

# Hearing Loss in the Elderly

Rohan Patel, BS<sup>a</sup>, Brian J. McKinnon, MD, MBA, MPH<sup>b,\*</sup>

## KEYWORDS

- Elderly • Geriatrics • Age-related hearing loss • Presbycusis • Hearing aids
- Osseointegrated auditory implants • Cochlear implants • Regenerative therapies

## KEY POINTS

- Hearing loss is a common sequela of aging and has a significant adverse impact on the health and well-being of the elderly.
- The hearing loss of aging reflects changes in both the peripheral and central auditory systems, with the greatest impact initially on the higher frequencies that are most important to understanding spoken language.
- Older patients, especially those with depression and dementia, benefit significantly from amplification and from cochlear implantation, although use of these technologies is not widespread within the population that could most benefit.
- There is a great deal of promising research focused on the regeneration of inner hair cells, in the areas of gene therapy, pharmacotherapy, and stem cells, that may in the near future markedly improve the lives of those with age-related hearing loss.

## INTRODUCTION

Much like the advent of penicillin in 1928, advances in medical technology and health care have led to an increase in life expectancy with a steep rise in the numbers of older Americans. Population reports from the US Census Bureau indicate that the percentage of residents 65 and older grew from 12.4% (35 million) in 2000 to 15.2% (49.2 million) in 2016 with the national median age increasing from 35.3 years in 2000 to 37.9 years in 2016.<sup>1</sup> Life expectancy for those 65 years of age and older increased by 15.2 more years in 1972 and then to 19.1 more years in 2010. A similar trend is seen for individuals 85 and older, from 5.5 more years of life expectancy in 1972 to 6.5 more years of life expectancy in 2010. This is projected to continue with those 65 years and older predicted to have 20.6 more years of life expectancy and those 85 years and older having 7 more years of life expectancy by 2050.<sup>2</sup> This growth within

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<sup>a</sup> Drexel University College of Medicine, 2900 West Queen Lane, Philadelphia, PA 19129, USA;

<sup>b</sup> Departments of Otolaryngology–Head and Neck Surgery and Neurosurgery, 219 North Broad Street, 10th Floor, Philadelphia, PA 19107, USA

\* Corresponding author. 219 North Broad Street, 10th Floor, Philadelphia, PA 19107.

E-mail address: [bmckinnon@phillyent.com](mailto:bmckinnon@phillyent.com)

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the older population presupposes an associated increase in geriatric and degenerative issues. Alterations in sensory functions, vision, balance, and hearing are some of the most common disturbances seen in the aging population and lead to dramatic social and functional disability.

Among the senses affected by increasing age, hearing loss is the most common. Presbycusis, or age-related hearing loss (ARHL), is a term that refers to hearing loss as a result of physiologic and pathologic changes associated with increasing age. As the aging population continues to grow, greater focus is placed on understanding and attempting to reverse this sensory loss for the benefit of geriatric patients. Today, there is an established although still evolving concept of the workings of the outer ear, middle ear, and inner ear. This basis has led to a better understanding of aberrant behavior in both the peripheral and central auditory pathways, resulting in various forms of geriatric hearing loss. With a strong understanding of the foundation of geriatric hearing loss, more focused and novel areas of research are being investigated with promising results.

## PRESENTATION

Presbycusis may present insidiously and be confounded by various medical, psychological, and pharmacologic factors. Only after thorough history, examination, and audiological testing can a diagnosis of presbycusis be made after excluding concurrent medical and pharmacologic effects. In general, the first signs of ARHL can be seen in late middle age with high-frequency hearing losses in the realm of conversation frequencies, ultimately progressing subtly to lower frequency tones. The range of human auditory frequencies spans 20 Hz to 20,000 Hz, with speech frequencies ranging from 400 Hz to 5000 Hz, with the greatest loss in hearing seen in frequencies greater than or equal to 2000 Hz.<sup>3,4</sup> The challenge to effortlessly understand speech stems from the natural frequencies of voice used to phonate consonants and vowels. In general, vowels vibrate at frequencies less than 1500 Hz compared with consonants, which vibrate at 1500 Hz or higher and are more softly spoken. Consequently, patients with ARHL have greater trouble hearing consonants within words that convey the bulk of the meaning within a word, are used to separate syllables, and indicate separation of words. The loss of this linguistic information results in many of the complaints in presbycusis. The loss of meaning is seen in deterioration of speech intelligibility, the loss of clear separation between words results in speech sounding mumbled, and the loss of syllables causes difficulty discerning similarly sounding words. Furthermore, similar to the natural frequencies of vowels and consonants, elderly patients may complain of difficulty hearing and understanding women and children, because their vocal registers are set to a higher range than are those for men. Patients with presbycusis rely on conversational, emotional, and postural context clues to compensate for their hearing impairment, requiring a greater amount of higher order cognitive functioning to understand daily conversations.

As the hearing loss progresses into lower frequencies, the difficulty becomes more apparent because a greater frequency range is affected and deficits are seen more often and in a greater number of conversations. Even if subconscious, the increased dependence on higher cognitive functioning to understand daily conversations puts the geriatric patient at increased strain when hearing in difficult hearing environments or with unfamiliar vocation. For example, conversations in noisy and crowded environments, such as restaurants and public areas, or with individuals with accents or faster speech result in a diminished speech intelligibility. As a product of relying on greater

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