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A Prospective Observational Study of Relationship between the C-Reactive Protein-to-Albumin Ratio and Uric Acid-to-Albumin Ratio to the Extent of CAD in Patients Presenting with Acute Coronary Syndrome in a Tertiary Care Centre

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Abstract: ***Background: This study aimed to investigate the predictive value of the newly defined C-reactive protein (CRP)-toalbumin ratio (CAR) and Uric acids albumin ratio (UAR) in determining the extent and severity of coronary artery disease (CAD) in comparison with the other inflammatory markers such as neutrophil-to lymphocyte ratio (NLR) in patients with Acute coronary syndrome (ACS). Patients and methods: This study is prospectively designed and includes 100 patients with ACS. The study cohort was subdivided into two groups according to Synergy between Percutaneous Coronary Intervention with Taxus and cardiac surgery score (SS) as low (< 22) and intermediate-high (≥22). Complete blood counts, serum CRP, and serum albumin were obtained at admission. The CAR, UAR and NLR values of all patients were calculated. Then, we evaluated the relationship of CAR, UAR and NLR with the CAD extent and severity. Results: CAR, UAR and NLR were moderately correlated with SS, but PLR showed weak correlation with SS. According to multivariate analysis models, CAR, NLR, and left ventricular ejection fraction were found to be independent predictors of CAD severity (P < 0.05. A CAR more than 17 and UAR of more than 0.16 predicted an intermediate-high SS. Conclusion: Novel inflammatory marker CAR and UAR can be used as a reliable marker in prediction of CAD severity in patients with ACS.***

Keywords: C-reactive protein (CRP)-to albumin ratio (CAR), Uric acids albumin ratio (UAR) neutrophil-to lymphocyte ratio (NLR) Acute coronary syndrome (ACS)

1. Introduction

Acute coronary syndrome (ACS) encompasses clinical presentations including ST segment elevation myocardial infarction, non-ST segment elevation myocardial infarction (NSTEMI), and unstable angina. The central core in the pathobiology of Acute coronary syndrome, in the progression of unstable plaque is inflammation and resulting in thrombosis. There is a big list of inflammatory markers are being studied and emerging as a novel marker of active inflammation. (1) An elevated inflammatory response reflected as with decreased synthesis and increased breakdown of SA. Lower SA levels may increase blood viscosity and damages the endothelial functions. Serum uric acid (UA), degradation of purine, increases the occurrence of atherosclerosis and accelerates the progression of CAD at high levels. Uric acid is an well known mediator of active inflammation. An elevated Uric acid is an independent predictor and risk factor for coronary artery disease. (2). C-reactive protein (CRP) is an acute phase reactant. Low levels of albumin, a negative acute phase reactant, are associated with many cardiovascular diseases. Various studies have demonstrated that the C-reactive protein (CRP)/albumin ratio (CAR), a marker of inflammation, is more accurate than to CRP and albumin levels alone in determining the inflammatory stress in cardiovascular diseases. (3) Even though there are various parameters for the assessment of extent and severity of coronary artery disease, SYNTAX scores (Synergy between PCI with Taxus and Cardiac Surgery) is the most widely used parameter. (4) We have planned to do this study to find out the relationship between the extent and severity of disease in correlation with the blood levels of various inflammatory markers.

2. Methods

2.1 Study Population

In our study 100 consecutive patients presenting to the Rajiv Gandhi medical college hospital department of cardiology with a diagnosis of Acute coronary syndrome were included during the study period-January 2022 to December 2022 (12 months). Patients baseline clinical and demographic characteristics were obtained. The diagnosis of ACS is made according to American College of Cardiology/American Heart Association guidelines.

2.2 Laboratory Measurements

Patients blood samples were collected within 24 h of hospital admission. All baseline investigations were measured. Serum albumin, Serum uric acid and CRP levels were measured by using a Roche Diagnostics Cobas 8000 c502 analyser. CAR was calculated as the ratio of serum

CRP level (mg/ l) to serum albumin level (g/l) multiplied by 100 for interpretation. The UAR was calculated as the ratio of serum uric acid (mg/dL) to serum albumin (g/L). The NLR was calculated by dividing the neutrophil count by the lymphocyte count. Left ventricular ejection fraction (LVEF) was estimated by using the modified Simpson method by standard views in both end-diastole and end-systole.

2.3 Angiographic Analysis

Coronary angiograms were examined by two cardiologists. The severity of coronary stenosis was evaluated with the anatomical SYNTAX score. The study population was divided into two groups as per the CAD severity by using SS: low (< 22) and intermediate-high (≥22).

2.4 Statistical Analysis

All statistical analyses were performed using the SPSS Software. Continuous variables were expressed as means ± SD or, in the case of a nonnormal distribution, as median 25th to 75th percentiles (IQR). Categorical variables were shown as percentages and numbers, and the $\chi 2$ test was used to compare groups. The Kolmogorov-Smirnov test was performed to assess whether the variables were normally distributed. The Student t test or the Mann-Whitney U test was performed to compare continuous variables between groups based on whether they were normally distributed or not. The Pearson coefficient was used to describe the degree of correlation of parameters among each other and with the SS. The Lin statistic (concordance correlation coefficient; CCC) was used to analyze the inter-operator agreement for image analysis.

3. Results

In the study population of 100, the mean age group was 55.6 ± 8.4 years and about 47% was in between 51 to 60 years. Among those 76% were male and 24% were female. In our study population 42% had diabetes 29.7% had hypertension and 30% were smoker as shown in table 1. In our study population Unstable angina and NSTEMI were the common presentation each of 28%, next to it is AWMI which is 21%. Majority of the patients were KILLIP class 2 while presentation. On analysing the severity of the disease 40 % of the population has triple vessel disease. And 38% had single vessel disease. Around 62% of the patient had syntax score of more than or equal to 23 as shown in table 2.

The median SYNTAX SCORE of the study population was 26, the 25 percentile was 16 and the 75 percentile was 28. The median Ejection fraction of the study population was 52 and the 25 percentile was 40 and the 75 percentile was 57. The median CAR of the study population was 18 and the 25 percentile was 12 and the 75 percentile was 24. The UAR of the study population was 0.16 and the 25 percentile was 0.13 and the 75 percentile was 0.17 as shown in table 3.

On correlating the SYNTAX SCORE with the NLR, CAR and UAR, all the three parameters were positively correlating with significant r Value and this correlation is also statistically significant with a p value of 0.016, 0.002, and 0.013 respectively As shown in figure 1, Figure 2 and Figure 3. On correlating the Ejection Fraction with the NLR, CAR and UAR, all the three parameters were Negative correlating with significant r Value and this correlation is also statistically significant with a p value of 0.021, <0.0001, and <0.0001 respectively.

Table 1: Baseline Characteristics

		Count (n-100)	Column N %
Age Group	<40	7	7.0%
	41-50	21	21.0%
	51-60	47	47.0%
	61-70	20	20.0%
	>71	5	5.0%
Sex	F	24	24.0%
	M	76	76.0%
DM	No	58	58.0%
	Yes	42	42.0%
HTN	No	71	71.0%
	Yes	29	29.0%
Smoker	No	74	74.0%
	Yes	26	26.0%
Alcoholic	No	87	87.0%
	Yes	13	13.0%

Table 2: Presentation and angiographic profile of the study population

		Count (n-100)	Column N %
Presentation	AWMI	21	21.0%
	IRPWMI	8	8.0%
	IWMI	11	11.0%
	LWMI	4	4.0%
	NSTEMI	28	28.0%
	USA	28	28.0%
KILLIP	1	46	46.0%
	2	35	35.0%
	3	14	14.0%
	4	5	5.0%
CAG-number of diseased vessel	0	2	2.0%
	1	38	38.0%
	2	20	20.0%
	3	40	40.0%
SYNTAX	<22	38	38.0%
	>23	62	62.0%

Table 3: Distribution of Laboratory Parameters in the Study Population

	Median	Percentile 25	Percentile 75
SYNTAX	26.00	16.00	28.00
NLR	1.90	1.30	2.00
CAR	18.00	12.00	24.00
UAR	0.16	0.13	0.17
EF	52.00	40.00	57.00

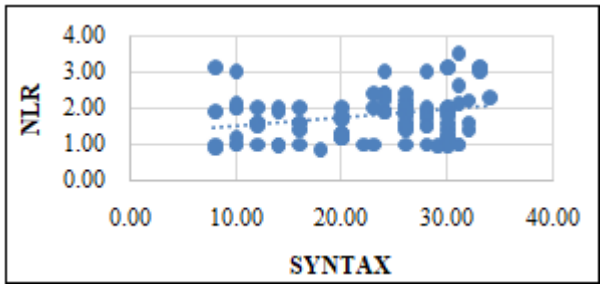

Figure 1

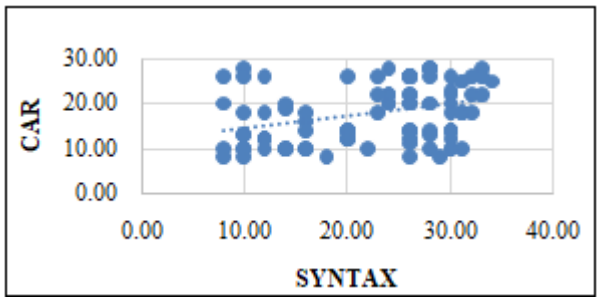

Figure 2

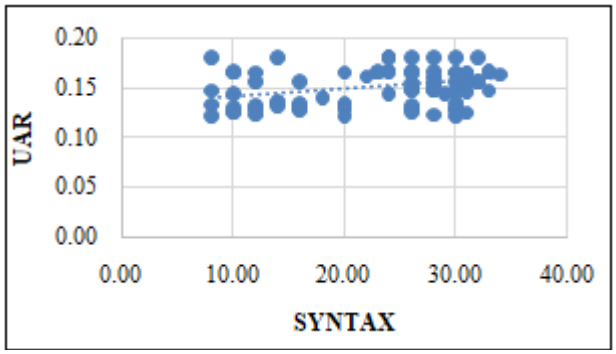

Figure 3

4. Discussion

The main findings in our study increased CAR, higher NLR, and lower LVEF values significantly correlating with CAD burden by syntax score in ACS persons. Elevated CAR, UAR and NLR seen in patients with extensive disease burden and low EF.

Inflammation is one of the most important factor plays a major role in disease progression and complications in coronary artery disease. Among the acute phase reactants CRP, Albumin and uric acid strongly correlates with the level of inflammation (5). Various literatures, increased CRP levels, Uric acid levels have been associated with the extent of CAD and cardiovascular events in stable CAD and ACS patients. It is well known as a novel inflammatory parameter, CAR is highly sensitive and specific as a systemic inflammatory state and prognosis in various non cardiac clinical conditions when compared with the predictive values of these two markers. Over the last few decades, multiple researches have reflected the direct deleterious impact of UA on other cardiovascular risk factors and CAD. Cınar et al postulated AT that CAR has good prognostic implications for predicting worse prognosis in patients with STEMI than with NLR (6). To be precise, there is an association with a more severe cardiovascular risk profile and also reviles that UA may accelerates atherosclerosis and vascular events ultimately leading to cardiovascular deaths have been proposed to explain more risk of death related with elevated UA levels and to more extensively with UAR (7).

This study demonstrated that decreased LVEF, higher CAR, elevated UAR value, and elevated NLR were independent predictors for CAD severity in terms of high Syntax score. We also observed that the predictive accuracy of CAR and UAR for CAD severity was better than that of NLR.

5. Conclusion

Our study showed that CAR and UAR shows strong association with SS and may be a potential available, easily measurable parameter for analysing the coronary atherosclerosis severity. It may be a part of cardiovascular examination to identify individuals with acute coronary syndrome at high risk for advanced CAD who may need a aggressive management approach and more periodic clinical follow-up. However, to evaluate the predictive value of CAR and UAR, mainly its prognostic value ACS patients, large-scale studies are still required

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