Post Hypertension and Stroke: A Case Control Study

Pasca Hipertensi dan Stroke: Studi Kasus Kontrol

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Abstract

Stroke is the leading non-communicable cause of death in Indonesia. The number of stroke patients increases every year. A prevention strategy needs to be implemented to control the number of stroke patients, starting by determining the factors affecting the incidence of stroke. This study aimed to determine factors affecting stroke incidence, including smoking status, past hypertension, past diabetes, diet, physical activity, and alcohol consumption. The total of respondents was 132, consisting of 66 cases and 66 controls. This study employed a case control design and systematic random sampling method. The study was conducted at Ngudi Waluyo Wlingi Public Hospital in Blitar District, East Java Province, Indonesia, in October-November 2017. Bivariate analysis showed that factors significantly related to stroke were smoking status (p-value = 0.011, OR = 2.6), past hypertension (p-value = 0.00, OR = 6), past diabetes (p-value = 0.015, OR = 5.7), and unhealthy diet (p-value = 0.00, OR = 5.7). Multivariate analysis showed that factors significantly affecting stroke were smoking status, past hypertension, and an unhealthy diet. In conclusion, smoking, past hypertension, and an unhealthy diet are factors affecting the incidence of stroke.

Keywords: Case control, hypertension, smoking, stroke, unhealthy diet

Abstrak

Stroke merupakan salah satu penyakit tidak menular yang menjadi penyebab kematian tertinggi di Indonesia. Jumlah penderita stroke selalu meningkat setiap tahunnya. Strategi pencegahan stroke perlu dilakukan untuk mengendalikan jumlah penderita stroke dengan mengetahui faktor yang memengaruhinya. Penelitian ini bertujuan menganalisis faktor yang memengaruhi kejadian stroke meliputi status merokok, riwayat hipertensi sebelumnya, riwayat diabetes sebelumnya, diet, aktivitas fisik, konsumsi alkohol. Responden berjumlah 132 orang yang terdiri dari 66 orang kelompok kasus dan 66 orang kelompok kontrol. Penelitian ini menggunakan desain penelitian kasus kontrol dan metode *systematic random sampling*. Penelitian ini dilakukan di RSUD Ngudi Waluyo Wlingi, Kabupaten Blitar, Provinsi Jawa Timur, Indonesia pada bulan Oktober–November 2017. Analisis bivariat menunjukkan bahwa faktor yang berhubungan secara signifikan terhadap stroke adalah status merokok (nilai p = 0,011; OR=2,6), riwayat hipertensi sebelumnya (nilai p = 0,00; OR = 6), riwayat diabetes sebelumnya (nilai p = 0,015; OR = 5,7), dan diet tidak sehat (nilai p = 0,00; OR = 5,7). Pada analisis multivariat, faktor yang berpengaruh secara signifikan terhadap stroke adalah merokok, memiliki riwayat hipertensi sebelumnya, dan diet tidak sehat. Sebagai kesimpulan, merokok, memiliki riwayat hipertensi sebelumnya dan diet tidak sehat merupakan faktor yang berpengaruh terhadap kejadian stroke.

Kata kunci: Kasus kontrol, hipertensi, merokok, stroke, diet tidak sehat

Introduction

Strokes are responsible for 10% (5.5 million out of 57 million) of the global mortality in 2002.[1] Heart disease and ischemic stroke are the world's major causes of death, with 56.4 million cases in 2015, and has also been the leading non-contagious cause of death for the last 15 years.[2] Stroke ranks the fifth among causes of death in the United States and kills 129,000 people annually there.[3] Stroke rates in low- and middle-income countries have doubled in the last four decades.[4]

Stroke occurs when something, usually a blood clot, blocks the blood supply to the part of the brain; or when a blood vessel enters the brain. This makes that part of the brain damaged or dead. Stroke can cause long-term brain damage, long-term disability, or even death.[5] Stroke often negatively affects patients' quality of life, the social and economic development of patients' families, and even a country's economic burden.

Stroke may occur at any age but it is preventable and controllable. An effective prevention and control strategy is necessary to prevent an increase in stroke incidence, especially in low- and middle-income countries. Stroke prevention and control can be carried out if the risk factors are ascertained. This study aimed to determine factors affecting stroke including smoking status, past hypertension, past diabetes, diet, alcohol consumption, and physical activity.

Method

This study was an analytical observational study using case control design, which was conducted to determine factors affecting the incidence of stroke. The study subjects were recruited from Ngudi Waluyo Wlingi Public Hospital in Blitar District, East Java Province. The study applied systematic random sampling with a multiple of four because, according to the outpatient morbidity reports at Ngudi Waluyo Wlingi Hospital in Blitar District, the number of stroke patients in 2016 was 2,588 people. Stroke is a chronic disease that requires a long treatment process, so that the estimated number of patients in 2017 is almost the same as in 2016. The number of randomization samples in multiples of four was obtained from the number of patient estimates in 1 month divided by the number of samples needed. Comparison of the number of case samples and control samples was 1: 1; the total number of samples was 132, consisting of 66 people for the case samples and 66 people for the control samples. The case samples were stroke patients who were aged over 17 years, while the control samples were hospital visitors who did not suffer from stroke and were aged over 17 years.

The questionnaire used in this study was adapted from the 2013 National Basic Health Research and the Ministry of Health of the Republic of Indonesia's Cohort Questionnaire of Non-Contagious Diseases in 2011, which was modified based on the needs of the study.

The questionnaire consisted of 24 statements. Respondents were categorized as smokers if they were current or former smokers. "Current smoker" referred to respondents who had smoked 100 or more cigarettes during lifetime and were still smoking when the data were collected. "Former smoker" referred to respondents who had smoked 100 or more cigarettes during lifetime but had quit smoking before the data were collected.[6]

Respondents were said to have an unhealthy diet if they consumed risky foods (sweet foods/drinks, salty foods, and fatty foods/foods high in cholesterol) once or more a day. Respondents were categorized as active in performing physical activity if the respondent performed heavy and/or moderate physical activities. Respondent were said to perform heavy physical activities if they performed a continuous activity for at least 10 minutes until the pulse increased and the respondent breathed faster than usual for a minimum of three days a week and total activity time ≥1500 metabolic equivalent of task (MET) minute. The MET minute of heavy physical activity is the length of time (in minutes) of performing an activity in one week multiplied by the weight of eight calories. Respondents were said to perform moderate physical activities if they performed moderate physical activity (including housework) at least five days or more when the total length of activity was 150 minutes in a week. Activity other than stated above was said to be light physical activity.[7]

Respondents were categorized as consuming alcohol if the respondent was consuming or had consumed alcohol one to three times a month. Respondents were categorized as having past stroke, diabetes, and hypertension if the respondent had once diagnosed with at least one of those diseases by a doctor.

All participants were provided with written informed consent approved by the Ethics Commission of Faculty of Public Health Universitas Airlangga (certificate number: 536-KEPK).

Collected data were input and analyzed using chi-square test and logistic regression. Chi-square analysis was carried out to determine the relation of each variable to stroke incidence, while logistic regression was taken to find out the most influential variable to stroke incidence. All statistical tests in this study used p-value < 0.05.

Results

Table 1 shows the results of bivariate analysis using Chi-square test to determine the relation of each variable being examined. Smoking status was related to stroke incidence with p-value = 0.011 (p-value < 0.05). Smokers were 2.6 times more likely to suffer from a

Table 1. Analysis of the Relation of Smoking Status, Past Hypertension, Past Diabetes Mellitus, Diet, Physical Activity, and Alcohol Consumption to Stroke Incidence

Variable	Category	Case		Control		p-Value	OR	95% CI	
		n	%	n	%			Lower	Upper
Smoking status	Smoker	31	47	17	25.8	0.011	2.6	1.226	5.316
	Non-smoker	35	53	49	74.2				
Past hypertension	Yes	56	84.8	32	48.5	0.00	6	2.599	13.620
	No	10	15.2	34	51.5				
Past diabetes mellitus	Yes	10	15.2	2	3	0, 0 15	5.7	1.201	27.192
	No	56	84.8	64	97				
Unhealthy diet	Yes	40	60.6	14	21.2	0.00	5.7	2.647	12.335
	No	26	39.4	52	78.8				
Physical activity	Not active	4	6.1	1	1.5	1.71	4.2	0.4560	38.5650
	Active	62	93.9	65	98.5				
Alcohol consumption	Yes	7	10.6	3	4.5	1.88	2.5	0.615	10.087
	No	59	89.4	63	95.5				

Notes: n= Number of Sample, OR= Odds Ratio, CI= Confidence Interval

Table 2. Results of Multivariate Analysis of Stroke Risk Factors

Independent Variable	B	OR	95% CI	p-Value
Exposed to cigarette smoke	1.277	3.586	1.181–10.889	0.024
Past hypertension	1.938	6.946	2.553–18.900	0.000
Past diabetes mellitus	0.666	1.946	0.350–10.826	0.447
Unhealthy diet	1.707	5.514	2.232–13.620	0.000
Less physical activity	1.210	3.354	0.278–40.461	0.341
Consuming alcohol	1.116	3.053	0.463–20.118	0.246

Notes: OR= Odds Ratio, CI= confidence interval, B= coefficient of determinant

stroke compared with non-smokers. Past hypertension was related to stroke incidence with p-value = 0.00 (p-value < 0.05). Respondents with past hypertension were six times more likely to suffer from a stroke compared with respondents who did not have past hypertension. A record of diabetes was related to stroke incidence with p-value = 0.015 (p-value < 0.05). Respondents with a record of diabetes were 5.7 times more likely to suffer from a stroke compared with respondents who did not have diabetes. An unhealthy diet was related to stroke incidence with significance value of p-value = 0.00 (p-value < 0.05). Respondents with unhealthy diet were 5.7 times more likely to suffer from a stroke than respondents with healthy diets. Physical activity was not related to stroke incidence with significance value of p =1.71 (p-value < 0.05). Alcohol consumption was not related to stroke incidence with p-value = 1.88 (p-value < 0.05).

Multivariate analysis was performed to analyze variables related to stroke incidence, and then cognitive regression test was performed to determine the influence of each factor as well as the factor with the greatest influence. Based on Table 2, factors affecting the incidence of stroke with a significance level of p value < 0.05 are smoking, past hypertension, and an unhealthy diet. Among the three factors, past hypertension was the factor with the greatest influence.

Discussion

Stroke is the leading non-contagious cause of death in the last 15 years.[2] Therefore, it is necessary to make preventive efforts to reduce the incidence of stroke, which will in turn lower the number of deaths.

Previous studies have suggested that there is a significant effect of smoking status on stroke incidence with a risk of 1.67 times. It means that smokers have a greater risk of stroke by 1.67 times compared with non-smokers.[8] Similarly, this study shows that there was a significant relationship between smoking and stroke. This means that smokers were 2.6 times more likely to suffer from a stroke compared with non-smokers. Smokers have a greater risk of stroke, at least two to four times, compared with non-smokers or those who have quit smoking more than 10 years ago. Smoking can cause intracerebral hemorrhage by damaging artery walls, which leads to rupture of blood vessels. One study found that smoking was one of the primary risk factors for bleeding.[9] The risk of smoking is greater for women than for men compared with non-smokers.[10] Cigarettes

contain nicotine, which can increase blood pressure.[11]

Similar studies have shown that past hypertension has a significant influence on stroke incidence in both men and women in urban populations.[12] Most stroke patients had hypertension. High blood pressure can damage arteries throughout the body and make them rupture or clog more easily. Weak arteries in the brain due to high blood pressure put hypertensive patients at high risk of stroke.[13] In this study, a previous record of hypertension had a significant relationship to the incidence of stroke with a large risk of six times. This means that people with a previous record of hypertension had a risk six times more likely to suffer from a stroke compared with people who did not suffer from hypertension before.

Diabetes mellitus (DM) is a long-term, chronic disease where the pancreas does not produce insulin to offset blood sugar.[14] People who suffer from diabetes have a risk of suffering from a stroke two to four times greater than people who do not suffer from diabetes. Diabetics are also at risk of heart disease and stroke at an earlier age. Diabetics have too much glucose in their blood, while their cells do not get sufficient energy. This glucose can cause increased fat or clots in blood vessel walls. These clots or fat may narrow or block the blood vessels and cause stroke.[15] Those having past DM have 5.7 times greater risk of stroke than those not having past DM. This means that people with a record of diabetes are 5.7 times more likely to suffer from a stroke compared with people who do not suffer from diabetes.

Diet is a modifiable risk factor for stroke.[16] A low-fiber diet is significantly related to earlier stroke incidence.[17] Much evidence suggests that high salt intake and hypertension increases the risk of stroke. In addition, consuming a high-calorie diet can lead to high risk of obesity.[18] Previous studies conducted on middle-aged Korean women showed that obesity is closely related to hypertension and arterial stiffness.[19] Sugary or sweet drinks are also contributors to increased sugar intake and weight gain and can lead to increased risk of stroke. A diet rich in grains, fruits, and vegetables can help reduce weight and can help reduce chronic illness and stroke.[18]

Physical activity is not one of the direct risk factors that can cause a stroke. However, physical activity combats several stroke risk factors, such as obesity, cholesterol, and high blood pressure. Good physical activity can help maintain weight, lower cholesterol level, and maintain blood pressure.[11]

Alcohol consumption can indeed increase the risk of stroke; however, the risk is not a direct one, but through other factors such as hypertension.[20] Consuming alcohol can increase hypertension, and hypertension may increase the risk of stroke.[11]

Table 2 illustrates that past hypertension, smoking, and unhealthy diet are factors affecting stroke incidence.

A previous record of hypertension is the factor with the greatest influence compared with other risk factors. A similar study showed that a previous record of hypertension had a significant influence to the incidence of stroke. Respondents with a record of hypertension had a risk of 2.87 times.[21] Other studies also show that there is a relationship between hypertension and the incidence of stroke with p-value = 0.000.[22] Hypertension is a risk factor that plays a major role in strokes in China.[23] The primary prevention that can be done to prevent stroke in the general population is to maintain systolic blood pressure < 140 mmHg and diastole < 90 mmHg. Conversely, for populations suffering from diabetes and cardiovascular and kidney diseases, blood pressure must be < 130/80 mmHg.[24] Stroke and hypertension are the main causes of long-term death and disability. Most stroke patients have also had hypertension before. High blood pressure can damage arteries throughout the body and can make the arteries break or clog more easily. Weak arteries in the brain due to high blood pressure put hypertensive sufferers at high risk of suffering from a stroke.[13] Additionally, not smoking and limiting the consumption of sweet foods and drinks, salty foods, and fatty foods/foods high in cholesterol are also necessary.

The strength of this study is the multivariate analysis to determine the most influential variables to the incidence of stroke, while one shortcoming of this study is that age and sex were not controlled for, which may have affected the accuracy of the data.

Conclusion

Based on the results of this study, past hypertension, unhealthy diet, and smoking increase the risk of stroke. Among the three factors, past hypertension is the factor with the greatest influence.

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