Hearing loss

Objectives:

- Definition of the HL (hearing loss).
- Prevalence of deafness.
- Etiology of: Conductive deafness, Sensorineural deafness.
- Who's at risk to develop HL
- Impact of HL
- Classification of hearing loss.
- Examination of the patient with HL
- Investigation of patient with HL
- Management of HL

Resources: 436, slides & notes
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[Color index: Important | Notes | Extra]

Introduction:

- Deafness is the Impairment of sound perception more than 20 (15) decibel[1] on pure tone audiogram. The normal is hearing at 20 if you need more than 20 its abnormal.
- Hearing impairment is partial or complete inability to hear from one side or both sides of the ear.
- 50% of deafness and hearing loss is avoidable through prevention, early diagnosis, and proper management.
- Hearing loss is divided into 3 different types: first type is conductive hearing loss (ex; otosclearosis), second type is sensorineural hearing loss (ex; congenital) and third type being a mixture of both first and second types called mixed hearing loss.
- How common is hearing loss? Extremely common in fact it is the commonest human disability.
    - Overall about 1 in 10.
    - 1 in 3 adults 65 - 75.
    - 1 in 2 older than 75.
    - 1-2% school age children.
    - 4% children under 5.

it's in the Saudi guideline to do newborn screening because it's the commonest congenital anomaly.

Signs of Hearing Loss:

- Talking louder than necessary. تلاحظها في كبار السن
- Turning up volume on the TV or radio.
- Complaints that other people "mumble".
- Confusion of similar sounding words نحلة/نخلة.
- Inappropriate responses in conversation.
- Ringing or buzzing in the ears.
- Lip Reading:

  * Watching a speaker's face intently

  * Difficulty "hearing" someone behind

  * Having difficulty speaking on the telephone

Congenital hearing loss is the commonest form of congenital anomalies. The problem is that it is not discovered, so it is recommended that we do screening to newborn.

The impact of hearing impairment:

- Affects Speech if the input is flawed then the output will be flawed too/ if you listen to something in a wrong way then you'll repeat it wrong too.
- Language
- Education
- Social They'll feel left out/isolated and depressed. They'll have thoughts like "what if others are talking about me"
- New studies that show hearing loss is associated with dementia, and the incidences decreased if hearing aids have been used.
- Limit activities, Isolation, Depression, Anxiety, Insecurity, strain relationships, Increase psychosocial difficulties

[1] decibel is a unit for expressing the relative intensity of sound on a logarithmic scale.

Effects	
- Don't enjoy conversations- too much work - People think you are an idiot - Scared to try new contacts - Scared to take new jobs - Limits your world	- Limit activities - Isolation - Depression - Anxiety - Insecurity - Strain relationships - Increases psychosocial difficulties

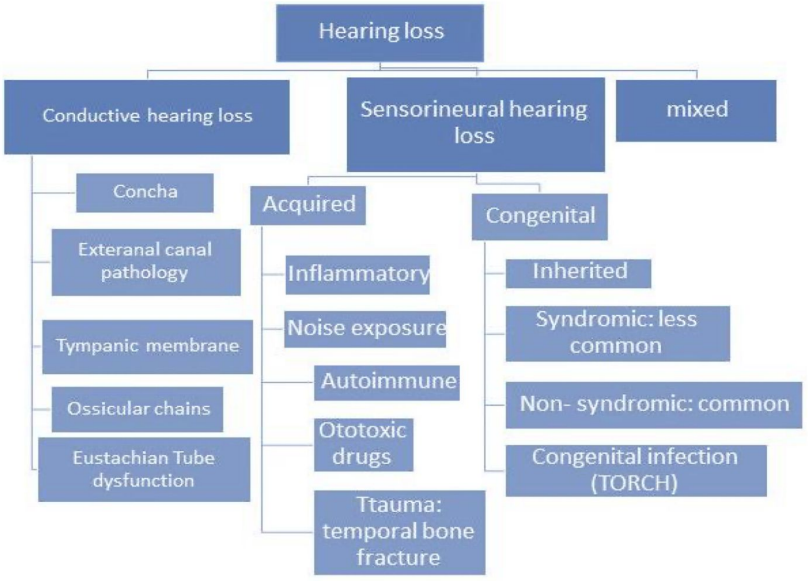
High Risk Criteria For Hearing Loss in Infants:

- Family history of hereditary childhood sensorineural hearing loss.
- Hyperbilirubinemia
- Ototoxic medications. Such as Aminoglycosides or chemotherapy like Methotrexate
- Bacterial meningitis.
- Birth weight less than 1500 grams
- In utero infections (toxoplasmosis, syphilis, rubella, cytomegalovirus and herpes).
- Craniofacial anomalies (including pinna and ear canal).
- Birth asphyxia.
- Mechanical ventilation lasting 5 days or longer.
- Stigmata or other findings associated with a syndrome known to include a sensorineural and/or conductive hearing loss. RF for adults such as trauma or noise exposure in airplanes (not wearing ear plugs)

Types of hearing loss :

437A: When the **external and the middle ear are affected= conductive hearing loss**. **Inner ear (cochlea) and the nerve = sensory hearing loss**. Cochlea's job is tuning of the sound.

437F2: We can identify the type of hearing loss by the location of the problem:
-If the problem is in the **outer or the middle ear** then it is **conductive hearing loss**.
-If the problem is in the **cochlea** then it is **sensory hearing loss**.
-If the problem is in the **nerve** then it is **neural hearing loss**.



Conductive hearing loss (CHL):

- Conduction of sound to the cochlea is impaired.
- Can be caused by **external** and **middle** ear disease (Concha ,Ear canal , Drum , ossicular chain ,Eustachian tube)
- The lesion may lie in the external ear and tympanic membrane, middle ear or ossicles up to stapedio vestibular joint. (433)

1. External canal pathology:

a. **Congenital**:

Atresia = رتق (no ear canal)

Microtia =صمعاء Deformity of the ear auricle

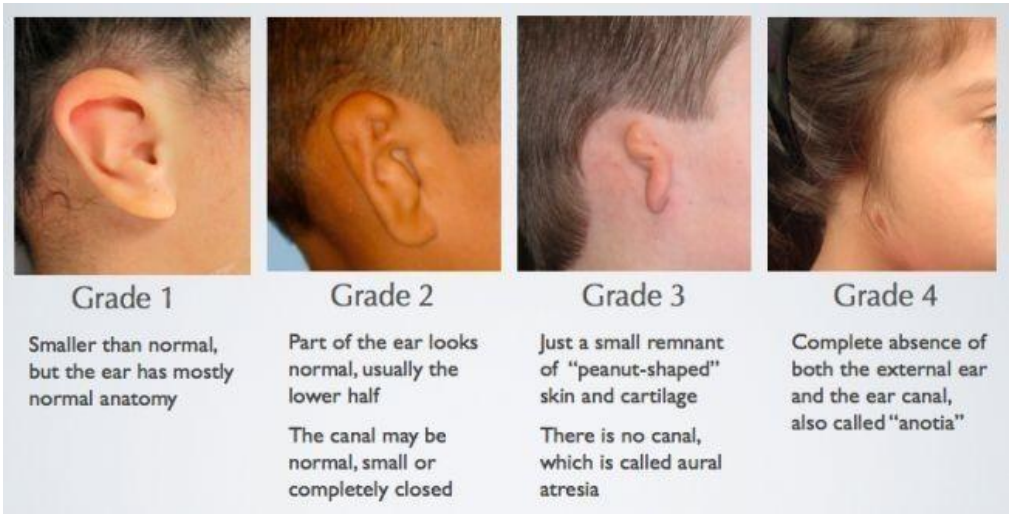
b. **Inflammatory**:

Otitis media: Acute suppurative (ASOM) – Otitis media with effusion (OME) - Chronic otitis media (CSOM).

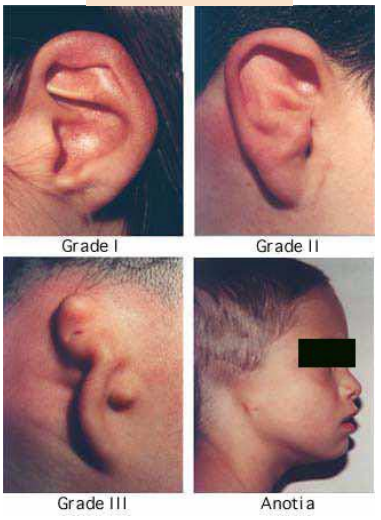
Acute otitis externa: It's a common condition involving inflammation of the ear canal. The acute form is caused primarily by bacterial infection, with Pseudomonas aeruginosa and Staphylococcus aureus the most common pathogens, very painful.

c. Obstruction:

* Wax: the commonest cause of conductive hearing loss (CHL).
* Foreign body: any form of obstruction can cause CHL like insekt or Q-tips.
* Tumors: Benign or malignant.
    - Osteoma: Benign bone tumor, single, unilateral, broad-base.
    - Exostosis: Benign bone overgrowth, multiple, bilateral, pedunculated, in cold regions (Austria and Scandinavia).
* Ear Drum scarring; perforation Trauma: Skull base fracture blood goes to the external auditory canal> tympanic membrane perforation > blood in the middle ear gives Raccoon eyes sign[3] and battle's sign. Ear drum Scarring.

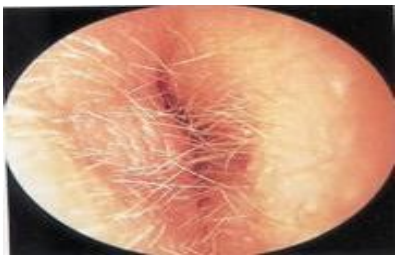


Microtia

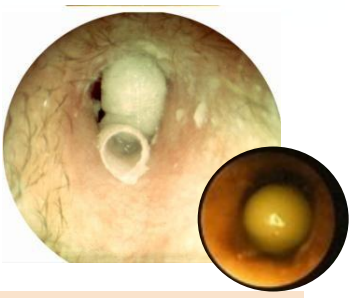


This patient has abnormal auricle and has No ear canal (microtia) so the sound will not go through to stimulate the middle ear ossicles and tympanic member

[3] periorbital ecchymosis



Acute otitis externa

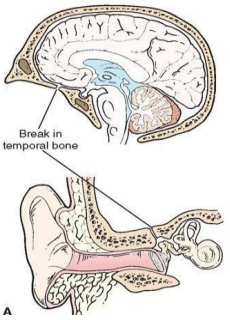


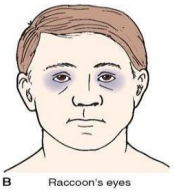
Foreign body

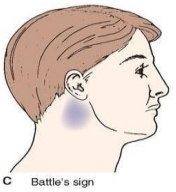
wax

Battle's sign

Racoon eyes sign







2. Tympanic membrane pathology:

a. **Absent** TM caused by <u>perforation</u>: Fresh blood indicates a recent injury (acute injury).

b. **Too thick** TM caused by <u>tympanosclerosis</u>. which can Impair the sound transmission to the tympanic member
Tympanosclerosis: Calcification of an old inflamed tissue, whitish, sclerotic plaques. (usually it's **asymptomatic** -most of the time-, but when it's symptomatic it causes CHL) (ask about previous infection in the ear while taking the history because it comes from recurrent infections), It's a condition characterized by the presence of masses of hard, dense connective tissue around the auditory ossicles in the middle ear, also known as myringosclerosis.
Multiple surgeries or infections (myringitis) causes TM scarring and thickening. This could fix the drum and ossicles causing conductive hearing loss.

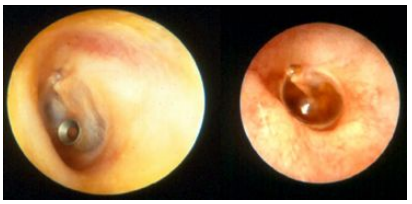
c. **To thin** TM caused by <u>Secretory otitis media (SOM), Retraction</u>.

3. Drum Retraction (Adhesive OM):

- It's also called Atresia, Atelectasis ear.
- The tympanic membrane gets sucked in because of eustachian tube dysfunction and negative pressure, which will suck the ear-drum inside. We treat it by ventilation tube, which prevents the ear from getting sucked inside by preventing the negative pressure. So perforation and retraction both of them are causes to conductive hearing loss.
- Treatment of adhesive OM is attachment of tube.

Tympanosclerosis

Fixed TM , Fixed ossicles
white patches; old infections

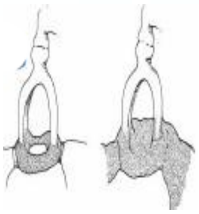


Middle Ear Effusion (MEE)

Drum Retraction (Adhesive OM)

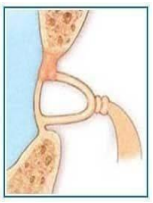
4. Ossicular chains:

As we know there are three ossicles in the middle ear (malleus, incus and stapes.) any one affected it will end up with CHL like in chronic ear or trauma

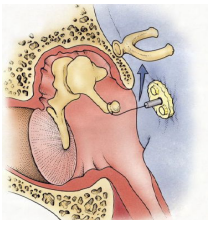


1. Absent & erosion.
2. Fixation: congenital or acquired otosclerosis.

- Otosclerosis**:**
  - Congenital inherited autosomal recessive disease causes fixation of the footplate (stapes) by new bone formation.
  - A disease of the bony otic capsule characterized by abnormal replacement of mature bone of the otic capsule by woven bone of greater thickness.



  - 10% otosclerosis lesions (10% symptomatic).
  - Middle-age.
  - Females: Male, 2: 1.
  - Occur in Caucasian and Europeans mostly.
  - Worse during pregnancy and improve after delivery (due to hormonal changes).
  - Treatment: Stapedectomy is a surgical procedure (if hearing aid did not work) in which the innermost bone (stapes) of the middle ear is replaced with a small plastic tube of stainless-steel wire to improve the movement of sound to the inner ear.



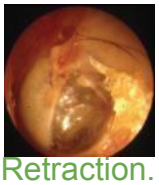
stapedectomy

  - It has nothing to do with infection.

3. Disrupted trauma or dislocation.

5. Eustachian Tube dysfunction:

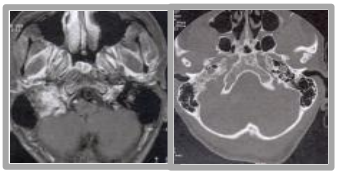
As we know the tube content the middle ear with the Nasopharynx .and it's main job to ventilate the middle ear , equally the pressure so and defect will end up with OM



Retraction.

Effusion

- Retraction.
- Effusion.
- Otitis media: acute suppurative (ASOM), otitis media with effusion (OME), chronic otitis media (CSOM).
- Congenital cholesteatoma
- Squamous cell carcinoma
- Paraganglioma
- Schwannoma



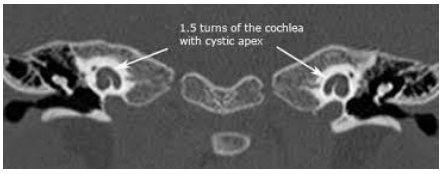
Sensorineural hearing loss (SNHL):

so common

- SNHL is a defect in the conversion of sound into neural signals or in the transmission of those signals to the cortex
- It can be caused by disease of the inner ear (cochlea), acoustic nerve (CNVIII), brainstem, or cortex.
- IT has Two types:
  - ➢ Sensory (the pathology is within hair cells in cochlea).
  - ➢ Neural (the pathology is within the auditory nerve and its connection)
- Etiologies:
  - Congenital
  - Trauma
  - Infection
  - Noise
  - Ototoxic
  - Presbycusis
  - Acoustic neuroma it may be congenital or acquired
  - Age

1. Congenital:

1. Inherited
2. Syndromic (less common)
3. Non-syndromic (more common).
4. Congenital infection (TORCH): can lead to delay speech and language development.



Mondini malformation

- Deafness affects 0.2%
- SNHL attributed to:
  * 50% genetic factors
  * 20-25% environmental
  * 25-30% sporadic

- Genetic:
  * 75% AR
  * 20% to AD
  * 5 % X-linked
- Over 400 syndromes

Waardenburg syndrome (white forelock)

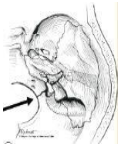
2. Acquired:

- Trauma:

- Temporal bone fracture: affect hearing, balance and facial nerve.
  1. Longitudinal fracture:
     · Bleeding from ear
     · Conductive hearing loss
     · Uncommon facial nerve paralysis
     · CSF
  2. Transverse fracture:
     · SNHL
     · Facial nerve paralysis common.
     · CSF
- Mixed



The directions of fracture from lateral to medial


The line going from posterior to anterior

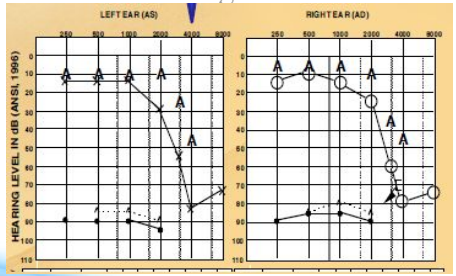
- Noise exposure induced SNHL:

- Boilermaker's deafness.
- One of the most common occupationally induced disabilities.

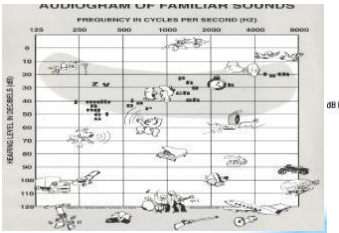
Those who are working on very noise environment like an airport, factories without protecting their

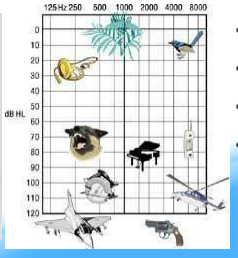
ears they have a special type of hearing loss which is noise induced hearing loss .
Follows chronic exposure to less intense sounds than seen in acoustic trauma and is mainly a hazard of noisy occupations. Here its cumulative like blow drying it is NOT REVERSIBLE (That's why they have devices that measure the noise in factories and airports loudspeakers in weddings have the same effects)

- Tinnitus only sign, earliest sign: commonly accompanied NISNHL, warning sign
- Warning sign: (one gunshot could cause SNHL, and in KSA fireworks), hunting or explosions are one time highly intense shots causing hearing loss straight away, causes damage to hair cells, starting in the basal turn of cochlea. Outer hair cells are affected before the inner hair cells.



We can see a normal hearing then a sudden drop at 4000hz , so any drop of hearing at 4000 we called it noise induce hearing loss





- 90 db for 8 hours
- 95 db for 4 hours
- 100 db for 2 hours
- 105 db for 1 hours

- Ototoxic: Almost all medications causes it

- Antibiotics "aminoglycosides", like Gentamicin.
- Diuretics, Furosemide they are known to cause oedema and cystic changes in the stria vascularis of the cochlear duct
- Antineoplastics
- Anti Inflammatories
- Antimalarial agents (chloroquine, quinine)
- Ototopic agents
- Others Chemotherapy agent
- Patients particularly at risk are those: Concomitantly receiving other ototoxic drugs, who have already received aminoglycoside antibiotics, who are receiving high doses of ototoxic drugs with high serum level of drug, who have genetic susceptibility to aminoglycosides (433 team).
- Higher risk patients:
  - Renal failure (Elevated peak and trough levels)
  - Liver failure
  - Immunocompromised
  - Collagen-vascular disorders
  - Advanced age (> 65 years)
  - Prior ototoxicity
  - Concurrent use of known ototoxic agents
  - Preexisting HL or Vestibular
  - Bacteremia (fever)
  - Treatment course longer than 14 days
  - + ve FHx of AG ototoxicity

- Acoustic neuroma (Vestibular Schwannoma):

- Vestibular Schwannoma is a benign nerve tumor in the internal auditory meatus or cerebello-pontine (CP) angle at the base of the skull. It is usually unilateral, except in the very rare familial neurofibromatosis type 2 (NF2), when it may be bilateral. In its early stages, it causes progressive hearing loss and imbalance. As it enlarges, it may encroach on the trigeminal nerve in the CP angle, causing loss of corneal sensation. In its advanced stage, there is raised intracranial pressure and brain stem displacement. Early diagnosis reduces the morbidity and mortality. Unilateral sensorineural deafness should always be investigated to exclude a neuroma. Audiometry will confirm the hearing loss. MR scanning will identify even small tumors.

- Presbycusis:

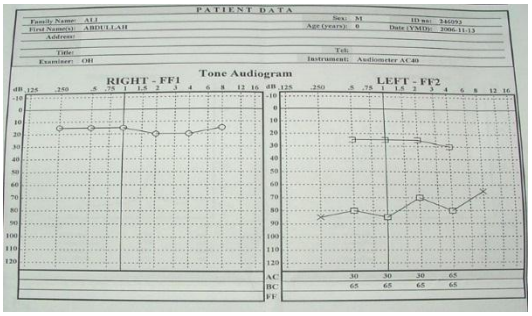
Aging process of human beings, it's associated with grey hair, cataract and SNHL, most common type. (age related hearing loss, at age 40 we expect patients to have cataract and hearing loss)

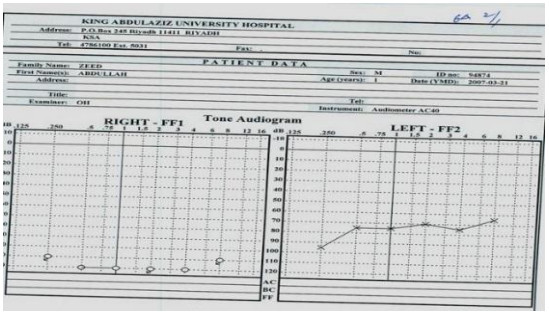
- Presbycusis = Deafness + Tinnitus "buzzing" + Recruitment "out of proportion of loudness" (recruitment meaning the patient can't hear, but when he hear, he hear everything louder than it's normal range.Patient will say ' why are u screaming?' The cochlea normally acts as a filter; it decreases loud voices and amplifies the low sounds, here the cochlea is not functioning well)
- Overview of Hearing Loss:
  - ✓ #1 handicapping disorder
  - ✓ 60% of Americans > 65 HL
  - ✓ 90% of > 75 Y have HL
  - ✓ HL + degenerative processes of aging
  - ✓ Half vestibular symptoms
- Problems with diagnosis includes: shame or embarrassment, HA social stigma, embarrassment prevents 15 million elderly people from getting help.

- Inflammatory: (labyrinthitis, meningitis): in meningitis it goes to cochlear through natural connection of the brain and ear causing ossification and the new bone being made causes death of OHC, some say the connection is through a blood supply, also it may affect Wernicke's and the temporal lobe causing neural hearing loss.

- Autoimmune (Cogan syndrome) with SLE or PRH

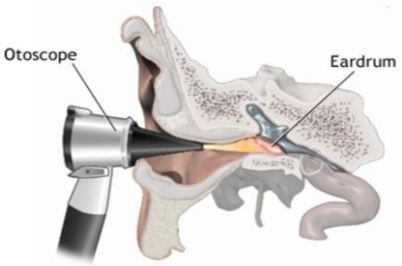
Conductive Hearing Loss	Sensorineural Hearing Loss
Negative Rinne test (BC > AC)	Positive Rinne test (AC > BC)
Weber lateralized to the poorer ear	Weber lateralized to better ear
Normal absolute bone conduction	Bone conduction reduced
Low frequencies affected more	More often involving high frequencies
Audiometry shows bone conduction better than air conduction, with air bone gap. Greater the air bone gap, more is the conductive loss	No gap between air & bone conduction curve on audiometry
Loss is not more than 60 dB	Loss may exceed 60 dB
Speech discrimination is good	Speech discrimination is poor
	There is difficulty in hearing in the presence of noise





Examination:

- After proper Hx keeping in mind all the possibilities regarding the causes and etiology of CHL and SNHL . THEN do full examinations
- General look (syndromic)
- Complete head and neck exam
- Otoscopic / microscopic ear exam for both ears
- Tuning fork test



Clinical testing of hearing:

A. Tuning forks:

- Tuning fork tests rely on the basic concept of classification of hearing loss. Deafness may be classified under one of these headings:
  - Conductive deafness
  - Sensorineural deafness
  - Mixed conductive and sensorineural deafness
- There are 2 tests:

1. Weber test: is a quick screening test for hearing. You need to know how to interpret the result
   - It can detect:
     - Unilateral conductive hearing loss (middle ear hearing loss), deviated to affected ear.
     - Unilateral sensorineural hearing loss (inner ear hearing loss), deviated to better ear.
   - The test is useful in determining the type of deafness and in deciding which ear has the better-functioning cochlea. The base of a vibrating tuning fork is held on the middle of the skull and the patient is asked whether the sound is heard centrally or is referred to one or another ear.
   - Interpretation:
     - In conductive deafness the sound is heard in the deafer ear.
     - In sensorineural deafness the sound is heard in the better-hearing ear.

2. Rinne test:
   - It compares perception of sounds transmitted by air conduction to those transmitted by bone conduction through mastoid. evaluates hearing loss in one ear.
   - This test compares hearing in one ear by air conduction (AC), and bone conduction (BC). It is usually performed as follows:
     - a tuning fork of 512Hz (cycles per second) is struck and held close to the patient's ear (AC); the base is then placed firmly on the mastoid process behind the ear (BC) and the patient is asked to state whether it is heard better by BC or AC (fig. 3.3-check it)
   - **Interpretation of Rinne's test:**

     * If **AC > BC** (called Rinne **positive)** the middle and outer ears are functioning normally.

     * If **BC > AC** (called Rinne **negative)** there is defective function of the outer or middle ear (conductive deafness).

- Try this on yourself. Then gently occlude your outer ear by pressing the tragus, giving yourself a mild temporary conductive deafness. Now repeat the test and you should find that Rinne becomes negative, demonstrating the conductive loss.
- Rinne's test tells you little or nothing about the cochlea. It is a test of middle-ear function.

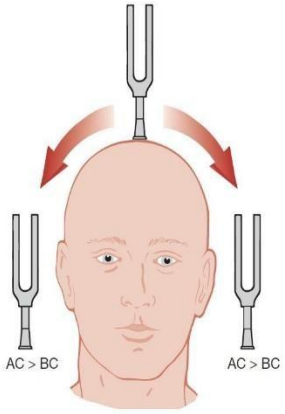


Figure 3.3 Tuning fork tests showing a positive Rinne in each ear and the Weber test referred equally to each ear, indicating symmetrical hearing in both ears with normal middle-ear function.

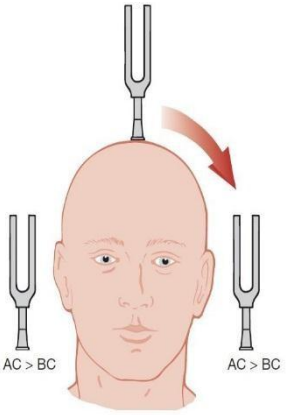
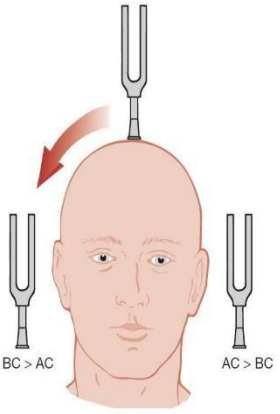


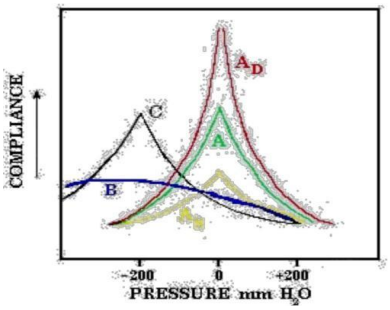
Figure 3.4 Sensorineural deafness in the right ear. The Rinne test is positive on both sides and the Weber test is referred to the left ear.



gure 3.5 Conductive deafness in the right ear. The Rinne test is negative on the right, sitive on the left, and the Weber test is referred to the right ear.

B. Impedance: Acoustic reflex.

C. Tympanogram:



- Is not a test of hearing ,it is a test of mobility of tympanic member and it will tell us about the status of the tympanic member and middle ear status
- Is graphic representation of the relationship between the air pressure in the ear canal and the movement of the tympanic membrane.
    - Type A: normal
        * Type Ad: ossicular disruption with normal TM
        * Type As: ossicular fixation
    - Type B: fluid or perforated tympanic membrane.we can distinguish between them by Air canal volume, if it big perforated member "it is relevant thing in compare to the other side if it is normal (less than 1-1.5 ml) anything above this it abnormal (big> perforated member)
    - Type C: negative pressure in the middle ear.

D. Audiogram:

- Pure tone audiogram: Is true testing of hearing sensation
    - Pure tone audiometry provides a measurement of hearing levels by AC and BC and depends on the co-operation of the subject.
    - The test should be carried out in a soundproofed room[1]. The signal is presented to the patient through earphones (for AC) or a small vibrator applied to the mastoid process (for BC). Signals of increasing intensity at each frequency are presented to the patient, who indicates when the test tone can be heard.
    - The threshold of hearing at each frequency is charted in the form of an audiogram (Figs 3.6–3.8), with hearing loss expressed in decibels (dB)[2].
    - When testing hearing by BC, it is essential to mask the opposite ear with narrow-band noise to avoid cross-transmission of the signal to that ear.
    - Tests the intensity of sound and its frequency, the patient decides the threshold by saying if he can or can't hear it.

[1] The audiometer is an instrument that generates pure tone signals ranging from 125 to 12 000 Hz (12 kHz) at variable intensities.
[2] Decibels are logarithmic units of relative intensity of sound energy.

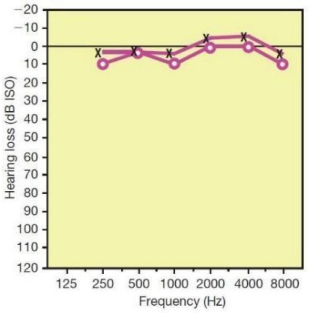


Figure 3.6 A normal pure tone audiogram. o–o–o, right ear; x–x–x, left ear.

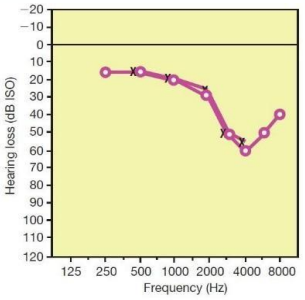


Figure 3.7 A pure tone audiogram showing sensorineural deafness maximal at 4 kHz typical of noise-induced deafness.

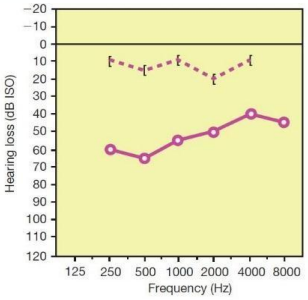
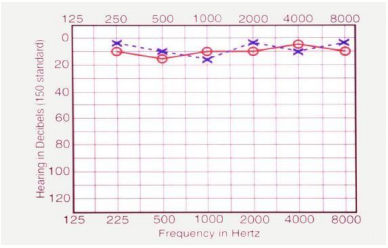


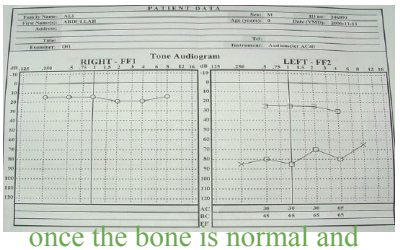
Figure 3.8 A pure tone audiogram showing conductive deafness. The BC (dashed line) is normal but the AC (solid line) is impaired. A case of otosclerosis.

Normal hearing



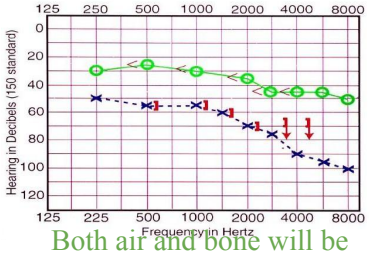
Normally the bone and air overlap each other

Conductive hearing loss



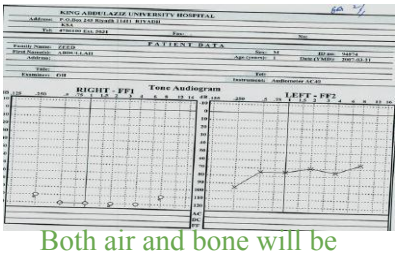
once the bone is normal and air is down more the 10dB then we call it CHL

Mixed hearing loss



Both air and bone will be down but will NOT be overlapping

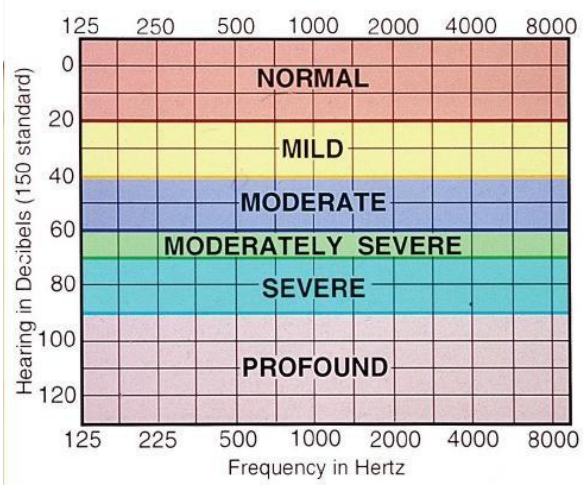
sensorineural hearing



Both air and bone will be overlapping and they will be down

- Speech audiogram:
  - Speech audiometry measures the ability of each ear to discriminate the spoken word at different intensities.
  - A recorded word list is supplied to the patient through the audiometer at increasing loudness levels, and the score is plotted on a graph.
  - In some disorders, the intelligibility of speech may fail above a certain intensity level.
  - Above a critical threshold, sounds are suddenly perceived as having become excessively loud – loudness recruitment. This suggests a cochlear disorder and is common in elderly patients with presbycusis.

Degree Of Hearing Impairment



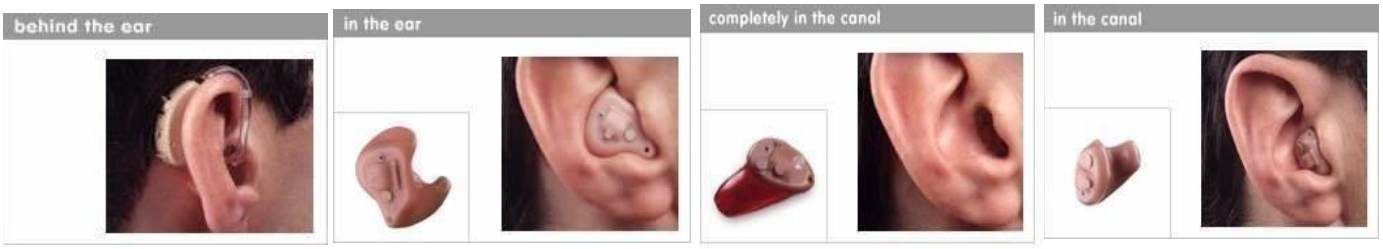
Management of hearing impairment:

Treat the underlying cause

- Two Types:

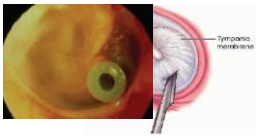
- **Medical** Which pathology can manage with medical ? OM with effusion, otitis externa some time labyrinthitis and autoimmune disease can be managed with steroids
- **Hearing Aid:** they magnify the sound so it reaches the cochlear amplified. Hearing aids are better in sensory rather than neural loss.

- History: 1550 by Girolamo Cardano when he saw that sound could be transmitted through the teeth.



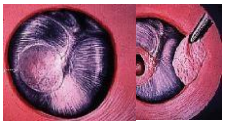
- **Surgery**

1. Myringoplasty & ventilation tube:



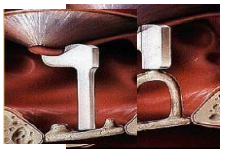
- In case of otitis media with effusion most common procedure performed (done in a eustachian tube infection) ventilation tube indication: 1-Persistent effusion 2-Eustachian tube dysfunction 3-Recurrent acute otitis media

2. Myringoplasty & tympanoplasty:



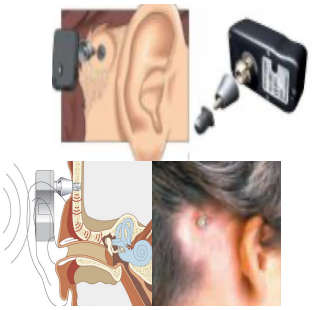
- In case of CSOM
- Myringoplasty> we do only patching of the tympanic member
- Tympanoplasty > we do patching as well as reconstruction on the ossicles

3. Ossiculoplasty:



- In case of ossicular discontinuity.Replace any one of the ossicles with artificial ossicles
- Either partial or complete (in case all 3 ossicles are involved) ossiculoplasty.

4. Bone Anchored Hearing Aids (B.A.H.A):



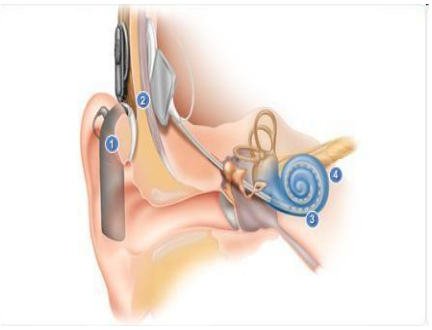
For conductive hearing loss

- Titanium implants, used in CHL (they use titanium because it doesn't react with the body)
- BAHA stimulates the cochlea by transmitting the sound waves through the bones in our skull, or bone conduction, thereby bypassing the outer and the middle ear.
- Atresia of external ear canal, and microtia
- Chronic drainage ear not responding to surgery
- Done for all types of HL (mainly conductive) it skips the middle and internal ear and goes straight to the cochlear and stimulates the bone directly.
- Someone with bilateral broken cochlear. (Blind and deaf)
- We can also reach the brainstem and due to the presence of the cardiac center you can stimulate one and the patient may die but they still want the procedure to be done so it says a lot about the importance of hearing.

5. Cochlear implant:

- Audiogram shows bilateral profound sensorineural hearing loss can be an indication.
- Patient with SNHL can be managed with hearing aid but some time the hearing loss is beyond the capability of the hearing aid and these type of patient we do cochlear implant
- Putting tiny electrode in the cochlea.
- Prelingual children and postlingual adult
- It bypass the external, middle and inner ear to stimulate the auditory nerve directly.

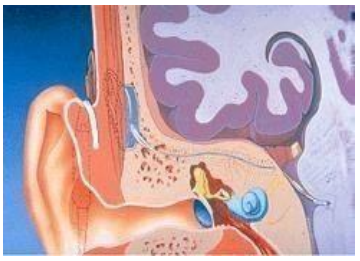
- In congenital HL the cochlear implant is ineffective after 5 years (The child will be prelingual and the child would've already learned sign language so it will be difficult to adapt), due to the disappearance of auditory segment from the brain (it gets used up by other centers of other senses that's why their other senses become better like vision for example). But in people who used to hear and then lost their hearing there is no time limit for the usage of cochlear implant, but we prefer to implant within 10 years.
- It's a device consisting of a microphone, signal processor, external transmitter, and implanted receiver; the receiver is surgically implanted under the skin near the mastoid process above and behind the ear.
- So, in the exam if they gave you a cochlear implant picture you should know it, it looks like a regular hearing aid but with a magnet from outside.



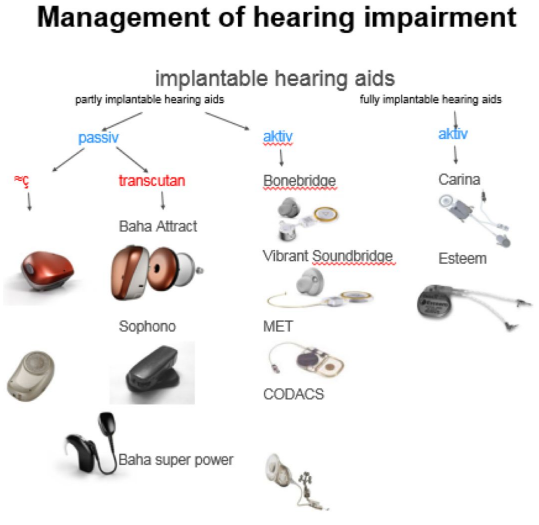
- **Classical indication of cochlear implant (Candidate):**
  1. Bilateral sensorineural hearing loss not benefiting from hearing aids, and less than 5 years of age if congenital hearing loss.
  2. It is standard practice everywhere to implant for children under 5 years old because of the improvement in the quality of life.
  3. We have to make sure that the patient has a cochlea and a nerve prior to implant.

6. Auditory brainstem implant (A.B.I):

- Implant in the brains
- When there's no cochlea or nerve we bypass them directly to brainstem. After the procedure is done there won't be a noise protective mechanism so we send the patients to the ICU to monitor them from any cardiorespiratory complication (because cardiac and respiratory centers in brainstem).



- Others management. :
- Lip Reading
- Signs Language



Secretory Otitis Media (Glue Ear)

- 3 Y
- Recurrent OM
- Hearing Loss

Fracture Base of Skull

- MVA
- Left earache
- Hearing loss

Otosclerosis vs Tympanosclerosis

- 33 y
- No hearing loss
- Ear exam →

  Tympanosclerosis

Cochlear implant

- What is this?

  Cochlear implant
- Which type of hearing loss?

  Indication: bilateral SNHL

15 years old girl

- What is this?

  BAHA
- Which type of hearing loss?

  Conductive hearing loss

Conductive hearing loss