

# **OTOLARYNGOLOGY**

## **PHYSIOLOGY OF THE EAR: HEARING & BALANCE**

The Hearing System consists of:

**1. Peripheral Auditory System:**

- . External Ear
- . Middle Ear
- . Inner Ear
- . The Cochlear division of the 8<sup>th</sup> Cr. Nerve

**2. Central Auditory Pathways:**

**FUNCTION OF THE MIDDLE EAR:**

1. Pressure equalization by Eustachian tube
2. Impedance matching by :

- A. Lever mechanism
- B. Area difference of TM & oval window

**THE FUNCTION OF THE INNER EAR**

The inner ear transform the physical properties into electrical neural impulses. Sound waves pass from the environment through the external and middle ears to cause vibrations of the cochlear perilymph. These vibrations produce travelling waves in the basilar membrane, these travelling waves reach maximum at specific points along the basilar membrane. The high frequencies are represented at the basal turn and low frequencies at the apical portion.

**THE VESTIBULAR SYSTEM:** consists of

**(A) Peripheral Vestibular System:**

1. Three Semicircular Canals: lateral, anterior & posterior

Receptors: Crista

2. Utricle & Sacculae

Receptors: Macula

3. Vestibular division of 8<sup>th</sup> Cr Nerve & Scarpa Ganglion

**(B) Central Vestibular Nuclei:** Superior, Medial, Lateral & Inferior

**PROJECTIONS OF VESTIBULAR NUCLEI:** to

1. Cerebral cortex (Voluntary sensation)

2. Cr. Nerves 3<sup>rd</sup>, 4<sup>th</sup> & 6<sup>th</sup> (Vestibulo-Ocular Reflex)- eye movements

3. Spinal Cord (Vestibulo-Spinal Reflex)- maintenance of body tone

4. Cerebellum- coordination of body movements

5. Autonomic nervous system through 10<sup>th</sup> Cr. nerve (pallor, sweating, nausea & vomiting).

- Reticular information & contralateral vestibular nuclei.

**THE BALANCE MECHANISM:**

The Balance of the body is maintained by co-ordination of information from three sensory systems:

1. The Vestibular system

2. The Eyes or Visual system

**3. The Proprioceptive system: sensation from muscles, joints, tendons and ligaments.**

**THE SEMICIRCULAR CANALS (SCCs): are stimulated by angular acceleration around an axis.**

**Lateral SCC: Ampulo-petal (utrículo-petal) movement of endolymph causes increase in discharge rates in vestibular nerve while in Anterior & Posterior SCCs, there is decrease in discharge**

**THE UTRICLES & SACCULES: are concerned with identification of head position in relation to gravitational field and linear acceleration & deceleration.**

## **EXAMINATION OF THE EAR, HEARING AND BALANCE**

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### **EQUIPMENTS:**

- Otoscope
- Seigle Speculum
- Tuning forks
- Headlight or Head Mirror and Stand Lamp
- Angled Tongue Depressor: for exam  
of post-nasal space

### **EXAMINATION OF THE EAR:**

**Introduce yourself and position the patient**

**Ask patient and start by exam the better ear,**

**Ask patient if the ear is sore to touch,**

**Examine the pinna,**

**Examine the External Auditory Canal (EAC),**

**Examine the TM,**

**Pneumatic examination of TM,**

**Fistula test,**

**Free field voice tests,**

**Tuning fork tests,**

**Facial nerve examination,**

**Postnasal space exam**

**EXAMINATION OF HEARING:**

**Start whispered voice at 60 cm from the ear**

**Tuning fork tests: Preferably 512 Hz**

**-Rinne`s test**

**-Weber`s test**

**-Absolute Bone Conduction (ABC) test**

**Audiometry: the measurement of hearing threshold by Audiometer & recorded on graph called "pure tone audiogram**

**(A) Subjective Audiometric Tests: such as**

**- Pure tone audiometry.**

**- Speech Audiometry.**

- In children: Behavioural hearing tests,  
visual response audiometry, and play audiometry

**(B) Objective Audiometric Tests: such as**

- Impedance audiometry: Tympanometry & Acoustic Reflex (AR)
- Oto-acoustic emissions (OAEs)
- Brainstem Evoked Response Audiometry (BERA).

**EXAMINATION OF VESTIBULAR FUNCTION:**

- Romberg test
- Unterberger test
- Gait test
- Fistula test or sign
- Examination of Nystagmus
- Positional Test (Hallpike manoeuvre)
- Caloric Test (Bithermal CT- COWS)
  - Cold water 30
  - Hot water 44
- Electronystagmography (ENG)