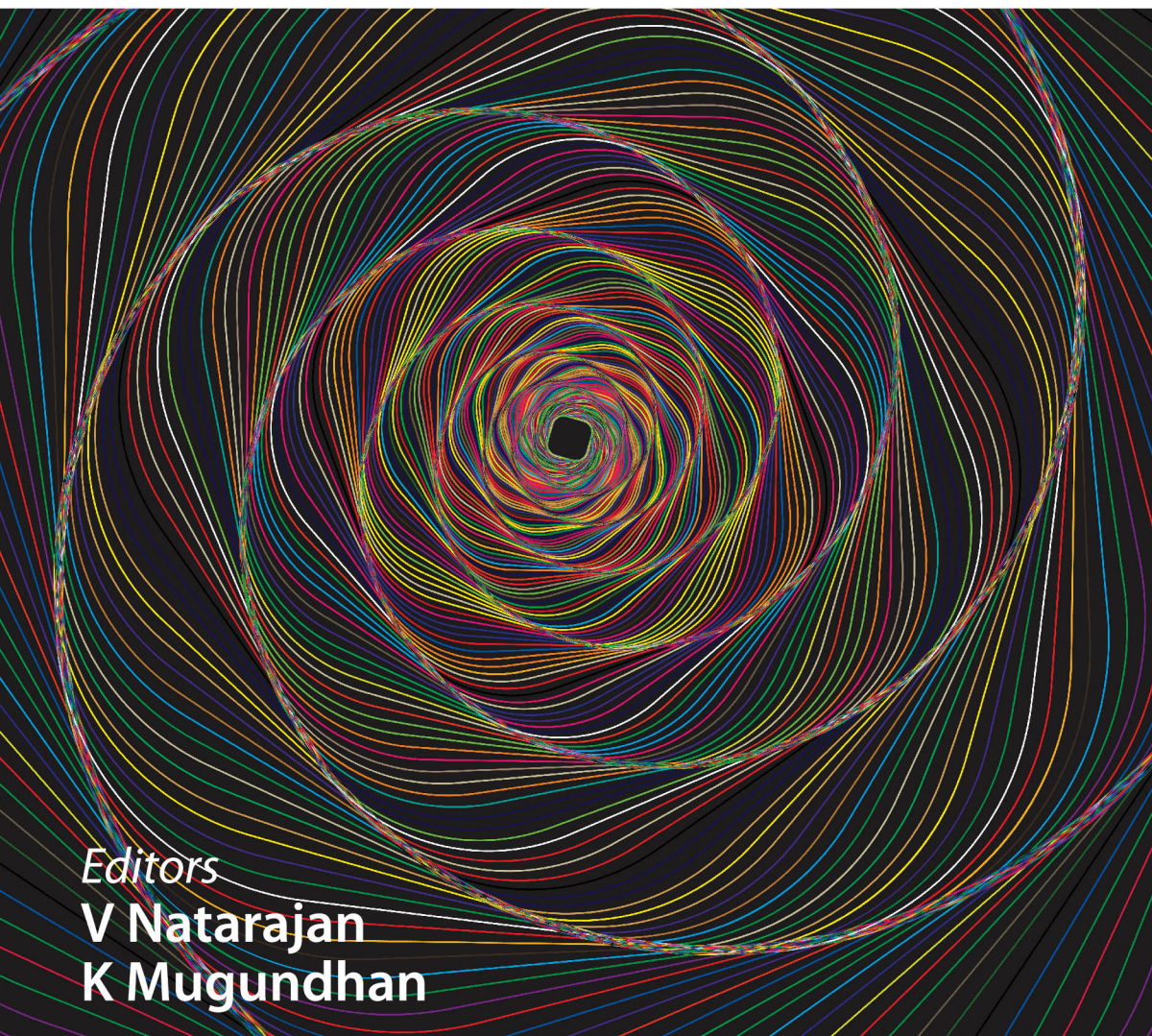
Monograph on Dizziness



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PART 1

Clinical Approach to Dizziness

INTRODUCTION

Dizziness and giddiness are used interchangeably by patients and refer to several descriptive symptoms collectively included under the above terms, and these descriptions make them difficult to understand.

These symptoms include:

- A sensation of spinning, either of the surroundings or of the self, with spinning of the head; and this symptom is referred to as vertigo, occurring due to vestibular system involvement.
- The other common description is a feeling of being pushed, and less often, of tilting or levitating, which also indicates dysfunction of the vestibular system.
- Another common description is that of feeling unsteady while walking, turning, or standing due to impairment of balance—a state of disequilibrium.
- A sensation of dimming of vision, a sinking feel, or a feeling of going to pass out are other descriptions indicating a state of presyncope or syncope per se.

The term 'giddy' or 'dizzy' expressed by the patient could mean any of the above symptoms and may also include a state of generalized weakness and anxiety. Hence, it becomes imperative to elicit from the patient directly, a detailed, and as accurate a history as possible. The attendant, even if it happens to be the wife or offspring, would not know what the patient experiences or has experienced. It would be pointless to elicit a history from them, even if the patient is unable to give a good description. This is the case quite often, making it difficult for the physician to understand the symptom. It is not easy for the patients to describe the details the way we want, and quite often, the description also keeps changing as more and more questions are asked of them. To complicate matters further, the relatives would chip in with their own understanding of the patient's symptoms, to confuse further.

SYMPTOM ANALYSIS OF THE TYPES OF DIZZINESS

Vertigo

This is a specific type of giddiness or dizziness in which the patient experiences the outside world to be spinning which is referred to as objective vertigo or the patient's head spinning inside which is referred to as subjective vertigo. Vertigo is not a separate disease process but, is a multisensory and sensorimotor syndrome with various etiologies and pathogenesis and has a lifetime prevalence of 20–30%.

The symptom could be worsened by movement of the head or neck, such as when looking up or down, turning to one side, rolling over, or getting into or out of bed. The patient could also experience a feeling of being tilted or pushed, and at times, being pushed backwards. This symptom is an indication of dysfunction of the vestibular system about which we shall discuss later. Vertigo is a symptom and not a diagnostic entity, though many patients and even doctors believe it to be so. It is not uncommon to see patients being treated continuously for months and even years as vertigo, for symptoms of dizziness with betahistines and calcium channel blockers, wherein they were not necessary. This happens as the symptom, vertigo is misunderstood and used erroneously to designate symptoms described below, leading to irrelevant investigations and possibly inappropriate treatment.

Imbalance

Imbalance or a state of disequilibrium is quite often referred to by patients as 'giddiness' when they have a sense of losing balance on standing or walking, or a feeling that they might fall while walking or turning, especially on uneven ground or in the dark, without having spinning or a sense of rotation. It is an indication of a disorder of gait, and evaluation for neurological disorders that cause gait dysfunction has to be carried out.

Presyncope

A cardiovascular disorder or massive blood loss can cause low blood pressure or reduced blood flow to the brain which results in the patient experiencing a dimming of the vision associated with the feeling of sinking or losing consciousness, along with palpitations or sweating. This might occur when the patient stands up or is in an upright position, and after exertion, or pressure over the neck by tight clothing, and is aggravated by rotating the neck, causing vagotonia. Such an experience is also described as giddiness by the patient, and in such situations, blood pressure needs to be checked in lying and standing positions at least on three occasions to exclude postural hypotension. This patient also needs to be evaluated for an underlying cardiac disorder.

Lightheadedness

Other descriptions given by patients as 'giddiness' would include lightheadedness or a heavy feel of the head, apart from tingling or numbness in the head associated with an inability to think or concentrate, and a wobbly feel within the head. These symptoms are often due to stress, depression, or feelings of insecurity. At times, these could indicate milder versions of the symptom complexes described earlier and one would have to enquire regarding occurrence of the triggers of the previously described conditions, to see whether it would fit into one of those conditions.

FURTHER HISTORY

After analyzing the type of dizziness and obtaining a detailed description of the symptom experienced by the patient, other details regarding the medications being currently taken and exposure to toxins have to be enquired. Dizziness can occur as an adverse effect of a number of medications and a review of the medications, and their adverse effects would be of great value. These medications would include antiseizure medications (ASMs), antidepressants, antipsychotics, aminoglycosides, antiarrhythmogenic agents, antihypertensives, and antihistamines. A history of psychiatric, neurologic, cardiac, renal, hepatic illness, and comorbid disorders such as diabetes mellitus, dyslipidemia, hypertension, and hypothyroidism have to be ascertained.

After triaging the patient's symptoms based on the above details, the focus shifts to the evaluation of vertigo, which is the most common type of dizziness.

The four *Ts* approach to vertigo would be helpful to remember, in which the four *Ts* are:

1. *T*ypes of dizziness as outlined earlier and 'TiTrATE' where
2. *T*i – stands for timing,
3. *T*r – indicates the triggers, and
4. A*T*E – stands for targeted examination, and this provides an ideal format for the evaluation

Timing would include the onset, duration, and evolution of the attacks and whether they last for:

- Seconds to minutes;
- Minutes to hours; or
- Days

Triggers refer to positions of the body and head, head movements, actions like standing, walking, turning, or situational occurrence such as orthostatic posture, Valsalva maneuver, or sound exposure. It could also occur spontaneously without any trigger.

A history of the features associated with the giddiness, helps in pointing to the diagnosis and these features include:

- Unilateral ear fullness, muffled hearing, a roaring tinnitus preceding or in association with the giddiness, all of which would indicates the possibility of Ménière's disease (MD).

- Sensory, motor, or visual disturbances which are accompaniments of transient ischemic attacks (TIAs).
- Associated ataxia, dysarthria, and visual disturbances that signify a cerebellar cause.
- Abnormal hearing of internal body sounds (autophony) which is a feature of superior canal dehiscence.
- Anxiety that can be an underlying cause or could occur as a reaction to the accompanying apprehension.

Vertigo is due to a disorder of the vestibular system, which comprises the vestibular end organs, vestibular division of the eighth nerve, vestibular nuclei in the brainstem, and their connections to the cerebellum.

The vestibular system could be considered to be the sixth sense organ, apart from the eyes, nose, ears, tongue, and skin. It is an invisible system that takes part in posture control, gaze stabilization, orientation, perception of motion of self, memory in space of different locations, spatial relations between objects, and the integration of multiple sensations **(Figs. 1 and 2)**.

Based on the history, the occurrence of vertigo can be categorized into the following syndromes, and accordingly, their causes.

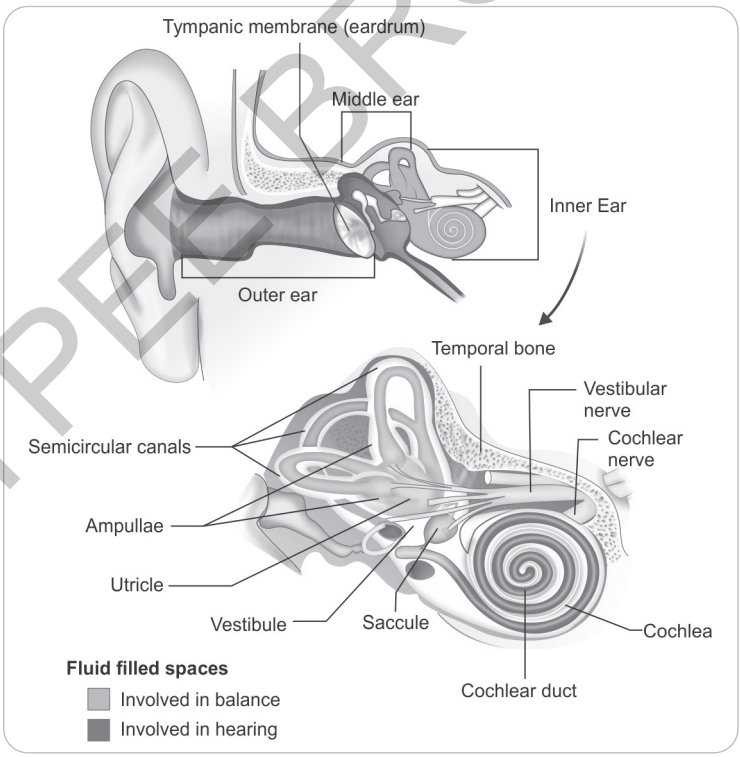


FIG. 1: Anatomy of the vestibular system includes three semicircular canals, utricle, and saccule.

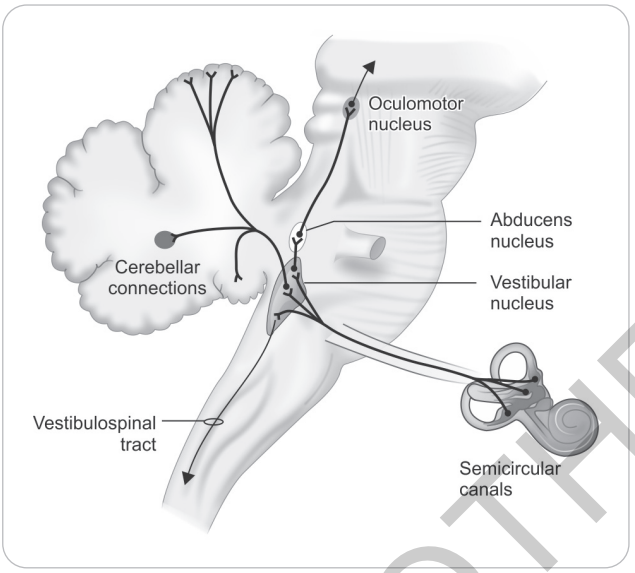


FIG. 2: Vestibular nuclei and their connections.

Episodic vestibular syndrome (EVS): It is characterized by intermittent, multiple, discrete episodes lasting for—

- Seconds to minutes—as in benign paroxysmal positional vertigo (BPPV) and vestibular paroxysmia
- Minutes to hours—in vestibular migraine, posterior circulation TIA, Ménière's disease, episodic ataxia type 2, and perilymphatic fistula
- Days—with vestibular migraine and multiple sclerosis

Acute vestibular syndrome (AVS): With acute onset and persistent dizziness lasting from days to weeks. It has a monophasic course, peaking of symptoms within a few days, and with fairly rapid improvement in a week, followed by more gradual improvement over weeks to months.

Acute vestibular syndrome can occur as a result of trauma, toxic exposure, or can be spontaneous.

- The traumatic syndrome occurs following blunt head trauma or blast injuries, which results in injury to the vestibular nerve, or concussion of the labyrinth, or disruption of inner ear membranes.
- Intoxication with ASMs, aminoglycosides, and carbon monoxide poisoning can cause a similar syndrome with dizziness, headaches, fatigue, unsteadiness of gait, and visual disturbances.
- The spontaneous AVS is characterized by an acute onset of continuous dizziness with vomiting, nystagmus, imbalance of gait, and inability to tolerate head movement, which lasts for days to weeks.

Patients are dizzy at rest, which gets aggravated with head movements. Conditions that cause spontaneous AVS include vestibular neuritis,

posterior circulation strokes, Wernicke's encephalopathy, brainstem encephalitis, and demyelinating disease.

Chronic vestibular syndrome (CVS): It is characterized by persistent dizziness which lasts for weeks to months, and is associated with unsteadiness on walking, hearing impairment, and nystagmus and occurs with uncompensated unilateral vestibular loss, or cerebellar degeneration, or persistent perceptive postural dizziness.

EXAMINATION

Examination of a patient with vertigo should comprise of general examination, examination of the ear, and targeted examination of the vestibular neurologic systems.

The general examination should includes examination of the pulse for arrhythmias, blood pressure for changes in pressure in different postures, for anemia, for features of hypothyroidism, and the cardiovascular system evaluation for low output states, all of which could cause dizziness.

Examination of the ears should be done to look at the auricle, canal, and tympanic membrane. This should include the test for Hennebert's sign by pressing on the tragus and the external auditory meatus on the affected side to induce vertigo or nystagmus. Hearing impairment can be assessed by rubbing the fingers close to the ear and using the tuning fork of 256 Hz frequency for the Weber and Rinne tests for further evaluation if hearing is impaired.

The targeted examination of the vestibular system comprises of the—

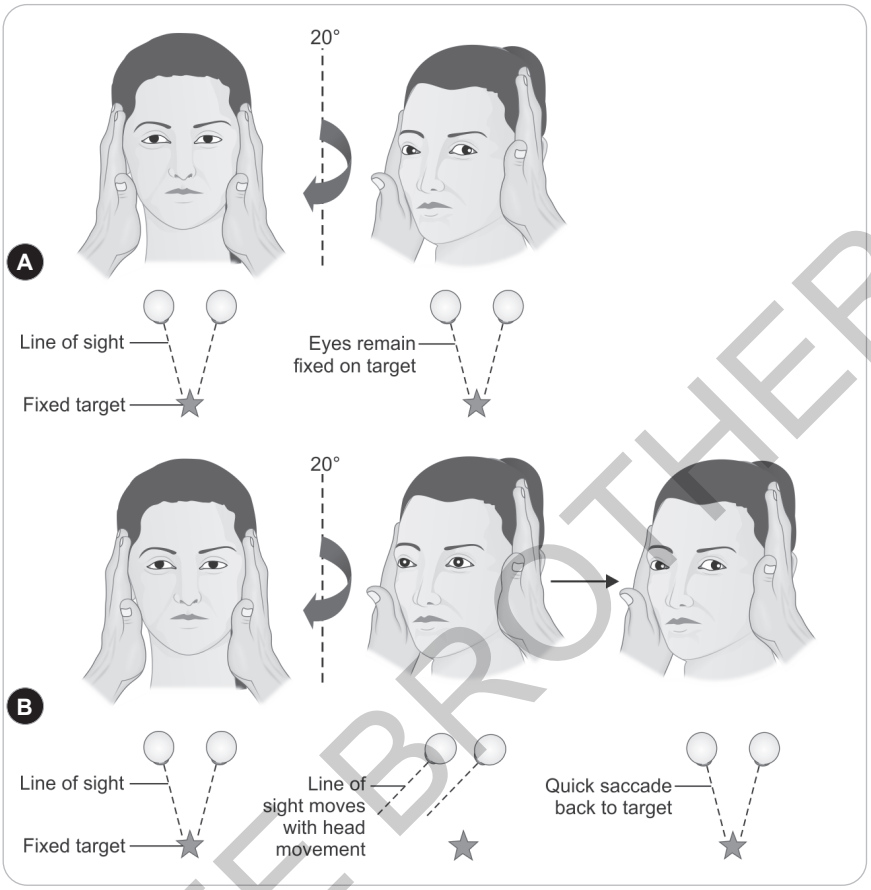
- Head impulse test (HIT) or head thrust test (HTT) **(Figs. 3A and B)**
- Evaluation of nystagmus
- Test for skew

This battery of three tests is given the acronym of HINTS (Head Impulse, Nystagmus, Test for Skew) and has high reliability in the assessment of AVS with a sensitivity of 100% and specificity of 96% in ruling out stroke.

The Head Impulse Test

This maneuver tests the integrity of the vestibulo-ocular reflex and distinguishes brainstem and cerebellar strokes from peripheral acute vestibular disorders presenting with vertigo.

The test is performed by making the patient sit in front of the examiner and holding the patient's head steady in the midline. The patient is asked to fix his vision on the examiner's nose. Quick thrusts of the head are done rapidly without informing beforehand, with horizontal movements about 20° to either side, left and right, one after the other, and the saccadic movements of the eyes are observed. Normally, the eyes move in a direction opposite to that of the head movement. After the head movement is stopped, the patient's eye is observed on the side to which the head is turned for refixation saccade. The eyes should remain focused on the examiner's nose



FIGS. 3A AND B: (A) The right ear has an intact peripheral vestibular function. When the head is turned to the right, the vestibulo-ocular reflex moves the eyes to maintain visual fixation. (B) The right ear now has impaired vestibular function. When the head is turned to the right, the eyes move with it, breaking visual fixation, and a refixation saccade is seen as the eyes dart back to the examiner's face. This indicates a peripheral vestibular disorder on the right side.

if the vestibulo-ocular reflex is intact when the test is considered negative. The test is abnormal or considered positive, if a corrective saccade is seen toward the affective side, to refixate on the examiner's nose.

The vestibulo-ocular reflex normally stabilizes the images on the fovea during head movements to provide clear vision. When the head moves, the vestibulo-ocular reflex is responsible for the eye movement, which is equal in magnitude to the head movement but in the opposite direction. However, in vestibulopathies, the eyes fail to correct for the head movement. The eyes move with the head and at the end of the head movement, the compensatory saccade corrects the error of gaze.

In patients with unilateral vestibulopathy, the corrective saccade occurs when the head is turned quickly toward the abnormal side. Left-

sided saccades following a head thrust to the right would indicate right side abnormality, whereas right-sided saccades following left head thrust would indicate a left-sided vestibular pathology. If a normal response is elicited in a person with acute vertigo, it would indicate a central lesion as the cause of the vertigo.

Nystagmus

Nystagmus is an abnormal alternating slow and fast movement of the eyes and can be horizontal, vertical, or torsional. The main objective of evaluating nystagmus in a person with vertigo is to find out the site of pathology, whether it is in the brain or outside, i.e., a central lesion or a peripheral lesion.

A person with vertigo could show three types of nystagmus:

1. Spontaneous nystagmus (seen in primary position)
2. Gaze-evoked nystagmus (in eccentric eye positions), i.e., in the direction of gaze
3. Positional and positioning nystagmus (seen with change of head positions)

In acute peripheral vestibular lesions, there is unidirectional horizontal and torsional nystagmus with quick phases beating away from the side of the lesion.

In the central lesions, bidirectional gaze-evoked nystagmus is seen, which could be vertical, typically downbeat, horizontal, or rotational, and importantly this nystagmus is not inhibited by fixation while the nystagmus due to peripheral lesions is inhibited by fixation.

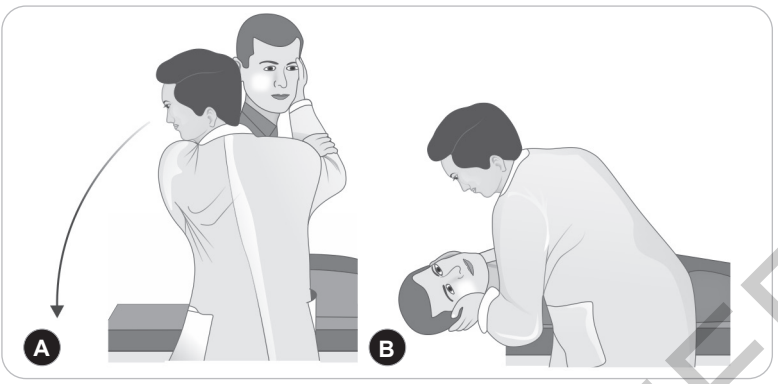
Spontaneous nystagmus is observed with the patient looking straight ahead, while gaze-evoked nystagmus is noted with the patient fixating on targets 30° to the right, left, up, and down.

The Dix–Hallpike maneuver is done to elicit the positional and positioning nystagmus **(Fig. 4)**.

The Dix–Hallpike Positioning Test

This test is carried out by the examiner standing behind the patient who is seated on a couch.

The examiner holds the head of the patient and gently turns it 45° to one side and brings the patient down from sitting to lying position with the neck extended about 20° downwards from the couch. In this position, the eyes are observed for the occurrence of nystagmus for about a minute. If there is no nystagmus, the patient is brought back to the sitting position. This procedure is repeated after waiting for about 30 seconds with the head now turned to the opposite side. The patient should keep his eyes open throughout this procedure and fix his eyes on the examiner's nose. A



FIGS. 4A AND B: Dix–Hallpike test demonstration. Turn head to 45° (A) and bring the patient down from sitting to lying position with the neck extended about 20° downwards from the couch (B).

word of caution: Care should be taken in doing this test on a person with pain in the neck.

If a nystagmus occurs, its direction, duration, and importantly, the latency in its occurrence should be noted.

The Dix–Hallpike test is the gold standard test for eliciting positional nystagmus in persons with benign paroxysmal positional vertigo (BPPV) and is considered to have 50–80% sensitivity in its diagnosis. With posterior canal-induced BPPV, the nystagmus may appear after a short latent period, and hence the importance of observing for this latency in the up-beating and torsional nystagmus, which lasts for < 1 minute. For diagnosing lateral or horizontal canal BPPV, the supine roll or supine lateral head turns test is employed. This test is done when the Dix–Hallpike test is negative in a patient with BPPV.

The patient is asked to lie down in a supine position and the head is rotated 90° laterally to either side, one after the other, and the patient is instructed to keep the eyes open for examining the nystagmus. In lateral canal BPPV, the nystagmus is typically horizontal with no torsional component and there are two types of horizontal nystagmus which could be seen. The fast phase could beat toward the ground when it is called geotropic, or away from the ground when it is called apogeotropic, depending on the presence of otoconial debris within the lateral semicircular canal.

The otoconial debris gets dislodged from within the utricle and migrates into one of the semicircular canals during changes in head position. They float freely in the duct of the canal, resulting in abnormal endolymphatic flow within the affected canal (canalithiasis), or get adhered to the cupula of the canal (cupulolithiasis).

Head Impulse Test, Nystagmus, and Test of Skew (HINTS)

This battery of three tests has proved useful in the evaluation of AVS to detect brainstem and cerebellar strokes with greater sensitivity than even neuroimaging, according to Kattah et al.

Test of Skew

Skew deviation refers to a misalignment of the ocular axis in the vertical plane due to an imbalance in the firing of the vestibular neurons from the right and left. Skew deviation is detected by doing the alternate cover test. First, one eye is covered, and next the cover is shifted to the other eye. Refixation saccade is looked for in the uncovered eye. This test is done alternately **(Fig. 5)**.

The presence of skew deviation is strongly indicative of brainstem lesion. A stroke can be identified by the presence of any one of these three signs:

1. Normal HIT
2. Horizontal nystagmus which changes direction according to the side of gaze
3. Presence of skew deviation

The mnemonic INFARCT would be useful in remembering these signs (*i*mpulse *n*ormal, *f*ast *p*hase *a*lternating, and *r*efixation on *c*over *t*est).

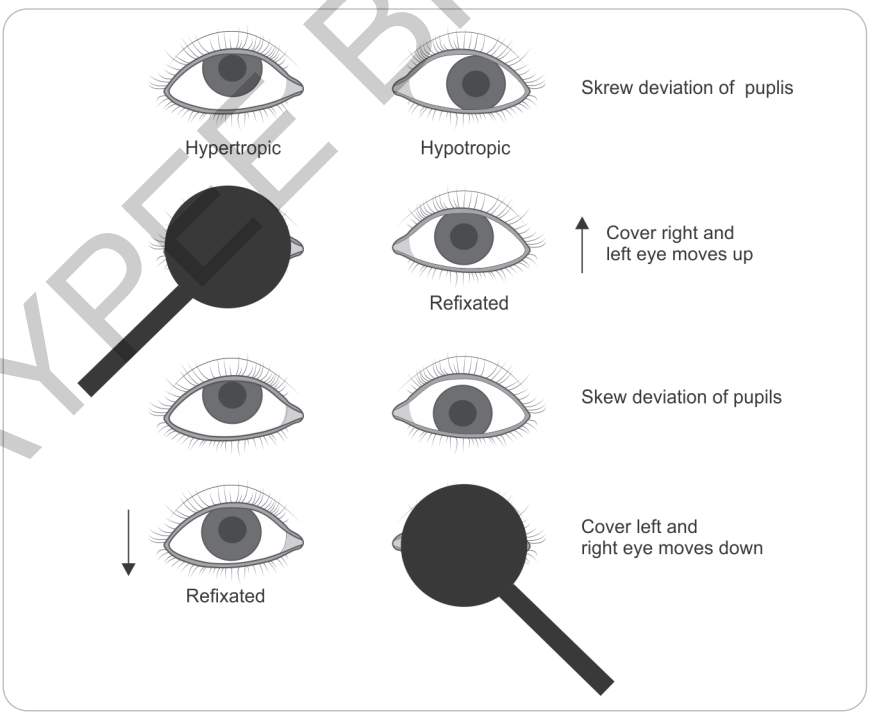


FIG. 5: Cover test for skew deviation.

HINTS Plus

The bedside hearing test was added to HINTS as the HINTS plus examination, to detect hearing loss due to cochlear or brainstem ischemia, and to increase the diagnostic accuracy in AVS and not miss a labyrinthine infarction.

Caloric Test

It is a fairly simple qualitative bedside test to assess the integrity of the lateral semicircular canals only and not the rest of the vestibular system. It is discussed further while dealing with investigations **(Table 1)**.

Other Bedside Clinical Examinations to Assess the Vestibular System (Flowchart 1)

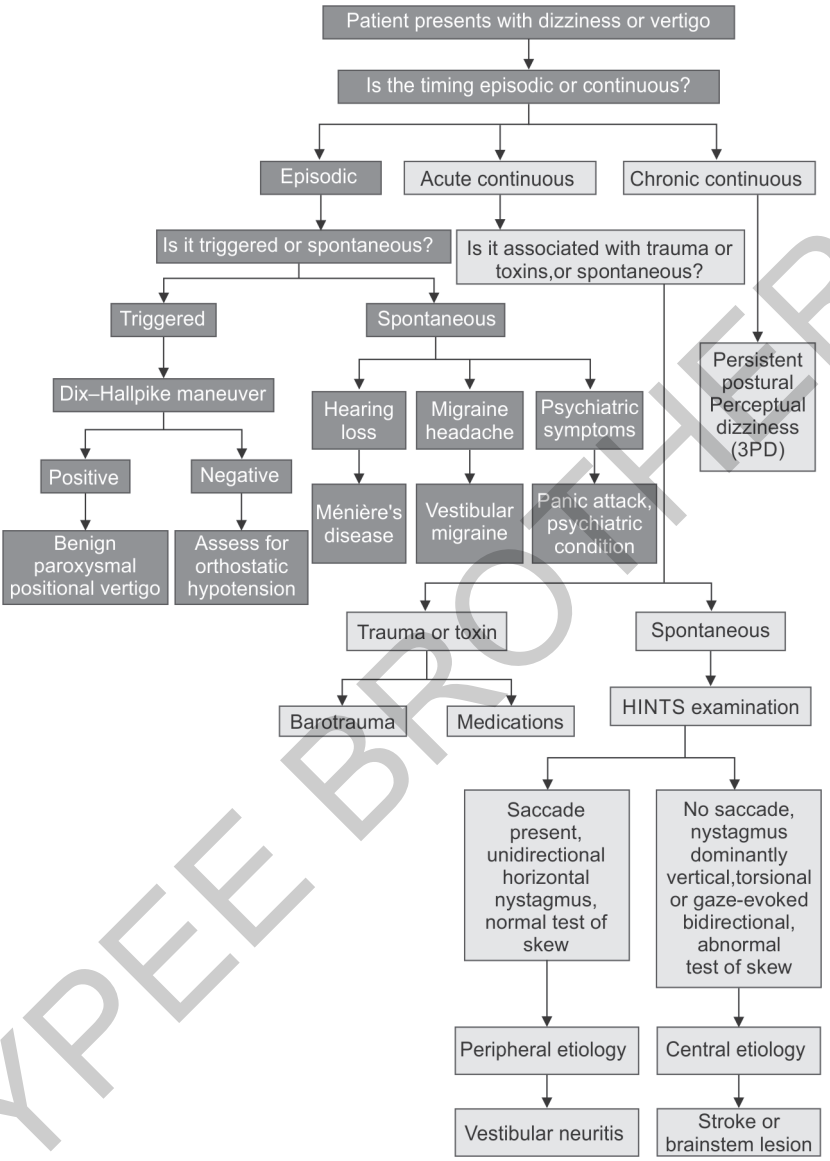
Eye Movements Examination

This includes assessing the range of eye movements, looking out for the presence of gaze paralysis or internuclear ophthalmoplegia, and oculomotor paralysis.

TABLE 1: Differences between peripheral and central vertigo.

Characteristic	Peripheral	Central
Onset	Sudden	Gradual or sudden
Intensity	Severe initially, often decreasing over time	Mild in most but can be severe in stroke, and multiple sclerosis
Duration	Intermittent episodes lasting seconds to less than a minute in BPPV; continuous and lasting hours to days in vestibular neuritis	Usually weeks, or months (continuous) but can be seconds or minutes with vascular causes, such as posterior circulation TIA
Direction of nystagmus	Usually torsional and upbeat (fast phase beating toward forehead) in classic posterior canal BPPV; horizontal in horizontal canal BPPV; horizontal-torsional in vestibular neuritis/labyrinthitis	Purely vertical, spontaneous and purely torsional, direction-changing on lateral gaze, down beating (fast phase beats toward the nose)
Effect of head position	Induces vertigo (BPPV); worsens vertigo (vestibular neuritis)	Usually little change but can worsen with a head position change
Associated neurologic findings	None	Usually present
Associated auditory findings	May be present, including tinnitus (Ménière's disease) and hearing loss (labyrinthitis)	Rarely present

(BPPV: benign paroxysmal positional vertigo; TIA: transient ischemic attack)



FLOWCHART 1: Algorithm of evaluation of dizziness.
(HINTS: head impulse, nystagmus, test for skew)

The assessment of eye movements would include looking at the saccadic, pursuit, and vergence movements. Abnormalities in these movements would indicate a central disorder. Saccadic movements are checked by asking the patient to look back and forth approximately 30° to each side or look at the ears of the examiner on either side horizontally, and also look up and down vertically. The latency, velocity, and accuracy of these movements are looked for. Delayed and slow saccades are seen in basal ganglia

degenerative disorders, and inaccurate saccades, either falling short or over shooting are seen in cerebellar disorders.

Past-pointing Test

The patient, seated in front of the examiner should be asked to point at the examiner's extended index finger with his index finger extended but not touching it. Another test for past pointing is to ask the patient to raise his hands with the index finger pointing up and then bring down the hands to exactly touch the examiner's fingertips in front of him. This test is repeated several times with eyes closed and consistent deviation to one side is considered past-pointing and is indicative of cerebellar dysfunction.

Romberg Test

The patient is asked to stand with feet together and remain still with eyes closed. The test is considered positive if the patient loses balance, indicating either a proprioceptive sensory abnormality or a vestibular system dysfunction. A sharpened Romberg test could also be done by asking the patient to carry out the same maneuver with one foot placed in front of the other in tandem.

Tandem Walking Test

The patient is asked to walk in a straight line, placing one foot in front of the other, and this is a test of cerebellar function. Vision would compensate in chronic proprioceptive or vestibular dysfunction, and hence it is assessed better with eyes closed **(Table 2)**.

INVESTIGATIONS

The number of investigations available to assess vertigo and the balancing system, which is quite complex, is expanding, with more hi-tech gadgetry becoming available, though at an exorbitant cost. Hence, it becomes imperative for the physician to know the indications and the limitations of these multiple investigations, which would be of help in effectively managing the patient. These investigations can be categorized into those that indicate structural abnormalities and those that help assess the site of the lesion, the extent of the functional deficit, and the probable etiology.

Imaging Studies

CT scan and MRI are the imaging modalities and MRI would be the choice to delineate structural abnormalities of the brainstem and cerebellum; and hence, it needs to be done in all patients suspected to have a central cause for the vertigo and also in patients with AVS.

Imaging studies are also indicated in those with chronic vestibular syndrome (CVS) to exclude central nervous system (CNS) lesions. Among the conditions causing EVS, patients with definite features of BPPV and

TABLE 2: Advantages and limitations of the various clinical tests of the vestibular system.

Test	Description	Limitations
Dix–Hallpike maneuver	Test of individual posterior semicircular canal, for the diagnosis of posterior canal BPPV	• No reliable data on sensitivity and specificity • Nausea and vomiting can occur and should be avoided in cervical spine instability
Supine roll test	Test of individual horizontal semicircular canal, for diagnosis of horizontal canal BPPV	• Avoided in cervical spine instability • No comparative tests are available
Head impulse tests	Tests of high-velocity VOR. Most useful for subjects over the age of 60 years with > 60% unilateral vestibular weakness and no cervical limitations	• Not useful for younger adults or older adults with reduced cervical spine ranges • A negative response does not necessarily indicate normal vestibular function
Romberg test	Tests of standing balance	Not useful for patients with lower extremity peripheral neuropathy
Tandem walking	Test of walking balance	Problematic in patients with lower extremity peripheral neuropathy
Fukuda stepping test	• Subjects should stand upright with arms extended in front and close their eyes and walk in place. If the vestibular system is normal, they should not rotate to either side but may move forward • Rotation to the side indicates the impaired side	Not useful as a diagnostic test, or for rehabilitation screening

(BPPV: benign paroxysmal positional vertigo; VOR: vestibulo-ocular reflex)

vestibular migraine do not need imaging, as the diagnosis is based on clinical features. Imaging is required only for Ménière's disease in this group of disorders.

MRI is the imaging of choice for detecting strokes and structural abnormalities in the brainstem, cerebellum, and craniovertebral junction anomalies. A CT scan is useful for evaluating bony abnormalities of the temporal bone and the temporal canal.

Other tests are done to identify functional abnormalities in different areas of the balancing system. Many of these neurological investigations require sophisticated evoked potential recording systems and image processing modalities, apart from high technical skills, and a sound knowledge in interpreting the results by the investigator. It necessitates a test battery approach as balance needs normal functioning of several

Monograph on Dizziness

Salient Features

- Dizziness is a common symptom for which a physician needs to provide appropriate treatment after understanding the symptoms and the underlying cause.
- The term "dizziness" includes many descriptions which a patient experiences. The commonly understood meaning is vertigo or a spinning sensation. However, there are other descriptions given, like a sensation of being pushed, a sensation of imbalance, and even a feel of weakness, each of which has a different cause and needs to be treated accordingly.
- Hence, a knowledge of the various causes of dizziness is required to formulate the management.
- This monograph consists of two parts. The first part deals with the clinical approach to the symptom and details the history to be collected that would help in classifying dizziness into syndromes such as episodic, acute, and chronic based on the occurrence of symptoms in episodes, or acutely, or persistently.
- This classification helps narrow the differential diagnosis of the various causes.
- The second part of this monograph discusses the various disorders causing dizziness and details their management.

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