

Association between grade of hypertension and sensorineural hearing loss

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Abstract

Background: Hearing loss is the most frequent sensory deficit in the human population. The prevalence of hypertension in developing countries is increasing rapidly. Hypertension causes increased blood viscosity, which reduce capillary blood flow and causes tissue hypoxia, thus causing hearing loss in patients. **Aim:** To evaluate the association between grade of hypertension and sensorineural hearing loss. **Material and Methods:** A total of 102 hypertensive patients, aged 45 to 65 years on treatment presenting with sensorineural hearing loss. Blood pressure was measured on two occasions, 6 hours apart, in the sitting position using a standard mercury sphygmomanometer with an adult cuff size. Hearing thresholds were then measured in both ears using pure tone audiometry. **Results:** Patients were divided into five subgroups based on type of sensorineural hearing loss. Percentage of patients with mild degree of sensorineural hearing loss was 15, that with moderate degree was 22, that with moderately severe was 12, with severe was 15 and that with profound was 6. The grade of hypertension also showed a significant influence on sensorineural hearing loss. **Conclusion:** This cohort study confirms that there is a possible association between hypertension and sensorineural hearing loss as demonstrated by higher prevalence and raised hearing threshold levels by pure tone audiometry in all frequencies in hypertensive patients.

Key Words: Hypertension, sensorineural hearing loss, pure tone audiometry, severity.

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Received Date: 08/10/2019 Revised Date: 20/11/2019 Accepted Date: 11/12/2019

DOI: <https://doi.org/10.26611/10161511>

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Quick Response Code:



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Accessed Date:
02 July 2020

INTRODUCTION

Hearing loss is any degree of impairment of the ability to comprehend sound. It is partial or total inability to hear sound in either one or both ears. Hearing loss is the most frequent sensory deficit in the human population with WHO,¹ estimating 360 million people in the world to have disabling hearing loss of which 328 million (91%) are adults. The hearing loss (HL) is a factor that

irrespective of the degree of commitment affects the quality of life and when acquired in adults, it appears gradually and may make the oral language receiving difficulty. Fifty percent of the causes are avoidable by prevention or early diagnosis and treatment. Hypertension is one of the causative factors. The prevalence of hypertension in developing countries is increasing rapidly despite it being a preventable disease in a significant number of cases.² High pressure in the vascular system may cause inner ear hemorrhage, which is supplied by the anterior inferior cerebellar artery, which supports the inner ear artery and is divided into cochlear artery and anterior vestibular artery, which may cause progressive or sudden hearing loss.³ This circulatory system pathology may directly affect hearing in a number of ways. One of the vascular physiopathological mechanisms described is the increase in blood viscosity, which reduce capillary blood flow and ends up reducing oxygen transport, causing tissue hypoxia, thus causing hearing complaints and hearing loss in patients. Moreover, arterial

hypertension may cause ionic changes in cell potentials, thus causing hearing loss. The present case control study was conducted to evaluate the association between grade of hypertension and sensorineural hearing loss.

MATERIAL AND METHODS

This case control study was conducted over a period of two years in the Department of ENT and outpatient department of General medicine at a tertiary care research center. The study sample comprised of randomly selected hypertensive patients, aged 45 to 65 years on treatment at medicine OPD presenting with sensorineural hearing loss (SNHL).

Sample Size

A total of 102 patients who satisfied the selection criteria and consented were included in the study.

Inclusion criteria

- Both sexes
- Diagnosed cases of Hypertension as approved under revised diagnostic criteria of HTN guidelines. (British antihypertensive society)
- Patients on treatment of HTN but were still having fluctuating blood pressure

Exclusion criteria

- Non hypertensive patients
- Age <45 years and >65 years
- Family history of deafness
- History of ear problems (discharge)
- History of head injury or meningitis

Methodology

A detailed information about the auditory and vestibular disorders symptomatology, presence of tinnitus, as well as exposure to hearing harmful agents, such as occupational or leisure noise, ototoxic drugs and general health conditions was noted. Blood pressure was measured on two occasions, 6 hours apart, in the sitting position using a standard mercury sphygmomanometer with an adult cuff size. Patients with arterial blood pressure $\geq 140/90$ mm of Hg in different measures, were considered positive for high blood pressure. Both ears of the participants were examined. Any obstructing wax observed during otoscopy was removed, after softening in outpatient department. Hearing thresholds were then measured in both ears using the Modified Hughson–Westlake method⁴ at 250, 500, 1000, 2000, 4000, 6000, and 8000 Hz for air conduction and 500, 1000, 2000, and

4000 Hz for bone conduction using a Diagnostic Audiometer in a sound isolated room, which satisfied the criteria of ISO 8253-1. Average of audiometric hearing thresholds at 500, 1000, 2000, and 4000 Hz for both air and bone conduction was determined, which was taken to be the pure tone average for both air and bone conduction. This was categorized in accordance to the WHO grades of hearing impairment as follows: normal hearing (<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).⁵ The hearing thresholds for the better ear was used for further analysis in both patient and control groups.

Ethical approval taken from Institutional ethical committee.

RESULTS

Total number of patients studied were 102 with age ranging from 45-65 years. They were divided into 4 groups. In group 1 (45-50 years) total patients were 41 out of 102, in group 2 (51-55 years) total patients were 23 out of 102, in group 3 (56-60 years) total patients were 12 out of 102, finally in group 4 (61-65 years) total patients were 26 out of 102. Again patients were divided according to their gender into two sub-groups. Males were 49 out of 102 and females were 53 out of 102. Patients were graded into three grades according to British Hypertension society, grade 1 includes 26, grade 2 includes 52 and grade 3 includes 24.

Table 1: Grades of Hypertension

Grade of HTN	Total	Percentage
Grade 1	26	25.49%
Grade 2	52	50.98%
Grade 3	24	23.52%
Total	102	100%

Patients are divided into three groups based on duration of sensorineural hearing loss post hypertension subgroup A includes 13 cases, subgroup B includes 34 cases, subgroup C includes 23%. Patients are divided into five subgroups based on type of sensorineural hearing loss. Percentage of patients with mild degree of sensorineural hearing loss was 15, that with moderate degree was 22, that with moderately severe was 12, with severe was 15 and that with profound was 6.

Table 2: Type of sensorineural hearing loss

Type of SNHL	Total	Percentage
Mild	15	21.42%
Moderate	22	31.42%
Moderately severe	12	17.14%
Severe	15	21.42%
Profound	6	8.57%
Total	70	100%

Table 3: Association of grade of hypertension with type of SN hearing loss

			Type of SN hearing loss						Total
			Mild	Mod	Mod-sev	Norm	Prof	Sev	
Grade of HTN	Mild	Count	11	3	0	4	0	8	26
		% within Grade of HTN	42.3%	11.5%	0.0%	15.4%	0.0%	30.8%	100%
	Moderate	Count	3	13	12	17	2	5	52
		% within Grade of HTN	5.8%	25.0%	23.1%	32.7%	3.8%	9.6%	100%
	Severe	Count	1	6	0	11	4	2	24
		% within Grade of HTN	4.2%	25.0%	0.0%	45.8%	16.7%	8.3%	100%
Total	Count	15	22	12	32	6	15	102	
	% within Grade of HTN	14.7%	21.6%	11.8%	31.4%	5.9%	14.7%	100.0%	

SN=sensorineural; Mod= Moderate; Sev= severe; Norm=Normal; Prof=profound

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	47.802 [#]	10	0.000
Likelihood Ratio	49.102	10	0.000
N of Valid Cases	102		

9 cells (50%) have expected count less than 5. The minimum expected count is 1.41.

The grade of hypertension showed a significant influence on sensorineural hearing loss (P-value=0.000).

DISCUSSION

Hearing loss which has multifactorial causation is currently a public health concern. Several studies in developed countries have been conducted to find out whether hypertension is one of the risk factors for hearing loss. The results have been contradictory with some showing positive correlation⁶⁻⁸ while others have shown no relation between hearing loss and hypertension^{9,10} with that in mind this study was conducted to ascertain whether hypertension is a risk factor for hearing loss in our setup where such data is not available. As to the methodological characteristics of this study, the case is taken in outline with the age factor, focusing on the age range of middle aged individuals, between 45 and 65 years, all being hypertensive patients. The strict exclusion criteria, eliminating individuals without hypertension and other specific conditions capable of producing hearing alterations. With aging, there is a higher number of chronic diseases. In this study we observed that although the sample individuals were between 45 and 65 years, higher age range proved not to be associated with hearing loss. Some studies justify that sensorineural hearing loss that happens with aging is related to microcirculatory insufficiency that occurs due to vascular occlusion caused by emboli, hemorrhage or vasospasm and these happen because of a syndrome of hyperviscosity or microangiopathy caused by diabetes or hypertension and the latter could, through histopathological mechanisms cause sensorineural hearing loss. 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. Many studies have shown relation between gender and hearing loss in relation to

age.⁶ In present study carried out in individuals with ages varying between 45 and 65 years, gender proved insignificantly associated with hearing loss. However, the studies by Chen *et al*¹¹ with 100% and Agarwal *et al*⁷ with 65.8% had higher numbers for male subjects. This may account for some differences in the results as males are more predisposed to hearing loss as shown by Pearson *et al*.¹² Eleven out of one hundred and two hypertensive patients with hearing loss (10.78%) had tinnitus, while seventeen out of one hundred and two hypertensive patients with hearing loss (17%) had vertigo. Hypertension as a risk factor for tinnitus has been demonstrated in other studies. Hypertension has been associated with hearing loss⁶⁻⁸ which is thought to occur due to microcirculatory insufficiency. In our study patients with hypertension were at higher risk of hearing loss and this is statistically significant at a P-value of 0.01. Our findings are similar to other studies⁶⁻⁸ which have shown a link between high blood pressure and sensorineural hearing loss. The grade of hypertension also showed a significant influence on sensorineural hearing loss (P-value=0.000).

CONCLUSION

This cohort study confirms that there is a possible association between hypertension and sensorineural hearing loss as demonstrated by higher prevalence and raised hearing threshold levels by PTA in all frequencies in hypertensive patients. The increase in hearing thresholds was most marked among those with grade 3 hypertension and among hypertensive patients, moderate degree of sensorineural hearing loss was most marked as per our study.

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Source of Support: None Declared
Conflict of Interest: None Declared

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