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RESEARCH

Comparison of the BUN/albumin ratio and BISAP score in predicting severity of acute pancreatitis

Akut pankreatitte şiddetin öngörülmesinde BUN/albümin oranı ile BISAP skorunun karşılaştırılması

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Abstract

Purpose: This study evaluated patients diagnosed with acute pancreatitis in the emergency department by comparing the BUN/Albumin Ratio (BAR) and BISAP scores to indicate disease severity and prognosis.

Materials and Methods: 457 patients diagnosed with acute pancreatitis between 2016 and 2021 were included in this observational study, which was planned retrospectively. The laboratory data of the patients and the calculated BISAP scores were recorded.

Results: Patients were categorized according to the BISAP score; 385 (84.2%) patients were at low risk for acute pancreatitis, while 72 (15.8%) were at high risk. The AUC for BAR values was 0.757 (75.7%), and this was statistically significant for determining cutoff values, with a cutoff value of >4.60 ($p<0.001$). Regression analysis of the BAR value was performed for the BISAP categories. As the BAR value increased, the BISAP high-risk value increased 38,339 times. The sensitivity ratio between BAR and BISAP evaluation criteria was found to be 68.67% (0.60-0.75), and it was determined that the BAR value was as strongly correlated with the severity of the disease as the BISAP score.

Conclusions: This study shows that BAR is as effective as BISAP scores in determining high-risk acute pancreatitis.

Keywords:. Emergency department, acute pancreatitis, BISAP, BAR.

Öz

Amaç: Bu çalışmada acil serviste akut pankreatit tanısı alan hastalar, hastalık şiddeti ve prognoz göstergesi olan BUN/Albumin oranı (BAR) ve BISAP skorları karşılaştırılarak değerlendirildi.

Gereç ve Yöntem: Retrospektif olarak planlanan bu gözlemsel çalışmaya 2016-2021 yılları arasında akut pankreatit tanısı alan 457 hasta dahil edildi. Hastaların laboratuvar verileri ve hesaplanan BİSAP skorları kaydedildi. Elde edilen tüm sonuçlar istatistiksel olarak değerlendirildi.

Bulgular: Hastalar BISAP skoruna göre sınıflandırıldı, 385 (%84,2) hasta akut pankreatit açısından düşük riskli iken, 72 (%15,8) hasta yüksek riskli idi. BİSAP kategorileri için BAR değerinin regresyon analizi yapılmıştır. BAR değeri arttıkça BİSAP yüksek risk değeri 38.339 kat arttı. BAR ve BİSAP değerlendirme kriterleri arasındaki duyarlılık oranı %68,67 (0,60-0,75) olarak bulundu ve BAR değerinin BİSAP skoru kadar hastalığın şiddeti ile güçlü bir şekilde ilişkili olduğu belirlendi.

Sonuç: Bu çalışma, BAR'ın yüksek riskli akut pankreatiti belirlemede BISAP skorları kadar etkili olduğunu göstermektedir.

Anahtar kelimeler: Acil servis, akut pankreatit, BİSAP, BAR.

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INTRODUCTION

Acute pancreatitis is an inflammatory condition extending from mild edematous to severe necrotizing pancreatitis and progressing clinically, morphologically, and functionally[1]. Various laboratory findings and radiological imaging methods are employed to determine the severity of acute pancreatitis. The use of scoring systems for predicting mortality is also recommended.

Several scoring systems, such as Ranson's criteria, Imrie score, APACHE-II, SIRS, the innocuous acute pancreatitis, the Balthazar score, and the bedside index of severity of acute pancreatitis (BISAP) score, have been utilized to determine the prognosis of acute pancreatitis. However, no widely used scoring system exhibits a high correlation with prognosis[2,3,4,5,6]. The guideline published by the World Society of Emergency Surgery (WSES) in 2019 recommended using the BISAP score in managing acute pancreatitis and severity assessment due to its ease of use and ability to provide successful predictions[7].

In recent studies, albumin and blood urea nitrogen (BUN) levels are prominent biomarkers to predict the severity of various diseases. BUN has a strong relationship with disease severity. In chronic obstructive pulmonary disease, pancreatitis, and acute myocardial infarction, the acute phase reactant albumin is a proven indicator of mortality. Recent studies have emphasized that the BUN/albumin ratio (BAR) is also a sensitive marker for determining mortality and morbidity, exhibiting a significant correlation with mortality, particularly in the elderly, patients with pneumonia, and patients without renal failure[8,9,10].

In this study, BAR and BISAP scores recommended in the WSES guideline were compared to evaluate their success in predicting the severity of the disease in patients diagnosed with acute pancreatitis in the emergency department. The study's primary aim was to investigate the predictive power of BAR value for mortality. The secondary result is to examine whether the BAR value is superior to the BISAP score. In addition, this study is the first to investigate the BAR value in predicting severity in acute pancreatitis patients presenting to the emergency department. Moreover, the study hypothesizes that the BAR value may predict severity.

MATERIALS AND METHODS

Procedure

This observational, retrospective study was conducted between January 2016 and November 2021 at the emergency medicine clinic of İzmir and Katip Çelebi University Atatürk Training and Research Hospital in Turkey. Our hospital collects and stores data in an electronic database, and the registration process is carried out automatically. The research commenced after receipt of the ethical committee sanction (no: 0589 dated 23.12.2021). During the study's planning and execution, the principles of the Declaration of Helsinki were rigorously adhered to.

The demographic characteristics and laboratory parameters of the patients diagnosed with acute pancreatitis were analyzed. Patients were divided into two groups based on the BISAP scores computed for each case. When calculating the BISAP score, 1 point is given for each: BUN>25 mg/dl, impaired mental status, SIRS<2 points, age<60 years, and presence of pleural effusion[6]. A total score is given between 0 and 5. Patients with a BISAP score of >2 were classified as having a high risk of acute pancreatitis, while those with scores of 2 or less were classified as having a low risk. The BAR value is the ratio calculated by dividing the BUN value by the albumin value, and this ratio was calculated for all patients in our study[9]. BAR values were compared to BISAP scores regarding their ability to predict acute pancreatitis with significant risk.

Sample

Patients over 18 diagnosed with acute pancreatitis and presenting to the emergency department were included in the study. Patients with medical histories of end-stage kidney failure and chronic liver disease, pregnant women, immunosuppressed patients, individuals with active malignancy, and those diagnosed with pancreatitis and treated at external centers were precluded from the study.

Inclusion criteria were being 18 years and above and having a diagnosis of acute pancreatitis in the emergency department. Exclusion criteria were the patients whose data were inaccessible or deficient and patients receiving routine dialysis due to kidney failure or having cirrhosis-related chronic liver failure, being immunosuppressed or pregnant.

Patients with abdominal pain compatible with acute pancreatitis and at least three-fold increases in serum lipase and amylase values were selected. Imaging techniques appropriate to these patients were selected and performed (with contrast abdominal computed tomography and/or abdominal ultrasound). Patients with findings consistent with acute pancreatitis at radiological imaging (such as edema or hemorrhage) were included in the study.

Data collection

Vital parameters, demographic information, and laboratory test results were recorded on patient forms for statistical analysis and compiled using the hospital's information system for the patients included in the study. Patients admitted to the wards or intensive care units for treatment were provided additional exitus or discharge information. After blood samples are taken in our hospital's emergency department, they are quickly delivered to the laboratory, and the results are recorded in the hospital's electronic information system. During the data collection process, the primary patient was scanned in the emergency department by two emergency medicine specialists who have followed the primary patient for three years. From the collected data, BAR values and BISAP scores were calculated and contrasted regarding their ability to predict acute pancreatitis.

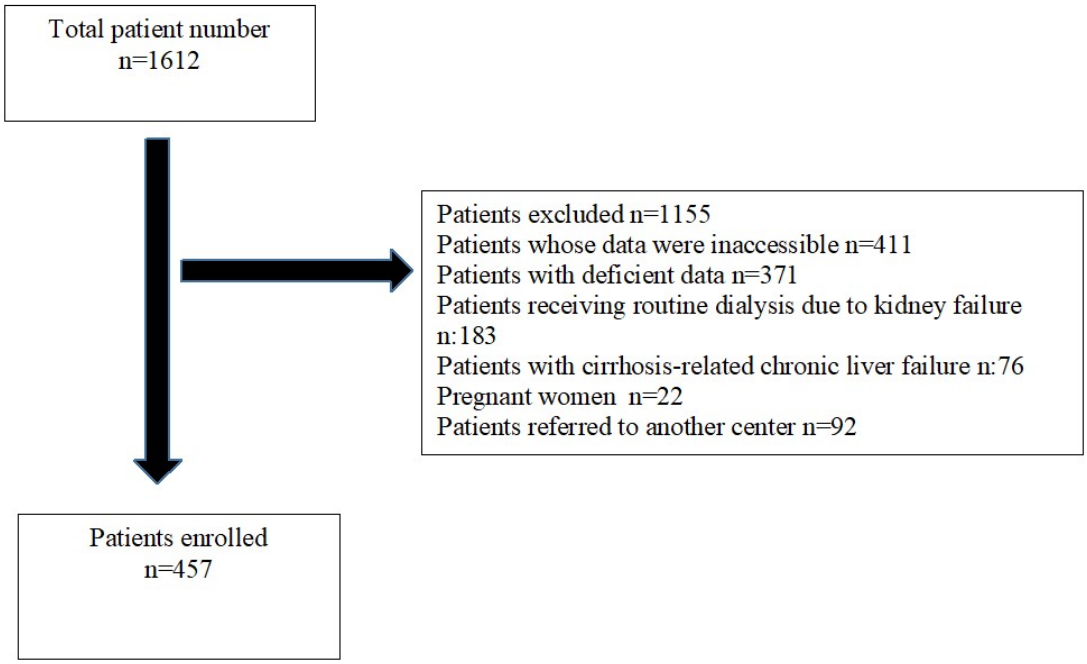

Figure 1. CONSULT diagram

Statistical analysis

The study's data were analyzed using SPPS version 20 (IBM Corporation, 2011). IBM SPSS Statistics for Windows, Version 20.0 (Armonk et al. of America: IBM Corp. Mean, standard deviation, median (25% and 75% percentiles), percentage, and frequency values were calculated for the study variables. In addition, the Levene test was used to evaluate the homogeneity of the variances, one of the prerequisites for parametric tests. Using the Shapiro-Wilk test, the normality assumptions were evaluated. In the comparison of 5 groups, continuous variables (BAR, age, respiration rate, Body temperature (°C), Heart Rate, BUN (mg/dl), Creatinine (mg/dl), CRP, Albumin, Amylase, Lipase, Leukocyte, Neutrophil, Lymphocyte) since the data did not meet normal distribution conditions, the Kruskal Wallis H test was used. In the comparison of 2 groups, continuous variables (BAR, age, respiration rate, Body

temperature (°C), Heart Rate, BUN (mg/dl), Creatinine (mg/dl), CRP, Albumin, Amylase, Lipase, Leukocyte, Neutrophil, Lymphocyte) since the data did not meet normal distribution conditions, Mann Whitney U test was used. Chi square method was used in categorical variables (Gender, State of consciousness, Body temperature, Pleural effusion, Hospitalization, In-hospital Mortality) to compare 5 groups and 2 groups. Relationships between two continuous variables were examined using Pearson's or Spearman's correlation coefficients when parametric test preconditions were not met. A test's efficacy may be determined by its diagnostic adequacy or capacity to correctly classify cases into subgroups (healthy/patient, etc.). ROC analysis was utilized to assess cutoff points. The AUC, sensitivity, and specificity were determined. As applicable, p values 0.05 and p 0.001 were considered statistically significant. As a result of the power analysis conducted for the "Independent two sample t test" method, the sample size was at least 130 individuals in each group, and at least 260 individuals in total. , has been determined. In this case, the power of the test is expected to be approximately 80.270%.

Table 1. Patients' descriptive statistics

Variables	Statistics
BAR $\bar{x}\pm$SD M (min-max)	0.46±0.36 0.37 (0.09-4.22)
Age $\bar{x}\pm$SD M (min-max)	56.28±17.01 56 (19-94)
BISAP categories	
Low risk	385 (84.2)
High risk	72 (15.8)
Sex *n* (%)	
Female	240 (52.5)
Male	217 (47.5)
State of consciousness *n* (%)	
Good	414(90.6)
Poor	43(9.4)
Respiration rate $\bar{x}\pm$SD M (min-max)	14.81±3.06 14 (10-35)
Body temperature (°C) $\bar{x}\pm$SD M (min-max)	36.85±1.30 36.7 (32.3-41.3)
Body temperature *n* (%) 35-39 <35 and >39	375(82.1) 82(17.9)
Heart rate $\bar{x}\pm$SD M (min-max)	85.04±15.73 84 (52-151)
Pleural effusion *n* (%)	
No	368(80.5)
Yes	89(19.5)
BUN (mg/dl) $\bar{x}\pm$SD M (min-max)	16.09±9.12 14(3-76)
Creatinine (mg/dl) $\bar{x}\pm$SD M (min-max)	0.96±0.67 0.82(0.20-8.04)
CRP (mg/L) $\bar{x}\pm$SD M (min-max)	55.81±71.32 23.45(0-399.50)
Albumin (g/L) $\bar{x}\pm$SD M (min-max)	36.65±5.67 37(18-50)
Amylase (IU/L) $\bar{x}\pm$SD M (min-max)	844.76±1644.33 434(4-29820)
Lipase (IU/L) $\bar{x}\pm$SD M (min-max)	1859.55±2640.41 831(4-19130)
Leukocyte ($\times10^9$/L) $\bar{x}\pm$SD M (min-max)	11.44±4.97 10.62(2.15-47.72)
Neutrophil ($\times10^9$/L) $\bar{x}\pm$SD M (min-max)	8.89±4.62 7.85(1.47-31.27)
Lymphocyte ($\times10^9$/L) $\bar{x}\pm$SD M (min-max)	1.57±0.85 1.47(0.18-6.25)
Hospitalization *n* (%)	
Outpatient	35(7.7)
Ward	415(90.8)
Intensive care	8(1.8)
In-hospital mortality *n* (%)	
Ex	2(0.4)
Discharged	455(99.6)

BAR: BUN/Albumin ratio, BISAP: Bedside Index for Severity in Acute Pancreatitis, BUN: Blood urea nitrogen, mg/dl: milligram/deciliter mg/L: milligram/liter, g/L: gram/liter, IU/L: international unit/liter, CRP: C-reactive protein, Ex: Exitus

RESULTS

We identified 1612 patients diagnosed with acute pancreatitis in the emergency department, and 457 patients with appropriate criteria were enrolled. The exclusion criteria are shown in a CONSULT diagram (Fıgure 1).

Men represented 217 (47.5%) of the patients included in the study, and women 240 (52.5%). Eight (1.8%) patients were admitted to intensive care units and 415 (90.8%) to the wards. Thirty-five (7.7%) were discharged, treatment having been planned in the emergency department. When the patients were divided into categories based on BISAP scores, 385 (84.2%) were at low risk of acute pancreatitis, and 72 (15.8%) were at high risk. In-hospital mortality occurred in two (0.4%) patients admitted to intensive care units. Patients' descriptive statistics are shown in Table 1. Age, sex distributions, vital findings, laboratory results, hospitalization status, and in-hospitality mortality were compared regarding patients' BISAP scores (Table 2).Patients were divided into two groups based on their BISAP scores, high-risk and low-risk acute pancreatitis and their data were compared. Significant differences were determined regarding patients' BAR values, age, state of consciousness, respiratory rate, heartbeat, pleural effusion, BUN, creatinine, CRP, albumın, and lymphocyte values, and hospitalizations. A comparison of descriptive characteristics by BISAP categories is shown in Table 3.

Table 2. Comparison of BISAP scores with descriptive values

	Groups					Test value	*p*
Variable	**0**	**1**	**2**	**3**	**4**		
BAR M (min-max)	0.33 (0.13-0.65)	0.32 (0.14-1.50)	0.51 (0.15-1.21)	0.70 (0.09-3.18)	0,76 (0,24-4,22)	*H*=89,706	<0,001
Age M (min-max)	48(20-60)	55(19-94)	65(31-90)	76(46-93)	72(50-84)	*H*=152,746	<0,001
Gender, n (%) Female Male	71 (55.9) 56 (44.1)	88 (51.2) 84 (48.8)	48 (55.8) 38 (44.2)	29 (46.0) 34 (54.0)	4 (44,4) 5 (55,6)	χ^2=2,384	0,666
State of consciousness, n (%) Good Poor	127(100) 0(0)	167(97.1) 5(2.9)	69(80.2) 17(19.8)	48(76.2) 15(23.8)	3(33,3) 6(66,7)	χ^2=82,489	<0,001
Respiration rate M (min-max)	14(11-19)	14(11-21)	14(10-24)	15(12-35)	14(12-24)	*H*=16,889	0,002
Body temperature (°C) M (min-max)	36.6 (36.0-37.9)	36.5(32.3-40.5)	36.8(35.6-41.3)	36.8(34.1-40.5)	36,7(34,1-37,5)	*H*=10,062	0,039
Body temperature n (%) 35-39 <35 and >39	127(100) 0(0)	123(71.5) 49(29.5)	69(80.2) 17(19.8)	48(76.2) 15(23.8)	8(88,9) 1(11,1)	χ^2=42,714	<0,001
Heart Rate M (min-max)	76(53-90)	84(52-133)	88(58-128)	96(60-151)	101(53-111)	*H*=76,312	<0,001
Pleural effusion, n (%) No Yes	127(100) 0(0)	164(95.3) 8(4.7)	57(66.3) 29(33.7)	19(30.2) 44(69.8)	1(1,11) 8(88,9)	χ^2=195,508	<0,001
BUN (mg/dl) *M* (*min-max*)	13(6-24)	12(3-51)	18(5-37)	22(3-70)	26(9-76)	*H*=77,826	<0,001
Creatinine (mg/dl) M (min-max)	0.78 (0.20-1.38)	0.79 (0.40-6.06)	0.86 (0.55-7.02)	0.93(0.49-8.04)	1,20(0,65-4,81)	*H*=32,334	<0,001
CRP (mg/L) *M* (*min-max*)	11.4(0.2-258)	23.6(0-374)	30.6 (0.2-289.5)	62.6(0.7-399.5)	33,4(0,2-258,8)	*H*=26,753	<0,001
Albümin (g/L) *M* (*min-max*)	38(26-49)	38(21-49)	35(21-48)	33(18-43)	34(18-43)	*H*=44,063	<0,001
Amylase (IU/L) M (min-max)	390(24-6773)	444(4-5167)	475(21-5368)	520(17-3560)	949(46-3010)	*H*=2,527	0,640
Lipase (IU/L) M (min-max)	762(9-12000)	842(4-18802)	990(5-19130)	748(4-11034)	1091(13-12000)	*H*=1,161	0,884

Leukocyte (×10⁹/L) M (min-max)	10.4(4.6-34.1)	11.1(2.1-47.7)	9.9(4.5-21.4)	11.1(4.3-35.1)	8,9(2,1-15,2)	*H*=2,408	0,661
Neutrophil (×10⁹/L) M (min-max)	7.6(3.1-30.4)	8.4(1.5-24.9)	7.4(2.7-19.1)	9.3(3.1-31.3)	6,8(1,7-13)	*H*=3,072	0,546
Lymphocyte (×10⁹/L) M (min-max)	1.6(0.3-5)	1.5(0.3-6.3)	1.9(0.2-4.5)	1.3(0.3-2.8)	0,9(0,3-1,8)	*H*=28,494	<0,001
Hospitalization, n (%)							
Outpatient	14(11.0)	13(7.6)	3(3.5)	5(7.9)	0(0)	χ^2=36,148	0,003
Ward	113(89.0)	158(91.9)	83(96.5)	52(82.5)	9(100)		
Intensive care	0(0)	1(0.6)	0(0)	6(9.5)	0(0)		
In-hospital Mortality, n (%)							
Ex	0(0)	0(0)	1(1.2)	1(1.6)	0(0)	χ^2=4,303	0,147
Discharged	127(100)	172(100)	85(98.8)	62(98.4)	9(100)		

BAR: BUN/Albumın ratio, BUN: Blood urea nitrogen, mg/dl: milligram/deciliter, mg/L: milligram/liter, g/L: gram/liter, IU/L: international unit/liter, CRP: C-reactive protein, Ex: Exitus

Table 3. A comparison of descriptive characteristics according to BISAP categories

	Groups		**Test value**	***p*-value**
Variable	**High risk**	**Low risk**		
BAR *M* (*min-max*)	0.40 (0.13-1.50)	0.85 (0.09-4.22)	z=6.916	**<0.001**
Age *M* (*min-max*)	53 (19-94)	73 (46-93)	z=9.517	**<0.001**
Gender, *n* (%)			χ^2=1.531	0.216
Female	207 (53.8)	33 (45.8)		
Male	178 (46.2)	39 (54.2)		
State of consciousness, *n* (%)				**<0.001**
Good	363 (94.3)	51 (70.8)	χ^2=39.139	
Poor	22 (5.7)	21 (29.2)		
Respiratory rate *M* (*min-max*)	14 (10-24)	17 (12-35)	z=3.664	**<0.001**
Body temperature *M* (*min-max*)	36.80 (32.30-41.30)	37.08 (34.10-40.50)	z=1.808	0.071
Body temperature			χ^2=1.063	0.303
35-39	319 (82.9)	56 (77.8)		
<35 and >39	66 (17.1)	16 (22.2)		
Heartbeat *M* (*min-max*)	83 (52-133)	94 (53-151)	z=5.207	**<0.001**
Pleural effusion			χ^2=151.630	**<0.001**
No	348 (90.4)	20 (27.8)		
Yes	37 (9.6)	52 (72.2)		
BUN (mg/dl) *M* (*min-max*)	14.48 (3-51)	25.75 (3-76)	z=6.554	**<0.001**
Creatinine (mg/dl) *M* (*min-max*)	0.89 (0.20-7.02)	1.35 (0.49-8.04)	z=4.269	**<0.001**
CRP (mg/L) *M* (*min-max*)	51.66 (0-374)	92.35 (0.20-399.50)	z=4.101	**<0.001**
Albumin (g/L) *M* (*min-max*)	37 (21-49)	33 (18-43)	z=4.660	**<0.001**
Amylase (IU/L) *M* (*min-max*)	804 (4-6773)	789 (17-3560)	z=0.203	0.839
Lipase (IU/L) *M* (*min-max*)	1841 (4-19130)	1855 (4-12000)	z=0.148	0.882
Leukocyte (×10⁹/L) *M* (*min-max*)	11.41 (2.16-47.72)	12.45 (2.15-35.09)	z=0.878	0.380
Neutrophil (×10⁹/L) *M* (*min-max*)	8.83 (1.47-30.42)	10.18 (1.70-31.27)	z=1.438	0.150
Lymphocyte (×10⁹/L) *M* (*min-max*)	1.61 (0.18-6.25)	1.29 (0.30-2.83)	z=2.585	**0.010**
Hospitalization, *n* (%)			χ^2=26.218	**<0.001**
Outpatient	30 (7.8)	5 (6.9)		
Ward	354 (91.9)	61 (84.7)		
Intensive care	1 (0.3)	6 (8.3)		
In-hospital mortality, *n* (%)			χ^2=1.775	0.183
Ex	1 (0.3)	1 (1.4)		
Discharged	384 (99.7)	71 (98.6)		

BAR: BUN/albumin ratio, BUN: Blood urea nitrogen, mg/dl: milligram/deciliter, mg/L: milligram/liter, g/L: gram/liter, IU/L: international unit/liter, CRP: C-reactive protein, Ex: Exitus

Table 4. BUN, albumin, and BUN/albumin ROC analysis for the BISAP categories

	Area under the curve (AUC)	Std. error	*p*	Area under the curve (AUC) 95% Confidence intervals		Sensitivity	Specificity	Cutoff value
				Lower limit	Upper limit			
BUN (mg/dl)	0.743	0.036	<0.001	0.700	0.782	68.02	72.99	>16
Albumin (g/L)	0.673	0.034	<0.001	0.627	0.715	59.72	66.75	≤35
BAR	0.757	0.036	<0.001	0.715	0.795	72.22	73.51	>0.46

BAR: BUN/albumin ratio, BUN: Blood urea nitrogen, mg/dl: milligram/deciliter, g/L: gram/liter

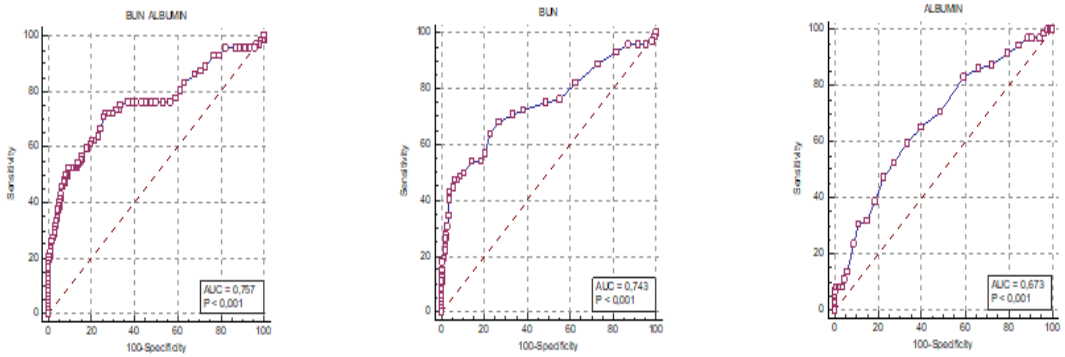

Figure 2. ROC analysis for determining the power of BAR, BUN, and albumin values to predict high-risk acute pancreatitis according to BISAP scores.

BAR: BUN/albumin ratio, BUN: Blood urea nitrogen

The area under the curve (AUC) in the BUN variable for the BISAP categories was calculated at 0.743 (74.3%), with a cutoff value of >16 (p<0.001). The AUC value for albumin was 0.673 (67.3%), a statistically significant figure, with a cutoff value of ≤35 (p<0.001). The AUC for BUN: albumin values were 0.757 (75.7%), and this was statistically significant for determining cutoff values, with a cutoff value of >4.60 (p<0.001) (Table 4) (Figure 2).

BAR value regression analysis was performed for the BISAP categories. The BISAP high-risk value increased 38.339-fold as BAR values increased.

The sensitivity between BAR and BISAP evaluation criteria was 68.67% (0.60-0.75), and BAR was found to exhibit as robust a correlation with disease severity as BISAP scores (p<0.01). However, it was more successful in the low-risk category than in the high-risk category and could successfully predict hospitalization or medical treatment and discharge.

DISCUSSION

Acute pancreatitis is a gastrointestinal emergency representing a frequent cause of presentations to the emergency department. The mortality rate among all cases is approximately 1%, rising to 20-30% in severe acute pancreatitis[11]. Clinical data, imaging techniques, and biochemical analyses are generally used to predict disease severity and mortality. However, it has been reported that the severity of acute pancreatitis is underestimated in up to 30% of cases. There is currently no generally recognized biomarker or scoring system with proven validity for evaluating the severity of acute pancreatitis. In their study investigating the assessment of prognosis in patients with acute pancreatitis, Hagjer et al. concluded that BISAP scores accurately estimated severity, organ failure, and mortality[13]. The 2019 WSES guideline also recommended the use of BISAP scoring[7]. However, the use of BISAP in elderly patients is restricted due to changes in consciousness for

secondary reasons not associated with pancreatitis and the limited value of SIRS[14].

BISAP scores are dependent on the state of consciousness and the presence of SIRS criteria. BISAP is, therefore, closely associated with patients' tolerance and the threshold values for laboratory data. Individual changes affect the BISAP score in case of increased disease severity. Moreover, patients with mental disorders predating pancreatitis, sequelae associated with previous diseases, and age-related loss of cognitive functions may be insufficiently evaluated, and the results may be misleading. BAR values yield results independent of these variables. Due to the compatibility between individual biochemical markers, it is decisive without requiring strict rules such as SIRS. Therefore, although BAR can be calculated with similar efficacy to BISAP scores, it yields more straightforward and valuable findings than BISAP since it does not entail dependent variables.

The mean general age of the patients in this study was 56.28±17.01 years, and the mean age of the patients with acute pancreatitis according to BISAP scores was 73 (46-93). The severity of acute pancreatitis is known to increase with age, and despite being at 1%, general mortality also increases with age. Mandalia et al. also reported increased mortality rates at age 70 and above.

BUN is a value marker in mortality and is particularly associated with sepsis-related dehydration[17,18]. Cheng et al. investigated the use of BUN values in predicting in-hospital mortality in patients with COVID-19 and concluded that BUN values were correlated with mortality ($p<0,001$)[19]. Liu Q. calculated BUN: creatinine ratios and concluded that these ratios were associated with mortality in COVID-19 patients[20]. In their meta-analysis, Shao M. et al. concluded that acute kidney failure and elevated BUN levels are useful predictors of mortality[21]. In acute pancreatitis, BUN elevation is a potent predictor of mortality and disease severity, according to Pando et al. Those authors concluded that BUN value calculation was a rapid and reliable test for predicting mortality and permanent multiple organ failure. In addition, BISAP scores were significantly higher in high-risk patients in that study compared to those with low risk ($p<0.001$)[22]. In the present study, the high-risk patient group had substantially higher mean BUN levels than the low-risk patient group, and the increase in BUN was strongly correlated with mortality and disease severity ($p<0.001$). This result is consistent with current research.

Albumin is a negative acute phase protein involved in endogenous and exogenous substance neutralization, antioxidation, immune system regulation, and anti-inflammatory processes. Shorr AF et al. reported that decreased albumin levels were associated with mortality in COPD patients. In patients with acute coronary syndrome, González-Pacheco found a relationship between mortality and albumin levels. Viasus reported an association between mortality and decreased albumin levels in bacterial pneumonia[8,25,26]. Hong et al. concluded that hypoalbuminia observed in patients with acute pancreatitis was associated with mortality and organ failure[27]. In the present study, mean albumin levels were significantly lower in the high-risk group based on BISAP scores compared to the low-risk group ($p<0.001$). The decline in albumin was associated with the disease's severity.

BAR calculated using BUN and albumin has been reported to yield more successful results than the individual evaluation of BUN and albumin in predicting mortality and severity of illness. It can be employed more effectively since it is less affected by variables. Ugajin et al. reported significant results in predicting in-hospital mortality in community-acquired pneumonia and determining pneumonia severity (odds ratio (OR); 1.10)[28]. Dündar et al. analyzed patients over 65 presenting to the emergency department, comparing BUN, albumin, and eGFR levels with BAR. Patients with a higher BAR were more likely to be hospitalized, and it correlated well with other laboratory parameters investigations in the emergency department for determining disease severity (OR = 2.82)[29]. Kücükceran characterized BAR as a potent predictor of in-hospital mortality among COVID-19 pneumonia patients in the emergency department. Sensitivity of 87.5% and specificity of 59.9% were calculated for BAR[30]. In the present study, the OR showing the increase in BISAP scores as BAR values rose was 38.34. In addition, an AUC value of 0.757 was calculated at a cutoff score of 4.60 with 73.51% selectivity and 72.22% sensitivity.

In addition, the AUC value in the present study was 0.757, and a cutoff score value of 4.60 was calculated with 73.51% specificity and 72.22% sensitivity. The negative predictive value of the success of the BAR value in the low-risk category can be effectively employed to predict hospitalization or discharge with medical treatment. In their study, Hagjer et al. found

the AUC value of the BISAP score to be 0.875 in predicting severity in patients with acute pancreatitis[13]. This value is similar to BAR. Since the BAR value is calculated with fewer parameters and is not affected by personal confounding factors such as mental status, it can be considered as a biomarker that can be used quickly as an alternative to the BISAP score in the emergency department, since it can predict severity at similar AUC values.

Efforts are being made to use simple, low-cost, objective, repeatable, non-invasive, and specific and sensitive laboratory parameters that require additional examination to determine disease severity early. This study found that the BAR value is as practical as the BISAP score in predicting severity in acute pancreatitis patients. However, this result should be confirmed by studies with larger participants. It is also recommended to compare it with other scores used to predict severity in patients with acute pancreatitis.

The main limitations of this study are its retrospective design, single-center design, and small number of patients. In addition, kidney diseases, liver diseases, and malignancies that are unknown or not yet diagnosed by the patient may have affected the calculated values and our results. Due to the small number of patients included in the study and the limited available data, it was impossible to evaluate the predictive power of BAR values in terms of mortality.

This study shows that BAR is as effective as BISAP scores in identifying high-risk acute pancreatitis. BAR is a robust and independent marker in determining mortality and severity of disease. It is a valuable indicator, especially in the emergency department, as it can be calculated easily and quickly using simple laboratory parameters and can be used to identify low-risk patients and, therefore, those who need inpatient treatment in a health institution. There is a need for studies with larger participants on this subject.

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