Comparative Evaluation of Albumin-Based Ratios for Predicting Intensive Care Unit Admission and Mortality in Acute Pancreatitis

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ABSTRACT

Background/Aims: *Early identification of patients at risk for severe acute pancreatitis (AP) remains challenging. The authors compared the performance of albumin-based ratios in predicting intensive care unit (ICU) admission and mortality among patients with AP.*

Materials and Methods: *This retrospective cohort study included 499 patients with AP. The C-reactive protein (CRP)/albumin ratio (CAR), glucose/albumin ratio (GAR), lactate dehydrogenase/albumin ratio (LAR), and red cell distribution width/albumin ratio (RAR) were calculated at admission and during the early phase of hospitalization. The need for ICU admission was the primary outcome.*

Results: *Eleven patients (2.2%) required ICU admission, and 5 (1.0%) died. At admission, CAR was elevated in patients requiring ICU admission (14.27 vs. 3.31, P = .022). At 48 hours, CAR was significantly higher in patients requiring ICU admission (88.86 vs. 13.24, P < .001) and demonstrated high discriminative ability (area under the curve [AUC], 0.921; 95% CI, 0.85-0.98), comparable with that of CRP (AUC = 0.922, P = .964). GAR and RAR demonstrated more modest associations. Exploratory mortality analyses suggested that early-phase CAR at 48 hours and admission RAR were higher among nonsurvivors.*

Conclusion: *Early-phase (48 hours) CAR is a reliable predictor of ICU admission in patients with AP, with predictive performance comparable with that of CRP while incorporating albumin status. It may serve as a simple adjunctive tool for early risk stratification.*

Keywords: *Acute pancreatitis, albumin-based ratios, albumin ratio, biomarkers, C-reactive protein, intensive care unit admission, prognosis*

INTRODUCTION

Acute pancreatitis (AP) is a common gastrointestinal emergency with a highly variable clinical course, ranging from mild, self-limiting inflammation to severe disease complicated by organ failure and death. Although approximately 80% of patients experience a mild course, the remainder may develop systemic inflammatory response syndrome (SIRS), pancreatic necrosis, and multiorgan dysfunction, which are associated with substantial morbidity and mortality. Early identification of patients at risk for clinical deterioration is therefore essential for appropriate monitoring, timely intervention, and optimal allocation of intensive care resources.[1-3]

Several clinical scoring systems, including the Ranson criteria, APACHE II, and BISAP, have been developed to predict disease severity in AP. Although these tools are valuable, their routine use in emergency settings is limited by the need for multiple variables, calculation complexity, and, in some cases, data collected during the first 24-48 hours of hospitalization. Consequently, there is ongoing interest in simple, readily available biomarkers that can be assessed at admission and during the early phase of hospitalization to support early risk stratification.[4-6]

C-reactive protein (CRP) is one of the most widely used inflammatory markers in AP and has been shown to correlate with disease severity. However, CRP levels often peak later in the disease course, which may limit their utility for very early risk stratification. In contrast, serum albumin is a negative acute-phase reactant that decreases in response to systemic inflammation, increased capillary permeability, and altered hepatic synthesis. Hypoalbuminemia has been associated with adverse outcomes in various inflammatory and critical illnesses, including AP.[7-9]

In recent years, composite indices based on the ratio of inflammatory or metabolic markers to albumin have

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gained attention as potential prognostic tools. These albumin-based ratios integrate information on inflammatory burden, metabolic stress, tissue injury, and nutritional or vascular status into a single parameter. Among these, the CRP/albumin ratio (CAR), glucose/albumin ratio (GAR), lactate dehydrogenase/albumin ratio (LAR), and red cell distribution width/albumin ratio (RAR) have each been evaluated in various disease populations, with variable results.[8,10-14]

Despite growing interest in these indices, data directly comparing multiple albumin-based ratios in patients with AP—particularly for early prediction of intensive care unit (ICU) admission and mortality—remain limited. Moreover, the relative contribution of these ratios beyond conventional inflammatory markers in the acute setting has not been fully assessed. Therefore, this study evaluated and compared the association of admission CAR, GAR, LAR, and RAR values and 48-hour CAR values with disease severity in patients presenting with AP, with ICU admission as the primary outcome and in-hospital mortality as the secondary outcome. By examining these readily available parameters measured at presentation and during the early phase of hospitalization, the authors sought to assess their potential utility as adjunctive tools for early risk stratification in routine clinical practice.

MATERIALS AND METHODS

Study Design and Ethical Approval

This retrospective, single-center observational cohort study was conducted at a tertiary care training and research hospital. The study protocol was approved by the local Institutional Ethics Committee (Sivas Cumhuriyet University Non-Interventional Research Ethics Committee Decision No: 2025-09/59, Date: September 18, 2025) and was conducted in accordance with the principles of the Declaration of Helsinki.

Main Points

- *Early-phase C-reactive protein (CRP)/albumin ratio (CAR) is a reliable predictor of intensive care unit admission in patients with acute pancreatitis.*
- *The prognostic performance of CAR is comparable with that of CRP alone but incorporates information on albumin status.*
- *Albumin-based ratios offer a simple, cost-effective approach to risk stratification at emergency department presentation.*
- *Although the red cell distribution width/albumin ratio shows promise for predicting mortality, larger multicenter studies are needed for validation.*

OpenAI was used to improve language and edit grammar during the preparation of the manuscript. All content was reviewed and edited by the authors after use of OpenAI.

Study Population

Adult patients aged 18 years or older who were admitted to the hospital and diagnosed with AP between January 2022 and September 2025 were retrospectively screened.

The diagnosis of AP was confirmed according to the revised Atlanta criteria, requiring at least 2 of the following 3 criteria:

1. Typical acute epigastric pain,
2. Serum amylase or lipase levels at least 3 times the upper limit of normal,
3. Radiological findings consistent with AP.[1-3]

Patients with incomplete laboratory data at admission and those with chronic pancreatitis, recurrent pancreatitis during the same hospitalization, active malignancy, chronic inflammatory diseases, or age younger than 18 years were excluded. A total of 499 patients with confirmed AP were included in the final analysis. For comparison of baseline laboratory values, 222 apparently healthy individuals who presented for routine health checkups and had no known acute or chronic systemic disease were included as a control group. The control group was used only for descriptive comparisons and was not included in prognostic outcome analyses.

Data Collection and Laboratory Parameters

Demographic characteristics, clinical outcomes, and laboratory parameters at admission were retrieved from electronic medical records. Serum albumin concentrations were standardized to g/dL for ratio calculations. CAR, GAR, LAR, and RAR were calculated using predefined formulas.

The following laboratory parameters at admission were recorded: white blood cell count (WBC), red cell distribution width (RDW), serum glucose, lactate dehydrogenase (LDH), albumin, CRP, amylase, and lipase. These parameters were obtained at the time of initial hospital admission, either in the emergency department or upon direct admission to the inpatient ward. To accurately capture the peak of the systemic inflammatory cascade and capillary leak, CRP and albumin levels were also assessed 48 hours after admission. All laboratory measurements were

performed using standardized automated analyzers in the hospital's central laboratory.

Calculation of Albumin-Based Ratios

The following albumin-based ratios were calculated using laboratory values:

$$\text{CAR} = \frac{CRP\,(mg/\text{L})}{Albumin\,(\text{g}/dL)}$$

$$\text{GAR} = \frac{Glucose\,(mg/dL)}{Albumin\,(\text{g}/dL)}$$

$$\text{LAR} = \frac{LDH\,(\text{U}/\text{L})}{Albumin\,(\text{g}/dL)}$$

$$\text{RAR} = \frac{RDW\,(\%)}{Albumin\,(\text{g}/dL)}$$

Clinical Outcomes

The primary outcome was ICU admission during hospitalization. Decisions regarding ICU admission were made by the attending physicians based on institutional protocols and clinical judgment. The secondary outcome was in-hospital mortality. Because of the limited number of mortality events, mortality analyses were considered exploratory. At this institution, ICU admission for AP is generally indicated for patients who present with or develop organ failure (e.g., respiratory failure requiring mechanical ventilation or hemodynamic instability requiring vasopressors), severe SIRS that does not respond to initial fluid resuscitation, or severe metabolic disturbances, consistent with the revised Atlanta classification and international guidelines.

Statistical Analysis

Statistical analyses were performed using Python v3.10 (Python Software Foundation; Wilmington, DE, USA). Normality was assessed using the Shapiro–Wilk test. Continuous variables were compared using the Mann–Whitney *U*-test. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate.

Receiver operating characteristic (ROC) curve analysis with 95% CIs was performed to evaluate diagnostic performance. Optimal cutoff values were determined using the Youden index. Correlations between continuous variables were assessed using Spearman's rank correlation coefficient. A parsimonious multivariable logistic regression model that included age and selected clinically relevant variables was constructed to identify independent predictors of ICU admission. Results were expressed as odds ratios (ORs) with 95% CIs. A 2-sided *P* value <.05 was considered statistically significant.

RESULTS

Baseline Characteristics

The study population included 499 patients diagnosed with AP and 222 healthy individuals included for descriptive reference. Baseline demographic characteristics were comparable between the AP and control groups. The mean age was 62.15 ± 17.47 years in the AP group and 62.71 ± 9.28 years in the control group (*P* = .576). The proportion of male patients was similar between groups (42.7% vs. 42.8%, *P* = 1.000).

As expected, admission laboratory parameters reflecting systemic inflammation differed significantly between groups. Median WBC and CRP levels were higher, whereas serum albumin levels were lower in patients with AP than in healthy controls (all *P* < .001).

Among the albumin-based ratios, CAR, GAR, RAR, and LAR values were significantly higher in the AP group than in the control group (all *P* < .001). Baseline laboratory parameters in the AP and control groups are summarized in Table 1. The control group was included only for descriptive laboratory comparisons and was not included in prognostic analyses.

Intensive Care Unit Admission Analysis

During hospitalization, 11 patients (2.2%) required ICU admission. Patients admitted to the ICU were significantly older than those managed on the ward (median age, 82 vs. 64 years, *P* = .004). Admission WBC counts were also higher in the ICU group (*P* = .037).

Among the albumin-based ratios, median CAR at admission (0 hours) was significantly higher in patients requiring ICU admission than in those who did not (14.27 vs. 3.31, *P* = .022). CAR values were even higher in patients requiring ICU admission than in those who did not (median: 88.86 vs. 13.24, *P* < .001). Similarly, GAR and RDW values were modestly higher in the ICU group (*P* = .049 and *P* = .007, respectively). Comparisons of clinical and laboratory variables according to ICU admission status are presented in Table 2.

Table 1. Baseline Demographic and Laboratory Characteristics of Patients with Acute Pancreatitis and Healthy Controls

Variable	Acute Pancreatitis (n = 499)	Healthy Controls (n = 222)	*P*
Age (years)	62.15 ± 17.47	62.71 ± 9.28	.577
Male sex, n (%)	213 (42.7)	95 (42.8)	1.000
WBC (10^3/μL)	10.20 [7.70-12.50]	6.58 [5.70-7.80]	<.001
RDW (%)	13.80 [13.10-14.70]	13.00 [12.40-13.60]	<.001
Glucose (mg/dL)	109.00 [97.00-137.00]	95.00 [88.00-105.00]	<.001
LDH (U/L)	211.00 [174.00-265.00]	174.00 [155.00-196.00]	<.001
Albumin (g/dL)	3.48 [3.10-3.90]	4.40 [4.10-4.70]	<.001
CRP (mg/L)	12.19 [4.64-40.55]	2.20 [1.20-3.60]	<.001
CAR	3.45 [1.30-11.34]	0.50 [0.30-0.90]	<.001
GAR	35.97 [28.40-45.50]	21.86 [19.30-24.44]	<.001
LAR	60.50 [48.00-76.00]	39.60 [34.30-45.60]	<.001
RAR	3.76 [3.42-4.22]	2.95 [2.67-3.21]	<.001

Continuous variables are presented as mean ± SD or median [interquartile range], as appropriate. Categorical variables are presented as number (%). Comparisons between groups were performed using the Mann–Whitney *U*-test or independent samples *t*-test for continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate. 48-hour CRP: 46.80 [16.80-109.10], CAR: 13.42 [4.70-31.60].
CAR, C-reactive protein/albumin ratio; CRP, C-reactive protein; GAR, glucose/albumin ratio; LAR, lactate dehydrogenase/albumin ratio; LDH, lactate dehydrogenase; RAR, red cell distribution width/albumin ratio; RDW, red cell distribution width; WBC, white blood cell.

In-Hospital Mortality Analysis (Exploratory)

In-hospital mortality occurred in 5 patients (1.0%). Because of the limited number of mortality events, mortality analyses were considered exploratory. Nonsurvivors had higher admission and 48-hour CRP and CAR values than survivors, with differences at 48 hours reaching statistical significance (both $P < 0.001$). In addition, RAR and RDW values were higher ($P = .001$), whereas serum albumin levels were lower among nonsurvivors ($P = .002$ for 48 hours). Age did not differ significantly between survivors and nonsurvivors ($P = .141$). Laboratory comparisons according to survival status are presented in Table 3. ROC analyses for mortality prediction were performed for descriptive purposes only, given the limited number

Table 2. Clinical and Laboratory Parameters According to Intensive Care Unit Admission in Patients with Acute Pancreatitis

Variable	ICU (+) (n = 11)	ICU (−) (n = 488)	*P*
Age (years)	82.00 [67.00-84.00]	64.00 [51.00-74.00]	.004
WBC (10^3/μL)	12.10 [10.90-14.40]	10.14 [7.70-12.40]	.037
CRP admission	48.65 [12.49-111.31]	11.87 [4.58-38.61]	.020
CRP at 48 hours	256.80 [224.00-403.60]	45.65 [16.50-104.80]	<.001
ALB admission	3.39 [3.11-3.99]	3.71 [3.38-3.94]	.276
ALB at 48 hours	2.95 [2.80-3.38]	3.49 [3.10-3.90]	<.001
CAR admission	14.27 [3.98-30.14]	3.31 [1.28-10.85]	.022
CAR at 48 hours	88.86 [68.10-107.60]	13.24 [4.60-31.30]	<.001
GAR	50.77 [36.20-76.00]	35.92 [28.50-45.40]	.049
RDW (%)	15.60 [14.40-16.50]	13.80 [13.10-14.70]	.007

Continuous variables are presented as median [interquartile range]. Comparisons between groups were performed using the Mann–Whitney *U*-test.
ALB, albumin (g/dL); CAR, C-reactive protein/albumin ratio; CRP, C-reactive protein (mg/L); GAR, glucose/albumin ratio; ICU, intensive care unit; RDW, red cell distribution width; WBC, white blood cell count.

Table 3. Exploratory Comparison of Clinical and Laboratory Parameters According to In-hospital Mortality

Variable	Nonsurvivors (n = 5)	Survivors (n = 494)	*P*
Age (years)	72.00 [68.00-77.00]	64.50 [51.00-75.00]	.141
CRP admission	78.10 [48.65-79.37]	12.00 [4.58-39.36]	.021
CRP at 48 hours	256.80 [234.80-388.80]	46.45 [16.70-108.00]	<.001
ALB admission	3.40 [3.02-3.41]	3.71 [3.37-3.95]	.023
ALB at 48 hours	2.80 [2.70-3.00]	3.50 [3.10-3.90]	.002
CAR admission	22.38 [14.27-23.34]	3.35 [1.29-11.00]	.018
CAR at 48 hours	88.86 [69.00-114.00]	13.32 [4.70-31.60]	<.001
RAR	5.43 [5.30-5.60]	3.76 [3.40-4.20]	.001
RDW (%)	16.40 [15.60-19.50]	13.80 [13.10-14.80]	.001

Due to the limited number of mortality events, all analyses presented in this table are exploratory. Continuous variables are presented as median [interquartile range] and compared using the Mann–Whitney *U*-test.
ALB, albumin (g/dL); CAR, C-reactive protein/albumin ratio; CRP, C-reactive protein (mg/L); RAR, RDW/albumin ratio; RDW, red cell distribution width.

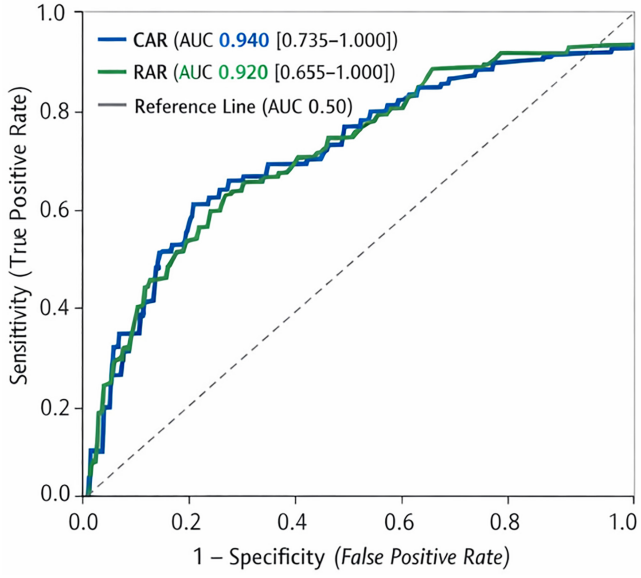

Figure 1. Exploratory receiver operating characteristic curves for predicting in-hospital mortality.

Table 4. Diagnostic Performance of Admission Laboratory Parameters for Predicting Intensive Care Unit Admission

Marker	AUC (95% CI)	Cutoff (Youden)	Sensitivity (%)	Specificity (%)	LR+	LR−
CAR at 48 hours	0.921 (0.850-0.981)	>51.87	90.9	90.2	9.24	0.1
CRP at 48 hours	0.922 (0.843-0.981)	>200.52	90.9	92.2	11.67	0.1
GAR	0.674 (0.504-0.846)	>43.34	72.7	70.7	2.48	0.39

Diagnostic performance was assessed using receiver operating characteristic curve analysis. Optimal cutoff values were determined using the Youden index. 95% CIs were estimated using bootstrap resampling (1000 iterations). DeLong's test for comparison of CAR and CRP AUCs: $P = .964$.
AUC, area under the curve; CAR, C-reactive protein/albumin ratio; CRP, C-reactive protein; GAR, glucose/albumin ratio; ICU, intensive care unit; LR+, positive likelihood ratio; LR−, negative likelihood ratio.

of events. Exploratory ROC curves for in-hospital mortality are shown in Figure 1. Supplementary exploratory ROC analyses further highlighted the kinetic superiority of the 48-hour CAR than admission CAR (area under the curve [AUC]: 0.940 vs. 0.805, respectively). Furthermore, RAR emerged as a highly robust secondary predictor of in-hospital mortality with an AUC of 0.920.

Diagnostic Performance for Intensive Care Unit Admission

ROC curve analysis was performed to evaluate the ability of admission laboratory parameters to predict ICU admission. Among albumin-based ratios, 48-hour CAR demonstrated a high AUC (0.921) for ICU admission prediction. At a cutoff value of >51.87, CAR had a sensitivity of 90.9% and specificity of 90.2%. In a supplementary kinetic analysis evaluating the optimal timing of biomarker measurement, 48-hour CAR demonstrated significantly greater discriminative ability for ICU admission than admission (0-hour) CAR (AUC = 0.921 vs. 0.701, respectively; DeLong test $P = .038$). This confirmed the superiority of early-phase assessment over initial admission evaluation. The 48-hour CRP demonstrated comparable predictive performance (AUC = 0.922). There was no significant difference between 48-hour CRP and CAR in predicting ICU admission (AUC = 0.921 vs. 0.922, respectively; DeLong test $P = .964$). GAR demonstrated lower discriminative ability (AUC = 0.674). ROC-derived performance metrics for ICU admission are summarized in Table 4, and the corresponding ROC curves are presented in Figure 2.

Correlation and Multivariable Analysis

Spearman correlation analysis demonstrated weak but statistically significant correlations between ICU admission and both CAR ($r = 0.22$, $P < .001$) and CRP ($r = 0.22$, $P < .001$).

A parsimonious multivariable logistic regression model including age, WBC, RDW, and CAR was constructed to identify independent predictors of ICU admission. After adjustment, 48-hour CAR remained independently associated with an increased risk of ICU admission (OR: 1.061, 95% CI = 1.036-1.086, $P < .001$). Age (OR: 1.039, $P = .207$), WBC (OR: 0.991, $P = .907$), and RDW (OR: 1.221, $P = .181$) did not reach statistical significance in the multivariable model.

DISCUSSION

In this retrospective observational study, the authors evaluated the prognostic performance of several albumin-based ratios measured at hospital admission in patients with AP. The principal finding was that CAR was associated with subsequent ICU admission and demonstrated high discriminative ability comparable with that of CRP alone while integrating information on inflammatory burden and nutritional and vascular status. Exploratory analyses also suggested potential associations of CAR and RAR with in-hospital mortality; however, these findings should

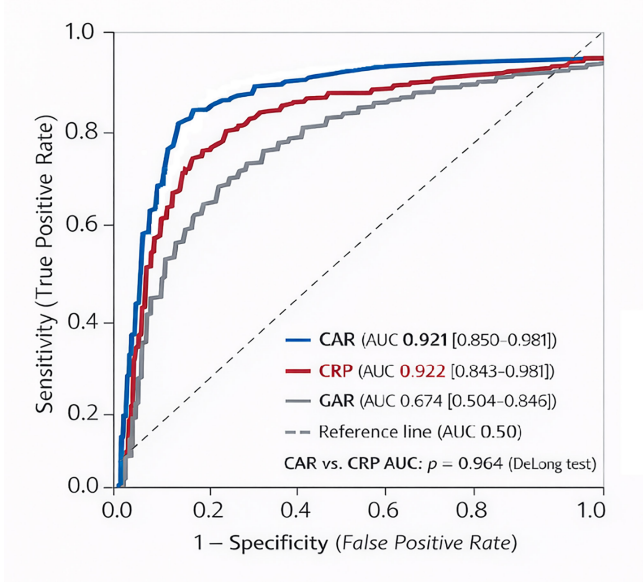

Figure 2. Receiver operating characteristic curves of early-phase laboratory parameters for predicting intensive care unit admission.

be interpreted cautiously because of the limited number of mortality events. These comparative findings should be interpreted within the context of a single-center, retrospective cohort and do not imply superiority testing in independent populations.[15]

Early identification of patients at risk for severe AP remains a major clinical challenge, as highlighted in recent consensus statements from the Turkish Society of Gastroenterology Acute Pancreatitis Committee.[16] Although established scoring systems such as the Ranson criteria, APACHE II, and BISAP are widely used, their reliance on multiple variables and, in some cases, delayed data acquisition limits their utility in fast-paced emergency settings. Consequently, there is growing interest in simple, admission-based biomarkers that may assist with early risk stratification.[10,17,18]

Albumin-based ratios integrate inflammatory burden and host nutritional and physiological reserve into a single parameter. Although acute-phase reactants such as CRP primarily reflect the intensity of systemic inflammation, serum albumin levels are influenced by capillary leakage, hepatic synthesis, and baseline nutritional status, all of which may be altered early in severe AP. This biological plausibility provides a conceptual framework for the potential incremental prognostic value of combined indices. Thus, ratios such as CAR may therefore provide a more balanced representation of disease severity than inflammatory markers alone.[8,10,19]

CRP is a well-established marker of systemic inflammation in AP; however, its predictive value typically peaks after the first 24-48 hours.[20] Serum albumin, on the other hand, is a negative acute-phase reactant that reflects not only nutritional status but also increased capillary permeability and systemic inflammation. Combining these 2 parameters into a single ratio provides a composite measure that may better capture the early pathophysiological processes underlying severe disease.[7,8,10,19]

In light of this information, in this study, although admission CRP and CAR levels were evaluated to characterize the initial inflammatory state, the primary prognostic ROC analyses were based specifically on measurements obtained at 48 hours. This time point was selected based on the pathophysiology of AP, as the systemic inflammatory response[7,10] and the resulting capillary leak (hypoalbuminemia) typically reach their prognostic peak at 48 hours.[9] Consequently, assessment of biomarkers at 48 hours provides a more reliable prediction of disease severity and ICU requirement than assessment at presentation.[1]

In the present study, CAR measured during the early phase was higher in patients who subsequently required ICU care and demonstrated a high AUC for predicting ICU admission. The supplementary kinetic analysis provides a pathophysiological rationale for this timing: CAR at 48 hours was statistically superior to admission CAR (AUC: 0.921 vs. 0.701, P = .038) for predicting ICU requirement. This difference suggests that, at presentation (0 hours), systemic capillary leak and hepatic reprioritization, reflected by hypoalbuminemia, together with the acute inflammatory response reflected by CRP, may not have fully developed. By 48 hours, CAR may better reflect the extent of physiological deterioration, supporting its use as an early-phase rather than an admission biomarker. Importantly, the predictive performance of CAR was comparable to that of CRP and was not clearly superior. Thus, although CAR may not replace CRP, it offers an alternative and complementary measure of early risk by incorporating albumin-related information.

Beyond CAR, the authors also evaluated GAR, LAR, and RAR, which have been proposed as prognostic indicators in various inflammatory and critical illnesses.[8,11-13] Bengi et al[21] reported that LAR was associated with disease severity and mortality in AP. In the present cohort, GAR demonstrated only modest discriminative ability for ICU admission, whereas LAR did not demonstrate meaningful predictive performance. These findings may reflect the multifactorial nature of early organ dysfunction in AP, in which systemic inflammatory response and vascular permeability may be more relevant to disease progression than isolated markers of metabolic stress or tissue injury.[1,3,22] Consensus guidance underscores the complex interplay among inflammation, vascular permeability, and organ dysfunction in early severe AP.[16]

RAR was elevated in patients with worse outcomes, particularly in the exploratory mortality analysis. RDW has been associated with chronic inflammation, oxidative stress, and impaired physiological reserve. When combined with albumin, RAR may reflect both hematological stress and systemic inflammatory and nutritional status.[8,13,23,24] Although these findings are biologically plausible, the limited number of mortality events precludes firm conclusions. The prognostic role of RAR in AP warrants further investigation.

In recent years, several studies have evaluated the prognostic utility of albumin-based ratios in AP. Kaplan et al[25] reported that CAR was an independent predictor of AP severity and mortality, often outperforming CRP alone when patients were strictly stratified according to the revised Atlanta criteria. Similarly, recent studies suggest that composite ratios capture both systemic inflammation and early capillary leak more comprehensively than individual biomarkers. Specifically, Zou et al[11] and Ge et al[12] reported significant prognostic roles of LAR and GAR with severe AP and sepsis-related critical illness. Although these findings are consistent with previous reports demonstrating the predictive value of CAR for ICU admission, the absence of statistically significant superiority of CAR over CRP in the unstratified acute cohort differs from some previous reports. This discrepancy is likely attributable to the unselected, acute presentation population and the inability to perform strict 48-hour severity stratification, highlighting that the true differential value of albumin-based ratios may become most apparent in pre-stratified or critically ill subgroups.

In parallel, RAR has emerged as a potential composite biomarker reflecting chronic oxidative stress, systemic hypoxia, and malnutrition.[26,27] Consistent with contemporary literature demonstrating RAR as a robust independent predictor of mortality in critical care and sepsis settings, this analysis revealed a significant association between elevated RAR levels and in-hospital mortality (P = .002).[26] This finding suggests that although CAR is closely associated with the acute inflammatory response, RAR may better reflect the underlying physiological frailty and the risk of long-term decompensation in patients with AP.[26,27]

From a clinical perspective, the findings of this study suggest that CAR, calculated using routinely available laboratory parameters at admission and during the early phase, may help identify patients at increased risk for clinical deterioration requiring ICU care. Given its simplicity and low cost, CAR may be considered an adjunctive parameter in the initial clinical assessment, particularly in settings where comprehensive scoring systems are impractical. However, CAR should not be viewed as a standalone decision-making tool; rather, it may complement clinical judgment and established risk assessment methods. The cutoff values derived from ROC analyses in this study should be interpreted with caution and externally validated before being applied in routine clinical practice.

Several limitations should be acknowledged. First, the retrospective, single-center design limits causal inference and generalizability. Moreover, specific durations of organ failure were not comprehensively documented, precluding strict subclassification according to the revised Atlanta criteria severity grades (mild, moderately severe, severe). Second, the number of ICU admissions and, in particular, mortality events was relatively small, which may have led to overestimation of diagnostic performance metrics and limited the robustness of regression analyses. Therefore, mortality-related findings were considered exploratory. Third, potential confounding factors such as comorbidities, pancreatitis etiology, and treatment-related variables could not be fully accounted for. Finally, established severity scoring systems (e.g., APACHE II, BISAP, and Ranson criteria) were not routinely recorded in the retrospective database and therefore could not be included for direct comparison.

In conclusion, this study demonstrates that CAR measured at admission and during the early phase is associated with ICU requirement in patients with AP and has predictive performance comparable to that of CRP alone, while incorporating additional information regarding nutritional and vascular status. Other albumin-based ratios demonstrated more limited or exploratory associations with clinical outcomes. Prospective, multicenter studies with larger numbers of patients with severe disease and mortality events are needed to validate these findings and clarify the role of albumin-based ratios as adjunctive tools for early risk stratification in AP.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

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