ISSN: 0975-3583,0976-2833 VOL14, ISSUE 03, 2023

# ORIGINAL RESEARCH

# Assessment of association between cardiovascular disease and its risk factors with hearing loss

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**Received: 12-02-2023** **Revised: 14-03-2023** **Accepted: 18-03-2023**

**ABSTRACT:**
**Background:** Hearing loss in elderly persons is a public health concern that is of increasing importance as the global population ages. The present study was conducted to assess association between cardiovascular disease and its risk factors with hearing loss.
**Materials & Methods:** 58 patients with CVDs of both genders were selected. 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).
**Results:** Out of 58 patients, males were 38 and females were 20. 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 4.39 (95% CI, 1.23-7.55) 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 6.52 (95% CI, 2.81-9.48) and 5.02 (95% CI, 0.46-9.66) dB HL. Multiple regression showed no predictive risk factors.
**Conclusion:** Cardiovascular risk factors and disease were associated with worse hearing and a greater rate of hearing deterioration.
**Key words:** Coronary artery disease, Hearing loss, hypertension

## Introduction

Hearing loss in elderly persons is a public health concern that is of increasing importance as the global population ages.[1] Left untreated, hearing loss leads to diminished quality of life and has been associated with overall morbidity and mortality, as well as greater cognitive decline. It is estimated to affect more than half of the adults older than 75 years in the United States, a population that is expected to double over the next 40 years.[2]

Research in age-related hearing loss (ARHL) has commonly grouped together individuals older than 70 years. Recent studies of hearing loss in the older old, defined as individuals older than 80 years, noted that it differs in critical ways from the younger-old group.[3] In addition to noting the ubiquitous nature of hearing loss in the older old, the investigators observed an increase in the rate of hearing loss in patients during the 10th decade of life compared with the ninth decade at all frequencies, representing a fundamental change that occurs along the course of ARHL.[4]

It is hypothesized that reduced blood supply to the stria vascularis of the cochlea due to Cardiovascular disease can lead to impairment of inner-ear function, resulting in HL.[5] Previous studies have found that cardiovascular-related HL may be greater at lower frequencies (250-2000 Hz). The distal part of the cochlea responsible for low frequency sound transduction, has less capillary vessels, and is therefore more sensitive to ischaemia.[6] Histopathological studies on human and mice temporal bones have demonstrated that the cochlea microvasculature undergoes physical degenerative changes in the atherosclerotic patient and diabetic patient.[7] The present study was conducted to assess association between cardiovascular disease and its risk factors with hearing loss.

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**Materials & Methods**

The present consisted of 58 patients with CVDs of both genders. All gave their written consent to participate in the study.

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. P value < 0.05 was considered significant.

**Results**

**Table I Distribution of patients**

| Total- 58 | | |
|---|---|---|
| **Gender** | **Male** | **Female** |
| Number | 38 | 20 |

Table I shows that out of 58 patients, males were 38 and females were 20.

**Table II Linear regression models for cardiovascular disease and hearing thresholds**

| Comorbidity | Parameters | Simple Linear Regression | Multiple Linear Regression |
|---|---|---|---|
| Hypertension | LFPTA | 2.93 | -0.41 |
| | HFPTA | 0.24 | -3.45 |
| Cerebrovascular accident | LFPTA | 5.02 | 3.94 |
| | HFPTA | 2.84 | 3.75 |
| Coronary artery disease | LFPTA | 6.52 | 2.34 |
| | HFPTA | 4.86 | 0.99 |

Table II shows that 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 4.39 (95% CI, 1.23-7.55) 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 6.52 (95% CI, 2.81-9.48) and 5.02 (95% CI, 0.46-9.66) dB HL. Multiple regression showed no predictive risk factors.

**Discussion**

CVDs are the number one cause of death globally. An estimated 17.9 million people died from CVDs in 2012, representing 34% of all global deaths under 70 years of age.[8,9] Early intervention and treatment of these disorders and their risk factors have led to a drop in the incidence, but further work thereon is needed. Simple, repeatable, and sensitive screening for CVDs and risk factors that lead to these diseases could improve detection and lead to early intervention before significant organ damage begins.[10,11] Hypertensive organ damage defined by current guidelines can develop in the heart, arteries, brain, kidneys, or eyes. Hearing impairment, or any form of damage to the auditory system, has not been recognized as evidence of organ damage due to vascular disease.[12,13] The present study was conducted to assess association between cardiovascular disease and its risk factors with hearing loss.

We found that out of 58 patients, males were 38 and females were 20. Wattamwar et al[14] investigated the association of cardiovascular disease (CVD)-related risk factors with auditory function among the older old (>80 years). Among the 433 patients (67% female; mean [SD] age, 89 [5.8] years), the presence of at least 1 cardiovascular morbidity was associated with elevated mean (SD) low-

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 03, 2023

frequency pure-tone average (LFPTA) of 42.4 (1.6) vs 36.9 (3.5) decibels hearing loss (dB HL), a difference of 5.47 (95% CI, 4.15-9.49) dB HL. Among the 96 patients with 2 audiograms performed at age 80 years or older from which the rate of hearing loss could be calculated, 32 patients had CVD or related risk factors and 64 were healthy controls. Those with at least 1 disease had accelerated hearing loss. Patients with cardiovascular morbidity experienced decline in LFPTA of 1.90 (0.27) vs 1.18 (0.42) dB HL/y, a difference of 0.72 (95% CI, 0.08-1.36) dB HL/y. Of the conditions studied, coronary artery disease had the highest association with audiometric thresholds and was associated with hearing loss at all frequencies tested and with poor word recognition score. Hearing loss was more strongly associated with CVD risk factors in men than in women.

We found that simple and multiple linear regressions were calculated to predict HFPTA based on hypertension, Cerebrovascular accident (CVA), and Coronary Artery Disease (CAD). Coronary artery disease was the only comorbidity predictive for HFPTA on simple regression, with an effect of 4.39 (95% CI, 1.23-7.55) 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 6.52 (95% CI, 2.81-9.48) and 5.02 (95% CI, 0.46-9.66) dB HL. Multiple regression showed no predictive risk factors.

Tar et al[15] investigated the relationship between hearing loss and cardiovascular disease risk factors. Of the participants, 54% were female, with the mean age of 58 years (range 45 to 69 years). Age, sex and family history of hearing loss were consistently strong determinants of hearing loss outcomes. After adjusting for these, obesity, current smoking, peripheral arterial disease and history of cardiovascular disease were significantly associated with pure-tone, low frequency and high-frequency hearing loss. In addition, high blood pressure, triglyceride and glycated haemoglobin were significantly associated with low-frequency hearing loss. There was a graded association between hearing loss and Framingham Risk Score for cardiovascular risk.

The limitation the study is small sample size.

**Conclusion**

Authors found that cardiovascular risk factors and disease were associated with worse hearing and a greater rate of hearing deterioration.

**References**

1. Rosen S, Olin P. Hearing loss and coronary heart disease. Arch Otolaryngol 1965;82:236-43.
2. Simpson AN, Matthews LJ, Dubno JR. Lipid and C-reactive protein levels as risk factors for hearing loss in older adults. Otolaryngol Head Neck Surg 2013;148:664-70.
3. Gopinath B, Flood VM, Teber E, McMahon CM, Mitchell P. Dietary intake of cholesterol is positively associated and use of cholesterol-lowering medication is negatively associated with prevalent age-related hearing loss. J Nutr 2011;141:1355-61.
4. Ašanin M, Beleslin B, Dobrić M, Dikić AĐ, Kovačević V, Nedeljković M, et al. The National Guide to Good Clinical Practice For Diagnosis and Treatment Of Ischemic Heart Disease. Ministry of Health of the Republic of Serbia, Belgrade; 2012.
5. Nondahl DM, Cruickshanks KJ, Wiley TL, Klein R, Klein BE, Tweed TS. Prevalence and 5-year incidence of tinnitus among older adults: The epidemiology of hearing loss study. J Am Acad Audiol 2002;13:323-31.
6. Jerger J, Chmiel R, Wilson N, Luchi R. Hearing impairment in older adults: New concepts. J Am Geriatr Soc 1995;43:928-35.
7. Spiess AC, Lang H, Schulte BA, Spicer SS, Schmiedt RA. Effects of gap junction uncoupling in the gerbil cochlea. Laryngoscope 2002;112:1635-41.
8. Morizane I, Hakuba N, Shimizu Y, Shinomori Y, Fujita K, Yoshida T, et al. Transient cochlear ischemia and its effects on the stria vascularis. Neuroreport 2005;16:799-802.
9. Cullen JR, Cinnamond MJ. Hearing loss in diabetics. J Laryngol Otol 1993;107:179-82.
10. Axelsson A, Sigorth K, Vertes D. Hearing in diabetics. Acta Otolaryngol 1978;356:3-21.
11. Jordao AM. Consideration on a case of diabetes. Un Med Paris 1857;11:446.
12. Edgar TO. Clinical studies of auditory organ diseases in diabetes mellitus. Mschr Ohrenheilk 1915;49:215-60.

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13. Harner SG. Hearing in adult-onset diabetes mellitus. Otolaryngol Head Neck Surg 1981;89:322-7.
14. Wattamwar K, Qian ZJ, Otter J, Leskowitz MJ, Caruana FF, Siedlecki B, Spitzer JB, Lalwani AK. Association of cardiovascular comorbidities with hearing loss in the older old. JAMA Otolaryngology–Head & Neck Surgery. 2018 Jul 1;144(7):623-9.
15. Tan HE, Lan NS, Knuiman MW, Divitini ML, Swanepoel DW, Hunter M, Brennan- Jones CG, Hung J, Eikelboom RH, Santa Maria PL. Associations between cardiovascular disease and its risk factors with hearing loss—A cross- sectional analysis. Clinical Otolaryngology. 2018 Feb;43(1):172-81.