ORİJİNAL MAKALE / ORIGINAL ARTICLE

Sağlık Bilimlerinde Değer / Sağlık Bil Değer
Value in Health Sciences / Value Health Sci
ISSN: 2792-0542 sabd@duzce.edu.tr 2024; 14(1): 33-38
doi: https://dx.doi.org/10.33631/sabd.1283601

The Role of Hemoglobin, Albumin, Lymphocyte, Platelet (HALP) Score in Acute Pancreatitis - An Analytical Study

Abuzer ÖZKAN [1], Cansu DUMAN [2], Serdar ÖZDEMİR [3]

ABSTRACT

Aim: The aim of this study is to assess the prognostic ability of Hemoglobin, Albumin, Lymphocyte, and Platelet parameters, as well as the calculated HALP score, in patients with acute pancreatitis. Additionally, it aimed to evaluate their association with prolonged hospitalization.

Material and Methods: This analytical study was designed retrospectively. The study population consisted of patients diagnosed with acute pancreatitis who were followed up in the emergency department between the date of May 15, 2022, and January 31, 2023. Patients were categorized into two groups based on their 30-day mortality, namely survivors and non-survivors. Patients hospitalized for more than eight days were classified as prolonged hospitalizations. HALP score was calculated by using formula of hemoglobin(g/dL) × albumin(g/dL) × lymphocyte(103/µL) / platelet(103/µL). Comparisons between groups were conducted for the HALP score.

Results: A total of 191 patients were included in the study. The rate of prolonged hospitalization was 23.6%. The mortality rate was 7.8%. The median HALP score was 3.1 (25th-75th percentiles: 2-5.4). There was no significant difference in the HALP score between survivors and non-survivors (3.2 (25th-75th percentiles: 2.1-5.4) versus 2.3 (25th-75th percentiles: 1.3-3.4), p = 0.050). However, there was a significant difference in the HALP score between the expected and prolonged hospitalization groups (3.4 (25th-75th percentiles: 2.1-5.7) versus 2.7 (25th-75th percentiles: 1.7-3.5), p=0.028).

Conclusion: The HALP score may not contribute significantly to predicting mortality in patients with acute pancreatitis. Nevertheless, utilizing the HALP score to predict hospitalization duration can enhance the efficiency of healthcare providers in managing patients.

Keywords: Hemoglobin; albumin; lymphocyte; platelet; acute pancreatitis.

Akut Pankreatitte Hemoglobin, Albümin, Lenfosit, Trombosit (HALP) Skorunun Rolü - Analitik Bir Çalışma

ÖZ

Amaç: Bu çalışmada akut pankreatitli hastalarda Hemoglobin, Albümin, Lenfosit, Trombosit parametreleri ile hesaplanan HALP skorunun prognostik yeteneğinin ilişkisini değerlendirmek amaçlandı. Ek olarak belirtilen parametrelerin uzamış hastanede yatışyla ilişkisi araştırıldı.

Gereç ve Yöntemler: Bu analitik çalışma retrospektif olarak tasarlandı. Araştırmanın evrenini 15 Mayıs 2022-31 Ocak 2023 tarihleri arasında acil serviste akut pankreatit tanısı ile takip edilen hastalar oluşturmaktadır. Hastalar 30 günlük mortalite durumlarına göre yaşayanlar ve yaşamayanlar olarak gruplandırıldı. Sekiz günden fazla hastane yatışı olan hastalar uzamış hastane yatışı olarak gruplandırıldı. HALP skoru hemoglobin (g/dL) × albumin (g/dL) × lenfosit sayısı (103/µL) / platelet (103/µL) formulu kullanılarak hesaplandı. Gruplar tüm parametreler ve HALP skoru açısından karşılaştırıldı.

Bulgular: Çalışmaya toplam 191 hasta dahil edildi. Uzamış hastane yatışı oranı %23,6 idi. Ölüm oranı %7,8 idi. Ortanca HALP skoru 3,1 (25.-75. persantil: 2-5.4) olarak hesaplandı. Hayatta kalanlar ve hayatta kalmayanlar arasında HALP skoru açısından anlamlı bir fark yoktu (3,2 (25. -75. yüzdelikler: 2,1-5,4) karşısında 2,3 (25. -75. yüzdelikler: 1,3-3,4), p=0,050). Ancak beklenen ve uzun süreli hastanede yatış grupları arasında HALP skoru açısından anlamlı bir fark vardı (3,4 (25. -75. yüzdelikler: 2,1-5,7) ve 2,7 (25. -75. yüzdelikler: 1,7-3,5), p=0,028).

1 Department of Emergency Medicine, University of Health Sciences Bağcılar Training and Research Hospital, Istanbul, Turkey.
2 Department of Emergency Medicine, Sultanbeylı State Hospıtal, Istanbul, Turkey
3 Department of Emergency Medicine, University of Health Sciences Umraniye Training and Research Hospital, Istanbul, Turkey

Sorumlu Yazar / Corresponding Author: Abuzer ÖZKAN , e-mail: ebuzerozkan@gmail.com
Geliş Tarihi / Received: 14.14.2023, Kabul Tarihi / Accepted: 10.10.2023

Sonuç: HALP skoru akut pankreatit hastalarının mortalite öngörülerinde klinisyenlere katkı sağlamayabilir. Yatış süresini öngörmede ise HALP skorundan faydalanmak hekimlerin hasta yönetiminde daha verimli olmasını sağlayacaktır.
Anahtar Kelimeler: Hemoglobin; albumin; lenfosit; platelet; akut pankreatit.

INTRODUCTION

Abdominal pathologies are among the leading causes of emergency department admissions (1). Acute pancreatitis is a nonspecific cause of abdominal pain. Physical examination alone is not sufficient to make a diagnosis. Physical examination findings, laboratory and radiological findings are evaluated together to make the diagnosis (2). Inflammation, which is involved in the pathogenesis of the disease, can be life-threatening when it causes an excessive response. Inflammation plays a key role in the path to death, and an excessive immune response (3). Various laboratory parameters and scoring systems have been developed to prognosticate the disease or to determine its severity or to predict prolonged hospitalization (4-6). Ranson, APACHE II, BISAP and ED-SAS are some of the scoring systems studied in this area (7). On the other hand, even if it does not end with mortality, acute pancreatitis can result in permanent damage in cases where it is complicated and causes significant loss of work power.

Hemoglobin, albumin, lymphocyte, platelet score (HALP score) has been shown in the literature to be a biomarker that is an indicator of inflammation and nutritional status in malignancies such as gastrointestinal system malignancies and bladder cancer (8,9). HALP score has been shown to be associated with prognosis in pancreatic malignancies, one of the pancreatic pathologies (10). The relationship between acute pancreatitis and HALP score has not been investigated in the literature yet. In this study, we aimed to test the prognostic ability of HALP score and its relationship with prolonged hospitalization in patients with acute pancreatitis.

MATERIAL AND METHODS

Design of the study

This analytical study was designed as a retrospective study. Our study was carried out in a training hospital with an average of 1123 emergency service applications per day during the study period. In the center where the study was conducted, there was a reference gastroenterology center of the region.

Study Population

The study population consisted of patients who presented to the emergency department of the center where the study was conducted between May 15, 2022, and January 31, 2023, with acute pancreatitis. Data were obtained from the hospital's electronic health record system. To access the data, the K.85 ICD code used for acute pancreatitis was searched from the emergency room patient records. The files of the patients registered with this code were examined by the researchers. The final diagnosis of acute pancreatitis was confirmed by the presence of at least two of the triad of abdominal pain, lipase elevation, and radiological findings. Patients with a confirmed diagnosis were included in the study. Patients with missing data were excluded from the study.

Organizing data

By examining electronic medical records, patients' demographics, comorbidities, length of hospital stay, all-cause mortality data within 30 days, and hematological and biochemical laboratory data were obtained. The patients were grouped in two different ways. First, survivor and non-survivor groups were formed according to all-cause mortality data within 30 days. Secondly, the cases were grouped according to their length of stay in the hospital. Those who were hospitalized for seven days or less were included in the expected hospitalization group, and those who were hospitalized for eight days, or more were included in the prolonged hospitalization group. We calculated HALP score by using formula of hemoglobin (g/dL) × albumin (g/dL) × lymphocyte (103/μL) / platelet (103/μL) (8).

Statistical Analysis

Jamovi program was used for statistical analysis. Firstly, the data were evaluated in terms of normal distribution with Shapiro Wilk test. Our data did not fit the normal distribution. Therefore, we used the Mann Whitney U test when comparing groups for continuous data. We used the chi-square test when comparing the categorical data. Number and percentage for categorical data, median for continuous data, and 25th and 75th percentiles were used when presenting the data. For statistical significance, values below 0.05 were preferred.

Ethical considerations

Approval for the study was obtained from the local ethics committee (with 02.23.2023/40). Since our study did not include the identity information of the cases, the informed consent form was not filled within the knowledge of the ethics committee.

RESULTS

A total of 256 patients were evaluated by the researchers. Forty-five cases were excluded from the study because they were not tested for complete blood count or albumin, and 20 cases were not available for mortality data. Ninety-five (49.7%) of the patients were female. The median age was 55 (41 to 67). The rate of prolonged hospitalization was 23.6%. The mortality rate was 7.8%. The median HALP score of 191 cases in the final study population was 3.1 (2-5.4). The main characteristics of the study population are presented in Table 1, along with a comparison of the short-term mortality and survivor groups. There was no statistically significant difference between the groups in terms of short-term mortality and baseline characteristics of the survivor groups.

Table 1. Baseline characteristics of the enrolled patients and their comparison between the survivor and non-survivor groups

Descriptive variables	Survivor (n = 176)	Non-survivor (n = 15)	Study Population (n = 191)	p
Age (years)	54 (41 to 66.2)	65 (52.5 to 78)	55 (41 to 67)	0.101 [a]
≥65 years	50 (28.4)	8 (53.3)	58 (30.4)	0.085 [b]
<65 years	126 (71.6)	7 (46.7)	133 (69.6)	
Gender *(n %)*				
Female	88 (50.0)	7 (46.7)	95 (49.7)	1.000 [b]
Male	88 (50.0)	8 (53.3)	96 (50.3)	
Comorbidities *(n %)*				
Chronic obstructive pulmonary disease	10 (5.7)	0 (0.0)	10 (5.2)	0.730 [b]
Hypertension	63 (35.8)	4 (26.7)	67 (35.1)	0.668 [b]
Diabetes mellitus	27 (15.3)	1 (6.7)	28 (14.7)	0.595 [b]
Coronary heart disease	27 (15.3)	0 (0.0)	27 (14.1)	0.211 [b]
Congestive heart failure	7 (4.0)	0 (0.0)	7 (3.7)	0.943 [b]
Chronic kidney disease	7 (4.0)	1 (6.7)	8 (4.2)	1.000 [b]
History of malignancy	14 (8.0)	3 (20.0)	17 (8.9)	0.271 [b]

[a] compared with Mann Whitney U test. [b] compared with chi square test.

Laboratory parameters such as creatinine, blood urea nitrogen, mean platelet volume, and glucose were found to be statistically significantly higher in the non-survivor group when compared to the survivor group. On the other hand, hemoglobin, lipase, albumin and amylase levels were significantly higher in the survivor group (p = 0.002, 0.002, 0.042, 0.047, 0.010, 0.007, 0.002, 0.014, respectively) (Table 2).

Table 2. Comparison of the investigated laboratory parameters and length of stay between survivors and non-survivors

Laboratory parameters	Survivor group (n = 176) (Median 25th -75th percentiles)	Non-survivor group (n = 15) (Median 25th -75th percentiles)	Study Population n = 191 (Median 25th -75th percentiles)	p
White blood cell count ($10^3/\mu L$)	10.9 (8.8 to 15)	11.8 (9.6 to 14.6)	11 (8.8 to 15)	0.620 [a]
Neutrophil count ($10^3/\mu L$)	8.6 (6.2 to 12.3)	9.9 (7.6 to 13.7)	8.7 (6.2 to 12.5)	0.388 [a]
Lymphocyte count ($10^3/\mu L$)	1.5 (1.0 to 2.3)	1.1 (0.7 to 1.6)	1.5 (1 to 2.3)	0.112 [a]
Hemoglobin (g/dL)	13.6 (12.5 to 15.0)	12.6 (8.8 to 13.8)	13.5 (12.3 to 14.9)	**0.010** [a]
Hematocrit (%)	41.2 (37.9 to 44.7)	38.6 (28.1 to 43.4)	41 (37.6 to 44.7)	0.039 [a]
Mean platelet volume (fL)	13.6 (13.2 to 14.3)	14.6 (13.6 to 15.8)	13.7 (13.2 to 14.4)	**0.042** [a]
Platelet count ($10^3/\mu L$)	257.5 (202.8 to 305.2)	221.0 (200.5 to 293.5)	255.0 (202.0 to 305.5)	0.416 [a]
Glucose (mg/dL)	122 (97.8 to 151)	157.0 (125.5 to 202.5)	124.0 (98.0 to 153.5)	**0.047** [a]
Albumin (g/dL)	42.1 (38.6 to 45)	37.1 (29.4 to 39.9)	42.0 (38.0 to 44.7)	**0.002** [a]
Alanine aminotransferase (IU/L)	91.5 (21.8 to 331.8)	59 (21 to 468)	91.0 (21.0 to 336.0)	0.819 [a]
Amylase (U/L)	740.5 (275.5 to 1764.5)	276 (213.5 to 439)	697.0 (262.5 to 1649.5)	**0.014** [a]
Aspartate aminotransferase (IU/L)	105 (28 to 250.5)	173 (21.5 to 340.5)	106 (26 to 263)	0.951 [a]
Blood urea nitrogen (mg/dL)	27.8 (23.4 to 38.1)	66 (30.2 to 134.2)	27.8 (23.5 to 38.9)	**0.002** [a]
Creatinine (mg/dL)	0.8 (0.7 to 1)	1.4 (0.8 to 2.8)	0.8 (0.7 to 1)	**0.002** [a]
C-reactive protein. (mg/dL)	9.7 (3 to 44.5)	18.8 (6.9 to 48.1)	10 (3 to 45.8)	0.291 [a]
Lipase (U/L)	1677.2 (540.7 to 3975.2)	478.8 (401.1 to 1350.7)	1556 (493 to 3687.9)	**0.007** [a]
Potassium (mmol/L)	4.3 (4.0 to 4.6)	4.2 (4.1 to 4.9)	4.3 (4.0 to 4.6)	0.851 [a]
Sodium (mEq/L)	139 (137 to 141)	137.2 (134.2 to 142)	139 (137 to 141)	0.364 [a]
Total bilirubin (mg/dL)	1.7 (0.6 to 3.4)	0.9 (0.6 to 2.2)	1.5 (0.6 to 3.4)	0.354 [a]
Direct Bilirubin (mg/dL)	0.9 (0.2 to 2)	0.3 (0.1 to 1.6)	0.8 (0.2 to 2)	0.332 [a]
Indirect Bilirubin (mg/dL)	0.7 (0.4 to 1.5)	0.4 (0.3 to 0.9)	0.6 (0.4 to 1.4)	0.201 [a]
HALP score	3.2 (2.1 to 5.4)	2.3 (1.3 to 3.4)	3.1 (2 to 5.4)	0.050 [a]
Length of Stay (Days) (25th-75th percentiles) [a]	4 (3 to 7)	3 (1 to 10)	4.0 (2 to 7)	0.361 [a]
≤ 7 days (%)	135 (76.7)	11 (73.3)	146 (76.4)	1.000 [b]
>7 days (%)	41 (23.3)	4 (26.7)	45 (23.6)	

a compared with Mann Whitney U test. b compared with chi square test.

The comparison of the expected and prolonged hospitalization groups in terms of basic characteristics is summarized in Table 3. There was no statistically significant between these two groups in terms of baseline characteristics. Comparing the expected and prolonged hospitalization groups in terms of laboratory parameters, it was observed that albumin, sodium, and HALP scores were significantly higher in the expected hospitalization group (p=0.040, 0.014, 0.028, respectively) (Table 4). The average length of stay for patients in the length of stay group was 11 days.

Table 3. Comparison of the investigated parameters between prolonged and expected hospitalization groups

Descriptive variables	***Expected hospitalization.*** *n = 146* n (%)	***Prolonged hospitalization*** *n = 45* n (%)	**p**
Age (years)	55 (41 to 67)	56 (45 to 61)	0.970 [a]
≥65 years	98 (67.1)	35 (77.8)	0.241[b]
<65 years	48 (32.9)	10 (22.2)	
Gender			
Female	69 (47.3)	26 (57.8)	0.288 [b]
Male	77 (52.7)	19 (42.2)	
Comorbidities			
Chronic obstructive pulmonary disease	6 (4.1)	4 (8.9)	0.381 [b]
Hypertension	47 (32.2)	20 (44.4)	0.184 [b]
Diabetes mellitus	19 (13.0)	9 (20.0)	0.359 [b]
Coronary heart disease	20 (13.7)	7 (15.6)	0.946 [b]
Congestive heart failure	5 (3.4)	2 (4.4)	1.000 [b]
Chronic kidney disease	5 (3.4)	3 (6.7)	0.601 [b]
History of malignancy	11 (7.5)	6 (13.3)	0.371 [b]

a compared with Mann Whitney U test. b compared with chi square test.

Table 4. Comparison of the investigated laboratory parameters and mortality between prolonged and expected hospitalization groups

Laboratory parameters	***Expected hospitalization.*** *n = 146* (Median 25th -75th percentiles)	***Prolonged hospitalization*** *n = 45* (Median 25th -75th percentiles)	**p**
White blood cell count ($10^3/\mu L$)	10.9 (8.8 to 14.8)	11.3 (8.4 to 15.8)	0.619 [a]
Neutrophil count ($10^3/\mu L$)	8.5 (6.2 to 12.0)	9.3 (6.1 to 14.0)	0.524 [a]
Lymphocyte count ($10^3/\mu L$)	1.5 (1.0 to 2.3)	1.5 (0.9 to 1.8)	0.379 [a]
Hemoglobin (g/dL)	13.8 (12.5 to 15.1)	13.1 (11.9 to 14.2)	0.113 [a]
Hematocrit (%)	41.3 (38.3 to 44.8)	39.6 (36.2 to 43.0)	0.094 [a]
Mean platelet volume (fL)	13.7 (13.2 to 14.4)	13.7 (13.2 to 14.4)	0.996 [a]
Platelet count ($10^3/\mu L$)	250 (202.2 to 301.2)	260 (202 to 306)	0.408 [a]
Glucose (mg/dL)	120.5 (97.0 to 152.8)	130.0 (104.0 to 161.0)	0.481 [a]
Albumin (g/dL)	42.2 (39.2 to 45.0)	40.8 (35.3 to 44.0)	**0.040** [a]
Alanine aminotransferase (IU/L)	90.0 (21.2 to 333.2)	91.0 (21.0 to 369.0)	0.501 [a]
Amylase (U/L)	697.5 (240.5 to 1716.5)	697.0 (270.0 to 1500.0)	0.842 [a]
Aspartate aminotransferase (IU/L)	105.0 (25.2 to 279.8)	106.0 (30.0 to 250.0)	0.935 [a]
Blood urea nitrogen (mg/dL)	27.8 (23.5 to 38.2)	30.0 (23.5 to 42.9)	0.430 [a]
Creatinine (mg/dL)	0.8 (0.7 to 1.0)	0.8 (0.7 to 1.0)	0.688 [a]
C-reactive protein. (mg/dL)	9.0 (3.0 to 39.6)	25.0 (4.0 to 79.6)	0.153 [a]
Lipase (U/L)	1651 (495.8 to 3859)	1150 (478.8 to 3526.8)	0.395 [a]
Potassium (mmol/L)	4.3 (4.0 to 4.6)	4.2 (4.0 to 4.6)	0.484 [a]
Sodium (mEq/L)	139 (137 to 141)	138 (136 to 140)	**0.014** [a]
Total bilirubin (mg/dL)	1.4 (0.6 to 3.1)	1.9 (0.6 to 4.5)	0.419 [a]
Direct Bilirubin (mg/dL)	0.8 (0.2 to 1.8)	0.9 (0.2 to 2.8)	0.317 [a]
Indirect Bilirubin (mg/dL)	0.7 (0.3 to 1.2)	0.6 (0.4 to 1.6)	0.716 [a]
HALP score	3.4 (2.1 to 5.7)	2.7 (1.7 to 3.5)	**0.028** [a]
Length of Stay Days	3 (2 to 5)	11 (9 to 14)	**<.001** [a]
Mortality (%)	11 (7.5)	4 (8.9)	1.000 [b]

a compared with Mann Whitney U test.
b compared with chi square test.

DISCUSSION

In the current study, we investigated the role of HALP score in acute pancreatitis. In order to reveal the role of HALP score in acute pancreatitis, we accepted mortality and prolonged hospitalization as primary outcomes in our sample. According to the results, there was a significant difference in the prolonged hospitalization groups, while it was insignificant for mortality. To our knowledge, the current study was the first to test the HALP score in patients with acute pancreatitis.

Although the pathogenesis of acute pancreatitis varies depending on the etiological cause, it is basically a self-digestion event with the activation of zymogens in the pancreas. Parenchymal damage begins with the effect of various factors in etiology (12). Pancreatic injury activates leukocytes and releases proinflammatory chemokines, promoting their migration to the damaged area. It has been reported that excessive inflammatory response may cause a decrease in platelet volume (13,14). Lymphocytes play an important role in the repair and elimination of inflammation. Low lymphocyte counts have been related to cytokine storm and poor prognosis in acute pancreatitis (15).

Another parameter associated with poor prognosis in acute pancreatitis is low albumin level (16). Here are a few mechanisms that may cause low albumin levels in acute pancreatitis. First of all, there is a decrease in albumin synthesis in the liver due to increased cytokine levels (17). Secondly, there is a decrease in amino acid supply with increased hunger and catabolism (18). Third, there is albumin leakage from the intravascular space to the interstitial space due to endothelial damage (19). As the current study results confirm the literature, both prolonged hospitalization and mortality were associated with low albumin levels.

Current literature has shown that the HALP score can reflect the inflammation and nutritional status of patients (20). Thrombosis and anemia increase inflammation, whereas lymphocytes reduce inflammation. Albumin level is an indicator of nutritional status. Researchers suggested that albumin as an acute phase reactant reflects the severity of inflammation and disease in acute diseases (21,22). In the light of all this information, we speculated that the HALP score may be associated with prognosis in acute pancreatitis. A logical explanation for our results showing that they were not associated with short-term mortality might be that the patients' laboratory tests were performed at admission. On the other hand, it is still reasonable for patients with relatively poor nutritional status to be hospitalized for longer.

There are several important limitations of our study. First, the fact that our study was designed retrospectively was an important limitation. Second, we were unable to report a radiological or clinical severity index that could describe our sample. Third, we only had initial HALP values of the patients. In acute pancreatitis prognosis, there are prognostic scores evaluated at 24th and 48th hours (23). We could not evaluate the 24th and 48th hour HALP scores. Finally, the relatively small sample size and single-center nature of our study limit the generalizability of the results of our study.

CONCLUSION

As a conclusion, according to the results of the current study, there was no significant difference in HALP score between the deceased and the survivors. However, the prolonged hospitalization group had lower values of HALP score. We think that the HALP score at admission can give an idea about predicting prolonged hospitalization. We believe that our data should be validated by multicenter studies with larger samples.

Acknowledgement

We would like to thank Dr. Neslihan Tolga for her contribution to the acquisition of the data.

Authors's Contributions: Idea/Concept: A.Ö., C.D., S.Ö.; Design: A.Ö., C.D., S.Ö.; Data Collection and/or Processing: C.D., S.Ö.; Analysis and/or Interpretation: A.Ö., C.D.; Literature Review: A.Ö., S.Ö.; Writing the Article: A.Ö., S.Ö.; Critical Review: A.Ö., C.D., S.Ö.

REFERENCES

1. Cervellin G, Mora R, Ticinesi A, Meschi T, Comelli I, Catena F, et al. Epidemiology and outcomes of acute abdominal pain in a large urban emergency department: retrospective analysis of 5,340 cases. Ann Transl Med. 2016; 4(19): 362.
2. Doganay F, Ak R, Yilmaz E. Predictive performance of lactate as a mortality predictor in patients with acute pancreatitis. J Coll Physicians Surg Pak. 2022; 32(4): 440-4.
3. Chen L, Deng H, Cui H, Fang J, Zuo Z, Deng J, et al. Inflammatory responses and inflammation-associated diseases in organs. Oncotarget. 2017; 9(6): 7204-18.
4. İslam MM, Osoydan Satıcı M, Ademoğlu E, Erdil FN, Odabaşı T, Eker A, et al. The role of delta neutrophil index in early identification of severe acute pancreatitis in adult patients: a prospective diagnostic accuracy study. Med Sci Discov. 2023; 10(7): 487-94.
5. Özdemir S, Altunok İ, Algın A. Relationship of the systemic immuno-inflammation index and hematological inflammatory index with mortality and hospitalization in acute pancreatitis: a cross-sectional study. Frontiers in Emergency Medicine. 2023 ;7(2): e13.
6. Şenlikci A, Ergüder E, Süleyman M, Koşmaz K, Durhan A, Şeneş M, et al. Does monocyte distribution width (MDW) have prognostic value in acute pancreatitis? J Contemp Med. 2021; 11(3): 335-9.
7. Emem MK, Ak R, Kılıç M. Investigation of the predictive ability of the ED-SAS scoring system on mortality for acute pancreatitis at the emergency department. South Clin Ist Euras. 2022; 33(3): 257-61.
8. Ekinci F, Balcik OY, Oktay E, Erdogan AP. HALP score as a new prognostic index in metastatic renal cell cancer. J Coll Physicians Surg Pak. 2022; 32(3): 313-8.
9. Kaya C, Caliskan S, Sungur M, Aydın C. HALP score and albumin levels in men with prostate cancer and benign prostate hyperplasia. Int J Clin Pract. 2021; 75(3): e13766.
10. Xu SS, Li S, Xu HX, Li H, Wu CT, Wang WQ, et al. Haemoglobin, albumin, lymphocyte and platelet

predicts postoperative survival in pancreatic cancer. World J Gastroenterol. 2020; 26(8): 828-38.
11. Kılıç M, Ak R, Alışkan H. The utility of hemoglobin, albumin, lymphocyte and platelet (HALP) score in predicting mortality among COVID-19 patients: a preliminary study. Signa Vitae. 2023; 19(1): 143-7.
12. Wang GJ, Gao CF, Wei D, Wang C, Ding SQ. Acute pancreatitis: etiology and common pathogenesis. World J Gastroenterol. 2009; 15(12): 1427-30.
13. Akoglu EU, Özdemir S, Ak R, Ozturk TC. The discriminative power of inflammatory markers in patients with mild-to-moderate acute pancreatitis: mean platelet volume, neutrophil-lymphocyte ratio, lymphocyte-monocyte ratio, and neutrophil-monocyte product. South Clin Ist Euras. 2021; 32(2): 159-64.
14. Altunok İ, Ozdemir S. Relationship between platelet indices and prolonged hospitalization in patients with acute pancreatitis: a retrospective observational study. J Contemp Med. 2022; 12(5): 743-8.
15. Tekyol D, Kılıç M. Usage of the Ranson criteria and neutrophil-lymphocyte ratio measured on presentation to the emergency department in the prediction of mortality in acute pancreatitis. Signa Vitae. 2022: 18(5); 133-7.
16. Hong W, Lin S, Zippi M, Geng W, Stock S, Basharat Z, et al. Serum albumin is independently associated with persistent organ failure in acute pancreatitis. Can J Gastroenterol Hepatol. 2017; 2017 :5297143.
17. Ocskay K, Vinko Z, Nemeth D, Szabo L, Bajor J, Godi S, et al. Hypoalbuminemia affects one third of acute pancreatitis patients and is independently associated with severity and mortality. Sci Rep. 2021; 11(1): 24158.
18. Li S, Zhang Y, Li M, Xie C, Wu H. Serum albumin, a good indicator of persistent organ failure in acute pancreatitis. BMC Gastroenterol. 2017; 17(1): 59.
19. Gundpatil DB, Somani BL, Saha TK, Banerjee M. Serum urea: albumin ratio as a prognostic marker in critical patients with non-chronic kidney disease. Indian J Clin Biochem. 2014; 29(1): 97-100.
20. Tian M, Li Y, Wang X, Tian X, Pei LL, Wang X, et al. The hemoglobin, albumin, lymphocyte, and platelet (HALP) score is associated with poor outcome of acute ischemic stroke. Front Neurol. 2021; 11: 610318.
21. Özdemir S, Algin A. Evaluation of the ability of the C-reactive protein-to-albumin ratio to predict short-term mortality in patients with COVID-19. J Clin Med Kaz. 2021; 18(6): 35-9.
22. Ozdemir S, Akca HŞ, Algin A, Eroğlu SE. Can C-reactive protein-to-albumin ratio be a predictor of short-term mortality in community-acquired pneumonia? Ann Clin Anal Med. 2021; 12(9): 1043-8. https://orcid.org/0000-0002-6186-6110
23. Wang L, Zeng YB, Chen JY, Luo Q, Wang R, Zhang R, et al. A simple new scoring system for predicting the mortality of severe acute pancreatitis: A retrospective clinical study. Medicine (Baltimore). 2020; 99(23): e20646.