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Exploring the Relationship between Hearing Loss and Fall Risk

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Samidha Joglekar, MCl Sc, Aud (C)

Recent studies have established important connections between hearing loss and a variety of medical, social, and cognitive ills including dementia, which is important given our aging population.[1,2] As audiologists we know all too well the debilitating effects that hearing loss can have on our patients. From trouble hearing in noise to difficulties with localization, tinnitus, and feelings of isolation, hearing loss leads to frustrating communication challenges. Yet, how many of us ask our patients whether they fall or lose their balance more often?

According to the public health agency of Canada, falls account for more than half of all injuries and 34% of all injury-related hospital admissions in Canadians 65-years and older.[3] Forty percent of falls in older Canadians result in life threatening hip fractures and approximately $2 billion annually is spent on direct health care costs related to falls.[3] Sadly, few statistics on falls address the prevalence of hearing loss among this population. Even so, research is pointing to an important relationship between hearing loss and fall risk, which is clearly another major public health concern.[4,5]

To determine whether hearing loss and risk of falling are connected, researchers at Johns Hopkins University used data from 2,017 participants in the National Health and Nutrition Examination Survey. Participants aged 40 to 69 underwent audiometric and objective vestibular testing, as well as an interviewer-administered questionnaire, to assess fall risk. Findings indicated that individuals with a mild hearing loss (PTA >25 dB HL) were three times more likely to have a history of falling in the previous year.[4] Every additional 10 dB of hearing loss resulted in a 1.4 fold increase in the odds of an individual reporting a fall. Adjustment for demographic factors (including smoking, diabetes, hypertension, stroke, age, gender, and education) did not alter the significance of this found association between hearing loss and fall risk.[4,5]

There are several mechanisms suggested in the literature to explain the observed association between hearing loss and risk of falling. One hypothesis is that there may be shared dysfunction in both the cochlear and vestibular organs given their shared location within the bony labyrinth of the cochlea.[5,6] Another is that decreased hearing sensitivity directly limits access to auditory cues needed for environmental awareness.[5] For example, research has shown that inter-aural time and level differences, squelch, and summation effects, which are skills that support hearing in complex environments, depend on reliable binaural input.[7] A decrement of this input, such as in hearing loss, coupled with an aging auditory system, creates great difficulties with localization and speech

understanding.[7] A third idea is that hearing loss imposes added cognitive demands on the affected individual (i.e., increased “cognitive load”) and thus reduces the “attentional” or cognitive resources that are dedicated to maintaining position and posture, thus impairing maintenance of balance in real-world situations and increasing the risk of falling.[1,5] Further research is needed to confirm these complex ideas.

An important clinical question is whether the treatment of hearing loss can play a role in restoring balance function.

Researchers at the University of Texas at Dallas are currently seeking answers to this question by trying to evaluate the effects of different types of hearing technology on gait and balance. Subjects with normal hearing and hearing loss, while wearing or not wearing hearing aids, will be monitored as they stand, walk, and perform routine daily tasks while repeating words or sentences played in the surrounding environment. Sensors will be placed on the arms and legs of participants while they walk on a treadmill or up and down stairs to measure various aspects of balance. The researchers plan to compare base-line tests gathered before amplification with results after six weeks of hearing aid use to determine whether balance improves when participants can hear better in noisy environments. The results of this study will be very interesting, as they may provide evidence that hearing loss is a modifiable risk factor for falls.[5]

Cochlear implantation, although an effective treatment for severe to profound hearing loss, causes unavoidable cochlear trauma that can lead to vestibulopathy in approximately 30–50% of patients.[6] In many cases the improved hearing that patients experience with cochlear implantation outweighs the balance issues that may result. However, it is important that we recognize that cochlear implantation can have negative effects on balance function and thus perhaps increase fall risk.[4,6] Some ongoing research aims to look into whether the activation of a cochlear implant can actually stabilize balance function under certain conditions. Schwab et al. (2010) studied the effect of electro-acoustic stimulation on vestibular function in CI patients to investigate whether electrically stimulating the inner ear influences the balance system in any way.[8] Fifty cochlear implant patients were randomly selected and all were tested at six to eight weeks post-implantation using dynamic posturography with EquiTest. The EquiTest is a clinical test used to assess the balance system as a whole, including the vestibular, visual, and somatosensory systems.[8] It involves asking patients to stand on a platform and having the platform or surroundings move with the patient's eyes closed or open. EquiTests were conducted with the implant switched on and off and compared to pre-operative tests of vestibular function, including caloric testing. Findings indicated that patients had subjective improvement in postural stability through electrical stimulation with a cochlear implant.[8] However, the overall findings were inconclusive as the authors reported that while an activated cochlear implant may lead to stabilization of balance in certain static conditions, it also lead to significant destabilization in other conditions.[8]

Hearing loss is prevalent and under treated in our society and current research is beginning to suggest some additional strong arguments for why hearing is important. Other than restoring communication ability, with better hearing we may live healthier and longer lives by reducing our chances of falling on slippery winter sidewalks. However, much more research is needed into whether current hearing loss treatments, including hearing aids and cochlear implants, favourably influence the vestibular system to improve balance and reduce fall risk.

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