Left bundle branch block

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Articles in this section are inspired by, but not based on, real cases to illustrate the importance of knowledge about ECGs in relation to clinical situations in general practice. Management is not discussed in detail.

Alex, aged 42 years, has come to your practice for the first time after having a routine work medical examination with a new company. They have suggested he be referred to a cardiologist because his ECG is abnormal. He tells you he has had no family or personal history of cardiac problems and he has no symptoms. He has never had a work medical before. He takes no medications and has no risk factors for heart disease. He is slightly overweight and he does not exercise regularly. He has a copy of his ECG and hands it over to you.

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Q1. What does this ECG show (see below)?

The ECG below shows a left bundle branch block (LBBB). The QRS is more than 120 msec in duration, there are no Q waves in leads I, aVL, V5 and V6, there are upright monomorphic R waves in leads I, V5 and V6, with no secondary R wave in V1, and the ST and T waves are reciprocal to the major deflection of the QRS complex. The QRS complex is usually positive in lead I. It should be noted that there is a wide variation in ECG appearance of LBBB.

Generally, as a summary, in a LBBB the QRS complex is more than 120 msec in duration and the QRS complex is usually positive in lead I.

Q2. What causes the classic LBBB ECG pattern?

The P wave rhythm is normal. Usually depolarisation travels to the left and right ventricles via the septum. In LBBB, the left bundle branch depolarisation is very slowed or blocked completely and so the electrical impulse travels from the right ventricle across the septum to the left ventricle. This results in a prolonged QRS duration and no Q waves in the lateral leads (I, V5 and V6). Because the right to left depolarisation is abnormal, there is poor R wave progression, tall R waves in the lateral leads (I, V5 and V6) and also deep S waves in the right praecordial leads (V1 to V3). Left axis deviation is usual. There is notching of the R wave in the lateral leads (I, V5 and V6) due to the right ventricle depolarising before the left.

Q3. What conditions are associated with LBBB?

- Slowly degenerative disease of the conductive system (the most common cause of LBBB)
- Aortic stenosis
- Myocardial ischaemia
- Myocardial infarction
- Cardiac failure
- Dilated cardiomyopathy
- Aortic root dilation and aortic regurgitation (especially from longstanding hypertension)
- Primary conduction defects
- Myocarditis
- Infiltrative conditions
- Lyme disease
- Congenital heart disease
- Digoxin toxicity.

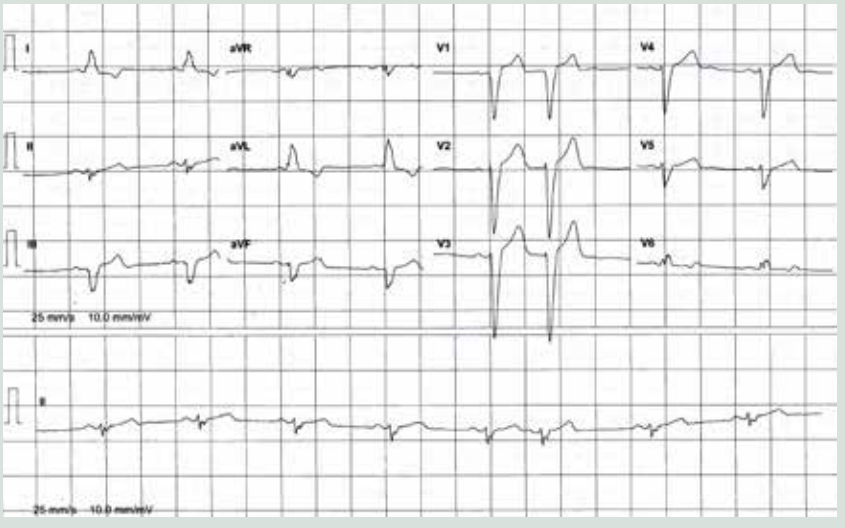

Figure. Left bundle branch block.

Q4. What are the differential diagnoses of LBBB?

- Right bundle branch block (the QRS complex is downwardly, not upwardly, deflected in lead I)
- Left ventricular hypertrophy (especially with strain)
- Left anterior hemiblock
- Left posterior hemiblock
- Bifascicular block
- Junctional rhythm
- Idioventricular rhythm
- Ventricular tachycardia
- Multiple ventricular ectopics
- Right ventricular pacing
- Pre-excitation (e.g. Wolff-Parkinson-White).

Q5. Is it possible to diagnose an acute myocardial infarction in the presence of an LBBB?

This is difficult to be definite of without a rise in the serum troponin level and/or classic symptoms and signs. An acute myocardial infarction may be suggested by a series of subtle changes apparent when compared with serial ECGs in the same patient. A new LBBB in the context of chest pain is always abnormal. It is also vital that a patient who has a pre-existing LBBB and chest pain must also have acute myocardial ischaemia considered. There are several criteria and signs of specialist interest to determine acute myocardial infarction in the presence of an LBBB, such as the Sgarbossa criteria.

Q6. Can an LBBB ever be considered normal?

Very occasionally people present asymptomatically with a LBBB on the ECG in the absence of a cause. They are usually under the age of 50 years. There are a number of options to investigate patients who have LBBB; however, all have limitations and increased false-positive rates in people with LBBB compared with people without. Patients with LBBB will need an assessment of their cardiovascular risk factors and a cardiology consult. They require a full investigation, including a cardiac echocardiography, and either exercise stress test echocardiography, a dobutamine stress test echocardiography, myocardial perfusion imaging (with thallium or technetium isotopes) or a stress cardiac MRI. The interpretation of an ordinary stress test is not helpful due to the LBBB. If all is considered normal the prognosis is excellent. There is evidence of a small reduction in cardiac efficiency during exercise in these patients, but this is considered medically insignificant.

Q7. Of what significance is incomplete LBBB?

Incomplete LBBB is diagnosed when a patient has the ECG criteria for LBBB but the QRS duration is less than 120 msec. These patients usually require the same investigations as patients with complete LBBB and the causes are the same. However, many such patients have no obvious apparent cause, as opposed to those with a complete LBBB. There is an increased risk, especially in people with diagnosed cardiac abnormalities, of the development of a complete LBBB.

Q8. What management is required for a patient with LBBB?

Patients with LBBB with no impairment of exercise tolerance and no evidence of cardiac failure do not require any treatment other than reducing their cardiovascular risk factors as appropriate. There is no specific treatment for LBBB itself, but reduction of general cardiovascular risk factors and medical management of any other myocardial disease is important.

Cardiac resynchronisation therapy may be indicated in patients with severe left ventricular impairment (left ventricular ejection fraction <35%), with breathlessness, normal sinus rhythm and LBBB (as a marker of left ventricular dyssynchrony), with or without a defibrillator, and in the absence of other bradycardia indications.

Outcome

You repeat Alex's ECG and it is unchanged. His fasting cholesterol and blood glucose levels and other routine blood tests are quite normal from the medical report. Alex is referred to a cardiologist where he undergoes a cardiac echocardiography and thallium stress test, the results of which are normal. He is reassured that this is likely to be of no medical concern in the future, but to be sure he should remain under the care of a cardiologist until this is certain. He is encouraged to lose weight and commence appropriate exercise regularly. **CT**

Key points

- **Generally, in patients with LBBB, the QRS complex is more than 120 msec in duration with upright monomorphic R waves in V5, V6, aVL and lead I without Q waves. There is no secondary R wave in V1.**
- **Incomplete LBBB is diagnosed when a patient has the ECG criteria for LBBB but the QRS duration is less than 120 msec.**
- **It is difficult to be definite of an acute myocardial infarction in the presence of an LBBB without a rise in the serum troponin level and/or classic symptoms and signs.**
- **Patients with incomplete or complete LBBB require full investigation, including a cardiac echocardiography, assessment of cardiovascular risk factors, consideration of functional stress testing and a cardiology consultation.**
- **Patients with no impairment of exercise tolerance and no evidence of cardiac failure do not require any treatment other than reducing their cardiovascular risk factors as appropriate.**
- **Pacemaker cardiac resynchronisation therapy is required for patients with LBBB who have a reduced ejection fraction, those who are symptomatic with exertion and those who have cardiomyopathy.**

Further reading

Steg, G, James SK, Atar D. ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J 2012; 33: 2569-2619.