Anatolian Journal of Emergency Medicine 2025;8(3):120-127

ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Comparison of Nutrition-Based Scoring Systems for Predicting Mortality in Patients with Acute Pancreatitis in the Emergency Department

Acil Serviste Akut Pankreatitli Hastalarda Mortaliteyi Öngörmede Beslenme Temelli Skorlama Sistemlerinin Karşılaştırılması

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ABSTRACT

Aim: In the emergency department (ED) management of patients with acute pancreatitis (AP), it is recommended not only to establish an early diagnosis but also to assess and apply risk stratification in clinical decision-making. Considering that AP is an immunonutritional disease, this study aimed to compare the performance of two immunonutrition-based scoring systems—the Prognostic Nutritional Index (PNI) and the Controlling Nutritional Status (CONUT)—calculated using laboratory parameters obtained at ED admission, in predicting 30-day mortality among hospitalized AP patients.

Material and Methods: This retrospective observational study analyzed the data of adult patients who were admitted to the hospital with a diagnosis of AP through the ED over a two-year period. PNI and CONUT scores were calculated using laboratory parameters obtained at initial presentation, and their predictive performance for 30-day mortality was compared.

Results: A total of 330 patients with AP were included in the study. By the end of the 30-day follow-up, 42 patients (12.7%) had died. Deceased patients were significantly older compared to survivors (69.1 ± 11.4 vs. 52.2 ± 14.0 years, $p < 0.001$). Albumin and total cholesterol levels were significantly lower, while C-reactive protein (CRP) and the CRP/albumin ratio were significantly higher in non-survivors (all $p < 0.001$). The PNI score was significantly lower in the deceased group (36.1 ± 3.02 vs. 43.0 ± 3.50, $p < 0.001$), while the CONUT score was significantly higher (5.50 ± 1.71 vs. 2.50 ± 1.35, $p < 0.001$). Logistic regression analysis identified both scores as independent predictors of 30-day mortality (PNI: OR = 0.64, 95% CI: 0.55–0.72; CONUT: OR = 2.95, 95% CI: 2.20–4.05; $p < 0.001$). Receiver operating characteristic (ROC) analysis showed an area under the curve (AUC) of 0.82 (95% CI: 0.76–0.88) for PNI and 0.85 (95% CI: 0.80–0.90) for CONUT. No statistically significant difference in discriminative performance was found between the two scores ($p = 0.116$).

Conclusion: This study compared the performance of the PNI and CONUT scores in predicting 30-day mortality among patients with acute pancreatitis admitted through the ED. Both scoring systems provided meaningful prognostic information. While the CONUT score was more sensitive in identifying high-risk patients, the PNI score was more effective in distinguishing those with lower mortality risk.

Keywords: Acute pancreatitis, emergency department, mortality, nutritional assessment, prognostic nutritional index, scoring systems.

ÖZ

Amaç: Acil servis (AS)'te akut pankreatit (AP) hastalarının yönetiminde yalnızca erken tanının konulması değil, aynı zamanda risk sınıflandırmasının da klinik karar verme sürecine dâhil edilmesi önerilmektedir. AP'nin immünonutrisyonel bir hastalık olduğu göz önüne alındığında, bu çalışmada, AS başvurusunda elde edilen laboratuvar parametreleri kullanılarak hesaplanan iki immünonutrisyon temelli skorlama sistemi—Prognostik Nutrisyonel İndeks (PNI) ve Kontrol Edilen Nutrisyonel Durum (CONUT)—arasında karşılaştırma yapılması ve bu skorların hastaneye yatırılan AP hastalarında 30 günlük mortaliteyi öngörmedeki performanslarının değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler: Bu retrospektif gözlemsel çalışmada, iki yıllık bir süre boyunca AS aracılığıyla AP tanısıyla hastaneye yatırılan erişkin hastaların verileri analiz edilmiştir. PNI ve CONUT skorları, hastaların ilk başvuru anında elde edilen laboratuvar parametreleri kullanılarak hesaplanmış ve bu skorların 30 günlük mortaliteyi öngörmedeki performansları karşılaştırılmıştır.

Bulgular: Çalışmaya toplam 330 AP hastası dâhil edilmiştir. Otuz günlük takip sonunda 42 hasta (%12,7) hayatını kaybetmiştir. Ölen hastalar, sağ kalanlara kıyasla anlamlı derecede daha yaşlıydı (69,1 ± 11,4 vs. 52,2 ± 14,0 yıl, $p < 0,001$). Albümin ve total kolesterol düzeyleri ölenlerde anlamlı şekilde daha düşük, C-reaktif protein (CRP) ve CRP/albümin oranı ise anlamlı şekilde daha yüksekti (tümü $p < 0,001$). PNI skoru ölen hastalarda anlamlı olarak daha düşük bulunurken (36,1 ± 3,02 vs. 43,0 ± 3,50, $p < 0,001$), CONUT skoru daha yüksekti (5,50 ± 1,71 vs. 2,50 ± 1,35, $p < 0,001$). Lojistik regresyon analizinde her iki skor da 30 günlük mortalitenin bağımsız öngördürücüleri olarak belirlendi (PNI: OR = 0,64, %95 GA: 0,55–0,72; CONUT: OR = 2,95, %95 GA: 2,20–4,05; $p < 0,001$). ROC analizinde PNI için eğri altı alan (AUC) 0,82 (%95 GA: 0,76–0,88), CONUT için ise 0,85 (%95 GA: 0,80–0,90) olarak bulundu. İki skor arasında ayırt edici performans açısından istatistiksel olarak anlamlı bir fark saptanmadı ($p = 0,116$).

Sonuç: Bu çalışma, AS üzerinden başvuran akut pankreatitli hastalarda 30 günlük mortaliteyi öngörmede PNI ve CONUT skorlarının performansını karşılaştırmıştır. Her iki skorlama sistemi de anlamlı prognostik bilgi sağlamıştır. CONUT skoru yüksek riskli hastaları belirlemede daha hassas iken, PNI skoru düşük mortalite riskine sahip hastaları ayırt etmede daha etkili bulunmuştur.

Anahtar Kelimeler: Akut pankreatit, acil servis, mortalite, nutrisyonel değerlendirme, prognostik nutrisyonel indeks, skorlama sistemleri.

Received: 14 July 2025 Accepted: 24 August 2025

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Atıf için/Cited as: Alpar S, Ergun Suzer N, Yilmaz S. Comparison of Nutrition-Based Scoring Systems for Predicting Mortality in Patients with Acute Pancreatitis in the Emergency Department. Anatolian J Emerg Med 2025;8(3):120-127. https://doi.org/10.54996/anatolianjem.1742080.

Introduction

Acute pancreatitis (AP) is an inflammatory disease of the pancreas that is commonly encountered in the emergency department (ED). It is characterized by abdominal pain and elevated levels of pancreatic enzymes in the blood, and its diagnostic and therapeutic approach is often complex due to its variable severity and potential for high mortality. The global incidence of AP has been increasing in recent years, ranging from 33 to 74 cases per 100,000 person-years (1). In the ED population, approximately one-third of AP cases are classified as moderate or severe at the time of diagnosis (2). Therefore, early diagnosis and timely risk stratification are critical for optimal management in the ED setting.

The pathophysiology of AP begins with the premature activation of trypsinogen to trypsin within acinar cells instead of the pancreatic ductal lumen, resulting in local pancreatic autodigestion (3). This early enzymatic activation leads to the release of damage-associated molecular patterns, which in turn trigger the inflammatory cascade, increasing capillary permeability, causing endothelial injury, and contributing to microvascular thrombosis. This pathologic sequence underlies both the local and systemic manifestations of AP. Consequently, AP progresses from a localized inflammatory condition to a systemic inflammatory response in the early stages.

According to the current guidelines of the American College of Gastroenterology, a risk assessment and hemodynamic evaluation should be performed at the time of AP diagnosis to guide decisions regarding hospital admission and appropriate level of care (ward vs. intensive care unit) (4). Although early hemodynamic parameters are often used to assess severity, a key limitation of existing prognostic tools is their inability to reliably distinguish between moderately severe and severe AP (5). Factors such as vomiting, third-space fluid loss, and hemoconcentration can complicate clinical interpretation.

Given the inflammatory and catabolic nature of AP, a patient's immune and nutritional status is increasingly recognized as a relevant indicator in early risk assessment. Accordingly, interest has grown in scoring systems that integrate laboratory-based immunonutritional markers. The Prognostic Nutritional Index (PNI), calculated using serum albumin and lymphocyte count, reflects both nutritional status and immune function. Originally developed by Onodera et al. to predict postoperative complications and mortality in gastrointestinal cancer surgery (6). PNI has since been applied in various clinical contexts to evaluate immunonutritional risk (7,8). The Controlling Nutritional Status (CONUT) score incorporates serum albumin, total lymphocyte count, and total cholesterol, and was developed by Ignacio de Ulíbarri and colleagues as a rapid and automated tool to identify malnutrition using routine laboratory data (9). CONUT is simple, cost-effective, and objective, enabling nutritional risk screening without the need for physical examination.

Despite the clinical value of both scoring systems in assessing immunonutritional status, studies comparing their prognostic performance in patients with acute pancreatitis remain scarce. In particular, there is a lack of evidence directly contrasting the predictive accuracy of PNI and CONUT in the emergency department setting, where early risk stratification is critical. Addressing this gap, the present study aimed to evaluate and compare the prognostic value of PNI and CONUT scores—calculated from laboratory tests obtained at ED admission—in predicting 30-day mortality among patients diagnosed with acute pancreatitis and subsequently hospitalized.

Material and Methods

Study Design

This study was designed as a retrospective, two-center, descriptive, and comparative observational study. It was conducted in the EDs of two tertiary care hospitals in Istanbul—one a university hospital and the other a private institution. The study included adult patients who were diagnosed with AP in the ED and subsequently hospitalized between January 1, 2023, and January 1, 2025. The primary objective was to compare the performance of the PNI and the CONUT scores—calculated based on laboratory parameters obtained at admission—in predicting 30-day mortality. This study was approved by the Ethics Committee of University of Memorial Bahcelievler Hospital (Approval No: 146, Date: 27.03.2025).

Study Population

The study population consisted of adult patients who presented to the EDs of two tertiary care hospitals in Istanbul during the two-year study period, were diagnosed with AP, and were subsequently hospitalized. The diagnosis of AP was made in accordance with the 2024 guidelines of the American College of Gastroenterology (4). which require the presence of at least two of the following: (1) characteristic clinical symptoms—particularly severe epigastric pain, (2) serum amylase and/or lipase levels elevated to more than three times the upper limit of normal, and (3) imaging findings consistent with AP on ultrasonography or computed tomography.

The university hospital participating in the study receives approximately 1,500–2,000 ED visits per month, while the private tertiary care hospital sees between 1,000–1,300 monthly ED visits. In both centers, the laboratory parameters required for calculating PNI and CONUT scores—namely serum albumin, total lymphocyte count, and total cholesterol—are available 24/7. As both centers are equipped with 24-hour access to medical equipment, diagnostic imaging, surgical intervention rooms, and on-call surgical teams, uninterrupted AP diagnosis and management are always possible.

Inclusion criteria were as follows: patients aged 18 years and older, diagnosed with AP, and with complete laboratory data obtained from peripheral venous blood samples at ED admission, including albumin, total lymphocyte count, and total cholesterol. Exclusion criteria included active malignancy or advanced-stage solid tumors, cirrhosis or severe chronic liver disease, use of immunosuppressive therapy (e.g., systemic corticosteroids, chemotherapy, or biologic agents), a diagnosis of chronic pancreatitis with acute exacerbation, major surgery within the past 30 days, signs of active infection at presentation, and missing laboratory data required for score calculation.

In our study, the decision to admit a patient to the ICU was based on clinical criteria and the treating physician's judgment at the time of presentation. Several factors

influenced this decision, including the patient's hemodynamic stability, comorbid conditions, and the availability of ICU beds.

The primary outcome was 30-day all-cause mortality after admission. Thirty-day mortality was selected instead of in-hospital or ICU mortality because it provides a standardized short-term outcome measure that encompasses both deaths occurring during hospitalization and those occurring shortly after discharge. This timeframe allows for a more comprehensive assessment of the early prognostic value of immunonutrition-based indices in acute pancreatitis.

Data Collection

In this study, data were retrospectively obtained from the hospital information management systems (HIMS) and patient files completed by ED nurses at both participating centers. The ED admission records, laboratory results, clinical observation forms, imaging reports, and discharge summaries of all eligible patients were systematically reviewed. Data were transferred in a standardized manner to a pre-designed data collection form created in line with the study objectives.

Two independent health records officers—one at each center—were responsible for retrieving the data. Both officers had at least three years of experience with hospital data systems and HIMS. In cases of uncertainty or disagreement between the two, consensus was achieved under the supervision of the principal investigator, an emergency physician.

The following data were collected at the time of ED admission: demographic information (age, sex, body mass index), presenting symptoms (abdominal pain, nausea, vomiting, fever), etiological factors (e.g., gallstones, alcohol use, hyperlipidemia, drug-related causes), vital signs, and laboratory values obtained from peripheral venous blood samples. These included C-reactive protein (CRP), albumin, total lymphocyte count, total cholesterol, blood urea nitrogen (BUN), creatinine, white blood cell (WBC) count, hemoglobin, procalcitonin, and neutrophil-to-lymphocyte ratio (NLR).

In addition, the following clinical outcomes were recorded: hospitalization details (admission unit—ward or intensive care unit), need for mechanical ventilation, length of hospital stay, and 30-day all-cause mortality after admission.

All collected data were anonymized and stored in a secure digital database accessible only to the research team. Data confidentiality and patient privacy were maintained in accordance with the principles of the Declaration of Helsinki and relevant national regulations.

Patients with missing values for any of the core laboratory parameters used in the nutritional scores (serum albumin, total lymphocyte count, or total cholesterol) were excluded from the final analysis (n = 14, 2.9% of initially screened cases). Due to the low proportion of missing data and the known limitations of imputation for clinical laboratory variables in acute settings, no imputation methods were applied, and complete-case analysis was used.

Score Calculation

Two different scoring systems were used in this study to assess the immunonutritional status of the patients: the PNI and the CONUT score.

The PNI was calculated using the following formula:

PNI = (10 × Albumin [g/dL]) + (0.005 × Total Lymphocyte Count [/mm³])

The CONUT score is calculated using three laboratory parameters: serum albumin, total lymphocyte count, and total cholesterol. Each parameter is assigned a specific score based on its value at admission, and the final CONUT score is the sum of the individual scores for each parameter (10). The scoring system is as follows: For serum albumin, a value of ≥3.50 g/dL is considered normal and scored as 0, while a value between 3.00 and 3.49 g/dL indicates mild undernutrition and is scored as 2. A value between 2.50 and 2.99 g/dL reflects moderate undernutrition with a score of 4, and a serum albumin level of <2.50 g/dL indicates severe undernutrition, scored as 6; For total lymphocyte count, a count of ≥1,600/mm³ is normal and scored as 0. A count between 1,200 and 1,599/mm³ suggests mild undernutrition, scoring 1 point. Moderate undernutrition corresponds to a lymphocyte count between 800 and 1,199/mm³, scoring 2 points, while a count of <800/mm³ indicates severe undernutrition and scores 3 points; For total cholesterol, a value of ≥180 mg/dL is normal and scored as 0. Mild undernutrition is indicated by a cholesterol level between 140 and 179 mg/dL, scoring 1 point. Moderate undernutrition is associated with a cholesterol level between 100 and 139 mg/dL, scoring 2 points, and severe undernutrition corresponds to a level of <100 mg/dL, scoring 3 points. The final CONUT score is the sum of the scores from each of the three parameters: serum albumin score, total lymphocyte score, and total cholesterol score. The score ranges from 0 to 12, with higher scores indicating a greater degree of undernutrition: 0–1 (normal), 2–4 (mild), 5–8 (moderate), and 9–12 (severe).

In addition to PNI and CONUT, the Bedside Index for Severity in Acute Pancreatitis (BISAP) score was also calculated, as it is a widely validated, simple, and easily applicable severity index in the early assessment of AP. Other established prognostic scores such as Ranson's criteria, APACHE II, and the Revised Atlanta Classification were not systematically incorporated, as the primary focus of this study was to evaluate and compare immunonutrition-based scores. BISAP was included to provide a familiar clinical benchmark for comparison in the ED setting.

Statistical Analysis

Statistical analyses were conducted using R version 4.4.2. Continuous variables were assessed for normality using the Kolmogorov-Smirnov test and visual inspection of histograms. Normally distributed variables were reported as mean ± standard deviation and compared using the independent samples t-test, while non-normally distributed variables were compared using the Mann-Whitney U test. Categorical variables were expressed as frequencies and percentages and analyzed using the chi-square test or Fisher's exact test, as appropriate.

The sample size was determined by including all eligible patients within the two-year study period, resulting in 330 patients and 42 mortality events. Logistic regression analysis was performed to assess the association between PNI and CONUT scores with 30-day mortality. To ensure the suitability of the regression model given the number of events per variable, we limited the number of covariates in the multivariable model and applied a threshold of $p < 0.20$

in univariate analyses for variable selection. Multicollinearity was assessed using the Variance Inflation Factor (VIF), and variables with VIF > 5 were excluded. To further reduce the risk of overfitting, model performance was validated using bootstrapping with 2,000 replicates. Model performance was evaluated using the area under the receiver operating characteristic curve (AUC). Confidence intervals for AUC values were derived using 2000 bootstrap replicates. Comparisons of AUC values between PNI and CONUT were conducted using DeLong's test for correlated ROC curves, with statistical significance set at $p < 0.05$. Diagnostic accuracy measures, including sensitivity, specificity, positive and negative likelihood ratios, were calculated.

Results

Patient flowchart is presented in Figure 1. A total of 330 patients diagnosed with acute pancreatitis were included in the study, with 288 survivors (87.3%) and 42 deceased patients (12.7%) at 30 days. The baseline characteristics, laboratory findings, and severity scores are summarized in Table 1. Deceased patients were significantly older (69.1 ± 11.4 vs. 52.2 ± 14.0 years, Δ16.9 [95% CI: 12.2–21.6], $p < 0.001$), but sex distribution and BMI were similar between groups. Among etiological factors, gallstone pancreatitis was the most common cause (49.1% of all cases). Significant differences were observed in laboratory values, particularly higher CRP in deceased patients (97 ± 18 mg/L vs. 80 ± 18 mg/L, Δ17.0 [95% CI: 9.6–24.4], $p < 0.001$), lower albumin levels in deceased patients (3.08 ± 0.28 g/dL vs. 3.65 ± 0.28 g/dL, Δ–0.57 [95% CI: –0.65 to –0.49], $p < 0.001$), higher CRP/albumin ratio ($p = 0.014$), and lower total cholesterol in deceased patients ($p < 0.001$). The PNI score was significantly lower in the deceased group (36.1 ± 3.02 vs. 43.0 ± 3.50, Δ–6.9 [95% CI: –8.0 to –5.7], $p < 0.001$), while the CONUT score was significantly higher (5.50 ± 1.71 vs. 2.50 ± 1.35, Δ3.0 [95% CI: 2.5–3.5], $p < 0.001$). There was no statistically significant difference in BISAP scores between groups.

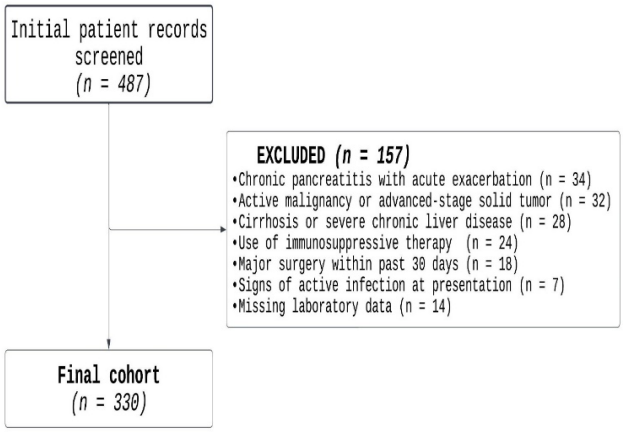

Figure 1. Patient flowchart

Variable	Total (n=330)	Survivors (n=288)	Deceased (n=42)	Mean Difference (95% CI)	p
Age, years	53.2 ± 14.0	52.2 ± 14.0	69.1 ± 11.4	-15.9 (-20.4 to -11.5)	<0.001
Female sex	147 (44.5)	130 (45.1)	17 (40.5)	-	0.688
BMI, kg/m²	24.8 ± 3.8	24.8 ± 3.8	24.5 ± 3.7	0.37 (-0.87 to 1.61)	0.559
Charlson Comorbidity Index	2.95 ± 1.76	2.95 ± 1.76	3.36 ± 2.06	0.41 (-0.99 to 0.18)	0.174
Etiology: gallstone	162 (49.1)	146 (50.7)	16 (38.1)	-	-
Etiology: alcohol	69 (20.9)	59 (20.5)	10 (23.8)	-	-
Etiology: hyperlipidemia	42 (12.7)	36 (12.5)	6 (14.3)	-	-
Etiology: drug-induced	39 (11.8)	30 (10.4)	9 (21.4)	-	-
Etiology: other	18 (5.5)	17 (5.9)	1 (2.4)	-	-
Abdominal pain,	188 (57.0)	160 (55.6)	28 (66.7)	-	-
Nausea	70 (21.2)	65 (22.6)	5 (11.9)	-	-
Vomiting	55 (16.7)	49 (17.0)	6 (14.3)	-	-
Fever	17 (5.2)	14 (4.9)	3 (7.1)	-	0.349
CRP, mg/L	81.8 ± 18.8	79.8 ± 17.8	97.3 ± 18.3	-15.6 (-21.7 to -9.5)	<0.001
Albumin, g/dL	3.62 ± 0.30	3.65 ± 0.28	3.08 ± 0.28	-0.54 (0.45 to 0.64)	<0.001
Lymphocyte, 10^3/µL	1.26 ± 0.40	1.30 ± 0.38	1.05 ± 0.31	-0.21 (0.08 to 0.34)	0.001
Total Cholesterol, mg/dL	168.7 ± 24.5	172.0 ± 23.0	150.2 ± 20.1	18.6 (10.8 to 26.4)	<0.001
CRP/Albumin Ratio	16.7 ± 11.6	15.0 ± 10.5	22.0 ± 19.9	-5.30 (-9.50 to -1.10)	0.014
BUN, mg/dL	24.1 ± 10.0	23.5 ± 9.8	27.2 ± 10.7	-3.11 (-6.39 to 0.18)	0.064
Creatinine, mg/dL	1.00 ± 0.40	1.05 ± 0.38	0.84 ± 0.32	0.17 (0.04 to 0.29)	0.011
Procalcitonin, ng/mL	1.98 ± 1.58	1.85 ± 1.45	2.03 ± 1.26	-0.05 (-0.56 to 0.45)	0.835
Hemoglobin, g/dL	13.0 ± 1.40	13.0 ± 1.35	13.1 ± 1.70	-0.04 (-0.51 to 0.43)	0.869
WBC, 10^3/µL	9.12 ± 3.15	9.20 ± 3.00	8.71 ± 2.76	0.41 (-0.60 to 1.42)	0.423
NLR	4.08 ± 2.13	3.98 ± 2.00	4.25 ± 2.19	-0.17 (-0.87 to 0.52)	0.624
PNI score	42.5 ± 3.67	43.0 ± 3.50	36.1 ± 3.02	6.47 (5.30 to 7.63)	<0.001
CONUT score	2.75 ± 1.43	2.50 ± 1.35	5.50 ± 1.71	-2.75 (-3.23 to -2.28)	<0.001
BISAP score	2.60 ± 0.80	2.60 ± 0.83	2.50 ± 0.51		0.278
Hospital Stay, days	11.1 ± 4.71	10.5 ± 4.50	14.3 ± 5.49	-3.20 (-4.76 to -1.63)	<0.001
ICU admission	76 (23.0)	52 (18.1)	24 (57.1)	-	<0.001
Mechanical ventilation	56 (17.0)	37 (12.8)	19 (45.2)	-	<0.001

Table 1. Baseline Characteristics of Acute Pancreatitis Patients by 30-Day Mortality

BMI = Body Mass Index; BUN = Blood Urea Nitrogen; CONUT = Controlling Nutritional Status; CRP = C-reactive Protein; ICU = Intensive Care Unit; NLR = Neutrophil-to-Lymphocyte Ratio; PNI = Prognostic Nutritional Index; SD = standard deviation; WBC = White Blood Cell.

Data are presented as mean ± SD or n (%).

Variable	Odds Ratio (95% CI)	p
PNI score	0.578 (0.491 – 0.663)	<0.001
CONUT score	3.143 (2.346 – 4.451)	<0.001
Age	1.04 (0.99 – 1.10)	0.145
CRP	1.05 (0.09 – 1.08)	0.074
Creatinine	0.56 (0.36 – 2.12)	0.555
Charlson Index	1.03 (0.92 – 1.12)	0.781
Total cholesterol	0.95 (0.91 – 1.02)	0.112

Table 2. Logistic regression analysis for 30-day mortality
AUC = Area Under the Curve; CI = Confidence Interval; +LR = Positive Likelihood Ratio; -LR = Negative Likelihood Ratio; PNI = Prognostic Nutritional Index; CONUT = Controlling Nutritional Status.

In the multivariable logistic regression analysis (Table 2), both the PNI and CONUT scores were independently associated with 30-day mortality. Lower PNI scores were significantly associated with increased odds of death [OR 0.578 (95% CI: 0.491–0.663), p < 0.001], while higher CONUT scores were also linked to elevated risk [OR 3.143 (95% CI: 2.346–4.451), p < 0.001]. Other variables, including age, CRP, creatinine, Charlson comorbidity index, and total cholesterol, were not statistically significant predictors. The model demonstrated good overall performance, with an area under the ROC curve (AUC) of 0.89 (95% CI: 0.84–0.94). Calibration assessed by the Hosmer-Lemeshow test yielded a p-value of 0.72, suggesting no significant lack of fit. The Nagelkerke R^2 was 0.48, and the Brier score was 0.094, indicating acceptable predictive accuracy and discrimination. Model discrimination was assessed using AUC values, with PNI achieving an AUC of 0.82 (95% CI: 0.76–0.88) and CONUT achieving an AUC of 0.85 (95% CI: 0.80–0.90). The comparison of AUC values indicated no statistically significant difference between the two scoring systems in predicting 30-day mortality (p = 0.29).

The PNI score had a sensitivity of 81% and specificity of 78%, while the CONUT score had a sensitivity of 85% and specificity of 75%. Positive likelihood ratios were 3.7 for PNI and 3.4 for CONUT, while negative likelihood ratios were 0.24 and 0.20, respectively. Overall, both nutritional scores demonstrated acceptable discrimination for predicting 30-day mortality in acute pancreatitis patients, but neither was significantly superior to the other. Figure 2 illustrates the ROC curves comparing the two scoring systems. The comparison of the ROC curves for PNI and CONUT scores using DeLong's test yielded a p-value of 0.116, indicating that there is no statistically significant difference between the two AUCs. The 95% confidence interval for the difference in AUC values ranged from -0.0077 to 0.0698, further supporting that any observed difference in discrimination ability between PNI and CONUT is not statistically significant. To further assess whether the prognostic value of the PNI and CONUT scores extended beyond their individual components, additional multivariable logistic regression models were constructed, including the scores and their constituent laboratory parameters. In the model adjusting for albumin and lymphocyte count, the association of PNI with 30-day mortality was no longer statistically significant (p = 0.471). Similarly, after adjustment for albumin, lymphocyte count, and total cholesterol, CONUT also lost its independent association with mortality (p = 0.599).

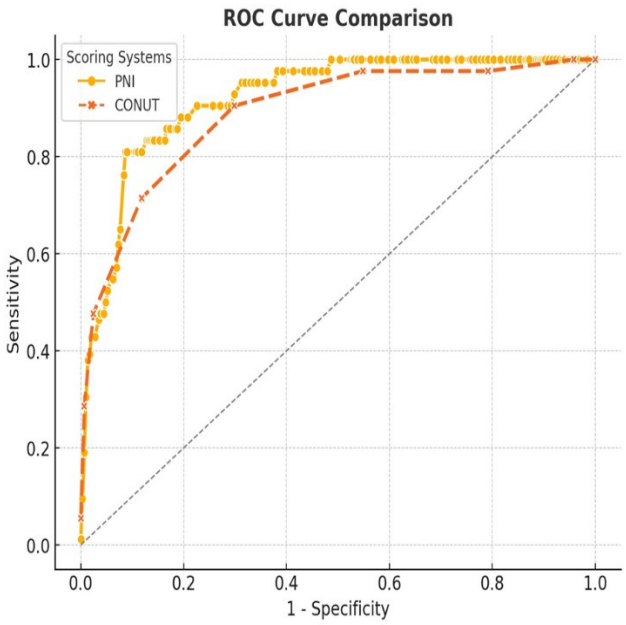

Figure 2. Comparison of PNI and CONUT Scores for 30-Day Mortality Prediction

However, these models exhibited substantial multicollinearity, particularly for PNI (VIF > 7000), suggesting that simultaneous inclusion of composite scores and their components may result in unstable estimates and limit interpretability.

Discussion

In this study, the prognostic value of the PNI and the CONUT scores—both considered indicators of immunonutritional status—was compared in predicting 30-day mortality among patients diagnosed with AP and hospitalized through the ED. Both scoring systems were found to be significantly associated with mortality and identified as independent risk factors. While the CONUT score demonstrated higher sensitivity, the PNI score showed better specificity. Both scores had good discriminative ability, although no statistically significant difference was observed between them.

When examining predictors of poor outcomes in patients with AP, factors such as age, sex, body mass index (BMI), alcohol consumption, presenting symptoms, and organ failure are commonly highlighted. Previous studies have reported that older and more obese patients tend to experience more severe clinical courses, whereas gender does not appear to be a significant factor (11,12). In the current study, age was significantly higher in patients who died within 30 days, but there were no differences in sex or BMI. While the literature defines obesity as a BMI >30 and investigates its relationship with AP severity, our study directly assessed the association between BMI and mortality, finding no significant correlation (13). The absence of such a relationship may be explained by the fact that the mean BMI in both cohorts was below 30, making our results consistent with the existing literature.

With respect to etiology, gallstone-related pancreatitis (49.1%), alcohol use (20.9%), hyperlipidemia (12.7%), drug-induced pancreatitis (11.8%), and other causes (5.5%) were observed in our patient population. This distribution is

largely consistent with data reported in the literature on the etiology of AP. In developing countries such as Türkiye, gallstones are the leading cause of AP (14), whereas alcohol-related cases are more common in Western populations (15). An increasing number of hyperlipidemia-induced AP cases has been noted in recent years, likely due to changes in lifestyle and dietary habits (16).

In terms of symptoms, most patients presented with persistent, severe epigastric and left upper quadrant abdominal pain, frequently accompanied by nausea and vomiting, which aligns with previous findings (17).

Certain laboratory values are commonly used to assess disease severity in AP. These include elevated hematocrit (≥44%), blood urea nitrogen (BUN ≥ 20 mg/dL), C-reactive protein (CRP ≥150 mg/L), and creatinine (≥2 mg/dL), all of which have been shown to be significant predictors of moderately severe and severe disease in prior studies (18,19). In our analysis, non-survivors had significantly higher CRP levels and CRP/albumin ratios, and significantly lower albumin and total cholesterol levels. Lymphocyte counts were also lower in the mortality group. Although BUN was higher in non-survivors, the difference was not statistically significant, and no significant differences were observed in other parameters such as procalcitonin, hemoglobin, or white blood cell (WBC) count. Interestingly, creatinine levels were lower in the mortality group, a finding that was unexpected and possibly related to differences in muscle mass, hydration status, or methodological factors.

The PNI score is calculated using serum albumin and peripheral lymphocyte count, while the CONUT score also includes total cholesterol. Albumin, lymphocyte count, and cholesterol levels have all been associated with both nutritional status and immune competence (20–22). In this study, both PNI and CONUT scores were found to be significant predictors of 30-day mortality in patients with AP. However, some notable differences emerged when the scores were compared. The PNI score was significantly lower among non-survivors, whereas the CONUT score was significantly higher. The inclusion of cholesterol in the CONUT score provides additional insight into the patient's metabolic stress, which may explain its stronger association with adverse outcomes.

Another potential limitation of our study is the absence of alternative nutritional indices, such as the Geriatric Nutritional Risk Index (GNRI), which has been proposed as a valuable tool for assessing nutritional status, particularly in older populations (23,24). Unlike the PNI and CONUT scores, which primarily incorporate serum albumin, lymphocyte count, and cholesterol levels, GNRI is calculated using serum albumin and body weight parameters. Specifically, GNRI is derived from the following formula: GNRI = [1.489 × albumin (g/L)] + [41.7 × (current weight/ideal weight)]. This difference in calculation makes GNRI particularly useful in populations where body mass index (BMI) and weight loss are crucial for evaluating nutritional risk. In contrast, PNI and CONUT scores focus more on immunonutritional and inflammatory markers. Considering that obesity and BMI were discussed as potential influencing factors in our study, the inclusion of GNRI could have provided additional insights, particularly in evaluating the nutritional risk of obese or elderly patients. Future studies could benefit from incorporating GNRI alongside PNI and CONUT to compare their prognostic value in patients with acute pancreatitis.

These findings reinforce that while individual laboratory components are associated with outcomes, the composite indices (PNI and CONUT) provide superior clinical utility by integrating multiple parameters into a single, validated score. Our findings are consistent with previous studies. For example, Shi et al. reported that the CONUT score strongly predicted short-term mortality in patients with severe AP (25). Akkuzu et al. also highlighted the prognostic value of both CONUT and PNI scores in AP and noted their responsiveness to inflammatory changes (26). In a study by Çavuşoğlu Türker et al., the CONUT score demonstrated high discriminative ability in predicting mortality compared to the BISAP score and the revised Atlanta classification (27). While the CONUT score showed greater overall discriminative power in our study, the difference between the two scores was not statistically significant. This suggests that both scoring systems offer comparable prognostic utility and may be used complementarily in clinical practice. The inclusion of cholesterol in the CONUT score may offer an advantage in patients with concurrent metabolic disturbances, whereas the PNI score may be more effective for identifying patients with a lower risk of mortality.

Limitations

This study has several limitations that should be acknowledged: 1) One of the potential limitations of our study is the variability in blood test data between the two participating centers. Although both hospitals adhere to national laboratory standardization systems and undergo regular quality assurance audits, minor differences in test results may still occur due to variations in equipment calibration and procedural nuances. Routine calibration processes are implemented to minimize such variability. Despite these standardization efforts, inter-center differences remain a potential limitation of this study; 2) The study was conducted in the EDs of two tertiary care hospitals equipped with advanced medical technology. It was assumed that patients hospitalized with a diagnosis of acute pancreatitis (AP) received treatment according to current clinical management algorithms. Post-admission treatments were presumed to follow these guidelines consistently. As a result, the study did not specifically evaluate the relationship between PNI and CONUT scores and individual treatment strategies; 3) A further limitation is that disease severity stratification was not performed using standardized classifications such as the Revised Atlanta criteria. By focusing solely on 30-day mortality, potential differences in the prognostic performance of PNI and CONUT scores across mild, moderately severe, and severe acute pancreatitis phenotypes could not be assessed. This may limit the granularity of our findings, and future studies incorporating both mortality and disease severity stratification are warranted.; 4) Both participating centers operate as private hospitals. While ICU admission is covered for patients in need, standard inpatient ward care is only available to those with private insurance. Patients without appropriate insurance coverage are often transferred to alternative hospitals, where their insurance is accepted. Due to the lack of follow-up data for these transferred patients, they were excluded from the study, potentially introducing selection

bias; 5) Another limitation relates to the study setting. Both participating centers were university-affiliated or private tertiary hospitals with advanced diagnostic and treatment capabilities. As such, the results may not be fully generalizable to public hospitals or resource-limited settings, where differences in patient populations, availability of laboratory tests, and clinical management protocols could influence outcomes. Caution is therefore warranted when extrapolating these findings beyond similar tertiary care environments; 6) One key limitation is the relatively small number of mortality events, which may have impacted our ability to fully adjust for key confounders, such as age, in the logistic regression analysis. Although age was included as a variable in the univariate analysis, the limited sample size of deceased patients restricted its incorporation into multivariable models. Further studies with larger sample sizes are necessary to better assess the impact of age and other potential confounding factors; 7) Although the regression models were adjusted to reduce overfitting through variable pre-selection and bootstrapping, the relatively limited number of events (42 deaths) restricted the complexity of the models and may still pose a risk of model instability; 8) An additional limitation is the relatively small number of patients in the mortality group (n = 42), which may limit the robustness of the multivariable analyses and reduce statistical power. This constraint restricted our ability to fully adjust for key confounding factors such as age and comorbidities, and the observed associations should therefore be interpreted with caution.

Conclusion

In this study, the performance of the PNI and the CONUT scores—calculated using laboratory data obtained at ED admission—was compared in predicting 30-day mortality in patients hospitalized with AP. Both scoring systems were found to be significant predictors of mortality. While the CONUT score provided a more sensitive approach to identifying high-risk patients, the PNI score demonstrated greater specificity, particularly in identifying low-risk individuals. However, no statistically significant difference was observed between the two scores, suggesting that both may offer comparable clinical utility.

Conflict of Interest: The authors declare that there is no conflict of interest.

Financial Support: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contribution: SA: Data curation, investigation, methodology, project administration, visualization, writing – original draft (lead) **NES:** Data curation, formal analysis, software, investigation, writing – original draft (supporting) **SY:** Conceptualization, data curation, formal analysis, investigation, methodology, project administration, supervision, writing – review & editing. All authors read and approved the final version of the manuscript.

Ethical Approval: Ethical approval was obtained from the Ethics Committee of University of Memorial Bahcelievler Hospital before the study (Approval No: 146, Date: 27.03.2025).

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