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Original research article

A study to evaluate the association between cardiovascular disease and its risk factors with hearing loss

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Abstract

Aim: The aim of the present study was assessing association between cardiovascular disease and its risk factors with hearing loss.

Methods: The present observational study consisted of 70 patients with CVDs of both genders. Prior consent was taken by all the participants before the start of the study. Data such as name, age, gender etc. were recorded. The hearing thresholds were measured in decibels hearing level (dB HL) at 0.25, 0.5, 1, 2, 3, 4, 6, and 8 kHz, along with the word recognition score (WRS). The audiologist's assessment of the type of hearing loss was also recorded.

Results: The research included 64.29% men and 35.71% women. Simple and complex linear regressions predicted HFPTA from hypertension, CVA, and CAD. Simple regression showed that only coronary artery disease predicted HFPTA, with an impact of 4.87 dB HL. Multiple regression showed no risk factor for HFPTA. LFPTA has simple and multivariate regressions. From greatest to least connection with hearing loss, simple regressions predicted coronary artery disease and CVA with effect values of 6.54- and 5.03-dB HL. Predictive risk variables were not found by multiple regression.

Conclusion: Cardiovascular risk factors and illness were linked to poorer hearing and faster hearing loss.

Keywords: Coronary artery disease, hearing loss, hypertension

Introduction

Hearing loss (HL) is a very common chronic condition. It is estimated globally, 2.5 billion people projected to be impacted by this debilitating illness by year 2050. Hearing loss (HL) may be categorized into two main types: conductive and sensorineural hearing loss (SNHL), with SNHL being more prevalent and representing the majority of all cases of HL [2]. Multiple studies have shown robust correlations between various cardiovascular risk factors, including smoking, diabetes, and a high body mass index (BMI), and the development of HL [3-5]. This has led to theories suggesting that the start of hearing loss may be caused by alterations in the small blood vessels supplying the cochlea, leading to a disturbance in blood flow and perhaps contributing to hearing loss [6-8]. Sensorineural hearing loss (SNHL) may be categorized into many subtypes, including as age-related SNHL, noise-induced hearing loss, and abrupt SNHL. We assessed the current idea that suggests a vascular mechanism as the cause of hearing loss and its potential role in the

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development of cardiovascular diseases (CVDs). Moreover, the correlation between abrupt hearing loss (HL) and cardiovascular disease (CVD) has been well investigated and confirmed. Cardiovascular diseases (CVD) [9, 10]. also impose a significant strain on global healthcare resources. Ischemic heart disease (IHD) and stroke are the two most prevalent cardiovascular diseases (CVD) and remain the primary causes of death worldwide, as well as major contributors to disability [11]. The prevalence of cardiovascular disease (CVD) is influenced by the existence of common cardiovascular risk factors such as smoking, hypertension, and hyperlipidemia [12]. Hearing loss in senior individuals is a matter of public health that is becoming more significant as the world's population continues to age [13].

Untreated hearing loss results in a reduced quality of life and has been linked to increased illness and death rates, as well as more significant cognitive decline. It is projected to impact over 50% of persons aged 75 and over in the United States, a demographic that is anticipated to double in size during the next four decades [14]. Studies on age-related hearing loss (ARHL) often categorize persons who are 70 years or older into a single group. A recent investigation on hearing impairment in the elderly, namely those aged 80 years and above, has observed significant distinctions when compared to the group of persons who are younger but still elderly [15]. The researchers not only observed that hearing loss is very common among older individuals, but they also noticed that the rate of hearing loss increases during the 10th decade of life compared to the ninth decade, across all frequencies. This represents a significant change that occurs during the progression of age-related hearing loss (ARHL) [16].

The objective of this research was to evaluate the correlation between cardiovascular disease and its risk factors and hearing loss.

Materials and Methods

The present observational study consisted of 70 patients with CVDs of both genders. Written consent was taken from all the participants in the study beforehand.

Data such as name, age, gender etc. was recorded. The hearing thresholds measured in decibels hearing level (dB HL) at 0.25, 0.5, 1, 2, 3, 4, 6, and 8 kHz, as well as the word recognition score (WRS). The audiologist's assessment of the type of hearing loss was also recorded.

The mean of the hearing thresholds at 0.5, 1, and 2 kHz was calculated and termed the low-frequency pure-tone average (LFPTA) to distinguish it from a high-frequency pure-tone average (HFPTA), similarly calculated from the thresholds at 3, 4, 6, and 8 kHz.

Patients were represented by the better threshold or pure-tone average of 2 ears. Data thus obtained were subjected to statistical analysis.

Results

Table 1: Distribution of patients

Gender	N	%
Male	45	64.29
Female	25	35.71
Total	70	100

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There was male predominance in the study where 64.29% were male and 35.71% were females.

Table 2: Linear regression models for cardiovascular disease and hearing thresholds

Comorbidity	Parameters	Simple Linear Regression	Multiple Linear Regression
Hypertension	LFPTA	2.95	-0.43
	HFPTA	0.22	-3.47
Cerebrovascular accident	LFPTA	5.03	3.95
	HFPTA	2.85	3.76
Coronary artery disease	LFPTA	6.54	2.36
	HFPTA	4.87	0.98

The simple and multiple linear regressions were calculated to predict HFPTA based on hypertension, CVA, and CAD. Coronary artery disease was the only comorbidity predictive for HFPTA on simple regression, with an effect of 4.87 dB HL. No risk factor predicted HFPTA on multiple regression. Simple and multivariate regressions were also calculated for LFPTA. Coronary artery disease and CVA were predictive on simple regressions, in order of greatest to least association with hearing loss, with respective effect sizes of 6.54- and 5.03-dB HL. Multiple regression showed no predictive risk factors.

Discussion

Smoking, diabetes, hypertension, dyslipidemia, and obesity, together known as cardiovascular disease (CVD) risk factors, contribute to around 50% of the population's risk for CVD in males in high-income nations. In women, these risk factors account for roughly 60 to 70% of the population's risk for CVD [17]. Cardiovascular disease (CVD) risk factors are linked to microvascular damage [18], which may hinder the movement of molecules (such as oxygen, ions, glucose, metabolites, or proteins) via capillary walls. Additionally, these risk factors can lead to inflammation and oxidative stress, potentially harming the structure and function of the cochlea [19].

Cardiovascular illness might potentially cause hearing loss by reducing blood flow to the stria vascularis of the cochlea, which impairs the function of the inner ear [20]. Prior research has shown that there may be a higher prevalence of hearing loss associated to cardiovascular issues at lower frequencies, namely between 250 and 2000 Hz. The distal portion of the cochlea, which is responsible for transducing low frequency sounds, has fewer capillary capillaries and is thus more susceptible to ischemia [21]. Histopathological examinations of temporal bones in both human and mouse subjects have shown that the microvasculature of the cochlea experiences physical degenerative alterations in individuals with atherosclerosis and diabetes [22]. The survey exhibited a male preponderance, with 64.29% of participants being male and 35.71% being female. Wattamwar *et al*. [23] examined how cardiovascular disease (CVD)-related risk variables are linked to auditory function in individuals over 80 years old.

The simple and complex linear regressions were computed to forecast HFPTA using hypertension, CVA, and CAD as predictors. Coronary artery disease was the only comorbidity that showed a predictive relationship with HFPTA on basic regression analysis, with an impact of 4.87 dB HL. Multiple regression analysis could not identify any risk factors that predicted HFPTA. Both simple and multivariate regressions

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were computed for LFPTA. Coronary artery disease and CVA showed significant predictive power in simple regressions when examining their connection with hearing loss. The effect sizes for coronary artery disease and CVA were 6.54 and 5.03 dB HL, respectively, with coronary artery disease having a stronger association. Multiple regression analysis could not identify any significant risk variables for prediction. Tar *et al*. [24] examined the correlation between hearing impairment and risk factors for cardiovascular disease. Out of all the participants, 54% were female, and their average age was 58 years, ranging from 45 to 69 years. Age, gender, and familial history of hearing loss were consistently robust factors in determining hearing loss outcomes. After accounting for these factors, obesity, current smoking, peripheral artery disease, and a history of cardiovascular disease were shown to have a significant association with hearing loss at pure-tone, low frequency, and high frequency levels. Furthermore, there was a strong correlation between high blood pressure, lipid levels, and glycated haemoglobin and low-frequency hearing loss. A direct correlation was seen between hearing loss and the Framingham Risk Score, which is a measure of cardiovascular risk.

Conclusion

Hearing loss and a higher rate of hearing degradation were shown to be connected with cardiovascular risk factors and illness, according to the findings of the current study.

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