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Association of Triglyceride/High Density Lipoprotein Cholesterol Ratio and Coronary Lesion Severity in Acute Myocardial Infarction Patients at Adam Malik Hospital, Medan

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ABSTRACT

Introduction: Coronary heart disease is the leading cause of worldwide death. A number of markers have been identified in terms of the atherogenic potential of the lipid profile.The TG/HDL-C ratio is an easy and economical non-invasive examination method as a predictor of coronary heart disease severity. The aim of this study is to assess the relationship of the TG/HDL-C ratio with the severity of coronary lesions.

Method: This cross-sectional study included 53 acute myocardial infarction patients undergoing coronary angiography. Exclusion criteria include (1)AMI patients receiving fibrinolytic therapy, (2) Patients who have routinely consumed lipid lowering drug for 6 weeks,(3) Incomplete coronary angiography and medical records. The TG/HDL-C ratio is the result of dividing the triglyceride value by HDL-C. The TG/HDL-C ratio was divided into 2 groups, namely the TG/HDL-C ratio <4 group and the TG/HDL-C ratio >4 group. The severity of coronary lesions was described by the SYNTAX score, which was divided into two: the low SYNTAX score group (<23) and medium-high SYNTAX score group (⩾23). Bivariate analysis was performed to find the relationship between the TG/HDL-C ratio and the SYNTAX score. The value of p <0.05 was considered statistically significant.

Results: From 53 patients, 26 patients (49.1%) had a SYNTAX score ⩾ 23 and 27 patients (50.9%) had a SYNTAX score < 23. Patients with NSTEMI, DM risk factors, and obesity were higher in the SYNTAX score group ⩾23. From the results of statistical analysis, there was a significant relationship between the TG/HDL ratio with coronary lesion severity (p = 0,004).

Conclusion: Enhancement of TG/HDL ratio is correlated with coronary lesion severity in acute myocardial infarction patients using the SYNTAX score.

Keywords

TG/HDL ratio, Coronary lesion severity, SYNTAX score

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INTRODUCTION

Acute Coronary Syndrome (ACS) is a cardiovascular disease that is still a major problem because it causes high hospitalization rates and high mortality rates. ACS consists of Unstable Angina Pectoris (UAP), Non ST-Segment Elevation Acute Myocardial Infarction (NSTEMI), and ST-Segment Elevation Acute Myocardial Infarction (STEMI). ACS is caused by decreased blood flow due to partial or total thrombus occlusion. Partial thrombus occlusion occurred in NSTEMI and UAP, while total thrombus occlusion occurred in STEMI.

The severity of coronary lesions can be assessed using the SYNTAX scoring system (SYNergy between PCI with TAXUS™ and Cardiac Surgery). The SYNTAX score is a score system that is comprehensively formulated to describe the complexity of coronary artery lesions based on angiographic results and predict the outcome of PCI or coronary artery bypass grafting (CABG). The SYNTAX score can assess the complexity of coronary artery lesions by taking into account not only the number of significant lesions and their location, but the complexity of each lesion independently. A higher SYNTAX score indicates a more complex disease state and a poorer prognosis.

The TG/HDL-C ratio is an easy and economical non-invasive examination method as a predictor of coronary heart disease severity. Previous studies have shown a significant relationship between the TG/HDL-C ratio and the severity of coronary artery lesions in a group of patients with stable angina pectoris without diabetes mellitus. A high TG/HDL-C ratio indicates a positive correlation with the severity of atherosclerotic lesions in patients with acute coronary syndromes.

METHOD

This study is an analytic study with a cross sectional study design carried out on AMI (Acute Myocardial Infarction) patients who underwent coronary angiography and were treated at H. Adam Malik Hospital Medan starting November 2021. The minimum sample size for each group was 25 people. The exclusion criteria were patients with incomplete medical records, patients who had routinely taken lipid lowering drugs for 6 weeks, AMI patients receiving fibrinolytic therapy. coronary angiographic recordings that did not meet interpretation requirements. Each individual who was included in the research sample was made an written consent signed by the participants and the researcher. The researcher examined the patient's medical record to see the history, physical examination, electrocardiography (ECG), blood laboratory, diagnosis, and coronary angiography and then performed complete data recording.

Laboratory tests of lipid profiles including the TG/HDL-C ratio are taken after the patient has fasted for about 9-12 hours. The 12-lead ECG was examined using the Bionet Cardiotouch 3000 with a speed of 25 mm/s and an amplitude of 10 mV. Measurements of the 12 lead ECG were performed within 10 minutes of the first contact with the patient in the ED.

Patients who met the inclusion and exclusion criteria were divided into 2 groups, the first group was patients with a TG/HDL-C ratio < 4. While the second group were patients with a TG/HDL-C ratio $\geq$ 4. Time of coronary angiography with or without Percutaneous coronary intervention was carried out according to the clinical judgment of the respective physician in charge. After coronary angiography was performed, the SYNTAX score was assessed. The SYNTAX score was assessed by looking at the recorded coronary angiography results by 2 cardiologists who did not know the value of the patient's TG/HDL-C ratio.

Statistical data processing and analysis using the SPSS application. Categorical variables are presented with frequency (n) and percentage (%). Numerical variables are presented with the mean (mean) and standard deviation (SD) for normally distributed data. Meanwhile, for data that are not normally distributed, numerical variables are presented with the median and interquartile ranges. The normality test for numerical variables on all research subjects used the Kolmogorov-Smirnov test with n > 50 or the Saphiro Wilk test if n < 50.

Bivariate analysis using Chi-square test for categorical data or Fisher's exact test if the Chi-square test conditions are not met. Bivariate analysis for numerical data with independent T-test if the data is normally distributed and Mann Whitney test for data that is not normally distributed. The variable is considered significant if the p value < 0.05.

RESULTS

The total number of research subjects was 53 people, divided into two groups. The first group were patients with a SYNTAX score 23 as many as 26 people (49.1%), and the second group were patients with a SYNTAX score < 23, which were 27 people (50.9%). The mean age of the subjects in the study was 56.4 ± 9.91 years with 42 people (72.9%) of whom were men. The average body mass index (BMI) of patients was 24.9 kg/m2,

32 people (60.4%) had a history of hypertension, 28 people (52.8%) had diabetes mellitus and 26 people (49.1%) is a smoker. A total of 27 (50.9%) people were diagnosed with NSTEMI, 26 (49.1%) were diagnosed with STEMI.

From the laboratory examination, the average value of hemoglobin was 13.4 g/dL, the median value of leukocytes was 10.893/uL, the mean value of platelets was 251,500/uL, the average value of ureum was 28 mg/dL, the median value of creatinine was 0.9 mg/dL, the median value of Fasting Plasma Glucose (FPG)117 mg/dL, median 2 hours post prandial blood glucose (PPG) 148 mg/dL, median HbA1c 7%, mean total cholesterol 168.6 mg/dL, median triglycerides 125 mg/dL, the mean value of HDL-C is 36.23 mg/dL, the mean value of LDL-C is 115.8 mg/dL. The median CKMB value was 65 U/L and the median troponin I value was 11.2. It was found that the mean value of the TG/HDL-C ratio was 4.4, and the mean SYNTAX score was 22.69.

Table 1. Basic Characteristics of Subjects

Variable	
Age (year)	57.2 ± 8.97
Type Sex (n, %)	
Man	42 (79.2%)
Woman	11 (20.8%)
BMI (kg/m ^{2})	24,9 (22.5-28.5)
Diagnosis (n, %)	
STEMI	26 (49.1%)
NSTEMI	27 (50.9%)
Factor risk (n, %)	
Diabetes Melitus	28 (52.8%)
Hypertension	32 (60.4%)
Smoker	26 (49.1%)
Laboratory	
Hemoglobin (g/ dL)	13.4 ± 2.0
Leukocytes (x10 ^{3} / uL)	10,893 (8.7-14.6)
Platelets (x10 ^{3} / uL)	251.5 ± 62.9
Fasting Plasma Glucose (FPG) (mg / dL)	117 (101-186)
2- hours PPG (mg / dL)	148 (116-223)
BGLs (mg / dL)	168 (110-213)
HbA1c (%)	7.0 (6.0-8.65)
Ureum (mg / dL)	28 (20-38.5)
Creatinine (mg / dL)	0.9 (0.7-1.2)
Cholesterol (mg / dL)	168.6 ± 40.0
Triglycerides (mg / dL)	125 (91-168)
HDL-C (mg / dL)	36.23 ± 9.415
LDL-C (mg / dL)	115.8 ± 43.83
CKMB (U/L)	65 (43.5-144.5)
Troponin I (ng / mL)	11,2 (1.8-15.0)
Ratio TG/ HDL-C	4.4 ± 5.2
SYNTAX score	22.69 ± 9.0

The group of patients with a SYNTAX score $\geq$ 23 had a significantly higher BMI. DM were significantly higher in the group with a SYNTAX score $\geq$ 23 ($p = 0.019$). NSTEMI patients were significantly higher in the group of patients with a SYNTAX score $\geq$ 23 ($p = 0.009$). The group of patients with a SYNTAX score $\geq$ 23 tended to have lower HDL-C, higher leukocyte, fasting blood glucose, 2 hours post prandial blood glucose,

HbA1c, ureum, and higher triglycerides than the group of patients with SYNTAX scores < 23. Patients with SYNTAX score ≥ 23 had a higher TG/HDL-C ratio than the SYNTAX score < 23 (p < 0.001).

Table 2. Characteristics of Subjects Based on Severity of Coronary Artery Lesions

Variable	SYNTAX < 23	SYNTAX ≥ 23	p value
Age (year)	56.56 ± 7.4	57.38 ± 6.9	0.677
Type Sex			0.344
Man	20 (74.1)	22 (84.6)	
Woman	7 (25.9)	4 (15,4)	
BMI (kg/m ^{2})	23,4 (20.7-29.3)	27.5 (22-31.2)	0.002
Diagnosis			0.009
NSTEMI	9 (33.3%)	18 (69.2)	
STEMI	18 (66.7%)	8 (30.8)	
Risk factor			
Diabetes Melitus	10 (35.7)	18 (69.2)	0.019
Hypertension	17 (63.0%)	18 (69.2)	0.630
Smoker	11 (40.7%)	15 (57.7)	0.217
Laboratory			
Hemoglobin (g/ dL)	13.2 ± 1.5	13.6 ± 2.4	0.489
Leukocytes (x10 ^{3} / uL)	9,63 (7.8-11.37)	12.99 (9,1- 16.7)	0.006
Platelets (x10 ^{3} / uL)	241 ± 52.8	262 ± 71.3	0.220
FPG (mg / dL)	108 (90-125)	130 (91-169)	0.002
2- hours PPG (mg / dL)	134 (101-167)	207 (152-262)	0.030
BGLs (mg / dL)	120 (75-165)	201 (152-250)	0.044
HbA1c (%)	6,4 (5.1-11.4)	7.75 (5.5-14.8)	0.010
Ureum (mg / dL)	21 (13-30)	30 (18-42)	0.023
Creatinine (mg / dL)	0.97(0.61-6.2.22)	0.97 (0.37-1.57)	0.188
Cholesterol (mg / dL)	161.8 ± 41.6	175.5 ± 37.8	0.216
Triglycerides (mg / dL)	98 (70-128)	151.5 (121-219)	0.002
HDL-C (mg / dL)	38.9 ± 8.7	33.3 ± 9.3	0.030
LDL-C (mg / dL)	115.9±39.8	115.8 ± 48.3	0.995
CKMB (U/L)	58 (18-97)	67 (37-98)	0.255
Troponin I (ng / mL)	9.1 (1.06-77.06)	11.45 (1.34-52)	0.678
Ratio TG/HDL-C	3.09 (1.39-4.6)	4.46 (1.9-40)	< 0.001

The group of DM patients tended to be older and have a higher BMI. A total of 21 (75%) DM patients were male. Higher risk factors for hypertension were found concurrently in the group of DM patients. DM patients in this study had higher FPG, 2- hours PPG, BGLs and HbA1c values. SYNTAX scores were found to be significantly higher in DM patients (p= 0.003). The DM group patients had a significantly higher TG/HDL-C ratio (p= 0.027).

Multivariate analysis was performed to determine which independent variable was the most dominant and correlated with the severity of coronary lesions. The variables in the bivariate analysis that were statistically significant (p < 0.05) were: leukocytes, FPG, HbA1c, ureum, triglycerides, and HDL. Variables with p value < 0.25 in the bivariate test with simple logistic regression were then entered into the multivariate analysis stage. From the results of multivariate analysis, there were no significant variables (p > 0.005).

The results of the comparison test for the value of the TG/HDL-C ratio with the severity of coronary lesions described by the SYNTAX score showed that there was a significant difference (p=0.004) (Table 5).

Table 3. Characteristics of Subjects Based on Diabetes Mellitus

Variable	DM	Non-DM	p value
Age (year)	59.04 ± 7.2	54.64 ± 6.4	0.024
Type Sex			0.420
Man	21 (75)	21 (84.6)	
Woman	7 (25)	4 (15,4)	
BMI (kg/m ^{2})	24,9 (22.5-28.5)	23.4 (22-25.3)	0.001
Diagnosis			0.685
NSTEMI	9 (33.3)	18 (69.2)	
STEMI	18 (66.7)	8 (30.8)	
Other risk factors			
Smoker	13 (46.4)	13 (52)	0.685
Hypertension	22 (78.5)	13 (52)	0.041
SYNTAX score	26.1 ± 8.6	18.8 ± 8.0	0.003
Laboratory			
Hemoglobin (g/ dL)	13.4 ± 2.0	13.4 ± 1.8	0.881
Leukocytes (x10 ^{3} / uL)	10,9 (8.7-14.6)	12.99 (9,1- 16.7)	0.605
Platelets (x10 ^{3} / uL)	251.5 ± 62.9	237 ± 49.2	0.133
FPG (mg / dL)	117 (101-186)	105 (93.5-119)	< 0.001
2- hours PPG (mg / dL)	148 (101-167)	126 (103-138.5)	< 0.001
BGLs (mg / dL)	168 (110-223)	110 (100-121.5)	< 0.001
HbA1c (%)	7.0 (6.0-8.65)	6.0 (5.6-6.5)	< 0.001
Ureum (mg / dL)	28 (20-38.5)	30 (18-42)	0.093
Creatinine (mg / dL)	0.90(0.75-1.27)	0.97 (0.37-1.57)	0.556
Cholesterol (mg / dL)	168.6 ± 40.0	175.5 ± 37.8	0.216
Triglycerides (mg / dL)	125 (91-168)	112 (89-144.5)	0.139
HDL (mg / dL)	36.2 ± 9.4	38.24 ± 9.3	0.143
LDL (mg / dL)	116.5 ± 38.4	115.1 ± 49.9	0.910
CKMB (U/L)	65 (43.5-74.5)	67 (37-98)	0.643
Troponin I (ng / mL)	11.2 (1.8-15.0)	11.45 (1.34-52)	0.282
Ratio TG/HDL-C	4.03 (2.62-4.6)	3,2 (2.4-4.25)	0.027

Table 4. Multivariate analysis

Variable	DM	Non-DM
BMI (kg/m ^{2})	0.002	0.937
infarction myocardial		
NSTEMI	0.009	0.937
STEMI		
Laboratory		
Diabetes Melitus	0.019	0.996
Smoke	0.217	0.991
Laboratory		
Leukocytes (x10 ^{3} / uL)	0.006	0.937
Platelets (x10 ^{3} / uL)	0.220	0.937
FPG (mg / dL)	0.002	0.996
2- hours PPG (mg / dL)	0.030	0.992
BGLs (mg / dL)	0.044	0.998
HbA1c (%)	0.010	0.937
Ureum (mg / dL)	0.023	0.993
Creatinine (mg / dL)	0.188	0.938

Table 4. Continuous

Variable	DM	Non-DM
Cholesterol (mg / dL)	0.216	0.977
Triglycerides (mg / dL)	0.002	0.987
HDL-C (mg / dL)	0.030	0.975
Ratio TG/HDL-C	< 0.001	0.979
Diabetes Melitus	0.019	0.996
Smoke	0.217	0.991

Table 5. Ratio TG/HDL-C

Ratio TG/HDL-C	SYNTAX		p-value
	<23	>23	
< 4	19 (70.4)	8 (30.8)	0.004
> 4	8 (29.6)	18 (69.2)	

DISCUSSION

In this study, there was no significant difference in LDL-C values (p = 0.095) in the two groups. This is in line with previous studies, where there was no significant difference in LDL-C values in the SYNTAX score group <23 compared to the SYNTAX score group > 23 in the Acute Coronary Syndrome population.

NSTEMI patients were found more frequently in the group of patients with a SYNTAX score > 23. This is in line with previous studies, where NSTEMI patients had a higher SYNTAX score than STEMI patients. The group of patients with a SYNTAX score > 23 had significantly higher triglyceride values (p = 0.002). The risk of cardiovascular disease increases if the triglyceride value is > 150 mg/dL. The use of daily doses of rosuvastatin 10mg to 80mg was shown to reduce triglycerides up to 7.5% more than simvastatin 10-80mg, but not significantly different when compared to atorvastatin 10mg-80mg. The group of patients with a SYNTAX score > 23 had significantly lower HDL scores (p = 0.03).

From the results of the bivariate test, the leukocyte, FPG, 2-hours PPG, HbA1c, ureum, triglyceride, and HDL-C variables were significantly different in the group of patients with a SYNTAX score > 23 (p < 0.05), but when multivariate test was performed, no results were obtained. significant (p > 0.05). This could be due to the small number of samples. In this study, the cutoff value of the TG/HDL-C ratio was 4.07 with a sensitivity value of 69.2% and a specificity of 70.4% as predictors of coronary lesion severity.

This is not much different from the previous study by Gharipour, where the cutoff value of the TG/HDL-C ratio as a predictor of cardiovascular events in the Iranian population was 3.68. The group of patients with a TG/HDL-C ratio > 4 tended to have a higher SYNTAX score. There was a significant relationship between the TG/HDL-C ratio and the severity of coronary lesions as described by the SYNTAX score. Amin et al also concluded that in a population of patients with acute coronary syndromes, an increase in the TG/HDL-C ratio > 4 is associated with the severity of coronary lesions.

CONCLUSION

From this study we concluded that patients with a SYNTAX score > 23 tend to be NSTEMI patients and patients with DM, the mean ratio of TG/HDL-C in AMI patients treated at Haji Adam Malik Hospital Medan is 4.48, the mean score of SYNTAX in AMI patients treated at H. Adam Malik Hospital Medan is 22.69, the cut-off value of the TG/HDL-C ratio in AMI patients treated at H. Adam Malik General Hospital Medan was 4.07 with a sensitivity of 69.2% and a specificity of 70.4% as predictors of coronary lesion severity, an increase in the TG/HDL-C ratio > 4 had a significant association with the severity of coronary lesions in AMI patients (p = 0.004).

DECLARATIONS

Ethics approval and consent to participate. Permission for this study was obtained from the Ethics Committee of Universitas Sumatera Utara and H. Adam Malik General Hospital.

CONSENT FOR PUBLICATION

The Authors agree to publication in Journal of Society Medicine.

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None.

AUTHORS' CONTRIBUTIONS

All authors significantly contribute to the work reported, whether in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas. Contribute to drafting, revising, or critically reviewing the article. Approved the final version to be published, agreed on the journal to be submitted, and agreed to be accountable for all aspects of the work.

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