Types and causes of hearing loss -1-
Recap for Auditory system

- Auditory system consists of:
  - Outer ear, Middle ear, Inner ear, 8\textsuperscript{th} cranial nerve (PERIPHERAL PATHWAY)
  - Central auditory nervous system (auditory brainstem and auditory cortex) (CENTRAL PATHWAY)
Peripheral auditory system

Outer ear (OE):

- Consists of Pinna (auricle), External ear canal and Tympanic Membrane

Middle Ear (ME):

- It’s an air-filled space with chain of tiny bones (Malleus, Incus and Stapes)
Inner ear (IE): Contains

- Cochlea (sensory organ)- responsible for hearing
- Vestibular system ”Semi-circular canals” (Balance organ).

The 8th cranial nerve: contains cochlear and vestibular branch.
Peripheral auditory pathway

- Stapes (attached to oval window)
- Malleus
- Incus
- Semicircular Canals
- Vestibular Nerve
- Cochlear Nerve
- Cochlea
- External Auditory Canal
- Tympanic Cavity
- Tympanic Membrane
- Round Window
- Eustachian Tube
Central auditory pathway

The auditory brainstem:

- Starts from cochlear nuclei and continues up to the auditory cortex.
- It involves cochlear nuclei, Superior Olivary Complex (SOC), Lateral Leminscuse (LL), Medial Geniculate body.
The Auditory cortex

- It is situated in the Temporal Lobe
- The right and left sides are connected via Corpus Callosums.
Central auditory pathway
• **The conductive mechanisms** are the outer and the middle ear.

• **The sensorineural mechanism** are the cochlea, 8th nerve and cochlear nuclei.
What is hearing Impairment?

- It’s a complete or partial loss of the ability to detect or discriminate sounds due to an abnormality associated with the physiology, anatomy or function of the ear.
• Hearing impairment described in terms of the:

  ➢ **Degree** of a hearing impairment, ranging from mild to a profound hearing impairment

  ➢ **Types** of hearing impairment, sensori-neural, conductive or a combination of both (mixed loss).
Types of Hearing loss

- Organic
  - Central (CAD)
- Non-organic
  - Peripheral
    - Conductive (CHL)
    - Sensory-neural (SNHL)
    - Mixed (MHL)
Organic Hearing Loss
CHL

- It refers to hearing loss resulted from any damage or lesion to the conductive mechanism (OE, ME).

- CHL can be revealed spontaneously, treated surgically or medically, therefore, it’s reversible usually.
Main Causes of CHL

Outer Ear Problems:

A. Atresia

- It’s the complete absence of the external auditory meatus because of congenital embryological anomaly.

- When the opening presents partially, it’s known as Stenosis.
Atresia usually happened in combination with **Microtia**, total or partial absence of the Auricle.

It’s usually unilateral and associated with a maximum CHL (60 dBHL)
Atresia, Microtia and stenosis
B. Collapsed external ear canal

- Resulted from the wrong placement of supra-aural earphone that leads to the blockage of the ear canal

- It leads to false CHL

- Highly happened among children and elderly, Why?

- It could be avoided by plastic tube or rubber foam
C. Cerumen Impaction

- Cerumen is the ear wax that formed by glands below the skin of the EAM.

- It has multiple advantages:
  - Lubricates the skin.
  - Prevents entrance of foreign bodies to the ear canal.
  - Protect against maceration.
The cerumen usually migrates laterally and falls out of the ear canal.

Possible causes for cerumen impaction

1) Some people due to their ear canal anatomy, the wax becomes unable to leave the ear canal, instead it impacted and occluded the ear canal.

2) Ear wax could be occluded also as a result of using the cotton-tipped to clean the ear.
3) Cerumen impaction usually occurs with **hearing aid users** since the wax is unable to migrate outward because of the earmould.

4) **Diving** is another cause of cerumen impaction.

- Cerumen accumulates gradually, the CHL happens when the meatus fully occluded.
- The hearing loss associated with that case usually has a sudden onset and varies from mild to moderate.
Impacted cerumen
D. Foreign bodies in the EAM.

- Like beans, cotton, buttons, crayons…etc
- It is usually seen in children’s ears
- The occluded ear canal with CHL and skin irritation that leads to Otitis externa.
- Tympanic membrane perforation may happen in some cases.
Foreign body
E. Bony growth.

- It is either Exostoses or Osteomas.

- **Exostoses:**
  - Multiple, hard bony growths of the ear canal covered with skin.

  - Frequent swimming in the cold, salty water is the main possible cause.

  - Often it is bilateral.
Osteomas:

- spongy, bony growths of the ear canal covered with skin.
- They are usually singles.

In contrast to Exostoses, Osteomas continue to grow and it should be removed and biopsied to ensure that they are not malignant.
Neither Exostoses nor Osteomas accompanied with CHL except when they lead to cerumen impaction or occluded the meatus.
Bony growth
F. External Otitis (Otitis Externa)

- The infection of the EAM skin, it also known as “swimmer’s ear”.

- External ear canal is an ideal environment for bacterial growth, Why!!

- It could be fungus or bacterial (more common)
Fungus caused by overuse of ear drops and known as Otomycosis

It could be the result of allergic reaction earplugs, hearing aids’ earmolds, soaps….etc

Its signs and symptoms are

- Itching and severe pain.
- Aural discharge in some cases.
- Fever happened rarely.
• Swelling and tenderness of the ear canal.

• CHL occurs if the ear canal is completely closed.

  ➢ It’s mostly treated with antibiotics
Otitis externa
G.TM perforation

- It caused either by;
  1. Direct trauma to the TM (direct penetration by sharp tool)
  2. Indirect trauma (explosion near the ear or ME infection).

- Traumatic perforation shows spontaneous healing better than one caused by disease.
- TM perforation could be repaired surgically during (Myringoplasty).

**Signs and symptoms**

- Pain, bleeding, hollow sensation in the ear.
- CHL that its degree varied depending on the size and site of the hole.
Different sizes of perforation
H. Tympanosclerosis

- It’s the formation of white plaques on the TM, causing thickening and scaring formation.

- It’s usually the result of repeated ME infections.

- They do not respond well to medical or surgical treatment.
TM with scar
ME problems

A. Negative ME pressure

- Poor Eustachian tube function is one of the most common ME disorders

- 2 of the most common cause for ET dysfunction are
  - infection or allergy
  - Hypertrophied adenoids
ET dysfunction affects pressure equalization

- Pressure will be increased within the ear canal
- TM retracted and not vibrate normally, that might produce slight CHL

It could be diagnosed using a technique name (politzer-ization)

Valsalva and Toynbee maneuver used to inflate the ET
B. Otitis Media

- It’s an inflammation of the ME that is associated with eustation tube dysfunction.

- It’s either **purulent** or **non-purulent** otitis media.
1) Purulent Otitis media,

- When there is ME effusion with the bacterial infection. And it’s either acute or chronic.

- **Acute POM** occurs more frequently in children less than 6 years.

- Repeated occurrences of APOM known as **repeated acute otitis media**.
• When the APOM persists for 12 weeks or more it’s known as **Chronic otitis media with effusion**.

• It is treated by suitable antibiotics and frequent removal of the bus
2) Serous (non-purulent) otitis media

- ME inflammation that accompanied with non-purulent, thin watery discharge.

- SOM is usually present in children with cleft palate, children with down syndrome and people with other cranio-facial anomalies.
Prolonged and/or recurrent SOM may result in adhesive OM, known as “glue ear”.

✓ Glue ear is associated with CHL.

Antibiotics are not recommended.

It might be treated by using decongestant-antihistamine combinations or decongestant alone.
Surgical treatment for ME fluids

- **Maringostomy** (opening into TM)

- Placement of **Pressure-Equalizing (PE) tube / tympanostomy tube** (inserted through the incision in the TM).

- Some removed by the doctor. While, some stay in place for couple of weeks or months and falling down naturally
Otitis media purulent Vs non-purulent
C. Otosclerosis

- It’s a progressive disease of Labyrinthine capsule and stapedial footplate.

- Involvement of stapes, stapedial footplate, leads to an impairment to stapedial movement, leading to progressive CHL.

- Some called it as otospongiosis
Signs and symptoms

- Gradually progressive CHL, that may stabilize.
- Early stages characterized by LF CHL that flattens with the disease progression.
- Audiometric configuration present with CARHART notch, it’s an elevation of bone-conduction threshold but not the air conduction one at 2000 Hz.
- Tinnitus, sometimes vertigo and nausea.
• Patients show bluish cast to the whites of their eyes

• Difficult to hear while chew

• Patients tend to understand speech better in the presence of noise (paracusis willisii)

➢ It’s more in female than the male (twice)??, rare in children and more in whites
Treatment

- Fenestration (bypassing the ossicular chain)
- Stapes mobilization and re-fixation of ossicular chain
- Stapedectomy following stapes mobilization
Audiogram for otosclerosis
D. Cholesteatoma

- It’s a cyst that usually formed in the ME cavity, but sometimes may seen in the temporal bone.

- It stated to be pesudotumor that forms a sac (keratin, squamous epithelium and cholestrol)

- It’s may be developed following chronic or recurrent otitis media, occasionally it’s idiopathic and rarely congenital.
Types
1. Primary acquired (no history of OME)
2. Secondary acquired (where cholesteatomas enter the ME through perforation)

Signs and symptoms:
- Earache, tinnitus, CHL with polluted smelling aural discharge.
- A SNHL may present in the cases where the cholesteatoma involves bony labyrinth, internal auditory canal or CPA.

Treatment
- Surgical
E. Ossicular Discontinuity

- It’s a break anywhere along the ossiculcular chain.
- It may be results from head trauma or congenital ME malformation.

Signs and symptoms

- CHL.
- Head trauma cases associated with skull fracture and facial nerve impairment.