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THE RELATIONSHIP BETWEEN HYPERTENSION AND THE INCIDENCE OF TINNITUS IN PATIENTS AT PKU MUHAMMADIYAH GAMPING HOSPITAL

Tiara Nastiti[1*], Rizka Fakhriani[2], Asti Widuri[2]
[1]Faculty of Medicine and Health Science, Universitas Muhammadiyah Yogyakarta
[2]Department of Otorhinolaryngology-Head and Neck Surgery, Faculty of Medicine and Health Science Universitas Muhammadiyah Yogyakarta

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Corresponding Author:
E-mail: tiaranastiti1@gmail.com

ABSTRACT

Background: According to information provided by the World Health Organization (WHO), around 15% of the world's total population experiences tinnitus. The causes of tinnitus vary, including underlying diseases, one of which is hypertension. Meanwhile, in the Special Region of Yogyakarta it ranks 4th for the province with the highest cases of hypertension in Indonesia. **Objective:** This study aims to determine the relationship between hypertension and the incidence of tinnitus at PKU Muhammadiyah Gamping Hospital. **Methods:** This type of research is quantitative with analytical observation using a cross-sectional approach using medical records as the data source. The total sample in this study was 56 patients at the ENT Polyclinic at PKU Muhammadiyah Gamping Hospital who met the exclusion and inclusion criteria. Data analysis used univariate and bivariate Fisher exact tests. **Results:** The research results showed that 30 of the 56 subjects had hypertension with tinnitus. The results of the bivariate test of the relationship between hypertension and tinnitus produced a p value of 0.008 ($p < 0.05$) and an r value of 0.377. **Conclusion:** There is a significant weak relationship between hypertension and tinnitus in patients at the ENT Polyclinic at PKU Muhammadiyah Gamping Hospital. Among the degrees of hypertension that have been studied, grade 2 hypertension has the strongest relationship with tinnitus. Hypertension conditions can cause damage to blood flow in the cochlea due to damage to blood flow autoregulation which then causes ischemia in the cochlea and causes clinical manifestations in the form of tinnitus.

BACKGROUND

Tinnitus is a type of hearing disorder in the form of a sensation of sound coming from inside the ear without any external stimulation. The sound sensations that arise from tinnitus can vary, such as ringing, roaring, buzzing, swishing, hissing, fluttering, and clicking sounds.[1] Based on information obtained from the World Health Organization (WHO), around 15% of people experience tinnitus from the total world population.[2] The prevalence rate of tinnitus in several countries has also increased, such as in the United States, which is around 45 million people and in Europe it has reached around 70 million.[3] In Indonesia itself, no research has been found on the prevalence of tinnitus in the national population.[4]

The causes of tinnitus vary, some of which are caused by underlying diseases, one of which is hypertension or increased blood pressure. According to The Joint National Committee 8, hypertension is classified into 4 levels, namely normal, pre-hypertension, grade 1 hypertension, and grade 2 hypertension. This research will use data on blood increases starting from pre-hypertension to grade 2 hypertension. In the Special Region of Yogyakarta itself, there are so many cases of hypertension that it ranks 4th for the province with the highest cases of hypertension in Indonesia.[5]

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According to previous research, hypertension is a high-risk factor for tinnitus.[6] However, based on cross-sectional research that has been carried out, there is no significant relationship found between hypertension and tinnitus.[7]

Based on previous research, there are several possible mechanisms of action that explain the effect of hypertension on tinnitus. For example, hypertension can cause damage to blood flow in the cochlea due to damage to blood flow autoregulation. This causes hearing loss.[8] Impaired blood flow autoregulation can cause ischemia in the cochlea and cause clinical manifestations in the form of tinnitus.[9] There are conflicting views on how hypertension relates to the occurrence of tinnitus. This forms the foundation for the researchers to investigate the relation between hypertension and the incidence of tinnitus at the Ear-Nose-Throat Polyclinic at PKU Muhammadiyah Gamping Hospital.

METHODS

This research is a quantitative study that uses an analytical observation approach with a cross-sectional method. Medical record data from 2020 – 2024, which is a type of secondary data, is used as a data source in this research. The population in this study were patients at the ENT Polyclinic at PKU Muhammadiyah Gamping Hospital. Meanwhile, the sample in this study consisted of patients who had been selected using inclusion and exclusion criteria. The inclusion criteria in question are patients with blood pressure data > 120/80 mmHg, aged between 18 – 55 years (young adults), have complete medical records, and are outpatients at the ENT Polyclinic at PKU Muhammadiyah Gamping Hospital. Meanwhile, the exclusion criteria in question are that patients have hearing loss, head trauma, ear infections, diabetes mellitus, neurological disease, previous use of hearing aids, occupational noise exposure history, and past ear surgery. The sample size to be studied is 56 patients. With calculations carried out using the Lemeshow formula, the minimum sample size is 50 samples.

RESULTS

Table 1. Age and Gender Characteristics

Characteristic		Gender					%
		Men	%	Women	%	Total	
Age	20 – 29	4	7,1	3	5,4	7	12,5
	30 – 39	3	5,4	2	3,6	5	8,9
	40 – 55	19	33,9	25	44,6	44	78,6
Total		26	46,4	30	53,6	56	100

The table shows that the majority of hypertensive patients in the ENT polyclinic are women, namely 30 people (53.6%), while men are 26 people (46.4%). The highest age range for hypertensive patients in ENT clinics was aged 40 – 55 (44 people [78.6%]) and the least was aged 30 – 39 (5 people [8.9%]).

Table 2. Gender Characteristics with Hypertension and Tinnitus

Gender	Classification of Hypertension						Incidence of Tinnitus			
	Pre-Hypertension		Grade 1 Hypertension		Grade 2 Hypertension		Tinnitus		Normal	
	n	%	n	%	n	%	n	%	n	%
Men	15	26,8	7	12,5	4	7,1	11	19,6	15	26,8
Women	12	21,4	15	26,8	3	5,4	19	33,9	11	19,6
Total	27	48,2	22	39,3	7	12,5	30	53,6	26	46,4

The table shows that patients in the ENT polyclinic who have blood pressure > 120/80 mmHg are mostly women, amount 30 people (53.6%) with the most classification of grade 1 hypertension, amount 15 people (26.8%). Meanwhile, the number of male patients who have blood pressure > 120/80 mmHg is 26 people (46.4%) with the most classification of pre-hypertension, amount 15 people (26.8%). In addition, it was also found that patients in the ENT polyclinic who had tinnitus were 30 people (53.6%) with the most being is female, amount 19 people (33.9%).

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Table 3. Age Characteristics with Hypertension and Tinnitus

Age	Classification of Hypertension						Incidence of Tinnitus			
	Pre-Hypertension		Grade 1 Hypertension		Grade 2 Hypertension		Tinnitus		Normal	
	n	%	n	%	n	%	n	%	n	%
20 – 29	6	10,7	1	1,8	0	0,0	3	5,4	4	7,1
30 – 39	2	3,6	3	5,4	0	0,0	1	1,8	4	7,1
40 – 55	19	33,9	18	32,1	7	12,5	26	46,4	18	32,1
Total	27	48,2	22	39,3	5	12,5	30	53,6	26	46,4

The table above shows that patients in the ENT polyclinic who have blood pressure > 120/80 mmHg are mostly in the age category of 40-55 years, which is 44 people (78.6%), with the most hypertension classification being pre-hypertension. Meanwhile, patients in the ENT polyclinic who have tinnitus are mostly in the age category of 40-55 years, which are 26 people (46.4%).

Table 4. Relationship between Hypertension and Tinnitus

Classification of Hypertension	Incidence of Tinnitus				Total		*p*	*r*
	Tinnitus		Normal					
	n	%	n	%	n	%		
Pre-Hypertension	10	17,9	17	30,4	27	48,2	0,008	0,377
Grade 1 Hypertension	13	23,2	9	16,1	22	39,3		
Grade 2 Hypertension	7	12,5	0	0,0	7	12,5		
Total					56	100,0		

The table indicates that patients at the ENT Polyclinic had a history of pre-hypertension combined with tinnitus, totaling 10 patients (17.9%), patients who had a history of grade 1 hypertension combined with tinnitus, totaling 13 patients (23.2%), and patients who had a history of grade 2 hypertension combined with tinnitus, totaling 7 patients (12.5%). Apart from that, it was also found that 17 patients with pre-hypertension did not have tinnitus (30.4%), 9 patients with grade 1 hypertension had no tinnitus (16.1%), and there were no grade 2 hypertension patients without tinnitus (0.0 %).

The bivariate test to determine the relation between variables was assessed utilized Fisher's Exact Test due to the study's data not meeting the Chi-Square Test's assumptions. The results obtained were $p = 0.008$ ($p < 0.05$) which shows that there is a relationship between the two variables and the value $r = 0.377$ which shows the strength of a weak significant relationship.

DISCUSSION

This research demonstrates a statistically significant, albeit weak, relationship between hypertension and the incidence of tinnitus in patients at the ENT Polyclinic at PKU Muhammadiyah Gamping Hospital. This finding aligns with the outcomes of prior studies conducted by Ramatsoma & Patrick, where 30.3% of hypertensive patients experienced tinnitus but no hearing loss, compared to 17.7% of non-hypertensive under similar conditions.[10] Moreover, a significant difference in the prevalence of tinnitus ($p = 0.008$) was observed between the hypertensive and non-hypertensive groups[10]. In the table, it is also found that the highest incidence of tinnitus was found in grade 2 hypertension, namely 100% of 7 people experienced tinnitus. Hypertension is identified as a risk factor for tinnitus, with a correlation suggesting that higher degrees of hypertension are associated with increased prevalence of tinnitus. However, the low strength of the correlation indicates that hypertension is not the only risk factor for increased incidence of tinnitus, but may be supported by other factors, such as anxiety disorders, depression, and smoking.[11]

According to the theory that has been proposed by the previous researchers, it was found that hypertension can increase damage to inner ear tissue

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and reduce the potential of the endocochlea which functions for the sensory transduction process, this occurs due to a decrease in blood supply to the stria vascularis in the cochlea.[12] The cochlear circulation does not have collateral or alternative blood flow so that when there is a decrease in blood supply, the basal tip of the cochlea which contains many hair cells will be damaged.[13] Lack of stimulus from the cochlea causes increased feedback in the auditory cortex which produces high frequency sounds called tinnitus.[14] Apart from that, the nature of drugs consumed by hypertensive patients such as diuretics, furosemide, ACE inhibitors can also be ototoxic. However, current evidence regarding the association of hypertension drugs causing hearing disorders including tinnitus is still lacking.[15]

Research limitations in this study are the research did not consider how long the patient had been diagnosed with hypertension, antihypertensive drugs the patient had used, and did not explain more specifically the characteristics of tinnitus felt by patients.

CONCLUSION

This study revealed that there was a significant relationship with weak strength between hypertension and the incidence of tinnitus in patients at the ENT Polyclinic of PKU Muhammadiyah Gamping Hospital with a significance value of $p = 0.008$ ($p < 0.05$) and a correlation coefficient of $r = 0.377$.

ETHICAL APPROVAL

Ethical approval for this study was granted by PKU Muhammadiyah Gamping Hospital Research Ethics Commission (No. 181/KEP-PKU/XI/2023).

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

T.N contributed to the study design, collected the data, performed the data analysis, and prepared this paper with support and input from R.F. and A.W. All authors discussed the results and contributed to the final manuscript.

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