

Hearing and Vestibular Disorders in the Workplace

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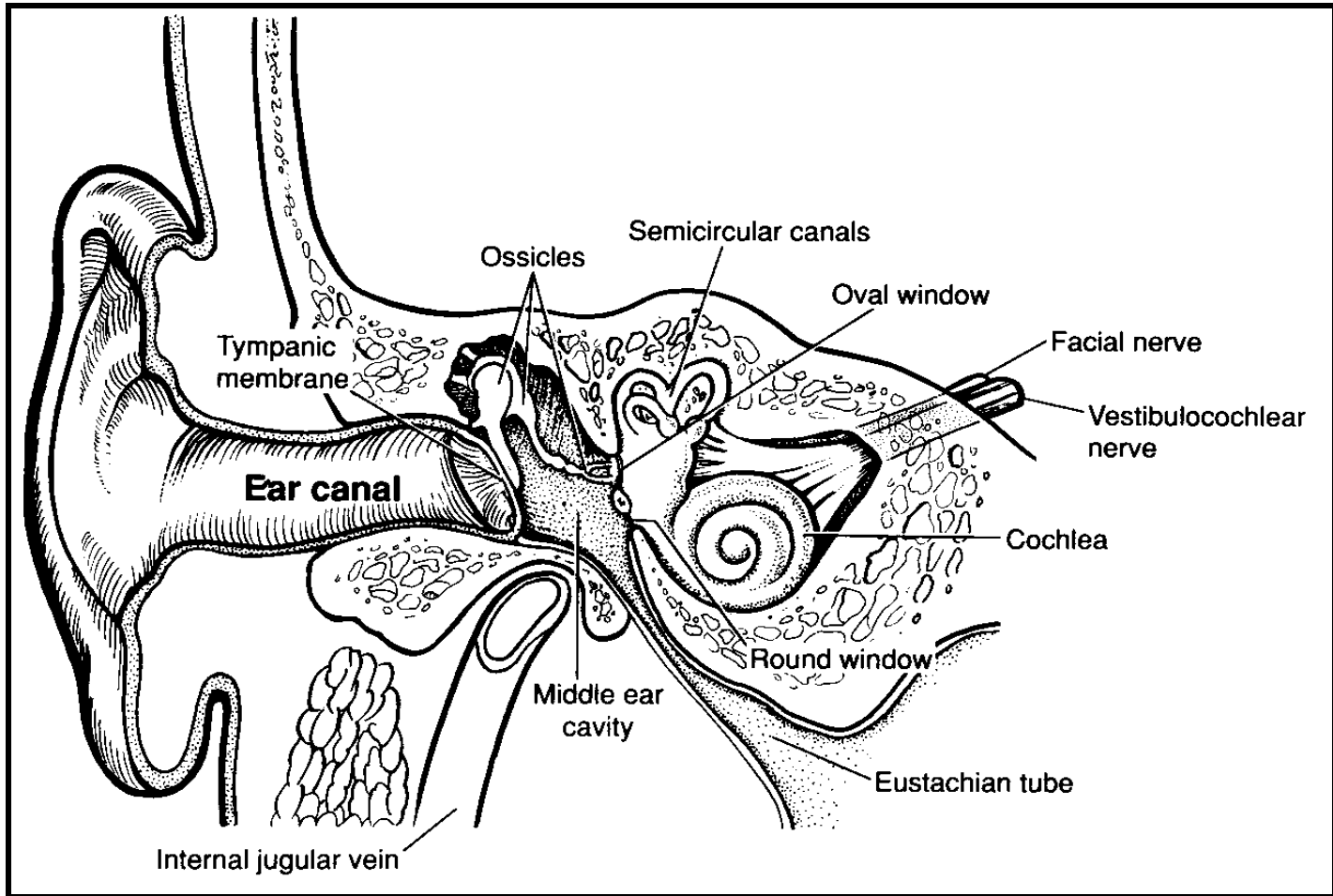
Definitions

- **Hearing loss** – loss of sensitivity to sounds between 250 and 8000Hz in one or both ears
- **Tinnitus**- perception of sound in the absence of an external stimulus
- **Dizziness** – lightheadedness
- **Vertigo** – illusion of movement
- **Imbalance** – perception of instability

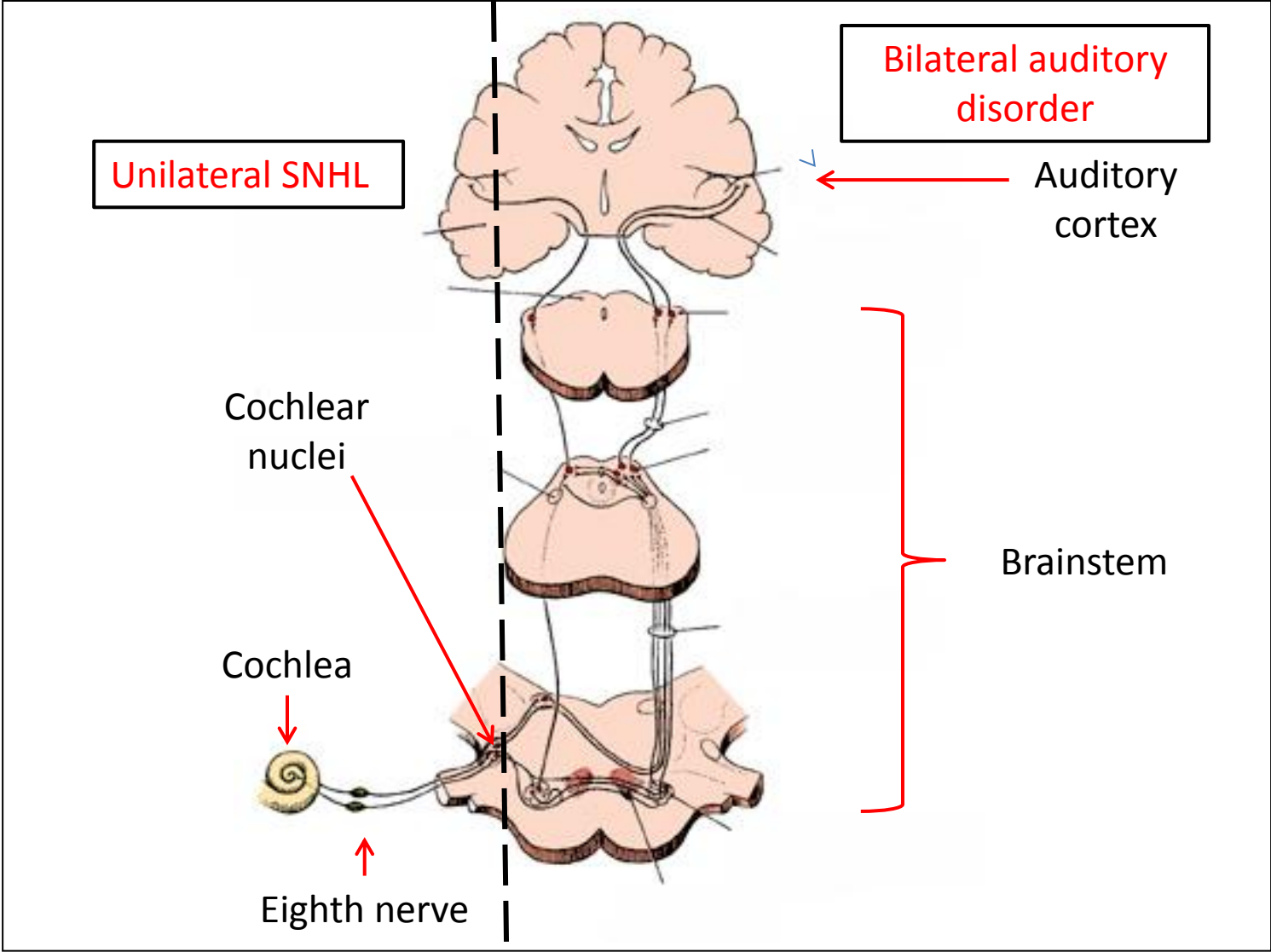
Epidemiology

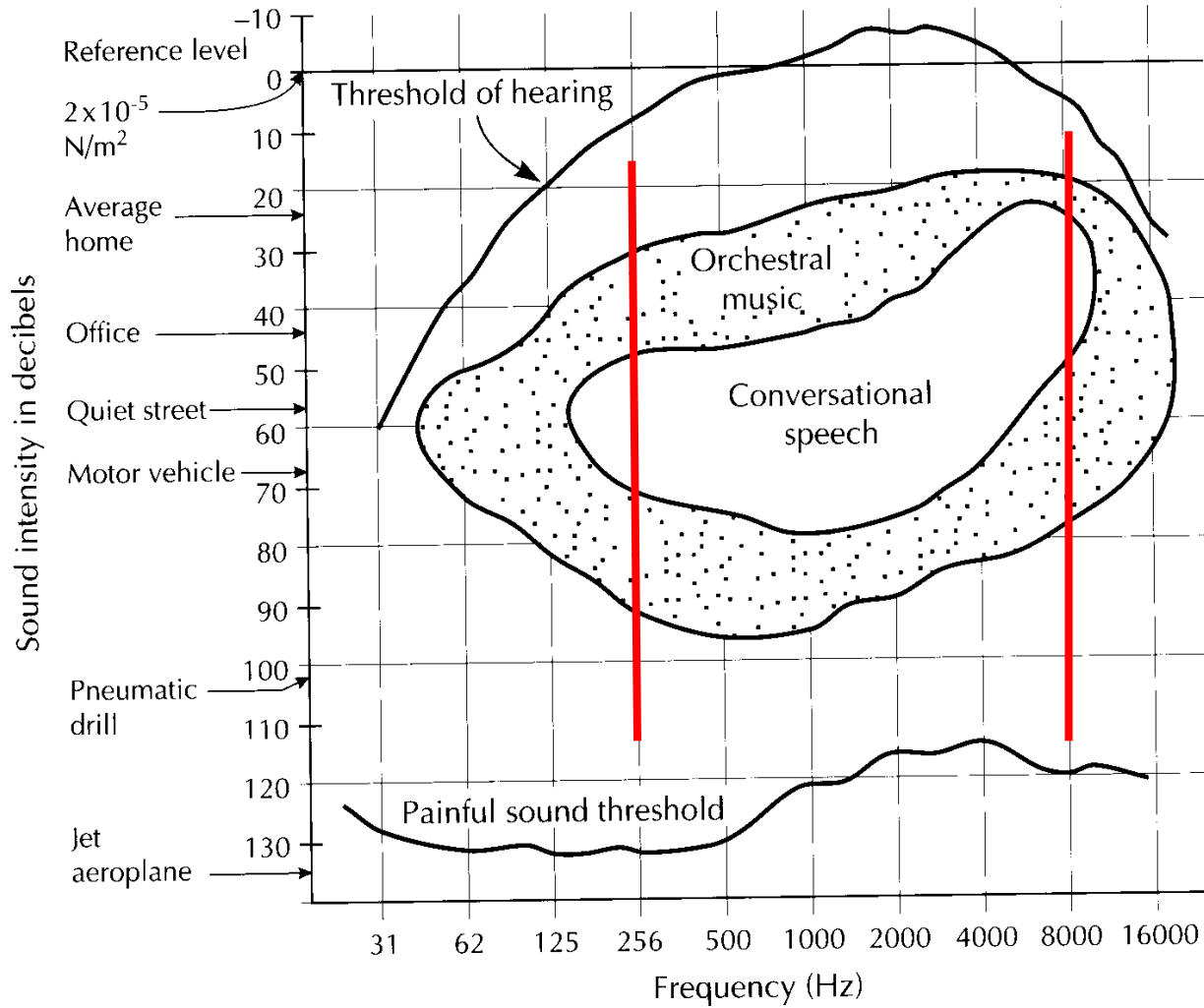
- **Hearing loss** ~ 17% of population
 - 10million in UK/3.7 m working age
 - 14.5m by 2031
 - 800K severe/profound HL
 - : 4x more likely to be unemployed
- **Tinnitus** ~ 10% of population
 - 4% present to doctor
 - <1% intrusive and intolerable
 - Higher prevalence in those with HL
 - Intrusiveness more related to psychological than psychoacoustic factors.

The Ear

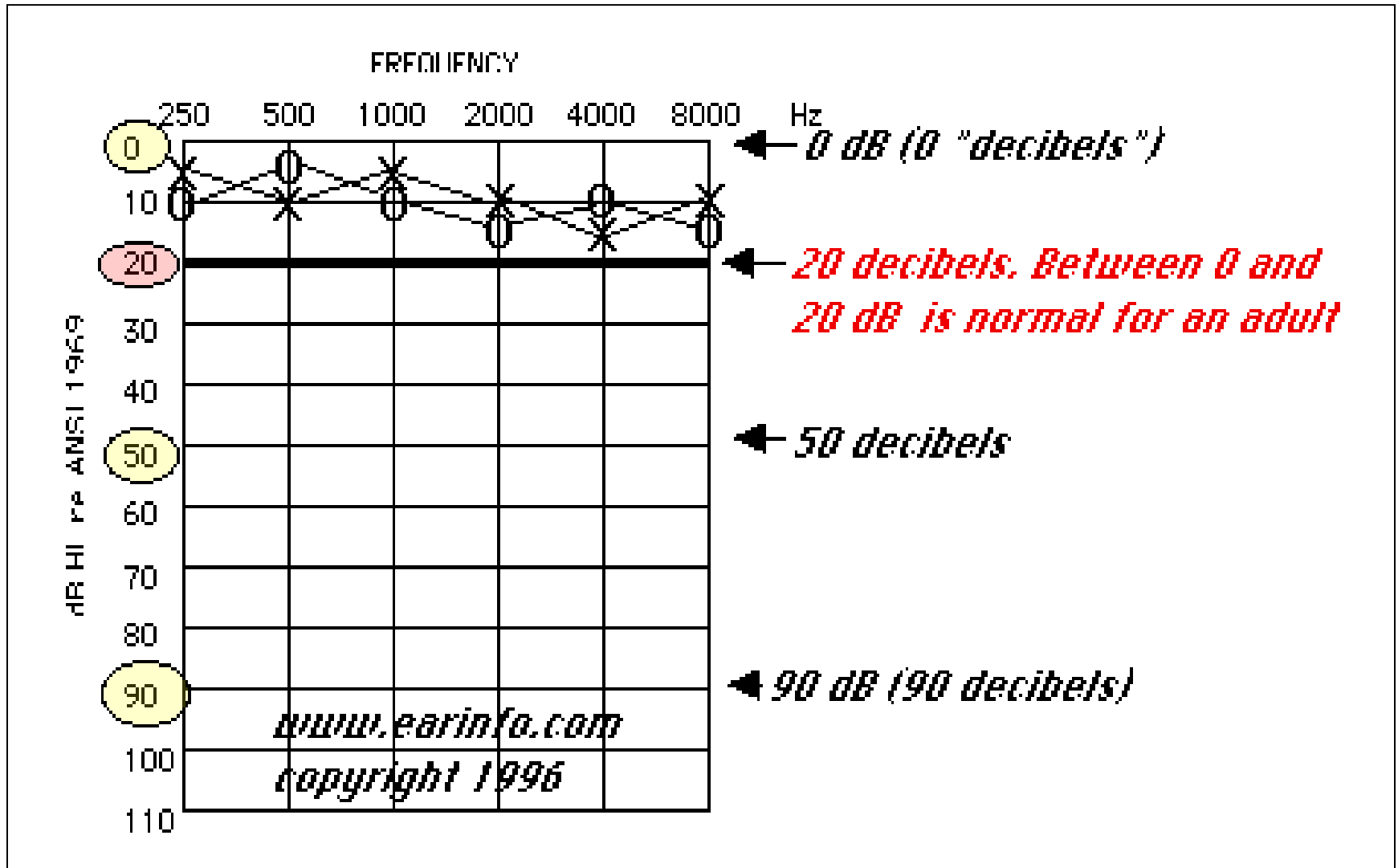


Central Auditory Pathway





Normal Hearing



Risk Factors for Acquired Hearing Impairment

- Age
- Gender (M>F)
- ?Race
- Lower social class
- Hazardous noise
- Smoking
- Head injury
- Hypertension
- Diabetes
- Alcohol

Causes of Hearing Loss

Genetic	Nonsyndromal Syndromal
Trauma	Physical Barotrauma Acoustic trauma
Vascular	Malformation Cardiovascular ischaemia Cerebrovascular ischaemia
Autoimmune	Isolated inner ear disease Systemic disorder, eg SLE, PAN
Infection	Bacterial Viral Fungal
Degenerative	Cochlea Neuropathy Neurological
Iatrogenic	Drugs Surgical Radiotherapy Organic chemicals

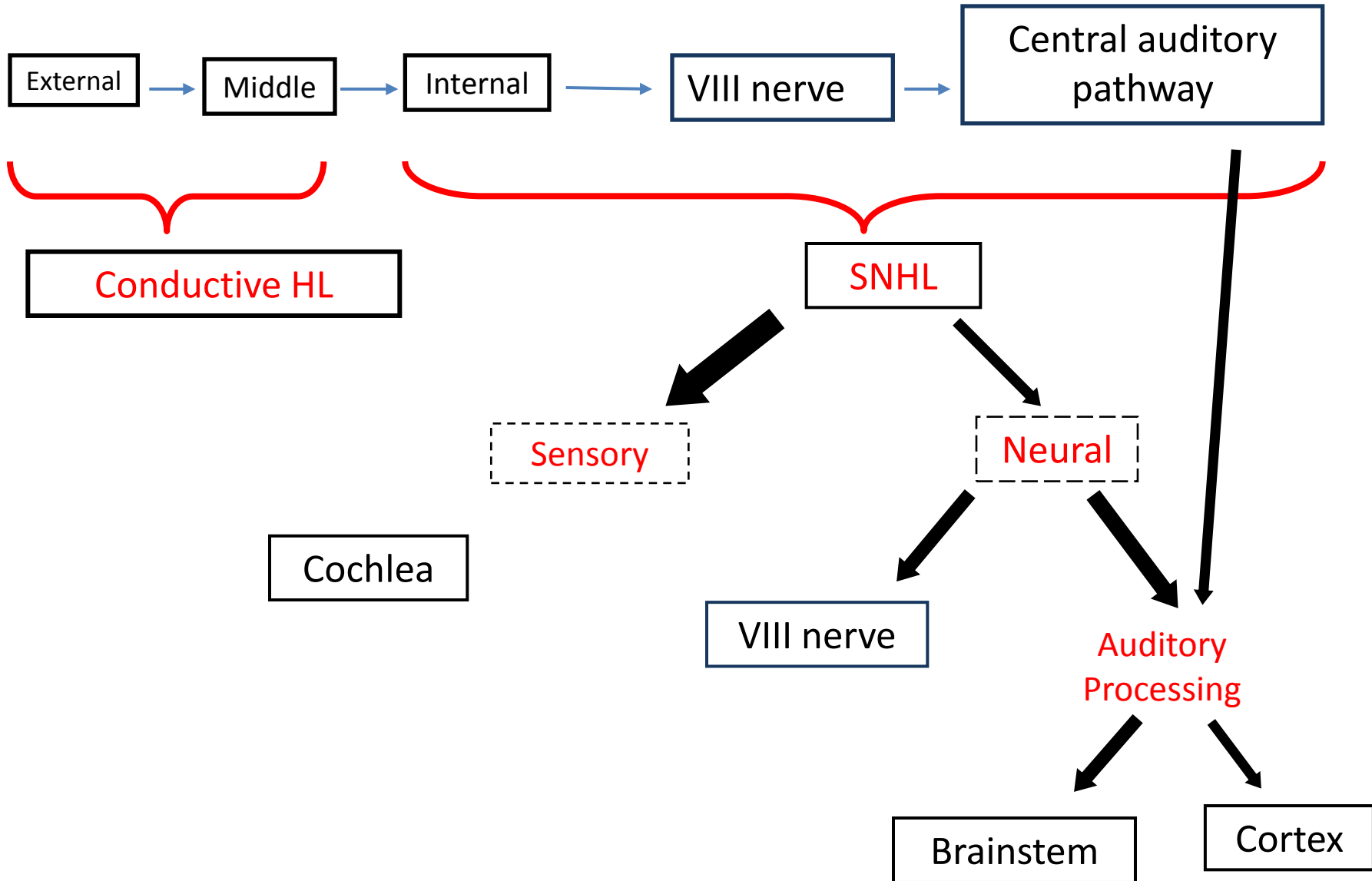
WHO descriptors of hearing impairment

Grade of impairment	Corresponding audiometric ISO value	Performance	Recommendations
0 - No impairment	25 dB or better (better ear)	No or very slight hearing problems. Able to hear whispers.	
1 - Slight /mild impairment	26-40 dB (better ear)	Able to hear and repeat words spoken in normal voice at 1 metre.	Counselling. Hearing aids may be needed.
2 - Moderate impairment	41-60 dB (better ear)	Able to hear and repeat words spoken in raised voice at 1 metre.	Hearing aids usually recommended.
3 - Severe impairment	61-80 dB (better ear)	Able to hear some words when shouted into better ear.	Hearing aids needed. If no hearing aids available, lip-reading and signing should be taught.
4 - Profound impairment including deafness	81 dB or greater (better ear)	Unable to hear and understand even a shouted voice.	Hearing aids may help understanding words. Additional rehabilitation needed. Lip-reading and sometimes signing essential.

Grades 2, 3 and 4 are classified as **disabling hearing impairment**.

The audiometric ISO values are averages of values at 500, 1000, 2000, 4000 Hz.

Types of Hearing Impairment



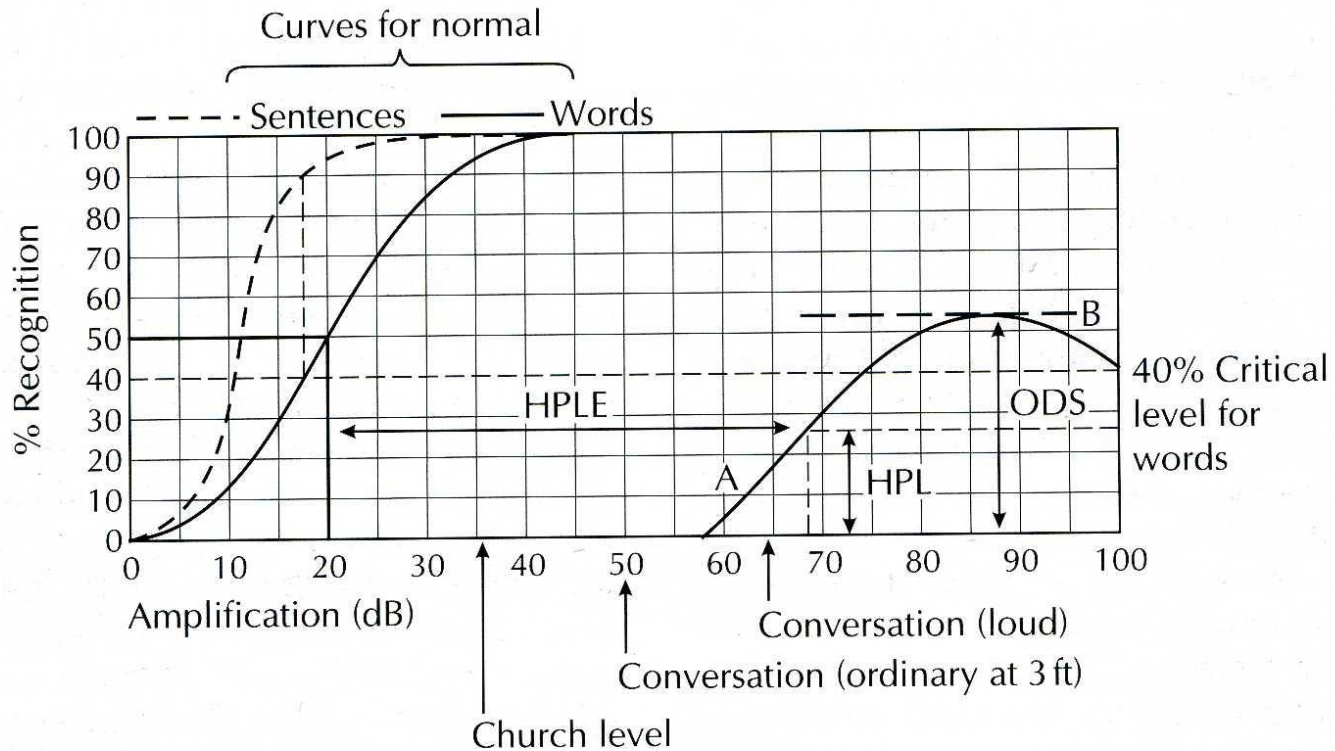
Simple Assessment of Hearing Loss?

- Self report
- Whisper test
- Action on Hearing Loss
“Hearing Check”
- Audioscopy

Auditory Tests

- **PTA** – time consuming, subjective, variable
- **Tympanometry** – objective
- **Otoacoustic emissions** – stable, objective, highly reproducible, quick, dependent upon outer hair cell function, but influenced by middle ear function
- **Evoked potentials** – objective, site of lesion, time consuming.
- **Speech audiometry**– variable, subjective

Speech Audiometry



Limitations of Pure Tone Audiometry

- Skilled task
- Appropriate environment essential
- Time consuming
- Affected by colds, recent loud noise
- Subjective
- 6-11dB variability
- Measured in 5 dB steps
- no information about site of lesion

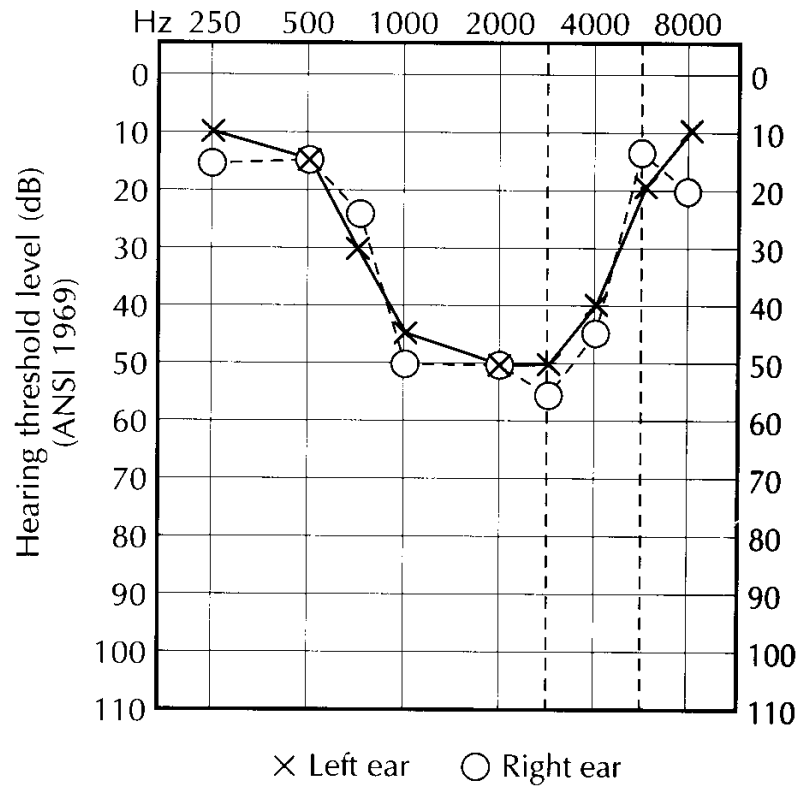
Impact of hearing loss

- Specific impacts on communication
- Self image and perception by others
- Associations with generic health-related quality of life
- Personal reaction to the problem
- Occupationally – liability to miss warning noise, moving vehicles or alarms
- Increased risk of accidents

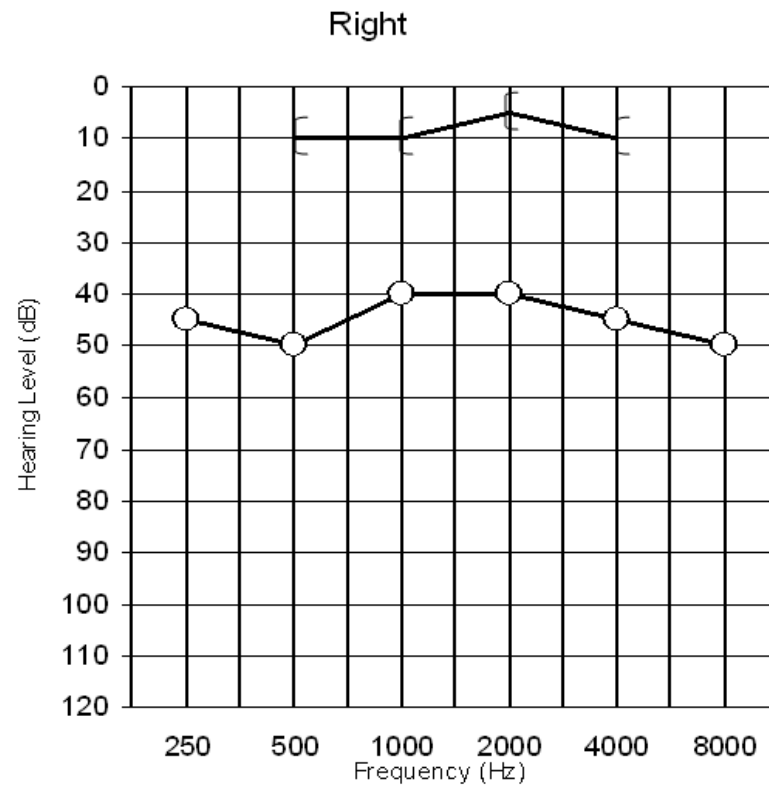
Hearing loss ~~=~~ Disability

- Motivation
- Situation
- Environmental factors
- Experience
- Complexity and predictability

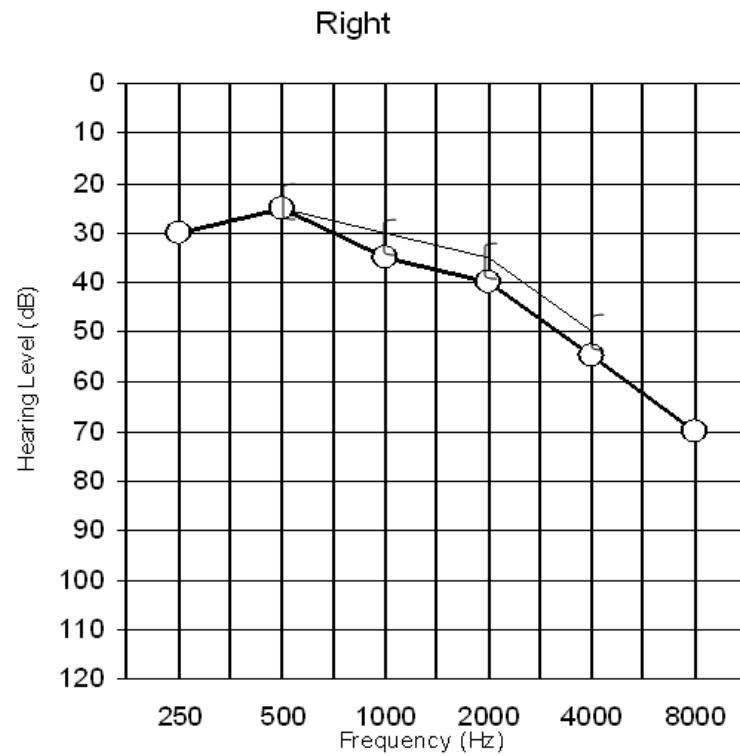
Genetic- “cookie-bite” Audiogram



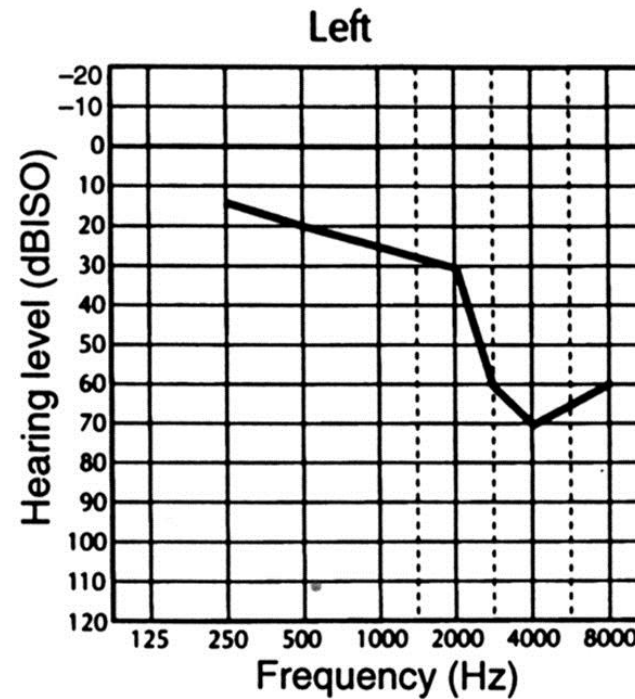
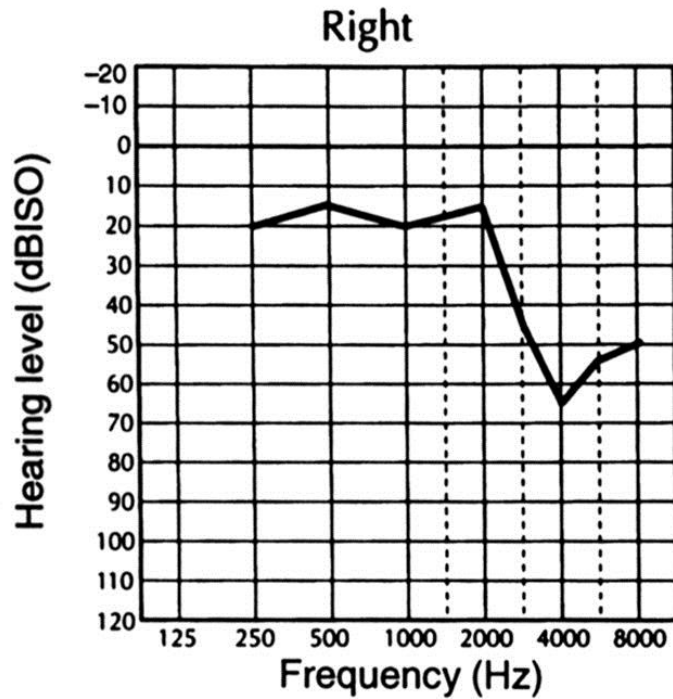
Conductive Hearing Loss



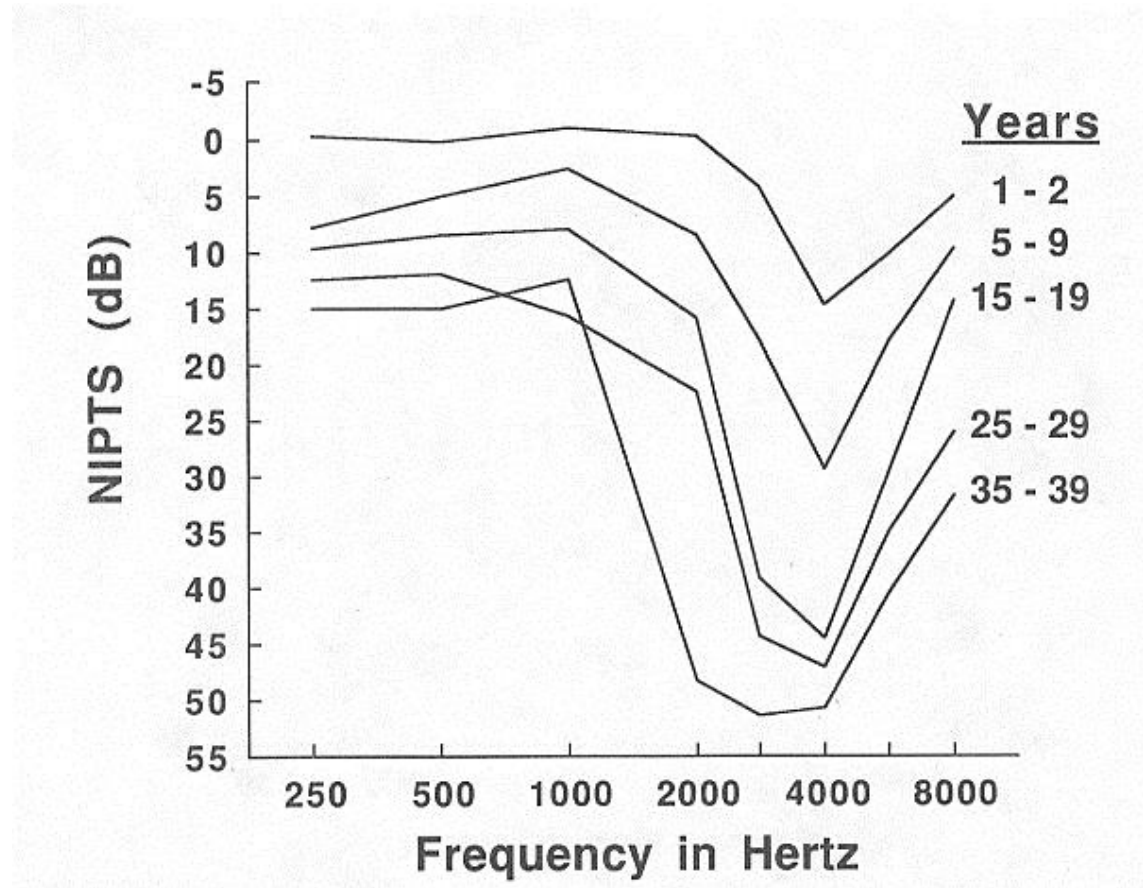
Age related- Presbycusis



Noise Induced Hearing Loss



Relationship of noise level and duration of exposure to NIHL



Sources of hazardous Noise

Occupational noise	Heavy industry, public services, transport
Military exposure	Combat, training
Leisure noise	Discos, PMP, rock concerts, fireworks
Medical noise	SCBU, bone drills, MRI scanners
Accidents	Explosions, noise feedback

Prevention of NIHL

- Legislation
- Identification and limitation of risk
- Pre-employment screening programmes
- Identification of subclinical damage
- Therapeutic interventions
- Education

Decisions regarding work

- Individual basis
- Access to Work scheme
- Change of position, compensation, medical retirement – objective testing mandatory
- Maritime and Coastguard Agency- “Hearing Check” + audiometry
- DVLA – for GRP 2 licensing: communication in emergency essential
- Military - PULHHEEMS classification

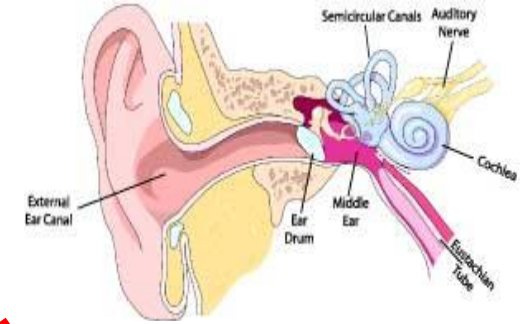
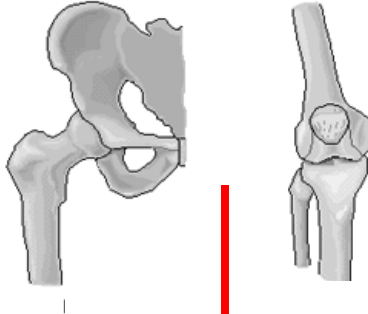
Management

- Hearing tactics
- Environmental aids + support
- Conductive loss- surgery, bone conduction aid, BAHA
- Bilateral SNHL - digital hearing aids
(2, AGC, ANR, localisation)
- Unilateral SNHL- CROS aid
- Profound loss- cochlear implants

Balance



Vision



Vestibular

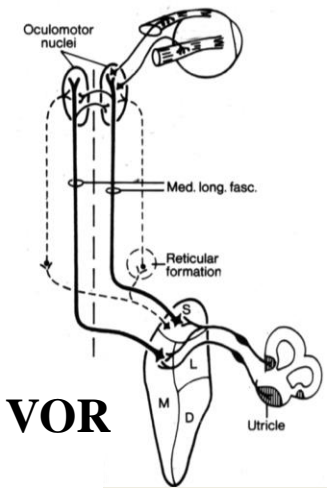
Integration and modulation



Posture/gait



Perception



Dizziness/Vertigo

- Vague complaint
- Plethora of causes
- Lack of diagnostic strategy
- Treatment not specific/effective
- Not life-threatening
- Spontaneous resolution

Demographics of Dizziness/ Vertigo

- 1/3 population by age of 65 years (Roydhouse,1974)
- 48% women and 37% men by 80 years (Pemberton,1956)
- 5/1000 consult GP for vertigo (RCGP/OPCS 1986)
- 10/1000 consult GP for dizziness (RCGP/OPCS 1986)
- 1 in 4 adults in community report dizziness (Yardley et al. 1998)

Causes of Dizziness

GENERAL MEDICAL

- **Haematological** - Anaemia
Hyperviscosity
Miscellaneous
- **Cardiovascular** - Postural hypotension
Carotid sinus syndrome
Dysrhythmia
Mechanical dysfunction
- **Metabolic** - Hypoglycaemia
Hyperventilation

NEUROLOGICAL

- **Supratentorial** - Epilepsy
Syncope
Psychogenic
- **Infratentorial** - Multiple sclerosis
VBI
Infective disorders
Degenerative disorders
Tumours
Foramen magnum abnormalities

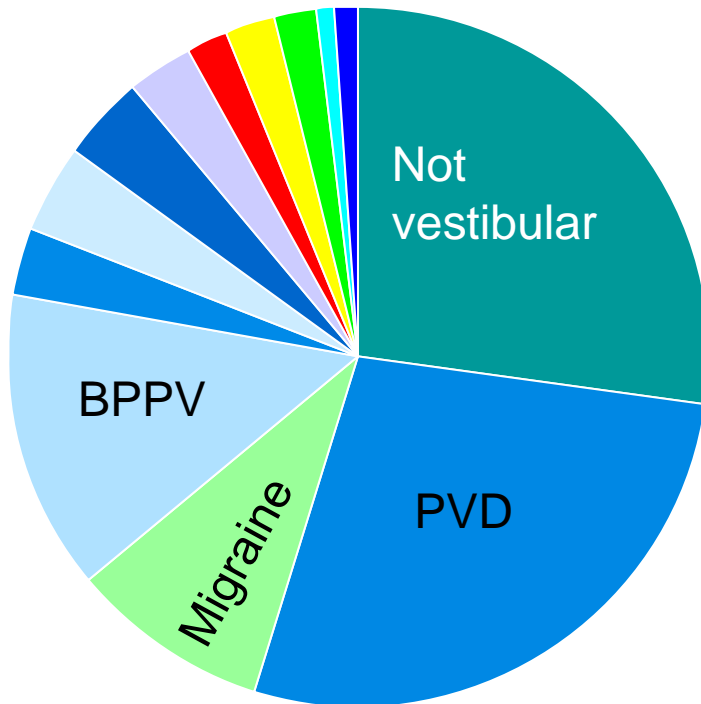
OTOLOGICAL

- Positional nystagmus
- Vestibular neuritis
- Vascular accidents
- Post-traumatic syndrome
- Drug intoxication
- Tumours
- Menière disease
- Infection
- Otosclerosis and Paget's disease
- Auto-immune disorders

MISCELLANEOUS

- **Ocular**
- **Multisensory**

Vertigo – Diagnosis in 466 cases



27%	No vestibular abnormality
27%	Peripheral Vest. Disorder
12%	Migraine
16%	BPPV
3%	Menière disease
3%	Central pathologies
4%	Ear diseases
3%	CVS causes
2%	Viral labyrinthitis, psychogenic
1%	Ocular, acoustic neuroma, multisensory dizziness, vestibular failure.

“Medical” Mechanisms of Vertigo/Dizziness

Type	Mechanism
Presyncopal	Diffuse cerebral ischaemia eg hypotension, cardiac dysrhythmia
Hypoglycaemic	Low blood glucose eg diabetes mellitus, insulinoma, elevated catecholamines
Drug induced	CNS depression, cerebellar/labyrinthine toxicity, change in SG of cupula (C ₂ H ₅ OH)

After Baloh and Honrubia, 2001

“Vestibular” Mechanisms of vertigo/ dizziness

Type	Mechanism
Physiological	Sensory conflict due to unusual combination of sensory inputs eg motion
Vertigo	Imbalance in tonic vestibular signals
Multisensory	Impairment in 2 or more sensory inputs for balance
Visual	Mismatch of visual and vestibular signals eg ocular pathology, vestibular asymmetry

After Baloh and Honrubia, 2001

“Neurological” Mechanisms of vertigo/dizziness

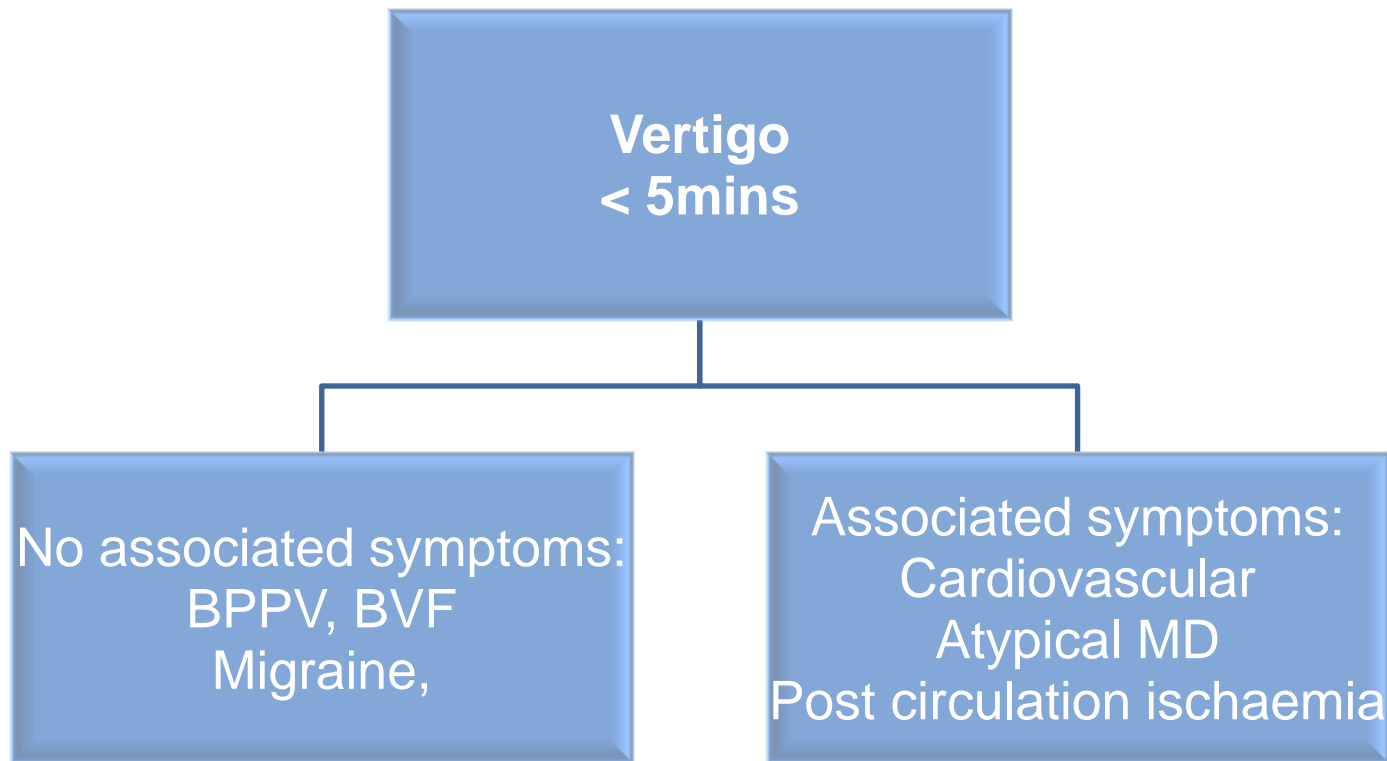
Type	Mechanism
Psycho-physiological	Impaired central integration of sensory inputs
Dysequilibrium/ataxia	Loss of neurological function(s): VS, cerebellar, proprioceptive, motor.

After Baloh and Honrubia, 2001

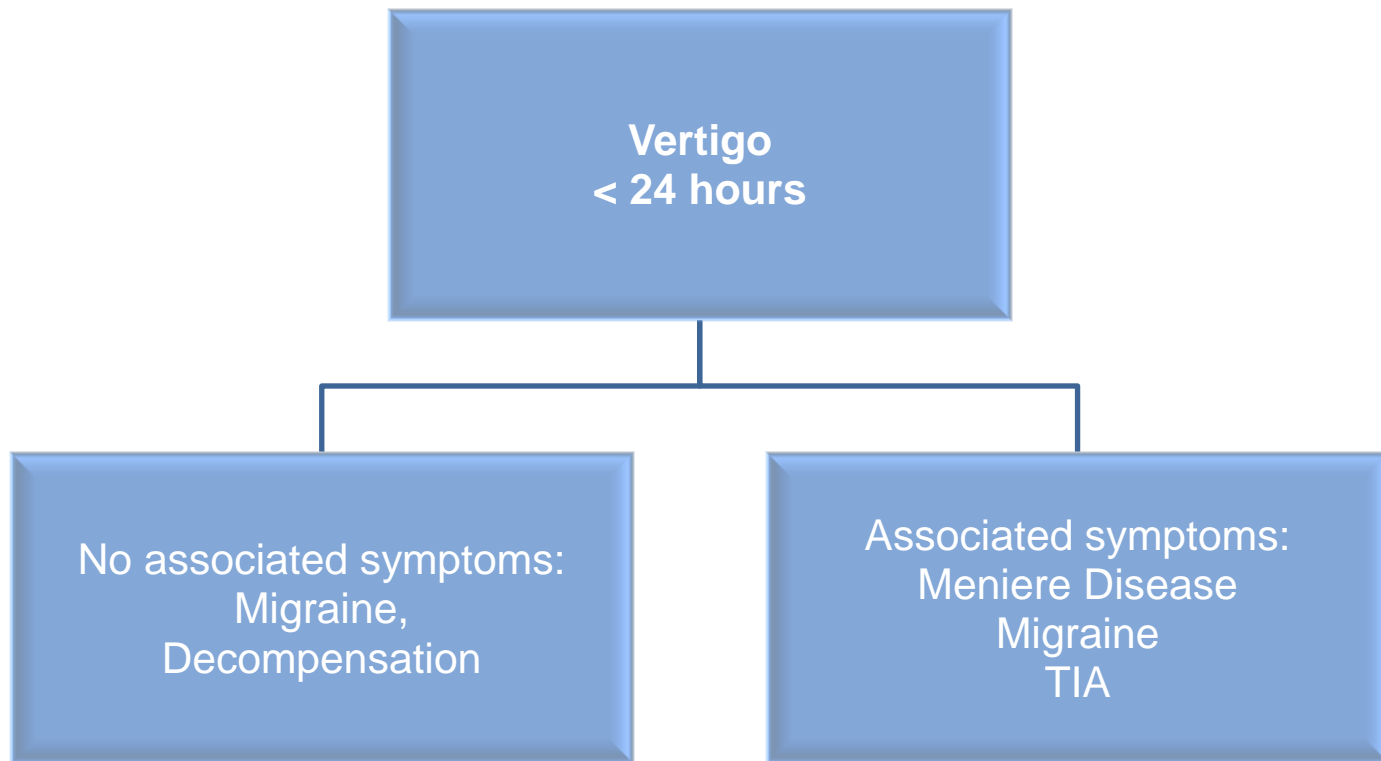
Diagnosis

- **Triggers:**
 - URTI, head injury, movement, visual stimuli
- **Symptom:** vertigo, dizziness
- **Duration** – each episode, whole problem
- **Associated symptoms:**
 - Headache, vision, palps, anxiety

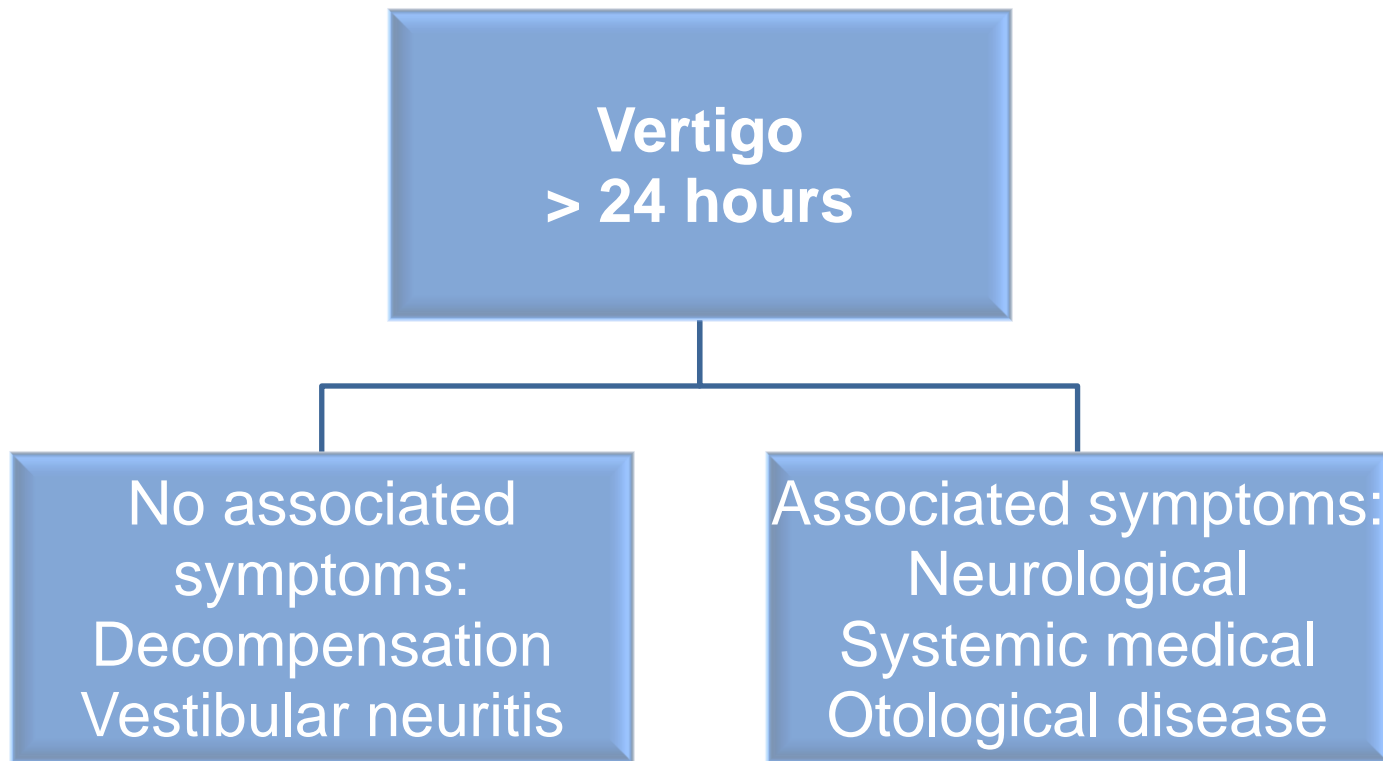
“Short” Episodes of Vertigo



“Medium” Episodes of Vertigo



“Long” Episodes of Vertigo

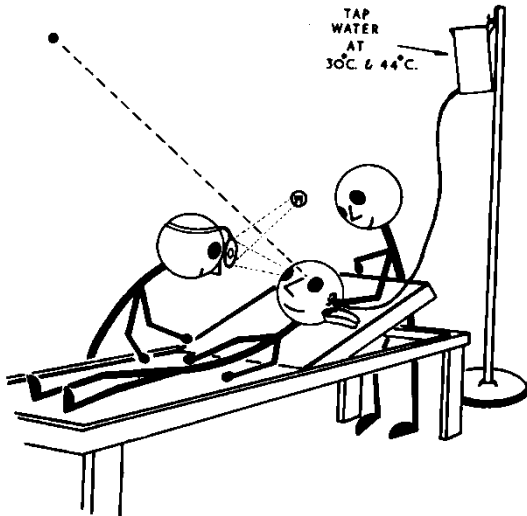


Balance Examination

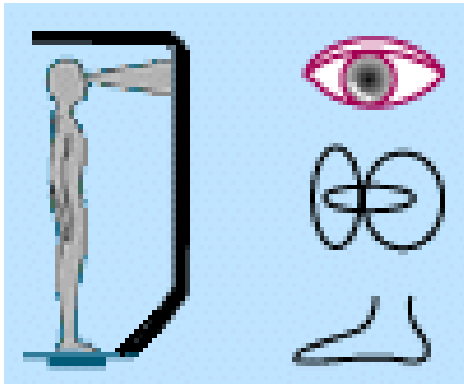
- Stance and gait
- Eye movements
- Hearing
- Cerebellar signs
- Posterior column signs
- Cardiovascular assessment
- Eye/vision assessment
- Musculoskeletal assessment

Vestibular Tests

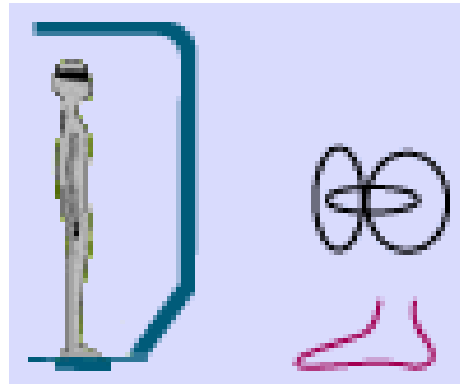
- Caloric
- Vestibular evoked myogenic potentials
- Eye movement recording
- Rotation testing
- Optokinetic testing
- Posturography



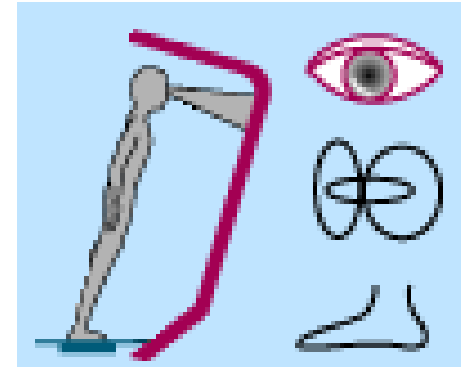
Equitest Test Conditions



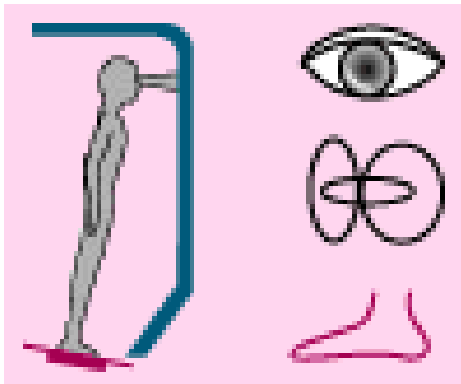
Condition 1



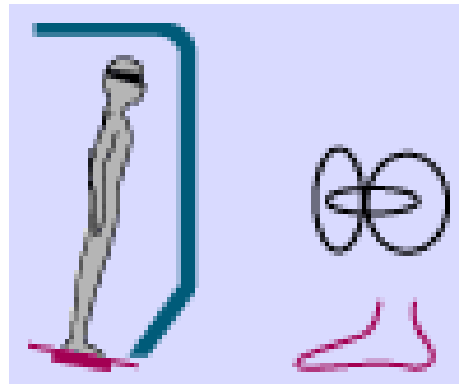
Condition 2



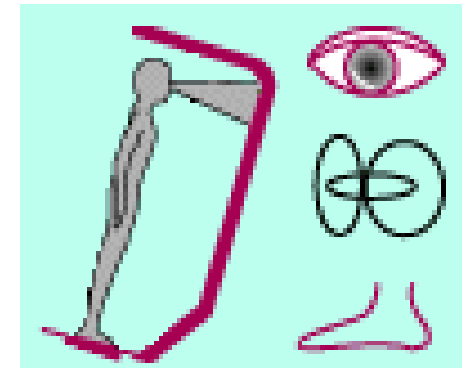
Condition 3



Condition 4

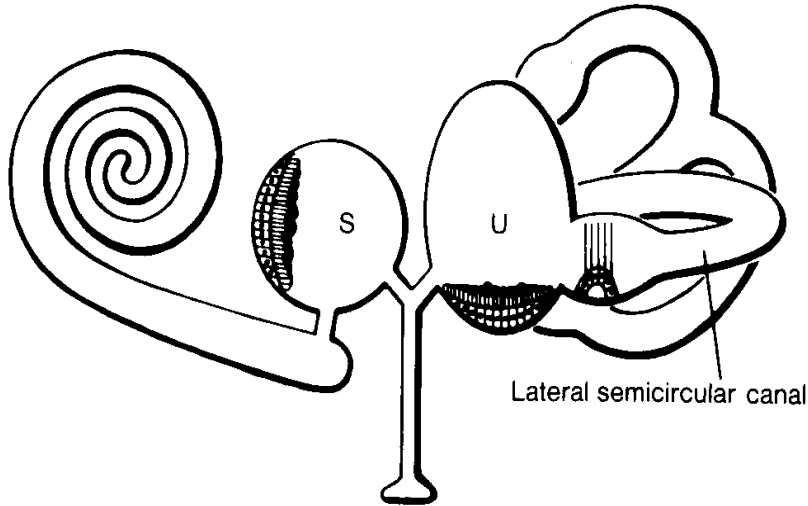


Condition 5



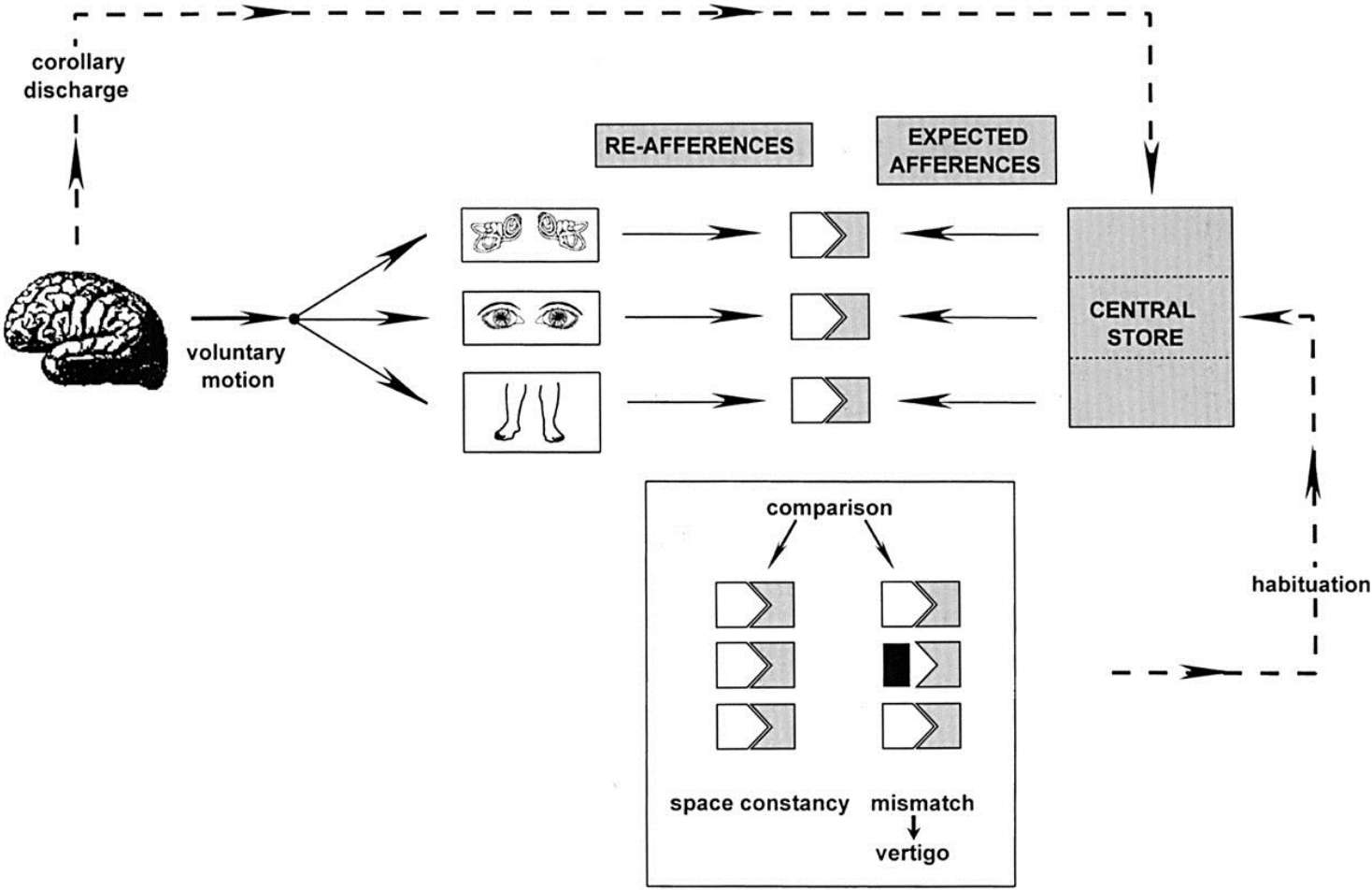
Condition 6

Peripheral Vestibular Disorder

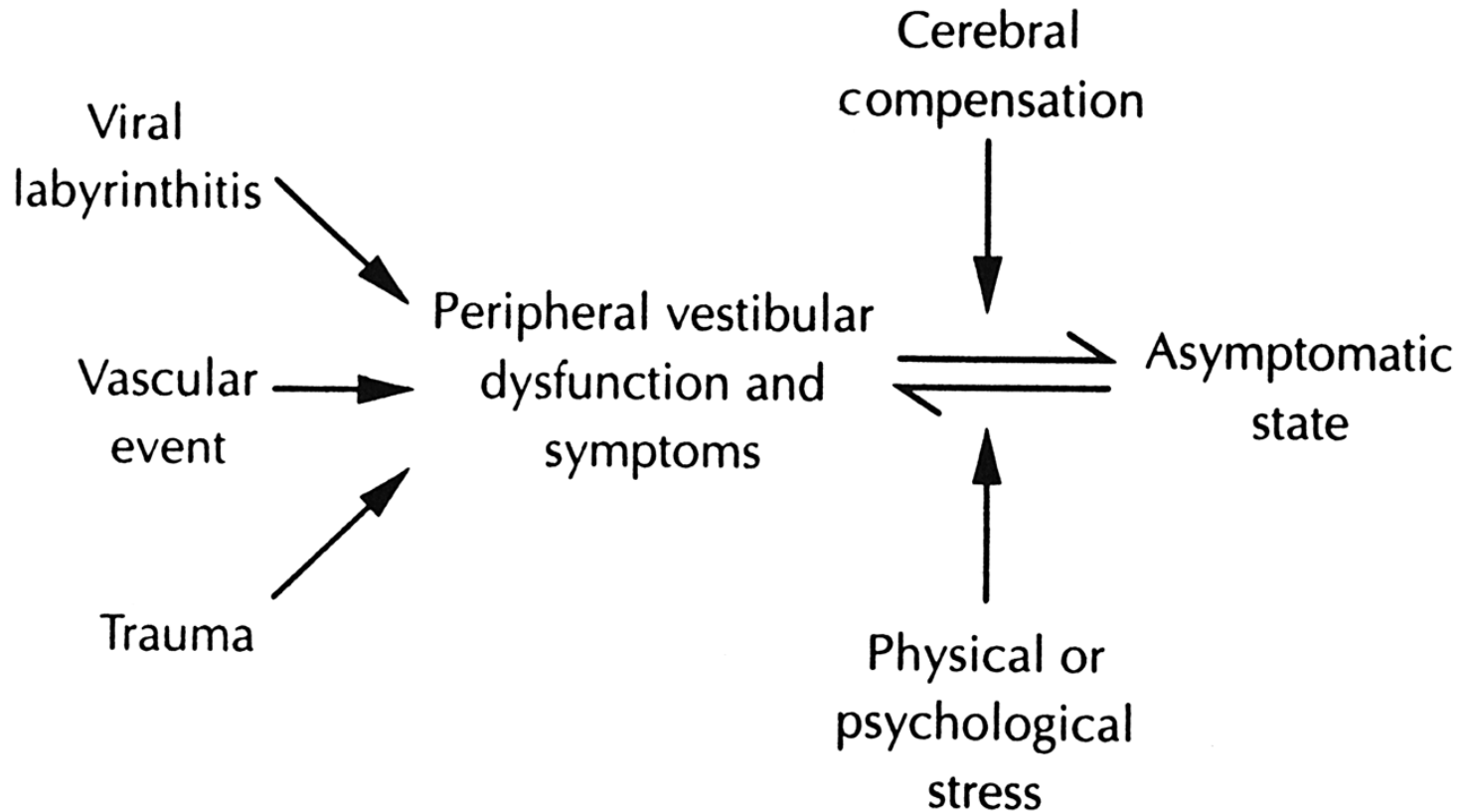


- Infection
- Vascular
- Autoimmune
- Neoplastic
- Ototoxic
- Traumatic
- Idiopathic
- Genetic

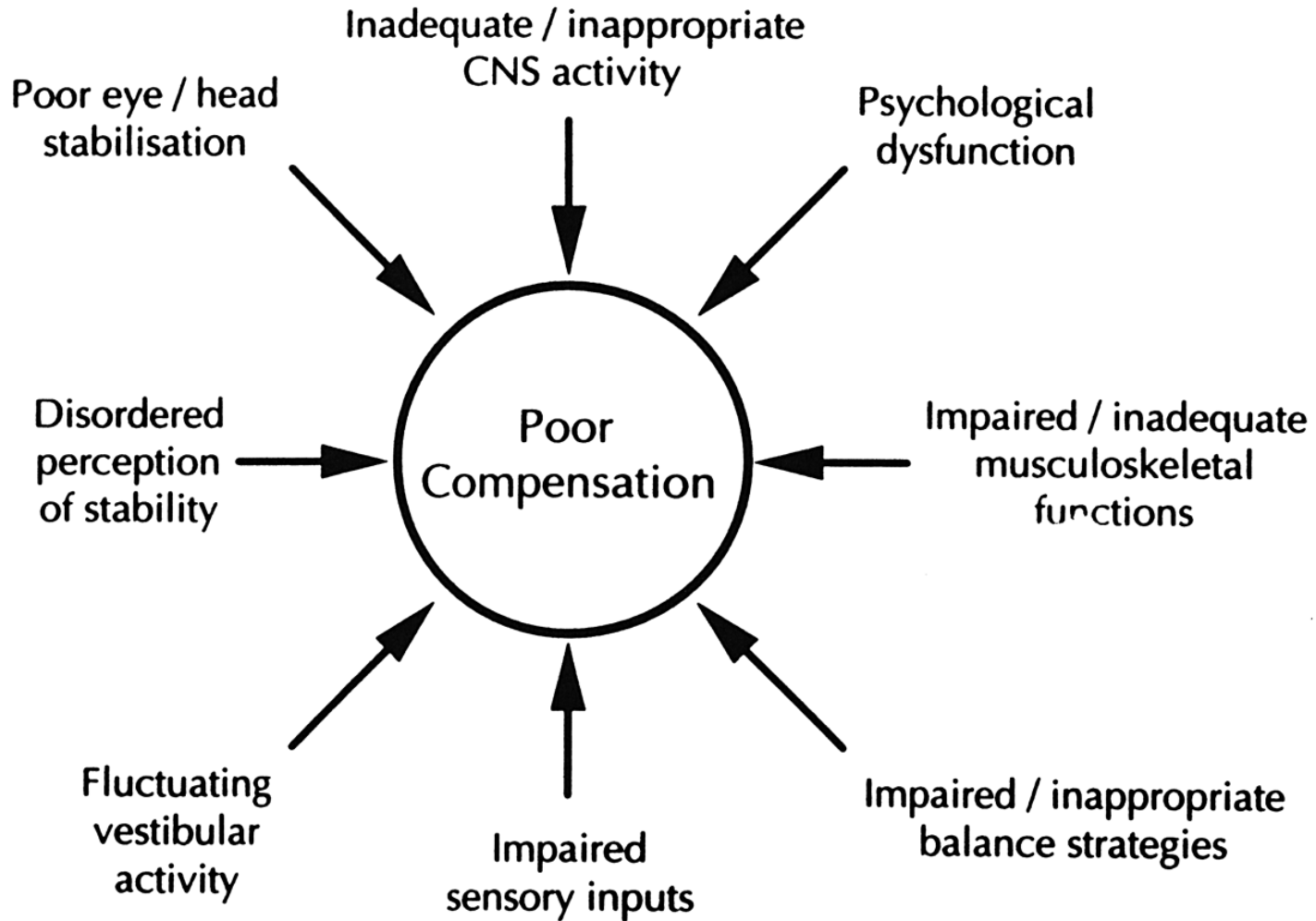
Mismatch Hypothesis of Vertigo



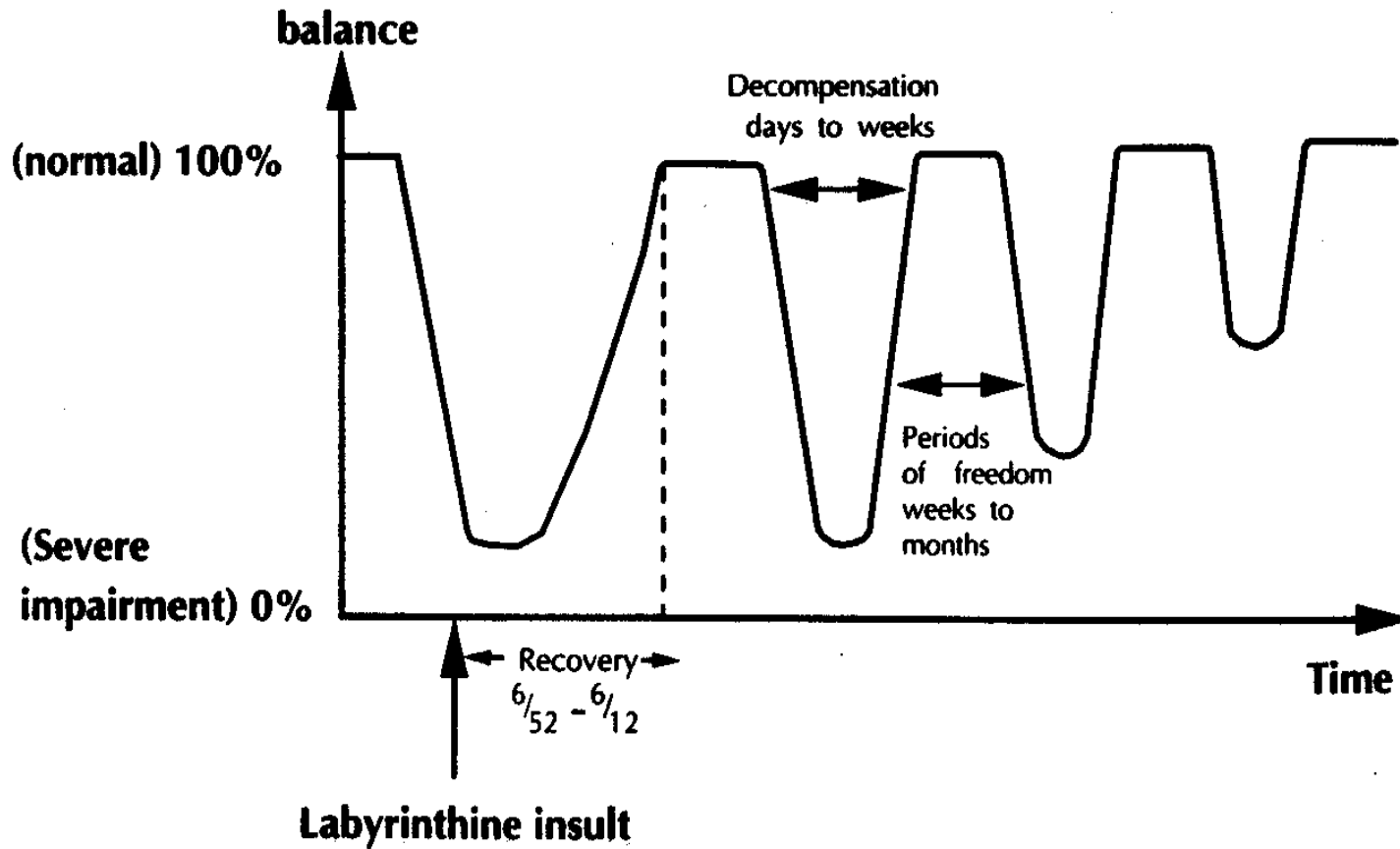
Vestibular compensation



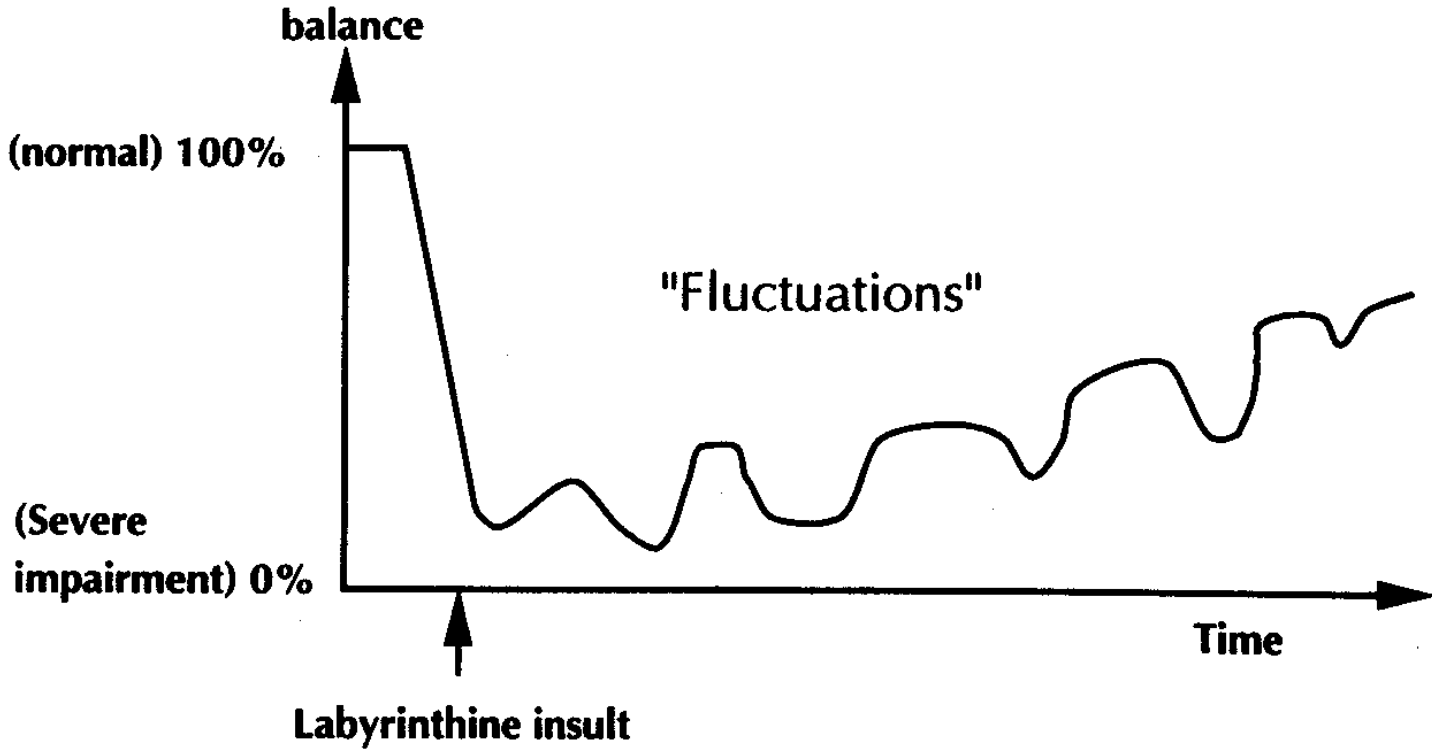
Causes of failure of compensation



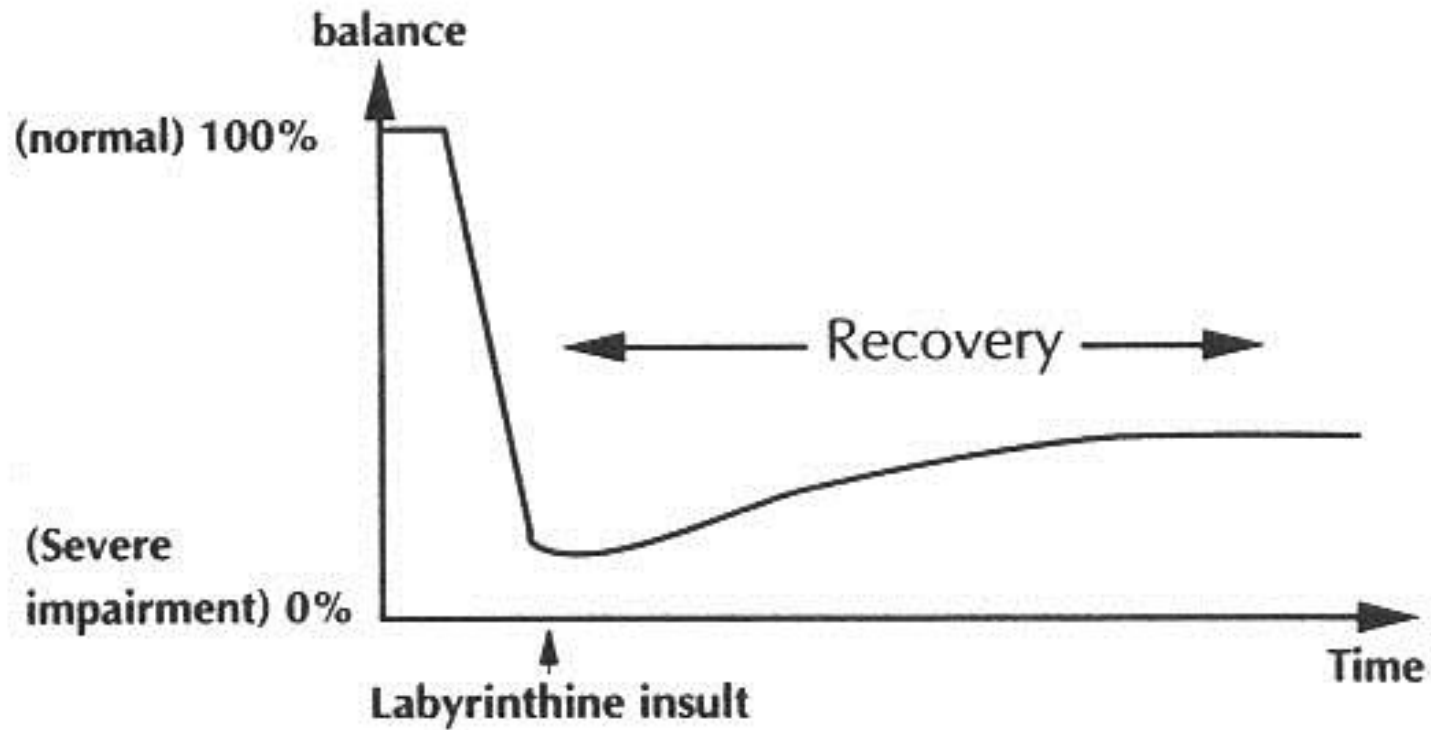
Poor Vestibular Compensation



Poor Vestibular Compensation



Poor Vestibular Compensation



Vestibular pathology

- Dizziness/vertigo across age range
- Common symptom both in primary care
- Pathologies in almost all systems
- Broad diagnostic strategy required
- Appropriate diagnostic strategy allows effective management
- Rarely result of psychological factors
- Frequently associated with psychological factors
- Rehabilitation is effective

Work Related Effects

- Personal safety
 - Increased risk of psychological disorder
 - Increased risk of falls
 - DVLA
- Poor attendance
 - Time off
 - Change of job
 - Early retirement
- Productivity reduced
 - Reduced cognition, multitasking, localisation skills

Occupational Summary

- Hearing and balance disorders- hidden handicaps
- Poorly managed medically
- Poor levels of knowledge
- Often bounce between specialties
- Psychological disorders become prominent diagnosis
- Workplace adjustments frequently not in place.

Thank you for your attention



Vestibular Neuritis/ Labyrinthitis

VN – vertigo without cochlear symptoms

Labyrinthitis – vertigo with cochlear symptoms

Age: all ages

Gender: M=F

Vertigo: acute onset

Preceding infection

Unidirectional horizontal nystagmus

Presentation Vestibular Neuritis

- Acute onset
- 2-3 days
 - difficulty moving,
 - nausea, vomiting
 - \pm fever
- Gradual recovery 2-6 weeks

Treatment of Acute Episode

- Reassurance and support
- Anti-emetics
 - Buccastem
- Vestibular sedatives
 - Cinnarizine

1-2 days ONLY

Start vestibular exercises

Encourage activity

Failure of vestibular compensation

- Primary and secondary symptoms
 - Neck pain
 - Fatigue
 - Headache
 - Depression/anxiety/avoidance behaviour
- Bizarre symptomatology

Meniere's Disease

Clinical diagnosis:

Episodes of acute vertigo

Hearing loss

Tinnitus

(Fullness/pressure)

Migraine

- Common migraine
- Classical Migraine
- Migraine with and without aura

Presentation

- Acute onset
- < 24 hours
- Nausea + vomiting
- ± Headache
- + Photophobia/phonophobia

- Background unsteadiness
- Positional exacerbation

Migraine + Vertigo

- History of migrainous headaches
- Space/motion discomfort
- Phonophobia + photophobia
(rarely fluctuating hearing loss)
- Unsteadiness
- Variety of vestibular symptoms
- Nausea and vomiting

Treatment of Migrainous Vertigo

- Lifestyle advice
- Treatment of acute attacks
 - Abortive
 - Prophylactic
- Treatment of background unsteadiness/visual vertigo

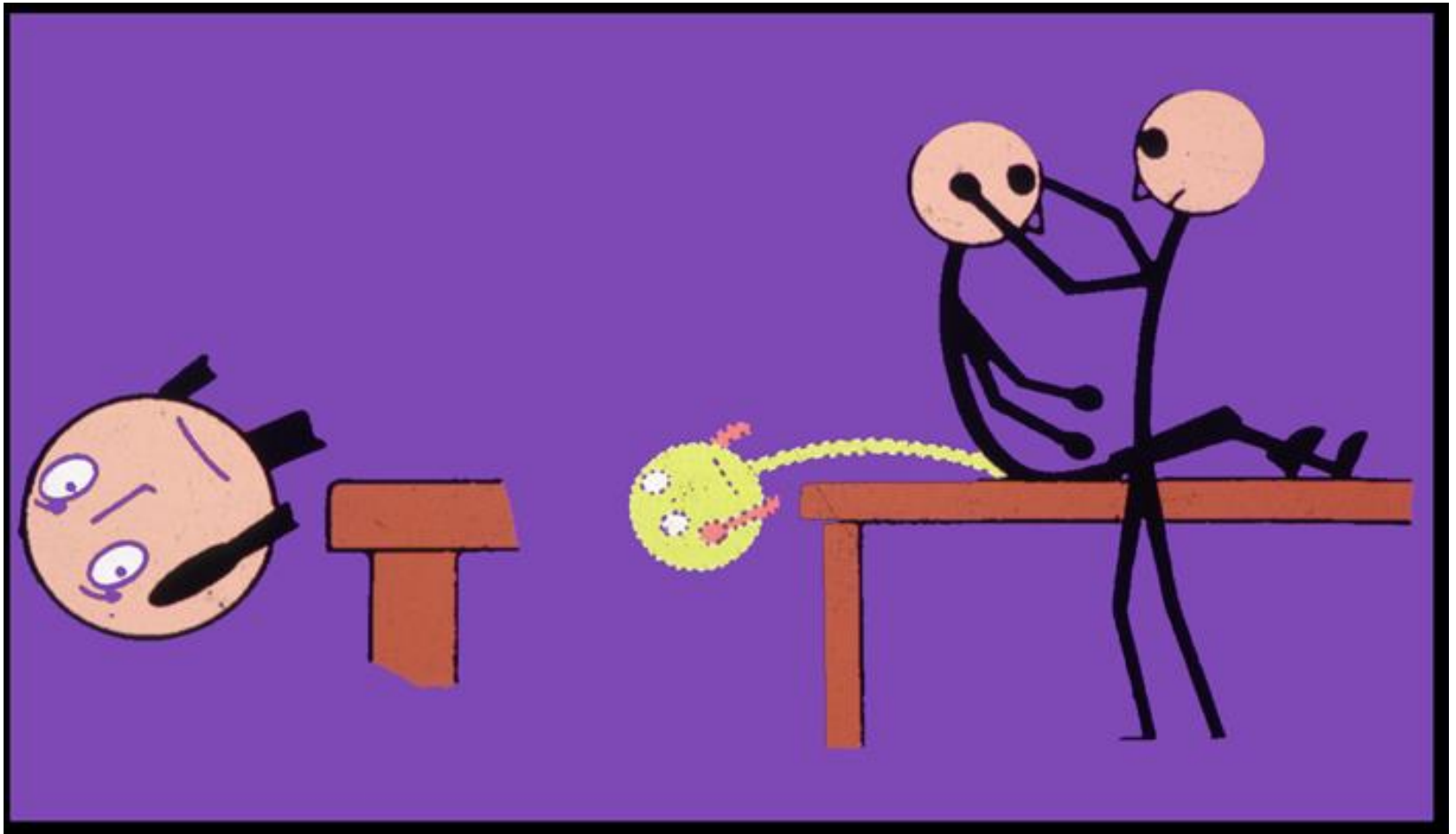
Benign Paroxysmal Positonal Vertigo (BPPV)

- Short, acute episodes of dizziness
- Critical head position
- Autonomic symptoms
- Clusters of attacks
- Frightening ++++
- Spontaneous remission

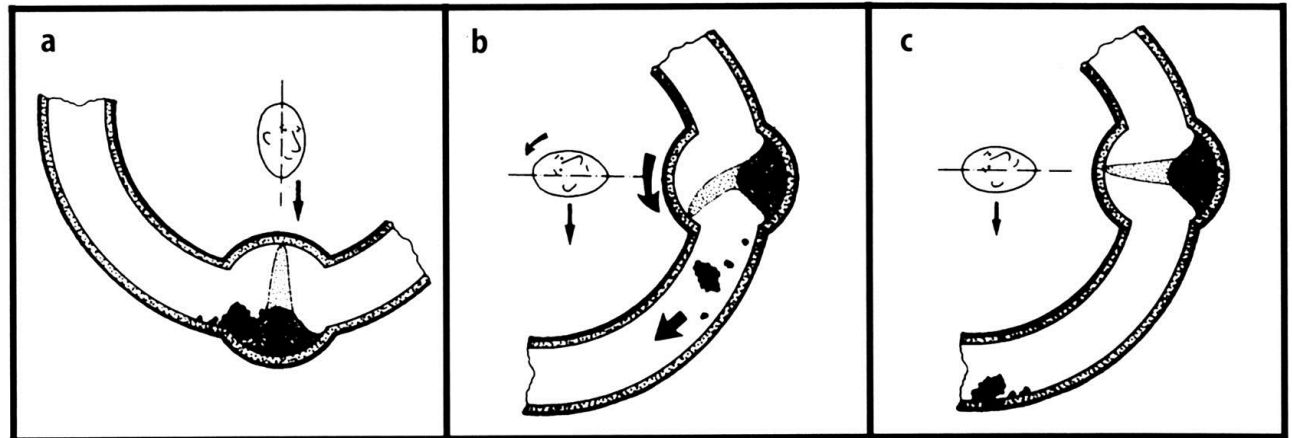
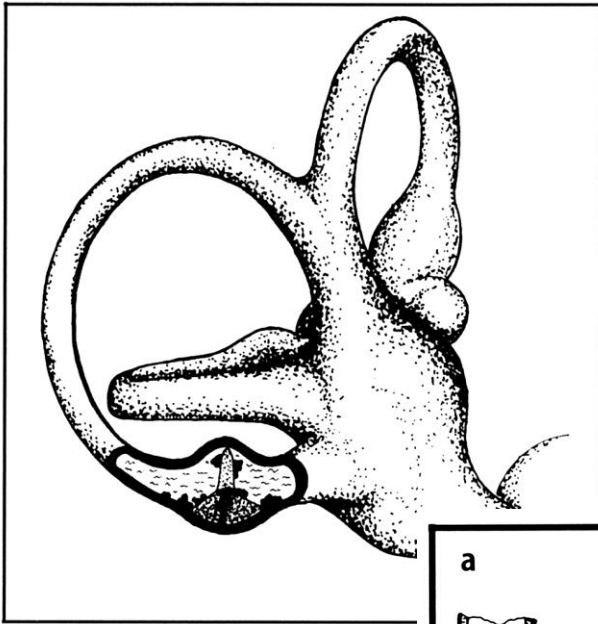
History of BPPV

- Turning in bed
- Erratic
- Sleeping on 4 pillows
- Getting things off the shelf in cupboard
- Frightened to go out alone
- Not sleeping well

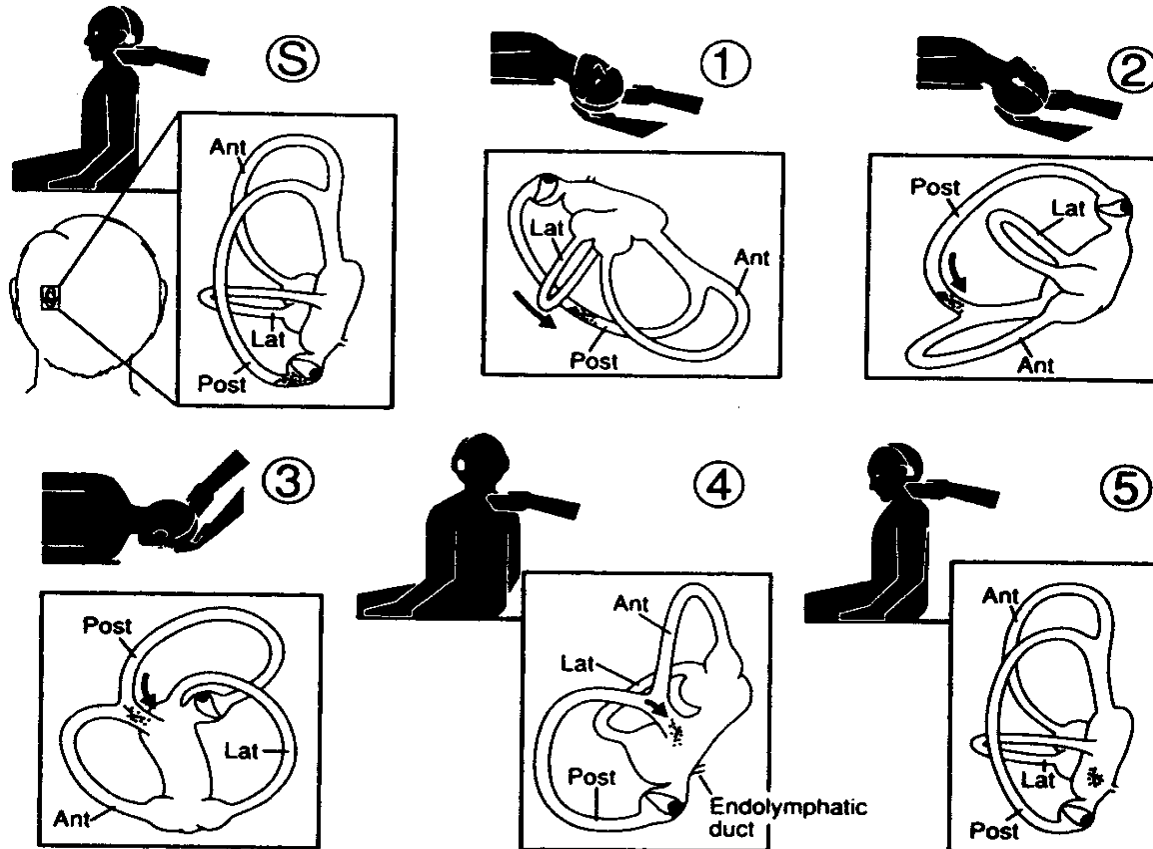
Hallpike Manoeuvre



Anatomical Disposition of Posterior Semicircular Canal



Treatment of BPPV



- Epley manoeuvre

Chronic Dizziness

- Drugs
- Uncompensated PVD
- Bilateral vestibular failure
- Neurological disorder
- Multiple comorbidities