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Association between grade of hypertension and sensorineural hearing loss: A cohort study at a tertiary care hospital

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Abstract - Introduction: Hypertension i.e blood pressure that is higher than normal causes hearing loss by various mechanisms of which, increase in the viscosity of blood causing hypoxia which inevitably results in target organ damage over a period of time which results in hearing loss is widely accepted. Aim: To assess the relationship between grades of hypertension and sensorineural hearing loss. Material and methods: This was a cohort study conducted at a tertiary care hospital over a period of 4 months from November 2022 to February 2023 at the department of ENT and the outpatient department of general medicine. A total of 104 patients aged between 45 to 65 who werecurrently on treatment were included in the study. Blood pressure was measured using a standard mercury sphygmomanometer with an adult cuff size, 6 hours apart, on two different occasions in sitting position. Hearing threshold was assessed using a pure tone audiometry in both the ears. Results: Based on the type of sensory neural hearing loss, patients were separated into five groups out of which patients with mild degree of sensorineural hearing was 12% patients, that with moderate degree was 24% patients, that with moderately severe sensorineural hearing loss was 12% patients, that with severe sensorineural hearing loss was 16% patients and profound sensorineural hearing loss was 6% patients. Conclusion: This study helped to assess the association between grades of hypertension and sensory neural hearing loss in hypertensives patients. Microcirculatory insufficiency might be the cause for it.
Keywords: Hearing loss, Hearing threshold, Hypertension, Sensorineural hearing loss,Pure tone audiometry, severity.

Introduction

Hearing loss with advancing age is inevitable in individuals who also have comorbidities like diabetes mellitus, hypertension and other diseases beyond 30 years of age. A load of hypertensive cases have been increasing in the country with epidemiological transition playing a major role. Hearing impairment may cause psychosocial effects, like low vanity, isolation, depression and irritability, which might interfere with the quality of life results in reduced oxygen transport thus causing tissue hypoxia which results in hearing complaints and hearing loss in patients.[2] Several other mechanisms for hearing loss due to hypertension have been hypothesized, ionic changes in the cochlear fluid[4], inhibition of depolarization by inhibition of potassium pumps in striae vascularis5, haemorrhage within the cochlea.[5] Factors like intense noise exposure or continuous noise exposure, inhalation of toxic substances, ingestion of ototoxic drugs, metabolic and circulatory alterations, infections, different types of injuries and genetic inheritance could also preventable through the interference of exposure to risk factors, and prompt treatment of disease conditions that affect the hearing threshold of people.[3]

Materials and methods

Study design:

The research was carried out as a cohort study after the project was approved by the review board. Ethical approval was taken from the Institutional ethical committee. Informed consent was obtained from the patients before participating in the study. The study was conducted over a period of 4 months from November 2022 to February 2023 at the department of ENT and the outpatient department of general medicine at a tertiary care hospital. The study sample consisted of randomly selected hypertensive patients aged between 45 to 65 years who were currently on treatment.

Hypertensive subjects:

210 patients who were diagnosed with hypertension and were receiving treatment from our tertiary care hospital were selected randomly. Out of which 160 patients satisfying the age criteria of 45 to 65 years were left behind and the rest were excluded from the study. Those patients who had pre-existing hearing impairment thus wearing hearing aids,

air-bone gap of >10 db and neurological disorders were excluded from the study. Furthermore, the patients who worked or had worked in an environment with the risk of developing noise-induced hearing loss, with vascular diseases like stroke, with kidney diseases, with metabolic diseases like diabetes, with a previous history of hearing impairment as seen in rubella and head injuries, with history of ingestion of ototoxic drugs, with history of previous ear surgeries, on current medications that can interfere with hearing, with history of cigarette smoking were all excluded from the study.

This left behind a total of 120 patients of which 16 failed to follow up leaving 104 patients to be included in the study.

Blood pressure measurement:

Questionnaires were given to the patients to obtain their biodata and medical history which included their name, age, gender, weight, height, duration of hypertension, treatment history, presence of tingling, tinnitus, vertigo, numbness and other features of hypertension. It was made sure that those questions were well explained by the interviewer if the patient had any doubts filling it. Anthropometric measurements of the patients were taken. Blood pressure was measured on each arm 5 minutes apart in sitting position with back rested on the chair, feet rested on the ground and the arms rested on the table using a standard mercury sphygmomanometer (Accoson, Accoson North Ayrshire, UK) with an adult cuff size. Korotkoff sounds phase I was taken as systolic and phase V was taken as diastolic blood pressure and recorded in mmHg respectively. The average of both the readings was taken and recorded as the person's blood pressure which was later used in the study. Participants with blood pressure more than 140/90 mmHg and who were on medications identified as antihypertensive were considered to have high blood pressure.

Pure tone audiometry:

both the ears of the participants were examined with an otoscope for wax that was removed after softening. Hearing thresholds were then measured in both ears using the for air conduction and 500, 1000, 2000, and 4000 Hz for bone conduction using Diagnostic Audiometer (Oscilla SM 960-D, Diagnostic Memory Audiometer, Otometrics, Taastrup, Denmark) in a sound isolated room that satisfied the criteria of ISO 8253-1.

The average of audiometric hearing thresholds at 500, 1000, 2000, and 4000 Hz for both air and bone conduction was determined and was taken as the pure tone average for both bone and air conduction to categorize sensorineural hearing loss in accordance to the WHO grades of hearing impairment as follows: normal hearing loss (<25 dB), mild hearing loss (26–40 dB), moderate hearing loss (41–60 dB), severe hearing loss (61–80 dB), and profound hearing loss (≥81 dB)8. For further analysis, the better ear was used.

Result

A total number of 104 patients were studied. They were divided into four groups, group 1 had 42 participants out of 104 in the age group 45-50, group 2 had 24 participants out of 104 in the age group 51-55 years, group 3 had 12 participants out of 104 in the age group 56-60 years, group 4 had 26 participants out of 104 in the age group 61-65 years. The participants were again subdivided into two subgroups based on their gender. There were 50 males out of 104 and 54 females out of 104. According to their arterial blood pressure, participants were graded into three grades according to the British Hypertension Society, grade 1 includes 29, grade 2 includes 52 and grade 3 involves 23.

Table 1: Grades of Hypertension

grade of HTN	total	percentage
grade 1	29	27.88%
grade 2	52	50.00%
grade 3	23	22.12%
total	104	100%

Participants were again divided into subgroups based on the duration of sensory neural hearing loss post hypertension, group A includes 20 participants, group B includes 25 participants and group C includes 25 participants. These patients were again separated into 5 subgroups based on the degree of sensorineural hearing loss,12 had mild sensorineural hearing loss, 24 had moderate sensorineural hearing loss, 12 had moderately severe sensorineural hearing loss, 16 had severe sensorineural hearing loss and 6 had profound sensorineural hearing loss.

Table 2: Types of sensory neural hearing loss

type of SNHL	total	percentage
mild	12	17.14%
moderate	24	34.29%
moderately severe	12	17.14%

severe	16	22.56%
profound	6	8.57%
total	70	100%

SNHL- sensorineural hearing loss

Table 3: Association of the grade of hypertension with the type of sensory neural hearing loss

	Types of sensorineural hearing loss								
			mild	moderate	moderatelysevere	severe	profound	normal	total
Grades of hypertension		count	7	4	0	9	0	9	29
	Grade 1 HT	% within-grade of HTN	24.14%	13.79%	0	31.03%	0	31.03 %	100 %
		count	3	15	12	5	3	14	52
	Grade 2 HT	% within-grade of HTN	5.77%	28.85%	23.08%	9.62%	5.77%	26.92 %	100 %
		count	2	5	0	2	3	11	23
	Grade 3 HT	% within-grade of HTN	8.70%	21.74%	0	8.70%	13.04%	47.83 %	100 %
		total count	12	24	12	16	6	34	104
		total % ofHTN	11.54%	23.08%	11.54%	15.38%	5.77%	32.69 %	100 %

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.86	10	0.000
Likelihood Ratio	33.23	10	0.000
no of Valid Cases	104		

Discussion

This study shows a positive correlation between hearing loss and hypertension with a p value of 0.000. Various other studies have also been done that show the same results though some results were contradictory. Hearing loss is multifactorial with hypertension being one of them.

As to the methodological characteristics of this study, the cases are taken in outline with the age factor, focusing mainly on middle-aged individuals, between 45 and 65 years, all being hypertensive patients. As to gender, there was a difference in men to women ratio due to the fact that we did not pair the sample, cases were taken at random, during regular medical visits. it was found that hypertension had caused hearing loss in workers exposed to noise. Some studies justify the sensory neural hearing caused by hypertension is due to syndrome of hyper viscosity or microangiopathy that causes microcirculatory insufficiency as a result of vascular occlusion caused by emboli, hemorrhage or vasospasm. which shows the significant association between grades of hypertension and sensorineural hearing loss. In our study, 13 out of 104 hypertensive participants with sensorineural hearing loss had tinnitus (12.5%), 17 out of 104 hypertensive participants with sensorineural hearing loss had vertigo (16.35%). Also, participants with hypertension were at a greater risk of developing sensory neural hearing loss with a p value of 0.001 and the grade of hypertension also had contributed to the severity of hearing loss with a p value of 0.00 thus it is statistically significant.

Conclusion

This study confirms the association of hypertension and sensorineural hearing loss that's demonstrated by the increasing hearing threshold in all frequencies by Pure Tone

Audiometry in hypertensive patients. Among the degrees of sensorineural hearing loss, moderate sensorineural hearing loss was most marked and hearing thresholds were most marked among those with grade 3.

Reference

1) Korivipati NK. Association between grade of hypertension and sensorineural hearingloss. MedPulse - International Journal of ENT. 2020;15(1):01–4.

2) Ohinata Y, Makimoto K, Kawakami M, Takahashi H. Blood viscosity and plasma viscosity in patients sudden deafness. Acta Otolaryngol 1994;(Stockh) Suppl 114(6):601-7.

3) Yikawe, S.S., Uguru, S.U., Solomon, J.H. *et al.* Hearing loss among hypertensive patients. *Egypt J Otolaryngol* 35, 307–312 (2019). https://doi.org/10.4103/ejo.ejo_16_19

4) 0 Zdebik AA, Wangemann P, Jentsch TJ. Potassium ion movement in the inner ear: insights from genetic disease and mouse models. Physiology 2009; 24:307–316.

5) Przewozny T, Gójska-Grymajło A, Kwarciany M, Gąsecki D, Narkiewicz K. Hypertension and cochlear hearing loss. Blood pressure 2015; 24:199–205

6) Agarwal, Saurabh et al. "Effects of hypertension on hearing." Indian journal of otolaryngology and head and neck surgery : official publication of the Association ofOtolaryngologists of India vol. 65,Suppl 3 (2013): 614-8. doi:10.1007/s12070-013-0630-1

7) Arlinger S. Psychoacoustic audiometry. In: Gleeson M, Browning GG, Burton MJ, Clarke R, Hibbert J, Jones NS, et al. editors. Scott − Brown's otolaryngology, head andneck surgery, 7th ed. London: Hodder Arnold 2008. pp. 3260–3275

8) World Health Organization. Prevention of blindness and deafness: grades of hearing impairment. Geneva: World Health Organization 2014

9) 8 Narlawar UW, Surjuse BG, Thakre SS. Hypertension and hearing impairment inworkers of iron and steel industry. Indian J Physiol Pharmacol 2006; 50:60–66.