Hearing Loss, High Frequency

Description/Etiology

High-frequency hearing loss (HFHL) is the most common form of hearing impairment. It is a type of sensorineural hearing loss (SNHL) resulting from damage to the cochlea (i.e., inner ear) or to the nerve pathways from the inner ear to the brain (i.e., called retrocochlear hearing loss). Unlike conductive hearing loss, which is a diminished sensitivity to sound, HFHL is characterized by the ability to hear sound in general, but not at high pitches. (For more information on conductive hearing loss, see Quick Lesson About … Hearing Loss, Conductive.)

The normal human ear perceives frequencies between 20 and 20,000 Hz. The 300–3,000 Hz range is the focus of speech recognition. Consonants are high-frequency sounds that make speech intelligible. With diminished ability to detect high-pitched sounds, speech is difficult to understand. With progressive hearing deterioration, social isolation and withdrawal may result. In children, proper auditory functioning is essential for the development of speech and language skills.

Diagnosis of HFHL begins with patient history and subjective report by patient or family on diminished ability or lack of ability to understand speech. Diagnostic tools include tuning fork examinations, otoacoustics emission testing, and audiometry. Unlike conductive hearing loss, which is largely reversible, HFHL and other forms of SNHL are permanent. HFHL can only be treated through use of assistive devices and attempts to prevent further loss. Cochlear implants may be considered for patients with useful hearing at lower frequencies (less than 1,000 Hz), but severe to profound losses at higher frequencies. Newly developed “hybrid” implants (e.g., Widex [i.e., Audibility Extender] linear frequency transposition [LFT], and Phonak [i.e., Sound Recover] non-linear frequency compression [NLFC] processing devices) combine the therapeutic effects of cochlear implants with maintenance of residual hearing.

Facts and Figures

Approximately 28 million people in the United States are affected by various kinds of hearing loss. The prevalence of HFHL increases dramatically with age; 50% of patients over age 75 experience hearing loss substantial enough to interfere with social functioning. Through all adult age ranges, hearing loss is more prevalent in men than in women. Conventional hearing aids, which do not specifically amplify higher frequencies, do not benefit patients with HFHL; newer digital hearing aids can be programmed and adjusted to match or compensate for the patient’s exact hearing loss.

Risk Factors

Presbycusis (i.e., progressive loss of hearing caused by aging) is the leading cause of bilateral HFHL in older adults. HFHL is also caused by a variety of diseases (e.g., recurrent otitis media [OM], systemic diseases [e.g., renal disease, HIV, Ménière’s] and in utero infections (e.g., cytomegalovirus, rubella, and syphilis). Other causes include birth injury; head trauma; use of firearms, administration of ototoxic drugs (e.g., gentamicin) and chemicals; and genetic syndromes. In addition, genetic factors influence all causes for hearing loss. Both short-term and long-term exposure to loud environments can also result in HFHL. Chronic mobile phone use has also been found to be a risk factor for HFHL in the dominant ear.
Signs and Symptoms/Clinical Presentation

Manifestations of HFHL in verbal children and adults include failure to respond to questions, responding inappropriately, complaining that others mumble, asking others to repeat themselves, and withdrawing from social situations or noisy environments. HFHL in children may be indicated by impaired speech and language development and delayed achievement of developmental milestones in social functioning; a comprehensive evaluation is required to rule out other developmental delays with similar manifestations.

Assessment

› Patient History
  • Ask about patient’s age and duration of symptoms
  • Encourage patient to give a subjective description of hearing loss that includes information about whether the patient has lack of clarity, inadequate volume, stable loss, or fluctuation in functioning or both
  • Ask about complete health and medical history, including previous ear disease, injuries, or surgeries; exposure to loud-noise environments; current and past medications; and family history of ear disease and hearing loss

› Physical Findings of Particular Interest
  • Physical assessment with otoscope may show no defect

› Diagnostic Tests/Studies
  • Audiogram may demonstrate a hearing loss in the range of 4,000 Hz in patients with less severe loss and through the 2,000 Hz range in patients with more severe loss
  • Otoacoustic emission testing, which measures cochlear outer hair cell function, may indicate HFHL (this test is routinely performed during neonatal screening)
  • Tuning fork examinations include the following:
    – Weber test: in patients with unilateral HFHL, sound heard is louder in the unaffected ear than in the affected ear
    – Rinne test: in patients with unilateral HFHL, sound is better heard in front of the auricle than over the mastoid bone
  • Pure-tone audiometry, which measures hearing threshold over a wide range of frequencies, will distinguish between SNHL and conductive hearing loss
  • Speech audiometry may reveal loss of clarity indicative of HFHL
  • Auditory brainstem response (ABR) testing detects or measures electrical activity in the cochlea and in the auditory nerve and brainstem pathways

Treatment Goals

› Reinforce Clinician Explanation of Treatment Options to Maintain or Improve Hearing
  • Evaluate hearing and communication ability and for underlying conditions that may cause HFHL (for details, see above and Red Flags, below); immediately report abnormalities and administer prescribed treatment
  • Discuss with patient/family alternate means of communication, as appropriate; if necessary, supply writing materials for patient communication
    – Encourage visitation, involvement in care, and rooming-in for family members of pediatric patients per facility protocol
  • For patients with loss caused by ototoxic drug use, evaluate medication regimen and reinforce clinician’s explanation of alternative pharmacologic therapies
  • Follow facility pre- and postsurgical protocols if patient becomes a candidate for implants; reinforce pre- and postsurgical education and verify completion of informed consent documents

› Provide Emotional Support and Educate
  • Assess patient/family anxiety level and coping ability; provide emotional support, educate, and encourage discussion about treatment risks and benefits, and on adaptive communication strategies, including lip reading and sign language
    – The aging adult with gradual hearing loss may show a lack of interest in available therapies; emphasize the connection between improved communication skills and increased quality of life
  • Request referral to a social worker, if appropriate, for identification of local resources for learning sign language, lip reading or both, support groups, and audiology evaluation
  • Encourage joining a support group for contact with others who face similar health challenges
  • Encourage routine hearing evaluation for patients in high-risk categories
Food for Thought

- Impaired communication as a consequence of a hearing deficit commonly interferes with patient education, and visual aids may be helpful for patients who are not also visually impaired
- The U.S. Preventive Services Task Force currently recommends against routine screening of asymptomatic adults aged 50 years and older for hearing loss, citing insufficient evidence
- In a recent study of 1,984 community-dwelling older adults, researchers reported that hearing impairment was associated with a 24% increased risk of new-onset cognitive impairment, with the rate of cognitive decline is markedly associated with the severity of hearing loss (Lin et al., 2013)
- Investigators who studied 107 industrial workers found evidence that at-time noise exposures below 85 dBA were not associated with HFHL (Rabinowitz et al., 2013)
- A retrospective analysis of 8,818 workers found a 25% increase in the acute injury risk in workers that had history of tinnitus combined with high-frequency hearing loss and that were exposed to high nosed environments (Cantley et al., 2015)
- A cross-sectional epidemiological study of hunters found 50% had a higher prevalence of HFHI in those that reported firing 1-6 shots with high caliber weapons (e.g., hunting rifle calibers) without hearing protections (Honeth et al., 2015)
- HFHL individuals’ presbycusis is significantly accelerated in HIV positive individuals as compared to HIV negative individuals, according to a recent study (Torre et al., 2014)

Red Flags

- Cochlear implantation is associated with risk for meningitis and residual hearing loss secondary to surgical trauma
- Sudden-onset unilateral SNHL is considered a medical emergency; patients should be referred to an otolaryngologist immediately
- Patients suffering from hearing loss have an increased risk of failing to hear alarms and smoke detectors, which usually emit high-frequency sounds

What Do I Need to Tell the Patient/Patient’s Family?

- Educate about hearing aid maintenance, including weekly cleaning of the ear molds; storage in a cool, dry place; and routine disconnection of the battery for longer battery life
- Educate that early intervention is crucial for normal speech and language development for the neonatal or pediatric patient
- Educate patients to wear ear protection in loud environments and if they participate in gun shooting sports
- Encourage the family to learn simple communication rules, including the following:
  - Face the person with hearing loss directly during verbal communication
  - Speak slowly and clearly; avoid whispering
  - Avoid becoming angry with the person; lack of ability to hear is not intentional
  - Reduce background noise

References


