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Evaluation of Preoperative Neutrophil-to-Lymphocyte Ratio and Platelet-to-Lymphocyte Ratio for their Predictive Value in Determining Short-Term Mortality in Patients with Operable Colorectal Cancers

Opere Edilebilir Kolorektal Kanserli Hastalarda Kısa Dönem Mortalitenin Belirlenmesinde Preoperatif Nötrofil-Lenfosit Oranı ve Trombosit-Lenfosit Oranının Öngörü Değerlerinin Değerlendirilmesi

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ABSTRACT

Aim: The aim of this study was to investigate whether preoperative neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) have a predictive value in short-term mortality in patients with operable colorectal cancer (CRC).
Material and Methods: A total of 231 (93 female, 138 male) patients with operated CRC between 2016 and 2021 in a university hospital were analyzed retrospectively. Median age was 68 (range, 26-92) years and patients had been under follow-up for a median of 25 (range, 0-54) months. Patients were grouped with respect to survival, those who were alive (n=175) and those who died (n=56) during the follow-up.
Results: The area under the curve for NLR was 0.649 (95% CI: 0.563-0.734, p=0.001), optimal cut-off was 5.08 and demonstrated a sensitivity of 48.2% and a specificity of 81.7% for predicting mortality. The area under the curve for PLR was 0.635 (95% CI: 0.546-0.723, p=0.002), optimal cut-off was 221.5 and demonstrated a sensitivity of 55.4% and a specificity of 72.0%. Multiple regression analysis revealed that recurrence (OR: 60.910, 95% CI: 9.807-378.319, p=<0.001), leakage (OR: 10.724, 95% CI: 1.281-89.747, p=0.029), high NLR (OR: 3.735, 95% CI: 1.602-8.711, p=0.002) and higher age (OR: 1.136, 95% CI: 1.081-1.193, p<0.001) were independently associated with mortality.
Conclusion: The results of this study support studies indicating that preoperative NLR and PLR are effective in predicting short-term mortality in CRC patients who underwent surgical resection. Although further studies are necessary, these biomarkers are promising for future use as prognostic tools in CRC patients.
Keywords: Colorectal cancer; mortality; neutrophil lymphocyte ratio; platelet lymphocyte ratio.

ÖZ

Amaç: Bu çalışmanın amacı, opere edilebilir kolorektal kanserli (KRK) hastalarda ameliyat öncesi nötrofil-lenfosit oranı (NLO) ve trombosit-lenfosit oranının (PLO) kısa dönem mortalitede prediktif bir değeri olup olmadığının araştırılmasıdır.
Gereç ve Yöntemler: 2016 ve 2021 yılları arasında bir üniversite hastanesinde KRK ameliyatı yapılmış olan toplam 231 (93 kadın, 138 erkek) hasta geriye dönük olarak incelendi. Ortanca yaş 68 (aralık, 26-92) yıl ve takip süresi ortancası 25 (aralık, 0-54) ay idi. Hastalar sağ kalım durumuna göre, sağ kalanlar (n=175) ve takipler sırasında ölenler (n=56) olmak üzere gruplandırıldı.
Bulgular: NLO için eğri altında kalan alan 0,649 (%95 GA: 0,563-0,734; p=0,001), optimal kesim noktası 5,08 idi ve bu kesim noktası mortaliteyi tahmin etmek için %48,2 duyarlılık ve %81,7 özgüllük gösterdi. PLO için eğri altında kalan alan 0,635 (%95 GA: 0,546-0,723; p=0,002), optimal kesim noktası 221,5 idi ve bu kesim noktası %55,4 duyarlılık ve %72,0 özgüllük gösterdi. Çoklu regresyon analizi, nüks (OR: 60,910; 95% GA: 9,807-378,319; p=<0,001), sızıntı (OR: 10,724; 95% GA: 1,281-89,747; p=0,029), yüksek NLO (OR: 3,735; 95% GA: 1,602-8,711; p=0,002) ve yaşın artışının (OR: 1,136; 95% GA: 1,081-1,193; p<0,001) bağımsız olarak mortalite ile ilişkili olduğunu ortaya koydu.
Sonuç: Bu çalışmanın sonuçları, cerrahi rezeksiyon uygulanan KRK hastalarında preoperatif NLO ve PLO'nun kısa dönem mortaliteyi öngörmede etkili olduğunu gösteren çalışmaları desteklemektedir. Bu konuda daha fazla çalışma gerekli olmasına rağmen, bu biyobelirteçler, KRK hastalarında prognostik araçlar olarak gelecekte kullanım açısından umut vericidir.
Anahtar kelimeler: Kolorektal kanser; mortalite; nötrofil lenfosit oranı; trombosit lenfosit oranı.

INTRODUCTION

Colorectal cancer (CRC) is the third most frequently diagnosed and the second most deadly malignancy in the world for both sexes (1). Even though mortality rates have decreased with advances in diagnosis and treatment, the clinical outcomes of CRCs remain largely unpredictable (2).

The TNM and Dukes classifications, which are used to predict the clinical course of CRCs and treatment decisions, have considerable limitations (3,4). Patients with the same clinical and pathological stage at diagnosis may show different prognoses, possibly due to differences in tumor biology (2). Although various parameters, including those evaluating the systemic inflammatory response, were found to have prognostic value independent of TNM classification in various diseases, data is limited (5,6). For these reasons, there is an ongoing need to identify optimal biomarkers that may be useful in predicting relapse, prognosis, and patients that can benefit from different treatment strategies (7).

The relationship between inflammation and cancer has been better defined and understood in recent years (8). Neutrophils and platelets, which are the main cells contributing to inflammatory response, have been established to promote tumor growth through the effects of cytokines and chemokines, while lymphocytes show antitumor activity (7,9). In addition, it has been shown that cancer-related inflammation affects different stages of cancer development and progression, such as proliferation, metastasis, etc. (8,10,11). Supporting evidence for the contributing role of chronic inflammation in CRC development has also been shown by the identification of chronic inflammatory bowel disease as a risk factor for CRC (12,13).

The effect of some inflammatory biomarkers calculated from simple hemogram parameters on the prognosis of various cancers, especially CRC, is an interesting topic. In addition to the increasing need for prognostic biomarkers, there is a high value in identifying markers that are easy to obtain, common, and inexpensive (14). Although there are various studies exploring the predictive value of inflammatory markers such as neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) in the prognosis of CRC, some points on this subject are still controversial.

The aim of this study was to evaluate whether preoperatively measured NLR and PLR have predictive value for the assessment of short-term mortality in patients operated for CRC.

MATERIAL AND METHODS

Patients

The medical records of 231 patients who underwent surgical treatment (curative resection) for Stage I-IV colon cancer between 2016 and 2021 at the General Surgery Department of Osmangazi University Medical Faculty Hospital, Eskisehir, Turkey were retrospectively reviewed. The definitive diagnosis of the patients was confirmed by routine pathology, and the study included patients with CRC of all stages. The exclusion criteria of the study were as follows: patients with synchronous and metachronous cancer, patients undergoing emergency surgery, those receiving neoadjuvant therapy, patients with cirrhosis, those with autoimmune diseases, those with hematological malignancies, individuals who received systemic corticosteroids in the last 6 months, subjects with active infection, and patients with incomplete clinicopathological data. This study was approved by the Non-Interventional Clinical Research Ethics Committee of Eskisehir Osmangazi University (Date: 01.06.2021, No: 05).

Procedure and Follow-up

The TNM classification of malignant tumors (8^{th} edition), described by the Union for International Cancer Control (UICC), was used to determine the TNM stage (15). Surgeries were performed according to the TNM stage of each patient with a laparoscopic or open approach. After the surgery, patients were routinely examined at 3-month intervals for the first 2 years, and every 6 months thereafter. The median follow-up of patients included in the study was 25 (range, 0-54) months. During the follow-up period, 56 patients died and 175 patients were alive.

Groups and Variables

Two groups were formed from the survivors and the deceased. Clinical data including age, gender, clinicopathological features (histopathology, primary tumor site, staging, type of surgery, extent of resection, postoperative complications, metastasis location), and preoperative laboratory data were obtained from the medical records of the patients. Neutrophil, lymphocyte, monocyte, and thrombocyte counts were measured by routine blood tests. The NLR value was determined by dividing the absolute neutrophil count by the absolute lymphocyte count; PLR was determined by dividing the absolute platelet count by the absolute lymphocyte count. In general, patients were admitted to the hospital two days before the operation and all laboratory values, including NLR and PLR, were obtained on the day of hospitalization.

Statistical Analysis

All analyses were performed on SPSS v.25 (SPSS Inc., Chicago, IL, USA) with a significance threshold set as a two-tailed p value of <0.05. The Kolmogorov-Smirnov test was used to determine whether continuous variables were normally distributed. Continuous data are given as mean±standard deviation (SD) or median (interquartile range, IQR) [min-max] according to the normality of distribution, and as frequency (percentage) for categorical variables. Between-group analyses were performed with the independent samples t-test or the Mann Whitney U test depending on the normality of distribution. Categorical variables were analyzed with the Pearson chi-square test or the Fisher's exact test. Receiver operating characteristics (ROC) curve analysis was performed to evaluate the predictive performance of variables in terms of mortality. Multiple logistic regression analysis (forward conditional method) was performed for the identification of variables that were significantly associated with mortality.

RESULTS

Among the patients included in the study, 138 (59.7%) were males, and the median (IQR) [minimum-maximum] age was 68 (16) [26-92] years. Median follow-up duration was 25 (18) [0-54] months. During the follow-up period 56 patients died, 175 patients were alive. Demographic, clinical, pathological and laboratory data of the patients were given in Table 1. In the deceased group, significantly

Table 1. Summary of patients and tumor characteristics and laboratory measurements with regard to mortality

	Total (n=231)	Exitus (n=56)	Alive (n=175)	p
Age (years)	68 (16) [26-92]	75 (11.5) [37-92]	65 (16) [26-87]	**<0.001**
Gender				
Female	93 (40.26%)	25 (44.64%)	68 (38.86%)	0.442
Male	138 (59.74%)	31 (55.36%)	107 (61.14%)	
Location				
Right colon	92 (39.83%)	24 (42.86%)	68 (38.86%)	
Transverse colon	29 (12.55%)	12 (21.43%)	17 (9.71%)	
Descending colon	24 (10.39%)	5 (8.93%)	19 (10.86%)	0.107
Sigmoid colon&rectosigmoid region	27 (11.69%)	6 (10.71%)	21 (12.00%)	
Rectum	59 (25.54%)	9 (16.07%)	50 (28.57%)	
Pathological diagnosis				
Non-mucinous adenocarcinoma	162 (70.13%)	38 (67.86%)	124 (70.86%)	0.795
Mucinous adenocarcinoma	69 (29.87%)	18 (32.14%)	51 (29.14%)	
Tumor size (mm)	43 (30) [1-130]	45 (27.5) [6-130]	40 (30) [1-122]	0.281
Number of lymph nodes	23 (19) [3-66]	20 (15) [4-66]	26 (19) [3-66]	**0.003**
Number of metastatic lymph nodes	0 (2) [0-25]	1 (2) [0-12]	0 (2) [0-25]	**0.013**
Differentiation				
Poor	29 (12.55%)	8 (14.29%)	21 (12.00%)	
Moderate	170 (73.59%)	42 (75.00%)	128 (73.14%)	0.697
Well	32 (13.85%)	6 (10.71%)	26 (14.86%)	
Radial surgical margin positivity	2 (0.87%)	2 (3.57%)	0 (0.00%)	0.058
Distal surgical margin positivity	2 (0.87%)	1 (1.79%)	1 (0.57%)	0.427
Perineural invasion	65 (28.14%)	20 (35.71%)	45 (25.71%)	0.201
Lymphovascular invasion	96 (41.56%)	23 (41.07%)	73 (41.71%)	1.000
T stage				
T1	9 (3.90%)	0 (0.00%)	9 (5.14%)	
T2	31 (13.42%)	1 (1.79%)	30 (17.14%)	**<0.001**
T3	142 (61.47%)	33 (58.93%)	109 (62.29%)	
T4	49 (21.21%)	22 (39.29%)	27 (15.43%)	
N stage				
N0	134 (58.01%)	24 (42.86%)	110 (62.86%)	
N1	66 (28.57%)	22 (39.29%)	44 (25.14%)	**0.031**
N2	31 (13.42%)	10 (17.86%)	21 (12.00%)	
Stage				
Stage 1	30 (12.99%)	1 (1.79%)	29 (16.57%)	
Stage 2	90 (38.96%)	21 (37.50%)	69 (39.43%)	**0.009**
Stage 3	81 (35.06%)	22 (39.29%)	59 (33.71%)	
Stage 4	30 (12.99%)	12 (21.43%)	18 (10.29%)	
Liver metastasis	26 (11.26%)	10 (17.86%)	16 (9.14%)	0.120
Type of surgery				
Laparoscopy	41 (17.75%)	3 (5.36%)	38 (21.71%)	**0.010**
Open surgery	190 (82.25%)	53 (94.64%)	137 (78.29%)	
Operation				
Right hemicolectomy	81 (35.06%)	19 (33.93%)	62 (35.43%)	
Transverse hemicolectomy	17 (7.36%)	5 (8.93%)	12 (6.86%)	
Left hemicolectomy	33 (14.29%)	11 (19.64%)	22 (12.57%)	
Anterior resection	34 (14.72%)	8 (14.29%)	26 (14.86%)	0.620
Low anterior resection	56 (24.24%)	10 (17.86%)	46 (26.29%)	
Abdominoperineal resection	8 (3.46%)	3 (5.36%)	5 (2.86%)	
Other	2 (0.87%)	0 (0.00%)	2 (1.14%)	
Ostomy	62 (26.84%)	21 (37.50%)	41 (23.43%)	0.058
Hemoglobin (g/dl)	12.08±2.20	10.95±1.95	12.44±2.16	**<0.001**
Hematocrit (%)	37.30±5.78	34.30±5.19	38.26±5.65	**<0.001**
White blood cell ($x10^3$)	7.69 (3.55) [3.12-23.89]	8.42 (4.16) [3.60-19.71]	7.50 (3.46) [3.12-23.89]	0.062
Neutrophil ($x10^3$)	5.10 (3.32) [1.77-20.64]	6.16 (4.12) [2.10-17.39]	4.90 (2.76) [1.77-20.64]	0.057
Lymphocyte ($x10^3$)	1.50 (1) [0.18-5.70]	1.21 (0.71) [0.47-4.30]	1.60 (0.92) [0.18-5.70]	**0.001**
Platelet ($x10^3$)	284 (142) [75-781]	314 (182.5) [75-636]	276 (121) [109-781]	0.123
Mean platelet volume (fl)	9.42±1.17	9.13±1.11	9.51±1.18	**0.033**
Neutrophil / lymphocyte ratio	3.09 (2.84) [1.05-27.94]	4.58 (4.69) [1.34-21.33]	3.00 (2.04) [1.05-27.94]	**0.001**
Platelet / lymphocyte ratio	177.50 (135.92) [29.41-824.53]	230.44 (198.39) [29.41-824.00]	171.88 (119.51) [54.62-824.53]	**0.002**
Length of stay in hospital (day)	6 (3) [3-40]	7 (4) [3-40]	6 (3) [3-21]	**0.032**
Follow-up time (months)	25 (18) [0-54]	11 (18.5) [0-37]	28 (18) [7-54]	**<0.001**
Leakage	10 (4.33%)	7 (12.50%)	3 (1.71%)	**0.002**
Infection	36 (15.58%)	11 (19.64%)	25 (14.29%)	0.453
Recurrence	11 (5.26%)	8 (17.78%)	3 (1.83%)	**<0.001**
Early (≤30 days) mortality	8 (3.46%)	8 (14.29%)	-	N/A

Data were given as mean±standard deviation or median (interquartile range) [minimum-maximum] for continuous variables, and as frequency (percentage) for categorical variables

higher values were determined for age (p<0.001), number of metastatic lymph nodes (p=0.013), frequency of T4 (p<0.001) and N1 disease (p=0.031), frequency of stage 4 disease (p=0.009), open surgery (p=0.010), length of hospital stay (p=0.032), leakage (p=0.002), recurrence (p<0.001), NLR (p=0.001) and PLR (p=0.002) compared to survivors. In the survivors, significantly higher values were found for regional lymph node count (p=0.003), frequency of T2 (p<0.001) and N0 disease (p=0.031), frequency of stage 1 disease (p=0.009), laparoscopic surgery (p=0.010), hemoglobin (p<0.001), hematocrit (p<0.001) and lymphocyte counts (p=0.001), mean platelet volume (MPV, p=0.033) and follow-up times (p<0.001) compared to the deceased group.

ROC analysis was used to identify optimal cut-off values for NLR and PLR in predicting mortality. The area under the curve (AUC) for NLR was 0.649 (95% CI: 0.563-0.734) and the optimal cut-off value was 5.08, showing a sensitivity value of 48.2% and a specificity value of 81.7%. The AUC for PLR was 0.635 (95% CI: 0.546-0.723) and the optimal cut-off was 221.5, showing a sensitivity of 55.4% and a specificity of 72.0% (Table 2, Figure 1).

We performed multiple logistic regression analysis to determine the risk factors of mortality. Patients with high NLR (≥5.08) were found to have a 3.735-fold higher risk of death than those with lower values (OR: 3.735, 95% CI: 1.602-8.711, p=0.002). Patients with leakage had a 10.724-fold higher risk of death than those without (OR: 10.724, 95% CI: 1.281-89.747, p=0.029). Patients with recurrence had a 60.910-fold higher risk of death than those without (OR: 60.910, 95% CI: 9.807-378.319, p<0.001). In addition, we found higher age (p<0.001) was associated with an increased risk of death (Table 3). Other variables included in the model, gender (p=0.059), number of metastatic lymph nodes (p=0.236), T stage (p=0.126), N stage (p=0.296), tumor stage (p=0.282), type of surgery (p=0.172), hemoglobin (p=0.194), MPV (p=0.133) and PLR (p=0.143) were found to be non-significant.

Table 2. Performance of NLR and PLR to predict mortality

	NLR	PLR
Cut-off	≥5.08	≥221.5
Sensitivity	48.21%	55.36%
Specificity	81.71%	72.00%
Accuracy	73.59%	67.97%
PPV	45.76%	38.75%
NPV	83.14%	83.44%
AUC (95.0% CI)	0.649 (0.563-0.734)	0.635 (0.546-0.723)
p	**0.001**	**0.002**

NLR: neutrophil to lymphocyte ratio, PLR: platelet to lymphocyte ratio, PPV: positive predictive value, NPV: negative predictive value, AUC: area under ROC curve, CI: confidence interval

Table 3. Significant risk factors of the mortality, multiple logistic regression analysis

	β	SE	p	OR	95% CI
Age	0.127	0.025	**<0.001**	1.136	1.081-1.193
NLR (≥5.08)	1.318	0.432	**0.002**	3.735	1.602-8.711
Leakage	2.373	1.084	**0.029**	10.724	1.281-89.747
Recurrence	4.109	0.932	**<0.001**	60.910	9.807-378.319

SE: standard error, OR: odds ratio, CI: confidence interval, NLR: neutrophil to lymphocyte ratio, Nagelkerke R^2=0.444; correct prediction=85.17%, p<0.001

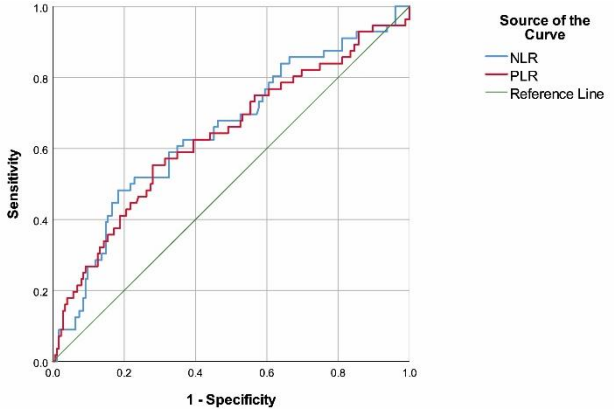

Figure 1. ROC curve of NLR and PLR to predict mortality
ROC: receiver operating characteristics, NLR: neutrophil/lymphocyte ratio, PLR: platelet/lymphocyte ratio

DISCUSSION

Studies assessing prognostic factors in CRC have gained interest in recent years due to the importance of prognosis prediction in individualized treatment planning in cancers which often demonstrate heterogeneous characteristics. For this purpose, we investigated preoperative NLR and PLR values in predicting short-term mortality in patients with resectable CRC and found that both NLR and PLR may be somewhat beneficial in this regard. In addition, we found that the factors independently associated with short-term CRC mortality were recurrence, leakage, NLR, and age.

The relationship of inflammatory markers obtained from hemogram parameters with the prognosis of various diseases has been a topic of interest for the last two decades. Numerous studies have been conducted on the prognostic value of both NLR and PLR in CRC patients, as they are common, inexpensive, and readily available (14).

NLR is one of the most investigated inflammation-related biomarkers in CRC, as the systemic inflammatory response associated with cancer is usually associated with increased circulating neutrophil counts (7). In the study by Xia et al. (9), NLR was found to be a valuable factor in predicting postoperative complications in early-stage (T1-T2) rectal cancers. In addition, a preoperative NLR greater than 2.8 was found to be an independent prognostic factor for poor disease-free survival. In our study, we included patients with CRC at all stages and the mortality-predicting cut-off for NLR was found to be 5.08, and having an NLR value exceeding this threshold was independently associated with mortality. In the study of Inamato et al. (16) in which a group of inflammatory markers was evaluated (including NLR) in CRC patients, the authors found NLR to be associated with overall survival and disease-free survival. The NLR cut-off value in this study was found to be 2.05; however, it has been established by various studies that cut-off values for NLR vary in a wide range from 2 to 5. The relatively high cut-off value in our study may be due to the low number of patients and heterogeneity of our groups, but it is also possible that the inclusion of patients with any CRC stage was associated with this finding (7,17). On the other hand, in our study, evaluations such as overall survival or disease-free survival were not performed because we did not have sufficient data.

In their study evaluating only stage III CRC patients, Yasui et al. (18) found that postoperative inflammation-based prognostic markers (including NLR) accurately predicted

overall survival and relapse-free survival; whereas, preoperative values had relatively lower value in this context. Interestingly, the mentioned study had a different design than many studies in the literature. The groups were classified according to elevated or normal inflammatory status at preoperative and postoperative assessment. For all markers evaluated, the group with normal inflammatory parameters had a significantly better prognosis than those with consistently elevated values. In our study, similar to many studies in the literature, the groups were evaluated only with preoperative NLR.

In addition to these studies, numerous reviews and meta-analyses have shown that various inflammatory biomarkers, including NLR, can be utilized as inexpensive biomarkers that can be used to predict the prognosis of patients with CRC at various stages, and may be useful in identifying high-risk patients who may benefit from adjuvant treatments (7,17,19-22). However, it has been reported that multicenter prospective studies are required to find the optimal cut-off values, as the characteristics of the enrolled patients and the cut-off values for each marker vary greatly from study to study (23). The cut-off value of NLR in our study was also consistent with this diversity in the literature. In relation, the literature shows that the prognostic value of NLR in patients with CRC is limited and inconsistent (16,23,24). In the review of Rossi et al. (23), it was stated that NLR can only be used as a prognostic marker in unresectable metastatic CRCs, and the authors emphasized the inconsistency of data in early-stage resectable CRC and resectable metastatic CRC. In addition, almost all studies focusing on the prognostic role of inflammatory markers have been reported to suffer from various forms of bias due to many problems, including their retrospective nature, heterogeneity of patient characteristics, and the lack of a common platform of exclusion criteria, mostly regarding comorbidities that may affect blood cell count (23).

Since platelets considerably contribute to inflammation, platelet-derived biomarkers have also been studied extensively for their role in CRC (7,9). PLR is one of these biomarkers. In the literature, studies exploring the relationships between CRC prognosis and blood count indices have mostly evaluated PLR together with NLR (7). Similar to NLR, PLR seems to be somewhat associated with the prognosis of CRC in many studies; however, a number of studies have claimed that it is not effective for prognostic evaluations (7,17,23-27). A study by Xia et al. (9) demonstrated that PLR was associated with both postoperative complications and poor overall survival and disease-free survival in patients with early-stage rectal cancer. In the study by Inamato et al. (16), which included all CRC stages and identified a PLR threshold value of 195, it was determined that PLR was not associated with overall survival or disease-free survival. The PLR cut-off in our study was 221.5, which was consistent with the PLR values varying in a wide range between 140-300 in the literature (7,17). In the review of Rossi et al. (23), it was stated that data were insufficient to support a prognostic role for PLR in CRC. In our study, it was found that PLR had a predictive value in predicting short-term mortality of CRC, consistent with the majority of literature.

The present study also identified recurrence, leakage, preoperative NLR, and age were independently associated with short-term mortality in patients who had undergone surgery for CRC. Leakage is one of the most serious early complications of CRC surgery and there are many publications in the literature showing that it increases mortality and morbidity in the short term, although its effects on long-term mortality are not clear (28-31). On the other hand, recurrence remains one of the most important clinical problems of curative CRC resection and there are publications in the literature that it is an indicator of poor prognosis (31-34). Finally, although few studies have shown that age does not affect prognosis, there are more studies reporting increased mortality rates in CRC patients over 75 years of age (32,33,35-37). Our findings in our study showing that recurrence, leakage, and age have predictive effects on mortality are consistent with the literature. Since determining prognosis gains importance in the planning of CRC treatment, research continues on both established prognostic factors and new prognostic factors in line with new biological, genetic and molecular information (4).

The most important limitation of our study is that it is a retrospective study. Other limitations of our study are that it is a single-center study, the limited number of patients, and heterogeneous patient characteristics due to the inclusion of patients at all CRC stages. In addition, due to insufficient data and a short follow-up period, survival assessments such as overall survival, disease-free survival, and relapse-free survival could not be performed. There are still unclear points in the literature regarding the utility of these inexpensive and common biomarkers that can be beneficial in predicting the prognosis of CRC patients, such as optimal cut-off values and validation. For this purpose, there is a need for prospective studies that include better categorized, homogeneous, and larger patient groups.

CONCLUSION

The results of our study support that preoperative NLR and PLR are effective in predicting short-term mortality in patients with operable CRC. Although the results were found to be significant, it can be said that the sensitivity and specificity values are relatively low. Therefore, more studies are needed to use these parameters in clinical practice. In addition, age, high NLR (≥5.08), leakage, and recurrence were determined as independent risk factors associated with early mortality in patients who underwent surgery for CRC. NLR and PLR are promising for future use as prognostic biomarkers in CRC patients, given that larger studies confirm the validity of these findings.

Ethics Committee Approval: The study was approved by the Non-Interventional Clinical Research Ethics Committee of Eskişehir Osmangazi University (01.06.2021, 05).

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