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Diagnostic and prognostic value of CRP/albumin and RDW/albumin ratios in young patients with acute coronary syndrome

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Key words: emergency department, C reactive protein, red blood cell distribution width, albumin, acute coronary syndrome.

Abstract

Acute Coronary Syndrome (ACS) is a common cause of emergency department admissions and remains an important contributor to morbidity and mortality. Early identification of disease severity and prognosis is particularly important in young patients with ACS. This study aimed to evaluate the diagnostic and prognostic value of the C-reactive protein to Albumin Ratio (CAR) and red cell distribution width to Albumin Ratio (RAR) in young patients with ACS. This retrospective study included 210 patients younger than 50 years of age who were diagnosed with ACS in the emergency department between January 1, 2020, and December 31, 2022. Demographic characteristics, ACS type (unstable angina, NSTEMI, and STEMI), laboratory parameters, hospitalization data, and mortality outcomes were recorded. CAR and RAR values were calculated and analyzed in relation to ACS type and mortality. Of the 210 patients, 30 (14.3%) were female and the mean age was 43.14±5.03 years. CAR ($p=0.002$) and RAR ($p<0.001$) values were significantly associated with ACS type and were highest in the STEMI group. Mortality occurred in 7(3.4%) patients, and both CAR and RAR values were significantly higher in patients who died (CAR: 27.35±20.37, $p<0.001$; RAR: 6.06±3.15, $p=0.009$). In multivariate analysis, hospitalization duration and RAR were identified as independent predictors associated with ACS classification. ROC analysis demonstrated that both CAR and RAR showed good predictive performance for

mortality. CAR and RAR appear to be useful inflammatory biomarkers that may assist in the clinical classification of ACS and in the early identification of mortality risk in young patients presenting with ACS.

Introductıon

Acute Coronary Syndrome (ACS) is a clinical spectrum of conditions resulting from myocardial ischemia, most commonly due to atherosclerotic plaque rupture and thrombosis, but it may also occur in the absence of obstructive coronary artery disease such as in vasospastic angina, MINOCA, or INOCA. This spectrum includes Unstable Angina (UA), ST-segment Elevation Myocardial İnfarction (STEMI), and non-ST-segment elevation myocardial infarction (NSTEMI). Each year, coronary artery disease affects a population over one million individuals in the United States (US), with a mortality rate of over 400,000.[1] The rates of hospitalizations related to Acute Myocardial İnfarction (AMI) have not exhibited a reduction among young adults, thereby emphasizing the imperative to conduct comprehensive investigations on AMI within this particular age group. It is worth noting that cardiovascular research has traditionally overlooked the study of AMI in young individuals.[2] Patients who are diagnosed with ACS at an early age experience a high risk of death and considerable post-event costs due to the use of healthcare and social services.[3]

Laboratory findings provide a significant role in the diagnosis of acute coronary syndrome, alongside signs, symptoms, physical examination, and Electrocardiogram (ECG). Recent studies have presented reliable evidence regarding the strong correlation between inflammation and atherosclerosis.[4] Serum albumin and C-Reactive Protein (CRP) are considered to be the primary serum proteins within the human body. CRP, a widely used biomarker, has been associated with endothelial dysfunction, a prothrombotic state, modification of atherosclerotic plaques, and their instability.[5,6] Even so, the occurrence of inflammation results in hypoalbuminemia due to a reduction in albumin synthesis and an increase in albumin breakdown. In the context of evaluating the systemic inflammatory status in noncardiac illnesses, a recent study introduced a novel ratio, known as the CRP to Albumin Ratio (CAR), as a potentially more sensitive and specific predictor compared to the individual measurements of CRP and albumin.[7]

The hematological characteristic known as Red cell Distribution Width (RDW) is utilized in the differential diagnosis of anemia to assess the variability in size of red blood cells. According to a recent study, the relationship between RDW and adverse outcomes in AMI was investigated. The research findings suggested that RDW, a simple indicator of systemic inflammation, was linked to a

less favorable prognosis among persons diagnosed with AMI.[8] The RDW to Albumin Ratio (RAR), representing the relationship between RDW and serum albumin levels, has emerged as an alternative risk indicator in recent research. Based on empirical research, it has been established that the presence of RAR plays a critical role in assessing the future course and outcome of many inflammatory conditions.[9,10]

The present study aimed to evaluate the diagnostic and prognostic significance of the CAR and RAR in young patients presenting with acute coronary syndrome. Specifically, we investigated the relationship of these inflammatory biomarkers with ACS type and in-hospital mortality.

Materıals and Methods

Study design and population

A group of 210 individuals below the age of 50 were enrolled in this study, comprising patients who sought medical attention at the Emergency Department and were diagnosed with ACS between January 1, 2020 and December 31, 2022.

The hospital's data recording system was utilized to gather demographic data, patient clinical histories, laboratory values, diagnostic information, hospitalization records, survival rates, and death statuses of the patients. The cases were examined in three groups according to the ACS classification: USAP, NSTEMI, and STEMI. The STEMI group was evaluated in six groups as inferior, anterior, posterior, anterolateral, inferolateral, and posterolateral. This classification was performed to explore whether the anatomical localization of myocardial infarction was associated with the investigated inflammatory parameters. Furthermore, the cases were classified into two groups as survival and exitus according to their mortality status. The hospital is able to be classified as a tertiary education and research hospital, and it has a secure data recording system. The study encompassed cases for which comprehensive data was available in the data processing system pertaining to demographics, laboratory results, clinical information, hospitalization records, and death outcomes.

Participants in the study were required to be at least 18 years old and less than 50 years old, have a definitive diagnosis of ACS without any concomitant diseases, and present themselves to an emergency department with chest pain. All patients who had consultations at the cardiology clinic following their initial diagnosis in the emergency clinic were considered for inclusion in this study. Only patients for whom both clinics concurred on the diagnosis and the diagnosis was further confirmed as ACS were included. The diagnosis of ACS and its subtypes (UA, NSTEMI, STEMI) was established based on clinical presentation, electrocardiographic findings, cardiac biomarker levels, and cardiology consultation in accordance with current international guidelines. In addition,

patients with complete history, physical examination, laboratory and clinical records were selected in the data records. Cases under the age of 18, cases over the age of 50, and cases with insufficient information in any category were eliminated from the study. During the admission process, individuals with cerebrovascular diseases, hormone-based diseases, patients undergoing psychiatric drug treatment, chronic liver diseases, kidney failure and those receiving dialysis treatment, infectious patients, chronic inflammatory diseases, malignancies, severe anemia, other hematological diseases, and individuals engaging in severe dieting were excluded from the study due to the potential impact on the investigated parameters. Therefore, the study population consisted of relatively young patients without major comorbid conditions that could influence inflammatory laboratory parameters.

After receiving approval from the local ethics committee (Decision date and number: 08.08.2022/2023/08/05/040), and the study was carried out in accordance with the principles of the Helsinki Declaration. Informed consent was obtained from the patients.

Laboratory analysis

The study consisted of analyzing the values of glucose, CRP, troponin T, White Blood Cell count (WBC), hemoglobin, RDW, platelet, urea, ALB, calcium, and magnesium in blood samples. Furthermore, the CAR and RAR ratios were computed based on the specified values.

Upon admission to the emergency department, hemogram and biochemical blood samples were collected from the patients. Blood samples used for the analysis were obtained at the time of the initial emergency department admission before initiation of definitive treatment. The hemogram blood analysis was conducted using the Sysmex DI-60 CBC Analyzer in Istanbul, Turkey. The blood samples were subjected to analysis using the Beckman Coulter Automated AU-680 instrument (Beckman Coulter, Inc., Fullerton, CA, USA). The hemogram and biochemistry data were analyzed within a time frame of 45 to 60 minutes. Despite the fact that follow-up control tests were conducted on some individuals, the initial examination results were considered to be reliable and accurate.

Statistical analysis

The data were subjected to analysis using SPSS 20 software (IBM Corp., Armonk, NY, USA). The Kolmogorov-Smirnov test was employed to examine the normality of the variables' distributions. The presentation of descriptive statistics included the mean ± standard deviation or median (minimum-maximum) for continuous variables, and the number of cases and percentage (%) for nominal variables. The Mann-Whitney U and Kruskal-Wallis H tests were employed to compare

groups, as the variables under consideration did not adhere to a normal distribution. The use of chi-square analysis was employed to investigate the associations among groups of nominal variables. Spearman's Rho analysis was employed to examine the association between ACS classification, STEMI classification, and mortality status with various covariates. A receiver operating characteristic (ROC) curve analysis was performed to evaluate the predictive performance of CAR and RAR for mortality. Statistical significance was determined by considering values below the significance level of 0.05 throughout the interpretation of the results.

Results

Among the 210 patients with ACS, 30 (14.3%) were female, and the mean age was 43.14±5.03 years. NSTEMI was the most frequent ACS type, observed in 127 patients (60.5%). Neither age nor sex was significantly associated with ACS type. However, hospitalization duration was significantly associated with ACS type ($p<0.001$). In the individual evaluation of laboratory parameters, troponin-T ($p<0.001$), WBC ($p<0.001$), and hemoglobin ($p=0.001$) were significantly associated with ACS type. CAR was highest in the STEMI group (9.03±10.53), and RAR was also highest in the STEMI group (5.49±2.29). Both ratios were lowest in the UA group. CRP, RDW, and albumin values alone were not significantly associated with ACS type; however, both CAR ($p=0.002$) and RAR ($p<0.001$) were significantly associated with ACS type (Table 1).

Overall, 7 patients (3.4%) died during hospitalization, and 6 of these patients were male. Mortality was most frequent in the STEMI group, with 5 deaths ($p=0.010$). Among the STEMI subtypes, anterior STEMI was the most common subtype in patients who died, accounting for 3 of 5 deaths (60.0%, $p<0.001$). Troponin-T was not significantly associated with mortality ($p=0.069$). In patients who died, CAR (27.35±20.37, $p<0.001$) and RAR (6.06±3.15, $p=0.009$) were significantly higher than in survivors. In addition, CRP was significantly higher (67.00±41.07 mg/dL) and albumin was significantly lower (2.75±0.87 g/dL) in non-survivors, whereas RDW was not significantly associated with mortality (Table 2).

In univariate Cox regression analysis, troponin-T, hemoglobin, hospitalization duration, WBC, platelet count, RAR, and CAR were significantly associated with ACS type, whereas age, glucose, CRP, RDW, urea, albumin, calcium, and magnesium were not. In multivariate Cox regression analysis, troponin-T, hemoglobin, hospitalization duration, and RAR remained independently associated with ACS type (Table 3).

In the correlation analysis, ACS type showed a moderate positive correlation with troponin-T and hospitalization duration, and a weak positive correlation with CAR, RAR, and hemoglobin. STEMI subtype showed a moderate positive correlation with RAR and weak positive correlations with

CAR, troponin-T, WBC, hemoglobin, and hospitalization duration. Mortality status showed weak positive correlations with CRP and CAR, and a very weak positive correlation with RAR. Albumin showed a weak negative correlation with mortality. Overall, CAR and RAR demonstrated significant positive correlations across the analyzed clinical groups (Table 4).

Figure 1 shows the ROC curve analysis for mortality. Both CAR and RAR demonstrated predictive performance for mortality. CAR showed an AUC of 0.911 (95% CI: 0.780-1.000, p<0.001), with 96.1% sensitivity and 94.6% specificity, whereas RAR showed an AUC of 0.791 (95% CI: 0.593-0.989, p=0.009), with 97.3% sensitivity and 93.6% specificity.

Discussion

Although ACS is traditionally considered more common in older individuals, recent studies have reported a noticeable increase in its incidence among younger populations.[11,12] This trend highlights the importance of further investigation of ACS in young patients, particularly regarding early diagnosis and prognosis.[13] Laboratory biomarkers that reflect inflammatory processes have attracted attention as potential tools for improving clinical assessment in ACS.[14,15] In the present study, we evaluated the relationship between CAR and RAR values and both ACS type and mortality in young patients presenting with ACS.

The definition of "young" in ACS varies across studies. The incidence of ACS is reported to be approximately 2–4% when the threshold is set at 40 years and up to 10% when 45 years is used as the cut-off.[16,17] In our study, we included patients younger than 50 years in order to obtain a broader representation of young ACS cases. Schoenenberger *et al.* analyzed 28,778 ACS cases and identified 195 young patients, of whom 14.9% were female. Similarly, in our cohort, 14.3% of the 210 patients were female.[18] In our study population, STEMI accounted for 25.7% of cases, which may be related to the relatively older age range included within the young ACS group.

The CRP serves as an important marker of inflammation in individuals with atherosclerosis and plays a role in the progression of the disease. CRP contributes to endothelial dysfunction, oxidative stress, uptake of oxidized low-density lipoprotein, and plaque instability, thereby increasing the risk of plaque rupture.[19] Albumin, a negative acute-phase reactant, reflects both nutritional status and systemic inflammatory activity. Decreased albumin levels have been associated with increased blood viscosity, platelet activation, and a higher risk of cardiovascular events in the general population.[20]

The RDW parameter serves as an indicator of the diversity in red blood cell volume, reflecting the variation in the sizes of RBCs present in the bloodstream. It is a readily accessible and cost-effective blood test.[21] Prior studies have demonstrated a correlation between RDW and ACS; yet,

the precise mechanisms that underlie this relationship remain incompletely elucidated.[22] RDW is regarded as an inflammatory biomarker that has the potential to exacerbate arteriosclerosis and is correlated with multiple other inflammatory biomarkers.[23]

Serum albumin levels are routinely evaluated in patients with acute myocardial infarction (AMI) and reflect both nutritional status and systemic inflammatory activity. Albumin synthesis is influenced by nutritional intake as well as inflammatory processes.[24] Proinflammatory cytokines such as interleukin (IL)-6 and tumor necrosis factor-α suppress albumin gene transcription, resulting in decreased albumin production. Reduced albumin levels have been associated with adverse clinical outcomes in patients with ACS.[25]

The CRP-to-Albumin Ratio (CAR) simultaneously reflects inflammatory activity and nutritional status, making it a potentially more informative marker than CRP or albumin alone. Previous studies have shown that CAR may be a useful predictor of mortality in critically ill patients.[26] In our study, CAR demonstrated a stronger correlation with mortality than CRP alone (r=0.256 *vs*. r=0.224). Consistent with these findings, CAR values were significantly higher in patients who died compared with survivors (27.35±20.37 *vs*. 5.86±5.76). Differences between our results and those reported in previous studies may be related to variations in patient characteristics, including the absence of major comorbidities and the younger age of our study population.

Nevertheless, several studies have investigated the relationship between CAR and Coronary Artery Disease (CAD). Çağdaş *et al.* reported a significant association between CAR and the severity of CAD in patients with ACS and stable angina.[27] A recent study conducted in a Southern Arab Peninsula population also demonstrated a significant association between the CRP/albumin ratio and the presence of coronary artery disease.[28] Similarly, Zhang *et al.* demonstrated that higher CAR levels were associated with increased mortality risk in patients with ACS.[29] In another study, Çınar *et al.* classified patients according to CAR levels and found that mortality rates were significantly higher in the high-CAR group during both in-hospital and long-term follow-up.[30] Consistent with these findings, our study demonstrated a significant association between CAR and ACS severity (p=0.002). These findings support the role of CAR as an inflammatory marker reflecting the combined effects of elevated CRP and reduced albumin levels.

The RAR indication, which integrates RDW and albumin, has been extensively investigated in a range of inflammation-related disorders. The study conducted by Long *et al.*[14] demonstrated that the presence of RAR is associated with a negative impact on the prognosis of individuals diagnosed with aortic aneurysms. Zhou *et al.*[10] revealed a substantial correlation between elevated RAR levels and higher rates of all-cause mortality in individuals with diabetic ketoacidosis, as well as an increased occurrence of infections connected to diabetic ketoacidosis. Moreover, ROC analysis has

demonstrated the prognostic value of RAR in conditions such as cancer[31] and acute respiratory distress syndrome.[9] Recent evidence also suggests that the RDW-to-albumin ratio may serve as a potential biomarker in coronary heart disease.[32]

In recent years, several studies have investigated the prognostic value of RAR in patients with AMI.[33–35] Li *et al.* evaluated 2081 AMI cases and reported that RAR values were significantly higher in the mortality group.[33] Similarly, another study including 826 AMI patients demonstrated that elevated RAR levels were associated with increased 30-day mortality.[34] In addition, a large intensive care cohort of 2594 AMI patients showed significantly higher RAR values in non-survivors.[35] Consistent with these findings, our study demonstrated that RAR values were significantly higher in patients who died. Moreover, the higher incidence observed in the STEMI group further supports the association between RAR and ACS severity in young patients without major comorbidities. To the best of our knowledge, this study is among the limited number of investigations specifically evaluating the prognostic value of CAR and RAR simultaneously in young patients with acute coronary syndrome without major comorbidities.

Limitations

The present study has several limitations. First, it was conducted at a single center and had a retrospective design, which may limit the generalizability of the findings. Second, only patients with complete records were included, which may introduce selection bias. Finally, laboratory parameters were evaluated based on measurements obtained at the time of admission, and follow-up laboratory data were not available.

Conclusions

Cases of ACS, which are a common cause of mortality and morbidity in emergency departments, inspire research enthusiasm in terms of both new diagnosis and novel treatment. As a consequence of our research, we reached to the conclusion that, particularly in young cases, RAR and CAR values can be used as predictive values in ACS cases for determining both clinical diagnosis groups and mortality status. Conducting new prospective studies in terms of both confirming this and the discovery of new laboratory parameters will add positive data to the literature.

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Table 1. Evaluation of baseline characteristics and laboratory findings according to acute coronary syndrome classification and mortality status.

Acute Coronary Syndrome Classification						
		All Patients	**USAP**	**NSTEMI**	**STEMI**	**p value****
Baseline Characteristics						
		n (%)	**n (%)**	**n (%)**	**n (%)**	
Gender	Female	30 (14.3)	6 (2.9)	20 (9.5)	4 (1.9)	ns
	Male	180 (85.7)	23 (11.0)	107 (51.0)	50 (23.8)	
Total		210 (100.0)	29 (13.8)	127 (60.5)	54 (25.7)	
		mean±SD	**mean±SD**	**mean±SD**	**mean±SD**	**p value***
Age		43.14±5.03	43.41±3.64	43.09±5.52	43.09±4.49	ns

Hospitalization (day)	3.42±2.77	1.72±0.79	3.35±2.58	4.50±3.37	**<0.001**
Laboratory Findings					
Glucose (mg/dL)	151.49±81.61	140.03±76.55	151.12±75.74	158.52±97.00	ns
CRP (mg/dL)	28.00±36.84	20.69±15.70	30.63±43.77	25.74±24.83	ns
Troponin-T (ng/L)	1504.98±3668.20	57.79±40.73	923.51±2496.60	3649.68±5621.33	**<0.001**
WBC (10^3/UL)	11.36±3.70	9.19±2.33	11.25±3.61	12.79±3.94	**<0.001**
Hemoglobin (g/dL)	14.57±1.79	13.64±2.40	14.54±1.69	15.13±1.39	**0.001**
RDW (%)	13.37±1.48	13.45±1.48	13.39±1.60	13.27±1.20	ns
Platelet (10^3/UL)	288.64±67.90	274.76±69.86	285.20±65.66	304.17±70.51	ns
Urea (mg/dL)	32.32±15.12	32.66±10.95	33.45±17.65	29.48±9.28	ns
Albumin (g/dL)	4.18±0.47	4.15±0.24	4.23±0.39	4.08±0.69	ns
Calcium (mg/dL)	9.41±0.56	9.30±0.39	9.41±0.60	9.47±0.55	ns
Magnesium (mg/dL)	2.13±0.24	2.16±0.23	2.13±0.24	2.12±0.23	ns
CAR	6.57±7.67	5.05±3.91	5.87±6.64	9.03±10.53	**0.002**
RAR	3.79±1.59	3.25±0.44	3.20±0.53	5.49±2.29	**<0.001**

USAP: Unstable Angina Pectoris; NSTEMI: non-ST-elevation Myocardial Infarction; STEMI: ST-elevation Myocardial Infarction; CRP: C reactive protein; WBC: white blood cell; RDW: red cell distrubition width; SD: Standard deviation; CAR: CRP to albumin ratio; RAR: RDW to albumin ratio. Bold values indicates significance at $p<0.05$. ns: not significant ($p > 0.05$)

*Kruskal-Wallis Test

**Chi-Square Test

Table 2. Evaluation of baseline characteristics, laboratory values, acute coronary syndrome groups and ST elevation groups on the basis of mortality status

Mortality Status					
		All Patients n(%) 210 (100)	**SURVIVAL n(%) 203 (96.6)**	**EXITUS n(%) 7 (3.4)**	**p value***
Gender	Female	30 (14.3)	29 (14.3)	1 (0.5)	ns
	Male	180 (85.7)	174 (85.7)	6 (2.9)	
ACS Classification	USAP	29 (13.8)	29 (14.3)	0 (0.0)	**0.010**
	NSTEMI	127 (60.5)	125 (62.0)	2 (1.0)	
	STEMI	54 (25.7)	49 (23.7)	5 (2.4)	
Total		210 (100.0)	203 (100)	7 (100)	
STEMI Classification	Inferior	10 (18.5)	10 (20.4)	0 (0.0)	**<0.001**
	Anterior	30 (55.6)	27 (55.1)	3 (60.0)	
	Posterior	4 (7.4)	4 (8.1)	0 (0.0)	
	Anterolateral	7 (13.0)	6 (12.2)	1 (20.0)	

Inferolateral	2 (3.7)	2 (4.1)	0 (0.0)	
Posterolateral	1 (1.9)	0 (0.0)	1 (20.0)	
Total	54(100.0)	49(100)	5(100)	
	mean±SD	**mean±SD**	**mean±SD**	**p value****
Age	43.14±5.03	43.11±4.94	43.86±7.71	ns
Hospitalization (day)	3.42±2.77	3.38±2.77	4.57±2.64	ns
CRP (mg/dL)	28.00±36.84	26.66±36.05	67.00±41.07	**0.001**
Troponin-T (ng/L)	1504.98±3668.20	1484.79±3719.58	2090.29±1582.34	ns
RDW (%)	13.37±1.48	13.38±1.50	13.00±0.75	ns
Urea (mg/dL)	32.32±15.12	32.62±15.23	23.77±7.95	**0.025**
Albumin (g/dL)	4.18±0.47	4.23±0.37	2.75±0.87	**0.001**
CAR	6.57±7.67	5.86±5.76	27.35±20.37	**<0.001**
RAR	3.79±1.59	3.72±1.46	6.06±3.15	**0.009**

ACS: Acute Coronary Syndrome; USAP: Unstable Angina Pectoris; NSTEMI: non-ST-elevation Myocardial Infarction; STEMI: ST-elevation Myocardial Infarction; CRP: C reactive protein; RDW: red cell distrubition width; SD: Standart Deviation; CAR: CRP to albumin ratio; RAR: RDW to albumin ratio. Bold values indicates significance at $p<0.05$. ns: not significant ($p > 0.05$)

*Chi-Square Test

**Mann-Whitney U Test

Table 3. Univariate and multivariate Cox regression analyses for predicting the acute coronary syndrome

Acute Coronary Syndrome Classification						
	Univariate			**Multivariate**		
	HR	**95% Cl**	**p-value**	**HR**	**95% Cl**	**p-value**
Troponin-T	0.111	0.000-0.000	**0.001**		0.000-0.000	**0.001**
Hemoglobin	0.061	0.040-0.131	**0.001**		0.020-0.102	**0.004**
RAR	0.273	0.158-0.248	**0.001**		0.150-0.241	**0.001**
Hospitalization	0.090	0.038-0.096	**0.001**		0.023-0.077	**0.001**
CAR	0.032	0.004-0.025	**0.010**		-0.011-0.014	ns
Age	0.001	-0.019-0.015	ns	0.472		
Glucose	0.005	-0.001-0.002	ns			
CRP	0.001	-0.002-0.003	ns			
WBC	0.086	0.000-0.000	**0.001**			
RDW	0.002	-0.074-0.040	ns			
Platelet	0.020	0.000-0.003	**0.041**			
Urea	0.007	-0.009-0.002	ns			

Albumin	0.006	-0.280-0.077	ns
Calcium	0.008	-0.054-0.045	ns
Magnesium	0.002	-0.478-0.238	ns

CRP: C reactive protein; WBC: white blood cellRDW: red cell distrubition width; CAR: CRP to albumin ratio; RAR: RDW to albumin ratio. All the variables from table were examined, and only those significant at a P<0.05 level are shown in univariate analysis. Multiple Cox proportional hazards model includes all the variables in univariate analysis with forward stepwise method. CI: confidence interval; HR, hazard ratio. ns: not significant (p > 0.05)

Table 4. Spearman correlation coefficients for acute coronary syndrome type, ST elevation type and mortality status

	Correlation Acute Coronary Syndrome Classification		**STEMI Classification**		**Mortality Status**	
	r	**p-value**	**r**	**p-value**	**r**	**p-value**
ACS Classification	-	-	**0.858**	**0.001**	**0.183**	**0.008**
Mortality Status	**0.183**	**0.008**	**0.215**	**0.002**	-	-
STEMI Classification	**0.858**	**0.001**	-	-	**0.215**	**0.002**
CAR	**0.220**	**0.001**	**0.256**	**0.001**	**0.256**	**0.001**
RAR	**0.361**	**0.001**	**0.467**	**0.001**	**0.181**	**0.009**
Age	-0.013	ns	-0.020	ns	0.080	ns
Gender	0.124	ns	0.109	ns	0.001	ns
Glucose	0.113	ns	0.066	ns	-0.041	ns
CRP	0.029	ns	0.018	ns	**0.224**	**0.001**
Troponin-T	**0.423**	**0.001**	**0.276**	**0.001**	0.126	ns
WBC	**0.308**	**0.001**	**0.223**	**0.001**	0.055	ns
Hemoglobin	**0.255**	**0.001**	**0.206**	**0.003**	0.120	ns
RDW	-0.022	ns	-0.013	ns	-0.021	ns
Platelet	**0.140**	**0.043**	0.119	ns	-0.074	ns
Urea	-0.124	ns	**-0.140**	**0.042**	**-0.155**	**0.025**
Albumin	0.035	ns	-0.020	ns	**-0.237**	**0.001**
Calcium	0.125	ns	0.100	ns	-0.086	ns
Magnesium	-0.022	ns	-0.001	ns	-0.101	ns
Hospitalization	**0.427**	**0.001**	**0.318**	**0.001**	0.106	ns

ACS: Acute Coronary Syndrome; CRP: C reactive protein; WBC: white blood cell; RDW: red cell distrubition width; CAR: CRP to albumin ratio; RAR: RDW to albumin ratio. Bold values indicates significance at $p<0.05$. (Spearman's Rho test was used for correlation). ns: not significant ($p > 0.05$)

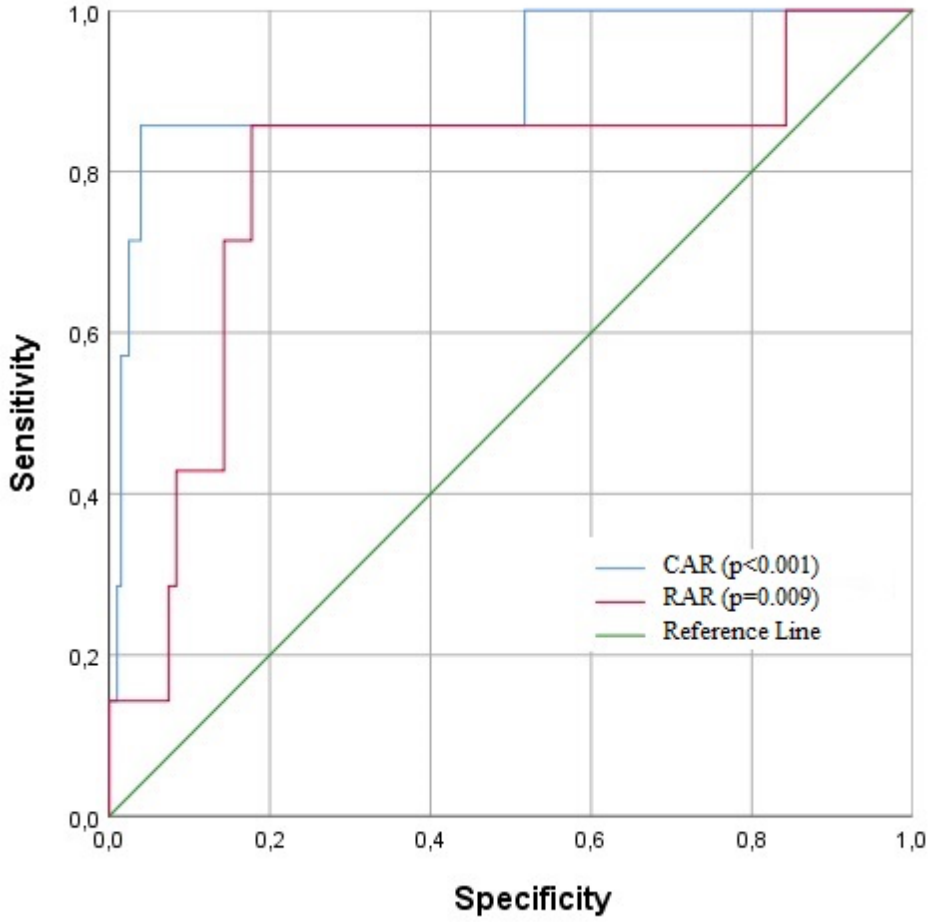

Figure 1. ROC curve analysis based on the mortality relationship between CAR and RAR values.

Contributions: all authors contrinuted equally to the present study and all authors approved the final version of the manuscript.

Ethics approval and consent to particpate: Patients were not required to give informed consent to the study as the analysis used anonymous data that were obtained after each patient agreed to treatment by written consent.

Institutional review board statement: The study was carried out with the permission of Health Sciences University Bagcilar Training and Research Hospital, Noninvasive Clinical Ethics Committee (Decision Date and No: 08.08.2022/2023/08/05/040)

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