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Preoperative halp score in gastric cancer patients undergoing upfront gastrectomy: Clinicopathological associations and survival outcomes

Primer gastrektomi uygulanan mide kanseri hastalarında preoperatif halp skoru: Klinikopatolojik ilişkiler ve sağkalım sonuçları

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ABSTRACT

Aim: This study aimed to evaluate the association of the preoperative hemoglobin–albumin–lymphocyte–platelet (HALP) score with clinicopathological characteristics and overall survival in gastric cancer patients undergoing primary curative-intent gastrectomy.

Materials and Methods: This retrospective single-center study included patients who underwent gastrectomy for histologically confirmed gastric adenocarcinoma between January 2010 and December 2025. Of 149 initially evaluated patients, 12 who received neoadjuvant treatment were excluded, and 137 patients were analyzed. The HALP score was evaluated as a continuous variable and was also categorized into low and high HALP groups according to the cohort median value of 34.97. Overall survival was assessed using the Kaplan–Meier method. Factors associated with survival were examined using univariable and multivariable Cox regression analyses.

Results: Sixty-seven patients were classified into the low HALP group and seventy patients into the high HALP group. Low HALP was associated with larger tumor diameter and a higher frequency of perioperative transfusion. Five-year overall survival was numerically lower in the low HALP group; however, the difference was not statistically significant (49.2% vs. 60.5%; p=0.552). In univariable analysis, HALP was not associated with overall survival as either a continuous or categorical variable. In the multivariable model, nodal stage and perioperative transfusion were independently associated with overall survival, whereas median-based low HALP was not an independent prognostic factor.

Conclusions: The preoperative HALP score may reflect baseline immunonutritional status in gastric cancer patients undergoing primary gastrectomy. However, median-based low HALP was not independently associated with overall survival after adjustment. Therefore, HALP should be interpreted cautiously as a standalone prognostic marker.

Keywords: Gastrectomy, gastric cancer, HALP score, overall survival, prognostic marker

ÖZ

Amaç: *Bu çalışmada, primer küratif amaçlı gastrektomi uygulanan mide kanseri hastalarında preoperatif hemoglobin–albümin–lenfosit–trombosit (HALP) skorunun klinikopatolojik özellikler ve genel sağkalım ile ilişkisinin değerlendirilmesi amaçlandı.*

Gereç ve Yöntem: *Bu retrospektif tek merkezli çalışmaya, Ocak 2010–Aralık 2025 tarihleri arasında histolojik olarak doğrulanmış mide adenokarsinomu nedeniyle gastrektomi uygulanan hastalar dahil edildi. Başlangıçta değerlendirilen 149 hastadan neoadjuvan tedavi alan 12 hasta dışlandı ve 137 hasta analiz edildi.*

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HALP skoru sürekli değişken olarak değerlendirildi ve ayrıca kohort medyan değeri olan 34,97'ye göre düşük ve yüksek HALP gruplarına ayrıldı. Genel sağkalım Kaplan–Meier yöntemiyle değerlendirildi. Sağkalımla ilişkili faktörler tek değişkenli ve çok değişkenli Cox regresyon analizleriyle incelendi.

Bulgular: *Altmış yedi hasta düşük, yetmiş hasta yüksek HALP grubunda sınıflandırıldı. Düşük HALP, daha büyük tümör çapı ve daha yüksek perioperatif transfüzyon sıklığı ile ilişkiliydi. Beş yıllık genel sağkalım düşük HALP grubunda sayısal olarak daha düşüktü; ancak fark istatistiksel olarak anlamlı değildi (%49,2'ye karşı %60,5; p=0,552). Tek değişkenli analizde HALP, sürekli veya kategorik değişken olarak genel sağkalım ile ilişkili bulunmadı. Çok değişkenli modelde nodal evre ve perioperatif transfüzyon genel sağkalım ile bağımsız olarak ilişkiliydi; medyan temelli düşük HALP ise bağımsız prognostik faktör değildi.*

Sonuç: *Preoperatif HALP skoru, primer gastrektomi uygulanan mide kanseri hastalarında başlangıç immünonütrisyonel durumu yansıtabilir. Ancak medyan temelli düşük HALP, düzeltme sonrası genel sağkalım ile bağımsız olarak ilişkili bulunmamıştır. Bu nedenle HALP, tek başına prognostik belirteç olarak dikkatli yorumlanmalıdır.*

Anahtar Sözcükler*: Gastrektomi, genel sağkalım, HALP skoru, mide kanseri, prognostik belirteç*

INTRODUCTION

Gastric cancer remains a major cause of cancer-related morbidity and mortality worldwide, despite advances in surgical techniques, perioperative care, and systemic treatment strategies (1). Curative-intent gastrectomy with adequate lymphadenectomy remains the cornerstone of treatment for resectable disease. However, long-term outcomes may vary considerably among patients with similar pathological stages, suggesting that conventional tumor-related staging may not fully explain the heterogeneity of survival after surgery.

In recent years, increasing attention has been directed toward host-related inflammatory and nutritional markers as potential prognostic indicators in gastrointestinal malignancies. These markers may reflect not only tumor biology but also the patient's baseline physiological reserve, immune competence, and ability to tolerate surgical stress. Several blood-based indices, including the neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, systemic immune-inflammation index, and prognostic nutritional index, have been investigated in gastric cancer with variable prognostic performance (2).

Among these indices, the hemoglobin–albumin–lymphocyte–platelet score, known as the HALP score, has been proposed as a composite immunonutritional marker incorporating anemia, protein reserve, lymphocyte-mediated immune status, and platelet-related inflammatory activity (3). Previous studies and meta-analyses have reported associations between low HALP scores and unfavorable oncologic outcomes in several malignancies, including digestive system cancers (4, 5). Gastric cancer-specific studies, including studies from Türkiye, have also suggested that lower HALP scores may be associated with postoperative complications, lymph node positivity, treatment response, recurrence, or survival outcomes (6-10).

Nevertheless, the prognostic role of HALP remains inconsistent across studies. Differences in patient selection, disease stage, treatment strategy, perioperative management, and HALP cut-off determination may partly explain these conflicting findings. In particular, the frequent use of sample-dependent cut-off values limits external validity and may obscure the true relationship between HALP and survival. Therefore, further evaluation of HALP in clearly defined surgical patient groups is needed. In the present study, we investigated the association of preoperative HALP score with clinicopathological characteristics and overall survival in patients undergoing upfront curative-intent gastrectomy for gastric cancer. HALP was evaluated both as a continuous variable and as a median-based categorical variable, while established pathological factors and perioperative transfusion were considered in the adjusted survival model.

MATERIALS and METHODS

Study design and patient selection

Patients aged 18 years or older who underwent upfront curative-intent gastrectomy with lymphadenectomy for histologically confirmed gastric adenocarcinoma at Mersin University University Faculty of Medicine, Department of General Surgery, between January 2010 and

December 2025 were retrospectively evaluated. A total of 149 patients were initially screened. Patients who received neoadjuvant chemotherapy or chemoradiotherapy were excluded to obtain a more homogeneous upfront surgical population. After excluding 12 patients who had received neoadjuvant treatment, the final analytical cohort consisted of 137 patients. Patients with metastatic disease at diagnosis, missing essential clinical or laboratory data, active infection, hematologic disease, severe liver failure, or other conditions that could substantially affect hemoglobin, albumin, lymphocyte, or platelet values were also excluded.

Data collection

Demographic, clinical, laboratory, operative, pathological, and follow-up data were obtained from institutional medical records. The recorded variables included age, sex, body mass index, tumor location, tumor diameter, pathological T stage, pathological N stage, pathological stage, lymphovascular invasion, perineural invasion, number of retrieved lymph nodes, number of metastatic lymph nodes, perioperative blood transfusion, surgical site infection, length of hospital stay, recurrence status, distant metastasis during follow-up, survival status, and follow-up duration.

Preoperative laboratory values were obtained from blood samples collected within 7 days before surgery. For patients with multiple tumor diameter measurements, the largest reported tumor diameter was used in the analysis.

HALP score calculation and grouping

The hemoglobin–albumin–lymphocyte–platelet score was calculated using the following formula:

HALP score = hemoglobin × albumin × lymphocyte count / platelet count

Higher HALP values indicate better immunonutritional status. Because there is no universally accepted HALP cut-off value for gastric cancer, HALP was evaluated both as a continuous variable and as a median-based categorical variable. The median HALP value was 34.97; therefore, patients were categorized as low HALP if the HALP score was <34.97 and high HALP if the HALP score was ≥34.97. The median-based grouping was used for descriptive comparisons, Kaplan–Meier survival analysis, and adjusted Cox regression modeling, but was not considered a validated biological threshold.

Outcomes

The primary outcome was overall survival, defined as the time from the date of surgery to death from any cause or last follow-up. Patients who were alive at the last follow-up were censored.

Secondary evaluations included the association of HALP groups with clinicopathological and perioperative characteristics. Recurrence and distant metastasis were recorded descriptively but were not included as covariates in Cox regression models for overall survival, because they represent post-baseline events occurring during follow-up rather than baseline prognostic variables.

Statistical analysis

Continuous variables were assessed for distribution using visual methods, including histograms and Q-Q plots, and formal normality testing. Homogeneity of variance was evaluated when parametric tests were used. Continuous variables were presented as mean ± standard deviation or median with 25th–75th percentiles according to data distribution. Categorical variables were presented as frequency and percentage.

Comparisons between low and high HALP groups were performed using the Student's t-test or Mann–Whitney U test for continuous variables, as appropriate. Categorical variables were compared using the chi-square test or Fisher's exact test according to expected cell counts. Exact p-values were reported with three decimal digits whenever possible. Overall survival was estimated using the Kaplan–Meier method, and differences between HALP groups were evaluated using the log-rank test. Median follow-up was estimated using the reverse Kaplan–Meier method. Univariable Cox proportional hazards regression analysis was performed to evaluate the association between baseline clinicopathological variables and overall survival. Variables evaluated in univariable analysis included age, sex, body mass index, tumor diameter, T stage, N stage, lymphovascular invasion, perineural invasion, perioperative transfusion, HALP as a continuous variable, and median-based HALP group.

A multivariable Cox proportional hazards regression model was constructed to assess

whether median-based HALP group was independently associated with overall survival after adjustment for clinically relevant covariates. Variables included in the adjusted model were age, sex, tumor diameter, T stage, N stage, lymphovascular invasion, perioperative transfusion, and median-based HALP group. Perioperative transfusion was included because it differed significantly between HALP groups and may act as a confounding factor in survival analysis. T stage and N stage were entered as ordinal variables. Pathological TNM stage was not included in the same model because of potential collinearity with T and N stage. Recurrence and distant metastasis were not included in Cox regression models because they represent post-baseline events during follow-up. Multicollinearity was assessed using variance inflation factors, and the proportional hazards assumption was evaluated for the Cox model. Hazard ratios and 95% confidence intervals were reported. A two-sided p-value of less than 0.050 was considered statistically significant.

RESULTS

Study population and baseline characteristics

A total of 149 patients were initially evaluated. After excluding 12 patients who received neoadjuvant chemotherapy or chemoradiotherapy, the final analytical population consisted of 137 patients. The median HALP value of the study population was 34.97. Accordingly, 67 patients were classified into the low HALP group and 70 patients into the high HALP group.

Baseline clinicopathological and perioperative characteristics according to HALP group are summarized in Table-1. Age, sex distribution, body mass index, N stage, pathological stage, number of retrieved lymph nodes, number of positive lymph nodes, perineural invasion, surgical site infection, and length of hospital stay were comparable between the two groups. Tumor location differed significantly between HALP groups (p=0.005). Patients in the low HALP group had significantly larger tumor diameters than those in the high HALP group [6.0 cm (2.8–9.2) vs. 3.2 cm (2.6–5.0), p=0.001]. T stage distribution also differed significantly between the groups (p=0.008), as shown in Table-1.

Lymphovascular invasion was observed in 34 patients (50.7%) in the low HALP group and 48 patients (68.6%) in the high HALP group (p=0.033). Perioperative transfusion was significantly more frequent in the low HALP group than in the high HALP group [30 patients (44.8%) vs. 13 patients (18.6%), p=0.001]. These clinicopathological and perioperative comparisons are presented in detail in Table-1.

Table-1. Baseline clinicopathological and perioperative characteristics according to HALP group

Variable	Low HALP <34.97 (n=67)	High HALP ≥34.97 (n=70)	p-value
Age, years	68.0 (61.0–74.0)	65.5 (59.2–72.0)	0.157
Male sex	45 (67.2)	45 (64.3)	0.723
BMI, kg/m²	25.9 (22.4–30.2)	26.0 (24.9–28.9)	0.412
HALP score	22.41 (13.29–25.94)	48.55 (38.28–67.60)	p<0.001
Tumor location			0.005
Proximal/cardia	18 (26.9)	18 (25.7)	
Corpus/fundus	24 (35.8)	9 (12.9)	
Distal/antrum-pylorus	17 (25.4)	35 (50.0)	
Multiregional/linitis	8 (11.9)	8 (11.4)	
Tumor diameter, cm	6.0 (2.8–9.2)	3.2 (2.6–5.0)	0.001
T stage			0.008
Tis	0 (0.0)	2 (2.9)	
T1	11 (16.4)	9 (12.9)	
T2	2 (3.0)	13 (18.6)	
T3	19 (28.4)	9 (12.9)	
T4	35 (52.2)	37 (52.9)	
N stage			0.261
N0	26 (38.8)	19 (27.1)	

N1	13 (19.4)	10 (14.3)	
N2	9 (13.4)	15 (21.4)	
N3	19 (28.4)	26 (37.1)	
Pathological stage			0.528
Stage 0/I	10 (14.9)	13 (18.6)	
Stage II	23 (34.3)	18 (25.7)	
Stage III	34 (50.7)	39 (55.7)	
Retrieved lymph nodes	25.0 (15.5–33.0)	22.5 (17.0–28.5)	0.368
Positive lymph nodes	2.0 (0.0–7.5)	4.5 (0.0–8.0)	0.224
Lymphovascular invasion	34 (50.7)	48 (68.6)	0.033
Perineural invasion	40 (59.7)	43 (63.2)	0.673
Perioperative transfusion	30 (44.8)	13 (18.6)	0.001
Surgical site infection	12 (17.9)	6 (8.6)	0.106
Length of hospital stay, days	13.0 (10.0–15.0)	14.0 (10.0–15.0)	0.363

Note: Values are presented as median (25th–75th percentile) or n (%). HALP: hemoglobin–albumin–lymphocyte–platelet; BMI: body mass index. Neoadjuvant-treated patients were excluded from this analysis. For tumor diameter values reported as multiple foci, the largest diameter was used. Two invalid perineural invasion entries were treated as missing for percentage calculation.

Survival outcomes according to HALP group

Survival outcomes according to HALP group are presented in Table-2. During follow-up, 32 deaths occurred in the low HALP group and 29 deaths occurred in the high HALP group. The mortality rate was 47.8% in the low HALP group and 41.4% in the high HALP group (p=0.452).

The median follow-up estimated using the reverse Kaplan–Meier method was 60.7 months in the low HALP group and 56.1 months in the high HALP group. The median overall survival was 42.9 months in the low HALP group and 68 months in the high HALP group. These survival-related descriptive findings are shown in Table-2.

The 1-, 3-, and 5-year overall survival rates were 85.1%, 58.1%, and 49.2% in the low HALP group, respectively. In the high HALP group, the corresponding survival rates were 87.1%, 66.9%, and 60.5%, respectively. Although survival rates were numerically lower in the low HALP group, the difference between the groups was not statistically significant by the log-rank test (p=0.552), as presented in Table-2. Kaplan–Meier overall survival curves according to HALP group are shown in Figure-1.

Table-2. Overall survival outcomes according to HALP group

Outcome	**Low HALP <34.97 n=67**	**High HALP ≥34.97 n=70**	**p-value**
Deaths, n (%)	32 (47.8)	29 (41.4)	0.452
Median follow-up, months	60.7	56.1	-
Median overall survival, months	42.9	68	-
1-year overall survival, % (95% CI)	85.1 (74.0-91.7)	87.1 (76.7-93.1)	
3-year overall survival, % (95% CI)	58.1 (45.0-69.1)	66.9 (54.5-76.6)	
5-year overall survival, % (95% CI)	49.2 (36.2-61.0)	60.5 (47.9-71.0)	
Log-rank test			0.552

Note: Values are presented as n (%) or Kaplan-Meier estimates with 95% confidence intervals. Median follow-up was estimated using the reverse Kaplan-Meier method. HALP: hemoglobin-albumin-lymphocyte-platelet; CI: confidence interval.

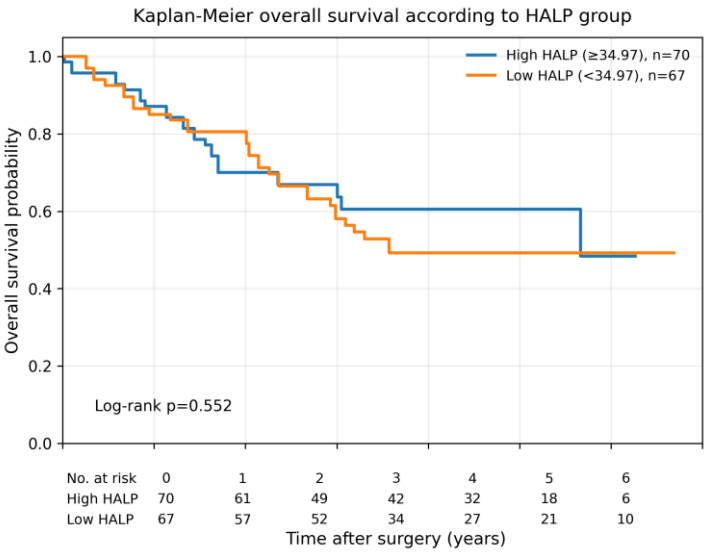

Figure 1. Kaplan–Meier overall survival curves according to preoperative HALP score

Univariable Cox regression analysis

The results of univariable Cox regression analysis for overall survival are shown in Table-3. Male sex was associated with poorer overall survival compared with female sex (HR=1.87, 95% CI=1.05–3.36, p=0.035). Larger tumor diameter was also significantly associated with poorer survival (HR=1.15, 95% CI=1.08–1.23, p<0.001).

Higher T stage (HR=1.67, 95% CI=1.24–2.25, p=0.001), higher N stage (HR=1.89, 95% CI=1.49–2.41, p<0.001), lymphovascular invasion (HR=2.06, 95% CI=1.17–3.61, p=0.012), and perioperative transfusion (HR=2.00, 95% CI=1.21–3.32, p=0.007) were significantly associated with poorer overall survival in univariable analysis. In contrast, age, body mass index, and perineural invasion were not significantly associated with overall survival. All univariable Cox regression results are detailed in Table-3.

HALP was not significantly associated with overall survival in univariable analysis when evaluated either as a continuous variable (HR=1.00, 95% CI=0.98–1.01, p=0.515) or as a median-based categorical variable (low HALP vs. high HALP: HR=1.16, 95% CI=0.70–1.92, p=0.557). These HALP-related univariable findings are also shown in Table-3. Recurrence and distant metastasis were not included in the Cox regression models because they represented post-baseline events during follow-up.

Table-3. Univariable Cox regression analysis for overall survival

Variable	HR	95% CI	p-value
Age, per year	1.00	0.98-1.02	0.976
Male sex, vs female	1.87	1.05-3.36	0.035
BMI, per kg/m²	0.98	0.92-1.04	0.464
Tumor diameter, per cm	1.15	1.08-1.23	<0.001
T stage, per increase	1.67	1.24-2.25	0.001
N stage, per increase	1.89	1.49-2.41	<0.001
Lymphovascular invasion, yes vs no	2.06	1.17-3.61	0.012
Perineural invasion, yes vs no	1.26	0.81-1.96	0.311
Perioperative transfusion, yes vs no	2.00	1.21-3.32	0.007
HALP score, per unit	1.00	0.98-1.01	0.515
Low HALP, <34.97 vs ≥34.97	1.16	0.70-1.92	0.557

Note. Cox proportional hazards regression was used. HR: hazard ratio; CI: confidence interval; BMI: body mass index; HALP: hemoglobin-albumin-lymphocyte-platelet. Recurrence and distant metastasis were not included in the Cox models because they represent post-baseline events during follow-up.

Multivariable Cox regression analysis

Multivariable Cox regression results are presented in Table-4. In the adjusted model including median-based HALP group, N stage and perioperative transfusion remained independently associated with overall survival. Higher N stage was associated with poorer survival (adjusted HR=1.62, 95% CI=1.22–2.15, p=0.001), and perioperative transfusion was also independently associated with worse overall survival (adjusted HR=1.86, 95% CI=1.05–3.31, p=0.033). Tumor diameter showed borderline significance (adjusted HR=1.08, 95% CI=1.00–1.17, p=0.061), whereas T stage, lymphovascular invasion, age, and sex were not independently associated with overall survival in the adjusted model. Median-based low HALP was not independently associated with overall survival (adjusted HR=0.93, 95% CI=0.50–1.74, p=0.821).

Table 4. Multivariable Cox regression analysis for overall survival

Variable	Adjusted HR	95% CI	p-value
Age, per year	1.00	0.98–1.03	0.834
Male sex, vs female	1.17	0.62–2.18	0.628
Tumor diameter, per cm	1.08	1.00–1.17	0.061
T stage, per increase	1.34	0.92–1.95	0.133
N stage, per increase	1.62	1.22–2.15	0.001
Lymphovascular invasion, yes vs no	0.87	0.43–1.76	0.706
Perioperative transfusion, yes vs no	1.86	1.05–3.31	0.033
Low HALP, <34.97 vs ≥34.97	0.93	0.50–1.74	0.821

Note: Cox proportional hazards regression was used. HR: hazard ratio; CI: confidence interval; HALP: hemoglobin–albumin–lymphocyte–platelet. HALP was included as a median-based categorical variable. T stage and N stage were entered as ordinal variables. TNM stage was not included because of collinearity with T and N stage. Recurrence and distant metastasis were not included because they represent post-baseline events during follow-up.

DISCUSSION

In this retrospective single-center study of patients undergoing upfront curative-intent gastrectomy for gastric cancer, lower preoperative HALP was associated with selected clinicopathological and perioperative characteristics, particularly larger tumor diameter and a higher frequency of perioperative transfusion. Patients in the low HALP group had numerically lower 5-year overall survival than those in the high HALP group; however, this difference was not statistically significant. In univariable analysis, HALP was not associated with overall survival either as a continuous variable or as a median-based categorical variable. In the multivariable model, median-based low HALP was not independently associated with overall survival, whereas nodal stage and perioperative transfusion remained independent prognostic factors. These findings suggest that preoperative HALP may reflect general immunonutritional status but should be interpreted cautiously as a standalone prognostic marker in this patient group. The higher frequency of lymphovascular invasion in the high HALP group was unexpected and may reflect baseline pathological imbalance rather than a biologically consistent HALP-related association.

The biological rationale for evaluating HALP in gastric cancer is clinically plausible. HALP combines hemoglobin, albumin, lymphocyte count, and platelet count into a single index, thereby incorporating different dimensions of host status, including anemia, nutritional reserve, immune competence, and inflammation-related

platelet activity (3). Previous systematic reviews and meta-analyses have reported that lower HALP scores are associated with poorer survival outcomes in patients with solid tumors and digestive system cancers (4, 5). Gastric cancer-specific studies have similarly suggested that HALP may be associated with postoperative outcomes, lymph node involvement, treatment response, recurrence, or survival (6-10). However, the magnitude and independence of this association vary considerably across studies, indicating that the prognostic performance of HALP may depend on disease stage, treatment setting, and analytical approach.

Several factors may explain why HALP was not a stable independent prognostic factor in the present study. First, our analysis focused on patients who underwent upfront gastrectomy, and patients receiving neoadjuvant treatment were excluded to obtain a more homogeneous surgical population. In such a setting, established tumor-related variables, particularly tumor burden and nodal involvement, may have a stronger influence on survival than preoperative blood-based indices. Second, HALP cut-off values differ substantially across the literature, and many studies use sample-dependent thresholds such as median values or receiver operating characteristic-derived cut-offs. This limits external validity and may partly explain inconsistent results. For this reason, HALP was evaluated both as a continuous variable in univariable analysis and as a median-based categorical variable for descriptive survival comparisons and adjusted modeling. However, the median-based cut-off was exploratory and should not be interpreted as a validated biological threshold. Third, HALP was measured at a single preoperative time point, whereas dynamic perioperative or postoperative changes in inflammatory and nutritional status may provide additional prognostic information.

The relationship between HALP and survival should also be interpreted in the context of perioperative transfusion. In our study, perioperative transfusion was significantly more frequent in the low HALP group and remained associated with overall survival in the multivariable model. Previous studies have suggested that perioperative blood transfusion may be associated with inferior oncologic outcomes after gastric cancer surgery, potentially through transfusion-related immunomodulation or as a marker of more advanced disease, anemia, operative complexity, or perioperative physiological stress (11, 12). More recent propensity-adjusted evidence has also emphasized that the apparent prognostic effect of transfusion may be partly influenced by confounding factors, including tumor stage, anemia, comorbidities, operative difficulty, and postoperative complications (13). Therefore, the association between low HALP and poorer numerical survival in the present study may partly reflect a broader perioperative risk profile rather than a direct independent effect of HALP itself.

This study has several limitations. First, its retrospective and single-center design may introduce selection bias and limits generalizability. Second, although the exclusion of neoadjuvant-treated patients provided a more homogeneous upfront surgical population, it may reduce applicability to contemporary multimodal treatment pathways. Third, the sample size was limited, and the study may have been underpowered to detect modest survival differences between HALP groups. Fourth, the median HALP cut-off was exploratory and should not be interpreted as a validated biological threshold. Fifth, HALP was based on a single preoperative laboratory measurement, and longitudinal changes were not evaluated. Finally, perioperative transfusion was analyzed as a binary variable, and detailed information regarding transfusion volume, timing, and indications was not available. Despite these limitations, the study has methodological strengths, including evaluation of HALP in both continuous and median-based categorical forms, exclusion of post-baseline events such as recurrence and distant metastasis from Cox regression models, inclusion of perioperative transfusion as a clinically relevant covariate, and avoidance of simultaneous inclusion of TNM stage with T and N stage in the multivariable model.

CONCLUSION

In conclusion, the present findings suggest that preoperative HALP may be useful as a general immunonutritional indicator in patients undergoing upfront gastrectomy for gastric cancer. However, median-based low HALP was not independently associated with overall survival after adjustment for established pathological factors and perioperative transfusion. Therefore, HALP should not be interpreted as a standalone prognostic marker in this setting. Larger prospective studies using standardized HALP assessment strategies and adequately powered survival models are

needed to clarify the role of HALP in gastric cancer risk stratification.

Congress: This manuscript has not been previously published, accepted for publication, or submitted elsewhere for consideration, and this study has not been presented as an oral or poster presentation at any scientific meeting.

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Analysis/Interpretation: E.G.

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References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74(3):229-63. doi:10.3322/caac.21834
2. Kim MR, Kim AS, Choi HI, Jung JH, Park JY, Ko HJ. Inflammatory markers for predicting overall survival in gastric cancer patients: a systematic review and meta-analysis. PLoS One. 2020;15(7): e0236445. doi: 10.1371/journal.pone.0236445
3. Farag CM, Antar R, Akosman S, Ng M, Whalen MJ. What is hemoglobin, albumin, lymphocyte, platelet (HALP) score? A comprehensive literature review of HALP's prognostic ability in different cancer types. Oncotarget. 2023; 14:153-72. doi:10.18632/oncotarget.28367
4. Xu H, Zheng X, Ai J, Yang L. Hemoglobin, albumin, lymphocyte, and platelet score and cancer prognosis: a systematic review and meta-analysis of 13,110 patients. Int Immunopharmacol. 2023; 114:109496. doi: 10.1016/j.intimp.2022.109496
5. Qian C, Liu J, Meng C, Cheng J, Wu B, Liao J. The significant prognostic value of the hemoglobin, albumin, lymphocyte, and platelet score in digestive system cancers: a systematic review and meta-analysis. BMC Cancer. 2025;25(1):1577. doi:10.1186/s12885-025-15068-x
6. Yalav O, Topal U, Ünal AG, Sarıtaş AG. Clinical value of hemoglobin and albumin levels and lymphocyte and platelet count (HALP) combination in predicting postoperative complications, lymph node positivity and prognosis in gastric cancer patients who underwent curative surgical resection. Cyprus J Med Sci. 2020;5(2):145-52. doi:10.5152/cjms.2020.1747
7. Sargin ZG, Dusunceli I. The effect of HALP score on the prognosis of gastric adenocarcinoma. J Coll Physicians Surg Pak. 2022;32(9):1154-9. doi:10.29271/jcpsp.2022.09.1154
8. Köşeci T, Seyyar M, Aydınalp Camadan Y, Çelik H, Mete B, Demirhindi H, et al. HALP score in predicting response to treatment in patients with early-stage gastric cancer: a multi-centred retrospective cohort study. Medicina (Kaunas). 2024;60(12):2087. doi:10.3390/medicina60122087
9. Aoyama T, Maezawa Y, Hashimoto I, Esashi R, Yamamoto S, Uchiyama M, et al. The clinical impact of hemoglobin, albumin, lymphocyte, platelet in gastric cancer patients who receive curative treatment. In Vivo. 2024;38(5):2494-500. doi:10.21873/invivo.13720
10. Şentürk A, Harmantepe AT, Gönüllü E, Cantürk AÖ, Mutlu F, Ercan M. Predictive role of HALP score, LCR value and CRP-albumin ratio for survival and recurrence in gastric cancer. Online Turkish Journal of Health Sciences. 2025;10(2):153-61. doi:10.26453/otjhs.1663269
11. Hsu FK, Chang WK, Lin KJ, Liu CY, Fang WL, Chang KY. The associations between perioperative blood transfusion and long-term outcomes after stomach cancer surgery. Cancers (Basel). 2021;13(21):5438. doi:10.3390/cancers13215438
12. Wang W, Zhao L, Niu P, Zhang X, Luan X, Zhao D, et al. Effects of perioperative blood transfusion in gastric cancer patients undergoing gastrectomy: a systematic review and meta-analysis. Front Surg. 2023; 9:1011005. doi:10.3389/fsurg.2022.1011005

13. Zhang W, Xu H, Huang B, Xu Y, Huang J. Association of perioperative allogeneic blood transfusions and long-term outcomes following radical surgery for gastric and colorectal cancers: systematic review and meta-analysis of propensity-adjusted observational studies. BJS Open. 2023;7(4): zrad075. doi:10.1093/bjsopen/zrad075