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Comparison of HALP and Ranson Scores in Predicting Outcomes of Acute Pancreatitis Admitted to the Emergency Department

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ABSTRACT

Objective: Acute pancreatitis (AP) often manifests as acute abdominal pain and carries significant risks of mortality and healthcare costs. Its incidence is rising, largely due to alcohol consumption and obesity. Several scoring systems, including the Ranson, Balthazar Severity score, and bedside index for severity in AP, are used to assess AP severity and prognosis, but challenges remain due to the need for prolonged observation and imaging. The present study assesses the ability of the Ranson and HALP scores to predict clinical outcomes and survival in patients with AP.

Materials and Methods: This retrospective analysis included patients with AP, collecting data on demographics, vital signs, laboratory values, comorbidities, and outcomes. The Ranson and HALP scores were calculated, and patients were grouped into survivors and non-survivors based on mortality. Receiver operating characteristic analysis was performed to evaluate the predictive ability of these scores for complications and mortality.

Results: The study included 598 patients, with an overall mortality rate of 12.2%. The non-survivor group had significantly higher mean age and a higher prevalence of malignancy and pancreatitis caused by pancreatic cancer. Severe pancreatitis (Ranson score ≥3) was observed in 21.1% of patients, with these patients exhibiting a higher mortality rate (30.2%). The HALP score demonstrated superior performance over the Ranson score in predicting long-term mortality (area under the curve: 0.800, 95% CI: 0.735–0.864, p=0.000). The first quartile group of the HALP score had significantly higher incidences of complications, severe pancreatitis, and mortality.

Conclusion: The HALP score offers a reliable and rapid alternative to the Ranson score for predicting mortality in AP patients, especially in emergency department settings where timely decision-making is crucial. Its simplicity and predictive value make it a useful tool for clinicians.

Keywords: Acute pancreatitis, ALP score, Emergency department, Mortality, Prognosis, Ranson score

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INTRODUCTION

Acute pancreatitis (AP) constitutes a major clinical condition presenting with acute abdominal pain. AP imposes significant physical and psychological distress on patients due to its rapid progression and high mortality rate, while also leading to substantial healthcare expenditures. A recent review estimated that AP accounts for approximately 280,000 hospitalizations annually in the U.S., contributing to healthcare costs of over $2.6 billion.[1] The incidence of AP has increased by approximately 3% over the past 60 years, driven by advancements in imaging techniques and the growing prevalence of risk factors such as alcohol consumption and obesity.[2] Given the potential for severe complications following AP, early risk stratification using reliable scoring systems is essential in clinical practice.[3,4] Mild and self-limiting AP episodes are more common; however, 15–25% of cases progress to moderate or severe forms, resulting in prolonged hospitalization and increased mortality.[5]

Scoring systems are frequently utilized in clinical practice to stratify the severity and predict the prognosis of AP. For this purpose, the Ranson criteria, Balthazar grading system, Acute Physiology and Chronic Health Evaluation II (APACHE II), the computed tomography severity index, and bedside index for severity in AP (BISAP) are widely utilized in clinical practice.[6] Scoring systems assist in guiding patient care and facilitating decisions regarding transfer to intensive care by providing accurate and objective prognosis predictions. Scoring systems have varying sensitivity and specificity values. The Ranson criteria require multiple parameters, some of which are obtained up to 48 h after hospitalization, presenting significant challenges for early evaluation of patients in the emergency department (ED).

The Ranson score has been a key method for assessing the severity of AP for over 30 years; however, it requires 48 h to complete, which significantly limits its applicability in the ED.[6] The HALP score, comprising hemoglobin, albumin, lymphocyte, and platelet counts, was first introduced in 2015 as an index to assess inflammation and nutritional status.[7] Research indicates that the HALP score effectively estimates disease outcomes across different pathologies.[8]

This study evaluated the clinical presentations and laboratory findings of AP patients admitted to the ED. Our aim was to assess the capacity of the Ranson and HALP scores to predict patient outcomes and mortality in AP, alongside exploring other contributing variables.

MATERIALS AND METHODS

This is a retrospective, cross-sectional study. The study analyzed patients diagnosed with AP at the ED of Haydarpaşa Numune Training and Research Hospital Hospital between January 2020 and January 2025. Patients presenting with abdominal pain to the ED were enrolled in this study. The annual number of patient visits to our ED is approximately 235.000, with around 8% of these visits being attributed to abdominal pain.

The diagnosis of AP was established when at least two of the following criteria were met: abdominal pain typical of AP, serum amylase and/or lipase levels more than three times the upper normal limit, or imaging findings characteristic of the disease.[5]

Patients aged ≥18 years with confirmed AP were included in the study. The exclusion criteria for the study were as follows: A history of hospitalization for any reason within the past 30 days, patients who received intravenous drug therapy, the presence of other gastrointestinal disorders, incomplete medical records. Following the diagnosis of AP, patients were managed in accordance with established clinical guidelines.

The data recorded from the hospital information system included age, gender, comorbidities, respiratory rate, systolic and diastolic blood pressure, fever, heart rate, lymphocyte count, neutrophil count, platelet count, hemoglobin, hematocrit, glucose levels, blood urea nitrogen (BUN), aspartate transaminase, alanine transaminase, and C-reactive protein (CRP) levels. In addition, the etiology of pancreatitis, complications, discharge or hospitalization status, length of hospital stay, and mortality were also documented.

Following enrollment, the patients were stratified according to pancreatitis-related mortality: survivors and non-survivors. Non-survivors were further categorized into three groups based on the timing of mortality: Short-term mortality (<1 month), mid-term mortality (1–6 months), and long-term mortality (6–9 months). Using the data from patients' admissions, the CRP/Albumin ratio, Ranson score, and HALP score were calculated. The HALP score was determined for all patients as described below:[7]

HALP = hemoglobin (g/L) × albumin (g/L) × lymphocyte (/L) / platelet (/L)

A Ranson score of 3 or higher was considered indicative of severe pancreatitis, whereas a score below 3 corresponded to mild disease. The demographic characteristics, Ranson score, and HALP score were analyzed across the survivor and non-survivor groups. Subsequently, the predictive value of the Ranson and HALP scores for complications and survival in AP patients was analyzed.

Ethics Statement

This study received approval from the Institutional Ethics Committee (Approval No: HNEAH-GOAEK 2025/53). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Because this study was retrospective, the Clinical Research Ethics Committee of University of Health Sciences Haydarpasa Numune Training and Research Hospital granted a waiver for informed consent.

Statistical Analysis

Statistical analyses were performed using IBM Statistical Package for the Social Sciences 23.0 (IBM Corp., Armonk, NY) and MedCalc 23.1.7. Descriptive statistics are presented as mean±standard deviation (SD) and as percentages. The normality of continuous variables was evaluated using the Kolmogorov–Smirnov test. For continuous variables, normally distributed data are shown as mean±SD, while non-normal data are expressed as median (interquartile range). Associations between categorical variables were examined using the Pearson Chi-square test. However, for categorical variables with expected frequencies below 5, Fisher's exact test was applied to ensure the validity of the results. Comparisons of continuous variables between two groups were conducted using the Student's t-test or Mann–Whitney U-test, as appropriate. The receiver operating characteristic (ROC) analysis was used to evaluate the ability of the scoring systems to predict outcomes. For the HALP score, four quartiles (25th, 50th, and 75th percentiles) were created based on the median values. A $p<0.05$ was considered statistically significant, and results are reported with 95% confidence intervals (CI).

RESULTS

The study group comprised 598 patients who met the inclusion criteria. Of these, 302 (50.5%) were male, with a mean age of 57.59±18.07 years. Twenty-four patients (4%) required intensive care unit admission, and their median length of stay was 5 days, ranging from 1 to 64 days. The overall mortality rate for all patients was 12.2% (73 patients). Among the non-survivor patients, 16 (21.9%) died within the 1st month (short-term), 8 (11.0%) between 1 and 6 months (mid-term), and 49 (67.1%) between 6–9 months (long-term). The non-survivor group had a significantly greater mean age compared with survivors (mean difference: 17.65, 95% CI: 13.84–21.46, $p<0.001$). The comorbidities of the patients were assessed. Malignancy was significantly more common among non-survivors ($p<0.001$). In addition, the etiologies of pancreatitis were examined. The non-survivor group had a significantly higher incidence of pancreatic cancer-related pancreatitis ($p<0.001$). The other etiologies of AP showed no significant differences between the groups. Patient characteristics are summarized in Table 1.

Table 1. Comparison of etiology and demographic characteristics according to outcome groups

	Total (n=598)	Survivor (n=525)	Non-survivor (n=73)	p
Age (years)	57.59 ±18.07	55.43±17.40	73.08±15.07	<0.001
Sex (male)	302 (50.5)	266 (44.5)	36 (6.0)	0.829
Comorbidities, n (%)				
Hypertension	219 (36.6)	188 (31.4)	31 (5.2)	0.269
Diabetes mellitus	135 (22.6)	121 (20.2)	14 (2.3)	0.459
Coronary artery disease	69 (11.5)	60 (10.0)	9 (1.5)	0.822
Hyperlipidemia	52 (8.7)	47 (7.9)	5 (0.8)	0.550
Malignancy (any)	46 (7.7)	31 (5.2)	15 (2.5)	<0.001
COPD	38 (6.4)	29 (4.8)	9 (1.5)	0.026
Chronic kidney disease	36 (6.0)	31 (5.2)	5 (0.8)	0.751
Hypothyroidism	30 (5.0)	24 (4.0)	6 (1.0)	0.181
Congestive heart failure	22 (3.7)	20 (3.3)	2 (0.3)	0.649
Cerebrovascular disease	21 (3.5)	17 (2.8)	4 (0.7)	0.330
Other	54 (9.0)	52 (8.7)	2 (0.3)	0.045
Etiology, n (%)				
Gallstones	350 (58.5)	303 (57.7)	47 (64.4)	0.278
Idiopathic	196 (32.8)	181 (34.5)	15 (20.5)	0.181
Hyperlipidemia	29 (4.8)	26 (5.0)	3 (4.1)	0.753
Alcohol	13 (2.2)	12 (2.3)	1 (1.4)	0.615
Pancreatic malignancy	10 (1.7)	3 (0.6)	7 (9.6)	<0.001

COPD: Chronic obstructive pulmonary disease.

The vital parameters and laboratory findings for the mortality groups are shown in Table 2. Non-survivors had lower diastolic blood pressure (66.99±13.35 vs. 70.95±13.33 mmHg, p=0.021) and higher heart rate (86.67±15.87 vs. 79.73±16.10 bpm, p=0.001) compared to survivors. Oxygen saturation was also significantly lower in non-survivors (93.0 [3.0] vs. 96.0 [3.0]%, p<0.001), while body temperature and systolic blood pressure did not differ significantly. Non-survivors exhibited lower lymphocyte counts, hemoglobin, hematocrit, and albumin levels (all p<0.01), whereas blood glucose, BUN, CRP, and CRP-to-albumin ratio were significantly higher. The HALP score was markedly reduced in non-survivors (1.79 [1.60] vs. 3.57 [2.68], p<0.001), reflecting impaired inflammatory and nutritional status. In addition, non-survivors had higher intensive care unit admission rates (21.9% vs. 1.5%, p<0.001), longer hospital stays (6.0 [6.0] vs. 5.0 [4.0] days, p<0.001), and more frequent complications (32.9% vs. 12.2%, p<0.001) than survivors. AP-related complications were identified in 88 out of 598 patients (14.7%).

According to the Ranson scores, severe pancreatitis (≥3) was detected in 126 patients (21.1%). The mortality rate in these 126 patients with severe pancreatitis was 30.2%, which was significantly higher (p<0.001). The effectiveness of the Ranson and HALP scores in predicting mortality was evaluated using ROC curve analysis (Fig. 1). The Ranson score and HALP score demonstrated similar effectiveness in predicting short-term mortality. The predictive performance of the HALP and Ranson scores for mortality was compared using ROC curve analysis. No significant difference was observed between the two scores for mortality within <1 month (p=0.895) and 1–6 months (p=0.737). However, for long-term mortality at 6–9 months, the HALP score demonstrated a significantly higher area under the curve (AUC) of 0.800 compared to the Ranson score (p=0.000), indicating superior predictive accuracy for long-term outcomes (Table 3).

Table 2. Comparison of vital signs, laboratory results, and outcomes between survivor and non-survivor groups

	Total (n=598)	Survivor (n=525)	Non-survivor (n=73)	p
Vital parameters				
Systolic blood pressure (mmHg)	121.80±18.69	122.34±18.13	117.88±22.03	0.056
Diastolic blood pressure (mmHg)	70.47±13.79	70.95±13.33	66.99±13.35	0.021
Heart rate (beat/minute)	80.58±16.21	79.73±16.10	86.67±15.87	0.001
Oxygen saturation (%)	95.0 (3.0)	96.0 (3.0)	93.0 (3.0)	<0.001
Body temperature (°C)	36.64±0.32	36.64±0.33	36.60±0.26	0.243
Laboratory results				
White blood cell (×10^9/L)	11.35±4.63	11.25±4.47	12.09±5.64	0.145
Lymphocyte (×10^9/L)	1.70±0.82	1.79±0.82	1.10±0.51	<0.001
Neutrophils (×10^9/L)	8.88±4.43	8.77±4.41	9.71±4.49	0.097
Platelet (×10^9/L)	240.2±68.2	241.0±67.4	234.6±73.8	0.480
Hemoglobin (g/dL)	11.99±1.58	12.16±1.48	10.82±1.75	<0.001
Hematocrit (%)	39.51±5.54	39.74±5.39	37.83±6.32	0.006
Blood glucose (mg/dL)	122.0 (55.0)	121.0 (53.0)	134.0 (63.0)	0.001
Blood urea (mg/dL)	14.7 (9.0)	14.0 (8.0)	20.0 (12.0)	<0.001
Aspartate transaminase (U/L)	79 (217)	80 (221)	78 (184)	0.484
Alanine transaminase (U/L)	64 (215)	71 (242)	55 (103)	0.042
Albumin (g/dL)	41.13±4.20	41.79±3.74	36.44±4.37	<0.001
C-reactive protein (mg/L)	1.1 (3.7)	0.9 (3.4)	2.8 (6.8)	0.001
HALP score	3.34 (2.74)	3.57 (2.68)	1.79 (1.60)	<0.001
C-reactive protein-to-albumin ratio	0.25 (0.95)	0.23 (0.83)	0.76 (1.84)	<0.001
Outcomes				
ICU admission (%)	24 (4.0)	8 (1.5)	16 (21.9)	<0.001
LOS (days)	5.0 (4.0)	5.0 (4.0)	6.0 (6.0)	<0.001
Complications (%)	88 (14.7)	64 (12.2)	24 (32.9)	<0.001

Values expressed as number (%), Mean±Standard Deviation, median (IQR: Interquartile Range). ICU: Intensive Care Unit; LOS: Length of the Hospital Stay.

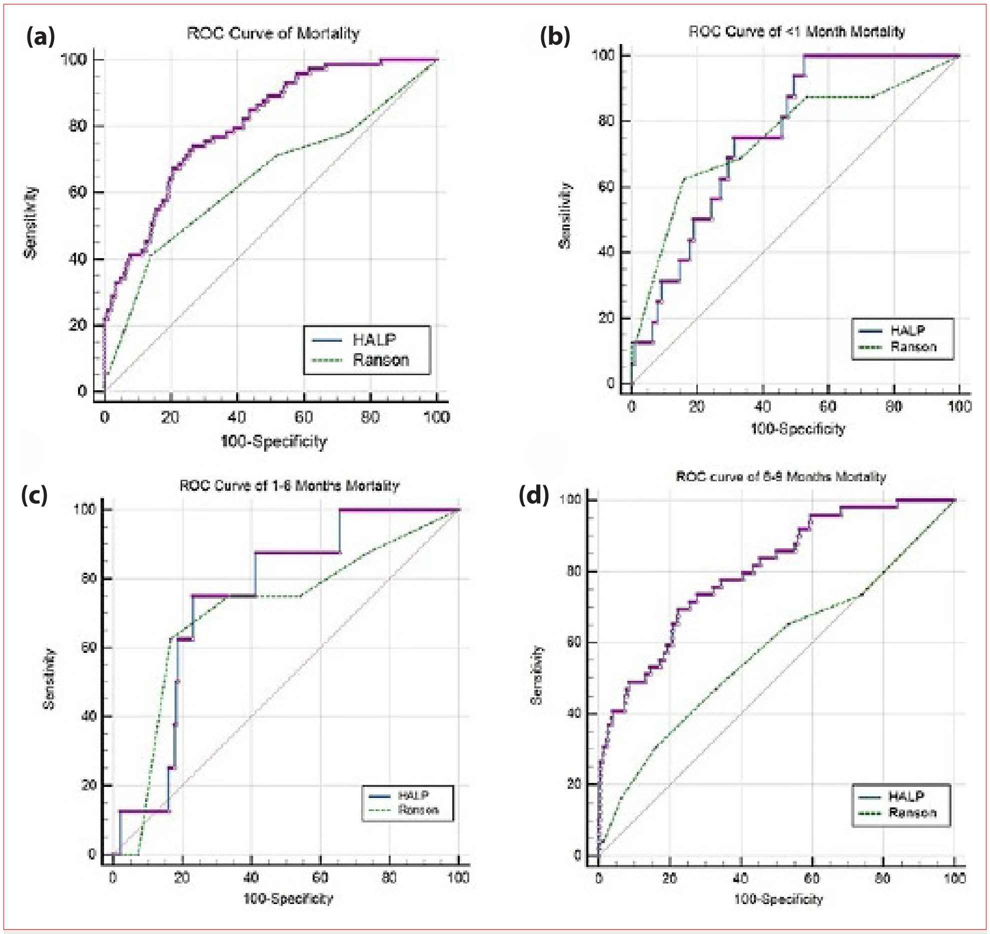

Figure 1. Receiver-operator characteristic curves (ROC curves) of the comparison of HALP and Ranson scores in predicting mortality. **(a)** The ROC curve of overall mortality (p=0.000). **(b)** The ROC curve showing mortality for <1 month (p=0.895). **(c)** The ROC curve showing mortality for 1–6 months (p=0.737). **(d)** The ROC curve showing mortality for 6–9 months (p=0.000).

Table 3. The ROC curve analysis of Ranson and HALP scores in predicting mortality in acute pancreatitis

	Mortality							
	Total (n=73)		<1 months (n=16)		1–6 months (n=8)		6–9 months (n=49)	
	AUC	p	AUC	p	AUC	p	AUC	p
Ranson score	0.641 (CI:0.565–0.717)	<0.001	0.752 (CI:0.615–0.890)	0.001	0.706 (CI:0.512–0.899)	0.046	0.577 (CI:0.484–0.670)	0.074
HALP score	0.804 (CI:0.754–0.854)	<0.001	0.760 (CI:0.673–0.847)	<0.001	0.746 (CI:0.618–0.875)	0.017	0.800 (CI:0.735–0.864)	<0.001

AUC: Area Under the Curve; CI: Confidence Interval.

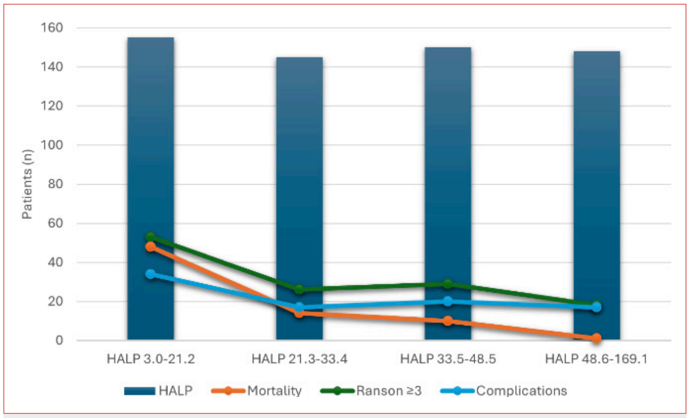

Figure 2. Distribution of patients with severe pancreatitis, complications, and mortality across HALP score quartiles.

The prognostic value of HALP score cutoff points for predicting mortality in AP patients was assessed. For a HALP score lower than 24, sensitivity was 71.2%, specificity was 74.9%, the PPV was 28.3%, and the NPV was 94.9%.

The frequency of complications, severe pancreatitis, and mortality was analyzed based on the 25th, 50th, and 75th percentiles of the HALP score (Fig. 2). The incidence of complications (p=0.030), severe AP (p<0.001), and mortality rate (p<0.001) in the first quartile group of the HALP score (3.0–21.2) were notably higher than in the other quartile groups.

DISCUSSION

We assessed the predictive performance of the HALP and Ranson scores for disease severity and mortality in patients with AP. Our findings indicated that the HALP score is a robust tool for stratifying patients with AP by severity during their initial evaluation in the ED. To date, no studies have compared the predictive performance of HALP and Ranson scores in patients with AP.

Papachristou et al.[6] determined the mortality rate to be 3.8% in their prospective cohort study. Güler et al.[8] reported a mortality rate of 9.1%. In the literature, the mortality rate of complicated pancreatitis has been reported to be between 10% and 30%.[2] In our study, the overall mortality rate was 12%. The mortality rate in patients with complicated AP was 27.3%. The mortality rate was found to be 30.2% in cases of severe AP.

Clinicians must diagnose severe AP early and be attentive during treatment, as severe AP cases are associated with high mortality rates. This has led clinicians to develop scoring systems for the early detection of severe AP, resulting in the creation of numerous different scoring systems. Although the APACHE-II score is among the most commonly used scoring systems for evaluating AP patients in the United States,[6] its application in the ED is limited due to the extensive range of parameters required for evaluation, making it impractical for rapid clinical decision-making. The Ranson score is determined by evaluating 11 parameters, with a score of 3 or more indicating severe disease. However, its reliance on multiple parameters and the necessity of a 48-h waiting period for calculation make it challenging to apply in fast-paced ED settings.

The HALP score has been highlighted as a potential indicator of both inflammatory status and nutritional status in patients.[9] Anemia-related tissue hypoxia can exacerbate inflammatory responses, while thrombosis may further promote inflammation through ischemia-reperfusion mechanisms.[9-11] Lymphocytes play a crucial role in modulating inflammation, and lymphopenia has been linked to adverse outcomes in various inflammatory diseases.[12] Serum albumin levels are an important marker for both nutritional status and the severity of the inflammatory response, with lower levels often associated with greater severity of inflammatory conditions.[13] The HALP score, calculated using only four parameters, offers the advantage of rapid assessment in ED settings compared to the more complex Ranson score. Recently, the HALP score has been utilized to predict prognosis in various patient populations, including those with gastric cancer, prostate cancer, colorectal cancer, pancreatitis, and stroke.[7-9,14,15]

Pancreatic cancer can be an underlying cause of AP and remains a lethal disease with poor prognosis. It leads to significant cancer-related mortality, with an overall 5-year survival rate of about 9%.[16] In our cohort, pancreatic cancer was significantly more frequent among non-survivors. Consequently, AP patients with underlying pancreatic cancer had higher mortality rates, suggesting that poor prognosis may be driven by the malignancy rather than AP alone. Components of the HALP score, such as low hemoglobin and albumin, are also commonly seen in cancer patients. This indicates that the HALP score may, in part, reflect the effect of high-risk comorbidities such as pancreatic cancer when predicting outcomes.

The superior performance of the HALP score in predicting 6–9-month mortality may be explained by its reflection of longer term patient factors, such as nutritional status and chronic inflammation, rather than solely the severity of the AP episode. In contrast, the Ranson score primarily captures acute disease severity, which may explain why it is less predictive of longer-term outcomes.

In a meta-analysis including 5476 AP patients, the AUC for predicting mortality with the Ranson and BISAP scores was found to be 0.91 and 0.92 respectively.[17] A separate study with 634 AP patients reported an AUC of 0.891 (95% CI: 0.833–0.949) for the HALP score in estimating short-term mortality. For a HALP score ≤15 cutoff value, the sensitivity and specificity were determined to be 82.8% and 86.8%, respectively.[8] In our study, the AUC for predicting mortality using the Ranson and HALP scores were 0.641 and 0.804, respectively. For predicting mortality between 6 and 9 months, the HALP score demonstrated superior performance, with an AUC of 0.800 (95% CI: 0.735–0.864, p<0.001), which was more successful compared to the Ranson score.

Limitations

This research has some inherent limitations. The main limitation of this study is its retrospective, single-center design, which may limit the generalizability of the results. In addition, although the sample size was relatively large, being conducted in a tertiary care ED may have introduced a selection bias toward more severe presentations of AP. Third, certain potential confounding factors – such as variations in treatment protocols, nutritional status prior to admission, and timing of laboratory measurements – could not be fully controlled due to the nature of retrospective data collection. Fourth, the HALP and Ranson scores were calculated based on laboratory values obtained at admission; serial measurements and dynamic changes over time were not assessed, which may have provided additional prognostic information. Fifth, although the HALP score has been associated with prognosis in various malignancy studies, our analysis did not evaluate the subtypes or severity of malignancies in the cohort. This represents a limitation of the study, as differences in malignancy types and severity could potentially influence HALP scores and their predictive performance. External validation in multicenter prospective cohorts is needed to verify the ability of the HALP score to predict outcomes in AP.

CONCLUSION

The results of our study indicate that the HALP score demonstrates a predictive value similar to the Ranson score in assessing mortality risk in patients with AP. The reliability of the Ranson score has been extensively documented in the academic literature. However, its use in ED is limited due to the inclusion of follow-up values obtained 48 h after admission. Given the high workload in ED, the HALP score, which can be calculated in a short time, will serve as a valuable tool for predicting mortality and guiding appropriate treatment planning for patients in the emergency setting.

DECLARATIONS

Ethics Committee Approval: The study was approved by University of Health Sciences Haydarpasa Numune Training and Research Hospital Ethics Committee (No: HNEAH-GOAEK 2025/53, Date: 22/04/2025).

Informed Consent: The Clinical Research Ethics Committee of Haydarpasa Numune Training and Research Hospital granted a waiver for informed consent.

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

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