Benign paroxysmal positional vertigo (BPPV) is the most common cause of vertigo which is experienced as the illusion of movement. Symptoms are due to inner ear dysfunction. Otoliths become detached from the macula (the utricle-based receptor for detecting head position and movement) into the semicircular canals. These are affected differentially due to anatomy:

- Posterior semicircular canal - 85-95% of patients.
- Inferior semicircular canal - 5-15% of patients.
- Anterior semicircular canals - very rare.

Hair cells embedded in otoliths are stimulated as they are pulled/pushed by the flow of endolymph through the semicircular canals following head movement and terminate as movement ceases. Detached otoliths may continue to move after the head has stopped moving and vertigo results from the conflicting sensation of ongoing movement with other sensory inputs.

Most BPPV is idiopathic. Causes can be attributed in about 40% and include:

- Head injury.
- Spontaneous degeneration of the labyrinth.
- Post-viral illness (viral neuronitis)\(^1\).
- Complication of stapes surgery.
- Chronic middle ear disease.

Epidemiology

- BPPV is common. A German study suggests a lifetime prevalence of 2.4% and previous year prevalence of 1.6\(^2\).
- BPPV can affect people of any age but commonly presents at around 50 years of age. Younger people may develop BPPV as a consequence of head trauma. Women are affected twice as often as men\(^3\).

Risk factors

- Older age - onset is most common between 40 and 60 years.
- It is more common in women (male:female ratio 1:2).
- Ménière's disease (co-diagnosis in up to 30%).
- Anxiety disorders\(^4\).
- Migraine\(^5\), particularly in children\(^6\).

Presentation

History

- Those affected by BPPV endure episodes of vertigo provoked by head movements (such as entailed in rolling over in bed, lying down, sitting up, leaning forward or turning the head in a horizontal plane).
- Patients often volunteer that symptoms are worse when the head is tilted to one particular side.
- Attacks are of sudden onset and usually last 20-30 seconds with rapid resolution if the head is kept still.
- There is normally a brief latent period (usually about 5 seconds but may be up to 20 seconds) between the provocative movement and the experience of vertigo.
- Nausea is common but vomiting is rare\(^3\).
- Symptoms are typically worse in the mornings.
- Hearing is not affected and tinnitus is not a feature. Symptoms such as hearing loss, tinnitus, ear or mastoid pain, headache and photophobia point towards alternative diagnoses.
- Light-headedness and imbalance are sometimes reported after the attack and may last for several minutes or hours\(^3\).
- BPPV may present as a fall. In one study, 54% of patients admitted to hospital following a fall and suitable for assessment were found to have BPPV\(^7\).

Examination

Clinical examination should include:

- Assessment of the external ear and tympanic membrane (excluding cholesteatoma and vesicles suggestive of herpes zoster oticus).
- Cranial nerve examination for evidence of palsies and hearing loss.
The Dix-Hallpike test is used to confirm posterior canal BPPV (this should be avoided in patients with neck- or back-related pathology such as cervical stenosis, severe rheumatoid arthritis, spinal cord injury, carotid stenosis or vertebral artery disease):

- Warn the patient that transient vertigo may occur in any position.
- Ask the patient to keep their eyes open and stare at the examiner's nose.
- Prepare the couch so the headrest is down and the patient's head will overhang the end.
- Begin with the patient sitting with their head turned 45° to the left to test the left posterior canal. With their head in this position, quickly lay the patient down until the head is dependent 30° below the level of the couch.
- Observe for nystagmus in each position (30 seconds) and then return the patient to the upright position.
- Repeat with the head turned to the right to test the right posterior canal.

If positive:

- The patient experiences vertigo and rotary nystagmus (best seen by looking at scleral vessels and radial markings on the iris) in posterior canal BPPV. Purely horizontal nystagmus suggests horizontal canal BPPV.
- A short latency period of a few seconds should be expected.
- Nystagmus (fast component) will be upbeat and in the direction of the undermost (affected) ear. This has a limited duration, lasting <30 seconds (adaption).
- On sitting, there is more vertigo, experienced as the room spinning in the opposite direction (with reversal of the nystagmus).

Generally with BPPV, only one side should test positive during the Dix-Hallpike test. Bilateral posterior semicircular canal BPPV is possible but unlikely and points towards horizontal canal involvement, vestibular neuritis or a central cause. Central positional nystagmus tends to persist whilst the provoking position is maintained (not adapting with time) and is not as direction-specific as BPPV, beating in any direction.

Differential diagnosis

Conditions causing vertigo and nystagmus include:

- Acute vestibular labyrinthitis.
- Multiple sclerosis.
- Ménière's disease.
- Cerebrovascular disease - transient ischaemic attack (TIA), stroke.
- Posterior cranial fossa tumours - eg, acoustic neuroma.
- Brainstem lesions.
- Herpes zoster oticus (Ramsay Hunt syndrome).
- Otosclerosis.
- Vertebrobasilar insufficiency.
- Cholesteatoma.
- Iatrogenic - eg, a side-effect of some anticonvulsant and antihypertensive medication.

Beware 'red flags' such as unilateral hearing loss or tinnitus, new-onset headache, focal neurological signs or cerebellar signs including gait ataxia, down-beating or other atypical nystagmus [8]. These suggest more serious causes of vertigo and should prompt rapid specialist referral.

Investigations

There are no current investigations that will demonstrate otoliths. Further investigation is not required where features are typical of BPPV; however, neuroimaging (CT or MRI scan) is indicated where there is diagnostic uncertainty. One study suggested a higher risk of unexpected intracranial pathology where there was no response to initial Epley's manoeuvre and in those with asymmetric hearing [9].

Management

General [3]

Where BPPV has been diagnosed as the cause of a patient's vertigo:

- Advise that symptoms are usually self-limiting over several weeks but may recur. In one small trial, 36% of patients had a recurrence within 48 months [10].
- Limit symptoms by getting out of bed slowly and reducing head movements.
- Offer a period of observation or immediate treatment (usually Epley's manoeuvre or Brandt-Daroff exercises).
- Consider safety:
  - Advise the person not to drive when dizzy or if driving might provoke an attack of vertigo.
  - In the UK, the DVLA must be notified if someone is liable to 'sudden and unprovoked or unprompted episodes of disabling giddiness' and driving is only permitted when satisfactory control of symptoms is achieved [11]. However experts suggest that, in general, BPPV is neither unprovoked nor unprompted.
  - Advise the patient to inform employers where vertigo may pose an occupational hazard (eg, working at heights, with machinery, driving).
  - Discuss measures to reduce the risk of falls.
- Follow-up should be in four weeks to check symptom resolution.
Referral to a specialist is appropriate where:
- Epley's manoeuvre cannot be provided in local primary care.
- Epley's manoeuvre has been performed and repeated without symptoms abating.
- The diagnosis is not certain.
- Symptoms and signs haven't resolved after four weeks.
- There have been three or more recurrences of vertigo.

Repositioning techniques

Epley's manoeuvre

This is the most widely used repositioning manoeuvre for BPPV. Its aim is to reposition otoliths back into the utricles from the posterior semicircular canals. A Cochrane review concluded that it is a safe, effective treatment for posterior BPPV (number needed to treat 2-4)[10]; outcomes are similar for Semont and Gans manoeuvres although these are less commonly used.

In a five-year follow-up study from treatment with Epley's manoeuvre, only 7% had had a severe recurrence of their BPPV, sufficient to seek medical attention[12]. However, it is unclear how this compares with the natural history of untreated disease.

To perform Epley's manoeuvre[3]:

- Sit the patient upright on the couch with their head turned 45° to the affected side (the side that tested positive using the Dix-Hallpike test).
- Place your hands on either side of the patient's head and guide the patient to lie down with the head dependent 30° over the edge of the couch (the same as in the Dix-Hallpike test). Wait for at least 30 seconds to a minute.
- Rotate their head 90° to the opposite side with the patient's face upward with the head remaining dependent.
- Roll the patient on to their side whilst holding their head in this position and then rotate the head so that it is facing downwards (tell the patient to look to the ground).
• Sit the patient up sideways while maintaining head rotation.
• Simultaneously rotate the head to a central position. (There should be no nystagmus by this stage, if the procedure has been successful, as the otoliths should by now be repositioned.)

For success:

• Whilst dependent, the head should be hanging over the edge of the couch at full neck extension. If a patient is unable to tolerate this, a couch can be used in the Trendelenburg position to simulate it.
• Each position should be maintained until full resolution of symptoms and nystagmus has been achieved for at least 30 seconds.
• There is evidence supporting a small additional beneficial effect of post-Epley postural restrictions (e.g., upright head posture for 48 hours, avoiding lying on affected side for 2-7 days) in comparison to Epley’s manoeuvre alone (NNT = 10)\(^{[13]}\).

Symptoms can improve quickly following treatment but full recovery can take days to several weeks. If symptoms have not settled by a week and the diagnosis of BPPV is highly likely, consider repeating Epley’s manoeuvre\(^{[14]}\).

There are also repositioning manoeuvres for horizontal canal BPPV (the ‘barbecue’ manoeuvre) and for anterior canal BPPV.

**Self-treatment using Epley's manoeuvre**: this can be taught to patients to perform at home using a pillow to support the shoulders, with the head resting on the bed, rather than over the side of the bed\(^{[15]}\). Many patients teach themselves from video-sharing websites\(^{[16]}\).

**Brandt-Daroff exercises**
These were developed as a series of home exercises to loosen and disperse inner ear debris. They are not as effective as Epley’s manoeuvre performed by a healthcare professional\(^{[10]}\). Tell the patient to:

• Sit on the side of bed with their head rotated 45° to one side.
• Close eyes to minimise vertigo.
• Quickly lie down to the opposite side until the head touches the bed (if the head is turned to the left, lie on the right side), nose up and lateral occiput resting on the bed.
• Stay in this position for 30 seconds then sit up.
• Turn head to the other side and repeat on the opposite side.
• One session should include six repetitions to each side; repeat three times daily until free of vertigo for at least two consecutive days.

Complications of repositioning manoeuvres include nausea (16.7% - 32%)\(^{[10]}\), vomiting, fainting and intolerable vertigo. Manoeuvres may be difficult in elderly or less mobile patients but they remain the most effective treatment available. Contra-indications are as for the Dix-Hallpike test (see 'Examination', above). Where symptoms persist despite attempts at repositioning manoeuvres, referral for further investigation and specialist re-evaluation should not be delayed.

**Vestibular rehabilitation**
There is evidence that vestibular rehabilitation is a safe, effective management for unilateral peripheral vestibular dysfunction and it resolves symptoms and improves functioning in the medium term. However, there is evidence that physical (repositioning) manoeuvres are more effective in the short term than exercise-based vestibular rehabilitation, although a combination of the two is effective for longer-term functional recovery\(^{[17]}\).

**Medication**
Avoid vestibular suppressant medications; they neither prevent the symptoms nor alter the natural history of the condition\(^{[13]}\).

**Surgery**
Surgery is very much regarded as an extreme last resort for intractable symptoms\(^{[18]}\) - denervating the posterior semicircular canal or obliterating it by laser (transmastoid) - but deafness is a risk.
Prognosis

The natural history for BPPV is for spontaneous remission but with a high chance of recurrence (approximately 50% at five years)[2]. Where the posterior semicircular canal is involved, approximately a third of patients’ symptoms will remit within a week compared with a half of those with horizontal semicircular canal involvement, related to ease of self-clearing of debris into the utricle[19]. BPPV is considered ‘benign’ but may increase the risk of falls and injuries and make some occupations impossible (eg, airline pilot)[20]. Frequent episodes of vertigo may diminish quality of life; treatment is effective and it should be actively treated.

Further reading & references

- Management of dizziness and vertigo: Imperial College London, Department of Medicine
- Benign paroxysmal vertigo; NICE CKS, September 2013 (UK access only)
- Assessing fitness to drive: guide for medical professionals; Driver and Vehicle Licensing Agency

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Author: Dr Jacqueline Payne
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