

Correlation of Triglyceride/High Density Lipoprotein Cholesterol Ratio with Major Cardiovascular Events in Acute Coronary Syndrome within 30 Days Post Coronary Revascularization in Haji Adam Malik General Hospital of Medan

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Abstract:-

Background: Coronary heart disease (CHD) is the main cause of death in the world. Major adverse cardiovascular events (MACE) show a combination of various side effects associated with the cardiovascular system that can lead to fatal outcomes for CHD. Predictors of the occurrence of coronary artery disease (CAD) is an important topic and much to be done, has an important role in the optimal management of acute coronary disease syndrome (ACS) in the early stages of hospitalization. The ratio of triglycerides to high-density lipoprotein cholesterol (HDL-C) is a strong predictor of myocardial infarction. This study was conducted to assess whether the triglyceride/HDL-C ratio could predict major adverse cardiovascular events (MACE) in ACS patients 30 days after coronary revascularization.

Methods: This study is a retrospective analytical observational study on 120 patients with a diagnosis of ACS in the period 1 January 2019-31 December 2019 at H. Adam Malik Hospital Medan. All patients involved had performed coronary revascularization, and recorded patient characteristics, risk factors, drug consumption history, and laboratory results, especially lipid profiles from the patient's medical record. Follow-up was performed for 30 days after coronary revascularization. Statistical tests were conducted to assess the relationship between variables.

Results: Hypertension, diabetes, and BMI had a significant relationship with the triglyceride/HDL-C ratio ($p = 0.070, < 0.001, < 0.001$ respectively). There were 62.5% of patients in the 2,067-14,330/HDL-C ratio group who experienced MACE, and the relationship between the triglyceride/HDL-C ratio and MACE ratio was known ($p < 0.001$; OR 3.487; 95% CI 1.995-6.096).

Conclusion: The triglyceride/HDL-C ratio can predict major adverse cardiovascular events (MACE) in ACS patients 30 days after coronary revascularization.

Keywords:- acute coronary syndrome, triglycerides, high-density lipoprotein, major cardiovascular events.

I. INTRODUCTION

Coronary heart disease (CHD) is the leading cause of death worldwide, and most CHD-related deaths occur in low- and middle-income countries (Fuster V, 2011). Data

from the World Health Organization (WHO) in 2015 stated that more than 17 million people in the world died from heart and blood vessel disease or about 31% of all deaths in the world, with most or around 8.7 million deaths caused by coroner heart disease. (Newby, 2016). Although the death rate in the last four decades has decreased in western countries, this condition remains the cause of one third of human deaths over the age of 35 years. Data from the Heart Diseases and Stroke Statistics from the AHA reports that 15.5 million people in the United States have CHD (Sanchis-Gomar, 2016).

Previous studies have shown that severe hypertriglyceridemia is positively correlated with cardiovascular disease (CVD) mortality (Neil, 2012). Low Density Lipoprotein Cholesterol is a key factor in the pathogenesis of coronary heart disease. Reduction of LDL-C levels is the main goal of cardiovascular risk reduction therapy, and LDL particle-lowering agents, such as statins, significantly reduce the risk of CHD (Thomas, 2013).

Gaziano et al were the first to identify that the TG/HDL ratio is a strong predictor of myocardial infarction (Gaziano, 1997). Hadaegh et al suggested that evaluation of the TG/HDL ratio should be considered for the prediction of CHD risk. (Hadaegh, 2011). In women with suspected myocardial ischemia, the TG/HDL-C ratio is a strong independent predictor of all-cause mortality (Bittner, 2011).

In particular, controlling HDL cholesterol, which is inversely correlated with TG, tends to substantially attenuate the association of TG with coronary heart disease (Hokanson, 2012). However, results from related studies failed to assess the prognostic utilization of the TG/HDL-C ratio in Acute Coronary Syndrome (ACS). Therefore, the aim of this study was to determine whether the TG/HDL-C ratio could predict major cardiovascular events (MCEs) in ACS patients.

Major cardiovascular events show a combination of side effects associated with the cardiovascular system that can lead to fatal outcomes for ACS patients. Predictors of the occurrence of MCEs is an important and widely researched topic, playing an important role in the optimal management of ACS patients in the early stages of hospitalization, for example, clinical decision-making of care and treatment, drug development and cost estimation. (Hu, 2019)

A study was conducted on 337 patients aged less than 80 years (47 with diabetes, 75 women) with a fasting triglyceride concentration of at least twice >5.0 mmol/l enrolled at 21 lipid clinics in the UK and followed prospectively between 1980 and 2008 for 4353 person-years. The standard mortality ratio (SMR) was calculated by comparison with the general population and resulted in the conclusion that severe hypertriglyceridemia was associated with increased mortality from cardiovascular disease, even in the absence of diabetes. In addition to lowering triglyceride concentrations to reduce the risk of pancreatitis, treatment should aim to reduce overall cardiovascular risk (Neil, 2012).

II. RESEARCH METHODS

A. Research Design

This study is a retrospective analytical observational study that aims to assess the TG/HDL-C ratio as a predictor of the occurrence of MCEs for 30 days in ACS patients at Haji Adam Malik General Hospital of Medan.

B. Place and Time

Sampling was carried out at Haji Adam Malik General Hospital of Medan from January 1, 2019 – December 31, 2019 and continued until the number of samples was met.

C. Population and Sample

The target population was patients diagnosed with Acute Coronary Syndrome. The accessible population was patients with a diagnosis of ACS who were treated at Haji Adam Malik General Hospital of Medan during the period of January 1, 2019 – December 31, 2019 or until the number of samples was met. The sample was an accessible population that met the inclusion and exclusion criteria.

Samples were collected sequentially (consecutive sampling). Researchers only observed and recorded data found in patients. All examinations were carried out by the doctor or cardiologist on duty.

D. Inclusion Criteria

- Subjects diagnosed with ACS who underwent revascularization (PCI) at Haji Adam Malik General Hospital of Medan in 2019.
- Patients diagnosed with Killip I – II.
- Patients not with acute systemic inflammatory disease.
- Patients not with renal or hepatic failure.
- Patients not with severe Valvular Heart Disease (VHD).
- Patients not with Myocarditis, Cardiomyopathy.
- Patients not with other malignancies.

E. Exclusion Criteria

- ACS patients who did not undergo coronary revascularization.
- Heart Failure patients with functional class of NYHA III and IV.
- Patients with incomplete Medical Record (MR) data.

F. Research Procedure and Flow

The sample in this study were patients diagnosed with acute coronary syndrome. The diagnosis of ACS was established based on the 2015 ESC criteria and the 2018 PERKI Guidelines. Researchers obtained data from the ACS registry and examined patients during treatment and obtained data on patient profiles, risk factors, ECG examinations, and laboratory tests.

The ECG examination was carried out using the Bionet Cardiotouch 3000 device with a speed of 25mm/s and an amplitude scale of 10mV/mm when the patient was admitted to the Emergency Unit (ER). Echocardiographic examination was performed using a Medison or VIVID GE device when the patient was admitted to the ER or during treatment, for the extraction of the Left Ventricular Ejective Fraction using the BP Simpson technique. Laboratory examinations were carried out when the patient had been hospitalized at Haji Adam Malik Hospital and had fasted for at least 10 hours to examine the lipid profile through blood samples taken by the Clinical Pathology laboratory at Haji Adam Malik Hospital of Medan using an ARCHITECT C 8000 type machine.

Patients who met the inclusion and exclusion criteria were then grouped into the TG/HDL-C ratio group. The patients were treated according to the clinical guidelines and policies of the doctors treating the patients. Major cardiovascular events during hospitalization in the sample were then assessed.

G. Data Processing and Analysis

Statistical data processing and analysis was carried out using the SPSS application. Categorical variables were presented with frequency (n) and percentage (%). Numerical variables were presented with the mean (mean) and standard deviation (SD) values for normally distributed data. Meanwhile, for non-normally distributed data, numerical variables were presented with the median and interquartile ranges. The normalization test for numerical variables on all research subjects used the Kolmogorov-Smirnov test if $n > 50$ or the Saphiro Wilk test if $n < 50$.

The relationship between the two variables was calculated by ANOVA if data was normally distributed, Kruskal Wallis if the data was not normally distributed. The variable was considered significant if the p value < 0.05 .

III. RESEARCH RESULTS

• Basic Characteristics of Research Subjects

This study involved 120 patients who had been diagnosed with ACS and were treated at Haji Adam Malik Hospital and passed the inclusion and exclusion criteria. Thus, the patient profile data, risk factors, ECG examination, and laboratory tests were obtained. Furthermore, a follow-up was performed to find out the patient's complaints within 30 days post coronary revascularization.

In Table 4.1, it is found that men experienced ACS more than women (56.7%, 43.3%, respectively). The most risk factors suffered by patients were hypertension (74.2%), followed by diabetes (47.5%) and smoking (38.3%). B-blockers (43.3%) were the type of routine drug that were

most frequently consumed by patients, and ARBs (16.7%) were the least consumed. The triglyceride and HDL-C ratios were recorded and categorized into three groups, namely

0.270-1.128, 1.129-2.066, and 2.067-14.33. There were 40 patients (33.3%) who had a triglyceride/HDL-C ratio in each category.

Characteristics	Total (n)(%)n=120
Gender	Male 68(56.7)
Hypertension	89(74.2)
Diabetes	57(47.5)
Smoking	46(38.3)
Medical History	
Aspirin	44(36.7)
Statin	51(42.5)
B-blocker	52(43.3)
Clopidogrel	24(20)
ACE-inhibitor	26(21.7)
ARB	20(16.7)
Lipid Profile	
Triglyceride/HDL-C Ratio	0.270-1.128 40(33.3)
	1.129-2.066 40(33.3)
	2.067-14.330 40(33.3)
	Total 120(100)

Table 1: Basic Characteristics of Categorical Research Subjects

The distribution of the data in this study was not normal, so the next data presentation used the median with the minimum and maximum values. In Table 4.2, the median age of the patients was 57.4 years with the youngest age being 39 and the oldest being 71. BMI values had a median of 22.9 kg/m², and lipid profiles, namely triglyceride, HDL, LDL, and triglyceride/HDL-C ratio

respectively had medians of 86.5, 44.0, 112.0 and 1.9. Furthermore, the triglyceride/HDL-C ratio was analyzed categorically (see Table 4.1). The patient's median Grace score was 88.0 with the lowest score being 75 and the highest 145. The lowest ejection fraction (EF) was 37% and the highest was 55% with a median of 49%.

Characteristics	Median	Min-Max	n=120
Age (years)	57.4	39.0-71.0	
BMI(kg/m ²)	22.9	19.5-29.7	
Lipid Profile			
Triglycerides(mg/dL)	86.5	53.0-220.0	
HDL(mg/dL)	44.0	21.0-65.0	
LDL(mg/dL)	112.0	87.0-165.0	
Triglyceride/HDL-C Ratio	1.9	1.1-8.7	
GraceScore	88.0	75.0-145.0	
Ejectionfraction (%)	49.0	37.0-55.0	

Table 2: Characteristics of Numerical Research Subjects

A. Major Cardiovascular Events (MCEs) within 30-Days Observation in ACS Patients Undergoing Coronary Revascularization

Major cardiovascular events (MCEs) in ACS patients within 30 days after coronary revascularization are recorded as heart failure, myocardial infarction, death, and stroke. It

was found that 25% of the patients experienced heart failure within 30 days after coronary revascularization with the incidence of stroke reaching 12.5%. In this study, no incidence of myocardial infarction and death was found (see Table 4.3).

Variable	Yes(n,%)	No (n,%)	n=120Heart
failure	30(25.0)	90 (75.0)	
Myocardial Infarction	0(0.0)	120(100)	
Death	0(0.0)	120(100)	
Stroke	15(12.5)	105(87.5)	

Table 3: Number of MCEs within 30 Days Post Coronary Revascularization

B. Correlation of Patient Characteristics and Risk Factors with Triglyceride/HDL-C Ratio

Women had more triglyceride/HDL-C ratios in the 2,067-14.33 (40.4%) group, while men had more triglyceride/HDL-C ratios in the 1.129-2,066 (36.8%) group. Patients with hypertension had the most triglyceride/HDL-C ratios in the 0.270-1,128 (38.2%) group, while patients with diabetes and smoking had the most triglyceride/HDL-C ratios in the 2.067-14.33 category (50.9%, 39.1%, respectively). In the triglyceride/HDL-C ratio group of

2.067-14.33, the median (minimum-maximum) age of the patient was 58 (44-66) years, BMI 25.5 (22.9-29.7), Grace score 122, 5 (95.0-145.0), and EF 47.0 (37.0-55.0). Statistical analysis was performed to assess whether there was a correlation between patient characteristics and risk factors on the triglyceride/HDL-C ratio. Of all patient characteristics and risk factors, diabetes, BMI, Grace score, and EF had a significant correlation with the triglyceride/HDL-C ratio ($p < 0.001$; < 0.001 ; < 0.001 ; 0.001 , respectively).

Variable	Group of TG/HDL-C Ratio			pValue
	0.270-1.128	1.129-2.066	2.067-14.330	
Gender, n(%)				
Male	24 (35.3)	25 (36.8)	19(27.9)	0.349 ^a
Female	16 (30.8)	15 (28.8)	21(40.4)	
Hypertension,n(%)				
Yes	34 (38.2)	25 (28.1)	30(33.7)	0.070 ^a
No	6 (19.4)	15 (48.4)	10 (32.3)	
Diabetes,n(%)				
Yes	9 (15.8)	19 (33.3)	29(50.9)	<0.001 ^a
No	31 (49.2)	21 (33.3)	11(17.5)	
Smoking,n(%)				
Yes	11 (23.9)	17 (37.0)	18(39.1)	0.220 ^a
No	29 (39.2)	23 (31.1)	22(29.7)	
Age, median(min-max)	55.0(39.0-66.0)	58.0(45.0-71.0)	58.0(44.0-66.0)	0.154 ^b
BMI,median(min-max)	21.2(19.5-24.0)	22.6(20.5-27.1)	25.5 (22.9-29.7)	<0.001 ^b
GraceScore,median(min-max)		81.0(75.0-88.0)	87.0(76.0-94.0)	122.5(94.0-145.0) <0.001 ^b
Ejectionfraction,median(min-max)				
^a Chi-square test		51.0(43.0-55.0)	49.0(43.0-54.0)	47.0(37.0-55.0) 0.001 ^b
^b Mann-Whitney test				

Table 4: Correlation of Patient Characteristics and Risk Factors with Triglyceride/HDL-C Ratio

C. Correlation of Triglyceride/HDL-C Ratio with Major Cardiovascular Events (MCEs) within 30 Days Post Coronary Revascularization

The correlation of the triglyceride/HDL-C ratio with MCEs for 30 days is shown in Table 4.5, where the

triglyceride/HDL-C ratio group of 2.067-14.33 experienced the most MCEs (62.5%). The triglyceride/HDL-C ratio had a significant relationship with major cardiovascular events within 30 days post coronary revascularization (OR 3,487, 95% CI 1,995-6.096; $p < 0.001$).

Group of TG/HDL-C Ratio	Major Cardiovascular Events		p Value	OR (IK 95%)
	Yes,n (%)	No, n (%)		
0.270-1.128	5(12.5)	35 (87.5)	<0.001*	3.487 (1.995-6.096) *Chi-square test
1.129-2.066	12(30.0)	28 (70.0)		
2.067-14.330	25(62.5)	15 (37.5)		

Table 5: Correlation of Triglyceride/HDL-C Ratio with MCEs within 30 Days Post Coronary Revascularization

IV. DISCUSSION

This study took samples of ACS patients (STEMI cases) with onset over 12 hours. The results showed that more men experienced ACS (56.7%). These results are in accordance with research by (Wan K, 2015), which reported that more men experienced ACS compared to women (74.8%: 25.2%). The same results were also obtained from research conducted by (Nadia Khan, 2013) that men experienced ACS more than women (69.9%: 30.1%). In a study conducted by (Hideki Wada, 2019) a comparison was obtained between men and women suffering from ACS (52.3%: 47.7%).

The age of the patients obtained was 39–71 years with a median of 57.4 years. Previous research stated that the age range of patients with ACS was 50-76 years with a median of 64.81 years (Wan K, 2015).

The patients' median BMI was 22.9 kg/m² with 19.5 kg/m² being the lowest value and 29.7 kg/m² being the highest value. Previous research stated that the median BMI was 23.9 kg/m² with the lowest value being 20.06 kg/m² and 28.08 kg/m² being the highest value (Wan K, 2015). Research conducted by (Hirofumi H, 2015) found that Lean Body Mass Index (LBMI) was more feasible to be one of the predictors of MCE among Asian populations affected by ACS who had undergone coronary revascularization, compared to BMI and Fat Mass Index (FMI). This study divided the LBMI into 3 groups, namely 11.7 - 17.6, 17.7 - 19.1, and 19.2 - 23.6. The results of the study found that the 11.7 - 17.6 group had an MCE rate of 12.6%, higher than the 17.7 - 19.1 and 19.2 - 23.6 groups, which had MCE rates of 5.6% and 3.4%, respectively. This is because the LBMI is clinically useful for detecting patients with sarcopenia, which is defined as an age-related decrease in LBM and muscle strength. This condition has been reported to be associated with muscle loss, obesity and insulin resistance due to increased visceral fat, which promotes cardiovascular disease and a high incidence of mortality (Hirofumi H, 2015).

V. CONCLUSION

- Out of a total of 120 post ACS patients who had coronary revascularization at Haji Adam Malik General Hospital of Medan, 30 people (25%) experienced heart failure and 15 people (12.5%) underwent re-hospitalization during 30 days of observation.
- The group with a high TG/HDL-C ratio, i.e. 2,067-14.33, had a higher rate of MCEs than the TG/HDL-C ratio group in other studies.
- MCE patients have diabetes risk factors, overweight-obese BMI and Grace scores which were mostly higher than non-MCE patients.
- Among patients with MCEs, the median age was 57.4 and the majority were male.
- Patients with a median Grace score of 109 were associated with future MCEs.

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