Presbycusis (Age-related Hearing Loss)

A Research Paper by the All4Smiles Research Team

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Abstract

Imagine your daily life. Your alarm clock rudely wakes you from slumber, the sound of egg sizzling against oil when you make breakfast, the beep of your car as you pull out of the driveway—our lives are full of sounds, sounds we often take for granted. Our ability to hear these sounds (both pleasant and annoying) deteriorates with age in a process known as presbycusis. In this paper, our research team will be going over the causes, signs and symptoms, effects, and treatment options for presbycusis.

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What Causes Presbycusis?

By: Evelyn Yao

Nature leaves its mark on our bodies in weathered ways, deteriorating our once robust abilities and leaving us with half of the capabilities as we previously had. An example of an age-related condition is presbycusis, which causes hearing loss. Presbycusis is relatively common, affecting about ⅔ of adults over the age of 70. Its prevalence establishes it as the most common type of hearing loss in older adults, as its muffled and distorted effects are felt by a majority of older adults. One topic of interest is the causes of presbycusis and how these triggers manifest themselves to present the condition.

Presbycusis arises primarily because of changes in certain parts of the ear. For instance, changes in the inner ear, within the middle ear, and along the nerve pathways to the brain all trigger presbycusis. These changes can include hair cell and nerve cell loss, as well as a change in DNA methylation that manifests in the cochlea. Additionally, other lifestyle factors can contribute to presbycusis. Long-term exposure to loud noises, such as music or work-related noises (like construction) is a notable stressor. A loss of hair cells that provide hearing function, inherited factors, aging, and other health conditions (diabetes and heart conditions) all may be attributed to presbycusis. Aging enables the natural deterioration of inner ear structures and auditory nerves, ultimately leading to hearing loss. Some people are also more genetically predisposed to presbycusis than others due to a family history of the condition. Taking certain medications, like ototoxic drugs, also accelerates the progression of presbycusis because they damage the inner ear. Lifestyle factors like sleep, smoking, diet, and stress all play their roles in acquiring presbycusis, but it is important to note that the journey to getting presbycusis differs for each person.

Specifically, Caucasians are three times as likely to develop presbycusis than other ethnicities. People with the GSTM1 or GSTT1 null genotype and the NAT*6 mutant allele have an increased chance of contracting presbycusis. Coincidentally, Caucasian people are more likely to possess these genes and the mutant allele, meaning that genetically they are more likely to develop presbycusis. Furthermore, people from low-income areas are also more likely to get presbycusis due to their limited access to healthcare and occupational hazards. These underserved people are more likely to live in run-down areas near many other people, contributing to constant loud noise. Many low-income people also have jobs that expose them to loud noises and chemicals, like construction jobs. Combined with a lack of preventative care, these environmental factors may all lead to the development of presbycusis. Because these people lack access to resources, they may also lack access to devices for hearing care, like hearing aids, further causing them to be at a higher risk for presbycusis.

Ultimately, presbycusis is caused by the natural deterioration of structures in the ear as well as hair and nerve cells. Caucasian and low-income people are at a higher risk for this condition due to genetic and environmental factors. However, it is important to keep in mind that presbycusis is a common part of aging and looks different for each individual.

Signs and Symptoms of Presbycusis

By: Ifra Iyoob

As with many medical conditions, the symptoms of presbycusis differ from person to person. However, some of the most common include the following: 1) other people's speech sounding mumbled or slurred, 2) having trouble hearing high-pitched sounds, 3) having trouble understanding conversations, often when there is background noise, 4) men's voices being easier to hear than women's, 5) some sounds seeming very loud and annoying, and 6) a ringing sound (this is known as tinnitus) in one or both ears.

It is important to remember that presbycusis develops gradually over time, so you might not notice it at first. However, once a patient notices that their hearing has declined or does not appear to be at the level it used to be, they should consult their healthcare provider or physician to schedule a session with an audiologist or otolaryngologist.

In diagnosing presbycusis, healthcare providers will use a lighted scope—this is known as an otoscope—to check in the outer ear canal and look at the eardrum. During this examination, your healthcare provider will be looking for damage to the ear drum, blockage of the ear canal from foreign objects or impacted earwax, and inflammation or infection. Another way that presbycusis is diagnosed is through hearing tests done by an audiologist. This is a pure tone test that finds the quietest volume that you can hear at each pitch. While taking the test, patients wear headphones or earplugs in order to hear the sounds and speech.

During these diagnoses, audiologists and healthcare providers may also include details of the type of presbycusis a patient might have. The type that one has depends on the specific damage done to the inner ear. The types of presbycusis include: 1) sensory presbycusis, and 2) neural presbycusis.

In sensory presbycusis, hearing loss happens when a patient loses outer hair cells in the organ of Corti at the base of the cochlea. This process will originate at the base and then slowly progress towards the apex. With neural presbycusis, the nerve cells in the cochlea and auditory pathway to the brain are lost as a part of aging. Considering that hearing heavily relies on these nerve cells, patients with neural presbycusis will encounter a significant reduction in the quality of their hearing.

Above all, it is essential to not self-diagnose. The best thing one can do if they believe they are experiencing signs or symptoms of presbycusis is to schedule an appointment with a trusted healthcare provider.

Impact of Presbycusis on Daily Life

By: Mumtahina Hemi

Hearing loss has a significant impact on an individual's quality of life, affecting communication, mental health, and social interactions. As the global population ages, it is important to understand these consequences.

One of the most immediate consequences is the difficulty in communication. Individuals with hearing impairment often struggle to understand speech, especially in noisy environments. This can lead to frequent misunderstandings and frustration (Shield, 2006). In professional settings, hearing loss can hinder career advancement due to difficulties in communication.

Hearing loss is strongly associated with social withdrawal and loneliness. People tend to stay away because of how many obstacles it takes to get through a conversation (Ciorba et al., 2012). This withdrawal contributes to an increase in mental health issues since hearing loss patients tend to feel misunderstood, causing depression and anxiety (Mener et al., 2013).

Additionally, undiagnosed hearing loss, according to Lin et al. (2013), people who have moderate to severe hearing loss have a significantly increased likelihood of developing dementia compared to those with normal hearing. This may be due to rain stimulation and social engagement, which are important for maintaining cognitive function.

Individuals who are impacted by hearing loss are also at risk during emergencies. If there are many sounds, calling the attention of others, it can be hard to ensure that it is being heard and that proper safety precautions are being taken.

Hearing loss may seem as if you can live with it, but the consequences of not getting checked will hurt you in the future. It is very important to visit the doctors and mention if you do

have any issues hearing. Recognizing the significant impacts of hearing impairment is a step closer to taking care of yourself.

Current Treatment Options

By: Joyce Sato

Age-related hearing loss, also known as presbycusis, is a very common condition that impacts many older individuals. Hearing loss can restrict social interaction, safety, and overall contentedness. However, many different treatment options aim to restore hearing for those experiencing a lessened ability.

Hearing aids are the most common and most effective device for age-related hearing loss. This extremely small and low-maintenance device is used to amplify sound, making it easier for individuals to hear and comprehend those around them. Hearing aids have developed over time, and are now able to be customized to each person's specific needs or preferences.

There are also other forms of assistive hearing devices available for use. Smartphone apps, amplification devices which include hearing aids, phone amplifiers, and closed circuit systems for public spaces. These devices amplify or increase sound and volume, making everyday life a lot easier and simpler for each individual.

Specific to age-related hearing loss, auditory rehabilitation programs have shown major successes in improving communication between individuals experiencing a decline in hearing. These programs often include lip-reading, communication strategies, cognitive stimulation therapy, and help programs for learning how to use sound-amplifying devices.

We must seek out methods of improving our daily lives and ensuring our safety. Surgical options are available, however, consulting with a doctor will be helpful in finding a treatment that works for you. There are many other methods of restoring an individual's hearing and comprehension abilities; we are lucky enough to have customizable treatment options specific to our needs.

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