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Original Article / Özgün Araştırma

The relationship between hemogram parameters with clinical progress in COVID-19 patients

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Abstract

Objective: In the present study, we aimed to show the relationship between the clinical characteristics age, gender, hospitalization time values and hemogram parameters of COVID-19 patients.

Methods: Total 70 patients who were diagnosed with COVID-19 between April 2020 and June 2020 in a secondary hospital and discharged with healing were retrospectively examined in terms of demographic data, epidemiological properties and hemogram parameters.

Results: The mean age of 70 patients included in the study is 43.8± 17.2 (range, 17 to 87) years; 28 (40%) were female and 42 (60%) were male. The mean hospitalization time of the patients was 6.33 ± 3.05 (range, 1 to 15) days. We observed a significant difference between eosinophil count (p = 0.05) and platelet distribution width (PDW) values (p = 0.032) according to the duration of hospitalization. There was no significant difference between the clinical progress and blood values in general. However, when patients with and without fever were compared, a significant difference was found for mean platelet volume (MPV) (p=0.035) values. Similarly, a statistically significant difference was found between hemoglobin (p = 0.046) and eosinophil number (p = 0.010) when male and female patients were compared.

Conclusion: The relationship between clinical progress and hemogram parameters in patients diagnosed with COVID-19 may be significant for the evaluation of prognosis.

Keywords: COVID-19, hemogram parameters, prognosis.

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COVID-19 Hastalarında Hemogram Parametrelerinin Klinik Seyir İle İlişkisi

Öz

Amaç: Bu çalışmamızda hastaların klinik özellikleri, yaş, cinsiyet, yatış süresi değerleri ile hemogram parametreleri arasındaki ilişkiyi göstermeyi amaçladık.

Yöntemler: İkinci basamak bir hastanede 1-04-2020 ve 1-06-2020 tarihleri arasında kesin COVID-19 tanısı ve kinik bulguları ile yatan ve şifa ile sonuçlanan 70 hastanın klinik verileri demografik veri, epidemiyolojik özellikler ve hemogram parametreleri retrospektif olarak incelenmiştir.

Bulgular: Çalışmaya dahil edilen 70 hastanın yaş ortalaması 43,8± 17,2 (min 17-max 87) yıl olup; 28 (%40)'ı kadın , 42 (%60)'ı erkekti. Hastaların ortalama yatış süresi 6,33±3,05 (min 1-max 15) gündü. Yatış süresine göre eozinofil sayısı (p=0,002) ve PDW (Trombosit Dağılım Genişliği) değerleri (p=0,032) arasında anlamlı fark gözledik. Klinikle kan değerleri arasında genel anlamda anlamlı fark çıkmamıştır. Ancak ateş olan ve olmayan hastalar karşılaştırıldığında MPV (Ortalama Trombosit Hacmi) (p=0,035) değerleri arasında anlamlı fark bulunmuştur. Aynı şekilde kadın ve erkek hastalar karşılaştırıldığında hemoglobin (p=0.0) ve eozinofil sayısı (p=0.0) değerleri arasında istatistiksel olarak anlamlı bir fark bulunmuştur.

Sonuç: COVID-19 tanısıyla yatan yoğun bakım gereksinimi olmayan hastalarda klinik seyir ile hematolojik parametreler arasındaki ilişki prognoz değerlendirmesi için anlamlı olabilir.

Anahtar kelimeler: COVID-19, hemogram parametreleri, prognoz.

INTRODUCTION

The SARS-CoV-2 infection outbreak has been called Coronavirus disease 2019 (COVID-19) by the World Health Organization (WHO). COVID-19 infection has rapidly spread to many countries and is an international public health problem, leading to the deaths of more than 4,000 people on March 11, 2019, and was officially declared a pandemic on that date[1]. COVID-19 is a respiratory disease first seen in Wuhan, China in December 2019. COVID-19 is highly contagious, its basic clinical signs are cough, fever, fatigue, myalgia, loss of smell and taste, and respiratory distress[2,3]. Following patients who are infected with COVID-19; it is very important to evaluate the severity, progression and treatment efficacy of the disease via hematologic and biochemical laboratory parameters. In addition, these tests provide guidance in determining the risk of low or high mortality in severe and non-severe patient separation. The aim of this study was to evaluate the correlation between hospitalized patients who are infected with COVID-19 clinical characteristics, hospitalization times, genders and hemogram parameters.

METHODS

Study Design

For this study, first of all, the Ministry of Health Scientific Research Platform and then the clinical Research Ethics Committee approved (Approval Number: 03.06.2020/892). Since the study was a retrospective study, no informed consent was obtained from the patients. The study was carried out in accordance with the ethical principles set out in the Declaration of Helsinki. In the study, 70 patients who were admitted to our hospital between 1-04-2020 and 1-06-2020 with the diagnosis of COVID-19 and clinical findings received medical treatment and resulted in healing were evaluated retrospectively. Patients in intensive care unit and in hospital for safe isolation for COVID-19 were excluded from the study.

Outcome Parameters

All patients' hospitalization clinics, symptoms, resumes, gender, additional disease, drug treatment, duration of hospitalization and

hematologic laboratory parameters were examined. Hematologic laboratory parameters hemoglobin (HB), white blood cell count (WBC), neutrophil count (Neu), lymphocytes (Lymph), the number of eosinophils (EOS), platelet count (Plt), mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT) values were examined.

Statistical Analysis

Descriptive statistics for continuous data mean, standard deviation, minimum and maximum values and percentage data are indicated in discrete data. Whether the distributions are in the normal range was determined by Kolmogrov Smirnov test. Chi-square test was used for group comparisons of Nominal variables and student-t test was used for group comparisons of numerical data. Prior to the Student-t test, the Levine test was used for the assumption of equality of variances between groups. The IBM SPSS Statistics Subscription (IBM, Chicago, IL) program was used for statistical analysis and $p < 0.05$ was considered significant.

RESULTS

The mean age of the 70 patients included in the study was 43.8 ± 17.2 (range, 17 to 87) years; 28 (40%) were female and 42 (60%) were male. Mean duration of hospitalization of patients was 6.33 ± 3.05 (range, 1 to 15) days. 53 patients (75.7%) stayed in hospital for under one week and 17 patients (24.3%) stayed in hospital for over one week.

We examined whether there was a significant difference between the mean of hemogram parameters according to the patient's gender and it was shown in Table 1. In the study, the mean hemoglobin value was higher in male patients than in female patients and the result was statistically significant ($p = 0.046$). Similarly, the mean value of eosinophil is higher in male patients ($p = 0.010$). There was no significant difference between male and female patients in other hemogram parameters (Table 1).

Table I: Hematologic laboratory parameters according to the patient's gender.

	Gender	**n**	**mean**	**SD**	***p* value**
Hemoglobin	Female	28	12.925	1.196	**0.046**
	Male	42	14.007	2.633	
White Cell Count	Female	28	5.703	2.412	0.265
	Male	42	6.408	2.674	
Neutrophil Count	Female	28	3.453	1.813	0.182
	Male	42	4.093	2.026	
Lymphocyte Count	Female	28	1.628	0.65628	0.604
	Male	42	1.543	0.68099	
Eosinophil Count	Female	28	0.0514	0.04797	**0.010**
	Male	42	0.1198	0.15526	
Platelet Count	Female	28	230.571	95.069	0.318
	Male	42	209.783	77.160	
Mean Platelet Volume	Female	28	10.289	1.346	0.064
	Male	42	9.729	1.132	
Plateletcrit	Female	28	0.232	0.088722	0.138
	Male	42	0.204	0.065629	
Platelet Distribution Width	Female	28	16.379	0.4909	0.357
	Male	42	16.205	0.9053	

n = Number; SD = Standard deviation

The averages of the hemogram parameters according to the patient's fever status were

examined and shown in Table 2. As shown in the table, it is statistically significant that the MPV value is higher in patients with fever (p = 0.035). There was no significant difference between patients with and without fever in other hemogram parameters. Respiratory distress and cough were observed to make no significant difference in any hemogram parameters.

Table II: Hematologic laboratory parameters according to patient's fever.

	Fever	**n**	**mean**	**SD**	***p* value**
Hemoglobin	Positive	18	13.519	2.732	0.903
	Negative	52	13.594	2.056	
White Cell Count	Positive	18	5.117	1.987	0.053
	Negative	52	6.475	2.682	
Neutrophil Count	Positive	18	3.113	1.871	0.068
	Negative	52	4.088	1.939	
Lymphocyte Count	Positive	18	1.478	0.46226	0.471
	Negative	52	1.611	0.72621	
Eosinophil Count	Positive	18	0.0611	0.10318	0.231
	Negative	52	0.1033	0.13461	
Platelet Count	Positive	18	199.667	99.693	0.288
	Negative	52	224.479	78.989	
Mean Platelet Volume	Positive	18	10.483	1.289	**0.035**
	Negative	52	9.769	1.186	
Plateletcrit	Positive	18	0.20439	0.093257	0.502
	Negative	52	0.21854	0.070227	
Platelet Distribution Width	Positive	18	16.556	0.4301	0.071
	Negative	52	16.177	0.8349	

n = Number; SD = Standard deviation

The difference between eosinophil (p = 0.002) and PDW (p = 0.032) parameters was statistically significant when compared with patients who stayed longer than 1 week and those who stayed less than one week (Table 3). There was no significant difference between fever, cough and respiratory distress between the duration of hospitalization.

Table III: Hematologic laboratory parameters according to patient's hospitalization time.

	Duration of Hospitalization	**n**	**mean**	**SD**	***p* value**
Hemoglobin	≤ one week	53	13.732	2.008	0.301
	> one week	17	13.085	2.824	
White Cell Count	≤ one week	53	6.209	2.697	0.639
	> one week	17	5.868	2.220	
Neutrophil Count	≤ one week	53	3.785	1.929	0.693
	> one week	17	4.002	2.087	
Lymphocyte Count	≤ one week	53	1.647	0.70492	0.124
	> one week	17	1.360	0.49168	
Eosinophil Count	≤ one week	53	0.109	0.14124	**0.002**
	> one week	17	0.040	0.04316	
Platelet Count	≤ one week	53	227.000	84.032	0.121
	> one week	17	190.347	83.258	
Mean Platelet Volume	≤ one week	53	10.045	1.268	0.276
	> one week	17	9.665	1.154	
Plateletcrit	≤ one week	53	0.224	0.079	0.082
	> one week	17	0.187	0.061	
Platelet Distribution Width	≤ one week	53	16.385	0.415	**0.032**
	> one week	17	15.929	1.346	

n = Number; SD = Standard deviation

DISCUSSION

COVID-19 is a respiratory disease caused by a novel coronavirus and first detected in Wuhan, China in December 2019. The disease is highly contagious, and its main clinical symptoms are fever, dry cough, fatigue, smell-taste loss, myalgia and shortness of breath. COVID-19 is highly contagious but has often been shown to be transmitted by rubbing hands on the face in contact with droplets, aerosols and contaminated floors[3]. The virus can be found in respiratory secretions 1-2 days before the onset of clinical symptoms and two weeks after disease symptoms[4,5]. The presence of the virus was also detected in whole blood, serum, urine and fecal samples[6].

Studies show that laboratory tests are very important for the recovery rates, severity, mortality and follow up of the disease in COVID-19 patients[7]. The clinic of COVID-19 disease is on a wide spectrum. Some patients are asymptomatic as well as some are severe, fatal. Hemogram parameters are important and helpful in diagnosis and managing the disease[8]. We aimed to show the correlation between the clinical characteristics, age, sex, duration of hospitalization and hemogram parameters of the patients in this study.

Normally, in the acute phase of viral lung infection, eosinophils accumulate in infected tissues to resist virus infection, resulting a decrease of eosinophils in the peripheral blood6. In our study we found the same scenario also exists in COVID-19. We observed a significant difference between the length of hospitalization and the number of eosinophils. There was a decrease in the number of eosinophils in our patients with a hospitalization period of 1 week or more. Also other studies supports eosinopenia in COVID-19 patients[9,10]. While the presence of lymphopenia and the rRT-PCR (real time reverse transcription polymerase chain reaction) test are diagnostic, data are insufficient to be a marker of eosinopenia observation[11].

In this study, we observed a significant difference in the number of hemoglobin and eosinophils compared with male and female patients. It is already known that the value of hemoglobin in men is higher than in women. This was also unchanged in COVID-19 patients. We found the number of eosinophils significantly lower in women; however, in the literature, eosinopenia was found in COVID-19 patients in general, with no sex discrimination[9,10,12].

In a meta-analysis study, a moderate increase in the number of leukocytes, an increase in the number of neutrophils, and a decrease in the number of lymphocytes were observed as the severity of the disease increased. In addition, the increase in neutrophils was responsible for the increase in leukocyte count[12]. We could not observe the same results in our study. This may be because the number of patients is smaller, and we do not include patients in intensive care in our study.

Thrombocytopenia has been observed in patients with COVID-19[13]. Although the mechanism of formation of thrombocytopenia is not clear in COVID-19 we did not observe a significant relationship between platelet counts and increased clinical symptoms or hospitalization time in our study. The reason for this may be that the clinical condition of the patients constituting our study group is not very severe and we exclude the patient group in the intensive care unit.

Platelet distribution width is the distribution range of platelets in the blood. PDW indicates homogeneity of platelet sizes. In a study conducted by Efe et al., an increase in PDW value was found to be a prognostic factor in increased mortality in intensive care patient[14]. In our study, contrary to Efe et al., PDW values decreased as the duration of hospitalization increased. Low PDW refers to impaired

production and platelet production in the bone marrow. Further studies are needed to indicate that COVID-19 infection leads to this condition.

For a long time, the importance of MPV in clinical use has not been fully understood due to inadequate studies[15,16]. Increased MPV was found in cardiovascular diseases, cerebral stroke, respiratory diseases, chronic kidney failure, nephrotic syndrome, intestinal diseases, rheumatoid diseases, diabetes and various cancers. Decreased MPV was recorded in tuberculosis during disease exacerbation, ulcerative colitis, SLE in adults, and different neoplastic disease[17,18]. In this study, a significant difference was found between MPV ($p=0.035$) values of COVID-19 patients who had fever and those who did not. No significant relationship was observed between cough and respiratory distress and hematological parameters.

CONCLUSION

The relationship between clinical progress and hemogram parameters in patients diagnosed with COVID-19 may be significant for the evaluation of prognosis. However, there are some deficiencies in our study, one of which is that the laboratory parameters of patients who are diagnosed with COVID-19 in intensive care unit and safe isolation at hospital and home are not included in the study. Therefore, we cannot generalize the significant parameters we find to all COVID-19 patients. More extensive studies are needed to generalize.

Ethics Committee Approval: For this study, first of all, the Ministry of Health Scientific Research Platform and then the clinical Research Ethics Committee approved (Approval Number: 03.06.2020/892). Since the study was a retrospective study, no informed consent was obtained from the patients. The study was carried out in accordance with the ethical principles set out in the Declaration of Helsinki.

Declaration of Conflicting Interests: The authors declare that they have no conflict of interest.

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