Images in Aortic Disease

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Imaging of Thoracic Intercostal Artery Rupture during the Propagation of a Type B Acute Aortic Syndrome

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Abstract

The natural history of an intramural hematoma (IMH) has not been completely defined. This is a case report of a 63-year-old woman, in whom imaging reveals intercostal artery rupture during the process of expansion of an IMH in a Type B acute aortic syndrome. This case demonstrates that intercostal artery rupture may act as a precursor for the transformation of IMH to a classical dissection. Interestingly, complete resolution of this condition is achieved through medical management.

Key Words

Aortic dissection · Vasa vasorum · Intramural hematoma

Introduction

The natural history of intramural hematoma (IMH) in the aorta remains difficult to define. A number of investigators have reported on factors that predict whether IMH will progress to formal aortic dissection (AD) or regress with complete resolution [1]. A consensus of opinion has developed that IMH in the ascending aorta and descending aorta should be treated as for formal Type A and Type B dissection, respectively [2]. However, it is known that roughly a third to a half of IMHs will regress with medical management [3]. The exact pathological evolution of this process has remained undefined. Intercostal artery rupture has been identified as part of the process of an acute aortic syndrome in an analysis of imaging follow-up data [4]. It is generally thought that rupture of vasa vasorum leads to the development of IMH and that expansion of the tunica media causes longitudinal distraction of the intercostal artery as it crosses the aortic mura, and this leads to rupture of the intercostal artery. Coalescence of blood from this rupture may lead to formal dissection.

In this report we present the case of a patient who demonstrated clear images of intercostal artery rupture during the process of expansion of IMH in a Type B acute aortic syndrome. Of unique interest is the demonstration of complete resolution of this pathology with medical management.

Case Presentation

A 63-year-old female presented to the Accident and Emergency Department of a District General Hospital with unremitting chest pain radiating to the intrascapular region. She had a documented history of hypertension. She had no cardiac family history and no other comorbidities. On examination, her blood pressure was 210/115 mm Hg in both arms with a

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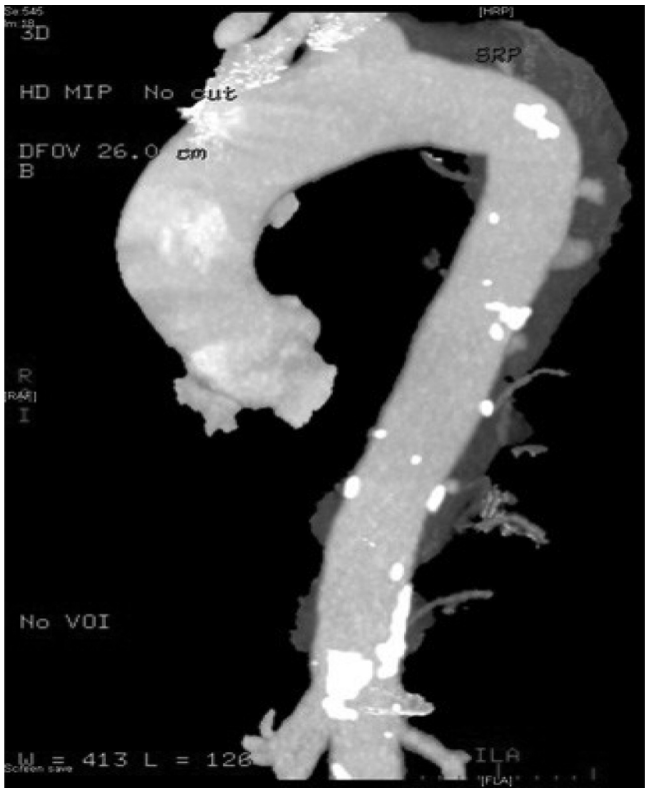

Figure 1. Contrast-enhanced CT scan of the thoracic aorta demonstrating several small collections of contrast in the intramural hematoma representing inflow from the intercostal arteries. There is good perfusion to the celiac axis superior mesenteric artery and renal arteries.

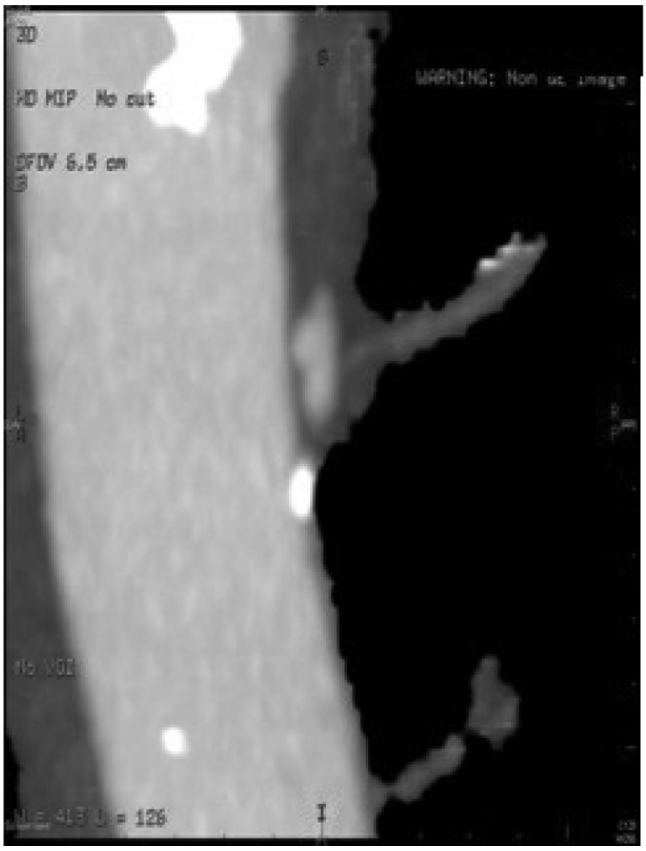

Figure 2. Close up of contrast-enhanced CT scan of the thoracic aorta demonstrating a small collection of contrast in the intramural hematoma representing inflow from the intercostal arteries.

regular pulse of 92 bpm. There was no pulse deficit or cardiac murmur, and no neurological deficit. Laboratory workup was normal. A 12-lead ECG showed normal sinus rhythm with no ischemic changes. She underwent a contrast-enhanced CT scan of the chest and abdomen (Fig. 1).

The CT scan demonstrated a normal caliber aortic root and ascending aorta. There was a common origin of the left common carotid and innominate artery. The left subclavian artery was normal in appearance, and an aberrant right subclavian artery with a thickened wall was present. There was an intramural hematoma extending from the proximal descending thoracic aorta, immediately distal to the left subclavian artery, which extended through to the midabdominal aorta, terminating just superior to the inferior mesenteric artery. Several small collections of contrast were seen within the thickened wall, which is most likely caused by inflow from ruptured intercostal arteries (Figs. 1 and 2). The maximal diameter of the descending aorta was 4.7 cm. A large left pleural effusion was noted on the scan with normal lung parenchyma and no hilar or mediastinal lymphadenopathy. The celiac axis, the superior mesenteric artery, and the renal arteries were adequately perfused. Otherwise, there were no other abnormalities noted.

The patient was immediately transferred to our center for further stabilization. She was admitted to the intensive care unit and started on intravenous infusion of labetalol to control her blood pressure. Over a period of 1 week, she was weaned from intravenous β-blockers to oral hypertensive medications. She was discharged home and regular follow-up was organized. Her current status, a further 2 years later, is stable. CT scans reveal no change in the size of her aorta and a regression of the IMH and pleural effusion (Fig. 3). She continues with medical management and yearly surveillance.

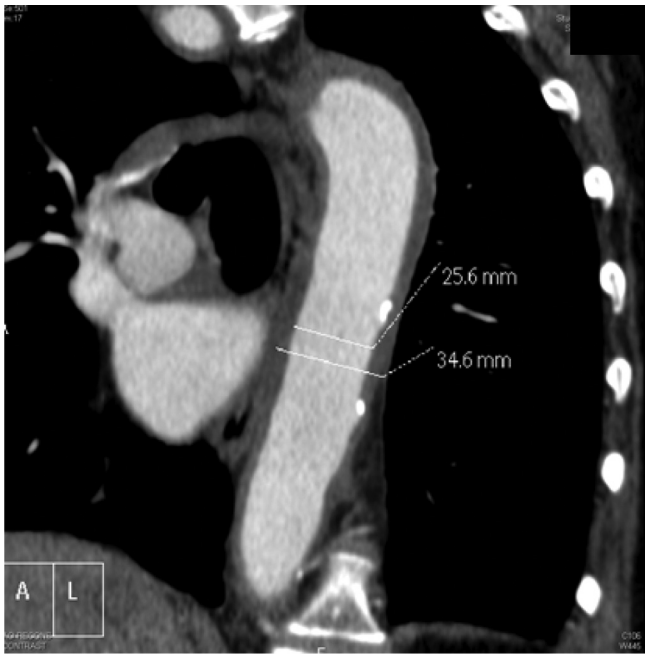

Figure 3. Follow up contrast-enhanced CT scan demonstrating a regression of the collections and IMH.

Discussion

Intramural hematoma is part of a spectrum of disease known as acute aortic syndrome and includes other pathologies such as intimal tear, penetrating atherosclerotic ulcers, and formal dissection. Hirst et al. [5] demonstrated that IMH was secondary to the rupture of vasa vasorum within the media and subadventitia. A functional definition of IMH, from the perspective of flow, is that it is a blood collection within the aortic wall, not freely communicating with the lumen, with restricted flow [6]. IMH comprises 10-30% of acute aortic syndrome [7]. The interesting behavior of IMH is that it may progress to formal dissection or regress to complete resolution [4–7]. Predicting its behavior has significant clinical consequence as surgery may be avoided if there is confidence that with appropriate medical management the pathology may resolve.

Whether the right aberrant subclavian artery encountered in this case report may have contributed to the IMH remains a possibility, but a challenge to prove. Penetrating atherosclerotic ulcer, classic aortic dissection, and aortic rupture may have similar clinical manifestations; however, they are radiologically distinguishable. The CT features of penetrating ulcers include focal involvement with adjacent subintimal hematoma located beneath the frequently calcified and inwardly displaced intima in the middle or distal third of the thoracic aorta. The ulcer is often associated with thickening or enhancement of the aortic wall [8].

Moreover, an interesting observation made previously is that expansion of IMH may cause rupture of intercostal arteries in their transmural portion leading to coalescence of pools of free blood within the wall of the aorta, so-called "aortic branch artery pseudoaneurysms" [7]. It is conceivable that such pseudoaneurysms and pooling of blood within the media is one possible intermediary step in the evolution to formal dissection. What has not been demonstrated so clearly before is that this phenomenon is clearly not an irreversible step. The patient presented here shows clearly the presence of aortic branch pseudoaneurysms and that with medical management there is complete resolution to normal size and morphology of the aorta.

Conclusion

Expanding intramural hematoma may cause rupture of intercostal and bronchial arteries in the transmural portion as they cross the tunica media of the aorta. This leads to pseudoaneurysms, which may be an intermediary step in the evolution of aortic dissection. Intercostal rupture is not an irreversible step, and our case presentation demonstrates reversibility of the process with good medical management.

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EDITOR'S COMMENTS AND QUESTIONS

Editor's Comment:

This is an instructive case report, nicely illustrated. The authors mention the possible origin of the intramural hematoma via rupture of the vasa vasorum. Recently, several experienced aortic surgeons (including Dr. Kouchoukos) have emphasized that, under deep hypothermic exposure, one usually finds an intimal tear somewhere in the affected aorta, even though it is not visualized on preoperative imaging. This observation suggests that the intramural hematoma may be caused by an intimal tear, just like typical aortic dissection.

Editor's Questions:

1. You say that the intramural hematoma and intercostal artery rupture healed completely, but did the intercostal arteries reconstitute, or did they occlude? We cannot tell from the single late image provided.

Currently the precise answer is unknown. We do not have conclusive evidence to present that could demonstrate whether or not the intercostal arteries reconstituted or occluded. The intramural hematoma meliorated within a process described in the context of the report and the patient certainly will require serial imaging and close follow-up to delineate the change.