Familial atrial standstill caused by amyloidosis

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SUMMARY Three of nine siblings were affected by atrial standstill. Clinical, electrophysiological, and histological findings in two of these cases were studied. Electrophysiological studies showed persistent atrial standstill in one and partial atrial standstill in the other. Biopsy specimens of the right atria showed amyloid deposits, but specimens of the right ventricles and skin did not. Neither patient had peripheral neuropathy, gastrointestinal disorder, or renal dysfunction. Familial atrial standstill is usually associated with peripheral neuropathy.

In the two cases studied amyloid deposition mainly affected the atrium, rather than the ventricles or other organs, and caused atrial standstill.

Amyloidosis is a cause of atrial standstill.¹⁻³ The most common clinical feature of cardiac amyloidosis is rapidly progressive heart failure^{4,5}; familial amyloidosis is usually also associated with peripheral neuropathy.⁶ We report on three cases of familial atrial standstill caused by amyloidosis in which there were no cardiac symptoms or peripheral neuropathy.

Case reports

CASE 1

A 36 year old man had a sudden onset of left hemiparesis on 29 October 1984. Cerebral infarction was diagnosed and bradycardia and cardiomegaly were found. On 29 November 1984 he was admitted to our hospital for further evaluation. On admission his pulse was regular at 48 beats/min and blood pressure was 140/80 mm Hg. A grade 2/6 ejection systolic murmur was heard along the left sternal border. The second sound was split widely and the width of splitting increased during the inspiratory phase. Neurological examination showed left hemiparesis and a mild speech disturbance.

An electrocardiogram showed a ventricular rate of 39 beats/min with complete right bundle branch block and a QRS width of 0.12 s. No P waves were found in any of the leads. Intravenous atropine sulphate (1.0 mg) and exercise increased the ventricular rate to 64 and 118 beats/min, respectively, but P waves remained absent.

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Chest x rays showed cardiomegaly with a cardio-thoracic ratio of 0.6. The echocardiogram showed dilatation of the right atrium with no A waves on the anterior mitral leaflet, but the wall thickness and contraction of the left ventricle were normal.

Cardiac catheterisation showed no a waves on the right atrial pressure curve. An intracardiac electrogram from the right atrium showed no A waves, fibrillary waves, or any other electrical activity. No extrasystoles could be induced by right atrial stimulation even at an output of 10 V. On the other hand, intrinsic ventricular contractions had a R wave amplitude of 14 mV, and artificial stimulation produced right ventricular activation at 0.3 V.

Biopsy samples from the right atrial wall showed amyloid deposits and considerable muscle loss with replacement fibrosis. But samples from the right ventricle, skin, and rectum showed no evidence of amyloid deposition.

The patient had a permanent pacemaker implanted and has been treated with oral anticoagulants to prevent systemic embolism. He continues to do well with regular visits to our outpatient clinic.

CASE 2

The 34 year old brother of case 1 was found to have bradycardia and cardiomegaly at the age of 27. On 30 November 1983 he was admitted to hospital with lower abdominal pain of sudden onset which was accompanied by an increase in the serum concentrations of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, and lactate dehydrogenase. Lower abdominal pain disappeared in a few days and enzyme concentrations returned to normal within two weeks, but the cause of lower abdominal pain was

Figure Electrocardiogram of case 1 showing absence of P waves and slow regular atrioventricular junctional rhythms in all leads.

never determined. He was admitted to our hospital for further evaluation on 31 March 1984.

On admission his pulse was regular at 35 beats/min and blood pressure was 140/80 mm Hg. There was no peripheral oedema and the liver and spleen were not palpable. A grade 2/6 ejection systolic murmur was heard along the left sternal border. The second sound was widely split and splitting increased during the inspiratory phase. The neurological examination was normal.

An electrocardiogram showed a ventricular rate of 44 beats/min with a QRS width of 0.08 s. No P waves were found in any leads. By contrast, an electrocardiogram obtained seven years earlier showed occasional low voltage P waves (≈ 0.1 mV) which were conducted to the ventricles, and one recorded a year earlier showed low voltage atrial flutter waves (≈ 0.05 mV) with a cycle length of 180 ms on leads II, III, and aVF accompanied by a ventricular rate of 40 beats/min. Intravenous atropine sulphate (1.0 mg) and exercise at our clinic increased the ventricular rate to 72 and 120 beats/min respectively, but no P waves appeared. Chest x rays showed cardiomegaly

with a cardiothoracic ratio of 0.64.

An echocardiogram showed dilatation of the right atrium, no A waves on the anterior mitral leaflet, and normal thickness and contraction of the ventricular wall (as in case 1).

Cardiac catheterisation showed no A waves on the right atrial pressure curve. A right atrial intracardiac electrogram, however, showed very low voltage flutter waves with a cycle length of 175 ms. A simultaneous surface electrocardiogram did not show flutter waves in any leads. Atrial capture could not be achieved with stimuli up to 10 V. On the other hand, the right ventricle showed normal response to stimulation at 0.5 V and R wave amplitude was normal.

Biopsy specimens of the right atrium, right ventricle, and skin were obtained for pathological examination. Only the right atrium contained amyloid deposits (as in case 1). Specimens from the right ventricle and skin were normal.

This patient also had a permanent pacemaker implanted because of considerable bradycardia. He remains well.

CASE 3

The 47 year old brother of the two previous patients was found to have bradycardia and cardiomegaly (cardiothoracic ratio 0.66) at another hospital when he was 37. An electrophysiological study was performed at the time, and a right atrial intracardiac electrogram showed no A waves. The right ventricle responded to stimulation at 0.6 V and R wave amplitude was 5.2 mV. Atrial standstill was diagnosed. A biopsy specimen of the right ventricle showed no abnormalities.

This patient also had a permanent pacemaker implanted for considerable bradycardia at the age of 42. When he was 46 pretibial oedema developed and chest x rays showed an increase of cardiothoracic ratio to 0.75. After a one month stay in hospital the pretibial oedema disappeared and his cardiothoracic ratio fell to 0.69. He is being followed at another outpatient clinic and his condition has not deteriorated.

Six other siblings of the above patients (five women and one man) have not been examined.

Discussion

Although familial atrial standstill has been reported,⁷⁻⁹ its aetiology was confirmed only by Allensworth *et al* and Harrison and Derric. Allensworth *et al* studied three siblings with atrial standstill and showed right atrial amyloid deposits in one of them.¹ Harrison and Derric reported two siblings with almost identical clinical and electrocardiographic features, and showed right atrial amyloid deposition in one.² There is also a report by Williams *et al* on familial atrial standstill that reports considerable muscle loss in only the right atrial wall with replacement fibrosis and no evidence of amyloid deposition.¹⁰

On the other hand, many cases of familial amyloidosis have been reported. In most of them the characteristic clinical findings are associated with peripheral neuropathy,^{6,11} but cardiac failure is also found,¹² though less often. There are also many reports of cardiac amyloidosis.^{4,5} The most common clinical feature is congestive heart failure, which is often refractory to treatment. Although electrocardiograms in cases of cardiac amyloidosis and familial amyloidosis frequently show sinus node dysfunction, abnormalities of atrioventricular conduction and other arrhythmias,^{13,14} atrial standstill is rarely seen.

Familial atrial standstill caused by amyloidosis was diagnosed in our three cases. None of them had peripheral neuropathy, rapidly progressive cardiac failure, gastrointestinal disorder, or renal dysfunc-

tion. The clinical, electrophysiological, and pathological findings of our cases differ from those of familial amyloidosis or cardiac amyloidosis reported earlier. Although the cases of Allensworth and Harrison seem to resemble our cases clinically, electrophysiologically, and pathologically, they did not have the same electrophysiological and pathological findings in the ventricle. Frederiksen *et al* stated that in familial amyloidosis, "Case reports show a high degree of uniformity within each family, whereas the symptoms may vary considerably from one family to another."¹² We agree, and we believe that the most important finding in our series was that amyloid deposition mainly affected the atrium rather than the ventricle or other organs and caused atrial standstill.

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