Section: Otorhinolaryngology

Original Research Article

A CROSS SECTIONAL STUDY OF AGE-RELATED HEARING LOSS AMONG PATIENTS ABOVE 60 YEARS WITH CO-MORBIDITIES AT GOVERNMENT GENERAL HOSPITAL, NIZAMABAD

Kathyayani Burugula[1], Adarapu Rajanikanth[2], Medi Anvesh Krishna[3], Harish Swamy Dharmagadda[4]

[1]*Assistant Professor, Department in Otorhinolaryngology, Government Medical College, Khaleelwadi, Nizamabad, India.*
[2]*Assistant Professor, Department in Otorhinolaryngology, Government Medical College, Khaleelwadi, Nizamabad, India.*
[3]*Assistant Professor, Department in Otorhinolaryngology, Government Medical College, Khaleelwadi, Nizamabad, India.*
[4]*Associate Professor, Department in Otorhinolaryngology, Government Medical College, Khaleelwadi, Nizamabad, India.*

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Corresponding Author:
Dr. Harish Swamy Dharmagadda,
Associate Professor,
Department in Otorhinolaryngology,
Government Medical College,
Khaleelwadi, Nizamabad, India.
Email: harishmsent1@gmail.com

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ABSTRACT

Background: Age related hearing loss is a major public health issue, Multiple variables have been evaluated that contribute to hearing loss with aging. **Aim:** To study Age related Hearing loss among patients above 60 years of age with comorbidities.

Materials and Methods: A cross sectional study of 100 elderly patients with and without various co-morbidities were investigated by pure tone audiometry to assess the hearing loss and the pure tone thresholds were compared among the various subgroups and the following results were obtained.

Results: Majority of the elderly study subjects belonged to 71-80 years (41%) followed by 34% in 61– 70-year age group. Majority of the study subjects were male (64%). The male to female ratio was 1.7:1. The most common comorbidity present was Diabetes mellitus (28%), followed by hypertension (24%) and dyslipidaemia (18%). Smoking constituted 14% and alcohol habit was present in 16% study subjects Sensorineural hearing loss was observed in all the patients under the study. The degree of hearing loss increased as age progresses in both the normal and patients with comorbidities. The hearing loss maintained a linear progression amongst all studied groups.

Conclusion: There is a definitive increase in hearing thresholds in patients of Diabetes mellitus, Hypertension, Dyslipidaemia, Smoking when compared to the normal whereas amongst alcohol consumers the hearing threshold was better when compared to the normal patient.

Keywords: Hearing loss (HL), Dyslipidaemia, Smoking, Diabetes mellitus, Hypertension.

INTRODUCTION

The proportion of older people (60 years or over) in the world's population is increasing, as a consequence of increased longevity and general population growth. There is an increased risk of developing various types of chronic health disorders at older age. Chronic conditions often occur in combination and multimorbidity, the coexistence of 2 or more chronic conditions, is common in older people. The high prevalence of multimorbidity is of huge concern, not only because of its detrimental impact on patients' functioning and quality of life (QoL), but also because healthcare costs increase exponentially with the number of coexisting chronic conditions in a person. Hearing loss (HL) is one of the most prevalent chronic conditions found among the elderly, and it can limit meaningful communication and social connectivity leading to a lower health-related quality of life and decreased physical and cognitive function.[1,2]

The most common type of HL is presbycusis, which is associated with ageing, and it is the third most common chronic condition reported by the elderly. Risk factors, such as hypertension, diabetes, dyslipidemia, alcohol intake and smoking may predispose individuals to suffer HL, especially when

associated with presbycusis. Some studies justify that inner ear alterations causing tinnitus, vertigo and hearing loss may be related to a microcirculatory insufficiency resulting from vascular occlusion by embolism, haemorrhage or vasospasm and that these, in turn, would be the result of a hyper viscosity or microangiopathy syndrome caused by DM or hypertension; therefore, hypertension and DM could cause sensorineural hearing loss due to these histopathological factors. Specifically, high blood glucose levels may damage the vessels in the stria vascularis and nerves impacting the biochemistry and neural innervation of the cochlea. Smoking may impact upon the auditory system via direct ototoxic effects of nicotine or other ototoxic substances found in cigarette smoke or vascular effects, such as increased blood viscosity and reduced available oxygen causing cochlear hypoxia.[3,4,5] Therefore, the present study was aimed to determine the possible association of HL with hypertension, DM and dyslipidaemia among the elderly population.

MATERIALS AND METHODS

This Cross-sectional study included patients aged 60 years and above with age related hearing Loss attending ENT department, Government medical college and General hospital Nizamabad from October 2020 to March 2022.

Inclusion Criteria: Patients >60 years having features of hearing loss and suffering from Diabetes, Hypertension, Dyslipidemia, smokers and alcoholics, with even single comorbidity are included

Exclusion Criteria: Patients with middle ear pathology, with SNHL with a known cause example: Meniere's disease, labyrinthitis, acoustic neuroma, temporal bone fracture, meningitis.

Patients who satisfied the criteria of selection were taken as subjects for the study. A total of 100 patients were selected for the study. A complete clinical history was obtained regarding the duration of hearing loss, associated symptoms if any. Other negative history was enquired to exclude other causes of hearing loss. Patients who were on medications for Diabetes mellitus, Hypertension and Dyslipidemia were only taken for the study. Smoking and alcohol consumption were historically evaluated. All the patients were evaluated with the following modalities General physical examination. Complete examination of the ear, nose, and throat. Otoscopic examination including signalization Assessment of hearing with tuning forks **Audiometry:** Hearing assessment was done on all patients with the same audiometer and pure tone thresholds for 250Hz, 500 Hz, 1KHz, 2 KHz, 4 KHz, 8 KHz for Air conduction and 250Hz, 500 Hz, 1KHz, 2 KHz, 4 KHz, for Bone conduction was determined using the standard conventional method and recorded in a PTA report as per annexure. Pure tone average of 500Hz, 1 KHz and 2 KHz Air conduction threshold was taken and tabulated on data spreadsheet.

Statistical Methods: Data was analyzed using the following methods. 1. Diagrammatic representation, Mean ± standard deviation.

RESULTS

Majority of the elderly study subjects belonged to 60-70 years (60%) followed by 25% in 71– 80-year age group. Majority of the study subjects were male (64%). The male to female ratio was 1.7:1 The most common comorbidity present was Diabetes mellitus (28%), followed by hypertension (24%) and dyslipidaemia (18%). Smoking constituted 14% and alcohol habit was present in 16% study subjects. [Table 1]

The Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of diabetic patients higher on comparing with the patients without any co-morbidity. [Table 2]

The Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of dyslipidaemia patients higher on comparing with the patients without any co-morbidity. [Table 3]

The Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of hypertensive patients higher on comparing with the patients without any co-morbidity. [Table 4]

The Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of smokers higher on comparing with the patients without any co-morbidity. [Table 5]

The Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of alcohol consumers were higher on comparing with the patients without any co-morbidity. [Table 6]

Table 1: Demographic distribution in present study

Age (in years)	Number	Percentage
60 - 70	60	60%
71 – 80	25	25%
81 – 90	9	9%
> 90	6	6%
Gender		
Male	64	64%

Female	36	36%
Comorbidities		
Diabetes Mellitus	14	28%
Hypertension	12	24%
Dyslipidaemia	9	18%
Smoking	7	14%
Alcohol	8	16%

Table 2: Comparison of hearing loss between Normal and diabetic study subjects

Age (in years)	Number	Percentage
60 - 70	60	60%
71 – 80	25	25%
81 – 90	9	9%
> 90	6	6%
Gender		
Male	64	64%
Female	36	36%
Comorbidities		
Diabetes Mellitus	14	28%
Hypertension	12	24%
Dyslipidaemia	9	18%
Smoking	7	14%
Alcohol	8	16%

Table 2: Comparison of hearing loss between Normal and diabetic study subjects

Age (in years)	PTA Normal						PTA Diabetics					
	250	500	1000	2000	4000	8000	250	500	1000	2000	4000	8000
60 – 70	33.7	38.5	46.2	52.2	73.8	82.4	45.5	51.62	58.45	64.52	74.62	83.95
71 – 80	34.61	40.31	47.94	56.66	71.66	78.42	44.9	50.49	61.85	66.49	77.99	81.92
81 – 90	37.98	44.83	51.03	65.26	79.43	86.79	47.91	55.69	62.07	71.81	80.05	81.62
>90	38.06	46.36	54.99	62.04	75.9	81.12	48.75	57.5	64.80	67.85	75.25	77.35

Table 3: Comparison of hearing loss between Normal and dyslipidemia study subjects

Age (in years)	PTA Normal						PTA Dyslipidaemia					
	250	500	1000	2000	4000	8000	250	500	1000	2000	4000	8000
60 – 70	33.7	38.5	46.2	52.2	73.8	82.4	43.37	48.62	56.5	64.8	78.62	78.95
71 – 80	34.61	40.31	47.94	56.66	71.66	78.42	47.55	56.44	63.48	65.64	70.31	76.98
81 – 90	37.98	44.83	51.03	65.26	79.43	86.79	47.12	58.42	66.89	68.30	75.25	80.41
>90	38.06	46.36	54.99	62.04	75.9	81.12	52.9	62.65	65.80	71.95	85.91	92.65

Table 4: Comparison of hearing loss between Normal and Hypertensive study subjects

Age (in years)	PTA Normal						PTA HTN					
	250	500	1000	2000	4000	8000	250	500	1000	2000	4000	8000
60 – 70	33.7	38.5	46.2	52.2	73.8	82.4	41.37	47.62	53.5	58.48	71.62	76.95
71 – 80	34.61	40.31	47.94	56.66	71.66	78.42	40.55	50.44	58.48	62.64	74.31	82.98
81 – 90	37.98	44.83	51.03	65.26	79.43	86.79	46.12	55.62	62.35	68.90	83.75	87.60
>90	38.06	46.36	54.99	62.04	75.9	81.12	42.9	57.85	68.70	74.95	83.25	85.96

Table 5: Comparison of hearing loss between Normal and smoking subjects

Age (in years)	PTA Normal						PTA Smokers					
	250	500	1000	2000	4000	8000	250	500	1000	2000	4000	8000
60 – 70	33.7	38.5	46.2	52.2	73.8	82.4	45.93	51.71	56.4	59.06	72.65	75.62
71 – 80	34.61	40.31	47.94	56.66	71.66	78.42	42.72	51.62	56.69	63.52	74.26	81.22
81 – 90	37.98	44.83	51.03	65.26	79.43	86.79	48.24	55.4	62.86	69.79	78.44	87.53
>90	38.06	46.36	54.99	62.04	75.9	81.12	42.75	57.5	64.75	70	78.5	87

Table 6: Comparison of PTA between Normal and Alcoholic study subjects

Age (in years)	PTA Normal						PTA Alcoholics					
	250	500	1000	2000	4000	8000	250	500	1000	2000	4000	8000
60 – 70	33.7	38.5	46.2	52.2	73.8	82.4	33.93	40.71	42.64	49.06	58.65	65.82
71 – 80	34.61	40.31	47.94	56.66	71.66	78.42	34.02	41.62	46.69	53.52	59.26	69.22
81 – 90	37.98	44.83	51.03	65.26	79.43	86.79	38.24	43.46	49.86	54.79	66.44	74.53
>90	38.06	46.36	54.99	62.04	75.9	81.12	42.75	48.75	58.75	71.89	78.5	79.6

DISCUSSION

The proportion of older people (60 years or over) in the world's population is increasing, as a consequence of increased longevity and general population growth. There is an increased risk of developing various types of chronic health disorders at older age. Chronic conditions often occur in combination and

multi-morbidity, the coexistence of 2 or more chronic conditions, is common in older people.[1] One of the most prevalent chronic health conditions in older ages hearing loss. HL is often observed in combination with other (chronic) diseases. In clinical care, one of the chronic conditions is often considered as the primary or "index" disease, which is the main focus of the clinical pathway in question, while other co-existent diseases are referred to as comorbid diseases or comorbidities. Depending on the severity of the co-existing diseases, the treatment of HL may play a secondary role in patient care. Nonetheless, the understanding, appropriate counselling, and treatment of hearing-impaired patients with comorbidities is of high importance and the process of rehabilitation should ideally take all comorbidities into account. The present study was undertaken to study the pattern of hearing loss among patients 60 years and above suffering from Co-morbidities like diabetes, hypertension and dyslipidaemia and addictions such as smoking and alcoholism.

In the present study, the Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of dyslipidaemia patients higher on comparing with the patients without any co- morbidity.

A linear relationship was seen between advancing age and increasing hearing impairment from the present study and the average hearing loss per decade amongst the dyslipidaemias was 3.10 dB for males from the average of 57.6dB in 50 -60-year-old males & 2.77dB from the average of 56.66dB in 50 – 60-year-old females. The hearing loss pattern was a right sloping curve with higher loss in higher frequencies.

The proposed mechanism of dyslipidaemia causing SNHL included lipidosis, microvascular disease, metabolic hypoxia, embolism, hereditary hyper viscosity and atherosclerosis of cochlear blood vessels. An increase in plasma level of LDL-C and TC are major risk factor for the development of atherosclerosis. Atherosclerosis of the labyrinthine blood vessels would reduce blood and nutrient supply to the inner ear with resultant SNHL. Thakur et al,[6] found LDL to be significantly associated with auditory dysfunction. The case control study by O. I. Odeh et al,[7] did not show any relationship between SNHL and the presence of dyslipidaemia. Dyslipidaemia values were not more frequently observed neither was the median values of the lipid parameters measured higher among our cases than the controls. Furthermore, there was no relationship between the degree of severity of hearing loss and the median values of the lipids among the cases.

Similar findings were reported in the study by Jones et al,[8] but contradicting results were reported in other similar studies. The reason for these observed differences is not known, however, it may be related to the duration or severity of dyslipidaemia suffered by the participants with long standing dyslipidaemia. The basis of the association between SNHL and dyslipidaemia requires that the dyslipidaemia be longstanding. Due to the design of this study, this could not be ascertained. Short term dietary changes have been shown to have no influence on loss of auditory function. It is also thought that the effect of dyslipidaemia and noise exposure on the cochlear may be synergistic.

In the study by O. I. Odeh,[7] the hearing threshold of the patients ranged from normal to profound hearing loss. Gates et al,[9] reported an inverse relationship between HDL level and low-frequency hearing thresholds in women. Lee et al,[10] in a similar study reported an inverse relationship between LDL/HDL ratio and hearing threshold in women. This present study did not find any relationship between plasma HDL-C and SNHL.HDL-C, unlike LDL-C is known to protect against atherosclerosis. Jones et al,[8] reported that an elevated fasting serum TC level was significantly associated with better hearing threshold levels but this present study found no relationship between hearing and serum TC, LDL-C, or triglyceride levels. It has also been suggested that the nature of dyslipidaemia associated with SNHL is that which is associated with elevated triglycerides. Elevated triglycerides were not common among the participants of this present study. The hearing loss due to dyslipidaemia is potentially reversible if dietary measures to reduce cholesterol were instituted.[10]

In our study, the Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of hypertensive patients higher on comparing with the patients without any co- morbidity. Bareli et al,[11] conducted a study including aged people, which concluded that the extent of HL was more or less the same in people with and without HTN. However, the audiometric results were different in both groups. Another study by Agarwal et al,[12] included 150 hypertensive participants and 124 normotensive participants; hearing in both groups was compared. It was found that hypertensive patients with blood pressure over180/110 mmHg were observed to bear worse hearing thresholds in high frequencies. Gates et al,[9] also found similar results in their study. Additionally, a relationship between HTN and low-frequency HL was found in females in these studies. On the contrary, other studies could not conclude a positive correlation between HTN and HL.

The possible explanation for the association between HL and HTN is thoroughly explained in several studies. The lateral wall of the cochlea has stria vascularis, which is meant to deliver auditory signals from the cochlea to the central nervous system. The vessels that supply to the stria vascularis originate from the terminal arteries, with no support from collateral circulation. This is why it is extremely sensitive when the vascular supply is restricted; this is further confirmed by animal studies showing decreased endocochlear potential and HL right after an event causing decreased oxygen supply. It is believed that HTN may cause restrictions in the

vascular supply to the stria vascularis, potentially leading to HL. Another possible explanation may be use of ototoxic anti-hypertensive medications such as loop diuretics. Loop diuretics were associated with the 10-year incidence of HL.

Meneses-Barriviera et al,[3] concluded that there is a prevalence of sensorineural HL compared with other HLs in individuals older than 60 years of age (66.26% with sensorineural HL, mixed HL in 3.21%, 19.17% with normal thresholds that declined at the frequencies of 6,000 Hz and 8,000 Hz, and11.34% with thresholds within normal limits). These results are similar to those of previous studies,[13,14] which also found a prevalence of sensorineural HL, with an association between HL and DM or hypertension in populations of different ages, but especially among the elderly.

Some studies point out that every cell in the body relies on an adequate supply of oxygen and nutrients to maintain its functions, depending on the structural and functional integrity of the heart and blood vessels. Hypertension can cause changes in the heart and blood vessels. The high pressure in the vascular system can result in bleeding into the inner ear, which may lead to sudden or progressive HL.[15] This result, which seems controversial when compared with the literature, is possibly due to the age of the study sample (between 60 to 97 years). In the study by Lin et al,[16] there were no significant associations ($p > 0.05$) between HL and other cardiovascular risk factors (hypertension, diabetes), even when multiple HL frequency bands were considered. However, the authors mention limitations such as 13% of older adults who did not complete the audiometric examination.

Diabetes mellitus is known to cause bilateral progressive SNHL. With aging, both hearing loss as well as risk of diabetes increases.[3] But hearing loss seen in these patients would be similar to that of presbycusis but with more severe losses and early onset than expected by aging alone. As a result, it is difficult to distinguish whether hearing loss in diabetes is due to normal process of aging or due to biochemical and the vascular abnormalities associated with diabetes. Most of the reported studies have shown diabetes to affect the hearing threshold in both young and elderly diabetics and in that some studies have shown higher frequencies being affected more than lower or mid frequencies. Whereas other studies have reported it to affect all the frequencies and some only in lower frequencies.

In the present study, the Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of diabetic patients higher on comparing with the patients without any co- morbidity. An extremely interesting population study looking at the association between hearing loss and diabetes was conducted by Kathleen Bainbridge and colleagues,[17] published in the July 2008 edition of the Annals of Internal Medicine. These researchers looked at 5,140 adult NHANES participants from 1999-2004. The researchers report that hearing impairment was found to be more prevalent among those participants with diabetes. Following multivariant analyses, they found that people with diabetes had significantly increased odds of hearing impairment in worse and better ears at all severity levels and frequencies.

Meta-analyses can often reveal effects that are obscured in individual studies, particularly for studies that have a small sample size. A systematic review used 13 eligible studies involving 20,194 participants and 7,377 individual cases. Consistent with the Bainbridge et al,[17] study above, their meta-analysis revealed that prevalence of hearing loss among those people with diabetes was more than twice that than those without diabetes. The association between hearing loss and diabetes was actually stronger among those people younger than age 60, and was independent of gender or chronic exposure to noise. In 2016, Kim et al,[5] published a prospective cohort study of over 253,000 adults with baseline normal hearing who were followed from 2002-2014. Among this large number of participants, the hazard ratio for developing hearing loss (adjusted for noise exposure, body mass index, smoking, alcohol use, and exercise) was 1.04 among those with pre-diabetes and 1.4 with diabetes. The authors posit that the vascular effects of diabetes damage the blood supply to the cochlea leading to sensorineural hearing loss. Specifically, high blood glucose levels may damage the vessels in the stria vascularis and nerves impacting the biochemistry and neural innervation of the cochlea.

Age and smoking had a multiplicative effect on the hearing impairment, which was in concordance with the findings of Noorhassim et al,[18] for each age-decade, as the frequency increased, the percentage of the ears which were able to respond, decreased. Smoking increased the risk of hearing loss and it was a contributory factor in age related hearing loss, which was also shown by other studies. A multicentre study also reported that smoking was a risk factor for age related hearing loss. Various mechanisms have been proposed by which tobacco smoke may affect the hearing. Cigarette smoking may affect the hearing through the direct ototoxic effect of nicotine on the cochlea as smokers are constantly exposed to the levels of carbon monoxide in the range of 500 to 1,500 parts per million, it has been suggested the carbon monoxide in tobacco smoke causes a rise in the carboxyhaemoglobin levels in smokers, which may in turn reduce the oxygen which is available for the organ of Corti resulting in a damage to the hair cells which are sensitive to oxygen.

One of the mechanisms through which the toxic chemicals in cigarettes may have an effect on hearing, is by causing damage to the anti-oxidative mechanisms or to the vasculature which supplies the auditory system.

Smoking reduces the blood supply due to the vasospasms which are induced by nicotine, the atherosclerotic narrowing of the blood vessels and by thrombotic occlusions. Therefore, at all the measured

frequencies, the percentage of the loss was greater for the smokers and it was the greatest at the higher frequencies.

In the present study, the Pure tone threshold of both the ears was averaged and compared to that of the normal subjects. The threshold on plotting shows a typical Right sloping curve, with the threshold of smokers higher on comparing with the patients without any co-morbidity. The statistical interactions between smoking and hearing loss and the fact that smoking was associated with an increased risk of hearing loss were reported in the studies which were done by Itoh,[19] Uchida,[20] Nakanishi, et al,[21] A meta- analysis study which was conducted in Japan also came with similar conclusions. This study had 15 observational studies, out of which the quality scores of 9 studies showed positive associations between smoking and hearing loss. In contrast to the findings of this study, no correlation was found between hearing loss and smoking in the Framingham and Baltimore studies.[22]

The debate on the effect of tobacco smoking on the sensorineural loss has been controversial. It has been shown that the hearing loss which was associated with smoking was SNHL, with the damage mainly affecting the higher frequencies. In the study by Aadesh Kumar et al,[23] a close association was found between smoking and the sensorineural hearing loss. Sharabi et al,[24] also described that any type of hearing loss i.e. conductive, sensorineural, or the mixed type had a significantly higher incidence ($p<0.0001$) in the current and the past smokers as compared to that in the non-smokers. But they also found that it was the conductive hearing loss which was more common than the sensorineural hearing loss in the current and the past smokers.

Hypothetically, smoking can cause alterations in the cochlear blood flow, thereby leading to different effects on the base and apex of the cochlea. However, such alterations are hard to investigate because of the cochlea's location. The consistent associations found for high- frequency loss suggest that at least the basal part of the cochlea is involved. The contrary seems true for the effect of alcohol consumption, as associations are only found with low-frequency loss, suggesting an influence upon the apical part of the cochlea. Dawes et al,[25] also found an inverse effect of alcohol on hearing loss suggesting alcohol has a protective function on hearing due to complex cardiovascular pathways.

Tahwinder Upile et al,[26] have shown a frequency-specific effect in which low frequencies were more severely affected than higher ones. This frequency-specific effect was confirmed by other studies; although they found an increase in thresholds at the frequencies important for speech discrimination above 1000 Hz which was nearly three times greater than that for lower frequencies. This difference is probably attributed to the fact that we examined a much younger cohort of individuals with little pre-existing hearing pathology.

In the study by Bauch CD et al,[27] acoustic reflex thresholds were measured for eighteen young adults (9 men and 9 women) at four different blood alcohol levels: 0.00%, ascending 0.10%, 0.15% (peak level), and descending 0.10%. Reflex-eliciting stimuli consisted of three narrow- band noises (300 to 600,600 to 1200, and 1200 to 2400 Hz) and three broad band noises (white noise, recorded rock music, and recorded factory noise). Pre-alcohol reflex thresholds were found to be significantly more sensitive than all post-alcohol reflex thresholds for all stimuli, and broad-band stimuli demonstrated greater threshold shifts than did narrow-band stimuli. Significant sex differences were not observed for any blood alcohol level. Popelka et al,[28] conducted a study using lower levels of alcohol over only two frequencies in five subjects with normal hearing and found a reduction in hearing ability. Specifically, acoustic reflex thresholds were raised, reflex magnitude decreased, and temporary threshold shift increased under alcohol conditions. An earlier cross-sectional study, although not specifically looking at alcohol consumption and hearing, showed a frequency-specific effect in which low frequencies were more severely affected than higher ones. This contradicts our finding that the effect of alcohol on hearing varies with degree of exposure and gender. However, the investigators did find an increase in the probability of having a hearing loss over the high frequencies in those with a history of heavy drinking.

CONCLUSION

In conclusion, hearing loss was associated with, systolic blood pressure, diabetes mellitus, dyslipidaemia, smoking, and alcohol consumption (inverse correlation). Results were different for low- and high-frequency loss, suggesting that different mechanisms are involved in the ethology of age-related hearing loss. Overall, a healthy lifestyle, e.g., without smoking or being overweight, may contribute to less hearing loss at an older age.

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