



Otorhinolaryngology

ASSOCIATION BETWEEN ESSENTIAL HYPERTENSION AND HEARING IMPAIRMENT: A COMPARATIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Methods: A comparative cross-sectional study was conducted in the Departments of Otorhinolaryngology and General Medicine at Bharat Ratna Late Shri Atal Bihari Vajpayee Memorial Medical College and Hospital, Rajnandgaon, during June 2024–June 2025. A total of 104 participants were included: 52 patients with essential hypertension and 52 matched non-hypertensive controls. Participants underwent ENT examination, tuning-fork assessment and pure-tone audiometry. Pure-tone average (PTA) was calculated at 500, 1000 and 2000 Hz. Hearing impairment was graded according to the study's WHO-based classification. Chi-square testing was used for categorical comparisons and Pearson correlation for continuous variables. **Results:** Hearing loss was identified in 44/52 (84.6%) hypertensive participants compared with 2/52 (3.8%) controls. The difference was highly statistically significant (Chi-square $p < 0.00001$), with a prevalence ratio of approximately 22.3. Bilateral high-frequency involvement, particularly around 4 kHz, was the predominant pattern reported in the hypertensive group. Among hypertensive participants, hearing-loss prevalence increased from 66.7% in those aged 20–40 years to 80.0% in those aged 41–60 years and 92.9% in those aged 61–80 years. Age showed a strong positive correlation with PTA severity in hypertensive participants ($r = 0.75$). **Conclusion:** The study demonstrates a strong association between essential hypertension and hearing impairment, with a marked burden of bilateral high-frequency hearing loss. Routine auditory assessment may be useful in hypertensive patients, particularly in older individuals, to facilitate early identification and rehabilitation.

KEYWORDS : essential hypertension; hearing impairment; sensorineural hearing loss; pure-tone audiometry; cochlea; vascular pathology

INTRODUCTION

Hearing is essential for communication, social interaction and quality of life. Hearing impairment may lead to social isolation and psychosocial consequences. The supplied study protocol notes that hearing thresholds of 20 dB or more are considered hearing loss according to the cited WHO definition and highlights the public-health importance of early detection. Essential hypertension, the commonest form of hypertension, is characterized by elevated blood pressure without an identifiable secondary cause.

The cochlea has a highly specialized vascular supply and is particularly sensitive to alterations in blood flow, oxygen delivery and cellular ionic homeostasis. The study rationale proposes that hypertension may impair cochlear function through vascular and hemodynamic mechanisms, including altered microcirculation, increased blood viscosity, reduced oxygen delivery and ionic disturbances. Previous studies cited in the thesis have reported associations between hypertension and high-frequency hearing loss. However, the supplied protocol emphasizes the need for local data and periodic hearing screening in hypertensive patients.

The aim of this study was to assess hearing thresholds among patients diagnosed with essential hypertension attending the study centre in Rajnandgaon. The objectives were to estimate the proportion, type and degree of hearing impairment, compare hypertensive participants with non-hypertensive controls, and assess the relationship between hypertension-related clinical variables and hearing impairment.

MATERIALS AND METHODS**Study design and participants**

This comparative cross-sectional study was conducted in the Departments of Otorhinolaryngology and General Medicine, Bharat Ratna Late Shri Atal Bihari Vajpayee Memorial Medical College and Hospital, Rajnandgaon, Chhattisgarh, from June 2024 to June 2025. The planned sample consisted of 104 participants, with 52 cases of physician-diagnosed essential hypertension and 52 age- and sex-matched non-hypertensive controls.

Hypertensive participants were adults diagnosed according to AHA/ACC criteria and attending the ENT or Medicine outpatient departments. Controls were adults with blood pressure below 130/80 mmHg. Participants with congenital hearing loss, family history of congenital deafness, active or chronic middle-ear disease, previous ear

surgery, prolonged loud-noise exposure, prolonged ototoxic-drug exposure, diabetes mellitus, chronic kidney disease, hyperlipidemia, stroke or other conditions considered capable of causing hearing impairment were excluded.

Audiological assessment

All participants underwent complete ENT examination, including otoscopy and tuning-fork tests, followed by pure-tone audiometry in an acoustically treated soundproof room using a Grason-Stadler GSI AudioStar Pro audiometer. Air-conduction thresholds were assessed at 250–8000 Hz and bone-conduction thresholds at 250–4000 Hz. PTA was calculated from 500, 1000 and 2000 Hz for each ear. Hearing was classified as normal (0–25 dB HL), mild (26–40), moderate (41–55), moderately severe (56–70), severe (71–90) and profound (>90 dB HL).

Statistical analysis

Data were recorded in a structured format and summarized using frequencies and percentages. Chi-square testing was used to assess categorical associations and Pearson correlation was used to examine relationships between continuous variables. The supplied thesis reports the difference in hearing-loss prevalence between groups as highly statistically significant.

RESULTS

Of the 104 participants, 52 had essential hypertension and 52 were non-hypertensive controls. Hearing impairment was present in 44 of 52 hypertensive participants (84.6%), compared with 2 of 52 controls (3.8%). Thus, the prevalence of hearing loss was approximately 22.3 times higher in the hypertensive group. The between-group difference was highly statistically significant (Chi-square $p < 0.00001$).

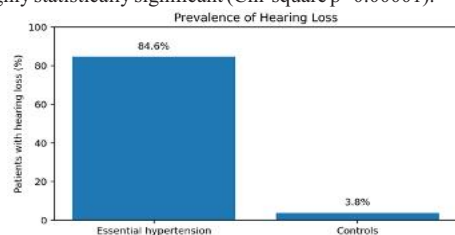


Figure 1. Prevalence of hearing loss in hypertensive and control groups.

The predominant auditory pattern reported in the hypertensive group was bilateral high-frequency involvement, with 4-kHz abnormalities frequently observed. The two controls with hearing loss had mild impairment involving frequencies at or below 1 kHz. The findings therefore showed a marked difference not only in prevalence but also in the pattern of auditory involvement.

Age-related analysis among hypertensive participants demonstrated a progressive increase in hearing-loss prevalence. In the 20–40-year group, 4 of 6 participants (66.7%) had hearing loss; in the 41–60-year group, 12 of 15 (80.0%) were affected; and in the 61–80-year group, 26 of 28 (92.9%) had hearing loss.

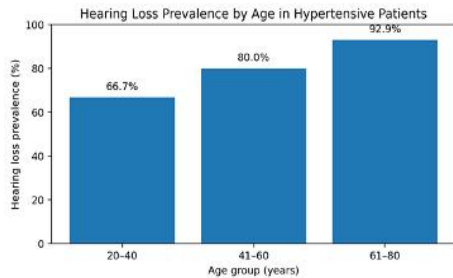


Figure 2. Age-wise prevalence of hearing loss among hypertensive participants.

The supplied thesis reports a strong positive correlation between age and PTA severity among hypertensive participants (Pearson $r \approx 0.75$). Mean PTA was approximately 28 dB HL in the 20–40-year group, 42 dB HL in the 41–60-year group and 58 dB HL in the 61–80-year group. These findings indicate increasing hearing-threshold elevation with advancing age among participants with hypertension.

DISCUSSION

The present study demonstrates a substantial association between essential hypertension and hearing impairment. Nearly five out of six hypertensive participants had hearing loss compared with fewer than one in twenty controls. The magnitude of the observed difference is consistent with the vascular hypothesis proposed in the study protocol. The cochlea depends on an uninterrupted microvascular supply, and chronic vascular dysfunction may reduce oxygen and nutrient delivery, alter blood rheology and disturb cochlear ionic homeostasis.

The predominance of bilateral high-frequency abnormalities is clinically relevant. The basal turn of the cochlea is responsible for high-frequency hearing and may be vulnerable to vascular and metabolic disturbances. The presence of high-frequency abnormalities even among younger hypertensive participants suggests that auditory changes may precede more obvious speech-frequency difficulties. This supports the concept of incorporating hearing assessment into long-term hypertension care.

The age-wise increase in hearing-loss prevalence is also important. Although age itself is a major determinant of hearing loss, the study found a very high burden across all hypertensive age groups, with prevalence approaching 93% in participants aged 61–80 years. The reported correlation between age and PTA severity ($r \approx 0.75$) indicates that increasing age was associated with worsening auditory thresholds in hypertensive participants. Because the study is cross-sectional and the hypertensive group was older on average, the findings should be interpreted as an association rather than proof of an independent causal effect.

The results are broadly consistent with studies cited in the supplied thesis, including work by Rosen et al., Marchiori et al., Agarwal et al., Mishra et al. and others, which reported relationships between systemic hypertension and auditory threshold elevation. At the same time, individual susceptibility and other vascular or metabolic factors may influence hearing, and the study therefore supports continued prospective research with larger samples and adjustment for age and other confounders.

LIMITATIONS

- The cross-sectional design demonstrates association but cannot establish causality or temporal progression.
- Age is an important potential confounder because hearing loss and hypertension both increase with age.

- The supplied thesis does not provide a numerical result for the planned correlation between duration of hypertension and hearing impairment; therefore, a specific duration–PTA effect size is not reported here.
- The study was conducted at a single institution, which may limit generalizability.

CONCLUSION

Essential hypertension was strongly associated with hearing impairment in this study. Hearing loss was present in 84.6% of hypertensive participants compared with 3.8% of controls, with a highly significant between-group difference. Bilateral high-frequency involvement was the predominant pattern, and hearing-loss prevalence increased progressively with age. These findings support awareness of auditory complications in patients with hypertension and suggest that periodic hearing evaluation, particularly in older hypertensive patients, may allow earlier detection and rehabilitation.

Clinical Implications

- Consider baseline and periodic pure-tone audiometry in patients with long-standing or clinically significant hypertension.
- Pay particular attention to high-frequency thresholds, which may show abnormalities before speech-frequency impairment becomes apparent.
- Coordinate care between physicians and otorhinolaryngologists for blood-pressure control, auditory monitoring and rehabilitation when required.

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