Original Research Article

Atherogenic Index Profile on Ischemic Stroke Patients at Neurology Department, Dr. Soetomo Surabaya: A Retrospective Study

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ABSTRACT

Stroke was associated with morbidity and mortality in the world. Lipid index discovered through lipid profile tests may be used as a predictor in vascular diseases. To increase the prediction value of lipid profile to stroke outcome, several lipoprotein ratios, called atherogenic index, were still being researched. Atherogenic indexes included Atherogenic index of plasma, Castelli Risk Index I and II, atherogenic coefficient, and non-high density lipoprotein cholesterol. The aim of this study is to find atherogenic index profile as a marker for atherogenicity on acute ischemic stroke patients at Neurology Department Dr. Soetomo hospital from January-September 2019.

This is a retrospective descriptive of 65 patients on stroke registry. Data collected including low and high AIP level on 19, 46 patients, respectively; low CRI I on 22 patients and high CRI I on 43 patients; low CRI II from 31 patients and high CRI II from 34 patients; low and high AC on 9 and 56 patients, respectively; also, low NHC on 21 patients and high NHC on 44 patients. Poor outcome on outpatient was identified in 30 patients (NIHSS >7)

This study indicates most ischemic stroke patients have high atherogenic index level. Analysis on the differences between lipid index and NIHSS poor outcome revealed AC and NHC level were significant with p = 0,031, CI 8,593 (1,007 – 73,319) and p = 0,01, CI 9,529 (2,435 – 37,3), respectively.

INTRODUCTION

Stroke is a condition caused by the disruption of blood flow to the brain, indicated by focal or global neurologic deficit happened more than 24 hours or died before 24 hours and other causes have been eliminated. Stroke is the cause of high mortality and morbidity in the world. Generally, in the last two and a half decades, there is a significant increase of stroke incident, especially in developing countries[1]. Data from Riskesdas Indonesia 2018 stated highest stroke prevalence was at East Kalimantan (14,7/1000), East Java on the 8th rank, are still higher than national prevalence (10,9/1000)[3].

Indonesia Stroke Registry 2013 noted 67.1% stroke cases was ischemic stroke and 32.9% was due to hemorrhage. There were 2 types of risk factors for ischemic stroke which are modifiable and non-modifiable factors. Non-modifiable factors such as age, gender, and genetic. Modifiable factors for example hypertension, diabetes, smoking, and hyperlipidemia. One of risk factors for ischemic stroke is dyslipidemia which causes ischemic stroke through atherosclerosis. Identifying ischemic stroke risk factor is important to control ischemic

stroke incidence in a country. Pinpointing risk factors associated with ischemic stroke enabling preventive actions.[9] Lipid serum abnormality may increase the risk of ischemic stroke up to 50% compared to normal.[7]

Patients were diagnosed based on National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) which consists total cholesterol (TC) > 240 mg/dL, low density lipoprotein cholesterol (LDL-C) > 160 mg/dL, high density lipoprotein cholesterol (HDL-C) < 40 mg/dL in male or < 50 mg/dL in female, triglyceride (TG) > 200 mg/dL (Garg et al., 2015). Cholesterol-lowering medication gave a depiction on declining of stroke and carotid atheroma risk. This showed lipid level abnormality is associated with pathophysiology and clinical outcome of stroke patients. This study indicated that lipid index calculated from lipid profile is a better predictor for cardiovascular diseases.

To increase predictor value of lipid profile to stroke outcome, several lipoprotein ratios, called atherogenic index, started to be studied. Previous studies stated lipid index was related to an increase of cardiovascular risk. Atherogenic index mentioned were Atherogenic index of plasma, Castelli Risk Index I and II, atherogenic coefficient (AC), and non-high density lipoprotein cholesterol (NHC).[10]

METHODS
Study Design

This study used a cross sectional design with the research subjects being patients with acute thrombotic stroke who were treated in the Nervous Room at RSUD Dr. Soetomo in the period July 2019 to Nov 2019. who met the inclusion and exclusion criteria. Inclusion criteria were patients with acute thrombotic stroke, first attack, age > 18 years, and complete medical record data. While the exclusion criteria were stroke patients with infections, tumors, myocardial infarction, and the use of statins or fibrates

Patients with acute thrombotic stroke who met the inclusion and exclusion criteria

underwent anamnesis, neurological physical examination, CT scan supporting examination, then lipid profile examination and NIHSS examination were performed. The NIHSS examination uses medical record data.

The size of the research subjects was determined by the sample size formula for the correlative analysis test with a type 1 error of 5% and a type II error of 20% and the number of research subjects was 65 research subjects. Statistical analysis used SPSS 24. Statistical analysis was performed with SPSS 24.0.

RESULTS
Subjects' Characteristics

Baseline characteristic included age and gender as shown on table 1.1 and 1.2.

Table 1.1 Subjects' characteristics based on gender

Subjects' characteristics	Ischemic stroke frequency	
Gender	Amount (n)	Percentage (%)
Male	38	58
Female	27	42
Total	**65**	**100**

Table above depicted ischemic stroke patients based on gender. Most of patients were male (58%), followed by female (42%).

Table 1.2 Subjects' characteristics based on age

Subjects' characteristics	Ischemic stroke frequency	
Age (year)	Amount (n)	Percentage (%)
≤ 60	30	46.15
> 60	35	53.85
Total	**65**	**100**

Based on table 4.2, ischemic stroke patients were mostly aged ≤ 60-year-old (46.15%), while > 60-year-old was 53.85%.

Atherogenic Index Profile Examination

Table 1.3 until 1.7 described the atherogenic index examination as followed:

Table 1.3 Subjects' characteristics based on AIP (Atherogenic Index of Plasma)

Subjects' characteristics	Ischemic stroke frequency	
AIP	Amount (n)	Percentage (%)
Low	19	30
High	46	70
Total	**65**	**100**

Based on table 1.3, subjects with low AIP were 19 subjects (30%) and high 46 subjects (70%). Analysis on the differences

between AIP and NIHSS poor outcome (NIHSS>7) is p= 0,53.

Table 1.4 Subjects' characteristics based on CRI I (Castelli Risk Index I)

Subjects' characteristics	Ischemic stroke frequency	
CRI I	Amount (n)	Percentage (%)
Low	22	33
High	43	67
Total	**65**	**100**

Based on table 4.4, there were 22 subjects (33%) with low CRI I value and 43 (67%) subjects with high value. Analysis on the differences between CRI I and NIHSS poor outcome (NIHSS>7) is p= 0,3.

Table 1.5 Subjects' characteristic based on CRI II (Castelli Risk Index II)

Subjects' characteristics	Ischemic stroke frequency	
CRI II	Amount (n)	Percentage (%)
Low	30	46
High	35	54
Total	**65**	**100**

Based on table 1.5, there were 30 subjects (46%) with low CRI II value and 35 subjects (54%) with high CRI II value. Analysis on the differences between CRI II and NIHSS poor outcome (NIHSS>7) is p= 0,62.

Table 1.6 Subjects' characteristics based on AC (Atherogenic Coefficient)

Subjects' characteristics	Ischemic stroke frequency	
AC	Amount (n)	Percentage (%)
Low	9	14
High	56	86
Total	**65**	**100**

Based on table 1.6, low and high AC value were detected in 9 (14%) and 56 (86%) subjects, respectively. Analysis on the differences between AC and NIHSS poor outcome (NIHSS>7) is p= 0,031.

Table 1.7 Subjects' characteristics based on NHC (Non-High Density Lipoprotein Cholesterol)

Subjects' characteristics	Ischemic stroke frequency	
NHC	Amount (n)	Percentage (%)
Low	21	32
High	44	68
Total	**65**	**100**

Low NHC was obtained by 21 subjects (32%) while high level was acquired by 44 subjects (68%) as listed in table 1.7. Analysis on the differences between AIP and NIHSS poor outcome (NIHSS>7) is p= 0,001.

DISCUSSION

In this study, most ischemic stroke patients were male patients compared to female (58% vs 42%). Similar gender proportion was also reported by Siswonoto, 33 where 69.8% subjects were male while the rest (30.2%) were female. A study at Raden Mattaher hospital also reported analogous percentage of 56.79% vs 43.20% for male and female, respectively. Male has a 1.25 higher risk to develop ischemic stroke compared to female. This was due to estrogen in female before menopause. Estrogen protects blood vessels from atherosclerosis process that may cause thrombotic stroke event.

All subjects were divided into two age groups, ≤ 60-year-old and > 60-year-old. Subjects aged ≤ 60-year-old was more than > 60-year-old which 46.15% vs 53.85%. The risk for a stroke event was twice higher after 550year-old. In male patients, the risk of stroke was between 45 to 84-year-old. This is due to several factors, such as plaque accumulation on artery causes atherosclerosis and, therefore, ischemic stroke.

Calculations of various lipid ratios and indices may show the existence of association if any. These indices include AIP, CRI, AC, and NHC.

According to table 1.3 – 1.7, low AIP value was observed in 3 subjects (5%), medium in 16 subjects (25%), and high in 46 (70%); low CRI I in 22 subjects (33%) and high in 43 (67%); CRI II was found low in 30 subjects (46%) and high in 35 subjects (54%); AC value was discovered low in 9 (14%) and high in 56 subjects (86%); low and high NHC value was obtained in 21 subjects (32%) and 44 subjects (68%), respectively. These results showed atherogenic index profile in acute ischemic stroke patients in Dr Soetomo hospital was high. This is similar with previous study describing atherogenic index was significantly high in stroke patients.

This study indicates most ischemic stroke patients have high atherogenic index level. Analysis on the differences between

lipid index and NIHSS poor outcome revealed AC and NHC level were significant with p = 0,031, CI 8,593 (1,007 – 73,319) and p = 0,01, CI 9,529 (2,435 – 37,3), respectively. his finding was consistent with the study by Wu, et al, Zhang et al and Sujatha et al.

CONCLUSION

In the present study, the atherogenic lipid indices were significantly higher in stroke patients compared to controls. Two indices AC, and NHC were found to be contributing to the risk of stroke significantly. These can be easily estimated from routinely done parameters and is therefore a cheaper alternative to other costly diagnostic tests and modalities. The inclusion of these indices in routine clinical setup may help to identify at risk individuals and guide effective treatment modalities in stroke patients

Suggestions

This study is a cross-sectional study with a small sample size and short study duration. Therefore, further study with bigger sample size and longer duration is needed to be able to give a more accurate result.

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