

Sensorineural Hearing Loss in Adults: Etiological Study

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ABSTRACT

Introduction: Sensorineural hearing loss (SNHL) is an extremely common disorder, with a spectrum of effect ranging from an almost undetectable degree of disability to a profound alteration in the ability to function in society. The purpose of this study was to identify patients with SNHL and to establish an etiological diagnosis.

Study design: It was a prospective study.

Materials and methods: Patients with SNHL attending the Department of ENT at a tertiary referral center in the state of Uttarakhand were evaluated; 135 patients with audiologically proven SNHL were included in this study and were evaluated to make an etiological diagnosis.

Results: Sensorineural hearing loss was found predominantly in males with a mean age of 45.5 years. The maximum patients were in the age group of 26 to 45 years (54 patients; 40%). The maximum incidence of SNHL was found in office workers (49 patients; 36.3%). A total of 119 (88%) patients reported to have a progressive hearing loss while only 16 (12%) patients had a sudden onset of hearing loss; 69 (51%) cases had unilateral and 66 (49%) cases had bilateral hearing loss. The patients with moderate hearing loss (41–55 dB) were 33 (24.4%), while profound deafness (more than 90 dB) was seen in 31 (23%). A maximum of 66 (49%) patients were diagnosed as having a cochlear disease and retrocochlear disease was seen in 38 patients (28%). The most common etiology of SNHL was idiopathic while the second most common was presbycusis followed by noise-induced deafness and Meniere's disease.

Conclusion: It was found that the majority of the patients with SNHL were males belonging to younger age group and therefore, had a greater significance of early identification and rehabilitation. The main etiological diagnosis in our study was idiopathic followed by presbycusis.

Keywords: Etiology, Hearing loss, Sensorineural.

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INTRODUCTION

Hearing loss is the most prevalent sensory deficit in humans. The prevalence of hearing loss increases with age. The most common type of hearing loss in adults is sensorineural, the etiology of which may not be apparent to the unsuspecting clinician. Sensorineural hearing loss accounts for about 90% of all hearing loss and it is found in 23% of the population older than 65 years of age.¹ Hearing loss in older adults is likely to be dubbed as “age related” and the same pattern of hearing loss in younger adults probably will be diagnosed as idiopathic, without consideration of possibility of the existence of an identifiable cause. Some of the treatable causes of SNHL are Meniere's disease, autoimmune disease, syphilitic hearing loss, cochlear otosclerosis, and endocrinal disorders, such as thyroid disorders. About 13 to 30% of those with meningitis develop hearing loss.² Postmeningitic hearing loss can be due to lesions of the cochlea, brain stem, and higher auditory pathways. Immune-mediated hearing loss requires a laboratory confirmation of this diagnosis. However, in a vast number of cases, it is difficult to recognize the etiology of hearing loss if the medical history and physical examination appear normal.¹ Common causes of bilateral SNHL can be noise-induced deafness and ototoxic hearing loss. Medical treatment is not yet available for cases of progressive SNHL of unclear etiology and is limited to prosthetic rehabilitation of auditory deficit.¹ The SNHL may be sudden or progressive. Sudden SNHL is defined as hearing loss of more than 30 dB in three contiguous frequencies occurring in 3 days or less. Although there are multiple etiologies, most investigators agree that viral infection, cochlear membrane breaks, and vascular obstruction represent the primary causes of idiopathic acute hearing loss. It is suspected that viral infection is the most common cause.³ Surprisingly perhaps, hypertension, obesity, and diabetes are not associated with an increased risk of hearing loss.⁴ There are many rare individual causes of SNHL like acoustic neuroma, meningioma, hyperviscosity syndrome, superficial siderosis, Kawasaki's disease, radiation to the ear, and carbon monoxide poisoning.^{5,6} The aim of the study was to establish an etiological diagnosis of SNHL which is helpful to identify treatable patients of SNHL and patients requiring rehabilitation.

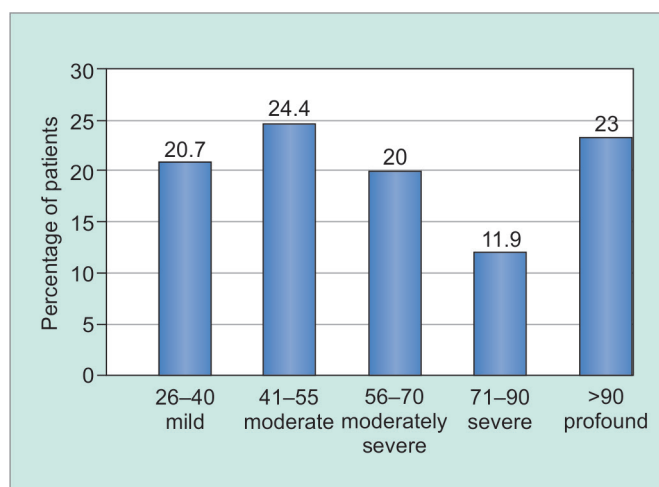
MATERIALS AND METHODS

The study was carried out in the Department of Otorhinolaryngology, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, India. All adult patients of either sex with complaints of hearing loss attending the otorhinolaryngology outpatient department were included in this study. Patients with congenital hearing loss were excluded from the study. All the patients were subjected to thorough ear, nose, and throat checkup in the form of otoscopy and tuning fork tests. Audiometric study in the form of pure tone audiometry and special tests in the form of short increment sensitivity index (SISI), threshold tone decay (TTD), and alternate binaural loudness balance (ABLB) were also performed. Radiological tests, such as magnetic resonance imaging, hematological, biochemical, and other special tests, such as glycerol test were also performed wherever applicable.

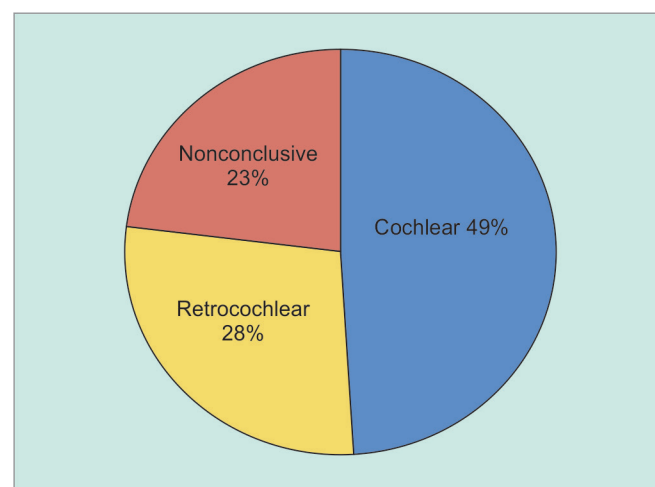
RESULTS

A total of 135 cases were included in the study. The maximum patients were in the age group of 26 to 45 years (54 patients; 40%). The mean age of the patients was 45.5 years. Male:female ratio was 2.9:1. The maximum incidence of SNHL was found in office workers in 49 (36.3%) patients; 66 (48.9%) patients reported within 1 day to 6 months, while 27 (20%) patients reported after 24 months of the onset of hearing loss. A total of 119 (88%) patients reported to have a progressive hearing loss, while only 16 (12%) patients had a sudden onset of hearing loss. A total of 53 (39.3%) patients gave a history of bilateral hearing loss, while 82 (60.7%) patients gave a history of unilateral hearing loss, out of which 48 (58.5%) complained of right-sided hearing loss and 34 (41.5%) complained of left-sided hearing loss. Patients complaining of tinnitus with hearing loss were 45 (32.5%) while those with vertigo were 2 (1.5%)

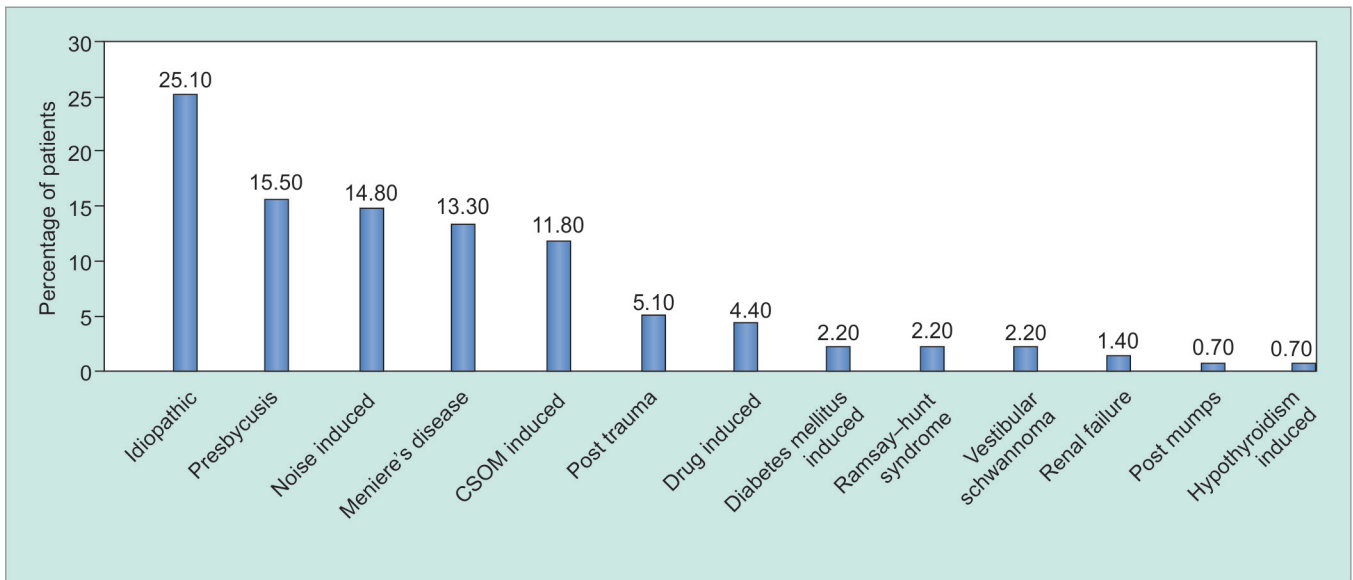
and patients complaining of both tinnitus and vertigo were 27 (20%). Based on pure tone audiometry, 69 (51%) cases were unilateral and 66 (49%) cases were bilateral. Out of the 69 unilateral cases of SNHL, right-sided deafness was found in 36 (52.2%) cases, while left-sided deafness was found in 33 (47.8%) cases. The patients with moderate hearing loss (41–55 dB) were 33 (24.4%), while the second most common group was of profound deafness (more than 90 dB) in 31 (23%), mild deafness (26–40 dB) in 28 (20.7%) patients, followed by moderately severe (56–70 dB) in 27 (20%), severe (71–90 dB) in 16 (11.9%; Graph 1). The SISI test was done in 104 (77%) patients at 1,000 Hz, the remaining 31 (23%) patients had profound hearing loss and so the test could not be done on these patients; 75 to 100% response was found in 66 (63.5%) patients and 0 to 25% response was found in 38 (36.5%) patients. The TTD was done in 104 (77%) patients and it was found positive in 38 (36.5%) patients and negative in 66 (63.5%) patients. The ABLB test was done in patients with unilateral hearing loss and those with bilateral asymmetrical hearing loss, 38 (28%) patients met this criterion. Recruitment was found in 24 (63.20%) cases and 14 (36.80%) cases did not show recruitment. Speech discrimination score test was done in 104 (77%) patients—90 to 100% score was found in 66 (49.00%) patients and score below 60% was found in 38 (28%) patients. Cochlear disease was seen in 66 (49%) patients, while retrocochlear disease was present in 38 (28%); 31 (23%) patients had profound SNHL, so the type could not be determined by audiometrical tests and hence, was labeled as inconclusive (Graph 2). Out of 135 patients, 34 (25%) patients had idiopathic etiology for SNHL, presbycusis was found in 21 (15.50%) patients, while noise-induced deafness was found in 20 (14.80%) patients. Meniere's disease was diagnosed in 18 (13.30%), SNHL due to chronic suppurative otitis media was found in 16 (11.80%), posttraumatic disorder was seen in 7 (5.10%), drug induced in 6 (4.40%) and 3 (2.2%) each in



Graph 1: Degree of hearing loss in patients



Graph 2: Types of SNHL



Graph 3: Etiological diagnosis of patients with SHNL

diabetes mellitus-induced, Ramsay–Hunt syndrome, and vestibular schwannoma, 2 (1.4%) due to renal failure and 1 (0.70%) each due to postmumps and hypothyroidism (Graph 3).

DISCUSSION

The SNHL is sometimes also called “nerve deafness,” although the term is not entirely accurate, as it leaves out disorders of the hair cells of the cochlea. The term “sensorineural” is used to indicate that there is either a cochlear or an auditory nerve lesion. Common causes include old age, where the hearing pattern is often called presbycusis, Meniere’s disease, ototoxic medications, immune disorders, and noise exposure. Trauma (inner ear concussion) can cause both temporary and permanent hearing loss. The age of the patients in this study ranged from 18 to 82 years with the mean age being 45.5 years. The maximum number of patients was in the age group of 26 to 35 years (20%) and 36 to 45 years (20%). Our findings differ from those of Angeli et al¹ who reported a mean age of 54.4 years. The mean age reported by Shah et al⁷ was 34.6 years; this contrast was due to the fact that Shah et al⁷ had also included pediatric patients in their study. Segal et al⁸ reported the maximum number of patients in the age group of 56 to 65 years (29.1%). This was due to the fact that they have included patients with asymmetric hearing loss only. Cruickshanks et al⁹ reported a mean age of 65.8 years. They had included patients within the age range of 48 to 92 years. As far as occupation was concerned, office workers (49; 36.30%) constituted the largest group, followed by homemakers (33; 24.4%) and laborers and farmers (17.70%). Defense personnel constituted 7% of the patients. This was in contrast to Cruickshanks et al⁹ who reported the

maximum incidence in patients involved in production and fabrication (21.3%) followed by patients involved in sales (24.6%). The high incidence of farmers and labourers in our study can be attributed to the fact that our hospital caters mostly to rural population where farming and manual labor is the main occupation. In our study, we have reported 16 (12%) cases with a history of sudden onset of hearing loss out of which 1 case (6.30%) was bilateral while 15 cases (93.70%) were unilateral. This is in accordance with those of Yimtae et al¹⁰ (92.9% unilateral and 3.1% bilateral). Fetterman et al¹¹ in their study had 1.7% bilateral and 98.3% unilateral cases. The maximum numbers of patients were diagnosed as having a cochlear disease (66; 49%), and retrocochlear disease was seen in 38 (28%) patients. A total of 31 (23%) patients had profound hearing loss and so the type of hearing loss could not be determined by audiometric tests. Sonkhya and Kaur¹² diagnosed 72% cases as having a cochlear hearing loss. This difference can be attributed to the fact that in our study the mean age of the patients was higher and maximum numbers of the patients were diagnosed as having neural type of presbycusis and the majority of the patients with idiopathic SNHL had a retrocochlear type of hearing loss. The majority of the patients had cochlear type of hearing loss and we had a good number of patients diagnosed as having noise-induced deafness, Meniere’s disease, and drug-induced deafness. The majority of the patients in our study were found to have no identifiable cause of SNHL and were labeled as having idiopathic hearing loss (34; 25.10%); it was followed by presbycusis (21; 15.50%), noise induced (20; 14.80%), and Meniere’s disease (18; 13.30%). This was in contrast to Sonkhya and Kaur,¹² who reported the maximum incidence of SNHL due to hypertension (22%). However, the incidence of

presbycusis (12%) was in accordance to our study. They attributed head injury (12%) and renal failure (10%) as other common causes. They also had patients with insignificant history (12%) in whom no cause could be found. Simon et al¹ achieved etiologic diagnosis in 6 out of 60 cases, as mitochondrial deoxyribonucleic acid mutation was found in 4 cases, cochlear otosclerosis in 1 case, and dilated vestibular aqueduct in 1 case. This was in contrast to our study as they had excluded all patients with acquired etiology for the hearing loss, such as ototoxicity, noise exposure, head trauma, Meniere's disease, and other retrocochlear causes. Surján et al¹³ in their study of etiology of hearing loss in adults found that a maximum incidence was of noise-induced deafness (20.1%) followed by presbycusis (19.5%), chronic otitis media (12.05%), and idiopathic SNHL (11.7%). The difference in the results could be attributed to the fact that they have included all types of hearing loss in their study while we had exclusively studied SNHL in the present study. In our study, we had 21 (15.50%) cases of presbycusis, which is in accordance with Sonkhya and Kaur¹² and Surján et al¹³ who had 12 and 19% cases respectively. All the patients had bilateral symmetrical SNHL, more in the high-frequency range. This is in accordance with Makishima¹⁴ who studied the clinicopathological aspects of presbycusis and concluded that presbycusis is an unexplained high-tone sensorineural hearing impairment occurring in the elderly people. There was a male predominance in the cases of presbycusis in our study; this is supported by Hinchcliffe¹⁵ who concluded that there was a significant difference in the hearing thresholds of men and women, thresholds of men being higher. Presbycusis is the most common type of hearing loss in the United States. This type of hearing loss is typically gradual, bilateral, and characterized by difficulty hearing high frequencies. In our study, we had 20 (14.80%) cases of noise-induced hearing loss while Surján et al¹³ reported 20.1% cases. There were 17 (85%) cases of hearing loss due to chronic noise exposure, while 3 (15%) had due to acoustic trauma; 10 (58.8%) out of 17 patients had bilaterally asymmetrical hearing loss, all of these were army or police personnel and were associated with firearm use on a regular basis. Because of occupational risk of noise-induced hearing loss, there are government standards regulating allowable noise exposure. Otoacoustic emission testing is very sensitive to noise-induced hearing loss. Noise can also cause a reversible hearing loss, called a temporary threshold shift. This typically occurs in individuals who are exposed to gunfire or firecrackers, and hear ringing in their ears after the event. Nonoccupational noise is also regularly encountered during recreational activities and is a source of premature hearing reduction. Portable compact disk players have

been evaluated and it has been determined that for most players, 1 hour of listening at 70% of the maximum volume level for a typical player is equivalent to the peak recommended noise exposure by the government for occupational exposure.¹⁶ The hearing loss was more on the left side seen in 8 (80%) cases, while in 2 (20%) patients it was on the right side. Studies by Cox and Ford,¹⁷ Taylor and Williams¹⁸ have also reported asymmetrical hearing loss in firearm use, more on the left side, which is further supported by Nondahl et al¹⁹ who concluded that hearing threshold in left ears of people using firearms was worse than in the right ear. This can be attributed to the head shadow effect that occurs when the target is sighted and weapon supported with the right shoulder. The head is turned in such a way that the right ear is more protected from the impulse noise while the left is more directly in line with the noise source. In our study, we had 18 (13.30%) patients with Meniere's disease; this is in contrast with Sonkhya and Kaur¹² who reported 3 (6%) cases and with Surján et al¹³ where only 0.45% cases were reported. We had 14 (77.7%) males and 4 (22.3%) females, which is in contrast with Shakeel²⁰ who reported an equal male:female ratio. All the patients in our study had unilateral disease. Paparella and Mancini²¹ reported unilateral hearing loss in 87.7% cases. In our study, right and left sides were almost equally involved (right 44.5% and left 55.5%), which is in accordance with Meyerhoff et al²² who observed that right and left ears are affected with fairly equal frequency. In our study, vertigo was present in all 18 (100%) cases and tinnitus was present in 17 (94.4%); this is in accordance with Meyerhoff et al²² who observed vertigo in 96.2% and tinnitus in 91.1%, although diabetes *per se* is not associated with an overall greater risk of hearing loss.⁴ Hearing loss starts at an early age than in the normal population. But eventually the general population catches up, so that by the age of 60, they are difficult to distinguish.²³ Pathological studies suggest that it is due to microangiopathic involvement of inner ear blood vessels and subsequent stria vascularis atrophy and hair cell loss. Good control of diabetes seems to be associated with slower progression of hearing loss. Diabetics are also more prone to get external and middle ear infections, as well as more prone to develop cranial nerve palsies and stroke. These problems can greatly complicate the hearing care of diabetics.

CONCLUSION

The majority of the patients with SNHL in this study were males with a mean age of 45.5 years. The most common etiology of SNHL is idiopathic, while the second most common is presbycusis followed by noise induced and Meniere's disease. Still a large number of patients remain

undiagnosed and are labeled as idiopathic SNHL. Most patients belong to younger age group and therefore, there is a greater significance of early identification and rehabilitation.

REFERENCES

1. Angeli SI, Yan D, Telischi F, Balkany TJ, Ouyang XM, Du LL, Eshraghi A, Goodwin L, Liu XZ. Etiologic diagnosis of sensorineural hearing loss in adults. *Otolaryngol Head Neck Surg* 2005 Jun;132(6):890-895.
2. Wellman MB, Sommer DD, McKenna J. Sensorineural hearing loss in postmeningitic children. *Otol Neurotol* 2003 Nov;24(6):907-912.
3. Mamak A, Suleyman Y, Cansiz H, Inci E, Gulcu E, Derekoylu L. A study of prognostic factors in sudden hearing loss. *Ear Nose Throat J* 2005 Oct;84(10):641-644.
4. Shargorodsky J, Curhan SG, Eavey R, Curhan GC. A prospective study of cardiovascular risk factors and incident hearing loss in men. *Laryngoscope* 2010 Sep;120(9):1887-1891.
5. Wood VH, Bird PA, Giles EC, Baber WJ. Unsuccessful cochlear implantation in two patients with superficial siderosis of the central nervous system. *Otol Neurotol* 2008 Aug;29(5):622-625.
6. Wang LF, Kuo WR, Ho KY, Lee KW, Lin CS. A long-term study on hearing status in patients with nasopharyngeal carcinoma after radiotherapy. *Otol Neurotol* 2004 Mar;25(2):168-173.
7. Shah RK, Blevins NH, Karmody CS. Mid frequency sensorineural hearing loss. *J Laryngol Otol* 2005 Jul;119(7):529-533.
8. Segal N, Shkolink M, Kochba A, Segal A, Kraus M. Asymmetric hearing loss in a random population of patients with mild to moderate sensorineural hearing loss. *Ann Otol Rhinol Laryngol* 2007 Jan;116(1):7-10.
9. Cruickshanks KJ, Tweed TS, Wiley TL, Klein BE, Klein R, Chappell R, Nondahl DM, Dalton DS. The 5 year incidence and progression of hearing loss: the epidemiology of hearing loss study. *Arch Otolaryngol Head Neck Surg* 2003 Oct;129(10):1041-1046.
10. Yimtae K, Srirompotong S, Kraitrakul S. Idiopathic sudden sensorineural hearing loss. *J Med Assoc Thai* 2001 Jan;84(1):113-119.
11. Fetterman BL, William M, Saunders JE. Sudden bilateral hearing loss. *Laryngoscope* 1996 Nov;106(11):1347-1350.
12. Sonkhya N, Kaur K. Evaluation of tone decay and short increment sensitivity index test in 50 cases of SNHL. *Indian J Otol* 2002;8(2):43-46.
13. Surján L, Dévald J, Pálfalvi L. Epidemiology of hearing loss. *Audiology* 1973 Sep-Dec;12(5):396-410.
14. Makishima K. Clinicopathological studies in presbycusis. *Otol Fukuoka* 1967;13(3):333.
15. Hinchcliffe R. The Threshold of hearing as a function of age. *Acoustica* 1959;9:303.
16. Fligor BJ, Cox LC. Output levels of commercially available portable compact disc players and the potential risk to hearing. *Ear Hear* 2004 Dec;25(6):513-527.
17. Cox HJ, Ford GR. Hearing loss associated with weapons noise exposure: when to investigate an asymmetrical loss. *J Laryngol Otol* 1995 Apr;109(4):291-295.
18. Taylor GD, Williams E. Acoustic trauma in sports hunter. *Laryngoscope* 1966 May;76(5):869-879.
19. Nondahl DM, Cruickshanks KJ, Wiley TL, Klein R, Klein BE, Tweed TS. Recreational firearm use and hearing loss. *Arch Fam Med* 2000 Apr;9(4):352-357.
20. Shakeel RS. Fortnightly review: diagnosis and treatment of Meniere's disease. *BMJ* 1998 Jan 31;316(7128):368-372.
21. Paparella MM, Mancini F. Vestibular Meniere's disease. *Otolaryngol Head Neck Surg* 1985 Apr;93(2):148-151.
22. Meyerhoff WL, Paparella MM, Gudbrandson FK. Clinical evaluation of Meniere's disease. *Laryngoscope* 1981 Oct;91(10):1663-1668.
23. Vaughan N, James K, McDermott D, Griest S, Fausti S. A 5-year prospective study of diabetes and hearing loss in a veteran population. *Otol Neurotol* 2006 Jan;27(1):37-43.