Can left bundle branch block cause chest pain?

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Introduction

Exercise-induced left bundle branch block usually indicates underlying coronary artery disease or myocardial disease. Association of left bundle branch block (LBBB) with chest pain in the absence of coronary artery disease is rare. We describe the case history of a patient with chest pain associated with left bundle branch block with normal coronary arteries and review the literature on left bundle branch block associated with chest pain.

Case report

A 39-year old woman was referred to the cardiology clinic with a four-month history of exertional chest tightness and palpitations, which consistently resolved with rest. There was no history of dizziness or syncope. The patient was a smoker of 15 cigarettes per day. There was no family history of ischaemic heart disease. She was on hormone replacement therapy for previous hysterectomy. Clinical examination did not reveal any abnormalities. Resting 12-lead electrocardiogram (ECG) was normal. The patient was euthyroid with serum total cholesterol of 4.5 mmol/L, low density lipoprotein of 3.3 mmol/L and triglycerides 0.69 mmol/L.

The patient underwent an exercise treadmill test on a Bruce protocol. During stage two, at a heart rate of 159 bpm, the patient developed LBBB associated with chest tightness and palpitations (figure 1). The bundle branch block resolved within two minutes into recovery along with relief of symptoms. A 24-hour ECG showed a few ventricular ectopics associated with palpitations, but no sustained arrhythmias. Transthoracic echocardiography showed a structurally normal heart with normal cardiac valves and good left ventricular function. She was commenced on atenolol 50 mg once daily, and aspirin.

During cardiac catheterisation, the patient developed chest pain while the dye for the ventriculogram was being injected. This was associated with onset of LBBB at a heart rate of 72 bpm (figure 2). The left ventricular end-diastolic pressure was 13 mmHg. After the left ventricular injection, she reverted to normal ventricular conduction with spontaneous resolution of her symptoms. Coronary angiograms showed normal coronary arteries. The patient was referred for electrophysiology studies. These showed the AH interval to be 120 ms and the HV interval to be 55 ms. Atrial overdrive and extrastimulus pacing showed development of LBBB at low pacing rates. Following isoprenaline

Figure 1. ECG showing onset of left bundle branch block with exercise at a heart rate of 159 bpm (arrow)

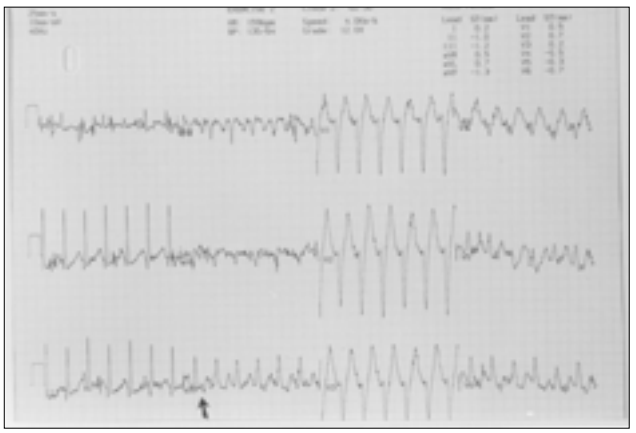
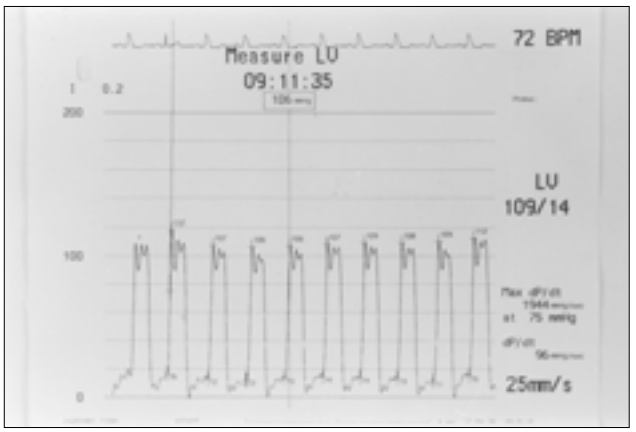


Figure 2. ECG showing left bundle branch block during left ventricular angiography at resting heart rate



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Key messages

- A rare case of chest pain associated with left bundle branch block and normal coronary arteries is described
- A literature review shows myocardial perfusion studies and metabolic indicators of ischaemia have been negative in such cases
- Cardiac dyssynergy caused by the aberrant conduction is suggested as the reason for chest pain in these patients

infusion, LBBB was induced at a heart rate of 130 bpm and reverted with lower rates. Supraventricular or ventricular tachycardia was not induced.

Discussion

Left bundle branch block (LBBB) with exercise develops either due to ischaemia of the left bundle (mainly the interventricular septum) or due to rate dependency (where the heart rate exceeds the refractory period of the bundle). LBBB during exercise is usually asymptomatic, but is an indication for termination of a treadmill test, as the ECG becomes uninterpretable. In our patient, LBBB along with chest pain developed during exercise and pacing, on a background of normal coronary arteries. Microvascular disease is unlikely in our patient in view of her age and the absence of diabetes mellitus and hypercholesterolaemia. The cause of her LBBB during the left ventriculogram is not known, but the consistency between the onset of LBBB and her chest pain is interesting. Treatment with beta blockade was ineffective.

Few authors have described the association of exertional chest pain with LBBB and normal coronary arteries.[1-3] Myocardial perfusion images have been studied in similar cases; reversible anteroseptal perfusion defects have been shown in these patients with normal coronary arteries on angiography.[4-6] In their series of 11 patients, Heurta *et al*. reports asynchronous septal motion on echocardiography along with the anteroseptal perfusion defect on thallium-201 scintigraphy.[5] The authors suggest that the perfusion defect in these patients could be due to abnormal septal movement and thus represents functional ischaemia. A more logical explanation would be that in LBBB, the duration of diastolic coronary flow is shortened in the septum by delayed relaxation, which results in inadequate diastolic coronary flow during tachycardia.[7] Therefore, myocardial perfusion imaging with pharmacological or paced tachycardia as 'stressor' might give perfusion defects at higher heart rates due to functional ischaemia. Rosano *et al.* measured coronary sinus pH and lactate metabolism in similar patients and could not demonstrate metabolic evidence of myocardial ischaemia.[8]

There is no consensus of opinion on why certain patients with exercise-induced or rate-dependent LBBB get chest pain in the absence of myocardial ischaemia. It has been speculated that sudden ventricular asynergy due to altered electrical conduction can be interpreted by the patient as chest pain.[9] This idea is supported by Virtanen *et al.* from their series where kinetocardiographic recordings showed sudden occurrence of paradoxical cardiac movement at the moment that LBBB and chest pain appeared – normal cardiac motion was restored with normal conduction.[3] Similar findings during radionuclide ventriculography have been reported by Bramlet *et al.*[10] In their patients, the onset of rate-dependent LBBB was associated with an abrupt decrease in left ventricular ejection fraction which reverted with onset of normal conduction.

Vasey *et al*. reports 28 patients with LBBB induced on treadmill testing as part of an investigation of chest pain. Atypical chest pain on history and a heart rate at onset of LBBB of > 125 bpm were found to be predictors of normal coronary vasculature.[2]

Exercise-induced LBBB with underlying structural heart disease has a pooled mortality of 2.7% per year. When no structural heart disease was identified, mortality was 0.17% per year.[11]

Development of permanent LBBB in patients with exercise-induced LBBB is related to presence or absence of underlying coronary artery disease or myocardial disease. When LBBB is found in the absence of underlying heart disease, there does not tend to be progression of the conduction disturbance; long-term prognosis is excellent.[12] However, Grady *et al*. have reported that exercise-induced LBBB is an independent predictor of mortality and cardiac morbidity.[13] In this study, patients were not further investigated to see the underlying pathology causing the LBBB. Therefore, it is not known whether this subgroup of patients had normal coronary vasculature.

Summary

There is a subgroup of patients with exercise-induced LBBB and no evidence of myocardial ischaemia, who get chest pain when they develop LBBB. The exact cause of the pain is not well understood, but might be due to increased sensitivity to cardiac dyssynergy. It is important to exclude myocardial disease or coronary artery disease in these patients as the long-term outcome is significantly different. Heinsimer *et al*. have described exercise training in such a patient, where the heart rate of onset of LBBB gradually increased to the point where the patient did not have symptoms with normal daily activities.[14] Even though this has been described in only one case, exercise training as part of a cardiac rehabilitation programme might be an ideal and safe way to treat these patients.

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