Predictive power of HALP score in estimating short-term mortality in patients with acute pancreatitis

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ABSTRACT

BACKGROUND: To examine the hemoglobin, albumin, lymphocyte, and platelet (HALP) scores' predictive power in predicting short-term mortality from acute pancreatitis (AP).

METHODS: The study was conducted at the emergency department (ED) of tertiary care hospital. The medical records of patients who admitted to the ED and were diagnosed with AP were reviewed retrospectively. İt was analyzed that the ability of the HALP score in predicting short-term mortality of these patients.

RESULTS: The study was achieved with a total of 634 patients. The mean age of these patients was 59.7±16.6 and 381 (60.1%) were female. While 42 (6.6%) of the total included patients were required to the intensive care unit, 58 (9.1%) died. To examine the HALP scores' predictive power in predicting short-term mortality, the Receiver Operating Characteristic (ROC) analysis was utilized. The value of the area under the curve was found as 0.891 (95% CI: 0.833–0.949). When the cut-off value of the HALP score in determining short-term mortality is >15, the Sensitivity of the score was found to be 82.8%, Specificity 86.8%, Positive Predictive Value 38.7%, and Negative Predictive Value 98.0%.

CONCLUSION: AP is a disease that requires early diagnosis and adequate treatment if not it can cause a high rate of mortality and morbidity. As a result of this study, it was concluded that the HALP score can be utilized during the prediction of short-term mortality for patients diagnosed with AP.

Keywords: Acute pancreatitis; HALP score; mortality.

INTRODUCTION

Acute pancreatitis (AP) can be described that is a disease that placed in the pancreas, clinically determined regarding abdominal pain and raised levels of pancreatic enzymes in the blood. The clinical severity of AP can progress from a localized, self-limiting condition to multi-organ failure, sepsis, and death.[1-3] While the incidence of mortality due to AP is 1% in general, the mortality rate can reach 40% in patients who are hospitalized and develop organ failure.[4] Thus, early diagnosis of AP patients who will require critical care is important.

Various prediction models are used for early detection of patients admitted to emergency department (ED).[5,6] Various following estimation models are used in estimating the prognosis of AP patients: Ranson criteria, Acute physiology and chronic health evaluation score, Sequential organ failure assessment score, Bedside index of severity in AP, Balthazar Severity score, which based on abdominal computed tomography (CT).[7,8] However, these models have limitations such as low sensitivity and specificity, difficulty in using them in clinical routine due to the complexity of the scoring system, inability to get a definite score until 48 h after admission, and being suitable only for evaluating intensive care patients.[9]

The hemoglobin, albumin, lymphocyte, and platelet (HALP)

score was specified by Chen et al. and then it was used for predicting the prognosis in patients with gastric carcinoma.[10] The HALP score includes four variables (hemoglobin, albumin, lymphocyte, and platelet) and is defined as an index of inflammation. It has been reported that the HALP score is successful in predicting the prognosis of different patient groups such as many malignancies, stroke, and COVID-19.[11-14]

This study aims to examine the predictive power of the HALP score in evaluating of short-term mortality in AP.

MATERIALS AND METHODS

This study held all legal permissions through the Local Ethics Committee with the number 2022/514/238/10 dated November 29, 2022. Since it was conducted as a retrospective study, not covering written consent from either the patient or his relatives. The study follows the Declaration of Helsinki, as a guideline.

All patients included in the study were retrospectively analyzed with medical records in terms of the following criteria: who were over the age of 18 and admitted to the ED and diagnosed with AP, in Kartal Dr. Lütfi Kırdar City Hospital, between May and November 2022. Patients with two or more of the AP diagnostic criteria (typical abdominal pain, amylase-lipase values higher than 3 times normal, and typical appearance on radiological imaging [CT, magnetic resonance imaging, or abdominal ultrasonography]) were considered AP. Patients under the age of 18, patients whose mortality status could not be followed up, and patients whose HALP score could

not be calculated were not included in the study. A data set was created for the study and the following information of the patients was recorded; age, gender, comorbid diseases, vital parameters and laboratory values at the time of admission, mortality status. Hematological tests were performed using an auto analyzer (Sysmex XN-1000, Sysmex Corporation, Kobe, Japan). Biochemical tests were performed with an automated biochemical analyzer (Cobas e801, Roche Diagnostics, Mannheim, Germany). The HALP score has been found as hemoglobin (g/L) × albumin (g/L) × lymphocyte (/L)/platelet (/L).[15] Primary outcome of the study was determined as short-term mortality (death from any cause in hospital or within 30 days of hospitalization). Hospital medical records and the national "Death Notification System" were used to reach the mortality status of the patients. 12 patients whose HALP score could not be calculated and 5 patients whose mortality status cannot be performed were excluded from this study.

Statistical Analysis

For statistical analysis, the SPSS-28 (SPSS Inc., Chicago, Illinois, USA) has been utilized. To determine the descriptive statistics of the data, mean, median minimum, maximum, frequency, standard deviation, and ratio values were operated. To distribute the variables Kolmogorov-Smirnov test was employed. For analyzing the independent-quantitative data, the Mann-Whitney U test was performed. For analyzing independent-qualitative data, the Chi-square test was utilized. If the Chi-square test was not successful, the Fischer test was maintained for this situation. Cut-off values of HALP score were established with Receiver Operating Character-

Table 1. Patients' general characteristics included in the study

	Total	Survivor	Non-survivor	P-value
Age (years)	59.7±16.6	58.6±16.2	70.5±16.7	<0.001
Gender (female)	381 (60.1%)	351 (60.9%)	30 (51.7%)	0.172
Comorbidities				
Hypertension	266 (42%)	224 (38.9%)	42 (72.4%)	<0.001
Diabetes mellitus	164 (25.9%)	143 (24.8%)	21 (36.2%)	0.039
CAD	78 (12.3%)	68 (11.8%)	10 (17.2%)	0.189
CHF	17 (2.7%)	14 (2.4%)	3 (5.2%)	0.197
Atrial fibrillation	13 (2.1%)	8 (1.4%)	5 (8.6%)	0.004
Hyperlipidemia	19 (3%)	14 (2.5%)	5 (8.6%)	0.023
Malignancy	33 (5.2%)	21 (3.6%)	12 (20.7%)	<0.001
Chronic renal failure	54 (8.5%)	36 (6.3%)	18 (31%)	<0.001
CVD	18 (2.8%)	12 (2.1%)	6 (10.3%)	0.004
COPD	57 (9%)	50 (8.7%)	7 (12.1%)	0.39
Etiology				
Non-biliary	58 (9.1%)	53 (9.2%)	5 (8.6%)	0.884
Biliary	576 (90.9%)	523 (90.8%)	53 (91.4%)	

COPD: Chronic obstructive pulmonary disease; CAD: Coronary Artery Disease; CVD: Cerebrovascular disease; CHF: congestive heart failure.

istic (ROC) analysis and it was examined whether it could be a predictive marker on short-term mortality. It was stated that if there will be a p-value below 0.05 would be taken as statistically significant.

RESULTS

The study was conducted with a total of 634 patients. Patients' mean age was 59.7±16.6 and 381 (60.1%) were female. While 42 (6.6%) of the total included patients were required to the intensive care unit, 58 (9.1%) died (Table 1). According to the short-term mortality status, patients were categorized into two groups survivor and non-survivor, and then various characteristics were compared (Table 2). It was found that the rate of this non-survivor group was significantly higher than the survivor group in terms of mean age (P<0.05). Hemoglobin, albumin, and lymphocyte averages of the non-survivor group were found to be higher than the survivor group, while the platelet averages were lower (P<0.05) [Table 2].

The analysis utilized to examine the predictive power of the HALP score in predicting short-term mortality was ROC. The area under the curve value has found as 0.891 (95% CI: 0.833–0.949). When the cut-off value of the HALP score in determining short-term mortality is ≤15, the sensitivity of the score has been found to be 82.8%, specificity 86.8%, Positive Predictive Value 38.7%, and Negative Predictive Value % 98.0 (Table 3 and Fig. 1).

Table 2. The comparison of several characteristics of survivor and non-survivor groups

	Total	Survivor	Non-survivor	P-value
Systolic BP (mmHg)	131.3±21.8	132.9±20.8	115.5±25.4	<0.001
Diastolic BP (mmHg)	78.8±33.9	79.4±35.2	72.2±14.9	0.005
Pulse rate (bpm)	81.5±14.2	80.8±13.2	88.3±20.9	0.042
RR (min)	16.2±6.3	16±6.5	18.1±3.7	<0.001
Temperature (°C)	36.7±0.6	36.7±0.6	36.7±0.5	0.495
SpO$_2$ (%)	95.4±7.7	95.5±8	94.1±4.1	0.001
WBC (10³u/L)	10.3±5	10.2±4.6	11.2±7.8	0.77
Hemoglobin (g/L)	110.8±10.9	12±1.8	10.2±2.05	<0.001
Lymphocyte (10³/mm3)	1.5±1	1.6±1	0.9±0.7	<0.001
Platelet (10³u/L)	224.8±82.6	216.1±73.6	311.8±112.5	<0.001
Albumin (g/L)	35.8±4.5	36.3±4.3	31.7±4.2	<0.001
HALP score	30.7±110.5	4±1.2	120±13	<0.001
Treatment Unit				
Ward	592 (93.4%)	565 (98.1%)	27 (46.6%)	<0.001
ICU	42 (6.6%)	11 (1.9%)	31 (53.4%)	
LoS	4.6±3.7			
Mortality	58 (9.1%)			

BP: Blood pressure; ICU: Intensive Care Unit; WBC: white blood cells; RR: Respiratory Rate; LoS: Length of the hospital stay.

Table 3. Diagnostic values and cut-off level of the HALP score in predicting short-term mortality for patients with acute pancreatitis

		AUC		% 95 CI			P-value
HALP score		0.891		0.833	-	0.949	0.000
HALP score (cut-off value 15)		0.848		0.789	-	0.906	0.000
		Survivor	Non-survivor				
HALP score	≤15	76	48		Sensitivity	82.8%	
	>15	500	10		PPV	38.7%	
					Specificity	86.8%	
					NPV	98.0%	

AUC: Area under the curve; CI: Confidence interval; PPV: Positive predictive value; NPV: Negative predictive value.
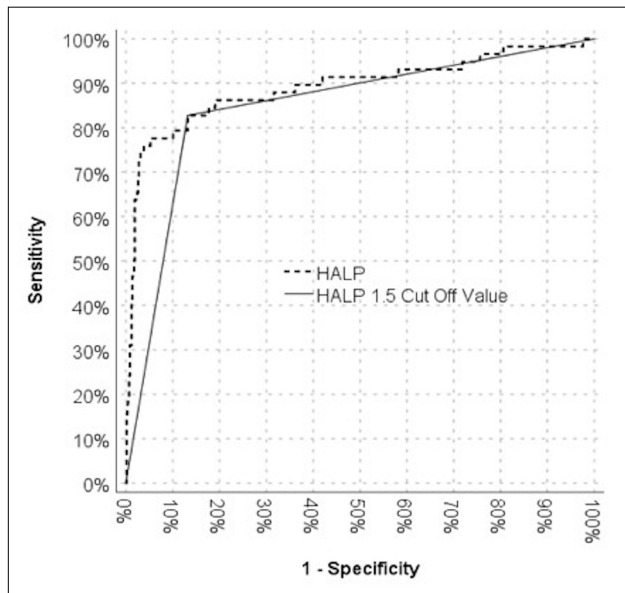
Figure 1. ROC of the HALP score in predicting short-term mortality among patients with acute pancreatitis

DISCUSSION

According to our study, the effectiveness of the HALP score in predicting short-term mortality in AP patients, it was concluded that the low HALP score could be employed during the process. Early diagnosis of AP and determination of prognosis are of great importance for accurate and rapid treatment planning. Especially in the high-risk patient group, application of specific treatments such as aggressive fluid support, close follow-up in terms of local and systemic complications, appropriate antibiotic use, and endoscopic interventional procedures without losing time reduces mortality and morbidity rates.[4]

Many different scoring systems and parameters have been used to determine the prognosis of AP. According to our investigation through the literature, there is no study examining the HALP score in predicting the prognosis of AP patients. However, there are studies examining the association between the variables of HALP score and AP.

The first variable of the HALP score is hemoglobin. It has been known that anemia leads to hypoxia by reducing the oxygen-carrying capacity of the blood. The severity of the disease increases due to hypoxia.[16] A study conducted in China has been examined the association between the prognosis and severity of AP patients and anemia. It has been a higher incidence concluded in AP cases diagnosed with anemia of acute renal failure and also seen poorer prognosis than patients without anemia.[17]

Albumin, the second variable of the HALP score, is a negative acute phase reactant. A decreased albumin in inflammation leads to the release of inflammatory cytokines. Therefore, serum albumin level would cause a reduction in inflammatory diseases.[18] In a multicenter study conducted with the data of 2461 AP patients, it was reported that mortality would increase more than 16 times if hypoalbuminemia was present in AP patients who admitted to the hospital.[19]

The third variable of the HALP score, the lymphocyte, is a portion of the white blood cells. Stress-increased lymphocytes mediate the inflammatory response. It has been shown that lymphopenia has a prognostic role in critical inflammatory diseases.[20] A study examining the result of lymphocyte percentage on prognosis in AP patients shows that the percentage of lymphocytes could be differentiated between mild and severe AP, and a lower lymphocyte ratio was detected in severe AP patients.[21]

Platelet, the last variable of the HALP score, shows a negative correlation with prognosis.[10] It has been shown that in the early inflammation phase of the pancreas, platelets contribute to ischemia-reperfusion injury.[22] In a small cohort study conducted in Japan, severe AP was detected in 87.9% of AP patients with thrombocytosis, and it was noted that patients diagnosed with thrombocytosis had a higher risk of local pancreatic complications.[23] In our study, we concluded that patients with a mortal course had lower hemoglobin, albumin, lymphocyte, and higher platelet ratios. However, since the studies examining the association between HALP score and AP do not exist in the literature yet, we did not compare the results of our research.

Since our study was single-centered and was conducted retrospectively, it has some limitations. Therefore, our findings should be confirmed by multicenter and large sample prospective studies. In this study, the efficacy of the scoring systems currently used for AP and the HALP scores were not compared. Therefore, we could not comment on whether the HALP score would be superior to other scores.

CONCLUSION

AP is a disease that can cause morbidity and mortality at high levels unless it is diagnosed early and treated properly. As a result of our study, it was concluded that the HALP score can be employed in predicting short-term mortality in AP patients. There is no study in the literature that reveals the HALP score's prognostic power in patients with AP, and our results will be the primary in the literature. However, the HALP score's prognostic value in AP patients can be revealed more clearly with multicenter, prospective validation studies that contain a larger number of patients.

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ORİJİNAL ÇALIŞMA - ÖZ

Akut pankreatitli hastalarda kısa dönem mortaliteyi tahmin etmede HALP skorunun öngörü gücü

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AMAÇ: HALP skorunun akut pankreatitte kısa vadeli mortaliteyi öngörme gücünü incelemek.

GEREÇ VE YÖNTEM: Çalışma üçüncü basamak bir hastanenin acil servisinde yapıldı. Acil servise başvuran ve akut pankreatit tanısı alan hastaların tıbbi kayıtları retrospektif olarak incelendi. HALP skorunun bu hastalarda kısa dönem mortaliteyi tahmin etme yeteneği analiz edildi.

BULGULAR: Çalışma toplam 634 hasta ile gerçekleştirildi. Bu hastaların yaş ortalaması 59.7±16.6 olup, 381'i (%60.1) kadındı. Dahil edilen toplam hastaların 42'si (%6.6) yoğun bakım ünitesine (YBÜ) alınırken, 58'i (%9.1) öldü. HALP skorlarının kısa vadeli mortaliteyi öngörme gücünü incelemek için alıcı çalışma karakteristikleri (ROC) analizi kullanıldı. Eğri altındaki alan (AUC) değeri 0.891 (%95 GA: 0.833-0.949) olarak bulundu. HALP skorunun kısa dönem mortaliteyi belirlemede cut-off değeri >15 olduğunda skorun duyarlılığı % 82.8, özgüllüğü % 86.8, pozitif öngörü değeri (PPV) %38.7 ve negatif öngörü değeri (NPV) %98.0.

SONUÇ: Akut pankreatit, erken tanı ve yeterli tedavi gerektiren bir hastalıktır, değilse yüksek oranda mortalite ve morbiditeye neden olabilir. Bu çalışma sonucunda HALP skorunun akut pankreatit tanılı hastalarda kısa dönem mortaliteyi öngörmede kullanılabileceği kanısına varıldı.

Anahtar sözcükler: Akut pankreatit; HALP skoru; mortalite.