Aortic root dissection

Another cause of early systolic closure of the aortic valve

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SUMMARY An early systolic closure of the aortic valve was recorded in the echocardiogram in two patients with aortic root dissection. This sign, initially described in discrete subaortic stenosis and occasionally observed in mitral regurgitation and interventricular septal defect, has not so far been described in dissecting aneurysm of the aorta.

After the first echocardiographic description of an aortic dissection by Millward *et al.*,¹ several reports on the echocardiographic criteria²⁻⁴ have been published.

Recently, we have studied two patients with dissecting aneurysm of the aorta which showed an echocardiographic peculiarity not so far reported: premature systolic closure of the aortic valve.

Case reports

CASE 1

A 64-year-old white woman, with a previous history of hypertension for the past nine years, was admitted to the coronary care unit because of retrosternal pain radiating toward the neck, accompanied by sweating, nausea, and vomiting, which had lasted for three hours at home. She was taken to hospital because of syncope. On admission to the coronary care unit the systolic blood pressure was 80 mmHg and the heart rate was 75 per minute. All peripheral pulses were feeble. In the aortic region a 2/6 ejection systolic murmur was heard. There was evidence of right ventricular failure and the central venous pressure was 21 cm H₂O. The electrocardiogram showed sinus rhythm at 75 per minute and it was unremarkable except for a diffusely abnormal repolarisation, with a straight ST segment and flat T wave, mainly in the lateral and inferior wall. The chest x-ray film showed a moderate cardiomegaly and a prominent dilatation of the ascending aorta. Under fluoroscopy the cardiac silhouette was hypokinetic. The echocardiogram disclosed an external diameter of the aorta of 72 mm; in the anterior wall two well-

defined and parallel echoes, separated by a distance of 22 mm, were recorded; and in the posterior wall a similar double contour, 22 mm wide, was recorded. The echoes of the aortic leaflets showed a poor systolic opening followed by an early closure motion and reopening with slight fluttering. The left atrium measured 10 mm at this level (Fig. 1). Pericardial effusion was present.

Aortography confirmed the diagnosis of dissecting aneurysm and excluded the presence of aortic regurgitation. The patient was immediately transferred to theatre but died on her way to the operating room.

Necropsy

There was a dissecting aneurysm of the ascending aorta which ruptured into the pericardium and the pleura (haemothorax of 3000 ml). The histological examination showed cystic medial necrosis and moderate atheromatosis.

CASE 2

A 49-year-old white man, with a known history of arterial hypertension of 20 years' duration, was admitted to the coronary care unit because of oppressive retrosternal pain radiating to the epigastrium accompanied by heavy sweating. On admission, the blood pressure was 180/80 mmHg and the heart rate 70 per minute. The carotid pulse was brisk and wide, and the rest of arterial pulses were normal. In the aortic area, a 2/6 ejection systolic murmur and a 2/6 decrescendo high pitched diastolic murmur were heard. The electrocardiogram showed sinus rhythm at 70 beats per minute and there was evidence of left ventricular hypertrophy. The x-ray film of the thorax showed a

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dilated ascending aorta. The echocardiogram showed absence of fluid in the pericardium. The external diameter of the aorta was 47 mm at the aortic mitral transition level, increasing progressively up to 56 mm when the transducer was directed slightly upwards and inwards. In the posterior wall, two parallel echoes separated by a width of 14 mm were recorded. The anterior aortic leaflet, following a normal systolic opening, showed an early backwards motion, remaining in an intermediate position during the rest of the systole (Fig. 2). The anterior mitral leaflet showed slight diastolic fluttering.

The patient was treated with nitroprusside and propranolol and aortography was performed the day after his admission. A false lumen starting at the aortic root level and continuing towards the descending aorta was found. The aortic regurgitation was moderately severe. The patient was operated upon and a prosthetic aortic valve and Dacron aortic graft were implanted. The patient died suddenly 30 minutes after operation.

Discussion

The echocardiographic diagnosis of aortic root dissection is based on the criteria reported by Nanda *et al.*²: (1) enlargement of the external diameter of the aortic root (42 mm or more); (2) widening of the anterior and posterior aortic wall above 16 and

Fig. 1 Case 1. (A) Valvar aortic echoes separate at the beginning of systole and join again immediately afterwards (vertical arrows); they are followed by a slight reopening during the rest of systole with a slight fluttering. (B) The echoes of the intima are recorded (small horizontal arrows) at 22 mm from the external layer of the aorta (large horizontal arrows) anteriorly and posteriorly.

Fig. 2 Case 2. The characteristics of the aortic root and the leaflets vary according to the transducer orientation. (A) The external diameter of the aorta is 47 mm and a double contour (horizontal arrows), separated by 14 mm from the posterior wall, is seen. (B) The external diameter of the aorta is 53 mm, and opening of the anterior aortic leaflet followed by an early systolic partial closure (vertical arrows) and slight fluttering during the ^f systole are shown.

10 mm, respectively; (3) maintenance of parallelism between the separated margins of the walls with normal aortic leaflets; (4) 8 mm or more variation in the width of the aortic wall, with only small changes in the direction of the transducer. For a definite diagnosis of dissecting aneurysm of the aorta several other conditions have to be considered. Aortic dilatation,^{2 4 5} aortic calcification,⁶ and pericardial effusion in the transverse sinus² have to be ruled out. On other occasions, echoes of the tricuspid ring, ventricular septum, right atrial appendage or pulmonary artery⁷ can be mistaken for a dissection of the anterior aortic wall. Likewise, false negative echocardiographic recordings of a dissecting aneurysm involving the lateral wall of the ascending aorta are possible, since this wall is not reached by the ultrasonic beam.

Our two patients showed an early systolic closure of the aortic valve in addition to the typical echocardiographic signs of dissecting aneurysm of the aorta. The early systolic closure of the aortic leaflets was described by Davis *et al.*⁸ as a pertinent finding of discrete subaortic stenosis, though later it was also seen in some cases of mitral regurgitation and intraventricular septal defect.⁹ Felner and Schlant,¹⁰ in a case of aortic root dissection, interpreted as a flap of the intima an echocardiographic finding very similar to the one found in our patients. Kasper *et al.*,¹¹ with a suprasternal echocardiographic recording, also found this sort of motion of the intima in another case of aortic root dissection. Nevertheless, in our echocardiographic recordings it is clear that the movement of early systolic closure is produced by the aortic leaflets and not by the intima, which was clearly recorded separately from them. This early systolic closure of the aortic leaflets could be related to the special haemodynamic conditions created by dissection of the proximal aorta during the first phase of systole: the initial bolus of the blood-stream produced by ventricular contraction would open the leaflets, but the areas of low pressure around this initial jet in a dilated aorta would produce a distortion of the stream prompting an early systolic valvar closure. Though

we certainly feel that this is not a pathognomonic sign of this entity we do think it is important to keep it in mind as a complementary finding in the differential diagnosis of aortic root dissection.

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