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Probability of Characteristics, Abdominal Obesity, Diabetes Mellitus and Hypertension on Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan

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Abstract

Stroke is a disease that often causes many problems, one of which is disability and death. Stroke is divided into two, namely ischemic and hemorrhagic strokes, 80% of Indonesians who have a stroke are a type of ischemic stroke. This study aims to analyze the effect of characteristics, abdominal obesity, diabetes mellitus and hypertension on the incidence of ischemic stroke in Ngimbang Regional Public Hospital of Lamongan. This research was analytic using case control design, with a sample size of 44 case groups and 44 control groups (1:1) with simple random sampling data collection techniques, analysis used with frequency distribution test, correlation analysis and influence test using logistic regression test. Based on the logistic regression analysis, it was found that the influence of respondents with age > 55 years ($p = 0.038$; OR = 24.973; 95% CI = 1.035-602.312), male sex ($p = 0.045$; OR = 21.581; 95% CI = 1.9015-516.968), abdominal obesity ($p = 0.036$; OR = 27.789; 95% CI = 1.020-757.089), hypertension ($p = 0.012$; OR = 59.975; 95% CI = 2/489-1.455E3) and diabetes mellitus ($p = 0.029$; OR = 17.628; 95% CI = 1.974-318.939). Male who has age >55 years with a non-working status and abdominal obesity accompanied by a history of hypertension and diabetes mellitus with a 98% chance of having an ischemic stroke. The next researcher is to be able to do further research on the risk of ischemic stroke.

Keywords: *Abdominal Obesity, Diabetes Mellitus, Hypertension, Ischemic Stroke.*

Background

Stroke is one of the non-communicable diseases that can cause second death and disability after heart disease¹. In Indonesia it is the largest stroke country in Asia, while in America 700,000 people experience strokes and cause around 150,000 deaths. In Indonesia, stroke is the number three deadly disease experienced by people after heart disease and cancer². The prevalence of stroke in Indonesia in 2007 was 8.3 per 1,000 and increased to 12.1 per 1,000. Whereas in 2020 an estimated 7.6 million people will die from strokes³.

World stroke organizations have conducted research that says that 85% of people are at risk for stroke, but that can be avoided if the trigger factors for a stroke can

be controlled from the start⁴. Stroke consists of 2 types, namely ischemic stroke and hemorrhagic stroke, in Asia ischemic stroke is greater (70%) than hemorrhagic stroke (30%)⁵.

There are several risk factors that influence the incidence of stroke, both risk factors that can be controlled and factors that cannot be controlled. Risk factors that can be controlled (hypertension, heart disease, sickle cell anemia, smoking, Transient Ischemic Attack, asymptomatic carotid stenosis, hyperlipidemia, obesity, physical activity, diet, diabetes mellitus) and cannot be controlled (age, sex, hereditary, race or ethnicity, genetic and geographical⁶).

Material and Methods

This study was an observational analytic study with a case control design. In the case group was a patient with a diagnosis of ischemic stroke who had received a diagnosis from a doctor by showing the results of a doctor's examination, while for the control group was a patient with a diagnosis other than ischemic

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stroke treated in Ngimbang Regional Public Hospital of Lamongan. This study was conducted in August to December 2016 at Ngimbang Regional Public Hospital of Lamongan. The population in this study were all patients diagnosed with ischemic stroke and all patients hospitalized in Ngimbang Regional Public Hospital with a diagnosis other than ischemic stroke. The sample in the study was a portion of patients suffering from ischemic stroke and non-ischemic stroke. The sample size in this study was 88 patients who were obtained after calculating the Lemeshow formula. The sampling technique using simple random sampling. This research has passed the ethical review at the Faculty of Public Health at Airlangga University.

Data analysis was performed using univariable analysis using frequency distribution tests to see the characteristics of patients, bivariable tests using Chi-Square test to filter out variables that met the requirements to construct predictive models of ischemic stroke and multivariable models using logistic regression tests used to construct predictive models.

Findings

The Correlation of Characteristics, Abdominal Obesity and Hypertension with Ischemic Stroke in Ngimbang Lamongan Regional Public Hospital

The results of the study regarding the correlation between Characteristics with the incidence of Ischemic stroke in Ngimbang Regional Public Hospital of Lamongan in 2016 can be seen in Table 1 below:

Table 1. Distribution of Characteristics Correlations with Incidence of Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan in 2016..

Characteristics	Incidence of Ischemic Stroke				p value
	Cases		Controls		
	n	%	n	%	
Age					
<55 Years	11	25.0	23	52.3	0.015
≥55 Years	33	75.0	21	47.7	
Total	44	100.0	44	100.0	
Sex					
Male	33	75.0	17	38.6	0.001
Female	11	25.0	27	61.4	
Total	44	100.0	44	100.0	
Job Status					
Employed	12	27.3	28	63.6	0.001
Unemployed	32	72.7	16	36.4	
Total	44	100.0	44	100.0	

The results of the analysis in Table 1 show that the age variable with a value of $p < 0.25$ ($p = 0.015$), which means that the age variable fulfills the requirements to prepare a predictive model of ischemic stroke. Gender variables indicate that the value of $p < 0.25$ ($p = 0.001$), which means the sex variable fulfills the requirements for preparing a predictive model of ischemic stroke.

Job status variables indicate that the value of $p < 0.05$ ($p = 0.001$), which means that there is a correlation between work variables and ischemic stroke in Ngimbang Regional Public Hospital of Lamongan 2016.

The results of the study regarding the correlation between abdominal obesity and the incidence of ischemic stroke in Ngimbang Regional Public Hospital of Lamongan in 2016 can be seen in Table 2 below:

Table 2: Correlation Distribution of Abdominal Obesity with Incidence of Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan in 2016.

Obesity	Incidence of Ischemic Stroke				p value
	Cases		Controls		
	n	%	n	%	
Obesity	40	90.9	15	34.1	0.000
Non-Obesity	4	9.1	29	65.9	
Total	44	100.0	44	100.0	

The results of the analysis in Table 2 show that the value of $p < 0.25$ ($p = 0.000$), which means the abdominal obesity variable meets the requirements to compile a predictive model of ischemic stroke.

The results of the study on the correlation between diabetes mellitus and the incidence of ischemic stroke in Ngimbang Lamongan Regional Public Hospital in 2016 can be seen in Table 3 below:

Table 3. Distribution of Correlation between Diabetes Mellitus with Incidence of Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan in 2016.

Diabetes Mellitus	Incidence of Ischemic Stroke				p value
	Cases		Controls		
	n	%	n	%	
Diabetes Mellitus	36	81.8	6	13.6	0.000
Non-Diabetes Mellitus	8	18.2	38	86.4	
Total	44	100.0	44	100.0	

The results of the analysis in Table 3 show that the value of $p < 0.25$ ($p = 0.001$), which means that the variable of diabetes mellitus meets the requirements to prepare a predictive model of ischemic stroke.

The results of the study regarding the correlation between hypertension and the incidence of ischemic stroke in Ngimbang Regional Public Hospital of Lamongan in 2016 can be seen in Table 4 as follows:

Table 4. Distribution of the Correlation between Hypertension with Incidence of Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan in 2016

Hypertension	Incidence of Ischemic Stroke				p value
	Cases		Controls		
	n	%	n	%	
Hypertension	43	97.7	11	25.0	0.000
Non-Hypertension	1	2.3	33	75.0	
Total	44	100.0	44	100.0	

In Table 4 shows that the value of $p < 0.25$ ($p = 0.000$), which means that the hypertension variable meets the requirements to prepare a predictive model of ischemic stroke.

Predictive Model of Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan

After a variable bivariate analysis test that fulfills the requirements for a multivariable statistical analysis test can be seen in Table 5 below:

Table 5. Recapitulation of the Correlation of Variables of Potential Factors with Incidence of Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan in 2016.

No.	Variable	OR	95% CI	p-value	Conclusions
1.	Age	3.286	1.332-8.107	0.015	Qualify
2.	Sex	4.765	1.912-11.875	0.001	Qualify
3.	Employment	4.667	1.890-11.526	0.001	Qualify
4.	Abdominal Obesity	19.333	5.811-64.322	0.000	Qualify
5.	Hypertension	129.000	15.848-1050.034	0.000	Qualify
6.	Diabetes Mellitus	28.500	9.002-90.233	0.000	Qualify

The results of bivariate analysis in Table 5 show that all variables have a value of $p < 0.25$ which means that all variables in this study qualify to be included in the multivariable statistical analysis test. The variables that will be tested by multivariable statistical analysis are age, gender, abdominal obesity, diabetes mellitus, and hypertension.

Based on the results of the multivariable statistical analysis test in Table 5 the most dominant variable is the variable hypertension followed by the variable abdominal obesity.

Table 6. Summary of Multivariable Analysis Results that Mean Statistically

Variable	B	Wald	p-value	OR	95% CI for OR	
					Lower	Upper
Age (≥ 55 years)	3.218	3.926	0.038	24.973	1.035	602.312
Sex (Male)	3.072	3.593	0.045	21.581	1.901	516.968
Abdominal Obesity (female ≥ 80 cm, male ≥ 90 cm)	3.325	3.888	0.036	27.789	1.020	757.089
Hypertension	4.094	6.359	0.012	59.975	2.489	1.445E3
Diabetes Mellitus	2.369	1.477	0.029	17.628	1.974	318.939
Constant	-11.273	3.687	0.002	0.000		

Discussion

The Correlation of Characteristics, Abdominal Obesity and Hypertension with Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan

Based on Table 1 shows that there is an association of age factors with ischemic stroke incidence in hospitalized patients in Ngimbang Regional Public Hospital of Lamongan in 2016. People who have age <55 years also have a greater risk of stroke. Ages >55 years will be twice the risk of every 10 years of age. Two thirds of stroke cases are 65 years old. Stroke mortality rates are more common in elderly cases⁷. Table 1 shows that there is a sex correlation with the incidence of ischemic stroke in hospitalized patients in Ngimbang Regional Public Hospital of Lamongan in 2016. The results of other studies indicate that the risk of stroke in hypertensive patients male sex 23.07 times greater stroke compared to women⁸, this shows that in terms of gender the incidence of stroke is more common in men⁹. Based on employment status variables (Table 1) shows that there is a correlation between work and incidence of ischemic stroke in hospitalized patients in Ngimbang Regional Public Hospital of Lamongan in 2016. This is because people who do not work will tend to live more relaxed, irregular eating patterns, lazy to exercise and higher stress levels than people who work. If the stress is too large so that it can cause a decrease in endurance, symptoms will arise such as headaches, irritability, insomnia which will stimulate the adrenal gland (cortex) to release hormones adrenaline and will accelerate the heart rate so that blood pressure rises and blood flow to the brain and peripheral muscles increases¹⁰.

Respondents with abdominal obesity status had a greater risk than respondents with no abdominal obesity (Table 2). Abdominal obesity as measured by waist circumference is said to be the main risk factor for developing insulin resistance in type 2 diabetes, about 50% of obese patients experience glucose tolerance. In accordance with the research that has been carried out that people with type 2 diabetes mellitus will increase the risk for ischemic stroke¹¹.

Respondents with diabetes mellitus had a greater risk than respondents who did not have diabetes mellitus. Respondents with diabetes mellitus had a 28.500 risk of ischemic stroke when compared to respondents who did not have diabetes mellitus (Table 3). Diabetes mellitus will cause the vascular constriction phase and damage to blood vessels through the glycosylation process.

Meanwhile, if there is a change in the two blood vessels, it will cause a reduction or even cause a blockage of blood flow to the brain which will cause ischemic stroke¹².

Respondents with hypertension status had a greater risk than respondents with non-hypertensive status. Respondents with hypertension had a risk of 129.000 times having an ischemic stroke when compared to respondents without hypertension (Table 4). Other studies have shown that patients with hypertension have a 20 times greater risk of stroke compared to patients without hypertension¹³. Other studies show that individuals who have a diastolic blood pressure of ≥ 90 mmHg have a risk of 3.10 times more likely to experience an ischemic stroke¹⁴.

Predictive Model of Ischemic Stroke in Ngimbang Regional Public Hospital of Lamongan

Through multiple logistic regression test results, it can be arranged formula predictive index for the incidence of ischemic stroke in Ngimbang Regional Public Hospital of Lamongan 2016. The logistic regression equation is as follows:

$$P = \frac{1}{1 + e^{-z}}$$

$$Z = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_nx_n$$

So that the model of equations that are formed for the incidence of ischemic stroke is obtained as below:

$$\begin{aligned} Z &= \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_nx_n \\ &= -11.273 + 4.094* \text{Hypertension} + 3.325* \\ &\quad \text{Abdominal Obesity} + 3.218* \text{Age} + 3.072* \\ &\quad \text{Sex} + 2.369* \text{Diabetes Mellitus} \\ &= 4.805 \end{aligned}$$

From the calculation of the predictive index, the value of $Z = 4.805$ is obtained. With a history of hypertension = yes (1), abdominal obesity = yes (1), age ≥ 55 years (1), gender = male (1), history of diabetes mellitus = yes (1).

Based on the 5 variables (age ≥ 55 years, male sex, abdominal obesity, history of hypertension and history of diabetes mellitus) if calculated based on probability events the results are as follows:

$$P = \frac{1}{1 + e^{-(\beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5 + x_5)}}$$

$$P = \frac{1}{1 + 2,71^{-(-11,273 + 3,218.1 + 3,072.1 + 3,325.1 + 4,094.1 + 2,369.1)}}$$

$$P = \frac{1}{1 + 2,71^{-(-4,805)}} = 0.9819 (98\%)$$

Based on the logistic regression equation, it can be seen that 98% of the probability of ischemic stroke caused by age ≥ 55 years, male sex, abdominal obesity ≥ 80 cm (female) and ≥ 90 cm (male), history of hypertension and history of diabetes mellitus, while 2% is influenced by other factors that are not measurable.

Conclusion

The incidence of ischemic stroke in hospitalized patients in Ngimbang Regional Public Hospital of Lamongan in 2016 it can be concluded that 98% of the likelihood of ischemic stroke caused by age ≥ 55 years, male sex, abdominal obesity ≥ 80 cm (female) and ≥ 90 cm (male), history of hypertension and history of diabetes mellitus, while 2% is influenced by other factors that are not measurable.

Suggestion: Further researchers are expected to examine more risk factors that can be changed to explain more specifically the occurrence of ischemic stroke, such as the risk of diabetes mellitus which types are more at risk for ischemic stroke, comparing abdominal obesity and BMI to the risk of ischemic stroke and other factors.

Conflict of Interest: None

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