International Journal of Otorhinolaryngology and Head and Neck Surgery
Mohan A et al. Int J Otorhinolaryngol Head Neck Surg. 2022 Jun;8(6):517-521
http://www.ijorl.com
pISSN 2454-5929 | eISSN 2454-5937

DOI: https://dx.doi.org/10.18203/issn.2454-5929.ijohns20221391

Original Research Article

Prevalence and risk factors of sensorineural hearing loss in patients with systemic hypertension

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Received: 10 April 2022
Revised: 01 May 2022
Accepted: 05 May 2022

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ABSTRACT

Background: Hearing loss severely affects the quality of life. At the same time there is a high burden of systemic hypertensives in the community. Various authors have conflicting opinions regarding the association of hearing loss with systemic hypertension. Our study was conducted in this context to find the prevalence and risk factors associated with sensorineural hearing loss in patients with systemic hypertension.
Methods: This is a hospital based cross-sectional study conducted at Dr. Somervell memorial CSI Medical College, Karakonam, during the period December 2015 to October 2017. A sample of 140 hypertensives were studied. They were subjected to pure tone audiometry after detailed history and physical examination including recording of blood pressure.
Results: Out of the 140 hypertensives, 61 patients (43.6%) were detected to have sensorineural hearing loss. In our study, age, stage of systemic hypertension and duration of systemic hypertension were the risk factors found to be associated with sensorineural hearing loss.
Conclusions: Sensorineural hearing loss has a high prevalence among patients with systemic hypertension. Hence, a pure tone audiometry should be done routinely in all hypertensives, particularly in elderly patients with long standing systemic hypertension. Periodic audiological assessment should be incorporated in them to start rehabilitation as early as possible. Early diagnosis of systemic hypertension in the community and initiation of treatment can help to further hinder the progression of microvascular disease that leads to target organ damage.

Keywords: Pure tone audiometry, Sensorineural hearing loss, Systemic hypertension

INTRODUCTION

Hearing loss severely affects the quality of life. People with hearing impairment experience difficulty in communication leading to social isolation, stigmatization and educational backwardness. Around 63 million people suffer from hearing loss in India.[1]

With the rapid increase in ageing population across the world, combined with evolving life style diseases like hypertension, its effect on hearing becomes significant. Some authors have found a positive association whereas some others have not found an association between the two. A case control study by Agarwal et al between hypertensives and normotensives in the age group 45-64 years had found a statistically significant association between systemic hypertension and hearing loss.[2] There are several potential mechanisms for hearing loss in patients with systemic hypertension that have been postulated in literature. Hypertension was found to be an accelerating factor for degeneration of the hearing apparatus with ageing. With ageing there is microcirculatory insufficiency, which could be aggravated by further vascular occlusion as a result of an emboli, vasospasm or hemorrhage caused by hypertension.[3,4]

However, with limited studies conducted in Kerala and a huge burden of systemic hypertension prevalent in the community, this study becomes significant. The objectives of the study are-to study the prevalence of sensorineural hearing loss in systemic hypertensives aged 45-60 years, to study the risk factors associated with sensorineural hearing loss among hypertensives.

METHODS

This is a cross-sectional study conducted during the period from December 2015 to October 2017 aimed at finding out the prevalence of sensorineural hearing loss and the risk factors related to hearing impairment among systemic hypertensives in Dr. S.M.C.S.I. Medical College, Karakonam. Sample size was calculated by the formula:

$$4pq \div d^2$$

Where, p=42 [prevalence in comparable studies][2] q=58 [100-p], d=relative precision i.e., 20% of previous prevalence

Substituting these values in the formula, $4pq \div d^2$= (4×42×58)/(8.4)^2 =138.09, approximately 140 cases.

Consecutive sampling was done and 140 patients attending the outpatient departments of general medicine meeting the inclusion and exclusion criteria were recruited for the study. Any patient with systemic hypertension coming under the age group of 45-60 years, having a systolic blood pressure ≥140 mmHg or a diastolic blood pressure ≥90 mmHg at the time of examination or a self-reported history of high blood pressure and on antihypertensive treatment was recruited. Patients with middle ear disease, chronic noise exposure, diabetes mellitus, head injury and cerebrovascular accidents were excluded. An informed consent will be taken from the participants of the study. Relevant data was taken using a pretested semi structured proforma, following which general examination, local examination of the ear and tuning fork tests were done.

Blood pressure of the study population at the time of examination was recorded in the left upper limb in sitting position using a mercury sphygmomanometer. The patient was asked to sit comfortably for 5 minutes before the examination was done. Two measurements have to be taken before labelling the patient hypertensive.

For newly detected hypertensives, the blood pressure recording at the time of examination was categorized as per the JNC 7 classification. In case of patients who are already on antihypertensive treatment, BP recording as per case records prior to initiation of treatment was also noted and categorized as per JNC 7 classification (Table 1).

Pure tone audiometry was done using GSI 61 clinical audiometer. It measured the hearing thresholds at frequencies including 250, 500, 1000, 2000, 4000 and 8000 Hz. The hearing loss was then measured from the audiogram by taking the average thresholds of hearing at frequencies of 500, 1000 and 2000 Hz in each ear. Hearing loss in individual frequencies were also noted individually in each ear. Degree of hearing loss was then classified according to WHO classification (1980).[5]

Table 1: JNC 7 classification of systemic hypertension.

Category	Systolic blood pressure (mmHg)	Diastolic blood pressure (mmHg)
Normal	<120, and	<80
Pre-hypertensive	120-139, or	80-89
Stage 1 hypertension	140-159, or	90-99
Stage 2 hypertension	≥160, or	≥100

Data was entered using Microsoft excel software and was analyzed using SPSS (Statistical package for social sciences software). The prevalence of sensorineural hearing loss in the sample was calculated. The associations were determined using chi square (χ^2) test and the significance ascertained by the p. A p value less than 0.05 was considered significant.

RESULTS

We selected 140 hypertensives who met the inclusion criteria for the study. All the subjects were in the 45-60 age group. Maximum participants were in the 55-60 age group (44.3%) (Figure 1). Female participants predominated in our study (65%).

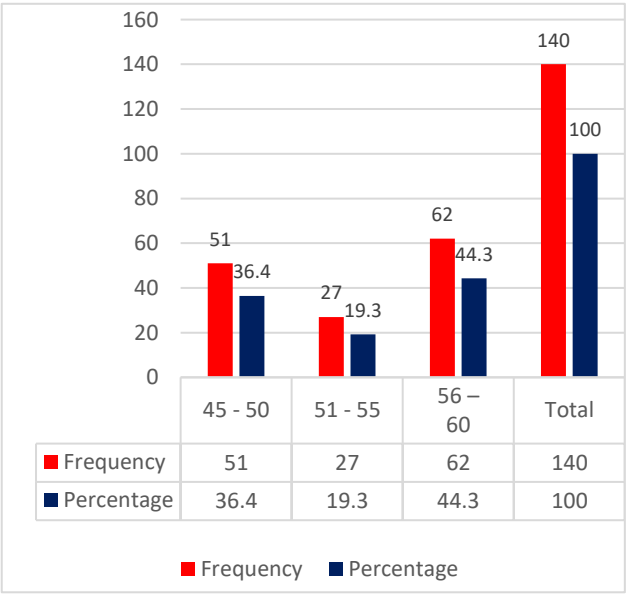

Figure 1: Age distribution of the study population.

In total, 61 patients (43.6%) had sensorineural hearing loss and 79 patients (56.4%) did not have sensorineural hearing loss. However, only 46 patients (32.9%) had symptoms of hearing loss. This suggests that mild hearing loss can go undetected unless it's looked for. When right ear and left ear were studied separately, 48 patients (34.3%) had sensorineural hearing loss in the right ear, whereas 46 patients (32.9%) had sensorineural hearing loss in left ear (Figure 2).

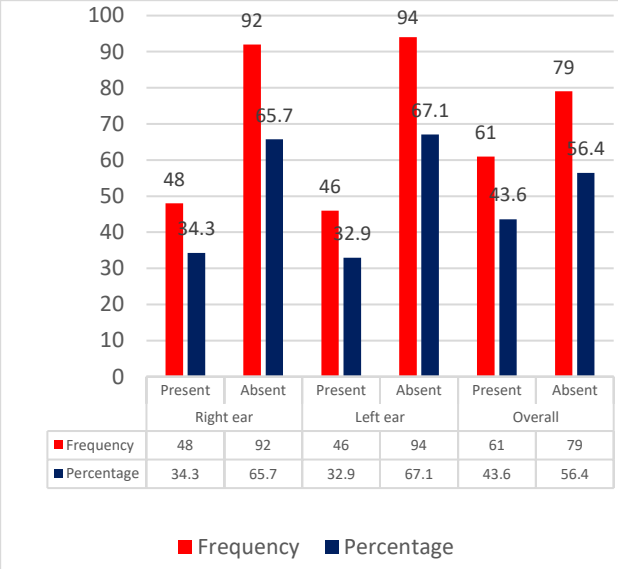

Figure 2: Prevalence of sensorineural hearing loss in systemic hypertension.

Based on the pure tone average, in the right ear, 92 patients (65.7%) had normal hearing, 24 patients (17.1%) had mild hearing loss, 8 patients (5.7%) had moderate hearing loss, 14 patients (10%) had moderately severe hearing loss, 1 patient (0.7%) had severe hearing loss and 1 patient (0.7%) had profound hearing loss. In the left ear, 94 patients (67.1%) had normal hearing, 28 patients (20%) had mild hearing loss, 15 patients (10.7%) had moderate hearing loss and 1 patient each (0.7% each) had moderately severe, severe and profound hearing loss respectively.

When hearing thresholds at individual frequencies were noted, in the right ear 58 patients (41.4 %) had hearing loss at 250 Hz, 51 patients (36.4%) had hearing loss at 500 Hz, 44 patients (31.4%) had hearing loss at 1 kHz, 48 patients (34.3%) had hearing loss at 2 kHz, 63 patients (45%) had hearing loss at 4 kHz and 84 patients (60%) had hearing loss at 8 kHz. Similarly, in the left ear, 50 patients (35.7%) had hearing loss at 250 Hz, 45 patients (32.1%) had hearing loss at 500 Hz, 39 patients (27.9%) had hearing loss at 1 kHz, 42 patients (30%) had hearing loss at 2 kHz, 65 patients (46.4%) had a hearing loss at 4 kHz and 85 patients (60.7%) had hearing loss at 8 kHz (Table 2). The patients in 55-60 age group had a higher incidence of hearing loss when compared to the remaining study population. In our study we found that increasing age is a risk factor for sensorineural hearing loss in hypertensives (Table 3).

Table 2: Prevalence of hearing loss in individual frequencies.

Frequency (Hz)	Sensorineural hearing loss-right ear		Sensorineural hearing loss-left ear	
	N	%	N	%
250	58	41.4	50	35.7
500	51	36.4	45	32.1
1000	44	31.4	39	27.9
2000	48	34.3	42	30.0
4000	63	45.0	65	46.4
8000	84	60.0	85	60.7

Table 3: Association of age with sensorineural hearing loss in hypertension.

Age (Years)	Sensorineural hearing loss				Total	
	Present		Absent			
	N	%	N	%	N	%
45-50	16	31.4	35	68.6	51	100
51-55	11	40.7	16	59.3	27	100
56-60	34	54.8	28	48.2	62	100
Total	61	43.6	79	56.4	140	100
$\chi 2$=6.376, df=2, p=0. 041.						

In our study, we had around 17 newly detected hypertensives, 31 patients with duration of hypertension less than 1 year, 49 patients with duration of illness ranging from 1-5 years, 28 patients with 6-10 years duration of hypertension and 15 patients having hypertension for more than 10 years. We studied whether duration of hypertension has any bearing on the development of sensorineural hearing loss and found out that patients with more than 10 years duration of hypertension had the highest prevalence of sensorineural hearing loss (Table 4). There is a statistically significant association between duration of systemic hypertension and sensorineural hearing loss (p<0.001).

Table 4: Association of duration of systemic hypertension with sensorineural hearing loss.

Duration of systemic hypertension (Years)	Sensorineural hearing loss				Total	
	Present		Absent			
	N	%	N	%	N	%
Newly detected	3	17.6	14	82.4	17	100
≤1	5	16.1	26	83.9	31	100
1-5	19	38.8	30	61.2	49	100
6-10	22	78.6	6	21.4	28	100
>10	12	80	3	20	15	100
Total	61	43.6	79	56.4	140	100
$\chi 2$=36.647, df=4, p<0.001						

Stage of systemic hypertension of 4 patients could not be identified as their blood pressure values prior to initiation of treatment was not known. Among the remaining 136 hypertensives, 53 patients had JNC 7 stage 1 systemic hypertension and 83 patients had JNC 7 stage 2 systemic hypertension. In patients with stage 1 systemic hypertension, 7 patients (13.2%) had sensorineural hearing loss, whereas in patients with stage 2 systemic hypertension, 51 patients (61.4%) had sensorineural hearing loss. There is a statistically significant association between stage of systemic hypertension and sensorineural hearing loss ($p<0.001$) (Table 5).

Table 5: Association of stage of systemic hypertension with sensorineural hearing loss.

Stage of systemic hypertension	Sensorineural hearing loss				Total	
	Present		Absent			
	N	%	N	%	N	%
Stage 1	7	13.2	46	86.8	53	100
Stage 2	51	61.4	32	38.6	83	100
Total	58	42.6	78	57.4	136	100
$\chi 2=30.772$, df=1, $p<0.001$						

The 83 patients had uncontrolled hypertension, whereas hypertension was controlled in the remaining 57 patients. In the group with uncontrolled hypertension, 39 patients (47%) had SNHL whereas in the group of patients who had their hypertension under control, 22 patients (38.6%) had SNHL. No significant association was found between control status of hypertension and sensorineural hearing loss ($p=0.325$).

DISCUSSION

Hypertension is a disease which affects almost all systems of the body. However, its effects on hearing have not been well studied till now. There are few studies regarding the effects of systemic hypertension on the hearing apparatus. Although some of these studies were able to establish a significant relationship between systemic hypertension and hearing loss, certain others were not able to find a statistical significance between the two. Moreover, there are very few studies done in our local population. Being a global disease, with a rapidly rising incidence across the world, if indeed hypertension causes an early degeneration of the hearing apparatus, its implications are far fetching.

Therefore, in this study we aim to assess the prevalence of sensorineural hearing loss in systemic hypertensives, from a hospital-based population. We also took into account various parameters such as age, gender, duration of disease, stage of hypertension, control status of hypertension to find out whether they had any role in accelerating hearing loss among hypertensives.

Out of 140 patients in our study, sensorineural hearing loss was noted in 61 patients, whereas 79 patients did not have any hearing loss. The prevalence of sensorineural hearing loss among patients with systemic hypertension in our study was 43.6%. This correlates with the findings of Agarwal et al who did a case control study comparing hearing loss among hypertensives and non-hypertensives in a similar age group of 45-64 years, and found out an overall prevalence of 42% among hypertensives.[2] However, studies done by Parving et al and Torre et al were not able to find a positive association between hypertension and hearing loss.[6,7]

In our study, the prevalence of sensorineural hearing loss was noted maximum in high frequencies, followed by the low frequencies and mid frequencies in both ears (8 KHz >4 KHz >250 Hz >500 Hz >2 KHz >1 KHz). This again correlates with the study done by Agarwal et al who in his study found that the mean pure tone thresholds were maximum in high frequencies.[2]

In our study, age proved to be a risk factor for sensorineural hearing loss. Apart from the normal presbycusis, that sets in with advanced age, accelerated loss of hearing seems to be happening in hypertensives. This was supported by Dubno et al who did a longitudinal study to assess the effects of age and gender on speech reception scores.[8] In his study, speech reception scores worsened with increasing age.

From our study, it was found that longer duration of systemic hypertension accelerates the hearing loss. This was supported by Chen et al who found that longer duration and complications of hypertension had a bearing on hearing parameters.[9]

In our study, stage of systemic hypertension proved to be a risk factor for developing sensorineural hearing loss whereas present control status had no effect on the hearing status. This implies that preventing systemic hypertension in the community would be more beneficial to prevent its complications than treating the disease once it has set in.

However, there are some limitations to the study. Though we have arrived at broad conclusions, based on our results, we cannot presume to have identified the exact etiological factors responsible for hearing loss. Since the study was done in a hospital-based population, it cannot be considered as a true representation of the community. Moreover, coexisting diseases like diabetes, dyslipidemia and hypothyroidism which are capable of causing SNHL may have gone undetected. Age could also have played a part in increased hearing thresholds particularly of the higher frequencies.

CONCLUSION

In our study we have identified a high prevalence of sensorineural hearing loss in patients with systemic hypertension. Age, duration and stage of systemic hypertension were found to be risk factors for hearing

loss in the study population. Based on our findings we recommend periodic audiological assessment with pure tone audiogram in all hypertensive patients, as early identification of hearing loss will enable us to provide hearing rehabilitation and prevent further worsening of hearing loss. This study will further help to create awareness among the medical fraternity about the high prevalence and risk factors of hearing loss in hypertensives. This will prompt them to actively screen for systemic hypertension in the community and initiate treatment as early as possible to prevent target organ damage including hearing loss.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Garg S, Chanda S, Malhotra S Agarwal AK. Deafness: Burden, prevention and control in India. Natl Med J India. 2009;22(2):79-81.
2. Agarwal S, Mishra A, Jagade M, Kasbekar V, Nagle SK. Effects of hypertension on hearing. Indian J Otolaryngol Head Neck Surg. 2013;65(3):614-8.
3. Carrasco VN, Prazma J, Faber JE, Triana RJ, Pillsbury HC. Cochlear microcirculation. Effect of adrenergic agonists on arteriole diameter. Arch Otolaryngol Head Neck Surg. 1990;116(4):411-7.
4. Gates GA, Cobb JL, D'Agostino RB, Wolf PA. The relation of hearing in the elderly to the presence of cardiovascular disease and cardiovascular risk factors. Arch Otolaryngol Head Neck Surg. 1993;119(2):156-61.
5. World Health Organization. Prevention of blindness and deafness. Geneva: WHO. 2017. Available at: http://www.who.int/pbd/deafness/hearing_impairment_grades/en. Accessed on 10 October, 2017.
6. Parving A, Hein HO, Suadicani P, Ostri B, Gyntelberg F. Epidemiology of hearing disorders. Some factors affecting hearing. The Copenhagen Male Study. Scand Audiol. 1993;22(2):101-7.
7. Torre P, Cruickshanks KJ, Klein BE, Klein R, Nondahl DM. The association between cardiovascular disease & cochlear function in older adults. J Speech Lang Hear Res. 2005;48(2):473-81.
8. Dubno JR, Lee FS, Matthews LJ, Mills JH. Age related and gender related changes in monoaural speech recognition. J Speech Lang Hear Res. 1997;40(2):444-52.
9. Chen YL, Ding YP. Relationship between hypertension and hearing disorders in the elderly. East Afr Med J. 1999;76(6):344-7.

Cite this article as: Mohan A, Renjit RE, Manonmony S. Prevalence and risk factors of sensorineural hearing loss in patients with systemic hypertension. Int J Otorhinolaryngol Head Neck Surg 2022;8:517-21.