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Research

Relation of NLR, PLR, LMR and RDW with Mortality and Type of Surgery

NLR, PLR, LMR ve RDW'nin Mortalite ve Cerrahi Tipi ile İlişkisi

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ABSTRACT

Objective: Neutrophil, lymphocyte, monocyte, thrombocyte counts and as novel inflammatory factors, neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), lymphocyte-to-monocyte ratio (LMR) and red cell distribution width (RDW) play an important role in the occurrence and development of diseases. In this study, it was aimed to investigate the relationship between preoperative NLR, PLR, LMR and RDW values of patients hospitalized in the intensive care unit (ICU) after oncological surgery, and the length of intensive care and mortality rates. In addition, it was aimed to compare the demographic, clinical characteristics and laboratory parameters of the patients between both groups.

Methods: Patients hospitalized in the ICU after oncological surgery were included in the study. The patients were divided into two groups as patients undergoing gastrointestinal malignancy (colorectal, stomach and hepatocellular) surgery (group 1) and patients who had undergoing urologic malignancy (kidney, bladder and prostate) surgery (group 2). Information regarding demographics (age and gender), comorbidities, neutrophil-lymphocyte-platelet counts, NLR-PLR-LMR-RDW values, length of ICU stay, acute physiology and chronic health evaluation II (APACHE-II) score, Glasgow coma scale and mortality rates were recorded.

Results: Two hundred sixty-eight patients were analyzed including 144 patients (99 women, 45 men) undergoing gastrointestinal malignancy surgery (group 1), 124 patients (28 women, 96 men) undergoing urologic malignancy surgery (group 2). We found differences in lymphocyte count, LMR, and PLR values between the two groups. We found that NLR, PLR, LMR, and RDW values, as well as the counts of neutrophils, lymphocytes, and platelets, can predict mortality at specific cut-off points. Furthermore, we also identified an association between NLR, PLR, RDW values, and the APACHE-II score with the length of ICU stay. There was a difference in lymphocyte count, LMR and PLR values between the two groups.

Conclusion: By utilizing cost-effective and practically applicable laboratory parameters, we can anticipate the mortality rates of patients following after cancer surgery. Patients predicted to have a high mortality rate can be followed more closely and comprehensively.

Keywords: Intensive care, lymphocyte-to-monocyte ratio, neutrophil to lymphocyte ratio, platelet to lymphocyte ratio, RDW

ÖZ

Amaç: Nötrofil, lenfosit, monosit, trombosit sayıları ve yeni enflamatuvar faktörler olarak nötrofil-lenfosit oranı (NLR), trombosit-lenfosit oranı (PLR), lenfosit-monosit oranı (LMR) ve kırmızı hücre dağılım genişliği (RDW) hastalıkların ortaya çıkması ve gelişmesinde önemli rol oynar. Bu çalışmada onkolojik cerrahi sonrası yoğun bakım ünitesine (YBÜ) yatırılan hastaların ameliyat öncesi NLR, PLR, LMR ve RDW değerleri ile yoğun bakım kalış süreleri ve mortalite oranları arasındaki ilişkinin araştırılması amaçlanmıştır. Ayrıca her iki grup arasında demografik ve klinik özellikler ile laboratuvar parametrelerinin karşılaştırılması da amaçlanmıştır.

Gereç ve Yöntem: Çalışmaya onkolojik cerrahi sonrası YBÜ'de yatan hastalar dahil edildi. Hastalar gastrointestinal malignite (kolorektal, mide ve hepatoselüler) cerrahisi geçiren hastalar (grup 1) ve ürolojik malignite (böbrek, mesane ve prostat) cerrahisi geçiren hastalar (grup 2) olarak iki gruba ayrıldı. Demografik bilgiler (yaş ve cinsiyet), eşlik eden hastalıklar, nötrofil-lenfosit-trombosit sayıları, NLR-PLR-LMR-RDW değerleri, YBÜ'de kalış süresi, akut fizyoloji ve kronik sağlık değerlendirmesi-II (APACHE-II), Glasgow koma skalası ve mortalite oranları kaydedildi.

Bulgular: Gastrointestinal malignite cerrahisi geçiren 144 hasta (99 kadın, 45 erkek) (grup 1), ürolojik malignite cerrahisi geçiren 124 hasta (28 kadın, 96 erkek) (grup 2) olmak üzere 268 hasta analiz edildi. Her iki grup arasında lenfosit sayısı, LMR ve PLR değerlerinde fark olduğunu bulduk. NLR, PLR, LMR ve RDW değerleri ile nötrofil, lenfosit ve trombosit sayılarının belirli cut-off değerlerinde mortaliteyi tahmin edebildiğini bulduk. Ayrıca NLR, PLR, RDW değerleri ve APACHE-II skoru ile YBÜ'de kalış süresi arasında da ilişki tespit ettik.

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Sonuç: Ucuz ve pratik uygulanabilen laboratuvar parametreleri kullanarak kanser cerrahisi sonrası takip edilen hastaların mortalite oranlarını tahmin edebiliriz. Yüksek mortalite beklenen hastaların daha yakın ve kapsamlı takibi sağlanabilir.

Anahtar Kelimeler: Yoğun bakım, lenfosit-monosit oranı, nötrofil-lenfosit oranı, platelet-lenfosit oranı, RDW

INTRODUCTION

Cancer is a significant contributor to global morbidity and mortality. Despite being a potential to be one of the most preventable and treatable chronic diseases, aggressive cancers may grow and spread so rapidly that they may metastasize before the cancer has been diagnosed (1). Cancers are the leading cause of death for individuals aged 45-64 and account for substantial healthcare expenditure (2). Thus, numerous biomarkers have been pursued to facilitate early cancer detection, prognosis assessment, and patient stratification based on treatment responsiveness (3,4).

Several studies have focused on the relationship between inflammation and cancer. Inflammation and activation of the immune system possess antitumor activity; however, they play a role in carcinogenesis, tumor growth, and the progression of human cancers (5). Platelets can stimulate tumor growth by increasing angiogenesis, microvascular permeability, and the extravasation of cancer cells (6). Neutrophil, lymphocyte, monocyte, thrombocyte counts, along with novel inflammatory factors, neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), lymphocyte-to-monocyte ratio (LMR) and red cell distribution width (RDW) play an important role in the occurrence and development of diseases. Therefore, these hemogram based markers have been used in the diagnosis and prognosis of many different diseases (7,8). NLR and PLR are of a certain diagnostic value for frailty in hemodialysis patients and also associated with an unfavorable prognosis (9). PLR-NLR combination has an essential effect on the prognostic analysis of acute myocardial infarction (10). NLR and PLR values could reflect inflammatory response and disease activity in lupus patients (11). NLR, PLR and LMR values can be used as diagnostic and prognostic markers for cancer (12,13). It has also been reported that RDW values can be used to determine cancer progression (14). These parameters are markers of systemic inflammation and have been used to predict prognosis in many different types of cancer. As these blood tests are inexpensive and easy to detect, they have also been used in population-based screening for cancers (15,16).

In this study, it was aimed to investigate the relationship between preoperative NLR, PLR, LMR and RDW values of patients hospitalized in the intensive care unit (ICU) after oncological surgery, and the length of ICU stay and mortality rates. In addition, it will be investigated whether there is a difference in these parameters according to the type of cancer in patients.

METHODS

This study was approved by the Ankara Etlik City Hospital Clinical Research Ethics Committee (decision no: AEŞH-EK1-2023-279, date: 14.06.2023). Patients hospitalized in the ICU after oncological surgery between 1 October 2022 and 1 June 2023 were included in the study. Patients under the age of 18 and patients with missing data were excluded from the study. This research is a descriptive epidemiological study, and the population of the study consists of the records of postoperative patients hospitalized in the ICU of our hospital on the relevant dates. The aim was to reach all the patients included in the study.

Patient data were scanned and recorded retrospectively from hospital information system and ICU assessment forms. The patients were divided into two groups as patients undergoing gastrointestinal malignancy (colorectal, stomach and hepatocellular) surgery (group 1) and patients who had undergoing urologic malignancy (kidney, bladder and prostate) surgery (group 2). Information regarding demographics (age and gender), comorbidities, neutrophil-lymphocyte-platelet counts, NLR-PLR-LMR-RDW values, length of ICU stay, the acute physiology and chronic health evaluation-II (APACHE-II) score, Glasgow coma scale (GCS) and mortality rates were recorded.

NLR was calculated by dividing the absolute neutrophil count by the absolute lymphocyte count. PLR was calculated by dividing the absolute platelet count by the absolute lymphocyte count. LMR was calculated by dividing the absolute lymphocyte count by the absolute monocyte count.

It was aimed to investigate the relationship between neutrophil-lymphocyte-platelet counts, NLR-PLR-LMR-RDW values and the length of intensive care and mortality rates. In addition, it was aimed to compare the demographic, clinical characteristics and laboratory parameters of the patients between both groups.

Statistical Analysis

All analyses were performed on IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). For

the normality check, the Shapiro-Wilks test was used. Data are given as mean ± standard deviation for continuous variables and as frequency (percentage) for categorical variables. Between groups analysis of non-normally distributed continuous variables were performed with the Mann-Whitney U test. Between groups analysis of categorical variables were performed with the chi-square test or Fisher's Exact test. Spearman correlation test was used to evaluate the relationship between continuous variables. Mortality prediction performance of the measurements were assessed by using receiver operating characteristic (ROC) curve analysis. Optimal cut-off points were determined by using Youden index. Measurements of performance (sensitivity, specificity) were calculated according to determined cut-off points. Logistic regression analyses were performed to evaluate association between measurements and mortality. Multiple linear regression analysis were performed to determine the related factors with the length of ICU stay. While constructing the regression model, parameters that were significant in univariable analyses were included in multivariable analyses. Two-tailed p-values of less than 0.05 were considered statistically significant.

RESULTS

The study included 321 patients who were admitted to the ICU after oncological surgery between October 1, 2022, and June 1, 2023. Of these, 12 patients were excluded from the study because of missing data, 7 patients died in the first 24 hours, 26 patients were hospitalized for less than 24 hours, and 8 patients were transferred to other ICUs. As a result, 268 patients were analyzed including 144 patients (99 women, 45 men) undergoing gastrointestinal malignancy surgery (group 1), 124 patients (28 women, 96 men) undergoing urologic malignancy surgery (group 2) (Figure 1). The number of female patients in group 1 and the number of male patients in group 2 was higher and there was a statistical difference between them (p<0.001). The mean age of the patients was 66.73±12.48 years (group 1: 66.08±12.75; group 2: 67.49±12.16) years. There was no difference in the mean age between the two groups (p=0.358) (Table 1).

Demographic and clinical characteristics of the patients are listed in Table 1.

While the mean length of ICU stay was 2.21±2.46 days in group 1, it was 1.83±1.64 days in group 2. There was no difference in the length of ICU stay between the two groups (p=0.150) (Table 1).

Twenty seven patients (group 1: 19, group 2: 8) died in the ICU, 241 patients (group 1: 125, group 2: 116) were

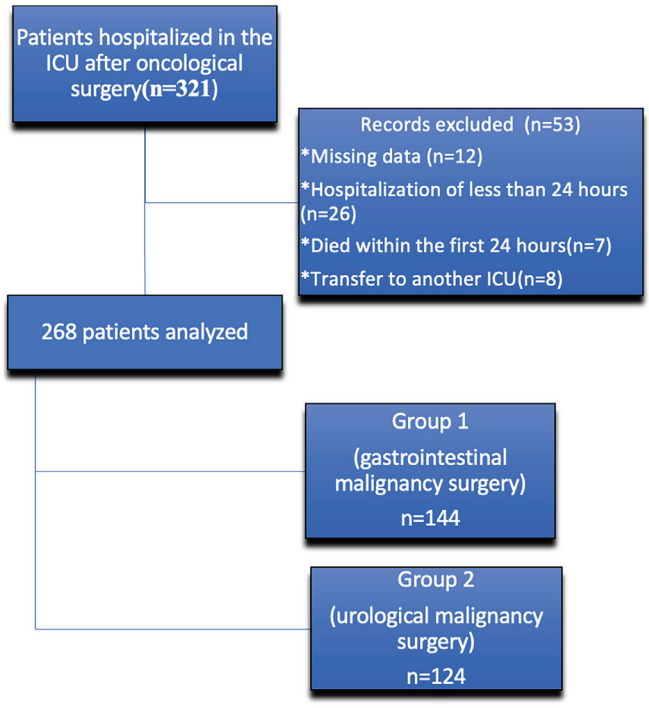

Figure 1. Flow chart of the patients
ICU: Intensive care unit

discharged from the ICU. When mortality rates were compared between the two groups, there was no statistically significant difference (p=0.067) (Table 1).

Comparisons between neutrophil/lymphocyte/monocyte/platelet counts and NLR/PLR/LMR/RDW values of the patients in the both groups are listed in Table 2.

The mean neutrophil count of the patients who died in the ICU was 8.86±2.88; lymphocyte count was 0.41±0.55; monocyte count was 0.68±0.49; platelet count was 197.51±130.1 and the mean NLR value was 30.03±15.33; PLR value was 627.52±409.65; LMR value was 1.10±1.21; RDW value was 61.35±10.69; APACHE-II score was 21.70±3.27; GCS was 13.33±2.11.

The mean neutrophil count of the patients discharged from the ICU was 5.64±3.09; lymphocyte count was 1.64±0.87; monocyte count was 0.69±0.58; and platelet count was 270.17±116.49 and the mean NLR value was 5.74±7.24; the PLR value was 228.49±193.42; the LMR value was 2.89±1.71; and the RDW value was 47.64±12.06; APACHE-II score was 14.15±5.13; GCS was 14.70±1.10.

While the neutrophil count and APACHE-II score, NLR, PLR, RDW values were higher in the patients who died in the ICU than the patients who were discharged from the ICU (p<0.001), the lymphocyte, platelet counts, GCS and LMR values were higher in the patients who were discharged

Table 1. Demographic data

	Group 1 (gastrointestinal malignancy surgery) n=144	Group 2 (urological malignancy surgery) n=124	p-value
Age (year)*	66.08±12.75	67.49±12.16	0.358
Sex (n) female/ male	99/45	28/96	**<0.001**
Length of ICU stay (day)*	2.21±2.46	1.83±1.64	0.150
APACHE-II score*	14.85±5.64	14.98±5.26	0.849
Glasgow coma scale*	14.46±1.59	14.68±0.83	0.157
Comorbidity			
COPD	49	43	0.911
CAD	55	65	***<0.05***
Cerebrovascular disease	23	23	0.577
Diabetes mellitus	57	47	0.778
Hypertension	47	39	0.836
Dementia/ Alzhemier	11	7	0.516
Renal disease	10	23	**<0.05**
Psychiatric disease	10	3	0.086
Rheumatological disease	4	1	0.234
Mechanical ventilation requirement (n)			
IMV/NIMV/SP	21/4/119	9/7/108	p=0.096
Result			
Exitus/discharge	19/125	8/116	p=0.067

APACHE-II: Acute physiology and chronic health evaluation-II, CAD: Coronary artery disease, COPD: Chronic obstructive pulmonary disease, ICU: Intensive care unit, IMV: Invasive mechanical ventilation, NIMV: Non-invasive mechanical ventilation, SP: Spontane breathing
*Mean ± standard deviation, p<0.05 was considered significant

from the ICU than the patients who died (p<0.001). The monocyte count was similar in the patients who died and were discharged (p=0.972).

Multiple logistic regression analysis had revealed that high NLR [odds ratio (OR): 1.177, 95% confidence interval (CI): 1.072-1.293, p=0.001] and high APACHE-II score (OR: 1.349, 95% CI: 1.021 - 1.783, p=0.035) were independently associated with the mortality. In addition, low GCS (OR: 0.425, 95% CI: 0.232-0.778, p=0.006) and having chronic obstructive pulmonary disease (COPD) (OR: 27.288, 95% CI: 1.617-460.607, p=0.022) were independently associated with the mortality (Table 3).

Table 2. Comparisons of hemogram based markers between groups

	Group 1 (gastrointestinal malignancy surgery) n=144	Group 2 (urological malignancy surgery) n=124	p-value
Neutrophil ($\times10^3/\mu L$)*	5.76±2.94	6.19±3.51	0.276
Lymphocyte ($\times10^3/\mu L$)*	1.34±0.80	1.74±1	**<0.001****
Monocyte ($\times10^3/\mu L$)*	0.71±0.7	0.67±0.36	0.631
Platelets ($\times10^3/\mu L$)*	264.38±115.63	261.08±124.7	0.823
NLR*	9.06±12.28	7.17±9.56	0.167
PLR*	307.27±287.39	223.88±200.29	**<0.05****
LMR*	2.42±1.59	3.05±1.86	**<0.05****
RDW (fL)*	49.2±10.53	48.82±14.7	0.809

LMR: Lymphocyte-to-monocyte ratio, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, RDW: Red cell distribution width
*Mean ± standard deviation, **p<0.05 was considered significant

NLR had 92.6% sensitivity and 90.0% specificity to predict mortality for the cut of point of 14,50 (higher values represent mortality), also had the highest area under ROC curve [Area under ROC curve (AUC): 0.946 (95% CI: 0.903-0,989), p<0.001]. PLR had 77.8% sensitivity and 79.7% specificity to predict mortality for the cut-off point of 304.29 (higher values represent mortality) [AUC: 0.827 (95% CI: 0.736-0.919), p<0.001]. LMR had 70.4% sensitivity and 93.4% specificity to predict mortality for the cut-off point of 0.725 (lower values represent mortality) [AUC: 0.828 (95% CI: 0.733-0.924), p<0.001]. In addition, neutrophil, lymphocyte, and platelet counts and RDW value were statistically significant predictors of mortality at certain cut-off points (Table 4, Figure 2).

Multiple linear regression analysis revealed that APACHE-II score (p=0.042), RDW (p=0.030), NLR (p=0.016), PLR (p<0.001) were independently associated with increased length of ICU stay (Table 5).

DISCUSSION

In this study, we aimed to investigate the impact of hemogram-based markers on the length of ICU stay and mortality rates in patients hospitalized in the ICU after gastrointestinal and urological malignancy surgery. We observed that the lymphocyte count and LMR value were lower in group 1 when compared to group 2; conversely, the PLR value was higher. Additionally, we found that NLR, PLR,

Table 3. Significant factors independently associated with mortality, multiple logistic regression analysis

Variables	β coefficient	Standard error	Wald	df	p	Exp (β)	95.0% CI for Exp (β)	
Age (year)	-0.084	0.056	2.231	1.000	0.135	0.919	0.823	1.027
APACHE-II	0.300	0.142	4.441	1.000	**0.035***	1.349	1.021	1.783
Glasgow coma scale	-0.856	0.308	7.702	1.000	**0.006***	0.425	0.232	0.778
RDW	0.046	0.026	3.292	1.000	0.070	1.048	0.996	1.101
NLR	0.163	0.048	11.623	1.000	**0.001***	1.177	1.072	1.293
PLR	-0.001	0.001	0.217	1.000	0.641	0.999	0.997	1.002
LMR	-0.008	0.260	0.001	1.000	0.974	0.992	0.596	1.650
COPD	3.306	1.442	5.258	1.000	**0.022***	27.288	1.617	460.607
CAD	1.876	1.061	3.124	1.000	0.077	6.527	0.815	52.257
Dementia/Alzhemier	-0.155	1.214	0.016	1.000	0.898	0.856	0.079	9.255
Renal disease	0.592	0.914	0.420	1.000	0.517	1.808	0.301	10.846
Constant	1.141	5.023	0.052	1.000	0.820	3.128	-	-

Dependent variable: Mortality; Nagelkerke R^2=0.792; CI: Confidence Interval.

APACHE-II: Acute physiology and chronic health evaluation II, CAD: Coronary artery disease, COPD: Chronic obstructive pulmonary disease, LMR: Lymphocyte-to-monocyte ratio, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, RDW: Red cell distribution width
*p<0.05 was considered significant

Table 4. Performance of variables to discriminate deceased cases

Variables	Cut-off	Sensitivity	Specificity	AUC (95% CI)	p-value
Neutrophil (×10³/μL)	>6.975	85.2	78.0	0.807 (0.717-0.897)	**<0.001***
Lymphocyte (×10³/μL)	<0.525	96.3	88.8	0.931 (0.862-1.000)	**<0.001***
Monocyte (×10³/μL)	-	-	-	0.501 (0.361-0.642)	0.981
Platelet (×10³/μL)	<156.00	55.6	89.6	0.689 (0.556-0.822)	**0.001***
RDW (fL)	>50.75	85.2	76.8	0.848 (0.760-0.937)	**<0.001***
NLR	>14.50	92.6	90.0	0.946 (0.903-0.989)	**<0.001***
PLR	>304.29	77.8	79.7	0.827 (0.736-0.919)	**<0.001***
LMR	<0.725	70.4	93.4	0.828 (0.733-0.924)	**<0.001***

AUC: Area under ROC curve, CI: Confidence intervals, LMR: Lymphocyte-to-monocyte ratio, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, RDW: Red cell distribution width
*p<0.05 was considered significant

LMR, and RDW values, as well as the counts of neutrophils, lymphocytes, and platelets, can predict mortality at specific cut-off points. Furthermore, we also identified an association between NLR, PLR, RDW values, and the APACHE-II score with the length of ICU stay.

Grossman et al. (17) reported that severe treatment-related lymphopenia, observed after initiating chemoradiation in patients with solid tumors, was independently associated with shorter survival from tumor progression. Péron et al. (18) reported that an increased incidence of lymphopenia was observed in advanced and metastatic cancers. In our study, we found that the lymphocyte count in patients operated for colorectal, gastric, pancreatic, and hepatocellular cancer was lower than the lymphocyte count in patients operated for kidney, bladder, and prostate cancer. We think, the reason for this situation is that patients who had undergone gastrointestinal surgery had more advanced cancer and had received preoperative chemotherapy/radiotherapy. We observed that there was a difference in LMR and PLR values between the two groups because of the low lymphocyte count.

Yang et al. (19) reported that elevated neutrophil counts independently predicted shorter survival among patients with metastatic colon cancer. Dou et al. (20) reported that

there is a relationship between low lymphocyte counts and inadequate response in rectal cancer cases. In our study, in line with the current literature, we found an increase in mortality among patients with high neutrophil counts and low lymphocyte counts.

Feliciano et al. (21) reported that there is a positive correlation between NLR value and sarcopenia and this is also associated with mortality. Cupp et al. (22) reported that there is a relationship between NLR value and mortality in cases of immunotherapy-treated urinary system cancers. Yao et al. (23) reported that NLR and PLR values were associated with mortality in patients with COPD. Capone et al. (24) also reported that there is a relationship between NLR value and survival in advanced cancer patients. In our study, we observed that the NLR, PLR, and RDW values were higher, while the LMR values were lower in patients who died in the ICU. Additionally, we found that NLR, PLR, LMR, RDW values, as well as neutrophil, lymphocyte, and platelet counts, could predict mortality at specific cutoff points. Our findings are consistent with the existing literature.

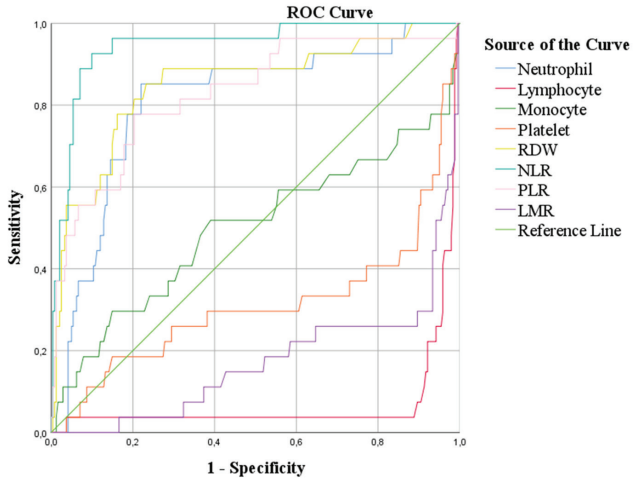

Figure 2. ROC curves of the measurements to predict mortality
NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, RDW: Red cell distribution width, LMR: Lymphocyte-to-monocyte ratio, ROC: Receiver operating characteristic

Miyamoto et al. (25) reported that the preoperative NLR is a useful predictor in gastric cancer patients and there is a relationship between NLR value and the prognosis. Dell'Aquila et al. (26) reported that their study confirmed the prognostic role of NLR in colorectal cancer patients. Chang et al. (27) found that preoperative albumin and LMR values were associated with postoperative prognosis in renal cell cancer patients. Chen et al. (28) demonstrated the close relationship between NLR, LMR, PLR values, and the grade and recurrence of bladder cancer. They also suggested that the combination of these three factors had the potential to aid in prognostic evaluation of bladder cancer. Wang et al. (29) reported a relationship between NLR value and length of hospital stay in patients with COPD. In our study, which included patients who had experienced gastrointestinal and urological malignancies, we found that NLR, PLR, and RDW values were associated with the length of ICU stay. Our findings are consistent with the existing literature.

Godinjak et al. (30) reported that the APACHE-II score can be used to predict mortality in the ICU. Cao et al. (31)

Table 5. Significant risk factors independently associated with length of ICU stay, multiple linear regression analysis

	Unstandardized β	Standard error	Standardized β	t	p	95.0% Confidence interval for β	
(Constant)	-0.915	1.509	-	-0.607	0.545	-3.886	2.056
Age	-0.017	0.010	-0.101	-1.751	0.081	-0.037	0.002
APACHE-II	0.054	0.027	0.139	2.040	**0.042***	0.002	0.106
GCS	0.040	0.081	0.025	0.496	0.620	-0.120	0.200
Neutrophil	0.046	0.044	0.069	1.042	0.299	-0.041	0.132
Lymphocyte	0.258	0.178	0.112	1.452	0.148	-0.092	0.608
Platelet	-0.001	0.001	-0.076	-1.182	0.239	-0.004	0.001
RDW	0.017	0.008	0.103	2.177	**0.030***	0.002	0.033
NLR	0.044	0.018	0.228	2.418	**0.016***	0.008	0.079
PLR	0.003	0.001	0.412	4.907	**<0.001***	0.002	0.005
LMR	-0.034	0.076	-0.028	-0.447	0.655	-0.184	0.116

APACHE-II: Acute physiology and chronic health evaluation II, GCS: Glasgow coma scale, LMR: Lymphocyte-to-monocyte ratio, NLR: Neutrophil-to-lymphocyte ratio, PLR: Platelet-to-lymphocyte ratio, RDW: Red cell distribution width
*$p<0.05$ was considered significant.
Dependent variable: Length of ICU stay; $R^2=0.520$; $F=18.212$

reported that in critically ill patients, the APACHE-II score, in conjunction with lactate levels, provides a better prediction of mortality. Ahmadi et al. (32) have also reported that the GCS is associated with mortality in patients with traumatic brain injury. In our study, we found a relationship between mortality rate and APACHE-II score, GCS. Furthermore, we found that the APACHE-II score is also associated with the length of ICU stay. We observed that our data were consistent with studies in the literature.

There are certain limitations to this study. First, our patient group operated for cancer was limited to gastrointestinal and urological cancer patients in our hospital. Since many different cancer surgeries such as lung cancer, larynx and nasopharyngeal cancer, orthopedic tumor surgeries were not operated in our hospital, we could not include the patients operated for different cancer types in our study group. Second, it was a single-center and retrospective study and this limited the number of patients.

CONCLUSION

The use of many different biomarkers in order determine the early diagnosis, treatment and prognosis of cancers is still being investigated today. Alterations in neutrophil, lymphocyte, monocyte, and platelet counts, as well as associated ratios, serve as indicators of systemic inflammation and are used to predict diagnosis, treatment and prognosis in many different types of cancer. These hemogram based markers are cost-effective and routinely requested in all preoperative patients. By utilizing cost-effective and practically applicable laboratory parameters, we can anticipate the mortality rates of patients following after cancer surgery. Patients predicted to have a high mortality rate can be followed more closely and comprehensively.

ETHICS

Ethics Committee Approval: This study was approved by the Ankara Etlik City Hospital Clinical Research Ethics Committee (decision no: AEŞH-EK1-2023-279, date: 14.06.2023).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: Y.Ö., S.A., Concept: Y.Ö., S.A., Design: Y.Ö., S.A., Data Collection or Processing: Y.Ö., S.A., Analysis or Interpretation: Y.Ö., S.A., Literature Search: Y.Ö., Writing: Y.Ö., S.A.

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