

Approach to hearing loss

Daniel Newsted Emily Rosen MCISc CASLPO Bonnie Cooke MCISc CASLPO
Michael M. Beyea MD PhD FRCPC Matthew T.W. Simpson MD MSc CD CCFP
Jason A. Beyea MD PhD FRCSC

Abstract

Objective To provide family physicians with a practical evidence-based approach to the management of patients with hearing loss.

Sources of information MEDLINE and PubMed databases were searched for English-language hearing loss research, review articles, and guidelines published between 1980 and 2020. Most of the retrieved articles provided level II or III evidence.

Main message Hearing loss is one of the most common sensory impairments worldwide and causes great detriment to a patient's overall well-being by affecting physical health, finances, social inclusion, and mental health. A robust clinical assessment of hearing loss includes a history and physical examination that effectively characterizes the deficit as conductive, sensorineural, or mixed. Patients presenting with red flags (such as sudden unilateral sensorineural hearing loss) must be urgently referred to otolaryngology–head and neck surgery or immediately assessed in the emergency department. Many nonurgent presentations of hearing loss will also require referral for further audiological assessment, diagnosis, and management.

Conclusion As primary care providers, family physicians are well equipped to manage the psychological concerns associated with hearing loss and to reinforce conservative treatment strategies. Frequently, referral or urgent workup, including imaging, is necessary to confirm a patient's diagnosis and initiate management in order to prevent further complications.

Case description

Mrs E. is a 60-year-old physics professor who has been experiencing gradual bilateral hearing loss over the past 15 years. She has no history of ear surgery, infections, head trauma, excessive noise exposure, or ototoxicity, and no family history of hearing loss. Recently, she has stopped attending scientific conferences, as she has difficulty hearing presentations and struggles to keep up with conversations at networking events. Concerned that her hearing problems are affecting her work, she is considering an early retirement.

Given Mrs E.'s history, her hearing loss is having a profound effect. What tools can we use to determine the cause of this hearing loss? How is hearing loss measured? Are there management strategies that could enhance her quality of life?

Sources of information

The approach described is a review based on the authors' clinical practices along with research and clinical review articles published between 1980 and 2020. MEDLINE and PubMed were searched using the terms *hearing loss* and *guidelines*. Most of the cited studies provided level II or III evidence.

Main message

Hearing loss is the complete or partial inability to hear and is one of the most common sensory impairments globally.¹ In Canada, approximately 20%

Editor's key points

- ▶ Hearing loss is the complete or partial inability to hear. In Canada, approximately 20% of adults aged 20 to 79 have audiometrically measured hearing loss; prevalence increases with age, approaching 65% in adults aged 70 to 79.
- ▶ There is a broad differential diagnosis. History and directed physical examination can guide diagnosis. Audiometric testing provides critical information and directs further management. Special attention given to red flags will highlight the need for urgent referral. For many patients with hearing loss, referral to otolaryngology–head and neck surgery is warranted.
- ▶ Hearing loss has a profound effect on a patient's well-being, from academic underperformance in children to risk of falls and cognitive decline in the elderly. In middle-aged adults, hearing loss limits social activity and causes emotional dysregulation.

of adults aged 20 to 79 have audiometrically measured hearing loss, although the prevalence increases with age, approaching 65% in adults aged 70 to 79.² In the elderly, hearing loss increases the risk of falls and might contribute to social isolation, mental illness, dementia, and cognitive decline.³⁻⁶ In working-aged adults, it is associated with reduced social activity and heightened emotional dysfunction.⁷ Hearing loss in children results in delayed speech and language development and lower academic performance.⁸ Clinically, hearing loss is described as a decibel loss exceeding 25 dB at frequencies between 250 and 8000 Hz and is categorized as conductive hearing loss (CHL), sensorineural hearing loss (SNHL), or mixed hearing loss (MHL).⁹ Although hearing loss can present with tinnitus, the diagnosis and management of tinnitus has been recently reviewed and will not be outlined herein.¹⁰

Symptoms and causes

Sensorineural hearing loss: Sensorineural hearing loss results from defective inner ear components or neural signaling to the auditory cortex. The most common cause of SNHL is age-related hearing loss, or *presbycusis*, which is slowly progressive and symmetrical (Figure 1).¹¹ Presbycusis is the result of aging, aggravated by noise damage, ototoxic agents, and otologic disorders.¹² Presbycusis initially impairs hearing sensitivity at high frequencies but also compromises sound clarity, potentially owing to cochlear synaptopathy.^{12,13} Noise-induced hearing loss is often a gradual bilateral hearing decline due to chronic noise exposure.^{14,15} Noise-induced hearing loss is preventable and is frequently caused by noise exposure in the workplace or during recreational activities.¹⁶ Ototoxic medications also cause gradual bilateral SNHL (Table 1).^{17,18} A gradual unilateral SNHL indicates the possibility of an acoustic neuroma that can present with focal neurologic signs.¹⁹ In patients experiencing vertigo alongside unilateral SNHL,

Ménière disease should be considered.^{20,21} In pediatric patients, SNHL requires an inquiry into the family history of genetic conditions and testing for TORCH infections (toxoplasmosis, rubella, cytomegalovirus, herpes simplex, and others such as syphilis).²²

Conductive hearing loss: This hearing loss results from physical anomalies that impede sound wave transmission through the ear. In the ear canal, otitis externa presents with inflammation and edema. Cerumen impaction, foreign bodies, and neoplasms also cause canal obstruction.²³ Tympanic membrane perforations result from repeated infections or trauma, with 80% resolving spontaneously within 3 months.²⁴ Otitis media presents with pain and membrane redness and bulging.²⁵ Unilateral pulsatile tinnitus and a bulging red mass directly behind the membrane suggests a glomus tumour.²⁶ Epithelial debris behind the membrane suggests a cholesteatoma.²⁷ Conductive hearing loss with normal otoscopic examination findings indicates middle ear pathology such as otosclerosis, which typically presents with a positive family history.²⁸

Mixed hearing loss: This describes a presentation that includes both CHL and SNHL. Chronic middle ear conditions including severe otosclerosis, cholesteatoma, and neoplasms can result in MHL.^{29,30} Alternatively, a primary CHL might exist alongside an unrelated secondary SNHL, or vice versa.

Red flags. When approaching hearing loss, it is important to identify red flags that direct clinical thinking toward conditions that have serious lasting consequences if they are not managed urgently.³¹ Sudden hearing loss is a red flag that can indicate trauma or stroke. Otoscopic examination is necessary to rule out nonurgent conditions including cerumen impaction, obstruction by foreign bodies, membrane perforation, or middle ear effusion.³² A history of head trauma and signs of trauma around the ear suggest temporal

Figure 1. Approach to the differential diagnosis of hearing loss

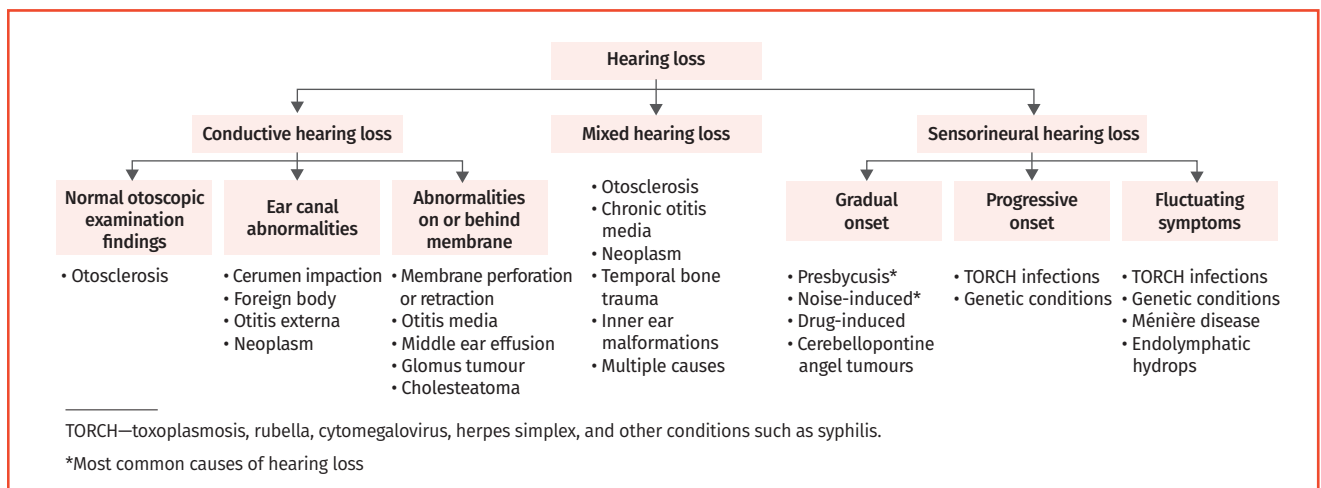


Table 1. Representative list of drugs and associated drug classes that are known to be ototoxic

DRUG CLASS	DRUG NAMES
Aminoglycosides	Neomycin, kanamycin, gentamicin, tobramycin, amikacin, streptomycin
Macrolides	Azithromycin, erythromycin
Glycopeptides	Vancomycin
Tuberactinomycins	Viomycin and substitutes
Antineoplastic drugs	Cisplatin, carboplatin, oxaliplatin
Nonsteroidal anti-inflammatory drugs	Salicylates
Antimalarial drugs	Quinine
Loop diuretics	Torsemeide, bumetanide, ethacrynic acid, furosemide (augment ototoxicity of cisplatin and aminoglycosides)

Table 2. Red flags for clinical presentations of hearing loss

DIAGNOSIS	RED FLAGS	MANAGEMENT
Unilateral sudden sensorineural hearing loss	<ul style="list-style-type: none"> • Sudden drop in hearing in one ear • Sudden onset of unilateral aural fullness • Sudden onset of unilateral tinnitus 	<ul style="list-style-type: none"> • Consider high-dose oral steroids if within 2 wk of symptom onset • Refer urgently to OtoHNS for audiometry and diagnosis
Head trauma, temporal bone fracture	<ul style="list-style-type: none"> • Lacerations or bruising around the ear • Pooling of blood behind the tympanic membrane • Neurologic signs 	<ul style="list-style-type: none"> • Refer to OtoHNS or emergency department for imaging
Stroke	<ul style="list-style-type: none"> • New focal neurologic symptoms and signs 	<ul style="list-style-type: none"> • Adhere to regional stroke protocol

OtoHNS—otolaryngology—head and neck surgery.

bone fracture (**Table 2**). Referral to otolaryngology—head and neck surgery (OtoHNS) or the emergency department is necessary for management.^{33,34} Unilateral sensorineural hearing loss with onset of new focal neurologic symptoms can indicate stroke and warrants adherence to regional stroke protocols.³²

Unilateral sudden sensorineural hearing loss is a rare otologic emergency (5 to 30 cases in 100 000, annually) that progresses within 72 hours and can be accompanied by unilateral aural fullness, unilateral tinnitus, or vertigo.³⁵ High-dose oral steroids offered in a timely fashion might limit progression to permanent hearing impairment.^{32,35,36} Following the initiation of oral steroids, patients should be urgently referred to OtoHNS within 14 days of symptom onset.³² In cases where systemic high-dose steroids are contraindicated or when recovery is incomplete 2 to 6 weeks following symptom onset, urgent referral to OtoHNS for intratympanic steroid injections is necessary.^{32,35}

Diagnosis

History: A detailed clinical history will refine the differential diagnosis. The onset and course of hearing loss and whether it is unilateral or bilateral are important and will aid in determining the urgency for referral. Symptoms including vertigo, tinnitus, focal neurologic symptoms, and ear pain will narrow the differential diagnosis. Further questioning about past environmental noise exposure, occupations, and medications is essential.

Physical examination: A careful physical examination guides the diagnosis. Visual inspection of the outer ear as well as otoscopic examination of the ear canal, tympanic membrane, and middle ear space might reveal signs of infection, trauma, neoplasms, and congenital abnormalities (reviewed by Hawke and Kwok³⁷). The Rinne and Weber tuning fork tests can aid in distinguishing between CHL and SNHL (**Figure 2**).³⁸ However, there is considerable variability in test implementation and accuracy that must be considered alongside results.³⁹ A focused neurologic examination includes testing cranial nerves III to XII.

Audiologic testing: Audiologic testing is indicated in patients with subjective hearing loss and includes history, otoscopic examination, acoustic immittance measures, threshold testing, speech testing, and counseling. Tympanometry assesses middle ear function and is used to identify outer or middle ear pathologies (**Figure 3**). Threshold testing provides the degree and pattern of hearing (**Figure 4**). Family doctors can use the Canadian Academy of Audiology website (findanaudiologist.ca) to find local audiologists. A preliminary referral to an audiologist should be considered in cases of subjective hearing complaints.

Laboratory tests and imaging: The cause of hearing loss is frequently determined by clinical diagnosis. A bacterial culture is recommended in cases of acute otitis externa that are unresponsive to first-line therapy. For advanced otologic diseases, investigations including

biopsies, computed tomography, and magnetic resonance imaging are typically ordered by OtoHNS.^{40,41}

Referral to OtoHNS: Referral to OtoHNS can be helpful with diagnostic clarification in nonurgent situations, including cases of CHL that might require surgical management. Tympanic membrane perforations associated with substantial hearing loss, recurrent drainage, use of hearing aids, or poor healing at 2 months after injury can be referred for surgical management.^{42,43} Clinical presentations that include red flags must prompt urgent

referral to OtoHNS, neurology, or the emergency department. Asymmetric SNHL, CHL, or MHL also warrant referral to OtoHNS.

The Canadian Infant Hearing Task Force recommends that all newborns be screened for congenital hearing loss before 1 month of age.⁴⁴ Among babies who do not pass the screening test, a confirmatory diagnostic test should be completed by a pediatric audiologist by 3 months of age, and hearing loss interventions should be started by 6 months of age for babies with

Figure 2. Rinne and Weber tests for differentiating between conductive, sensorineural, and mixed hearing loss: Typically, a 512-Hz tuning fork is used in the clinical setting. Note that the Weber test will only lateralize in cases of asymmetrical hearing loss. In cases of symmetrical hearing loss (conductive and sensorineural hearing loss) the Weber test findings will be equal at the midline.

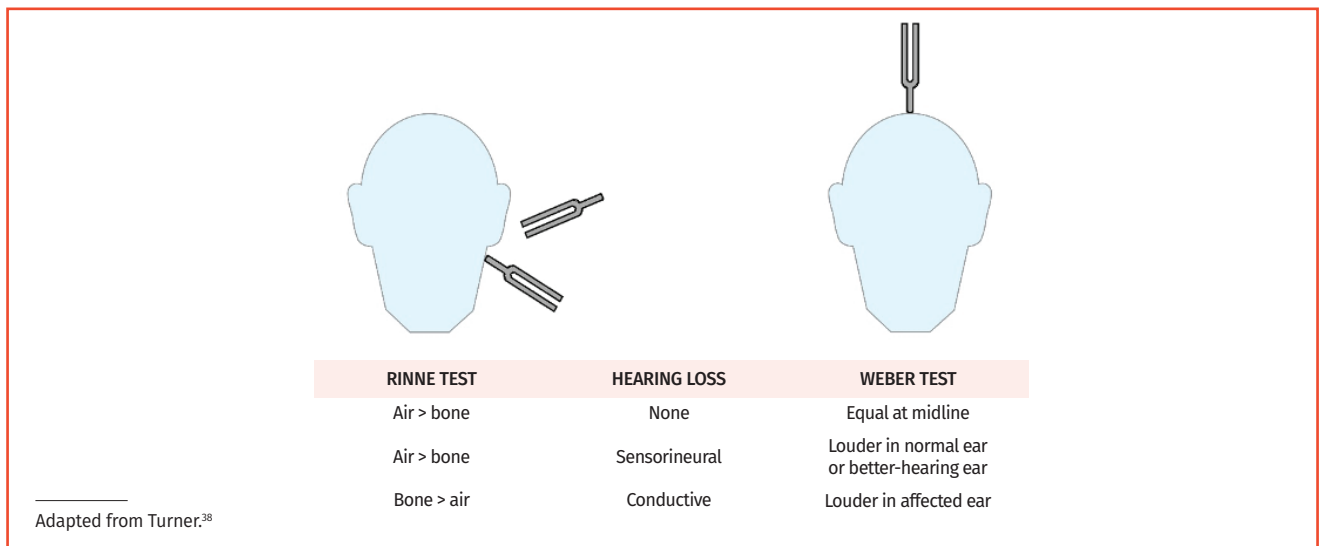


Figure 3. Tympanometry patterns that accompany middle ear or tympanic membrane pathology: A tympanometer is inserted into the ear canal and generates a constant tone that alters the air pressure within the external auditory canal. The device then measures the amount of sound that returns from the tympanic membrane as a function of air pressure change. The type A pattern is normal and denotes normal middle ear air pressure and tympanic membrane mobility.

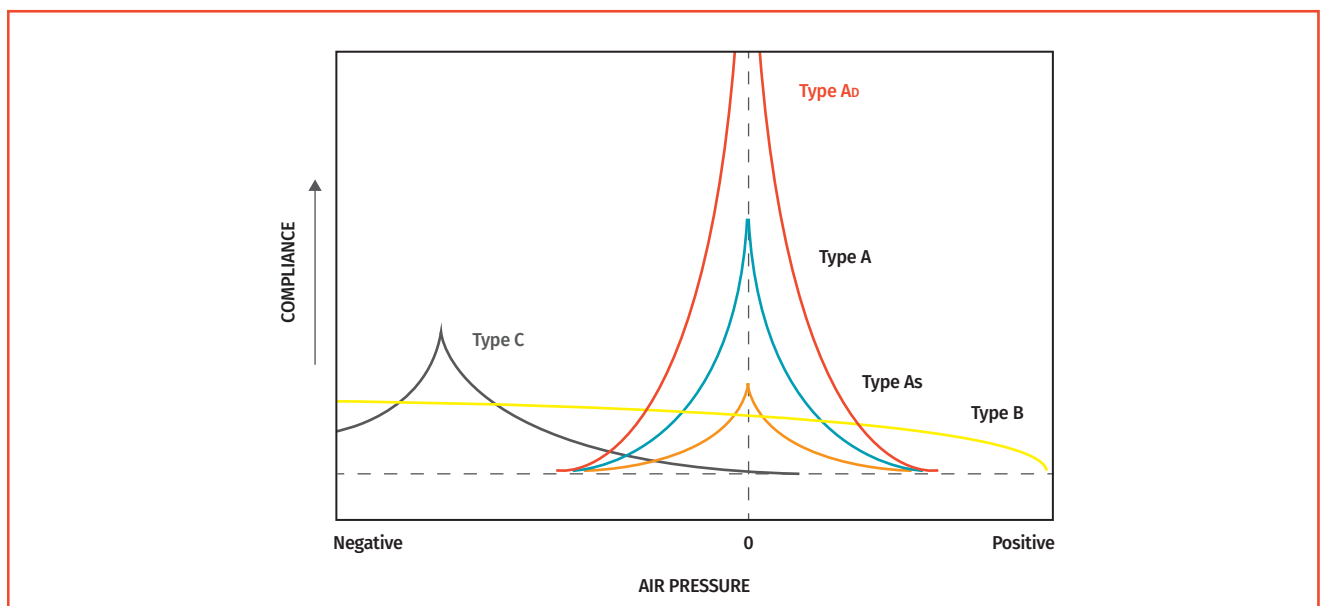
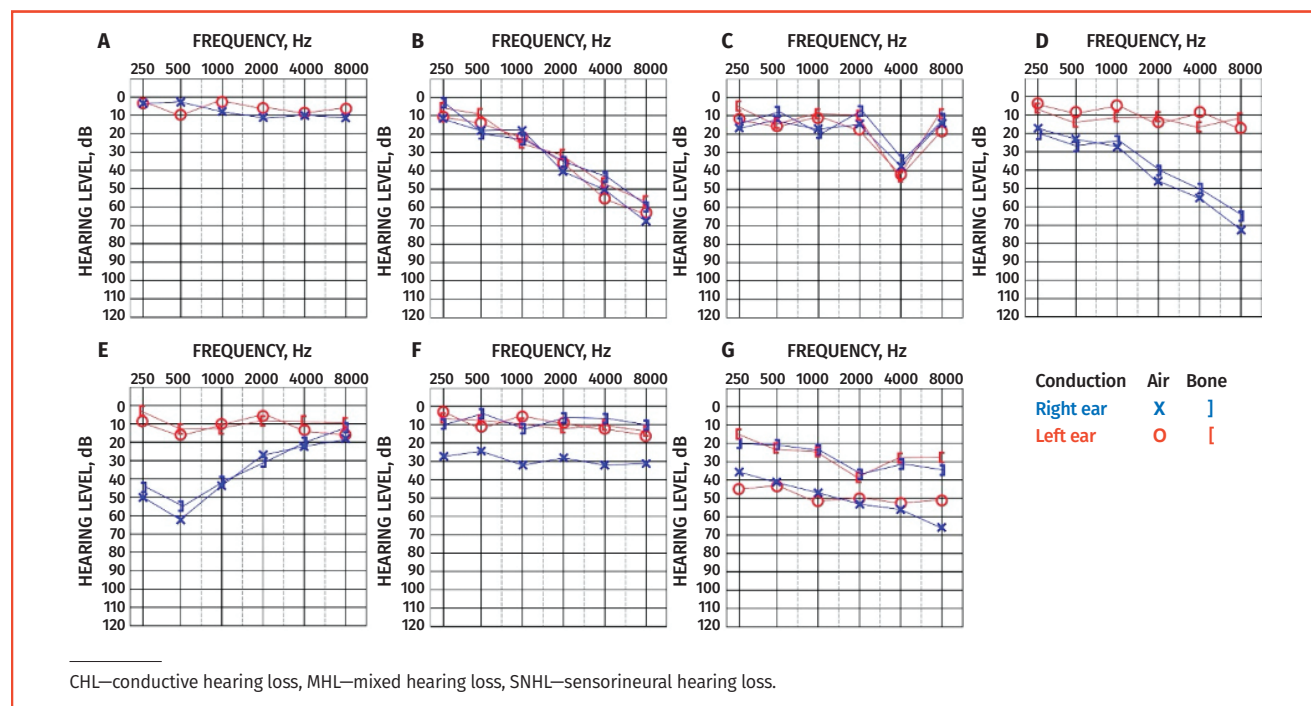


Figure 4. Representative audiograms for conditions associated with hearing loss: A) Normal findings; B) presbycusis (bilateral high-frequency SNHL); C) noise-induced hearing loss (bilateral SNHL); D) acoustic neuroma (unilateral high-frequency SNHL); E) Ménière disease (low-frequency SNHL); F) middle ear effusion (unilateral CHL); and G) otosclerosis (bilateral MHL; note Carhart notch at 2000 Hz).



confirmed hearing loss. Despite the recommendation, not all provinces have high-quality early hearing detection and intervention programs.⁴⁵ Some children develop progressive hearing loss later in childhood that will not be detected by newborn hearing screening programs. Family physicians must investigate subjective complaints of pediatric hearing loss by parents with a complete history, physical examination, and referral to pediatric audiology.

Management

Prevention: Primary and secondary prevention strategies can reduce the effects of irreversible SNHL. Programs targeting early noise prevention in youth at risk of noise-induced hearing loss are essential, considering the potential for long-term noise-induced cochlear alterations and the high levels of recreational noise exposure in this age group.⁴⁶ Strategies informing the use of hearing-protector devices and responsibly using personal listening devices have been successful.^{47,48} Preventive measures for occupation-induced hearing loss involve increasing earplug use where appropriate.^{49,50} The prevention of presbycusis requires addressing risk factors including smoking, cardiovascular disease, and noise exposure.⁵¹

Conservative measures: Conservative treatment strategies are viable for some patients with hearing loss, particularly in elderly patients with few associated symptoms and multiple comorbidities.⁵² Serial observation is

frequently considered when managing acoustic neuromas, establishing the growth rate and effects on quality of life.⁵³ Trauma-induced CHL can also benefit from initial conservative management.

Family physicians are critical in the management of cerumen impaction and should educate patients on harmful hygiene practices that promote impaction.²³ In patients who have been diagnosed by otoscopic examination and assessment of symptoms, family physicians should treat cerumen impaction with irrigation, cerumenolytic agents, or manual removal of cerumen.^{23,54}

Pharmacologic therapy: Early steroid therapy offered for suspected unilateral sudden SNHL includes oral prednisone (1 mg/kg to a maximum of 60 mg/d for 1 week, tapering during the second week) or intratympanic steroid injections. Acute otitis externa can be treated with antibiotic otic drops; acute otitis media can be treated with oral antibiotics.

Amplification technology: Patients with SNHL, particularly presbycusis, can benefit from hearing aids. Current evidence demonstrates quality-of-life improvements related to general health and hearing in adults with mild to moderate hearing loss.⁵⁵ Profound SNHL insufficiently restored by hearing aids can be treated with cochlear implants. Adult patients should have been postlingually deafened, have no medical contraindications, and have realistic expectations about hearing improvement after implantation.⁵⁶

Surgical interventions: Some causes of hearing loss are amenable to surgical intervention. Tympanic

membrane perforations are repaired by tympanoplasty. Patients with otosclerosis can be offered stapedectomy. Cholesteatoma removal is performed with a tympanoplasty plus atticotomy or mastoidectomy.⁵⁷ Cerebellopontine angle tumours can be resected with skull-based surgeries; however, hearing loss that occurs as a result of the tumour cannot be restored.⁵⁸


Considerations for physicians. Patients with hearing loss report weaker physician-patient relationships and poorer health care experiences.⁵⁹ Strategies including speaking clearly and minimizing background noise in clinical settings can improve patient satisfaction.⁶⁰ Additionally, third-party disabilities associated with hearing loss, including communication difficulties, lifestyle alterations, and emotional stresses, affect familial well-being.⁶¹ Family physicians are well-equipped to address these concerns using family-centred approaches.⁶¹

Case resolution

Considering Mrs E.'s age, occupation, gradual course, and lack of other symptoms, the most likely cause of her hearing loss is age-related hearing loss. Otoscopic examination reveals no signs of inflammation, cerumen, or lesions. Tuning fork tests suggest symmetric SNHL. The neurologic examination findings are unremarkable. Audiometry reveals symmetric mild sloping to moderate SNHL bilaterally with excellent discrimination scores. The patient's history, physical examination findings, and audiometric testing results suggest a diagnosis of presbycusis.

Mrs E. decides to meet with the audiologist and try hearing aids. After several hearing aid adjustments, she no longer listens to the television at high volumes. Mrs E. returns to the clinic after 3 months. Her subjective hearing has improved substantially with the use of hearing aids. No longer considering retirement, she now happily participates in networking opportunities at scientific conferences.

Conclusion

Hearing loss is one of the most common sensory impairments and has considerable effects on the well-being of patients. There is a broad differential diagnosis. History and directed physical examination can guide the diagnosis. Audiometric testing provides critical information and directs further management of the patient. Family physicians are well equipped to manage the psychological concerns associated with hearing loss. Special attention given to red flags will highlight the need for urgent referral. For many patients with hearing loss, referral to OtoHNS is warranted. 

Mr Newsted is a doctoral candidate and medical student in the Department of Otolaryngology at Queen's University in Kingston, Ont. **Ms Rosen** and **Ms Cooke** are registered clinical audiologists in the Department of Audiology and Speech-Language Pathology at Hotel Dieu Hospital in Kingston. **Dr M.M. Beyea** is an emergency physician in the Department of Emergency Medicine at Hamilton Health Sciences in Ontario.

Dr Simpson is Assistant Professor and Faculty Development Director in the Department of Family Medicine at Queen's University. **Dr J.A. Beyea** is Assistant Professor and Research Director in the Division of Otolaryngology-Head and Neck Surgery at Queen's University and Adjunct Scientist with ICES Queen's.

Contributors

All authors contributed to the literature review and preparation of the manuscript, as well as approval of the final version.

Competing interests

None declared

Correspondence

Dr Jason A. Beyea; e-mail jason.beyea@queensu.ca

References

- Wilson BS, Tucci DL, O'Donoghue GM, Merson MH, Frankish H. A Lancet Commission to address the global burden of hearing loss. *Lancet* 2019;393(10186):2106-8. Epub 2019 Feb 28.
- Feder K, Michaud D, Ramage-Morin P, McNamee J, Bearegard Y. Prevalence of hearing loss among Canadians aged 20 to 79: audiometric results from the 2012/2013 Canadian Health Measures Survey. *Health Rep* 2015;26(7):18-25.
- Thomson RS, Auduong P, Miller AT, Gurgel RK. Hearing loss as a risk factor for dementia: a systematic review. *Laryngoscope Investig Otolaryngol* 2017;2(2):69-79. Epub 2017 Mar 16.
- Dawes P, Emsley R, Cruickshanks KJ, Moore DR, Fortnum H, Edmondson-Jones M, et al. Hearing loss and cognition: the role of hearing aids, social isolation and depression. *PLoS One* 2015;10(3):e0119616.
- Castiglione A, Benatti A, Velardita C, Favaro D, Padoan E, Severi D, et al. Aging, cognitive decline and hearing loss: effects of auditory rehabilitation and training with hearing aids and cochlear implants on cognitive function and depression among older adults. *Audiol Neurootol* 2016;21(Suppl 1):21-8. Epub 2016 Nov 3.
- Deal JA, Reed NS, Kravetz AD, Weinreich H, Yeh C, Lin FR, et al. Incident hearing loss and comorbidity: a longitudinal administrative claims study. *JAMA Otolaryngol Head Neck Surg* 2019;145(1):36-43.
- Monzani D, Galeazzi GM, Genovese E, Marrara A, Martini A. Psychological profile and social behaviour of working adults with mild or moderate hearing loss. *Acta Otorhinolaryngol Ital* 2008;28(2):61-6.
- Michael R, Attias J, Raveh E. Cochlear implantation and social-emotional functioning of children with hearing loss. *J Deaf Stud Deaf Educ* 2019;24(1):25-31.
- Kochhar A, Hildebrand MS, Smith RJH. Clinical aspects of hereditary hearing loss. *Genet Med* 2007;9(7):393-408.
- Wu V, Cooke B, Eitutus S, Simpson MTW, Beyea JA. Approach to tinnitus management. *Can Fam Physician* 2018;64:491-5 (Eng), e293-8 (Fr).
- Ciorba A, Bianchini C, Pelucchi S, Pastore A. The impact of hearing loss on the quality of life of elderly adults. *Clin Interv Aging* 2012;7:159-63. Epub 2012 Jun 15.
- Gates GA, Mills JH. Presbycusis. *Lancet* 2005;366(9491):1111-20.
- Sergeyenko Y, Lall K, Liberman MC, Kujawa SG. Age-related cochlear synaptopathy: an early-onset contributor to auditory functional decline. *J Neurosci* 2013;33(34):13686-94.
- Probst R. Occupational noise-induced hearing loss [article in German]. *Schweiz Rundsch Med Prax* 1986;75(13):357-9.
- Le TN, Straatman LV, Lea J, Westerberg B. Current insights in noise-induced hearing loss: a literature review of the underlying mechanism, pathophysiology, asymmetry, and management options. *J Otolaryngol Head Neck Surg* 2017;46(1):41.
- Sliwiska-Kowalska M, Davis A. Noise-induced hearing loss. *Noise Health* 2012;14(61):274-80.
- Bisht M, Bist SS. Ototoxicity: the hidden menace. *Indian J Otolaryngol Head Neck Surg* 2011;63(3):255-9.
- Lanvers-Kaminsky C, Zehnhoff-Dinnesen AA, Parfitt R, Ciarimboli G. Drug-induced ototoxicity: mechanisms, pharmacogenetics, and protective strategies. *Clin Pharmacol Ther* 2017;101(4):491-500. Epub 2017 Feb 3.
- Tos M, Charabi S, Thomsen J. Clinical experience with vestibular schwannomas: epidemiology, symptomatology, diagnosis, and surgical results. *Eur Arch Otorhinolaryngol* 1998;255(1):1-6.
- Lopez-Escamez JA, Carey J, Chung WH, Goebel JA, Magnusson M, Mandalà M, et al. Diagnostic criteria for Menière's disease. *J Vestib Res* 2015;25(1):1-7.
- Wu V, Sykes EA, Beyea MM, Simpson MTW, Beyea JA. Approach to Ménière disease management. *Can Fam Physician* 2019;65:463-7 (Eng), 468-72 (Fr).
- Cohen BE, Durstenfeld A, Roehm PC. Viral causes of hearing loss: a review for hearing health professionals. *Trends Hear* 2014;18:2331216514541361.
- Schwartz SR, Magit AE, Rosenfeld RM, Ballachanda BB, Hackell JM, Krouse HJ, et al. Clinical practice guideline (update): earwax (cerumen impaction) executive summary. *Otolaryngol Head Neck Surg* 2017;156(1):14-29.
- Kristensen S. Spontaneous healing of traumatic tympanic membrane perforations in man: a century of experience. *J Laryngol Otol* 1992;106(12):1037-50.
- Rosenfeld RM, Shin JJ, Schwartz SR, Coggins R, Gagnon L, Hackell JM, et al. Clinical practice guideline: otitis media with effusion executive summary (update). *Otolaryngol Head Neck Surg* 2016;154(2):201-14.
- Semaan MT, Megerian CA. Current assessment and management of glomus tumors. *Curr Opin Otolaryngol Head Neck Surg* 2008;16(5):420-6.
- Gulati M, Gupta S, Prakash A, Garg A, Dixit R. HRCIT imaging of acquired cholesteatoma: a pictorial review. *Insights Imaging* 2019;10(1):92.
- Markou K, Goudakos J. An overview of the etiology of otosclerosis. *Eur Arch Otorhinolaryngol* 2009;266(1):25-35. Epub 2008 Aug 13.

29. Ramsay HA, Linthicum FH Jr. Mixed hearing loss in otosclerosis: indication for long-term follow-up. *Am J Otol* 1994;15(4):536-9.
30. Verhaert N, Desloovere C, Wouters J. Acoustic hearing implants for mixed hearing loss: a systematic review. *Otol Neurotol* 2013;34(7):1201-9.
31. Ftouh S, Harrop-Griffiths K, Harker M, Munro KJ, Levertont T, Guideline Committee. Hearing loss in adults, assessment and management: summary of NICE guidance. *BMJ* 2018;361:k2219. Epub 2018 Jun 22.
32. Chandrasekhar SS, Tsai Do BS, Schwartz SR, Bontempo LJ, Faucett EA, Finestone SA, et al. Clinical practice guideline: sudden hearing loss (update) executive summary. *Otolaryngol Head Neck Surg* 2019;161(2):195-210.
33. Expert Panel on Neurologic Imaging; Sharma A, Kirsch CFE, Aulino JM, Chakraborty S, Choudhri AF, et al. ACR Appropriateness Criteria® hearing loss and/or vertigo. *J Am Coll Radiol* 2018;15(11S):S321-31.
34. Grant JR, Arganbright J, Friedland DR. Outcomes for conservative management of traumatic conductive hearing loss. *Otol Neurotol* 2008;29(3):344-9.
35. Lawrence R, Thevasagayam R. Controversies in the management of sudden sensorineural hearing loss: an evidence-based review. *Clin Otolaryngol* 2015;40(3):176-82.
36. Chau JK, Lin JR, Atashband S, Irvine RA, Westerberg BD. Systematic review of the evidence for the etiology of adult sudden sensorineural hearing loss. *Laryngoscope* 2010;120(5):1011-21.
37. Hawke M, Kwok P. A mini-atlas of ear-drum pathology. *Can Fam Physician* 1987;33:1501-7.
38. Turner J. The ear and auditory system. In: Walker H, Hall W, Hurst J, editors. *Clinical methods: the history, physical, and laboratory examinations*. 3rd ed. Boston, MA: Butterworths; 1990.
39. Kelly EA, Li B, Adams ME. Diagnostic accuracy of tuning fork tests for hearing loss: a systematic review. *Otolaryngol Head Neck Surg* 2018;159(2):220-30. Epub 2018 Apr 17.
40. Abou Tayoun AN, Al Turki SH, Oza AM, Bowser MJ, Hernandez AL, Funke BH, et al. Improving hearing loss gene testing: a systematic review of gene evidence toward more efficient next-generation sequencing-based diagnostic testing and interpretation. *Genet Med* 2016;18(6):545-53. Epub 2015 Nov 12.
41. Sweeney AD, Carlson ML, Shepard NT, McCracken DJ, Vivas EX, Neff BA, et al. Congress of Neurological Surgeons systematic review and evidence-based guidelines on otologic and audiology screening for patients with vestibular schwannomas. *Neurosurgery* 2018;82(2):E29-31.
42. Ott MC, Lundy LB. Tympanic membrane perforation in adults: how to manage, when to refer. *Postgrad Med* 2001;110(5):81-4.
43. Isaacson JE, Vora NM. Differential diagnosis and treatment of hearing loss. *Am Fam Physician* 2003;68(6):1125-32.
44. Canadian Infant Hearing Task Force [website]. Ottawa, ON: Canadian Academy of Audiology and Speech-Language; Audiology Canada; 2020. Available from: www.infanthearingcanada.ca. Accessed 2020 Jul 7.
45. 2019 Report card on Canadian early hearing detection and intervention programs. Ottawa, ON: Canadian Infant Hearing Task Force; 2019. Available from: www.infanthearingcanada.ca/wp-content/uploads/2019/04/Report-Card-2019_FINAL_VERSION_EN.pdf. Accessed 2020 Oct 5.
46. Fernandez KA, Jeffers PWC, Lall K, Liberman MC, Kujawa SG. Aging after noise exposure: acceleration of cochlear synaptopathy in "recovered" ears. *J Neurosci* 2015;35(19):7509-20.
47. Keppler H, Ingeborg D, Sofie D, Bart V. The effects of a hearing education program on recreational noise exposure, attitudes and beliefs toward noise, hearing loss, and hearing protector devices in young adults. *Noise Health* 2015;17(78):253-62.
48. Gilles A, Van de Heyning P. Effectiveness of a preventive campaign for noise-induced hearing damage in adolescents. *Int J Pediatr Otorhinolaryngol* 2014;78(4):604-9. Epub 2014 Jan 17.
49. Mirza RA, Kirchner DB; ACOEM Task Force on Occupational Hearing Loss. The role of the professional supervisor in the audiometric testing component of hearing conservation programs. *J Occup Environ Med* 2018;60(9):e502-6.
50. Davies H, Marion S, Teschke K. The impact of hearing conservation programs on incidence of noise-induced hearing loss in Canadian workers. *Am J Ind Med* 2008;51(12):923-31.
51. Agrawal Y, Platz EA, Niparko JK. Prevalence of hearing loss and differences by demographic characteristics among US adults: data from the National Health and Nutrition Examination Survey, 1999-2004. *Arch Intern Med* 2008;168(14):1522-30.
52. Besser J, Stropahl M, Urry E, Launer S. Comorbidities of hearing loss and the implications of multimorbidity for audiological care. *Hear Res* 2018;369:3-14. Epub 2018 Jun 19.
53. Jethanamest D, Rivera AM, Ji H, Chokkalingam V, Telischi FF, Angeli SI. Conservative management of vestibular schwannoma: predictors of growth and hearing. *Laryngoscope* 2015;125(9):2163-8. Epub 2015 Feb 3.
54. Horton GA, Simpson MTW, Beyea MM, Beyea JA. Cerumen management: an updated clinical review and evidence-based approach for primary care physicians. *J Prim Care Community Health* 2020;11:2150132720904181.
55. Ferguson MA, Kitterick PT, Chong LY, Edmondson-Jones M, Barker F, Hoare DJ. Hearing aids for mild to moderate hearing loss in adults. *Cochrane Database Syst Rev* 2017;9(9):CD012023.
56. Mosnier I, Vanier A, Bonnard D, Lina-Granade G, Truy E, Bordure P, et al. Long-term cognitive prognosis of profoundly deaf older adults after hearing rehabilitation using cochlear implants. *J Am Geriatr Soc* 2018;66(8):1553-61. Epub 2018 Aug 8.
57. Kuo CL, Liao WH, Shiao AS. A review of current progress in acquired cholesteatoma management. *Eur Arch Otorhinolaryngol* 2015;272(12):3601-9. Epub 2014 Sep 17.
58. Carlson ML, Vivas EX, McCracken DJ, Sweeney AD, Neff BA, Shepard NT, et al. Congress of Neurological Surgeons systematic review and evidence-based guidelines on hearing preservation outcomes in patients with sporadic vestibular schwannomas. *Neurosurgery* 2018;82(2):E35-9.
59. Mick P, Foley DM, Lin FR. Hearing loss is associated with poorer ratings of patient-physician communication and healthcare quality. *J Am Geriatr Soc* 2014;62(11):2207-9.
60. University of California San Francisco Health. *Communicating with people with hearing loss*. San Francisco, CA: University of California San Francisco Health. Available from: <https://www.ucsfhealth.org/education/communicating-with-people-with-hearing-loss>. Accessed 2020 Apr 6.
61. Scarinci N, Worrall L, Hickson L. Factors associated with third-party disability in spouses of older people with hearing impairment. *Ear Hear* 2012;33(6):698-708.

This article is eligible for Mainpro+ certified Self-Learning credits. To earn credits, go to www.cfp.ca and click on the Mainpro+ link.

This article has been peer reviewed. *Can Fam Physician* 2020;66:803-9

La traduction en français de cet article se trouve à www.cfp.ca dans la table des matières du numéro de novembre 2020 à la page e279.