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Is the Ranson score sufficient and up-to-date for predicting prognosis in acute pancreatitis?

Akut pankreatitte prognostik öngörüde Ranson skoru yeterli ve güncel mi?

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ABSTRACT

Aim: Early identification of patients at risk for poor prognosis in acute pancreatitis (AP) is essential in the emergency department. This study aimed to evaluate whether the admission Ranson score predicts poor prognosis and to compare its performance with simple inflammatory markers, particularly the neutrophil-to-lymphocyte ratio (NLR).
Materials and Methods: This retrospective study included adult patients diagnosed with AP in the emergency department between January 2022 and January 2025. Demographic characteristics, etiology, laboratory parameters obtained at admission, radiological imaging status, and length of hospital stay were recorded. Poor prognosis was defined as the presence of at least one of the following: pancreatic necrosis, admission to the intensive care unit (ICU), or in-hospital mortality. Multivariable logistic regression and receiver operating characteristic (ROC) curve analyses were performed.
Results: A total of 319 patients were included, of whom 68 (21.3%) had poor prognosis. Patients with poor prognosis were older and had higher white blood cell counts, glucose levels, and NLR values. In multivariable analysis, biliary etiology (adjusted OR=0.30, 95% CI=0.14–0.67) and NLR (adjusted OR=1.06, 95% CI=1.02–1.11) were independently associated with poor prognosis, whereas the admission Ranson score was not. NLR demonstrated a higher, but limited, discriminative ability (AUC=0.678) compared with the Ranson score (AUC=0.611) and WBC (AUC=0.597).
Conclusion: The admission Ranson score has limited value for predicting poor prognosis in patients with AP. In contrast, NLR is a simple, inexpensive, and more useful biomarker for early risk stratification in the emergency department.

Keywords: *Acute pancreatitis, Ranson score, Emergency department, Prognosis*

ÖZ

Amaç: Akut pankreatitte (AP) kötü prognoz riski taşıyan hastaların erken tanınması acil serviste kritik öneme sahiptir. Bu çalışmanın amacı, başvuruda hesaplanan Ranson skorunun kötü prognozu öngörüp öngöremediğini değerlendirmek ve performansını özellikle nötrofil-lenfosit oranı (NLR) başta olmak üzere basit inflamatuvar belirteçlerle karşılaştırmaktır.
Gereçler ve Yöntemler: Bu retrospektif çalışmaya Ocak 2022–Ocak 2025 tarihleri arasında acil serviste AP tanısı alan erişkin hastalar dahil edildi. Demografik özellikler, etiyoloji, başvuru anındaki laboratuvar parametreleri, radyolojik görüntüleme durumu ve hastanede yatış süresi kaydedildi. Kötü prognoz; pankreatik nekroz varlığı, yoğun bakım ünitesine (YBÜ) yatış veya hastane içi mortaliteden en az birinin bulunması olarak tanımlandı. Çok değişkenli lojistik regresyon ve alıcı işletim karakteristiği (ROC) eğrisi analizleri yapıldı.
Bulgular: Toplam 319 hasta çalışmaya alındı ve bunların 68'inde (%21,3) kötü prognoz saptandı. Kötü prognozlu hastalar daha yaşlıydı ve beyaz küre sayısı, glukoz düzeyi ve NLR değerleri daha yüksekti. Çok değişkenli analizde biliyer etiyoloji (düzeltilmiş OR=0.30; %95 GA=0,14–0,67) ve NLR (düzeltilmiş OR=1,06; %95 GA=1,02–1,11) kötü prognoz ile bağımsız olarak ilişkili bulundu; başvuru Ranson skoru ise ilişkili değildi. NLR (AUC=0,678), Ranson skoru (AUC=0,611), ve beyaz küre sayısına (AUC=0,597), kıyasla daha yüksek, ancak sınırlı bir ayırt edici güce sahipti.
Sonuç: Başvuru Ranson skorunun AP'li hastalarda kötü prognozu öngörmede sınırlı değeri vardır. Buna karşılık NLR, acil serviste erken risk sınıflandırması için basit, ucuz ve daha kullanışlı bir biyobelirteçtir.

Anahtar Kelimeler: *Akut pankreatit, Ranson skor, Acil servis, Prognoz*

INTRODUCTION

Acute pancreatitis (AP) is an inflammatory condition that disrupts trypsin activation, resulting in the digestion of pancreatic parenchyma by other activated enzymes (1). Abdominal pain is a prominent symptom of AP, typically radiating from the epigastrium to the flank and back. This discomfort tends to persist and may be accompanied by additional symptoms such as vomiting and nausea. AP is diagnosed when at least two of the following are present: typical abdominal pain, ≥3-fold elevation of serum lipase/amylase, and compatible imaging findings (2,3).

AP is one of the most common gastrointestinal diseases in wards and intensive care units, occurring in 13–45 cases per 100,000 individuals annually (4). The worldwide prevalence of AP varies between 4.9 and 73.4 per 100,000 individuals (5). From 2002 to 2012, there was a 16% increase in the number of hospital admissions for pancreatitis (6). Gallstones have a prevalence of 8.1% in adults; although approximately 75% of cases are asymptomatic, they lead to AP in nearly 8% and account for 40–70% of all AP cases (6–9). Most cases (~80%) are acute edematous pancreatitis with a mild, self-limiting course, while ~20% develop acute necrotizing pancreatitis associated with severe organ failure and high morbidity and mortality (9,10).

Contrast enhanced computed tomography (CECT) is not routinely recommended to confirm AP in patients with typical abdominal pain and elevated pancreatic enzymes; however, it may be used when one diagnostic criterion is absent. If clinical and biochemical findings indicate mild disease and the patient improves within the first 24 hours, imaging is not required for severity assessment (11,12). Overall mortality in AP is approximately 3–10%, increasing to 36–50% in severe cases (13–15). Therefore, early identification of patients who may require aggressive management is essential to reduce morbidity and mortality. Disease severity can be assessed using several single- and multiparameter predictors, including Ranson, APACHE II, Multiple Organ Failure Score, and Modified Glasgow scoring systems (16).

The first scoring system developed for the purpose of predicting severity and mortality in AP was introduced by John Ranson and colleagues in 1974. One of the scoring systems that has been analysed and is widely used is Ranson (17). Initially, a total of 43 parameters were included. In 1982, the criteria were modified to include 11 parameters: five evaluated at admission and six after 48 h (18). This first AP scoring system can be applied to both biliary and non-biliary pancreatitis. It uses parameters obtained at admission to estimate the risk of pancreatic necrosis and includes an additional component assessed at 48 hours to evaluate the risk of severe disease, incorporating indicators such as hemoconcentration, pre-renal acute kidney injury, acidosis, hypocalcemia, and hypoxemia.

The neutrophil-to-lymphocyte ratio (NLR), which reflects the balance between neutrophil-mediated inflammation and lymphocyte-mediated immune regulation, has emerged as a simple and readily available marker of systemic inflammatory response and has shown potential prognostic value in AP (19,20). In comparison to other such systems, such as the Acute Physiology and Chronic Health Evaluation (APACHE-II) score, which was developed for the management of critically ill patients in intensive care units, Ranson was developed specifically for AP, with parameters at initial admission and at 48 hours (21).

The objective of this study was to evaluate whether the admission Ranson score predicts poor prognosis and to compare its performance with simple inflammatory markers, particularly NLR.

MATERIALS AND METHODS

This retrospective study was conducted in the emergency department (ED) of a tertiary-level hospital with approximately 600,000 patient visits per year and included patients admitted between January 2022 and January 2025. The study was approved by the Elazig City Hospital Non-Interventional Research Ethics Committee on 20 February 2025, with decision number 2025/4-13.

According to the Oxford Centre for Evidence-Based Medicine (CEBM) Levels of Evidence, this retrospective observational study provides Level 3 evidence.

Patients aged ≥18 years who were diagnosed with AP according to the revised Atlanta criteria (presence of at least two of the following: characteristic abdominal pain, serum amylase or lipase levels ≥3 times the upper limit of normal, and/or imaging findings consistent with AP) were included. Patients with chronic pancreatitis, pancreatic malignancy, hematological disorders, active infection, immunosuppressive therapy, missing laboratory data at admission, or incomplete medical records were excluded. Demographic characteristics (age, sex), etiology (biliary vs. non-biliary), laboratory parameters obtained at admission (white blood cell count, neutrophil count, lymphocyte count, glucose, amylase, lipase, AST, ALT, LDH, and C-Reactive Protein (CRP)), radiological imaging status, and length of hospital stay were recorded. CECT was performed based on the clinical judgment of the emergency physician or upon the recommendation of the consulting physician in patients with suspected complications, lack of clinical improvement, or diagnostic uncertainty, in accordance with current clinical practice.

Admission Ranson score was calculated using the five parameters available at presentation, with different threshold values for biliary and non-biliary pancreatitis, as originally described. The 48-hour components of the Ranson score were not included. Poor prognosis was defined as a composite outcome and was considered present if at least one of the following was observed: pancreatic necrosis, admission to the intensive care unit (ICU), or in-hospital mortality.

Statistical Analysis

SPSS statistical program (IBM Corp. Released in 2013. IBM SPSS Statistics for Windows, version 22.0. Armonk, NY: IBM Corp.) was used for data analysis. Normality of continuous variables was assessed using the Kolmogorov-Smirnov test. Continuous variables were expressed as median (minimum–maximum), and categorical variables as number and percentage.

Comparisons between patients with and without poor prognosis were performed using the Mann–Whitney U test for continuous variables and the Chi-square test for categorical variables.

Variables were selected for multivariable logistic regression based on clinical relevance and study objectives. Age, biliary etiology, admission Ranson score, and NLR were included in the final model. Results were presented as adjusted odds ratios (OR) with 95% confidence intervals (CI). Although WBC and NLR were both associated with prognosis in univariate analysis, only NLR was included in the multivariable model to avoid multicollinearity. Potential multicollinearity between NLR, WBC, and Ranson score was considered during model construction, and variables with overlapping components were not included simultaneously in the model.

Receiver operating characteristic (ROC) curve analysis was performed to evaluate the discriminative ability of Ranson score, NLR, white blood cell (WBC), and CRP for predicting poor prognosis. The area under the curve (AUC) with 95% CI was calculated. Optimal cut-off values were determined using the Youden index. A p-value <0.05 was considered statistically significant.

Additionally, an a priori power analysis using G*Power (version 3.1.9.4) for comparison of two independent groups (two-tailed, effect size d=0.5, α=0.05, power=0.95, allocation ratio 3:1) indicated a required total sample size of 280 participants. Since 319 patients were included, the sample size was considered adequate.

RESULTS

A total of 319 patients with AP were included in the study. Poor prognosis, defined as the presence of pancreatic necrosis and/or intensive care unit (ICU) admission and/or in-hospital mortality, was observed in 68 patients (21.3%), whereas 251 patients (78.7%) had no poor prognosis.

Baseline demographic, etiological, imaging, and laboratory characteristics according to prognosis are summarized in Table 1. Patients with poor prognosis were significantly older than those without poor prognosis (p<0.001). Biliary etiology was less frequent in the poor prognosis group (p=0.009). Patients with poor prognosis had higher WBC counts (p=0.014), higher NLR values (p<0.001), and higher serum glucose levels (p=0.038). Lipase levels were also higher in the poor prognosis group (p=0.032), whereas CRP levels did not differ significantly between groups (p=0.791). CT examination was performed more frequently in patients with poor prognosis (p<0.001). This finding likely reflects clinical decision-making in more severe cases rather than a causal relationship between CT use and poor prognosis. Length of hospital stay was longer in patients with poor prognosis (p=0.003). Although median admission Ranson scores were identical between groups, their distributions differed significantly, resulting in a statistically significant p value. This difference is likely attributable to variations in the distribution of values between the groups.

Table 2 presents the distribution of pancreatic necrosis, ICU admission, and in-hospital mortality according to admission Ranson thresholds (≥1, ≥2 and ≥3), with descriptive NLR values.

Table 1. Baseline demographic, clinical and laboratory characteristics according to poor prognosis

Variable	Total (n=319)	Poor prognosis (-) (n=251)	Poor prognosis (+) (n=68)	p
Age, years	61 (18-97)	58 (18-93)	70 (28-97)	<0.001
Male sex, %	47.0	46.6	48.5	0.886
Biliary, %	65.5	69.3	51.5	0.009
WBC ($\times10^9/\mu L$)	9.8 (2.0-45.5)	9.7 (2.4-28.9)	11.2 (2.0-45.5)	0.014
AST (U/L)	113 (7-1167)	120 (12-984)	53 (7-1167)	0.012
LDH (U/L)	327 (77-3104)	321 (77 -1110)	350.5 (149-3104)	0.756
Glucose (mg/dL)	120 (39-586)	116 (63-542)	132.5 (39-586)	0.038
ALT (U/L)	87.0 (6-1144)	112.5 (8-1144)	46 (6-941)	0.002
Amylase (U/L)	1032 (36-6694)	1038 (60-6694)	968.5 (36-4411)	0.808
Lipase (U/L)	1468 (8-16967)	1351 (8-16967)	2173 (153-11593)	0.032
ALR	0.57 (0.04-18.71)	0.64 (0.04-18.71)	0.49 (0.17-8.43)	0.038
CT exam, %	47	42.2	64.7	<0.001
Ranson score	1 (0-4)	1 (0-4)	1 (0-4)	0.003
NLR	5.8 (0.7-49.4)	4.9 (0.7-45.7)	7.8 (1.9-49.4)	<0.001
CRP (mg/L)	11.6 (0.5-287.3)	13 (1-169)	10.3 (0.5-287.3)	0.791
LoS, days	5 (1-66)	5 (1-23)	6 (1-66)	0.003

Data are presented as median (min–max) or percentage.
Categorical variables were compared using Chi-square test.
Continuous variables were compared using Mann–Whitney U test.
ALR: Amylase/Lipase Ratio, NLR: Neutrophile/Lymphocyte Ratio
LoS: Length of stay, WBC: White Blood Cell, AST: Aspartate Aminotransferase, LDH: Lactate Dehydrogenase, ALT: Alanine Aminotransferase, CT: Computed Tomography, CRP: C-Reactive Protein

Table 2. Distribution of individual poor prognosis components according to admission Ranson thresholds and NLR

Outcome component	n (%)	Ranson ≥1 (%)	Ranson ≥2 (%)	Ranson ≥3 (%)	Median NLR
Pancreatic necrosis	6 (1.9%)	66.7	50.0	33.3	9.6
ICU admission	67 (21.0%)	85.1	46.3	19.4	7.8
In-hospital mortality	8 (2.5%)	100	50.0	25.0	18.5

Footnote: Values are presented as percentage or median. NLR values are provided for descriptive purposes only because of the limited number of events.

Multivariable logistic regression analysis was performed to identify independent predictors of poor prognosis (Table 3). After adjustment for age, biliary etiology, Ranson score, and NLR, biliary etiology (adjusted

OR 0.30, 95% CI 0.14–0.67, p=0.003) and NLR (adjusted OR 1.06, 95% CI 1.02–1.11, p=0.005) remained independently associated with poor prognosis. Age showed a borderline association with poor prognosis (p=0.068). Ranson score was not an independent predictor in the adjusted model (p=0.521).

Table 3. Multivariate regression analysis for poor prognosis

	Adjusted OR	95% CI	p
Age (years)	1.02	1.00-1.05	0.068
Biliary etiology	0.30	0.14-0.67	0.003
Ranson score	1.14	0.76-1.70	0.521
NLR	1.06	1.02-1.11	0.005

NLR: Neutrophile/Lymphocyte Ratio

In ROC curve analysis, NLR showed a relatively higher discriminative ability compared to the Ranson score and WBC; however, its overall performance remained limited. The optimal cut-off value for NLR was 3.46, yielding high sensitivity (93.6%) but low specificity (35.8%), suggesting that NLR may be more useful as a rule-out marker rather than a rule-in tool for early risk stratification. The Ranson score demonstrated limited discriminative ability (AUC 0.611), with a sensitivity of 85.3% and a specificity of 34.3% at the optimal cut-off value of 1.0. CRP showed no meaningful discriminative performance (AUC 0.515) and, ROC curve analysis of predictors for poor prognosis is presented in Table 4 and Figure 1.

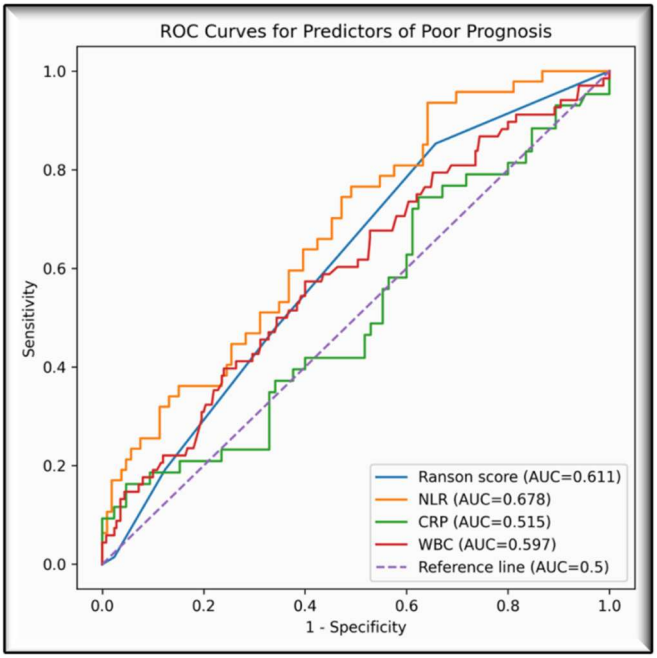

Figure 1. Receiver operating characteristic (ROC) curves of Ranson score, neutrophil-to-lymphocyte ratio (NLR), C-reactive protein (CRP), and white blood cell (WBC) count for predicting poor prognosis. The diagonal dashed line represents the line of no discrimination (AUC = 0.5).

Table 4. ROC Analysis of predictors for poor prognosis

Variable	AUC (95% CI)	p	Optimal cut-off	Sensitivity (%)	Specificity (%)
Ranson score	0.611 (0.540–0.683)	0.005	1.0	85.3	34.3
NLR	0.678 (0.589–0.766)	<0.001	3.46	93.6	35.8
CRP (mg/L)	0.515 (0.407–0.622)	0.789	6.09	74.4	37.6
WBC ($\times10^9$/μL)	0.597 (0.520–0.674)	0.014	10.41	57.4	60.0

NLR: Neutrophile/Lymphocyte Ratio, CRP: C-Reactive Protein, WBC: White Blood Cell

DISCUSSION

AP has the potential to become a significant cause of mortality (10,11). Therefore, early identification of patients at risk for severe disease is crucial. Several prognostic scoring systems have been developed to identify severe pancreatitis, with the Ranson score being one of the earliest. The present study evaluated the prognostic performance of the admission Ranson score and compared it with simple inflammatory markers in patients with AP. The main finding of our study is that NLR demonstrated superior prognostic performance compared with the admission Ranson score. Moreover, NLR remained independently associated with poor prognosis in multivariable analysis, whereas the admission Ranson score did not.

Although the male-to-female ratio in our study was 0.89 and no statistically significant sex predominance was observed (p=0.886, Table 1), this finding aligns with recent epidemiological evidence suggesting that sex distribution in AP can vary across populations and etiological patterns. In some contemporary cohorts, near-equal or even female-predominant distributions have been reported, particularly in populations with a high frequency of biliary etiology, which is more common in women. For example, a recent regional cohort study reported that females comprised 52.1% of patients with AP and that biliary etiology accounted for 66.1% of cases, with significant variation by age and sex (22). A recent study of 2.8 million AP cases worldwide revealed a male-to-female ratio of 1.21 (23). In this study patients diagnosed with AP, the distribution of etiologies was consistent with that reported in the literature, with biliary etiology being the most common (65.5%).

Despite the findings of a study published in 2024 which concluded that CRP levels are associated with the severity of pancreatitis (24), the low optimal cut-off value and poor discriminative ability of CRP likely reflect the limited usefulness of admission CRP for early prognostic assessment.

Kılıç et al. reported an AUC of 0.625 (95% CI, 0.49–0.77) for the Ranson score in predicting poor prognosis (25). Similarly, in our study, ROC analysis demonstrated only modest discriminative ability of the Ranson score for poor prognostic criteria (AUC: 0.611, 95% CI: 0.540–0.683; p=0.005). In a recent prospective study involving 131 patients, NLR demonstrated good predictive ability for AP

severity (AUC = 0.82, p < 0.001) (26). In the present study, the NLR was identified as the most effective predictor of poor prognosis among the parameters examined (AUC:0.678, 95% CI 0.589–0.766, p<0.001).

The application of the admission Ranson criteria showed limited usefulness in indicating prognosis. In our study, AST did not demonstrate independent prognostic value. Şenkal et al. identified an AST level below the established threshold as a reliable indicator of necrosis (22). A recent study involving 938 patients concluded that Ranson's criteria may be more effective when the initial AST value is excluded (27).

The limited prognostic performance of the Ranson score in our study may be explained by several factors. First, we evaluated only the admission Ranson score without including the 48-hour components. Completion of the full Ranson score requires a 48-hour period, which substantially limits its usefulness for early clinical decision-making and timely initiation of appropriate management. In line with these considerations, our analysis showed that only a minority of patients with necrosis, ICU admission, or mortality fulfilled higher admission Ranson thresholds (≥2 and ≥3), consistent with previous reports (25,27).

In contrast, NLR is readily available at presentation and reflects the balance between neutrophil-mediated inflammation and lymphocyte-mediated immune regulation, thereby serving as a sensitive indicator of early systemic inflammatory response that drives disease severity. From a clinical perspective, early identification of patients at risk for poor prognosis is essential to guide monitoring intensity, imaging decisions, and level of care. Our results suggest that NLR, which is inexpensive and routinely available at admission, may be more useful than the admission Ranson score for early risk stratification in the emergency department. Given its high sensitivity but low specificity, NLR may be more useful for excluding poor prognosis rather than confirming it in the early clinical setting.

CONCLUSION

In conclusion, the admission Ranson score has limited value for predicting poor prognosis in patients with AP. In contrast, NLR appears to be a simple, inexpensive, and more useful biomarker for early risk stratification in the emergency department. Prospective multicenter studies are warranted to validate these findings and to develop practical early prediction models.

Limitations

Due to the nature of this study, there are some limitations. Primarily, the study was retrospective, which implies that the data obtained were naturally limited, affecting comprehensiveness. For this reason, other prognostic scoring systems such as the Systemic Inflammatory Response Syndrome (SIRS), Bedside Severity Index (BISAP), and Acute Physiology and Chronic Health Evaluation (APACHE)-II score could not be evaluated. Secondly, representativeness may be limited due to the relatively small sample size and single-center design. Another limitation is the use of a composite poor prognosis outcome consisting of ICU admission, pancreatic necrosis, and mortality, which represent different clinical severities. In addition, the decision to perform contrast-enhanced CT was based on clinician judgment, which may have introduced variability in detecting local complications. Although NLR demonstrated superior performance compared with the admission Ranson score, its discriminative ability remained moderate. Furthermore, we evaluated only the admission Ranson score and did not include the 48-hour components, as our focus was on early prediction at presentation.

Ethical Approval

This retrospective study was approved by the Elazig City Hospital Non-Interventional Research Ethics Committee on 20 February 2025 (Decision No: 2025/4-13). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Due to the retrospective nature of the study, the requirement for informed consent was waived by the Ethics Committee.

Conflict of Interest

The authors declare that they have no conflicts of interest regarding the publication of this paper**.**

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Authors' Contributions

All authors contributed substantially to the conception and design of the study, data collection, analysis and interpretation of data, drafting and revising the manuscript, and approved the final version for publication.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request, subject to applicable ethical and legal restrictions.

Declaration of generative AI and AI-assisted technologies in the writing process

The authors used AI-assisted tools only for language editing and proofreading. The authors take full responsibility for the content of the manuscript.

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