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Hyperglycemia, Ankle-Brachial Index and HDL Ratio to Total Cholesterol as Predictor of Stroke Severity using NIHSS

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***Abstract*:- Stroke is one of the leading cause of death and disability worldwide. In Indonesia stroke is the highest cause of death similar to heart disease and the second cause of disability. 15 -30% of stroke cases result in permanent disability. Stroke results in varying clinical manifestations. Depending on which of the blood vessels is affected and the condition of collateral vessels in the brain. This study aims to analyze the relationship of hyperglycemia. ABI and HDL ratio to total cholesterol as a predictor of stroke severity. This research is analytical descriptive with cross sectional approach with NIHSS observation sheet. ABI measurement sheet and laboratory examination sheet. Data is processed using linear regression. The results showed a significant association between hyperglycemia. ABI and HDL to total cholesterol ratio with stroke severity with p = 0.024. Hyperglycemia. ABI and HDL-Cholesterol Total ratios are jointly influential and can be used to predict stroke severity. The severity of neurological deficits caused by stroke was influenced by the collateral vascularization conditions present in the brain. If vascularization is good efforts to save as many areas of ischemic activity can be done.**

Keywords: *Stroke, Hyperglycemia, ABI, HDL, Total Cholesterol.*

I. INTRODUCTION

Stroke is the leading cause of death and disability worldwide including America and many other countries (Kernan et al. 2014). In Indonesia. stroke is the highest cause of death equals heart disease funding causes second disability (Riskesdas. 2013). Kernan et al (2014) mentioned that 15 - 30% of stroke cases result in permanent disability. Luitse et al (2012) even identified the disability occurring in stroke patients incurring high costs. 52.5% of stroke patient and family income only spent on stroke treatment.

In United States. stroke incidence is approximately 795.000 cases per year (new stroke 700 cases). 20% of whom die within the first year after stroke (Kernan et al. 2014). Estimated that by 2050 this number will increase to 1 million annually. In Indonesia. stroke is the highest cause of death similar to heart disease (Riskesdas. 2013). Although since 2000-2010 the death rate from stroke has decreased by 22.8%. but there is a tendency of increasing stroke cases in case of incidence. as well as disability in developing countries (Perdossi. 2011). Even according to Karunawan et al (2016). stroke in Indonesia until 2013 is the first cause of death in hospital.

Stroke is a cerebral circulation disorder that occurs due to a pathological process in the blood vessels that eventually leads to atherosclerosis (thrombosis) or rupture of arterial blood vessels (Smith et al. 2001). Stroke is also affected by several risk factors such as age. sex. genetics and race and family history of stroke as an uncontrollable risk factor. Stroke is also influenced by risk factors that can be controlled that is high blood pressure. high total cholesterol. diabetes mellitus. smoking. carotid stenosi and atrial fibrillation (PERDOSSI. 2011). Stroke generates a variety of clinical manifestations. making it difficult to be recognized by the public even by health workers themselves. This condition results in stroke patients experiencing delays in seeking health assistance that will increase the severity and risk of disability in patients (PERDOSSI. 2011). The research of Hariyanti et al (2015) proved that of 101 stroke patients. 31.5% went directly to hospitals with varying time span of 18.7% in less than 3 hours. while the rest was more than 3 hours. Even 22% were not taken to any hospital or health worker.

Hyperglycemia is one of the risk factors that will aggravate the condition and affect the prognosis of stroke due to intracellular acidosis. increased lipolysis and cerebral edema (Badiger et al. 2013). Previous research conducted by Karunawan on hyperglycemia against functional outcome using mRS showed no significant relationship. The second risk factor is the ratio of HDL to total cholesterol. Low HDL ratios are believed to affect the increased risk of plaque buildup in blood vessel walls that will affect the elasticity of the blood vessels themselves. In addition. the plaque formed is likely to be a blockage that will interfere with cerebral blood flow. The aim of this study is analyze the relationship of hyperglycemia. ABI and HDL ratios to total cholesterol as a predictor of stroke severity by using NIHSS.

II. METHODS

A. Research design

This research was a descriptive analytic design with cross sectional study approach.

B. Research subjects

The population of this study were all stroke patients treated in ER and stroke unit. There were 30 patients who selected with purposive sampling.

C. Instruments

Stroke Severity Assessment of stroke patient condition by using awareness indicator. best gaze. visual. facial palsy. motor arm. leg motor. limb ataxia. sensory. best language. dysartria and Extinction and Inattention measured at first 24

hours post onsite attack Minimum score 0 and maximum score is 42.

Blood sugar levels and HDL ratio to total cholesterol levels according to secondary data. results of laboratory examination when the patient hospitalized. Blood sugar was categorized into 2 classes: Normall if blood sugar levels < 200 mg/dl. High if blood sugar levels > 200 mg/dl. While HDL ratio was categorized into 2 classes: Normal if < 4. high if > 4.

ABI (Ankle-Brachial Index) was measuring by compare blood pressure value in stroke patient ankle and stroke patient arm by using tensimeter and doppler ultrasound. That was categorized into 2 classes: Normal> 1.0 (0.9 - 1.3) and Bad <0.9.

D. Research Ethics

Ethical approval was obtained from the Health Research Ethics Commission at Poltekkes Kemenkes Malang. Study permission was obtained from the General Hospital in District Pasuruan to carry out research by disseminating the intent and purpose of research. The researcher explained the objectives and procedures of the study. and asked for the patient's willingness to be the respondent in the study and signed the informed consent.

E. Data Analysis

The data has been collected then analyzed by multivariate statistical analysis (linear regression).

III. RESULTS

Characteristic of respondents of this research were consists of 60% of respondent were male and 40 % were female. The age range of respondents is 55-60 years. which is 19 respondents (64%). In addition. the average age of respondents was 60.77 years. with a Standard Deviation of 6.044. The youngest age is 55 years and the oldest age is 75 years.

Characteristic		n	%	Mean	Med	Mo	Min	Max	St. Dev
Age	55-60	19	64	60.77	60	55	55	75	6.04
	61-65	6	20						
	66-70	1	3						
	71-75	4	13						
Gender	Male	18	40						
	Female	12	60						

Table 1:- Distribution of respondents based on gender and age

Parameter	Mean	Min	Max	St. Dev
Blood Sugar Level	159	125	200	23.4
ABI	0.905	0.6	1.2	0.180
Ratio HDL	4.346	2.21	6.81	1.127

Table 2:- Average Blood Sugar Levels. ABI (ankle Brachial Index) and HDL Ratio to Total CHolesterol in Stroke Patients

Table 2 shows the mean blood sugar levels of patients on initial examination in the ER are 159 mg / dl, with a minimum value of 125 mg / dl and a maximum value of 200 mg / dl.The average value of ABI is 0.905 with a minimum value of 0.6 and a maximum of 1.2 and the average ratio of HDL-Cholesterol Total is 4.346 with a minimum value of 2.21 and a maximum of 6.81.

	Mean	Min	Max	Std. Def
NIHSS	16,26	3,00	42,00	13,856

Table 3:- Severity of Stroke Patients using NIHSS

Table 3 shows that the average severity value using NIHSS is 16.26 with a minimum value of 3.00 and a maximum of 42.00

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1670.374	3	556.791	3.714	.024[a]
	Residual	3897.493	26	149.904		
	Total	5567.867	29			

Table 4:- Relationship of Hyperglycaemia, ABI and the Total HDL-Cholesterol Ratio on Stroke Severity Assessed using NIHSS

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Table 4 shows that p value is 0.024 which is smaller than 0.05, so H1 is accepted which means there is a correlation between hyperglycemia, ABI, HDL-Total Cholesterol ratio with stroke severity assessed by using NIHSS. Thus, hyperglycemia, ABI and HDL-Cholesterol Total ratios are jointly influential and can be used to predict stroke severity.

Parameters	T value	Sig.
HDL-Cholesterol Total	2.209	.036*
ABI	-1.371	.182
Blood Sugar	1.539	.136
**significant level (<0,05)*		

Table 5:- Relationship of Hyperglycaemia, ABI and the Total HDL-Cholesterol Ratio on Stroke Severity using T Test

Table 5 shows the results T-value arithmetic of indicated that there was statistically HDL-Cholesterol Total ratio > t table or significantofrelationshipHDL-Total 2.209 > 2.052 and p value < 0,05, which Cholesterol Ratio with the stroke severity.

IV. DISCUSSION

A. Blood Sugar Levels in Stroke Patients

The results showed that the mean blood glucose level of the patients at baseline examination at IGD was 159 mg / dl, with a minimum value of 125 mg / dl and a maximum value of 200 mg / dl. Of 30 respondents, 36.7% of their blood sugar levels were within normal limits of ≤140 mg/ dl. The remaining 63.3% had hyperglycemia with blood sugar> 140 mg / dl. The findings in this study outweigh the findings of Luitse, et al (2012) which states that hyperglycemia conditions occur in 30-40% of acute ischemic stroke patients with no history of diabetes (Karunawan et al., 2016). It was further stated that hyperglycemia in acute stroke is the impact of stress response. This stress response mediates the release of cortisol and norepinephrine with the relative deficiency of insulin, gluconeogenesis, and lipolysis.

B. Value of ABI in Stroke Patients

The results showed that the average value of ABI was 0.905 with a minimum value of 0.6 and a maximum of 1.2. Of the 30 respondents, 56.6% had a poor ABI score of <0.9 and the remaining 43.4% had normal ABI values of ≥1 (0.9-1.3). ABI value <0.9 indicates the presence of large blood vessel abnormalities (arteries) especially in the leg area due to atherosclerosis (Chesbro et al. 2011 in Widyanthari, 2016). It is also mentioned that PAD is associated with hypertension is about 33-35% with PAD indicates the presence of hypertension. Danchun et al. (2010) added that patients with PAD risk three to four times more exposed to cardiovascular disease than patients without PAD. This is supported by research by Busch et al (2009) which states that low ABI values increase a person's risk twice as likely to suffer a stroke compared to individuals with normal ABI values. In addition, with low ABI values it will be possible the severity of clinical manifestations that occur, so complications due to stroke will increase. Low ABI values are also possible due to occlusion of blood vessels in the brain.

C. Total HDL-Cholesterol Ratio in Stroke Patients

The results showed that the average ratio of HDL-Cholesterol Total is 4.346 with a minimum value of 2.21 and a maximum of 6.81. Of the 30 respondents 40% had a normal HDL-Cholesterol ratio of ≤ 4 and the remaining 60% had a high ratio of> 4. The higher the ratio of HDL to total cholesterol, the greater the risk of developing vascular disease. As the theory put forward by Durstine, 2006 that the risk of stroke will increase in conditions where the increase in total cholesterol levels followed by a decrease in HDL levels. In these conditions, the ratio between total cholesterol levels to HDL will rise so as to spur the formation of atherosclerosis. The ratio of total cholesterol to HDL is a strong predictor of stroke risk. The results of this study in accordance with previous research conducted by Woodward, et al, 2007 that the ratio of total cholesterol to HDL high will increase the risk of CHD events by 1.81 times.

D. Severity of Stroke Patients with NIHSS

The results showed that the average severity value using NIHSS was 16.26 with a minimum value of 3.00 and a maximum of 42.00. The observations of hemorrhagic stroke were more severe than ischemic stroke because most respondents who suffered a hemorrhagic stroke got a score of 3 for a coma consciousness score on the consciousness level parameter. It affects other parameters such as answering questions, following commands, horizontal conjugate eye movements, viewing field, facial paresis, motor arms and legs, liver ataxia, sensory, reversed language, dysarthria, neglect and inatension and causing other parameters to be obtained high score for each parameter. This results in a high number of hemorrhagic stroke scores, which means severe neurological deficits. This is in accordance with the theory of Soeharto (2004) which states that hemorrhagic stroke although rare, but more dangerous and cause many deaths. While ischemic stroke most likely survived more than a hemorrhagic stroke.

Neurologic deficits are believed to always cause permanent disruption of function, disability and decreased quality of life. Neurological deficits that occur about various neurological domains such as motor, sensory, sight, language, cognition and affects. Due to the heterogenicity of the symptoms of stroke and its severity, there are many possible categories of stroke output measurements, one of which is the NIHSS score (Tsao. 2005).

E. Relationship of Hyperglycemia, ABI and Total HDL-Cholesterol Ratio in Stroke Patients

Research Results with p value being 0.024 which is smaller than 0.05, H1 means there is a relationship between hyperglycemia, ABI, HDL-Total Cholesterol ratio with stroke severity associated with using NIHSS. Thus, hyperglycemia, ABI and HDL-Cholesterol Total ratio together and can be used to predict stroke severity. This condition can be understood, because the severity of neurological deficits caused by stroke by the condition of vascularization in the brain. If vascularization is good, it is safe to save as much of the ischemic area as possible (Hudak & Gallo. 1996). The key to successful stroke management is the adequacy of oxygen flow, glucose and blood flow (Black & Hawk. 2005). Hyperglycemia worsens prognosis by way of intracellular acidosis, increased lipolysis, blood-brain barrier disorder, spurred on the confirmation of hemorrhagic infarction, glutamate accumulation, and cerebral edema (Badiger et al.

2013). This condition is calculated by the ratio of HDL-Total Cholesterol, allowing HDL to transport the cholesterol in the blood and the walls that can not be achieved well by atherosclerosis. Muhammad (2009) who stated that the higher levels of HDL means very good because of the risk for stroke.

Durstine (2006) explained that the risk of stroke will increase in conditions where the increase in total cholesterol levels followed by a decrease in HDL levels. In these conditions, the ratio between total cholesterol levels to HDL will rise so as to spur the formation of atheroclerosis. The ratio of total cholesterol to HDL is a strong predictor of stroke risk. This is evidenced by a study from Wicaksono (2014) which states that there is a relationship between the ratio of total cholesterol to HDL with the incidence of ischemic stroke (OR = 2,676, 95% CI = 1, 049 - 6,827) and patients with a ratio of total cholesterol to HDL high had a risk of ischemic stroke 2.676 times greater than patients who had a ratio of total cholesterol to normal HDL. The study is in line by Poh-Shiow Yeh et al. (2013) who said that patients who stated that patients with low HDL levels had a high stroke severity. High HDL levels can act as a protective factor against atherosclerosis, but in this study there were some stroke patients with high HDL levels but severe severity. This suggests that not only HDL levels affect the severity of sroke patients, but may be caused by other risk factors such as elevated total cholesterol levels.

V. CONCLUSION

Hyperglycemia, ABI and HDL-Cholesterol Total ratios are jointly influential and can be used to predict stroke severity. The severity of neurological deficits caused by stroke was influenced by the collateral vascularization conditions present in the brain. The efforts to save as many areas of ischemic activity can be done if the vascularization process is good.

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