Endomyocardial fibrosis *Problems in differential diagnosis*

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The clinical and angiographic findings in 5 consecutive patients with congestive cardiac failure are presented to illustrate the pitfalls in the clinical diagnosis of endomyocardial fibrosis. In one patient the clinical diagnosis was confirmed at angiography while another patient who had angiographic evidence of early right ventricular endomyocardial fibrosis was diagnosed clinically as mitral stenosis. In 2 patients the clinical diagnosis was erroneous, there being no evidence of endomyocardial fibrosis on angiography. The fifth patient, who had angiographic evidence of idiopathic cardiomegaly, was diagnosed clinically as either idiopathic cardiomegaly or advanced left ventricular endomyocardial fibrosis. In tropical countries, where endomyocardial fibrosis, rheumatic heart disease, and idiopathic cardiomegaly are common, accurate clinical diagnosis of endomyocardial fibrosis is often difficult and angiographic studies are essential for confirmation.

The clinical, pathological, haemodynamic, and radiological features of endomyocardial fibrosis are well known (Davies, 1948; Ball, Williams, and Davies, 1954; Shillingford and Somers, 1961; Parry and Abrahams, 1963; World Health Organization, 1965; Cockshott, Saric, and Ikeme, 1967; Somers *et al.*, 1968 a, b) but the aetiology is not. While an accurate bedside diagnosis is sometimes possible in advanced right ventricular or biventricular disease (Abrahams, 1962; World Health Organization, 1965; Fowler and Somers, 1968), difficulties may arise in mild to moderate cases where the clinical features of mitral or tricuspid regurgitation may be confused with rheumatic heart disease and idiopathic cardiomegaly (congestive cardiomegaly of obscure origin). We report here the clinical and angiographic findings in 5 consecutive cases of endomyocardial fibrosis to show the difficulties that may frustrate a bedside diagnosis.

Patients and methods

The patients were referred to the cardiac clinic of University College Hospital, Ibadan, in congestive cardiac failure. After physical examination and preliminary investigations cardiac catheterization was done by the usual technique. Pressures were measured by a Statham pressure transducer Model P23 DB and re-

corded by an Electronics for Medicine Multiple Channel Recorder. A point midway between the plane of the patient's sternum and the plane of the catheter table was taken as the zero pressure baseline. Angiograms were taken with an Elema-Schonander AOT rapid film changer.

Case reports

Case 1

A boy of 13 years was first seen in June 1974 with a year's history of exertional dyspnoea, cough, and progressive swelling of the face and abdomen. He had had no previous illness. He had bilateral proptosis and was severely dyspnoeic. His jugular veins were engorged and, though the height of the jugular venous pressure could not be assessed accurately, a giant 'v' wave with a steep 'y' descent were discernible. His pulse was of low volume and he had atrial fibrillation with a ventricular rate of about 120/min. His blood pressure was 90/60 mmHg (12.0/8.0 kPa) and there was obvious pulsus paradoxus. No murmur was heard but an early 3rd sound was audible at the apex and also at the left sternal edge. His pulmonary closure sound (P2) was not loud. He had bilateral rhonchi but no crepitations in the chest. His liver was enlarged to 5 cm below the ribs and showed systolic pulsation. Gross ascites was present though he had only minimal ankle oedema.

A diagnosis of right ventricular endomyocardial fibrosis with pericardial effusion was made. An electrocardiogram showed low voltage QRS complexes, atrial fibrillation, and right ventricular preponderance. Chest x-ray examination showed oligemic lung fields and an enor-

Received 8 August 1975.

mously enlarged heart, with a silhouette indicating pericardial effusion. Laboratory investigations were normal except for an eosinophilia of 13 per cent out of a total white count of 7400/mm³ and a low serum albumin of (2.3 g/100 ml).

Two pericardial taps were performed at different times during his stay in hospital and a total of 1100 ml of straw-coloured fluid was removed from the pericardial cavity. Management consisted of bed rest, digoxin, and diuretics. When his condition improved, right heart catheterization was performed and his intracardiac

A

B

FIG. 1A and B. Case 1. Right ventricular angiogram, (A) during systole and (B) diastole, showing small right ventricular chamber with dilated contractile outflow portion and gross reflux into aneurysmal right atrium.

pressures are summarized in the Table. The ventricular tracings showed the typical 'dip-and-plateau' configuration. Angiocardiography showed an enormously enlarged right atrium and severe tricuspid regurgitation. The right ventricle was diminutive in size and had a dilated contractile outflow tract (Fig. 1A and B).

At the time of discharge from hospital he had no ascites or peripheral oedema. His jugular venous pressure was still raised with a prominent 'v' wave.

Case 2

A 20-year-old student was initially admitted to the hospital with congestive cardiac failure in 1973. He had previously been well. He had a right inguinal herniorrhaphy in 1971, when no cardiac disease was found. He was in atrial fibrillation, his pulse was of low volume, and his jugular venous pressure was raised, with a giant 'v' wave. An opening snap followed by a mid-diastolic murmur was heard between the apex and the left sternal edge. The murmur was not constant, it tended to vary, but became easily heard when he was not in heart failure. He also had minimal bilateral ankle oedema, an enlarged pulsatile liver, but no ascites.

He improved considerably on bed rest, digoxin, and diuretics, and was discharged for follow-up as an outpatient. In November 1974 he was readmitted in congestive cardiac failure, but his physical signs had not changed significantly. His electrocardiogram showed atrial fibrillation and inverted T waves in leads II, III, aVF, V1, V2, V3, and V4. There was counterclockwise rotation over the precordial leads. Chest x-ray examination showed an enlarged heart with a prominent pulmonary conus. All other laboratory investigations were normal and he had no eosinophilia. A diagnosis of severe mitral stenosis with pulmonary hypertension and functional tricuspid regurgitation was made.

At cardiac catheterization the right ventricle was difficult to catheterize and the pulmonary artery was entered with much difficulty. The patient's intracardiac pressure readings are summarized in the Table. The right ventricular trace showed the typical 'square-root' configuration. The right ventricular angiogram (Fig. 2) showed moderate tricuspid regurgitation with a dilated right atrium. The outflow tract of the right ventricle was dilated and the ventricle itself was shrunken in its main portion. The left ventricular angiogram was normal and there was no evidence of aortic regurgitation on aortic root injection. There was no gradient across the mitral and tricuspid valves. A diagnosis of right ventricular endomyocardial fibrosis was therefore made.

Case 3

A 17-year-old boy was admitted in November 1974 with a three months' history of increasing exertional dyspnoea and swelling of the legs and abdomen. There was no preceding illness. He was in severe congestive failure, his fingers were clubbed, and he was mildly cyanosed. His pulse was of low volume, his blood pressure was 100/60 mmHg (13.3/8.0 kPa), and he was in atrial fibrillation with a pulse rate of about 100/min. The apex beat was displaced but quiet and his jugular venous pressure was raised to the angle of the jaw, with a

FIG. 2 Case 2. Right ventricular angiogram showing tricuspid regurgitation, dilated outflow tract, and shrunk right ventricular chamber. Right atrium is also dilated.

prominent 'v' wave. He had a pansystolic murmur radiating to the axilla together with a loud early third sound. No murmur of tricuspid regurgitation was heard. His chest was clear clinically and his liver was enlarged and pulsatile. An electrocardiogram showed low voltage QRS complexes and atrial fibrillation. Chest x-ray examination showed cardiac enlargement which was predominantly right sided but with left atrial enlargement on the lateral film done with barium swallow. The lung fields were clear. A blood film did not show eosinophilia.

A clinical diagnosis of biventricular endomyocardial fibrosis with mitral and tricuspid regurgitation was made. The patient's intracardiac pressures are summarized in the Table. The right ventricular angiogram showed severe tricuspid regurgitation, a dilated right atrium, and a normal-sized right ventricle. A left ventricular angiogram showed a slightly enlarged left ventricle which contracted well. There was, however, severe mitral regurgitation and a small apical aneurysm (Fig. 3). There was no evidence of endomyocardial fibrosis on angiography. The findings suggested primary lesions of the mitral and tricuspid valves.

Case 4

A 45-year-old housewife was admitted with a year's history of exertional dyspnoea and cough. At about the same time she noticed that her abdomen and her ankles were progressively swelling and that she had a pulsation at the side of her neck. She was in severe congestive cardiac failure, her pulse was 80/min, regular, but of low volume. Her blood pressure was 95/65 mmHg (12.6/8.6 kPa). Her apex beat was in the 6th intercostal space at the anterior axillary line and was quiet. There was, however, a right ventricular heave. She had a pansystolic murmur at the apex, louder in expiration and radiating to the axilla. Another pansystolic murmur, louder in inspira-

tion, was heard at the lower left sternal edge. A loud, early third sound was audible at the apex and the P2 was loud. Her chest was clear but she had an enlarged liver with a systolic pulsation. There was no ankle oedema but she had ascites. An electrocardiogram showed sinus rhythm, left atrial enlargement, left axis deviation, and T wave inversion in leads V4 to V6 but no left ventricular hypertrophy. Chest x-ray examination showed a grossly enlarged heart. Left atrial enlargement was confirmed on the lateral chest film with barium in the oesophagus. Other laboratory investigations were normal except for an eosinophilia of 10 per cent out of a total white blood cell count of 7400.

Biventricular endomyocardial fibrosis was thought to be the most probable diagnosis. The intracardiac pressures at catheterization are summarized in the Table. The right and the left ventricular pressure tracings showed the 'dip-and-plateau' configuration, but no evidence of endomyocardial fibrosis was found at angiography. There was gross mitral and tricuspid regurgitation and all the chambers of the heart were dilated. The left ventricle showed very poor contraction.

Case 5

A 35-year-old housewife was admitted with a 9-months' history of exertional dyspnoea and progressive swelling

FIG. 3 Case 3. Left ventricular angiogram during diastole showing slightly dilated left ventricle with severe mitral regurgitation. Ventricle contracted well during systole. Note small aneurysm (see arrow) at apex of heart.

of the abdomen and feet. The patient also complained of swelling of the face which usually receded as the day advanced. She was in severe congestive cardiac failure with the jugular venous pressure raised to the angle of the jaw, a blood pressure of 90/60 mmHg (12.0/8.0 kPa), massive ascites, sacral oedema, and gross oedema of both legs. Her extremities were cold and her pulse rate was 120/min, regular, but of very poor volume. The apex beat could not be located but there was a right ventricular heave. On auscultation she had no murmurs but a loud third sound was heard at the fifth left intercostal space. Her P2 was loud, there were crepitations at both lung bases, and the liver was enlarged and tender. An electrocardiogram showed left atrial enlargement and T wave inversions in leads II, III, aVF, V1 to V6. Chest x-ray examination showed a grossly enlarged heart and a right pleural effusion. She had an eosinophilia of 7 per cent out of a total white count of 5500/mm³. All other laboratory investigations were normal.

She was thought to be suffering from advanced left ventricular endomyocardial fibrosis though idiopathic cardiomegaly could not be excluded. A left heart study showed a low systolic left ventricular pressure with raised end-diastolic pressure (Table). An angiogram showed a poorly contractile ventricle with severe mitral regurgitation. There was no evidence of endomyocardial fibrosis.

Discussion

The clinical presentation of endomyocardial fibrosis depends on the chamber involved and the severity of the disease. Disease of both ventricles, with mitral and tricuspid regurgitation, occurs more often than disease of only one ventricle (Somers and Fowler, 1968). Right-sided endomyocardial fibrosis presents with three obvious features: a very high venous pressure with a dominant systolic wave indicative of tricuspid regurgitation, massive ascites, and minimal or no ankle oedema (Abrahams, 1962). Left-sided endomyocardial fibrosis presents with mitral regurgitation and features of left ventricular failure. Pulmonary oedema occurs in the early stages, and then later, as the pulmonary vascular resistance rises, signs of pulmonary hyper-

tension are found (Somers and Fowler 1968).

The major effect of endomyocardial fibrosis of either ventricle is to restrict the filling and output of the ventricle (Somers and Fowler, 1968). The haemodynamic effect of this restriction is, however, seen only in advanced cases. Cardiac failure supervenes ultimately, often in the absence of striking cardiac enlargement and with trivial or no murmurs (Somers and Fowler, 1968). In advanced cases the disease may present with severe heart failure without any murmurs but with a loud third heart sound. The latter presentation is seen commonly in right ventricular endomyocardial fibrosis (Abrahams, 1962) and is illustrated by Case 1. Case 2, by contrast, had less severe disease. The finding of a mid-diastolic murmur thought to be the result of mitral stenosis in this patient was misleading and was most probably a flow murmur across the tricuspid valve. This case is similar to that described by Faruque (1963) in a report on endomyocardial fibrosis in adults in Britain. The patient had murmurs suggestive of mitral stenosis but at necropsy was found to have severe biventricular endomyocardial fibrosis.

Cases 3 and 4 show that the clinical picture of biventricular endomyocardial fibrosis may be mimicked by other causes of mitral and tricuspid regurgitation. The angiographic pictures of Case 3 suggested primary diseases of the mitral and the tricuspid valves. Though a type 3 endomyocardial fibrosis affecting only the valvular region (Shaper, Hutt, and Coles, 1968) may produce this picture, rheumatic mitral and tricuspid regurgitation has to be excluded. Finger clubbing and cyanosis further confused the clinical picture as these signs are not uncommon in endomyocardial fibrosis (Abrahams, 1962; Somers *et al.*, 1968b). Though Case 3 was afebrile throughout admission, subsequent blood cultures persistently yielded *Staphylococcus albus* and he was treated for infective endocarditis.

Cases 4 and 5 highlight the difficulty in dis-

TABLE Intracardiac pressures (mmHg) recorded in all 5 patients

Case No.	Right atrium	Right ventricle	Pulm. artery	Pulm. capill. wedge	Left ventricle	Aorta
1	v 16	30/14	34/24 Mean 28	—	120/10	—
2	v 18 Mean 14	20/14	20/16 Mean 18	11	120/10	110/60
3	v 20 Mean 16	40/16	40/23	28	140/32	135/82
4	v 14 Mean 10	40/16	40/25	45	120/50	125/80
5	—	—	—	—	95/30	100/65

Conversion factor from Traditional to SI units: 1 mmHg $\approx$ 0.133 kPa.

tinguishing endomyocardial fibrosis from idiopathic cardiomegaly, also commonly seen in the tropics. Their clinical signs are frequently similar, no age group is exempt from either disease (Ball *et al.*, 1954; Cockshott *et al.*, 1967; World Health Organization, 1965; Antia, 1968), and the finding of a third sound is common to both diseases and is not a very helpful discriminatory sign. The absence of a murmur of mitral or tricuspid regurgitation can occur in advanced stages of both diseases and is the result of poor myocardial function which is not forceful enough to generate audible vibrations.

Cardiomegaly on chest *x*-ray examination is not specific to endomyocardial fibrosis nor is the presence of a large cardiac contour on plain film suggestive of a pericardial collection pathognomonic. Tuberculous pericarditis is prevalent in many areas where endomyocardial fibrosis occurs and both diseases may present as pericardial effusion (Abrahams, 1962). Calcification in the apical endocardium is a very useful diagnostic sign but calcified ventricular aneurysm, common in Nigeria, must be considered as a differential diagnosis (Ive *et al.*, 1967).

The electrocardiogram in endomyocardial fibrosis has no specific diagnostic pattern (Williams and Somers, 1960) and is not very useful at the bedside. The electrocardiographic finding of right ventricular hypertrophy in Case 1 is difficult to explain since the right ventricle was almost non-existent on angiography.

The 'dip-and-plateau' configuration on ventricular trace, which has been used by some as the sole criterion for diagnosis during cardiac catheterization (Ive *et al.*, 1967), is not confined only to patients with endomyocardial fibrosis. It has been reported in amyloidosis (Hetzel, Wood, and Burchell, 1953; Gunnar *et al.*, 1955), in diffuse myocardial fibrosis (Burwell and Robin, 1954), and in cardiomyopathy (Goodwin *et al.*, 1961). It was first reported by Bloomfield *et al.* (1946) in patients with either right ventricular failure with tricuspid regurgitation or constrictive pericarditis, and is evidently a non-specific pattern of little use for diagnostic purposes.

Right ventricular endomyocardial fibrosis also has to be distinguished from constrictive pericarditis. The venous pressures in both diseases are high, and ascites with minimal or no peripheral oedema is common. Auscultation may give similar findings and the electrocardiograms may be similar (Abrahams, 1962; World Health Organization, 1965). The presence of murmurs may, however, suggest the diagnosis of endomyocardial fibrosis, and obvious pericardial calcification confirms the diagnosis of constrictive pericarditis. Left ventricular endomyocardial fibrosis also has to

be distinguished from other causes of mitral regurgitation.

Angiographic study is the most useful procedure in diagnosing endomyocardial fibrosis and it can differentiate rheumatic mitral regurgitation from left ventricular endomyocardial fibrosis (Cockshott, 1965; Cockshott *et al.*, 1967). The angiographic appearances of right ventricular endomyocardial fibrosis are also pathognomonic and easily distinguished from other causes of tricuspid regurgitation and constrictive pericarditis—as Cases 3 and 4 show. Selective angiocardigraphy, however, is not infallible, since it is useful only when the disease is sufficiently advanced to cause visible deformity in one or both ventricles (Somers and Fowler, 1968).

The diagnosis of endomyocardial fibrosis is therefore fraught with many pitfalls, and angiographic studies are needed in most cases to make a definite diagnosis. Without them investigations may yield misleading results. Definite diagnosis at the present seems to depend upon sophisticated investigations not available in every centre.

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