correspondence:** Abdel-Rauf Zeina, MD, Department of Radiology, Hillel Yaffe Medical Center, P.O.B. 169, Hadera 38100, Israel
(raufzeina3@hotmail.com)

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ABSTRACT

Aortic dissection is a life-threatening condition that might require immediate assessment and therapy. We present the case of a 71-year-old woman with essential hypertension complaining about low back pain; unenhanced thoracic-lumbar spine computed tomography examination (CT) revealed a hyperdense thin line across the aorta with an appearance of "double aortic lumen". Enhanced CT scan confirmed the diagnosis of type B aortic dissection. Radiologists should be familiar with this finding that could be considered a new radiological sign of aortic dissection on unenhanced CT examination.

CASE REPORT

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A 71-year-old woman with a history of essential hypertension was admitted to our hospital because of low back pain. A physical examination revealed local tenderness over the lower thoracic and lumbar spine. Motor power was normal in both lower limbs, as was sensation. The anal tone was normal. Examination of her cardiovascular and respiratory systems was unremarkable. She was afebrile. On admission, her blood pressure was high (140/90 mm Hg). Routine blood studies showed microcytic anemia. Plain radiographs of the lumbar spine showed diffuse degenerative changes. Symptomatic treatment was not useful and the patient underwent unenhanced thoracic-lumbar spine computed tomography examination (CT). The CT revealed degenerative changes associated with posterior disc bulge causing discrete anterior thecal sac compression at various levels. In addition, we observed a hyperdense thin line across the descending thoracic aorta and the abdominal aorta with an appearance of "double aortic lumen" (Figures 1 A and 1B). This finding suggests aortic dissection. Therefore, CT angiography (CTA) of the aorta was performed using 64-MDCT instrument (Brilliance-64, Philips Healthcare). The imaging parameters were as follows: detector collimation, 64 × 0.625 mm; helical pitch, 0.798; gantry rotation time, 0.5 second; reconstructed section thickness, 2.0 mm; reconstruction interval, 1.0 mm; tube voltage, 120 kV; and planned tube current-time product, 300 mAs. CTA revealed an intimal flap involving the descending thoracic and the abdominal aorta including bifurcation corresponding to type B aortic dissection (Figures 1 C and 1 D). The patient was then transferred to the cardiovascular intensive care unit for medical treatment and follow-up.

DISCUSSION

Aortic dissection is a life-threatening condition that might require immediate assessment and therapy (1). The clinical spectrum of presentation of acute aortic dissection is broad and unpredictable (2). Dissection is considered acute if the symptoms last less than 2 weeks and chronic if they last longer (3). A routine chest x-ray is abnormal in 60% to 90% of cases of suspected aortic dissection. However, acute dissection (especially type A) can present with a normal chest film, and this may distract physicians from pursuing further imaging (4, 5). In the International Registry of Aortic Dissection, the first diagnostic test used was transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) in 33%, computed tomography (CT) in 61%, magnetic resonance imaging (MRI) in 2%, and angiography in 4%, reflecting the current use of diagnostic resources (4).

The pathognomonic finding of aortic dissection is the intimal flap, and all cross-sectional modalities allow its identification. Cross-sectional imaging with state of the art CTA is currently the imaging modality of choice for the diagnosis of acute aortic dissection (6, 7). The most recent published data on CT show it to have 100% sensitivity and specificity for detection of aortic dissection (8, 9).

Aortic dissection results in the formation of a true and false lumen separated from each other by a flap of intimal lining and inner layers of media. CT also is useful for identifying atypical forms of dissection, such as intramural hematoma and penetrating aortic ulcer. In patients suspected to have acute aortic dissection, the MDCT protocol should include unenhanced CT acquisition for visualization of the aortic intramural hematoma and a contrast-enhanced axial CT images from the lung apices to the acetabular roof for visualization of the classic intimomedial flap. Aortic intramural hematoma is likely related to hemorrhage from the vasa vasorum and is identified on unenhanced CT as a crescentic high-attenuating clot within the media, with internally displaced calcification. Penetrating atherosclerotic ulcers are seen as craters penetrating through the aortic intima via a focal tear having an angiographic appearance analogous to peptic ulcers. On cross-sectional imaging such as CT and MRI, a focal aortic wall ulcer is seen communicating with the arterial lumen and may be associated with adjacent intramural hematoma. Hemorrhagic pleural and pericardial effusions and mediastinal hematoma may also be seen in patients with acute aortic dissection (which would be referred to as aortic transection).

Basic MRI sequences for evaluating aortic dissection include spin-echo T1-weighted or breath-hold double inversion recovery sequences, cardiac-gated gradient-echo sequences, and three-dimensional thin-section MR angiography (MRA) with a bolus injection of a single or double dose of gadolinium-based contrast agent. Aortic dissection is identified as an intimal flap of medium signal intensity surrounded by a signal void of fast-flowing blood on "black blood" ECG-gated spin-echo or double inversion recovery single-shot fast spin-echo MRI. With cine gradient echo imaging, the intimal flap appears as a dark line against the high signal intensity of the flowing blood. Phase-contrast MRI (PC-MRI), a noninvasive technique with which flow can be measured accurately with flexible spatial and temporal resolution (10). PC-MRI can be helpful for the diagnosis of aortic dissection and for elucidation of true and false lumens and entry points into a false lumen (Figure 2). Aortic intramural hematoma is identified as bright crescent along the periphery of the aorta on precontrast T1-weighted MR images.

TEE can demonstrate true and false lumens, direction of flow, and complications such as aortic regurgitation (Figure 3). CTA is the imaging technique usually carried out before TEE in cases of suspected acute aortic dissection. This is mainly due to the considerable around-theclock availability of CT scanners in emergency departments. MRI has a high sensitivity (95%-100%) and specificity (94%-98%) for the diagnostics of acute aortic dissection (11-13); however, this modality has several disadvantages compared to CT scan: the spatial resolution of MRI is currently inferior to that of CTA; MRI is not usually available in an emergency department; the acquisition of several sequences is much longer, and the monitoring of an instable patient can be difficult. MRI seems preferable to CTA for long-term follow-up in order to limit repeated radiation exposure. A major advantage of TEE over MRI and CT is its portability, as it is useful at the bedside or in the operating room in unstable patients. However, TEE requires a skilled operator to achieve proper safety levels and high diagnostic value. In addition, not all cardiac and vascular surgeons feel confident in performing surgery on the basis of TEE findings alone. Aortography, the previous gold standard for the diagnosis of aortic dissection, is more invasive, expensive, time-consuming, and labor-intensive than CT.

In our patient, the mid aortic hyperdense line detected on the unenhanced CT scan represents, in fact, internal displacement of intimal calcifications and corresponds to the intimal flap on the enhanced CT. This radiological finding may be of value in the evaluation of unenhanced CT examination of patients with chest, back or abdominal pain. The mid aortic hyperdense line is rarely seen on unenhanced CT scans and may be confused with an aneurysm with calcified mural thrombus (14, 15). It is crucial for the finding that calcification is present in the dissection membrane; otherwise it will most likely be missed. Radiologists should be familiar with this finding that could be considered a new radiological sign of aortic dissection on unenhanced CT examination.

TEACHING POINT

The mid aortic hyperdense line represents aortic dissection on unenhanced CT. Hyperdense mid aortic line could be considered a new radiological sign of aortic dissection on unenhanced CT examination.

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FIGURES

Figure 1: 71-year-old woman with low back pain and type B aortic dissection. Axial (A) and sagittal (B) unenhanced CT images of the aorta show mid aortic hyperdense thin line (arrows) representing intimal calcification. Axial enhanced CT image (C) of the abdominal aorta obtained at the same level of "A" shows the intimal flap corresponding to aortic dissection (imaging parameters: detector collimation, 64 × 0.625 mm; helical pitch, 0.798; gantry rotation time, 0.5 second; reconstructed section thickness, 2.0 mm; reconstruction interval, 1.0 mm; tube voltage, 120 kV; and planned tube current-time product, 300 mAs). (D) Multiplanar reformatted enhanced CT image shows the dissection involving the thoraco-abdominal aorta (arrows).

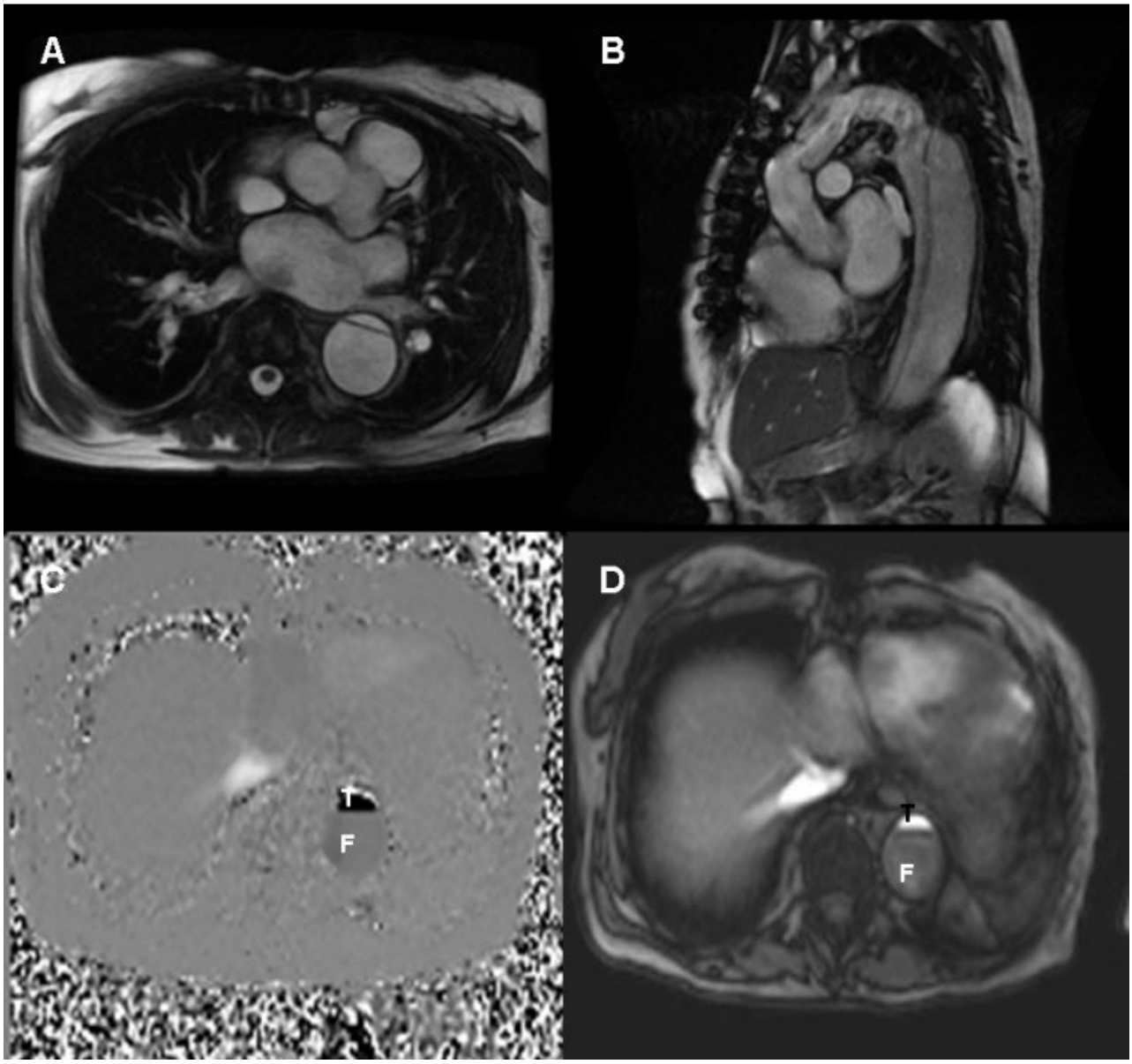

Figure 2: (Different patient as in figure 1) 69-year-old man with chest pain and type B aortic dissection. Axial (A) and sagittal (B) SSFP (Steady-state free precession) MRI images showing the intimal flap corresponding to aortic dissection. Phase-contrast MRI with velocity encoding (C) and magnitude encoding (D) images showing the high velocity flow in the true lumen (T) and low velocity in the false lumen (F).

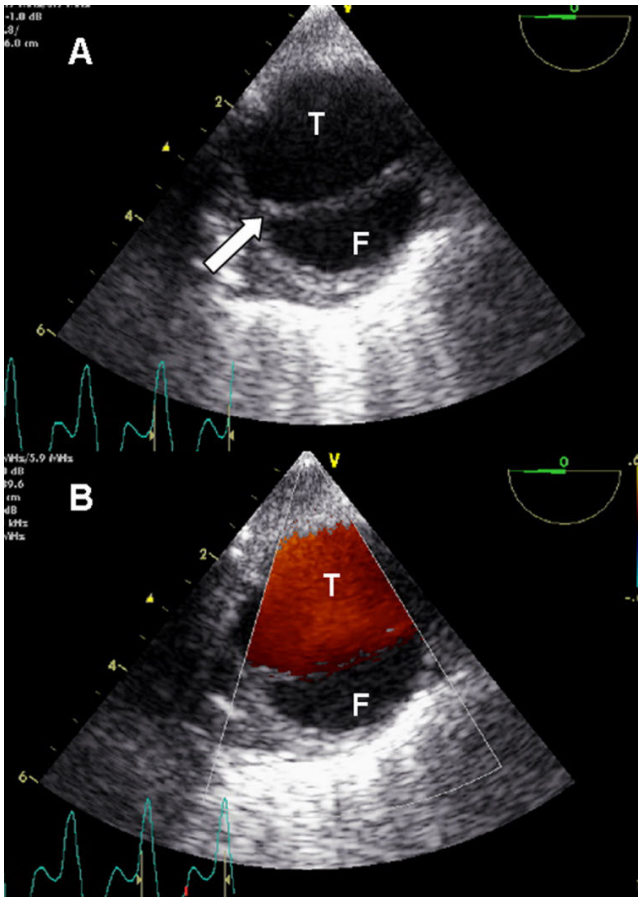

Figure 3: (Different patient as in figure 1) 73-year-old woman with chest pain and type B aortic dissection. Grayscale (A) and color Doppler (B) TEE images showing the true (T) and false (F) lumens in the descending thoracic aorta. The arrow indicates the intimal flap. Images courtesy of David S. Blondheim, MD, Hillel Yaffe Medical Center, Hadera, Israel.

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ABBREVIATIONS

CT = Computed Tomography
CTA = Computed Tomography Angiography
MRA = Magnetic Resonance Angiography
MRI = Magnetic Resonance Imaging
PC-MRI = Phase Contrast MRI
TEE = Transesophageal Echocardiography
TTE = Transthoracic Echocardiography

KEYWORDS

Aortic dissection; intimal flap; CT angiography