Invited Commentary

Balance, Falls, and Hearing Loss: Is it Time for a Paradigm Shift?

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In this issue of *JAMA Otolaryngology–Head & Neck Surgery*, Bang et al[1] report a large, population-based study using data from the Korea National Health and Nutrition Examination Survey V. In this survey, 3864 adults (40 years and older) underwent a hearing test and a balance test. Hearing was measured on both sides via pure tone average and was classified according to the World Health Organization categories for normal, mild, or moderate hearing loss. Static balance was measured by the ability to stand on foam with eyes closed (feet 10 cm apart). Postural instability was defined as failure to maintain a position for at least 20 seconds. The authors found that, adjusting for age and sex, the odds of balance task failure were twice as high if a person had moderate hearing loss in at least one ear (compared with having no hearing loss or mild hearing loss).

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These results add to a growing body of literature regarding a potential association between hearing loss, fall risk, and balance dysfunction. A national US survey of 2017 participants (ages 40 to 69 years old) found that for every 10-dB increase in hearing loss there was a 1.4-fold (95% CI, 1.3-1.5) increased odds of the individual reporting a fall over the past 12 months.[2] This association remained statistically significant after adjusting for potential confounders (eg, vestibular function, neurological conditions, and age).[2] In contrast, Purchase-Helzner et al[3] did not identify an association between hearing loss and fall risk in older women. However, they used a hearing screening instrument rather than pure tone average. Likewise, Heitz et al[4] identified an association between self-reported hearing loss and self-reported non-fatal fall-related injuries in 994 adults responding to the National Health Interview Survey. Hearing loss was self-reported in a survey with classifications from "a little trouble hearing" to "deaf." Nevertheless, the association was no longer significant when adjusting for vestibular vertigo.

An association has also been identified between hearing loss and balance performance in aging adults. In 1075 patients with dizziness and various vestibular disorders, Berge et al[5] found that increased hearing loss was an independent factor in increased postural sway during posturography. Maheu et al[6] compared balance performance between 14 individuals with congenital bilateral deafness with 14 controls. They found that individuals with bilateral deafness had more postural sway, particularly when standing on foam with eyes closed; furthermore, participants with bilateral deafness and evidence of vestibular dysfunction performed worse.[6] Liu et al[7] found that individuals with profound sudden unilateral sensorineural hearing loss showed worse balance performance on the sensory organization test compared with those with minimal or moderate hearing loss, particularly on conditions with sensory conflict.

A fundamental limitation in observational studies is the possibility of confounders. Bang et al[1] measured age, sex, hearing loss, and timed standing balance. Several confounders could explain the observed association (eg, lower extremity injuries, neuropathy, and visual impairments). As the frequency of such confounders is known to increase with age, the authors properly adjusted for age. Nevertheless, other surveys suggest that the most important confounder is an underlying vestibular dysfunction accompanying the hearing loss. Liu et al[7] proposed that the association between hearing loss and balance problems may be mediated via an underlying subthreshold vestibular dysfunction, even without vestibular symptoms. This suggestion was based on their finding that some participants with unilateral sensorineural hearing loss, who did not report dizziness, had positive findings on diagnostic vestibular testing, such as ocular and cervical vestibular evoked myogenic potentials and caloric testing. Bang et al[1] did not report results of vestibular testing or self-reported dizziness. Consequently, findings from their study should be interpreted with caution.

As in any association study, no directionality or causality can be inferred from the observed association. Several mechanisms have been proposed to explain a possible independent association between hearing loss, balance performance, and falls. One of these proposed mechanisms is a shared dysfunction of the cochlear and vestibular sensing organs. Others suggest that auditory cues are needed for environmental awareness and that reduced awareness leads to falls. It is also possible that individuals with hearing loss develop substitution strategies making them more dependent on vision, vestibular, or somatosensory information to maintain their balance. In addition, reduced attentional resources in individuals with hearing loss may impair the ability to control balance in complex real-world environments.

Is it time for a paradigm shift in the inquiry of postural control? Vision, somatosensory, and vestibular information are known to be crucial sensory inputs for balance. Should auditory input be added to this model? New evidence suggests that balance is impaired and often overlooked in patients with hearing loss. Clinically, a paradigm shift calls for individuals with hearing loss to be screened for balance performance and fall risk. In addition, evaluation of hearing interventions should include measures of balance and self-reported falls. Scientifically, a paradigm shift calls for the inclusion of auditory cues in postural control studies to better understand the mechanism explaining the observed association. Overall, as Bang et al[1] suggest, hearing loss should be considered beyond its auditory implications and taking into consideration its broader association with the individual's quality of life and fall risk.

ARTICLE INFORMATION

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