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What is a tilt table test and why is it performed during the investigation of syncope?

Laura White[1]

Howell T Jones[1,2]

Anne Davies[1]

Author details can be found at the end of this article

Correspondence to:
Laura White;
laura.white18@nhs.net

Abstract

Falls are one of the most common reasons for patients to present to the emergency department. Syncope is a common cause of falls, which disproportionately affects older people. In most cases, syncope can be confirmed with a detailed history and simple bedside tests, but tilt table testing remains an invaluable diagnostic adjunct in more complex cases. Often misunderstood, the tilt table test is a useful way to reproduce a patient's symptoms in a safe and controlled environment. The tilt table test is considered positive if the patient experiences symptoms associated with a drop in blood pressure or postural tachycardia. The test can support a diagnosis and can direct therapeutic interventions.

Key words: Arrhythmia; Hypotension; Orthostatic; Syncope; Tilt table test; Vasovagal

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Introduction

The key tool in understanding the diagnosis behind a syncopal event will always remain the history, supplemented with lying and standing blood pressure, heart rate and an electrocardiogram; in most cases, no further investigation is required to make a diagnosis. However, tilt table testing presents an invaluable diagnostic adjunct in more complex cases.

Medical students and doctors in training should understand the different types of syncope, as well as the relevance of tilt table testing to its investigation and management. Both syncope and pre-syncope are listed in the internal medicine training curriculum as 'key presentations.'

What is syncope and who is affected by it?

Syncope falls under a broader umbrella term of transient loss of consciousness. While taking a detailed clinical history, it is the clinician's role to unpick the various causes of transient loss of consciousness. Cardiovascular causes, namely syncope, are the most common, but neurological causes, such as epilepsy or psychogenic causes, should be considered. Syncope is distinct from other causes of transient loss of consciousness because of its rapid onset and recovery, as highlighted in the European Society of Cardiology definition: 'a transient loss of consciousness due to cerebral hypoperfusion, characterized by a rapid onset, short duration, and spontaneous complete recovery' (Brignole et al, 2018).

The presenting complaint following syncope is often described as a fall, and a London-based study showed that 8% of all 999 calls were to attend to a person who had fallen (Snooks et al, 2006). There were 220 160 emergency UK hospital admissions in 2017–18 following a fall and this disproportionately affected older people, with 66.6% of patients being aged 80 years and over (National Institute for Health and Care Excellence, 2010). Although the aetiologies of falls in older people are numerous, the British Geriatric Society estimates that, overall, 20% of falls in older people are secondary to transient loss of consciousness (Conroy, 2012).

Why is an accurate diagnosis important?

Patients often describe syncope as a 'faint', 'black out', 'collapse' or 'funny turn'. Syncope is especially common with advancing age, with an incidence of 2–6% for those above 80 years of age. In comparison, the incidence of epilepsy in older people is significantly less

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at 1% (Sardar et al, 2014). Unfortunately, cerebral hypoperfusion in syncope commonly manifests with myoclonic jerks, which can be mistaken for epileptiform movements. A misdiagnosis of epilepsy is expensive, costing £138 million annually in England and Wales, notwithstanding the cost to the patient in terms of stigma, lifestyle constraints and medication side effects (Juarez-Garcia et al, 2006).

What causes syncope?

Cerebral perfusion is dependent on an adequate systolic blood pressure, with a reduction in perfusion for as little as 7 seconds being sufficient to produce a complete loss of consciousness (Wieling et al, 2009). Systolic blood pressure is the product of cardiac output and peripheral vascular resistance. Syncope may occur with an abnormality in one or both of these variables.

Syncope can be subdivided into three types: reflex syncope, orthostatic hypotension and cardiac syncope, with each having several causes (Table 1) (Brignole et al, 2018).

- Orthostatic hypotension results from an insufficient increase in sympathetic nervous system activity to counteract gravity when moving from a supine to standing position
- Total peripheral resistance is primarily dependent on the activity of the sympathetic nervous system so that sudden withdrawal of the resting sympathetic tone leaves the resting parasympathetic tone unopposed, producing reflex syncope. Less commonly, it can also occur as a result of parasympathetic overactivity
- Cardiac syncope occurs as a result of a low cardiac output typically from structural cardiac disease or arrhythmias.

What is the role of the tilt table test in making an accurate diagnosis?

The clinical history, supported by a collateral history from any witnesses is often enough to diagnose syncope. However, clinical examination and simple investigations such as

Table 1. Classification of syncope and examples of underlying conditions

Orthostatic hypotension Typically occurs when moving from a lying or sitting to a standing position. May or may not be associated with prodromal features	Drug induced	For example, vasodilators, diuretics, antidepressants
	Volume depletion	For example, haemorrhage, diarrhoea, vomiting
	Primary autonomic failure	For example, pure autonomic failure, multiple system atrophy, idiopathic Parkinson's disease, Lewy body dementia
	Secondary autonomic failure	For example, diabetes, amyloidosis, spinal cord injury, autonomic neuropathies
Reflex syncope: the 3 Ps Posture such as on standing after prolonged sitting Provoking factors such as pain or a medical procedure Prodromal symptoms such as sweating or feeling hot	Vasovagal	Orthostatic component so that this typically occurs on standing Emotional component, such as in response to fear, pain or shock
	Situational	Micturition, excessive coughing, swallowing
	Carotid sinus hypersensitivity	Pressure over the carotid sinus (eg while shaving) produces syncope
Cardiac syncope Often occurs very suddenly and without significant prodromal features. Cardiac syncope may occur at any time including while patient is sitting or lying down	Arrhythmia	Bradycardia, eg sinus node or atrioventricular conduction system disease Tachycardia, eg supraventricular or ventricular
	Structural cardiac disease	Aortic stenosis, hypertrophic obstructive cardiomyopathy, cardiac tumours such as atrial myxoma
	Pericardial disease	Restrictive pericarditis, tamponade
	Vascular disease	Pulmonary embolism or pulmonary hypertension

From National Institute for Health and Care Excellence (2010); Brignole et al (2018)

a lying and standing blood pressure and an electrocardiogram can help to confirm it. If further evidence is needed a tilt table test can be considered (Figure 1).

Tilt table testing presents an invaluable diagnostic adjunct as it mimics the scenario of prolonged standing to reproduce clinical symptoms in a safe and controlled environment. A tilt table test is designed to provoke syncope in a patient with a hypotensive susceptibility as a more potent orthostatic challenge than a simple lying and standing blood pressure check. Hypotensive susceptibility commonly underlies all types of syncope, but particularly reflex syncope and orthostatic hypotension (Brignole et al, 2018).

A tilt table test should be considered for:

1. A patient with suspected orthostatic hypotension that was not confirmed by a standard lying and standing blood pressure – a tilt test allows assessment of delayed orthostatic hypotension and a positive result tilt would support this diagnosis
2. A patient with suspected reflex syncope that was not entirely clear on first assessment. If this patient has a tilt test that is positive, this supports the diagnosis of reflex syncope by confirming hypotensive susceptibility (a key component of reflex syncope)
3. A negative tilt test is also valuable. This does not rule out syncope (false negative in 30% of cases of true syncope) but should prompt a review of syncope as the suspected diagnosis (National Institute for Health and Care Excellence, 2010; Brignole et al, 2018).

A tilt table test can also support treatment of syncope:

- Patient education – tilt table testing can support patients in recognising their own prodromal symptoms, as well as providing an opportunity to practice physical manoeuvres to avoid a syncopal event
- Opportunity for cardiovascular monitoring – monitoring a patient's heart rate during tilt table testing may capture an arrhythmia and warrant change in management, such as the need for pacemaker insertion.

Before the test

Patients are advised to attend appointments accompanied where possible to avoid the need to drive home in case they feel unwell after the test. They are also advised not to eat or drink for 4 hours before their appointment, to reduce the chance of nausea, but should still take all usual medications, except blood glucose-lowering medication, which may require adjusting. Most tilt table clinics will take place on a morning list for this reason.

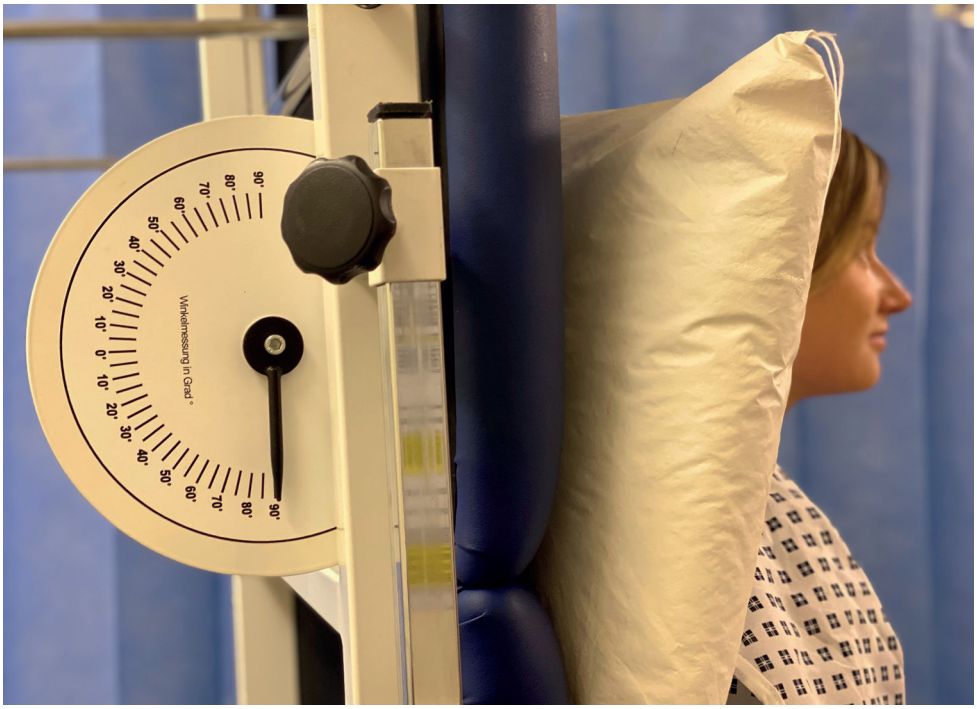

Figure 1. The tilt table test in progress.

A full history is taken and cardiovascular examination performed before the test, as well as a postural blood pressure and an electrocardiogram (Brignole et al, 2018). The procedure is fully explained and written information provided outlying the risks. If the patient is happy to proceed, written consent is then typically obtained.

Contraindications include (Kenny et al, 2000):

- Severe carotid or coronary stenosis
- Severe left ventricular outflow obstruction as it may cause arrhythmias
- Recent (<3 months) after myocardial infarction, transient ischaemic attack or stroke because of the risk of a potential arrhythmia
- Pregnancy
- Morbid obesity
- Inability to stand for long periods as a result of pain.

How is a tilt table test performed and what does it involve for the patient?

A tilt table test is a simple procedure and is generally well tolerated. It is performed by a physician or specialist nurse in a quiet, dark room to prevent any unnecessary sympathetic stimulation. The patient lies on a special couch that can tilted to a standing position, and blood pressure, heart rate and rhythm are continuously monitored (Figure 2). Patients are strapped to the couch for safety to prevent injury should they have a syncopal episode and are made aware that they can stop the test at any time (Figure 3). Different centres will have variations in exactly how the test is performed, and the details and adjuncts suggested below are a general guide.

When ready the patient is tilted, head up to standing (60–70°) and maintained in that position for 20 minutes or until symptoms occur.

If patients remain asymptomatic after 20 minutes, then a short-acting vasodilating medication (such as glyceryl trinitrate 400 micrograms as a sublingual spray or tablet) can be administered and other provocation, such as following a meal, may also be considered. The test then continues for a further 20 minutes to see if symptoms can by provoked or syncope occurs.

Glyceryl trinitrate should not be used in patients with a history of (Joint Formulary Committee, 2020):

- Hypertrophic obstructive cardiomyopathy
- Aortic stenosis
- Mitral stenosis
- Restrictive pericarditis
- Pulmonary hypertension
- Marked anaemia.

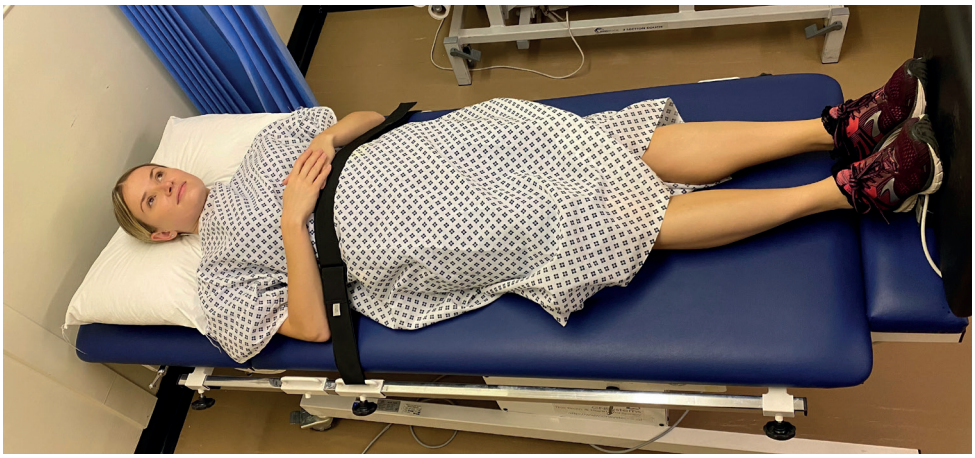

Figure 2. Beginning of the tilt table test with pillow and strap in place to ensure the safety and comfort of the patient.

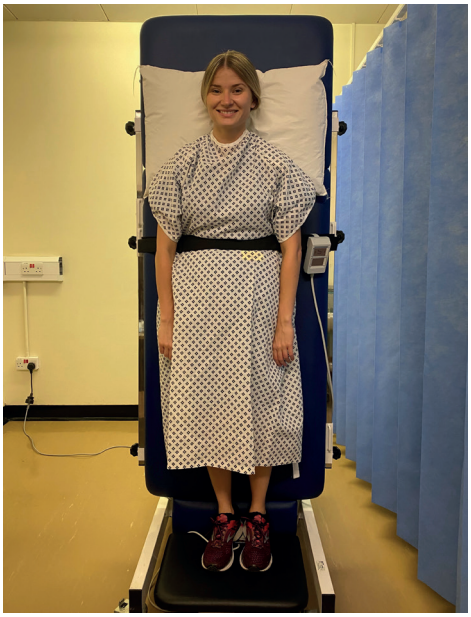

Figure 3. The tilt table test is generally well tolerated.

If the patient is asymptomatic after 40 minutes, then the test is complete. The patient is monitored for a period in the department to ensure they remain well before being allowed to return home.

The test should be abandoned and the patient laid flat immediately if the systolic blood pressure falls below 80 mmHg or is falling rapidly, the heart rate falls below 50 or rises above 170 beats per minute or is changing quickly, there is evidence of arrhythmia on electrocardiogram monitoring, or if the patient asks to stop or is seen to be in distress (Cooper, 2008).

What are the risks of tilt table testing?

Tilt testing is generally a safe procedure, during which the patient is securely attached to the table and closely monitored throughout the test. Despite the low risk, it is recommended that resuscitation equipment should be available (Cooper, 2008).

The potential risks of tilt table testing are:

- Pre-syncopal symptoms, such as nausea, light-headedness and palpitations
- Inducing actual syncope
- Arrhythmias, such as ventricular tachycardia or fibrillation
- Severe bradycardia which could, in the worst case scenario, result in asystole, cardiac arrest and death (very rare)
- Side effects of glyceryl trinitrate: headache, chest pain, arrhythmias, hypotension, dizziness, nausea, vomiting, flushing, fatigue.

Limitations of tilt table testing

Although tilt table testing is most frequently positive in the categories of reflex and orthostatic syncope, it is important that it is not used to try and differentiate syncope of uncertain cause, as a positive tilt table test is a commonality of all types of syncope. For example, although tilt table testing is positive in 92% of patients with emotionally triggered vasovagal syncope the tilt table test is still positive in 47% of patients with pure cardiac syncope and 8–13% in patients who do not have syncope at all (Brignole et al, 2018). In addition, National Institute for Health and Care Excellence (2010) guidance specifies that an ambulatory electrocardiogram is the recommended investigation for unexplained syncope.

The role of tilt table testing is best understood as confirming hypotensive susceptibility, which provides a significant predisposition to all types of syncope and therefore supports a suggested diagnosis in the correct clinical context. The presence or absence of a positive

Key points

- Syncope is common and its incidence increases with age.
- Syncope can be classified as reflex syncope, orthostatic hypotension or cardiac syncope.
- Syncope can often be identified by a good history supplemented with lying and standing blood pressure and heart rate, and in most cases no further investigation is required to make the diagnosis.
- Tilt table testing should be considered in specific scenarios such as when despite a detailed history there remains diagnostic uncertainty.
- A tilt table test allows clinicians to recreate the situation that may cause patients to experience the symptoms and signs of syncope in a safe monitored environment, which is useful for diagnosis and management.
- A tilt table test is positive where symptoms occur in association with a drop in blood pressure or positional arrhythmia.
- If hypotensive susceptibility is detected, this has specific implications for a change in the patient's management plan.

tilt table test can explain the variation in syncope between individuals with a common pathology, for example the same degree of aortic stenosis, where the added finding of hypotensive susceptibility confers a greater risk of cardiac syncope (Brignole et al, 2018).

This principle of hypotensive susceptibility also has practical implications for therapy, including highlighting the importance of specific treatment strategies. For example, in patients with proven cardiac syncope who require a pacemaker and have confirmed additional hypotensive susceptibility, insertion syncope is more likely to reoccur despite pacemaker insertion. Therefore, confirmation of hypotensive susceptibility should prompt additional treatment strategies, such as discontinuation or reduction of hypotensive drugs and the administration of fludrocortisone or midodrine (Brignole et al, 2018).

What about carotid sinus massage?

If carotid sinus hypersensitivity is suspected, carotid sinus massage is performed during the tilt test. Patients undergoing carotid sinus massage should be consented for specific risks of carotid sinus massage, including localised discomfort and the potential risk of neurological sequelae, such as transient ischaemic attack or stroke, which occurs in approximately 1 in 500 patients (Munro et al, 1994; Davies and Kenny, 1998). The clinician performing the procedure must be competent to do so and have excluded any contraindications. The pathophysiology of carotid sinus hypersensitivity and how to perform carotid sinus massage are described elsewhere (Cooper, 2008).

Contraindications to carotid sinus massage include (Cooper, 2008):

- Patient refusal
- Previous reaction to carotid sinus massage
- Carotid stenosis of 50% or more
- Recent (<3 months) myocardial infarction, transient ischaemic attack or stroke
- Previous ventricular fibrillation or ventricular tachycardia.

Conclusions

Tilt table testing is an invaluable diagnostic adjunct to a detailed clinical history for detecting hypotensive sensitivity, which has significant implications for the management of all subtypes of syncope. Tilt table testing is a relatively simple, safe and well tolerated procedure in diagnostic evaluation, although it is often underused. However, the key tool in understanding the diagnosis behind a syncopal event will always remain the history, supplemented with lying and standing blood pressure, heart rate and an electrocardiogram.

Curriculum checklist

This article covers the following areas from the general internal medicine curriculum:

- Is focussed on patient safety and delivers effective quality improvement in patient care
- Managing patients in an outpatient clinic, ambulatory or community setting, including management of long-term conditions
- Managing medical problems in patients in other specialties and special cases.

Author details

[1]Department of Elderly Medicine, Royal Free Hospital, Royal Free London NHS Foundation Trust, London, UK

[2]MRC Unit for Lifelong Health and Ageing at UCL, London, UK

Conflicts of interest

The authors declare that they have no conflicts of interest.

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