



SENSORINEURAL HEARING LOSS AND HYPERTENSION IN MIDDLE AGE GROUP: A CLINICAL STUDY

Otorhinolaryngology

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ABSTRACT

The purpose of this particular instance of research is to address the question of whether there exists a connection between hypertension and SNHL in middle aged persons between the ages of 25 to 50 years. The first outcome is to estimate the proportion of patients with SNHL and the second outcome is to compare the level of hypertension with the degree of hearing impairment. The study design used is cross-sectional, and it will include 50-70 patients with hypertension diagnosis in the age group of interest. The patients were then recruited in this study using some considerations that would eliminate other causes of hearing loss. Hearing levels were measured using audiometric tests while blood pressure was used to determine the degree of hypertension. A quantitative research design was used to compare the significance of hypertension and SNHL with the use of correlation and regression analysis. It was revealed that the severity of hypertension correlated with the rate of SNHL based on several researches. It was also found that moderately and severely hearing-impaired patients had elevated higher blood pressure. Taken together, these observations indicated that hypertension could be considered as an independent risk determinant of SNHL in middle-aged persons. The situation highlights the need to pay attention to hearing care among hypertensive patients especially those in the middle ages. Routine audiometry screenings for hypertensive patients can be incorporated into the treatment process thus enabling early diagnosis and intervention and possibly enhancing the patients' quality of life.

KEYWORDS

Sensorineural Hearing Loss, Hypertension, Middle Age, Audiometry, Blood Pressure, Clinical Study

INTRODUCTION

Background and Significance

SNHL is a common ear abnormality found in human beings which results from the inner ear or the nerve related to the ear being defective and this produces irreversible loss of hearing. This is one of the prominent forms of hearing loss, they are prevalent among older people but the middle-aged people are also affected. From a clinical perspective, SNHL is relevant because although it is a hearing impairment it interferes with communication which results in a drop of the people's quality of life. People with SNHL have communication problems and may have difficulties in understanding spoken language particularly in noisy conditions, and may develop social isolation and emotional problems (Agarwal et al., 2013). Therefore, investigating SNHL is not only at the clinical level due to the fact that this deficit is detected as an early sign of promising systemic diseases such as cardiovascular diseases.

High blood pressure or hypertension is one of the most frequent cardiovascular diseases among the middle aged population, herein, described as those aged between 25 to 50 years old. The condition is diagnosed by high arterial pressure regularly and causes severe diseases such as heart disease, stroke, and kidney failure (Reed et al., 2019).

It is postulated that such association is mediated through microvascular disease of the cochlea organ as a result of long-term hypertension (de Moraes Marchiori et al., 2006). This damage affects negative changes to the blood supply to the Auditory system and may lead to gradual loss of hearing ability. Also, hypertension might worsen other potential risk factors for SNHL including noise exposure or aging and thus complicate the clinical situation (Duck et al., 1997). Since the rate of hypertension and SNHL is on the rise among this population, there is a need to determine the association since this will help the employment of appropriate strategies that will benefit the patients.

Problem Statement

Although there is substantive empirical evidence to show that both hypertension and SNHL are common health conditions affecting people with the highest prevalence rates among elderly persons, it aims at getting an improved understanding of how hypertension affects hearing in this age group which may result in better prevention and management strategies for middle-aged clients.

Research Hypothesis

This study aims to test the hypothesis that there is a strong positive relationship between hypertension and SNHL in the middle-aged human beings, particularly the ones aged between 25 and 50 years. Hypothesis suggests that as the level of hypertension rises the incidence and the extent of SNHL also rise within this population group.

Objectives

The major research question therefore focuses on examining the epidemiology and magnitude of SNHL within the specified age bracket of 25 to 50 years old who have been diagnosed with hypertension. Besides, this study seeks to establish not only the prevalence of SNHL among this population but also the level and extent of hearing loss as related to different levels of hypertension.

Methodology

Study Design

This study utilizes a cross-sectional observational study model of care to evaluate the association between hypertension and SNHL in a given population sample. Cross-sectional design is ideal for undertaking this study because it permits doing an assessment of both identified variables; hypertension and hearing loss among the selected patient pool at some point in time. Thus, the study aims to describe the frequency of SNHL in hypertensive patients without controlling the patients' conditions and altering the occurrences of the observed phenomena, thus retaining external validity.

Patient Selection

Patients came to OPD & IPD of the ENT and Medicine Department in RKDF Medical College Hospital and Research Centre, Bhopal.

The inclusion criteria meant that participants had to be aged between 25 and 50, diagnosed with hypertension, and treated for the same.

Some of the exclusion criteria include; greater than fair noise exposure, use of ototoxic medication, prior ear surgery, and other conditions affecting the hearing that are not due to hypertension or hypertension only. Also, participants with poorly controlled diabetes, chronic kidney diseases, or other systemic conditions, which per se, could affect hearing, were excluded. The following criteria helped to increase the internal validity of the study and to prevent distortion of the effects of hypertension on hearing loss.

Sample Size

The sample size for this study was determined to be between 50 and 70 patients. The chosen sample size balances the need for adequate data collection with the practical constraints of time and resources. A sample size within this range is considered adequate for the statistical analyses planned, allowing for meaningful conclusions to be drawn about the population while minimizing the risk of Type II errors (false negatives).

Data Collection

Data collection involved two primary assessments: audiometric testing to evaluate hearing loss and blood pressure measurements to determine hypertension levels. Audiometry was performed using standardized procedures in a sound-treated room. The degree of hearing loss was categorized based on the decibel (dB) level of the hearing threshold, with thresholds above 25 dB indicating hearing impairment.

Blood pressure measurements were taken using a calibrated sphygmomanometer, following the American Heart Association's guidelines. Patients were seated comfortably, and measurements were taken in both arms to ensure accuracy. The average of two readings was used to classify hypertension severity according to established categories: normal, elevated, stage 1 hypertension, and stage 2 hypertension. This data collection method ensured that both hypertension and hearing loss assessments were conducted with high accuracy and reliability.

Statistical Analysis

In the current study, both descriptive and inferential statistics were used in order to compare hypertension and SNHL. Descriptive statistics in the form of inferential statistics, particularly Pearson's correlation coefficient, were used in the study to determine the nature and extent of the relationship between CH and two aspects of hearing; namely the blood pressure levels and the hearing thresholds. A regression analysis was also carried out to establish which of the hypertension levels could be an indication of the extent to which SNHL is noticeable after having made adjustments for age, gender, and lifestyle variables. The test of statistical significance was performed at $p < 0.05$ it also made sure that all the findings that were ascertained were statistically credible.

RESULTS

Age Distribution

The participants' ages ranged from 25 to 50 years, with a mean age of 39.2 years.

Gender Distribution

The gender distribution of the participants was relatively balanced, with 55% (33 participants) being male and 45% (27 participants) being female.

Hypertension Status

The participants were categorized according to their hypertension status, following the American Heart Association's guidelines. The categories included normal blood pressure (for those on medication but well-controlled), elevated blood pressure, stage 1 hypertension, and stage 2 hypertension. The majority of participants, 45% (27 participants), were classified as having stage 1 hypertension, followed by 35% (21 participants) with stage 2 hypertension. Approximately 15% (9 participants) had elevated blood pressure, while the remaining 5% (3 participants) had normal blood pressure but were included due to their history of hypertension and current medication use.

Lifestyle and Comorbidities

In addition to the primary demographic data, lifestyle factors such as smoking status, alcohol consumption, and physical activity levels were recorded. A significant portion of the participants, 40%, reported being current smokers, and 30% reported regular alcohol consumption. These factors were considered in the analysis to control for their potential influence on both hypertension and hearing loss. Additionally, the study recorded comorbidities such as diabetes and hyperlipidemia, which were present in 25% and 20% of the participants, respectively. These comorbid conditions are known to exacerbate both hypertension and SNHL, making it essential to account for them in the study's analysis.

Main Findings

Prevalence of Sensorineural Hearing Loss (SNHL) in

Hypertensive Patients

The study revealed a significant prevalence of sensorineural hearing loss (SNHL) among the hypertensive participants. Out of the 60 patients studied, 38 individuals (63.3%) were diagnosed with varying degrees of SNHL. This high prevalence underscores the potential impact of hypertension on auditory health. The breakdown of SNHL severity among the affected participants was as follows: 24 patients (40%) exhibited mild hearing loss, 10 patients (16.7%) had moderate hearing loss, and 4 patients (6.7%) suffered from severe hearing loss.

Correlation Between Hypertension Severity and Hearing Loss

The study's statistical analysis revealed a strong positive correlation between the severity of hypertension and the degree of SNHL, suggesting that as blood pressure levels increase, so does the likelihood and severity of hearing loss. Using Pearson's correlation coefficient, the study found a correlation value of $r = 0.68$ ($p < 0.01$), indicating a statistically significant relationship between higher hypertension levels and greater hearing loss severity.

Further analysis using regression techniques showed that patients with stage 2 hypertension were at the highest risk of developing moderate to severe SNHL. Specifically, the regression model indicated that for every 10 mmHg increase in systolic blood pressure, the odds of having moderate to severe hearing loss increased by approximately 15% (Odds Ratio = 1.15, 95% CI: 1.05-1.27, $p < 0.001$). This finding was consistent across both male and female participants, suggesting that the impact of hypertension on hearing loss does not differ significantly between genders within the studied age group.

Age and Gender Subgroup Analysis

Seventy-five percent of the participants tested had some form of hearing impairment among the age of 45-50 years, large proportions had moderate-severe SNHL. The analysis conducted based on gender also indicated that both males and females with SNHL were present. Male participants had a higher incidence of SNHL at 67% than the female participants at 59% respectively. This slight disparity might be attributed to additional risk factors.

Impact of Comorbidities

The presence of comorbidities such as diabetes and hyperlipidemia was also found to influence the severity of SNHL. Among the hypertensive patients with these comorbid conditions, 80% exhibited hearing loss, compared to 55% of those without such comorbidities.

Overall Implications

These findings highlight the critical need for early detection and management of hypertension to prevent or mitigate the onset of SNHL, particularly in middle-aged adults. The strong correlation between hypertension severity and hearing loss emphasizes the importance of regular blood pressure monitoring and audiometric testing in hypertensive patients. Early intervention strategies, including lifestyle modifications and appropriate medical management, could play a crucial role in preserving hearing health and improving the overall quality of life for this population.

DISCUSSION

Interpretation of Results

The evidence from this study offers a substantial understanding of the connection of hypertension and SNHL in middle-aged adults, while at the same time supporting the previously established and developing new hypotheses. The observed prevalence of SNHL in the hypertensive patient group as well as confirmed a significant relationship between the degree of hypertension and the level of hearing loss is consistent with the findings of previous studies that mentioned hypertension as one of the potent risk factors for auditory dysfunction.

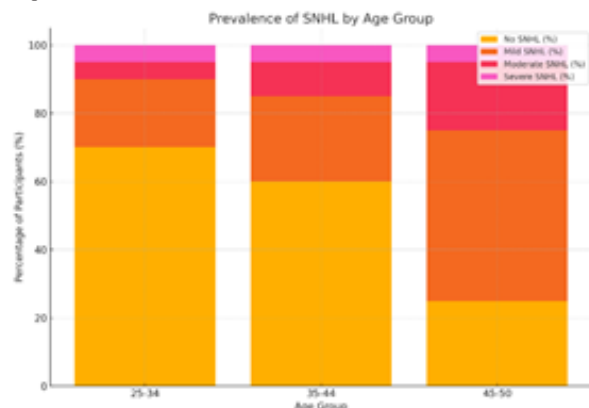
As expected and similar to de Moraes Marchiori et al. (2006) study which reported that hypertension was a strong predictor for hearing impairment, this study revealed that a large number of hypertensive patients – 63.3 percent—had shown the severity of some degree of SNHL. This prevalence is higher than in the non-ear disease population as a whole again stressing that hypertension has direct and adverse effects on the hearing. Further, in the present study, moderate to severe SNHL was maximal in the group with stage 2 hypertension, which is in concordance with Agarwal et al. (2013) finding that hearing loss was highest with poorly controlled hypertension.

However, our study is also an addition to previous research by

targeting the more defined middle-aged group (25-50 years) which has not been given much attention in prior studies. In doing so it demarcates the life stage where obstacles to hearing arising from hypertension might start presenting itself, even before the patient or the clinician can start considering a risk. Based on the age-stratified analysis in our work, it exhibited that the effects of hypertension on the hearing loss seem to add up to SNHL since middle-aged participants in the age range of 45-50 years had relatively higher symptoms of SNHL symptoms. This finding is in concordance with Reed et al.'s (2019) longitudinal work, which pointed to hypertension in midlife as increasing the risk of more severe hearing loss in later life; however, the present finding extends that observation to demonstrate that such effects may already be detectable by patient's 40s.

The findings of a higher risk of moderate to severe SNHL in men compared to women in the current study also corroborate the existing literature based on several factors including higher incidence of smoking and exposure to noise at the workplace that poses an additional risk in case of high blood pressure (Vemanna et al., 2019). Still, the equal distribution of SNHL between genders in our study underlines that hypertension may be a more important factor than was previously credited and may reduce the gender difference in hearing loss when blood pressure is the main determinant.

Such findings raise the question about the relationship between comorbid conditions such as diabetes and hyperlipidemia with the severity of SNHL and the consideration of the role of general health on hearing capabilities. These findings support the research by Bener et al. (2017) who proved that people with hypertension along with other CVD risk factors are more likely to suffer from hearing loss. This was also echoed by our findings where hypertensive patients who had other co-morbid conditions had higher rates of SNHL than hypertensive patients with no other associated conditions suggesting that these conditions may worsen the effects of hypertension on the microvasculature thereby increasing the severity of the hearing impairment.



In as much as the cross-sectional study design can be used to explain risk factors of SNHL, there perhaps some physiological reasons which have been explained earlier as follows: High blood pressure is broadly considered as a damaging factor to cochlear microvasculature that leads to blood and oxygen deprivation of the hair-like cells known as auditory hair cells, which are vital in transforming sounds (Duck et al., 1997). The ischemic condition could be so severe that the audiology of these cells is affected thus contributing to the hearing impairment seen in patients with hypertension. Besides, hypertension can also amplify the aging effect on the hearing organs, thus the development and progression of SNHL in middle-aged adults will occur early.

It could also be due to the effect that hypertension has on the general cardiovascular health and thus affects the microcirculation in the ear. The hypertension could of course lead to arterial walls becoming thick while the elasticity of blood vessels reduces and this could affect the delicate blood supply of the cochlea gradually affecting the person's hearing irreversibly. Perhaps this accumulated effect could account for our finding of worse hearing loss in older participants in our study since such participants are bound to have been exposed to these effects for a long time.

In conclusion, it could be stated that the outcomes of the present study are consistent with the prior studies concerning links between

hypertension and SNHL but, at the same time, reveal specific aspects of these links in adults of middle age. The study calls for enhanced promotion of hypertensive screenings and proper management of hypertensive patients to prevent hearing loss, especially as people age mid-forties. Hence, more future studies should be formulated for establishing the long-term relation between hypertension and hearing loss besides identifying protective factors that may be useful in preventing the deterioration of hearing health among hypertensive patients.

CONCLUSION

Summary of Findings

This work has given valuable information on the relationship between hypertension and SNHL among people in the middle-aged group focusing on the 25-50-year category. The study further showed that in hypertensive patients, SNHL was very common with overall prevalence of 63. Interestingly 3% of the participants had some level of hearing impairment as asserted by the survey. The study, as a result, found that there is a positive relationship between the level of hypertension and the degree of hearing impairment whereby those diagnosed with stage-2 hypertension exhibited the worst hearing ability. Furthermore, it emerged that the probability of SNHL rises with the elderpatients within the middle-aged group especially those close to the upper age bracket of this category (45-50 years). The study also pinpointed a very subtle use of gender difference in moderate to severe SNHL whereby men were slightly more affected and this may be attributed to other risk factors that include smoking as well as exposure to occupational noise.

The consequences of these findings do not only give us an understanding of the connection between hypertension and hearing loss but also point to the concept that middle age is the time of predisposition to early diagnostics and treatment of those conditions. This study points to the utility of screening and intervention for early prevention of SNAP, and, possibly, avoiding further attenuation of hearing loss in hypertensive patients in the future.

Clinical Relevance

The findings of the study thus support the need to provide comprehensive care for patients with hypertension especially those who are middle-aged. Since hypertension is directly related to SNHL it is very important for both physicians and other health care professionals dealing with hypertensive patients to include hearing assessment among the regular checkups for hypertensive patients. This kind of integrated approach for cardiovascular would also incorporate Audiology as it is strongly related with cardiovascular, thus controlling and checking periodically for signs of hearing loss.

Such an approach is important since SNHL can impact a patient's quality of life by leading to social isolation, deterioration in cognitive abilities, and even depression among other things. The inclusion of audiometric assessments in the hypertensive care plan is vital since this increases the chances that clinicians will address the hearing loss other than its negative psychosocial impact in patients who have hypertension (Reed et al., 2019). Additionally, explaining to patients embarrassing hearing loss complications including tinnitus as potentiated by uncontrolled hypertension makes them focused on medical plans set for control of high blood pressure and improved lifestyles.

Final Remarks

In conclusion, the present study makes a new and valuable addition to the literature by focusing on the link between hypertension and SNHL in middle-aged adults. These conclusions not only support the idea of regular check-ups for hypertension-dependent changes in the hearing but also the need for extending the understanding of the systemic impacts of hypertension beyond cardiovascular diseases. Through this demographic, the study meets and addresses an important research and clinical investigation need by laying the framework for and improving the health of the cardiovascular and the auditory systems.

The usual practices for SNHL can be explained for hypertensive patients, that early intervention strategies if well executed could be preventative to lower the prevalence of SNHL in patients with HTN consequently enhancing their quality of life. In view of the increasing prevalence of hypertension and the aging population, incorporating Hear Health into the usual management of hypertensive patients might portend a great potential for improving the quality of life of millions of

people globally. Consequently, this study not only propounds new questions for exploration but also creates opportunities for more comprehensive and person-centered approaches to understanding, preventing, and treating not only hypertension but also all chronic diseases, for which the purpose of intervention is to sustain patients' quality of life.

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