

Correlation of C - Reactive Protein/Albumin Ratio with Coronary Lesion Severity using Syntax Score in Non ST Elevation Acute Miocard Infark Patients in Adam Malik Hospital, Medan

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Abstract:-

Introduction: Myocardial Infarction Acute with Non ST Segment Elevation (IMA-NEST) is acute coronary syndromes that has a high mortality rate. Inflammation plays a major role in the progression and destabilization of atherosclerotic plaque in coronary heart disease. C-Reactive Protein/albumin ratio is new prognostic marker and believed to be a more accurate indicator of the inflammatory status than C-Reactive Protein or albumin alone. The severity of myocardial ischemia or infarction is determined by the lesion of coronary artery and can be measured based on the SYNTAX score. This study at to determine the relationship between the C-Reactive Protein/albumin ratio and the severity of coronary lesions using the SYNTAX score.

Method: This is a cross-sectional study of 50 NSTEMI patients who underwent angiography at the RSUP HAM from March 2022 to July 2022. Measurements of C-Reactive Protein/albumin ratio based on laboratory findings. The SYNTAX score was calculated based on the results of the angiography. Bivariate analysis was conducted to assess the correlation between the two variables. Then, ROC analysis was performed to assess the C-Reactive Protein/albumin ratio as a predictor of coronary lesion severity.

Result: Total subjects were 50 NSTEMI patients consist of 15 (27%) patients with non-severe coronary lesions (SYNTAX score < 23) and 35 (73%) patients with severe coronary lesions (SYNTAX score 23). There is a moderate positive correlation between the C-Reactive Protein/albumin ratio and the SYNTAX score ($r = 0.401$; $p < 0.001$). Based on ROC analysis, C-Reactive Protein/albumin can predict the severity of coronary lesions with AUC = 88%.

Conclusion: C-Reactive Protein/albumin ratio has a correlation with the SYNTAX score and can predict the severity of coronary lesions in NSTEMI patients.

Keywords:- NSTEMI, SYNTAX score, C-Reactive Protein/albumin ratio.

I. INTRODUCTION

Cardiovascular disease is a major cause of morbidity and mortality globally. Cardiovascular disease is a group of diseases of the heart and blood vessels, including coronary heart disease, cerebrovascular disease, rheumatic heart disease and other diseases. Heart attacks and strokes account for more than four-fifths of cardiovascular deaths, and one-third of these deaths occur prematurely in people under the age of 70. According to WHO data, an estimated 17.9 million people died from cardiovascular disease in 2019, accounting for 32% of global deaths. Of these deaths, 85% were caused by heart attacks and strokes. Of the 17 million premature deaths (under the age of 70) due to non-communicable diseases in 2019, 38% were due to cardiovascular disease. More than three-quarters of deaths from cardiovascular disease occur in low- and middle-income countries. (WHO, 2021)

Heart disease in Indonesia is still one of the highest causes of death, so the whole community needs to take a role in preventing high rates of morbidity and mortality. The Institute for Health Metrics and Evaluation (IHME) reports that 14.4% of the causes of death in Indonesia are coronary heart disease (CHD), it is reported that 50% of patients with CHD have the potential to experience sudden cardiac arrest. Riskesdas data in 2018 showed the prevalence of cardiovascular disease in Indonesia reached 1.5%, 15 out of 1000 people, or there were 4.2 million people suffering from cardiovascular disease. In the province of North Sumatra, the prevalence of heart disease reaches 1.3% (RISKESDAS, 2018)

Acute Coronary Syndrome (ACS) is a major cardiovascular problem because it causes high hospitalization rates and high mortality rates. (Irmalita et al, 2018). Most ACS is an acute manifestation of a torn or ruptured coronary atheromatous plaque. This is related to changes in plaque composition and thinning of the fibrous cap that covers the plaque. This event will be followed by the process of platelet aggregation and activation of the coagulation pathway. A thrombus rich in platelets (white thrombus) is formed. This thrombus will block the coronary arteries, either totally or partially; or become microemboli that occlude more distal coronary vessels. ACS is divided into ST-segment elevation myocardial infarction (AMI-EST), non-ST-segment elevation myocardial infarction (NEST) and unstable angina pectoris. (PERKI, 2018)

The diagnosis of IMA-NEST and unstable angina pectoris is made if there is a complaint of acute angina pectoris without persistent ST-segment elevation in two adjacent leads. The ECG recordings at presentation may be ST segment depression, T wave inversion, flat T waves, pseudo-normalized T waves, or even no changes. Unstable angina pectoris and IMA-NEST are differentiated based on the incidence of myocardial infarction which is characterized by an increase in cardiac markers. Commonly used cardiac markers are Troponin I or CK-MB. The results of the biochemical examination of cardiac markers if there is a significant increase, then the diagnosis is IMA-NEST. Unstable angina pectoris has no significant increase in cardiac markers. ACS with the threshold value for an abnormal increase in troponin is several units above the upper limits of normal (ULN). (PERKI, 2018)

The SYNTAX score (SYNergy between percutaneous coronary intervention with TAXus and cardiac surgery) is a scoring system developed comprehensively to describe the coronary artery complexity of angiographic findings. The SYNTAX score was created taking into account the number of lesions and their functional consequences, location and complexity. Therefore, a higher SYNTAX score indicates a more complex disease and a poorer prognosis. This SYNTAX score helps determine whether a patient should undergo Coronary Artery Bypass Surgery (CABG) or Percutaneous Coronary Intervention (PCI). In patients with low (0-22) and intermediate (23-32) SYNTAX scores, the clinical outcomes of PCI and CABG were nearly identical. (Sianos et al, 2005)

Patients with a SYNTAX score of more than 32 were clinically better with CABG at 12 months. The SYNTAX score has also been shown to be a predictor of medium-term outcome after PCI in patients with occlusion of all 3 coronary arteries and can be used to help select a revascularization strategy in patients with occlusion of all 3 coronary arteries. From the previous study, 80% of IMA-NEST patients had multivessel disease. So that the complexity of the lesion at IMA-NEST is higher than that of IMA-EST (Sianos et al, 2005; Erdoan et al, 2020).

The association of coronary artery disease severity with increased C-Reactive Protein and decreased albumin levels has been reported in several studies. One of the markers that can be used to see the presence of inflammation is C-Reactive Protein. C-Reactive Protein examination can detect acute inflammation and severe tissue damage. Examination of C-Reactive Protein can be used to detect early the presence of an inflammatory process in CHD. (Pearson, 2003). Sipahutar's research (2019) showed that there was a significant relationship between C-Reactive Protein and the number of lesions, but several studies found that C-Reactive Protein had a weak positive correlation with the degree of stenosis with a high syntax score ($r = 0.207$, $p = 0.009$). . (Huningkor , 2018)

Epidemiological studies have also shown an association between hypoalbuminemia and the development of CHD. In patients with CHD, hypoalbuminemia has also been identified as a risk factor for the development of Acute Myocardial Infarction (AMI) but there is no evidence of a prognostic value of albumin levels in AMI patients. (Kurtul et al, 2015) According to previous research, it was shown that the ratio of C-Reactive Protein/albumin was associated with the association of coronary artery disease severity with SYNTAX scores in patients with ACS. The C-Reactive Protein/albumin ratio is a newly introduced inflammation-based risk index, proven to better reflect inflammatory status, and is superior to C-Reactive Protein or albumin alone. The ratio of C-Reactive Protein / albumin has a better predictive value in detecting the presence of CHD and multivessel disease significantly compared to other inflammatory parameters. The study also showed that the C-Reactive Protein/albumin ratio was an independent predictor of high SYNTAX scores and was associated with prognosis in ACS patients for in-hospital mortality. (Cagdas et al, 2017; Tanriverdi Z et al, 2019; El-Moaty et al, 2021). Research in Indonesia regarding marker index data for the ratio of C-Reactive Protein/albumin to the severity of coronary lesions has not been carried out.

Considering the incidence of acute coronary syndrome and the need for appropriate decisions in determining the invasive strategy to be applied and considering simple non-invasive tests that can be done, this study aims to find the relationship between the ratio of C-Reactive Protein/albumin to the severity of coronary lesions in AMI patients. -NEST at RSUP. H. Adam Malik Medan.

II. METHODS

A. Research design

This study is a descriptive analytic study with a cross-sectional study design, namely by assessing the relationship (correlation) between the increase in the ratio of C Reactive Protein/albumin with the severity of coronary lesions in IMA-NEST patients. Researchers will take all study subjects with a diagnosis of acute coronary syndrome based on ECG and clinical and cardiac enzymes, while the severity of coronary lesions is assessed from the SYNTAX score after the patient undergoes coronary angiography. The study was conducted on patients with non-ST-segment elevation acute myocardial infarction who underwent coronary angiography and were treated at H. Adam Malik General Hospital Medan from March 2022 until the number of samples was met.

B. Population and Sample

The target population in this study were patients with IMA-NEST who underwent coronary angiography. While the affordable population is patients with IMA-NEST who underwent coronary angiography at H. Adam Malik Hospital, Medan. The sample is an affordable population that meets the inclusion and exclusion criteria. The sample in this study was collected using a consecutive sampling technique.

C. Inclusion and Exclusion Criteria

Inclusion criteria in this study were Patients with clinical and supportive examinations as IMA-NEST (based on clinical, ECG and cardiac biomarkers), IMA-NEST patients who underwent coronary angiography procedures during hospitalization, Patients not with malignancy, Patients not with liver disease, Patients without blood disorders, Non-infectious disease (sepsis), Patients without impaired renal function (GFR <30 ml/min). Exclusion criteria are patients with incomplete data and medical records, patients who are not willing to participate in the study.

D. Protocol Research

Before starting the research, the researcher asked for information on passing the ethical clearance to the permanent committee to assess research ethics at the Faculty of Medicine, University of North Sumatra. Each individual who is included in the research sample must have an informed consent form signed by the participant and the researcher. All samples of this study were patients diagnosed with IMA-NEST who were included in the inclusion criteria during guard duty and daily work duties and undergoing treatment at H. Adam Malik Hospital Medan. Researchers examined patients in the form of ECG, chest X-ray, blood laboratory and echocardiography. Patients with IMA-NEST will have the ratio of C-Reactive Protein/albumin calculated. The ratio of C-Reactive Protein/albumin was obtained from the calculation of the C-Reactive Protein value divided by the albumin value. Angiography was performed in the catheterization laboratory of H. Adam Malik Hospital, Medan. Calculation of the SYNTAX score and the severity or severity of coronary artery lesions will be assessed using the SYNTAX score using the application at <http://www.syntaxscore.com/calculator/start.html>. The SYNTAX score will be assessed by two different observers. For the purposes of data processing, the results of the calculation of the SYNTAX score are in numerical form, and are presented in 2 groups, namely the group with the SYNTAX score < 23 and the SYNTAX score 23. Laboratory examinations were carried out when the patient was admitted through the Hospital Clinical Pathology laboratory. Haji Adam Malik Medan. Blood samples for diagnosis were taken when the patient was admitted to the hospital, except for tests for lipid profile and fasting blood sugar, which were taken after the patient had fasted for about 8 hours. CRP examination using agglutination method and albumin using ARCHITECT CI 8200. The results of these tests were recorded. Optimal and standardized medical therapy is provided to all patients during treatment. The selection of reperfusion measures is carried out according to the clinical assessment of the respective doctors in charge.

E. Analysis

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) values 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 used the Chi-square test for categorical data or Fisher's exact test if the Chi-square test conditions were 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 correlation between the two variables was calculated by Pearson correlation-regression statistical analysis for normally distributed data and Spearman correlation analysis for non-normally distributed data. The variable is considered significant if the p value < 0.05. Multivariate analysis was carried out on variables that had a p value of <0.25 or variables that were theoretically important. Multivariate test of categorical independent variables with categorical dependent variable tested by logistic regression. The variable is considered significant if the p value < 0.05. The level of accuracy of the independent variables in predicting the occurrence of the dependent variable was analyzed using the Receiving Operator Curve (ROC) curve so as to produce the cut off point, sensitivity and specificity of the independent variables. This research will seek approval from the Health Research Ethics Committee, Faculty of Medicine, University of North Sumatra.

III. RESEARCH RESULT

A. Research Characteristics

This research was conducted at the Department of Cardiology and Vascular Medicine, RS. H. Adam Malik starting from March 2022 to July 2022 by collecting samples by looking at the medical records of IMA-NEST patients at care at the Cardiac Special Emergency Service Unit (UPK2J), Cardiovascular Intensive Care (CVCU), and inpatient treatment (RIC). The number of IMA-NEST patients in that period was 53 people. The number of samples was 50 people who met the inclusion criteria and exclusion criteria so that they could be included in the study. From the total number of samples included in the study, data were collected from the clinical condition of the patient at the time of admission, the results of laboratory examinations, and electrocardiography and coronary angiography examinations.

B. Characteristics of Research Subjects

The subjects who participated in this study were 50 people, consisting of 38 men and 12 women. The mean age of the patients in this study was 59.24 ± 7.968 . Data that are normally distributed are presented in the form of a mean with a standard deviation while data that are not normally distributed are presented in the form of a median with minimum and maximum values. In this study, the highest risk factors were hypertension 38 people (76%), followed by diabetes mellitus 23 people (46%), and smoking 22 people (44%). On physical examination, the median systolic blood pressure was 140 (90-170). Based on laboratory examination, the median levels of C-Reactive Protein were 1.4 (0.62-2.7), albumin was 3.4 (2-3.5) and the median C-Reactive Protein/albumin ratio was 0.38 (0,2-0.7). On echocardiography, the median left ventricular ejection fraction was 51 (26-76). The results of angiography showed that 9 people (18%) had a single coronary lesion, while 41

(82%) had multiple coronary lesions. The median SYNTAX score in this study was 25.68 ± 7.84 .

Characteristics	
Gender	
Man	38 (76%)
Woman	12 (24%)
Age (years)	59.24 ± 7.968
Risk factor	
History of Hypertension	38 (76%)
DM history	23 (46%)
Smoking History	22 (44%)
BMI	25.20 ± 2.90
Hemodynamic Parameters	
Systolic BP (mmHg)	140 (90-170)
Diastolic BP (mmHg)	80 (60 - 110)
Laboratory Parameters	
Hemoglobin (g/dL)	13.22 ± 1.454
Leukocytes (/ μ L)	9365 ± 368.73
Platelets (10^3 / μ L)	245.5 (157 – 563)
Urea (mg/dL)	27 (13-90)
Creatinine (mg/dL)	0.81 (0.48-1.38)
Glucose (mg/dL)	142 (69-517)
Troponin I (ng/mL)	2.2 (0.8-15)
CKMB (U/L)	46.50 ± 15.57
Total Cholesterol (mg/dL)	175.98 ± 27.02
Triglycerides (mg/dL)	135 (85-240)
HDL (mg/dL)	35 (20 – 57)
LDL (mg/dL)	125 (66-220)
C-Reactive Protein	1.4 (0.62-2.7)
Albumin	3.4 (2-3.5)
Albumin to Total Protein Ratio	0.38 (0.2-0.7)
Echocardiographic Parameters	
LVEF (%)	51 (26-76)
Angiographic Parameters	
Single Vessel	9 (18%)
Multi Vessels	41 (82%)
SYNTAX Score	25.68 ± 7.84

Table 1: Sample characteristics

The results of the SYNTAX score measurement from the angiography results are numerical data, so to minimize bias at the time of measurement, measurements were carried out 2 times by 2 experienced observers (Interventional Cardiologist). Furthermore, the interobserver reliability

assessment was carried out using the Bland-Altman test, the difference in the measurement results between the two observers did not exceed 5, so the results obtained were quite reliable for the SYNTAX score.

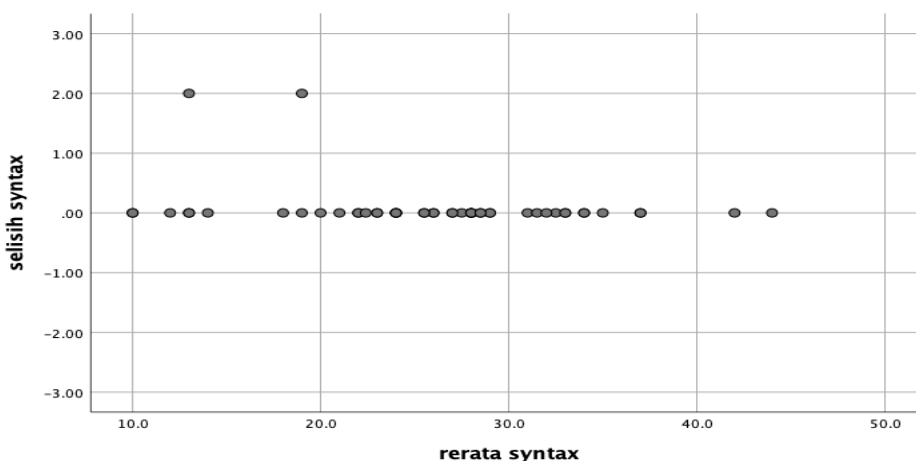


Fig. 1: Graph of Bland-Altman SYNTAX score on Intraobserver Reliability Test

C. Bivariate Analysis of Research Subjects on Severity of Coronary Lesions

Bivariate analysis using T-Independent Test, Mann-Whitney Test, Chi-Square Test, and Fisher's Test was conducted to determine whether there was a significant relationship or difference between the characteristics of the study subjects based on the severity of coronary lesions. SYNTAX score 23 was classified as Severe CAD in 35

(73%) people and SYNTAX score < 23 was grouped as Non-Severe CAD as many as 15 (27%) people. Based on the results of bivariate analysis, several parameters were statistically significant (p<0.005) on the severity of coronary lesions, namely history of diabetes mellitus, LDL, C-Reactive Protein, albumin, C-Reactive Protein/albumin ratio, number of coronary lesions and syntax scores.

Characteristics	Severe CAD n = 35 (73%)	Non-Severe CAD n = 15 (27%)	p value
Gender			
Man	28 (73.7%)	10 (26.3%)	0.471 ²
Woman	7 (58.3%)	5 (41.7%)	
Age (years)	58.57±7.99	60.8±7.94	0.370 ³
Risk factor			
Hypertension	25 (65.8%)	10 (34.2%)	0.304 ²
DM	24 (88.9%)	3 (11.1%)	0.004 ¹
Smoke	15 (68.2%)	7 (31.8%)	0.804 ¹
BMI	25.21±3.00	25.17±2.77	63 ³
hemodynamics			
Systolic BP (mmHg)	140 (90-170)	140 (110-150)	0.407 ⁴
Diastolic BP (mmHg)	70 (60-90)	70 (70-75)	0.199 ⁴
laboratory			
Hemoglobin (g/dL)	13.1 (11-16.8)	13.4 (11.6-15.9)	0.812 ³
Leukocytes (/ μL)	9850 (1075-15420)	8950 (10-11860)	0.421 ⁴
Platelets (10 ³ / μL)	256 (176 – 490)	256 (278 – 459)	0.890 ⁴
Urea (mg/dL)	28 (13-62)	24 (15-90)	0.641 ⁴
Creatinine (mg/dL)	0.8 (0.48-1.38)	0.82 (0.68-1.2)	0.726 ⁴
Glucose (mg/dL)	140 (69-517)	142 (69-223)	0.433 ⁴
Troponin I (ng/mL)	2.3 (0.2 – 17.6)	1.5 (0.05 – 26.20)	0.054 ³
CKMB (U/L)	48 ±16.36	46 ±14.06	0.763 ³
Total Cholesterol (mg/dL)	179 ±25.83	171 ±27.51	0.361 ³
Triglycerides (mg/dL)	139 (73 – 305)	154 (92 – 347)	0.471 ⁴
HDL (mg/dL)	35 (20 – 54)	35 (25 – 57)	0.087 ⁴
LDL (mg/dL)	132 ±41.86	135 ±35.61	0.003 ³
C-Reactive Protein	1.4 (0.2-2.7)	1.1 (0.9-1.8)	0.002 ³
C-Reactive Protein / Albumin Ratio	3.4 (2-3.5)	3.4 (3.2-3.5)	0.002 ⁴
C-Reactive Protein / Albumin Ratio	0.41 (0.23-1.31)	0.32 (0.26-0.37)	<0.001 ⁴
echocardiography			
LVEF (%)	51.54 ±10.26	51.67 ±5.52	0.698 ³
coronary Angiography			
Single Vessel	0 (0%)	9 (100%)	<0.001 ¹
Multi Vessels	35 (85.4%)	6 (14.6%)	
SYNTAX Score	30.92 ±7.07	14.06 ±5.52	<0.001 ³

Table 2: Bivariate Analysis of Research Subject Characteristics on Severity of Coronary Lesions

D. Multivariate Analysis of Coronary Lesion Severity

Multivariate analysis was used to determine the factors that were predictors of coronary lesion severity, which are presented in Table 5. Variables that had a P value < 0.25 in bivariate analysis were included in the logistic regression analysis of the severity of coronary lesions. Based on the analysis, it was found that the value of the C-Reactive

Protein/Albumin ratio was a statistically significant predictor factor (P<0.005).

Variable	p value	OR	IK95% (Min-max)	
DM	0.004	4.14	1.38	4.18
C-Reactive Protein/Albumin Ratio	0.004	2.52	1.47	2.57

Table 3: Multivariate Analysis of Coronary Lesion Severity

E. Correlation Analysis of C-Reactive Protein, Albumin, and C-Reactive Protein/Albumin Ratio with Coronary Lesions Severity

In determining the correlation of C-Reactive Protein, albumin, and the ratio of C-Reactive Protein/albumin to the SYNTAX score, Pearson correlation analysis was performed with the data distribution normally distributed. The results

obtained are that there is a positive correlation with moderate correlation strength for the value of the C-Reactive Protein/Albumin Ratio (P=0.006; R=0.41) compared to C-Reactive Protein on the SYNTAX score with (P=0.036; R=0.298). In the albumin parameter, there was no statistically significant correlation with P=0.63 and R=-0.265.

	Coefficient	C-Reactive Protein	Albumin	Ratio C-Reactive Protein/Albumin
SYNTAX Score	p value	0.036	0.063	0.006
	r	0.298	-0.265	0.41

Table 4: Correlation Analysis of C-Reactive Protein, Albumin, and Ratio

F. ROC Analysis of C-Reactive Protein and C-Reactive Protein/Albumin Ratio on Coronary Lesions Severity

ROC analysis was performed to assess the accuracy of the C-Reactive Protein and CRP/Albumin ratio in predicting the severity of coronary lesions. Severity of coronary lesions was presented in Severe CAD (SYNTAX score \geq 23) and

Non-Severe CAD (SYNTAX score $<$ 23). The results obtained were area under the curve (AUC) with a CRP Albumin ratio of 88% which was statistically significant, having a strong accuracy, namely P $<$ 0.001. The Cut-Off value for the ratio of CRP/Albumin to coronary lesion severity was 0.358.

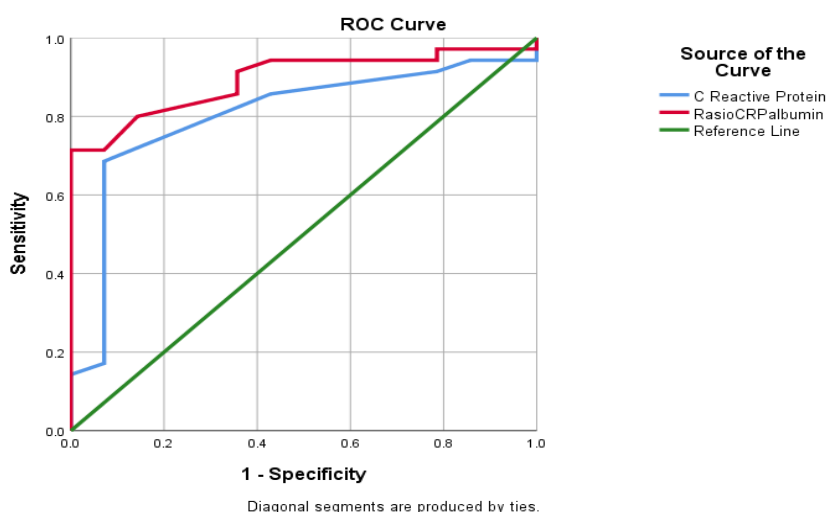


Fig. 2: ROC Analysis of C-Reactive Protein/Albumin Ratio on Coronary Lesions Severity

Parameter	AUC	P value	Cut off	Sensitivity	Specificity
CRP	80%	0.001	1.3	68.6%	72.9%
CRP /Albumin Ratio	88%	$<$ 0.001	0.358	80%	85.7%

Table 5: C Reactive Protein Cut-off Point and C-Reactive Protein/Albumin Ratio to Coronary Lesions Severity

IV. DISCUSSION

This study is a cross-sectional study of patients with IMA-NEST at the Haji Adam Malik General Hospital, which was conducted from March 2022. This study aimed to assess the relationship or correlation between the CRP/albumin ratio and the severity or severity of coronary lesions. Severity or severity of coronary lesions is measured based on a long-known score, namely the SYNTAX score, so the relationship obtained is in the form of a correlation.

Coronary heart disease is caused by the presence of atherosclerotic plaques. The inflammatory process of atherosclerotic plaque formation is characterized by an increase in inflammatory markers such as acute phase proteins and cytokines. Previous studies have shown that anti-inflammatory markers such as the CRP/albumin ratio can predict the prognosis of coronary heart disease. The CRP/albumin ratio is also one of the factors that can affect the SYNTAX value (Kurtul et al, 2016).

Based on the characteristics of the study, the average age in this study was 59.24 ± 1.12 with more male population than female (76% male and 24% female). This result is similar to the study conducted by El Moaty et al, where the average age was 54.520 ± 7.889 , with the majority of the sample being male (63%). However, in this study, no statistically significant relationship was found on the parameters of age and gender. This finding is in line with El Moaty's research, where there was no significant relationship between these two parameters (Saleh Abd El-Moaty et al, 2021). In cardiovascular risk parameters, the most common risk factors found were diabetes mellitus (52%), followed by hypertension in 24 people (48%) and smoking 22 people (44%). This finding is quite different from the previous study by Cagdas et al, the most common risk factors found were hypertension (58.7%), followed by smoking (49.1%) and diabetes mellitus (27.9%). Based on these risk factors, diabetes mellitus and hypertension had a significant relationship with $P < 0.001$ and $P = 0.14$. (Çağdaş et al., 2019) These results are similar to the previous study by Elaal et al, namely, a significant relationship was found between diabetes and hypertension in the severity of coronary lesions with $P=0.04$ and $P=0.003$ values. The study by Zebua (2022), explained the same thing, where there was a significant difference in the history of diabetes mellitus in IMA-NEST patients with p value = 0.021.

In blood laboratory parameters, LDL levels were found to be higher in the group with severe CAD and had a significant relationship with lesion severity ($P=0.003$). Research conducted by Lin et al, on 594 samples of patients with suspected coronary heart disease, found that LDL had a positive correlation with the severity of coronary lesions ($r=0.632$ and $P<0.001$). This is because coronary heart disease is closely associated with impaired lipid metabolism and inflammatory processes. Low HDL levels accompanied by an increase in LDL are important risk factors for coronary heart disease (Lin et al, 2018). The results of this study showed that as many as 35 people had severe CAD with a SYNTAX score 23. In this group, inflammatory markers such as CRP and higher CRP/albumin ratio were found compared to the non-severe CAD group. Based on bivariate analysis, it was found that there was a significant relationship with $P<0.005$ on the CRP parameters and the CRP/albumin ratio. This is in line with the study of Cagdas et al in patients with acute coronary syndromes, which found higher CRP levels and CRP/albumin ratios in the Severe CAD group, the study also showed a significant relationship in both parameters with P values in both < 0.001 . The essence of coronary heart disease is the formation of atherosclerotic plaques, in this case inflammation also plays a role in the pathological process of plaque formation. CRP is an inflammatory mediator that is excreted during the formation of atherosclerotic plaques. An increase in CRP will increase levels of reactive oxygen species (ROS) in the blood, increase LDL absorption and induce endothelial damage and apoptosis which results in the proliferation of vascular smooth muscle and increases the risk of plaque rupture (Çağdaş et al., 2019).

The results of the multivariate test of DM history and CRP/albumin ratio were statistically significant as strong predictors of coronary lesion severity ($P=0.004$, $OR=4.14$; $P=0.004$, $OR: 2.25$). This result is in line with the findings of Cagdas et al, where DM and CRP/albumin ratio were independent predictors of coronary lesion severity ($P=0.002$, $OR=2.451$; $P<0.001$, $OR=1.020$). An increase in the CRP/albumin ratio indicates a higher inflammatory state and is better than CRP and albumin alone in determining the prevalence and severity of coronary lesions. The study also showed that increased levels of the CRP/albumin ratio in patients with coronary heart disease were an independent predictor of the higher SYNTAX score group (Kurtul et al., 2016). Another study conducted by Karbag et al also showed that the CRP/albumin ratio was found to be higher in the SYNTAX score >22 group and in the multivariate analysis using regression, the CRP/albumin ratio was one of the independent predictors of the SYNTAX score ($P<0.001$; $OR; 1.290$)(Karabağ et al., 2018)

In this study, the CRP/albumin ratio was found to be better than C-Reactive Protein alone in predicting the severity of coronary lesions. This can be seen in the ROC curve where CRP/albumin has an AUC value of 0.88 ($P<0.001$) and CRP has an AUC value of 0.80 ($P=0.001$). Based on the results of the specificity and sensitivity, the ratio of CRP/albumin was higher than that of CRP. This finding is similar to the results of research by Karabağ et al. In that study, the CRP/albumin ratio was superior to CRP and albumin alone in predicting the severity of coronary lesions with values (AUC: 0.716 for CRP/albumin ratio, AUC; 0.701 for CRP and AUC: 0.611 for albumin) (Karabağ et al., 2018).

V. CONCLUSION

Based on the results of the analysis of the data obtained in this study, it was concluded that the mean ratio of C-Reactive protein/albumin in AMI-NEST patients in this study was 0.38 (0.2-0.7), The mean SYNTAX score for AMI-NEST patients in this study was 25.68 ± 7.84 , There is a relationship between the ratio of C-Reactive Protein/Albumin to the severity or severity of coronary lesions based on the SYNTAX score, for the ratio of C-Reactive Protein/Albumin ($p = 0.006$, $R=0.41$) with a positive correlation direction and a moderate correlation strength ($0.4 < r < 0.6$), C-Reactive Protein/Albumin ratio can predict the severity of coronary lesions based on the SYNTAX score (AUC = 88.5%) with a cut-off of 0.358.

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