# Comparison of BAR, BISAP and NEWS Scores in Predicting Mortality in Patients with Acute Pancreatitis

## Akut Pankreatitli Hastalarda Mortaliteyi Tahmin Etmede BAR, BISAP ve NEWS Skorlarının Karşılaştırılması

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**ABSTRACT**

**Objective:** Acute pancreatitis is a gastrointestinal emergency with a high mortality rate. Multiple biomarkers and scoring systems are used to predict mortality in acute pancreatitis. Traditional methods such as BISAPS (Bedside Index of Severity of Acute Pancreatitis Score) and NEWS (National Early Warning Score) contain too many parameters. To predict mortality in patients with acute pancreatitis who apply to the emergency department with the BUN/Albumin ratio (BAR).

**Material and Method:** Patients who were admitted to the emergency department between 01/01/2021 and 31/12/2022 and whose lipase value was more than three times the reference value were included in our study by retrospectively scanning hospital data. Patients were divided into two groups according to in-hospital mortality. BAR, BISAP and NEWS values of all patients were calculated and compared.

**Result:** In the ROC analysis performed to evaluate the mortality predictive power; AUC values of NEWS 0.637 (0.546-0.727), BISAPS 0.684 (0.589-0.779), BAR 0.748 (0.663-0.832) were obtained. In the logistic regression analysis; BAR was found to be the highest independent predictor of in-hospital mortality of acute pancreatitis. It was found that a 1 unit increase in BAR increased in-hospital mortality by 1,071 times.

**Conclusions:** BAR is more effective in predicting mortality than NEWS and BISAPS in patients with acute pancreatitis who present to the emergency department.

**Keywords:** Acute Pancreatitis, BAR, BISAPS, NEWS, Mortality

**ÖZET**

**Amaç:** Akut pankreatit, yüksek mortalite oranına sahip bir gastrointestinal acil durumdur. Akut pankreatitte mortaliteyi öngörmek için çeşitli biyobelirteçler ve skorlama sistemleri kullanılmaktadır. BISAPS (Bedside Index of Severity of Acute Pancreatitis Score) ve NEWS (National Early Warning Score) gibi geleneksel yöntemler çok fazla parametre içermektedir. Bu çalışmada, acil servise başvuran akut pankreatitli hastalarda BUN/Albümin oranı (BAR) ile mortalitenin öngörülmesi amaçlandı.

**Gereç ve Yöntem:** 01/01/2021 ile 31/12/2022 tarihleri arasında acil servise başvuran ve lipaz değeri referans değerin üç katından fazla olan hastalar, hastane verileri retrospektif olarak taranarak çalışmaya dahil edildi. Hastalar, hastane içi mortaliteye göre iki gruba ayrıldı. Tüm hastaların BAR, BISAP ve NEWS değerleri hesaplanarak karşılaştırıldı.

**Bulgular:** Mortaliteyi öngörme gücünü değerlendirmek için yapılan ROC analizinde; AUC değerleri NEWS için 0,637 (0.546-0.727), BISAPS için 0,684 (0.589-0.779), BAR için 0,748 (0.663-0.832) olarak bulundu. Lojistik regresyon analizinde; BAR, akut pankreatitli hastalarda hastane içi mortalitenin en güçlü bağımsız belirleyicisi olarak bulundu. BAR'da 1 birimlik artışın hastane içi mortaliteyi 1,071 kat artırdığı tespit edildi.

**Sonuç:** Acil servise başvuran akut pankreatitli hastalarda, BAR skoru, NEWS ve BISAPS skorlarına göre mortaliteyi öngörmede daha etkilidir.

**Anahtar Kelimeler:** Akut Pankreatit, BAR, BISAPS, NEWS, Mortalite

## INTRODUCTION

In non-traumatic emergency department (ED) admissions, gastrointestinal (GI) system diseases are seen as the most common second system disease. Among GI system diseases, one of the most common reasons for admission is acute pancreatitis. Therefore, multiple scoring systems have been used to determine the prognosis in patients with acute pancreatitis (1-2). Biomarkers and scoring systems have been used to predict mortality in patients with acute pancreatitis due to the high mortality rate associated with the condition (3-4).

One of the scoring systems used to predict mortality early in acute pancreatitis is the Bedside Index of Severity in Acute Pancreatitis (BISAP) score (4). The BISAP scoring system contains fewer parameters compared to traditional pancreatitis scoring systems (Apache II, Ranson, and Balthazar) and is easier to use (5). BISAP is a newer scoring system compared to the old Ranson criteria. Data scoring is not required until 48 hours after patients are admitted to the hospital. The BISAP scoring system also includes consciousness status and Systemic Inflammatory Response Syndrome (SIRS) criteria. Evaluation with this scoring system may be challenging and may yield misleading results in patients with cognitive diseases like dementia, sequelae of previous illnesses, and

mental disorders.

The National Early Warning Score (NEWS) is a scoring system used in many clinical conditions to predict mortality (6). Its ability to predict mortality is attributed to being a scoring system based on vital parameters. Therefore, while it accurately predicts mortality in the geriatric population, it may not perform well in non-geriatric patient populations due to compensatory mechanisms (endocrine, cardiac, central). Recently, various parameters have been compared with NEWS in literature studies in various clinical conditions (7).

Blood urea nitrogen (BUN) is a type of nitrogen produced in protein metabolism and excreted by the kidneys (8). Blood urea nitrogen is associated with mortality linked to sepsis-related dehydration (9). Blood urea nitrogen and albumin reflect protein intake, protein catabolism, and fluid balance in patients. Both are also frequently used as prognostic markers (10). Increased fluid requirements and BUN elevation leading to acute kidney injury develop in acute pancreatitis due to increased fluid needs and inflammation (11-13). BUN values are also included in the calculation of BISAP scores and Ranson criteria.

The Blood Urea Nitrogen/Albumin Ratio (BAR) has gained a place as a prognostic marker in literature studies in various clinical conditions due to being a quickly accessible and easily calculable parameter (14)

In this study, we aimed to compare BAR with NEWS and BISAP scoring systems in predicting mortality in patients with acute pancreatitis presenting to the ED.

**MATERIAL AND METHODS**

This study received ethical approval from the Necmettin Erbakan University (Konya, Turkey) Faculty of Medicine Clinical Studies Ethics Committee on 7 June 2024, with decision number 2024/4997. Patients' medical data were accessed retrospectively through the hospital's electronic medical record system, following the approval of the institutional ethics committee. All data were anonymized to protect patient confidentiality. Patients who presented to the ED between 01/01/2021 and 31/12/2022 with a lipase value three times higher than the reference value were screened. Patients under eighteen years of age, trauma patients, those with missing laboratory parameters, those with missing vital signs, and those whose final diagnosis was not pancreatitis were excluded from the study (Figure 1). The parameters analyzed in the study were obtained from history taken in the ED, physical examination findings, laboratory, and imaging results. Patients who met at least two of the diagnostic criteria for acute pancreatitis (three times the reference value of amylase and/or lipase, typical abdominal pain of acute pancreatitis, and imaging findings) were considered to have acute pancreatitis and included in the study. Demographic data, vital signs (blood pressure, temperature, pulse rate, respiratory rate, oxygen saturation), consciousness status (AVPU score), laboratory findings (hemoglobin, leukocyte, neutrophil, lymphocyte, BUN, creatinine, amylase, lipase, albumin, CRP, lactate), presenting complaints, comorbidities, etiological causes, and hospital outcomes of the patients included in the study were recorded. BAR values and BISAP, NEWS scores were calculated from the obtained data.

**RESULTS**

A total of 934 patients were included in the study, and their medical records were reviewed. The median age of the patients was determined to be 59, and 507 (54.3%) were female. The most common complaint detected at admission was abdominal pain with 902 patients. The most common comorbidities were hypertension with 319 (34.2%), diabetes with 190 (20.3%), and coronary artery disease with 108 (11.6%) (Table 1 and Table 2). The median BAR value of the cases was found to be 3.62 (2.63-5.34). The median NEWS and BISAPS values of the cases were 1 (0-2) and 1 (0-1), respectively. The cases were divided into biliary (558 (59.7%)) and non-biliary (376 (40.3%)) etiological causes. Among non-biliary causes, mass (abscess, tumor) was the most common cause with a total of 51 patients. Of the patients, 791 were hospitalized, and 63 were admitted to the intensive care unit. As a hospital outcome, 796
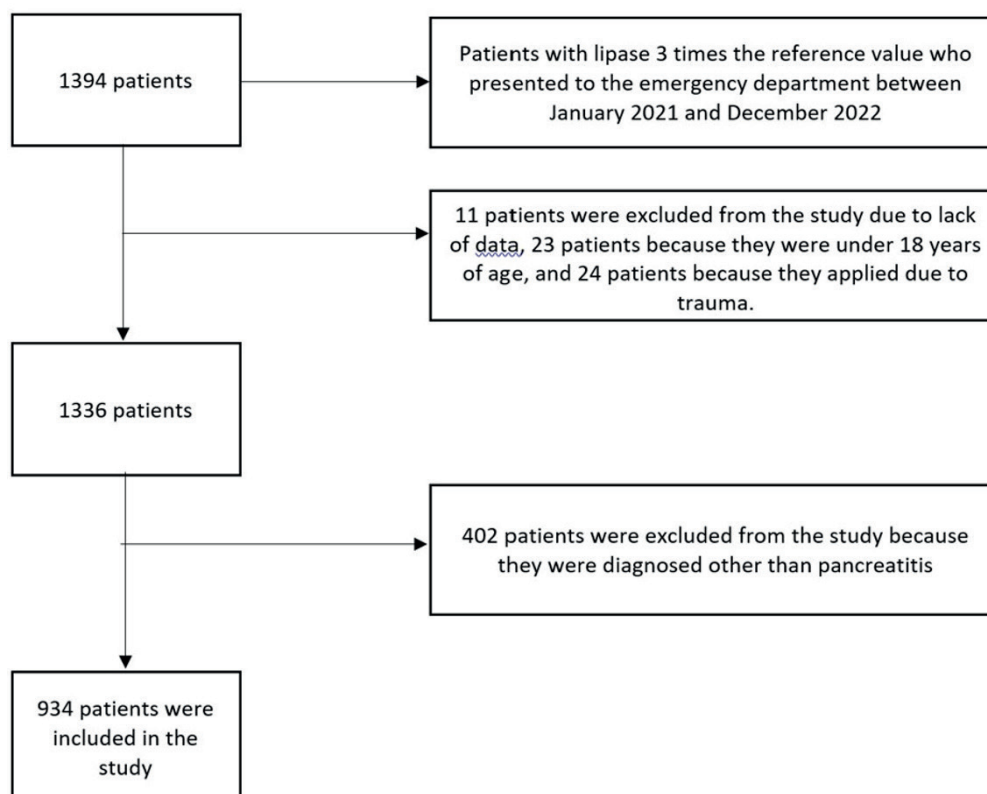
**Figure 1:** Flowchart

**Table 1:** Features of Participants and comparison of survivor and nonsurvior

|  | | Total patients (n=934) | Non survivor (n=44) | Survivor (n=890) | p value |
|---|---|---|---|---|---|
| **Age** | | 59(43.75-72) | 69(57.75-81.75) | 57(42-71) | 0.001* |
| **NEWS** | | 1(0-2) | 1(0.25-4) | 1(0-2) | <0.001* |
| **BISAPS** | | 1(0-1) | 1.5(1-2.75) | 1(0-1) | <0.001* |
| **eGFR** | | 86.54(62.58-107) | 64.71(40.77-90.24) | 86.33(65.08-107.83) | 0.001* |
| **BUN** | | 15.3(11.23-20.74) | 22.22(15.61-41.32) | 14.77(10.98-20.23) | <0.001* |
| **Albumine** | | 4.15(3.75-4.4) | 3.66(3.12-4.14) | 4.16(3.8-4.41) | <0.001* |
| **BAR** | | 3.62(2.63-5.34) | 6.34(4.52-10.96) | 3.5(2.6-5.14) | <0.001* |
| **Creatinine** | | 0.84(0.7-1.1) | 1.04(0.8-1.71) | 0.85(0.7-1.09) | 0.001* |
| **Sodium** | | 138(136-140) | 137(132-139) | 138(136-140) | 0.013* |
| **Potassium** | | 4.3(3.98-4.6) | 4.31(3.89-4.69) | 4.26(3.96-4.58) | 0.449* |
| **Amilase** | | 731(264-1709.5) | 356(168.75-1385) | 753(270.5-1715 | 0.014* |
| **Lipase** | | 1389.85(536.28-3182.25 | 670(372.88-2285.63) | 1444(547.5-3201.35) | 0.011* |
| **CRP** | | 11(3.4-38.15) | 57.25(15.32-158.01) | 10.44(3.2-33.54) | <0.001* |
| **WBC** | | 10.49(8.16-13.3) | 11.57(7.98-18.61) | 10.46(8.18-13.15) | 0.088* |
| **Neutrophil** | | 8.1(5.76-10.91) | 9.64(5.97-16.45) | 8.04(5.71-10.81) | 0.031* |
| **Lymphocyte** | | 1.32(0.88-1.83) | 1(0.59-1.63) | 1.33(0.9-1.86) | 0.008* |
| **NLR** | | 6.01(3.38-11.41) | 11.21(5.36-22.4) | 5.87(3.36-10.96) | <0.001* |
| **Hgb** | | 13.41±2.03 | 13.19±2.89 | 13.42±1.98 | 0.617** |
| **Hospital Stay Duration** | | 5(3-8) | 4(2.25-21) | 5(3-8) | 0.527* |
| **Intensive Care Hospitalization Duration** | | 0(0-0) | 2(1-7) | 0(0-0) | <0.001* |
| **Sex** | Male | 427(45.7%) | 26(59.1%) | 401(45.1%) | 0.068*** |
| | Female | 507(54.3%) | 18(40.9%) | 489(54.9%) | |

*: Man whitney u test was used
**: Student t test was used
***: Chi square test was used
NEWS: National Early Warning Score, BISAPS: Bedside Index of Severity of Acute Pancreatitis Score eGFR: Estimate Glomerular Filtration Rate, BUN: Blood Urea Nitrogen, BAR: BUN – Albumin Ration, CRP: C-reactive protein, Hgb: haemoglobin

(85.2%) of the patients were discharged (Table 3).
The cases were examined by dividing them into two groups according to in-hospital mortality status. The group with mortality comprised 44 patients, constituting 4.7% of the cases. The collected data between the two groups were compared. The median BAR, BISAPS, NEWS values of the cases with mortality were statistically significantly higher compared to those who survived (6.34 (4.52-10.96), 3.5 (2.6-5.14), p<0.001; 1.5 (1-2.75), 1 (0-1), p<0.001; 1 (0.25-4), 1 (0-2), p<0.001). The median NLR and CRP values were also statistically significantly higher in the mortality group compared to the other group (11.21 (5.36-22.4), 5.87 (3.36-10.96), p<0.001; 57.25 (15.32-158.01), 10.44 (3.2-33.54), p<0.001). Moreover, non-biliary causes in etiology and the occurrence of malignancies as comorbidities were more common in the mortality group and statistically significant (30 (68.2%), 346 (38.9%), p <0.001; 14 (31.8%), 57 (6.4%), p<0.001). Detailed characteristics of the compared data between the two groups are given in Table 1 and Table 2.
In ROC analysis conducted to evaluate the predictive power of mortality; AUC values of BAR 0.748 (0.663-0.832), BISAPS 0.684 (0.589-0.779), NEWS 0.637 (0.546-0.727), NLR 0.677 (0.583-0.771) were obtained ( Table 4) ( Figure 2).
In logistic regression analysis, BAR, NLR, and CRP were found to be independent predictors in predicting in-hospital mortality of acute pancreatitis. An increase of 1 unit in BAR, NLR, and CRP values was found to increase in-hospital
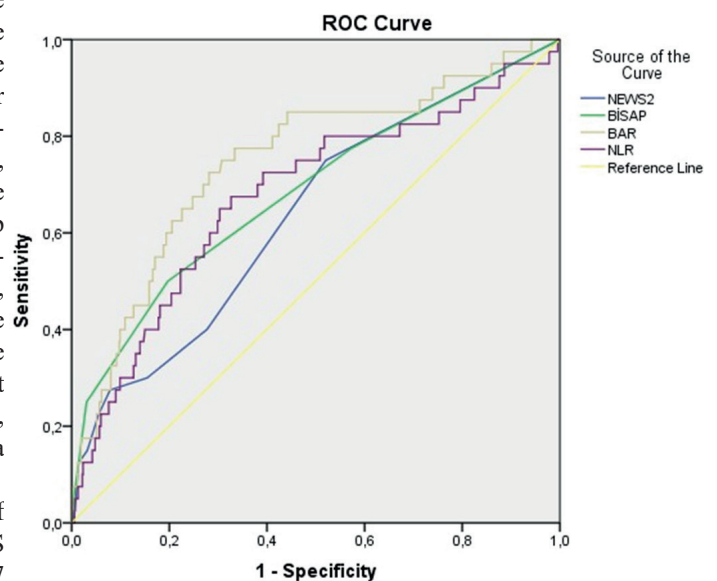


**Figure 2:** ROC Curve Analysis of Prognostic Scores for Mortality Prediction

**Table 2:** Comparative analysis of survivors and non-survivors with respect to initial clinical presentation and past medical history

| | n(%) | n(%) | n(%) | p value |
|---|---|---|---|---|
| **Abdominal pain** | 902(96.6) | 43(97.7) | 859(96.5) | 0.999* |
| **Nausea-vomiting** | 508(54.4) | 20(45.5) | 488(54.8) | 0.223** |
| **Back pain** | 352(37.7) | 14(31.8) | 338(38) | 0.411** |
| **Abdominal swelling** | 13(1.4) | 2(4.5) | 11(1.2) | 0.122* |
| **Other complaint** | 54(5.8) | 10(22.7) | 44(4.9) | <0.001* |
| **Etiology**    **Biliary** | 558(59.7) | 14(31.8) | 544(61.1) | <0.001** |
|    **Nonbiliary** | 376(40.3) | 30(68.2) | 346(38.9) | |
| **Morbidity** | 635(68) | 35(79.5) | 600(67.4) | 0.092** |
| **Pancreatitis** | 129(13.8) | 5(11.4) | 124(13.9) | 0.630** |
| **Hyperlipidemia** | 59(6.3) | 3(6.8) | 56(6.3) | 0.753* |
| **Hypertension** | 319(34.2) | 14(31.8) | 305(34.3) | 0.738** |
| **Diabetes mellitus** | 190(20.3) | 11(25) | 179(20.1) | 0.432** |
| **Coronary artery disease** | 108(11.6) | 5(11.4) | 103(11.6) | 0.966** |
| **Congestive heart failure** | 38(4.1) | 3(6.8) | 35(3.9) | 0.418* |
| **Arrhythmia** | 29(3.1) | 3(6.8) | 26(2.9) | 0.152* |
| **Liver, pancreas and biliary tract malignancies** | 14(1.5) | 4(9.1) | 10(1.1) | 0.003* |
| **Malignancy** | 71(7.6) | 14(31.8) | 57(6.4) | <0.001* |
| **Asthma-COPD** | 78(8.4) | 5(11.4) | 73(8.2) | 0.405* |
| **Chronic renal failure** | 56(6) | 3(6.8) | 53(6) | 0.743* |
| **Cerebrovascular disease** | 37(4) | 2(4.5) | 35(3.9) | 0.692* |
| **Thyroid** | 34(3.6) | 2(4.5) | 32(3.6) | 0.672* |
| **Gastrointestinal tract bleeding** | 1(0.1) | 0(0) | 1(0.1) | 0.999* |
| **Crohn's disease, ulcerative colitis, celiac** | 9(1) | 0(0) | 9(1) | 0.999* |
| **Rheumatological disease** | 30(3.2) | 3(6.8) | 27(3) | 0.164* |
| **Liver cirrhosis** | 5(0.5) | 0(0) | 5(0.6) | 0.999* |
| **Other comorbidity** | 36(3.9) | 3(6.8) | 33(3.7) | 0.238* |
| **Cholecystitis** | 1(0.1) | 0(0) | 1(0.1) | 0.999* |
| **Cholelithiasis, Choledocholithiasis** | 56(6) | 1(2.3) | 55(6.2) | 0.511* |
| **Cholecystectomy** | 130(13.9) | 3(6.8) | 127(14.3) | 0.163** |

*: Ficher exact test was used
**: Chi square test was used
COPD: Chronic obstructive pulmonary disease

**Table 3:** Patients' emergency outcomes, in-hospital outcomes, and in-hospital mortality

| | | |
|---|---|---|
| **Emergency department outcome** | Discharge | 33(3.5%) |
| | Service Hospitalization | 791(84.7%) |
| | Intensive Care Hospitalization | 63(6.7%) |
| | Discharged voluntarily | 43(4.6% |
| | Transfer to another hospital | 4(0.4%) |
| **Hospital outcome** | Discharge | 796(85.2%) |
| | Discharged voluntarily | 84(9%) |
| | Transfer to another hospital | 10(1.1%) |
| | Exitus | 44(4.7%) |
| **In-hospital mortality** | | 44(4.7%) |

mortality by 1.071, 1.022, and 1.006 times, respectively (Table 5).

## DISCUSSION

Acute pancreatitis has a high mortality rate among GI emergencies and constitutes the majority of ED admissions. NEWS and BISAP scoring systems were used in the study on acute pancreatitis (15). Therefore, predicting mortality in patients with acute pancreatitis is important. Our study aims to demonstrate the predictive power of BAR in predicting mortality. To the best of our knowledge, our study is the first to evaluate mortality in acute pancreatitis using BAR in the literature.

BUN value is a frequently used biomarker to assess kidney function and is commonly used in clinical practice. The increase in BUN value in patients with acute pancreatitis is due to increased fluid needs associated with intravascular fluid loss, leading to acute kidney injury (14). Additionally, kidney damage occurs due to inflammatory release (16). Albumin regulates plasma osmotic pressure and constitutes the majority of plasma proteins (17). Albumin is also a negative

**Table 4:** AUC value of ROC Analysis

| ROC Analysis | AUC | 95% CI | p value |
|---|---|---|---|
| **Age** | 0.667 | 0.583-0.750 | <0.001 |
| **NEWS** | 0.637 | 0.546-0.727 | 0.004 |
| **BISAPS** | 0.684 | 0.589-0.779 | <0.001 |
| **eGFR** | 0.626 | 0.527-0.726 | 0.007 |
| **BUN** | 0.695 | 0.602-0.789 | <0.001 |
| **Albumin** | 0.709 | 0.615-0.803 | <0.001 |
| **BAR** | 0.748 | 0.663-0.832 | <0.001 |
| **Creatin** | 0.620 | 0.518-0.722 | 0.011 |
| **CRP** | 0.744 | 0.663-0.824 | <0.001 |
| **Neutrophil** | 0.590 | 0.481-0.699 | 0.056 |
| **Lymphocyte** | 0.637 | 0.547-0.728 | 0.004 |
| **NLR** | 0.677 | 0.583-0.771 | <0.001 |

*NEWS: National Early Warning Score, BISAPS: Bedside Index of Severity of Acute Pancreatitis Score eGFR: Estimate Glomerular Filtration Rate, BUN: Blood Urea Nitrogen, BAR: BUN – Albumin Ration, CRP: C-reactive protein, NLR: Neutrophil Lymphocyte Ratio*

acute-phase reactant. While serum albumin levels decrease during inflammatory processes, the transfer of albumin from the vascular compartment to the outside increases, and hypoalbuminemia deepens (18). Kang et al. found in a study that the BUN value is correlated with mortality in patients with acute pancreatitis (19) There are also studies showing that BAR is an independent prognostic factor in various diseases such as community-acquired pneumonia, ischemic stroke, and COVID-19 pneumonia (20-22). In a study on the use of BAR in predicting mortality in patients with early-stage sepsis admitted to the ED by Tianyong and colleagues, the AUC value of BAR was found to be 0.741 (23). We found the AUC value of BAR to be 0.748 in our study. When comparing the AUC values of NEWS, BISAPS, and BAR, we reached values of 0.637, 0.684, and 0.748, respectively. We observed that the BAR value was more effective in predicting in-hospital mortality compared to the BISAPS and NEWS scoring systems.

In our study, the NEWS value was found to be high in patients with acute pancreatitis who had a fatal course. In a study conducted by the PANC study group with 2580 patients, they found the NEWS value of all pancreatitis patients to be 1 (0-2) (24). Furthermore, in our study, the NEWS value was found to be high in patients with acute pancreatitis who had a fatal course. In a study by Tan JW and colleagues, the median NEWS value of patients with fatal pancreatitis was found to be 11 (0-18) (25). In our study, we found the median NEWS value in patients with fatal pancreatitis to be 1 (0-14).

In our study, the average age of patients with acute pancreatitis presenting to our ED was 59, and the female ratio was 54.3%. In a study aimed at preventing hospitalization of patients with acute pancreatitis, the average age was found to be 56, and the female ratio was 53.2% (26) Our study is consistent with the literature. The most common complaint was abdominal pain, and the most common comorbidity was hypertension at 34.2%. The most common etiology was biliary pathologies at 59.7%. The most common cause among non-biliary pathologies was a mass. In a study by Şenkal et al. on patients with acute pancreatitis, the most common etiology was biliary pathologies at 76%. Alcohol was the most common cause among non-biliary pathologies at 20% (27,28).

There are some limitations to our study. Our study was a single-center and retrospective study. Moreover, the number of patients with fatal outcomes in our study had a small sample size. Also, during the screening of patients in our study, patients with amylase and lipase values three times higher than the reference value were included; however, patients whose amylase and lipase values were not three times higher than the reference value but who had imaging and typical abdominal pain of acute pancreatitis were not included in the study. If these patients had been included in the study, the results could have varied. For these reasons, it is recommended to conduct multicenter studies with larger sample sizes.

**CONCLUSION**

In patients with acute pancreatitis presenting to the ED with a fatal course, NEWS, BISAPS, and BAR values were found to be statistically significantly higher compared to those who

**Table 5:** Logistic Regression Analysis Result

| Parameters | Univariate Odds rate | 95% CI | p value | Multivariate Parameters | Odds rate | 95% CI | p value |
|---|---|---|---|---|---|---|---|
| **Age** | 1.032 | 1.012-1.052 | 0.001* | Age | 1.016 | 0.990-1.043 | 0.234 |
| **NEWS** | 1.374 | 1.223-1.544 | <0.001* | NEWS | 1.077 | 0.908-1.279 | 0.395 |
| **BISAPS** | 2.567 | 1.890-3.486 | <0.001* | BISAPS | 1.084 | 0.648-1.814 | 0.758 |
| **eGFR** | 0.995 | 0.987-1.003 | 0.251 | | | | |
| **BUN** | 1.036 | 1.022-1.050 | <0.001 | | | | |
| **Albumin** | 0.228 | 0.134-0.387 | <0.001 | | | | |
| **BAR** | 1.124 | 1.073-1.177 | <0.001* | BAR | 1.071 | 1.016-1.129 | 0.011 |
| **Creatin** | 1.194 | 0.980-1.456 | 0.079 | | | | |
| **CRP** | 1.009 | 1.006-1.013 | <0.001* | CRP | 1.006 | 1.002-1.010 | 0.001 |
| **Neutrophil** | 1.118 | 1.063-1.175 | <0.001 | | | | |
| **Lymphocyte** | 0.675 | 0.444-1.027 | 0.066 | | | | |
| **NLR** | 1.036 | 1.017-1.055 | <0.001* | NLR | 1.022 | 0.977-1.048 | 0.013 |

*\*: Parameters included in multivariate analysis*
*NEWS: National Early Warning Score, BISAPS: Bedside Index of Severity of Acute Pancreatitis Score eGFR: Estimate Glomerular Filtration Rate, BUN: Blood Urea Nitrogen, BAR: BUN – Albumin Ration, CRP: C-reactive protein, NLR: Neutrophil Lymphocyte Ratio*

survived. The AUC value of BAR in predicting in-hospital mortality was found to be higher compared to the AUC values of NEWS and BISAPS.

BAR is more effective than NEWS and BISAPS in predicting mortality in patients with acute pancreatitis presenting to the ED.

This study highlights BAR as a stronger and more practical predictor of in-hospital mortality than NEWS and BISAP in patients with acute pancreatitis. Its ease of calculation and accessibility make it a promising tool for early risk assessment in emergency settings.

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