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SCREENING AND DIAGNOSTIC

Longitudinal Changes in Pure-Tone Thresholds among Cochlear Hearing Loss Patients: A Retrospective Analysis

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Background

Age-related hearing loss (ARHL), also referred to as presbycusis, involves a gradual and progressive decline in hearing ability. This decline is influenced by various factors, including age, gender, and initial hearing status. Annual changes in hearing thresholds can range from 0.25 to 1.5 dB, depending on frequency and age, as observed in longitudinal studies of individuals with normal hearing at baseline. The progression of hearing loss tends to accelerate with advancing age. Research suggests that ARHL often worsens more rapidly in individuals with cochlear pathology. It is crucial to note that the progression of hearing deterioration is not solely determined by age or gender, but also by the underlying cause of any pre-existing hearing impairment.

This retrospective study aimed to evaluate the longitudinal changes in pure-tone thresholds among patients with confirmed cochlear hearing loss, while considering the influence of age on these changes.

Methods

The study included 165 adults aged between 20 and 85 years with cochlear hearing loss, whose audiograms were retrospectively analyzed from routine follow-up visits over the years. Pure-tone thresholds were measured at 10 frequencies ranging from 0.250 to 8 kHz. Subjects underwent between 2 and 16 visits over a period of 1 to 30 years, with pure-tone thresholds measured at each visit. Subjects were excluded if evidence of conductive hearing loss or active otologic/neurologic disease were present. The slope of a linear regression was used to estimate the rate of change in pure-tone thresholds for each ear.

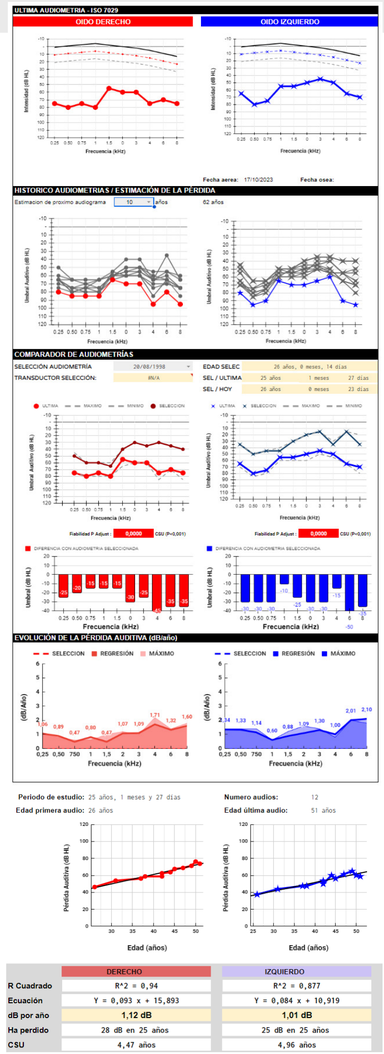

Figure 1: *25-year longitudinal analysis of hearing loss in an individual case.*

Results

Figure 1 presents a 25-year longitudinal analysis of a patient's hearing loss across 12 assessment visits. The upper section **(a)** shows the most recent audiograms for both ears. Historical audiograms **(b)** illustrate progressive decline. Future 10-year projections are in red (right ear) and blue (left ear). The middle section **(c)** compares initial and final audiograms, highlighting frequency threshold changes. The lower section **(d)** shows dB/year loss for each frequency, with linear regression lines **(e)** indicating annual changes of 1.12 dB (right ear) and 1.01 dB (left ear). Additional details **(f)** cover total dB loss over the study.

Figure 2 (a) shows average rates of change in pure-tone thresholds for 330 ears in cochlear hearing loss patients. The rate ranged from 0.8 dB/year at 0.25 kHz to 1.50 dB/year at 8 kHz. Dashed lines represent Lee et al.'s (2005) results in presbycusis patients. The rates observed here were slightly higher, likely reflecting underlying cochlear pathology**.**

Figure 2 (b) shows variations in the rate of change across three age cohorts. The oldest group experienced faster deterioration than the middle-aged, who showed a more rapid decline than the youngest cohort, particularly in the lower frequency range (0.25-1 kHz), where statistically significant differences were observed.

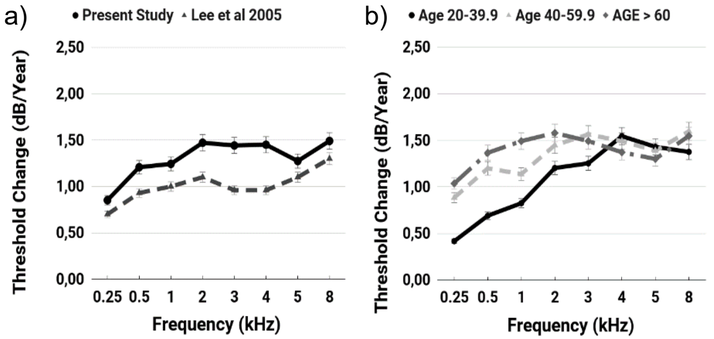

Figure 2: *Frequency-dependent hearing threshold changes. a) Threshold changes across all subjects. b) Threshold changes categorized by age groups.*

Conclusion

The study highlights the significant impact of age on the decline in pure-tone thresholds in individuals with cochlear hearing loss. The findings align with previous research, showing more rapid deterioration, particularly at higher frequencies, with increasing age. The observed decline rates were slightly higher than those associated with ARHL, likely due to cochlear pathology. The pronounced decline in older individuals emphasizes the need to consider age-related trends when monitoring hearing loss. These findings deepen our understanding of hearing loss progression and call for further research into different types of cochlear hearing loss and their distinct patterns.

References

Lee, F.-S., Matthews, L. J., Dubno, J. R., & Mills, J. H. (2005). Longitudinal Study of Pure-Tone Thresholds in Older Persons. *Ear and Hearing, 26(1), 1–11.*

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