Hearing examination

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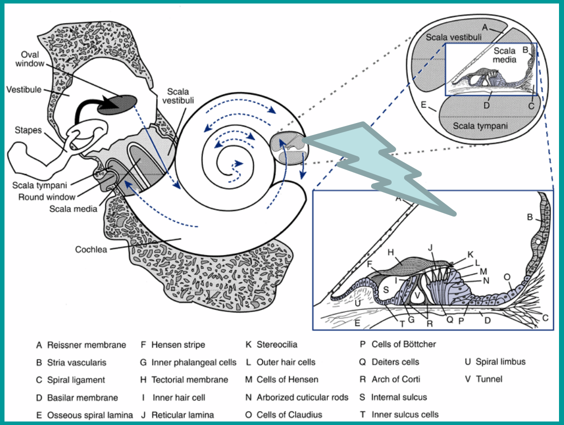
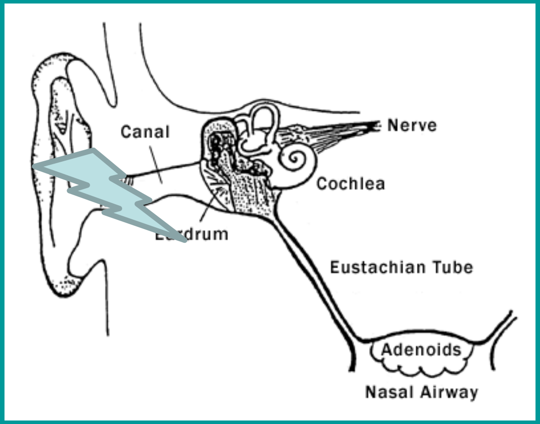
HEARING EXAMINATION

Why do we test hearing

- To detect one of major hearing impairment
  - Senzorineural (perception)
  - Conductive

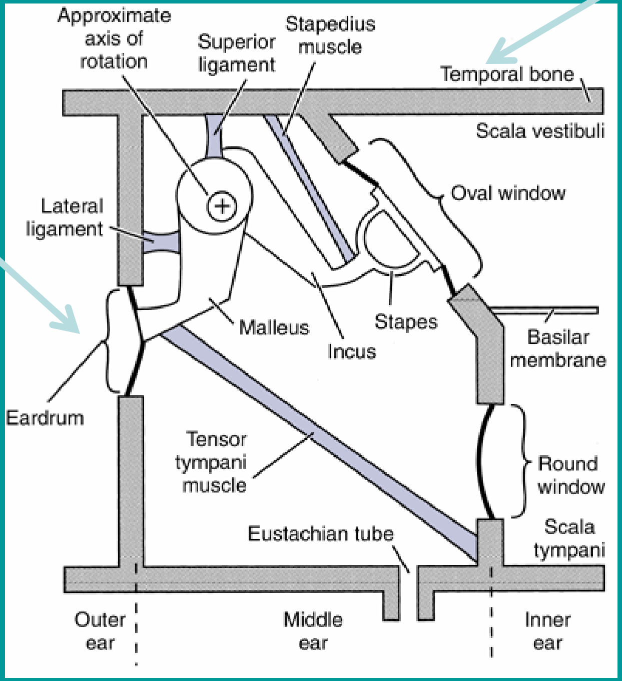




Principles of hearing

Air-conduction

Bone-conduction



- Speech test
  - Loud
  - Whisper
- Tuning fork test
  - Weber
  - Rinne
  - Bing
  - Schwabach
- Audiometry
  - Objective
  - Subjective

Speech test

- 5 meter distance
- Each ear must be test separately

- Patient should repeat 5 words whispered by the doctor, 5 words told loudly
  - High-frequency words (silence, similarly, sitting)
  - Low-frequency words (drum, button)

Results: lost of high frequencies – perception disease (f.e. presbyacusis)

low frequencies – conductive disease (f.e. otitis media)

Tuning fork tests

these allow one to distinguish (much more clearly) between conductive and sensorineural deafness

Tuning fork tests

- using a 512 Hz can assess hearing
- Rinne test : compares air conduction (AC) with bone conduction (BC)

  -normal ,or HL<20 db : AC>BC (Rinne test+)

  -CHL :BC>AC (Rhinne test -)
- Weber test :The tuning fork is placed at the top of the patient's head the pt asked which ear hear the sound loudest or if it is in the middle

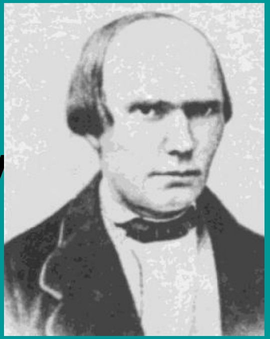
  - normal: vibration hearing in the middle

  - CHL: hearing of vibration at affected side

  -SNHL :louder hearing in better hearing or unaffected
- Schwabach"s test ; compares the pt hearing to a presumed normal hearing person (the examiner)

Rinne´s test

- comparison is made between bone and air conduction
- base of a tuning fork is placed to the mastoid area (bone), and then after the sound is no longer appreciated, the vibrating top is placed near the external ear canal (air)
- positive Rinne – healthly or perceptiv disease

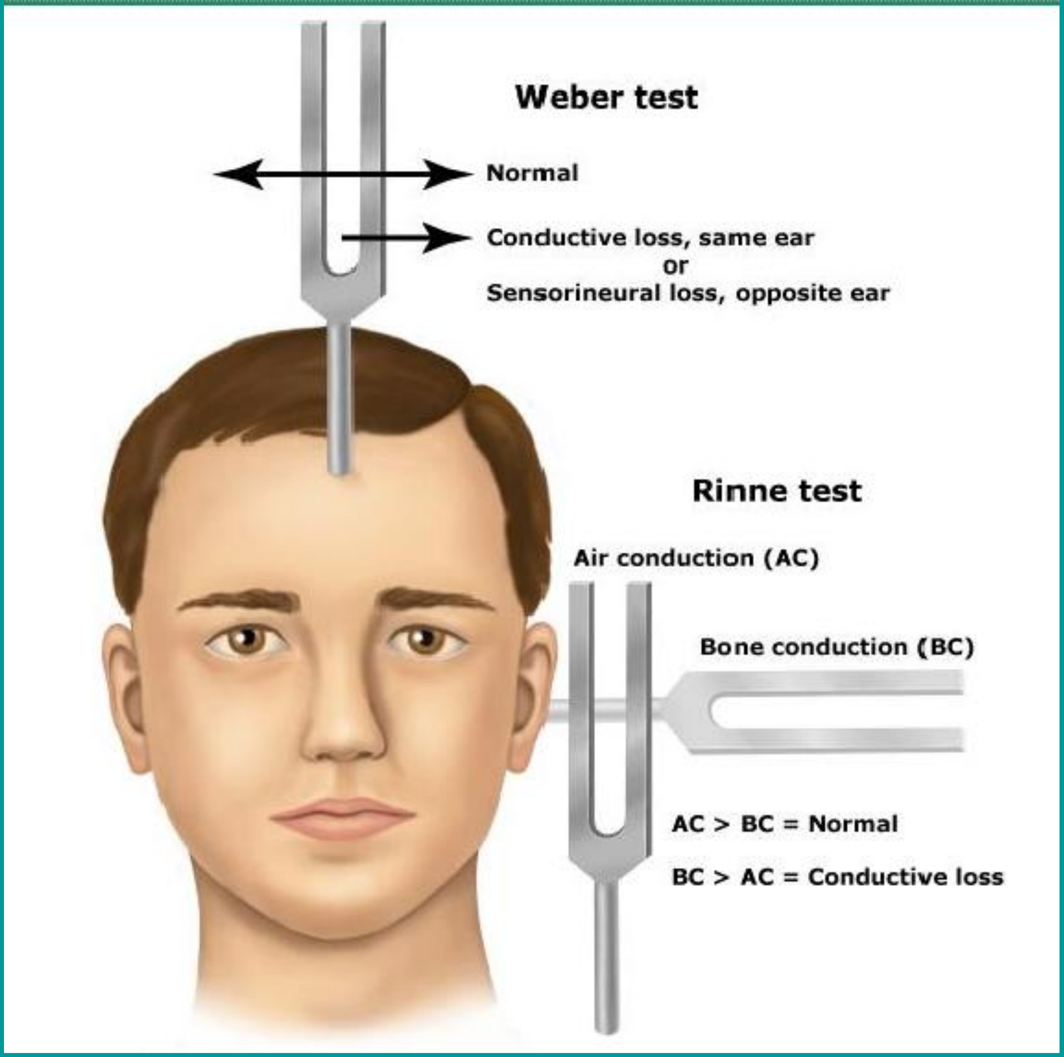


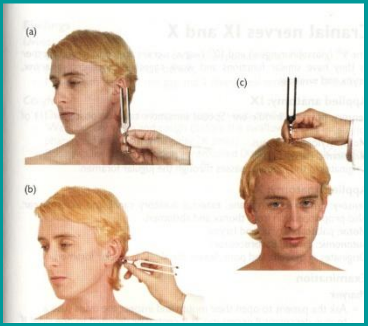
- negative – conductive disease

Weber´s test

- tuning fork is placed on the patient's forehead (or in the middle line)
- If the sound lateralizes (is louder on one side than the other), the patient may have either an ipsilateral conductive hearing loss or a contralateral sensorineural hearing loss

Weber & Rinne tests





Weber test: Place the base of a struck tuning fork on the bridge of the forehead, nose or teeth. In a normal test **there is no lateralization** of sound. With conductive loss, sound lateralizes **towards affected ear**.
With sensorineural loss, sound lateralizes to **uninvolved side**.

Rinne test: Place the base of a struck tuning fork on the mastoid bone behind the ear. Have the patient indicate when sound is no longer heard. Move fork (held at base) beside ear and ask if now audible.
In a normal test, AC > BC; patient can hear fork at ear.
With conductive loss, BC > AC;patient will not hear fork at ear.

Bing test

- fork is struck and placed on the patient's mastoid tip
- examiner alternately occludes the patient's external meatus
- patient with normal hearing or a sensorineural loss, he or she will notice a change in intensity with occlusion
- patient with conductive hearing loss, he or she will notice no change

Schwabach´s test

- compares the patient's bone conduction to that of the examiner's
- If the patient stops hearing before the examiner, this suggests a sensorineural loss
- If the patient hears it longer than the examiner, this suggests a conductive loss

This test is contingent on the examiner having normal hearing..

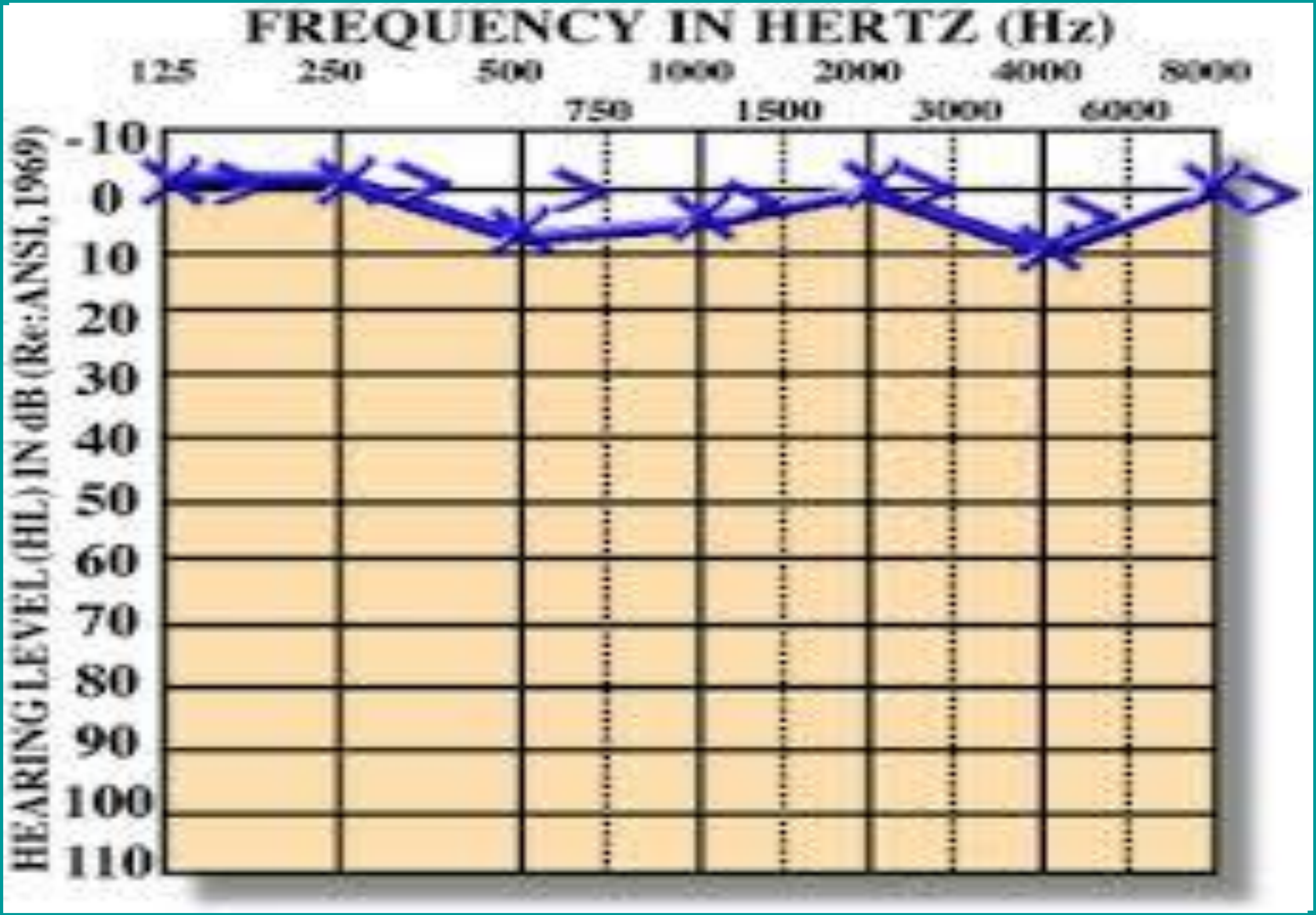
Audiometry

- Def: An audiometry is a graphic of auditory thresholds response obtained from testing a patient's hearing with pure tone stimuli.
- The parameters of audiogram:

  -frequency measured in cycle per

  second HZ

  - intensity measured in decibel (dB)

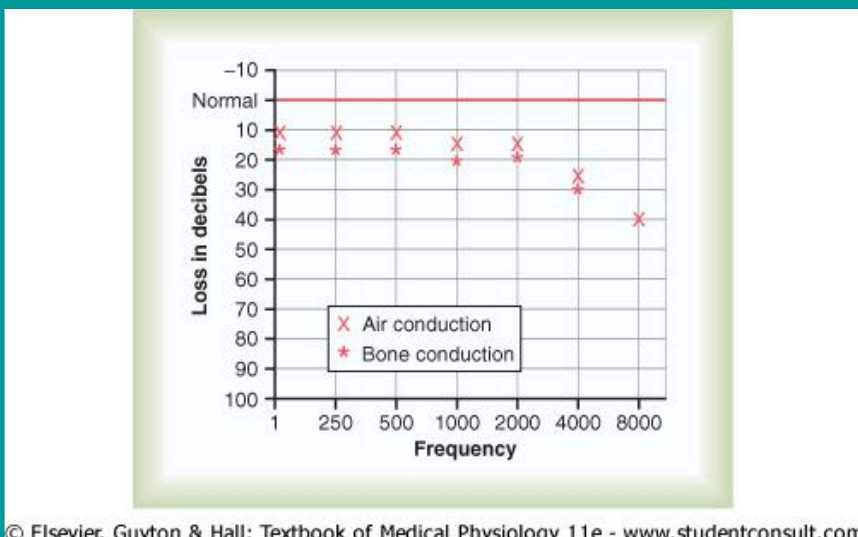


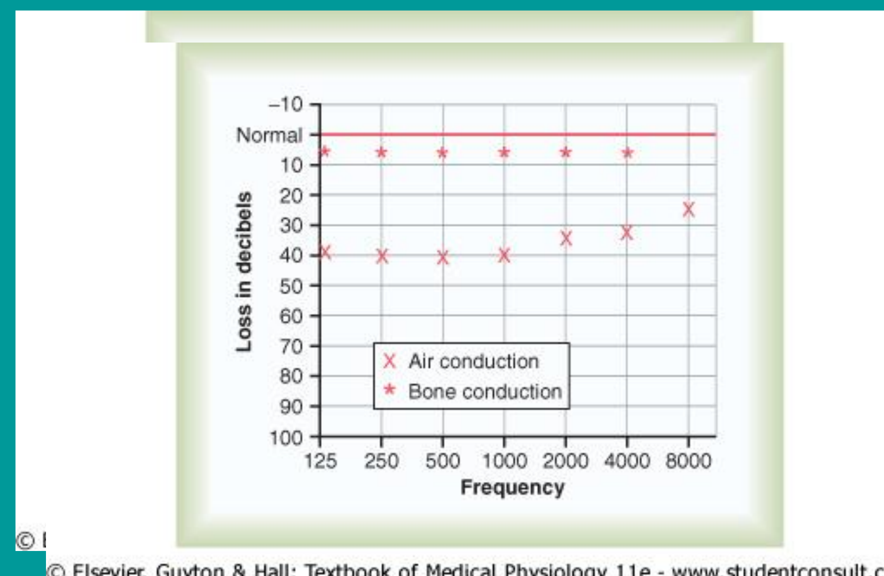
FREQUENCY IN HERTZ (Hz)
125
250
500
1000
2000
4000
8000
750
1500
3000
6000
HEARING LEVEL (HL) IN dB (Re: ANSI, 1969)
-10
0
10
20
30
40
50
60
70
80
90
100
110

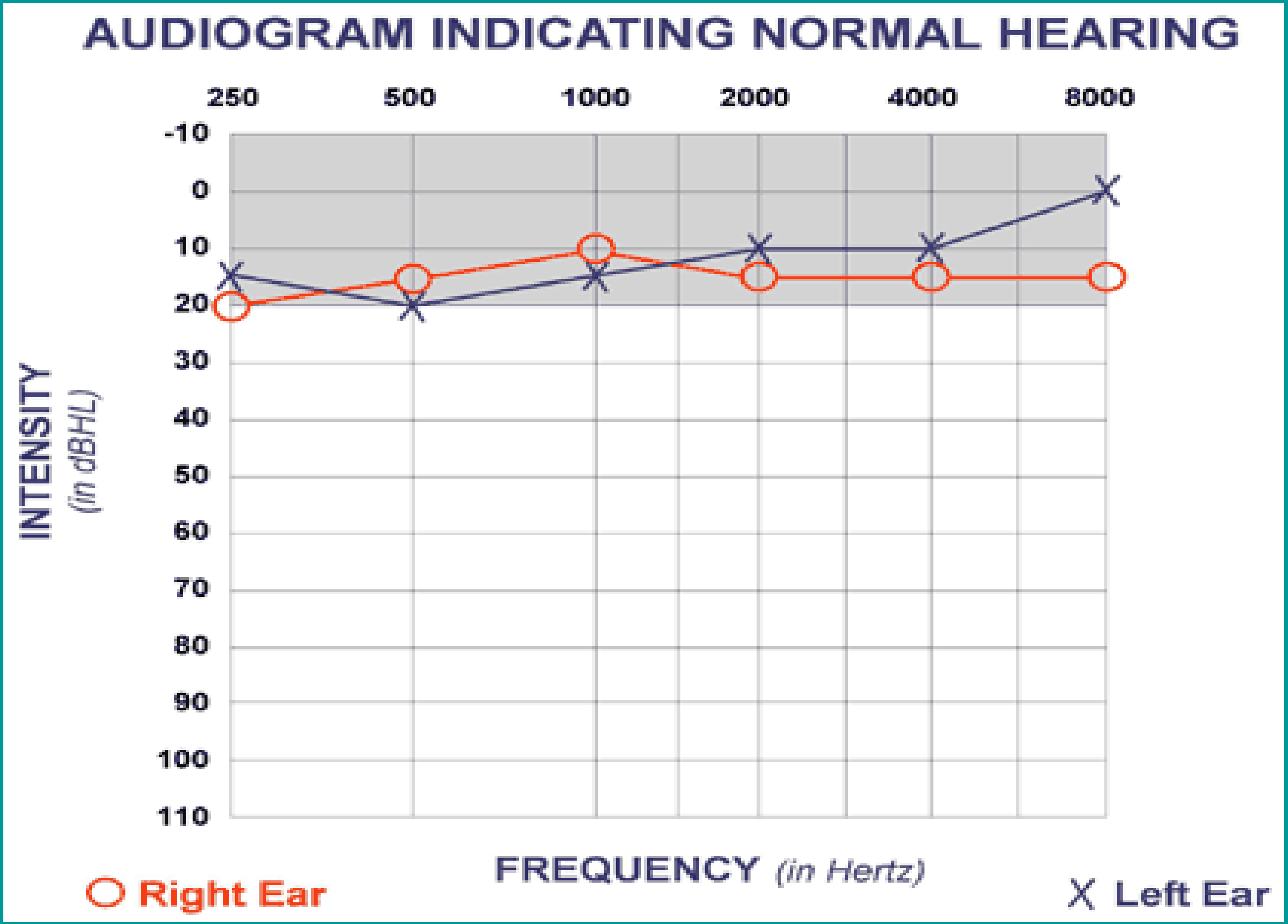
Hearing abnormalities and audiometry

Sensorineural impairment

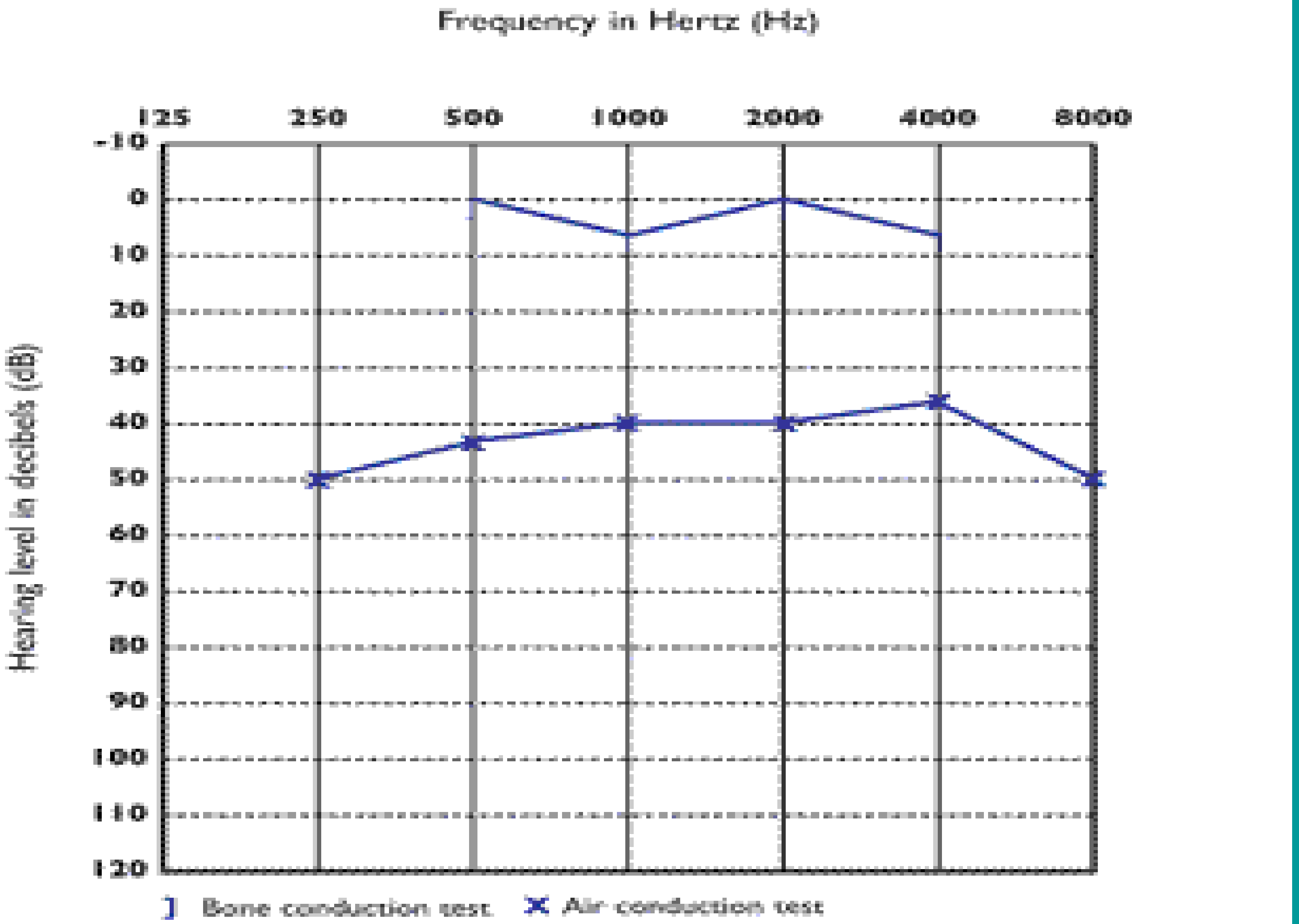
Conductive disease

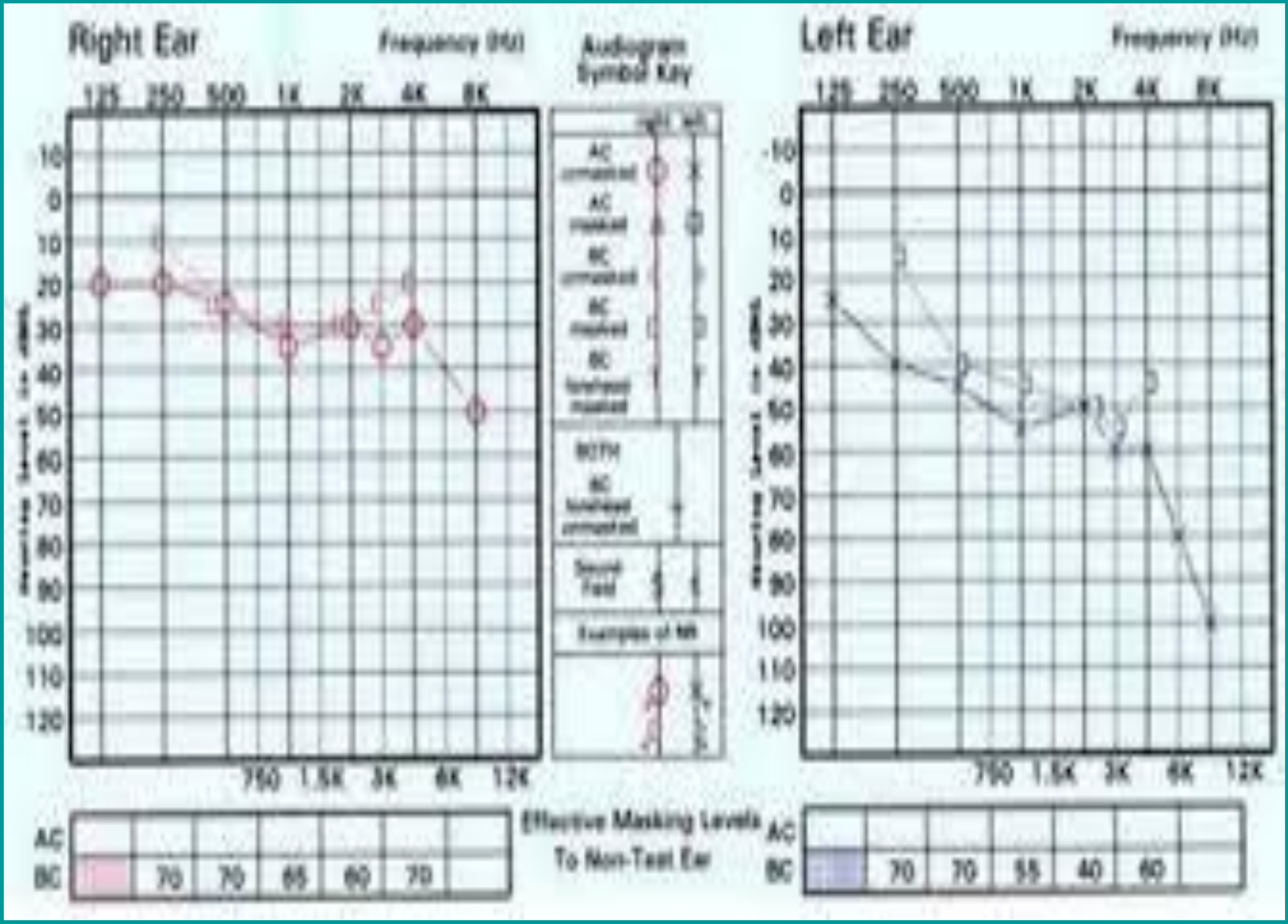




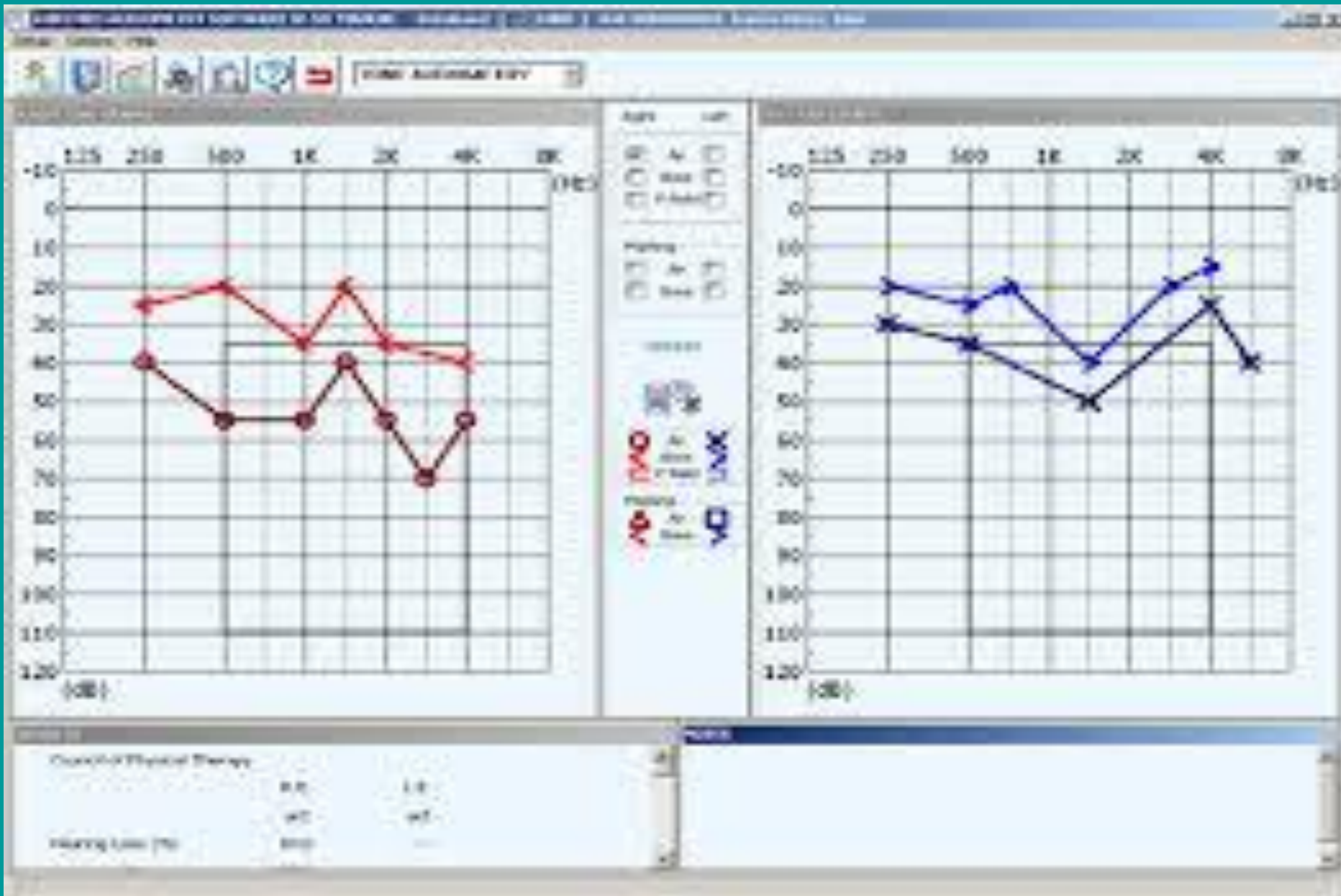


AUDIOGRAM INDICATING NORMAL HEARING
250
500
1000
2000
4000
8000
-10
0
10
20
30
40
50
60
70
80
90
100
110
INTENSITY
(in dBHL)
FREQUENCY (in Hertz)
Right Ear
Left Ear


Frequency in Hertz (Hz)
125
250
500
1000
2000
4000
8000
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
Hearing level in decibels (dB)
] Bone conduction test
X Air conduction test



Right Ear
Frequency (Hz)
125 250 500 1K 2K 4K 8K
750 1.5K 3K 6K 12K
Audiogram Symbol Key
Left Ear
Frequency (Hz)
Effective Masking Levels To Non-Test Ear
AC
BC
70 70 65 60 70
70 70 55 40 60



125 250 500 1K 2K 4K 8K
(Hz)
-10 0 10 20 30 40 50 60 70 80 90 100 110 120
(dB)

Audiometry

- Hearing thresholds levels

  *<20dB→ normal hearing

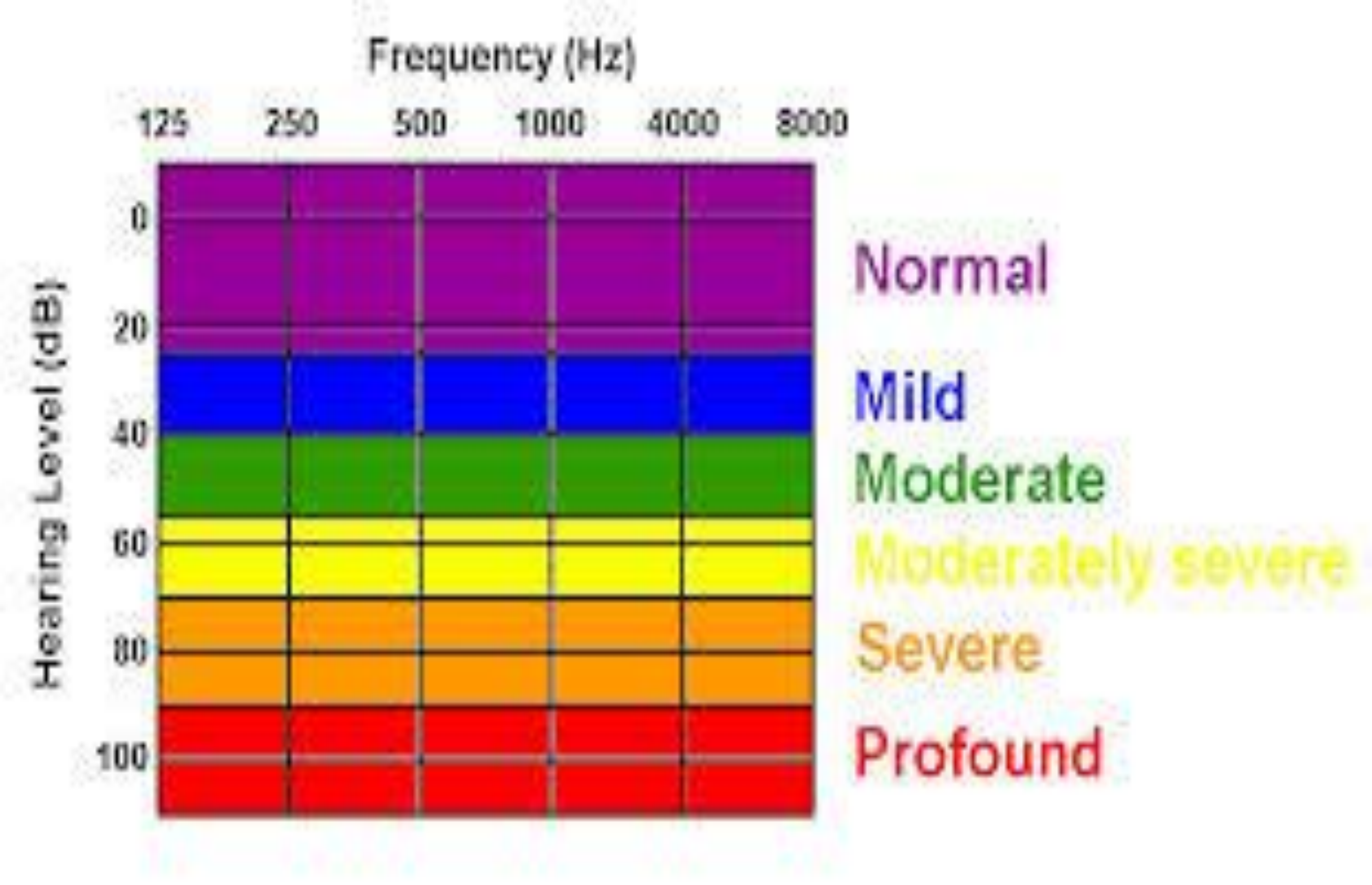
  *20-40dB→ mild hearing loss

  *40-55 dB → moderate hearing loss

  * 55-70 dB→moderate to severe hearing loss

  *70-90 dB → severe hearing loss

  *>90 dB →profound hearing loss


Frequency (Hz)
125
250
500
1000
4000
8000
Hearing Level (dB)
0
20
40
60
80
100
Normal
Mild
Moderate
Moderately severe
Severe
Profound


Turn up your hearing aid! He said, "your money or your life," not your money or your wife.

Impedance audiometry

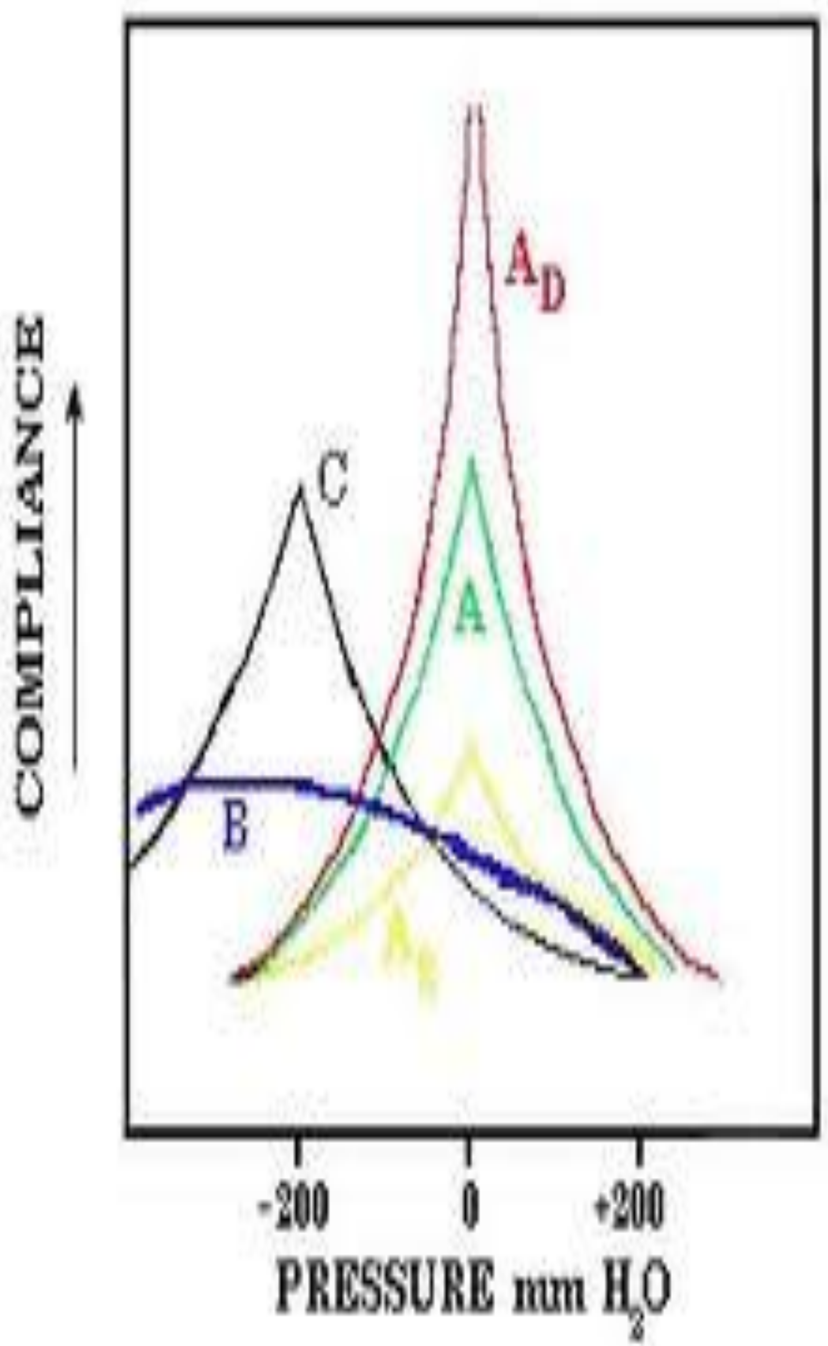
- It is an objective test widely used in clinical practice ,particularly useful in children it consist of :

  A) Tympanometry

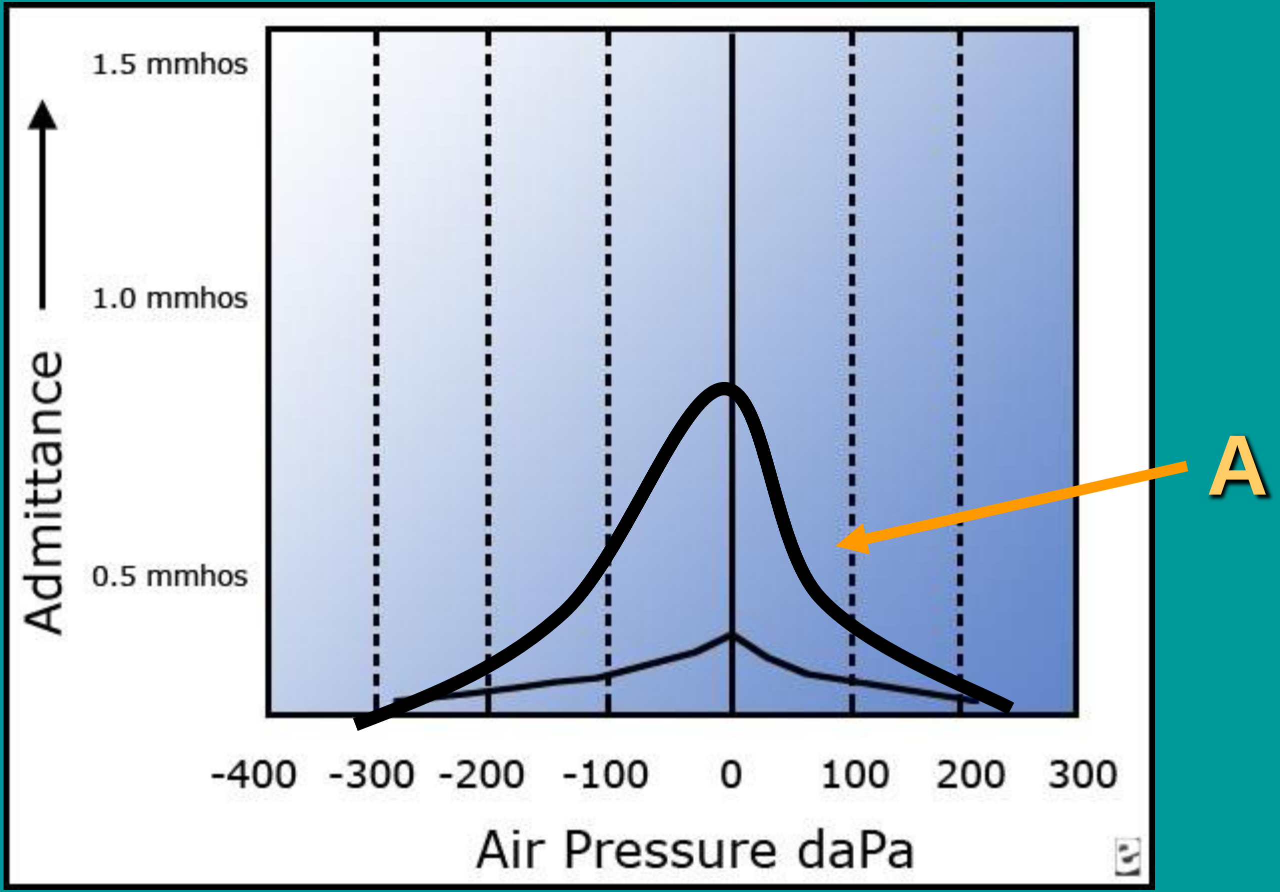
  B) Acoustic reflex measurement

Tympanometry

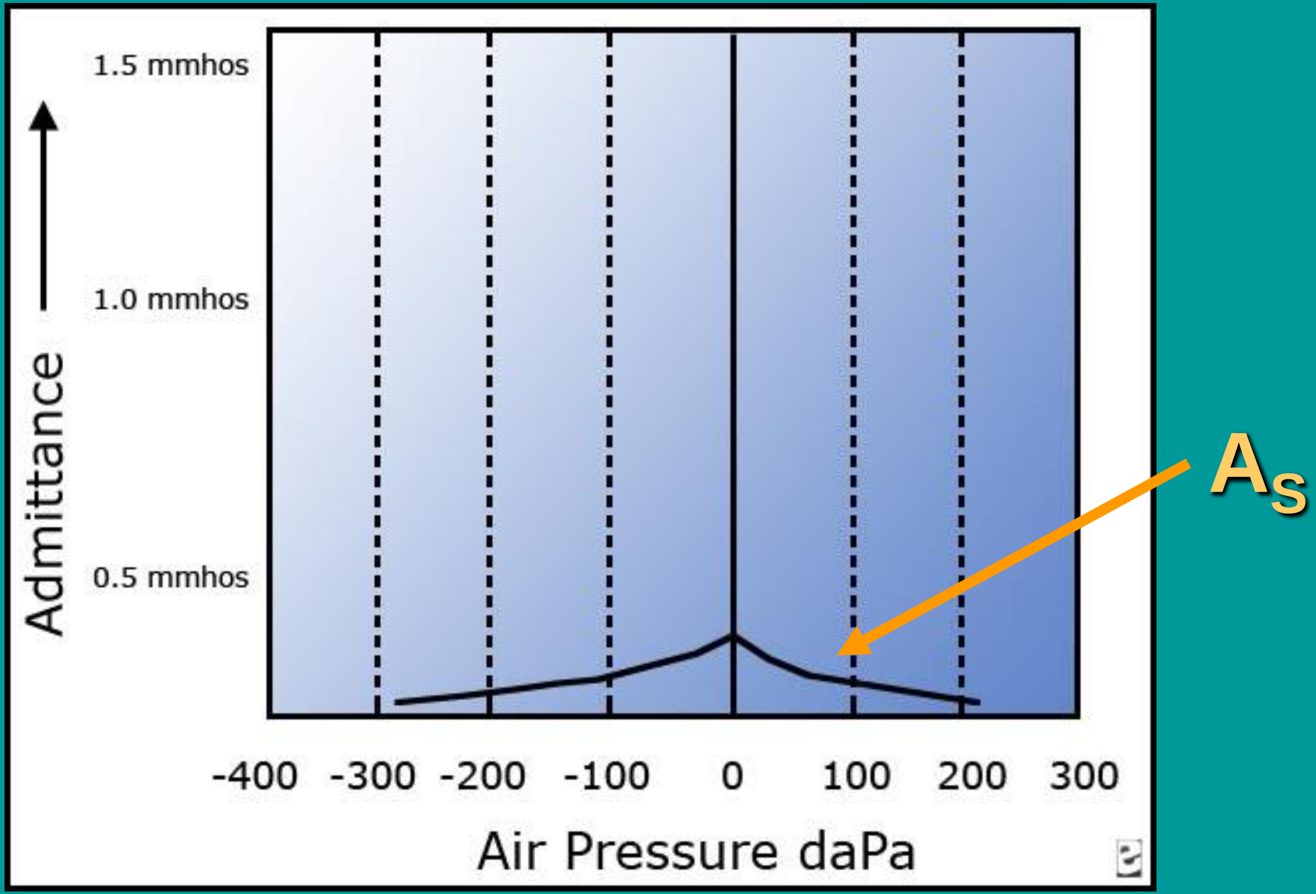
- Measures the mobility or compliance of the TM
- Different types of graphs called tympanograms are obtained which are diagnostic of certain middle ear pathologies:
- Type A : normal tympanogram
- Type As: compliance is lower seen in fixation of ossicles e.g. otosclerosis or malleus fixation
- Type Ad : high compliance seen in Ossicular discontinuity
- Type B : flat graph seen in M.E effusion ,or TM perforation
- Type C: Maximum compliance occurs with negative pressure ,seen in retracted TM


COMPLIANCE
A_D
C
A
B
A_s
-200
0
+200
PRESSURE mm H_2O

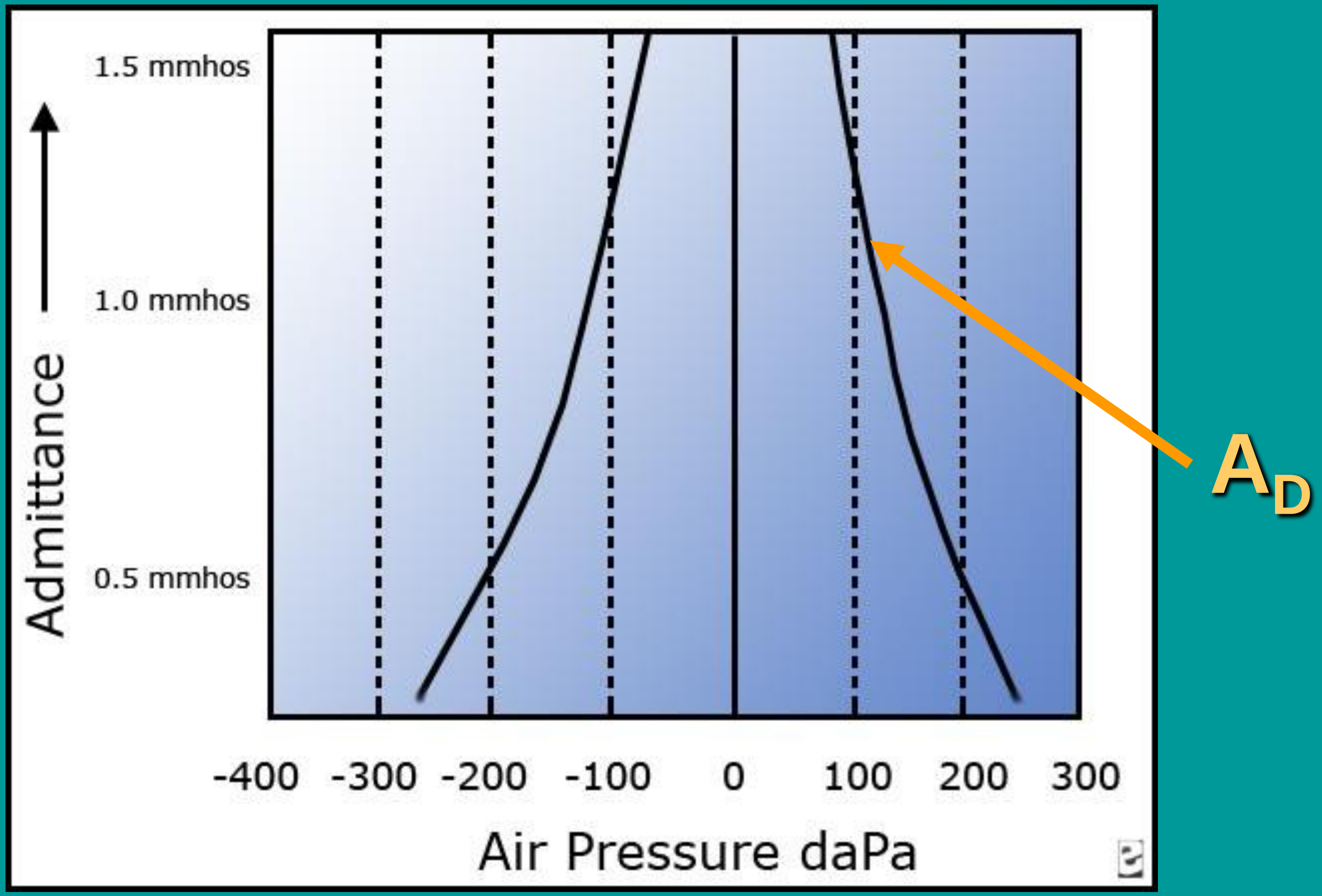
Jerger-Liden Classifications



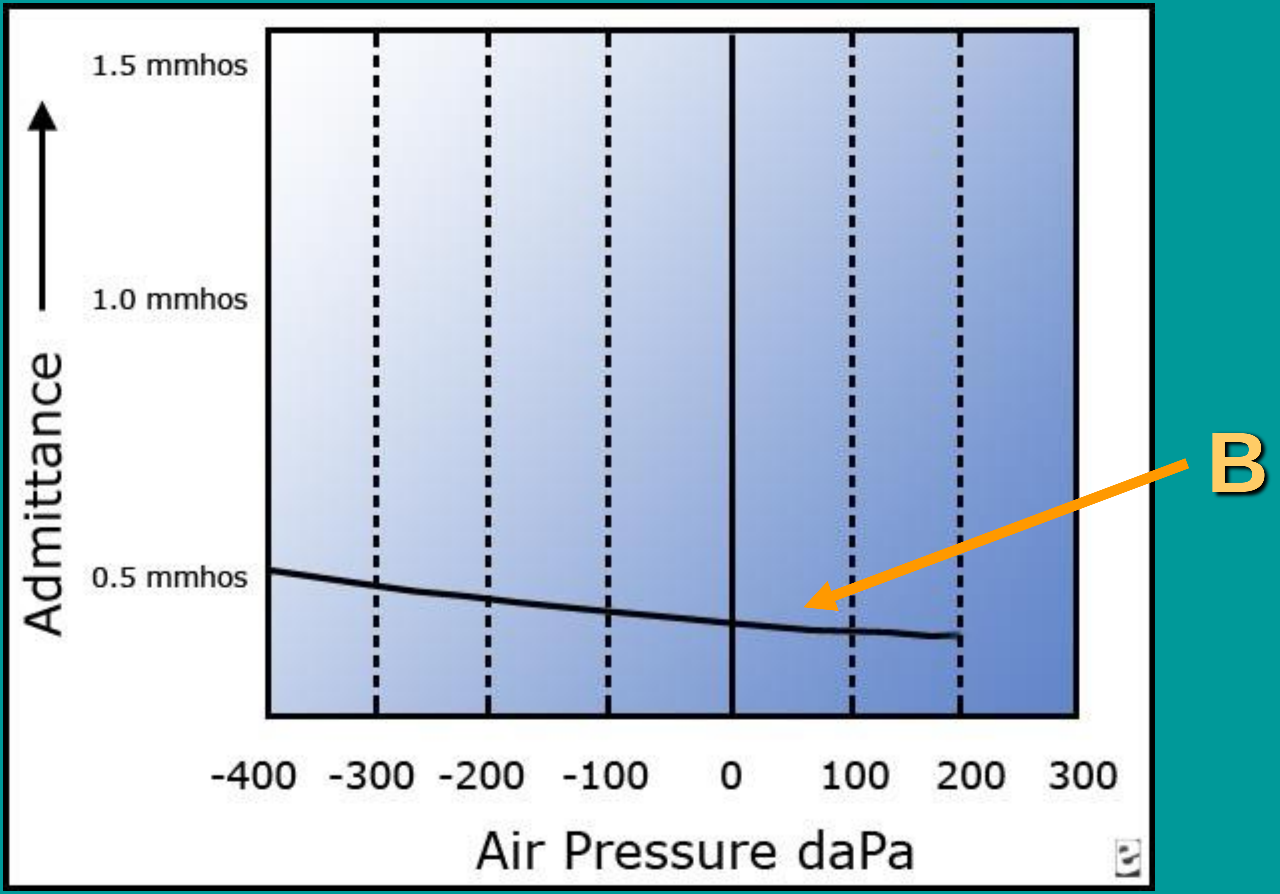
Some Fluid or Ossicular Fixation



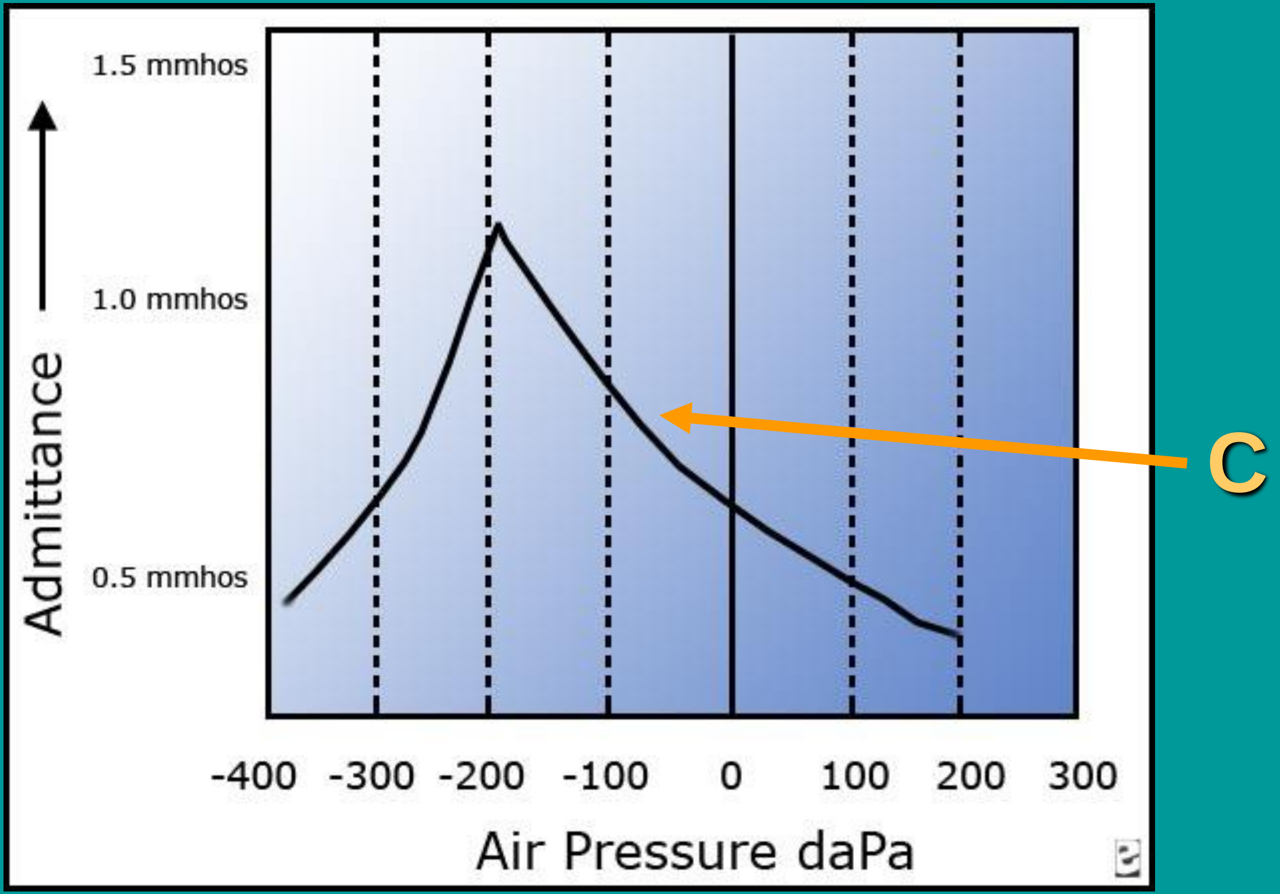
Ossicular Disarticulation, Atrophic Tympanic Membrane Scarring



Middle Ear Effusion, TM Perforation, Cerumen Occlusion

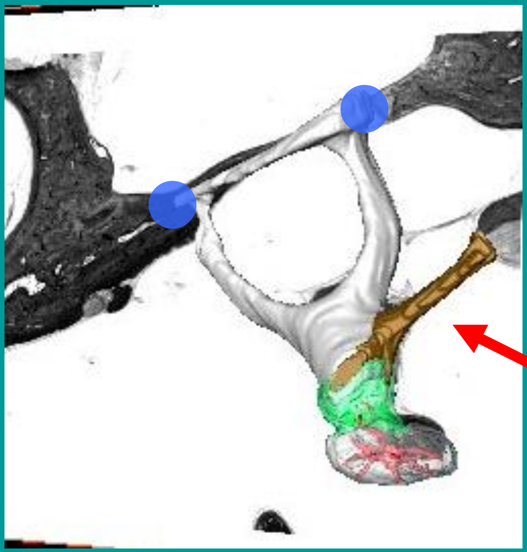


Negative Middle Ear Pressure



The Acoustic Reflex

Anatomy



Acoustic reflex(Stapedial reflex)

- BASED on the fact that a loud sound,70-100 dB above the threshold of hearing of particular ear causes bilateral contraction of stapedial muscle which can be detected by tympanometry ,tone can be delivered to one ear and the reflex picked from the same or the contralateral ear
- The test is useful in several ways :

A) Test the hearing in infants & young children , it is an objective method .

B) To find malingers

C) To detect cochlear pathology: presence of stapedial reflex at lower intensities e.g. (40-60)dB indicate recruitment(cochlear type of HL)

D) To detect VIII nerve lesion :(Decay test)

E) Lesions of facial nerve : absence of stapedial reflex when hearing is normal ,it can also be used to find prognosis of facial nerve paralysis reappearance of reflex is a favorable prognosis

Auditory brainstem response audiometry (ABR)

- objective non invasive test to find the integrity of central auditory pathways through the VIIIth nerve ,Pons ,and midbrain

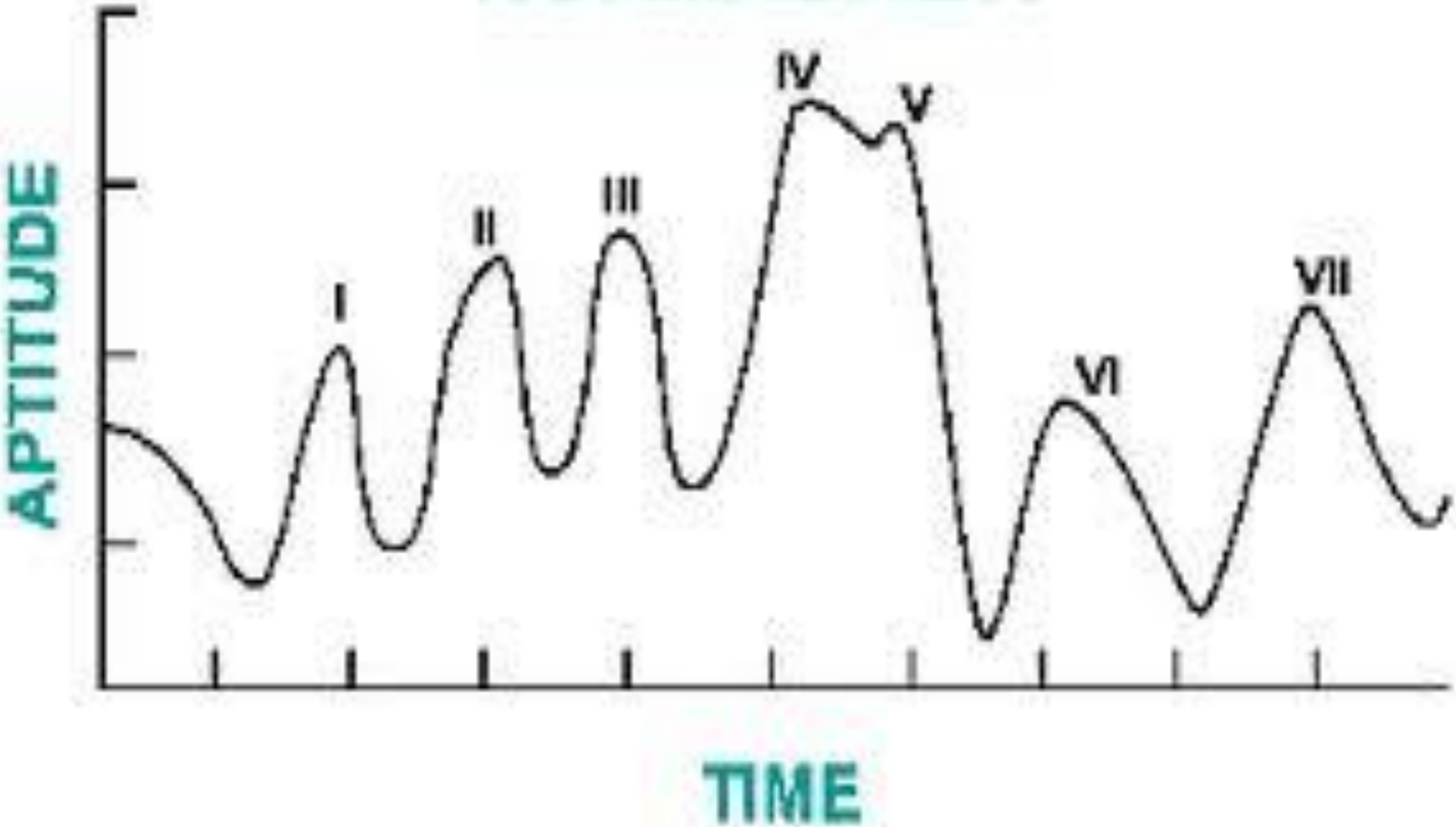
-ABR is of great value to find out the threshold of hearing in infants ,particularly the high risk groups, and the diagnosis of retrocochlear lesion

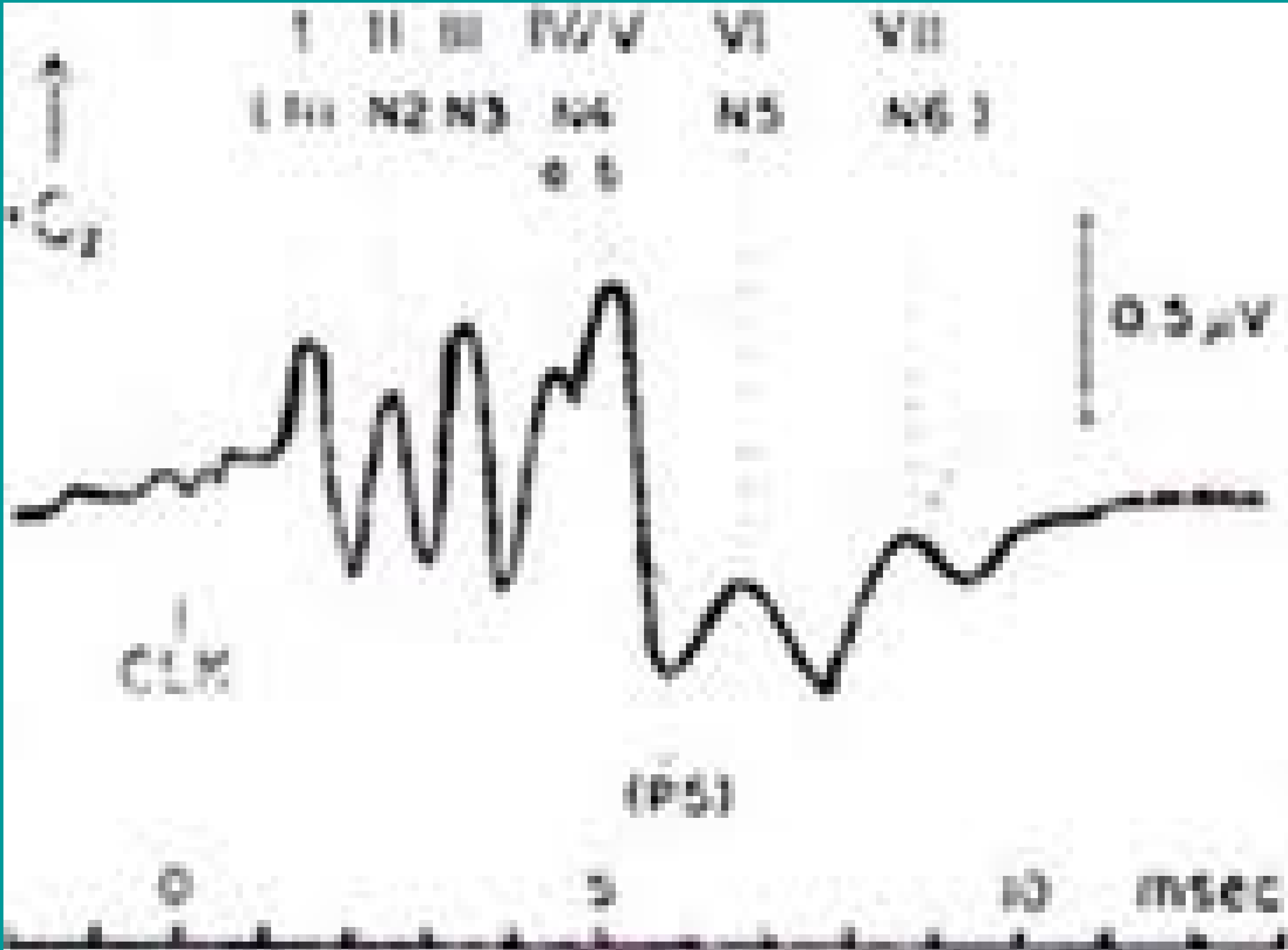
-

Auditory brainstem response audiometry (ABR)

- It measures hearing sensivity in the range of 1000-4000 HZ
- In a normal person, 7 waves are produced in the first 10 msec
- V1 ,V3 ,V5 are most stable and are used in measurements.
- The waves are studied for absolute latency ,inter-wave latency(VI-V5) and the amplitude

NORMAL ABR

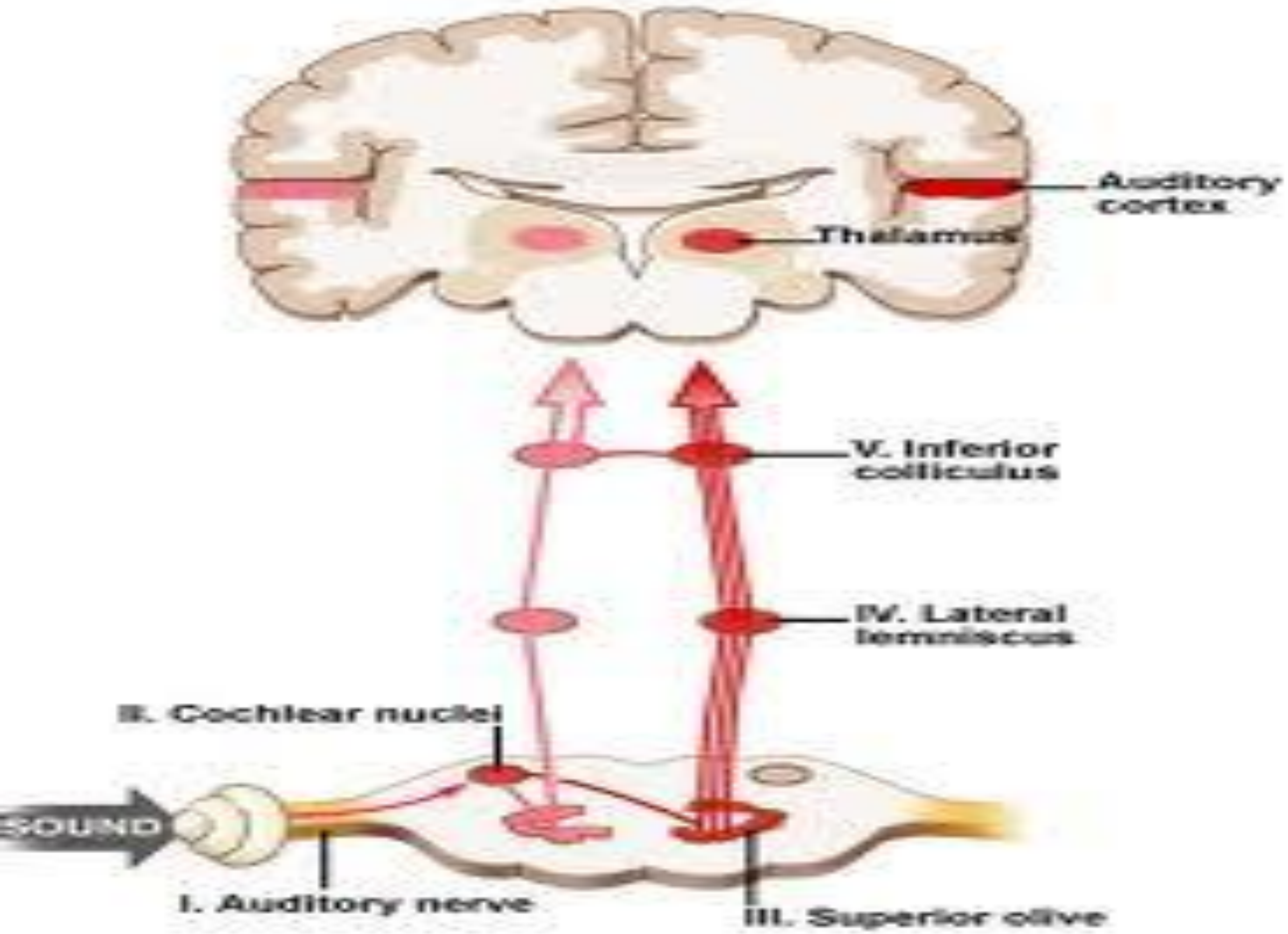



I II III IV/V VI VII
N2 N3 N4 N5 N6
0.5 μV
CLK
(P5)
0 5 10 msec

Auditory brainstem response audiometry (ABR)

- The mnemonic ,E.COLI .MA .will help to remember which structure corresponds to each wave form.

- Wave I : VIIIth nerve
- Wave II : Cochlear nuclei (Pons)
- Wave III: Superior olivary complex (pons)
- Wave IV : lateral lemniscus (Pons)
- Wave V : Inf colliculus (mid brain)
- Wave VI : Medial geniculate body (thalamus)
- Wave VII: Auditory radiations (thalamocortical)


Auditory cortex
Thalamus
V. Inferior colliculus
IV. Lateral lemniscus
II. Cochlear nuclei
SOUND
I. Auditory nerve
III. Superior olive

otoacoustic Emissions OAE

- It is non-invasive objective test of cochlear pathology
- OAE are low intensity sound produced by movements of the outer hair cells of the cochlea and produced spontaneously or in response to the acoustic stimuli
- OAE :can picked up by microphone placed in the EAC
- OAE : valuable in the diagnosis of HL where there is damage to the outer hair cells e.g. acoustic trauma ,and Ototoxic drugs ,and assessment of haring in infants

34 y

TEOAE : R = 19.5 dB SPL

L = 17.3 dB SPL

TEOAE suppression :

R = 0.6 dB

L = 0 dB