ORIGINAL RESEARCH

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Can CRP/Albumin Ratio, A Non-invasive Test, Predict the Severity of Acute Pancreatitis?

Non-invaziv Bir Test Olan CRP/Albümin Oranı Akut Pankreatitin Ciddiyetini Öngördürebilir mi?

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Abstract

Objective: We intended to determine the relationship between the severity and clinical outcomes of acute pancreatitis and the C-reactive protein (CRP)/albumin ratio (CAR).

Method: A total of 580 patients with acute pancreatitis, treated in the ınternal medicine clinic, were reviewed retrospectively. According to the revised Atlanta criteria, the patients were categorized into three groups: Mild, moderate, and severe pancreatitis. The CAR, hospital stay duration, requirement for intensive care, and mortality rates were compared among these groups.

Results: The CAR was associated with severe acute pancreatitis [odds ratio 1.04; 95% confidence interval (CI): 1.03-1.06; p<0.001]. To identify the severe pancreatitis group according to the Atlanta criteria, the CRP/albumin level was determined to be >15.59 with a sensitivity of 96.77% and a specificity of 75.32%. The area under the ROC curve for the CAR in severe acute pancreatitis was 0.89 (95% CI: 0.87-0.92). When comparing the areas under the curve for albumin, CRP, and the CAR in identifying severe disease according to the Atlanta criteria, the CAR was statistically significantly higher than CRP and marginally different from albumin.

Conclusion: The CAR, which is easily obtainable and a non-invasive test, can be used as a marker in addition to existing risk scores to determine acute pancreatitis severity.

Keywords: Acute pancreatitis, albumin, C-reactive protein

Öz

Amaç: Akut pankreatitin ciddiyetini ve klinik sonuçları ile C-reaktif protein (CRP)/albümin oranı (CAO) arasındaki ilişkiyi belirlemeyi amaçladık.

Yöntem: İç hastalıkları kliniğinde yatırılarak tedavi gören toplam 580 akut pankreatitli hasta retrospektif olarak değerlendirildi. Hastalar revize Atlanta kriterlerine göre hafif, orta ve şiddetli pankreatit olarak 3 gruba ayrıldı. Bu gruplar arasında CAO, hastanede yatış süresi, yoğun bakım yatış ihtiyacı ve mortalite oranları karşılaştırıldı.

Bulgular: CAO şiddetli akut pankreatit ile ilişkili saptandı [olasılık oranı 1,04; %95 güven aralığı (GA): 1,03-1,06; p<0,001]. Atlanta kriterlerine göre şiddetli pankreatit hasta grubunu belirlemede CRP/albümin düzeyi %96,77 sensivite, %75,32 spesifite ile >15,59 olarak saptandı. Şiddetli akut pankreatitte CAO'nun ROC eğrisi altında kalan alan 0,89 (%95 GA: 0,87-0,92) idi. Albümin, CRP, CAO'nun Atlanta kriterlerine göre şiddetli hastalığı saptamada eğri altındaki alanlarını karşılaştırmada CAO, CRP'ye göre istatistiksel olarak anlamlı yüksek, albümin ile sınırda farklı saptandı.

Sonuç: Kolaylıkla bakılabilen ve non-invaziv bir test olan CAO akut pankreatitin ciddiyetini belirlemek için mevcut risk skorlarına ek olarak bir marker olarak kullanılabilir.

Anahtar kelimeler: Albümin, akut pankreatit, C-reaktif protein

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Introduction

Acute pancreatitis is a severe condition with a rising incidence globally. While most cases of acute pancreatitis are mild, it can sometimes progress to severe forms that may result in mortality. Thus, identifying potentially severe cases of acute pancreatitis early is essential.

Various risk scores, such as APACHE, Atlanta, bedside index of severity in acute pancreatitis (BISAP), and Ranson, are utilized to assess the severity of acute pancreatitis (1-4). However, due to their comprehensive nature, these risk scores are not widely used at the bedside. No scoring system has been established as the gold standard.

C-reactive protein (CRP) and albumin are commonly used inflammatory markers to assess the severity of various diseases. During inflammation, CRP levels rise while albumin levels drop. Albumin levels can be influenced by malnutrition. Therefore, instead of using CRP or albumin alone, the CRP/albumin ratio (CAR) is becoming an emerging marker for assessing disease seriousness (5-7). However, there is no definitive threshold value for the CAR in assessing acute pancreatitis seriousness.

In our study, we examined the usability of the CAR in determining the severity, and fatality of acute pancreatitis. In doing so, we evaluated the feasibility of using the CAR as a cost-effective test for assessing the seriousness and outcome of acute pancreatitis in hospitals with limited diagnostic facilities.

Materials and Methods

The research examined 580 cases, with acute pancreatitis admitted to the Internal Medicine Clinic at a specific hospital between January 1, 2021, and January 1, 2024. This research was conducted in accordance with the Declaration of Helsinki. Participants were briefed regarding the research, and their written consent was acquired.

Patients aged 18 years and older, regardless of gender, were part of the study. This research was performed as a retrospective analysis. The diagnosis of acute pancreatitis and the severity of the disease were made based on the revised Atlanta criteria (2).

The seriousness of the disease was evaluated based on the revised Atlanta criteria and BISAP scores (2,3).

The study investigated the relationship between the CRP/albumin ratio and severe pancreatitis, as well as its components in patients with acute pancreatitis. Data collected included patients' age, gender, smoking status, alcohol consumption, comorbid chronic diseases, etiology of acute pancreatitis, BISAP score, and classification of pancreatitis severity based on the revised Atlanta criteria (mild, moderate, severe). Biochemical and hemogram parameters were recorded. The serum CAR was determined by dividing the CRP level (mg/L) by the serum albumin level (g/L). The CRP/albumin ratio was analyzed from blood samples taken on the day admission to the emergency department. Additionally, data on the requirement for intensive care unit (ICU) admission, duration of hospitalization, and mortality were documented.

Exclusion criteria were defined as patients younger than 18, pregnant individuals, those with chronic pancreatitis, and those with post-ERCP pancreatitis.

For this research, approval was issued by University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital's Ethics Committee under protocol number 4424 on June 11, 2024.

Statistical Analysis

Statistical analysis was conducted using SPSS version 15.0 for Windows. Descriptive statistics were reported as counts and percentages for categorical variables, and as mean, standard deviation, minimum, maximum, and median for numerical variables. Proportions in the groups were compared using the chi-square test. Numerical variables were compared using the Student's t-test for two independent groups and the One-Way ANOVA test for more than two independent groups, provided that normal distribution conditions were satisfied. When normal distribution conditions were not met, the Mann-Whitney U test and the Kruskal-Wallis test were employed for comparisons. Post-hoc analyses for non-parametric tests with more than two groups were performed using the Mann-Whitney U test, and a Bonferroni correction was applied. Determinants were examined using logistic regression analysis. Cut-off values were determined using ROC curve analysis. The level of significance was set at α=0.05.

Results

The average age of the participants was 71.8±15.3 years (range 21-100). Of the participants, 42.6% were male and 57.4% were female. The most common etiology was gallstones, followed by idiopathic causes. According to the revised Atlanta criteria, 51% of the 580 patients had mild acute pancreatitis (n=294), 44% had moderate acute pancreatitis (n=255), and 5% had severe acute pancreatitis (n=31).

Patients with severe pancreatitis exhibited a higher average age (Table 1). In subgroup analyses, patients with moderate pancreatitis had markedly higher average ages compared to those with mild pancreatitis while patients with severe pancreatitis had significantly higher average ages compared to those with mild pancreatitis. However, while the mean age of cases with severe pancreatitis was numerically higher than that with moderate pancreatitis, the difference did not reach significance (Table 2).

The hospital stay duration was notably shorter in cases with mild pancreatitis compared to cases with moderate and severe pancreatitis. No marked difference was found in the hospital stay duration between cases with moderate and severe pancreatitis (Table 2).

When comparing ICU stay durations, patients with mild and moderate pancreatitis had shorter stays than those with severe pancreatitis. No ICU admissions were observed in patients with mild pancreatitis (Table 2).

Laboratory values such as leukocyte count, urea, and creatinine were lower in cases of mild pancreatitis compared to moderate and severe pancreatitis cases. Additionally, lactate dehydrogenase (LDH) levels were markedly elevated in severe pancreatitis cases compared to mild and moderate cases (Table 2, 3).

CRP and CRP/albumin levels were markedly elevated in cases with severe pancreatitis compared to mild and moderate pancreatitis, and were also higher in cases with moderate pancreatitis compared to mild pancreatitis. Albumin levels were markedly lower in severe pancreatitis cases compared to mild and moderate pancreatitis, and lower in moderate pancreatitis cases, compared to mild pancreatitis (Table 2, 3).

Table 1. Clinical characteristics of acute pancreatitis patients classified according to the revised Atlanta criteria

		Total	Revised Atlanta classification							
			Mild		Moderately		Severe		p	
Age Mean ± SD min-max (median)		71.8±15.3 21-100 (74)		66.6±18.2 21-97 (71)		76.7±8.8 46-100 (76)		80.2±8.2 66-96 (81)		**<0.001**
Gender n (%)	Female	333	57.4	165	56.1	151	59.2	17	54.8	0.732
	Male	247	42.6	129	43.9	104	40.8	14	45.2	
Smoking n (%)		178	30.7	100	34.0	68	26.7	10	32.3	0.174
Alcohol n (%)		53	9.1	37	12.6	15	5.9	1	3.2	**0.012**
Comorbidity n (%)	Diabetes mellitus	174	30.0	83	28.2	85	33.3	6	19.4	0.177
	Hypertension	367	63.3	163	55.4	186	72.9	18	58.1	**<0.001**
	Chronic renal disease	50	8.6	21	7.1	27	10.6	2	6.5	0.324
	†COPD	79	13.6	36	12.2	36	14.1	7	22.6	0.267
	Cerebrocascular disease	48	8.3	15	5.1	27	10.6	6	19.4	**0.005**
	Ischemic heart disease	126	21.7	51	17.3	71	27.8	4	12.9	**0.006**
	Malignancy	61	10.5	24	8.2	31	12.2	6	19.4	0.081
	Cholecystectomy history	56	9.7	29	9.9	24	9.4	3	9.7	0.984
Etiology	Gallstones	437	75.3	215	73.1	199	78.0	23	74.2	0.407
	Hypertriglyceridemia	2	0.3	2	0.7	0	0.0	0	0.0	0.554
	Alcohol	13	2.2	12	4.1	1	0.4	0	0.0	**0.010**
	Drug	9	1.6	2	0.7	6	2.4	1	3.2	0.153
	Idiopathic	114	19.7	64	21.8	45	17.6	5	16.1	0.422
	Necrotizing pancreatitis	8	1.4	0	0.0	3	1.2	5	16.1	**<0.001**
Bedside Index	≥3	259	44.7	67	22.8	161	63.1	31	100	**<0.001**
	<3	321	55.3	227	77.2	94	36.9	0	0.0	
Mortality n (%)		24	4.1	0	0.0	8	3.1	16	51.6	**<0.001**
‡**LOHS** Mean ± SD min-max (median)		8.3±5.7 1-42 (7)		5.3±2.2 2-15 (5)		11.2±6.1 1-42 (10)		12.5±9.3 1-35 (12)		**<0.001**
§**ICUS** Mean ± SD min-max (median)		0.4±2.5 0-32 (0)		0.0±0.0 0-0 (0)		0.1±0.8 0-12 (0)		6.9±8.3 0-32 (4)		**<0.001**

†: Chronic obstructive pulmonary disease (COPD), ‡: Length of hospital stay, days, §: Length of ıntensive care unit stay, days, SD: Standard deviation

Table 2. Subgroup analyzes

	Mild vs. Moderately	Mild vs. Severe	Moderately vs. Severe
	p†	p†	p†
Age	**<0.001**	**<0.001**	0.046
‡LOHS	**<0.001**	**<0.001**	0.742
§ICUS	**0.016**	**<0.001**	**<0.001**
Leukocyte	**<0.001**	**<0.001**	0.018
Hemoglobin	**0.016**	0.027	0.221
Hematocrit	0.109	0.077	0.219
Urea	**<0.001**	**<0.001**	0.559
Creatinine	**<0.001**	**<0.001**	0.498
ALT	0.208	0.219	0.437
AST	0.670	0.982	0.931
LDH	0.934	**0.007**	**0.006**
Amylase	0.398	0.350	0.561
Lipase	**0.014**	0.898	0.333
Total bilirubin	0.030	0.124	0.477
Direct bilirubin	0.167	**0.012**	0.057
CRP/albumin	**<0.001**	**<0.001**	**<0.001**
CRP	**<0.001**	**<0.001**	**<0.001**
Albumin	**<0.001**	**<0.001**	**<0.001**

†: Mann-Whitney U test Bonferroni's Correction p<0.017, ‡: Length of hospital stay, days, §: Length of intensive care unit stay, days, ALT: Alanine transaminase, AST: Aspartate transaminase, LDH: Lactate dehydrogenase, CRP: C-reactive protein

The predictive effect of laboratory levels on patients with severe acute pancreatitis, based on the Atlanta criteria, was analyzed using univariate logistic regression analysis. It was found that increases in leukocytes, total bilirubin, direct bilirubin, CAR, and CRP were risk factors for severe disease, while an increase in albumin was recognized as a protective factor. When analyzed using multivariate logistic regression, an increase in albumin was recognized as a shielding factor (Table 4).

When acute pancreatitis patients were separated into two groups -individuals who stayed in the general ward and individuals who required ICU admission and/or died- laboratory values including leukocyte count, urea, creatinine, LDH, total bilirubin, direct bilirubin, CRP, and the CAR were markedly elevated in the ICU admission and/or mortality group. Albumin value was significantly lower in this group (Table 5).

The CAR was found to be >15.59 with a sensitivity of 96.77% and specificity of 75.32% for identifying severe pancreatitis cases according to the Atlanta criteria (Figure 1).

In comparing the areas under the receiver operating characteristic curve for albumin, CRP, and the CAR in identifying severe disease according to the Atlanta criteria, the CAR was determined to be significantly higher than CRP and not significantly different from albumin (Figure 2).

Discussion

Most individuals with acute pancreatitis have a mild course that is self-limiting, but it can also progress to a severe course that may result in mortality. Therefore, it is essential to recognize cases of acute pancreatitis that may develop a severe course in advance.

In a study by Kazmi et al. (8), similar to our findings, the CRP/albumin ratio was found to have greater sensitivity than CRP alone in determining severe pancreatitis in cases with acute pancreatitis.

In Kaplan et al.'s (9) study on cases with acute pancreatitis, the CAR was elevated in patients who did not survive compared to those who did. Our study also found that the CRP and CRP/albumin ratios were significantly elevated in cases that resulted in death.

In a systematic review performed by Tarar et al. (10), similar to our study, the CAR at hospital admission in cases with acute pancreatitis was found to correlate with

Table 3. Laboratory characteristics of acute pancreatitis patients classified according to the revised Atlanta criteria

		Revised Atlanta classification			
	Total	Mild	Moderately	Severe	
	Mean ± SD Min-max (median)	Mean ± SD Min-max (median)	Mean ± SD Min-max (median)	Mean ± SD Min-max (median)	p†
Leukocyte, 10^3 mm^3	23.6±27.9 2.8-67.2 (11.3)	11.1±5.3 4.2-67.2 (10.1)	12.9±5.0 2.8-32.3 (12.3)	15.6±6.5 3.3-26.18 (14.8)	**<0.001**
Hemoglobin, g/dL	12.8±1.9 7.1-18.2 (12.8)	13.0±1.9 7.1-18.2 (13.1)	12.6±1.8 7.1-17.6 (12.7)	12.2±2.0 9.2-16.3 (12.3)	**0.016**
Hematocrit, %	38.3±5.2 20.1-52.3 (38.5)	38.6±5.1 20.1-52.3 (39)	38.1±5.1 20.2-50.8 (38.2)	36.9±5.8 27.8-47.7 (36.7)	0.131‡
Urea, mg/dL	46.8±30.3 12-271 (40)	35.8±18.7 12-198 (33)	58.1±36.3 20-271 (50)	57.8±27.4 22-151 (51)	**<0.001**
Creatinine, mg/dL	1.10±0.91 0.32-12.78 (0.88)	0.88±0.60 0.32-7.23 (0.78)	1.32±1.14 0.45-12.78 (1.04)	1.29±0.62 0.51-3.07 (1.18)	**<0.001**
ALT, u/L	107.4±110.5 5-750 (66.5)	115.1±116.5 7-750 (73)	100.9±104.7 5-515 (63)	87.5±95.1 7-387 (51)	0.267
AST, u/L	89.7±102.5 6-731 (46)	92.2±102.0 10-557 (46.5)	86.4±102.4 6-731 (47)	92.1±109.7 10-439 (43)	0.917
LDH, u/L	281.2±166.7 116-2484 (231)	276.6±138.1 118-885 (223)	278.9±192.6 116-2484 (233)	342.9±175.9 167-813 (297)	**0.019**
Amylase, u/L	819.2±798.7 78-9244 (606)	829.0±924.5 78-9244 (572)	796.2±629.3 107-3651 (622)	918.1±770.1 103-3282 (703)	0.513
Lipase, u/L	1456.2±1535.9 99-9772 (1001.5)	1629.7±1711.0 112-9772 (1072)	1254.2±1300.4 99-8801 (909)	1455.9±1380.1 100-5414 (1183)	**0.044**
Total bilirubin, mg/dL	1.54±1.68 0.14-16.66 (0.94)	1.35±1.43 0.15-11.73 (0.89)	1.62±1.52 0.14-8.58 (1.03)	2.66±3.58 0.37-16.66 (1.08)	0.050
Direct bilirubin, mg/dL	0.92±1.39 0.02-14.63 (0.36)	0.80±1.22 0.02-10.83 (0.34)	0.94±1.25 0.05-7.89 (0.37)	1.96±2.93 0.10-14.63 (0.58)	**0.029**
CRP/albumin	15.0±22.2 0.1-131.4 (4.4)	2.7±3.8 0.1-30.3 (1.2)	24.6±23.3 0.4-131.4 (15.4)	52.0±33.0 8.8-123.5 (40.3)	**<0.001**
CRP, mg/L	49.5±71.3 0.4-494.1 (16.2)	10.2±14.5 0.4-130.7 (4.6)	82.1±75.5 1.4-426 (53.0)	155.6±109.7 30-494.1 (119)	**<0.001**
Albumin, g/L	3.60±0.48 1.85-5.1 (3.64)	3.78±0.40 2.60-5.10 (3.8)	3.46±0.44 1.85-4.54 (3.50)	3.01±0.53 1.96-4 (3)	**<0.001**

†: Kruskal-Wallis test, ‡: One-Way ANOVA, ALT: Alanine transaminase, AST: Aspartate transaminase, LDH: Lactate dehydrogenase, CRP: C-reactive protein, SD: Standard deviation

Table 4. Univariate and multivariate logistic regression analysis for predicting severe acute pancreatitis according to the Atlanta criteria based on laboratory levels

Variables	Univariate			Multivariate		
	p	OR	95% CI	p	OR	95% CI
Leukocyte	**0.003**	1.085	1.028-1.144	0.321	0.851	0.620-1.170
Hemoglobin	0.112	0.946	0.883-1.013	0.585	0.970	0.869-1.083
Creatinine	0.235	1.176	0.900-1.536	0.436	1.304	0.669-2.540
ALT	0.304	0.998	0.994-1.002	0.069	0.994	0.988-1.000
LDH	0.060	1.001	1.000-1.003	0.816	1.000	0.998-1.002
Total bilirubin	**0.001**	1.276	1.105-1.474	0.833	0.945	0.560-1.595
Direct bilirubin	**<0.001**	1.349	1.140-1.596	0.051	1.837	0.998-3.380
CRP/albumin	**<0.001**	1.045	1.032-1.057	0.266	0.942	0.849-1.046
CRP	**<0.001**	1.012	1.009-1.016	0.120	1.027	0.993-1.062
Albumin	**<0.001**	0.084	0.039-0.184	**0.005**	0.055	0.007-0.426

CI: Confidence interval, OR: Odds ratio, CRP: C-reactive protein, ALT: Alanine transaminase, LDH: Lactate dehydrogenase

Table 5. Comparison of laboratory characteristics between acute pancreatitis patients with ICU admission and/or mortality and those with ward admission

	Hospital ward stay	In-hospital mortality and/or ICU stay	
	Mean ± SD Min-max (median)	Mean ± SD Min-max (median)	p†
Leukocyte, 10^3 mm^3	11.9±5.2 2.76-67.2 (11.11)	15.3±6.6 3.3-26.2 (14.1)	**0.001**
Hemoglobin, g/dL	12.8±1.9 7.1-18.2 (12.8)	12.5±1.9 9.2-16.3 (12.6)	0.295‡
Hematokrit, %	38.3±5.1 20.1-52.3 (38.6)	37.9±5.6 27.8-47.7 (37.8)	0.565‡
Urea, mg/dL	45.3±28.5 12-265 (39)	64.6±44.1 22-271 (53)	**<0.001**
Creatinine, mg/dL	1.07±0.89 0.32-12.78 (0.87)	1.42±1.08 0.51-7.21 (1.16)	**0.001**
ALT, u/L	107.7±111.0 5-750 (68)	102.7±105.6 7-400 (63)	0.807
AST, u/L	88.0±101.1 6-731 (45)	110.0±117.4 10-439 (55)	0.224
LDH, u/L	270.7±133.5 116-911 (227)	411.2±369.2 167-2484 (301)	**<0.001**
Amylase, u/L	807.2±797.1 78-9244 (601)	971.8±813.4 103-3417 (783.5)	0.189
Lipase, u/L	1451.2±1553.1 99-9772 (991)	1519.9±1310.0 100-5414 (1227)	0.256
Total bilirubin, mg/dL	1.46±1.47 0.14-11.73 (0.92)	2.57±3.16 0.37-16.66 (1.25)	**0.039**
Direct bilirubin, mg/dL	0.86±1.23 0.02-10.83 (0.35)	1.74±2.57 0.10-14.63 (0.58)	**0.005**
CRP/albumin	12.5±19.2 0.1-131.4 (3.7)	45.9±32.1 2.3-123.5 (37.8)	**<0.001**
CRP, mg/L	42.3±62.6 0.38-425.96 (13.3)	140.6±104.4 7.3-494.1 (116.7)	**<0.001**
Albumin, g/L	3.63±0.45 1.85-5.10 (3.7)	3.11±0.51 1.96-4.17 (3.15)	**<0.001**

†: Mann-Whitney U test, ‡: Student's t-test, SD: Standard deviation, ALT: Alanine transaminase, AST: Aspartate transaminase, LDH: Lactate dehydrogenase, CRP: C-reactive protein, ICU: Intensive care unit

a more severe disease course, higher mortality, and longer hospital stay.

In Behera et al.'s (11) study involving 116 patients with acute pancreatitis, the CAR was observed to predict severe acute pancreatitis, and it was an independent determinant of mortality.

Yılmaz and Kandemir's (12) study involving 264 cases with acute pancreatitis, the CAR was identified as markedly elevated in the severe pancreatitis cases compared to the moderately severe pancreatitis cases. The Ranson score was utilized to assess the severity of pancreatitis (12).

In Saad et al.'s (13) review of acute pancreatitis patients, the CAR measured at admission was elevated in cases with severe acute pancreatitis compared to those with mild to moderate cases. Additionally, the CAR was markedly elevated in patients who did not survive compared to those who did (13).

In a review and meta-analysis by Mariadi et al. (14) involving 2.244 cases with acute pancreatitis, the CAR was elevated in severe acute pancreatitis cases relative to mild to moderate cases. The ratio was also markedly elevated in patients who did not survive compared to those who did (14).

Zhao et al.'s (15) study on 284 cases with acute pancreatitis found that the CAR measured on the second day was linked to severe acute pancreatitis and mortality. The ratio on the third day was linked to higher severity, pancreatic necrosis, organ dysfunction, and mortality (15). In our research, the CAR was evaluated only at the time of hospital admission.

In Piñerúa-Gonsálvez et al.'s (16) study involving 722 cases with acute pancreatitis, the CAR was linked to severe cases. The optimal cut-off value to estimate severe acute pancreatitis was 7.51, with a sensitivity of 63.4% and specificity of 65.6%. Although the sensitivity and specificity are low, the CRP/albumin ratio may still serve as an additional marker in evaluating the prognosis of acute pancreatitis (16). In our research, the optimal cut-off value for the CAR to identify severe acute pancreatitis cases based on the Atlanta criteria was determined to be 15.59, with a sensitivity of 96.77% and a specificity of 75.32%.

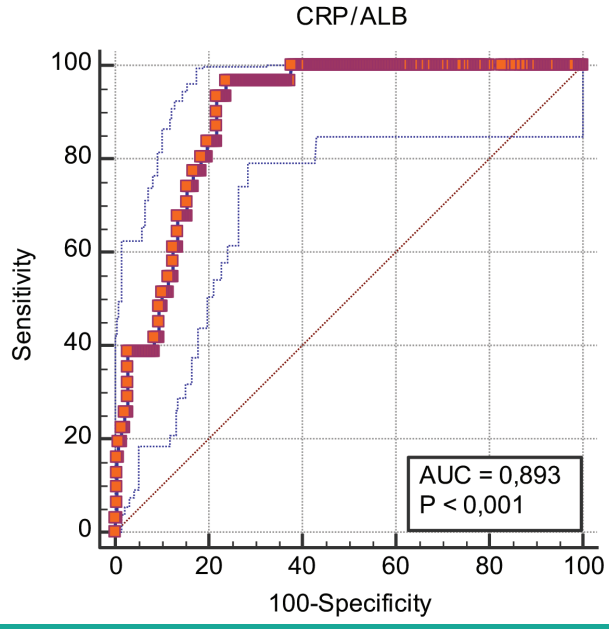

Figure 1. ROC curve for determining the risk of severe pancreatitis using the CRP/albumin ratio

CRP: C-reactive protein, AUC: Area under the curve, ROC: Receiver operating characteristic, ALB: Albumin

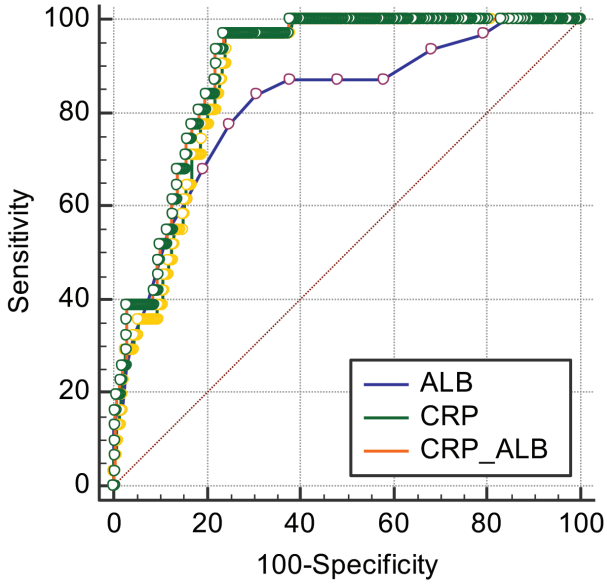

Figure 2. ROC curve of albumin, CRP and CRP/albumin ratio to determine the risk of severe pancreatitis

CRP: C-reactive protein, ROC: Receiver operating characteristic, ALB: Albumin

In the research by Yogesh et al. (17) involving 150 cases with acute pancreatitis classified based on the Atlanta criteria, the CAR was more elevated in cases with severe acute pancreatitis than in those with mild pancreatitis. At a cut-off value of 0.25, the CAR had a sensitivity of 85% and a specificity of 80% in forecasting organ failure (17). In our research, the CAR was elevated in severe pancreatitis cases compared to mild and moderate pancreatitis and was higher in moderate pancreatitis cases compared to mild pancreatitis.

In Karabuga et al.'s (18) study involving 500 patients with acute pancreatitis, the CAR, neutrophil to lymphocyte ratio, platelet-lymphocyte ratio, and red cell distribution width values were markedly elevated in severe acute pancreatitis cases compared to mild acute pancreatitis cases based on the BISAP score.

The study by Ghaffar et al. (19), identified a marked connection between the severity of acute pancreatitis and the CAR. This ratio can be particularly useful in assessing the severity of acute pancreatitis in resource-limited settings (19).

In a study investigating the CAR as a determinant of mortality in critically ill cases, the CAR was found to predict mortality better than CRP alone (20). In our study, the CRP and CRP/albumin values were markedly elevated among patients who died or were admitted to the ICU compared to those who were admitted to the general ward with acute pancreatitis. Therefore, we believe that the CRP/albumin level can be used during initial hospital admission to predict severe pancreatitis and mortality.

Consequently, I would like to present a summary of all the studies referenced in my article regarding acute pancreatitis and the CRP/CAR in one comprehensive table, including sample sizes, pancreatitis etiologies, patient outcomes, and the countries of origin (Table 6).

Study Limitations

This study's limitations include its single-center design and the relatively small sample size. The tests were conducted only at the time of the patients' initial hospital admission, and repeated measurements were not evaluated.

Table 6. Summary of studies on C-reactive protein/albumin ratio (CAR) in acute pancreatitis: Etiologies, patient outcomes, and diagnostic performance

Study name	Sample sizes	Pancreatitis etiologies	Patient outcomes	The countries of origin
Kazmi et al. (8)	225	N/A	CAR >4.35: Sensitivity 87%, Accuracy 76% (SAP)	Pakistan
Kaplan et al. (9)	192	Gallstone 80.2%, Alcohol 2.6%, Hypertriglyceridemia 1.6%, Hereditary 9.4%, ERCP 1.6%, Other 4.7%	CAR >16.28: Sensitivity 92.1%, Specificity 58% (mortality)	Turkey
Tarar et al. (10)	956	N/A	CAR at admission linked to SAP, longer hospital stay, higher mortality	United Kingdom
Behera et al. (11)	116	Alcohol 46.6%, Biliary 38.8%, Idiopathic 6%, Post ERCP 5.1%	CAR predicts mortality and AP severity	India
Yılmaz and Kandemir (12)	264	N/A	CAR higher in severe vs moderate	Turkey
Saaad et al. (13)	2244	N/A	CAR higher in severe AP and non-survivors	Egypt
Mariadi et al. (14)	2244	N/A	CAR higher in severe AP and non-survivors	Indonesia
Zhao et al. (15)	284	Gallstone 54.23%, Hyperlipidemia 24.30%, Alcohol 4.58%, Other 21.48%	Day 2 CAR linked to SAP and mortality	China
Piñerúa-Gonsálvez et al. (16)	722	N/A	CAR optimal cutoff for predicting SAP: 7.51	Spain
Yogesh et al. (17)	150	Alcohol 60%, Biliary 23%, Others 17%	CAR higher in severe vs mild AP. At 0.25 cutoff: Sn 85%, Sp 80% for organ failure	India
Karabuga et al. (18)	500	Biliary 72.20%, Nonbiliary 27.80%	CAR: Sn 71.43%, Sp 70.88% for predicting SAP	Turkey
Ghaffar et al. (19)	N/A	N/A	CAR strongly correlates with AP severity	Pakistan, Congo, Kenya

Prospective studies are essential to evaluate the function of the CAR in the course of acute pancreatitis.

Conclusion

We believe that the CAR measured at the time of hospital admission can serve as an additional marker to existing risk scores and can evaluate the seriousness and prognosis of acute pancreatitis as a cost-effective test in hospitals with limited diagnostic facilities.

Ethics

Ethics Committee Approval: For this research, approval was issued by University of Health Sciences Turkey, Şişli Hamidiye Etfal Training and Research Hospital's Ethics Committee under protocol number 4424 on June 11, 2024.

Informed Consent: Participants were briefed regarding the research, and their written consent was acquired.

Footnotes

Authorship Contributions

Concept: A.Ç., Design: A.Ç., Data Collection or Processing: A.Ç., Ç.E., Analysis or Interpretation: A.Ç., Ç.E., Literature Search: A.Ç., Ç.E., Writing: A.Ç., Ç.E.

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