

Dizziness—Unplugged

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Abstract

Provides an overview of vertigo and its management. It is useful for students of vertigo and clinicians managing vertigo. It introduces clinicians to a systematic approach of assessing dizzy patients. Vertigo is a very difficult subject to master. The cornerstone of managing a dizzy patient is first and foremost a good history. This is followed by appropriate examination and investigations. The general practitioner is the first expert to be involved in the management of dizzy patient followed by specialists in particular Otorhinolaryngologists, Audiovestibular Medicine Specialists and Neurologists and finally, allied healthcare personnel. The key concepts in assessing, diagnosing and managing common vestibular disorders are briefly described. Differential diagnosis of vertigo along with certain characteristic traits are mentioned. Etiology and pathophysiology of associated symptoms of dizziness are discussed. Importance of timing and triggering factors are highlighted. Discussion on balance and gait along with role of nystagmus in differentiating central from peripheral vertigo is done. Usage of certain specific drugs including special role of Betahistidine is mentioned. Vertigo from peripheral vestibular diseases normally improves within 2 to 3 months from a number of processes known as cerebral compensation. Here vestibular rehabilitation exercises play a very crucial part in management of a dizzy patient. Special vestibular investigations like ENG / VNG is computer based and runs a battery of tests which assess the oculomotor function of the affected patient. Video Head Impulse Test (VHIT) and Vestibular Evoked Myogenic Potentials (VEMP) are done for diagnosing vestibular neuritis. The role of traditional Caloric testing and EcochG which is a variant of BSERA cannot be undermined in a dizzy patient. Newer methods to assess balance like Dynamic Posturography, Rotatory Chair are computer driven tests for analysing vision, proprioception and vestibular function. These are useful to detect malingering. Finally, summary and conclusions are drawn upon.

Keywords: *Vertigo, Dizziness, audio vestibular medicine, Disequilibrium, Syncope, BPPV (Benign Paroxysmal Positional Vertigo), Vestibular neuritis, acoustic neuroma, Vestibulopathy, SSC dehiscence syndrome, Labyrinthitis, Meniere's disease, Tinnitus, Romberg test, Dix-Hall pike maneuver, Agarophobia, Epley's maneuver, Canalithiais, Semont maneuver, Gufoni maneuver, (Brandt – Daroff Exercise), Lempert Maneuver, Barbecue Roll Maneuver, Romberg's test, Nystagmus, Supine Roll Test, Echo Cochleography, Betahistidine, Barany's rotary chair, Dynamic posturography, Video Nystagmography (VNG), Video Head Impulse test (VHIT), Vestibular Evoked Myogenic Potential (VEMP), Craniocorpography, Vestibulospinal Tests, Cawthorne, Cookesey Exercises, Electro Nystagmography (ENG), Computerized dynamic posturography (CDP), Vestibular Ocular reflex (VOR), Vestibular rehabilitation Exercises.*

INTRODUCTION

This work provides an overview of vertigo and its management. It is useful for students of vertigo and clinicians managing vertigo. It introduces clinicians to a systematic approach of assessing dizzy patients. Vertigo is an illusion of movement or any abnormal sensation of motion between a patient and his / her surroundings. Dizziness is a non-specific term used

by patients to describe a sensation of altered spatial orientation. Vertigo is not a diagnosis but a symptom.

The general practitioner is the first expert to be involved in the management of dizzy patient followed by specialists in particular Otorhinolaryngologists, audiovestibular medicine specialists and neurologists and finally, allied healthcare personnel. And hence 10% of the cases show up with general practitioners and 20% with Otorhinolaryngologists. The first and

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foremost cornerstone of managing a dizzy patient is a good history. This is followed by appropriate examination and investigations.

The patient history can classify dizziness into five categories: Disequilibrium, Near Syncope, undifferentiatedness/light headedness, psychiatric and vertigo. Disequilibrium can be neurological, felt with walking or with standing eg: Postural hypotension. Undifferentiatedness/ lightheadedness can be caused by medical conditions such as Anaemia, hyperthyroidism, hypoglycaemia, fibromyalgia etc. Near syncope can be caused by cerebral hypo perfusion, CVS. Symptoms can be transient such as blurred vision or blackout and can occur during seated or standing positions. Psychiatric dizziness can occur due to psychiatric or stress related history without physiological and neurological involvement.

Practical approach to etiology of vertigo includes BPPV, Vestibular neuritis and stroke.

The key concepts in assessing, diagnosing and managing common vestibular disorders are briefly described. Differential diagnosis of vertigo along with certain characteristic traits are mentioned. Etiology and pathophysiology of associated symptoms of dizziness are discussed. Importance of timing and triggering factors are highlighted. Causes of vertigo can be peripheral or central. Peripheral causes of vertigo are BPPV, vestibular neuritis, Meniere's disease, acoustic neuroma, Perilymphatic fistula, herpes zoster oticus, recurrent vestibulopathy, SSC dehiscence syndrome, aminoglycoside or cisplatin toxicity and otitis media. Central causes of vertigo are vestibular migraine, brainstem ischemia, Cerebellar infarction and hemorrhage and multipurpose sclerosis.

Cause	Timing	Triggering
BPPV	Recurrent, brief (seconds)	Initiated by movement of head and neck
Vestibular neuritis	Single episodes, acute onset, lasts days(more prolonged and severe episodes)	Recent viral symptoms, Labyrinthitis is same but associated with hearing loss
Labyrinthitis		Spontaneous, unilateral tinnitus, hearing loss, ear fullness
Meniere's disease	Recurrent, typically lasts hours but can be brief	
Vestibular migraine	History of migraine	
Brainstem infarction	Single or recurrent, lasts several minutes to hours	Older patients, vascular risk factors, cervical trauma, neurological symptoms
Cerebellar infarction / hemorrhage		Coughing, sneezing, exertion or loud noises
Perilymphatic Fistula		

Target examination includes assessing vital signs (BP – sitting/lying, Pulse-A.F), CNS exam (Cranial nerves, sensory, motor, reflexes, cerebellar signs, Romberg test), CVS exam(Auscultatory for A.S), Carotid bruit, ear exam(Otoscopy, Hearing), Dix-Hall pike(maneuver & or supine head roll test vs HINTS – Head impulse/ nystagmus, test of skew).

Symptoms associated with dizziness are nausea, vomiting and anxiety.

Nausea/vomiting are the most common symptoms, 3 to 9% of the patients visiting dizziness centers experience these symptoms. These symptoms significantly affect the quality of life and have a significant effect on daily activities which lead to psychological and emotional hardship. Nausea/vomiting of vestibular origin acts via different receptors as compared to that of other origin.

Histamine and acetylcholine receptors are predominantly involved in vestibular type and hence anti-histamine and anti-cholinergic activity is essential.

Anxiety: 60% of the patients presenting with chronic dizziness are found to have primary / secondary anxiety. So, 3 out of 5 dizziness patients suffer from anxiety. A higher prevalence of abnormal anxiety in men (24%) as compared to women (15%) has been found in dizziness patients. Patients with vestibular disorders are prone to develop anxiety and depression symptoms including panic attacks and agoraphobia. Hardships faced by the patient are unable to go out alone, difficulties at work, social life restricted, physical disability, psycho social difficulties, unable to take part in active leisure pursuits and therefore, PQLI of the individual is affected.

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Different conditions presenting as dizziness are as follows

Otological	Neurological
BPPV	Migrainous vertigo
Vestibular neuritis/ Labyrinthitis	Demyelinating diseases
Meniere's disease	CNS lesions
Degenerative changes labyrinth/ototoxicity	Metabolic/ Vascular/ degenerative CNS disorders

Presenting features in peripheral and central vertigo are

Peripheral vertigo	Central Vertigo
Doesn't have CNS related symptoms	Often produces other neurologic symptoms
Auditory symptoms are more common	Gradual onset but slowly deteriorating
Associated with nausea/vomiting	Tend to be much less intense than those associated with peripheral vertigo
Abrupt onset but slowly improving	More of instability
More of a spinning sensation	

BENIGN PAROXYSMAL POSITIONAL VERTIGO (BPPV)

It is disorder of the inner ear characterized by episodes of vertigo triggered by changed in head position. Most common cause of vertigo constituting 20-40% of all patients with peripheral disorder. It is thought to be caused by the presence of otoconia in one or more SSC. Common characteristics of BPPV include rotational vertigo/ nausea / vomiting / imbalance/ fear of falling. Symptomatic management of BPPV includes medical therapy, maneuvers and surgical treatment.

Medical Therapy

Three major Vestibular suppressant medications are used for management. Anticholinergics, anti

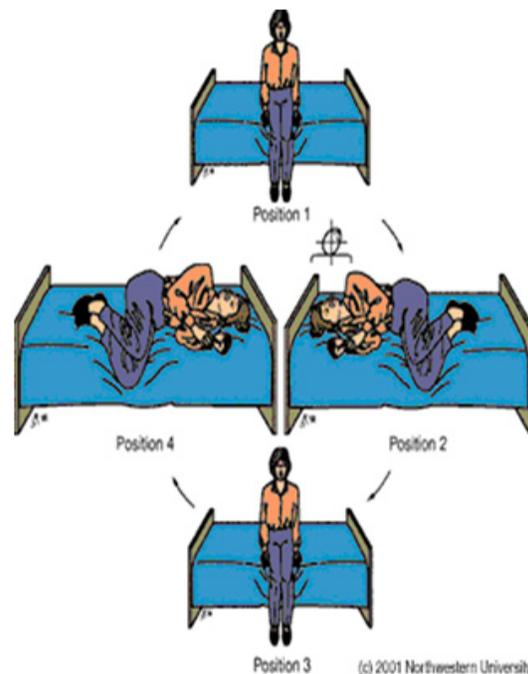
histaminics and benzodiazepines (minimizes anxiety associated with vertigo), prochlorperazine is useful as short term treatment of severe non-psychotic anxiety. The medications are effective in reducing the intensity of vertigo and nystagmus evoked by a vestibular imbalance, reducing the associated motion sensitivity and motion sickness, managing anxiety associated with vertigo.

Maneuvers are considered as definitive line of therapy such as Epley's maneuver, Semont maneuver and Gufoni maneuver. Surgical treatment in selective cases is considered such as single neurectomy, vestibular neurectomy and posterior semicircular canal occlusion.

EPLEY'S MANEUVER



Figure 2. In the modified Epley maneuver, the patient's head is systematically rotated so that the loose particles slide out of the posterior semicircular canal and back into the utricle. The first step in the maneuver is the Dix-Hallpike test. If the vertigo affects the right ear, the patient is brought to the head-tilting position with the right ear turned downward (A-C). The physician then moves to the end of the table and rotates the patient's head to the left, with the right ear turned upward (D). The head is held in that position for 30 seconds. The patient then rolls onto the left side (E). Meanwhile, the examiner rotates the patient's head leftward until the nose points toward the floor. That position is also held for 30 seconds. Finally, the patient is lifted into the sitting position with the head facing left (F).



Epley Maneuver

Used to treat benign paroxysmal positional vertigo of the posterior or anterior canals

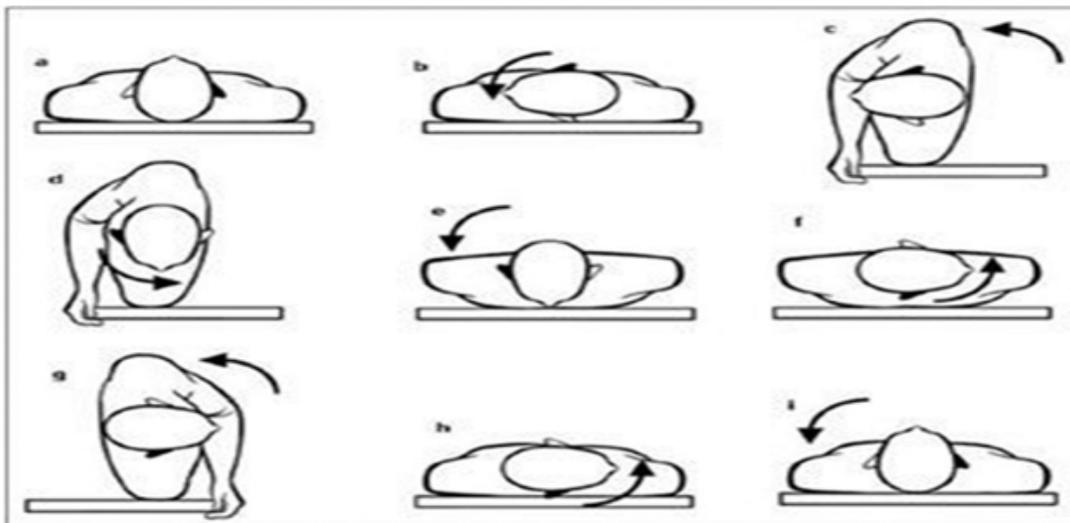
- 1 • Begin in upright sitting posture
• Legs extended
• Head rotated 45-degrees towards the side of positive Dix-Hallpike test
- 2 • Patient is quickly and passively forced down backwards into supine position
• Head held approx. in a 30-degree neck extension
- 3 • Observes patient's eyes for primary stage nystagmus
• Patient remains in this position for 1 - 2 minutes
- 4 • Patient's head rotated 90-degrees to opposite direction
• Patient remains in this position for 1 - 2 minutes
- 5 • Patient rolls into shoulder, rotating head 90-degrees
• Patient now looking downward at 45-degree angle
• Observe for secondary stage nystagmus
• Remains in position for 1 - 2 minutes
- 6 • Patient slowly brought upright, maintaining 45-degree rotation of head
• Patient holds seating position for 30 seconds

BRANDT - DAROFF EXERCISE: AT HOME MANEUVER



For right & left posterior canalithiaias

LEMPERT MANEUVER (BARBECUE ROLL MANEUVER): This maneuver is 75% effective in treating lateral BPPV.



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Discussion on balance and gait along with role of nystagmus in differentiating central from peripheral vertigo is done. In BPPV Romberg's test is also an important procedure to assess the site of lesion. If there is an imbalance with eyes open, the problem might lie in the cerebellum and if there is imbalance with closed eyes, the problem might lie in the vestibular or proprioceptive systems. Ear examination

is performed such as otoscopy (evidence of otitis media, Herpes Zoster oticus – Ramsay Hunt syndrome or Cholesteatoma) and Hearing evaluation (Unilateral SNHL suggests a peripheral lesion e.g. Meniere's disease).

NYSTAGMUS following factors are assessed to differentiate between central and peripheral site of lesion.

Feature	Central	Peripheral
Latency	None	2-30 sec
Duration	>30 Sec	5-30 sec
Fatigability	No	Yes
Vertigo	Usually Absent	Usually present
Fixation	No Suppression	Suppression
Habituation	No	Yes
Direction	-Bidirectional -vertical or Horizontal	-Unidirectional -Horizontal or rotatory

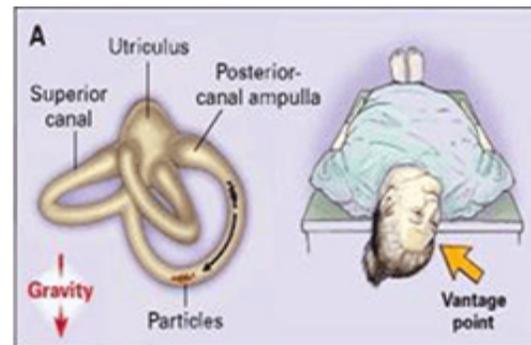
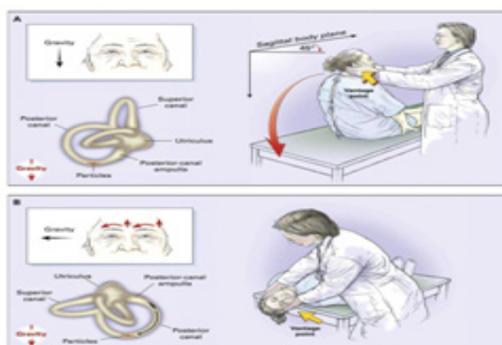
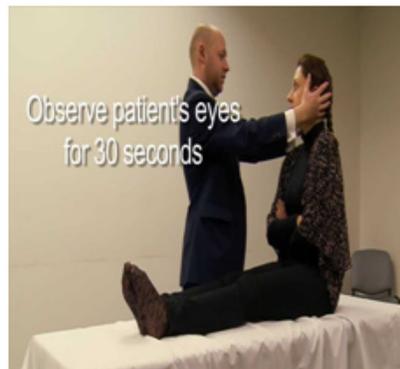
TREATMENT

Benign paroxysmal positional vertigo	Repositioning maneuvers
Vestibular neuritis/ Labyrinthitis	Medications and Vestibular rehabilitation
Meniere's disease	Salt, caffeine, tobacco restriction, diuretics and surgical
Vestibular migraine	As migraine
Brainstem infarction/ cerebellar infarction	A/E referral

Dix Hall Pike Maneuver

Nystagmus from Dix-Hall pike test in posterior SSC

BPPV is up beating & torsional. There is sensitivity of 80% & a specificity of 70% in posterior canal BPPV.

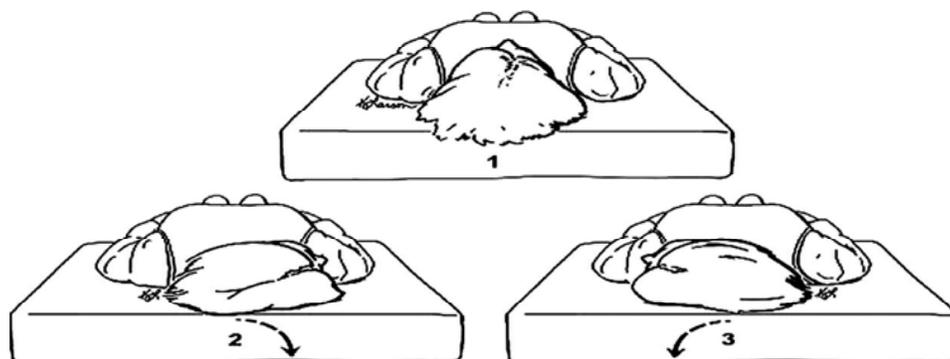


SUPINE ROLL TEST

Diagnosis of Lateral (Horizontal) SSC BPPV

If the pt. has a history compatible with BPPV & the Dix-

Hall pike’s test exhibits horizontal or no nystagmus, the clinician should perform a supine roll test to assess for lateral SSC BPPV.



DRUG TREATMENT OF DIZZINESS / VERTIGO

Various combinations of Acetylcholine, Dopamine, and Histamine receptor antagonists. Wide variety of medications are used to treat vertigo & the frequently concurrent nausea / emesis. The American gastroenterological association recommends anticholinergics & antihistamines for treatment of nausea associated with vertigo or motion sickness.

- Antihistaminics - H1-receptor & calcium channel antagonists
- Dopaminergic- dopamine receptors - scopolamine
- Benzodiazepines---GABA receptors.

Vestibular suppressants should be used for a few days at most because they delay the brain’s natural compensatory mechanism for peripheral vertigo.

INVESTIGATIONS

No routine investigations are required. If indicated, then one may ask for CBC / TFT / KFT, CECT—HEAD/ MRI, ECG, Cardiac monitoring, Carotid Doppler, Audiometry, ENG / VNG, VHIT, Vestibulospinal tests.

VESTIBULAR SUPPRESSANTS – TYPES

- Benzodiazepines - (diazepam)
- Antihistaminics - (prochlorperazine, dimenhydrinate, diphenhydramine, cinnarizine, meclizine)
- Anticholinergics - (scopolamine)
- Antiemetics - (metoclopramide, domperidone, ondansetron, dexamethasone)

VESTIBULAR SUPPRESSANTS

They reduce the asymmetry in the vestibular tone between the ears and thereby reduce vertigo. They exhibit MoA by inhibiting various receptors.

PROCHLORPERAZINE Vs CINNARIZINE

PROCHLORPERAZINE is superior to Cinnarizine in treatment of vertigo irrespective of the central or peripheral vertigo.

- Anticholinergics- acts on muscarinic receptors (M3 & M5)

Property	Prochlorperazine	Cinnarizine
MoA	<ul style="list-style-type: none"> • Antihistaminic (H1) • Anti-cholinergic • Anti-dopaminergic • Vestibulo- suppressant 	<ul style="list-style-type: none"> • Cinnarizine – Ca+ channel blocker with local vasodilatation (H1 antagonist)
Efficacy	<ul style="list-style-type: none"> • Very effective drug for symptomatic relief. • CNS depressant- hence very likely to inhibit vest .Comp. Mech 	<ul style="list-style-type: none"> • Reasonably symptomatic relief. • Enhances blood supply in brain/ inner ear. • Likely to inhibit vest. Comp. Mech.
Common side-effects	Hypotension	Pedal edema, drowsiness
Rare side- effects	Occasional EPS (1%)	<ul style="list-style-type: none"> • Extrapyramidal symptoms (EPS) • Parkinsonism (Long-term effect)

BETAHISTINE IN VERTIGO

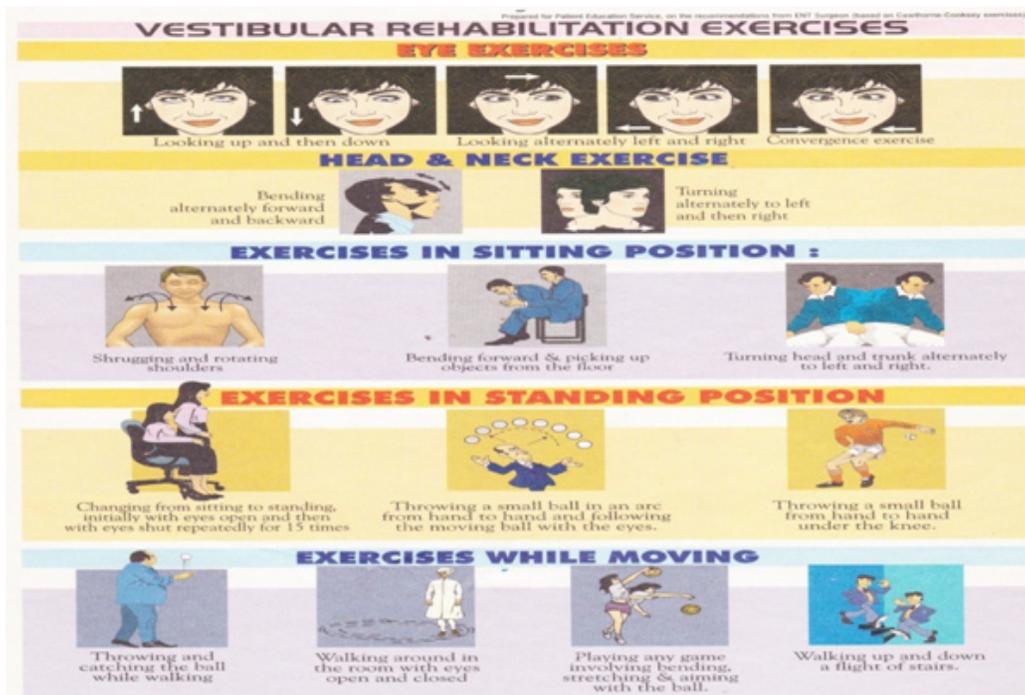
Betahistine is found to be well tolerated when administered at 48mg/day for 2 months, and should be considered as a good therapy option by clinicians treating vertigo. An observational study found that treatment of vestibular vertigo with this drug (@48mg./Day) appeared to be effective in reducing vertigo associated symptoms in routine OPD setting. Low quality evidence suggests that in pts. Suffering from vertigo from different causes there may be a

positive effect of Betahistine in terms of reduction in vertigo symptoms.

VESTIBULAR REHABILITATION THERAPY

Specific form of physical therapy designed to promote habituation & compensation for deficits related to a wide variety of balance disorders. Effective in improving the functional deficits & subjective symptoms resulting from unilateral and bilateral peripheral vestibular hypofunction as well as from central balance disorders. Very useful in at risk elderly patients as a preventing role in reducing falls.

CAWTHORNE-COOKESEY EXERCISES



VESTIBULAR REHABILITATION THERAPY

All exercises should be done first with eyes open & then with eyes closed for 5-10 mins. Approx. 1 hr. everyday. / Repeat each exercise 20 times. May get dizziness / nausea. Not to overdo / No Gym. VRT needs to be customized to the individual's impairment & exercises needs to be tailored according to each pt.'s rate of progression.

- Echo Cochleography (variant of BSERA) along with caloric testing is very important.
- Dynamic posturography / Rotatory chair are computer driven tests for analysing vision, proprioception & vestibular functions.

These tests are very useful to detect malingering

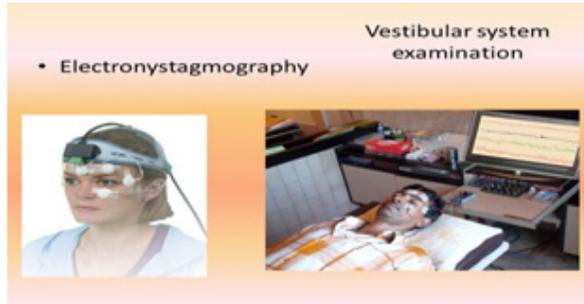
LATEST TESTS

- Special vestibular computer based inv. like ENG/ VNG assess the oculomotor function of the affected patient.
- VHIT & VEMP are done for diagnosing vestibular neuritis.

ENG

Most widely practised test to detect any abnormality in the vestibular system. To find out whether the lesion is static, progressive or recovering. Computerized or digital ENG greatly reduces the time spend in identifying nystagmus beats, calculating & interpreting ENG recordings.

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BARANY'S ROTARY CHAIR

This when connected to an ENG machine, can observe & record direction / intensity of nystagmus for both clockwise & anti-clockwise rotation of the chair.

Nystagmus in normal persons should be Rt. beating for clockwise and Lt. Beating for anti-clockwise rotation. It should last for 20-30 secs. & Intensity should be same for both clockwise & anti-clockwise rotation of the chair.



VNG

Provides very high resolution, so it can replace ENG. Nystagmus & other types of eye movements are recorded using a goggle mounted with cameras. These

images are measured, recorded, displayed & stored in the software to provide information for the diagnosis of vestibular disorders. VNG can record torsional/ rotational eye movts. Apart from horizontal / vertical eye movts.



VHIT

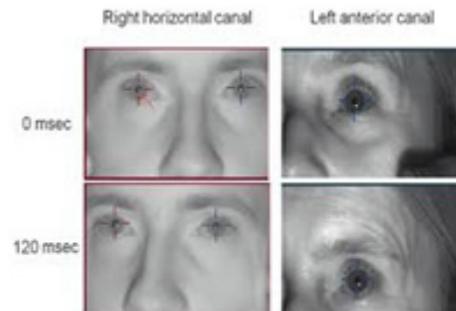
Very popular test for evaluation of VOR. VOR is the biological mechanism that helps to stabilize images in the fovea.

VHIT result is evaluated on 3 parameters namely,

- Presence/ absence of Saccades (when smoothness of the eye movts. is jeopardized with the head movement, the eyes will move in one or more jerks).

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- $VOR \text{ gain} = \text{Speed of eye movt.} / \text{Speed of head movt.}$
- Shape of the eye position tracing or eye velocity tracing.



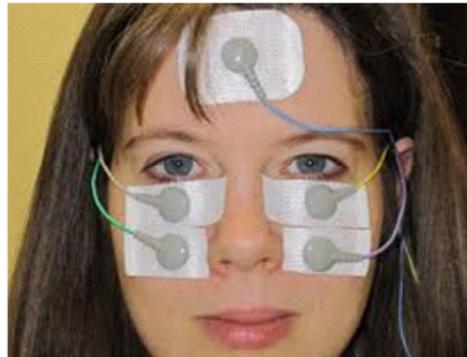
VEMP

They are generated by sound / vibrations and are actually vestibular & not auditory responses.

VEMPs are of 3 types..... Ocular / Cervical / Bone conducted. Ocular VEMPs are utricular responses



& cervical VEMPs are saccular responses. This was established by Ian S. Curthoys in 2015 in *Clinical Neurophysiology*: vol. 126. VEMP is just another peephole into the very complex functioning of the vestibular system and to evaluate vestibular function.



Vestibulospinal Tests

CCG (Craniocorpography) ---tests the vestibulospinal reflexes. Claussen devised these tests & Prof. Kirtane developed them to its present level. **CDP (Computerized dynamic posturography)** it is a method of evaluation of overall balance function and the capacity of the body to maintain erect posture / or stance and gait.It quantifies the degree of instability of the balance disorder patient.

CONCLUSIONS

Vertigo / dizziness are linked to a higher incidence of falls / cognitive spatial & non spatial impairment / psychological impairment / daily life handicap.Poor quality of life in vestibular patients is a consequence of the limitations caused by physical, cognitive, and psychological disturbances in daily life activities. Drug therapy and physical rehabilitation reduce the functional disability of vertigo patients & improve their quality of life.

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