CASE REPORT

Trifascicular block progressing to complete AV block on exercise: a rare presentation demonstrating the usefulness of exercise testing

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SUMMARY

A 41-year-old man presented with dyspnoea and giddiness on exertion for the last 1 month. A resting ECG during showed trifascicular block with complete right bundle branch block, left anterior fascicular block and a prolonged PR interval of >0.24 s. His echocardiography showed no evidence of wall motion abnormality. He was subjected to a treadmill test for exercise-induced ischaemia, which showed complete atrioventricular (AV) block during first stage of Bruce protocol. His symptoms of dyspnoea and giddiness were also reproduced. The test was terminated and ECG returned to trifascicular block, similar to that at his baseline ECG during recovery. Coronary angiogram (CAG) was performed to rule out any ischaemic cause for this exercise-induced AV block, which was normal. In view of his reproducible symptoms and demonstration of complete AV block on exercise, a dual-chamber pacemaker (DDD) was implanted. His symptoms disappeared and he remained asymptomatic on follow-up.

BACKGROUND

Resting ECG may not reveal underlying conduction disturbance, as was seen in the exercise-induced atrioventricular (AV) block in this case, in many patients. Exercise-induced AV block has clinical implications such that it may produce symptoms of dyspnoea, giddiness and syncope or presyncope. Exercise testing is helpful in unmasking exercise-induced AV block in patients with normal resting ECG or with some conduction disorder at baseline, as in our case. Exercise-induced AV block is rare in patients with normal 1:1 AV conduction at rest and not all exercise-induced AV blocks have an ischaemic aetiology. They can be due to degeneration of the conduction system, which is probably the most likely aetiology in this case, and these patients may do well with implantation of a permanent pacemaker.

CASE PRESENTATION

A 41-year-old man presented with class III dyspnoea on exertion for the past 1 month. He also had a history of giddiness on exertion. He did not give any history of orthopnoea or paroxysmal nocturnal dyspnoea.

His physical examination was normal with resting blood pressure in right arm of 130/80 mm Hg with heart rate of 83/min at rest. His systemic examination was also normal.

There was no significant medical history. There was no history of hypertension, diabetes mellitus or

bronchial asthma. The patient did not give any history of smoking. His medical examinations with us showed normal resting ECG, echocardiography and a normal exercise test.

INVESTIGATIONS

The patient's resting ECG this visit showed trifascicular block as it had complete right bundle branch block (RBBB) with left anterior fascicular block (LAFB) and a prolonged PR interval of >0.24 s, with 1:1 AV conduction and heart rate of 83/min (figure 1). Echocardiography was also normal with normal left ventricular (LV) systolic function and no wall motion abnormality.

In view of the patient's symptoms of dyspnoea and giddiness on exertion, an exercise test was performed, which revealed progression of his trifascicular block to complete AV block during stage 1 of Bruce protocol with drop in heart rate to 51/min from a baseline of 83/min (figures 2 and 3). He also developed symptoms of dyspnoea and giddiness during this time. Owing to his symptoms and complete AV block in the first stage, the test was terminated. His ECG during recovery after 1 min returned to his baseline trifascicular block with increase in heart rate to 85/min and his symptoms disappeared (figure 4). To rule out ischaemia as the cause of his symptoms and exercise-induced complete AV block, coronary angiogram was performed, which showed no evidence of flow-limiting stenosis in any of the three coronary arteries. Aetiological work up for causes of complete heart block such as infiltrative, infective, ischaemic, endocrinal, rheumatological and structural ruled them out. The possibility of a generative progressive cardiac conduction defect, such as Lenegre's or Lev's disease, as the aetiology of complete heart block in this case, was considered.

DIFFERENTIAL DIAGNOSIS

Trifascicular block progressing to exercise-induced complete AV block. The cause of exercise-induced complete AV block in this case can be due to:

1. Underlying coronary artery disease producing ischaemia of the conduction system on exercise.
2. Autonomic imbalance.
3. Degenerative disorder of the conduction system.

TREATMENT

Although the site of the block was confirmed to be infranodal, the patient was advised to undergo

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Figure 1 Baseline ECG showing complete right bundle branch block with left anterior fascicular block and a prolonged PR interval of >0.24 s (trifascicular block), with 1:1 atrioventricular conduction.

electrophysiological study for documentation, which he refused. In view of his symptoms and complete AV block on exercise, we decided to implant a DDD pacemaker in him.

OUTCOME AND FOLLOW-UP

After implantation of DDD pacemaker in our patient his symptoms resolved and he was asymptomatic during his follow-up.

DISCUSSION

The reported incidence of exercise-induced AV block in patients with normal 1:1 AV conduction at rest is 0.45%.¹ This type of AV block can lead to dyspnoea and syncope on exertion.² Most cases of exercise-induced AV block are infranodal, as in this case, but an electrophysiological study is required to locate the exact anatomic site of the block. Some cases can have an infranodal block, which can be induced by myocardial ischaemia. Two mechanisms are described for this kind of AV block. First, normally during exercise, conduction velocity increases as vagal tone and refractory period of AV node decreases with exercise. But the His-Purkinje system is not influenced by the autonomic nervous system, and so the refractory period of the His-Purkinje

system is not significantly decreased with exercise. In patients with underlying conduction system abnormality, this difference between the refractoriness of AV node and the His-Purkinje system can induce AV block on exercise, but not in patients with normal conduction systems. Most cases of exercise-induced complete AV block are due to this mechanism and show tachycardia-dependant block due to the disease of the His-Purkinje system.³⁻⁴ This mechanism is also known as the gap phenomenon, which is due to functional differences of conduction and refractoriness in two or more regions of the conducting system, with a distal area with long refractory period and proximal area with a shorter refractory period.⁵ A second mechanism can be due to AV nodal ischaemia. These patients may report of chest pain during exercise testing and may show ischaemic changes on ECG and evidence of flow limiting stenosis on coronary angiogram. Exercise testing is important in these cases as it helps to differentiate between AV nodal and infranodal block and also in unmasking conduction system abnormality in patients with normal 1:1 AV conduction at rest.⁶⁻⁷ EP study can also be made to delineate the exact site of block. Prognosis varies according to the level at which the block

Figure 2 Baseline ECG during treadmill test by Bruce protocol showing trifascicular block with 1:1 atrioventricular conduction with heart rate of 80/min.

Figure 3 ECG during first stage of treadmill test showing progression of trifascicular block to complete atrioventricular block with heart rate of 50/min.

occurs. Treatment of exercise-induced complete AV block involves the implantation of a permanent pacemaker if the patient is symptomatic and other reversible aetiology has been ruled out.

The aetiology of this type of block is probably progressive cardiac conduction defects, referred to as Lenegre's or Lev's disease. Lenegre's disease is characterised by progressive, fibrotic, sclerodegenerative disease of the conduction system in younger individuals leading through slow progression to complete heart block. It may be associated with mutation in the

gene encoding the cardiac sodium channel, SCN5A.⁸ Lev's disease is characterised by fibrosis or calcification extending from any of the fibrous structures adjacent to the conduction system into the conduction system and usually occurs in older individuals.⁹ As genetic testing was not feasible in our patient, we screened his family members for conduction abnormalities, of which there were none. Other conditions such as infiltrative disorders (lymphoma, sarcoidosis) and infective conditions (chagas) can present in a similar manner, but were ruled out in this index case.^{10 11}

Figure 4 ECG during recovery of treadmill test showing return of rhythm back to baseline trifascicular block with increase in heart rate to 84/min.

Learning points

- ▶ Exercise-induced complete atrioventricular (AV) block is a rare phenomenon in patients with normal AV conduction at rest and can cause symptoms of dyspnoea, giddiness and syncope.
- ▶ The site of exercise-induced AV block is mostly infranodal but can be intranodal also.
- ▶ The aetiology is mostly a degenerative disorder of the conduction system.
- ▶ Exercise testing is very useful in diagnosis and to differentiate AV nodal from infranodal site of exercise-induced complete AV block, although an EP study can also be performed.
- ▶ Treatment of symptomatic exercise-induced AV block is implantation of a permanent pacemaker, once reversible aetiology has been ruled out.

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Competing interests None.

Patient consent Obtained.

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