

Permanent Damage from Longstanding Hearing Loss Due to Middle Ear Infection

Sound deprivation leads to irreversible hearing loss

Researchers show that chronic conductive hearing loss leads to cochlear degeneration

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Summary: Sound deprivation in adult mice causes irreversible damage to the inner ear. The findings suggest that chronic conductive hearing loss, such as that caused by recurrent ear infections, leads to permanent hearing impairment if it remains untreated.

Massachusetts Eye and Ear investigators have shown that sound deprivation in adult mice causes irreversible damage to the inner ear. The findings, published in *PLOS ONE*, suggest that chronic conductive hearing loss, such as that caused by recurrent ear infections, leads to permanent hearing impairment if it remains untreated.

Sound waves travel through the ear canal before reaching the eardrum and the tiny bones of the middle ear. They are then converted into electrical signals within the inner ear and transmitted to the brain by the auditory nerve. Conductive hearing loss occurs when sound transmission from the ear canal to the inner ear is impaired. It causes a reduction in sound level and an inability to hear soft sounds.

In this study, a team of researchers led by Stephane F. Maison, Ph.D., investigator in the Eaton-Peabody Laboratories at Mass. Eye and Ear and assistant professor of otolaryngology at Harvard Medical School, followed the inner ear changes in a group of mice with chronic conductive hearing loss in one ear.

"After a year of sound deprivation, we observed dramatic changes in the inner ear -- notably, a significant loss of the synaptic connections through which the sensory cells send their electrical signals to the brain," Dr. Maison said. "Although there have been many studies of acoustic deprivation on the auditory system, few have looked at adult-onset deprivation, and none, to our knowledge, has documented changes in the inner ear."

Leading causes of conductive hearing loss include earwax blockage, otitis media (ear infections) and otosclerosis.

"Although these conditions are routinely treated in industrial societies, a number of patients choose not to receive treatment, particularly when their medical condition affects only one ear," Dr. Maison said. "For instance, patients with unilateral atresia, a condition in which the ear canal is closed or absent, see limited benefits of undergoing surgery when they can simply use their good ear."

At least 80 percent of children will experience one or more bouts of otitis media before they reach 3 years of age. Ear infections are the most common cause for physician visits and medication prescriptions among children in the United States. These bouts can persist for many months in some cases, and deficits in communication abilities can persist for years after the middle-ear pathology has resolved.

Data from the present study suggest that the auditory deprivation, in itself, damages the inner ear in ways similar to that seen in age-related and noise-induced hearing loss. Although the mechanisms underlying this inner ear damage following sound-deprivation are not known, the authors suggest that its effects need to be considered in the management of chronic conductive hearing loss in clinic.

"Our findings suggest that audiologists and physicians should advocate for early intervention and treat these middle ear conditions," Dr. Maison said.

Story Source:

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Journal Reference:

1. M. Charles Liberman, Leslie D. Liberman, Stéphane F. Maison. **Chronic Conductive Hearing Loss Leads to Cochlear Degeneration.** *PLOS ONE*, 2015; 10 (11): e0142341 DOI: [10.1371/journal.pone.0142341](https://doi.org/10.1371/journal.pone.0142341)