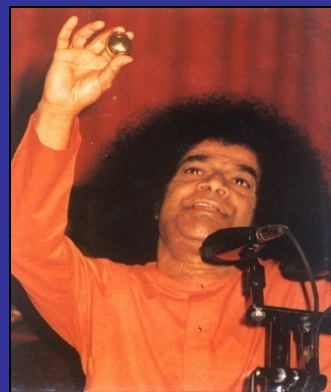
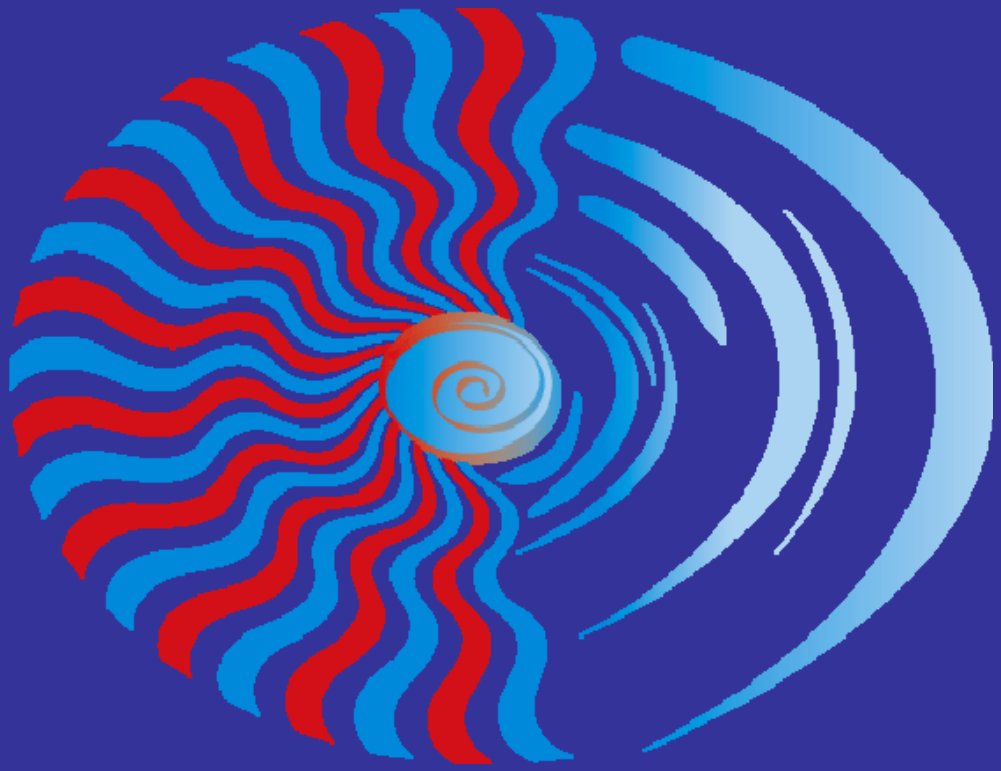
VERTIGO-NEUROPHYSICIAN'S PERSPECTIVES

PROF.A.V.SRINIVASAN, MD, DM, PhD, DSc, FRCP(LON) F.A.A.N, F.I.A.N,
EMERITUS PROFESSOR-THE TAMILNADU DR MGR MEDICAL UNIVERSITY
FORMER PROFESSOR OF NEUROLOGY AND HEAD- INSTITUTE OF NEUROLOGY
MADRAS MEDICAL COLLEGE

CHENNAI AUGUST 10, 2014



Vertigo denotes a hallucinatory sensation of movement



Balance the imbalance

Being ignorant is not so much a shame as being unwilling to learn

Prevalence of Vertigo and Giddiness

- 5 % of Patients visiting the General Practitioner
- 10 % of Patients visiting the Otorhinolaryngologist

Oosterveld WJ, Adv. Oto-rhino-laryng, 1983, 29, 39-49

"My Opinions are founded on knowledge but modified by experience"

What causes vertigo?

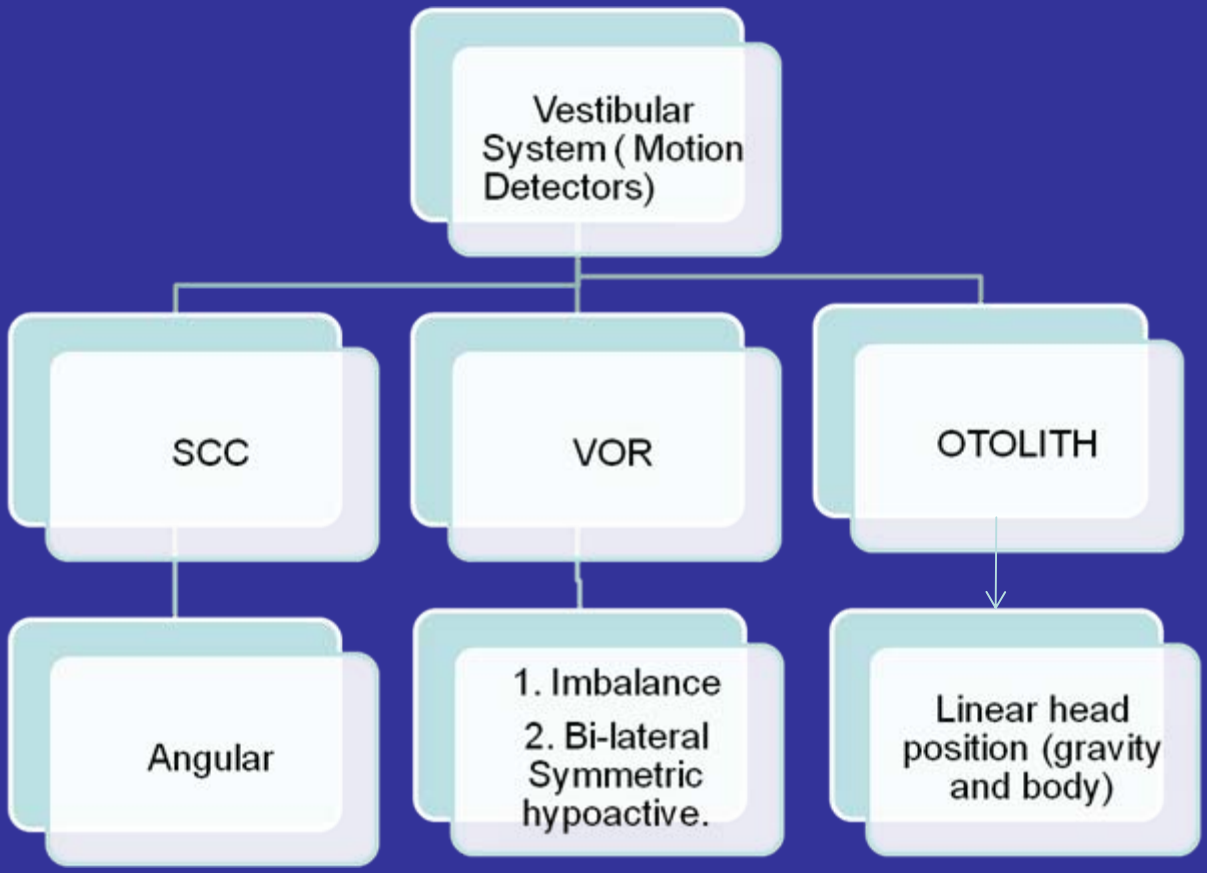
- Contradictory information from
  - The vestibular system (ears)
  - The visual system (eyes)
  - The Proprioceptive system (muscles, joints)

Daroff RB, 'Faintness, Syncope, Dizziness and Vertigo' IN Harrison's Principles of Internal Medicine, 14 th edn, 105

Experience can be defined as

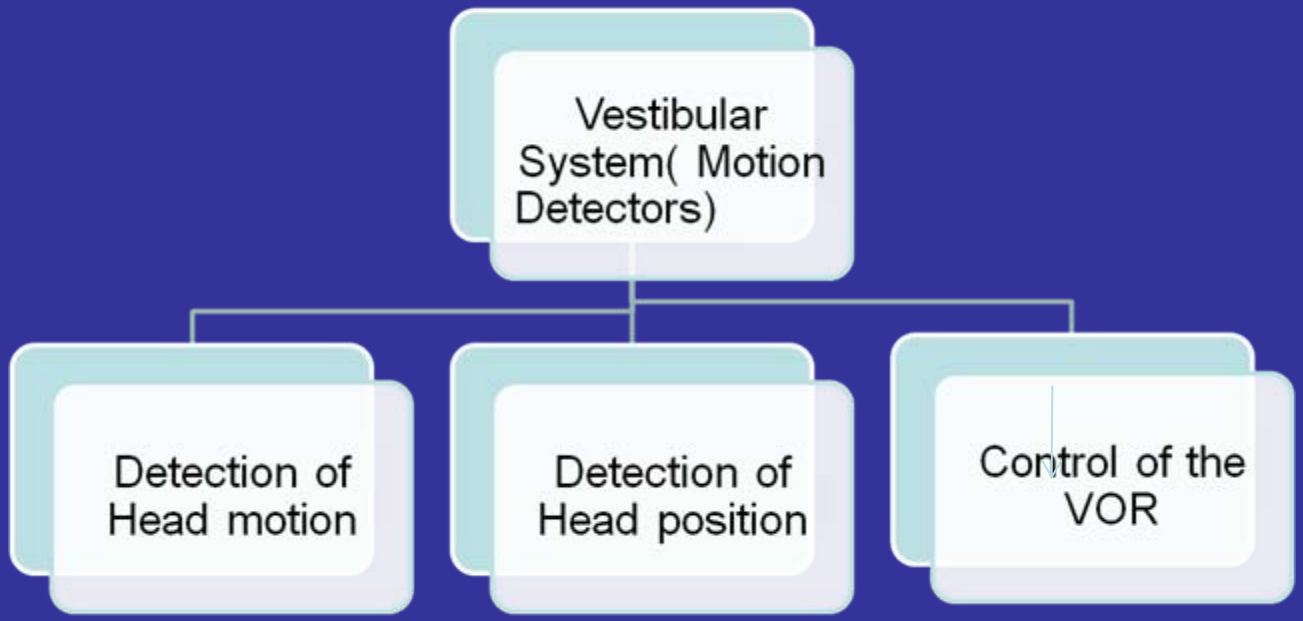
yesterday's answer to today's problems

Anatomical Structures



Being ignorant is not so much a shame as being unwilling to learn

Physiology



Being ignorant is not so much a shame as being unwilling to learn

Saccades and Vestibular Ocular motor adaptation

- **Saccade adaptation**
- **Cross-axis adaptation**
- **On axis adaptation: New findings**
- **Changes in the dynamic properties of adapted saccades**
- **A role for forward models in the control of saccades**
- **Behavioral deficits in saccade adaptation with cerebellar lesions**
- **Vestibulo-Ocular Reflex (VOR) adaptation**
- **VOR adaptation induced by position and alternate error signals**
- **Compensatory saccades as an adaptation to abnormal peripheral VOR function**
- **Physiological correlates of saccade and VOR adaptation**

Imagination is more Important than Knowledge

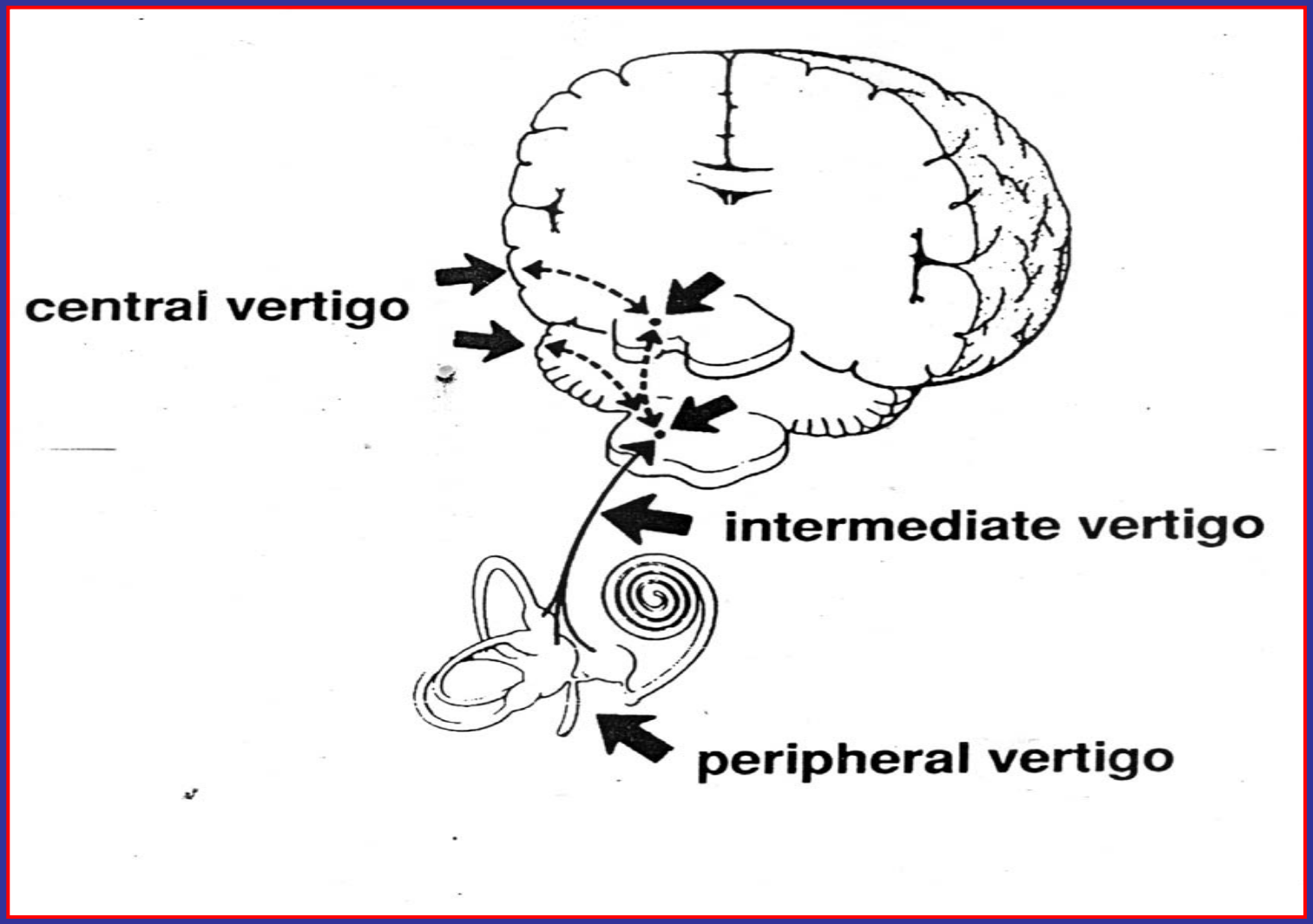
Types of Dizziness

1. Light headedness
2. Multiple sensory deficit
3. Cervical spine disease
4. Imbalance
5. Faintness
6. Acute vertigo with nausea and worse with head motion
7. Vertigo present only with head motion

Being ignorant is not so much a shame

as being unwilling to learn

Sites of Vertigo



The secret of walking on water is

Knowing where the stones are

Causes of Vertigo
(Peripheral Vestibular - arises in Vestibule)

- Benign Paroxysmal Positional Vertigo
- Meniere's Disease
- Labyrinthitis
- Head Injuries & Surgical Trauma
- Pressure Vertigo

Memory, the daughter of attention ,

is the teeming mother of knowledge - Martin Tupper

Causes of Vertigo

(Intermediate Vestibular - arises in Vestibular Nerve)

- Vestibular neuronitis
- Acoustic neuroma
- Drugs

Science is below the mind; Spirituality is beyond the mind

Causes of Vertigo

(Central vestibular - arises in Vestibular Nuclei)

- VBI (Vertebrobasilar Insufficiency)
- Arteriosclerosis
- Cervical Spondylosis
- Whiplash injuries of Neck
- Brain Tumors

Success is a prize to be won. Action is the road to it.
Chance is what may lurk in the shadows at the road side.

Non-Vestibular Causes of Vertigo

- **Ocular vertigo**
- **Anemia**
- **Cardiovascular (orthostatic hypotension)**
- **Cerebrovascular disorders**
- **Psychogenic**
- **Brain tumors**

- ☞ **Head injuries**
- ☞ **Epilepsy**
- ☞ **Multiple sclerosis**
- ☞ **Hypoglycemia**
- ☞ **Migraine**

In any field, find the strangest thing and explore it

Another classification of vertigo

- Paroxysmal Vertigo - sudden attack comes on quickly, lasts for a short time
- The single attack - sudden intense attack fading away slowly
- Chronic vertigo - not severe
- Positional vertigo - occurs following sudden movements of head in certain positions
- Dizzy spells - lasting a few seconds occurring irregularly

DIAGNOSIS OF VERTIGO
Medical History

- Description of symptoms by patient
- Classification of vertigo attacks (Which type, how debilitating, frequency, duration, vegetative symptoms)
- Influencing circumstances (Injuries, drugs taken, stress, eating pattern, Illnesses)
- Secondary symptoms (Tinnitus, Hearing loss, Headache, nausea/ vomiting)

Biswas A., 'Neurotological History Taking' IN An Introduction to Neurotology, 1998, 8-11

Take time to think; it is the source of power
Take time to read; it is the foundation of wisdom
Take time to work; it is the price of success

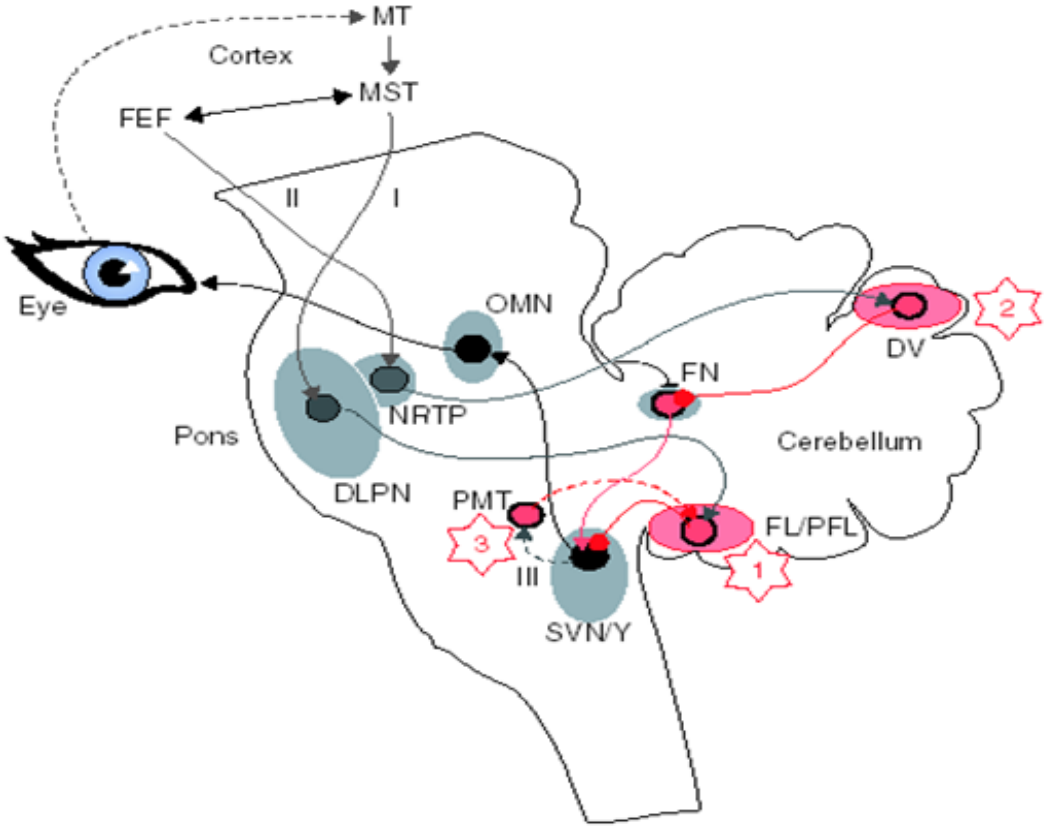
Clinical Examination

- Duration of Vertigo
  - < 5 seconds – Hypoactive Labrynth
  - 5 – 90 secods – BPPV
  - 90 seconds – 20 minutes - Migraine , TIA
  - 20 minutes – 24 hours – Meniere's disease
    Perilymphatic Fistula
  - Days – CNS Disorder, Vestibular Neuronitis

Character gets you out of bed; Commitment moves you to action; Faith, Hope and Discipline follow through to completion

Clinical Examination

- Neurological Examination
- Expanded vestibular Examination
  - ➢Study of Nystagmus
  - ➢Hallpike – Dix Test
  - ➢Test of vestibular imbalance or hypofunction
    - Head thrust test
    - Dynamic Visual Acuity
    - Head shaking test



Schematic representation of a putative model of the pathomechanism of DBN. We propose that all patients with DBN share a final common pathway (disinhibition of the SVN and neurons of the Y group). The ocular motor circuitries involved are the two smooth pursuit eye movement pathways (I, II) and the vertical gaze-holding pathway (III). The different lesion sites that can lead to DBN are shown in red (1 - 3). See Discussion for details (from [65]).

Reprinted with permission from Hufner K et al, Structural and functional MRIs disclose cerebellar pathologies in idiopathic downbeat nystagmus. Neurology 2007;69:1128-35.

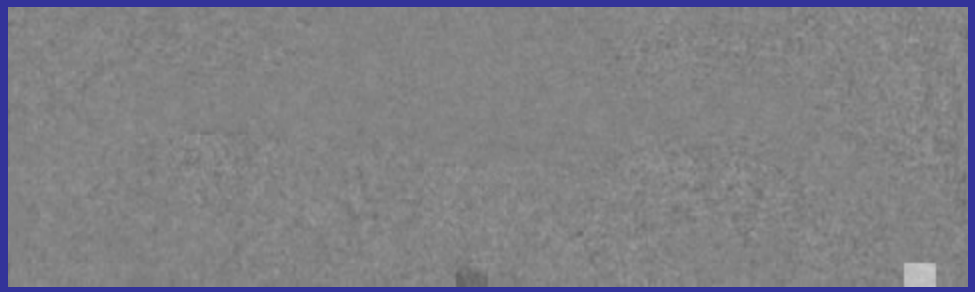
DLPN: Dorsolateral pontine nuclei; DV: Dorsal, ocular motor vermis; FEF: Frontal eye field; FN: Fastigial nucleus; MST: Medial superior temporal area; MT: Middle temporal area; NRTP: Nucleus reticularis tegmenti pontis; OMN: Ocular motor nuclei; PMT: Nucleus of the paramedian tract; SVN: Superior vestibular nucleus; Y: Neurons of the Y group. Reprinted with permission from Hufner K *et al*, Structural and functional MRIs disclose cerebellar pathologies in idiopathic downbeat nystagmus. Neurology 2007; 69: 1128 -35.

"The True Art of Memory is The Art of Attention" - **S.Johnson**

Nystagmus Videos

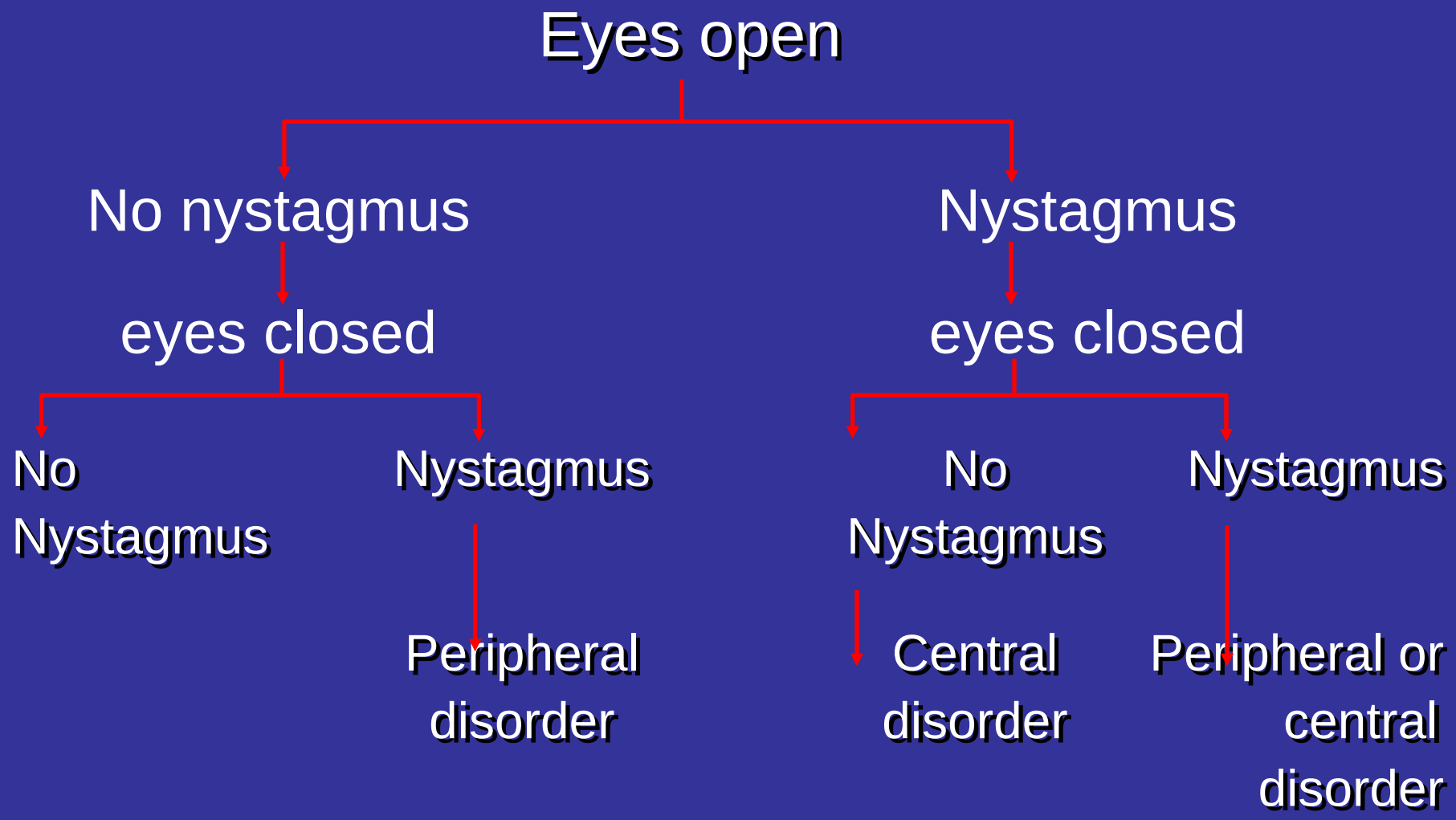
Gaze evoked Nystagmus

Rebound Nystagmus



Vertical Nystagmus

Spontaneous nystagmus



Truth comes out of error sooner than that of confusion

Induced nystagmus

- Positional nystagmus

  Any nystagmus that occurs when the head is in position other than normal upright

- Positioning nystagmus

  occurs when change of head position and used to diagnose BPPV

Differentiation of Peripheral and Central Vertigo

Sign / Symptom (Brainstem	Peripheral (Labyrinth)	Central or Cerebellum)
Direction of associated nystagmus	Unidirectional; fast phase opposite lesion*	Bidirectional or unidirectional
Purely horizontal nystagmus without torsional component	Uncommon	Common
Vertical or purely present torsional nysagmus	Never present	May be
Visual fixation	Inhibits nystagmus and vertigo	No inhibition

* In Meniere's disease, the direction of the fast phase is variable.

Daroff R. B., 'Faintness Syncope, Dizziness and vertigo IN Harrisons Principles of Internal Medicine, 14th Edition, 105

"Fools Admire but of men of sense approve"

Differentiation of Peripheral and Central Vertigo

Sign / Symptom	Peripheral (Labyrinth)	Central (Brainstem or Cerebellum)
Severity of vertigo	Marked	Often mild
Direction of spin	Toward fast phase	Varied
Direction of fall	Toward slow phase	Variable
Duration of symptoms	Finite (minutes, days, weeks) but recurrent	May be chronic
Tinnitus and /or deafness	Often present	Usually absent
Associated central common abnormalities	None	Extremely
Common causes demyelinating,	Infection (labyrinthitis),	Vascular,
	Meniere's, neuronitis, ischemia, trauma, toxin	neoplasm

Daroff R. B., 'Faintness Syncope, Dizziness and vertigo IN Harrisons Principles of Internal Medicine, 14th Edition, 105

Clinical Pearls

Peripheral Disease

HOH → Tinnitus → Aural Fullness

Acute Peripheral Vestibular Disease

Distortion of Sounds → ANS symptoms

Meniere's Disease

Episodic Tinnitus → HOH

Peripheral less predictable in CNS

Postural Aggravation

Clinical Pearls…contd

Viral Labyrinthitis or Internal. AUD. Artery

- Acute Vertigo
- Hearing Loss

CNS

- Headache
- LOC
- Seizures
- Hemiparesis
- Cranial nerve

Drugs

- Benzodiazepine
- Anti-histaminics
- Scopolamine

Neuro-ophthalmology and neuro-otology

Familial recurrent vertigo syndromes

(1)	Episodic ataxia
(2)	Benign recurrent vertigo
(3)	Bilateral vestibulopathy
(4)	Vertigo, migraine and essential tremor
(5)	Familial audiovestibular dysfunction/Ménière's disease

" We Sometimes think we have forgotten something when in fact we never really learned it **in the first place"**
Imp.Your Memory Skills

Clinical and genetic features of familial episodic ataxia syndromes

	EA1	EA2	EA3	PATX/EA4	EA5	EA6	EA7	Other episodic ataxias
Online Mendelian Inheritance in Man	160120	108500	606554	606552	601949	600111	unassigned	unassigned
Attack duration	seconds/minutes	hours	1 min–6 h	brief	hours	hours/days	hours/days	hours/days
Age of onset (years)	2–15	2–20	1–42	23–60	3–teens	5	teens	after 30
Myokymia	usual	no	usual	no	no	no	no	no
Nystagmus	no	usual	occasional	usual	usual	no	no	usual
Epilepsy	occasional	infrequent	occasional	occasional	usual	yes	no	no
Migraine	no	usual	usual	no	no	usual	no	variable
Tinnitus	infrequent	no	usual	occasional	no	no	no	no
Acetazolamide	occasional	usual	usual	no	transient	no	no	occasional
Vertigo	no	yes	yes	yes	yes	no	yes	usual
Weakness	no	usual	no	no	no	no	yes	occasional
Dysarthria	no	yes	yes	yes	no	no	yes	usual
Inheritance	autosomal dominant	autosomal dominant	autosomal dominant	autosomal dominant	autosomal dominant	sporadic	autosomal dominant	multiple
Chromosome locus	12q13	19p13	1q42	unknown	2q22–q23	5p	19q13	unknown
Mutated gene	*KCNA1*	*CACNA1A*	unknown	unknown	*CACNB4*	*SLC1A3*	unknown	unknown
Mutant protein	Kv1.1	Cav2.1	unknown	unknown	Cav2.1	excitatory amino acid transporter type 1	unknown	unknown

Summary of the clinical features, pathophysiology, etiology, site of lesion, and current treatment options of downbeat and upbeat nystagmus.

	Direction of the nystagmus (quick phase)	Waveform (slow phase)	Special features	Sites of lesion	Etiology	Treatment
Downbeat nystagmus	Downward, may be diagonal at lateral gaze	Jerk, linear, increasing or decreasing velocity of the slow phase	Increase in intensity during lateral and downward gaze	Cerebellum (bilateral floccular hypofunction); lower brain-stem	Degenerative cerebellar disorders, ischemia, idiopathic; often associated with bilateral vestibulopathy	4-amino-pyridine,3,4-diaminopyridine, baclofen, clonazepam
Upbeat nystagmus	Upward	Jerk, linear, increasing or decreasing velocity of the slow phase	Increase in intensity during upward gaze	Medulla, ponto-mesencephalic and cerebellum	Ischemia, bleeding, Wernicke's encephalopathy	Since often transient, treatment not necessary; baclofen, 4-aminopyridine

Whatever the Mind can conceive and Believe,
the mind can Achieve -**Napoleon Hill**

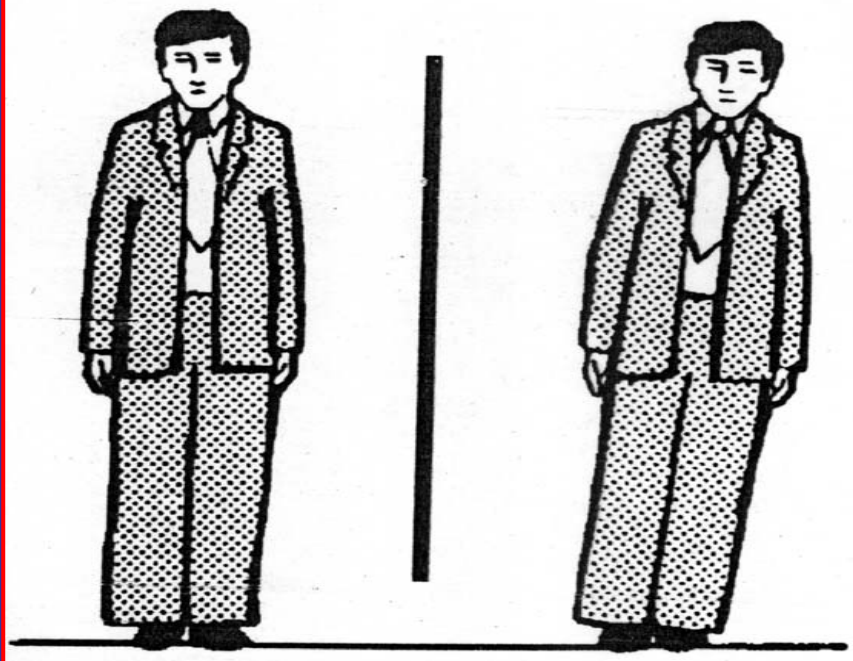
Balance Tests

- Postural tests
  - Romberg test
  - Unterberger test
  - Babinski-weill test
  - Barany Pointing test
- Eye movement test
  - Nystagmus

Adapted from Biswas A.,'Clinical tests in Neurotology' IN An Introduction to Neurotology, 1998, 13-25

Character gets you out of bed; Commitment moves you to action; Faith, Hope and Discipline follow through to completion

ROMBERG TEST

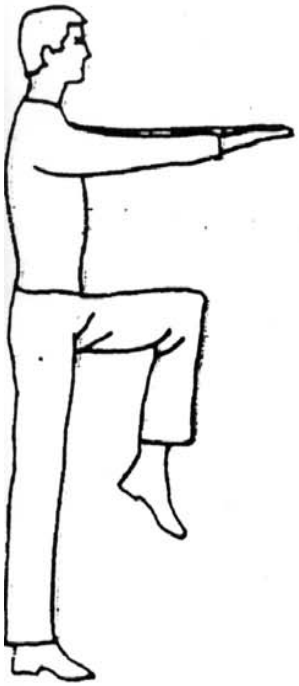


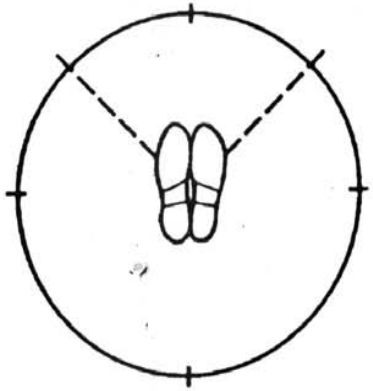
Eyes closed,
feet together

VERTIGO:
Patient leans to compensate for the sensation of movement

Every thing should be made as simple as possible; but not simpler

UNTERBERGER'S TEST

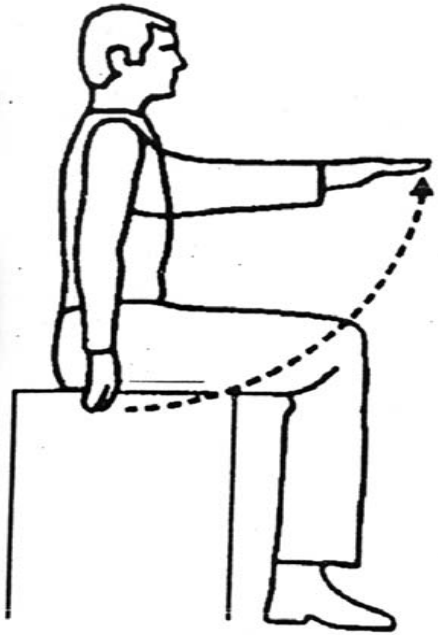




- Patient closes eyes and stretches arms out in front
- Walks on spot for a minute
- The knees raised as high as possible
- Patients with vertigo will start to turn his axis in particular direction

"Healthy Mind and Healthy expression of Emotion go hand in Hand"

BARANY'S PAST POINTING TEST

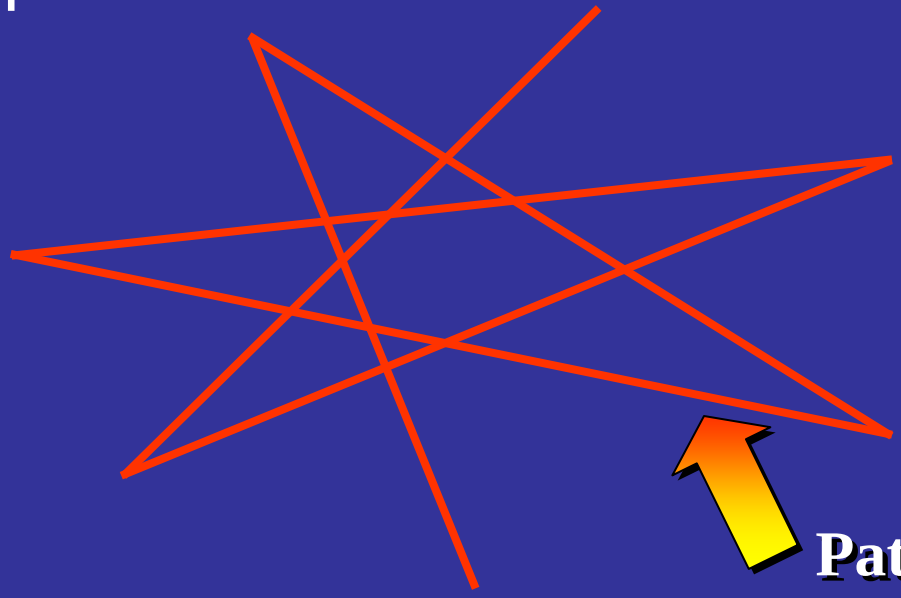


- doctor holds an object in front of the patient
- patient closes his/her eyes and points to object several times
- **Deviation to one side in pointing occurs in patients with vertigo**

*Give us the **GRACE** to accept with serenity the things that cannot be changed the **COURAGE** to change the things that should be changed and the **WISDOM** to know the difference*

Babinsky- Weill Test

Patient closes his eyes and takes 5 steps forward and 5 steps back for 30 seconds



Patient with vertigo starts to walk in a star shape

NATURE, TIME AND PATIENCE
are the 3 great physicians

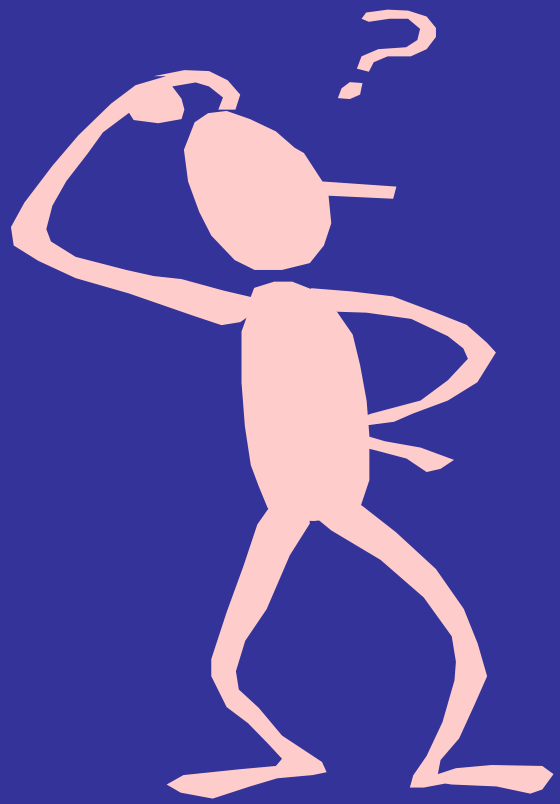
Management of vertigo

- Pharmacotherapy
- Adaptation exercises
- Surgery

"Social Isolation is in itself a pathogenic Factor for disease production"

I WANT ..

- Fewer attacks every month
- Attacks should not be as bad as before
- Attacks should not last long



A Vertigo Patient

A true commitment is a heart felt promise to yourself from which you will not back down

Pharmacotherapy (Antivertigo drugs)

Vertigo suppression drugs

- Anticholinergics
- Sympathomimetics
- Antihistaminics
- Psychotherapeutic drugs
- Antiemetic phenothiazines

Drugs modifying underlying pathology

- Cerebroactive drugs
- Vasodilators
- Diuretics
- Corticosteroids
- Antibacterial drugs

Thinking is the hardest work there is,

which is probable reason why so few engage in it.

Site of action of anti-vertigo drugs

- Labryinth – Diuretic and corticosteroids
- Blood flow – Vasodilators
- Reticular formation – Sympathomimetics
- Reticular formation (cholinergic pathway) vestibular nuclei – Antiemetic, Antihistamines, Anticholinergics
- GABAnergic suppression of vestibular nuclei - Psychotherapeutic drugs

Mind is the great level of all things; human thought is the process by which human ends are ultimately answered

Phenothiazines (Prochlorperazine,Thiethylperazine)

- Prochlorperazine is less sedating than some other phenothiazines but drowsiness still occurs
- Also causes hypotension, Parkinsonian side effects

--Betts T et al, Brit. J. Clin. Pharmac, 1991, 32, 455-8,

--Curley JWA, E N T Journal, 1984, 65, 555-560

- "The drug which most commonly causes parkinsonism in general practice is Prochlorperazine"

--Chaplin S, Geriatric Medicine, 1989, Feb, 13-14

Serious, sincere, systematic studies, surely secure supreme success

Anxiolytics (Tranquilizers)
(Benzodiazepines such as diazepam, Lorazepam)

- No effect on the underlying vertigo
- Helps patient endure the symptoms by allaying anxiety
- Many side effects drowsiness and sedation, dependence and addiction abuse potential, psychomotor impairment, memory loss, interactions with alcohol

Harris T, Ear Nose Throat J, 1984, 65, 551-5

"Men of Genius Admired: Men of Wealth envied women of power feared but only women of character are trusted"

Diuretics (e.g. Furosemide, Hydrochlorthiazide)

- Used in vertigo and meniere's disease
- Reduce the volume of endolymph by promoting urine flow and reducing fluid retention.
- Use mainly associated with electrolyte imbalance

Ludman H, Brit. Med. J., 1981, 282, 454-457, Harris T, Ear Nose Throat J, 1984, 65, 551-5

"Motivation is the Spark that lights the Fire of Knowledge and fuels the engine of Accomplishment"

Antihistamines

Cinnarizine, Flunarizine, Cyclizine

- Drowsiness and blurred vision (Difficult for patients who drive or operate machinery)
- Delay normal vestibular compensation process
- Cinnarizine and Flunarizine act via calcium antagonism, unspecific action may cause side effects
  - Weight gain & depression (serotonergic effects)
  - Extrapyramidal symptoms (dopaminergic effects)
  - G.I. upset

Cinnarizine, Collin Dollery Therapeutic Drugs, C240-3, Godfraind T et al, Drugs of Today, 1982, XVIII(1), 27-42, Venkataraman S, Neurosciences Today, 1997, Vol. I, 3&4, 205-6, Norre M E, Crit Rev. Phy. Rehab. Med., 1990, 2,2,101-20

Betahistine

Trusted therapy for more than

41 million

Vertigo patients worldwide

At twenty the will rules

At thirty the intellect

At forty the Judgment

Betahistine - Summary

- Pharmacokinetics: Rapid and complete absorption after oral route
- Pharmacology: It is a H1 agonist and H3 receptor antagonist. It increases cochlear and cerebral blood flow and regulates firing activity of vestibular nuclei.
- Dose: 24-48 mg /day
- Indication: vertigo, meniere's syndrome
- Contraindications: not known
- Precaution for use: pheochromocytoma, peptic ulcer, bronchial asthma

"The True Art of Memory is The Art of Attention"

Global evaluation (n=29)

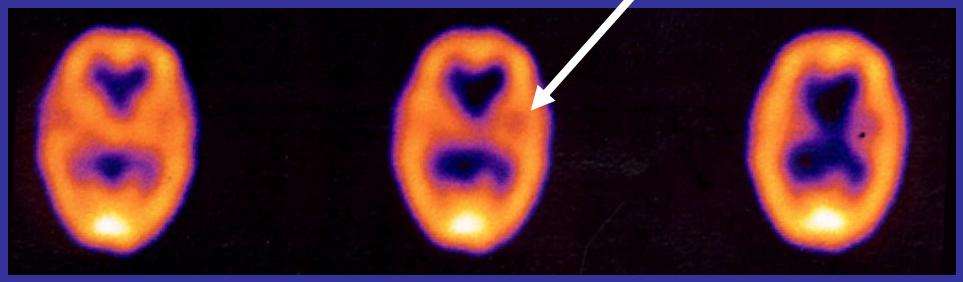
Parameters rating in	Excellent-good % of patients by	
	Patients	Physicians
Efficacy	100%	100%
Tolerance	100%	100%
Effect on associated symptoms	95%	95%

Bradoo RA, Ind. J. Otolaryngol H N S, 2000, 52 (2), 151-8

Whatever the Mind can conceive and Believe,
the mind can Achieve

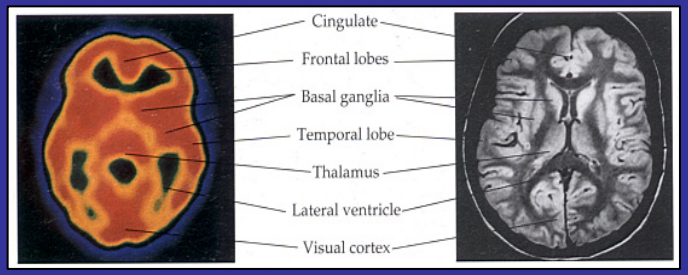
^{99m} Tc HMPAO transaxial images of brain (6mm slices)
P.D. Hinduja National Hospital, Mumbai

Pre-Betahistine Therapy (15.06.1999) No. 2540



Reference Image

SPECT **MRI**



R **L** **R** **L**

Post-Betahistine Therapy (12.07.1999) No. 2922

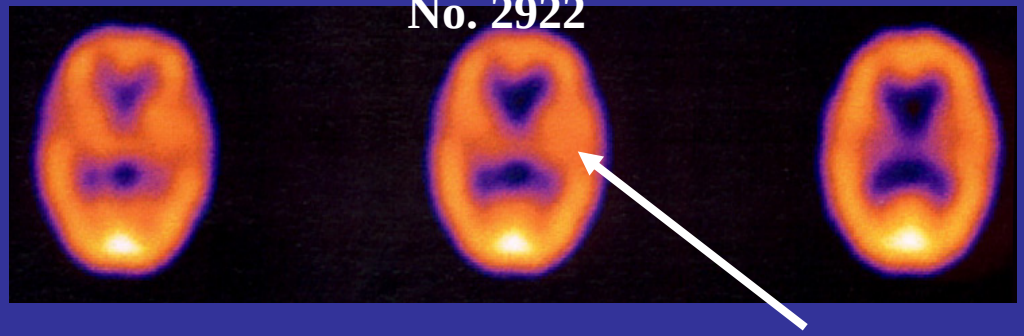


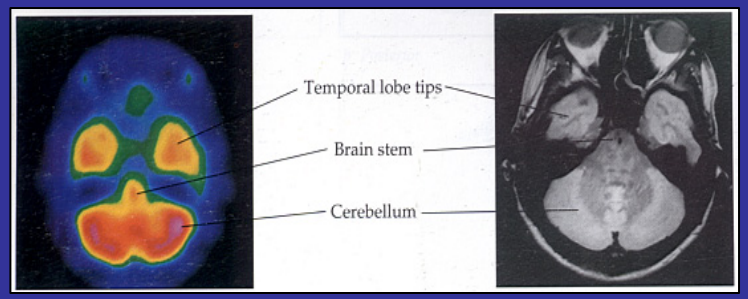
Figure I: The top row images show HYPOPERFUSION in the left temporal lobe prior to therapy & the bottom row images of the same patient show complete NORMALISATION OF PERFUSION after 4 weeks of Betahistine therapy 16 mg three times daily

Krishna BA, Kirtane MV, Neurology India, 2000,48, 255-9

^{99m} Tc- HMPAO transaxial images of brain (6 mm slices)
P.D.Hinduja National Hospital, Mumbai

Reference Image

SPECT **MRI**



R L R
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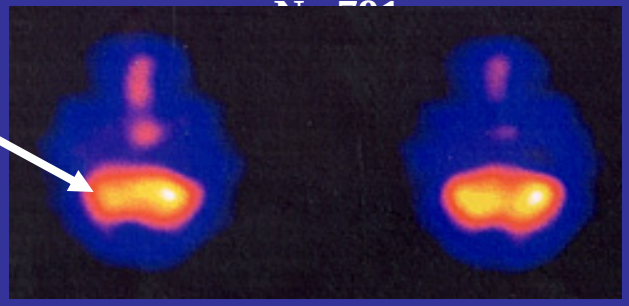
Pre-Betahistine Therapy (27.02.1998)



Post-Betahistine Therapy (10.03.1998)

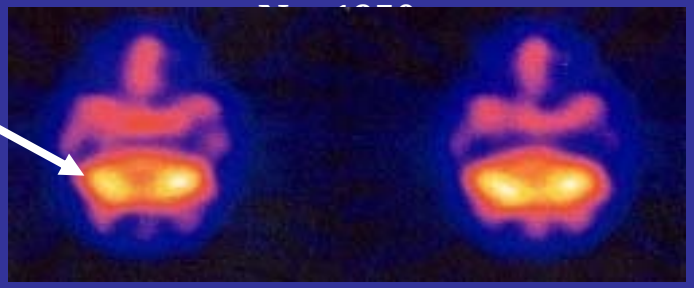


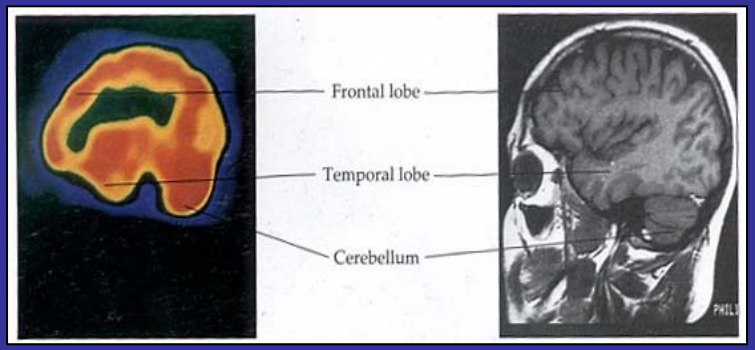
Figure II: The top row images show HYPOPERFUSION in the right inferior cerebellar region prior to therapy. The bottom row images show almost complete NORMALISATION OF PERFUSION following 2 weeks of Betahistine therapy 16 mg three times daily.

Krishna BA, Kirtane MV, Neurology India, 2000,48, 255-9

^{99m} Tc- HMPAO sagittal images of brain (6 mm slices)
P.D. Hinduja National Hospital, Mumbai

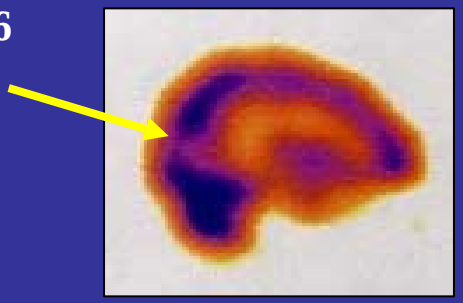
Reference Image

SPECT MRI



R L R L

Pre-Betahistine Therapy (17.03.1999)
No.1086



Post-Betahistine Therapy (08.04.1999)
No.1599

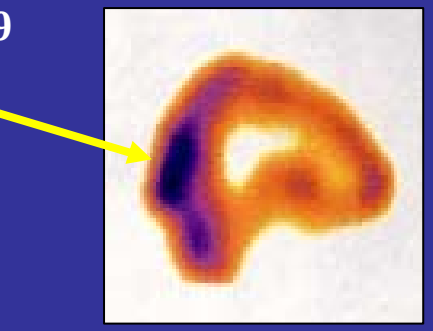


Figure III: The top row images show a well-defined focalized **HYPOPERFUSION** in the right parieto-occipital region prior to therapy. The bottom row images show almost complete **NORMALISATION OF PERFUSION** of this region after 3 weeks of Betahistine therapy 16 mg three times daily.

Krishna BA, Kirtane MV, Neurology India, 2000,48, 255-9

Do's and don'ts in encouraging vestibular compensation

Encourage

- Alertness
- Active & passive movements
- Large Support Surface
- Fine motor task
- Visual stimuli
- General care

Avoid

- Sedation
- Immobility
- Dark environment
- Solitude standing

Kirtane MV, Ind. J. Otolaryngol HNS, 1999, 51 (2), 27-36.

Many Ideas grow better when transplanted into another mind than in the one where they sprang UP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LISTEN ***not to contradict or confute***

Nor to Believe and Take for Granted

but **TO WEIGH AND CONSIDER**

THANK YOU