

Hearing Loss for the Primary Care Physician

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What is an audiologist?

Audiologists are the primary health-care professionals who evaluate, diagnose, treat, and manage hearing loss and balance disorders in adults and children

Most earn a clinical doctorate in audiology (AuD), however some possess a PhD, doctor of science degree, (ScD) or a Master's degree

State licensed

Additional certifications exist (ABA Board Certified, CCC-A, PASC, CISC)

Patient A

- **80 year-old Female**
- **Long-term patient**
- **Accompanied by daughter who is speaking loudly to her**
- **Difficulty communicating in office**
- **Reported trying hearing aids 10 years ago**
 - **Limited benefit**
 - **Expensive**

Untreated Hearing loss

- **Physical, emotional and social consequences**
 - **Adherence to medical recommendations**
 - **More likely to report**
 - **Depression**
 - **Anxiety**
 - **Paranoia**
 - **Social isolation**

Patient A in Office Screening?

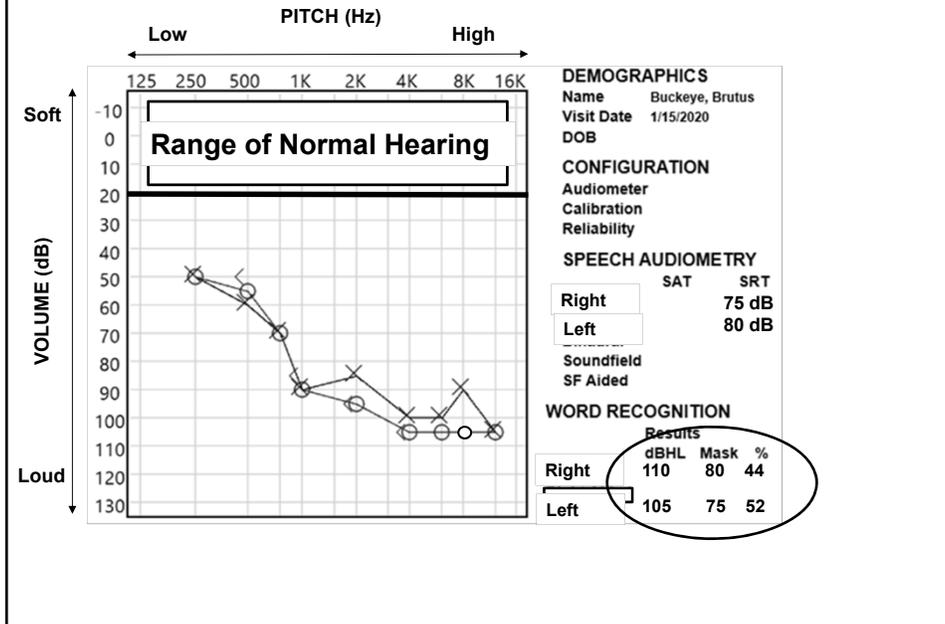
- **Whispered voice test**
- **Finger rubbing**
 - **Quick, simple, inexpensive**
 - **Limitations: subjective and not standardized**
- **Tuning Fork**
- **Hearing Handicap Inventory for Adults/Elderly (HHIA/E)**
- **Standardized sound production device**
- **Referral to audiology for confirmatory testing!**

Amplified Headset



- **Amplified headsets can be purchased through retail stores**
- **Pros:**
 - **Inexpensive- around \$150**
 - **Ease of use for visually impaired and those with dexterity challenges**
- **Cons:**
 - **Cosmetics**
 - **Limited distance for the microphone to pick up- hard wired to patient**

Patient A's hearing test



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

- Asymmetric air conduction thresholds
- Air-Bone Gap
- Asymmetric speech discrimination
- Chronic middle ear disease

Types of (Traditional) Hearing Aids



Hearing Aids: Factors to consider

- **Age of patient**
- **Dexterity**
- **Severity/configuration of hearing loss**
- **Cosmetics**
- **Battery life**
- **Anatomy of the patient's ear**
- **Health of patient's ear**

Newer Features in Hearing Aids

Available in some advanced level products

- **Wireless connectivity to Bluetooth devices**
 - **Direct streaming with Smartphones**
- **Automatic program changes**
- **Feedback control**
- **Adaptive microphones**
- **Rechargeable batteries**
- **Wireless accessories**

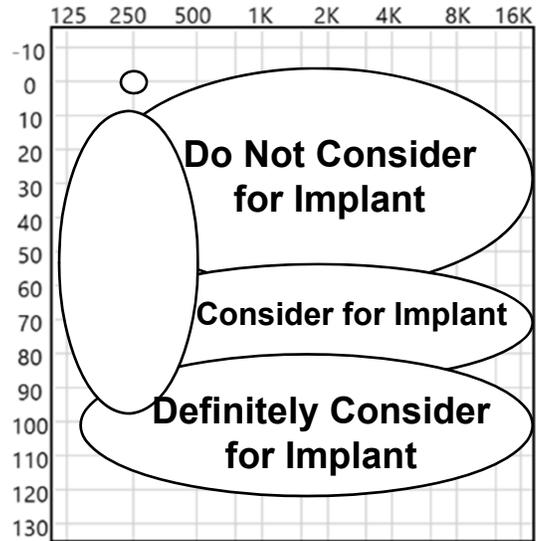
When Hearing Aids Are Not Enough

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

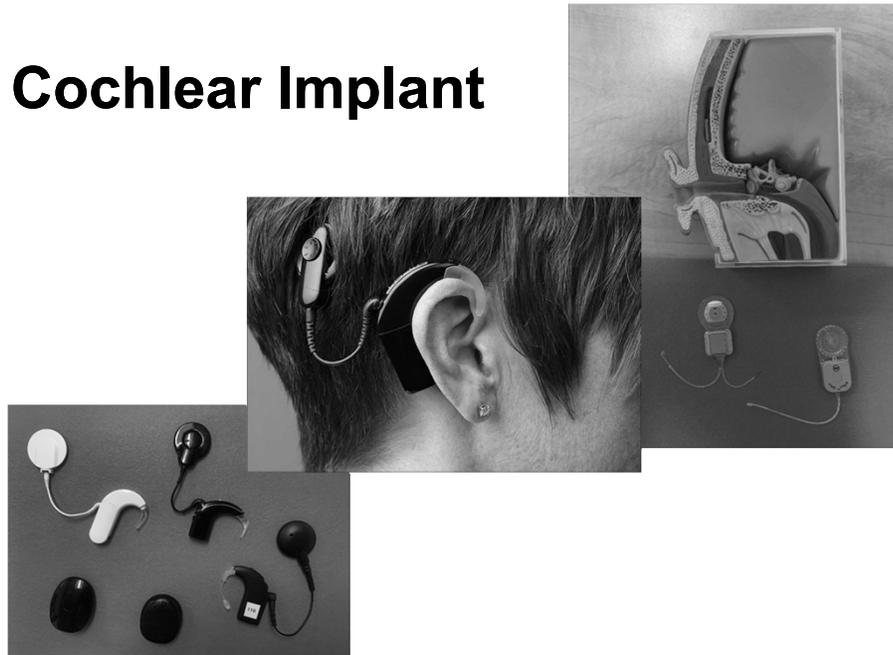
Cochlear Implant Candidacy- Adults

- **A cochlear implant consists of two parts: one is a surgically implanted device that sends electrical impulses directly to the auditory nerve and one is the external processor.**
- **Moderate to profound sensorineural hearing loss bilaterally, however, criteria has expanded more recently, which can include hearing within normal limits in the lower frequencies and unilateral hearing losses.**
- **Limited benefit from amplification defined by preoperative sentence recognition scores**

Cochlear Implant Candidacy- Adults



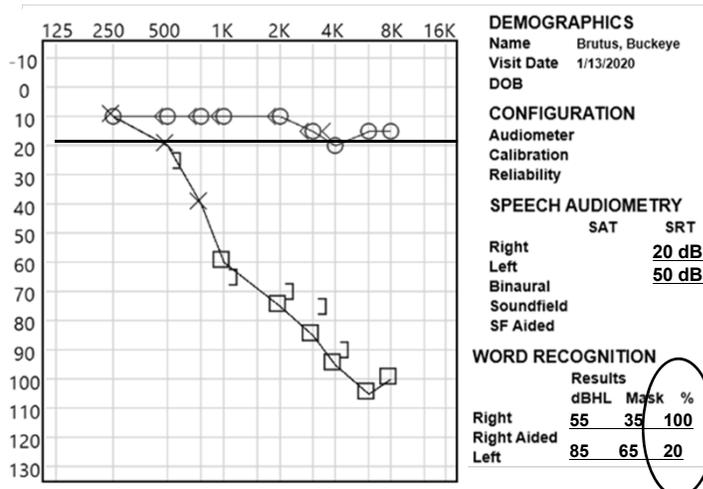
Cochlear Implant



Patient B

- 52 year-old female
- Routine physical
- Lawyer
- Hearing loss in her left ear since early 20s
- Increasing difficulty in social situations and at work
- Tinnitus, most noticeable at nighttime

Patient B's audiogram



Asymmetric Hearing Loss

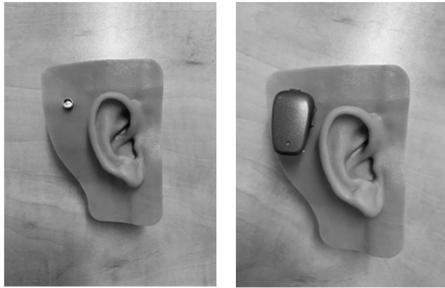
- **Referral to ENT**
 - **Imaging?**
 - **Monitoring**
- **Treatment Options pending medical clearance**
 - **Traditional hearing aid**
 - **CROS technology**
 - **Bone-anchored devices**
 - **Cochlear Implant**

Contralateral Routing of Signal (CROS)

- **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**

Bone-Anchored Auditory Implants

- Surgically implanted
- Transmit sound via bone conduction bypassing the middle ear to a normally hearing cochlea (either ipsilaterally or contralaterally).
- Implications for single sided deafness and conductive/mixed hearing losses



Non-surgical Bone-conduction Devices



Tinnitus

Ringing, buzzing, hissing, whistling, swooshing, clicking, thumping, and/or static noise

- **Defined as an auditory perception of sound not produced by an external source**
- **As many as 50 million adults- 15% of the population experience tinnitus**
 - **More than 20 million struggle with chronic tinnitus**
 - **2 million have extreme and debilitating cases of tinnitus**
- **May cause sufferers to report**
 - **Interference with sleep**
 - **Difficulty concentrating**
 - **Depression**
 - **Anxiety**
 - **Inability to tolerate moderate levels of noise (hyperacusis)**

Causes of Tinnitus

- The exact mechanism underlying tinnitus is unknown, however, some of the potential causes are
 - Disorders of the outer ear
 - Disorders of the middle ear
 - Disorder of the inner ear
 - Temporary effects from high dosages of medications such as anti-inflammatories, sedatives, and antidepressants
 - Systemic disorders
 - Trauma to the head/neck, cervical problems, and temporomandibular misalignment
 - Sinus pressure and barometric trauma
 - Traumatic Brain Injury

Tinnitus Management

While there is no cure for most forms of tinnitus, there are a variety of management options available.

Audiologists specialize in hearing aids, tinnitus sound therapy, and can educate patient's regarding their tinnitus.

Additional referrals may be needed: physical therapy, dentistry, cognitive behavioral therapy.

Take Home: When to Refer to Audiology

- **C/o Hearing loss**
 - **If hearing is significantly better in one ear compared to the other**
 - **If patient regularly asks to have things repeated**
- **Tinnitus- ringing/buzzing/sound in ears**
- **Hearing sensitivity**
- **Aural fullness**
- **History of ear infections**
- **Family history of hearing loss**
- **Occupational or recreational noise exposure**
- **Prescribed or exposed to ototoxic medications**
- **Vertigo, dizziness or imbalance**

**Tinnitus with and
without hearing loss**

**Hearing aids and
health insurance**

Beyond Antibiotics and Hearing Aids

**Edward E. Dodson, MD
Professor**

**Otology, Neurotology & Cranial Base Surgery
Department of Otolaryngology-Head & Neck Surgery
The Ohio State University Wexner Medical Center**

Case Study

- **8 year old male presents with hearing loss of approximately 6 months duration**

Patient with Hearing Loss

- **Before we obtain a history and physical...**
- **What do we want to figure out?**
 - **Conductive vs Sensorineural**
 - **Progressive/Stable/Reversible**
 - **Etiology**
 - **Association with other symptoms**
 - **Association with other disease(s)**
 - **Treatment/Referral(surgery/HA)**

Patient with Hearing Loss

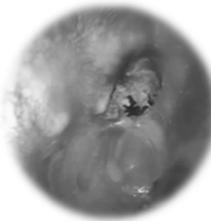
- **If otoscopy is normal, what can we rule out:**
 - **Otitis externa**
 - **Acquired atresia**
 - **Cerumen/Foreign body**
 - **TM perforation/retraction**
 - **Middle ear effusion/mass**
- **And our differential diagnosis would be:**
 - **Sensorineural hearing loss**
 - **Conductive hearing loss - Ossicular problem (Fixation, Erosion, Fracture, Dislocation)**
 - **Tympanosclerosis**
 - **Otosclerosis**
 - **Congenital fixation of malleus or stapes**
 - **Incus or stapes erosion from infection or cholesteatoma**
 - **Incus or stapes fracture**
 - **Incus or stapes dislocation**

History

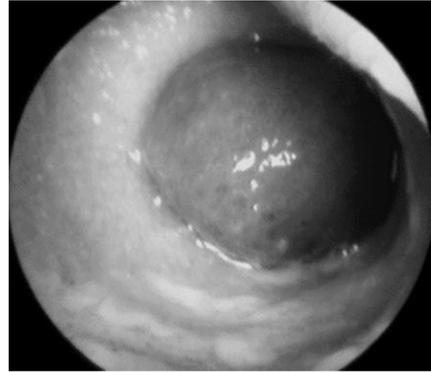
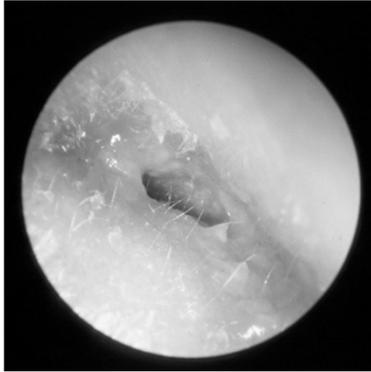
- Hx of childhood otitis media with tympanostomy tubes at age 2
- Passed school hearing screening exams
- Intermittent drainage and debris from right ear for 12 months
- Hearing subjectively decreased on right and normal on left
- No pain (otalgia), dizziness, or tinnitus
- No noise exposure or exposure to ototoxic medications
- No head trauma or penetrating ear trauma
- No family history of hearing loss

Physical Exam

- Auricle – Normal
- External Auditory Canal – Mildly inflamed
- Tympanic Membrane – See above
- Pneumatic Otoscopy – Immobile
- Tuning Fork Testing
 - Weber – Lateralizes to right ear
 - Rinne – Bone > Air
- Facial nerve function – Normal
- Left ear – All normal



Alternative Exams



Digression – The Otic “Drop”

- Many types and brand names
 - Presence/absence of antibiotic/antifungal
 - pH & viscosity
 - Single agents or combination products.
 - CiproDex, Ofloxacin, Neomycin/Polymyxin/HC
 - Acetic Acid +/- HC, Domeboro
 - Clotrimazole, Fluconazole
 - Ciloxin, Ofloxacin, Tobramycin, Sulfacetamide
 - Ophthalmic preparations
- Quinolones most popular
- Cost



The Power of Ototopicals

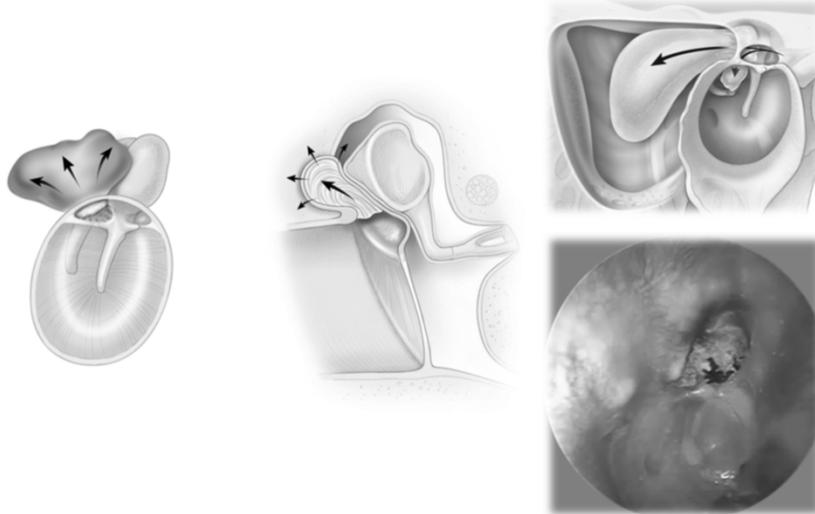
- **Pseudomonas** organism with an MIC of 8 mcg/mL for ciprofloxacin is considered resistant
- A 0.3% antibiotic solution contains 3000 mcg/mL of antibiotic.
 - Middle ear concentrations after oral
 - Amoxicillin at 90 mg/kg (6-10 mcg/mL)
 - Cefuroxime at 500mg dose (2-4 mcg/mL)
 - Cefpodoxime at 200mg dose (1-2 mcg/mL)
 - Clarithromycin at 500mg dose (2-5 mcg/mL)
 - Ciprofloxacin at 500mg dose (3-7 mcg/mL)

Billings KR. Otological Antibiotics. Medscape, Nov 29, 2016.
<https://emedicine.medscape.com/article/873963-overview>

Back to our 8 yr old with hearing loss and otorrhea

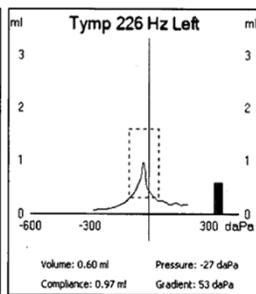
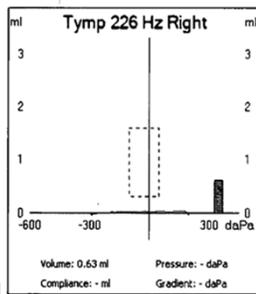
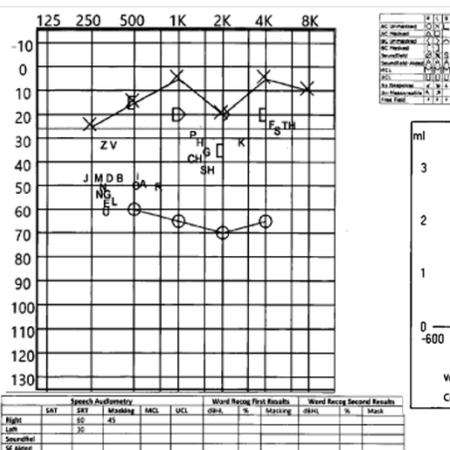
- **What do we know based on history and physical exam?**
 - History suggests?
 - Exam suggests?
 - Tuning fork?
- **Differential diagnosis:**
 - “Attic” cholesteatoma
 - Chronic atticotympanic suppurative otitis media
 - Left conductive hearing loss

Cholesteatoma – Don't be fooled!



Stanford University Online Otologic Surgery Atlas. <http://med.stanford.edu/sm/ohns-otologic-surgery-atlas/> Permission granted for non-profit, educational use of images. Created by: Robert Jackler (surgeon) and Christine Galapp (artist)

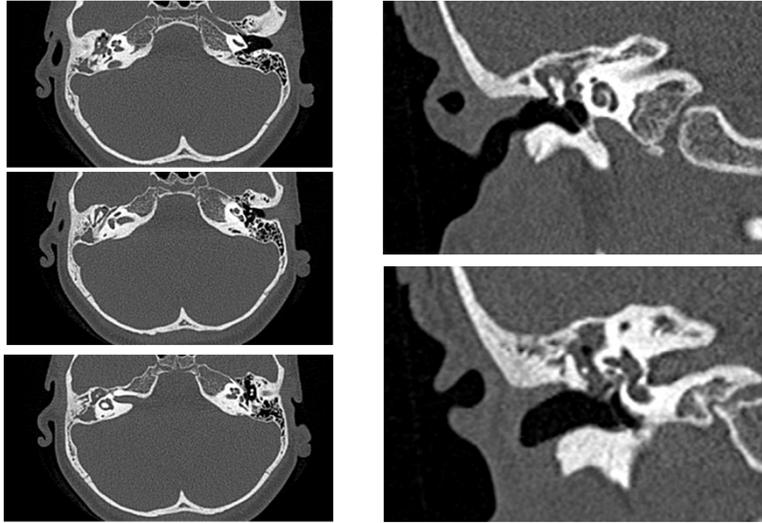
Audiogram



	Speech Audiometry		Word Recognition Results				Word Recognition Results	
	SAT	SRT	UCL	UCL	Word	%	Meaning	Dist.
Right	50	45						
Left	30							
Severely								
Mildly								

Notes:
Patient presents with recurring OM bilaterally R>L. No concerns for hearing at this time.
Type: L-Type A (normal) R-Type B (flat)
Audio: L-Normal hearing sensitivity. R-Moderately-severe to severe CHL. SRTs are consistent with PTA's.

CT Scan



Management

- **Treatment Options:**
 - **Cholesteatoma is a surgical disease**
 - **Tympanomastoidectomy**
 - **Ossicular reconstruction – often staged**

Take Home Messages

- **Look not only at the tympanic membrane, but through it**
- **Examine the pars flaccida (“attic”)**
- **Don’t forget tuning fork exam**
- **Drainage that recurs or persists should be referred**
- **Otic drops are safe in all situations, but know which one to use**

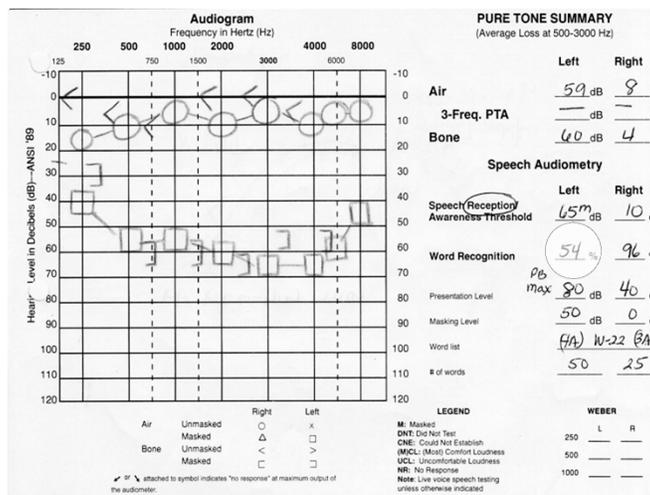
Case Presentation

- **38 year old male, otherwise healthy, awakens with marked decrease in left ear hearing**
- **+ high frequency tinnitus**
- **No dizziness or imbalance**
- **No otalgia or otorrhea**
- **Denies trauma, URI, fever**

Course of Management

- Seen at Urgent Care
- Assessment: left otitis media
- Treatment: Amoxicillin 875mg BID x 10 days
- Follow up with PCP 3 weeks later with no improvement
- Exam: normal TM, no middle ear effusion
- Referred for audiometric testing

Audiogram – 1 month post-onset



Sudden Sensorineural Hearing Loss

- 30dB loss at 3 contiguous frequencies over a period of < 3 days
- 5-20/100,000 per year
 - Columbus Metropolitan Statistical Area (10 counties)
 - population of 2.4 million
 - 120-480 cases/year
- 85-90% are idiopathic at time of presentation
- 50% have associated vertigo
- 32-65% will have some spontaneous recovery
 - Usually within 2 weeks of onset
- Shape of audiogram correlates with chance of recovery

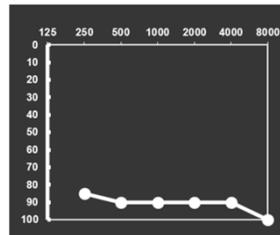
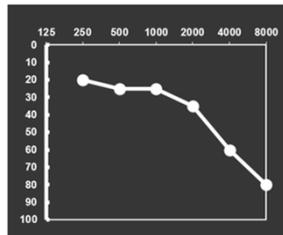
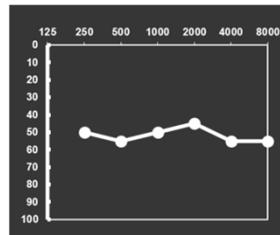
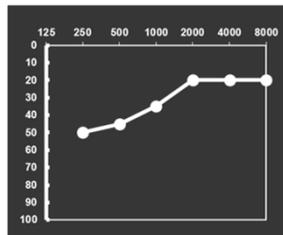
Etiology

- | | | |
|---------------------------------------|--|------------------------------------|
| • Herpes Simplex I | • Relapsing polychondritis | • Myeloma |
| • Lyme Disease | • Ulcerative Colitis | • Multiple Sclerosis |
| • Cytomegalovirus | • Wegener's Granulomatosis | • Meningeal Carcinomatosis |
| • HIV | • Red Blood Cell Deformability | • Ototoxicity |
| • Meningococcal Meningitis | • Vertebrobasilar Insufficiency | • Perilymph Fistula |
| • Cryptococcal Meningitis | • Sickle Cell | • Meniere's |
| • Syphilis | • Focal Pontine Ischemia | • Inner Ear Decompression Sickness |
| • Toxoplasmosis | • Vascular Disease Associated with Mitochondriopathy | • Otologic Surgery |
| • Rubella | • Migraine | • Inner Ear Concussion |
| • Mumps | • Small Vessel Disease | • Temporal Bone Fracture |
| • Autoimmune Inner Ear Disease (AIED) | • Blood Dyscrasias | • Large Vestibular Aqueduct |
| • Cogan's Syndrome | • Cardiopulmonary Bypass | • CSF Leak (LP) |
| • Polyarteritis Nodosa | • Acoustic Neuroma | |
| • Lupus | • Leukemia | |

Prognostic Factors for Hearing Recovery

- **Good Prognosis**
 - Age <60
 - minimal hearing loss
 - low frequency hearing loss
 - no vestibular symptoms
 - early onset recovery
- **Poor Prognosis**
 - Age >60
 - total deafness
 - high frequency hearing loss
 - objective vestibular symptoms
 - vascular risk factors

Audiogram Patterns: Prognosis



Initial Evaluation

- **History**
 - **Onset, Severity, Laterality**
- **Exam**
 - **Otосcopy, Pneumatic Otосcopy**
- **“Hearing” Tests**
 - **Whisper, Hum, Tuning Fork**

Rauch SD. Clinical Practice. Idiopathic sudden sensorineural hearing loss. N Engl J Med 2008;359:833-40.

Tuning Fork Testing (remember left ear HL in this case)

Weber

Louder here suggests
sensorineural hearing
loss on left



Louder here
suggests
conductive hearing
loss on left

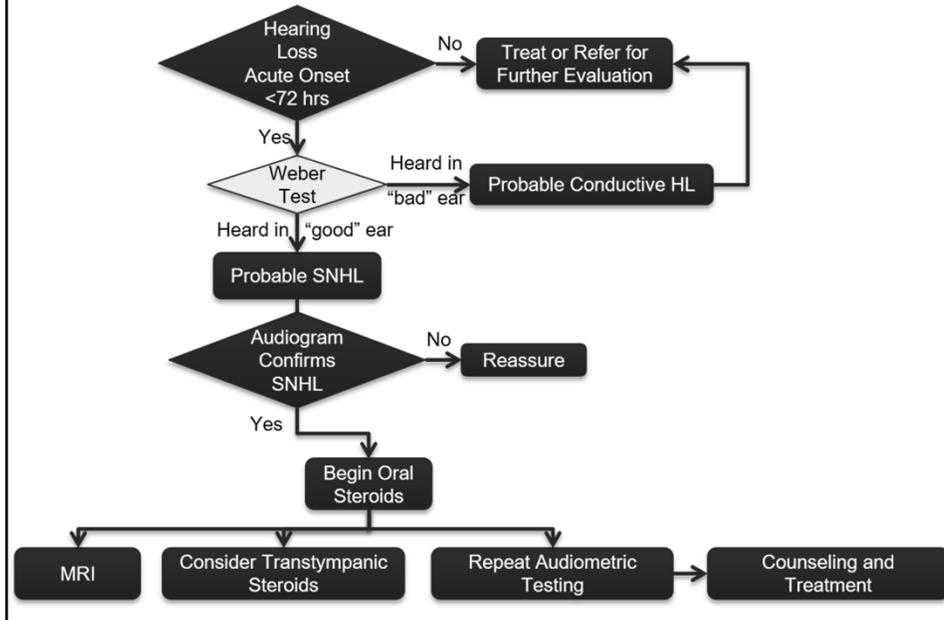


Rinne



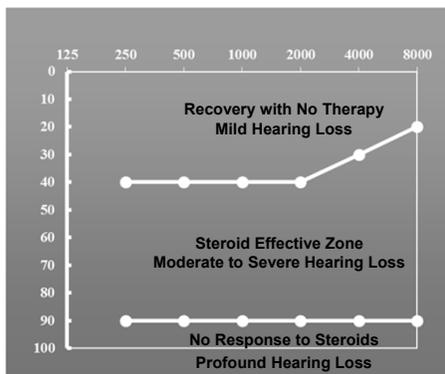
Normal is
louder by air
conduction

Management Algorithm



Role of Systemic Steroids

- **Wilson et al., 1980**
 - 78% recovery in moderate/severe hearing loss
 - 38% recovery with placebo

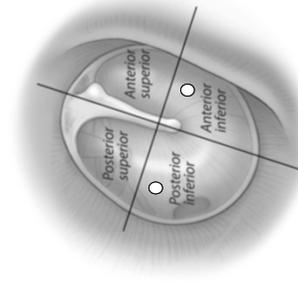


- **Rx:**
Prednisone
 - 1mg/kg (max 60mg/day)
 - 7-10 days with taper

Wilson WR, Byl FM, Laird N. The Efficacy of Steroids in the Treatment of Idiopathic Sudden Hearing Loss: A Double-blind Clinical Study. Arch Otolaryngol. 1980;106(12):772-776.

Transtympanic Steroid Injection

- Studies that show equal efficacy to systemic steroids
- Role of “rescue” therapy also documented
- No consensus on dosing
 - Dexamethasone
 - Hydrocortisone
 - Methylprednisolone



Stanford University Online Otolgic Surgery Atlas. <http://med.stanford.edu/sm/ohns-otologic-surgery-atlas/>
Permission granted for non-profit, educational use of images. Created by: Robert Jackler (surgeon) and Christine Gralapp (artist)
Herrera M, Berrocal JRG, Arumi AG, Lavilla MJ, Plaza G. Actualización del consenso sobre el diagnóstico y tratamiento de la sordera súbita idiopática. Acta Otorrinolaringol Esp. 2019;70:290-300.
Rauch SD, Halpin CF, Antonelli PJ, Babu S, Carey JP, Gantz BJ, Goebel JA, Hammerschlag PE, Harris JP, Isaacson B, Lee D, Linstrom CJ, Parnes LS, Shi H, Slattery WH, Telian SA, Vrabec JT, Reda DJ. Oral vs intratympanic corticosteroid therapy for idiopathic sudden sensorineural hearing loss: a randomized trial. JAMA. 2011 May 25;305(20):2071-9. doi: 10.1001/jama.2011.679.
Jeon EJ, Park YS. Intratympanic Steroid Therapy for Sudden Sensorineural Hearing Loss. Korean Journal of Audiology. 2011;15(2):53-61.

Difference in PTA Improvement Compared to Placebo

- IT plus systemic steroids **25.85 dB**
- IV + PO steroids **22.06 dB**
- IT steroids **18.24 dB**

Ahmadzai N, Kilty S, Cheng W, et al. A systematic review and network meta-analysis of existing pharmacologic therapies in patients with idiopathic sudden sensorineural hearing loss. PLoS One. 2019;14(9):e0221713. Published 2019 Sep 9. doi:10.1371/journal.pone.0221713

The Importance of Prompt Evaluation

- Presentation to a physician less than a week after onset of SSNHL also correlates with improved odds of hearing recovery, with chances of complete hearing recovery decreasing after that time.
 - If diagnosis & treatment are correct
- Rates of hearing recovery following evaluation/audiogram within:
 - Few days of onset **87%**
 - Within 1 week **87%**
 - 2 weeks **52%**
 - > 3 months **<10%**

Kuhn M, Heman-Ackah SE, Shaikh JA, Roehm PC. Sudden sensorineural hearing loss: a review of diagnosis, treatment, and prognosis. Trends Amplif. 2011;15(3):91-105. doi:10.1177/1084713811408349

Clinical Practice Guideline: Sudden Hearing Loss

- Distinguish CHL from SNHL
- Head CT and routine labs not recommended
- MRI indicated
- STATEMENT 1. EXCLUSION OF CONDUCTIVE HEARING LOSS: Clinicians should distinguish sensorineural hearing loss (SNHL) from conductive hearing loss (CHL) in a patient presenting with sudden hearing loss.
- STATEMENT 2. MODIFYING FACTORS: Clinicians should assess patients with presumptive sudden sensorineural hearing loss for bilateral sudden hearing loss, recurrent episodes of sudden hearing loss, or focal neurologic findings.
- STATEMENT 3. COMPUTED TOMOGRAPHY: Clinicians should not order computerized tomography of the head/brain in the initial evaluation of a patient with presumptive SSNHL.
- STATEMENT 4. AUDIOMETRIC CONFIRMATION OF ISSNHL: Clinicians should diagnose presumptive ISSNHL if audiometry confirms a 30 dB hearing loss at three consecutive frequencies AND an underlying condition cannot be identified by history and physical examination.
- STATEMENT 5. LABORATORY TESTING: Clinicians should not obtain routine laboratory tests in patients with ISSNHL.
- STATEMENT 6. RETROCOCHLEAR PATHOLOGY: Clinicians should evaluate patients with ISSNHL for retrocochlear pathology by obtaining an MRI, Auditory Brainstem Response (ABR), or audiometric follow-up.

Stachler RJ, Chandrasekhar SS, Archer SM, et al. Clinical practice guideline: sudden hearing loss. Otolaryngol Head Neck Surg 2012; 146: S1-35.

Clinical Practice Guideline: Sudden Hearing Loss

- **Counseling on risks, benefits, and limitations of treatment**
 - **Steroids (Oral +/- intratympanic)**
 - **No antivirals, thrombolytics, or vasoactive medications**
 - **F/u audiogram within 6 months**
 - **Counseling on treatment options if recovery is incomplete**
- **STATEMENT 7. PATIENT EDUCATION:** Clinicians should educate patients with ISSNHL about the natural history of the condition, the benefits and risks of medical interventions, and the limitations of existing evidence regarding efficacy.
 - **STATEMENT 8. INITIAL CORTICOSTEROIDS:** Clinicians may offer corticosteroids as initial therapy to patients with ISSNHL.
 - **STATEMENT 9. HYPERBARIC OXYGEN THERAPY:** Clinicians may offer hyperbaric oxygen therapy within three months of diagnosis of ISSNHL.
 - **STATEMENT 10. OTHER PHARMACOLOGIC THERAPY:** Clinicians should not routinely prescribe antivirals, thrombolytics, vasodilators, vasoactive substances, or antioxidants to patients with ISSNHL.
 - **STATEMENT 11. SALVAGE THERAPY:** Clinicians should offer IT steroid perfusion when patients have incomplete recovery from ISSNHL after failure of initial management.
 - **STATEMENT 12. OUTCOMES ASSESSMENT:** Clinicians should obtain follow-up audiometric evaluation within six months of diagnosis for patients with ISSNHL.
 - **STATEMENT 13. REHABILITATION:** Clinicians should counsel patients with incomplete recovery of hearing about the possible benefits of amplification and hearing assistive technology (HAT) and other supportive measures.

Stachler RJ, Chandrasekhar SS, Archer SM, et al. Clinical practice guideline: sudden hearing loss. *Otolaryngol Head Neck Surg* 2012; 146: S1–35.

Take Home Messages

- **One of the few otologic emergencies**
 - **Own a tuning fork, and use it!**
 - **Don't talk yourself into a diagnosis of otitis media**
 - **A prompt audiogram can make a difference**
- **Steroids are the primary mode of therapy**
 - **Benefits of oral therapy probably outweigh risks even in the setting of delayed referral**
- **Unilateral hearing loss can result in significant disability**
 - **Counseling regarding hearing aids (medical and surgical) and ALDs should be provided**

