VERTIGO

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INTRODUCTION

Vertigo is the sense of false motion(internal/externa) rotating, shifting or tilting (1). A sensation of self-motion (of head/body) when no self-motion is occurring or the sensation of distorted self-motion during an otherwise normal head movement.others;-disequilibrium, dizinness, presyncope

International consensus definitions for major vestibular symptoms(2)

Dizziness is the sensation of disturbed or impaired spatial orientation/no impaired motion

Presyncope (*near syncope*, *faintness*) is the sensation of impending loss of consciousness.

Syncope (*faint*) is transient loss of consciousness due to transient global cerebral hypoperfusion.

Unsteadiness is the feeling of being unstable while seated, standing, or walking without a particular directional preference.

FUNCTION OF THE VESTIBULAR SYSTEM

The primary function of the vestibular system is to provide information about our orientation in space by:(3)

1. Sensing angular accelerations and stabilizing gaze.
2. Sensing transient linear accelerations and stabilizing body position.
3. Sensing gravity and setting background muscle tonus

Balance control requires: visual, vestibular and proprioreceptive inputs.

VESTIBULAR ANATOMY

Peripheral and central

PERIPHERAL- vestibular apparatus , vestibular nerve

Bony labyrinth

- 3 semicircular canals

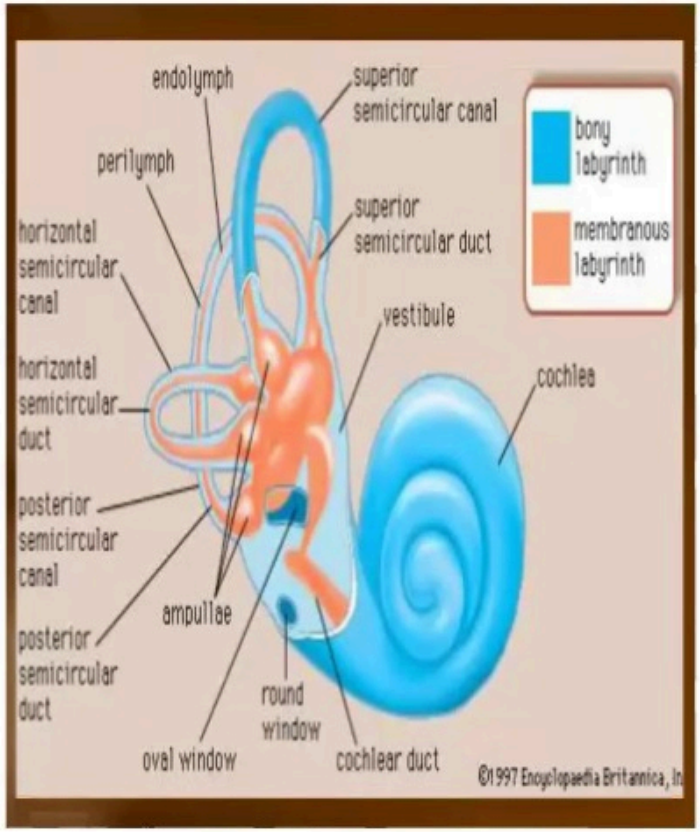
- cochlear

-vestibule(central chamber)

Membranous labyrinth

-suspended within bony labyrinth by perilymphatic fluid - contain five sensory organs;

- membranous portion of semicircular canals
- otolith organs- utricle ,saccule



VESTIBULAR ANATOMY CT'

Otolith organs

Register forces related to linear acceleration

Saccule

-vertical

-senses occipital caudal motion

Utricle

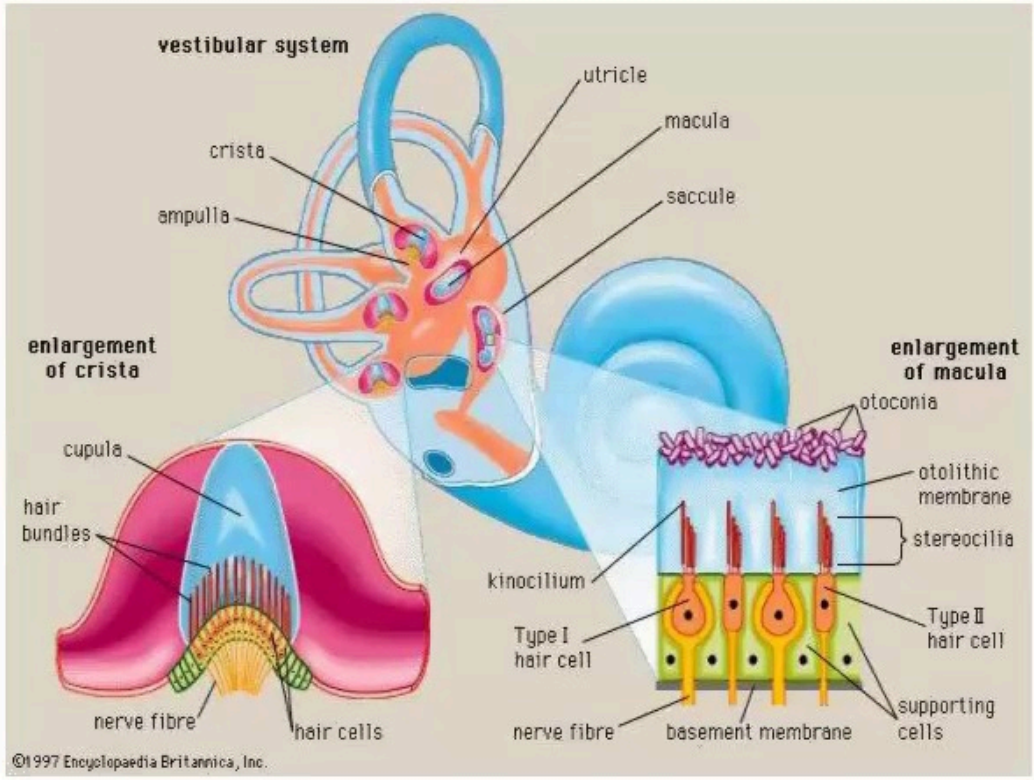
- horizontal

- senses antero-posterior motion

Hair cells

contained in each ampulla and otolith organ

convert displacement of the head into neural firing



BALANCE CONTROL: VESTIBULAR INPUT

Vestibular input mechanisms are necessary for balance control through reflexes.

1. Vestibular Ocular Reflex (VOR) : Signals from the inner ear continously drive the eye muscles to co-ordinate eye movt with head movt. VOR is responsible for maintaining a still image on the fovea of the retina in the presence of head movement.
2. Vestibular Spinal Reflex (VSR) : responsible for maintaining an upright posture in the presence of gravity.

DIFFERENTIAL DIAGNOSIS OF VERTIGO

Peripheral causes	Central causes of vertigo
Acute labyrinthitis	Cerebellopontine angle tumors
Acute vestibular neuronitis	Posterior fossa tumors
Benign positional paroxysmal vertigo	Cerebrovascular disease(vertebrobasillar)
Cholesteatoma	Vestibular migraine
Ménière's disease	Multiple sclerosis
Otosclerosis	
Perilymphatic fistula	

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EVALUATION

HISTORY-upto 80% of diagnoses

1.Nature of Dizziness: vertigo, dysequilibrium, lightheadness, drop attacks(otolithic crisis of Turmakin) oscillopsia

2.Onset & time course- episodic or continuous- secs, mins, hours

3.Associated symptoms- symptoms/signs: hearing loss, tinnitus, aura, headache, aural fullness, visual disturbance preceding viral infection

4.Precipitating, aggravating and relieving factors e.g. change in position of head/body, tullio phenomenon

5.Associated symptoms- nausea, vomiting, sweating, palpitations

6.Drug History-ototoxic drugs eg aminoglycosides, antihypertensive, oral hypoglycemic, chemotherapeutic agents

7. Previous surgery – ear surgery-drilling ,dental maxillofacial

8.Co- morbidities: diabetes,hyperuricemia, migraine, neurological or vascular dx

9.H/o Trauma

10.Family history- migraine,

11.Psycho- social history

CHARACTERISTICS

Duration Of Episode	Differential Diagnosis
A few seconds	Peripheral cause: unilateral loss of vestibular function; late stages of acute vestibular neuritis; late stages of Meniere's disease
Several seconds to a few minutes	BPPV; perilymphatic fistula
Several minutes to one hour	Posterior transient ischemic attack; perilymphatic fistula
Hours	Meniere's disease, perilymphatic fistula, migraine
Days	Stroke, migraine, Multiple sclerosis, Labyrinthitis
Weeks	Psychogenic, Acoustic Neuroma,

AGGRAVATING/ RELIEVING

Provoking factor	Differential Diagnosis
Change in head position	BPPV; acute Labyrinthitis
Recent upper respiratory viral illness	Acute vestibular neuronitis
Mental Stress	Migraine, psychological
Immunosuppression	Herpes Zoster oticus
Changes in ear pressure, head trauma, excessive straining, loud noises **(Tullio phenomenon)**	BPPV,Perilymphatic fistula, Superior canal dehiscence

4.RONALD H. LABUGEN. INITIAL EVALUATION OF VERTIGO. JOURNAL OF AMERICA FAMILY PHYSICIAN. 2006 JAN 15;73(2):244-51

ASSOCIATED SYMPTOMS(4)

SYMPTOM	SUGGESTED DIAGNOSIS
Aural fullness	Acoustic neuroma; Ménière's disease
Ear or mastoid pain	Acoustic neuroma; acute middle ear disease (e.g., otitis media, herpes zoster oticus)
Facial weakness	Acoustic neuroma; herpes zoster oticus
Focal neurologic findings	Cerebellopontine angle tumor; cerebrovascular disease; multiple sclerosis (especially findings not explained by single neurologic lesion)
Headache	Acoustic neuroma; migraine
Hearing loss	Ménière's disease; perilymphatic fistula; acoustic neuroma; cholesteatoma; otosclerosis; transient ischemic attack or stroke involving anterior inferior cerebellar artery; herpes zoster oticus
Imbalance	Acute vestibular neuronitis (usually moderate); cerebellopontine angle tumor (usually severe)
Phonophobia, photophobia	Migraine
Tinnitus	Acute labyrinthitis; acoustic neuroma; Ménière's disease

4.RONALD H. LABUGEN. INITIAL EVALUATION OF VERTIGO. JOURNAL OF AMERICA FAMILY PHYSICIAN. 2006 JAN 15;73(2):244-51

VESTIBULAR FUNCTION TESTS

Systematic

Standing

1. Gait
2. Romberg test
3. Fukuda step test
4. Tandem gait walk

Sitting

5. General Physical Examination

Vitals: BP**(including orthostatic**)

6. Head and neck, Ear, nose Throat

Ear: scars, otoscopy, fistula test

7. Neurological Examination

Cranial Nerves and Cerebellar function

8. Eye examinations

i) Spontaneous nystagmus

ii) Gaze test

iii) Saccades

iv) Smooth pursuit

9. Head thrust

10. Head shake

11. Dynamic visual acuity

On the couch

13. Positional test: Dix hallpike

14. Caloric test

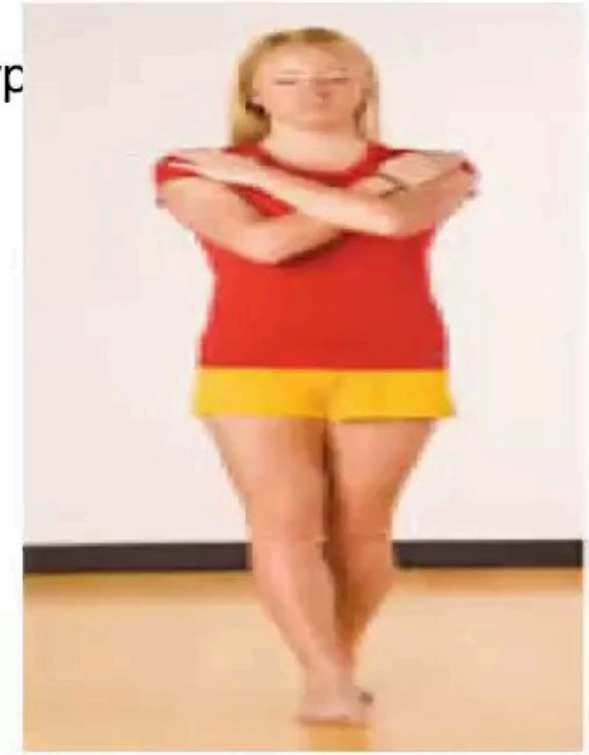
Others.Rotatory chair test, ECoG, VEMP

Test Name	Procedure	Interpretation
1. Gait	Assess patient walking: Steadiness, stride length, width, clumsiness	severe gait impairment ;neurologic disorder. Off balance, can walk with assistance: peripheral lesion.
2. Romberg and sharpened Romberg	patient stands with feet together, arms folded, first with eyes open and then with eyes closed Stand heel to toe	Positive - increased sway or falls when eyes are closed. vestibular lesions: fall or sway to the side of lesion. Cerebellar lesions: little enhancement with eye closure.
3. Fukuda step test	Arms extended forward, marches in place with eyes closed	vestibular malfunction tend to rotate towards affected side > 45egrees
4. Tandem gait walk	walk in a straight line heel to toe, first with eyes open, then with eyes closed.	Unilateral vestibular failure, sway towards affected side with eyes open

Rhomber

Fig 1. CTSIB position 4.

Sharp



CEREBELLAR TESTS

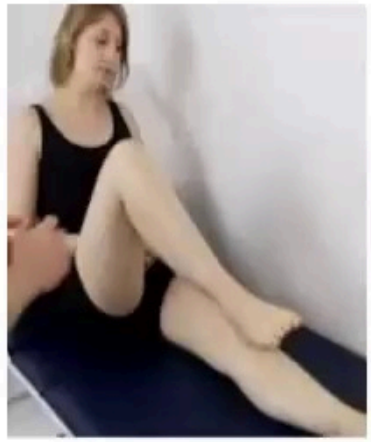
Dysmetria: inability to measure the distance for reaching intended target

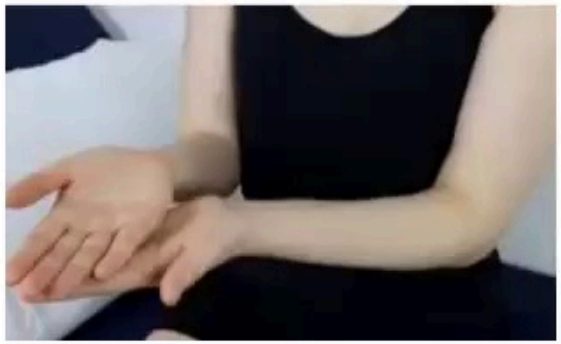
Test: Finger nose test

Finger finger test

Dysdiadokinesia: inability to do alternate opposite movements; Supination and pronation

Heel shin test-inability to perform this motion rapidly is abnormal(motor, proprioception or cerebellar)





EYE EXAMINATION
NYSTAGMUS

	Peripheral	Central
Type	Typically horizontal and torsional	Usually vertical, Pendular
Direction	Fast beat away from side of lesion	Fast beat towards side of lesion
Visual fixation	Relieved by gaze fixation	Not relieved by gaze fixation
Associated Cerebellar signs	absent	Present

Test	Procedure	Finding
i) Spontaneous Nystagmus	Ask the patient to fixate/focus on a stationary target Observe for nystagmus	Peripheral or Central. Spontaneous nystagmus for peripheral lesions beats in the direction of the fast phase
ii) Gaze stability test	Fix gaze on object and follow it (up, down, left, right)	Right lesion has left beating nystagmus.Gaze to the left makes the nystagmus even worse.(Alexanders law)
iii) Saccades	Have 2 objects or outstretched fingers patient looks back and forth	Corrective saccades : central lesion
iv) Smooth pursuit	follow target without moving head. Take 4-5s to move from left to right. Not more than 30 degrees	Test results should resemble a smooth sinusoid. Abnormal pursuit + vertigo= central lesion Normal pursuit +vertigo = peripheral

Test	Procedure	Interpretation
8. Head thrust	Thrust the head while patient focuses gaze on examiners nose-observe for corrective saccade	Corrective saccade-peripheral vertigo
9. Dynamic visual Acuity	Use Snellen Chart; determine baseline VA. Head shake 2Hz and assess VA	Drop of 3 or more-abnormal VOR
10.Head shaking nystagmus(9)	Use frenzel lenses,patient shake head approx. 30 times horizontally then stop. Look for nystagmus	Normal- no nystagmus Unilateral vestibular hypofunction-nystagmus, fast phase towards the normal side
11. Orthostatic BP	BP on sitting and standing	Difference of >20mmHg SBP and 10mmHg DBP; increase 30 bmin in pulse -Vascular

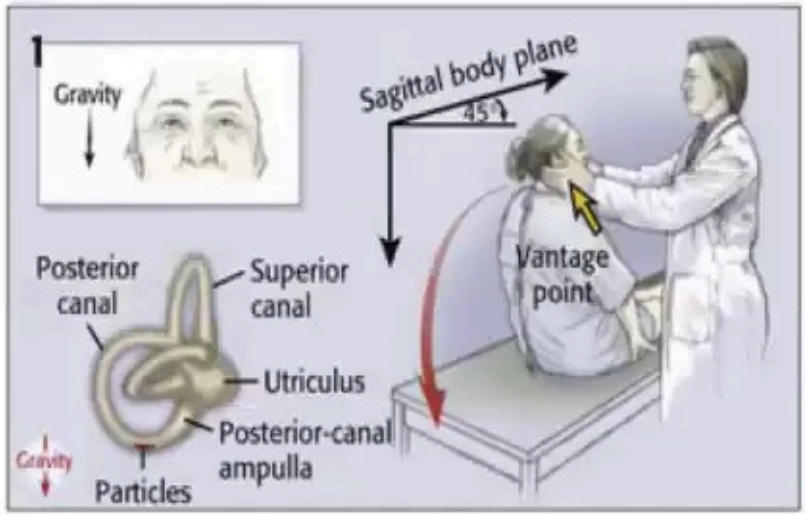
Normal leftward head impulse

Positive leftward head impulse

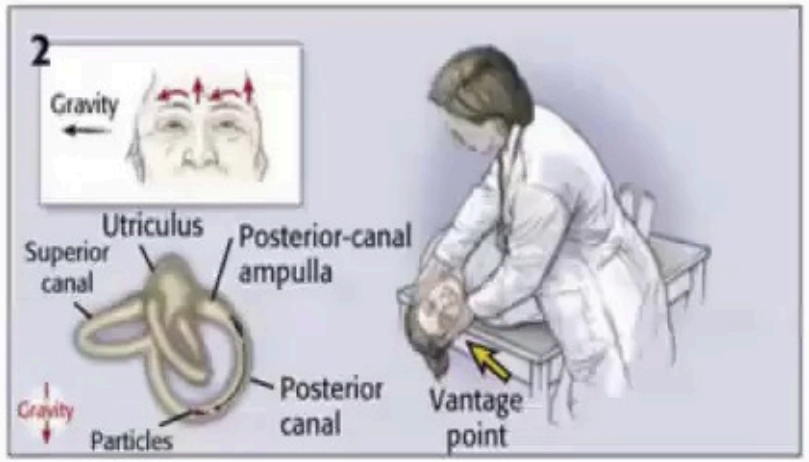
9. GARY P. JACOBSON, ET AL. SENSITIVITY AND SPECIFICITY OF HEAD SHAKE NYSTAGMUS FOR DET

POSITIONAL TESTING

DIX-HALLPIKE MANEUVER



The examiner stands at the patient's head, 45° to the right, to align the right posterior semicircular canal with the sagittal plane of the body.



The examiner moves the patient, whose eyes are open, from the seated to the supine, right-ear-down position and then extends the patient's neck slightly so that the chin is pointed slightly upward. The latency, duration, and direction of nystagmus, if present, and the latency and duration of vertigo, if present, should be noted. *Inset:* The arrows over the eyes depict the direction of nystagmus in patients with typical BPPV. The presumed location in the labyrinth of the free-floating debris thought to cause the disorder is also shown.

VESTIBULAR LABORATORY

ROLE/USE

Identify cause of clinical symptoms

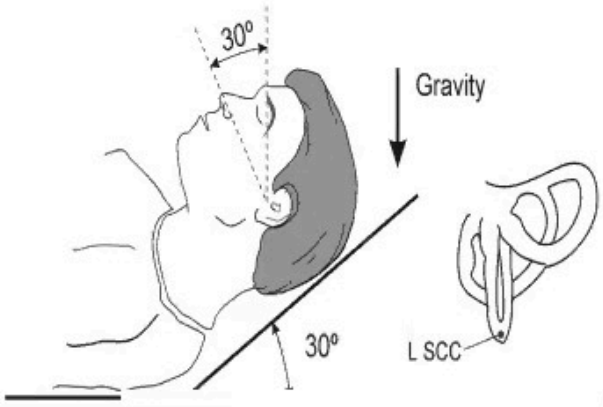
Confirm clinical findings

Plan therapy

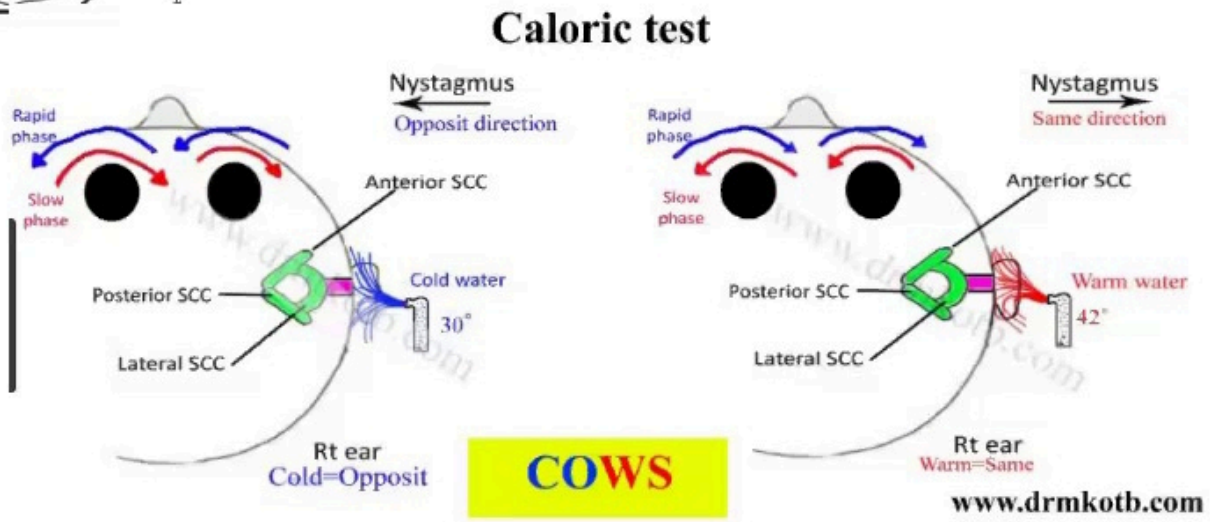
Monitor response

Include- ENG,VNG,EOG,CT posturography, VEMP

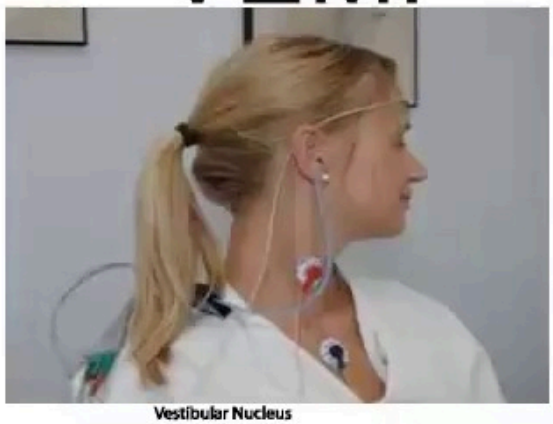
BITHERMAL CALORIC

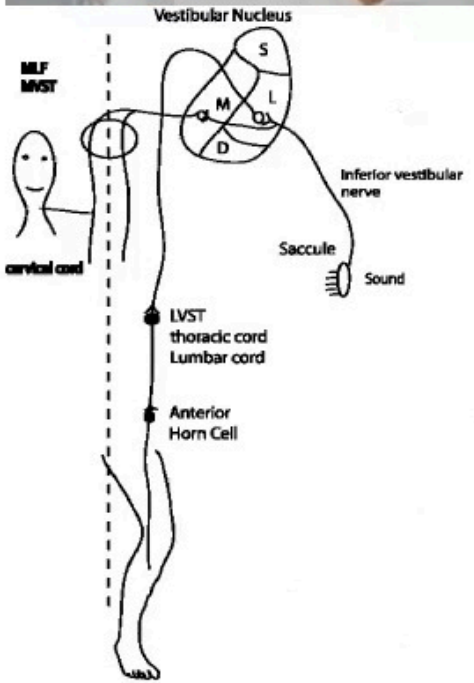


- lateral canal in the vertical plane,perform warm irrigations (44 degrees C) and cold irrigations (30 degrees) order



VEMP





Reduced amplitude/no response is seen on affected side

<u>Clinical uses of VEMP</u> .(12)

Reduced /absent vemp

- Vestibular neuritis
- Otolithic vertigo
- Aminoglycoside toxicity
- Acoustic neuroma

Present with CHL(2)

- Superior canal dehiscence syndrome
- Enlarged vestibular aqueduct

2.GLASSCOCK .M, GULIA. A , SURGERY OF THE EAR, 5TH EDITION, 2003; PAGE 79, ONTARIO
12.CUMMINGS CW ET AL; CUMMINGS ORL – HNS TEXT BOOK, 5TH ED

VESTUBULAR LABORATORY TESTS CT;

Other Tests	Components of the Test	Clinical Application
ENG/VNG	Spontaneous Nystagmus, saccades,gaze pursuit, OKN, Positional Tests, Calorics	Assess significant asymmetry in the response of the labyrinths, which can indicate peripheral lesion
VEMP	Assess otolith function. EMG of SCM elicited by acoustic stimulation	Reduced /absent vemp Vestibular neuritis Otolithic vertigo Aminoglycoside toxicity Acoustic neuroma Superior semicircular canal dehiscence syndrome. VEMP with reduced threshold or vemp+CHL
Rotatory Chair	VOR; eye velocity and head velocity	Diagnose peripheral bilateral vestibular lesions, monitor patients undergoing pharmacologic vestibular ablation for Ménière disease, children

OTHER TESTS

1. Audiogram-SNHL(aminoglycoside, Meniere's disease)
2. HRCT temporal bone-superior canal dehiscence syndrome,cholesteatoma etc
3. MRI-Vertebrobasillar insufficiency
4. Serologic tests- syphilis, antiphospholipid syndrome

7.DEEPAK PATKAR ET AL. J.P JOURNALS .MAY 2012
12.CUMMINGS CW ET AL; CUMMINGS ORL – HNS TEXT BOOK, 5TH

CENTRAL VERSUS PERIPHERAL VERTIGO

Peripheral

- Falls in Romberg position and deviates during walking with closed eyes to the side of the lesion(slow component)
- Direction of nystagmus does not change with direction of gaze but is suppressed with fixation
- Nystagmus can be horizontal, or rotational, but
- never vertical
- Nystagmus occurs after a brief latent period, fatiguable
- Severe rotating, whirling vertigo
- Symptoms aggravate after moving of the head position
- Severe vegetative signs (vomiting, sweating)
- Caloric response decreased on side of lesion

Central

Falls in Romberg position and deviates during walking with closed eyes to the side of the fast component of nystagmus

Direction of nystagmus might change with direction of gaze

Not suppressed by visual fixation

nystagmus is vertical or dissociated and not fatiguable, may be perverted

Vertigo usually not whirling

Vegetative signs are less severe if any

Associated neurological signs: diplopia, dysarthria, dysphagia, numbness, paresis,

HINTS

	Peripheral Vertigo	Central Vertigo
Head Impulse Test	Abnormal; corrective saccade to midline with rotation of head	Normal; no corrective saccade
Nystagmus	Unidirectional; horizontal	Horizontal & direction-changing; vertical; torsional
Test of Skew	No skew deviation	Skew deviation present

TAKE HOME MESSAGE

A thorough history , physical examination and structured clinical vestibular examination is key in the diagnosis of a patient with vertigo

Vestibular laboratory test for vertigo primarily play a confirmatory role

Imaging modalities indicated for patient with neurologic signs and symptoms and those at risk for cerebral vascular accidents