Review on Sensorineural Hearing Loss

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1.Introduction

Sensorineural hearing loss is a type of hearing loss in which there is damage to the hair cells or nerve pathways that transmit sound signals to the brain. This can be caused by a variety of factors, including noise exposure, aging, genetics, infections, medications, and other medical conditions. Sensorineural hearing loss can affect individuals of all ages, from newborns to seniors, and can impact various aspects of life including communication, social interactions, and emotional well-being.

2.Review

2.1 Physiological cause

The physiological or pathological cause of sensorineural hearing loss involves damage or dysfunction of the inner ear (cochlea) or the auditory nerve responsible for carrying sound impulses to the brain. The following are the major causes of Sensorineural hearing loss:

- Noise-induced hearing loss: exposure to loud noise, such as machinery, music, or explosions, can cause damage to the hair cells of the inner ear, leading to sensorineural hearing loss.
- Aging: As individuals age, the hair cells within the inner ear begin to lose function and, over time, degenerate. This degeneration can lead to hearing loss, especially in the higher frequencies.
- Genetics: Sensorineural hearing loss is also caused by genetic factors, which affect the development, maintenance, or function of the inner ear.
- Certain diseases: Certain diseases such as Meniere's disease, autoimmune disorders, and infections like meningitis, measles or mumps can cause sensorineural hearing loss.
- Medication and chemicals: Certain drugs or chemicals such as antibiotics, chemotherapy agents, and pesticides can damage the hair cells and nerves in the ear.
- Physical damage: Trauma to the ear or head can result in damage to the inner ear or auditory nerve, leading to sensorineural hearing loss.

In conclusion, sensorineural hearing loss is caused by a variety of physiological or pathological factors that lead to damage or dysfunction of the inner ear or auditory nerve. The underlying cause of the hearing loss can guide the most appropriate treatment or care measures.

2.2 Statistic about sensorineural hearing loss

Sensorineural hearing loss is a common type of hearing loss caused by damage to the inner ear or the nerve pathway that connects the inner ear to the brain. According to the World Health Organization (WHO), approximately 466 million people worldwide have disabling hearing loss, of which 34 million are children. It's estimated that around 90% of people with hearing loss have sensorineural hearing loss.

Here are some additional statistics related to sensorineural hearing loss:

- Sensorineural hearing loss is the most common type of hearing loss, accounting for approximately 90% of all cases.
- Sensorineural hearing loss is more common in older individuals, with about one-third of adults over the age of 65 experiencing some degree of hearing loss. It can also occur in infants who are born with hearing impairments or who develop hearing loss early in life.
- In the United States, an estimated 15% of adults aged 18 and over report some trouble hearing, while 2-3 out of every 1,000 children are born with hearing loss in one or both ears.
- The prevalence of hearing loss increases with age: among adults aged 20-69, the overall prevalence of hearing loss is around 14%, while among adults aged 70 and over it increases to 58%.
- Men are more likely to experience hearing loss than women, with an estimated 13.8% of men and 11.1% of women aged 20-69 experiencing it.
- Exposure to loud noises is a major cause of sensorineural hearing loss, with an estimated 15% of Americans between the ages of 20 and 69 experiencing hearing loss due to noise exposure.

2.3 behaviour features of sensorineural hearing loss

The behaviour features of sensorineural hearing loss can be listed as follows:

- Difficulty understanding speech: Sensorineural hearing loss affects the inner ear or auditory nerve, which can make it difficult to pick up and process speech sounds, particularly in noisy environments or when multiple people are speaking at once. This can result in a reduced ability to understand and follow conversations.

- Asking others to repeat themselves: People with sensorineural hearing loss may have difficulty hearing certain words or phrases, leading to frequent requests to have them repeated. They may also ask others to speak more loudly or to face them when speaking.
- Listening fatigue: Listening when you have sensorineural hearing loss can be tiring and take more effort than it does for people with normal hearing. This can result in listening fatigue, where people with hearing loss may find it hard to concentrate during conversations or meetings.
- Withdrawal from social situations: Hearing loss can lead to a sense of isolation and detachment from social situations. People may find it more challenging to participate in conversations, leading to withdrawal from social events that they once enjoyed.
- Tinnitus: Tinnitus is a common symptom of sensorineural hearing loss, where individuals may experience ringing, buzzing, or other noises in their ears. This can be distracting and may make it more difficult to hear speech and other sounds.
- Emotional changes: Living with sensorineural hearing loss can be frustrating and lead to a range of emotional changes. People may feel sad, anxious, or frustrated, particularly when they find it challenging to communicate with others.

2.4 Current treatments

There are several treatments available for sensorineural hearing loss, depending on the cause and severity of the condition. Here are some of the current treatments:

- Hearing Aids: The most common treatment for sensorineural hearing loss is the use of hearing aids. Hearing aids amplify sound and help improve hearing in people with mild to moderate hearing loss.
- Cochlear Implants: For people with severe hearing loss, cochlear implants may be an option. Cochlear implants are surgically implanted devices that bypass damaged hair cells in the inner ear and directly stimulate the auditory nerve.
- Bone-Anchored Hearing Aids (BAHA): For people with conductive hearing loss or single-sided deafness, a bone-anchored hearing aid may be an option. BAHA devices use bone conduction to transmit sound to the inner ear.
- Medications: In some cases, medications may improve hearing loss caused by certain conditions such as Meniere's disease or autoimmune disorders.
- Surgery: In rare cases, surgery may be an option to improve hearing loss. This may include removal of a tumor or repair of a damaged ear drum.
- Assistive Devices: Assistive devices such as FM systems or personal amplifiers may be used in conjunction with other treatments to help improve hearing in specific situations, such as in noisy environments.

3.Conclusion:My Thinking

The symptoms of sensorineural hearing loss can include difficulty hearing high-pitched sounds, difficulty understanding speech in noisy environments, trouble hearing consonants, and a distorted or muffled quality of sound. Treatment options depend on the severity, type, and cause of the hearing loss. Some common treatments include hearing aids, cochlear implants, bone-anchored hearing aids (BAHA), medications, and surgery. Cochlear implants have been proved to be an effective treatment for patients with sensorineural hearing loss. As a highly successful neural prostheses, cochlear implant have been used for many years to help patients who suffer from sensorineural hearing loss recover the sense of hearing. Despite the significant improvements that have been made in the past decades, the performance of modern cochlear implants is still far behind the healthy cochlea. In a conclusion, A complete cure for the disease is still a long way off.

4.refernce

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Prevalence Rate	Source and Year	Age Range	Type/Degree of Hearing Loss	Notes
14.9% of children	CDC's Third National Health and Nutrition Examination Survey (NHANES III), 1988 – 1994 [Read article]	6-19 years of age	Low- or high-frequency hearing loss of at least 16-decibel hearing level in one or both ears.	National population-based, cross-sectional survey with an in-person interview and audiometric testing at 0.5 to 8 kilohertz.
5 per 1,000 children	CDC's National Health Interview Survey, 1997-2005 [Read article]	3-17 years of age	N/A	Parent-reported hearing loss based on the question, "Which statement best describes the child's hearing without a hearing aid: good, a little trouble, a lot of trouble, or deaf?"
1.7 per 1,000 babies screened	CDC's Hearing Screening and Follow-up Survey, 2019 (Data table)	Babies	N/A	Includes only babies documented as being screened for hearing loss. Does not reflect cases of hearing loss that were identified but never reported to the state or territorial Early Hearing Detection and Intervention (EHDI) program.
1.4 per 1,000 children	CDC's Metropolitan Atlanta Developmental Disabilities Surveillance Program (MADDSP), 1991-2010 [Read article]	8 years of age	Bilateral hearing loss of 40 decibels or more	MADDSP identifies children with moderate to profound hearing loss by reviewing existing records at multiple health and education sources.

Fig.1 the number of children with hearing loss

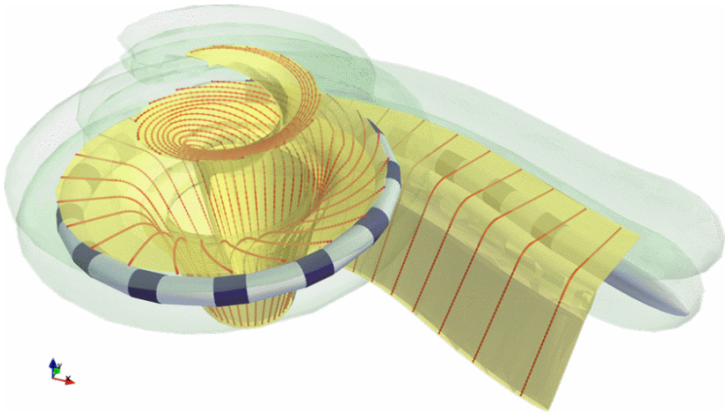

Fig.2 The parametric cochlear model

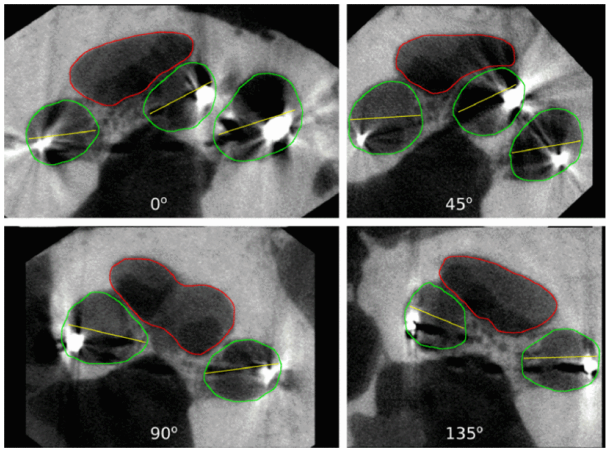

Fig.3 Vertical cross-sections of the cochlea at four angular coordinates