

# Assessment of Hearing in children

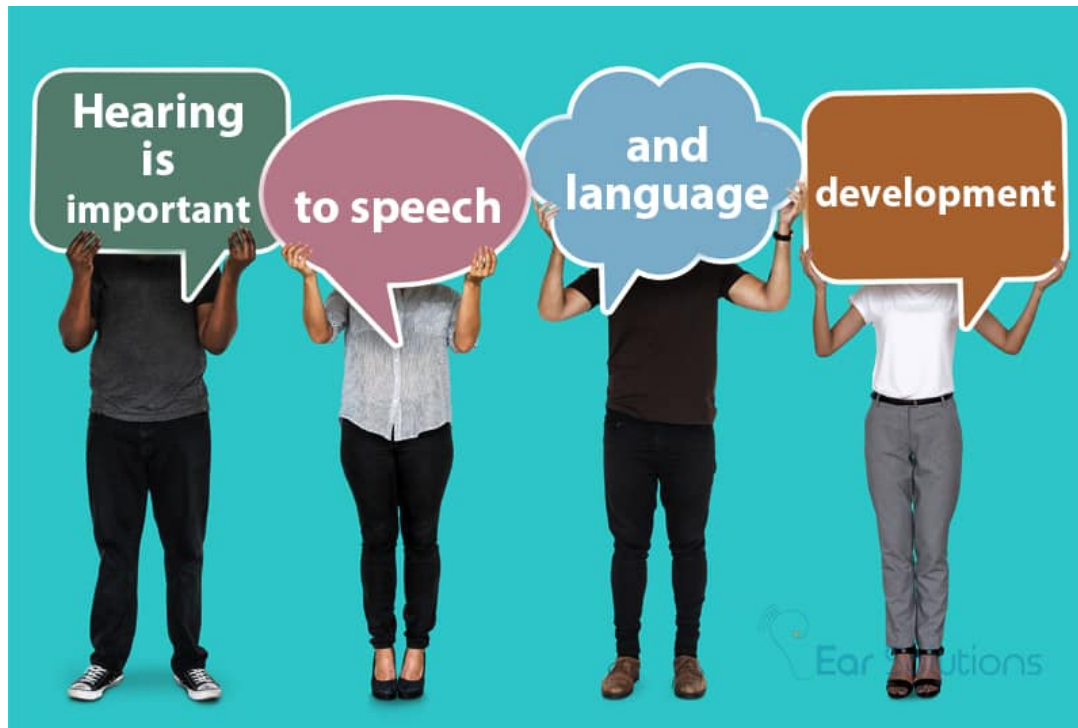
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**School of Medicine, University of Jordan**

**V. August 2023**

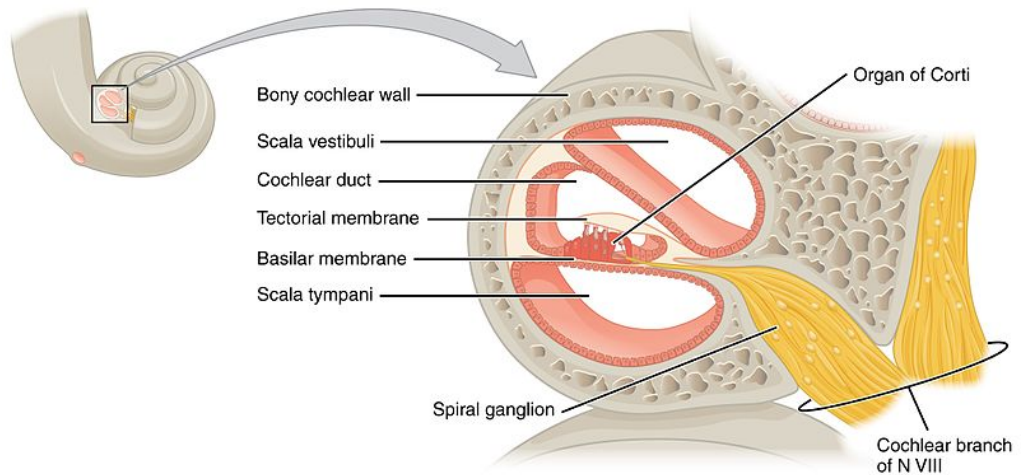
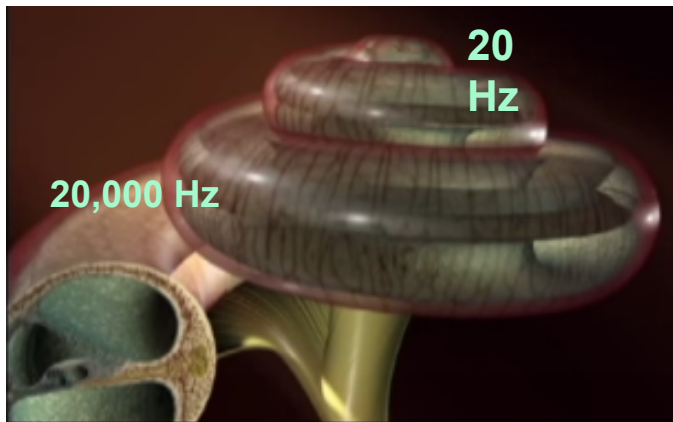
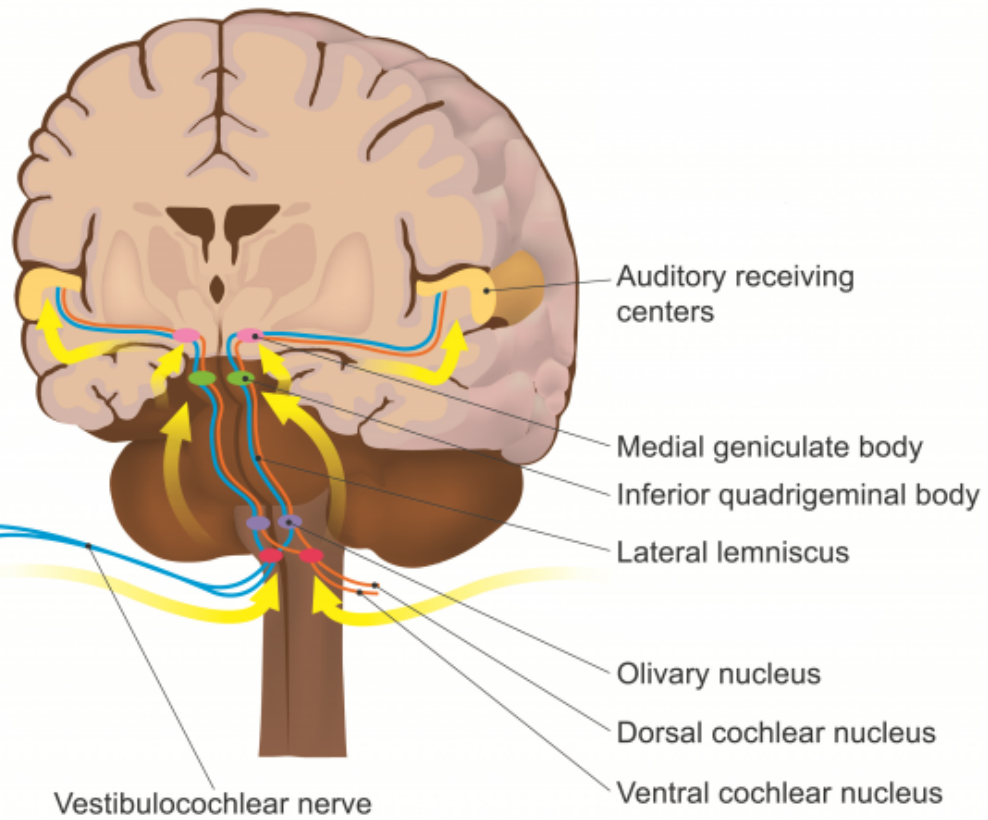
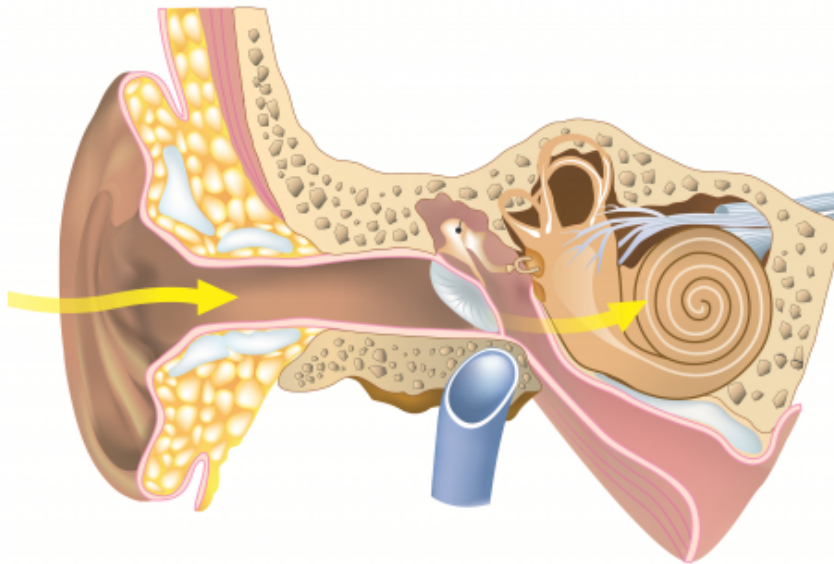


# Why assess for and address hearing loss?

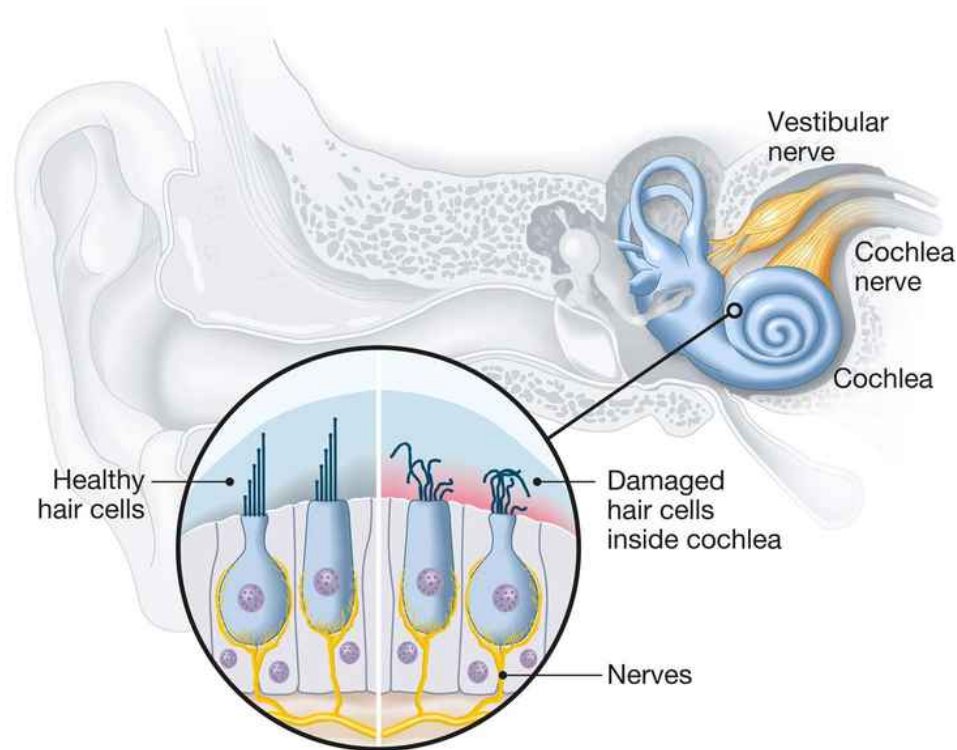


# How do we hear?

- Medial geniculate
- Inferior colliculus
- Superior olive
- Cochlear nucleus

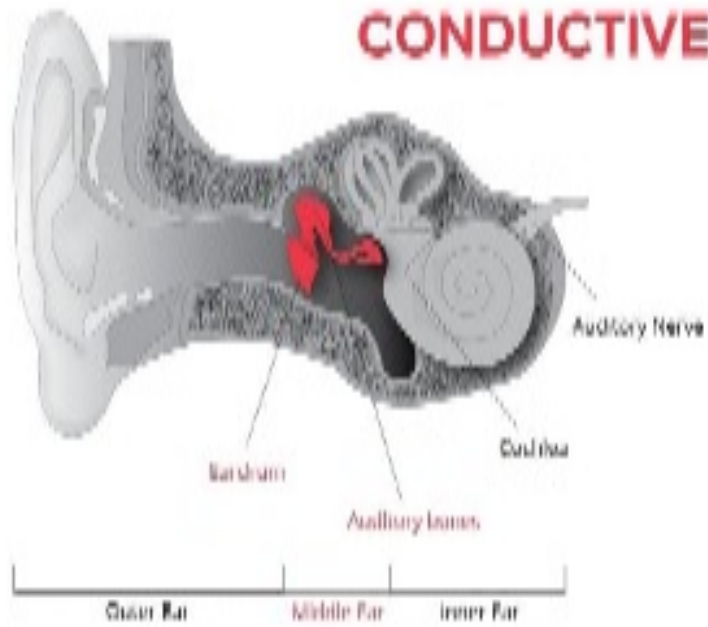


The most common form of sensorineural hearing loss is due to cochlear pathology (sensory hearing loss).

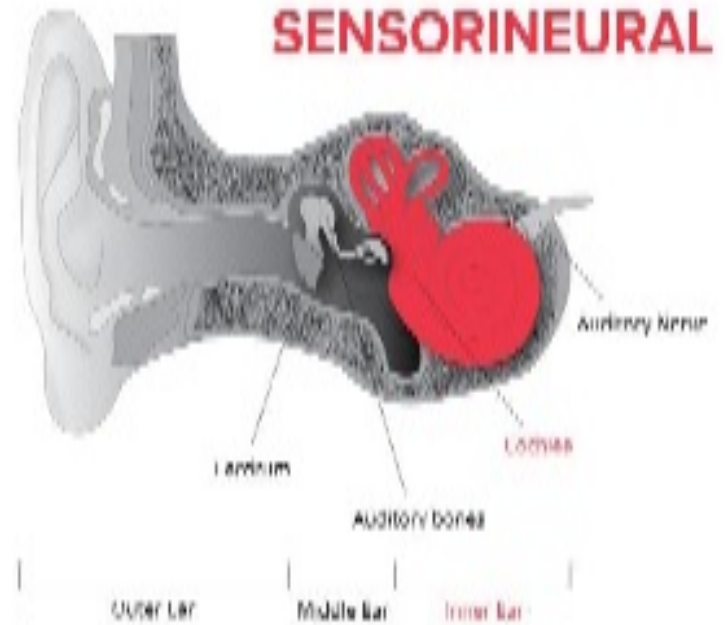




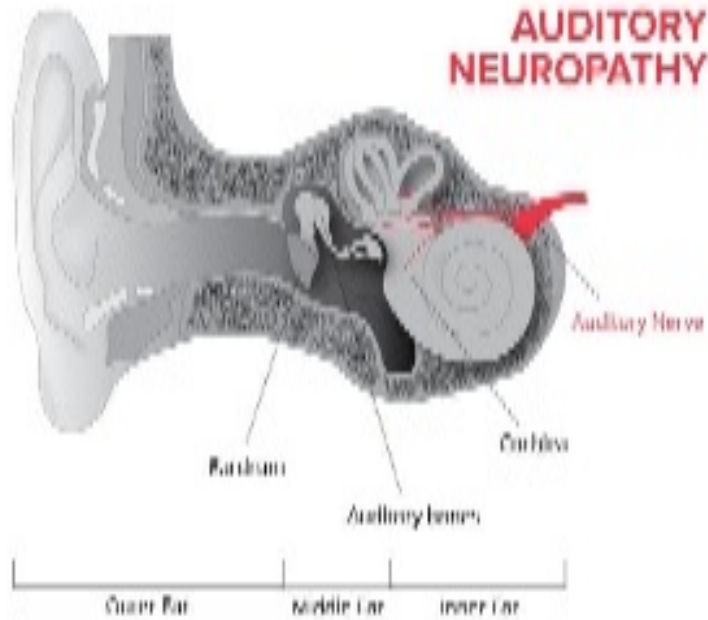
## CONDUCTIVE



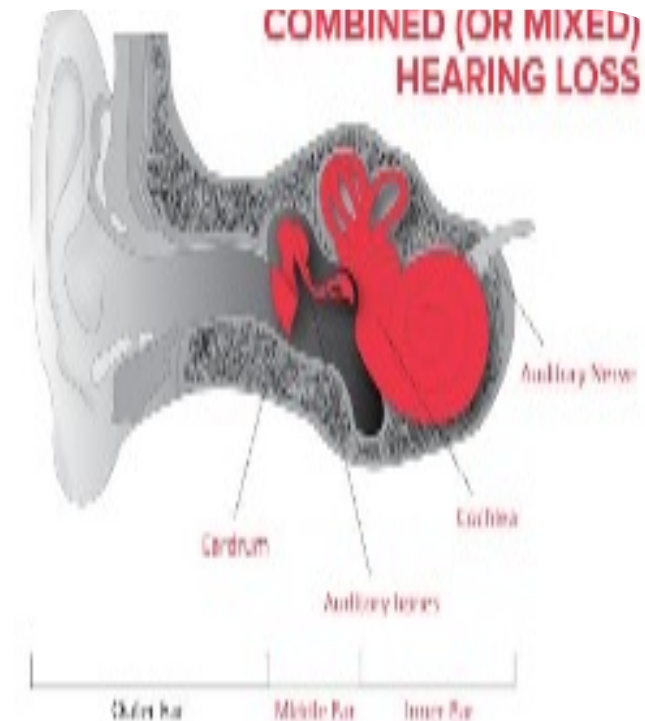
## SENSORINEURAL

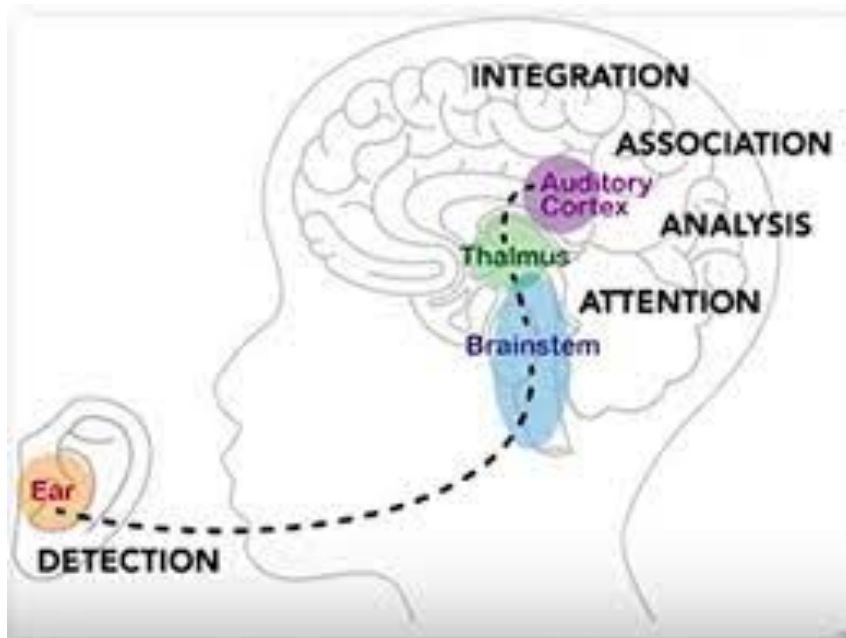


## AUDITORY NEUROPATHY



## COMBINED (OR MIXED) HEARING LOSS





**Auditory processing disorder**



# How to **FAKE** a Hearing Loss

**Non-organic hearing loss**

# Screening for Hearing loss in children

To diagnose and  
manage hearing loss  
early on.

Ideally all newborn  
infants should be  
screened  
(1 month).

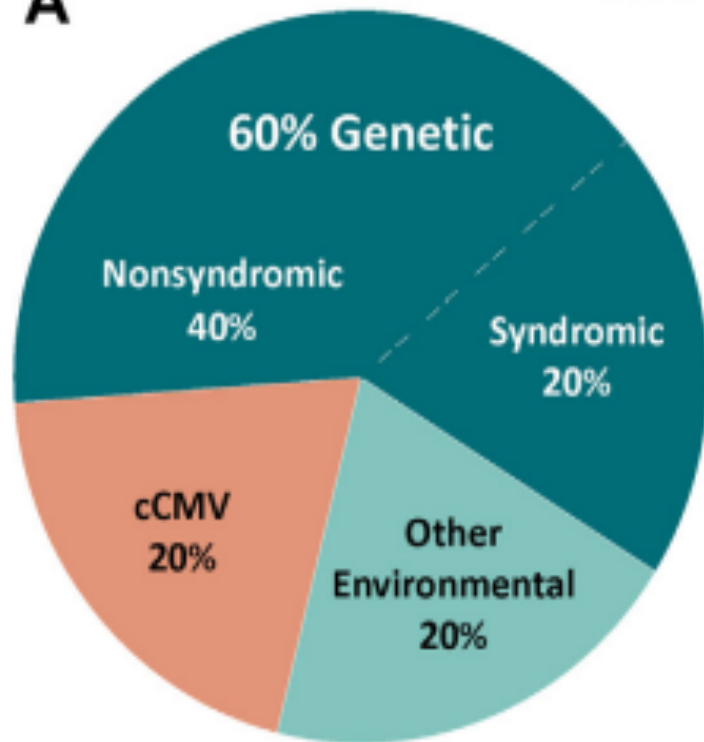
People at high risk  
should be screened  
repeatedly.

50% of patient with  
hearing loss do not  
have any known risk  
factor

# Sensorineural hearing loss (SNHL)

Incidence in newborns  
(1 to 2 per 1,000)

**A**



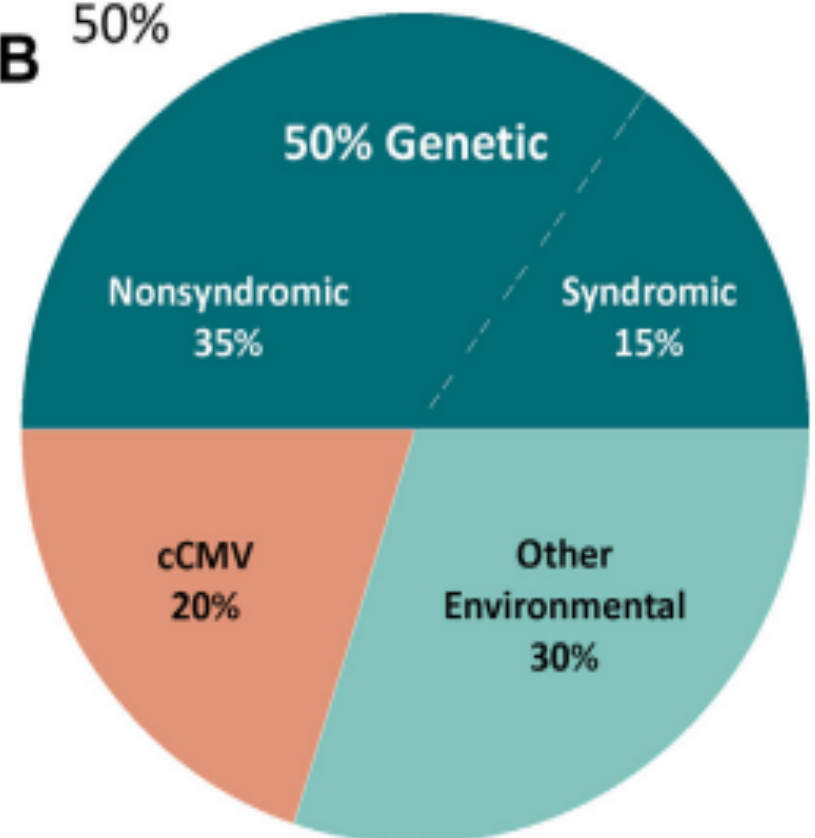
TOTAL  
GENETIC

60%

**B**

50%

Prevalence in children  
(3 to 4 per 1,000)





Hearing loss is considerably higher in low-income countries

Country	Rate per 1,000	Country	Rate per 1,000
Brazil	2.4	Pakistan	13
China	2.8	Philippines	22.1
Cyprus	1.19	Qatar	53.4
India	5.0-5.6	Saudi Arabia	1.8
Jordan	13.7	Slovakia	1.5
Kuwait	51.2	South Africa	1
Malaysia	4.4-12.5	Taiwan	1.3
Mexico	1.6	Thailand	67.1
Nigeria	5.3-28	Turkey	4.2
Oman	1.2		

# Risk factors for hearing loss among children

Maternal infection: toxoplasmosis, rubella, cytomegalovirus, herpes simplex, syphilis, septicemia	Childhood infectious disease (e.g., bacterial meningitis)
Intrauterine exposure to radiation	Stigma of syndromes or craniofacial anomalies
Maternal or child ototoxic drug use	Head trauma
Hypoxia and prolonged mechanical ventilation	Family history
Birth weight <1500 g	Children with neurodegenerative disorders
Prematurity	Parental suspicion of hearing loss
Hyperbilirubinemia	Parents concern of delayed language and speech



History and physical examination



# Audiologic tools of hearing assessment

- Otoacoustic emissions (OAE)
- Auditory Brainstem Response Audiometry (ABR)
- Pure Tone Audiometry (PTA)
- Play Audiometry
- Visual Reinforcement Audiometry (VRA)
- Tympanometry



Infants and children who cannot give behavioural response



- Otoacoustic emissions (OAE)
- Auditory Brainstem Response Audiometry (ABR)

Older children who can perform the behavioural tests

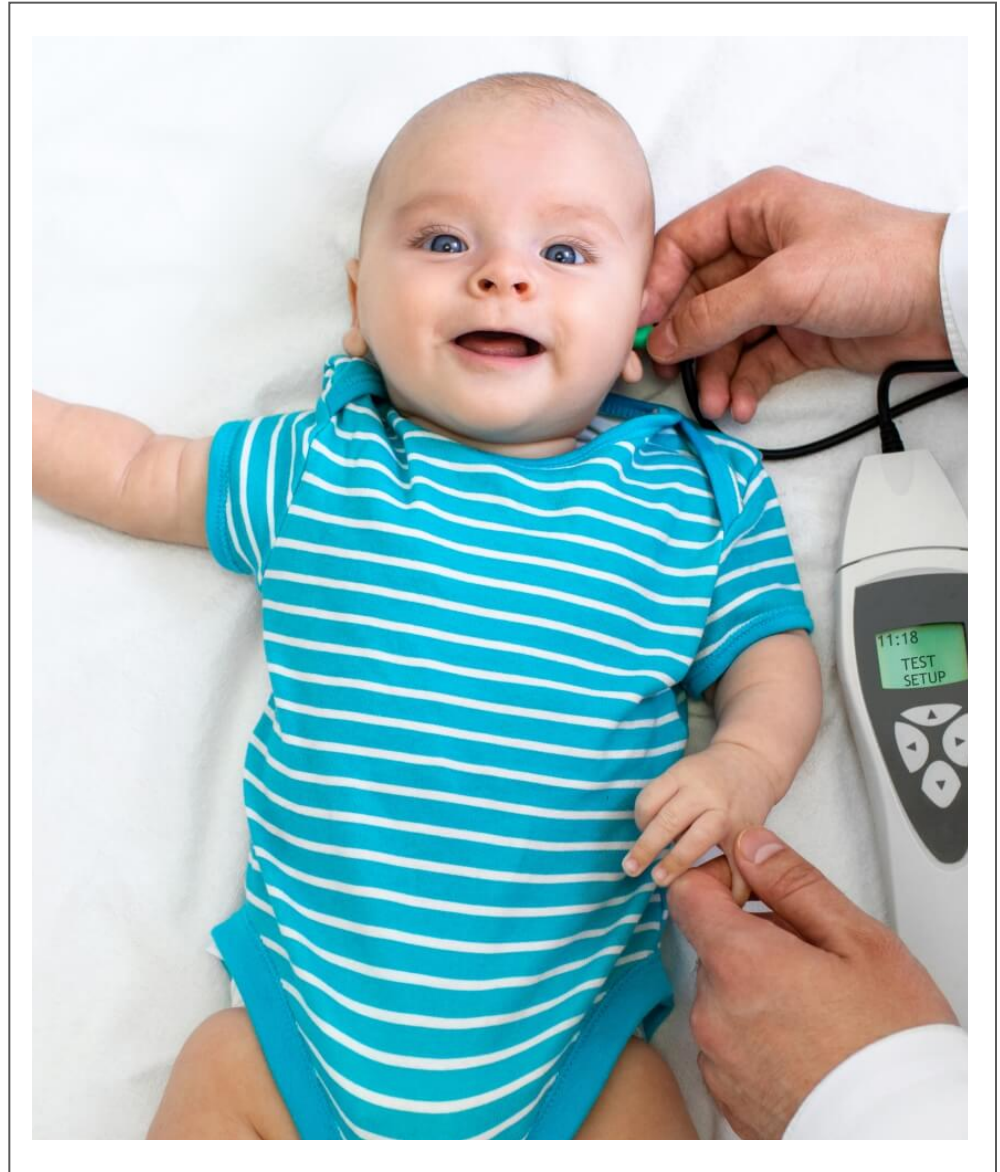


- Pure Tone Audiometry (PTA)
- Play Audiometry
- Visual Reinforcement Audiometry (VRA)

Most need to be accompanied by middle ear testing by Tympanometry

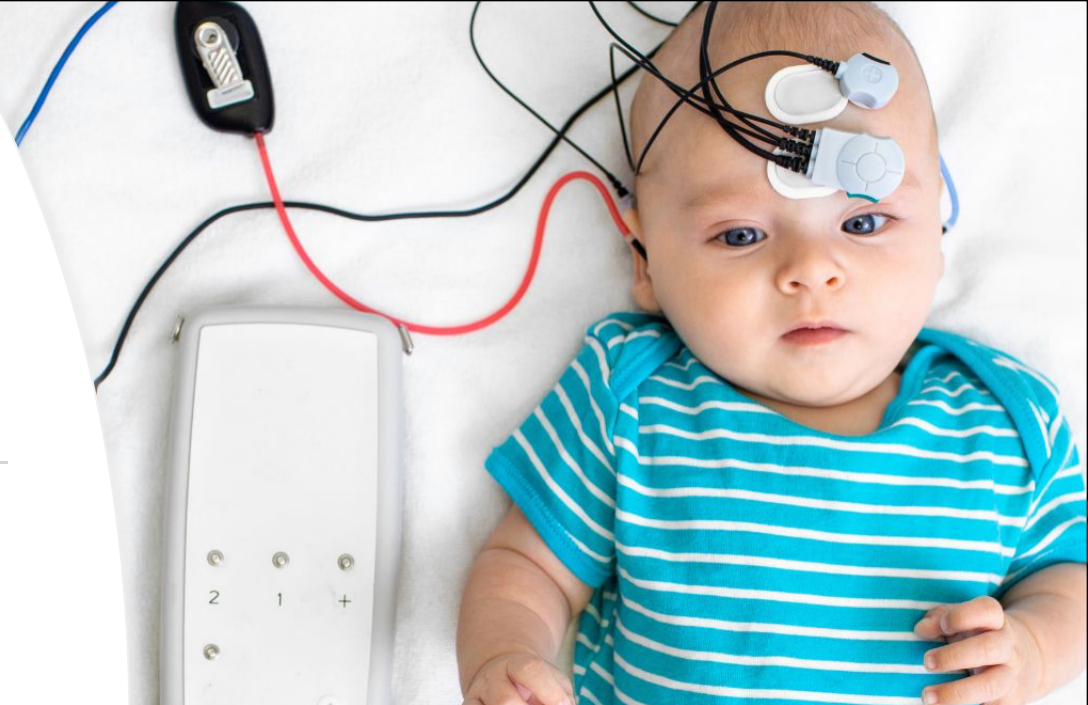
# Otoacoustic Emissions (OAE)

- Sounds are produced by the cochlea.
- Outer hair cell motility generates mechanical energy within the cochlea and propagates to the external ear canal via the middle ear which can be measured by sensitive microphones.
- Cost-effective objective screening tool.
- 80-90% sensitivity and specificity.
- Cannot detect auditory neuropathy.
- Results can be affected by external and middle ear conditions.



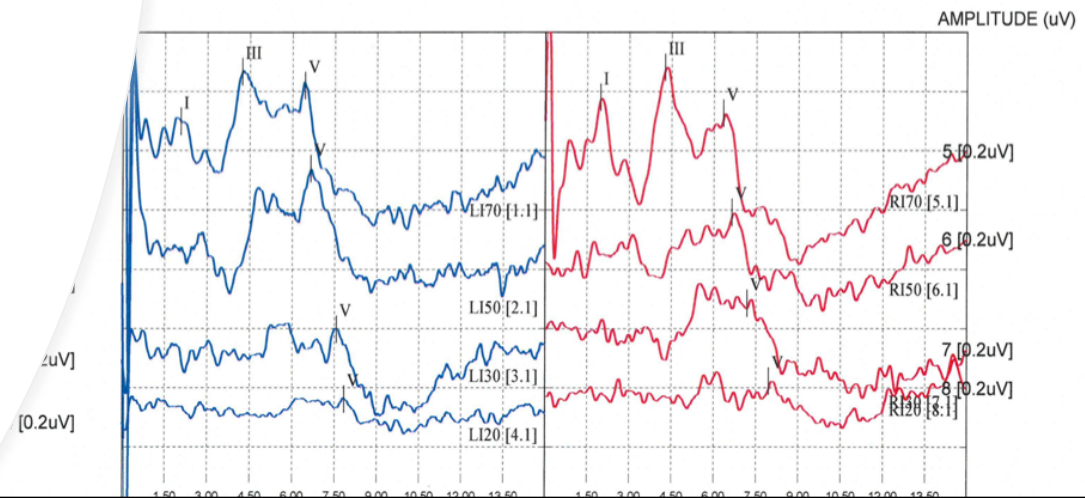
# Auditory Brainstem Response Audiometry (ABR)

- Auditory evoked potentials extracted from ongoing electrical activity in the brainstem and brain, after acoustic stimulation.
  - Recorded via electrodes placed on the scalp.
  - It is a test of synchronous neural function. However, it can be used to estimate hearing sensitivity.
- ✓ Detects auditory neuropathy.
- ✓ More specific but more expensive.
- ✓ Needs the individual to be sleeping or completely relaxed. Sometimes sedation.



## Jordan University Hospital Otolaryngology-Audiology clinic Auditory Evoked Potentials

Birthdate: 25/12/2012



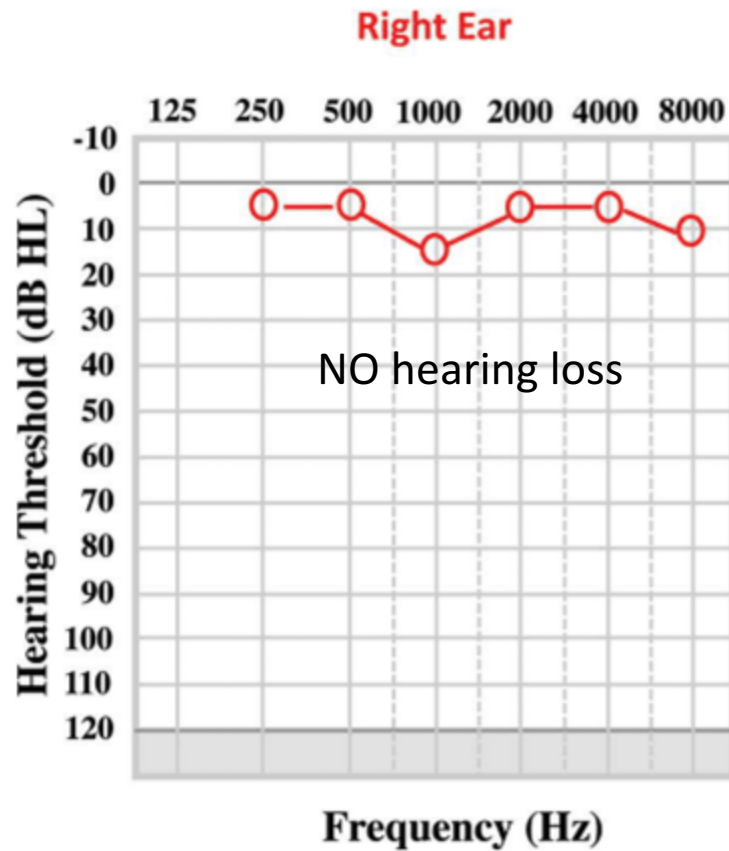


# Pure tone audiometry PTA

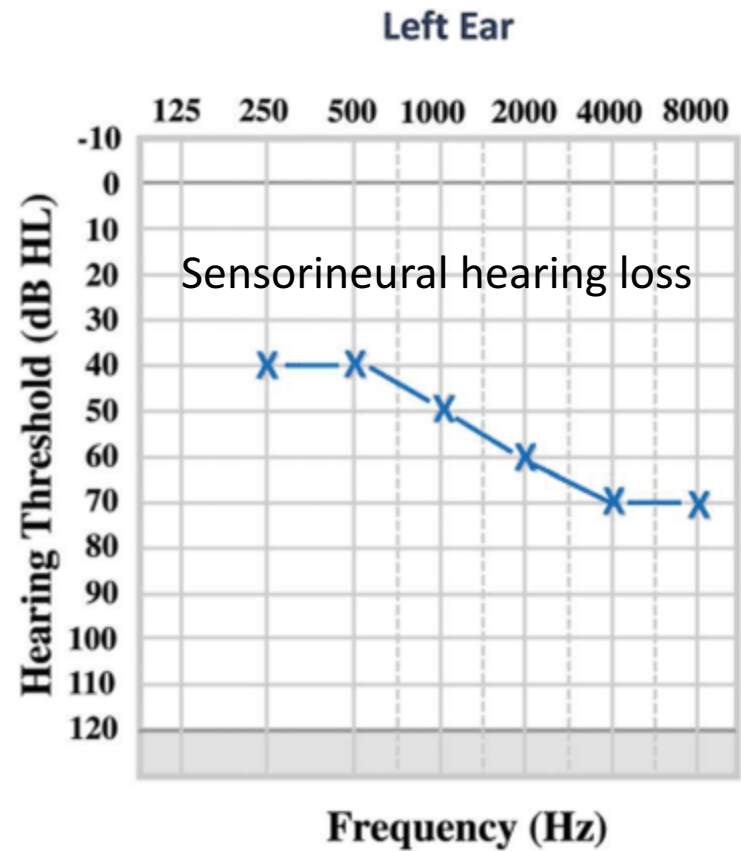
- Needs the child to understand and cooperate.
- Mental age above 4 years.



# Pure tone audiometry



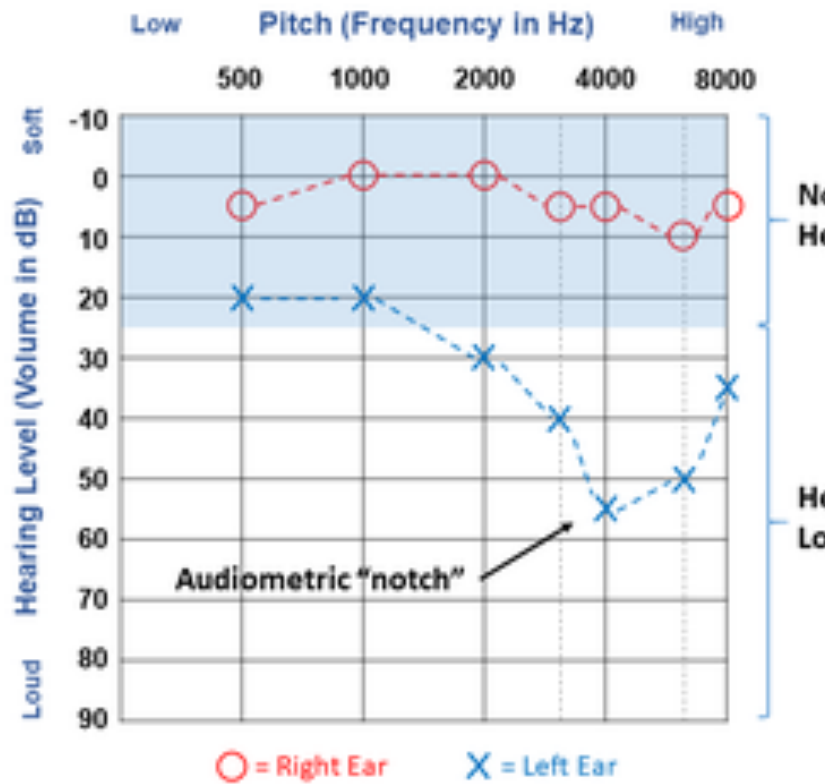
(a)



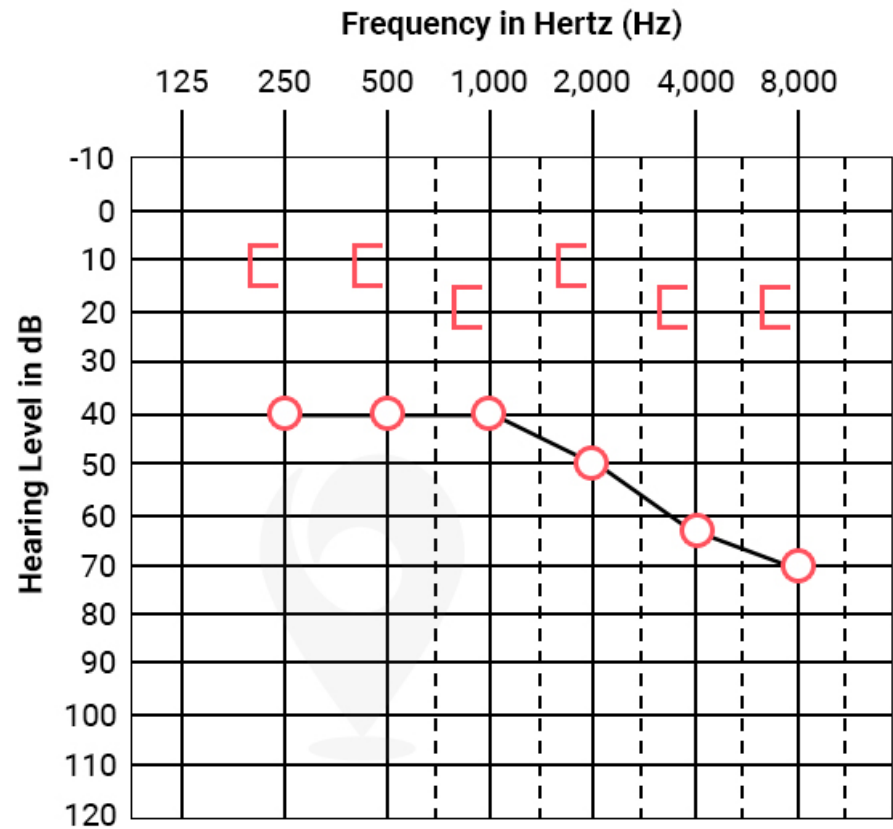
(b)



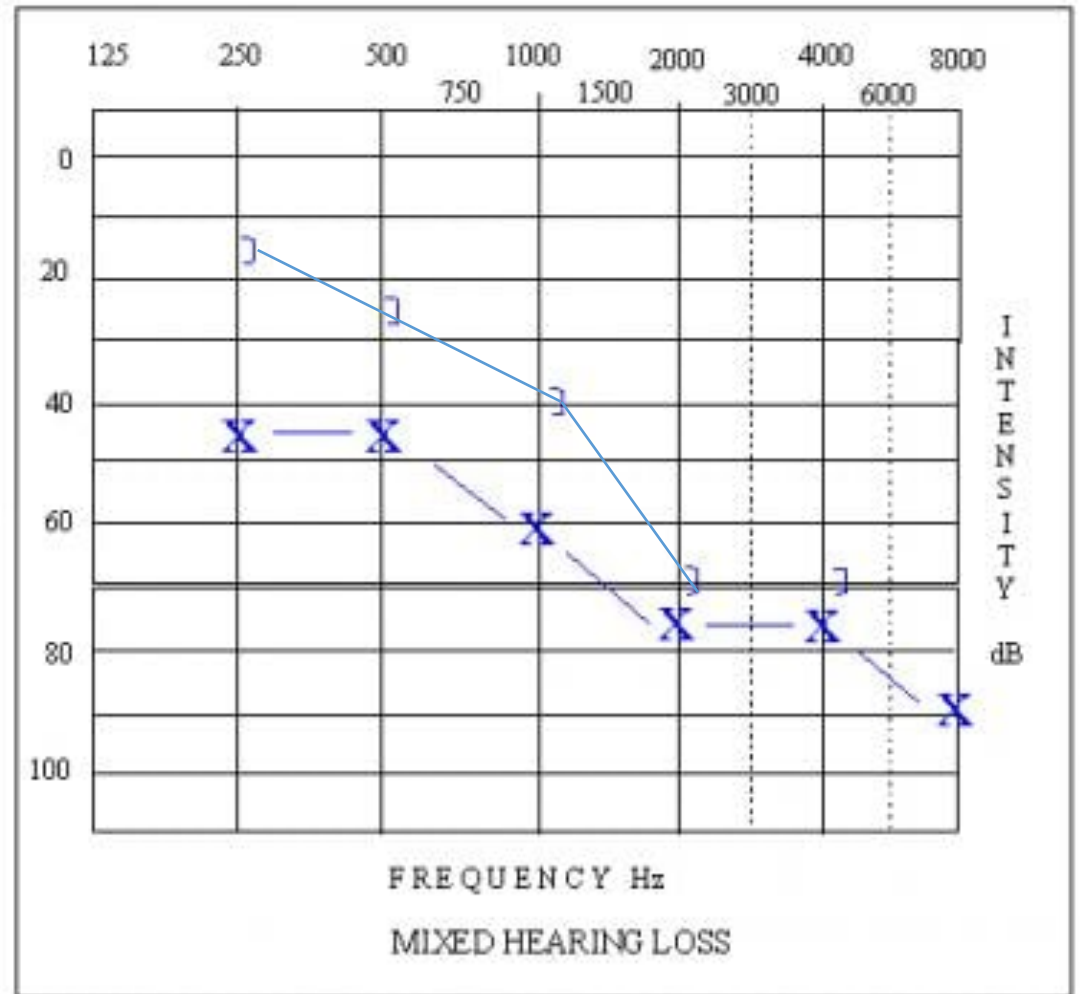
Right Normal  
Left SNHL



Right conductive hearing loss



# Mixed hearing loss



# Play Audiometry

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- A modification of standard pure tone audiometry.
- Play audiometry conditions the child to respond to the sound by playing e.g. placing a toy in a container.



# Visual reinforcement audiometry VRA

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- A modification of standard pure tone audiometry.
- For younger children.
- Encourage the child to respond to the sound by giving a visual stimulus when the child responds correctly to the sound.

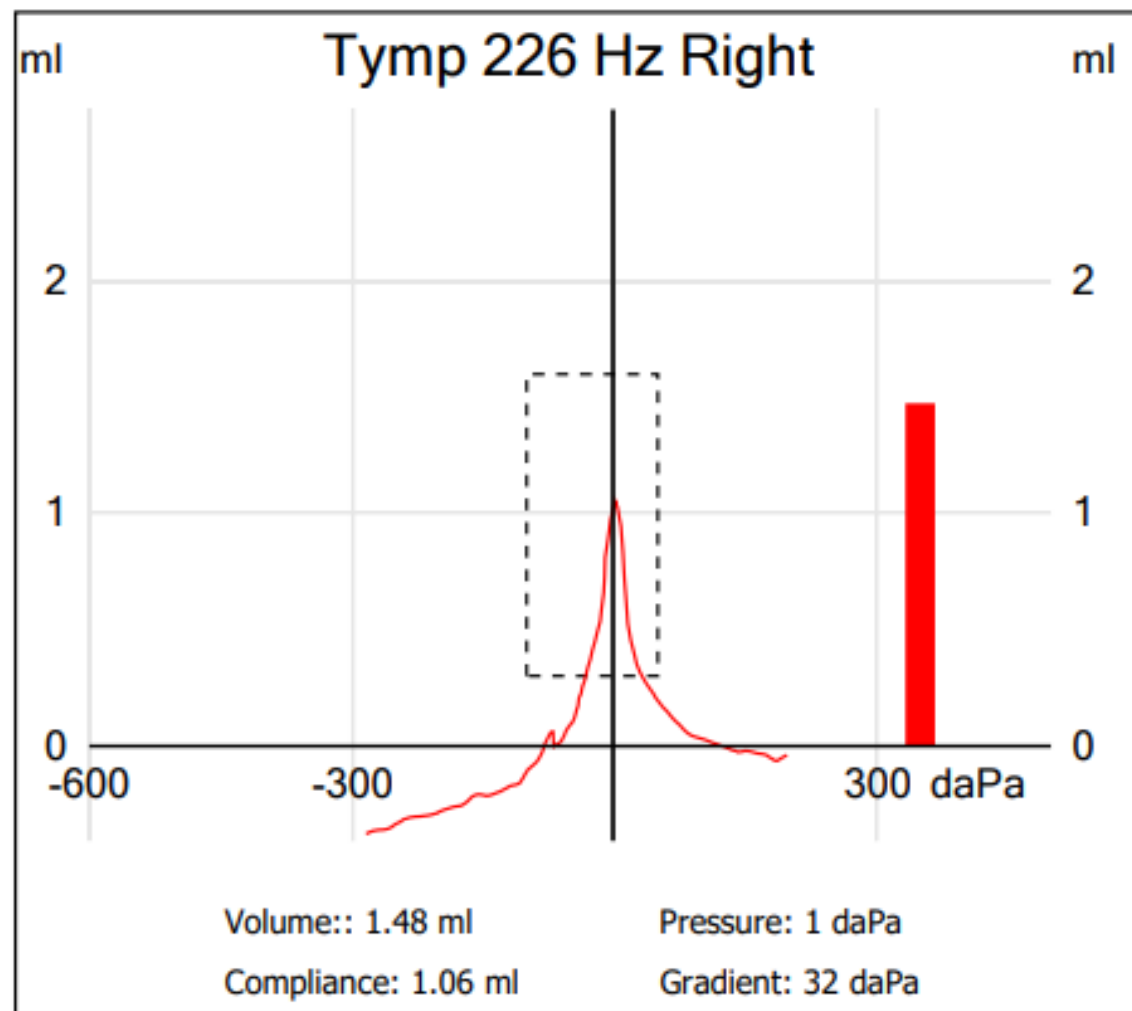


# Tympanometry

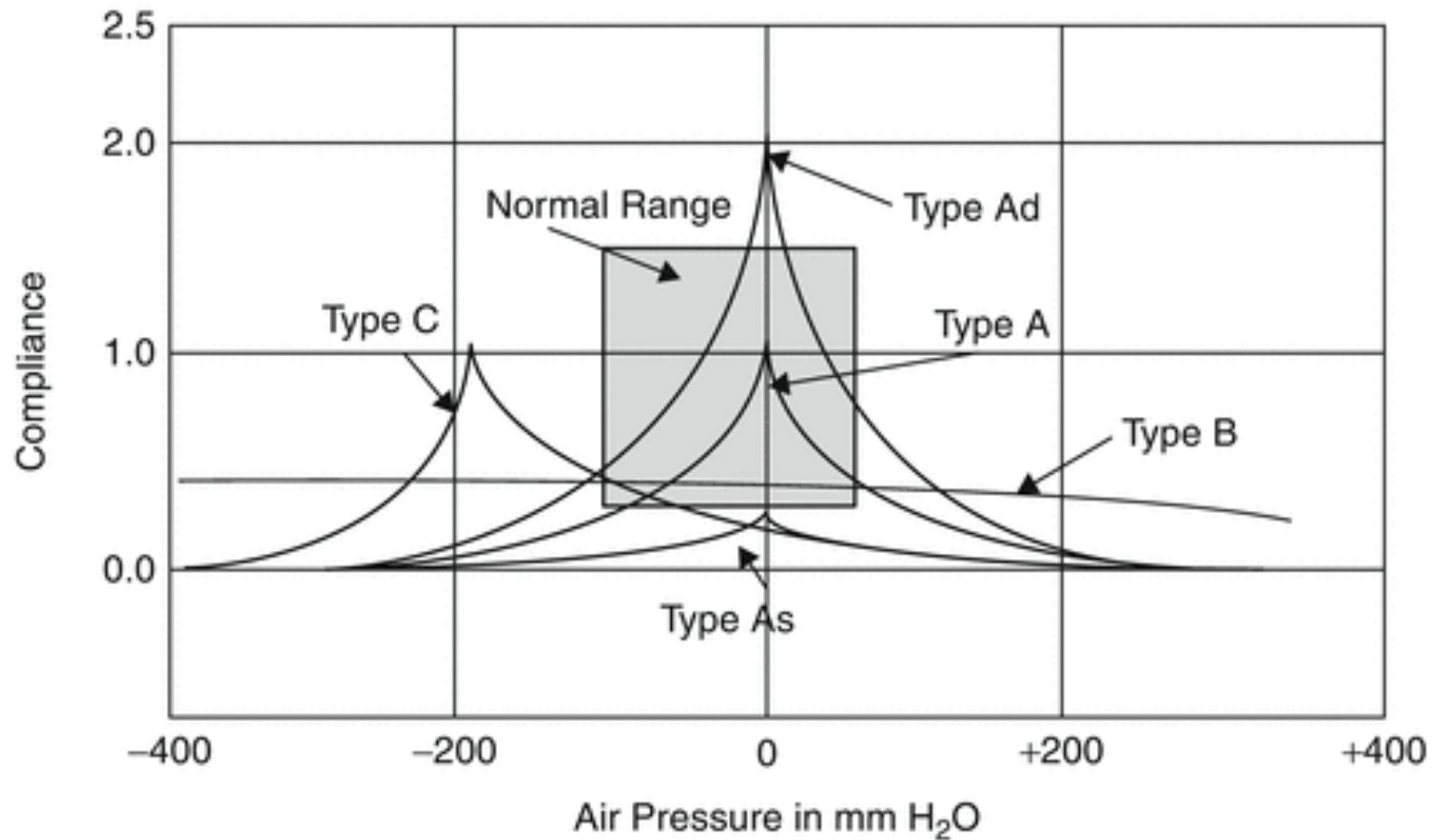




# Tympanometry



# Tympanograms: normal & abnormal shapes



# Rehabilitation Options

- Hearing Aids
- Cochlear implants
- Hearing rehabilitation; sign language, school for deaf people, lip reading

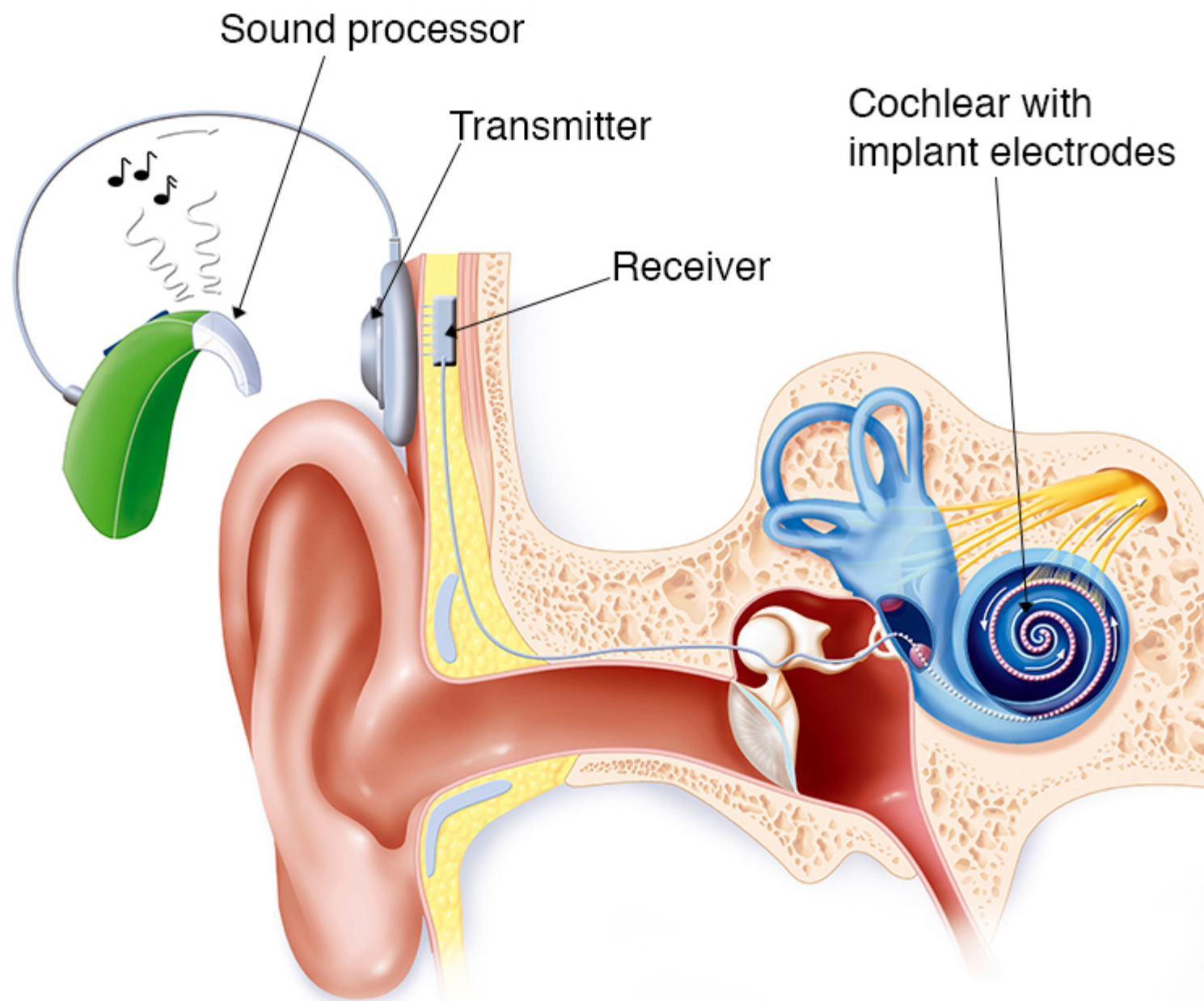
**Pediatric  
Hearing Aid  
Devices**



# Cochlear implant







**Cochlear implant**

The end