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Evaluation of the Relationship Between Laboratory Parameters, Severity of Coronary Artery Disease, and Adverse Clinical Outcomes in Patients Undergoing Coronary Angiography

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ABSTRACT

Introduction: Acute coronary syndrome (ACS) continues to represent a major challenge in cardiovascular field despite significant progress in diagnostic and therapeutic interventions. The blood urea nitrogen-to-albumin ratio (BAR), a composite marker easily derived from routine laboratory tests, has recently emerged as a promising indicator in patients with various clinical settings. We aimed to assess the relationship between the BAR and the occurrence of in-hospital major adverse cardiovascular events (MACE) in patients with ACS.

Methods: A retrospective analysis was conducted on patients with ACS between December 2022 and June 2025. Patients were categorized into two groups in terms of in-hospital MACE, defined as all-cause mortality, myocardial infarction (MI), or stroke. Clinical variables associated with MACE were analyzed among the comparative groups. To determine independent predictors of in-hospital MACE, both univariate and multivariate logistic regression analyses were conducted. Furthermore, the discriminatory ability of the BAR for predicting in-hospital MACE was evaluated through receiver operating characteristic (ROC) curve analysis.

Results: Eight hundred twenty nine patients were included in the study, and 61 (7.4%) experienced in-hospital MACE. Patients who experienced in-hospital MACE had a significantly elevated BAR values compared to those who did not (2.33 vs. 1.58; $p<0.001$). Multivariate logistic regression analysis revealed that BAR was an independent predictor of in-hospital MACE (odds ratio: 1.312; 95% confidence interval: 1.010-1.703; $p=0.042$), alongside ST-elevation MI, SYNTAX (SYNergy between PCI with TAXUS™ and Cardiac Surgery) score and lower levels of hemoglobin and serum albumin. ROC curve analysis demonstrated that BAR had a good ability to discriminate between patients who did and did not experience in-hospital MACE, with an area under the curve of 0.784. A BAR cut-off value of 1.72 was identified, offering a sensitivity of 85.2% and a specificity of 61.2% for predicting in-hospital MACE.

Conclusion: Our findings suggest that the BAR, a simple, cost-effective biomarker routinely available in clinical practice, is independently associated with in-hospital MACE in ACS patients.

Keywords: Acute coronary syndrome, BUN to albumin raito, BAR, ACS, MACE

Introduction

Despite significant advances in diagnostic methods, medical therapy, and interventional cardiology, ischemic heart disease continues to be the foremost contributor to mortality globally (1). Acute coronary syndromes (ACS) constitute a principal cause of mortality and morbidity within the spectrum of cardiovascular diseases (2). The spectrum of ACS includes unstable angina pectoris (UAP) and non-ST-elevation myocardial infarction (NSTEMI), collectively referred to as non-ST elevation ACS, as well as ST-elevation myocardial infarction (STEMI). Although the in-hospital mortality of clinical entities within the ACS spectrum has led to a decline over recent years, according to data from the Global Registry of Acute Coronary Events (GRACE), the overall in-hospital mortality rate for patients with ACS remains significant, reported at 3.6% (3,4).

The inflammatory mechanism has a central role in the process of vascular atherogenesis and the development and prognosis of ACS. Clinical studies demonstrating the beneficial effects of anti-inflammatory therapies on clinical outcomes further support this relationship (5-7). Numerous laboratory parameters have been recognized as markers of systemic inflammation, among which hypoalbuminemia has been identified as a particularly significant and clinically pertinent biomarker

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of inflammation (8,9). Beyond inflammation, renal function holds significant importance in patients with ACS, both in terms of guiding treatment strategies and influencing prognosis. Impaired renal function has been consistently recognized as a significant determinant of poor clinical outcomes, including mortality and myocardial infarction (MI), in patients with ACS (10,11).

Renal function constitutes a critical determinant in both the therapeutic approach and prognostic evaluation of patients with ACS. Decline in renal function has been consistently linked to increased mortality among ACS patients, underscoring its prognostic significance in this population (12,13). Blood urea nitrogen (BUN) is a metabolic waste product generated during the catabolism of proteins within the body. It is predominantly eliminated via renal excretion, indicating that BUN levels may be a critical biomarker for evaluating renal function. While it is commonly used as an indirect marker of kidney function, BUN levels can also be affected by other conditions such as increased protein breakdown, dehydration, or gastrointestinal bleeding, making it a reflection of both renal and systemic health (14,15).

In light of the established clinical relevance of both albumin and BUN levels, the blood urea nitrogen-to-albumin ratio (BAR) has emerged as a composite biomarker, with studies demonstrating its significant association with adverse clinical outcomes across various patient populations (16,17).

The management of ACS necessitates a comprehensive and multifaceted approach, which involves rapid clinical evaluation, incorporation of biomarker data, interpretation of electrocardiographic findings, and the utilization of advanced imaging techniques, as well as timely revascularization procedures, when clinically indicated. Building on this clinical framework, we aimed to investigate the potential relationship between the BAR and the incidence of in-hospital major adverse cardiovascular events (MACE), including death, MI, and stroke, among patients presenting with ACS. Through this analysis, our objective was to enhance understanding of the prognostic significance of BAR within this high-risk cohort, during the vulnerable hospitalization period, thereby contributing to improved risk stratification and potentially guiding more personalized therapeutic decision-making.

Methods

Study Population

This retrospective study analyzed data from patients hospitalized with a confirmed diagnosis of ACS between December 2022 and June 2025. The selected timeframe facilitated the systematic collection and analysis of clinical and demographic data, thereby enabling a rigorous evaluation of patient outcomes and contributing factors within a well-defined hospital cohort. All participants underwent coronary angiography and/or percutaneous coronary intervention as part of the management of ACS. SYNTAX (SYNergy between PCI with TAXUS™ and Cardiac Surgery) score was used to determine the anatomical burden and distribution of coronary atherosclerotic involvement (18). The inclusion criteria were age older than 18 years and admission with a confirmed diagnosis of ACS, encompassing STEMI, NSTEMI, or UAP. Laboratory data were evaluated based on blood samples collected at the time of admission. To ensure an accurate assessment of the BAR, only patients with documented measurements of both BUN and serum albumin upon admission were deemed eligible for inclusion in the study. Exclusion criteria were as follows: subjects with dialysis-dependent end-stage kidney disease; advanced hepatic dysfunction; active malignancy undergoing treatment; a known chronic inflammatory or infectious disease that could interfere with the interpretation of inflammatory biomarkers; incomplete medical records; missing laboratory data, including BUN or serum albumin levels; those who underwent coronary artery bypass graft surgery during hospitalization; active gastrointestinal bleeding; corticosteroid use; and refusal to participate in the study.

Baseline demographic characteristics, along with pertinent clinical and laboratory parameters, were systematically retrieved from the hospital's electronic medical records. The study cohort was stratified into two groups according to the occurrence of in-hospital MACE: MACE (+) group and the control group. Clinical variables associated with MACE were analyzed between the comparative groups, and independent predictors of MACE development were identified.

The study was approved by the University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital Non-Interventional Clinical Research Ethics Committee (approval number: 2022-12-05, date: 09.07.2025). This study was carefully conducted with full respect for the ethical principles outlined in the Declaration of Helsinki, underscoring our deep commitment to research integrity and the well-being of all participants.

Statistical Analysis

Continuous variables were presented as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Comparisons between patients with and without in-hospital MACE were conducted using the independent Student's t-test for normally distributed continuous variables and the Mann-Whitney U test for non-normally distributed variables. Comparative analysis of categorical variables was performed using the chi-square test. A receiver operating characteristic (ROC) curve was constructed to evaluate the predictive value of the BAR for in-hospital MACE. Univariable logistic regression analysis was used to identify potential predictors of in-hospital MACE, and variables that reached statistical significance in the univariable analysis were subsequently included in a multivariable logistic regression model to determine independent predictors. Due to the strong correlation between BUN and creatinine levels, only BUN was included in the multivariable analysis. A p-value <0.05 was considered statistically significant. All statistical analyses were performed using SPSS software, version 25.0 (IBM Corp., Armonk, NY, USA).

Endpoint

The primary endpoint of our study was in-hospital MACE, which included death, MI, and stroke.

Results

The study encompassed a total of 829 individuals who met the inclusion criteria and were subsequently enrolled, of whom 61 (7.4%) experienced MACE. Among these, death occurred in 39 patients (4.7%), MI in 15

patients (1.81%), and stroke in 7 patients (0.84%). While the MACE group was slightly older (61.05±10.92 vs. 59.31±11.17 years), the difference in age was not statistically significant between groups (p=0.241). Two groups were comparable across several baseline characteristics, including sex, smoking status, diabetes mellitus, hypertension, and cerebrovascular accident history. However, STEMI rates were higher in the MACE group (75.4% vs. 56%, p=0.013), which was also characterized by a higher mean SYNTAX score. Laboratory findings showed that patients in the MACE group had significantly lower serum albumin and hemoglobin levels, as well as reduced left ventricular ejection fraction (LVEF) compared to those in control group. In contrast, patients in the MACE group exhibited higher neutrophil counts, admission glucose, BUN, creatinine, and troponin levels compared to the control group. The BAR was found to be markedly higher in the group that experienced MACE when compared to the control group with values of 2.33 and 1.58, respectively (p<0.001). Baseline characteristics, laboratory, and clinical variables are presented in Table 1.

A univariate logistic regression analysis was conducted to systematically evaluate potential variables linked to the occurrence of in-hospital MACE. STEMI exhibited a notable linkage to MACE [odds ratio (OR): 2.411, 95% confidence interval (CI): 1.323-4.392, p=0.004], 2.411, 95%CI: 1.323-4.392, p=0.004). Hemoglobin, serum albumin levels, and LVEF demonstrated an inverse relation with in-hospital MACE, while SYNTAX score, neutrophil counts, serum glucose, BUN, creatinine, and troponin levels were positively related with an increased risk of MACE. Notably, the BAR demonstrated a strong relation to MACE (OR: 1.552, 95% CI: 1.273-1.892, p<0.001), highlighting its potential as a composite prognostic indicator in terms of in-hospital MACE. Table 2 summarizes the findings of the univariate analysis.

To comprehensively evaluate the factors independently associated with MACE, a multivariate logistic regression analysis was performed. STEMI presentation, SYNTAX score, and declined hemoglobin in conjunction with suppressed serum albumin levels was found to be significant predictors of MACE. BAR was significantly associated with MACE (OR: 1.312, 95% CI: 1.010-1.703, p=0.042), suggesting that an increase in BAR is independently linked to a higher likelihood of experiencing major adverse cardiovascular outcomes (Table 3).

These statistical findings suggest that BAR remained independently associated with in-hospital MACE, even after adjusting for well-established prognostic indicators such as STEMI presentation, SYNTAX score, hemoglobin concentration, and serum albumin levels. This

Table 1. Comparison of baseline clinical and laboratory characteristics between patients with and without major adverse cardiovascular events

Variable	Overall (n=829)	Control group (n=768)	MACE group (n=61)	p
Age (years)	59.44±11.15	59.31±11.17	61.05±10.92	0.241
Female (%)	184 (22.2)	170 (22.1)	14 (23)	0.883
Smoker (%)	404 (48.7)	381 (49.6)	23 (37.7)	0.073
DM (%)	304 (36.7)	279 (36.3)	25 (41)	0.468
HTN (%)	451 (54.4)	420 (54.7)	31 (50.8)	0.559
CVA (%)	40 (4.6)	35 (4.6)	5 (8.2)	0.207
Type of ACS				0.013
STEMI (%)	476 (57.4)	430 (56)	46 (75.4)	
NSTEMI (%)	252 (30.4)	241 (31.4)	11 (18)	
UAP (%)	101 (12.2)	97 (12.6)	4 (6.6)	
SYNTAX score	15.5 (9.00-22.50)	15.00 (9.00-22.00)	19.00 (13.25-33.00)	0.001
Hemoglobin (g/dL)	13.90 (12.70-15.90)	14.00 (12.80-15.10)	13.00 (12.65-15.30)	0.001
Platelet (10^9/L)	237 (201-285)	238 (200.75-285)	235 (199.5-284)	0.792
Neutrophils (10^9/L)	6.07 (4.39-8.70)	6.00 (4.30-8.55)	7.30 (5.35-10.22)	0.009
Lymphocytes (10^9/L)	2.12 (1.56-2.89)	2.12 (1.59-2.87)	1.87 (1.29-3.14)	0.294
LDL (mg/dL)	113.50 (84.00-141.00)	114.00 (84.00-141.00)	106.50 (81.75-138.50)	0.594
Glucose (mg/dL)	129.5 (104.00-185.25)	127.00 (103.00-175.65)	172.00 (130.00-263.00)	<0.001
BUN (mg/dL)	69.76 (55.64-87.74)	68.90 (54.83-85.60)	83.24 (66.98-109.78)	<0.001
Creatinine (mg/dL)	0.90 (0.76-1.07)	0.90 (0.76-1.06)	1.01 (0.78-1.33)	0.014
Albumin (g/L)	42.80 (40.00-45.50)	43.00 (40.60-45.60)	36.30 (35.00-37.60)	<0.001
BAR (BUN/Albumin Ratio)	1.61 (1.28-2.07)	1.58 (1.26-2.00)	2.33 (1.81-3.14)	<0.001
Troponin (ng/L)	58.00 (12.00-410.00)	49.23 (11.00-372.00)	191.00 (38.00-980.00)	<0.001
LVEF (%)	55.00 (45.00-60.00)	55.00 (45.00-60.00)	47.50 (35.00-55.00)	0.001

ACS: Acute coronary syndrome, BAR: BUN-to-albumin ratio, BUN: Blood urea nitrogen, CVA: Cerebrovascular accident, DM: Diabetes mellitus, HTN: Hypertension, LDL: Low-density lipoprotein, LVEF: Left ventricular ejection fraction, MACE: Major adverse cardiovascular events, NSTEMI: Non-ST-elevation myocardial infarction, STEMI: ST-elevation myocardial infarction, SYNTAX: SYNergy between PCI with TAXUS™ and Cardiac Surgery, UAP: Unstable angina pectoris

underscores its potential as a valuable adjunctive tool in the early risk stratification process. BAR may capture additional dimensions of patient vulnerability.

ROC curve analysis was conducted to assess the ability of the BAR to predict the occurrence of MACE. BAR is a valuable predictor of MACE with an area under the curve of 0.784 (95% CI: 0.735-0.883, p<0.001) and demonstrates good overall discriminative performance. A discriminatory threshold of 1.72 was identified, providing a sensitivity of 85.2% and a specificity of 61.2% (Figure 1).

Table 2. Univariate logistic regression analysis of variables associate with major adverse cardiovascular events

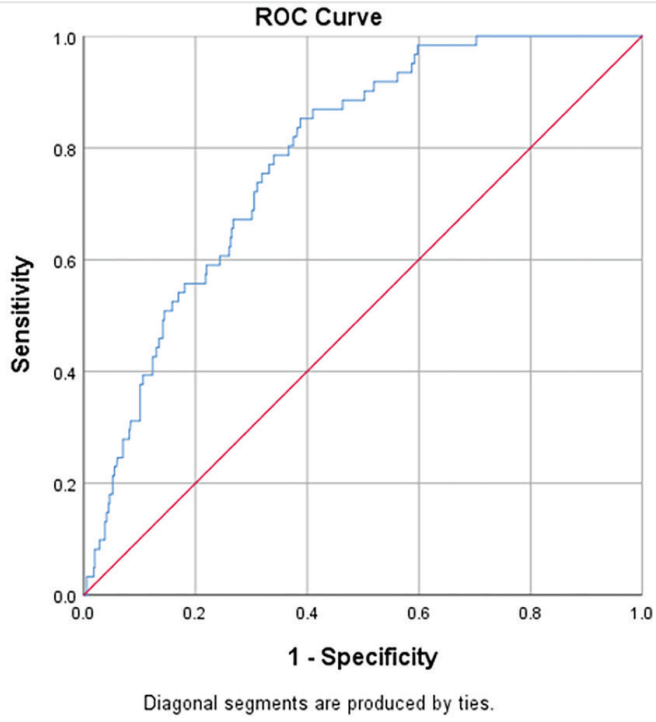
Variable	Odds ratio	95% confidence interval	p
STEMI	2.411	1.323-4.392	0.004
SYNTAX score	1.061	1.031-1.093	<0.001
Hemoglobin	0.803	0.702-0.918	0.001
Neutrophil	1.100	1.037-1.166	0.001
Glucose	1.005	1.003-1.007	<0.001
BUN	1.007	1.003-1.012	0.001
Creatinine	1.002	1.001-1.086	0.043
Albumin	0.842	0.799-0.887	<0.001
BAR	1.552	1.273-1.892	<0.001
Troponin	1.002	1.001-1.003	0.016
LVEF	0.961	0.937-0.985	0.002

BAR: Blood urea nitrogen to albumin ratio, BUN: Blood urea nitrogen, LVEF: Left ventricular ejection fraction, STEMI: ST segment elevation myocardial infarction, SYNTAX: SYNergy between PCI with TAXUS™ and Cardiac Surgery

Table 3. Multivariate logistic regression analysis of independent predictors for major adverse cardiovascular events

Variable	Odds ratio	95% confidence interval	p
MODEL A			
STEMI	4.189	1.430-12.273	0.009
SYNTAX score	1.042	1.000-1.086	0.043
Hemoglobin	0.799	0.637-0.997	0.049
Neutrophil	1.031	0.907-1.172	0.643
Glucose	1.002	0.997-1.007	0.464
BUN	1.004	0.996-1.011	0.342
Albumin	0.778	0.709-0.854	<0.001
Troponin	1.000	0.999-1.000	0.148
LVEF	1.003	0.953-1.055	0.914
MODEL B			
STEMI	4.641	1.682-12.809	0.003
SYNTAX score	1.037	1.002-1.077	0.046
Hemoglobin	0.760	0.618-0.935	0.009
Neutrophil	1.049	0.935-1.176	0.417
Glucose	1.001	0.997-1.006	0.539
Troponin	1.000	0.999-1.000	0.289
LVEF	1.005	0.960-1.052	0.823
BAR	1.312	1.010-1.703	0.042

BAR: Blood urea nitrogen to albumin ratio, BUN: Blood urea nitrogen, LVEF: Left ventricular ejection fraction, STEMI: ST segment elevation myocardial infarction, SYNTAX: SYNergy between PCI with TAXUS™ and Cardiac Surgery



	AUC	p-value	95% CI	Cutoff	Sensitivity (%)	Specificity (%)
BAR	0.784	<0.001	0.735 – 0.883	1.72	85.2	61.2

Figure 1. Receiver operating characteristic curve analysis of BAR for predicting in-hospital MACE
AUC: Area under curve, BAR: Blood urea nitrogen to albumin ratio, CI: Confidence interval, ROC: Receiver operating characteristic, MACE: Major adverse cardiovascular events

Discussion

In our study, we examined the relationship between the BAR and the incidence of in-hospital MACE, including death, MI, and stroke, among patients with ACS. Through this investigation, our objective was to examine the role of BAR as a readily accessible and cost-effective biomarker designed to enable prompt risk assessment in individuals with ACS, a population inherently at increased risk. Several noteworthy findings emerged from our analysis, highlighting the potential of BAR as an independent predictor of in-hospital adverse cardiovascular outcomes. The main goal of the present study is not only to clarify the prognostic significance of BAR in this high-risk cohort but also to contribute to the expanding body of evidence that supports the integration of easily obtainable biomarkers into clinical risk assessment frameworks during hospitalization.

Among the key findings, one of the most was that BAR emerged as an independent predictor of in-hospital MACE. This finding indicates that an elevated BAR value is associated with a significantly increased risk of in-hospital MACE, with an OR of 1.312, suggesting that patients with higher BAR levels have a notably greater likelihood of MACE during hospitalization. In addition to BAR, STEMI presentation, lower hemoglobin, and decreased serum albumin levels were also identified as independent predictors of MACE.

BUN, a byproduct of protein catabolism, serves not only as a routine biochemical marker but also as a clinically significant prognostic indicator across a range of medical conditions. Its serum concentration reflects the interplay between hepatic urea production and renal excretory function, and is modulated by various physiological and pathological factors, including dietary protein intake, volume status, and renal function (14,15,19-21). Seki et al. (14) reported that elevated BUN levels were independently associated with unfavorable renal outcomes, suggesting BUN may hold prognostic value in anticipating the progression of kidney disease. Additionally, there is compelling scientific evidence demonstrating that renal function plays a critical role in the clinical course and outcomes of patients with ACS. Renal dysfunction is well established as a critical factor influencing the prognosis of patients with ACS. An expanding body of evidence underscores the critical impact of impaired kidney function on patient outcomes, revealing that individuals with compromised renal function face a significantly higher risk of in-hospital mortality, along with an increased likelihood of long-term mortality. This association persists across diverse patient populations and clinical settings, highlighting the importance of early identification and comprehensive management of kidney dysfunction as an integral component of improving both immediate and long-term prognoses (11,13). In our study, the primary endpoint was MACE. Importantly, renal function has been shown to be associated not only

with mortality but also with other key components of MACE, including MI and stroke. Evidence indicates that impaired kidney function serves an independent risk factor for both MI and stroke (22,23).

Serum albumin, a key plasma protein, plays an essential role in maintaining oncotic pressure and serves as a marker of nutritional and inflammatory status (24,25). Serum albumin levels participate significantly in determining the prognosis of cardiovascular diseases. In patients with ACS, low serum albumin levels are associated with both in-hospital and long-term mortality (26,27). In addition to its association with mortality, hypoalbuminemia may play an etiological role in the development of stroke. In a study conducted by Zhang et al. (28), a significant association was identified between low serum albumin levels and the risk of recurrent ischemic stroke. Moreover, inflammation plays a pivotal role in the molecular mechanisms underlying both coronary artery disease and ACS, serving as one of the key drivers in disease initiation and progression (7,25). Low serum albumin levels have been consistently associated with systemic inflammation and are considered a reliable marker of both nutritional and inflammatory status (29).

The BAR has emerged as a novel and accessible biomarker that reflects multiple critical physiological domains, including volume status, renal function, protein metabolism, nutritional status, and systemic inflammation. Elevated BUN levels often reflect underlying renal dysfunction, volume depletion, or heightened catabolic processes, whereas reduced serum albumin concentrations commonly signify systemic inflammation, compromised nutritional status, and poorer clinical prognosis. The integration of these two biomarkers into the BAR offers a more holistic evaluation of a patient's physiological state, capturing both metabolic and inflammatory dimensions that might be overlooked when considering each parameter independently.

When considered alongside the aforementioned scientific evidence, the findings of our study indicate that the BAR offers clinicians a valuable and practical biomarker for predicting the risk of in-hospital MACE in patients presenting with ACS. As a clinical index derived from routinely obtained laboratory parameters, the BAR offers a practical, accessible, and cost-effective tool for daily clinical use. Its ease of application and ability to reflect underlying physiological disturbances make it particularly valuable for predicting adverse clinical outcomes, thus supporting timely and informed decision-making in patient care.

The integrative nature of the BAR facilitates a more comprehensive evaluation of a patient's underlying physiological status, surpassing the insights provided by isolated laboratory parameters. This multidimensional approach enables clinicians to discern complex pathophysiological interactions that contribute to adverse cardiovascular outcomes, which may otherwise remain undetected. The robust and independent predictive capability of BAR for in-hospital MACE in patients with ACS underscores its potential utility as a critical instrument for early risk stratification. Such timely identification of high-risk individuals is essential for optimizing clinical decision-making processes and judicious allocation of healthcare resources. Furthermore, the derivation of BAR from routine laboratory tests confers substantial advantages in terms of accessibility, cost-effectiveness, and feasibility, particularly within diverse clinical environments including those constrained by limited resources or time pressures. These pragmatic attributes facilitate prompt risk assessment and enable the implementation of more intensive monitoring and personalized therapeutic strategies tailored to patient-specific needs. In this regard, BAR complements established risk scoring systems and clinical evaluations, enriching the clinician's ability to adopt a holistic and individualized approach to patient management. Ultimately, this integrative biomarker serves not only to enhance prognostic precision but also to support improved clinical outcomes and promote more efficient utilization of healthcare resources.

Study Limitations

This study is subject to several limitations that merit careful consideration. First, its retrospective nature and single-center design may constrain the generalizability of the findings to broader, more heterogeneous patient populations across diverse healthcare settings. Such limitations underscore the need for caution when extrapolating these results beyond the studied cohort. Second, the assessment of albumin and BUN levels was confined to a single measurement upon admission. The absence of serial biomarker evaluations during hospitalization precludes a comprehensive understanding of temporal fluctuations and their potential prognostic implications. Longitudinal monitoring of these parameters could yield critical insights into their dynamic relationship with disease progression and clinical outcomes. Third, the predictive value of the BAR for long-term clinical outcomes could not be evaluated due to the absence of follow-up data beyond the in-hospital period. A notable limitation of our study is the restricted use of multivariable models. The absence of adjustments for other well-established risk predictors in ACS, such as Killip class and components of the GRACE score, limits the strength of our conclusions regarding the independent predictive value of the BAR.

Conclusion

Our study sheds light on the emerging relevance of the BAR as a meaningful and practical biomarker of adverse clinical outcomes in the care of patients with ACS. What makes BAR particularly compelling is its ability to reflect multiple aspects of a patient's physiological state-encompassing kidney function, nutritional status, and systemic inflammation-all of which are known to influence clinical outcomes but are often assessed in isolation. By combining these factors into a single, cost-effective, reproducible, and easy-to-calculate ratio, BAR offers clinicians a more complete picture of patient risk at the time of admission. Its routine availability and low cost make it especially useful in real-world settings where time and resources may be limited. Still, while our findings are promising, they represent a step rather than a destination. Larger, prospective studies across varied patient groups will be essential to confirm BAR's role and determine how best it can complement current risk assessment tools. Ultimately, integrating such accessible biomarkers into everyday practice could help clinicians make more informed, timely, and personalized decisions-improving care during the most critical phases of treatment.

Ethics

Ethics Committee Approval: The study was approved by the University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital Non-Interventional Clinical Research Ethics Committee (approval number: 2025-12-05, date: 09.07.2025).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions: Surgical and Medical Practices - E.A., C.Y.; Concept - E.A., C.Y.; Design - E.A., C.Y.; Data Collection or Processing - E.A., C.Y.; Analysis or Interpretation - E.A., C.Y.; Literature Search - E.A., C.Y.; Writing - E.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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