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CASE REPORT

Painless Asymptomatic Ascending Aortic Dissection with Four-Dimensional Flow Magnetic Resonance Imaging: a Case Report

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INTRODUCTION

Aortic dissection is an uncommon condition with a high mortality.[1,2] Over 90% of cases present with severe chest or back pain.[1-3] Other presenting symptoms include syncope, focal neurological deficits, paraplegia, or symptoms of congestive heart failure.[1,3,4] We present an extremely rare case of asymptomatic ascending aortic dissection discovered incidentally during scheduled cardiac magnetic resonance imaging (MRI) for research purposes.

CASE REPORT

A 57-year-old man, non-smoker, with hyperlipidaemia and hypertension on 5 mg amlodipine orally once daily, participated in a cardiac MRI research programme at The University of Hong Kong. He had no history of connective tissue disorders such as Marfan or Ehlers–Danlos syndrome. Initial cardiac MRI in July 2017 revealed a dilated ascending thoracic aorta measuring 4.4 cm in diameter, moderate aortic regurgitation and normal left ventricular systolic function. No intimal flap was seen in this initial study (Figure 1a and b). A further research cardiac MRI in October 2019 revealed a new incidental finding of a focal dissection flap in the ascending thoracic aorta consistent with a Stanford type A aortic dissection (Figure 1c and d). There was an increase in the diameter of the ascending thoracic aorta to 5.3 cm and moderate/severe aortic regurgitation with normal left ventricular systolic function. There was no haemopericardium or para-aortic haematoma. Four-dimensional (4D) flow imaging demonstrated vortex formation within the ascending aorta indicative of altered flow dynamics unlike the typical laminar flow seen in normal aortas (Figure 1e and f).

The patient was immediately contacted and advised to attend the emergency department. On admission, he was asymptomatic. His latest exercise tolerance was excellent, and he had just competed in a 10-km run. His blood pressure measured at home was stable at <140 mmHg/<85 mmHg. On examination, his vital signs were normal with blood pressure 130 mmHg/80 mmHg, heart rate 80 bpm, respiratory rate 16/minute, and SpO_2 95%. Heart sounds were normal with an early diastolic

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Ethics Approval: The patient was treated in accordance with the tenets of the Declaration of Helsinki. The patient provided written informed consent for all treatments and procedures.

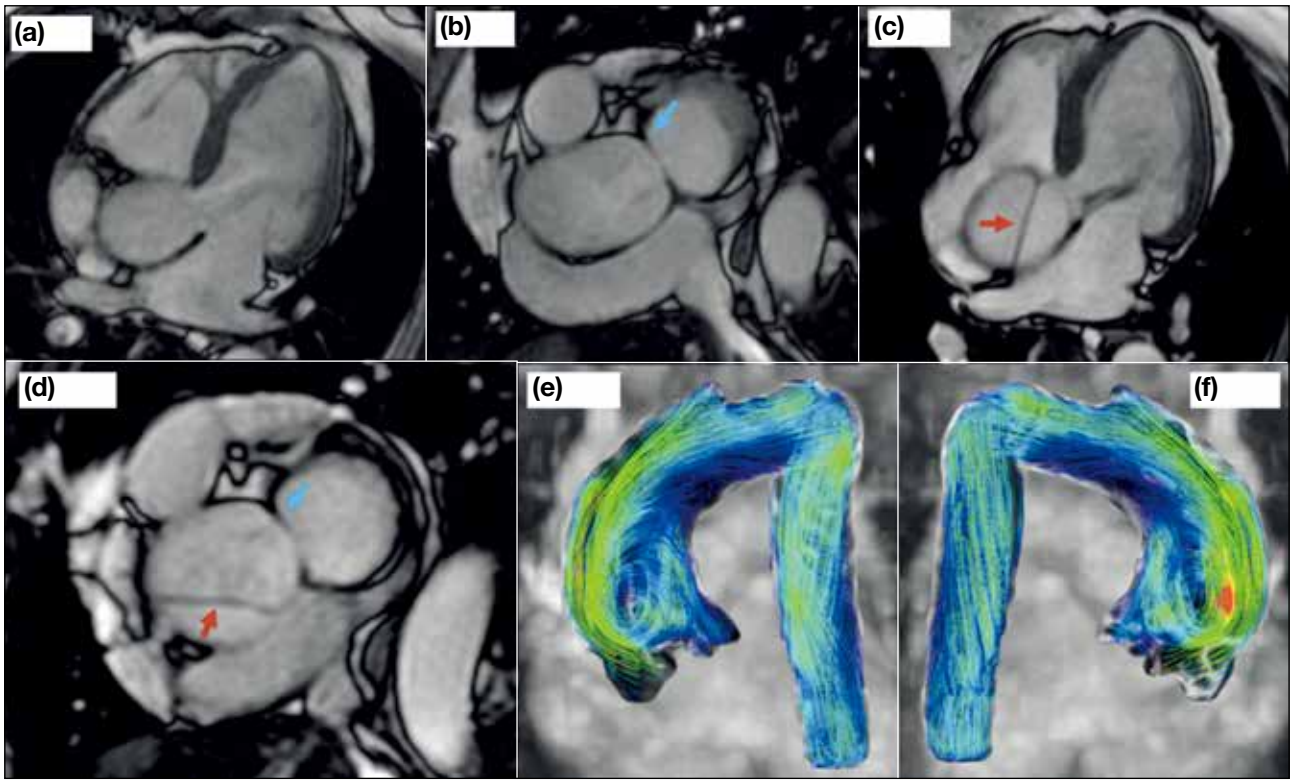

Figure 1. (a) Horizontal long-axis and (b) short-axis cardiac cine magnetic resonance balanced steady-state free precession images (July 2017) showing no dissection flap at the ascending aorta. The blue arrow indicates the position of the aortic valve. The ascending aorta is mildly dilated and measures 4.4 cm. Cardiac magnetic resonance balanced steady-state free precession images (October 2019) showing an incidental finding of a dissection flap (red arrow) at the ascending aorta just distal to the aortic valve (blue arrow) in the (c) four-chamber view and (d) coronal plane. The ascending aorta diameter measures 5.3 cm. (e, f) Four-dimensional flow images (October 2019) show vortex flow within the ascending thoracic aorta in our patient with asymptomatic Stanford type A aortic dissection.

murmur. There was no radio-radial delay on either arm or blood pressure discrepancy between arms. Blood tests (including complete blood count, liver and renal function profile, clotting profile, troponin, and creatinine kinase) were unremarkable. Echocardiogram demonstrated sinus rhythm with no acute ischaemic changes. A computed tomography aortogram was performed 5 days after the incidental finding to confirm and evaluate the extent of the dissection. A static focal dissection flap in the ascending thoracic aorta without extension to the aortic arch or coronary arteries was confirmed (Figure 2a and b). There was no aortic intramural haematoma or penetrating atherosclerotic ulcer. Echocardiography confirmed moderate aortic regurgitation but no aortic stenosis. The patient underwent an open-heart aortic root replacement and aortic valve valvuloplasty 20 days after the incidental MRI finding of Stanford type A aortic dissection. Postoperative recovery was uneventful and the patient was discharged home. Postoperative echocardiogram showed no valvular stenosis or regurgitation. The patient was well and asymptomatic at the last outpatient follow-up, 78 days after surgery.

DISCUSSION

Aortic dissection is an uncommon but often fatal condition with an annual incidence of 2.9 per 100,000 population.[1,2,4] Although approximately 6.4% of patients present with painless aortic dissection,[4] there is no recognised literature describing the incidence of asymptomatic presentation.

There are multiple proposed mechanisms of painless aortic dissection, including: less wall stretching due to slow dissection; sparing of the adventitial dissection; damaged aortic wall sensation due to prior cardiovascular surgery or known aortic aneurysm; degeneration or denervation of periaortic pain receptors in the elderly patients or patients with diabetes mellitus; and cerebral insult (ischaemic stroke or syncope) leading to attenuation of pain perception.[4]

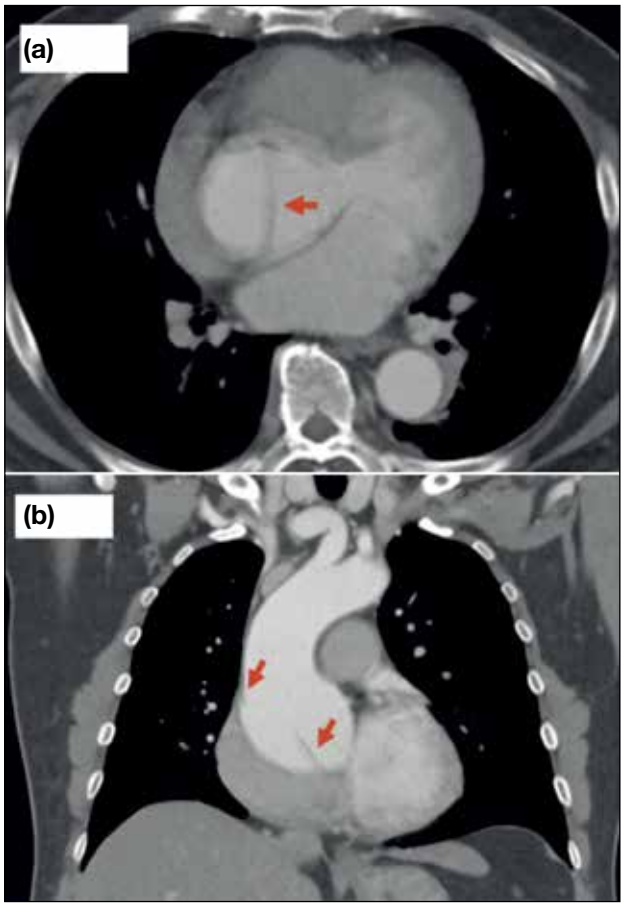

Figure 2. Computed tomography with contrast confirmed a focal dissection at the ascending aorta (arrows) in the (a) axial and (b) coronal planes. No interval progression or extension to the aortic arch or coronary arteries were noted.

Painless aortic dissections typically present with other symptoms and include syncope, symptoms of congestive heart failure, focal neurological deficit, or paraplegia.[1,3,4] These symptoms are usually due to extension of the dissection into other structures or vessels, e.g., aortic valve, coronary arteries, common carotid arteries, and intercostal arteries.

Painless aortic dissection has an older mean age (67 vs. 61 years) at presentation and is more common in the presence of diabetes (10.2% vs. 4.0%), aortic aneurysm (29.5% vs. 13.1%), and prior cardiovascular surgery (48.1% vs. 19.7%).[4] Our patient was unusual in that he was younger and generally of good health with no history of diabetes or connective tissue disorders. However, he did have a mildly dilated ascending aorta of 4.4 cm although his hypertension was well controlled. He had no neurological symptoms or deficit. Aortic stenosis was not evident on echocardiogram. After reviewing the first MRI scan, we confirmed that the incidental finding of focal type A aortic dissection was a novel development between the first and second MRI rather than being missed. We propose that the unusual presentation and outcome in our case was due to early discovery of a focal aortic dissection before progression or any complication with subsequent prompt management.

Despite being described in a previous case report,[5] asymptomatic ascending aortic dissection is extremely rare, likely because patients with completely asymptomatic ascending aortic dissection do not present to medical services until complications arise.

In this case, the diagnosis was based on identifying the dissection flap on the cine images. The 4D flow images did not alter the diagnosis or patient management per se. The patient's 4D flow images demonstrated turbulent flow in the aortic aneurysm and dissection that has been commonly described.[6,7] The clinical application of 4D flow MRI is becoming increasingly clear. In cases of aortic stenosis, studies have demonstrated that 4D flow is better in measuring the peak velocity compared with traditional two-dimensional flow which is operator dependent. It provides better understanding of altered aortic blood flow and regional wall shear stress in the expression of an aortopathy phenotype.[8-10] Moreover, 4D flow is particularly useful in patients with congenital heart disease before and after operation where multiple two-dimensional flow measurements are routinely required in highly complex and abnormal anatomy that is challenging, even in the most experienced hands.[9] 4D flow can potentially save time by acquiring a whole volume dataset and allowing the experienced cardiothoracic radiologist to perform post-processing in exchange for longer scanning time. Lastly, 4D flow provides information about intracardiac blood flow that was previously not possible (e.g., amount of flow travelling directly from the atrium to the ventricle and out into the aorta in a single cardiac cycle) and is an area under investigation.[9]

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