Dix–Hallpike and Epley manoeuvres

Introduction

The Dix–Hallpike manoeuvre is an important constituent of the neuro-otological examination of a patient with symptoms of vertigo. This article describes how to perform the manoeuvre in an examination and outlines the interpretation of the clinical signs elicited which can be confusing.

Background

In 1952 Charles Skinner Hallpike and Margaret Dix published a paper describing a provocative positional test for what they called 'positional nystagmus of the benign positional type'. This condition is more commonly known as benign paroxysmal positional vertigo. It is characterized by brief attacks of rotatory vertigo and nystagmus that are precipitated by certain head movements. It is the most common cause of true vertigo in adults.

Clinical anatomy

It is important to have a basic grasp of the anatomy of the vestibular system in order to understand benign paroxysmal positional vertigo and how the Dix–Hallpike manoeuvre works.

The vestibular system within the inner ear is made up of the semicircular canals and the otolith organs (utricle and saccule) which respond to rotational and linear acceleration respectively (*Figure 1*).

In each inner ear there are three fluid-filled semicircular canals (superior, posterior and lateral) orientated approximately at right angles to one another (*Figure* 2). There is a dilated end of each semicircular canal called the ampulla where the sensory neuroepithelium is located. The ampulla contains a gelatinous component called the cupula which has the hair cells embedded within it. Movement of endolymph against the cupula causes deflection of cilia on the hair cells and thus the transduction of mechanical movement to electrical signals.

Each semicircular canal is maximally stimulated by movement in the plane of the canal, e.g. the lateral semicircular canal is stimulated by rotation of the head around a vertical axis (pirouetting).

The actions of the semicircular canals are paired such that turning to the right will stimulate the right lateral semicircular canal and inhibit the left semicircular canal. In the same way turning back and to the left will stimulate the left posterior semicircular canal and inhibit the right superior semicircular canal.

When do we use the Dix–Hallpike manoeuvre?

The Dix–Hallpike manoeuvre is used to help with the diagnosis of posterior semicircular canal benign paroxysmal positional vertigo (*Table 1*).

Benign paroxysmal positional vertigo is caused by deposition of calcium carbonate crystals called otoliths in the duct (canalolithiasis) or the cupula of a semicircular canal (cupulolithiasis). These otoliths are usually suspended in a gelatinous matrix within the utricle.

Changes in head position in the plane of the affected semicircular canal results in abnormal movement of the endolymph which contains the heavier otolith debris. This in turn causes vertigo and nystagmus in the plane of the stimulated semicircular canal.

In the majority of cases there is no obvious cause but occasionally there may be a prior history of recent head trauma.

Figure 1. Semicircular canals.

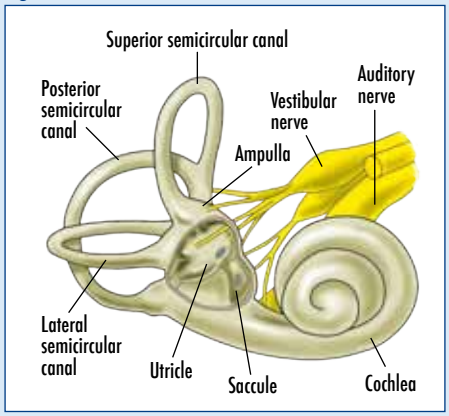

Figure 2. Angles and spatial organization of the semicircular canals.

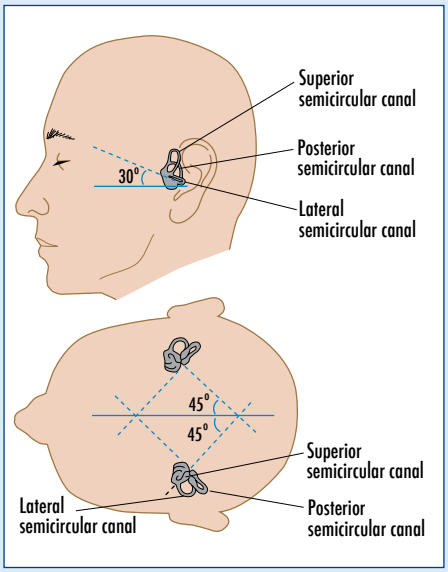

Table 1. Distinguishing features of benign positional paroxysmal vertigo when performing the Dix–Hallpike manoeuvre

	Benign paroxysmal positional vertigo	CNS lesion
Latent period	Few seconds	No latent period
Subjective response	Patient distressed, manoeuvre may elicit severe nausea and cause vomiting	Nil
Direction of nystagmus	Vertical torsional	Variable
Duration of nystagmus	Less than 30 seconds	Persists as long as position is maintained
Fatiguability	Yes	No

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Performing the Dix–Hallpike manoeuvre

The Dix–Hallpike manoeuvre aims to elicit the symptoms of benign paroxysmal positional vertigo by positioning the head in the direction of greatest stimulation.

The posterior semicircular canal is the most commonly affected (around 90% of cases) as the otoliths are most likely to 'fall' into it because of gravitational forces. The left and right posterior semicircular canals are most stimulated when moving the head backward and to the left and right respectively, forming the basis of the Dix–Hallpike manoeuvre.

The Dix–Hallpike manoeuvre involves passively moving the neck of the patient and also positioning him/her in a supine position (*Figures 3–7*). It is very important to make sure that the patient does not suffer from neck problems, e.g. cervical arthritis, and that the patient can tolerate lying flat for a short period of time. The patient should also be warned that the manoeuvre may provoke the symptoms resulting in nausea and occasionally vomiting.

The patient is positioned sitting up with the head turned 45° to one side. The examiner should always look at the patient's eyes to see if there is any nystagmus (*Figure 3*).

Figure 3. Patient positioned on examination table with the head turned to the tested side at 45°.

Figure 5. Continuation of the Dix–Hallpike into the Epley manoeuvre. The patient's head is passively turned 90° to the opposite side, and held in this position for 30 seconds.

The patient is then placed lying down with the head extended over the edge of the couch 20° below the horizontal (i.e. in the plane of the posterior semicircular canal) (*Figure 4*). The midpoint of the semicircular canal is now at its lowest point and any otoliths will move away from the ampulla. This creates a negative fluid pressure and excitatory ampullofugal deflection of the cupula.

After a latent period of a few seconds there is pronounced vertical torsional nystagmus with the fast phase towards the affected ear. The latent period is caused by the time lag for gravity to accelerate the otoliths sufficiently to cause vestibular stimulation (*Figures 5* and *8*).

The vertigo lasts for less than 30 seconds and can be very disturbing, resulting in significant nausea and occasionally vomiting. There is a classic crescendo of symptoms and nystagmus as the particles start moving and cause deflection of the cupula and gradual decrescendo as the particles settle down in the bottom of the canal.

In benign paroxysmal positional vertigo repeated applications of the Dix–Hallpike test result in a gradual reduction in the symptoms and nystagmus (fatigue) as a result of dispersion of the otoliths. A lack of fatigue is an important clinical finding and means that the examiner should consider other diagnoses, particularly central pathology. Evaluation of nystagmus should ideally involve the use of Frenzel goggles in a darkened room to allow maximum illuminations and magnification of the eyes.

The Dix–Hallpike manoeuvre has a sensitivity of 79–82% and a specificity of 71–75% (Bhattacharyya et al, 2008; Halker et al, 2008). Evidence-based guidelines suggest that a diagnosis of posterior canal benign paroxysmal positional vertigo can be made when vertigo and nystagmus are precipitated by the Dix–Hallpike manoeuvre (Bhattacharyya et al, 2008). Radiographic imaging and vestibular testing is not indicated unless there is uncertainty or additional symptoms or signs unrelated to benign paroxysmal positional vertigo that warrant testing.

The lateral semicircular canal is affected in about 6–8% of cases. When the Dix–Hallpike manoeuvre is performed there is nystagmus that is horizontal and geotropic

Figure 4. The patient is placed lying down with the head extended over the edge of the couch 20° below the horizontal (i.e. in the plane of the posterior semicircular canal). Observe for nystagmus for at least 30 seconds.

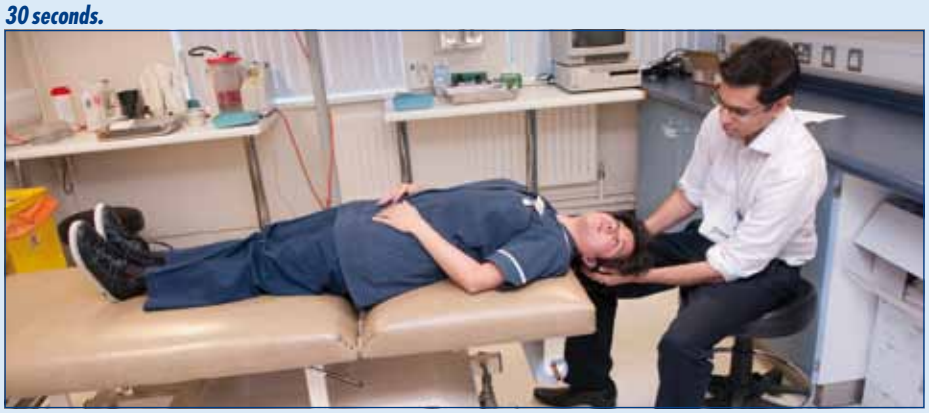

Figure 6. The patient is asked to turned on to her side so that her head is nearly in the face down position.

(fast phase beats towards the earth), because the otoliths in the lateral semicircular canal move towards the cupula when the manoeuvre is performed. When the patient is rolled on to the normal side the otoliths move away from the cupula, causing a geotropic horizontal nystagmus.

As unilateral disease will provoke nystagmus on both sides it is more difficult to localize the side of pathology. The side which is associated with the most severe nystagmus and vertigo is presumed to be the affected side. In cases of cupulolithiasis there may be ageotropic nystagmus (fast phase beats towards the sky) where the reverse applies (*Figure 9*).

The Epley manoeuvre

Dr John Epley (1980) described this canalith repositioning manoeuvre to treat the symptoms of posterior canal benign paroxysmal positional vertigo. It can be carried out immediately after the Dix–Hallpike manoeuvre to guide the otoliths out of the posterior canal and into the vestibule. The manoeuvre is shown in detail in *Figures 3–7*.

A Cochrane review including five well-constructed randomized controlled trials concluded that the Epley manoeuvre is a safe effective treatment for posterior canal benign paroxysmal positional vertigo (Hilton and Pinder, 2009). An odds ratio of 4.2 (95% confidence interval 2.0–9.1) was found in favour of treatment for subjective symptom resolution in posterior canal benign paroxysmal positional vertigo; an odds ratio of 5.1 (95% confidence interval, 2.3–11.4) was found in favour of treatment for conversion of a positive to negative Dix–Hallpike test.

However, there is no significant evidence available regarding long-term benefit. There is also no consensus as to how often the manoeuvre should be repeated. BJHM

Conflict of interest: none.

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Hilton M, Pinder D (2009) The Epley (canalith repositioning) manoeuvre for benign paroxysmal positional vertigo. *Cochrane Database Syst Rev* (2): CD003162

Figure 7. The patient is returned to the upright position to complete the Epley manoeuvre.

Figure 8. Interpreting the vertical torsional nystagmus from the Dix–Hallpike manoeuvre.

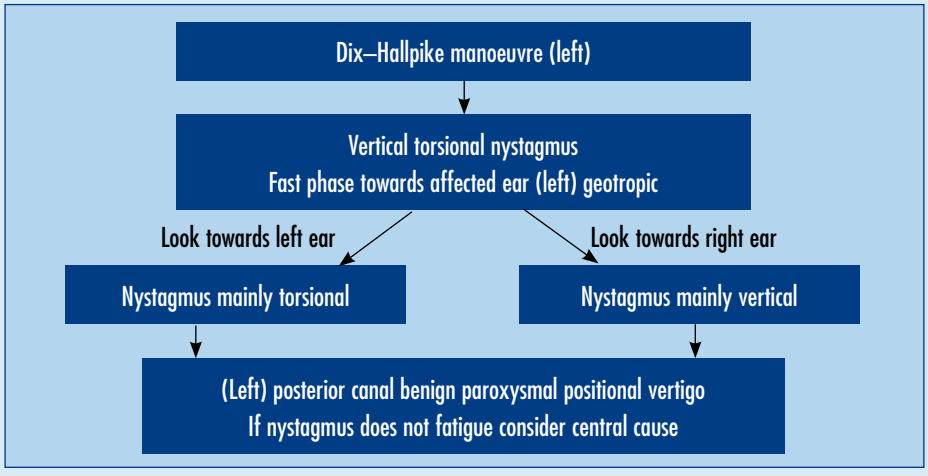
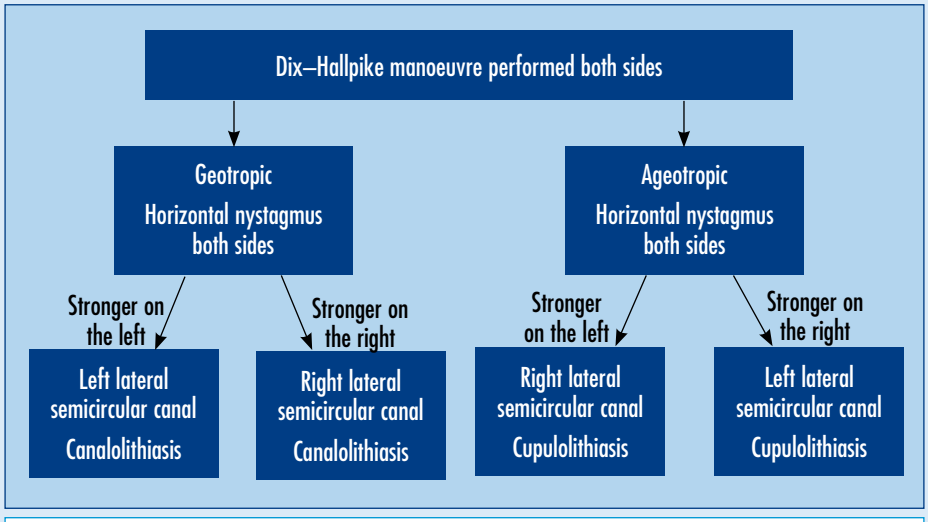


Figure 9. Interpreting the horizontal nystagmus from the Dix–Hallpike manoeuvre.



KEY POINTS

- Benign paroxysmal positional vertigo may be diagnosed from history and examination alone.
- In benign paroxysmal positional vertigo, the Dix–Hallpike manoeuvre is associated with a latent period between completion of test and onset of nystagmus. The vertigo and nystagmus should resolve within 60 seconds from the onset of the nystagmus prompted by the manoeuvre.
- The Epley manoeuvre is the treatment of choice for benign paroxysmal positional vertigo.
- Disturbances of the vestibular system may be associated with jerk nystagmus – a slow phase eye movement in one direction followed by a correcting fast phase component.