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Analysis of Factors Related to Stroke Occurrence at William Booth Hospital Semarang

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Abstract

Stroke is a serious disease that occurs when blood flow to the brain is disrupted, either due to a blockage in the blood vessels (ischemic stroke) or a rupture of the blood vessels (hemorrhagic stroke). This condition can cause brain cell death in a short period of time and is at risk of causing permanent disability. This study aims to analyze the factors associated with the occurrence of stroke in hypertensive patients at RSU William Booth Semarang. This research is a quantitative study with a nested case-control design, using electronic medical record data from RSU William Booth Semarang in 2023. The variables in this study are age, gender, blood sugar levels, total cholesterol levels, triglyceride levels, HDL levels, LDL levels, uric acid levels, and a history of heart disease. The analysis used includes univariate analysis, bivariate analysis with chi-square test. The variables that are statistically significant are age (p=0.005), gender (p=0.021), random blood sugar levels (p=0.010), total cholesterol levels (p=0.009), triglyceride levels (p=0.034), HDL blood levels (p=0.049), LDL blood levels (p=0.034), and history of heart disease (p=0.023). The conclusion of this study is that early detection and management of risk factors, especially blood pressure control and cholesterol levels, are very important in preventing stroke. Educating the public about healthy lifestyles can also help reduce the incidence of strokes in the future.

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INTRODUCTION

Stroke is one of the major diseases that cause death and disability worldwide. This disease occurs due to impaired blood supply to the brain, both due to blockage of blood vessels (ischemic stroke) and rupture of blood vessels (hemoragic stroke) (Kuriakose and Xiao, 2020). These disorders result in short-time death of brain cells due to lack of oxygen, which can lead to various complications such as cognitive impairment, physical disability, and depression (Natha et al., 2023).

Global data show that stroke is the third leading cause of death after coronary heart disease and cancer (Sonia Gandi, 2023). Based on the World Health Organization (WHO) report in 2020, there are around 13.7 million new stroke cases every year, with a mortality rate of 5.5 million people. Meanwhile, the global stroke prevalence in 2017 reached 104.2 million cases, consisting of 82.4 million cases of ischemic stroke, 17.9 million cases of cerebral hemorrhage, and 9.3 million cases of subarachnoid hemorrhage (WHO, 2024).

In Indonesia, stroke is a major public health challenge. According to the 2023 Indonesian Health Survey (SKI), the prevalence of stroke in Indonesia is 8.3 per 1,000 people. This means that approximately 8 out of every 1,000 people suffer from a stroke. This data also shows that stroke is a significant cause of disability and death in Indonesia, and most cases are preventable by controlling risk factors such as hypertension, diabetes, and an unhealthy lifestyle.

In addition, stroke is the main cause of Disability Adjusted Life Years (DALYS) lost in Indonesia, with a figure of 4.0% of the total national disease burden (WHO, 2019). According to the South East Asian Medical Information Center (SEAMIC), Indonesia has the highest stroke mortality rate in Southeast Asia, followed by the Philippines, Singapore, and Malaysia (Sibagar).

Various risk factors contribute to the incidence of stroke, including hypertension, diabetes mellitus, hyperlipidemia, obesity, unhealthy lifestyle, and smoking (Martono et al., 2022; Hardika et al., 2020). Studies conducted at Charitas Hospital and Myria Hospital Palembang show that the history of hypertension, total blood cholesterol levels, education levels, sex, and obesity have a significant impact on non-hemoragic stroke events (Hardika et al., 2020). In addition, research conducted in China shows that stroke is the main cause of disability, with more than 3.4 million cases of stroke being hospitalized in 2020 (Tu et al., 2023).

In Semarang City, data from the Semarang City Health Profile shows the low prevalence of non-communicable diseases, including stroke. In 2017, the stroke prevalence in Semarang was recorded at 0.19% and increased the following year (Semarang City Health Office, 2017).

This study aims to analyze the factors related to stroke events at William Booth Hospital Semarang. Using a nested case-control design, this study will explore the rarely studied variables of cholesterol, LDL, HDL, and uric acid levels.

METHOD

This research is quantitative, employing an observational analytical approach. It employed a nested case-control design. This design was chosen because medical record data at William Booth Hospital in Semarang was collected using a cohort design. This study sought to retrospectively determine the factors contributing to stroke incidence, thus choosing a nested case-control design. The nested case-control design was applied to cohort data.

In a nested case-control study, samples for both case and control groups are drawn from a cohort design that has been followed for a specific period. This approach is considered a robust observational method compared to previous cohort studies, as it can reduce bias in measuring the relationship between exposure and outcome (Langholz & Richardson, 2009). In this nested case-control design, respondents are categorized into a case group (stroke patients) and a control group (patients without stroke). This study used data from the Electronic Medical Record at William Booth General Hospital, Semarang, in 2023.

The population and sample cases in this study were hypertensive patients with stroke in

outpatients recorded in the electronic medical record of William Booth Hospital Semarang in 2023 ICD-10 code I10-Eseential (primary) Hypertension accompanied by code I64-Stroke, not specified as hemorrhage or infarction. (Medical Record Department of William Booth Hospital Semarang, 2024). While the population and control samples in this study were hypertensive patients who did not experience hypertension complications in outpatients recorded in the electronic medical record of William Booth Hospital Semarang in 2023 ICD-10 code I10-Eseential (primary) Hypertension. (Medical Record Department of William Booth Hospital Semarang, 2024. This study used the Lameshow formula so that the minimum sample in this study was 87 samples. The case-control ratio was 1:1 so that the total minimum sample size was 174 samples, with 87 case samples and 87 control samples.

STUDY VARIABLES

The independent variable in this study are age, gender, current blood sugar level, total cholesterol level, triglyceride level, blood HDL level, blood LDL level, blood uric acid level, history of heart disease while in the dependent variable is stroke in hypertension patients.

STATISTICAL ANALYSIS

An univariate analysis through descriptive statistics was conducted to determine the frequency distribution of the variables studied. The data from the study were described in tables and narratives to evaluate the proportion of each variable. Then a bivariate analysis using the Chi-Square test was conducted on independent and dependent variables to find out the relationship between age, gender, blood sugar level, total cholesterol level, triglyceride level, blood HDL level, blood LDL level, blood uric acid level, and blood. a history of heart disease with stroke in hypertensive patients. In an analysis of the significance test between observed and expected data conducted with 95% confidence, p-value values were considered statistically significant (Hastono, 2021).

RESULTS AND DISCUSSIONS

Based on the analysis results of the unvariate in table 1, it can be seen that by age category >= 70 years old as many as 30 patients (17.2%), age 60-69 years old as many as 65 patients (37.4%), age 50-59 years old as 52 patients (29.9%) and age group < 50 years old as many as 27.5% . Based on the sex category, as many as 100 patients (57.5%) were male and as many as 74 patients (42.5%) were female. Based on the examination of blood sugar level when >= 200 mg/dL as many as 90 patients (51.7%) while blood sugar level when < 200 mg/dL as many as 84 patients (48.3%).

Table 1. Univariate Analysis of Independent and Dependent Variables in this study

Variable	Category	F	%
Stroke Occurrence	Yes (HT with stroke occurrence)	87	50
	No (HT without hypertension complications)	87	50
Age	At risk (≥ 55 years)	122	70.1
	No risk (< 55 years)	52	29.9
Gender	Male	100	57.5
	Female	74	42.5
Blood glucose levels	>= 200 mg/dL	90	51.7
	< 200 mg/dL	84	48.3
Cholesterol levels total	>= 200 mg/dL	98	56.3
	< 200 mg/dL	76	43.7
Rate Triglycerides blood	>= 200 mg/dL	85	48.9
	< 200 mg/dL	89	51.1
Rate HDL blood	< 40 mg/dL	90	51.7
	>= 40 mg/dL	84	48.3
Rate LDL blood	>= 160 mg/dL	91	52.3
	< 160 mg/dL	83	47.7
Uric acid levels	High	85	48.9
	Normal	89	51.1
Regarding history of heart disease	had a history of heart disease	88	50.6
	had no a history of heart disease	86	49.4

Based on the examination of total cholesterol level >= 200 mg/dL as many as 98 patients (56.3%) while at total cholesterol level < 200 mg/dL as many as 76 patients (43.7%). Based on the examination of blood triglyceride level >= 200 mg/dL as many as 85 patients (48.9%) while blood triglyceride level < 200 mg/dL as many as 89 paasien (51.1%). Based on the examination of

blood HDL level < 40 mg/dL as many as 90 patients (51.7%) while on blood HDL level >= 40 mg/dL as many as 84 patients (48.3%).

Based on the examination of blood LDL level >= 160 mg/dL as many as 91 patients (52.3%) while blood LDL level < 160 mg/dL as many as 83 patients (47.7%). Based on the examination of uric acid level >= 7.0 mg/dL as many as 72 patients (41.4%) while on uric acid level < 7.0mg/dL as many as 102 patients (58.6%). Based on patients who have a history of heart disease as many as 88 patients (50.6%) while those who do not have a heart history as many as 86 patients (49.4%).

Table 2. Bivariate analysis of the independent variable age with the dependent variable stroke incidence

Variable		Stroke Occurrence		Total	p-value	OR (CI 95%)
		Yes	No			
Age	A risk ≥ 55 *Years old*	70	52	122	0.005	2.771
		80,5%	59,9%	70,1%		(1.402-5.47)
	< 55 *Years old*	17	35	52		
		19,5%	40,2%	29,9%		
	Total	87	87	174		
		100%	100%	100%		

Table 2 presents a cross-tabulation of the bivariate analysis between age status and the occurrence of stroke. Based on the chi-square test results, it shows that hypertensive patients with stroke events occur more frequently in the age group of ≥ 55 years at 80.5%, compared to those aged < 55 years at 19.5%. In hypertensive patients without hypertension complications, the occurrence is higher in the age group of ≥ 50 years at 59.9%, compared to those aged < 50 years at 40.2%. Based on the bivariate analysis, the p-value obtained for age is 0.005 (p<0.05), which leads to the acceptance of Ha and the rejection of H0, indicating that there is a significant relationship between age and the occurrence of stroke in hypertensive patients at RSU William Booth Semarang in 2023, with an odds ratio of 2.771. This means that individuals aged ≥ 55 years are 2.771 times more likely to experience a stroke among hypertensive patients.

This research reveals that an increase in age can raise the risk of stroke due to increased oxidative stress and the accelerated process of atherosclerotic plaque thickening in the blood vessels of the brain. Although most stroke cases occur in the elderly, about 10% to 14% of cases are also found in individuals aged 18 to 45 years. The main factors contributing to stroke in young age are often related to heart abnormalities that trigger embolization. However, overall, the prevalence of stroke remains higher as age increases (Ari Sandy & Dwi Sanyoto, 2020).

Stroke risk groups mainly include those aged over 55 years, men who are at a higher risk than women, a family history of stroke, and medical conditions. The symptoms of a stroke can be physical, psychological, or behavioral. The most characteristic physical symptoms are weakness in the limbs to paralysis, loss of sensation in the face, asymmetric lips, difficulty speaking (aphasia) or slurring, difficulty swallowing, decreased consciousness, headache, vertigo, nausea and vomiting, and loss of vision on one side or potential blindness (Kamal et al.,

Table 3. Bivariate Analysis of sex variables with stroke event bound variables

Variable		Stroke Occurrence		Total	p-value	OR (CI 95%)
		Yes	No			
Gender	Male	58	42	100	0.021	2.143
		66,7%	48,3%	57,5%		(1.161-3.955)
	Female	29	45	74		
		33,3%	51,7%	42,5%		
	Total	87	87	174		
		100%	100%	100%		

2021; Kemenkes, 2020).

In table 3 this is the cross-tabulation (crosstab) of the results of bivariate analysis between sex and stroke occurrence. The prevalence of hypertension patients with stroke shows that hypertension patients with stroke occurrence, occurring more in males by 66.7%, than in females by 33.3%. In hypertensive patients without hypertensive complications, 51.7% occur in females compared to 48.3%.

Based on the results of the bivariate analysis using the chisquare test, in patients with sex obtained a p-value of 0.021 (p<0.05) means that there is a significant relationship between patients based on sex and stroke occurrence in patients with hypertension at the William Booth Semarang General Hospital in 2023 with an Odds ratio of 2,143. This is called the protective factor.

In this study, in line with the results of a study conducted by Ghani (2016) stated that men are at higher risk of stroke than women. The higher risk of stroke in men is largely affected by men's lifestyles such as smoking, lack of physical activity, and drinking alcohol which are at risk of stroke and require rehabilitation management (Ghani et al., 2016). This is also in line with the research (Danang, 2022), (Andrean, 2018) and (Pratiwi & Andina, 2018) that states that sex relations with stroke occurrences result that men are twice as risky as women with α 0.001 which means < 0.005.

Dawson (2023), in a study, had higher results in men, but more strokes occurred in women. Women tend not to come into service stroke within four hours, and are more likely to show less common symptoms there are some reasonable explanations for why stroke incidents can differ in men and women. First, women have a longer life expectancy and thus experience more stroke occurrences (Dawson, 2023).

In a study conducted by Peters (2020) it also explained that women have a longer life expectancy and therefore experience more events such as stroke symptoms. In addition, the relationship between many common cardiovascular risk factors and stroke differs in men and women. Based on recent data analysis from UK Biobank shows that the relationship between blood pressure, body mass, lipids, diabetes, and atrial fibrillation to any stroke is similar in men and women, but hypertension, smoking, and poor socioeconomic status are more strongly linked to risk in women (Peters et al., 2020).

In some studies it has been studied that women are more likely to experience less common stroke symptoms such as headaches and cognitive impairments.

In table 4 this is the cross-tabulation (crosstab) of the results of a bivariate analysis between blood sugar levels when with stroke occurrence. The prevalence of hypertension patients with stroke incidence indicates that hypertension patients with stroke occurrence tend to be obtained from the group of patients with blood sugar levels at >= 200 mg/dL of 62.1%, compared to blood sugar levels at < 200 mg/dL of 37.9%. In hypertensive patients without hypertensive complications, more is obtained from the group of patients with blood sugar levels at < 200 mg/dL of 58.6%, compared to blood sugar levels at >= 200 mg/dL of 41.4%.

As a result of a bivariate analysis using the chisquare test, the sex variable has a p-value of 0.010 (p<0.05) which means there is a significant relationship between blood sugar levels when with stroke in hypertensive patients at William Booth Semarang General Hospital in 2023 and an Odds ratio of 2,318, respectively. This is called the protective factor.

Table 4. Bivariate analysis of blood glucose levels variables when with stroke event bound variables

Variable		Stroke Occurrence		Total	p-value	OR
		Yes	No			(CI 95%)
GDS	>= 200 mg/dL	54	36	90	0.010	2.318 (1.262-4.258)
		62,1%	41,4%	51,7%		
	< 200 mg/dL	33	51	84		
		37,9%	58,6%	48,3%		
	Total	87	87	174		
		100%	100%	100%		

Table 5. Bivariate Analysis of total cholesterol level variables with stroke event bound variables

Variable		Stroke Occurrence		Total	p-value	OR
		Yes	No			(CI 95%)
CHO	>= 200 mg/dL	58	40	98	0.009	2.350 (1.272-4.340)
		66,,7%	46,0%	56,3%		
	< 200 mg/dL	29	47	76		
		33,3%	55,0%	43,7%		
	Total	87	87	174		
		100%	100%	100%		

Table 6. Bivariate analysis of blood triglyceride level variables with stroke event bound variables

Variable		Stroke Occurrence		Total	p-value	OR
		Yes	No			(CI 95%)
TGC	>= 200 mg/dL	50	35	85	0.034	2.008 (1.098-3.671)
		57,5%	40,2%	48,9%		
	< 200 mg/dL	37	52	89		
		42,5%	59,8%	51,1%		
	Total	87	87	174		
		100%	100%	100%		

Table 7. Bivariate analysis of blood HDL-level variables with stroke event bound variables

Variable		Stroke Occurrence		Total	p-value	OR
		Yes	No			(CI 95%)
HDL	>= 200 mg/dL	52	38	90	0.049	1.916 (1.049-3.500)
		59,8%	43,7%	51,7%		
	< 200 mg/dL	35	49	84		
		40,2%	56,3%	48,3%		
	Total	87	87	174		

Table 8. Bivariate analysis of blood LDL-level variables with stroke event bound variables

Variable		Stroke Occurrence		Total	p-value	OR
		Yes	No			(CI 95%)
LDL	>= 200 mg/dL	53	38	91	0.034	2.010 (1.099-3.678)
		60,9%	43,7%	52,3%		
	< 200 mg/dL	34	49	83		
		39,1%	56,3%	47,7%		
	Total	87	87	174		
		100%	100%	100%		

Table 9. Bivariate analysis of uric acid variables with stroke event bound variables

Variable		Stroke Occurrence		Total	p-value	OR
		Yes	No			(CI 95%)
Uric acid	High	47	38	85	0.225	1.515 (0.833-2.754)
		54,0%	43,7%	48,9%		
	Normal	40	49	89		
		46,0%	56,3%	51,1%		
	Total	87	87	174		
		100%	100%	100%		

Table 10. Bivariate Analysis of Heart Disease History Variables with Stroke Event-bound Variables

Variable		Stroke Occurrence		Total	p-value	OR (CI 95%)
		Yes	No			
Heart disease history	Yes	52	36	88	0.023	2.105 (1.150-3.853)
		59,8%	41,4%	50,6%		
	No	35	51	86		
		40,2%	58,6%	49,4%		
	Total	87	87	174		
		100%	100%	100%		

In this result, in line with the research (Andre Pramudia Krishna; Isra Thristy, 2021) obtained from 70 patients, an increased blood sugar level of 43 patients (61.4%), while 27 patients (38, etc.).6%) with blood sugar levels within normal limits and in the study of Basic Health Research (Riskesdas) in 33 provinces in Indonesia on the dominant risk factor for stroke patients in Indonesia in 2013 it was found that stroke was at a greater risk of 2.96x greater in people with high blood sugar than people with normal blood sugar.

In the results of the study of Indriasari (2021) it is in line with this study that there is a relationship between high blood sugar levels and stroke incidence and OR 3.9 in nerve patients at Budi Kemulian Hospital Batam Riau Islands. This means that patients who experience high blood sugar levels with a potential of 3.9 times are at risk of stroke than patients who do not have a history of high blood sugar levels (Indriasari, 2021).

In addition, another study has similarities, namely the 2021 Evakarmila Sari study with a high percentage of stroke patients with a history of blood sugar levels of 65 patients. Statistical test results show that OR obtained is 3.4 which means that patients with a high blood sugar history have a 3.4 higher risk potential for stroke in the bougenville ward of Dr. Abdul Moeloek Hospital with hyperglycemia risk factors. Lack of insulin secretion causes a person's blood sugar to increase. In addition to damaging the walls of peripheral and large blood vessels, hyperglycemia increases platelet aggregation which can cause atherosclerosis and stroke due to the atherosclerosis process clogging blood vessels in the brain stem (Karmila Sari et al., 2021).

In table 5 this is the cross tabulation (crosstab) of the results of a bivariate analysis between total cholesterol level and stroke occurrence. Prevalence of hypertension patients with stroke occurrence

The results of the bivariate analysis using the variable chisquare test of cholesterol levels have a p-value of 0.009 ($p<0.05$) which means there is a significant relationship between cholesterol levels and stroke occurrence in hypertensive patients at William Booth Semarang General Hospital in 2023 and an Odds ratio of 2,350. This is called the protective factor.

Hyperlipidemia is usually associated with atherosclerosis and coronary heart disease. High levels of serum cholesterol are a strong predictor of coronary heart disease, also an independent predictor of non-hemoragic stroke according to research (Sitorus et al., 2008).

The relationship between high cholesterol levels and stroke risk is very complex, in the results of a study in line with this study, it is shown that an increase in total cholesterol and low-density lipoprotein cholesterol (LDL-C) is associated with an increase in stroke risk (Kurthe et al., 2007). This is also in line with the research (Pakpahan & Hartati, 2022.) obtained the results of a chi-square statistical test with a p-value of 0.03 which means < 0.05, so that Ho is rejected and Ha is accepted, this means that there is a significant relationship between total cholesterol level and stroke occurrence.

Based on the results of a study that is in line with this study, high cholesterol levels affect prognosis and mortality in stroke occurrences. Research in the Korean state found high total cholesterol lipid levels associated with health-related outcomes that could lead to death, myocardial infarction, and stroke. In middle-aged adults and older adults have a higher mortality rate of stroke related to total cholesterol of more than 240 mg/dL (Yi et al., 2018), (Mee Kyoung Kim, 2017).

In table 6 this is the cross -tabulation

(crosstab) of the results of a bivariate analysis between triglycerd levels and stroke occurrence. Prevalence of hypertension patients with stroke occurrence

The results of the bivariate analysis using the triglyceride variable chisquare test have a p-value of 0.034 (p<0.05) which means there is a significant relationship between blood triglyceride levels and stroke incidence in hypertensive patients at William Booth Semarang General Hospital in 2023 and Odds ratio of 2,008, respectively. This is called the protective factor.

This is in line with this study, most of the patients experienced the first stroke of triglyceride level with (P < 0.01) (Kamgang et al., 2021). Other studies conducted in Korea found that higher triglycerides >200 mg/dL, and lower HDL-C, are significantly related to clinical events (death, MI, and stroke). Based on research results (Sun et al., 2020) and (Feng et al., 2024). Triglycerides are a type of fat that is absorbed by the intestine after hydrolysis. Triglycerides then enter the plasma in two forms: a chylomicron produced by intestinal absorption after fat is consumed, and a Very Low Density Lipoprotein (VLDL) formed by the liver with the aid of insulin.

Based on research results, the average value of triglyceride levels in people with new ischemic strokes is 143 mg/dl. This is in line with previous studies where the triglyceride level in new stroke sufferers is >150 mg/dl. Meanwhile, the average value of total cholesterol levels in people with new ischemic strokes is 205.8 mg/dl. This is in line with previous studies where the average triglyceride level in people with new ischemic stroke was >200 mg/dl.7.8 (Chaudhury et al., 2014) (Feryadi et al., 2014)

This is in line with previous studies where the average triglyceride level in stroke sufferers was >150 mg/dl and another study that received the average triglyceride level in recurrent ischemic stroke sufferers was >200 mg/dl.9.10 (Andalas et al., 2010) (Al Ghifari & Andina, 2017).

In table 7, this is the cross-tabulation (crosstab) of the results of a bivariate analysis between blood HDL levels and stroke occurrence. Prevalence of hypertension patients with stroke occurrence

The results of the bivariate analysis using the blood HDL variable chisquare test have a p-value of 0.049 (p<0.05) which means there is a significant relationship between blood HDL levels and stroke incidence in hypertensive patients at William Booth Semarang General Hospital in 2023 and an Odds ratio of 1,916, this is considered a protective factor.

Low HDL cholesterol levels can increase the risk of blood clots. The formation of blood clots in the carotid artery can cause a risk of stroke. HDL cholesterol levels too low are as dangerous as having LDL cholesterol levels too high. Too low HDL cholesterol levels accompanied by high LDL cholesterol levels can trigger plaque formation in arterial vessels, and potentially inhibit blood flow to all organs, and the brain. (Kandou et al., 2016).

HDL cholesterol levels are one of the risk factors for stroke. The results of this study are in accordance with a study conducted by (Heidy patricia, 15 C.E.) on High Density Lipoprotein Cholesterol and Ischemic Stroke, stating that higher HDL levels are associated with a 0.20-fold decrease in ischemic stroke risk (95% CI = 0.08-0.50). HDL blocks inflammation by acting as an antioxidant by limiting cytokine esxcretion such as tumor necrosis factor α and interleukin-1 that mediates leukocyte adhesion to endothelites. HDL can also reduce thrombotic risk through inhibition of platelet activation and aggregation and can improve endothelial function by stimulating the release of prostacyclines (Boehme et al., 2017).

This is in line with the research (Sipkhotun Windayani, 2016) it is proven that stroke occurrence in patients with low HDL levels of 33 patients (78.6%) and normal HDL levels of 9 patients (21.4%). Based on these results, it can be concluded that HDL levels are one of the risk factors for ischemic stroke. In line with the research (Johansen et al., 2023) conducted by Heidy Patricia et al in 2015 using a retrospective descriptive research method, 45 patients (60%) with low HDL cholesterol levels and 30 patients (40%) with normal HDL cholesterol levels. Other research results correspond to Sacco et al's 2001 study of High Density Lipoprotein.

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Elderly states that higher HDL cholesterol levels are associated with a decrease in the risk of ischemic stroke by 0.20 times (95% CI = 0.08-0.50).

In table 8 this is the cross-tabulation (crosstab) of the results of a bivariate analysis between blood LDL levels and stroke occurrence. Prevalence of hypertension patients with stroke occurrence

The results of the bivariate analysis using the variable chisquare test of blood LDL levels have a p-value of 0.034 (p<0.05) which means there is a significant relationship between blood LDL levels and stroke occurrence in hypertensive patients at William Booth Semarang General Hospital in 2023 and an Odds ratio of 2.010, respectively. This is called the protective factor.

This is in line with this study obtained by most patients experiencing stroke with LDL levels (P < 0.01) (Kamgang et al., 2021). Based on previous studies, people with dyslipidemia experience more ischemic and hemorrhagic strokes. Dyslipidemia is a condition with abnormal fat levels in the blood, one of which is an increase in LDL levels. Dyslipidemia, especially with increased LDL, can lead to the formation of atherosclerosis plaque which leads to stroke. Increased blood cholesterol levels cause changes in the permeability of the blood vessel endothelial walls, leading to lipid migration, especially LDL, to the arterial walls of the subendothelial lining and subsequent release of VCAM-1 (vascular adhesion molecule-1). The release of VCAM-1 (vascular adhesion molecule-1) results in the release of VCAM-1 (vascular adhesion molecule-1). This causes the monocytes to attach to the subendothelial space of the blood vessels and become macrophages. LDL oxidizes and binds to macrophages and forms foam cells. Innocent muscle cells in the nucleus will also bind to oxidized LDLs and form foam cells. Proliferation of blood vessel muscles leads to thickening and forming sclerosis and into atherosclerosis plaque.

The results of this study are in accordance with several other studies that state that stroke patients based on LDL levels are found to have a high average LDL level of 52.5% of all study samples. Samples with low and borderline LDL levels were 31.25% and 16.25% (Abdul Fahma Firmana, 2013). Meanwhile, in a study conducted by Immamura in Japan, the percentage of stroke patients with high LDL levels was quite high, namely 74% or 140 out of 191 stroke patients (Imamura et al., 2009).

Table 9 presents a cross-tabulation (crosstab) of the bivariate analysis between uric acid and the incidence of stroke. The prevalence of hypertensive patients with stroke incidence.

Based on the results of the chi-square test, it shows that hypertensive patients with a stroke event are more likely to be found in the group of patients with high uric acid levels at 54.0%, compared to those with normal uric acid levels at 46.0%. In hypertensive patients without hypertensive complications, they are more commonly found in the group of patients with normal uric acid levels at 56.3%, compared to those with high uric acid levels at 43.7%.Based on the clinical interpretation guidelines for reporting at RSU William Booth Semarang, the normal levels of uric acid are stated to be < 7.0 mg/dL for males and < 6.0 mg/dL for females (Kemenkes, 2011). Uric acid is formed from the breakdown of nucleic acids, and the concentration of urate in serum increases when there is excessive production or destruction of cells or an inability to excrete urate through the kidneys. This is inconsistent with this study which describes that the majority of patients experienced strokes related to uric acid, yielding an OR of 4.34 and a 95% CI of 1.09-18.09 (Kamgang et al., 2021). Based on several journals, it can also be concluded that high levels of uric acid are closely related to stroke risk factors. Hyperuricemia is an indicator in patients at high risk of stroke.

However, this study is in line with the research conducted by (Cahyadi et al., 2019) which found a p > 0.05 result, meaning no significant relationship was found, and in the study by (Daniel Mahendrakrisna, 2020) there was also no relationship and correlation between blood uric acid levels at admission and clinical outcomes assessed using mRS, resulting in a p-value of 0.54. These results are similar to the study conducted by (Saadat et al., 2018) on 170 stroke patients in Iran, where they found no significant relationship between uric acid levels and stroke incidence. High uric acid levels are

associated with an increased risk of fatal stroke. Thus, hyperuricemia is associated with an increase in the amount of triglycerides and LDL cholesterol. The average serum uric acid level in the studied patients was found to result in hyperuricemia in about 47.3% of the patients, which is approximately half. There is a significant correlation between their serum uric acid levels (p=0.04, R=-0.27). According to the study by Storhaug et al. (2013), it is mentioned that serum uric acid levels are a risk factor for ischemic stroke and a cause of death in the Tromsø population, Norway. This study is a cohort study with a total of 27,158 subjects over 12 years (Storhaug et al., 2013).

Based on the theoretical foundation, the relationship between serum uric acid levels and the probability of ischemic stroke is explained through several mechanisms. The first mechanism is through the relationship between elevated serum uric acid levels and cardiovascular disease. Hyperuricemia can increase cholesterol and triglyceride levels, thus increasing the risk of cardiovascular disease. Then, hyperuricemia can enhance xanthine oxidase activity, which produces an enzymatic response in the form of reactive oxygen species production, thereby increasing oxidative stress and causing insulin resistance and diabetes mellitus (MARCELO HEINIG MD, 2006).

In table 10 this is the cross-tabulation (crosstab) of the results of a bivariate analysis between the history of heart disease and the incidence of stroke. Prevalence of hypertension patients with stroke occurrence

The results of the bivariate analysis using the cardiac history variable chisquare test have a p-value of 0.023 (p<0.05) which means there is a significant relationship between heart disease history and stroke incidence in hypertensive patients at William Booth Semarang General Hospital in 2023 and an Odds ratio of 2,105. This is called the protective factor.

The results of a study conducted by (Wilda Maulida Hikmah, 2019) said that there is a relationship between heart disease and stroke. In addition to the research done by Handayani et al. (2018) found that stroke patients with a history of hypertension, diabetes mellitus and dyslipidemia tend to show worse clinical symptoms than stroke patients with no comorbital disease.

Research conducted previously according to (Ghani et al., 2016) the prevalence of stroke in the coronary heart was (7.25%) and after being controlled by other factors, it was at risk with OR= 3.13 times (95% CI 2.72-3, or 3.5%).60) in the study of the article stated that a quarter of previous stroke sufferers had a history of coronary symptoms that tended to recur. Getting p-0.001 then it can be concluded that there is a historical relationship of coronary heart disease to stroke. Heart defects are primarily associated with embolism. Atrial fibrillation is the most common case and is at 3–4 stroke risk. Non-valvular atrial fibrillation is the cause of embolism, where embolism is one of the factors that contribute to atrial fibrillation. This was confirmed by AHA/ASA (2006), that individuals suffering from atrial fibrillation, 2 - 4% had stroke attacks (Wayunah & Saefulloh, 2017) (Handayani et al., 2023).

CONCLUSION

The results of this study indicate a relationship between age, gender, random blood sugar levels, total cholesterol levels, triglyceride levels, blood HDL levels, blood LDL levels, and a history of heart disease. Therefore, this study suggests that early detection and management of risk factors, especially blood pressure and cholesterol control, are crucial in preventing stroke. Public education about healthy lifestyles can also help reduce the incidence of stroke in the future.

REFERENCES

Al Ghifari, M., & Andina, M. (2017). Gambaran Tekanan Darah pada Pasien Stroke Akut di Rumah Sakit Umum Haji Medan Tahun 2015 Blood Pressure in Acute Stroke Patient of Rumah Sakit Umum Haji (Vol. 2, Issue 1). UMSU. http://jurnal.umsu.ac.id/index.php/buletin_farmatera

Alchuriyah, S., & Wahjuni, C. U. (2016). FAKTOR RISIKO KEJADIAN STROKE USIA MUDA PADA PASIEN RUMAH SAKIT BRAWIJAYA SURABAYA The Factors that Affect Stroke at Young Age in Brawijaya Hospital Surabaya. 62–73.

https://doi.org/10.20473/jbe.v4i1.62-73

Andalas, J. K., Faktor, G., Dan, R., Stroke, T., Rawat, P., Di, I., Penyakit, B., Rsud, D., Solok, K., Periode, S., Dinata, C. A., Safrita, Y., & Abstrak, S. S. (2010). Gambaran Faktor Risiko dan Tipe Stroke pada Pasien Rawat Inap di Bagian Penyakit Dalam RSUD Kabupaten Solok Selatan Periode 1 Januari 2010 - 31 Juni 2012. http://jurnal.

Andrean, A. (2018). HUBUNGAN AKTIVITAS FISIK DENGAN NYERI KEPALA PRIMER PADA MAHASISWA PRAKLINIK PROGRAM STUDI PENDIDIKAN DOKTER FAKULTAS KEDOKTERAN UNIVERSISTAS SRIWIJAYA.

Boehme, A. K., Esenwa, C., & Elkind, M. S. V. (2017). Stroke Risk Factors, Genetics, and Prevention. In Circulation Research (Vol. 120, Issue 3, pp. 472–495). Lippincott Williams and Wilkins. https://doi.org/10.1161/CIRCRESAHA.116.308398

Danang, M. (2022). HUBUNGAN KADAR GULA DARAH DENGAN ANGKA KEJADIAN STROKE DI RSI SULTAN AGUNG SEMARANG (Studi Observasional Analitik di RSI Sultan Agung Semarang).

Dawson, J., & MacDonald, A. (2023). Sex and hypertensive organ damage: stroke. In Journal of Human Hypertension (Vol. 37, Issue 8, pp. 644–648). Springer Nature. https://doi.org/10.1038/s41371-023-00830-0

Feng, Q., Li, H., Zhang, R. Y., Sun, L., Zhang, S. Y., Chen, Y., Zhang, Y., Shan, B. S., Zhao, Z., Zhou, H., & Xu, X. (2024). Elevated remnant cholesterol is a risk factor for acute ischemic stroke. Journal of Stroke and Cerebrovascular Diseases, 33(8), 1–7. https://doi.org/10.1016/j.jstrokecerebrovasdis.2024.107773

Feryadi, R., Sulastri, D., & Kadri, H. (2014). Hubungan Kadar Profil Lipid dengan Kejadian Hipertensi pada Masyarakat Etnik Minangkabau di Kota Padang Tahun 2012. In Jurnal Kesehatan Andalas (Vol. 3, Issue 2). http://jurnal.fk.unand.ac.id

Ghani, L., Mihardja, L. K., & Delima, D. (2016). Faktor Risiko Dominan Penderita Stroke di Indonesia. Buletin Penelitian Kesehatan, 44(1). https://doi.org/10.22435/bpk.v44i1.4949.49-58

Handayani, I. Y., Aini Isnawati, I., Hamim, H. N., Tinggi, S., Kesehatan, I., Pesantren, H., & Hasan Probolinggo, Z. (2023). Faktor-faktor Yang Mempengaruhi Tingkat eparahan Stroke Di Ruang Melati RSUD Dr. Haryoto Lumajang. https://journal-mandiracendikia.com/jikmc

Hardika, B. D., Yuwono, M., & Zulkarnain, H. M. (2020). Faktor Risiko yang Mempengaruhi Terjadinya Stroke Non Hemoragik pada Pasien di RS RK Charitas dan RS Myria Palembang. 9(2), 268–274. https://doi.org/10.36565/jab.v9i2.234

Hasan, A. M., Rahmayani, F., Rudiyanto, W., Kedokteran, F., Lampung, U., Prof, J., Sumantri, I., No, B., Meneng, G., Rajabasa, K., & Lampung, K. B. (2022). PENGARUH KADAR LDL DAN HDL PADA STROKE. http://jurnal.globalhealthsciencegroup.com/index.php/JPPP

Hasanah, U., & Putro Ragil Santoso, A. (2020). Association between Triglyceride Serum Levels and Glomerular Filtration Rate (eGFR) in Patients with Chronic Renal Failure at Jemursari Islamic Hospital Surabaya, Indonesia.

Heidy patricia, M. A. H. K. M. J. T. (2015). Karakteristik Penderita Stroke Iskemik Yang Di Rawat Inap Di RSUP Prof. DR. R. D. Kandou Manado Tahun 2012-2013. Jurnal E-Clinic, 445–451.

Indriasari, S. S. A. A. F. P. (2021). HUBUNGAN DIABETES MELITUS TIPE 2 DENGAN STROKE ISKEMIK PADA PASIEN POLIKLINIK SARAF DI RUMAH SAKIT BUDI KEMULIAAN KOTA BATAM TAHUN 2021. Universitas Batam, 13, 342–350.

Iskandar, A., Hadisaputro, S., Pudjonarko, D., Tugasworo Pramukarso, D., Muhammadiyah Aceh, U., Kesehatan Semarang, P., Kedokteran Undip, F., Kesehatan Masyarakat Undip, F., & Kariadi, R. (2018). Gaya Hidup yang Berpengaruh terhadap Kejadian Stroke Iskemik pada Usia Kurang dari 45 Tahun (Studi Pada BLUD * ** *** (Issue 2).

Johansen, M. C., Ye, W., Gross, A., Gottesman, R. F., Han, D., Whitney, R., Briceño, E. M., Giordani, B. J., Shore, S., Elkind, M. S. V., Manly, J. J., Sacco, R. L., Fohner, A., Griswold, M., Psaty, B. M., Sidney, S., Sussman, J., Yaffe, K., Moran, A. E., … Levine, D. A. (2023). Association Between Acute Myocardial Infarction and Cognition. JAMA Neurology, 80(7), 723–731. https://doi.org/10.1001/jamaneurol.2023.1331

Kabi, G. Y. C. R., Tumewah, R., & Kembuan, M.

A. H. N. (2015). GAMBARAN FAKTOR RISIKO PADA PENDERITA STROKE ISKEMIK YANG DIRAWAT INAP NEUROLOGI RSUP PROF. DR. R. D. KANDOU MANADO PERIODE JULI 2012-JUNI 2013. In Jurnal e-Clinic (eCl) (Vol. 3, Issue 1).

Kandou, R. D., Laulo, A., Tumboimbela, M. J., & Mahama, C. N. (2016). Gambaran profil lipid pada pasien stroke iskemik dan stroke hemoragik yang di rawat inap di Irina F RSUP Prof. In Jurnal e-Clinic (eCl) (Vol. 4, Issue 2).

Karmila Sari, E., Agata, A., & Studi Keperawatan, P. (2021). Korelasi Riwayat Hipertensi dan Diabetes Mellitus dengan Kejadian Stroke. In Jurnal Ilmu Keperawatan Indonesia (JIKPI) (Vol. 2, Issue 2).

Langholz, B., & Richardson, D. (2009). Are nested case-control studies biased? Epidemiology, 20(3), 321–329. https://doi.org/10.1097/EDE.0b013e3181 9e370b

Mangontan, T., Berhimpon, S. L., & Wowor, M. F. (2024). Gambaran Kadar Glukosa Darah Puasa pada Pasien Stroke Iskemik di RSUP Prof. Dr. R. D. Kandou Manado tahun 2022. Medical Scope Journal, 6(2), 282–288. https://doi.org/10.35790/msj.v6i2.53651

Manurung, M., Diani, N., Studi Ilmu Keperawatan Fakultas Kedokteran Universitas Lambung Mangkurat, P., Keperawatan Medikal Bedah Program Studi Ilmu Keperawatan Fakultas Kedokteran Universitas Lambung Mangkurat, B., & Keperawatan Medikal Bedah Program Studi Ilmu Keperawatan Fakultas Kedokteran, B. (2015). Analisis Faktor Risiko Stroke Pada Pasien Stroke Rawat Inap Di RSUD Banjarbaru.

Mapoure, Y. N., Ayeah, C. M., Doualla, M. S., Ba, H., Ngahane, H. B. M., Mbahe, S., & Luma, H. N. (2017). Serum Uric Acid is Associated with Poor Outcome in Black Africans in the Acute Phase of Stroke. Stroke Research and Treatment, 2017. https://doi.org/10.1155/2017/1935136

Martono, M., Darmawan, R. E., & Anggraeni, D. N. (2022). Faktor-Faktor Yang Berhubungan Dengan Kejadian Stroke Pada Usia Produktif. Jurnal Keperawatan Muhammadiyah, 7(1), 2022.

Maulin Halimatunnisa', Lalu Hersika Asmawariza, Azwar Hadi, Vera Yulandasari, Erwin Wiksuarini, D. Mustamu Qamal Pa'ni, Iwan Wahyudi, & Aoladul Muqarrobin. (2023). Faktor Risiko Stroke di Rumah Sakit Umum Daerah Praya Tahun 2022. Jurnal Kesehatan Qamarul Huda, 11(1), 371–381. https://doi.org/10.37824/jkqh.v11i1.2023. 507

Mee Kyoung Kim, K. H. H.-S. K. Y.-M. P. (2017). Cholesterol variability: A marker for increased risk or a risk factor? In European Heart Journal (Vol. 38, Issue 48, pp. 3567–3568). Oxford University Press. https://doi.org/10.1093/eurheartj/ehx656

Natha, M. H. J., Maliawan, S., Niryana, I. W., & Kusuma, G. F. P. (2023). Gambaran karakteristik pasien stroke hemoragik di RSUP Prof. Dr. I.G.N.G Ngoerah Bali, Indonesia, tahun 2019-2021. Intisari Sains Medis, 14(2), 664–668. https://doi.org/10.15562/ism.v14i2.1740

Ospel, J., Singh, N., Ganesh, A., & Goyal, M. (2023). Sex and Gender Differences in Stroke and Their Practical Implications in Acute Care. In Journal of Stroke (Vol. 25, Issue 1, pp. 16–25). Korean Stroke Society. https://doi.org/10.5853/jos.2022.04077

Pakpahan, J. E. S., & Hartati, B. (2022). Hubungan dislipidemia dengan kejadian stroke. Holistik Jurnal Kesehatan, 16(6), 542–551. https://doi.org/10.33024/hjk.v16i6.8089

Peters, S. A. E., Carcel, C., Millett, E. R. C., & Woodward, M. (2020). Sex differences in the association between major risk factors and the risk of stroke in the UK Biobank cohort study. Neurology, 95(20), E2715–E2726. https://doi.org/10.1212/WNL.000000000 0010982

Pratiwi, L. N., & Andina, M. (2018). ARTIKEL PENELITIAN Perbedaan Kadar Trigliserida dan Kadar Kolesterol Total pada Penderita Stroke Iskemik Baru dengan Rekuren di Rumah Sakit Umum Haji Medan Provinsi Sumatera Utara Tahun 2015-2016. Anatomica Medical Journal Fakultas Kedokteran. http://jurnal.umsu.ac.id/index.php/AMJ

Riskesdas. (2018). Laporan Riskesdas 2018 Nasional.

Rizqiputri, S., Siregar, M., & Boy, E. (2022). Faktor Risiko pada Pasien Dislipidemia. 3. https://jurnal.umsu.ac.id/index.php/JIH/ article/view/12241/pdf

Sahetapi, C. M., Roseville, C., & Aritonang, L. (2021). Differences in blood sugar levels during ischemic stroke and hemorrhagic stroke at RSU UKI Jakarta. International Journal of Medical and Health Research, 7(6), 67–76.

www.medicalsciencejournal.com

Sarfo, F. S., Akpa, O., Ovbiagele, B., Akpalu, A., Wahab, K., Komolafe, M., Obiako, R., Owolabi, L., Osaigbovo, G. O., Jenkins, C., Ogbole, G., Fakunle, A., Tiwari, H. K., Arulogun, O., Arnett, D. K., Asowata, O., Ogah, O., Akinyemi, R. O., & Owolabi, M. O. (2021). Influence of age on links between major modifiable risk factors and stroke occurrence in West Africa. Journal of the Neurological Sciences, 428. https://doi.org/10.1016/j.jns.2021.117573

Sipkhotun Windayani. (2016). HUBUNGAN TINGKAT KADAR KOLESTEROL HIGH DENSITY LIPOPROTEIN DENGAN KEJADIAN STROKE ISKEMIK DI RSUD DR. MOEWARDI.

Sitorus, R. J., Hadisaputro, S., & Kustiowati, E. (2008). Faktor-Faktor Risiko Yang Mempengaruhi Kejadian Stroke Pada Usia Muda Kurang Dari 40 Tahun (Studi Kasus Di Rumah Sakit Di Kota Semarang). www.pdffactory.com

Sonia Gandi, F. (2023). LATIHAN MOBILISASI SEDERHANA PADA PASIEN STROKE HEMOROGIK DI ROUJIN HOME JEPANG. In ADVANCES in Social Humanities Research (Vol. 1, Issue 7).

Sun, J., Lv, X., Gao, X., Chen, Z., Wei, D., Ling, Y., Zhang, J., Gu, Q., Liu, J., Chen, W., & Liu, S. (2020). The association between serum uric acid level and the risk of cognitive impairment after ischemic stroke. Neuroscience Letters, 734, 1–5. https://doi.org/10.1016/j.neulet.2020.135098

Tu, W. J., Wang, L. De, Yan, F., Peng, B., Hua, Y., Liu, M., Ji, X. M., Ma, L., Shan, C. L., Wang, Y. L., Zeng, J. S., Chen, H. S., Fan, D. S., Gu, Y. X., Tan, G. J., Hu, B., Kang, D. Z., Liu, J. M., Liu, Y. L., … Wu, J. (2023). China stroke surveillance report 2021. In Military Medical Research (Vol. 10, Issue 1). BioMed Central Ltd. https://doi.org/10.1186/s40779-023-00463-x

WHO. (2024, August 7). 10 penyebab kematian teratas. WHO. https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death

Williams, B., Mancia, G., Spiering, W., Rosei, E. A., Azizi, M., Burnier, M., Clement, D. L., Coca, A., De Simone, G., Dominiczak, A., Kahan, T., Mahfoud, F., Redon, J., Ruilope, L., Zanchetti, A., Kerins, M., Kjeldsen, S. E., Kreutz, R., Laurent, S., … Zamorano, J. L. (2018). 2018 ESC/ESH Guidelines for themanagement of arterial hypertension. In European Heart Journal (Vol. 39, Issue 33, pp. 3021–3104). Oxford University Press. https://doi.org/10.1093/eurheartj/ehy339

Wulandari, A., Atika Sari, S., & Keperawatan Dharma Wacana Metro, A. (2023). IMPLEMENTATION OF BENSON RELAXATION ON BLOOD PRESSURE IN HYPERTENSION PATIENTS AT THE GENERAL HOSPITAL AHMAD YANI, METRO CITY IN 2022. Jurnal Cendikia Muda, 3(2).

Yang, W., Jin, J., Xie, M., & Ai, C. (2024). Association of circulating adiponectin levels with the incidence of ischemic stroke : A meta-analysis. Journal of Neurorestoratology, 12(2), 100119. https://doi.org/10.1016/j.jnrt.2024.100119

Zhong, J., Cai, H., Zhang, Z., Wang, J., Xiao, L., Zhang, P., Xu, Y., Tu, W., Zhu, W., Liu, X., & Sun, W. (2024). Serum uric acid and prognosis of ischemic stroke: Cohort study, meta-analysis and Mendelian randomization study. European Stroke Journal, 9(1), 235–243. https://doi.org/10.1177/23969873231209620