Hearing Loss in Primary Care

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Overview

- Review ear anatomy
- Evaluation of hearing
- Types of hearing loss
- Specific causes of hearing loss
Normal Ear Anatomy

Evaluation of Hearing

- Bedside Testing
  - Whisper test
  - Tuning forks (512 Hz): Weber and Rinne
- Audiometry
- Electrical Tests
  - ABR: Auditory Brainstem Response
  - Otoacoustic emissions
- Tympanometry
Types of Hearing Loss

- Conductive
  - Loss at level of external ear or middle ear
- Sensorineural
  - Loss at level of inner ear, auditory nerve, or brain
- Mixed
  - Combination of conductive and sensorineural loss

Weber Test

- Tuning fork (512 Hz)
- Forehead bone conduction
- Patient will hear:
  - ON side of conductive loss
  - AWAY from side of sensorineural loss
Rinne Test

- Tuning fork (512 Hz)
- Compare bone conduction (mastoid) with air conduction
- Patient will hear:
  - Louder BONE if conductive hearing loss
  - Louder AIR if normal or sensorineural loss

Normal Audiogram

Image source: Wellcome Images
Sensorineural Hearing Loss

- **Frequency (Hz)**
- **Sound Pressure Level (dB SPL)**
- **Discrimination**
- **R: 40 %**

Conductive Hearing Loss

- **Frequency (Hz)**
- **Sound Pressure Level (dB SPL)**
- **Discrimination**
- **R: 96 %**
- **L: 100 %**
Causes of Conductive Hearing Loss: External Ear

Cerumen Impaction or Foreign Body

[Image from Wikimedia Commons]
[Image from Wellcome Images]
Infectious Disease

– Otitis Externa
– Cellulitis
– Herpes Zoster (Ramsay-Hunt Syndrome)

Congenital Malformation of External Ear

Microtia/Atresia
Ear Canal Exostoses

Carcinoma of the Ear Canal
Causes of Conductive Hearing Loss: Middle Ear

Acute Otitis Media

[Image: Wikimedia Commons]
# Etiology of Acute Otitis Media

<table>
<thead>
<tr>
<th>Organism</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. pneumoniae</td>
<td>25%</td>
</tr>
<tr>
<td>H. influenzae</td>
<td>20-25%</td>
</tr>
<tr>
<td>M. catarrhalis</td>
<td>10-20%</td>
</tr>
<tr>
<td>S. pyogenes (gr. A)</td>
<td>2%</td>
</tr>
<tr>
<td>S. aureus</td>
<td>1%</td>
</tr>
<tr>
<td>No growth</td>
<td>up to 35%</td>
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</tbody>
</table>

Beta-lactam resistance is growing in all isolates.

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# Otitis Media with Effusion

[Image: [Wikimedia Commons]](https://commons.wikimedia.org/wiki/File:Otitis_media_with_effusion.png)
Medical Treatment of OME

- Observation
- Antibiotics
  - Beneficial short-term resolution of OME
  - Unclear long-term impact
- Audiogram at 3 months with persistent effusion
- Follow-up every 6 weeks

Complications of Otitis Media
Otitis Media

• When to refer to Oto-HNS?
  – 3 bouts AOM in 6 months
  – 4 bouts AOM in 12 months
  – Chronic OME >3mos, hearing loss, speech delay
  – Complication
  – Earlier if anatomic or immune problem

Hemotympanum

Wikimedia Commons
Otosclerosis

Causes of Sensorineural Hearing Loss: Inner Ear or Auditory Nerve
Presbycusis

Sudden Sensorineural Hearing Loss

Discrimination:
R: 96 %
L: 72%
### Sudden Sensorineural Hearing Loss

Viral? ... Vascular? ... Autoimmune?

**Rule of Thirds**
- 1/3 full recovery
- 1/3 partial recovery
- 1/3 permanent hearing loss (15% progressive)

**WITHOUT INTERVENTION**
EARLY STEROID THERAPY

### Noise Induced Hearing Loss

- Related to intensity, duration, and frequency of noise exposure
- May affect the ears asymmetrically
- Sustained work day (8-hour) exposures >85 dB require the hearing protection and annual audiograms
- Initially affects the 3000-4000 Hz frequency range
Noise Induced Loss

![Graph showing Noise Induced Loss](image)

**Vestibular Neuronitis/Labyrinthitis**

- Put simply, “an inner ear infection”
- Usually viral. Treated symptomatically. Steroids may help. Antibiotics not usually required. May takes weeks to resolve.
- Labyrinthitis causes hearing loss and vertigo. Hearing loss can be permanent.
**Meniere’s Disease**

- Episodic vertigo, tinnitus, aural fullness & hearing loss
- Treatment: low salt diet, thiazide diuretics and PRN vestibular suppressants.
- Other interventions: transtympanic gentamicin/steroid injection, endolymphatic shunt surgery, labyrinthectomy, or vestibular nerve section
- Up to 30% bilateral

**Acoustic Neuroma/Vestibular Schwannoma**

- 8th cranial nerve
- Hearing loss, tinnitus, & disequilibrium early
- Facial numbness, facial weakness, hydrocephalus late
- 5% are associated with Type II Neurofibromatosis
- Tx: Surgery, gamma knife, observation
## Summary

- Review ear anatomy
- Evaluation of hearing
- Types of hearing loss
- Specific causes of hearing loss

## Hearing Loss for Primary Care Physicians

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Medical Clearance

- Medical Clearance is required prior to a patient being fit with hearing aids.
- Medical Clearance may be obtained 3 ways
  - Evaluation by an ENT/Otologist
  - Evaluation by PCP, provided results do not warrant referral to an ENT
  - Patient Medical Waiver
What to look for when giving medical clearance for amplification

<table>
<thead>
<tr>
<th>Factor</th>
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<tbody>
<tr>
<td>Asymmetrical air conduction thresholds</td>
</tr>
<tr>
<td>Conductive component of hearing loss</td>
</tr>
<tr>
<td>– ‘air-bone gap’</td>
</tr>
<tr>
<td>Asymmetrical speech discrimination</td>
</tr>
<tr>
<td>Chronic middle ear disease</td>
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Hearing Aids : Factors to consider

<table>
<thead>
<tr>
<th>Factor</th>
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<tbody>
<tr>
<td>Age of patient</td>
</tr>
<tr>
<td>Dexterity</td>
</tr>
<tr>
<td>Severity/configuration of hearing loss</td>
</tr>
<tr>
<td>Cosmetics</td>
</tr>
<tr>
<td>Battery life</td>
</tr>
<tr>
<td>Anatomy of the patient’s ear</td>
</tr>
</tbody>
</table>
## Styles of Hearing Aids

<table>
<thead>
<tr>
<th>Completely-In-The Canal (CIC)</th>
<th>In-The-Canal (ITC)</th>
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<tbody>
<tr>
<td>In-The-Ear (ITE)</td>
<td>Behind-The-Ear (BTE)</td>
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Photos courtesy of Phonak

## ‘Open Fitting’ Hearing Aids

- Appropriate for hearing loss that is normal/mild in the low frequencies.
- Inappropriate if much gain is needed at 250-500Hz
  - Can be coupled to an earmold, however to give low frequency gain
- Designed to eliminate the occlusion effect and improve cosmetics

Photos courtesy of Phonak
### Newer Features in Hearing Aids

- In some advanced level products the following features are now available:
  - Wireless connectivity between ears
  - Automatic program changes
  - Better feedback control
  - Adaptive directionality
  - Wireless connectivity to bluetooth devices

### Bluetooth Compatibility

- Some hearing aids now have capability to connect with bluetooth devices
- Phone compatibility
- TV compatibility

Photos courtesy of Phonak
CROS/BICROS amplification

- For use when one ear is not aidable
- Transmitter on the poorer hearing ear
- Receiver and hearing aid on the better hearing ear
- Wireless communication

Photos courtesy of Phonak

FM System

- Transmitter
- Receiver

- Options for CI/BAHA

Photos courtesy of Phonak and Cochlear Americas
When hearing aids are not enough

- Cochlear implants and bone anchored hearing solutions are options for patients who cannot benefit from traditional amplification.

- What are bone anchored hearing solutions?
  - Bone anchored hearing solutions are surgically implanted devices that transmit sound via bone conduction bypassing the middle ear to a normally hearing cochlea (either ipsi or contralaterally).
  - Often referred to as BAHA
  - Implications for single sided deafness and conductive/mixed hearing losses that cannot be conventionally amplified.
**BAHA Candidacy**

- **Single Sided Deafness**
  - Poorer ear - Profound SNHL
  - Good Ear - PTA AC threshold $\leq 20\text{dB} \times 500, 1000, 2000, \text{and} 3000\text{Hz}$

- **Mixed/Conductive**
  - PTA BC threshold $\leq 65\text{dBHL} \times 500, 1000, 2000, 3000\text{Hz}$.

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**BAHA**

![BAHA Diagram](image)

*Photos courtesy of Cochlear Americas*
Cochlear Implant

- Consists of an external speech processor and a surgically implanted device
- Electrode implanted in the cochlea to electrically stimulate the nerve

Photos courtesy of Cochlear Americas

Cochlear Implant Candidacy- Children

- Profound sensorineural hearing loss bilaterally
  - Age 12-24 months
- Severe to profound sensorineural hearing loss
  - Age 2-17 years
- Limited benefit from binaural amplification trial
### Cochlear Implant Candidacy - Adults

- Moderate to profound sensorineural hearing loss bilaterally
- Limited benefit from amplification defined by preoperative sentence recognition scores

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### Watch out for:

- **Cochlear Implant Patients**
  - Redness at magnet site
- **Hearing Aid Patients**
  - Otitis Externa caused by earmold closing off ear canal
- **BAHA**
  - Skin overgrowth at abutment site
- **Patients who have hearing concerns**