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COVID-19'lu Yatan Hastalarda Nötrofil/Lenfosit Oranı, Lenfosit/Monosit Oranı, Platelet/ Lenfosit Oranı ve Hematolojik Parametrelerin Hastalığın Şiddet ve Prognozu ile İlişkisi

The Association of Neutrophil/Lymphocyte Ratio, Lymphocyte/Monocyte Ratio, Platelet/ Lymphocyte Ratio and Hematological Parameters with Severity and Prognosis in Hospitalized Patients with COVID-19

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ÖZ

Amaç: Hastanede yatan COVID-19'lu hastalarda nötrofil/ lenfosit oranı (NLR), lenfosit/monosit oranı (LMR), platelet/lenfosit oranı (PLR) ve hematolojik parametrelerin hastalığın şiddeti ve prognozunu belirlemedeki değerini araştırmaktır.

Materyal ve Metot: Çalışma bir göğüs hastalıkları kliniğinde Nisan-Eylül 2020 tarihleri arasında COVID-19 nedeniyle yatan 182 hasta ve 91 kontrol grubu ile retrospektif olarak gerçekleştirildi. Takipte hematolojik parametreler ile diğer parametreler arasındaki ilişki ve farklılıklar araştırıldı.

Bulgular: Lenfosit, monosit, eozinofil, bazofil, hemoglobin, trombosit ve LMR anlamlı olarak daha düşüktü. NLR ve PLR daha yüksekti. Taburcu aşamasında, hematolojik parametreler ve PLR'de anlamlı artış bulundu. Radyolojik pnömoni şiddet skoru ile NLR (r=0,234; p=0,001) ve PLR (r=0,128; p=0,042) arasında anlamlı pozitif korelasyon ve LMR ile anlamlı ters korelasyon (r=-0,206; p=0,003) vardı. NLR (r=0,140; p=0,030) ve PLR (r=0,125; p=0,046) ile semptom-taburcu süresi arasında pozitif yönlü, LMR ile hem semptom-taburcu (r=-0,137; p=0,032) hem de hastanede kalış süresi arasında ters yönlü korelasyon tespit edildi (r=
-0,135; p=0,034). Hastaneye kabul ve taburculukta CRP ile NLR ve PLR arasında da pozitif bir korelasyon vardı.

Sonuç: NLR, LMR ve PLR, COVİD-19'lu hastalarda hastalığın takibinde CRP'yle birlikte kullanılabilecek, hastalığın şiddetiyle anlamlı korelasyon gösteren, tedaviye yanıtı izlemede ve prognozu öngörmede faydalanılabilecek hematolojik prediktörler olarak bulunmuştur.

Anahtar Kelimeler: COVİD-19, lenfosit monosit oranı, nötrofil lenfosit oranı, platelet lenfosit oranı, radyolojik pnömoni şiddet skoru

ABSTRACT

Objective: To investigate neutrophil/lymphocyte (NLR), lymphocyte/monocyte (LMR), platelet/lymphocyte (PLR) ratios, and the value of these parameters in determining disease severity and progression in hospitalized COVID-19 patients.

Materials and Methods: Study was conducted retrospectively with 182 in-patients and 91 controls due to COVID-19 between April-September 2020 in the chest diseases clinic. Hematological parameters and rates were compared with controls' parameters. Correlations and differences between hematological parameters and other parameters were investigated.

Results: Lymphocyte, monocyte, eosinophil, basophil, hemoglobin, thrombocyte, and LMR were significantly lower. NLR and PLR were higher. There were significant increases in hematological parameters and PLR on discharge. A positive correlation existed between radiological pneumonia severity score, and NLR (r=0.234, p=0.001) and PLR (r=0.128, p=0.042), and significant inverse correlation with LMR (r=-0.206, p=0.003). Positive correlations were detected between NLR (r=0.140, p=0.030) and PLR (r=0.125, p=0.046), and symptom-discharge time, and inverse correlation between LMR and both symptom-discharge (r=-0.137, p=0.032) and hospital stay time (r=-0.135, p=0.034). A positive correlation existed between CRP, and NLR and PLR on admission and discharge.

Conclusion: NLR, LMR and PLR were found as hematological predictors to be used with CRP in following-up COVID-19, showing a significant correlation with disease severity, monitoring responses to treatment and predicting prognosis.

Keywords: COVID-19, lymphocyte monocyte ratio, neutrophil lymphocyte ratio, platelet lymphocyte ratio, radiological pneumonia severity score

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INTRODUCTION

Coronavirus disease has been identified as the cause of the pandemic in Wuhan, China, as of December 2019.[1] The World Health Organization (WHO) reported that a new coronavirus (2019-nCoV) was approved on 7th January 2020,[2,3] and so the condition was named as COVID-19 disease by WHO. It was reported that the number of leukocytes, lymphocytes, and platelets is generally decreased in COVID-19 disease,[4-6] and progressive lymphocytopenia reveals the severity of the disease.[6] A study revealed that NLR was effective in predicting the severe disease in the early stage of COVID-19, and the patients of >50 years of age and NLR ≥3.13 are prone to severe disease and should be referred to the intensive care units (ICU) rapidly, if necessary.[7] Another study also stated that the novel coronavirus can be mainly effective on lymphocytes, especially on T lymphocytes, and monitoring NLR and lymphocyte subsets helps the diagnosis and treatment of COVID-19, and the early detection of critical COVID-19 patients.[8] Recent evidence has revealed that there is a positive correlation between NLR and platelet/lymphocyte ratio (PLR), and inflammatory markers. Besides, lymphocyte/monocyte ratio (LMR), such as NLR and PLR, has also been reported to be used as an indicator of the systemic inflammatory response.[9] In a literature review including 3,508 patients that were constituted by scanning a total of 20 studies in EMBASE, MEDLINE and Google Scholar, NLR and PLR were stated to be used as independent prognostic markers to distinguish between severe and non-severe COVID-19 patients. Since those parameters are cost-effective and easily accessible in all laboratories, NLR and PLR trends have been recommended to be compared with the pace of the disease in future studies.[10]

Here, we aimed to investigate the association of NLR, LMR, PLR, leukocyte, neutrophil, lymphocyte, monocyte, eosinophil, hemoglobin (Hgb), mean corpuscular volume (MCV), platelet, and mean platelet volume (MPV) with the values in the follow-up period, the severity of pulmonary involvement, responses to the treatment and the prognosis in COVID-19 patients.

MATERIALS AND METHODS

The present study was performed under the 1964 Helsinki Declaration of Good Clinical Practice, and also approved by the Ethics Committee of Meram Medical Faculty, Necmettin Erbakan University (Date: 07/08/2020, decision no: 2020/2776).

Our study was carried out retrospectively with inpatients diagnosed, followed-up, and treated due to COVID-19 disease, and the control group in the chest diseases clinic of a university-affiliated hospital between April-September 2020. Scanning all COVID-19 patients >18 years of age that were followed-up in the clinic of chest diseases from the hospital information management system, 182 patients diagnosed with COVID-19 through the polymerase chain reaction (PCR) method were included in the study. From the hospital information management system, such features as age, gender, hematological parameters on admission and discharge, radiological findings, symptoms, additional diseases, treatments received by the patients, length of hospital stay, symptom- discharge time, readmission after discharge, referral to ICU and final status were recorded. While the patients discharged with good health were considered those with a good prognosis, those referred to ICU, requiring re-hospitalization after discharge, and those dying were accepted as poor prognosis. The radiological pneumonia severity score (RPSS), one of the most important parameters in determining the severity of COVID-19, was used to determine the extent of pulmonary involvement. Each of five lung lobes was examined for the degree of the involvement, scoring as 0: 0% involvement, 1: 1-25% involvement, 2: 26-50% involvement, 3: 51-75% involvement, and 4: 76-100% involvement, and the overall “lung severity score” was calculated by

adding the scores of the five lobes (score range, 0-20).[11,12]

From the patients' history previously admitted to the clinic of chest diseases with similar age level and gender ratio (female/male) to those of COVID-19 patients, the radiological and laboratory findings were investigated, and 91 individuals without any metabolic diseases, cancers, rheumatological diseases, vasculitis, hematological disease, or other pulmonary diseases were enrolled as the control group.

Patients' hematological parameters and rates were compared with controls' parameters. Correlations and differences between hematological parameters and other parameters in follow-up were investigated.

***Statistical Analysis**:* All analyses detected in the study were conducted with the Statistical Package for the Social Sciences software package for Windows, version 22.0 (SPSS Inc, Chicago, IL, USA). The compliance analysis with normal distribution was performed through SPSS. While the student *t*-test was used for continuous numerical variables showing normal distribution, the Mann-Whitney U test was utilized for the variables without normal distribution. The relationship between variables was evaluated using the Pearson's correlation analysis. A p-value of <0.05 was considered statistically significant.

RESULTS

Mean age was calculated as 59.92±12.36 in the patient group and 57.65±11.83 in the controls. While 102 (56%) patients were male and 80 (44%) were female in the patient group, 57 (62.6%) and 34 (37.4%) of those in the control group were men and women, respectively. No significant difference was observed between the patient and control groups concerning age and gender (p<0.05). While the average and median times from the onset of symptoms to discharge were found as 14.19±8.41 and 13(4-75) days respectively, the mean and median hospital stay times were detected as 9.77±7.86 and 8(2-72) days, respectively (Table 1).

While 145 (79.7%) of COVID-19 patients had an additional disease, no additional diseases were determined in 37 (20.3%) COVID-19 patients. The most commonly encountered additional diseases were detected as hypertension (46.7%), asthma (24.2%), diabetes mellitus (17%), and coronary artery disease (12.6%). However, among the most common symptoms were cough (63.7%), fatigue (61.5%), shortness of breath (40.7%), and fever (40.1%). Hydroxychloroquine sulfate of 200 mg tablet (91.2%), enoxaparin (70.3%), and favipiravir of 200 mg tablet (60.4%) were administered as the most common treatment regimes (Table 1).

There were 138 patients with pulmonary involvement. When scored radiologically regarding RPSS, the mean and the highest scores were found as 4.86±3.99 and 15, respectively. The severity score of pneumonia witnessed most commonly was measured as 5 and seen in 26 (14.3%) patients (Table 2).

Compared the hematological parameters in COVID-19 patients with those of the controls, leukocyte, lymphocyte, monocyte, eosinophil, basophil, Hgb, thrombocyte, and LMR values were found significantly lower in COVID-19 patients, while NLR and PLR were significantly higher. When COVID-19 patients without additional disease were compared with the controls, while leukocyte, neutrophil, lymphocyte, monocyte, eosinophil, basophil, thrombocyte, MPV, and LMR values were detected to be significantly lower in COVID-19 patients without additional diseases, NLR and PLR were seen to be significantly higher (Table 3).

Given the hematological parameters and the rates found on admission and discharge stages of the patients, while leukocytes, lymphocytes, monocytes, eosinophils, and thrombocyte counts, and PLR were seen to increase significantly on discharge, CRP was observed to decrease significantly (Table 4).

LMR was observed to be significantly lower in COVID-19 patients with pneumonia. Even so, NLR and PLR values were higher in those with pneumonia, but not statistically significant (Table 5).

While a weak statistically significant positive correlation was detected between RPSS and NLR values (r=0.234, p=0.001), there was a weak statistically significant negative correlation between RPSS and LMR (r=-0.206, p=0.003). Even so, a weak statistically significant positive correlation was found between RPSS and PLR, (r=0.128, p=0.042).

Although there was a weak statistically significant positive correlation between NLR and symptom-discharge time (r=0.140, p=0.030), a weak statistically significant inverse correlation was determined between LMR and symptom-discharge time (r=-0.137, p=0.032). Besides a weak statistically significant positive correlation between PLR and symptom-discharge time (r=0.125, p=0.046), there was also a weak statistically significant inverse correlation was found between LMR and length of hospital stay (r = -0.135, p = 0.034). However, no significant correlation was observed between NLR and PLR, and length of

hospital stay.

In addition to the positive, moderately strong and statistically significant correlation between the onset of symptom-discharge time, and RPSS (r=0.394, p<0.001), a positive moderate statistically significant correlation was also observed between the length of hospital stay and RPSS (r=0.364, p<0.001).

No significant difference was found between those with and without any additional disease in terms of the existence of pneumonia.

One hundred and sixty-eight patients were discharged with full recovery and evaluated as good prognosis. The remaining 14 patients were considered to have a poor prognosis since two died, two were readmitted after the discharge, and 10 were referred to ICU. Among 10 patients with ICU referral, three died. Since five of all 182 study participants died, the mortality rate was calculated as 2.74%. As opposed to the significantly lower value of LMR in the patients with poor prognosis, NLR and PLR values were found to be statistically significantly higher (Table 5).

Although a moderately strong and statistically significant positive correlation was found between CRP and NLR values on admission (r=0.503, p<0.001), there was a weak statistically significant negative correlation between hospitalization CRP and LMR on admission (r=-0.133, p=0.036). As consistent with the moderately strong and statistically significant positive correlation between CRP and PLR values on admission (r=0.372, p<0.001), a moderately strong statistically significant positive correlation was also found between PLR and sedimentation on admission (r=0.259, p=0.001). However, no significant correlation was detected between NLR and LMR values, and sedimentation on admission.

On discharge, in addition to the weak statistically significant positive correlation between CRP and NLR values (r=0.193, p=0.005), a weak statistically significant inverse correlation also existed between CRP and LMR (r=-0.154, p=0.019). While a moderate positive statistically significant correlation was found between CRP and PLR values on discharge from the hospital (r=0.148, p=0.024), no significant correlation was observed between NLR, LMR, PLR values, and sedimentation rates.

DISCUSSION AND CONCLUSION

In our study, among the hematological parameters of the patients with COVID-19, the values of leukocyte, lymphocyte, monocyte, eosinophil, basophil, Hgb, thrombocyte, and LMR were found to be significantly lower than the control group, while NLR and PLR were detected to be significantly higher. When COVID-19 patients without additional diseases were compared with the controls to rule out the effects of comorbidities, the levels of leukocyte, neutrophil, lymphocyte, monocyte, eosinophil, basophil, thrombocyte, MPV, and LMR were determined to be significantly lower in COVID-19 patients, while NLR and PLR values were significantly higher in those with COVID-19. Additionally, a statistically significant increase in leukocyte, neutrophil, lymphocyte, monocyte, eosinophil, thrombocyte, and PLR values, and a significant decrease in CRP values were found at the time of discharge. While LMR was detected to be significantly lower in those with pneumonia, NLR and PLR values were observed to be higher; however, such an increase in NLR and PLR values was not statistically significant.

In the study where Wang et al.[13] investigated the association between the clinical features of COVID-19 and the disease severity in hospitalized patients, lymphocyte count was found to be lower in the patients with severe disease, compared to mild and moderate patients. In severe COVID-19 patients, while CRP, NLR, and PLR values were higher, LMR was seen to be significantly reduced. Given the results of univariate logistic regression analysis, lower lymphocyte count, and higher CRP, NLR, and PLR values were reported to be risk factors for the severity of COVID-19 disease. In a recent study investigating the hematological parameters in predicting the severity and mortality in COVID-19 patients in Pakistan, it has been stated that inflammatory markers and hematological indices were a good guide for predicting the severity and outcome of COVID-19 disease, and although NLR and PLR values increased in severe disease, LMR was disproportionately decreased to disease severity.[14] In another recent study, RPSS has also been reported to be an independent predictor of intubation, long-term hospital stay, and death.[15] In another study conducted to explore the association between the findings of imaging and clinical classification of COVID-19 disease, the quantitative analysis of CT images was stated to have high consistency and reflect the clinical classification of COVID-19 disease.[12] In our study, a statistically significant positive correlation was determined between NLR and PLR values, and RPSS, and a statistically significant inverse correlation was seen between RPSS and LMR. Additionally, a

statistically significant correlation was also observed between RPSS, and symptom-discharge time, and hospital stay time in our study.

In a study performed with 225 COVID-19 patients hospitalized in a tertiary university hospital in Iran, while increased NLR and PLR were detected to be significantly higher, Hgb and platelet values were found significantly lower among the patients not surviving.[16] In our study, however, NLR and PLR values were found to be statistically significantly higher, while LMR values were significantly lower in COVID-19 patients with poor prognosis. The relationship between the hematological parameters, and symptom-discharge time and hospital stay time as other two parameters providing information about the pace of the disease and response time to the treatment was also investigated in our study. To our knowledge, the present study is the first to investigate such a relationship. Although a positive statistically significant correlation was found between NLR and PLR and symptom-discharge time, there was a statistically significant inverse correlation between LMR, and both symptom-discharge time and time of hospital stay.

In a systematic review including 52 studies (46 from China) where the length of hospital stay in COVID-19 patients was investigated, it was reported that the median time of hospital stay was 14 days in studies performed in China and five days in those out of China.[17] In a comprehensive and geographically far-reaching study where 64781 patients with COVID-19 were analyzed, and involving 592 acute care hospitals in the United States (USA), the median time of hospital stay was stated to be six (3-10) days, compared with eight days in our study. In the study, the median age and in-hospital mortality were reported as 65 (52-77) years and 20.3% for hospitalized patients, respectively, and 19.4% of the patients were referred to ICU.[18] Even so, the median age, in-hospital mortality, and referral rate to ICU were found as 60(18-90) years, 2.7%, and 5.4% in our patients, respectively.

In numerous studies, COVID-19 disease has been reported to be more severe in patients with any additional disease.[19] In our study, no significant difference was found between those with and without additional diseases in terms of the existence of pneumonia. While the mean value of RPSS was 6.41±3.72 in pneumonia patients with any additional disease, the value was found lower as 6.10±2.94 among those without additional disease; however, no statistically significant difference was found. The reason for the lack of a significant difference may have been that we included not only serious diseases but all additional diseases in the statistical analyses, as well.

In conclusion; the values of leukocyte, lymphocyte, monocyte, eosinophil, and thrombocyte were found both significantly lower on admission and significantly increased at the time of discharge in the patient group than the controls, demonstrating that hematological laboratory parameters always have a diagnostic value in infectious disease and are an important component of follow-up parameters. In our study, NLR, LMR, and PLR as easily accessible and rapidly computable routine hemogram tests in COVID-19 inpatients were found as hematological predictors to be used along with CRP in the diagnosis and follow-up of the condition, showing a significant correlation with disease severity in monitoring response to treatment and predicting the prognosis.

Ethics Committee Approval: The study was approved by the Ethics Committee of the Medical Faculty of Necmettin Erbakan University (Date: 07/08/2020, decision no: 2020/2776).

Conflict of Interest: No conflict of interest was declared by the author.

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Table 1. The characteristics of age, gender, hospital stay, and symptom-discharge time, additional diseases, symptoms, and treatments administered to patients with COVID-19 pneumonia.

			Patients (n=182)			**Controls** (n=91)		
Gender	**Male**		102 (56%)			57 (62.6%)		
	Female		80 (44%)			34 (37.4%)		
			Mean±SD	Median	Min-Max	Mean±SD	Median	Min-Max
Age			59.92±12.36	60	18-90	57.65±11.83	58	23-71
Hospital stay time			9.77±7.86	8	2-72			
Symptom-discharge time			14.19±8.41	13	4-75			
Additional Diseases	**n**	**Percentage (%)**	**Symptoms**	**n**	**Percentage (%)**	**Treatment**	**n**	**Percentage (%)**
HT	85	46.7	Cough	116	63.7	Hydroxychloroquine	166	91.2
Asthma	44	24.2	Fatigue	112	61.5	Enoxaparin	128	70.3
DM	31	17	Shortness of breath	74	40.7	Favipiravir	110	60.4
CAD	23	12.6	Fever	73	40.1	Cephalosporin	79	43.4
CVE	9	4.9	Muscle pain	31	17	Azithromycin	52	28.6
CHF	8	4.4	Sputum production	26	14.3	Meropenem	52	28.6
Osteoporosis	8	4.4	Headache	24	13.2	Oseltamivir	41	22.5
COPD	7	3.8	Loss of appetite	23	12.6	Immunoplasma	39	21.4
CRF	6	3.3	Sore throat	21	11.5	Dexametazon	38	20.9
Rheumatoid Arthritis	6	3.3	Nausea and/or vomiting	20	11	Piperacillin/ Tazobactam	30	16.5
Migraine	4	2.2	Diarrhea	11	6	Quinolone	17	9.3
Hyperthyroidism	4	2.2	Ageusia and/or anosmia	10	5.5	Vancomycin	11	6
Hyperlipidemia	4	2.2	Chest pain	2	1.1	Linezolid	4	2.2
Hypothyroidism	3	1.6				Tigecycline	4	2.2
Arrhythmia	2	1.1				Vitamin C-D	4	2.2
OSAS	1	0.5				Doxycycline	1	0.5
Sarcoidosis	1	0.5						
Heart Valve Disease	1	0.5						
Systemic Sclerosis	1	0.5						
Hepatitis B	1	0.5						
Epilepsy	1	0.5						
Thalassemia Minor	1	0.5						
Lymphoma	1	0.5						
Breast Carcinoma	1	0.5						

CAD: Coronary artery disease; CHF: Congestive heart failure; COPD: Chronic obstructive pulmonary disease; CRF: Chronic renal failure; CVO: Cerebrovascular event; DM: Diabetes mellitus; HT: Hypertension; OSAS: Obstructive sleep apnea syndrome; SD: Standard deviation.

Table 2. Radiological pneumonia severity scores of patients with COVID-19 pneumonia.

RPSS	n	Percentage (%)
0	44	24.2
1	8	4.4
2	7	3.8
3	10	5.5
4	14	7.7
5	26	14.3
6	10	5.5
7	23	12.6
8	10	5.5
9	4	2.2
10	3	1.6
11	9	4.9
12	5	2.7
13	6	3.3
14	2	1.1
15	1	0.5
Total	182	100

RPSS: Radiological pneumonia severity score.

Table 3. The comparisons of NLR, LMR, PLR, and hematological parameters of COVID-19 patient and control groups.

Hematological Parameters and Rates	**All COVID-19 Patients** Mean±SD (n=182)	**Controls** Mean±SD (n=91)	**p***	**COVID-19 Patients with no Additional Diseases** Mean±SD (n=37)	**p****
Leukocyte (cells/mm^3)	6118±2500	7307±1809	<0.001	5471±1724	<0.001
Neutrophil (cells/mm^3)	4126±2165	4188±1561	0.806	3352±1332	0.005
Lymphocyte (cells/mm^3)	1480±741	2373±623	<0.001	1596±815	<0.001
Monocyte (cells/mm^3)	431±180	512±154	<0.001	411±149	0.001
Eosinophil (cells/mm^3)	52±89	171±125	<0.001	63±99	<0.001
Basophil (cells/mm^3)	18±60	38±20	0.002	11±12	<0.001
Hgb (g/dL)	13.27±1.81	13.97±1.27	0.001	13.64±1.61	0.22
MCV (fL)	90.58±68.88	86.09±4.83	0.536	85.38±8.58	0.55
Thrombocyte (cells/mm^3)	211082±83705	266891±81304	<0.001	204388±82747	<0.001
MPV (fL)	11.03±7.15	10.16±1.08	0.248	10.58±0.72	0.03
NLR	3.65±3.41	1.89±0.94	<0.001	2.88±2.60	0.002
LMR	3.67±1.69	4.91±1.54	<0.001	4.17±2.00	0.025
PLR	170.52±99.84	117.56±38.53	<0.001	144.20±76.28	0.008

Hgb: Hemoglobin; LMR: Lymphocyte/monocyte ratio; MCV: Mean corpuscular volume; MPV: Mean platelet volume; NLR: Neutrophil/lymphocyte ratio; PLR: Platelet/lymphocyte ratio; SD: Standard deviation; p*: p values between all COVID-19 patients and controls; p**: p values between COVID-19 patients without additional diseases and controls.

Table 4. The comparisons of NLR, LMR, PLR, CRP, hematological parameters, and hospitalization and discharge values of patients with COVID-19 pneumonia.

Hematological Parameters, Ratios, and CRP	**Admission Mean±SD (n=182)**	**Discharge Mean±SD (n=182)**	**p**
Leukocyte (cells/mm^3)	6118.13±2500.55	7025.66±2563.56	<0.001
Neutrophil (cells/mm^3)	4126.15±2165.30	4668.79±2422.42	0.005
Lymphocyte (cells/mm^3)	1480.44±741.63	1747.53±777.28	<0.001
Monocyte (cells/mm^3)	431.70±180.68	480.22±204.28	0.003
Eosinophil (cells/mm^3)	52.21±89.84	115.64±121.45	<0.001
Basophil (cells/mm^3)	18.34±60.26	19.83±17.68	0.735
Hgb(g/dL)	13.27±1.81	12.61±1.70	<0.001
MCV (fL)	90.58±68.88	85.69±7.68	0.331
Thrombocyte (cells/mm^3)	211082.42±83705.93	313743.65±258928.68	<0.001
MPV (fL)	11.03±7.15	11.35±8.75	0.711
Sedimentation (mm/h)	41.48±21.23	48.67±25.52	0.001
CRP	37.28±41.42	16.88±26.17	<0.001
NLR	3.65±3.41	3.91±5.39	0.539
LMR	3.67±1.69	3.94±1.72	0.062
PLR	170.52±99.84	234.01±269.51	0.01

CRP: C-reactive protein; Hgb: Hemoglobin; MCV: Mean corpuscular volume; MPV: Mean platelet volume; NLR: Neutrophil/ lymphocyte ratio; LMR: Lymphocyte/monocyte ratio; PLR: platelet/lymphocyte ratio; SD: Standard deviation.

Table 5. The comparisons of NLR, LMR, and PLR values of COVID-19 patients with and without pneumonia, and the comparison of NLR, LMR, and PLR values in terms of prognosis.

Ratios of Hematological Parameters	**COVID-19 Pneumonia/Yes Mean±SD (n=138)**	**COVID-19 Pneumonia/No Mean±SD (n=44)**	**p**
NLR	3.87±3.46	2.95±3.19	0.119
LMR	3.52±1.59	4.14±1.91	0.033
PLR	176.79±92.44	150.86±119.23	0.134
	COVID-19 Patients with Poor Prognosis Mean±SD (n=14)	**COVID-19 Patients with Good Prognosis Mean±SD (n=168)**	**p**
NLR	5.74±3.45	3.48±3.36	0.004
LMR	2.46±0.83	3.77±1.71	0.002
PLR	232.20±114.21	165.38±97.18	0.009

LMR: Lymphocyte/monocyte ratio; NLR: Neutrophil/Lymphocyte ratio; PLR: Platelet/lymphocyte ratio; SD: Standard deviation.