FEATURE

Investigating the patient with syncope

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Syncope is a common symptom among patients of all ages and ranges from a benign symptom to a warning of impending sudden cardiac death. Physicians should use a framework approach when investigating patients with syncope to ensure life-threatening causes are not missed.

Key points

- **Syncope is a common presentation to GPs, emergency physicians and cardiologists and may be the presenting symptom in a patient at risk of sudden cardiac death.**
- **The most common causes of syncope are cardiac and neurocardiogenic syncope; neurological causes of syncope are rare.**
- **Patients with a history of cardiac disease or family history of sudden cardiac death are at particular risk of syncope.**
- **An ECG is essential in any patient presenting with syncope.**
- **Patients with an unexplained first episode of syncope or recurrent syncope should be referred to a cardiologist for further investigation.**
- **Driving restrictions exist following syncopal episodes and need to be enforced by GPs and specialists.**

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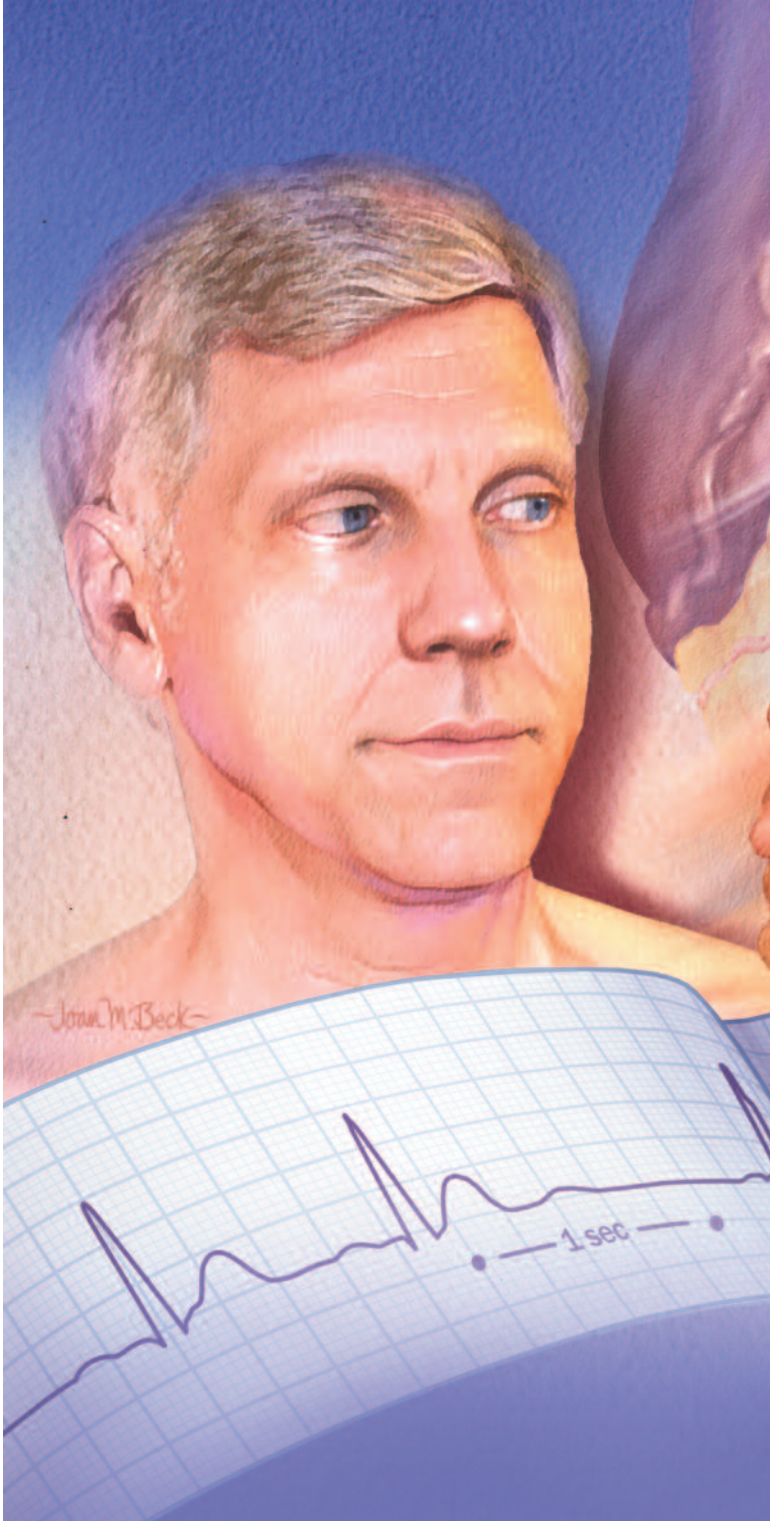
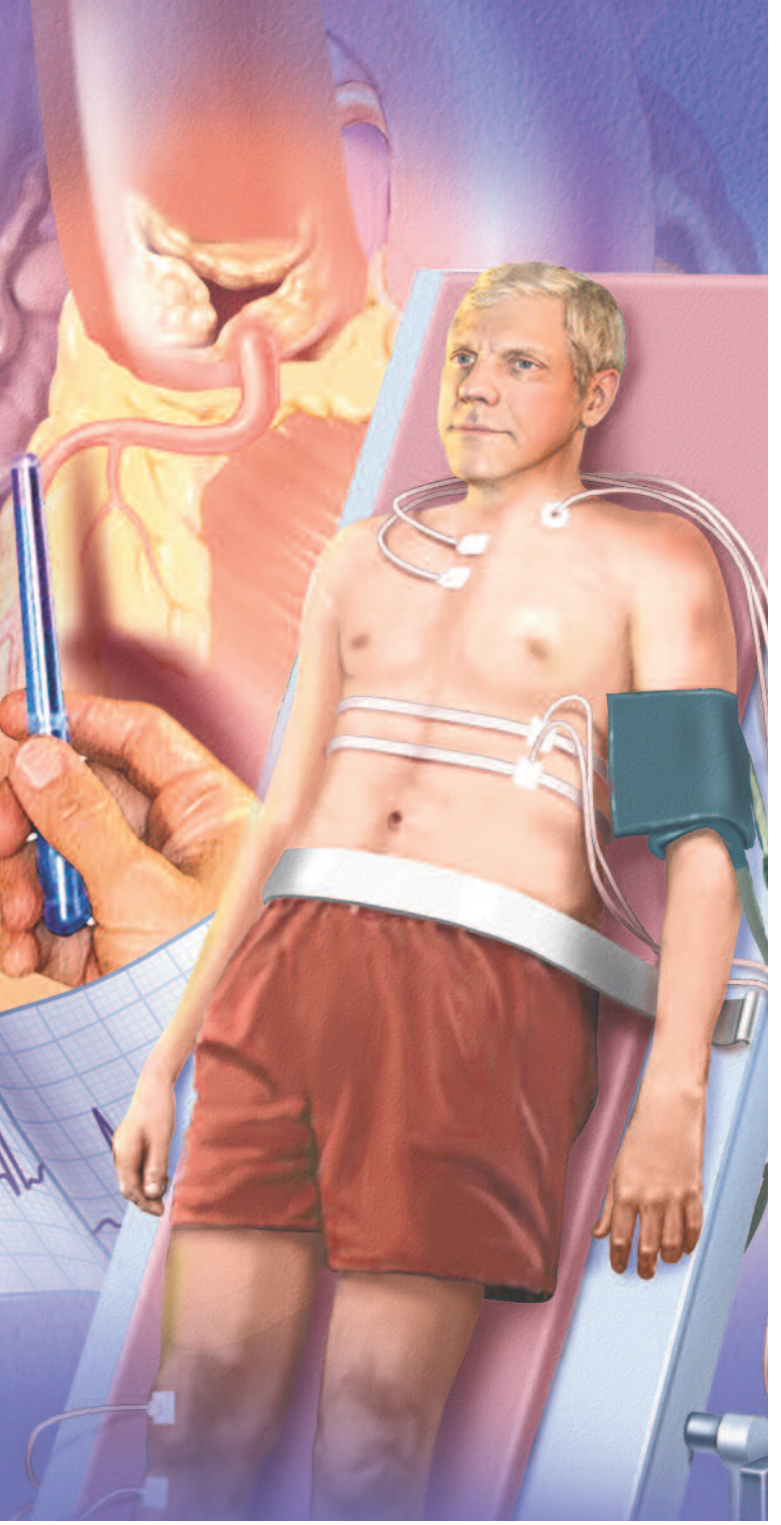


Syncope is defined as 'sudden, spontaneous loss of consciousness with associated loss of postural tone, from which the recovery is also spontaneous'.[1] Syncope ranges from a benign symptom to a warning of impending sudden cardiac death. It is important to use a framework to determine the cause of syncope in a patient to triage life-threatening causes from more benign causes. The box on page 11 shows a comprehensive list of potential causes of syncope and syncope mimics. The most common causes of syncope are neurocardiogenic (58%) and cardiac (29%) abnormalities. Neurological causes of syncope are rare (1%), as are psychiatric presentations (<0.5%). Syncope should be differentiated from syncope mimics (e.g. seizures or transient



ischaemic attacks [TIAs]) that can also cause transient loss of consciousness.

Investigations are often tailored to the individual patient depending on the suspected cause of the syncope. If there is no clear cause of syncope then excluding severe causes that place the patient at risk of sudden death are the goal of the investigations. Obviously, initial investigations should be simple and noninvasive (e.g. 12-lead electrocardiogram [ECG], echocardiogram and 24-hour Holter monitor). If these investigations show evidence of significant cardiac disease, then more detailed and invasive investigations are usually appropriate under specialist guidance. However, even if initial tests do not reveal abnormalities, repeated syncopal episodes still suggest

Causes of syncope

Cardiac arrhythmias

Tachyarrhythmias

- Ventricular tachycardia
- Supraventricular tachycardia including atrial fibrillation
- Ventricular fibrillation

Bradyarrhythmias

- Sick sinus syndrome
- Atrioventricular block (second- or third-degree heart block)
- Implanted device (permanent pacemaker/automated implantable cardioverter defibrillator) malfunction

Abnormal cardiac function

Left ventricular outflow obstruction

- Aortic stenosis
- Hypertrophic cardiomyopathy

Right ventricular outflow obstruction

- Pulmonary embolus
- Pulmonary stenosis (rare)

Left ventricular inflow limitation

- Mitral stenosis
- Atrial myxoma

Pump failure

- Myocardial infarction
- Dilated cardiomyopathy

Neurocardiogenic (reflex) syncope

Vasovagal

- Mediated by emotional distress (e.g. pain, instrumentation, blood phobia)
- Mediated by orthostatic stress

Situational

- Micturition, defaecation, cough

Syncope due to orthostatic hypotension

Autonomic failure

- Primary (e.g. Parkinson's disease, Lewy body disease)
- Secondary (e.g. diabetes, uraemia, spinal cord injury)

Drug-induced orthostatic hypotension

- Diuretics, vasodilators, antidepressants

Volume depletion

- Haemorrhage
- Diarrhoea, vomiting

Neurological

- Seizures
- Cerebrovascular disease

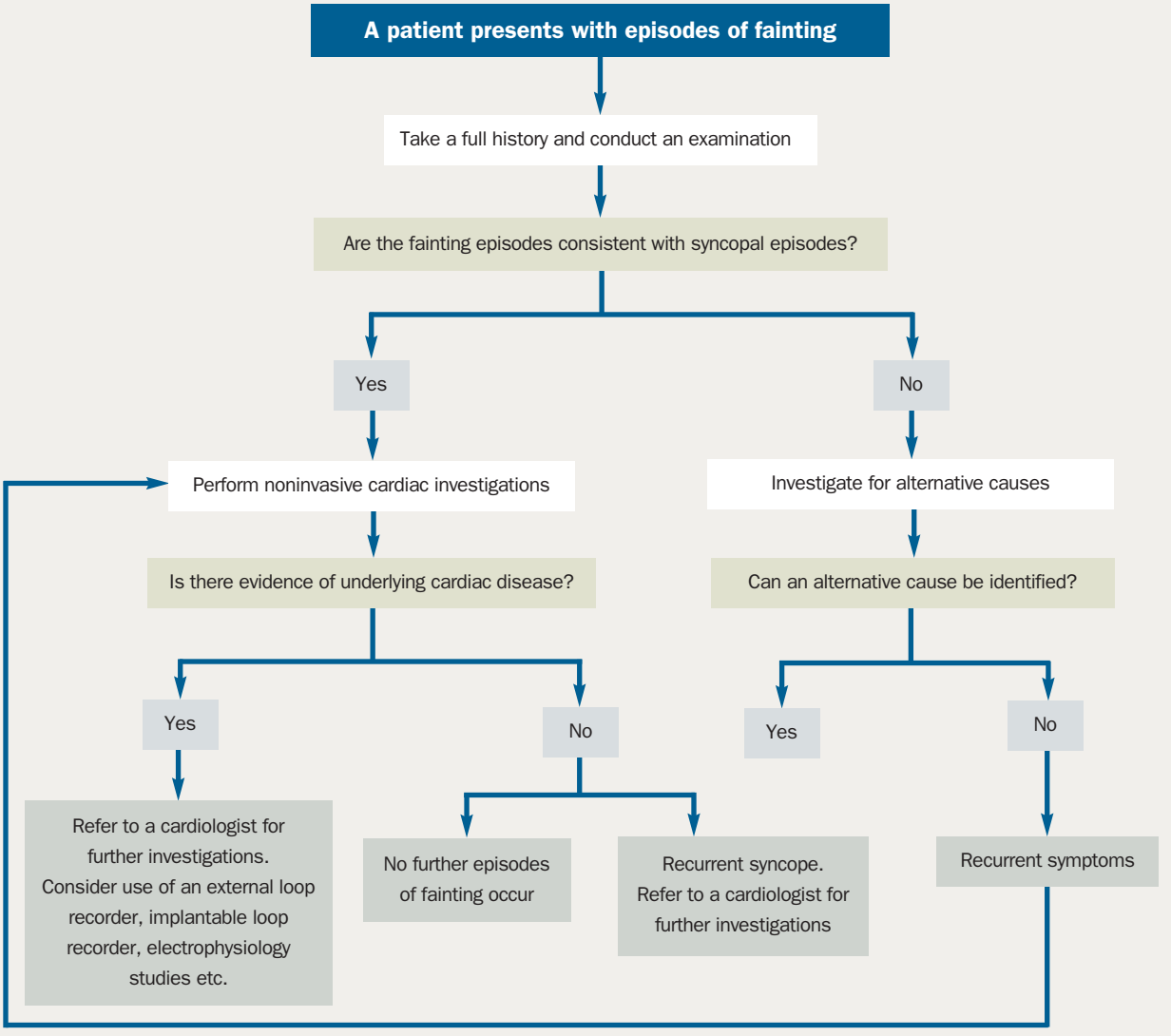
Metabolic

- Hypoglycaemia
- Electrolyte disturbances

Psychological

- Anxiety
- Somatisation disorders (e.g. psychogenic pseudosyncope)

Framework for diagnosing a patient with syncope



the need for referral of patients to a cardiologist for detailed cardiac investigations.

The flowchart on this page provides a framework for the diagnosis of syncope.

History

It is critical to take a thorough history for any patient presenting with syncope. The events leading to any syncopal episode may help to determine the cause (e.g. micturition, defaecation, prolonged standing). Were there any prodromal symptoms such as dizziness or lightheaded feelings? Did the syncope occur after an unpleasant smell, sight, sound, feeling or fear? All of these symptoms are suggestive of vasovagal (neurocardiogenic) syncope. Sometimes witness accounts can be helpful to describe the events following the collapse, particularly with seizures; however, it is important to highlight that patients with serious pathological cardiac arrhythmias (e.g. ventricular fibrillation/ventricular tachycardia) may have evidence of seizure-like activity when they collapse. It is important to determine whether the patient has a history of recurrent syncope, and the usual prodrome or events surrounding the patient's previous syncopal events.

A history of ischaemic heart disease, previous cardiac surgery or chest pain and/or palpitations before the syncopal event suggests a cardiac cause that almost always requires further investigation. If the

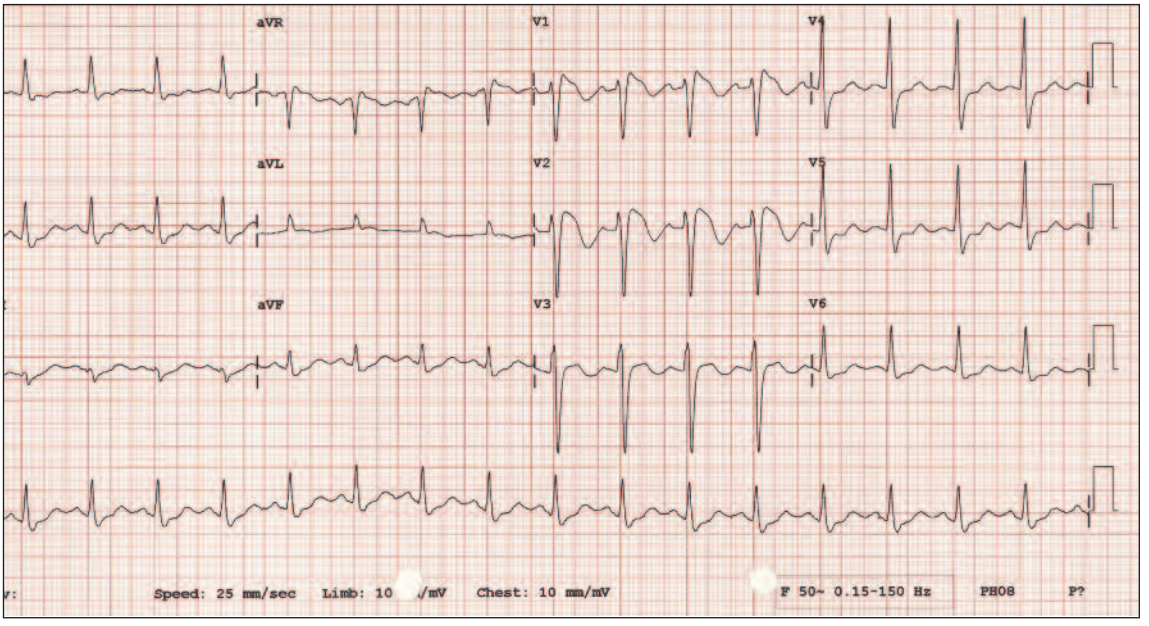


Figure. ECG showing the typical cove-shaped ST elevation with associated T-wave inversion, in the right precordial leads diagnostic of type I Brugada pattern.

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patient has structural heart disease, he or she may be at risk of dangerous arrhythmias such as ventricular tachycardia. It is important to ask the patient if there is any family history of sudden death because this may suggest an inherited cardiac disorder.

A history of associated tongue biting or urinary or faecal incontinence may suggest a neurological cause, particularly a seizure. If the patient has evidence of weakness, numbness or involuntary movements, it may be suggestive of a stroke or TIA. Vertigo and diplopia are symptoms that should alert the physician to potential basilar migraine, subclavian steal syndrome or posterior circulation stroke.

It is also always important to take a detailed medication history. Elderly patients are particularly at risk of hypotension secondary to excessive use of diuretics or other blood pressure medications. Psychotropic and psychiatric drugs, as well as other medications, can increase a patient's risk of postural hypotension. Other drugs such as antiarrhythmics and recreational drugs can also cause syncope.

Other important features of the history include whether the patient has any risk factors for venous thromboembolism (e.g. recent long-haul travel, malignancy, previous deep venous thrombosis) or any features suggestive of gastrointestinal bleeding. Both of these diagnoses are rare causes of syncope but are potentially life-threatening and therefore critical to exclude.

Examination

A thorough cardiovascular and neurological examination is the main focus of a physical assessment when investigating a patient with syncope. Important features of the examination include measurement of pulse rate and blood pressure, auscultation for cardiac murmurs (particularly aortic stenosis) or carotid bruits, and examination of the upper and lower limbs for features suggestive of stroke or TIA.

All patients should have their blood pressure measured in the supine position; they should then stand up for at least three minutes and have their blood pressure measured while standing several times during this period. It is important to wait for a full three minutes to ensure orthostatic hypotension is not missed. Orthostatic hypotension is defined as a postural difference in systolic blood pressure of more than 20 mmHg.

Electrocardiography

Electrocardiography is the initial investigation for all patients with syncope. The patient's heart rate and rhythm should be noted (normal heart rate, 60 to 100 beats per minute). Other features that may be seen on the ECG that would suggest the patient is at risk of cardiac syncope include:

- PR prolongation (first-degree heart block)
- QT prolongation
- left and right bundle branch blocks.

The presence of complete heart block (third-degree heart block) or Mobitz type II second-degree heart block on the ECG indicate a high-grade atrioventricular (AV) block and the patient is at risk of sudden cardiac death due to asystole. These conditions have class 1 indications for permanent pacemaker insertion, even in asymptomatic patients. Symptomatic Mobitz type I (Wenkebach) second-degree heart block is also an indication for pacemaker insertion. Patients with serious arrhythmias such as severe bradycardia (heart rate less than 40 beats per minute), ventricular tachycardia or severe AV nodal block (second and third degree) require urgent cardiology assessment.

The ST segments of the ECG should be inspected for any evidence of ischaemia. ST elevation in the context of syncope and chest pain

suggests acute coronary syndrome. These patients should be urgently referred to the nearest hospital. ST depression, particularly when it is planar, also suggests ischaemia and the patient needs urgent cardiology assessment. Other causes of ST change on ECG include left ventricular (LV) hypertrophy and hypertrophic cardiomyopathy. Features suggesting old myocardial infarction, such as Q waves, highlight that the patient may be at risk of ventricular arrhythmias such as ventricular tachycardia.

Delta waves suggesting Wolff–Parkinson–White syndrome are important to note and these patients should be referred to a cardiologist. Rarer inherited cardiac diseases often present with syncope and are often diagnosed on the ECG (e.g. Brugada syndrome [Figure], long QT syndrome).

Echocardiography

An echocardiogram should be obtained from all patients presenting with recurrent syncope. Echocardiography is a particularly important investigation in any patient with an abnormal ECG or a murmur on physical examination. Any patient with chest pain or palpitations preceding their syncopal event should also have an echocardiogram obtained. Echocardiography is readily available, cheap and noninvasive. It also provides detailed assessment of cardiac structure including LV and valvular function, both of which may predispose a patient to cardiac syncope if they are abnormal. It is particularly important to exclude valvular pathology such as aortic stenosis, especially in elderly patients. Any patients with abnormal LV function, features suggestive of hypertrophic cardiomyopathy or structural abnormalities are particularly at risk of cardiac syncope and warrant urgent referral to a cardiologist.

Holter monitor

Sometimes patients have transient arrhythmias that lead to syncopal events and resolve before presentation. In these patients, a 24-hour Holter monitor can capture arrhythmia episodes, particularly if they are occurring frequently. Holter monitors also provide information on the average, minimum and maximum heart rates over a 24-hour period, which can suggest potential causes for syncope. The main issue with a Holter monitor is that if the patient does not have any symptoms – that is, no syncopal events – when wearing the monitor, serious cardiac arrhthymias are not necessarily excluded.

External loop recorder

Patients who have had unexplained recurrent syncopal episodes may benefit from wearing an external loop recorder. These recorders can be activated by the patient or by a bystander (e.g. friends or family) if a syncopal event occurs. When activated, the loop recorder begins cardiac monitoring for five minutes and saves the preceding 60 seconds, hopefully capturing the heart rhythm of the patient at the time of the event. In patients who have had negative Holter monitor tests, a loop recorder can reveal bradyarrhythmias or tachyarrhythmias that cause syncope. It is also useful if the external loop recorder shows normal sinus rhythm at the time of the event because the likelihood of life-threatening cardiac pathology is significantly reduced.

Implantable loop recorder

Implantable loop recorders have provided the greatest advancement in the past 10 years in the investigation of patients with syncope.

These devices, about the size and shape of a USB memory stick, are surgically implanted under the skin next to the sternum. Implantable loop recorders constantly monitor heart rate and rhythm, and are programmed to save any abnormal heart rates or runs of arrhythmia (according to predetermined parameters). Patients are also able to use an activator when they feel symptoms to initiate the loop recorder to store the heart's rhythm.

Patients with implantable loop recorders are required to attend pacemaker clinics to have the device interrogated and any events will be notified to the treating cardiologist. Patients with implantable loop recorders are also instructed to have the device interrogated as soon as possible following any symptomatic syncopal episodes for the treating physician to hopefully make a diagnosis and initiate treatment.

Electrophysiology studies

In patients with recurrent syncope, electrophysiology studies may be required to help exclude serious cardiac arrhythmias. Electrophysiology studies directly assess intracardiac conduction and assess for the presence of inducible supraventricular and ventricular arrhythmias by intracardiac stimulation. Sinus node and AV node function are also assessed; however, electrophysiology studies are not particularly sensitive to bradyarrhythmias.

Electrophysiology studies are also appropriate in patients with evidence of structural heart disease, particularly patients with impaired LV function who are at risk of serious cardiac arrhythmias such as ventricular tachycardia. Electrophysiologists are also able to organise provocative drug challenges to increase the sensitivity of diagnosing inherited channelopathies such as long QT and Brugada syndromes.

Tilt-table testing

Tilt-table testing involves the patient laying supine for 15 minutes and then the bed is elevated at an angle of 60° for a further 45 minutes. The patient is attached to an ECG monitor for the duration of the test and blood pressure measurements are taken every five minutes. Tilt-table testing is useful to confirm the diagnosis in patients who have suspected neurocardiogenic syncope (vasovagal). Tilt-table testing is not necessary in most patients with a typical history of neurocardiogenic syncope, but may be useful in some cases to confirm the diagnosis and to educate the patient about prodromal symptoms and management.

Excluding myocardial ischaemia

Myocardial ischaemia is a rare cause of syncope. In some cases, it will be appropriate to order an exercise stress test, a nuclear sestamibi parathyroid scan, a stress echocardiogram or coronary angiography. However, it is important to note that syncope usually only occurs in patients with severe triple vessel coronary disease or left main coronary disease, which may actually cause false-negative stress tests due to balanced ischaemia, and therefore coronary angiography may be necessary.

Genetic testing

In patients with a suspected underlying genetic cause for the common causes of syncope, arrhythmia or structural heart disease (e.g. hypertrophic cardiomyopathy, Brugada syndrome, long QT syndrome), referral to a genetic heart disease centre may be useful. This is a rapidly advancing area of cardiology due to increased availability and decreased costs of genetic testing. Specialised genetic heart disease clinics have multidisciplinary teams on site, including genetic counsellors, nurses and specialist cardiologists, who are trained in dealing with complexities associated with genetic heart disease and sudden cardiac death in young people.

Other tests

A brain CT or MRI scan should be considered in any patient in which there is a suspicion of a neurological cause of syncope. These patients should be referred to a neurologist for further specialist assessment. An electroencephalogram can help to diagnose seizure disorders, which are rare causes of syncope. Again, this should be in consultation with a specialist neurologist.

A computed tomography pulmonary angiography/perfusion ventilation scan should be ordered in patients with a sudden syncopal episode in the context of recent long-haul travel, malignancy or other risk factors for venous thromboembolism. Saddle pulmonary embolism is a life-threatening cause of syncope and must be excluded in these patients. Patients may give a history of preceding dyspnoea, pleuritic chest pain or calf swelling or pain.

Conclusion

Syncope is a common presentation with many potential underlying causes. In some patients, syncope is benign; however, in others it is the warning of impending sudden cardiac death. It is important to use a framework when investigating patients with syncope to identify patients who are at particular risk of sudden cardiac death. In patients with unexplained or recurrent syncope, excluding underlying cardiac disease is of the utmost importance. **CT**

Reference

1. Kapoor WN. Syncope. N Engl J Med 2000; 343: 1856-1862.

Further reading

Cardiac Society of Australia and New Zealand. Guidelines for diagnosis and management of Brugada syndrome. Sydney: CSANZ; 2011. Available online at: http://www.csanz.edu.au/LinkClick.aspx?fileticket=UVBe8rE_gk4%3D&tabid=148 (accessed February 2013).

Cardiac Society of Australia and New Zealand. Guidelines for diagnosis and management of familial long QT syndrome. Sydney: CSANZ; 2011. Available online at: http://www.csanz.edu.au/Portals/0/Guidelines/Practice/Diagnosis%20and%20Management%20of%20Long%20QT%20Syndrome%202011.pdf (accessed February 2013).

Cardiac Society of Australia and New Zealand. Guidelines for diagnosis and management of hypertrophic cardiomyopathy. Sydney: CSANZ; 2010. Available online at: http://www.csanz.edu.au/LinkClick.aspx?fileticket=40h0rtp7xYc%3D&tabid=148 (accessed February 2013).

Task Force for the Diagnosis and Management of Syncope; European Society of Cardiology (ESC); European Heart Rhythm Association (EHRA); Heart Failure Association (HFA); Heart Rhythm Society (HRS), Moya A, Sutton R, Ammirati F, et al. Guidelines for the diagnosis and management of syncope (version 2009). Eur Heart J 2009; 30: 2631-2671.

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