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Original Research Article

Descriptive Epidemiological Assessment of Prevalence and Associated Risk Factors with Sensorineural Hearing Loss in Patients with Systemic Hypertension

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Abstract

Aim: The aim of the present study was to find the prevalence and risk factors associated with sensorineural hearing loss in patients with systemic hypertension.

Material & Methods: A retrospective study conducted during the period of 18 months aimed at finding out the prevalence of sensorineural hearing loss and the risk factors related to hearing impairment among systemic hypertensives in Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India from May 2021 to December 2022. 100 patients attending the outpatient Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India meeting the inclusion and exclusion criteria were recruited for the study.

Results: Maximum participants were in the 56-60 age group (47%). Female participants predominated in our study (66%). When right ear and left ear were studied separately, 35 patients (35%) had sensorineural hearing loss in the right ear, whereas 33 patients (33%) had sensorineural hearing loss in left ear. When hearing thresholds at individual frequencies were noted, in the right ear 42 patients (42%) had hearing loss at 250 Hz, 34 patients (34%) had hearing loss at 500 Hz. Similarly, in the left ear, 37 patients (37%) had hearing loss at 250 Hz, 33 patients (33%) had hearing loss at 500 Hz. 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. 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.

Conclusion: 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

Hypertension is a chronic medical condition characterized by elevated arterial blood pressure. [1] According to WHO/International Society of Hypertension guidelines, hypertension is defined as systolic blood pressure ≥ 140 mmHg and diastolic blood pressure ≥ 90 mmHg, and/or self-reported treatment of hypertension with antihypertensive medications taken in preceding 2 weeks. The classification of adult blood pressure is divided into the normal group of systolic blood pressure (SBP) < 120 mmHg and diastolic blood pressure (DBP) < 80 mmHg, prehypertension SBP: 120-139 mmHg and DBP: 80-90 mmHg, first-degree hypertension SBP: 140-159 mmHg and DBP: 90-99 mmHg, second-degree hypertension SBP > 160 mmHg and DBP > 100 mmHg. [2]

Hypertension affects about 1 billion people globally and it is the main risk factor for many other cardiovascular diseases. [3,4,5] With the rapid increase in ageing population across the world, combined with evolving life style diseases like hypertension, its effect on hearing becomes significant. [6] Hearing is considered one of the important factors which enriches our day-to-day life. Hearing loss severely affects the quality of life. [7] 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. [8] Hypertension may be associated with progressive hearing loss of sensorineural type. Chronic hypertension has also been implicated in the development of hearing loss. [9]

Hypertension is an independent risk factor for hearing loss due to the possible impact on the microcirculation of the inner ear; the subsequent degeneration of the inner ear will lead to hearing loss. The effect of hypertension on the inner ear can be manifested by thrombus formation secondary to damage to arterial inner lining from the increased pressure. [10] Occlusion of blood flow can lead to cell death in distal structures. Atherosclerosis can also occur in the cochlear arteries following long standing hypertension with fat collection in the damaged arteries. High body mass index (BMI) and large waist circumference, which are risk factors of hypertension, are associated independently with an increased risk of hearing loss. [11] Obesity-related atherosclerosis may lead to stiffening and constriction of the internal auditory artery and reduction in cochlear blood flow. This can lead to capillary constriction within the stria vascularis, cell death, and hearing loss. [12] Studies have shown that chronic hypertension causes a decrease in cochlear function and leads to histologic cochlear damage.

Hence the objectives of the study are-to study the prevalence of sensorineural hearing loss in systemic hypertensives patients and to study the risk factors associated with sensorineural hearing loss among hypertensives.

Material & Methods

A cross-sectional study conducted during the period of 18 months aimed at finding out the prevalence of sensorineural hearing loss and the risk factors related to hearing impairment among systemic hypertensives in Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India from May 2021 to December 2022. 100 patients attending the outpatient Department of ENT, Nalanda Medical College and Hospital, Patna, Bihar, India meeting the inclusion and exclusion criteria were recruited for the study.

Inclusion Criteria

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.

Exclusion Criteria

Patients with middle ear disease, chronic noise exposure, diabetes mellitus, head injury and cerebrovascular accidents were excluded.

Methodology

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.

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). [13]

Statistical Analysis

Data was entered using Microsoft excel software and was analysed 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 ($\chi 2$) test and the significance ascertained by the p. A p value less than 0.05 were considered significant.

Results

Table 1: Age and gender distribution of the study population and prevalence of sensorineural hearing loss in systemic hypertension

Age groups in years	**N%**
45-50	35 (35)
51-55	18 (18)
56-60	47 (47)
Total	100 (100)
Gender	
Male	34 (34)
Female	66 (66)
Prevalence of sensorineural hearing loss in systemic hypertension	
Right ear	
Present	35 (35)
Absent	65 (65)
Left ear	
Present	33 (33)
Absent	67 (67)

Maximum participants were in the 56-60 age group (47%). Female participants predominated in our study (66%). When right ear and left ear were studied separately, 35 patients (35%) had sensorineural hearing loss in the right ear, whereas 33 patients (33%) had sensorineural hearing loss in left ear.

Table 2: Prevalence of hearing loss in individual frequencies

Frequency(Hz)	**Sensorineuralhearing loss- right ear**		**Sensorineural hearing loss-left ear**	
	N	**%**	**N**	**%**
250	42	42	37	37
500	34	34	33	33
1000	32	32	28	28
2000	36	36	32	32
4000	46	46	44	44
8000	62	62	58	58

When hearing thresholds at individual frequencies were noted, in the right ear 42 patients (42%) had hearing loss at 250 Hz, 34 patients (34%) had hearing loss at 500 Hz, 32 patients (32%) had hearing loss at 1 kHz, 36 patients (36%) had hearing loss at 2 kHz, 46 patients (46%) had hearing loss at 4 kHz and 62 patients (62%) had hearing loss at 8 kHz. Similarly, in the left ear, 37 patients (37%) had hearing loss at 250 Hz, 33 patients (33%) had hearing loss at 500 Hz, 28 patients (28%) had hearing loss at 1 kHz, 32 patients (32%) had hearing loss at 2 kHz, 44 patients (44%) had a hearing loss at 4 kHz and 58 patients (58%) had hearing loss at 8 kHz.

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

Age (Years)	**Sensorineural hearing loss**				**Total**	
	Present		**Absent**			
	N	**%**	**N**	**%**	**N**	**%**
45-50	11	31.42	24	68.58	35	100
51-55	7	38.88	11	61.12	18	100
56-60	27	57.44	20	42.56	47	100
Total	45	45	55	55	100	100
p=0. 045						

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

Duration of systemic hypertension (Years)	Sensorineural hearingloss				Total	
	Present		Absent			
	N	%	N	%	N	%
Newly detected	2	16.66	10	83.34	12	100
≤1	4	18.18	18	81.82	22	100
1-5	14	40	21	60	35	100
6-10	16	80	4	20	20	100
>10	9	81.82	2	18.18	11	100
Total	45	45	55	55	100	100
p<0.001						

In our study, we had around 12 newly detected hypertensives, 22 patients with duration of hypertension less than 1 year, 35 patients with duration of illness ranging from 1-5 years, 20 patients with 6-10 years duration of hypertension and 11 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 5: Association of stage of systemic hypertension with sensorineural hearing loss

Stage of systemic hypertension	Sensorineural hearingloss				Total	
	Present		Absent			
	N	%	N	%	N	%
Stage 1	5	12.5	35	87.50	40	100
Stage 2	40	66.66	20	33.34	60	100
Total	45	45	55	55	100	100
p<0.001						

Among the remaining 100 hypertensives,40 patients had JNC 7 stage 1 systemic hypertension and 60 patients had JNC 7 stage 2 systemic hypertension. In patients with stage 1 systemic hypertension, 5 patients (12.5%) had sensorineural hearing loss, whereas in patients with stage 2 systemic hypertension, 40 patients (66.66%) had sensorineural hearing loss. There was a statistically significant association between stage of systemic hypertension and sensorineural hearing loss.

Discussion

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. [13] 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 haemorrhage caused by hypertension. [14,15]

Maximum participants were in the 56-60 age group (47%). Female participants predominated in our study (66%). When right ear and left ear were studied separately, 35 patients (35%) had sensorineural hearing loss in the right ear, whereas 33 patients (33%) had sensorineural hearing loss in left ear. When hearing thresholds at individual frequencies were noted, in the right ear 42 patients (42%) had hearing loss at 250 Hz, 34 patients (34%) had hearing loss at 500 Hz. Similarly, in the left ear, 37 patients (37%) had hearing loss at 250 Hz, 33 patients (33%) had hearing loss at 500 Hz. Out of 100 patients in our study, sensorineural hearing loss was noted in 45 patients, whereas 55 patients did not have any hearing loss. The prevalence of sensorineural hearing loss among patients with systemic hypertension in our study was 45%. 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. [13] However, studies done by Parving et al and Torre et al were not able to find a positive association between hypertension and hearing loss. [17,18] 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. [13]

The decision to lower the upper limit of normal hearing from 26 to 20 dB was informed by extensive clinical experience and evidence in literature demonstrating the negative impacts of hearing loss above 20 dB HL such as difficulty hearing conversational speech in noise. [19,20] Unaddressed hearing loss—of any degree—among hypertensive adults has the potential to greatly impact their quality of life, their ability to communicate without difficulty, and in turn their ability to obtain and retain employment. As stated in the International Classification of Functioning, Disability and Health (ICF), an individual with the smallest reduction in hearing sensitivity has a potentially "disabling" condition. 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. 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. [21] In his study, speech reception scores worsened with increasing age.

In our study, we had around 12 newly detected hypertensives, 22 patients with duration of hypertension less than 1 year, 35 patients with duration of illness ranging from 1-5 years, 20 patients with 6-10 years duration of hypertension and 11 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. This was supported by Chen et al who found that longer duration and complications of hypertension had a bearing on hearing parameters. [22] Among the remaining 100 hypertensives, 40 patients had JNC 7 stage 1 systemic hypertension and 60 patients had JNC 7 stage 2 systemic hypertension. In patients with stage 1 systemic hypertension, 5 patients (12.5%) had sensorineural hearing loss, whereas in patients with stage 2 systemic hypertension, 40 patients (66.66%) had sensorineural hearing loss. There was a statistically significant association between stage of systemic hypertension and sensorineural hearing loss.

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.

References

1. World Health Organization (2013) A global brief on hypertension : silent killer, global public health crisis: World Health Day 2013. World Health Organization.
2. National High Blood Pressure Education Program. The Seventh Report of the Joint Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. B.ethesda: NIH/National Heart, Lung and Blood Institute (US). 2004.
3. Adeloye D, Basquill C, Aderemi AV, Thompson JY, Obi FA. An estimate of the prevalence of hypertension in Nigeria: a systematic review and meta-analysis. Journal of hypertension. 2015 Feb 1;33(2):230-42.
4. Sola AO, Chinyere OI, Stephen AO, Kayode JA (2013) Hypertension prevalence in an urban and rural area of Nigeria. J Med Sci 4(4):149–154.
5. Mbanya JC, Minkoulou EM, Salah JN, Balkau B (1998) The prevalence of hypertension in rural and urban Cameroon. Int J Epidemiol 27 (2):181–185
6. Mohan A et al. Prevalence and risk factors of sensorineural hearing loss in patients with systemic hypertension Int J Otorhinolaryngol Head Neck Surg. 2022 Jun;8(6):517-521
7. 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. Archives of Otolar yngology–Head & Neck Surgery. 1993 Feb 1; 119(2):156-61.
8. Garg S, Chanda S, Malhotra S Agarwal AK. Deafness: Burden, prevention and control in India. Natl Med J India. 2009;22(2):79-81.
9. Makishima K. Arteriolar sclerosis as a cause of presbycusis. Otolaryngology. 1978 Mar;86 (2): ORL-322.
10. Hinojosa R, Kohut RI (1990) Clinical diagnosis of anterior inferior cerebellar artery thrombosis. Autopsy and Temporal bone histopathologic study. Ann Otol Rhinol Laryngol 99(4pt1):261–272
11. Curhan SG, Eavey R, Wang M, Stamfer MJ, Curhan GC (2013) Body mass index, waist circumference, physical activity, and risk of

hearing loss in women. Am J Med 126(12): 11 42–1142.e8
12. Shashikala KT, Srinivas K (2015) Sensorineural hearing loss in young adults with BMI of 25 or more. J Evol Med Dent Sci 4(29):4997–5002.
13. World Health Organization. Prevention of blindness and deafness. Geneva: WHO. 2017.
14. 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.
15. 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.
16. 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.
17. 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.
18. 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.
19. World Health Organization.World Report on Hearing. Geneva (2021).
20. Olusanya BO, Davis AC, Hoffman HJ. Hearing loss grades and the International classification of functioning, disability and health. Bulletin of the World Health Organization. 2019 Oct 10;97(10):725.
21. 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.
22. Chen YL, Ding YP. Relationship between hypertension and hearing disorders in the elderly. East Afr Med J. 1999;76(6):344-7.