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INTRODUCTION

- When a patient presents to an audiology clinic with a complaint of difficulty hearing with his/her current hearing aids, it is important to determine if the problem is with the hearing aids or changes in the patient's auditory system or both. To assume the hearing aids are not functioning adequately, can allow the hearing aid complaints to mask a co-existing condition that may require medical management. It is the responsibility of the audiologist to fully assess the patient's auditory status. It is also critical to utilize the cross-check principle, meaning that results of a single test are cross-checked and confirmed by other independent test measures. The goal of this study is to illustrate the importance of this principle for accurate diagnosis and optimal patient care.

CASE DESCRIPTION

Patient History

- 84 year old male; currently uses an internal heart defibrillator due to past congestive heart failure; uses a cane when walking
- Long term history of hearing loss and hearing aid use
- Ototoxic Medications:**
 - Current medications included furosemide and aspirin, which can be mildly ototoxic for some patients; not suspected to be contributing to the hearing loss in this case

Audiologic Assessment

- Pure tone Audiometry:** A behavioral test to assess hearing sensitivity. Results are recorded in graphic form on an audiogram that exhibits the severity of the hearing loss across a range of frequencies
- Speech Audiometry:** A behavioral test of word recognition that can be performed at varying intensity levels
- Tympanometry:** A physiologic test of middle ear function performed by measuring sound pressure level at the eardrum

RESULTS

- Pure tone Audiometry:** Bilateral moderate to profound mixed hearing loss, indicating both middle ear and inner ear pathology based on the difference between air- and bone-conduction thresholds (See Figure 1)
- Speech Audiometry:** Word recognition scores of 72% right ear and 76% left ear were fair and were consistent with pure tone thresholds

Tympanometry: Results were consistent with a middle ear pathology, bilaterally, and served as a good physiologic cross-check with the pure tone results, which also indicate middle ear pathology (See Figure 2)

Figure 1. Audiogram showing air- and bone-conducted pure tone thresholds.

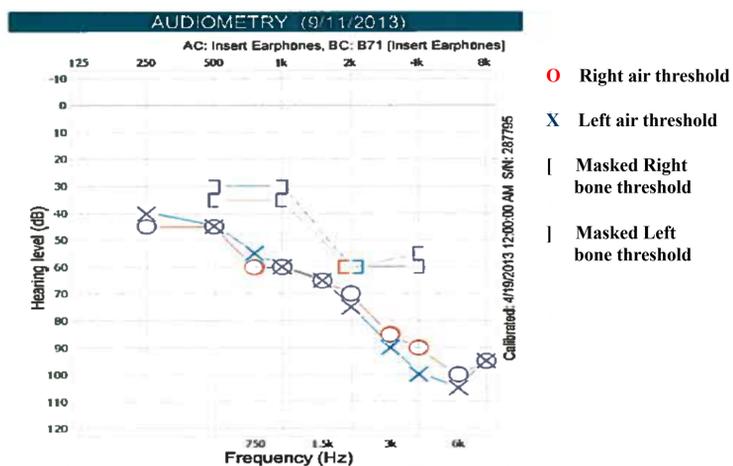
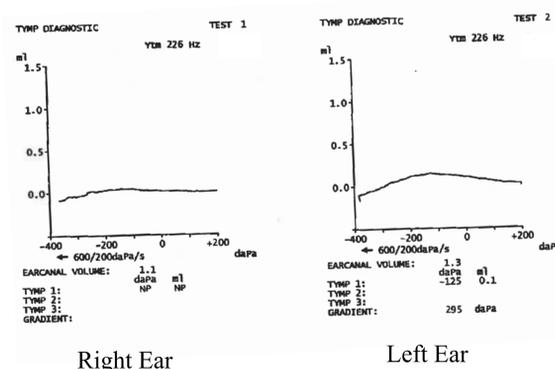


Figure 2. Tympanometric results



RECOMMENDATIONS

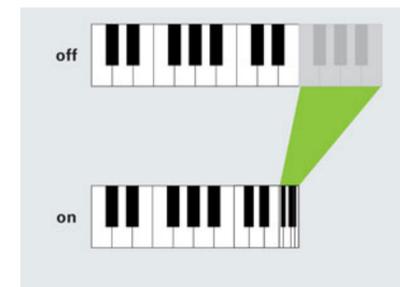
- Referral to PCP or ENT for an otologic evaluation of possible middle ear pathology based on the air-bone gap and abnormal tympanometric results
- Evaluation of amplification technology options, following medical intervention and clearance

HEARING AID TECHNOLOGY

There are various digital hearing aid technology features that may assist this patient. These may include:

- Sound Recover—a feature which compresses and shifts the high frequency acoustic information to a lower frequency range where hearing loss is less severe (See figure 3)
- Automatic directionality—a feature that allows for the hearing aids to automatically adjust to the acoustic environment by analyzing sounds and focusing more amplification on the sounds from in front of the listener and providing less boost to sounds coming from other directions, thus improving the signal-to-noise ratio
- Digital noise reduction—a feature that can further increase the signal-to-noise ratio by reducing steady-state noise such as the humming of an air conditioner

Figure 3. An analogy of frequency compression as illustrated with the keys on a piano.



DISCUSSION

- Using the cross-check principle with appropriate audiologic tests allowed for the diagnosis of a moderate to profound mixed hearing loss with sensorineural and conductive components
- Referral to the PCP was necessary due to the conductive component
- The sensorineural loss can be treated with amplification technology such as frequency compression, automatic directionality and digital noise reduction to address the severity of the high frequency thresholds and the patient's needs

Acknowledgements

I would like to thank my preceptor, Dr. Gabrielle Sadowsky, from Desert Sounds Audiology for the use of this case. Thanks to Dr. Tabitha Parent-Buck and Dr. Zarin Mehta for guiding me throughout this study.

References

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 "SoundRecover: Information for Teacher" Image. n.p. n.d. Web. 9, May, 2014