



Who should get a pacemaker or an ICD?

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There are different indications for the use of a pacemaker or an implanted cardioverter defibrillator (ICD). A thorough evaluation of the patient is required to discover the underlying condition before the decision on which to use can be made.

Case scenario

Bill is a 75-year-old man who had been previously well. He comes to see you with a bruised face. He reports having a 'black-out' when he suddenly lost consciousness and fell to the floor of his kitchen, hitting his head on the granite counter. His wife saw him fall and thought he had died but he woke up quickly and was not confused.

Differential diagnoses

Bill has experienced syncope – a sudden transient loss of consciousness. The most common causes of syncope are an arrhythmia, a faint or a fit. The most important piece of diagnostic information is the patient's history. Bill collapsed without warning and injured

Key points

- The history is important in evaluating the cause of syncope and the ECG is the most important investigation.
- A sudden loss of consciousness with no premonitory symptoms and no features of a convulsion is likely to be due to an arrhythmia.
- The usual indication for a pacemaker is symptomatic bradycardia; patients with asymptomatic bradycardia usually do not need a pacemaker.
- An implanted cardioverter defibrillator (ICD) is usually indicated in patients who have been resuscitated from a cardiac arrest or who are at high risk of a cardiac arrest by the nature of their heart disease.

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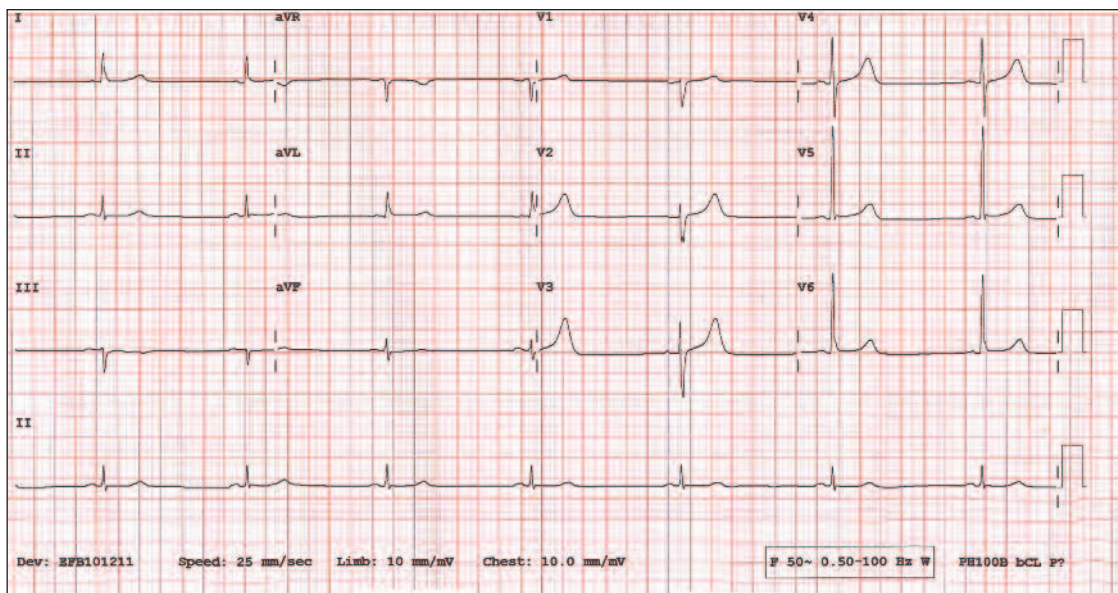


Figure 1. An ECG showing sinus bradycardia at a rate of 43 beats per minute. The need for pacing would be established based on the patient's symptoms, rather than just on the slow rate.

himself on the way down, which is typical of an arrhythmia. He did not convulse, bite his tongue or lose control of his bladder, so a fit is less likely. He did not have any warning symptoms of dizziness, light headedness, nausea or tunnel vision, so a faint is also less likely. A faint (or vasovagal syncope) is a combination of bradycardia and hypotension, often triggered by prolonged standing, a hot room or a frightening situation.

The most common arrhythmia to cause a sudden loss of consciousness is a bradycardia such as complete heart block or sinus node dysfunction (SND). However, if Bill had a history of heart disease, including a previous heart attack or cardiac failure, then a fast ventricular arrhythmia such as ventricular tachycardia is a strong possibility.

Investigations

A physical examination is important in patients with syncope to look for evidence of heart disease, neurological disease or postural hypotension.

An ECG is a vital investigation. It may show a bradycardia, which makes the diagnosis straightforward, or a previous myocardial infarction. The presence of left bundle branch block or bifascicular block (right bundle branch block plus left anterior hemiblock) in a patient with syncope makes a sudden bradycardia due to heart block very likely and is an indication that a permanent pacemaker is needed.

The ECG may be, and commonly is, normal. Further investigation of the patient with prolonged ECG monitoring and/or tests of cardiac function and ischaemia may be necessary. Specialist referral is usually necessary for patients with syncope.

Patients with severe bradycardia, whether permanent or intermittent, may benefit from an implanted pacemaker and patients with ventricular tachycardias may benefit from an implanted

cardioverter defibrillator (ICD). Detailed guidelines for the selection of patients for implantation of pacemakers and ICDs are available.¹

Indications for a pacemaker

The most important indication for a pacemaker is symptomatic bradycardia. The emphasis is on both a significantly slow rhythm, either transient or permanent, and symptoms such as syncope, presyncope, dizziness, light-headedness, fatigue or dyspnoea. If transient bradycardia is demonstrated on, for example, a Holter monitor, then it should correlate in time with a symptom.

Many people, especially if they are young and fit, have asymptomatic bradycardia including sinus bradycardia, sinus pauses (less than three seconds) and second-degree Wenckebach block, and do not require a pacemaker.

Bradycardias

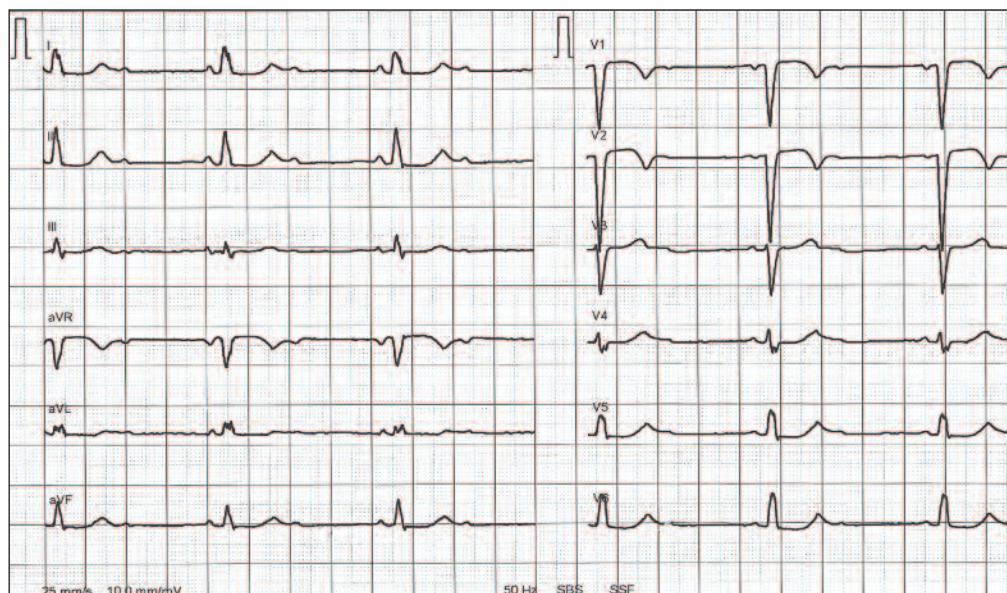
SND (formerly called sick sinus syndrome) is a type of bradycardia that includes sinus pauses and persistent severe sinus bradycardia (Figure 1), which may be associated with paroxysmal atrial fibrillation in the bradycardia-tachycardia syndrome, a variant of SND. SND may also include chronotropic incompetence in which there is an inadequate heart rate response to exertion.

Atrioventricular (AV) block is another type of bradycardia. Second-degree AV block (Figure 2) occurs when not every atrial beat is followed by a ventricular beat. Third-degree AV block occurs when no atrial beats are conducted to the ventricle. The ventricle continues to beat due to pacemaker cells in the ventricle initiating an impulse, giving an 'escape rhythm'.

It is important to rule out a correctible cause for the bradycardia. The most common cause is use of β -blockers but use of other drugs including digoxin, amiodarone and some calcium-channel



Figure 2. An ECG showing second-degree atrioventricular block and left bundle branch block. Patients will usually require a pacemaker.



blockers (e.g. verapamil and diltiazem) can cause bradycardia. Hypothyroidism is an important medical cause of bradycardia.

Sometimes, drugs are required to treat patients with tachycardias, particularly atrial fibrillation, and the patient cannot stop taking them. In these cases, pacemakers are indicated to treat patients with bradycardia and allow them to continue taking the anti-tachycardia drugs.

In recent times, special pacemakers have been inserted to improve symptoms and survival in patients with poor cardiac function, wide QRS (especially if due to left bundle branch block) and heart failure. These pacemakers pace both ventricles ('biventricular pacing') to resynchronise, and therefore improve, the ventricular contraction. Referral of patients to a specialist centre is appropriate to decide whether this form of pacing is indicated.

Indications for an implantable cardioverter defibrillator

A patient who has survived a cardiac arrest or sustained ventricular tachycardia is at high risk of sudden cardiac death (SCD) or having another severe arrhythmia or cardiac arrest. This risk is irrespective of the patient's underlying cardiac condition, unless the event occurred during the early hours of an acute myocardial infarction or has a reversible cause. An ICD is the most effective way to prevent SCD in these patients and is referred to as 'secondary prevention'.

'Primary prevention' refers to the prevention of SCD in patients with no history of cardiac arrest or sustained ventricular tachycardia, but who have a high risk of SCD. This includes some patients with coronary artery disease, asymptomatic left

ventricular dysfunction, heart failure and several less common conditions, including hypertrophic cardiomyopathy and long QT syndrome. About one-half of patients with heart failure die suddenly, mostly from ventricular arrhythmias. There is now a significant body of evidence to support the benefit of ICDs for primary prevention in patients with poor left ventricular function (left ventricular ejection fraction of 30 to 35% or less), whether or not they have symptoms of cardiac failure and syncope.

Assessment of patients for ICD implantation should be performed at a specialist centre. In some patients, an electrophysiology study may be part of this assessment.

Conclusion

Pacemakers and ICDs are sophisticated, expensive devices that can improve symptoms and prolong life. Careful evaluation of the patient with syncope or symptomatic

bradycardia may lead to pacemaker implantation. Specialised evaluation of the patient following a cardiac arrest or ventricular tachycardia, or of the patient at high risk for SCD, may lead to the implantation of an ICD.

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Reference

1. Epstein AE, DiMarco JP, Ellenbogen KA, et al; ACC/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol* 2008; 51: e1-62. Available online at: www.cardiosource.org/acc, www.heart.org/HEARTORG and www.hrsonline.org (accessed February 2012).

COMPETING INTERESTS: None.