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A Study on Sensorineural Hearing Loss in Hypertensive Patients

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Abstract
Essential hypertension is a form of hypertension that has no identifiable cause. It is a common type of hypertension affecting 95% hypertensive population[1].In people with hypertension early presbyacusis can set in at an early decade which can become worse by added factors like noise pollution and vascular pathologies[2]. To assess the type and degree of hearing impairment among essential hypertensive's attending otorhinolaryngology department at Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu. To correlate the duration of hypertension and degree of hearing impairment in essential hypertensive patients. A descriptive cross-sectional study of 100 Essential hypertensive patients attending otorhinolaryngological department with various ailments were screened for hearing impairment from November 2023-May 2024 whose symptoms went unnoticed and thereby resulting in hearing loss was studied. Among 100 Essential hypertensive patients, the most common age group is 51-60 years. Male patients are more common in our study with an average of 69%. The most common presenting symptom is tinnitus. 66% of patients had tinnitus, 18% had hearing loss and 5% had vertigo. Tuning fork test were carried out for all patients none of the ears showed evidence of conductive hearing loss and 42% of them had sensorineural hearing loss in females and 61% had Sensorineural hearing loss in males. The analysis of the type of hearing loss among 100 essential hypertensive patients based on audiogram report obtained in our study indicates that 55% of patients had Sensorineural hearing loss. In our study there were 24% patients in less than a year hypertensive patients, 57% people were of three years duration and 19% above three years. Among 100 essential hypertensive's 99% were taking antihypertensive medications. 1% were not taking medication. There is an association between hearing loss and hypertension, though most of the hypertensive subjects had mild sensorineural hearing loss. The prevelance and severity of the hearing loss worsens with the degree of hypertension. Incorporating regular audiological assessment for hypertensive patients could improve the quality of care for hypertension and quality of life for hypertensive patients.

INTRODUCTION

Sensorineural hearing loss results when the sensory or neural mechanisms within the cochlea are not functioning. It can also be caused by disorders of eighth nerve or auditory brainstem, such type of disorder is termed as retro cochlear disorders. When any structure in the Sensorineural mechanism is damaged, or lost its ability to transduce mechanical energy into electrical energy is reduced, which results in changes in cochlear processing and a reduction in sensitivity of the cochlear receptors.

Sensorineural Neural Hearing loss has at Least Three Important Effects on Hearing:

- Reduction in cochlear sensitivity,
- Reduction in frequency resolution,
- Dynamic range of hearing mechanism[3].

One of the features of Sensorineural hearing loss is recruitment (abnormal loudness growth). Loudness grows more rapidly than normal at intensity levels just above the threshold in an ear with Sensorineural hearing loss resulting in reduced dynamic range from the threshold level to the discomfort level. Reduction in dynamic range and frequency resolution affects perception of speech. Extreme reduction in frequency resolution and dynamic range, can severely limit the usefulness of the residual hearing[4].

Essential hypertension is also called primary hypertension, is a form of hypertension that by definition has no identifiable cause. It is a common type of hypertension affecting 95% of hypertensive patients. Prevalence of hypertension increases with age[5].

Hypertension is a common disease in India and our set of population does not undergo master health check up and periodic blood pressure check up. The public health awareness is improving but not to the extent of health consciousness and staying fit. Health consciousness like obesity, hip abdominal ratio and BMR are not prevailing consciousness in our population.

Hearing is Affected in Hypertensive in the Following Manner: The atherosclerotic blood vessels in hypertensive's cause changes in the blood hemodynamics[6,7].

The rapidity of blood flow in the cochlea may affect the cochlear dynamics and produce hearing loss at high frequencies at basal turn and apical turn at low frequencies[6,7].

Sodium and potassium perfusion variation can also affect hearing loss[8].

In hypertensive patients due to rapid flow of blood there is no proper exchange of oxygen and nutrients, so they depend on the integrity of the heart and blood vessels. The circulatory system pathology can also affect the hearing directly by increase in blood viscosity[6,7].

Reduced capillary blood flow which results in reduced oxygen supply resulting in hypoxia which results in hearing loss[6,7].

Apart from this the arterial hypertension can cause ionic changes in cell potentials and causes hearing loss[8].

Hypertension is the most common vascular disorder which facilitates structural changes in the heart and blood vessels[9]. High pressure in the vascular system may cause inner ear hemorrhage, which is supplied by the anterior inferior cerebellar artery, it divides into anterior vestibular artery and cochlear artery and supply inner ear[10]. They cause progressive or sudden hearing loss[9,11]. The circulatory system pathology may directly affect hearing in number of ways. One of the vascular pathophysiological mechanisms described is the increase in blood viscosity, which reduces capillary blood flow and ends up reducing oxygen transport, causing tissue hypoxia thus causing hearing complaints and hearing loss in patients[10]. Moreover arterial hypertension may cause ionic changes in cell potentials, thus causing hearing loss[8].

Tinnitus is defined as a sound perceived for more than five minutes at a time in the absence of any external acoustical or electrical stimulation of the ear and not occurring immediately after exposure to loud noise[13], phantom auditory perception, or head noise. Tinnitus is described as subjective, audible only to the patient, or objective, audible to the examiner as well. Tinnitus prevalence rises with increasing hearing loss[14] with 74% of patients complaining of hearing loss having tinnitus[15]. In about 50% of population with self reported tinnitus has been judged as normal[16]. It can be assumed that the alterations in spontaneous activity leading to tinnitus arise from changes in the balance between excitation and inhibition within the auditory system through different underlying mechanisms.

- Abnormal afferent nerve fibers excitation at the cochlear level.
- Mechanical tinnitus based on spontaneous cochlear oscillations.
- Glutamate neuroexitotoxicity.
- Modulation of NMDA and nonNMDA receptors.
- Abnormal ion channel conductance-calcium channel dysfunction.
- Efferent dysfunction/reduction of GABA effect.
- Alteration of spontaneous activity and tonotopic
- Reorganization.
- Stress/psychological disorder.

Objective:

- To assess the type and degree of hearing impairment among essential hypertensive's attending otorhinolaryngology department at Sree Mookambika Institute of Medical Sciences, Kulasekharam, Tamil Nadu.
- To correlate the duration of hypertension and degree of hearing impairment in essential hypertensive patients.

MATERIALS AND METHODS

A descriptive cross-sectional study of 100 Essential hypertensive patients aged between 18-60 years attending otorhinolaryngological department with various ailments were screened for hearing impairment from November 2023-May 2024 whose symptoms went unnoticed and thereby resulting in hearing loss was studied. Essential hypertensive patients on medications as well as newly diagnosed patients and Patients on only hypertensive medication are included in the study. All were screened for deafness using tuning fork tests and pure tone audiogram, along with general physical examination, ear, nose, throat examination and laboratory tests after applying the inclusion and exclusion criteria and willing for informed consent.

All patients willing for taking part in the study were explained in detail about the procedure and informed consent was obtained for the same. Essential hypertensive patients who attend Otorhinolaryngology department at Sree Mookambika Institute of Medical Sciences are selected. Detailed history is taken with emphasis on the hypertensive medications being taken (class of drugs, dosage and duration of treatment). Detailed ear, nose and throat examination which includes otoscopic examination and tuning fork tests to rule out external and middle ear diseases.

Systemic examination (cardiovascular, neurological, renal, hepatobiliary, endocrine, loco motor system) are also carried out for the patients. Hematological investigations include hemoglobin, total count, Differential count and Erythrocyte Sedimentation Rate (ESR), platelet count, blood sugar, serum electrolytes, blood grouping and typing, HIV, HBsAG, and Bleeding time, clotting time, liver function tests, renal function tests, mastoid x-rays and ECG.

After clinical examination was done, patient's blood pressure was measured in sitting position using a manual sphygmomanometer.

After which all patients were subjected to audiological evaluation. Air conduction and bone conduction tests were performed, pure tone average was calculated for three frequencies of 500Hz, 1000Hz, 2000Hz, for both the right and the left ear and plotted in a graph. Similarly the air bone gap was calculated for the frequencies 500Hz, 1000Hz, 2000Hz and plotted in a graph.

RESULTS AND DISCUSSIONS

The most common age group is 51-60 years (50%), then 41-50 years (30%), 30-40 years (18%) and less than 30 years (2%).

There were 100 essential hypertensive patients in our study. Male participants predominated in our study with an average of 69%.

Among 100 patients, 66% of patients had tinnitus, 18% had hearing loss, 5% had vertigo and 11% had other symptoms.

Tuning fork tests rinne test and Weber's test were carried out for all patients. This was done to identify the type of hearing loss clinically. Absolute bone conduction test was done to assess the sensorineural hearing loss. From the above table we observe that none of the ears showed evidence of conductive hearing loss and 42% of them had sensorineural hearing loss in females and 61% had Sensorineural hearing loss in males.

The analysis of the type of hearing loss among 100 essential hypertensive's based on audiogram report obtained in our study indicates that 55% of patients had Sensorineural hearing loss.

On PTA evaluation, in the right ear 45% of patients had normal hearing, 26% had mild sensorineural hearing loss (SNHL), 15% had moderate SNHL, 6% had moderately severe SNHL and 8% had severe SNHL. In the left ear 47% had normal hearing, 13% had mild SNHL, 33% had moderate SNHL, 5% had moderately severe SNHL and 2% had severe SNHL.As per the hearing loss there was predominance of mild and moderate degree hearing loss. The degree of hearing loss was primarily in the mild category with 26% on the right and 37% on the left ear.

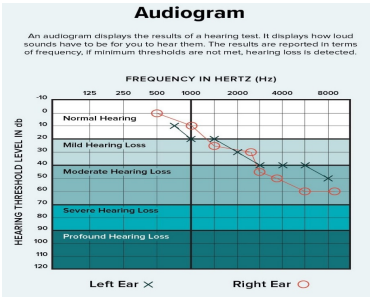

Fig. 1: Audiogram showing degree of hearing loss

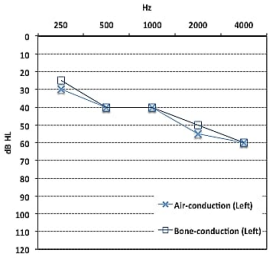

Fig. 2: Audiogram showing sensory neural hearing loss

Table 1: Degree of Hearing Loss

Degree	Hearing loss range (Decibel)
Normal	0-25dB
Mild	26-40dB
Moderate	41-55dB
Moderately severe	56-70dB
Severe	71-90dB
Profound	>90Db

Table 2: Blood pressure classification

Category	Systolic BP (mmHg)	Diastolic BP (mmHg)
Normal	<120	<80
Pre hypertension	120-139	80-89
Stage-I Hypertension	140-159	90-99
Stage-II Hypertension	>160	>100

Table 3: Showing the Age distribution of patients studied

Age in years	No. of patients	percentage
<30	2	2
30-40	18	18
41-50	30	30
51-60	50	50
Total	100	100

Table 4: Showing the Gender distribution of patients studied

Gender	No. of patients	percentage
Female	31	31
Male	69	69
Total	100	100.0

Table 5: Showing the Symptoms distribution of patients studied

	Gender		
Symptoms	Female (n = 31)	Male (n = 69)	Total(n = 100)
Tinnitus	15(48%)	51(74%)	66(66%)
Hearing loss	9(29%)	9(13%)	18(18%)
Vertigo	3(10%)	2(3%)	5(5%)
Others	4(13%)	7(10%)	11(11%)

Table 6: Tuning fork test interpretation of patients studied

	Gender		
Tuning fork test	Female (n = 31)	Male (n = 69)	Total (n = 100)
Rinne right	31(100%)	69(100%)	100(100%)
Rinne left	31(100%)	69(100%)	100(100%)
Weber	31(100%)	69(100%)	100(100%)
ABC Right	13(42%)	42(61%)	55(55%)
ABC Left	13(42%)	40(58%)	53(53%)

Table 7: Audiogram results of patients studied

	Gender		
Audiogram	Female (n = 31)	Male (n = 69)	Total (n = 100)
Right			
SNHL	13(42%)	42(61%)	55(55%)
WNL	18(58%)	27(39%)	45(45%)
Left			
SNHL	13(42%)	40(58%)	53(53%)
WNL	18(58%)	29(42%)	47(47%)

Table 8: PTA results distribution of patients studied

	Gender		
PTA	Female (n = 31)	Male (n = 69)	Total (n = 100)
Right			
0-26	18(58%)	27(40%)	45(45%)
26-40	8(26%)	18(26%)	26(26%)
41-55	3(10%)	12(17%)	15(15%)
56-70	1(3%)	5(7%)	6(6%)
71-90	1(3%)	7(10%)	8(8%)
>90	0(0%)	0(0%)	0(0%)
Left			
0-26	18 (58%)	29(42%)	47(47%)
26-40	7(23%)	30(44%)	37(37%)
41-55	3(10%)	6(9%)	9(9%)
56-70	2(6%)	3(4%)	5(5%)
71-90	1(3%)	1(1%)	2(2%)
>90	0(0%)	0(0%)	0(0%)

Table 9: Blood Pressure distribution of patients studied

	Gender		
Blood Pressure	Female (n = 31)	Male (n = 69)	Total Total (n = 100)
SBP (mm Hg)			
<120	0(0%)	0(0%)	0(0%)
120-139	30(97%)	68(99%)	98(98%)
140-159	1(3%)	1(1%)	2(2%)
≥160	0(0%)	0(0%)	0(0%)
DBP (mm Hg)			
<80	0(0%)	0(0%)	0(0%)
80-89	23(74%)	45(65%)	68(68%)
90-99	8(26%)	24(35%)	32(32%)
≥100	0(0%)	0(0%)	0(0%)

Table 10: Duration (months) distribution of patients studied

	Gender		
Duration (months)	Female	Male	Total
<10	10(32%)	14(20%)	24(24%)
10-40	14(45%)	43(62%)	57(57%)
>40	7(23%)	12(18%)	19(19%)
Total	31(100%)	69(100%)	100(100%)

Table 11: Treatment distribution of patients studied

	Gender		
Treatment	Female	Male	Total
No	0(0%)	1(1%)	1(1%)
Yes	31(100%)	68(99%)	99(99%)
Total	31(100%)	69(100%)	100(100%)

In our study there were 98 patients systolic blood pressure of 120-139mm Hg and 2 patients with 140-159 mm Hg. The diastolic blood pressure in 68 patients was 80-89mm Hg and 90-99mm Hg in 32 patients.

In our study there were 24% patients in less than a year hypertensive patients, 57% people were of three years duration and 19% above three years.

Among 100 essential hypertensive's 99% were taking antihypertensive medications. 1% were not taking medication.

Hearing loss is referred to as the silent, overlooked epidemic of the developing countries because of its invisible nature which prevents detection through routine clinical procedures. In the present study, the association between essential hypertension and hearing loss in the age group between 18-60 years were studied. This study showed that hearing loss can occur when they become hypertensive. The increase in duration of hypertension can cause hearing loss. Many environmental factors play vital role especially fatty diet, stress, family history, and raised cholesterol can cause hypertension. Methods have to be identified to prevent hearing loss due to essential hypertension

In the present study the age group was between 18-60 years, among them the most commonly affected individuals were in the age group 51-60 years. In 100 essential hypertensive patients participated, 69% were males and 31% were females. In both genders tinnitus was the presenting symptom in 66% of the patients followed by hearing loss in 18%, vertigo in 5% and other symptoms in 11%.

In our study based on clinical and audiometric evaluation all essential hypertensive patients having hearing loss were found to have sensorineural hearing loss. On PTA evaluation, in the right ear 45% of patients had normal hearing, 26% had mild sensorineural hearing loss (SNHL), 15% had moderate SNHL, 6% had moderately severe SNHL and 8% had severe SNHL. In the left ear 47% had normal hearing, 37% had mild SNHL, 9% had moderate SNHL, 5% had moderately severe SNHL and 2% had severe SNHL. As per the hearing loss there was predominance of mild and moderate degree hearing loss.

In our study 24% patients were hypertensive for less than a year. 57% patients were hypertensive for three years and 19% patients were hypertensive for more than three years. Among 120 essential hypertensive patients, 99% were taking antihypertensive medications.

Rosen[2] conducted a study on hypertensive patients in USA, there was a correlation between high blood pressure and hearing loss in high frequencies. In the present study correlation was found in mild and moderate frequencies. This may be due to the fact that the present study was done only on essential hypertensive patients.

Bohem *et al* did audiological assessment of 50 hypertensive patients who were above 45 years, in Brazil. He found that 62% had sensorineural hearing loss. Marchiori[7] studied 552 patients, 137 were patients with arterial hypertension of both genders of which 88.32% of these hypertensive patients had Sensorineural hearing loss[17].In the present study patients were in the age group between 18-60 year and 55% of the patients had SNHL.

In a case controlled study carried out in Kenya with 50 elderly individuals using angiotensin receptor blocker medication, Chen *et al* observed a relationship between hearing loss and arterial hypertension in this population[18].

Mondolli *et al* conducted a study in 2009 to verify the relationship between systemic arterial hypertension and hearing loss. In this study there were 392 patients of both genders, aged from 45-60 years old. Their study showed an evident association between systemic arterial hypertension and hearing loss[19]. In the present study also there was a significant correlation between systolic blood pressure and PTA results for both the ears and significant correlation between diastolic blood pressure and PTA results.

According to Baraldi GS *et al,* systemic arterial hypertension and hearing loss have important prevalence in the elderly population[20]. Micro circulatory insufficiency can result in hearing loss due to occlusion of the inferior cerebellar artery. Microangiopathy prevents oxygen and nutrient exchange at cochlear level thus damaging inner and outer hair cells which results in hearing loss[21].

Tinnitus develops in some patients this may be due to metabolic abnormalities, high cholesterol and vascular problems like spasm, occlusion and hemorrhage. In the present study population tinnitus was the presenting symptom in 66% followed by hearing loss in 18%, vertigo in 5% and other symptoms in 11%.

There are many environmental factors such as noise, metabolic alterations, infections, trauma, inhaling of toxic substances, hereditary, ototoxic drugs which can speed up the hair cell damage if they are associated in hypertensive patients[22,23]. Hypertensive patients develop early presbyacusis at an early decade of life compared to the normal people.

CONCLUSION

A descriptive cross-sectional study of hearing impairment among essential hypertensives attending otorhinolaryngology department for various ailments during the period of November 2023-May 2024 was done. There were 100 essential hypertensive patients of both genders 69% were males and 31% were females. Most of the patients were in the 51-60 years age group. The occurrence of hearing loss among essential hypertensive patients in our study is 55%. In both genders tinnitus was the presenting symptom in 66% of patients, followed by hearing loss in 18%, vertigo in 5% and other symptoms in 11%. Among 100 essential hypertensive patients, based on audiogram report obtained in our study indicates that 55% of patients had sensorineural hearing loss. There is a significant association of hearing loss in essential hypertensive patients. The degree of hearing loss was primarily in the mild category with 26% on the right and 37% on the left ear, 15% on right and 9% on left with moderate hearing loss, moderately severe hearing loss in 6% on the right ear and 5% on the left side and severe degree hearing loss in 8% on the right ear and 2% on the left ear of hypertensive patients.

This study was an attempt to show importance of early routine screening for hearing loss in essential hypertensive patients. There is an association between hearing loss and hypertension, though most of the hypertensive subjects had mild sensorineural hearing loss. The prevalence and severity of the hearing loss worsens with the degree of hypertension. Incorporating regular audiological assessment for hypertensive patients could improve the quality of care for hypertension and quality of life for hypertensive patients.

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