

## Frequency of Hypertension in Patients Diagnosed with Sensorineural Hearing Loss At a Tertiary Care Hospital

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### Abstract

**Objective:** To determine frequency of hypertension in adult patients diagnosed with sensorineural hearing loss and to determine which hearing frequencies & degrees are more affected with respect to grades of hypertension.

**Method:** This is a Cross sectional study which was conducted in the ENT Department UNIT-I, Services Institute of Medical Sciences, Lahore / Services Hospital, Lahore. Duration of this study was One year from May 2020 to April 2021. 100 patients who met the inclusion criteria were enrolled for the study. Then history of patient for hypertension was taken and blood pressure was also checked on the spot and hypertension was labelled accordingly. Hearing thresholds were assessed via pure tone audiometry by delivering pure tones at frequencies of 125-8000hz at the intensities from 0 dB to 120 dB in 5 dB steps to check for both air and bone conduction by using Garson Stadler audiometer & categorized according to WHO criteria of normal hearing <25dB, mild 26-40dB, moderate 41-60 dB, severe 61-80dB, profound > 80 dB hearing loss.

**Results:** Patients' mean age was 47.70±9.04 years, 67(67%) patients were male. The hypertension was found in 55(55%) patients in which grade I severity of hypertension was noted in 42(76.4 %) patients and grade II severity of hypertension was noted in 13(23.6%) patients.

**Conclusion:** According to this study the frequency of hypertension was 55% in adult patients with sensorineural hearing loss in which 76.4% had grade I and 23.6% had grade II hypertension

**Keywords:** Sensorineural Hearing Loss, Hypertension.

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### Introduction

Hearing loss affects 360 million people globally, making it the sixth most common reason for years spent with a disability.<sup>1</sup> A person's ability to carry on daily conversations, locate sounds and interpret speech, remember things, operate cognitively, and maintain their psychosocial well-being are all significantly

impacted by hearing loss. Various congenital and acquired factors, including aging, noise exposure, ototoxic medications, genetic changes, and systemic disorders, can cause hearing loss.<sup>1</sup> Hypertension is a major global health burden. Systolic Blood Pressure of at least 110 to 115 mm Hg was estimated in 3.5 billion adults and Systolic Blood Pressure of 140 mm Hg or higher was estimated in 874 million adults worldwide.<sup>2</sup> Among all community groups around the world, hypertension is a major risk factor for cardiovascular illnesses. Variations in blood pressure have been associated with mortality, end-organ damage, and cardiovascular events according to several studies.<sup>1</sup> Vascular disease and mortality are significantly increased by arterial hypertension. It is connected to vascular disease, renal disease, heart disease, and stroke.<sup>3</sup> Heart and blood vessels structural changes are likely to result from hypertension<sup>4</sup>. Hyper-

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tension induced microangiopathy leads to atrophy in cranial nerve VIII, blood vessels and spiral ganglion.<sup>5</sup> Cochlea is mainly supplied by end arteries. Hypertension induced blood pressure variation makes the ears more susceptible to damage.<sup>6</sup> The most significant contributor to cochlear damage brought on by hypertension appears to be stria vascularis dysfunction. Additionally, the most common cause of internal ear bleeding through the cochlear, anterior vestibular, and anterior inferior cerebellar arteries is hypertension in the vascular system. This, in turn, is likely to cause progressive or sudden hearing loss.<sup>7</sup> Hearing loss, tinnitus, and vertigo is associated with smoking, hypertension, diabetes mellitus, lifestyle, age, family history of illness, leisure activities, and occupational noise exposure. The incidence of auditory symptoms also appears to be correlated with noise exposure over the course of a person's lifetime.<sup>8</sup> Data showed that 4.6% of people between the ages of 18 and 44 have hearing loss. In comparison, 54 percent of people over 65 years old and 14% of people between the ages of 45 and 64 encounter hearing. Joss is affected by a number of factors, including repeated exposure to loud noise, breathing poisonous materials, ingesting ototoxic drugs and pollutants, injuries, and genetic predisposition.<sup>9</sup> Literature showed that chances of hypertension were high among patients of sensorineural hearing loss. According to a study done in Nigeria, 16 percent of hypertensive participants experienced mild to severe sensorineural hearing loss, particularly in the higher frequencies, as a result of inner ear microangiopathy, cochlear nerve neuropathy and reduced blood flow to the stria vascularis. Patients with hypertension have been found to have vasoconstriction leading to decreased blood flow to stria vascularis.<sup>10</sup> A large study conducted in china showed increased hearing thresholds among hypertensive patients.<sup>7</sup> Another study published in Brazil in 2017, showed that prevalence of bilateral high frequency mild sensorineural hearing loss in hypertensive individuals above 60 years of age was 66.26% who underwent audiometric assessment.<sup>6</sup> According to one study, people with sensorineural hearing loss had a significant frequency of hypertension, or 46.8% of cases.<sup>11</sup> Such a study has not yet been conducted in Pakistan, and no local data is found which could help us to determine the prevalence of hypertension in patients of sensorineural hearing loss. This study aims to get local magnitudes which will be helpful for us to implement the screening of hypertensive patients to prevent sensorineural hearing loss in adults. One early disability prevention strategy may be the early referral of hyper-

tensive individuals for audiometric testing.

## Materials and Methods

This was a Cross sectional study, carried out Department of ENT Unit-I, Services Institute of Medical Sciences, Lahore / Services Hospital, Lahore. and duration of study was one year from May 2020 to April 2021. Sampling technique was Non-probability consecutive sampling and a Sample size of 100 patients was calculated with 95% confidence level, 10% margin of error and taking expected percentage of hypertension i .e. 46.8% patients with sensorineural hearing loss.<sup>11</sup> Patients with sensorineural hearing loss (as per operational criteria) between the ages of 35 and 65, of either gender were included in the study. Patients other than essential hypertension & >65 years of age, patients with history of conductive or mixed type of hearing loss, ear infections, previous ear surgery, head injuries, history of ototoxic drugs, noise trauma, acoustic neuroma as assessed by history, ear examination & previous medical record. Patients with kidney diseases, diabetes, history of cerebral stroke, degenerative diseases of the central nervous system, coagulopathies, dyslipidemias as assessed by history & previous medical record were excluded from study. Data collection procedure: Through the outpatient department of ENT Unit-I, Services Hospital, Lahore, 100 patients who met the inclusion criteria were enrolled. Consent was obtained in writing and informed. Demographic information (name, age, sex) and presenting complaints were noted on the given Performa. Hearing thresholds were assessed via pure tone audiometry by delivering pure tones at frequencies of 125-8000Hz at the intensities from 0dB to 120dB in 5 dB steps to check for both air and bone conduction by using Garson Stadler audiometer and hearing loss was labeled according to the WHO criteria, which classify hearing loss into four categories: mild (normal hearing is 25 dB), moderate (41-60 dB), severe (61-80 dB), and profound (>80 dB). Patients with sensorineural hearing loss were assessed for hypertension. History of these patients was checked for hypertension (>10 years) and BP was also checked on the spot and hypertension was labeled (according to operational definition). Patients were then treated in accordance with hospital practice. Performa contains a record of all of this data (attached). Data analysis: In order to evaluate the collected data, SPSS version 20 was used. Age and blood pressure were provided as quantitative

variables with a mean and standard deviation. The frequency and percentage of qualitative characteristics including gender, smoking, and hypertension were shown. Age, gender, and smoking status were stratified in the data. Chi-square test was used post-stratification to compare hypertension in stratified groups. P value 0.05 was taken as significant.

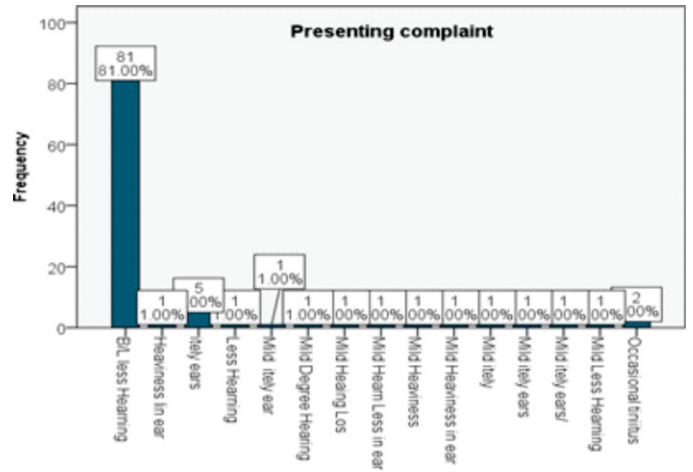
## Results

The patients ranged in age from 35 to 63 years old, with a mean age of  $47.70 \pm 9.04$  years. 33 patients (33%) were female and 67 (67%) were male patients. The patients' male to female ratio was 2.03 Table-1. In this study most of the 81(81%) patients presented with bilaterally decreased hearing followed by itchy ears, occa-

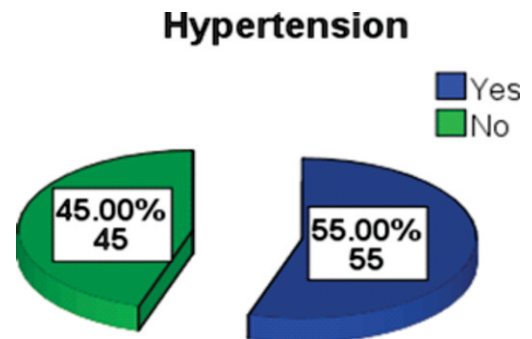
**Table 1:** Summary statistics of age (years) and Sex.

	N	100
Age (Years)	Mean	47.70
	Standard Deviation	9.04
	Minimum	35.00
	Maximum	63.00
Sex	Male	67
	Female	33

sional tinnitus and rest of the patients reported other complaints. Fig-1 According to this study the most common severity of hearing loss was bilateral mild to moderate Sensorineural hearing loss noted in 26(26%) patients followed by bilateral moderate degree of Sensorineural hearing loss and rest of the patients belonged to other severity of hearing loss. The hypertension was found in 55(55%) patients. Fig-2 In this study the mean systolic blood pressure of the patients was  $136.50 \pm 10.48$  mmHg and the mean diastolic blood pressure of the patients was  $88.41 \pm 7.05$  mmHg. Of 55 patients, grade I severity of hypertension was noted in 42(76.4%) patients and grade II severity of hypertension was noted in 13(23.6%) patients. (Table 2). Patients age  $\leq 50$  years the hypertension was found in 17(28.3%) patients and in patients having age  $>50$  years the hypertension was found in 38(95%) patients ( $p$  value= $<0.001$ ). In male patients the hypertension was found in 41(61.2%) patients and in female patients the hypertension was found in 14(42.4%) patients ( $p$ -value=0.076). Similarly in patients with H/O smoking the hypertension was found in 20(74.1%) patients and in patients without H/O smoking the hypertension was found in 35(47.9%) patients ( $p$ -value=0.02). Table 3



**Fig-1:** Distribution of Presenting Complaint



**Fig-2:** Hypertension

**Table 2:** Distribution of severity of hypertension (n=55)

	Frequency	Percent
Grade	I	42
	II	13
	Total	55
		100.0

**Table 3:** Comparison of hypertension between age groups, gender and H/O smoking

	Hypertension		Total	p-value	
	Yes	No			
Age groups	$\leq 50$	17	43	60	$<0.001$
	$>50$	38	2	40	
Gender	Male	41	26	67	0.076
	Female	14	19	33	
H/O Smoking	Yes	20	7	27	0.020
	No	35	38	73	
					100.0%



## Discussion

The onset of cognitive decline in older persons has been linked to midlife increases in sensory neurological deficits in hearing, vision, and olfaction.<sup>12</sup> Untreated hearing loss increases the likelihood of cognitive decline, falls, hospitalization, and other adverse effects.<sup>13</sup> Age, sex, race, and genetics are a few of the risk factors that cannot be changed, but other lifestyle-related factors can. Their research is essential.<sup>14</sup> For adults, hearing is traditionally evaluated using pure-tone Audiometry.<sup>15</sup> Regardless of the severity, hearing loss is a problem that lowers quality of life. When hearing loss is developed in adulthood, it develops gradually and may make oral language comprehension challenging. Studies on the adult population have shown that hearing loss begins around the age of 30 and worsens over time. Men experience the effects sooner and more strongly than women. Despite similarities in the audiologic configuration. A hearing system issue could have negative psychosocial effects on a person's quality of life, including low self-esteem, loneliness, unhappiness, and impatience. Furthermore, it is well recognized that adult metabolic changes, such as systemic arterial hypertension (SAH), are widespread and may be made worse by the presence of hearing loss or the reverse.<sup>16</sup>

In this study, hypertension was found in 55(55%) patients. Of 55 patients grade I severity was noted in 42(76.4%) patients and grade II severity of hypertension was noted in 13(23.6%) patients. Some of the studies are discussed below showing their results as. Both prospective investigations by Agrawal et al.<sup>16</sup> and Lin et al<sup>17</sup>. found correlations between hypertension and the likelihood of hearing impairment. However, they found that a higher percentage of their individuals had hypertension (27% in the study by Agrawal et al.<sup>12</sup> and 30.8% in the study by Lin. et al.<sup>17</sup>

Starck et al<sup>18</sup> further supported these conclusions in their investigation, where reported that hearing impairment was influenced by diastolic blood pressure. Agarwal et al.<sup>16</sup> discovered that individuals with grade I hypertension had a prevalence of hearing loss of 36.7% in their case-control study of hearing loss in hypertensives, which included both hypertensives and a control group. With an increase in the severity of hypertension, they saw an increasing prevalence of hearing loss. According to a study done in Nigeria, 16% of hypertensive participants experienced mild to moderate sensorineural hearing loss, especially at higher frequencies because of inner ear microangiopathy and cochlear nerve neuropathy. The blood flow to the stria vascularis has been found

to be decreased in hypertension patients as a result of vasoconstriction.<sup>10</sup> According to Saurabh Agarwal et al.<sup>16</sup>, there may be a connection between hypertension and an increase in hearing threshold. Patients with hypertension exhibit a greater increase in hearing threshold compared to those without hypertension. Those with grade 3 hypertension showed the most noticeable increase in hearing threshold, especially at higher frequencies. 50 hypertension individuals over the age of 45 in Brazil were examined audio metrically by Brohem et al.<sup>19</sup>; 62% of them showed sensorineural hearing loss. A large study conducted in china showed increased hearing threshold among hypertensive patients.<sup>7</sup> Another study published in Brazil in 2017, showed prevalence of bilaterally high frequency mild sensorineural hearing loss in hypertensive individuals above 60 years of age was (66.26%) who underwent audiometric assessment.<sup>6</sup> One study showed the frequency of hypertension was high in patients with sensorineural hearing loss i.e. 46.8 % cases.<sup>11</sup> According to a study by Boshen Wang et al<sup>9</sup>, persons with hypertension have much more hearing loss than patients without the condition. A noticeable increase in hearing loss was observed in patients with grade 2 hypertension. The risk of hearing loss will be reduced by effective and doable techniques for reducing the risk of hypertension and work-related noise exposure. In light of this study the results showed that grade 1 hypertension, grades 2 and 3, and isolated systolic hypertension all had a clear effect on hearing impairment. ( $P < 0.05$ ).<sup>9</sup> According to Rosen et al,<sup>20</sup> there is a connection between high blood pressure and hearing loss in the high frequencies, according to a study conducted with hypertension patients in the USA. After examining the hearing symptoms of 50 hypertensive patients, Markova,<sup>21</sup> in the Check Republic, concluded that arterial hypertension is a significant risk factor for hearing loss. On the other hand, in a retrospective investigation carried out in Denmark utilizing the records of 342 patients assessed between 1945 and 1961 sequentially, Hansen et al<sup>22</sup> did not connect arterial hypertension to hearing loss in this cohort. Contrary to what had been reported in earlier investigations, Sharorodsky et al<sup>23</sup> and other studies also revealed no association between high blood pressure and the chance of hearing loss.<sup>24,25</sup>

## Conclusion

The prevalence of hypertension in adult patients with sensorineural hearing loss was 55 percent, with 76.4% having grade I and 23.6% having grade II

hypertension.

**Conflict of Interest**

*None*

**Funding Source**

*None*

## References

1. Bao M, Song Y, Cai J, Wu S, Yang X. Blood Pressure Variability Is Associated with Hearing and Hearing Loss: A Population-Based Study in Males. *International Journal of Hypertension* 2019;2019.
2. Williams B, Mancia G, Spiering W, Rosei EA, Azizi M, Burnier M, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension: The Task Force for the management of arterial hypertension of the European Society of Cardiology and the European Society of Hypertension. *Journal of hypertension* 2018;36(10):1953-2041.
3. Naeije R, Gerges M, Vachiery J-L, Caravita S, Gerges C, Lang IM. Hemodynamic phenotyping of pulmonary hypertension in left heart failure. *Circulation: Heart Failure* 2017;10(9):e004082.
4. Hunter A, Holdsworth D, D'Arcy J, Bailey K, Casadei B. Hypertension in the military patient. *Journal of the Royal Army Medical Corps* 2015;161(3):200-5.
5. Przewozny T, Gójska-Grymajło A, Kwarciany M, Graff B, Szmuda T, Gasecki D, et al. Hypertension is associated with dysfunction of both peripheral and central auditory system. *Journal of hypertension* 2016; 34(4): 736-44.
6. Romdhoni AC. The Effect of Hypertension on Hearing Sense. *Biomolecular and Health Science Journal* 2018; 1(1):69-74.
7. Przewoźny T, Gójska-Grymajło A, Kwarciany M, Gasecki D, Narkiewicz K. Hypertension and cochlear hearing loss. *Blood Pressure* 2015;24(4):199-205.
8. Meneses-Barriviera CL, Bazoni JA, Doi MY, de Moraes Marchiori LL. Probable Association of Hearing Loss, Hypertension and Diabetes Mellitus in the Elderly. *International archives of otorhinolaryngology* 2018; 22(04):337-41.
9. Wang B, Han L, Dai S, Li X, Cai W, Yang D, et al. Hearing loss characteristics of workers with hypertension exposed to occupational noise: a cross-sectional study of 270,033 participants. *BioMed research international* 2018;2018.
10. Yikawe SS, Iseh KR, Sabir AA, Inoh MI, Solomon JH, Aliyu N. Cardiovascular risk factors and hearing loss among adults in a tertiary center of Northwestern Nigeria. *World journal of otorhinolaryngology- head and neck surgery* 2018;4(4):253-7.
11. Marchiori LLdM, Rego Filho EdA, Matsuo T. Hypertension as a factor associated with hearing loss. *Revista Brasileira de Otorrinolaringologia* 2006;72(4):533-40.
12. Schubert CR, Cruickshanks KJ, Fischer ME, Pinto AA, Chen Y, Huang GH, Klein BEK, Klein R, Pankow JS, Paulsen AJ, Dalton DS, Tweed TS. Sensorineural Impairments, Cardiovascular Risk Factors, and 10-Year Incidence of Cognitive Impairment and Decline in Midlife: The Beaver Dam Offspring Study. *J Gerontol A Biol Sci Med Sci.* 2019 Oct 4;74(11):1786-1792.
13. Arnold ML, Hyer K, Small BJ, Chisolm T, Saunders GH, McEvoy CL, Lee DJ, Dhar S, Bainbridge KE. Hearing Aid Prevalence and Factors Related to Use Among Older Adults From the Hispanic Community Health Study/Study of Latinos. *JAMA Otolaryngol Head Neck Surg.* 2019 Jun 1;145(6):501-508.
14. Huang Q, Jin Y, Reed NS, Ma Y, Power MC, Talegawkar SA. Diet quality and hearing loss among middle-older aged adults in the USA: findings from National Health and Nutrition Examination Survey. *Public Health Nutr.* 2020 Apr;23(5):812-820
15. Anthea Bott, Louise Hickson, Carly Meyer, Fabrice Bardy, Bram Van Dun & Nancy A. Pachana (2020) Is cortical automatic threshold estimation a feasible alternative for hearing threshold estimation with adults with dementia living in aged care?, *International Journal of Audiology*, 59:10, 745-752.
16. Agarwal S, Mishra A, Jagade M, Kasbekar V, Nagle SK. Effects of hypertension on hearing. *Indian Journal of Otolaryngology and Head & Neck Surgery* 2013; 65(3): 614-8.
17. Lin BM, Curhan SG, Wang M, Eavey R, Stankovic KM, Curhan GC. Hypertension, diuretic use, and risk of hearing loss. *The American journal of medicine* 2016; 129(4):416-22.
18. Starck J, Toppila E, Pyykkö I. Smoking as a risk factor in sensory neural hearing loss among workers exposed to occupational noise. *Acta oto-laryngologica* 1999; 119 (3): 302-5.
19. Brohem VMA, Caovilla HH, Ganança MM. Dos sintomas e achados audiológicos e vestibulares em indivíduos com hipertensão arterial. *Acta Awho* 1996:4-10.
20. Rosen S, Bergman M, Plester D, El-Mofty A, Satti MH. LXII Presbycusis Study of a Relatively Noise-Free Population in the Sudan. *Annals of Otology, Rhinology & Laryngology* 1962;71(3):727-43.
21. Marková M. The cochleovestibular syndrome in hypertension. *Ceskoslovenska otolaryngologie* 1990; 39(2): 89-97.

22. Hansen CC. Perceptive hearing loss and arterial hypertension. Archives of Otolaryngology 1968; 87(2): 119-22.
23. Shargorodsky J, Curhan SG, Eavey R, Curhan GC. A prospective study of cardiovascular risk factors and incident hearing loss in men. the Laryngoscope 2010; 120(9):1887-91.
24. Lin FR, Thorpe R, Gordon-Salant S, Ferrucci L. Hearing loss prevalence and risk factors among older adults in the United States. Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences 2011; 66 (5): 582-90.
25. Bainbridge KE, Hoffman HJ, Cowie CC. Diabetes and hearing impairment in the United States: audiometric evidence from the National Health and Nutrition Examination Survey, 1999 to 2004. Annals of internal medicine 2008;149(1):1-10.

### **Authors Contribution**

**FR:** Conceptualization of Project

**MI:** Data Collection

**JA:** Literature Search

**SN:** Statistical Analysis

**AK:** Drafting, Revision

**GM:** Writing of Manuscript