



Hypertension as a Risk Factor of Hearing Loss

Tapaswani Mishra^{1*}, Kiran Dukhu¹, Dipti Mohapatra¹, Manasi Behera¹, Nibedita Priyadarsini¹, Priyambada Panda¹, Mahesh C. Sahu²

¹Department of Physiology, IMS and Sum Hospital, K8, KalingaNagara, Siksha O Anusandhan University, Bhubaneswar, Odisha, India.

²Central Research Laboratory, IMS and Sum Hospital, K8, KalingaNagara, Siksha O Anusandhan University, Bhubaneswar, Odisha, India.

*Corresponding author's E-mail: neetho@yahoo.com

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ABSTRACT

Hearing loss is a factor that affects the quality of life of people and it may make oral language receiving difficult. Studies confirm that hearing changes may derive from arterial hypertension. So the study was undertaken to evaluate hypertension as a risk factor of hearing loss. The study was carried out in the Department of Physiology in collaboration with the Department of ENT and Department of Medicine, IMS and SUM Hospital, Bhubaneswar, Odisha, India. In this study, 150 cases and 150 controls groups were taken both genders aged 45-64 years. Hypertension was verified through blood pressure readings by sphygmomanometer, and by systematized questionnaire about hypertension and use of medication for hypertension. Hearing loss was assessed through pure tone audiometry. Only sensory neural deafness was taken. Statistical analysis was made. There is significant risk factor of hearing loss because of hypertension. Hearing loss population under study suggests that hypertension is an accelerating factor of degeneration of the hearing apparatus. By this study we can prevent hearing loss by early detection of hypertension and make an individual lead a normal social life.

Keywords: Hypertension, Hearing loss, Pure tone audiometer, Risk factor.

INTRODUCTION

Hearing impairment affects every fifth adult worldwide. The hearing loss (HL) is a factor that irrespective of the degree of commitment affects the quality of life of the people and when acquired in adult, it appears gradually and may make the oral language receiving difficult. According to data from ASHA (American Speech- Language- Hearing Association)¹ there are currently 28 million individuals in USA with some type of hearing loss and 80 % of those are irreversible cases. These data also shows that 4.6% of the individuals between 18 and 44 years have hearing loss while 14% of the middle aged individuals between 45 and 64 years and 54% of population above 65 years have some hearing loss. This is due to number of factors, such as intense or continuous noise exposure, inhalation of toxic substances, ingestion of ototoxic drugs, metabolic and circulatory alteration, infections, different types of injuries and genetic inheritance. In the adult population studies confirmed that HL starts at about 30 years of age and increases progressively along the years, although there is resemblance in the audiologic configuration between men and women, men are affected earlier and more intensely than women. The hearing system affection may cause psychosocial effect, amongst which low self-esteem, isolation, depression and irritability and these problems interfere with the quality of life of individuals.

However it is known that metabolic changes, such as systemic arterial hypertension (SAH) is present in adults and may be empowered by the presence of hearing loss or vice versa.

Katz² says that all living cells in the human body depend on proper supply of oxygen and nutrients in order to maintain their function and such supply depend on functional and structural integrity of the heart and blood vessels. Hypertension is most common vascular disorder, may facilitate structural changes in the heart and blood vessels. High blood pressure in vascular system may cause inner ear hemorrhage, which may cause progressive or sudden hearing loss. This circulatory system pathology may directly affect hearing in a 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 hearing complaints and hearing loss in patients. Moreover, arterial hypertension may cause ionic changes in the cell potentials, thus causing hearing loss. Studies confirmed that hearing changes may derive from systemic arterial hypertension (SAH) and a few diseases are responsible for such frequent complications such as those arising out of arterial hypertension: cerebro vascular accident, cardiac, renal, and peripheral vascular insufficiency. Hypertension is taken as a silent disease for it doesn't present any symptom. However some people present headache, dizziness, tinnitus, chest pain and weakness, which may be alert signals. The association between tinnitus and hearing loss has already been fully described. According to literature 85% to 96% of the patient with tinnitus has some degree of hearing loss and the prevalence of tinnitus increases along the aging years. The results attained with the present research project will certainly serve as basis for a greater integration between cardiologist, nephrologist, otorhinolaryngology's, speech therapist and other health care professionals involved with arterial hypertension and hearing loss care, bringing



for the professionals involved in order to improve quality of care in therapy and rehabilitation of these patients.

MATERIALS AND METHODS

Hearing loss with hypertension patients were studied in the Department of Physiology, in collaboration with the Department of ENT and the Department of Medicine IMS and SUM Hospital, Bhubaneswar, in the period of June 2011 to July 2013. There were 150 cases and 150 control group taken for the study. Patients were included in the age of 45-65 years. 150 patients with hearing loss (incident cases) were obtained in the sequence of medical visits. Only sensory neural hearing loss patients were taken. 150 patients of control group who were living nearby area of cases. The control group individuals were without hearing loss. Some individuals were with hypertension and some were without hypertension. With the help of pure tone audiometer (PTA) hearing patients were identified. The result, when plotted graphically is called a pure tone audiogram. The instrument used for this is an electronic device called pure tone audiometer. It consist of an audio-oscillator which generate pure tone sounds of various frequencies usually at regular steps of 125, 250, 500, 1000, 1500, 2000, 3000, 4000, 6000, 8000 and 10,000Hz only. Each tone can be separately amplified to a maximum of 100 or 110 dB in most frequencies except the very low and very high frequencies where the range is slightly lesser. The tones are attenuated by an attenuator dial which is marked in decibels (dB) and graduated in 5 decibel steps from -10 to 110 dB. The audiometer is connected to standard and specified earphones or to a bone conduction vibrator through which the sound is presented to the subject's ear. The audiometer is operated by means of a noiseless switch called interrupter which can introduce or interrupt a tone. PTA only measures thresholds, rather than other aspects of hearing such as sound localization. However, there are benefits of using PTA over other forms of hearing test, such as click auditory brainstem response. PTA provides ear specific thresholds, and uses frequency specific pure tones to give place specific responses, so that the configuration of a hearing loss can be identified. As PTA uses both air and bone conduction audiometry, the type of loss can also be identified via the air-bone gap. Conventional audiometry tests frequencies between 250 hertz (Hz) and 8 kHz, whereas high frequency audiometry tests in the region of 8 kHz-20 kHz. Some environmental factors, such as ototoxic medication and noise exposure, appear to be more detrimental to high frequency sensitivity than to that of mid or low frequencies. Therefore, high frequency audiometry is an effective method of monitoring losses that are suspected to have been caused by these factors. It is also effective in detecting the auditory sensitivity changes that occur with ageing. With questioner discussion of patients the data of age, gender, schooling, weight, height, and arterial pressure were maintained. All the data generated from the patients were statistically analyzed in the excel Microsoft office 2007.

RESULTS

A total of 150 test cases and 150 control cases were studied among them 83(55.7%) were male and 67(44.3%) were female. In the control group 76(50.7%) and the numbers of females among the control group were 74(49.3%). There were slightly more number of males than the number of females in the control group.

It was found that 88 (58.7%) of the individuals had both hearing loss and hypertension, 62 (41.3%) of the individuals had hearing loss but no hypertension, 31 (20.7%) of the individuals did not had hearing loss but had hypertension and 119 (79.3%) of the individuals neither had hearing loss nor hypertension. There is a significant association between hypertension and hearing loss (p-value < 0.0001) (Table 1).

Table 1: Complete distribution of cases and controls according to hypertension and hearing loss, BP>140/90.

Hypertension	Hearing Loss			
	Yes		No	
	Number of Cases	Percentage (%)	Number of controls	Percentage (%)
Yes	88	58.7	31	20.7
No	62	41.3	119	79.3
Total	150	100	150	100

The number of individuals in the age groups 45-50 years who had both hypertension (HTN) and hearing loss (HL) was 14 (15.9%). In the age group 51-55 years who had both hearing loss and hypertension was 13 (14.8%) and in the age group 56-60 years who had both hearing loss and hypertension was 27 (30.7%). In the age group 61-65 years who had both hearing loss and hypertension was 34 (38.6%). The higher age group 61-65 years were significantly affected with hypertension and hearing loss the lower age groups. (p-value< 0.001) (Table 2).

Table 2: Age distribution of individuals with both hearing loss and hypertension

Age	No. of cases with both HTN and HL	Percentage of both HTN and HL (%)
45-50 years	14	15.9
51-55 years	13	14.8
56-60 years	27	30.7
61-65 years	34	38.6

The number of males in the age group 45-50 years with hearing loss and hypertension were 8 (15.6%). The number of males in the age group 51-55 years with hearing loss and hypertension were 7 (13.8%). The number of males in the age group 56-60 years with hearing loss and hypertension were 18 (35.3%). The number of males in the age group 61-64 years with hearing loss and hypertension were 18(35.3%). The higher age group males were significantly affected with hearing



loss and hypertension than lower age group with p-value < 0.002 (Table 3).

Table 3: Age distribution of males with both hypertension and hearing loss

Age	No. of males	Percentage (%)
45-50 years	8	15.6
51-55 years	7	13.8
56-60 years	18	35.3
61-65 years	18	35.3

The table shows that the number of males with both hearing loss and hypertension were 51 (58%) and the number of females with both hearing loss and hypertension were 37 (42%). There were significantly more number of males than females with hypertension and hearing loss p-value < 0.0001 (Table 4).

Table 4: Sex distribution of cases with hearing loss and hypertension

Sex	Total No. of cases	No. of cases with HTN and HL	Percentage (%)
Male	83	51	58
Female	67	37	42
Total	150	88	100

The number of females with both hearing loss and hypertension in the age group 45-50 years is 6 (16.2%) which was also same for the age group 51-55 years. The number of females with both hearing loss and hypertension in age group 56-60 years was 9 (24.3%). The number of females with both hearing loss and hypertension in the age group 61-65 years was 16 (43.5%). The higher age groups of females were significantly affected more with hearing loss and hypertension than the lower age groups (p value < 0.0001) (Table 5).

Table 5: Age distribution of females with both hearing loss and hypertension among cases

Age	No. of females with HTN and HL	Percentage (%)
45-50 years	6	16.2
51-55 years	6	16.2
56-60 years	9	24.3
61-65 years	16	43.5

Among the 88 cases with hypertension, only 10 (11.3%) did not use medications. Among the 31 control group with hypertension only 2(6.5%) did not use medication. Among the total 119 individual with hypertension only 12(10.2%) did not use anti-hypertensive medication (Table 6).

Table 6: Distribution of individuals not taking antihypertensive medications

Hypertensive individuals	No. of individuals	Individuals not taking anti-hypertensive medications	Percentage (%) of individuals not taking anti-hypertensive medication
Cases	88	10	11.3
Controls	31	2	6.5
Total	119	12	10.2

DISCUSSION

The present study showed the existence of an association between hearing loss and arterial hypertension in individual between 45 and 65 years. Such associations between hearing loss and arterial hypertension has been an important object of research of Lucianalozza de moraes Marchiori et al (2006).³ This is also in accordance with the report of Rosen et al and Hansen et al⁴ and Maria Fernanda et al (2009).⁵ While Amstutz et al (1999)⁶ and Baraldi GS et al (2004)⁷ deny this association and even present different result in the studies carried at distinct times. As to the methodological characteristics of this study the care taken in outlining the age factor, focusing on the age range of middle aged individuals between 45 and 65 years as they do in hypertension investigations, (Antikainen RL et al(1998, 2000)⁸ the strict exclusion criteria, eliminating individuals with the diseases and specific activities capable of producing hearing alterations and care taken in diagnosing their hearing loss and arterial hypertension certainly helped to reduce selection biases. Pertaining to the statistical analysis it was found out that there was a significant association between hearing loss and hypertension (p =0 .0001). This present study was non-paired case control study and was done by SPSS version 17, odds ratio = 5.45. This means that individuals having hypertension are five times more risk for developing hearing loss than normotensive individuals. This is in accordance to Luciana lozza de moraes Marchiori et al (2006) ³. With ageing, there is higher number of chronic diseases. Systemic arterial hypertension and hearing loss have important prevalence in the elderly population according to Baraldi GS et al (2004).⁷ In this study we observed that although the sample individuals were between 45 and 65 years (middle age) the higher age group proved to be an independent risk factor for hearing loss(p-value < 0.001). This is probably due to the fact that as we all know, with age there are structural alteration in the whole body, including the hearing system which is in accordance with ASHA (American- Speech- Language- Hearing – Association, 2004).¹ Despite these structural changes caused by age, Pedalini MEB et al (1997)⁹ and Otaviani et al (1998)¹⁰ mention presbycusis, which usually start at around 65 years of age and is a hearing loss type accruing from ageing itself and is associated to specific audiologic characteristics being a descending, bilateral and symmetrical sensorineural hearing loss type.

According to Rarey KE et al (1996)¹¹ in the experimental study using rats with arterial hypertension, it was noted that hypertension is an important risk factor for age-related hearing loss with ageing. The hypertensive animals had a higher action potential threshold, a higher electro chemical potential happened only in the extremely aged animals, while potassium concentration increased not only in the endolymphatic cells, but also in the perilymphatic ones. These data help us understand hearing loss in hypertensive individuals. According to Marchiori L L M et al(2003)¹² and Collet L et al (1992)¹³ the environment factors such as noise, inhalation of toxic substances, certain metabolic and circulatory alteration, infections and genetic inheritance, may also influence the individuals hearing, often times accelerating the process of cochlear degeneration. As to gender, there was a difference in the men to women ratio in both groups, due to fact it was not a pair sample. Cases were taken at random, during regular medical visits, while the control groups were selected by the individuals staying nearby places of hearing loss patients. Greater number of men was taken because of hearing impairment suspicion. In this study in the cases group among hypertension and hearing loss, men were significantly affected more than women (p-value< 0.0001).

As per Dubno JR et al (1997)¹⁴ after a study that correlated age, gender and hearing acuity for spoken word, reported that males had a significant age related drop in their hearing acuity and speech recognition, while women did not show such pattern. This corroborates with the present study. Pearson et al (1995)¹⁵ after a longitudinal study involving 681 men and 416 women, without signs of specific hearing disorders, unilateral or noise-induced hearing loss, reported that there is a two fold increase in the speed at which men lose their hearing, when compared to women, showing that age and gender are indeed related to hearing loss even in groups without signs of noise-induced hearing loss which is in accordance with the present study. According to Collet et al (1992)¹³ after studying the influence of age and gender, reported that it was possible to determine a correlation with hearing. In the present study, carried out with male individuals with ages varying between 45 and 65 years among cases, the male gender proved to be an independent risk factor for hearing loss. This corroborates the studies that have reported a significant drop in hearing acuity for male individuals as they age. (Dubno JR et al (1997)¹⁴ Pearson et al (1995)¹⁵ and Collet et al 1992.¹³ The care related to arterial hypertension and hearing loss will certainly serve to avoid the frustrations caused by the reduction in one's capacity to understand oral language caused by a reduction in hearing acuity, as per Ferreira DR et al (2004)¹⁶, Tambs K et al (2004)¹⁷ and Marques et al (2004)¹⁸ which may happen to arterial hypertensive patients.

CONCLUSION

In this study we found that the incidence of hearing loss and hypertension is more in higher age group i.e. 61-65 years. Increased incidence of hearing loss and hypertension is significantly more in males than in females among cases. The present study shows that there is a very significant association between hearing loss and hypertension. By this study we conclude that patients having hypertension will have five times risk of developing hearing loss than a normal person without hypertension. Since the study has shown that arterial hypertension is an independent risk factor for hearing loss, beside the male gender and advanced age, it is to highlight that may mitigate the mechanism that cause degeneration of hearing apparatus caused by circulatory problems most specifically high blood pressure. Therefore the result in this research, through evidence of association between arterial hypertension and hearing loss, can allow for an integrated work of cardiologist, nephrologist, otolaryngologist, audiologist and other health professionals concerned with alteration caused by arterial hypertension.

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