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Pictorial Review

Acute aortic syndrome: CT findings

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ARTICLE INFORMATION

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Acute aortic syndrome (AAS) is a constellation of potentially life-threatening acute aortic diseases. The spectrum includes penetrating atherosclerotic ulcer, intramural haematoma, dissection, and unstable thoracic aneurysm. AAS cannot be reliably diagnosed clinically and multidetector computed tomography (MDCT) has revolutionized the diagnosis and management of this group of conditions in the acute setting due to its availability, speed, and accuracy. The purpose of this review is to illustrate key MDCT findings of AAS. Imaging techniques, radiological findings, and common pitfalls are also discussed.

Introduction

Acute aortic syndrome (AAS) is a medical emergency that requires accurate diagnosis and prompt management. It has an estimated incidence of 2.6–3.5/100,000/year with two-thirds affected being male with an average age of over 60 years old.[1] This syndrome encompasses several potentially life-threatening thoracic aortic diseases including aortic dissection (AD), intramural haematoma (IMH), penetrating atherosclerotic aortic ulcer (PAU), and unstable thoracic aneurysm.[2]

The clinical presentations of patients with AAS are diverse, classically as acute tearing chest pain, although sharp chest pain is the most common presenting complaint.[3] As these symptoms are so non-specific, distinguishing different entities clinically is difficult. Multidetector computed tomography (MDCT) has become the technique of choice in evaluating this subset of patients because of its speed of acquisition, availability, and high sensitivity. MDCT has a sensitivity and specificity approaching 100% in diagnosing underlying aortic disease.[4] It has superseded other imaging options in the UK, such as plain film, catheter angiography, and transoesophageal echocardiography (TOE).[5]

Imaging technique

The introduction of cardiac synchronization (ECG-gating) enables the evaluation of the ascending aorta with reduced pulsatile artefacts. This can be achieved either retrospectively (data from a specific part of the cardiac cycle selected retrospectively and used to construct images) or prospectively (image acquired during a pre-specified part of the cardiac cycle). The prospective approach offers patients less ionizing radiation, but allows little ability to correct for artefacts due to motion or dysrhythmias.[6]

In our department the imaging protocol for ECG-gated CT angiography is based on a 40 section helical CT system. A standard tube voltage of 120 kV and current of 380 mA are used. The rotation time of the scanner is 0.4 s with a pitch of 0.2. Images are acquired from the bifurcation of the common carotid artery to the bifurcation of the common iliac arteries. A bolus injection of 120 ml Ioversol, (350 mg iodine/ml; Optiray 350, Covidien, UK) followed by 50 ml normal saline intravenously through a peripheral 18 G cannula via a pump at 4 ml/s. The scan is initiated by bolus tracking on the descending aorta triggered at 150 HU. The imaged section thickness is 1.4 mm. The scan is

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retrospectively gated with images reconstructed at 65% of R–R interval.

AD

AD is the most common acute aortic disorder. Associated risk factors include hypertension, old age, atherosclerosis, previous cardiac surgery, and connective tissue diseases (such as Marfan or Ehlers–Danlos sydrome).[7] AD is characterized by a tear within the intimal layer of the aorta causing an inflow of blood into the media, forming a true and a false lumen separated by an intimomedial flap. Different mechanisms for the disruption of the intima have been proposed, from primary disruption of the intima to secondary rupture from haematoma from the vasa vasorum with increased pressure on the intima.[8,9]

There are two classifications of AD: De Bakey and Stanford. Both are based on the origin of the intimal tear and the extent of aortic involvement. The Stanford classification classifies dissection into two types (A and B) and is currently the most often used system as it reflects the established approach to treatment.

Type A dissection involves the ascending aorta regardless of the origin of the intimal tear or the extent of the dissection (Fig 1). It may be complicated by aortic rupture (Fig 2), aortic regurgitation, acute myocardial infarction, cardiac tamponade or compromise to the arch branches (Fig 3). Untreated, type A dissection has a mortality rate of 20% at 24 h and 50% within 1 month. Surgical repair of the ascending aorta with concurrent repair of the aortic arch, aortic root, or aortic valve is currently the treatment of choice.[10] Although at an experimental stage, the advent of endovascular repair is set to play an important role in the future with its high technical success rate and low morbidity and mortality. The aim of endovascular repair is revascularization of vascular beds suffering from malperfusion syndrome and therapeutic options include branch vessel stenting, aortic fenestration, and aortic endograft placement.[11] Type B dissection affects only the descending aorta and is generally managed conservatively with antihypertensive medication (Fig 4).[10] It may be complicated by dilatation (Fig 5) and rupture of the false lumen, end-organ ischaemia (Fig 6) and progression to type A dissection.[6] Complicated type B dissection can be managed by endovascular repair. The aim of endovascular repair is to exclude the primary entry tear to facilitate false lumen thrombosis and regression. Deliberate fenestrations are occasionally performed to equalize pressure and flow in both false and true channels to resolve end organ ischaemia.

The roles of CT in AD are to identify (1) the entry point, presence of intimal flap, and re-entry point; (2) signs of rupture; (3) extension into the aortic valve; (4) presence and location of true and false lumen; (5) end-organ perfusion; and (6) dilatation of the false lumen (Figs 1–6).[8]

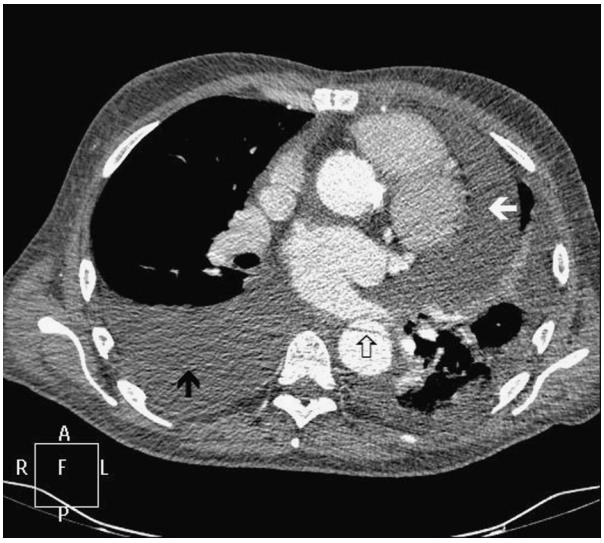

Figure 2 Axial Image of an aortic rupture. This patient presented with a type A dissection (unfilled arrow denoting the intimal flap). There is a large pericardial effusion (white arrow) and a moderate haemothorax (black arrow).

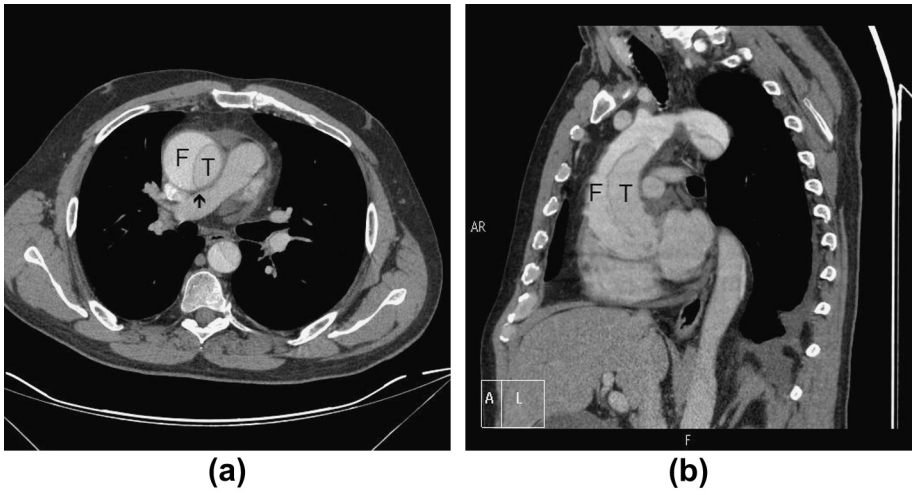

Figure 1 Axial and sagittal images of a Stanford type A AD. The ascending aorta is involved. The images showed the presence of true (T) and false (F) lumens. The black arrow denotes the "beak" sign, an angled formed by the outer wall of the false lumen and the intimal flap.