ORIGINAL ARTICLE

Evaluation of the relationship between Hemoglobin, Albumin, Lymphocyte, Platelet (HALP) score and treatment modality and mortality in patients with ileus

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ABSTRACT

BACKGROUND: Ileus is a clinical condition defined as obstruction of the intestines and develops as a result of a mechanical obstruction or paralytic etiologies. Small bowel obstructions are primarily referred to as surgical conditions, but conservative treatment is one of the treatment protocols of choice in some of patients. The aim of the present study was to evaluate the effectiveness of hemoglobin, albumin, lymphocyte, and platelet (HALP) score in determining the conservative versus surgical treatment decision, mortality, and length of hospitalization and demonstrate its superiority over other parameters thought to be associated with inflammation in patients with ileus.

METHODS: Patients with a diagnosis of ileus were included in the study. Age, gender, comorbidities, selected treatment modality (conservative or surgical), length of hospitalization, and in-hospital mortality were determined and recorded. White blood cell, hemoglobin, platelet, neutrophil, lymphocyte, neutrophil, lymphocyte, urea, creatinine, aspartate aminotransferase (AST), bilirubin, albumin, and C-reactive protein (CRP) levels from biochemistry parameters were recorded. HALP score was calculated and the relationship with mortality, length of hospitalization, and conservative versus surgical treatment decision was analyzed.

RESULTS: A total of 286 patients were included in the study. Conservative treatment was used in 245 (85.7%) patients. Mortality was not observed in 262 (91.6%) patients, 24 (8.4%) of the patients were died. HALP score was significantly higher in surviving patients (p=0.045). The median albumin value of the surviving patients was lower than that of the patients who died (p<0.001). The patients with mortality had significantly higher age, urea, creatinine, AST, and CRP values than those without (p=0.002, p<0.001, p<0.001, p<0.001, p<0.001, and p=0.001, respectively). HALP score of patients with conservative treatment was significantly higher (p=0.003) than those who underwent surgical treatment. Lymphocyte value was significantly higher in patients followed up with conservative treatment (p=0.027). Age, urea, creatinine, and CRP scores were higher in patients who underwent surgery (p=0.007, p<0.001, 0.003, and p<0.001, respectively). HALP score demonstrated that sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio values for a HALP score of 28 were 50.6%, 78.0%, 2.3, and 0.63 for predicting conservative treatment (AUC 0.645 [95% confidence interval =0.556–0.735]; p=0.003).

CONCLUSION: The HALP score is an important scoring system that may be useful in determining mortality and treatment modality in patients with ileus. We believe that HALP score will contribute positively to the management of patients with a diagnosis of ileus, both in reducing mortality and in determining the appropriate treatment modality.

Keywords: Albumin; hemoglobins; ileus; intestines; lymphocytes; platelets.

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INTRODUCTION

Ileus is a clinical condition defined as complete or partial obstruction of intestinal transit and develops as a result of a mechanical obstruction in the intestines or paralytic etiologies.[1] Although stuck hernias are the major cause of mechanical obstruction in developing countries, the most common cause in developed countries is post-operative adhesions.[2] In addition, primary and secondary paralytic ileus are included in the differential diagnosis.[2] Although small bowel obstructions are primarily referred to as surgical conditions, conservative treatment is one of the treatment protocols of choice.[3] In patients managed non-operatively, 90% of success rate is observed in the absence of peritonitis or perforation.[4] Considering that emergency laparotomies are thought to increase mortality, especially in patients aged >80 years, decision regarding opting for surgical or conservative treatment can be a dilemma for surgeons.[5] Although early diagnosis and correct treatment can partially prevent the development of life-threatening processes, determining the ideal treatment method and completely eliminating mortality continue to be a challenge.[6]

The hemoglobin, albumin, lymphocyte, and platelet score (HALP score) is a scoring system that has recently been investigated for its diagnostic and prognostic value. This score reveals systemic inflammation and nutritional status, and, as it can be easily calculated, it can be used in diseases with severe inflammation.[7,8] The HALP score has been associated with survival in gastric, colorectal, bladder, and renal cancers,[9-12] and recent studies have examined its prognostic value in diseases progressing with inflammation.[13] Ileus is an inflammatory process and can lead to the development of nutritional disorders; thus, it may be associated with HALP score. Therefore, the aim of the present study was to evaluate the effectiveness of the HALP score in determining the conservative versus surgical treatment decision, mortality, and length of hospitalization and demonstrate its superiority over other parameters thought to be associated with inflammation in patients with ileus.

MATERIALS AND METHODS

Study Design

The population in this cross-sectional study consisted of patients admitted to the emergency department between January 01, 2018, and December 31, 2022, and diagnosed with ileus in the emergency department. This study was performed in accordance with the principles of the Declaration of Helsinki. Approval for this study was provided by the Karabük University Faculty of Medicine Ethics Committee. All data were anonymized and statistical analyses were performed after anonymization.

Selection of Patients

Patients hospitalized in the emergency department of our hospital with a diagnosis of ileus were included in the study. Patients younger than 18 years, pregnant women, patients with missing data, and patients who were diagnosed with ileus during follow-up in the emergency department but whose diagnosis changed after hospitalization were excluded from the study.

Data Collection

Demographic characteristics such as age, gender, comorbidities (diabetes mellitus, coronary artery disease, hypertension, chronic obstructive pulmonary disease, chronic renal failure, cerebrovascular disease, and malignancy), selected treatment modality (conservative or surgical), length of hospitalization, and in-hospital mortality were determined and recorded. White blood cell, hemoglobin, platelet, neutrophil, lymphocyte, neutrophil, and lymphocyte levels from hemogram parameters and urea, creatinine, aspartate aminotransferase (AST), bilirubin, albumin, and C-reactive protein (CRP) levels from biochemistry parameters were recorded. HALP score was calculated with the following formula:[14]

hemoglobin (g/L) × albumin (g/L) × lymphocyte (n/L) / platelet (n/L)

HALP score was calculated and its relationship with mortality, length of hospitalization, and conservative versus surgical treatment decision was analyzed. Finally, the HALP score was compared with some other parameters known to be associated with inflammation (AST, urea, creatinine, neutrophils, bilirubin, CRP, and white blood cell count). Patients were divided into the following two groups: Those who underwent surgery and those who were followed conservatively. Criteria for surgical treatment were as follows: (1) Presence of strangulated hernia, (2) cecal diameter of >10 cm, (3) presence of perforations, (4) suspicion of sepsis, (5) vascular obstructions, (6) metabolic acidosis and lactic acidosis resistant to fluid therapy, and (7) intra-abdominal complications.

Outcome

The primary outcome was to determine the relationship between HALP score, treatment strategy, and mortality in patients with ileus. The secondary outcome was to determine the relationship of white blood cells, urea, creatinine, AST, bilirubin, albumin, and CRP values, which are known to be affected during inflammation, with HALP score, treatment strategy, and mortality.

Statistical Analysis

Statistical analyses were performed using IBM SPSS version 22.0. Normality of continuous variables was evaluated through Shapiro–Wilks and Kolmogorov–Smirnov tests. Data were expressed as mean ± standard deviation for normally distributed variables and median (1st and 3rd quartiles) for non-normally distributed variables. Intergroup differences were evaluated using Student's t-test or Mann–Whitney U-test where appropriate. Pearson Chi-square test was used to compare categorical data. Receiver operating characteristic (ROC) analysis was used to determine the sensitivity and specificity of the HALP score, and sensitivity and specificity were calculated for selected values. Statistical significance was indicated by $P<0.05$.

Table 1. Demographic data of the patients

Variable	Median (Q1-Q3)
Age (year)	71 (57–79)
	n (%)
Gender	
Female	117 (40.9%)
Male	169 (59.1%)
Comorbidities	180 (62.9%)
Hypertension	86 (30.1%)
Coronary artery disease	82 (28.7%)
Diabetes Mellitus	82 (28.7%)
Malignancy	66 (23.1%)
Chronic Obstructive Pulmonary	50 (17.5%)
Disease Ischemic Cerebrovascular Event	9 (3.1%)
Chronic Renal Failure	
Treatment modality	
Conservative	245 (85.7%)
Surgical	41 (14.3%)
Mortality	
Yes	24 (8.4%)
No	262 (91.6%)

RESULTS

A total of 306 patients were diagnosed with ileus in the emergency department during the study period. Six patients were excluded from the study according to exclusion criteria and 14 patients with missing data were removed from the sample. A total of 286 patients were included in the study. The median age of the patients was 71 (57–79) years. Of the patients included in the study, 169 (59.1%) were women. When the comorbidities of the patients were analyzed, hypertension was present in 180 (62.9%) patients and was the most common comorbidity. The second most common comorbidity was coronary artery disease in 86 (30.1%) patients. Conservative treatment was used in 245 (85.7%) patients. Mortality was not observed in 262 (91.6%) patients, whereas 24 (8.4%) patients died. Other demographic data of the patients are summarized in Table 1.

Analyses of the relationship between age, laboratory parameters, HALP score, length of hospitalization, and mortality status of the patients revealed that the median HALP score was 26.5 (16.9–43.2) in surviving patients and 21.4 (11.5–31.6) in patients with mortality. HALP score was significantly higher in surviving patients (p=0.045). Aside from the HALP score, the median albumin value of the surviving patients was 4.3 (3.9–4.7), which was significantly lower than that of the patients who died (p<0.001). In contrast to HALP and albu-

Table 2. Relationship between mortality and age, laboratory parameters, and length of hospitalization

	Total n=286 (100%)	Mortality		P-value
	Mean±SD	No n=262 (91.6%) Mean±SD	Yes n=24 (9.4%) Mean±SD	
Hemoglobin¥ (g/dl)	13.21±2.18	13.30 ±2.16	12.7± 2.30	0.087
	Median (Q1-Q3)	Median (Q1-Q3)	Median (Q1-Q3)	
Age£ (year)	71 (57–79)	70 (57–79)	79 (70–85)	0.002*
White blood cells (10^9/L) £	10.3 (7.8–14.8)	10.2 (7.9–14.4)	11.8 (6.6–16.2)	0.780
Platelet£ (10^9/L)	256 (206–321)	257 (208–319)	215 (297–336)	0.366
Neutrophil£ (10^9/L)	8.0 (5.9–12.0)	8.0 (5.9–12)	9.9 (5.0–14.2)	0.641
Lymphocyte£				
(10^9/L)	1.2 (0.9–1.7)	1.2 (0.9–1.7)	1.0 (0.6–1.5)	0.188
Urea£ (mg/dl)	46 (33–73)	45 (32–64)	88 (60–168)	<0.001*
Creatinine£ (mg/dl)	0.96 (0.74–1.39)	0.92 (0.73–1.30)	1.58 (1.21–2.03)	<0.001*
AST£ (U/L)	26 (20–33)	25 (20–32)	34 (25–60)	<0.001*
Total bilirubin£ (mg/dl)	0.7 (0.5–1)	0.7 (0.5–1)	0.8 (0.5–0.9)	0.640
Direct bilirubin£				
(mg/dl)	0.5 (0.3–0.7)	0.5 (0.3–0.7)	0.4 (0.3–0.6)	0.272
Albumin£ (g/L)	4.3 (3.8–4.7)	4.3 (3.9–4.7)	3.6 (2.9–4.4)	<0.001*
CRP£ (mg/L)	22.2 (6.2–69.6)	19.5 (5.3–60.3)	85.0 (27.3–124.8)	=0.001
HALP score£	25.7 (16.1–42.0)	26.5 (16.9–43.2)	21.4 (11.5–31.6)	0.045*
Length of Hospitalization £ (day)	2 (1–4)	2 (1–4)	2 (1–6)	0.362

¥ P<0.05 Student's t-test was used. £P<0.05 Mann–Whitney U-test was used.

Table 3. The relationship between age, laboratory parameters, and length of hospitalization and treatment modalities

		Treatment Modality		P-value
	Total n=286 (100%)	Conservative n=245 (85.7%)	Surgical n=41 (14.3%)	
	Mean±SD	Mean±SD	Mean±SD	
Hemoglobin¥ (g/dl)	13.21±2.18	13.30 ±2.16	12.7± 2.30	0.087
	Median (Q1-Q3)	Median (Q1-Q3)	Median (Q1-Q3)	
Age£ (year)	71 (57–79)	70 (57–79)	79 (70–85)	0.002*
White blood cells (10^9/L) £	10.3 (7.8–14.8)	10.2 (7.9–14.4)	11.8 (6.6–16.2)	0.780
Platelet£ (10^9/L)	256 (206–321)	257 (208–319)	215 (297–336)	0.366
Neutrophil£ (10^9/L)	8.0 (5.9–12.0)	8.0 (5.9–12)	9.9 (5.0–14.2)	0.641
Lymphocyte£				
(10^9/L)	1.2 (0.9–1.7)	1.2 (0.9–1.7)	1.0 (0.6–1.5)	0.188
Urea£ (mg/dl)	46 (33–73)	45 (32–64)	88 (60–168)	<0.001*
Creatinine£ (mg/dl)	0.96 (0.74–1.39)	0.92 (0.73–1.30)	1.58 (1.21–2.03)	<0.001*
AST£ (U/L)	26 (20–33)	25 (20–32)	34 (25–60)	<0.001*
Total bilirubin£ (mg/dl)	0.7 (0.5–1)	0.7 (0.5–1)	0.8 (0.5–0.9)	0.640
Direct bilirubin£				
(mg/dl)	0.5 (0.3–0.7)	0.5 (0.3–0.7)	0.4 (0.3–0.6)	0.272
Albumin£ (g/L)	4.3 (3.8–4.7)	4.3 (3.9–4.7)	3.6 (2.9–4.4)	<0.001*
CRP£ (mg/L)	22.2 (6.2–69.6)	19.5 (5.3–60.3)	85.0 (27.3–124.8)	=0.001
HALP score£	25.7 (16.1–42.0)	26.5 (16.9–43.2)	21.4 (11.5–31.6)	0.045*
Length of Hospitalization £ (day)	2 (1–4)	2 (1–4)	2 (1–6)	0.362

¥ P<0.05 Student's t-test was used. £p<0.05 Mann–Whitney U-test was used.

min values, the patients with mortality had significantly higher age, urea, creatinine, AST, and CRP values than those without (p=0.002, <0.001, <0.001, <0.001, <0.001, and =0.001, respectively). No was observed correlation between other laboratory parameters and mortality. In addition, the median length of hospitalization was 2 days (1–6 days) in patients with mortality and 2 days (1–4 days) in patients without mortality, with no significant difference between the two groups in terms of length of hospitalization (p=0.362). The relationship between mortality and age, laboratory parameters, and length of hospitalization is shown in Table 2.

Analysis of the relationship between treatment modality and age, laboratory parameters, HALP score, and length of hospitalization revealed that the median HALP score was 28.5 (17.1–44.4) in patients who were followed up with conservative treatment and 20.3 (12.3–27.5) in patients who underwent surgical treatment. The HALP score of patients who were followed up with conservative treatment was significantly higher (p=0.003) than those who underwent surgical treatment. In addition to the HALP score, lymphocyte value was significantly higher in patients followed up with conservative treatment (p=0.027). Age, urea, creatinine, and CRP scores were higher in patients who underwent surgery (p=0.007, <0.001, 0.003, and <0.001, respectively). In addition, the length of hospitalization was 2 days (1–3) in conservatively treated patients and 8 days (5–14) in surgically treated patients (p<0.001). The relationship between age, laboratory parameters, length of hospitalization, and treatment modalities is shown in Table 3.

Results of the ROC analysis performed for treatment modality and HALP score demonstrated that sensitivity, specificity, positive likelihood ratio, and negative likelihood ratio values for a HALP score of 28 were 50.6%, 78.0%, 2.3, and 0.63 for predicting conservative treatment (AUC 0.645 [95% confidence interval = 0.556–0.735]; p=0.003) (Fig. 1).

DISCUSSION

The results obtained in the present study showed that the risk of mortality was high in patients with a low HALP score, and a low HALP score was predictive for the need to undergo surgical treatment. A review of the studies in the relevant literature revealed that high CRP levels were correlated with the duration of hospitalization and were a predictive factor in determining in-hospital mortality.[15,16] In the present study, high CRP was associated with mortality, consistent with the

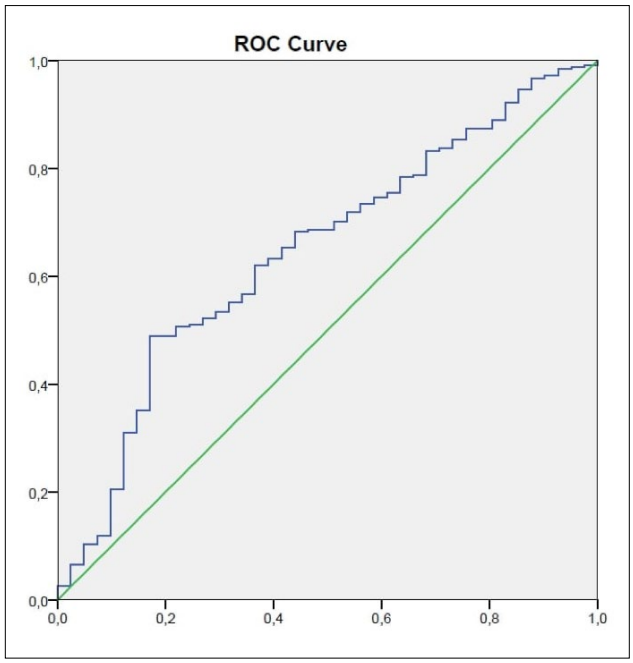

Figure 1. ROC curve for treatment modality and HALP score.

literature. Yoon and Lee reported that high neutrophil levels were predictive factors in determining in-hospital mortality, whereas lymphocyte levels were not effective in predicting mortality in the same study.[15] In the present study, no significant difference was observed in the neutrophil and lymphocyte levels in patients with mortality. Studies performed on patients who underwent surgery for small bowel obstruction showed that low albumin levels were correlated with the duration of hospitalization and were a risk factor for mortality.[16,17] In the present study, an association between low albumin levels and mortality was identified. In addition, this is possibly the first study to evaluate the relationship between HALP score and mortality in patients with ileus. Results of this evaluation showed that mortality rate was higher in patients with low HALP scores. This may be explained by the fact that HALP score, albumin, and CRP are associated with inflammation, and organ dysfunctions develop in patients as disease severity increases.

Another aim of the present study was to examine the relationship between treatment modality and HALP score in patients with ileus. In a study investigating the effectiveness of biomarkers in determining mortality and treatment modality in patients with ileus in the emergency department, high CRP and low albumin levels were significant in predicting the surgical treatment modality.[16] Lapsekili and Bilge examined the parameters used to determine the treatment modality in patients with intestinal obstruction and reported that neutrophil and lymphocyte levels were not significant when comparing surgical and conservative treatment groups.[18] In the present study, neutrophil and albumin levels were not significant in predicting surgical treatment modality, whereas low lymphocyte levels, low HALP scores, and high CRP levels were significant.

Notably, 15% of small bowel obstructions present to the hospital requiring emergency surgery.[19] The decision between conservative and surgical treatment is the biggest challenge in the management of these patient groups.[19] Although clinical examination and early radiological imaging are the main methods used in the decision-making process, supporting these methods with laboratory parameters may help to eliminate the possibility of delayed surgery. In the present study, 85.7% of the patients were followed up with conservative treatment, whereas 14.3% underwent surgical treatment.

Although the mortality rate is 3% in cases of small bowel obstruction not complicated with necrosis and perforation, which may result in 30,000 deaths per year, this rate reaches up to 30% in complicated cases.[3] In the present study, the mortality rate was 8.4% in the patients included, and we believe that this was attributable to the fact that obstruction complications were not analyzed separately in the methodology of the study.

Limitation

This study was planned retrospectively and all parameters affecting inflammatory processes could not be taken into consideration. Furthermore, decisions regarding the need for conservative or surgical treatment were made by general surgeons. In addition to the clinical condition of the patients, reasons such as refusal of the operation or the patient's preoperative condition posing a high risk for anesthesia were also taken into consideration and may have caused changes in the parameters.

CONCLUSION

The HALP score is an important scoring system that may be useful in determining mortality and treatment modality in patients with ileus. When evaluated together with clinical examination and radiological imaging methods, we believe that the HALP score will contribute positively to the management of patients with a diagnosis of ileus, both in reducing mortality and in determining the appropriate treatment modality.

Ethics Committee Approval: This study was approved by the Karabuk University, Medicine Faculty Ethics Committee (Date: 27.03.2023, Decision No: 2023/1307).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: B.B., B.C.; Design: B.B., B.C.; Supervision: S.E.A., B.B.; Resource: B.C., B.B.; Materials: B.B., S.E.A.; Data collection and/or processing: B.B., B.C.; Analysis and/or interpretation: M.D., Y.K.G.; Literature search: Y.K.G., M.D.; Writing: B.B., S.E.A.; Critical review: Y.K.G., B.C., M.D.

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ORİJİNAL ÇALIŞMA - *ÖZ*

İleus hastalarında tedavi modalitesi ve mortalite ile hemoglobin, albumin, lenfosit, platelet (HALP) skoru arasındaki ilişkinin değerlendirilmesi

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AMAÇ: İleus, bağırsak geçişinin tıkanması olarak tanımlanan ve bağırsaklarda mekanik obstrüksiyon veya paralitik nedenlere bağlı olarak gelişen klinik durumdur. İnce bağırsak obstrüksiyonları primer olarak cerrahi durumlar olarak anılsada, konservatif tedavi bazı hastalarda seçilen bir tedavi protokolüdür. Bu çalışmanın amacı, ileus hastalarında HALP skorunun konservatif-cerrahi tedavi kararını, mortaliteyi ve hastanede kalış süresini belirlemede efektivitesini ve enflamasyonla ilişkili diğer parametrelere üstünlüğünü değerlendirmektir.

GEREÇ VE YÖNTEM: Çalışmaya ileus tanısı alan hastalar dahil edildi. Yaş, cinsiyet, komorbiditeler, seçilen tedavi yöntemi (konservatif veya cerrahi), hastanede kalış süresi ve hastane içi mortalite kaydedildi. Biyokimya parametrelerinden beyaz kan hücresi, hemoglobin, trombosit, nötrofil, lenfosit, nötrofil, lenfosit, üre, kreatinin, aspartat aminotransferaz, bilirubin, albümin ve C-reaktif protein seviyeleri kaydedildi. HALP skoru hesaplandı ve mortalite, hastanede kalış süresi, konservatif ve cerrahi tedavi kararı arasındaki ilişki analiz edildi.

BULGULAR: Çalışmaya toplam 286 hasta alındı. 245 (%85.7) hastada konservatif tedavi uygulandı. 262 (%91.6) hastada mortalite izlenmedi, 24'ünde (%8.4) mortalite izlendi. HALP skoru mortalite izlenmeyen hastalarda anlamlı olarak yüksekti (p=0.045). Mortalite izlenmeyen hastaların medyan albümin değeri mortalite izlenen hastalardan daha düşüktü (p<0.001). Mortalite izlenen hastaların yaş, üre, kreatinin, AST ve CRP değerleri, izlenmeyenlere göre anlamlı olarak daha yüksekti (sırasıyla, p=0.002, p<0.001, p<0.001, p<0.001, p<0.001 ve p=0.001). Konservatif tedavi uygulanan hastaların HALP skoru, cerrahi tedavi uygulananlara göre anlamlı olarak yüksekti (p=0.003). Lenfosit değeri konservatif tedavi ile izlenen hastalarda anlamlı olarak yüksekti (p=0.027). Ameliyat olan hastalarda yaş, üre, kreatinin ve CRP skorları daha yüksekti (sırasıyla, p=0.007, p<0.001, 0.003 ve p<0.001). Tedavi yöntemi ve HALP skoru için ROC analizi yapılıp HALP skoru 28 olarak alındığında konservatif tedaviyi saptamada duyarlılık 50.6%, özgüllük 78.0%, pozitif LR 2.3 ve negatif LR 0.63 olarak tespit edildi. (EAA 0,645 [%95 güven aralığı = 0.556–0.735)]; p=0.003).

SONUÇ: HALP skoru ileuslu hastalarda mortalite ve tedavi şeklinin belirlenmesinde faydalı olabilecek önemli bir skorlama sistemidir. HALP skorunun ileus tanılı hastaların yönetiminde, hem mortaliteyi azaltmada hem de uygun tedavi yöntemini belirlemede olumlu katkı sağlayacağı kanaatindeyiz.

Anahtar sözcükler: Albumin; hemoglobin; ileus; intestine; lenfosit; platelet.

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