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THE ASSOCIATION BETWEEN HYPERTENSION AND STROKE IN PKU MUHAMMADIYAH GAMPING HOSPITAL

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ABSTRACT

Background: Stroke is a non-communicable disease whose annual incidence or prevalence continues to increase. The most common cause of stroke is hypertension. Hypertension is a condition of increased blood pressure, if not controlled, can lead to complications. The incidence of stroke in Sleman Regency reaches 10,4% and the incidence of hypertension in Sleman Regency reaches 23,7%. **Objective:** To determine the relationship between patients who have hypertension with the occurrence of stroke. **Methods:** A quantitative analytic study using a cross-sectional design among medical records of 99 patients, obtained by purposive sampling. The inclusion criteria of the study were medical records containing data on patients with a history of hypertension with a head CT scan. Exclusion criteria were medical records data that does not include a history of previous illness and patients who experienced TIA, and have a history of cardiovascular diseases such as coronary heart disease, and dyslipidemia. Analysis of the data using Chi-Square. **Results:** The result showed that the majority of patients had hemorrhagic stroke (62,6%) with grade 3 hypertension (37,3%). The odds ratio (OR) for hypertension grade 3 has a risk of 7,153 times having a stroke compared to grade 1 hypertension ($p=0,001$). **Conclusion:** grade 1 hypertension has an association for the occurrence of ischemic stroke, grade 2 hypertension has an equal for the occurrence of ischemic and hemorrhagic stroke, and grade 3 hypertension has an association for the occurrence of hemorrhagic stroke.

Keywords:

*High blood pressure,
hemorrhagic stroke,
hypertension grade,
risk factor*

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INTRODUCTION

The World Health Organization (2018) states that more than 41 million people die or equal to 70% of death cases worldwide due to non-communicable diseases, especially cardiovascular diseases, such as stroke and coronary heart disease (CHD).¹ Based on data from the World Stroke Organization in 2019, deaths caused by stroke are more than 5.5 million with more than 13.7 million stroke patients each year. As many as 250 thousand people or more than 2.5

percent of people died in Indonesia and the rest were disabled.² Based on Basic Health Research (Riskesdas) data in 2013, the prevalence of stroke in Indonesia continues to increase with age, and the highest age of stroke is ≥ 75 years with a percentage of 67%.³ According to the Centers for Disease Control and Prevention, two types of risk factors can cause stroke, such as modifiable risk factors and non-modifiable risk factors.⁴ Modifiable risk factors include lifestyle characteristics such as



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smoking, being overweight, lack of exercise, and poor diet, while non-modifiable risk factors are genetics and age. Hypertension is a modifiable risk factor for stroke.

Based on Basic Health Research (Riskesdas) in 2018, the highest stroke cases in South Sulawesi Province followed by DIY Province. Stroke cases in DIY have increased, which initially in 2007 was in 13th position of all provinces in Indonesia, then in 2013 in second place. Based on the diagnosis of doctors in 2013 Riskesdas data, the incidence of stroke in DIY reached 16.9%, which exceeded the national stroke prevalence of 12.1%. The prevalence of stroke > 15 years in Sleman Regency reached 10.4%.⁵

Based on Riskesdas, the prevalence of hypertension at the age of 18 years in DIY Province ranks include the top 15 of all provinces in Indonesia. The prevalence of hypertension at the age of 18 years in DIY was 25.7%, and the national prevalence of hypertension was 25.8%. The incidence of hypertension in DIY is high especially in Sleman Regency.⁵

High blood pressure over a long time (months or years) can cause hyalinization of the muscle layer of the cerebral blood vessels. Increased systemic pressure will cause perfusion pressure in the capillary wall to be high, causing hyperemia, edema, and possible bleeding in the brain.⁷ Based on research by Razdiq, stroke patients are more common in grade 1 hypertension at the age ≥ 55 years.⁹ There has been no research related to grade 2 and grade 3 hypertension. In this study, the aim is to analyze the relationship of various grades of hypertension with the incidence of stroke in PKU Muhammadiyah Gamping Hospital.

METHODS

The population for this study consist of all hypertension patients in PKU Muhammadiyah Gamping. Inclusion criteria are medical records containing data on patients with a history of hypertension with a head CT scan. Exclusion criteria are medical records data that does not include a history of previous illness and patients who

experienced TIA, and have a history of cardiovascular diseases such as coronary heart disease, and dyslipidemia.

Univariate analysis was conducted to determine the distribution of stroke patients and frequency distribution of type hypertension. Bivariate analysis was carried out to examine the relationship between hypertension and stroke in PKU Muhammadiyah Gamping Hospital. This is a quantitative study with a cross-sectional research design. The data collection consist of secondary data from medical records. Analysis data using the Chi-Square method with the Statistical Package for the Social Sciences (SPSS).

Table 1. Criteria Hypertension of ESC 2018

Category	Systolic	Diastolic
HT grade 1	140-159 /	90-99
HT grade 2	160-179 /	100-109
HT grade 3	≥ 180 /	≥ 110

RESULTS

Based on the collected data from PKU Muhammadiyah Gamping Hospital, a total of 99 patients met the inclusion and exclusion criteria for the study.

Table 2. Characteristics of Research Subjects HT (hypertension)

Variables		Σ	%
Age	< 60	32	31,1
	≥ 60	67	68,9
Gender	Female	41	31,1
	Male	58	68,9
Type of stroke	Hemorrhagic	62	62,6
	Ischemic	37	37,4
Type of HT	HT 1	36	36,4
	HT 2	26	26,3
	HT 3	37	37,3

Table 2 shows that the respondent characteristics of 99 patients who suffered a stroke with hypertension at PKU Muhammadiyah Gamping Hospital, 31.1% had a stroke at the age less than 60 years, and 68.9% had a stroke at the age of more than 60 years. there were 36 patients (36.4%) with grade 1 hypertension, 26 patients (26.3%) with grade 2 hypertension, and 37 patients (37.3%) with grade 3 hypertension.



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Table 3. The Association Between Hypertension Grade 1 and 2 with Stroke

Grade	Ischemic	Hemorrhagic	Total	P Value (CI 95%)	OR
HT 1	19	17	36	0.001	1,118
HT 2	13	13	26		
Total	32	30	62		

Table 3 shows that the grade 1 hypertension had 1.118-fold increased risk of ischemic stroke than grade 2 hypertension

Table 4. The Association Between Hypertension Grade 1 and 3 with Stroke

Grade	Ischemic	Hemorrhagic	Total	P Value (CI 95%)	OR
HT 1	19	17	36	0.001	7.153
HT 3	5	32	37		
Total	24	49	73		

Table 4 shows that the grade 3 hypertension had 7.153-fold increased risk of hemorrhagic stroke than grade 1 hypertension

Table 5. The Association Between Hypertension Grade 2 and 3 with Stroke

Grade	Ischemic	Hemorrhagic	Total	P Value (CI 95%)	OR
HT 2	13	13	26	0.004	6.400
HT 3	5	32	37		
Total	18	45	63		

Table 5 shows that the grade 3 hypertension had 6.4-fold increased risk of hemorrhagic stroke than grade 2 hypertension

DISCUSSION

The results of research conducted at PKU Muhammadiyah Gamping Hospital showed that the prevalence of stroke was 32.3% were stroke patients under the age of 60 years. According to research conducted by Rizka, the 60-74 age category experienced more strokes than other age categories.⁷ A study by Laily resulted in a high incidence of stroke at age ≥ 55 years compared to age ≤ 55 years. In this study, the risk of stroke at age ≥ 55 was 3,650-fold increased risk of stroke at ≤ 55 years.⁶ Research conducted by Maydinar et al which used a cross sectional method that the elderly experienced more

strokes than productive age, as 52.6% had stroke in 60 years, and as 47.7% occurred under 60 years.⁷

Based on the results of research conducted at PKU Muhammadiyah Gamping Hospital, the prevalence of stroke was most prevalent in male is 58.6%, while in female is 41.4%. Research conducted by Sary, male have more stroke cases than female, the percentage of male is 61.36% while in female 40.91%.⁸ The risk estimate test results found that male were 5-fold higher risk hemorrhagic stroke more than female. The incidence of stroke is higher in male because the testosterone hormone in male can increase LDL levels. If higher LDL, it can cause an increase in cholesterol in the blood, this is one of the risk factors that can increase the occurrence of stroke.⁸

From the results of research conducted by researchers, the ischemic stroke patients were 37.4%, while the hemorrhagic stroke patients were 62.6%. Hemorrhagic stroke and ischemic stroke can occur due to hypertension. Hypertension will trigger the appearance of plaque or atherosclerosis in blood vessels. The presence of plaque in the blood vessels can cause narrowing of the lumen of the blood vessels. If this plaque is unstable, it will rupture and cause blockage of the cerebral blood vessels resulting in ischemic stroke. In addition, an increase in systemic blood pressure causes narrowing of the cerebral blood vessels, can cause bleeding in the brain, resulting in hemorrhagic stroke.⁶

Based on the results of research conducted at PKU Muhammadiyah Gamping Hospital, it shows that there are 36.4% grade 1 hypertension, 26.3% grade 2 hypertension, and 37.3% grade 3 hypertension. This is in line with research conducted by Laily that as many as 97.7% of stroke patients have hypertension.⁶

Hypertension is a silent killer disease that can have no signs or symptoms, causing sufferers not to realize that their blood pressure has increased. In some people, signs and symptoms such as epistaxis, vomiting, or headache.¹⁰ Based on research conducted by Darussalam and Waseno, in patient who has hypertension, has a tendency to often forget and because the hypertension have no recovery, causing patients to become bored to take medicine and most patients only take medicine if they feel sick.¹¹



Relationship between Hypertension and Stroke

Hypertension can cause an increase in peripheral blood pressure, thus worsening the hemodynamic system which can result in thickening of blood vessels and hypertrophy of the heart muscle.¹⁶ This is exacerbated by consuming large amounts of foods high in fat and salt, which can lead to the formation of atherosclerotic plaques. High blood pressure over a long period of time (months or years) can cause hyalinization of the muscle layer of the cerebral blood vessels. This causes the diameter of the blood vessel lumen to become fixed so that the blood vessels cannot dilate or constrict to cope with fluctuations in systemic blood pressure.¹⁵ If systemic blood pressure increases, it causes an increase in capillary wall perfusion pressure which results in hyperemia, edema and bleeding in the brain.¹²

Research conducted by Audina and Halimuddin that there is a relationship between the type of stroke and the classification of hypertension.¹³ Because, systemic blood pressure can cause an increase and make cerebral blood constrict. The degree of constriction is influenced by an increase in blood pressure.¹⁹ Increased systemic pressure will cause perfusion pressure in the capillary wall to be high, causing hyperemia, edema, and possible bleeding in the brain. In a study conducted by Maydinar et al, that there is a significant relationship between hypertension and the incidence of hemorrhagic stroke.⁷ The results of the risk estimate test in this study found that someone who has hypertension has an 11-fold increased risk of hemorrhagic stroke. Research conducted by Soewarno and Annisa, which states that patients with hypertension have a higher risk of hemorrhagic stroke.¹⁴ This is because bleeding in hemorrhagic stroke is usually caused by a ruptured aneurysm.²⁰

The limitation of this study were no analyze about the frequency of occurrence of the stroke, whether it was the first time of stroke or a recurrent of stroke. There was no exclusion for the risk factor such as diabetes mellitus, history of stroke, and obesity.

CONCLUSION

The incidence of stroke at PKU Muhammadiyah Gamping Hospital was mostly among those aged more than 60 years (68.9%) and dominated by men (58.6%). The number of patients who experienced hemorrhagic stroke (62.6%) was more when compared to ischemic stroke (37.4%). There is an association between higher hypertension grade and hemorrhagic stroke in PKU Muhammadiyah Gamping Hospital.

ETHICAL APPROVAL

An ethical clearance was obtained from the Health Research Ethics Commission (KEPK) Faculty of Medicine Universitas Ahmad Dahlan with No. F11/263/H.1/X/2021

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

Conceptualization, IDP and RGPP; methodology, AT; software, AT; validation, IDP, RGPP, and AT; investigation, RGPP; resources, IDP; data curation, AT; writing—review and editing, IDP; supervision, RGPP; project administration, AT

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