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McGill University Health Centre

Hearing loss: What you need to know to save an ear

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Disclosure

No conflicts of interest

Objectives

- Identify the **key clinical features** of **sudden sensorineural hearing loss** for a prompt diagnosis

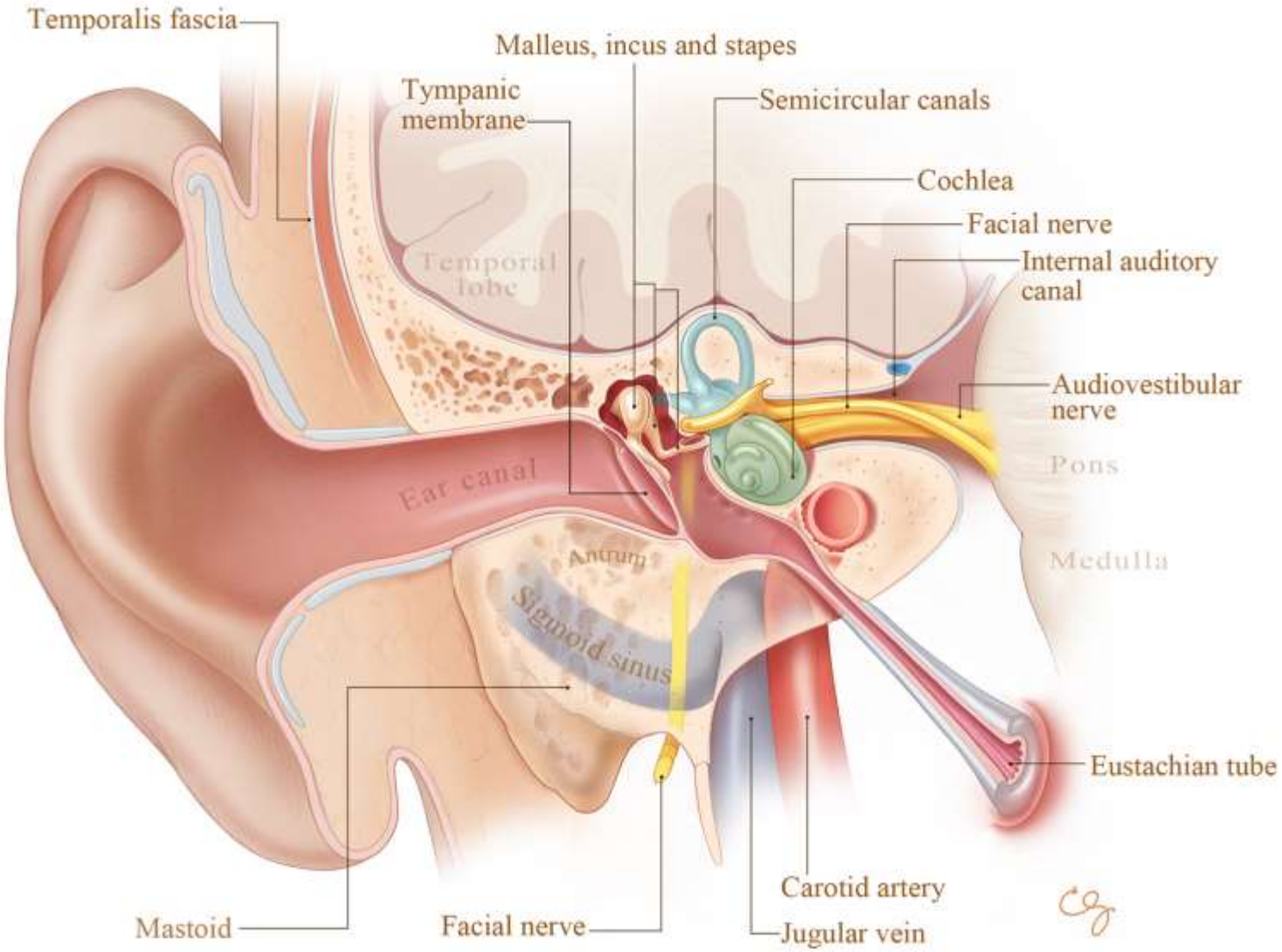
- **Initiate therapy** for sudden sensorineural hearing loss

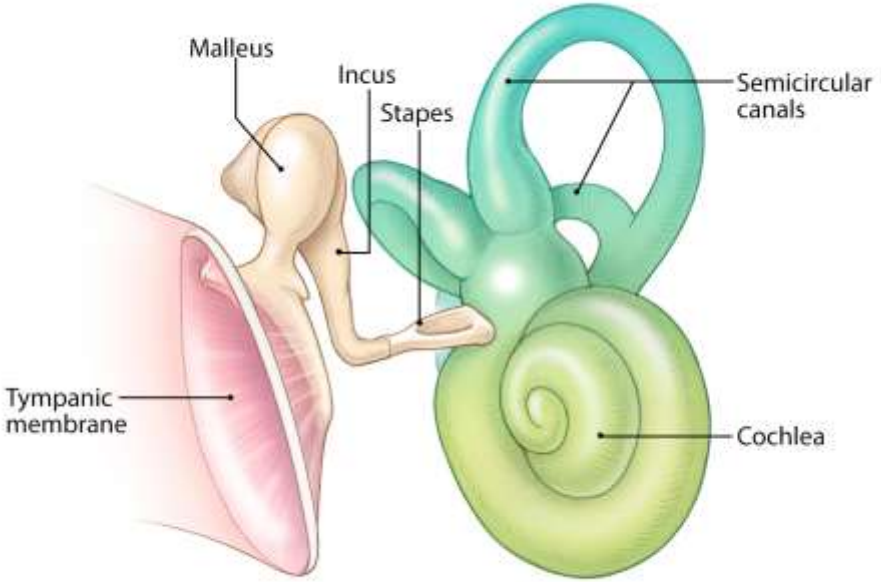
- Develop a general understanding of the **work up** and **treatment** of hearing loss

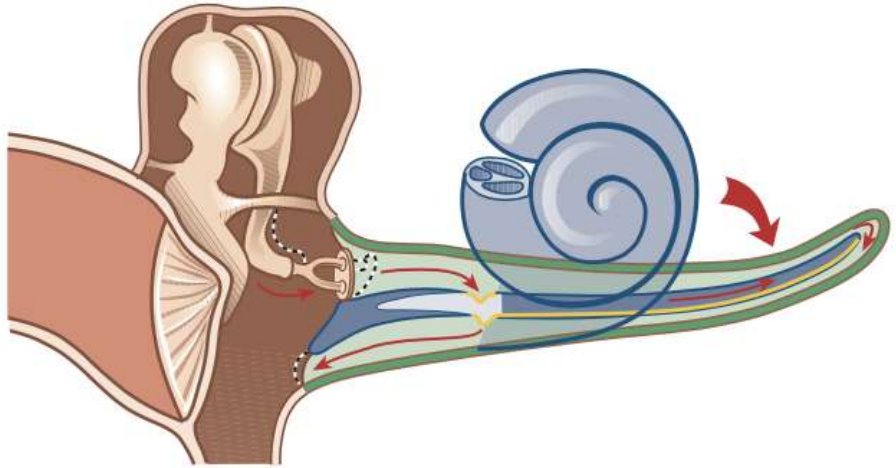
Clinical scenario

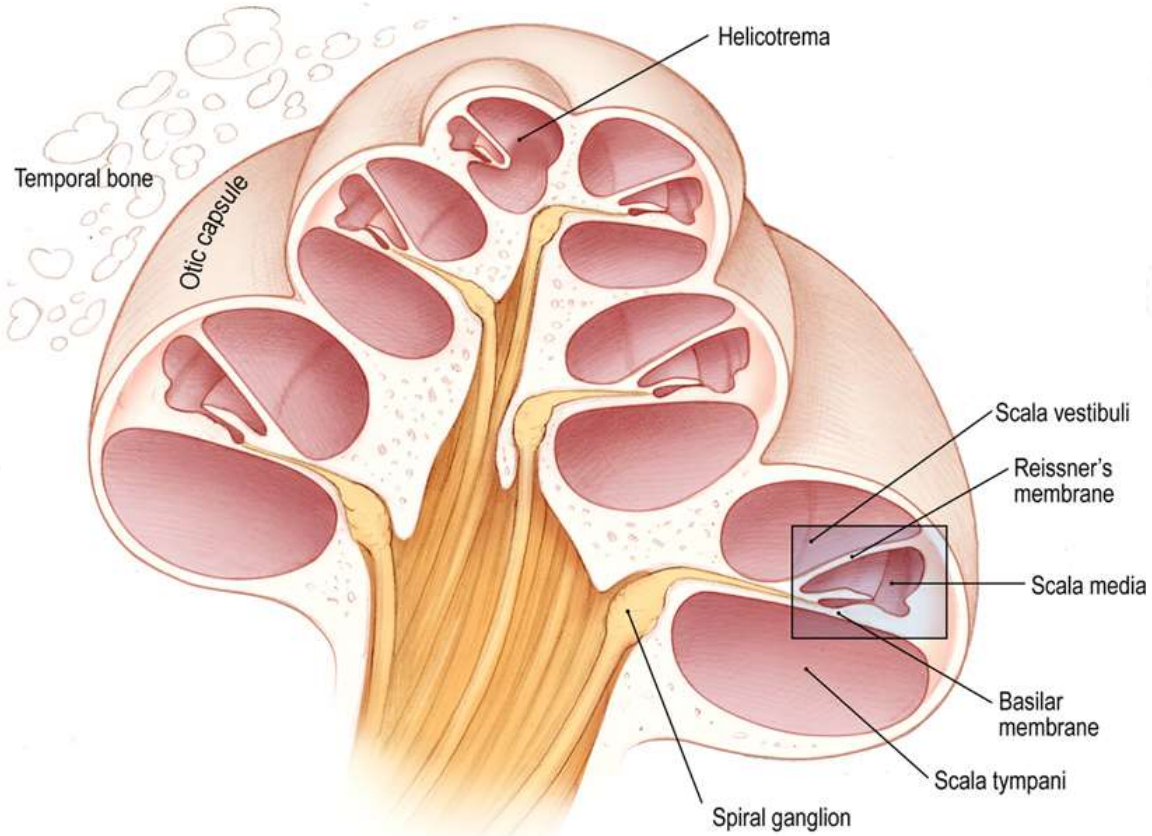
- 36 F, healthy
- **RC:** Right ear hearing loss
- **HPI:** 3 days hx of feeling like her hearing on the right side is muffled, blocked sensation. She had a cold last week that is overall resolved.
- **OTOLOGIC ROS:**
  - No vertigo, feels a bit imbalanced
  - On-Off right sided tinnitus
  - No otalgia
  - No otorrhea
  - + Fullness
- **OE:**
  - No distress, No fever
  - EARs: small amount of non-obstructive wax
  - ? TM red, but overall normal
  - Nose: mild congestion
  - Mouth: N
  - Neck: N

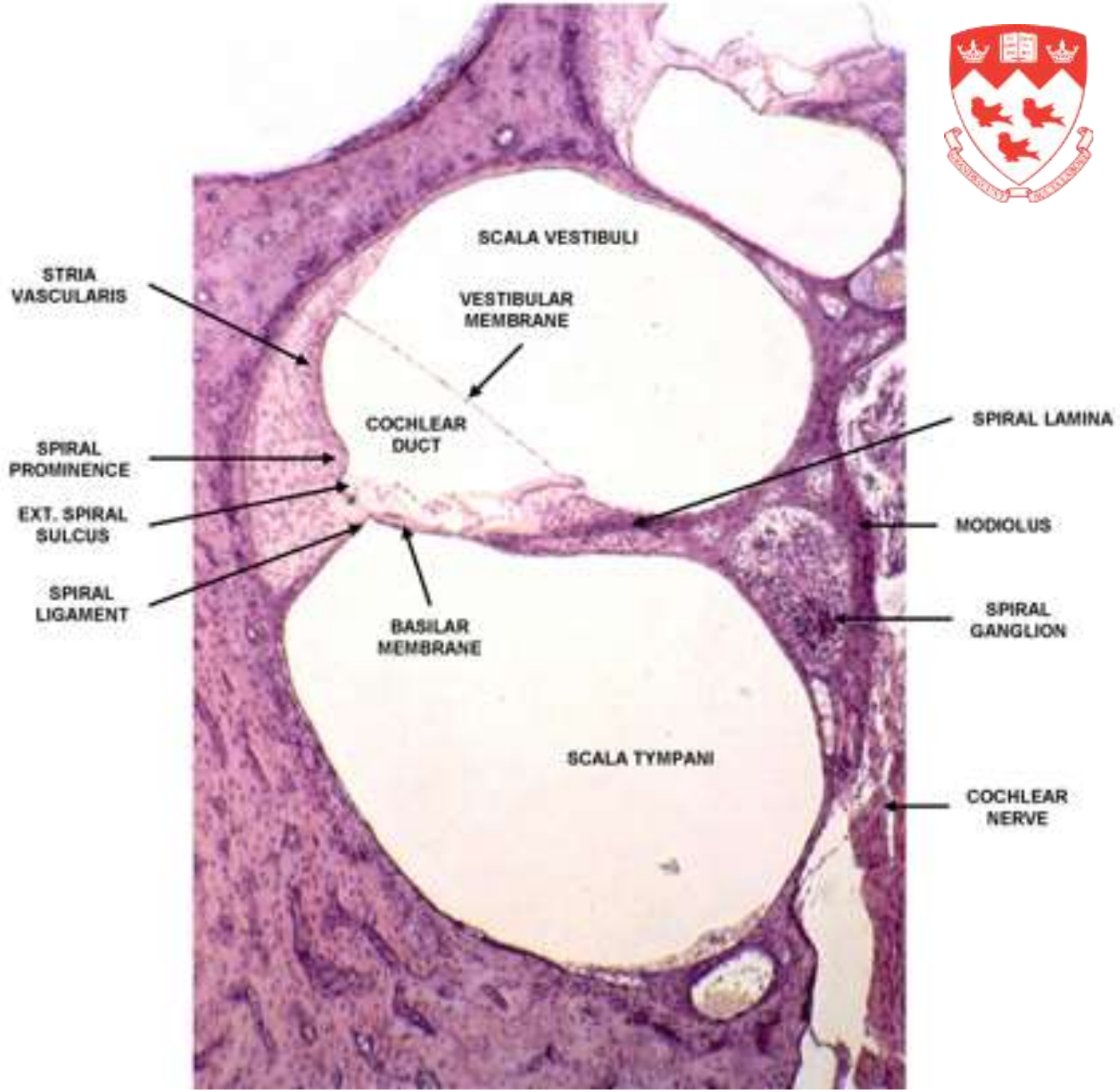
Review of the EAR

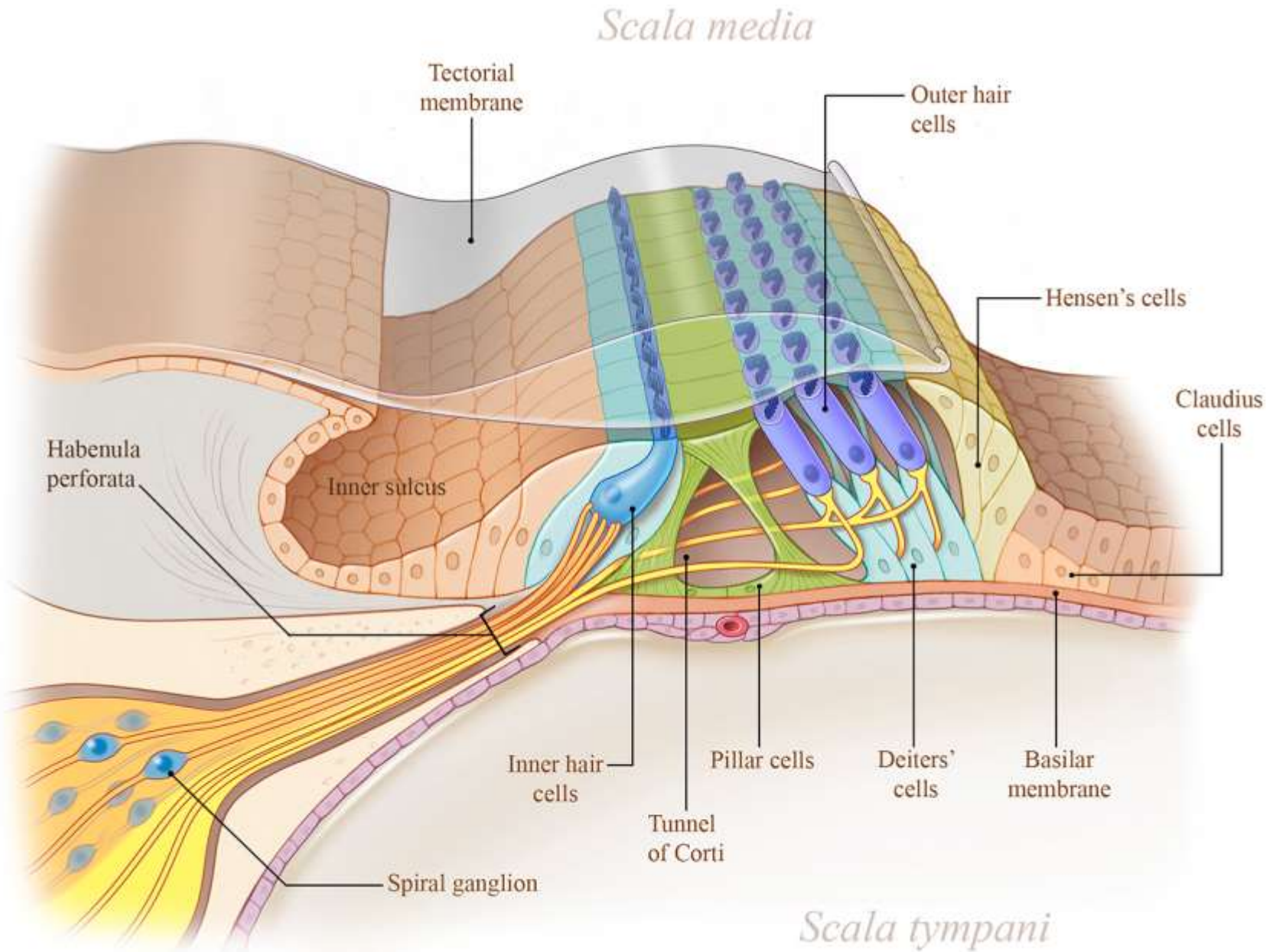


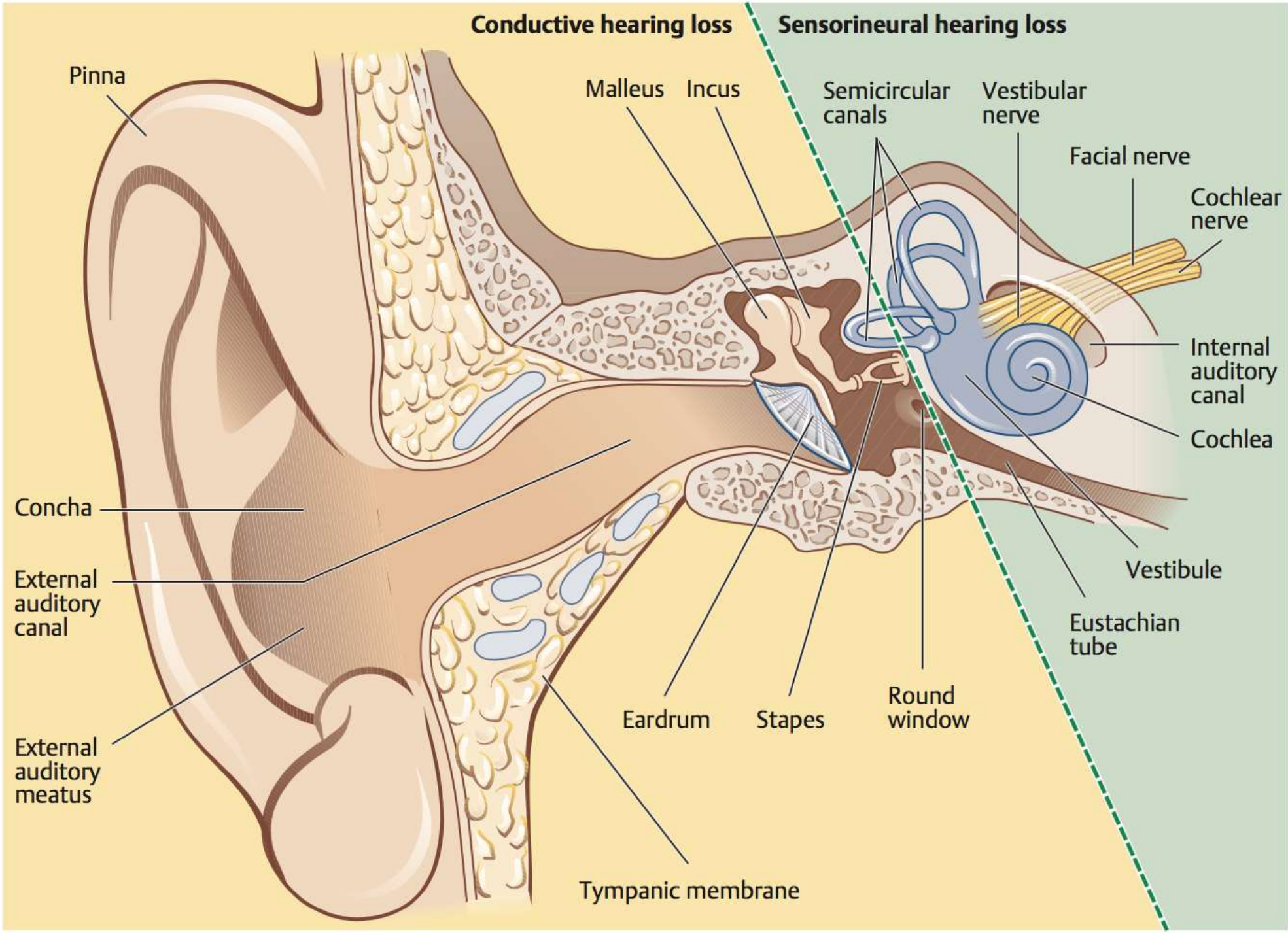





Helicotrema
Temporal bone
Otic capsule
Scala vestibuli
Reissner's membrane
Scala media
Basilar membrane
Scala tympani
Spiral ganglion


SCALA VESTIBULI
STRIA VASCULARIS
VESTIBULAR MEMBRANE
COCHLEAR DUCT
SPIRAL PROMINENCE
EXT. SPIRAL SULCUS
SPIRAL LIGAMENT
BASILAR MEMBRANE
SCALA TYMPANI
SPIRAL LAMINA
MODIOLUS
SPIRAL GANGLION
COCHLEAR NERVE

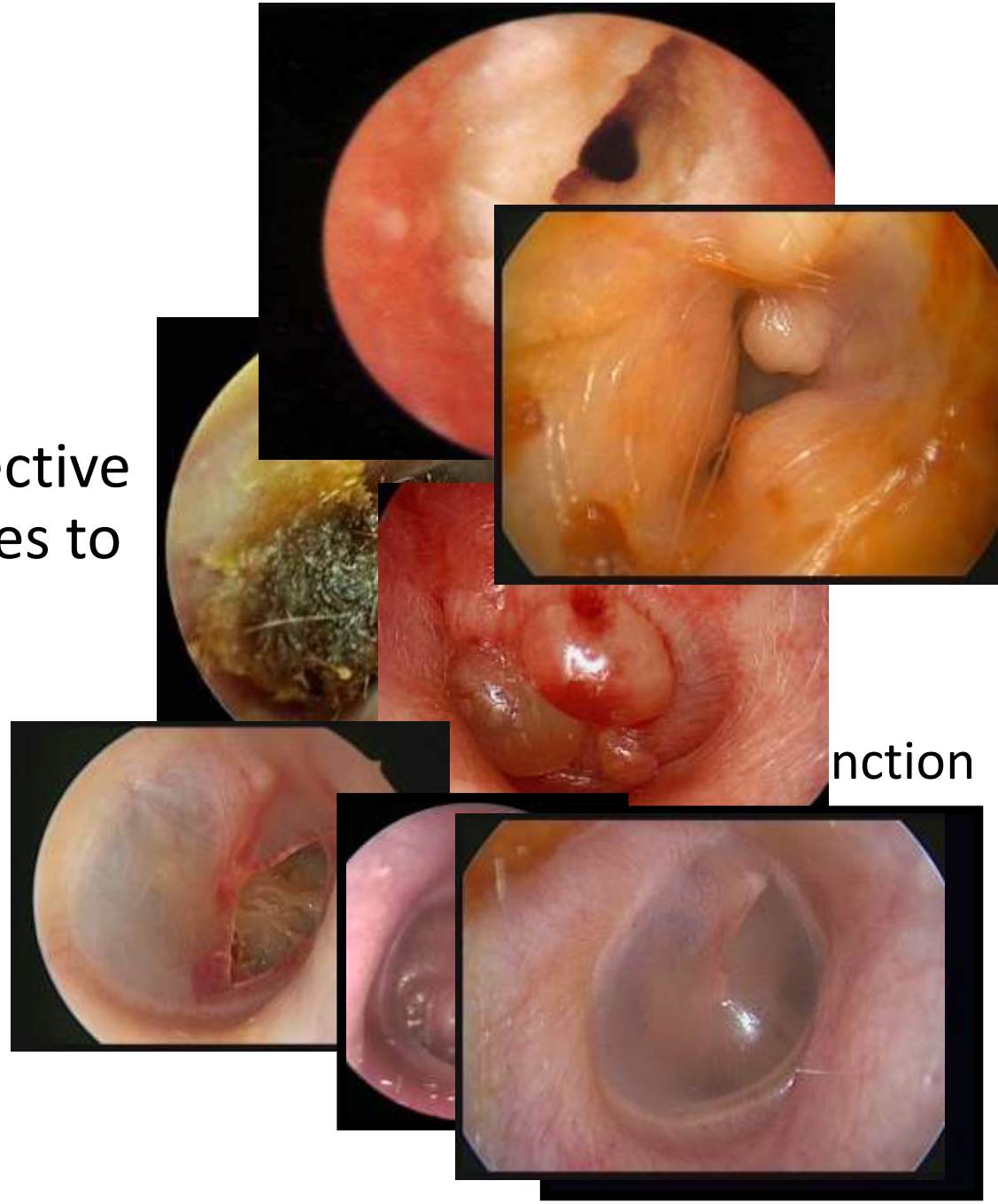

Scala media
Tectorial membrane
Outer hair cells
Hensen's cells
Claudius cells
Habenula perforata
Inner sulcus
Inner hair cells
Pillar cells
Deiters' cells
Basilar membrane
Tunnel of Corti
Spiral ganglion
Scala tympani


Conductive hearing loss
Sensorineural hearing loss
Pinna
Malleus
Incus
Semicircular canals
Vestibular nerve
Facial nerve
Cochlear nerve
Internal auditory canal
Cochlea
Vestibule
Eustachian tube
Concha
External auditory canal
External auditory meatus
Eardrum
Stapes
Round window
Tympanic membrane

Hearing loss

Conductive Hearing Loss

- Pathologies preventing effective **transmission** of sound waves to the cochlea
  - External ear:
    - Pinna
    - External Auditory Canal
    - Tympanic membrane
  - Middle ear
    - Aerated space
    - Ossicles



er ear
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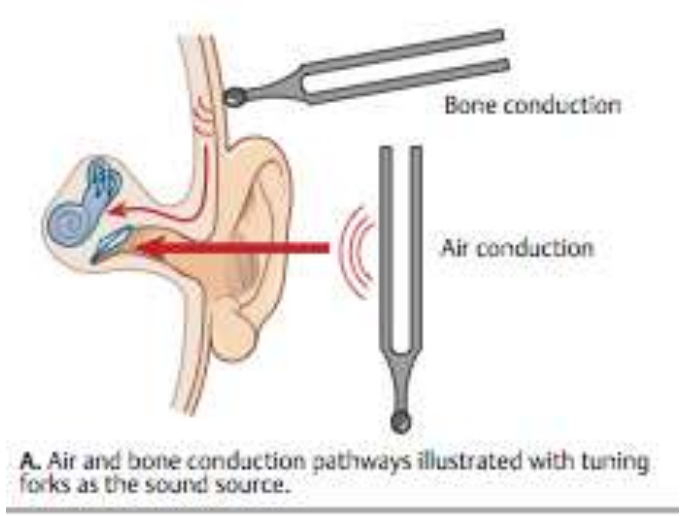
Physical Examination = Tuning forks

512 Hz Tuning fork



A. Air and bone conduction pathways illustrated with tuning forks as the sound source.

STEPS:

1. Striking the TF on firm but non-resonating surface (e.g: Elbow)
2. Subjective comparisons between both ears (AIR)
3. **Weber** test
   - Forehead, nasal bridge, teeth
4. **Rinne** test

B. Rinne tuning fork test to screen air conduction and bone conduction pathways.

C. Weber tuning fork test to screen for nature of unilateral loss (conductive vs. sensorineural).

Physical Examination = Tuning forks

Examination of our case patient:

1. **Striking the TF** on firm but non-resonating surface (e.g: Elbow)
2. **Subjective comparisons** between both ears (AIR)
    - Our patient says that **RIGHT ear** is clearly worse
3. **Weber test** – forehead not sure, nose:
    - If our patient hears it on the **LEFT = suggesting a SNHL on the RIGHT**
    - If our patient hears it on the **RIGHT = suggesting a CHL on the RIGHT**

    - A very small CHL (5-10dB) is needed for the weber to lateralize

4. **Rinne** test is mainly used for QUANTIFYING the degree of CHL
    - A larger CHL (25dB) is needed for the Rinne to show a BONE > AIR

Common Tuning fork MISTAKE

- RINNE done on our patient complaining on right hearing loss:
  - On the left side: Air better than bone
  - On the right side: Bone better than air

CONCLUSION: she must have CHL on the right if bone is better than AIR

Common Tuning fork MISTAKE

- RINNE done on our patient complaining on right hearing loss:
  - On the left side: Air better than bone
  - On the right side: Bone better than air

~~CONCLUSION: she must have CHL on the right if bone is better than AIR~~

Keep in mind that TF application on the **bone** is **heard by both ears**!!!

Even if the TF is applied on the right mastoid, it can be heard by the left cochlea…

With a severe SNHL on the right the patient might feel that they hear the bone and not the air.

Weber test (looking for lateralization) is the KEY test to do in emergency setting

Validity of the Hum Test, a Simple and Reliable Alternative to the Weber Test

Annals of Otology, Rhinology & Laryngology
2018, Vol. 127(6) 402–405

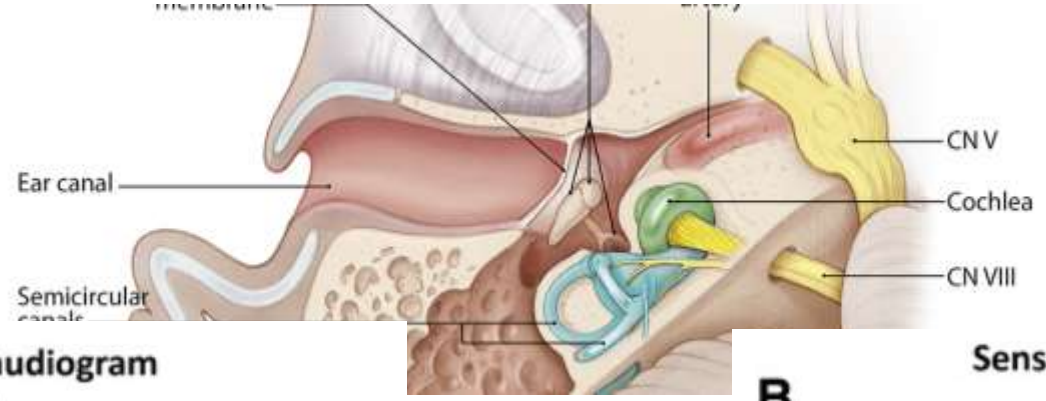
DOI: 10.1177/0003489418772860
journals.sagepub.com/home/aor
SAGE

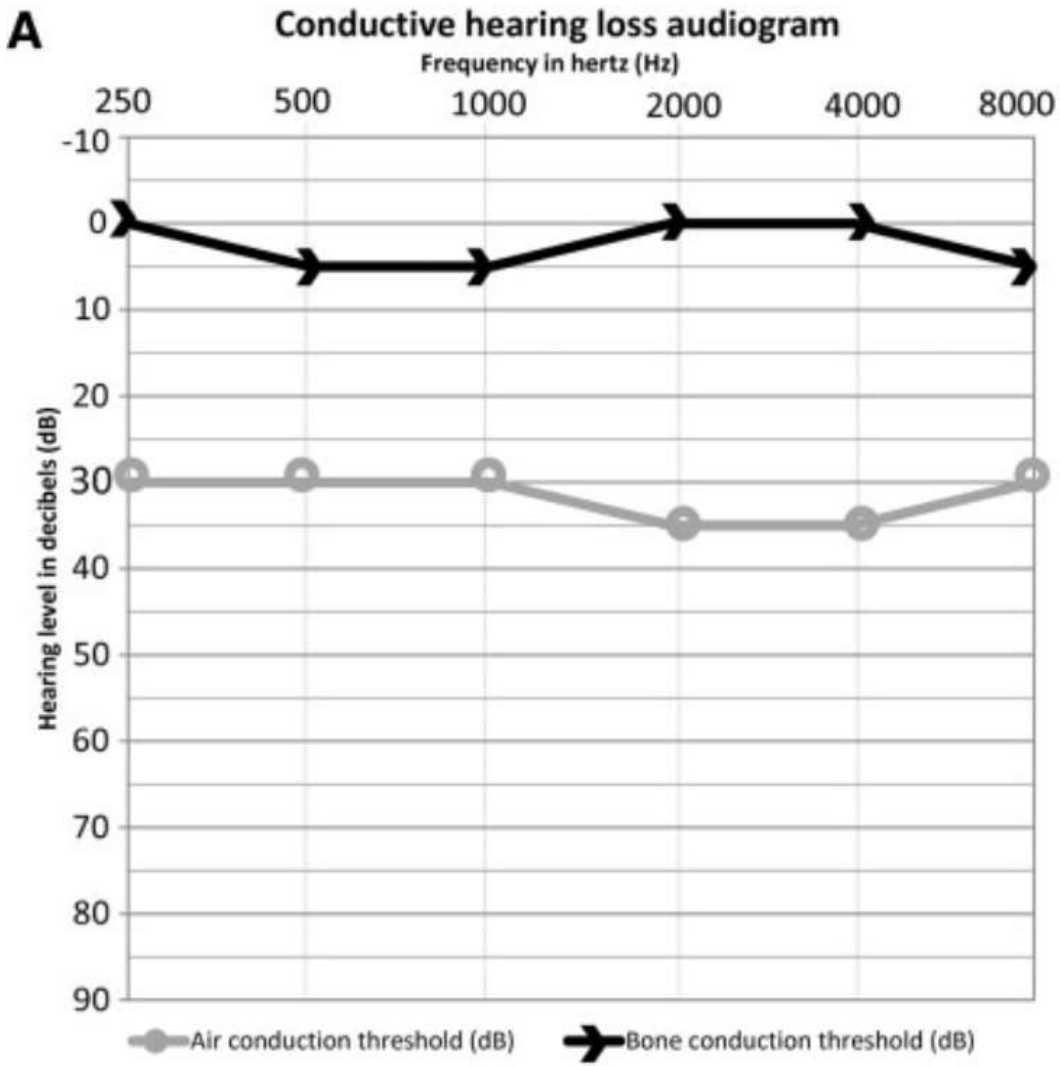
Omar H. Ahmed, MD[1], Sara C. Gallant, MD[1], Ryan Ruiz, MD[1], Binhuan Wang, PhD[2], William H. Shapiro, AuD[3], and Erich P. Voigt, MD[1]

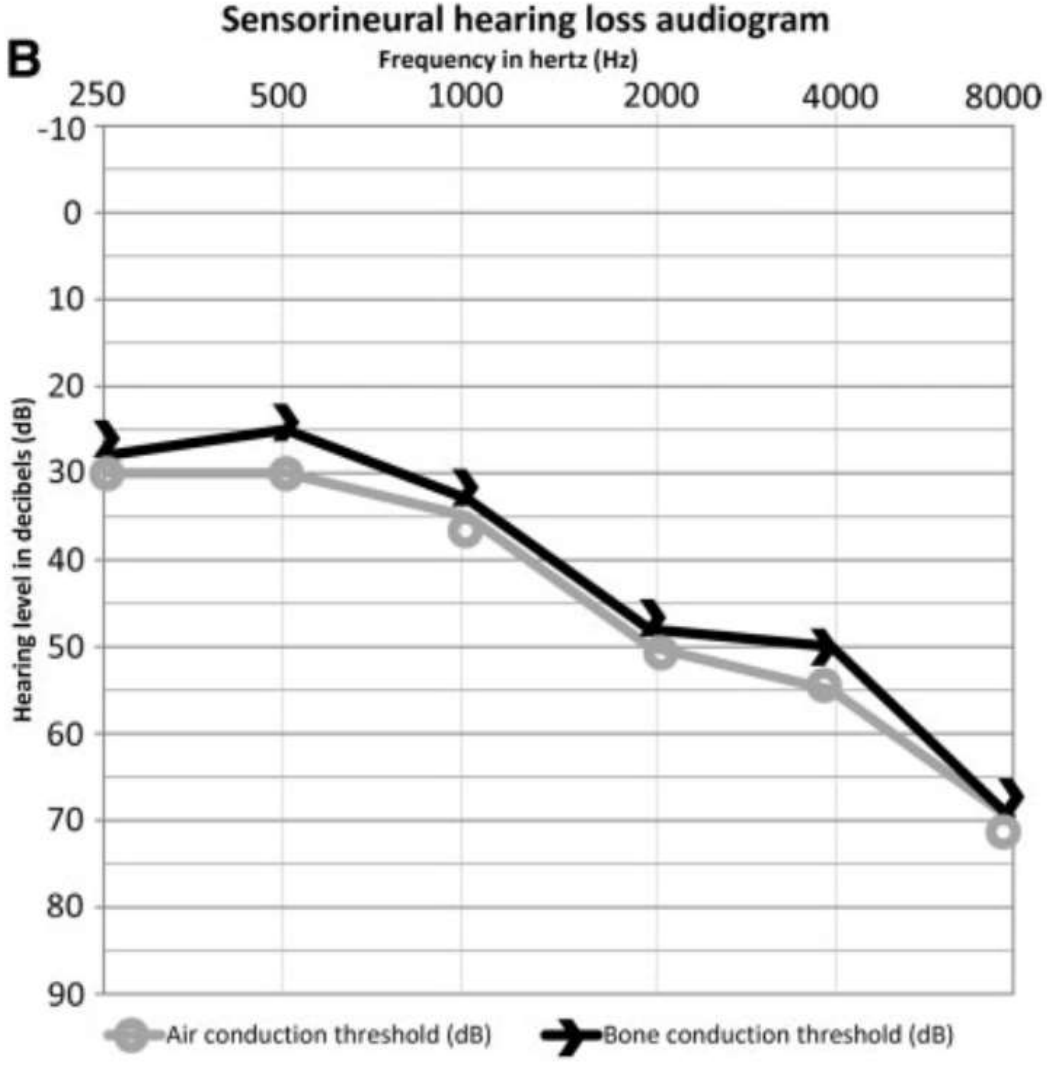
Ask the patient to produce a **low pitch HUMMMMM**

- For our patient complaining of **RIGHT hearing loss**:
  - If she hears the HUM on the **RIGHT side = CHL**
  - If she hears in on the **LEFT side = SNHL**

Audiogram


Ear canal
Semicircular
CN V
Cochlea
CN VIII


A
Conductive hearing loss audiogram
Frequency in hertz (Hz)
250
500
1000
2000
4000
8000
-10
0
10
20
30
40
50
60
70
80
90
Hearing level in decibels (dB)
Air conduction threshold (dB)
Bone conduction threshold (dB)


B
Sensorineural hearing loss audiogram
Frequency in hertz (Hz)
250
500
1000
2000
4000
8000
-10
0
10
20
30
40
50
60
70
80
90
Hearing level in decibels (dB)
Air conduction threshold (dB)
Bone conduction threshold (dB)

Sensorineural hearing loss

- Congenital (eg. Connexin 26 – Gap Junction protein)
- Infectious (eg. Viral SSNHL – quick in less than 72h)
- Inflammatory (eg. Autoimmune Inner ear disease)
- Traumatic (including Noise)
- Toxic (Ototoxic antibiotics or chemo such as Gentamycin and Cisplatin)
- Neoplastic (eg. Acoustic Neuroma)
- Degenerative (Presbycusis)

Timing of SNHL

SUDDEN < 3 days

- **Sudden SSNHL --> Idiopathic**
  - Infectious (viral)
  - Autoimmune
  - Ischemic
  - Other: traumatic – membrane rupture

Weeks to Months

- Autoimmune inner ear disease
- Ototoxic
- Neoplastic

Months to Years

- Genetic
- Noise
- Presbycusis

Clinical Scenario

- 36 F, healthy
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- **OE:**
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  - ? TM red, but overall normal
  - Nose: mild congestion
  - Mouth: N
  - Neck: N

TF = 512 Hz

Right subjectively worse

Weber to the left

= HIGH suspicion of Sudden SNHL

Sudden SNHL

- Prevalence of 5-20 in 100 000

- Sudden hearing loss is defined as a rapid onset, occurring over a 72-hour period, of a subjective sensation of hearing impairment in one or both ears.
- Sudden sensorineural hearing loss (SNHL) is a subset of SHL that (a) is sensorineural in nature and (b) meets certain audiometric criteria.

  (a) Sensorineural hearing loss indicates an abnormality of the cochlea, auditory nerve, or higher aspects of central auditory perception or processing.
  (b) The most frequently used audiometric criterion is a decrease in hearing of ≥30 decibels (dB), affecting at least 3 consecutive frequencies. Because premorbid audiometry is generally unavailable, hearing loss is defined as related to the opposite ear's thresholds.

- Idiopathic sudden sensorineural hearing loss (ISSNHL) is defined as SSNHL with no identifiable cause despite adequate investigation.

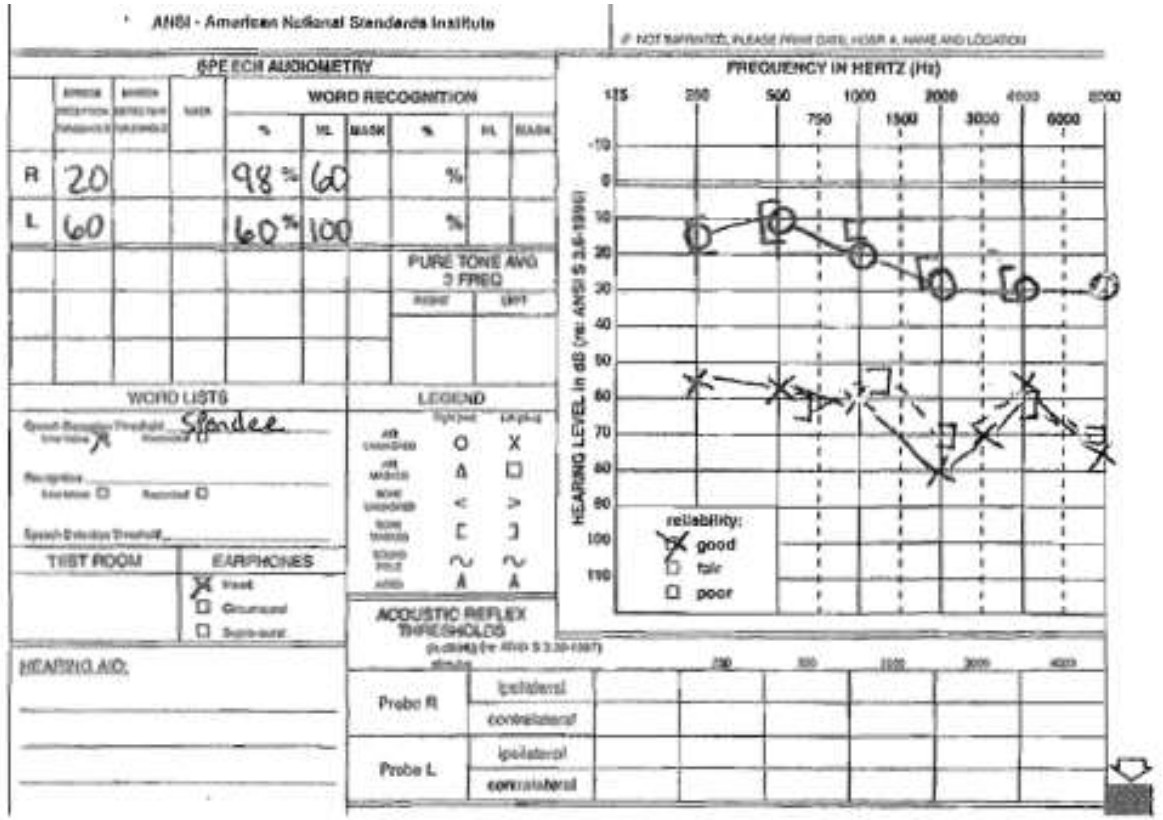
Sudden SNHL

Modifying Factors (3)

- Clinicians should assess patients with presumptive sudden sensorineural hearing loss for :
  - **bilateral sudden hearing loss → Meningitis, trauma, syphilis, lyme**
  - **recurrent episodes of sudden hearing loss → Meniere, Cogan**
  - **focal neurologic findings → AICA stroke**
- Identification of patients with a high likelihood of alternative and potentially serious underlying cause, who require specialized assessment and management

Management

- Referral to an OTL → **Call your affiliated OTL**
- Urgent audiogram – SAME day or following



Prognostic factors

Good

- Absence of Vestibular symptoms
- Low frequency loss (upsloping shape)
- Minimal hearing loss
- **Early treatment (within 3 days)**

Bad

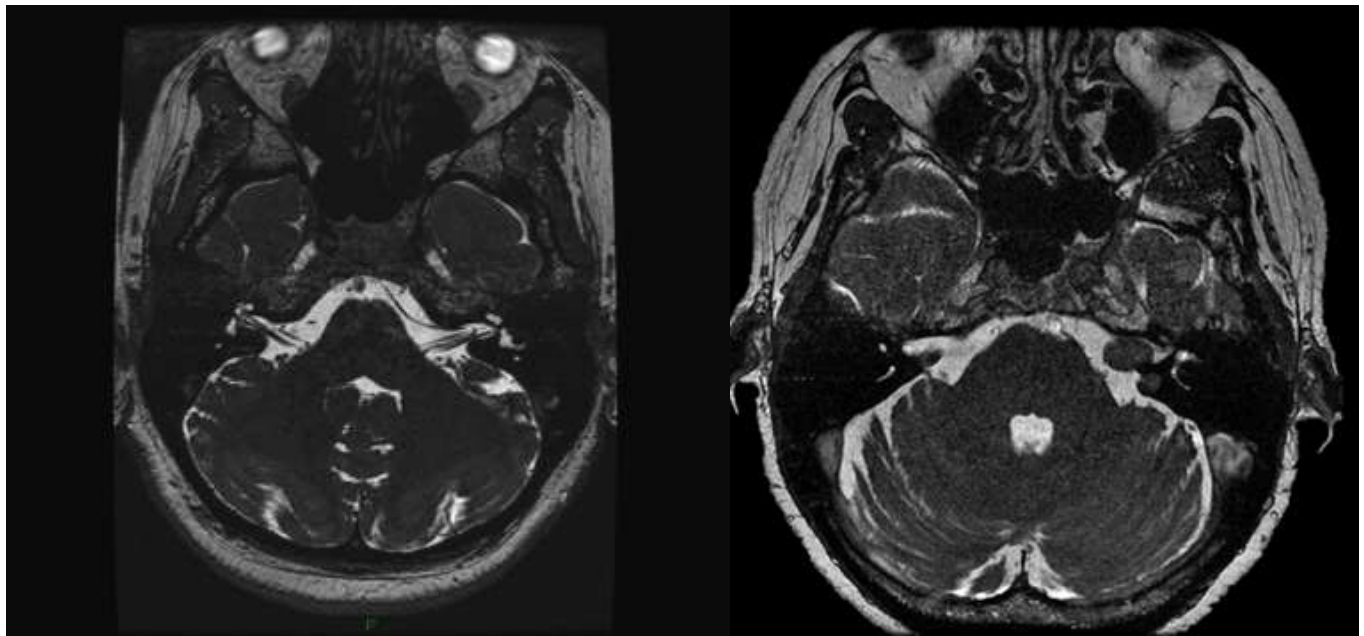
- Presence of Vertigo (30%)
- Age (advanced = poorer)
- Severity (total deafness worse)
- Audiogram shape (flat/downsloping worse)
- Other vascular Risk factors (HTN, DM)
- **Delay in initiation of treatment**

Additional diagnostic tests?

- There is **NO INDICATION** to order any **CT or routine lab** tests when investigating patients with SSNHL in the emergency setting

- The OTL will be looking for a **retrocochlear pathology** with an **MRI IAC** (Internal auditory) done on non-emergency basis.

Screening T2 (FIESTA protocol without contrast)



Treatment options

1. **Observation** – 1/3 - 2/3 may recover spontaneously
2. **Initial Corticosteroids** (Oral vs IT) = 75% recovery rate
3. **HBO (20 dives)**
4. **Other:** Clinicians should not routinely prescribe antivirals, thrombolytics, vasodilators, vasoactive substances, or antioxidants to patients with ISSNHL.
5. **Salvage therapy**

Corticosteroids

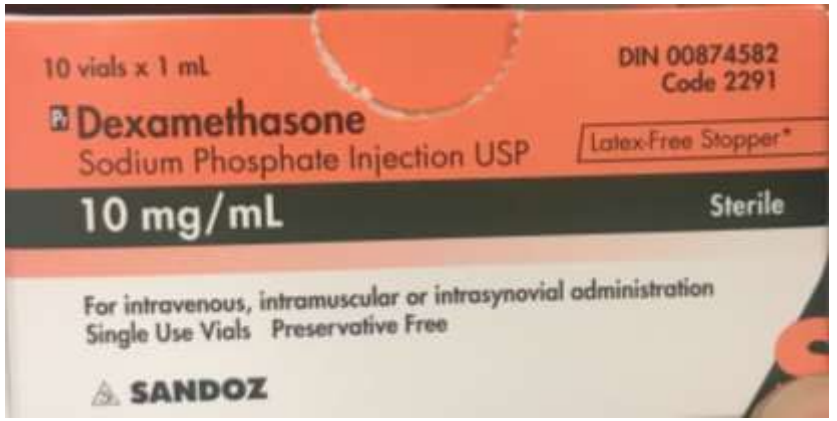
- **Oral**: easy and low cost
- Benefits up to 6 weeks after onset
- **PREDNISONE 1mg/kg/day x 7 days with taper**
- Side effects and Risks:
  - **Dysphoric feeling/Sleep disturbances**
  - **HPA axis suppression (low in short term)**
  - **Avascular necrosis of the hip**
  - **Increased risks in pt with**
    - **insulin-dependent or poorly controlled diabetes**
    - **HTN**
    - **tuberculosis**
    - **peptic ulcer disease**

1 month of PPIs as prophylaxis

Corticosteroids

- **Intra-tympanic injections of steroids**:
  - **Dexamethasone 10mg/ml 3X in 1 week**
  - Local reactions of pain, tympanic membrane perforation, transient dizziness
  - High cost and multiple office visits – potential added benefit
  - Options:
    - In addition to the oral pred
    - As sole rx in pts who cannot have oral pred
    - As salvage treatment after oral prednisone and no sign of recovery

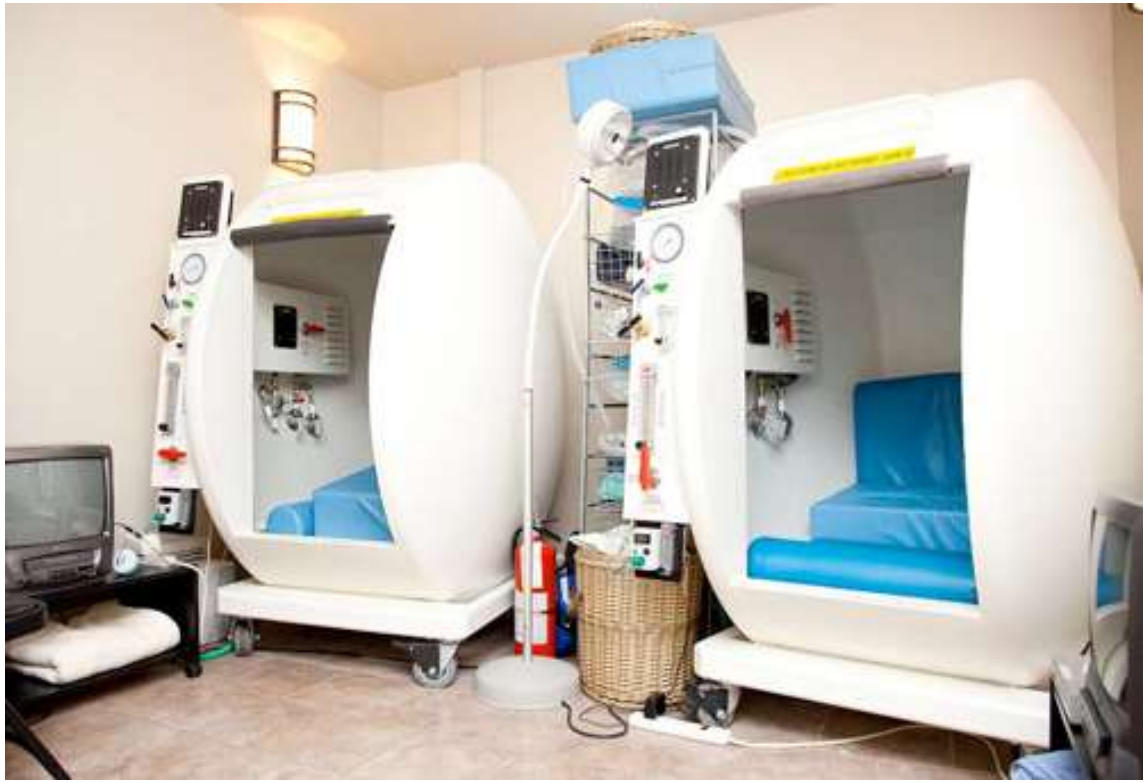
1cc of Dex 10mg/ml



HBO

Table 10. Summary of Hyperbaric Oxygen Therapy for Idiopathic Sudden Sensorineural Hearing Loss

Younger patients respond better to hyperbaric oxygen therapy (HBOT) than older patients (the age cutoffs varied from 50-60 years).[173,235-238]
Early HBOT is better than late HBOT (early is defined from 2 weeks to 3 months).[173,177,235,236,238-241]
Patients with moderate to severe hearing loss benefit more from HBOT than those with mild hearing loss (moderate hearing loss cutoff was usually at 60 dB).[168,170-172,242-244]
Results of studies detailing effectiveness of HBOT depend on the choice of outcome measures.[166]



Summary of Guidelines

Table 3. Summary of Evidence-Based Statements

Management of Patients with Sudden Hearing Loss (Evidence-Based Statement)	Statement Strength
Diagnosis	
Exclusion of conductive hearing loss (Statement 1)	Strong recommendation
Modifying factors (Statement 2)	Recommendation
Computed tomography (Statement 3)	Strong recommendation against
Audiometric confirmation of idiopathic sudden sensorineural hearing loss (Statement 4)	Recommendation
Laboratory testing (Statement 5)	Strong recommendation against
Retrocochlear pathology (Statement 6)	Recommendation
Shared decision making	
Patient education (Statement 7)	Strong recommendation
Treatment	
Initial corticosteroids (Statement 8)	Option
Hyperbaric oxygen therapy (Statement 9)	Option
Other pharmacologic therapy (Statement 10)	Recommendation against
Salvage therapy (Statement 11)	Recommendation
Follow-up	
Outcomes assessment (Statement 12)	Recommendation
Rehabilitation (Statement 13)	Strong recommendation

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  - ? TM red, but overall normal
  - Nose: mild congestion
  - Mouth: N
  - Neck: N
  - TF = High suspicion of SSNHL

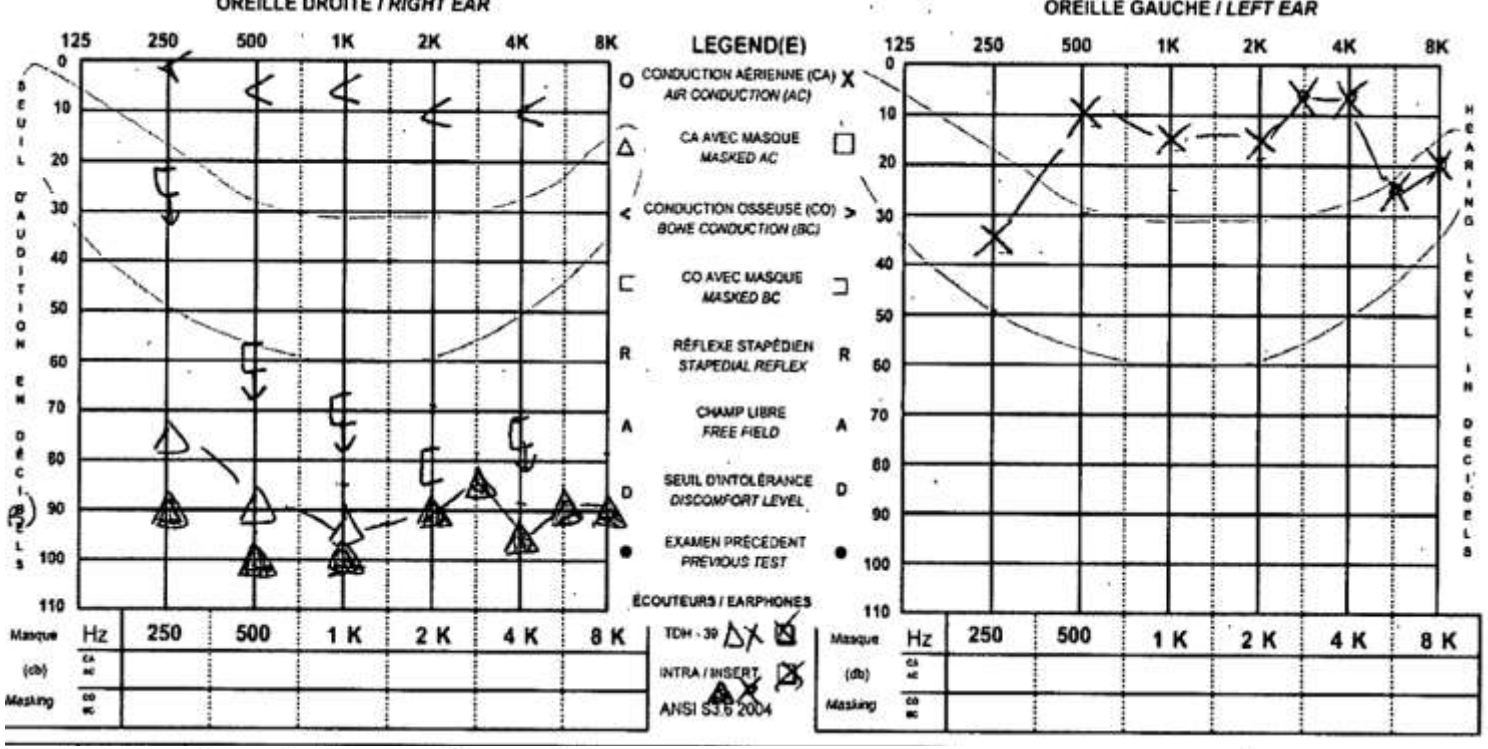
Started on Oral pred 60 mg po QD in the ER

Had an Audiogram and 3 IT dex injections that week

MRI IAC = normal

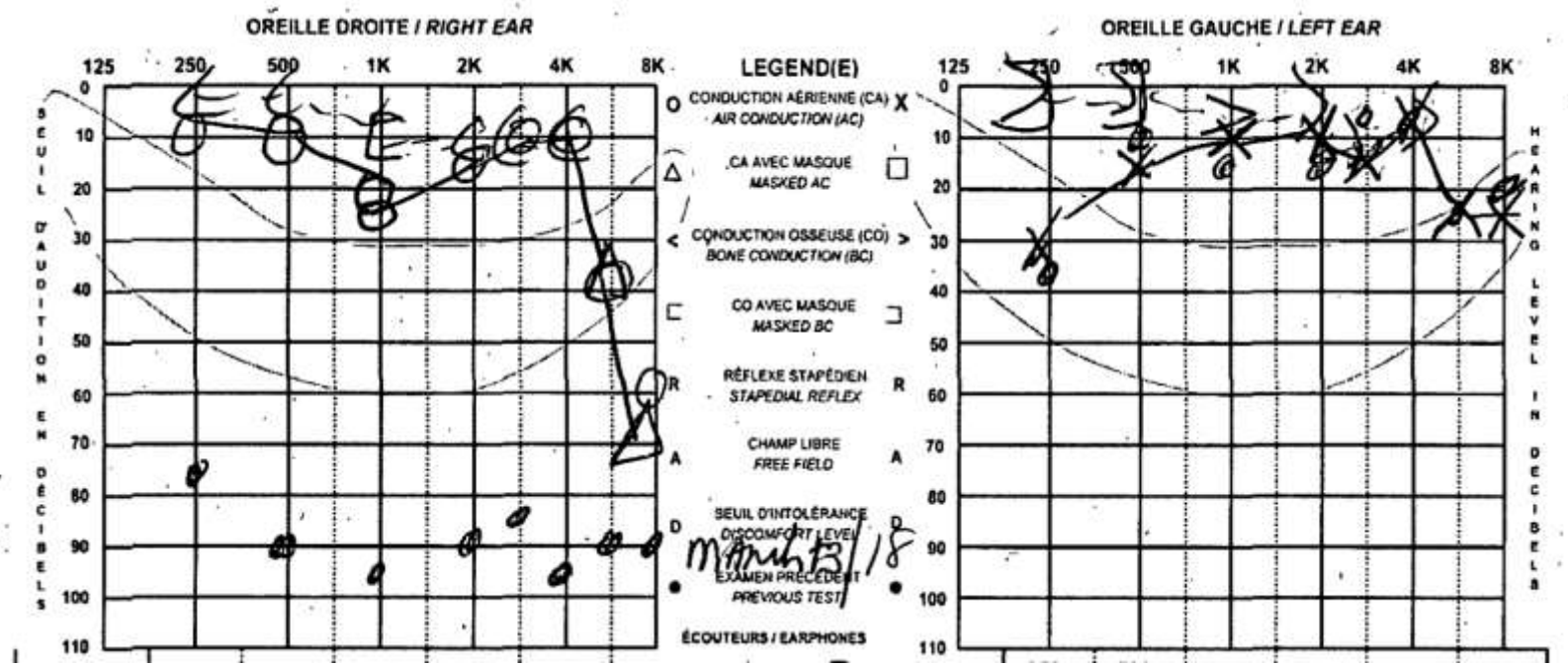
Initial audio:

Severe to profound Right SNHL



1 month after onset audio:

High frequency SNHL, remaining of hearing vastly recovered



Take home messages

- Keep a high suspicion for Sudden SNHL when assessing pt complaining of acute HL
- Exclude Conductive hearing loss through examination and proper TF testing
- Early initiation of treatment can be key

Presbycusis

Hearing loss related to aging

Progressive symmetrical bilateral SNHL beginning in the 6th decade

Ask about hearing loss in those over 50!

History

- Slow onset
- Insidious
- Lack of clarity, difficulty in noisy environments
- Tinnitus (30-50%)
- Social isolation/depression

First Step => Audiogram

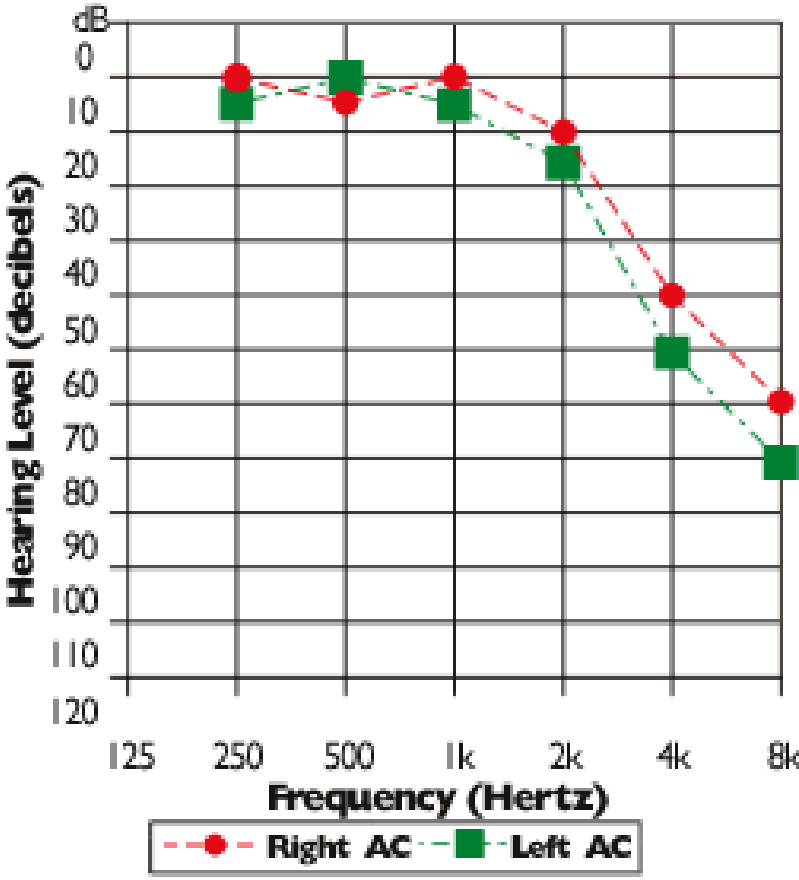
- Screening audiograms = done by technicians and audioprosthesists
  - Can be a good first step to assess the extent
  - Outside of hospital = often free or small fee

- Full audiograms = done by certified audiologists
  - In hospital = long wait lists 6 mo to 1 year
  - In privet offices = 75$ to 115$
  - Needed to prescribe a hearing aid

- **Hearing aids** = covered when average is below 35dB
  - Needs an OTL to prescribe it

- RAMQ covers 2 hearing aids for full time workers and 1 for unemployed or retired pt every 5 years

- If patient has hx of work related noise exposure = CNSST



Hearing aids => Breaking the stigma

- Technology is booming
  - Smaller
  - More comfortable
  - THEY WORK

Self-Reported Hearing Loss, Hearing Aids, and Cognitive Decline in Elderly Adults: A 25-Year Study

Hélène Amieva, PhD, Camille Ouvrard, MSc, Caroline Giulioli, MSc, Céline Meillon, MSc, Laetitia Rullier, PhD, and Jean-François Dartigues, MD, PhD

Management

- Inform and educate
  - Explain the nature of their hearing impairment and likely progression
  - Adapt their behaviour to optimize their acoustic environment
    - Background noise, traffic, etc
    - Face to face, using other visual cues
    - Let the other person know
    - Lip reading classes

- **Assisted listening devices**
  - Infrared TV headphones
  - Volume controllable telephones
  - Loud doorbells, flashing lights, vibrating systems

Summary

- Think of hearing loss when seeing your patients above the age of 50
- Initial assessments and screening can be done in Hearing Clinics
- Hearing aids can be covered by the RAMQ if hearing loss is significant
- Early use of hearing aids can slow the cognitive decline associated with aging!