

Original Research Article

Correlation between atherogenic index of plasma and national institutes of health stroke scale score in acute ischemic stroke patients at Haji Adam Malik general hospital, Medan

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ABSTRACT

Background: Stroke is the leading cause of morbidity and mortality in Indonesia. Dyslipidemia is one of the main risk factors of ischemic stroke. Atherogenic index of plasma (AIP) is the logarithm of the triglyceride's plasma ratio concentration to high density lipoprotein cholesterol (HDL-C) plasma concentration. Previous studies showed that the high AIP at hospital admission was associated with deterioration of neurological deficits in patients with acute ischemic stroke.

Methods: This is a cross sectional study with 82 sample of acute ischemic stroke subjects that consecutively collected from the medical records of Haji Adam Malik general hospital Medan from January to December 2019, AIP assessment performed at the 1st day of hospitalization and then at the 7th -onset the national institutes of health stroke scale (NIHSS) score assessment was count. Data analysis is conducted with Spearman test.

Results: Demographic characteristics showed that most subjects were female (51.2%), at age range between 60 -68 years (30.5%), had high school education level (48.8%), self-employed (35.4%) and Bataknese (68.3%). The mean of AIP was 0.15 ± 0.26 and the mean NIHSS score was 6.70 ± 3.6 . There was a positive significant and mild power of correlation between AIP and the NIHSS score ($p=0.017$; $r=0.262$).

Conclusions: There is a significant relationship between AIP and the NIHSS score. The higher the AIP of acute ischemic stroke patients was associated with the increase in the NIHSS scores.

Keywords: AIP, NIHSS, Acute ischemic stroke

INTRODUCTION

Stroke is an episode of acute neurologic dysfunction caused by ischemia or hemorrhage, lasting 24 hours or causing death, but there is insufficient evidence to classify it. Ischemic stroke is an episode of neurological dysfunction caused by focal, spinal, or retinal cerebral infarction.¹ In Indonesia, Stroke is a non-communicable disease that causes the most deaths. In 2018 the prevalence of stroke rose from 7% to 10.9%.²

Some of the main risk factors for stroke are hypertension,

atrial fibrillation (AF) and heart valve disease, diabetes mellitus, high level of hematocrit and fibrinogen, polycythemia, dyslipidemia, contraceptive pills, smoking, alcohol and a history of stroke.³ Dyslipidemia is a risk factor that causes atherosclerosis of extracranial and intracranial blood vessels.⁴

The size of low-density lipoprotein cholesterol (LDL-C) and HDL-C particles associated with plasma triglyceride levels plays a major role in the atherogenic process. The AIP shows the size of LDL-C and HDL-C particles and has a sensitivity to predict coronary heart disease and

cardiovascular disease.⁵ The AIP values obtained from logarithms (serum triglycerides/serum HDL-C), AIP values-0.3-0.1 low risk, 0.10-0.24 moderate risk, >0.24 high risk of cardiovascular disease.⁶

NIHSS scores were used in patients with acute stroke. It is known that the NIHSS score correlates with mortality and clinical outcomes of ischemic stroke patients.⁷

Previous study in 2012 stated that AIP was closely related to cardiovascular disease in familial hypercholesterolemia (FH) patients.⁵ In another study, it was stated that the high triglyceride/HDL-C ratio in ischemic stroke patients indicated a high possibility of cardiovascular complications including recurrent stroke.⁸ Another study in 2017 stated that 96.6% of stroke patients had AIP>0.1 (high risk).⁶ Other research in 2017 stated that a high AIP upon admission to the hospital was associated with a worsening degree of neurological deficit in acute ischemic stroke patients.⁹

This study aims to determine the relationship between AIP and NIHSS score in acute ischemic stroke patients at Haji Adam Malik hospital Medan.

METHODS

Study sample

This study sample was taken from medical record data from acute ischemic stroke patients. There were 82 subjects from data population of acute ischemic stroke patients at Haji Adam Malik hospital Medan from January to December 2019. This study using consecutive sampling techniques. The medical records of the study participants were analyzed, and data collected include age, gender, lipid profile parameters (HDL-C and triglyceride levels), and NIHSS score. The Inclusion criteria included acute ischemic stroke patients who were diagnosed based on history, physical examination, neurological examination and head computed tomography (CT) scan and had complete medical record data including lipid profile levels, NIHSS score at admission and discharge. While the exclusion criteria were patients with brain stem ischemic stroke, embolic stroke, ischemic stroke with hemorrhagic transformation, recurrent ischemic stroke, kidney failure, heart failure,

sepsis, and a history of taking antihyperlipidemic drugs. This research has passed the ethical test from the research ethics commission of the faculty of medicine, universitas Sumatera Utara.⁶

Study design

This study was a cross-sectional design. The dependent variable of this study was the NIHSS score measured on the 7th day of stroke onset. NIHSS is a measurement tool for stroke severity. The scale consists of 15 items, with the maximum total score is 42 points. Zero value indicates no clinical neurological abnormalities were found. The independent variable of this study was the AIP assessment performed at the 1st day of hospitalization. AIP indices were calculated using following formulae: AIP=Log (serum triglyceride/serum HDL-C).

Statistical analysis

The data research was statistically analyzed using the windows SPSS (Statistical product and science service) computer program version 22.0. The analysis and presentation of univariate data in this study aims to analyze the characteristics of one variable by conducting a descriptive test. The bivariate analysis of this study aimed to analyze relationship between AIP and the NIHSS score of acute ischemic stroke patients with the Spearman correlation test to determine significance and R correlation. Furthermore, correlation coefficient is used to measure degree of correlation between 2 variables.

RESULTS

There were 82 subjects from data population of acute ischemic stroke patients at Haji Adam Malik hospital Medan from January to December 2019 2019 who participated in this study. The median age of the subjects was 58.5 years. 25 subjects are between 60-68 years age group (30.5%). There were 42 females (51.2%) and 40 males (48.8%). The education level of the most subjects was senior high school (40 subjects, 48.8%). The occupation of the most subjects was self-employed (29 subjects, 35.4%). The ethnic of the most subjects were Bataknese with 56 subjects (68.3%). Demographic characteristics are shown in Table 1.

Table 1: Subject characteristic.

Respondents' characteristic	N (82)	Percentage (%)
Median	58.5 (33-86)	
Age (years)		
33-41	4	4.9
42-50	20	24.4
51-59	21	25.5
60-68	25	30.5
69-77	8	9.8
78-86	4	4.9

Continued.

Respondents' characteristic	N (82)	Percentage (%)
Gender		
Male	40	48.8
Female	42	51.2
Education		
Primary school	13	15.9
Junior high school	12	14.6
Senior high school	40	48.8
Bachelor	17	20.7
Occupation		
Self-employed	29	35.4
Government employees	17	20.7
Housewife	17	20.7
Unemployment	19	23.2
Ethnic		
Batak	56	68.3
Melayu	7	8.5
Jawa	10	12.2
Aceh	9	11

* Data is presented in the form of median and minimum-maximum values (data not normally distributed)

Based on the results of descriptive analysis, the mean score of AIP was 0.15 ± 0.26 and the mean of NIHSS score was 6.70 ± 3.61 , AIP characteristics and NIHSS score are shown in Table 2. Based on the Spearman test, there is a relationship between the AIP and the NIHSS score with a $p=0.017$ ($p<0.05$) with a positive correlation direction and a weak correlation strength, $r=0.262$. This can be seen in Table 3.

Table 2: Characteristic of AIP and NIHSS.

Characteristic	Mean \pm SD
AIP	0.15 ± 0.26
NIHSS score	6.70 ± 3.61

Data is presented in terms of mean and standard deviation (normally distributed data)

Table 3: Correlation between AIP and NIHSS score.

AIP	NIHSS score
	$r=0.262$, $p<0.017$, $n=82$

Spearman test, $p<0.05$ =significant, $r=0.2$ - <0.4 (weak strength)

DISCUSSION

This was descriptive analytic study with cross-sectional data collection methods sourced from population data of acute ischemic stroke patients at Haji Adam Malik hospital Medan from January to December 2019 with the aim of knowing the relationship between AIP and NIHSS score. The number of research subjects were 82 subjects who met the inclusion and exclusion criteria. In this study, the number of subjects with dyslipidemia were 21 (25.60%) and non-dyslipidemia were 61 subjects (74.40%).

The median age of this study was 58.5 years. Most of the

subjects belonged to age group of 60-68 years with 25 subjects (30.5%). The results of this study are relevant to past research which states the mean age is 59 years.¹⁰ Other study also found similar finding that the highest age range was 55-65 years, 21 subjects (55.3%).¹¹ Other study also found similar finding that the most subjects aged 56-70 years were 20 subjects (50%).¹² Stroke is a common disease in geriatric, often occurs at the age of ≥ 65 years.¹³ The risk of stroke doubles after the age of ≥ 55 years.¹⁴

The research subjects were 42 female (51.2%) more than male with 40 subjects (48.8%), the number of female subjects in the age range 60-68 years were 19 subjects (45.24% of 42 female subjects and 23.12% of the 82 research subjects). The results of this study are relevant to previous study that also found more women than men affected, namely 52.7%.¹⁰ Women have several different factors than men, including coagulation factors, hormonal reproductive factors, including pregnancy and childbirth, as well as social factors that can influence stroke risk and stroke outcome.¹⁵ The incidence of stroke in women is said to increase at the age of 10 years after menopause. This is due to a decrease in the estrogen hormone to 60% and an increase in androgen hormones thereby increasing cardiovascular risk factors in women.¹⁶ According to WHO in 2014 menopause is a permanent cessation of the menstrual cycle caused by loss of Ovarian follicles activity which are stated if experiencing amenorrhea (no menstruation) for 12 months, generally occurring at the age of 45-55 years, in this study the number of female subjects aged 45 years were 40 subjects (95.24%) and the number of subjects aged 10 years after menopause were 27 subjects (64.29%) of the total female subjects.¹⁷

The highest level of education in this study was senior high school with 40 subjects (48.8%). Most of the

occupation is self-employed with 29 subjects (35.4%). According to RISKESDAS of 2018, the prevalence of stroke tends to be higher in people with low education levels (21.2%). The higher prevalence among people who do not work is 21.8%.² According to previous study the incidence of stroke, its risk factors and death rates will increase in lower socioeconomic status in the world. This is related to the utilization of health access and low health costs in prevention of stroke, namely controlling stroke risk factors so that quality of health is also low.¹⁸

The ethnic group of Batak dominated the sample population with 56 subjects (68.3%). The results of this study are relevant to past research, it was found that the most ethnic group of Batak were 26 subjects (65%).¹² The cause of the high incidence may be due to the ethnic group of Batak having the characteristics of eating more than other ethnic groups so they are more likely to be obese.¹⁹ Batak food also contains high levels of cholesterol.²⁰

Based on this study, the mean of AIP was 0.15 ± 0.26 . This is not relevant with the past study which obtained the mean of AIP was 0.56 ± 0.27 .⁶ This is thought to be due to the fact that it did not exclude several comorbid diseases, one of it is heart disease which is the main complication of dyslipidemia, while in this study heart disease was one of the exclusion criteria. Other study found the mean of AIP was 0.43 ± 0.21 . This is also different from this study because in the past study sample used the inclusion criteria of patients with acute ischemic stroke, the type of large artery arteriosclerosis and small vessel occlusion based on the TOAST classification, which is a major complication of dyslipidemia as well.⁹

In this study, the mean of NIHSS core was 6.70 ± 3.61 . This is relevant to the previous research where the median of NIHSS score on the 7th day of treatment was 6.50 (1-17). However, the NIHSS score mean of this study is smaller than other study, where the NIHSS score mean of onset less than 72 hours is 7.71 ± 6.17 .⁹ The above differences can be explained through research which examined the NIHSS score of ischemic stroke patients when entering and leaving treatment, it was found that the NIHSS score at admission was higher than at discharge.²¹

In this study, there is a significant relationship between AIP and the NIHSS score with a $p=0.017$ ($p<0.05$) with a positive direction of correlation and a weak correlation strength of $r=0.262$. The direction of positive correlation means that the higher the AIP of ischemic stroke patients, the higher the NIHSS score. The results of this study are relevant to previous study that showed a positive correlation between AIP and the NIHSS score with $r=0.35$ statistically significant with a $p=0.007$ and weak correlation strength. The study also stated that a high AIP on admission was associated with a worsening degree of neurologic deficit in acute ischemic stroke patients.⁹

Another research stated that 96.6% of stroke patients have $AIP>0.1$. The higher AIP increases the risk of cardiovascular disease. Researchers assess in this study that a high risk of cardiovascular disease, especially acute ischemic stroke seen from the description of the NIHSS score, the higher the AIP of acute ischemic stroke patients will be in line with the increase in the NIHSS scores which describes the severity of stroke.⁶

Other study also stated that AIP described the size of small LDL-C and HDL-C particles that were closely related to cardiovascular disease in FH patients.⁵ In this study, the higher AIP describes the smaller and denser LDL-C and HDL-C particles, this results in the difficulty of these particles binding to their receptors, and the easier it is to infiltrate at the intima as the beginning of the atherogenic process. This process is strongly suspected to be closely related to the pathophysiology of ischemic stroke and the severity of the stroke. The severity of the stroke was measured using the NIHSS score.

The previous research, it was stated that the high triglyceride/HDL-C ratio in ischemic stroke patients indicates a high possibility of cardiovascular complications including recurrent stroke.⁸

In this study, the mean AIP was smaller than the mean AIP in previous studies, but had a relevant mean NIHSS or was close to the mean of NIHSS score in previous studies. This is estimated because the NIHSS score in this study is also influenced by other stroke risk factors. It was stated that the NIHSS score was higher in ischemic stroke patients with hypertension and carotid artery stenosis 50%.²²

CONCLUSION

There is a significant relationship between AIP and the NIHSS score. The higher the AIP of acute ischemic stroke patients was associated with the increase in the NIHSS scores. It means that a high AIP on admission was associated with a worsening degree of neurologic deficit in acute ischemic stroke patients

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