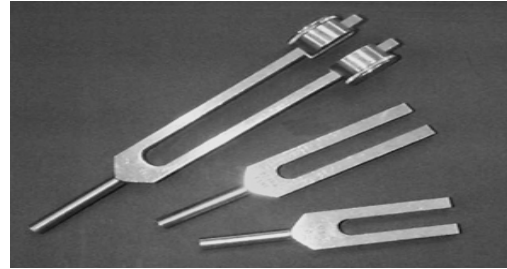


END ORGAN OF HEARING

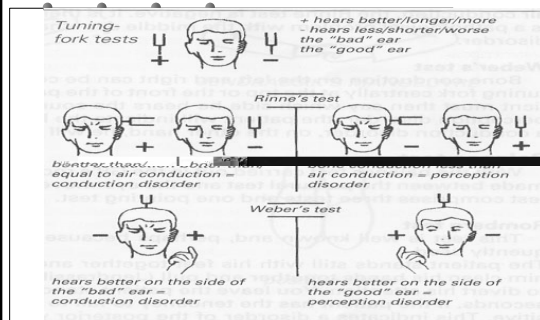


- Inner ear: oval window, cochlea (fluid, basilar membrane, organ of Corti [hair cells, cilia])
- The basilar membrane is not uniform: near the oval window [base] it is narrow and thick (and responds to high frequency waves), at the other end [apex] it is wider and thinner (and responds to low frequency waves). The **tonotopic theory** states that different points on the basilar membrane represent different sound frequencies.

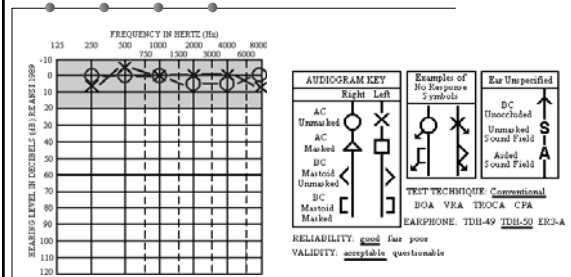
Tuning Fork – 512 Hz is the optimal frequency



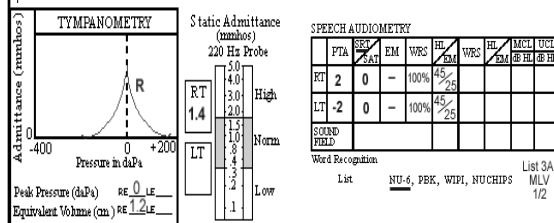
ENT Examination – Hearing Test



Audiogram for a Patient With Normal Hearing



Normal Tympanometry and Speech Audiometry



ORGAN OF EQUILIBRIUM

- Auditory pathway
- axons from the hair cells leave the cochlea to form the auditory nerve (8th cranial nerve); projects to the medulla [lower brainstem], synapsing in either dorsal or ventral cochlear nuclei or superior olivary nucleus – temporal cortex
- MEMBRANOUS VESTIBULAR LABYRINTH** :-
UTRICLE & SACCULE – Utricular maculae, situated in the horizontal plane, respond to the slightest tilt and to linear acceleration.
SEMICIRCULAR CANAL – the crista ampullaris, located in the expanded end (ampulla), respond to angular acceleration of the head.
- The Labyrinthine reflexes in the maintenance of posture**
- Static reflexes** – when the body is at rest, reflexes arising in the muscles, joints and others, k/s **Labyrinthine reflexes**.
- Kinetic reflexes** – The postural reactions of the body when in movement, either angular or progressive.
- The function of vestibular labyrinth can be assessed by stimulating it artificially to produce nystagmus, by caloric test and rotation test.

TABLE 15.1 Functional Regions of the Cerebellum

REGION	FUNCTIONS	MOTOR PATHWAYS INFLUENCED
Lateral hemispheres	Motor planning for extremities	Lateral corticospinal tract
Intermediate hemispheres	Distal limb coordination	Lateral corticospinal tract, rubrospinal tract
Vermis and flocculonodular lobe	Proximal limb and trunk coordination	Anterior corticospinal tract, reticulospinal tract, vestibulospinal tract, tectospinal tract
	Balance and vestibulo-ocular reflexes	Medial longitudinal fasciculus

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Cerebellar Input Pathways
Cerebellar afferents originate from many areas:

- 1) Many areas of cerebral cortex
- 2) Vestibular, auditory, visual and somatosensory systems
- 3) Brainstem nuclei
- 4) Spinal cord

Vascular Supply of the Cerebellum
Arterial supply of cerebellum supplied by 3 branches of the vertebral/basilar artery system

- 1) Posterior inferior cerebellar artery
- 2) Anterior inferior cerebellar artery
- 3) Superior cerebellar artery

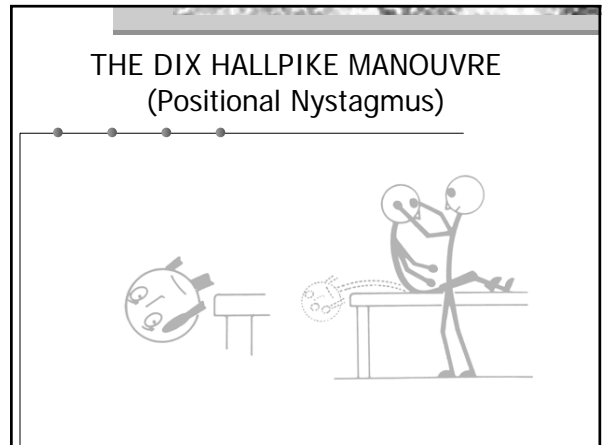
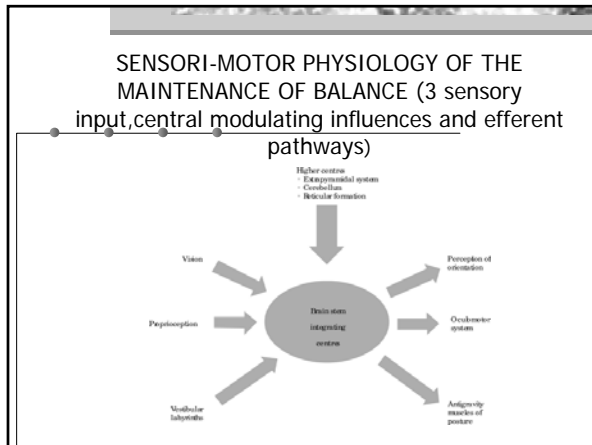
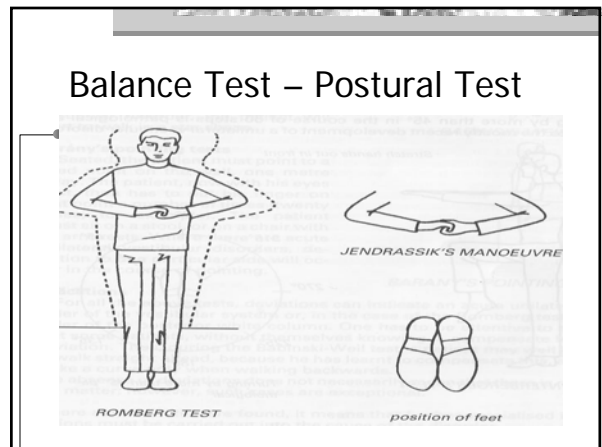
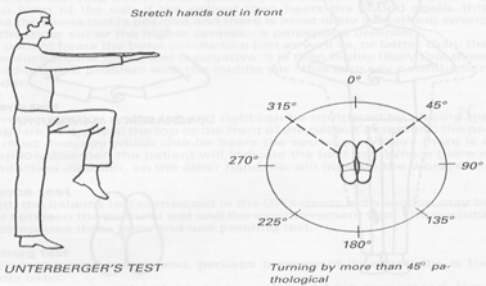


Table :- Comparison of benign paroxysmal positional nystagmus (BPPN) and central positional nystagmus (CPN)

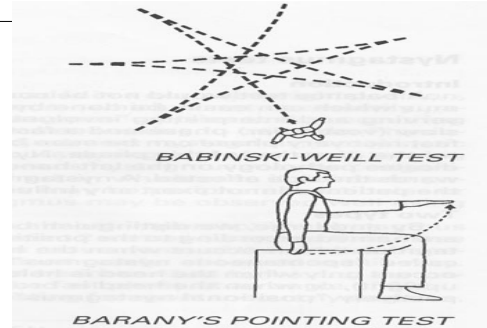
	BPPN	CPN
Latent period	2–45 seconds	0 seconds
Adaptation	Within 30 seconds	Persisting
Fatigability	Disappears on repetition	Persists
Vertigo	Present, sometimes severe	Usually absent, or very mild
Direction of nystagmus	Torsional and geotropic	Any
Incidence	Common	Rare



Balance Test – Postural Test



Balance Test – Postural test



Common problems reported by adults with hearing loss (cited in Martin, 2001)

- The majority of the population with hearing loss are functionally "hard of hearing" rather than "deaf" (Flexer, 1993; Davis, Fortnum, & Bamford, 1998)
 - **tinnitus**: high-pitched throbbing or ringing sounds
 - **Deafness**: total, profound, severe, moderate, mild, insignificant
 - typically total or profound loss of auditory sensitivity and little or no auditory perception
 - **Hard of Hearing**: severe, moderate, mild
 - partial or residual hearing--able to process language through auditory reception (may use hearing aid)
- Complaint
- listening to TV/radio
 - general conversation
 - doorbell
 - group conversation
 - speech against background noise
 - telephone signal

Information and Physical Examination to Elicit on Patient with Hearing Loss

History

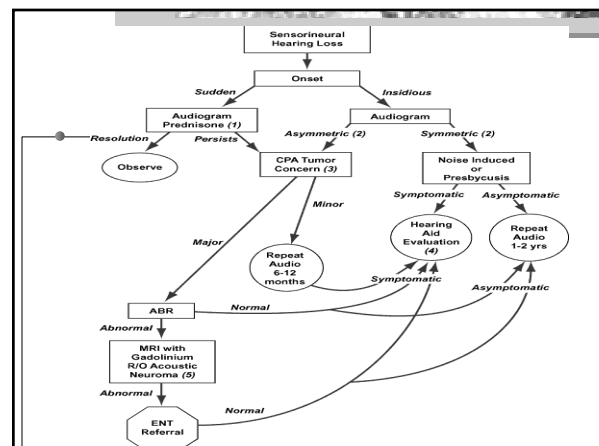
- Hearing loss – time, course, severity, progression and symmetry.
- Associated Symptoms – vertigo, fullness, tinnitus, facial hyperaesthesia and neurological symptoms
- Recent Event – surgery, trauma, ototoxic medication & barotrauma
- Past history – General medical condition, noise exposure, occupational exposure.
- Hearing Loss in past

Physical Examination

- Hearing Test
- Cranial nerves II – XII
- Vestibular system
- Stigmata of other disease

Condition associated with asymmetric sensorineural hearing loss (VITAMINCDE)

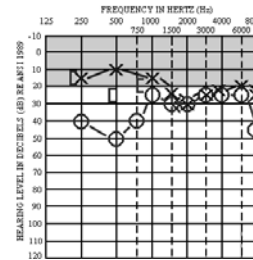
- Vascular – Migraine, atherosclerosis
- Infection/ Inflammatory – CSOM, meningitis, mump, measles, syphilis, Lyme disease, multiple sclerosis.
- Traumatic – Noise induced trauma, temporal bone fracture, barotrauma & perilymphatic fistula.
- Autoimmune – Lupus, rheumatoid arthritis, polymyositis
- Metabolic – Hyperlipidaemia
- Iatrogenic / Idiopathic – Ototoxic medications, Meniere's disease.
- Neoplastic – CPA tumour
- Congenital –
- Degenerative – Presbycusis (usually symmetrical)
- Endocrine – Diabetes, hypothyroidism



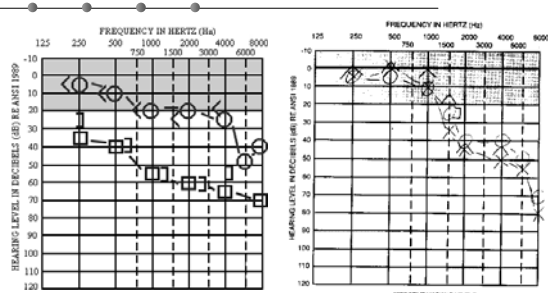
AUDIOMETRY and MRI FINDINGS IN CPA

- Pure tone Audiometry – To diagnose a symmetry, one must demonstrate a discrepancy in pure tone average of at least 10 dB in at least three frequencies, or a 20dB difference in two frequencies, or a 30dB difference in pure tone average at one frequency.
- A minimum of 15% in speech discrimination score.
- Auditory Brain Stem Response – ABR : varies according to the size of tumour. Abnormal I-V interpeak latencies, a significant interaural latency difference for wave V, and poor waveform morphologic characteristics are suggestive of retrocochlear pathology on ABR. Sensitivity for tumour less than 1 cm in diameter is between 69% and 83%. Diagnosis as well as preoperative assessment for hearing preservation.
- MRI – for early detection of small tumour < 2cm in diameter.
- Vestibular Schwannoma – Globular, centred on IAC, erosion of IAC +, commonly cystic, no calcification on CT scan.
- Meningioma – sessile, dural based, eccentric with respect to IAC, hyperostosis with calcification on CT scan.

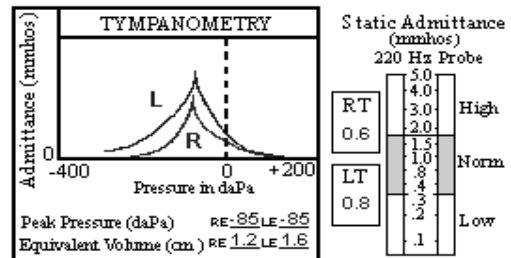
Conductive hearing loss



Comparison for audiogram of Acoustic Neuroma and Presbycusis



Tympanometry for the CPA



Masses arising in the CPA produce symptoms via 4 mechanisms

- Compression of vessels, leading to arterial or venous infarction – growing in IAC cause pressure to AICA and CN VIII
 - Compression of nerves – 80%-95% of patient present with SNHL, 15% with Acute SNHL and normal in 5% of patient. Facial hyperaesthesia in patient with tumour size > 3 cm.
 - Displacement of brain stem structure - Disequilibrium
 - Distortion of fourth ventricle - Increased ICP in tumour > 3 cm in diameter.
- Management of sudden deafness:
- Vasodilator Drugs include 5%CO₂(in the form of Carbogen), atropine, histamine, procaine hydrochloride, and papaverine hydrochloride.
 - Diuretic for labyrinthine hydrops
 - Corticosteroids – benefit for moderate unilateral hearing loss below 40 year of age

THANK YOU

