Orjinal Araştırma Makalesi/ Original Paper

Investigation of the Disease Process and Some Blood Parameters of Patients with COVID-19 Positive Diagnosis Registered at The Family Health Center

Aile Sağlığı Merkezinde Kayıtlı Olan COVID-19 Pozitif Hastaların Hastalık Süreci ve Bazı Kan Parametrelerinin İncelenmesi

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ÖZET
Amaç: Bu çalışmanın amacı Covid-19 pozitif tanılı hastalardan alınan bilgiler ışığında hastalığın seyri ve kan parametreleri değişkenlerini araştırmaktır. Bu sayede mümkün olan en kısa sürede Covid-19 hastalığının teşhis edilebilir ve prognozu belirlenebilir.
Materyal ve Metot: Nisan 2020 ile Aralık 2020 tarihleri arasında bir aile sağlığı merkezinde kayıtlı olan 113 hastanın retrospektif olarak dosya kayıtları incelenerek yapılmıştır. Biyokimyasal kan testlerinden trombosit (PLT), lenfosit (LYM), % lenfosit (LYM ½), monosit (MONO), % monosit (MONO ½) ve nötrofil sayıları, nötrofil/lenfosit oranı (NLR), C- Reaktif Protein (CRP), Ferritin, Laktat Dehidrojenaz (LDH), Aspartat aminotransferaz (AST), Alanin aminotransferaz (ALT), Kreatin kinaz (CK), Troponin, Hematokrit (HTC), ve Hemoglobin (HGB) sonuçları incelenmiştir.
Bulgular: Cinsiyete göre karşılaştırma yaptığımızda erkeklerde AST, ALT, CK, LDH, HGB, HCT, Ferritin, Monosit ve Troponin düzeyleri kadınlara göre yüksek, trombosit düzeylerinin ise düşük olduğu tespit edilmiştir (p<0.05). Akciğer tutulumu varlığında CRP, LDH, AST, nötrofil, ferritin, troponin, LYM ½ ve NLR düzeylerinin akciğer tutulumu yokluğuna göre daha yüksek, MONO½ düzeylerinin ise akciğer tutulumu varlığında düşük olduğu belirlenmiştir (p<0.05). Kronik hastalık varlığında CRP, AST, ALT, LDH ve Troponin düzeyleri kronik hastalık yokluğuna göre yüksek, MONO½ ve MONO düzeylerinin ise düşük olduğu belirlenmiştir (p<0.05).
Sonuç: Çalışmamız sonuçlarına göre erkek cinsiyet, yüksek AST, ALT, Ferritin, Troponin, CRP ve LDH düzeyleri ve düşük Monosit düzeyleri COVİD-19 için kötü prognoz kriteri olabilir. Hematolojik ve biyokimyasal parametreler tedavinin takibi yanı sıra gerek tanısal amaçla başvuru sırasında gerekse de hastalığın şiddetinin, prognozunun belirlenmesinde tedavi sürecinde prediktif belirteçler olarak kullanılabilirler.
Anahtar Kelimeler: COVİD-19; SARS-CoV-2; Hematolojik parametreler, Biyokimyasal parametreler; Prognoz; Cinsiyet.

ABSTRACT
Objective: The aim of this study is to investigate the course of the disease and the variables of blood parameters in light of the information obtained from patients with a positive diagnosis of Covid-19. In this way, it is thought that Covid-19 disease can be diagnosed and its prognosis can be determined as soon as possible.
Material and Method: File records of 113 patients enrolled in a family health center between April 2020 and December 2020 were retrospectively reviewed. From biochemical blood tests, platelet (PLT), lymphocyte (LYM), lymphocyte % (LYM ½), monocytes (MONO), % monocytes (MONO ½) and neutrophil counts, neutrophil/lymphocyte ratio (NLR), C- Reactive Protein (CRP), Ferritin, Lactate Dehydrogenase (LDH), Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Creatine kinase (CK), Troponin, Hematocrit (HTC), and Hemoglobin (HGB) results were examined.
Results: When compared according to gender, AST, ALT, CK, LDH, HGB, HCT, Ferritin, Monocyte and Troponin levels were found to be higher in males and lower platelet levels than females (p<0.05). In the presence of lung involvement, CRP, LDH, AST, neutrophil, ferritin, troponin, LYM ½ and NLR levels were higher than in the absence of lung involvement, and MONO½ levels were lower in the presence of lung involvement (p<0.05). In the presence of chronic disease, CRP, AST, ALT, LDH, and Troponin levels were higher than in the absence of chronic disease, while MONO½ and MONO levels were lower (p<0.05).
Conclusion: According to the results of our study, male gender, high AST, ALT, Ferritin, Troponin, CRP and LDH levels, and low Monocyte levels may be poor prognostic criteria for COVID-19. Hematological and biochemical parameters can be used as predictive markers during the treatment process, both at the time of admission for diagnostic purposes and in determining the severity and prognosis of the disease, as well as the follow-up of the treatment.
Keywords: COVID-19, SARS-CoV-2, Biomarkers, Hematologic Tests, Prognosis, Gender Identity.

INTRODUCTION

The new coronavirus (SARS-CoV-2) first emerged in the city of Wuhan, China, with people who applied to the hospital with the complaints of cough and shortness of breath seen in more than one person. It was soon realized that this disease, which causes pneumonia of varying severity, is contagious and spreads rapidly (Muniyappa and Gubbi, 2020; Rizzo et al., 2020).

Coronaviruses are spherical in structure, enveloped, approximately 125 nm in diameter, and these viruses are called coronavirus (crowned virus), which means crown in Latin, due to the fact that they have rod-like extensions on the surface (Zhou et al., 2019). Coronaviruses are known as viruses with the largest RNA genome. Coronaviruses are spherical and pleomorphic, 80-120 nm in diameter.

Sequence analysis results of samples taken from the lower respiratory tract showed that this virus is a new type of coronavirus. It has higher spread and lower death/case rates than other coronaviruses (Ceccarelli et al., 2020). Due to its high prevalence, the World Health Organization (WHO) declared a pandemic on March 11, 2020 (Chan et al., 2020).

SARS-CoV-2 spreads by droplet and contact (Song et al., 2019). It is known that the replication of this virus occurs mostly in the cytoplasm of the respiratory system and gastrointestinal epithelial cells (Beniac et al., 2006).

SARS-CoV-2 causes chronic respiratory failure and the disease it causes has been named Novel Coronavirus Disease (COVID-19) (Song et al., 2019). However, COVID-19 does not have the same effect on everyone. Most of the cases (80%) show a milder clinical picture, 15% of them are severe and 5% of them are patients who need intensive care. Biochemical and hematological parameters are used to evaluate the severity of the disease, whether it will require intensive care or whether it will result in mortality. Therefore, clinical laboratory tests are important in determining the prognosis of the disease. In many studies, it has been shown that the increase

in C-Reactive Protein (CRP), lactate dehydrogenase (LDH), procalcitonin (PCT), ferritin, and D-dimer levels and low lymphocyte count are indicators of a more severe clinical picture (Kavsak et al., 2020; O'Shea et al., 2020; Pourbagheri-Sigaroodi et al., 2020; García de Guadiana-Romualdo et al., 2021).

CRP is a proinflammatory biomarker and a prognostic factor related to the underlying disease course. It has been documented that CRP level increases while albumin level decreases secondary to inflammation and immune response in COVID-19 patients. In COVID-19 cases, CRP levels begin to rise before the computed tomography findings are detected. On admission, low serum albumin levels indicate a more severe disease course and increased mortality risk. Recently, a few studies reported that the ratio of CRP to albumin (CAR) might be a significant parameter for early diagnosis of severe COVID-19. Some studies, patients with severe COVID-19 had significantly higher CAR levels than patients with a mild course (Kılıçcıoğlu et al, 2022).

LDH is an enzyme found more in tissues, especially in the myocardium and liver, and is released out of the cell during tissue damage. Elevated LDH level is considered as a poor prognosis in immunocompromised patients. There are studies stating that there is an independent risk factor for mortality in COVID-19 patients (Kalın and Solmaz, 2022).

It is known that infectious pathogens can trigger inflammatory response and thromboembolic events vital for host defence in patients with COVID-19. These incidents encountered especially in serious and critical cases can show themselves in various conditions such as myovascular thrombosis, venous, pulmonary thromboembolism and acute arterial thrombosis. Although, the pathogenesis of SARSCoV-2 could not be well-defined, coagulation test abnormalities can be seen without bleeding signs in the early stage of its infection. Among these tests, fibrinogen degradation products and an increase in the level of D-dimer are characteristic features. D-dimer analyses are the tests having low

spesifity, high sensitivity and negative predictive value in cases with suspicious of thromboembolic disease. Some studies suggested that higher D-dimer levels in COVID-19 patients could be used as a marker to determine the mortality rates and clinic follow-up (Karagülle, 2022).

PCT levels increase with bacterial infections and are relatively low with viral infections, so they can be used to differentiate between bacterial and viral infections. Recently, several studies have reported that PCT is positively associated with COVID-19 severity.

It is reported that the most plausible explanation for the high PCT level in cases of COVID-19 may be bacterial coinfection. In some studies evaluating cases of COVID-19, those with a critical and severe clinical course had higher PCT levels compared to those with moderate severity; It has been reported that cases with high PCT levels have more severe disease and the majority of cases with high PCT levels are elderly (Kilbas et al., 2021).

Serum ferritin, being an "acute phase reactant", mirrors the degree of both chronic as well as acute inflammatory reaction inside the body. However there is uncertainty whether hyperferritinaemia is a result or mediator of inflammation. A higher ferritin level indicates an activated monocyte-macrophage system. In monocytes and macrophages, synthesis of ferritin is responsive to alteration in cytokine status at both the transcriptional and translational level. Higher level of ferritin was also noted among COVID-19 patients with kidney involvement. Patients without COVID-19 related thrombotic complications had lower serum ferritin levels compared to patients showing thrombotic complications.

These findings highlight the importance of serum ferritin as a biomarker of severity in COVID-19 (Kaushal et al., 2022).

The most common laboratory finding in Covid-19 patients is lymphopenia. The immune response to the virus is dependent on lymphocyte function. De-creased CD4+ lymphocyte count in systemic inflammation cellular immunity may be suppressed as a result. Many studies have defined lymphopenia rates between 35–75%. A study of 1099 confirmed COVID-19 patients in China showed that lymphopenia was more pronounced in severe cases than in mild cases. Low lymphocyte counts may cause the immune system to deteriorate, causing bacterial infections to occur more easily in severe COVID-19 patients (Yıldız et al., 2022).

According to the recommendations published by the International Federation of Clinical Chemistry COVID-19 Working Group, biochemical and hematological tests will be useful in the diagnosis of tissue-organ damage related to infection, in identifying the patient with a low risk of severe disease and the patient with a poor prognosis, and in monitoring the course of the disease (Thompson et al., 2020).

In addition, biomarkers that can provide reliable diagnosis in a short time gain importance in cases where there is a very intense patient application such as pandemic. Although RT-PCR is a reliable test in the diagnosis of the COVID-19 pandemic, it may not be suitable for rapid decision-making, especially in emergency service applications, due to the long prompt-result period. For this reason, the determination of certain cut-off values, in which faster results are obtained and one or more test results are evaluated together, can provide a more precise decision for hospitalization. In a study, 75.8% of COVID-19 patients admitted to the emergency department had low albumin levels, 58.3% high CRP, and 57.0% high LDH. Then, suggestions were made to evaluate some routine parameters and to establish certain threshold-values for some parameters and evaluate accordingly, and 210 U/L for LDH and 35 U/L for aspartate aminotransferase (AST) were suggested as threshold values (Gürsoy Doruk et al., 2021).

In a study conducted in the Netherlands, a scale was created that can be used to differentiate SARS-CoV-2 positive and negative patients. This scale is called

the "Corona Score". The scale includes age, gender, CRP, ferritin, LDH, lymphocyte count, neutrophil count, and chest X-ray results (Kurstjens et al., 2020).

It should be noted that in order to ensure maximum patient safety, no test should be considered alone, the biological and analytical variation in test performance should be considered in the interpretation of test results, and similar tests should be evaluated together and the clinical picture should be considered (Lippi et al., 2020).

In this study, we aimed to investigate the course of the disease and the variables of blood parameters in the light of the information obtained from patients with a positive diagnosis of Covid-19. We believe that, in this way, Covid-19 disease can be diagnosed as soon as possible and it can be beneficial in determining the prognosis.

MATERIAL and METHODS

This study was carried out by retrospectively examining the file records of 113 patients who were diagnosed with COVID-19 in Kırşehir Ahi Evran Training and Research Hospital and registered at the Ahmedi Gülşehri family health center between April 2020 and December 2020. During the quarantine period, the patients were followed for 10 days and the recorded information was evaluated retrospectively. The research is single-center. Permission for the study was obtained from the Kırşehir provincial health directorate with the letter numbered E-42884709-020 and from the Kırşehir Ahi Evran University Clinical Research Ethics Committee with the decision number 2021-06/65 on 23.03.2021.

From biochemical blood tests, platelet (PLT), lymphocyte (LYM), lymphocyte % (LYM ½), monocytes (MONO), % monocytes (MONO ½) and neutrophil counts, neutrophil/lymphocyte ratio (NLR), CRP, Ferritin, LDH, AST , Alanine aminotransferase (ALT), Creatine kinase (CK), Troponin, Hematocrit (HTC), and Hemoglobin (HGB) results were analyzed.

Whether the patients had any involvement in the thorax tomography was recorded by looking at the

radiology results. These outpatients took the medicines given by the Ministry of Health at home and did not take any other medicine. None of the patients had respiratory distress and were not hospitalized for this reason. All of them remained in isolation at home until the end of the quarantine period. The data obtained were taken 2-4 weeks after the diagnosis of Covid-19.

Statistical Analysis

All data were analyzed with the SPSS-23 package program (IBM Corp., Armonk, N.Y. USA). Mean+standard error values were given for parameters suitable for normal distribution, and median (minimum-maximum) values were given for parameters that not suitable for normal distribution. The relationship between categorical parameters was investigated using Chi-Square or, where appropriate, Fisher's Exact test. Chi-square test or Fisher's exact test was used to compare categorical variables. Non-categorical variables were compared with the Student-t test or Mann-Whitney U test according to whether they showed normal distribution or not. A p value of <0.05 was evaluated as statistical significance.

RESULTS

The study included 113 patients aged 13-87 years, who were registered at the Ahmedi Gülşehri Family Health Center between April 2020 and December 2020 and were diagnosed with Covid 19 and entered the follow-up list. The demographic distribution of these 113 patients consists of 54 (47.8%) male and 59 (52.2%) female patients.

Whether the patients included in the study had a chronic disease was examined. A total of 24 people (17.7%) have a chronic disease, which were categorized as hypertension, diabetes, and asthma. There are two patients with asthma, sixteen patients with hypertension and six patients with diabetes, which are among the important risk factors for those diagnosed with Covid 19 positive.

The mean, standard error, median, minimum and maximum values of the parameters in male and female genders, and the p values obtained as a result of the comparison of these parameters between genders are given in Table 1. According to the results of our study, all parameters were within the normal range in both male and female patients. When we made a comparison according to gender, it was observed that AST, ALT, CK, LDH, HGB, HCT, Ferritin, Monocyte and Troponin levels were higher in males

and platelet levels were lower than females (p<0.05). When compared with women, it was seen that the lymphocyte count was low in men, while CRP, neutrophil and NLR were high, but it was not statistically significant (p>0.05).

Hemoglobin levels in men are statistically significantly higher than in women (p<0.05). However, this has no prognostic significance.

Table 1. Comparison of all parameters according to male and female gender

Parameter (Reference range)	Female	Male	p-value
AST (5-50 U/L)	21.00 [11.00-74.00]	24.00 [14.00-202.00]	**0.03***
ALT (5-50 U/L)	18.00 [7.00-62.00]	24.00 [9.00-266.00]	**0.005***
CK (20-171 U/L)	58.00 [11.00-614.00]	88.00[23.00-419.00]	**0***
CRP (0,15-5 MG/L)	4.00 [.00-103.00]	6.00 [1.00-159.00]	0.073*
NEU (1,8 - 7 10^3/UL)	3.47 [.91-11.18]	3.82 [.66-16.45]	0.246*
LDH (135-248 U/L)	202.00 [139.00-857.00]	220.00[157.00-406.00]	**0.02***
FERRITIN (24-336 NG/ML)	33.50 [4.00-486.00]	103.00 [4.00-582.00]	**0***
TROPONİN (0-17,5 PG/ML)	2.30 [1.00-7.90]	2.30 [2.20-36.20]	**0.006***
HGB	13.24 ± 0.18	15.03 ± 0.23	**0****
(MALE 14,0-17,5 G/DL)			
(FEMALE 12,3-15,3 G/DL)			
PLT (130 - 450 10^3/UL)	237.00 [32.00-416.00]	214.50[139.00-335.00]	**0.019***
HCT (40 - 52 %)	40.40 [4.50-47.90]	45.05 [34.10-52.90]	**0***
MONO ½ (4,3 - 12,0 %)	9.20 [1.20-20.50]	9.50 [2.90-24.30]	0.114*
MONO (0 - 1,1 10^3/UL)	0.54 [0.22-1.15]	0.66 [.11-1.36]	**0.025***
LYM½ (18,5 - 46 %)	30.20 ± 1.61	27.10 ± 1.43	0.12**
LYM (1,26 - 3,35 10^3/UL)	1.88 [0.50-3.98]	1.67 [.45-5.18]	0.333*
NEU/LYM	1.83 [.61-12.52]	2.14 [.00-18.06]	0.157*

*: Mann – Whitney U Test ; **: T Test

The results of blood parameters measured in the study of patients with and without lung involvement in thorax CT are given in Table 2. According to the results of our study, CRP and LDH levels were above normal limits in the presence of lung involvement in COVID-19 and higher than in the absence of lung involvement (p<0.05). AST, neutrophil, ferritin, troponin, LYM ½ and NLR levels were within normal limits, but were found to be higher in patients with

lung involvement than in patients without lung involvement (p<0.05).

Monocyte and lymphocyte levels of prognostic parameters were found to be lower in patients with lung involvement than in patients without lung involvement, but it was not statistically significant (p>0.05). MONO½ levels were found to be significantly lower in patients with lung involvement (p<0.05). In the presence of lung involvement, ALT

levels were higher than in the absence of lung involvement, but this elevation was not significant (p>0.05).

The results of blood parameters in the presence of chronic disease and in the absence of chronic disease are presented in Table 3. According to the results of our study, CRP levels were above normal limits in the presence of chronic disease and higher than in the absence of chronic disease (p<0.05).

Table 2. Comparison of all parameters in the presence of lung involvement and in the absence of lung involvement.

Parameter (Reference range)	In the presence of lung involvement	In the absence of lung involvement	p-value
AST (5-50 U/L)	31.50 [11.00-74.00]	23.00 [14.00-202.00]	**0.008***
ALT (5-50 U/L)	21.00 [7.00-93.00]	19.00 [9.00-266.00]	0.290*
CK (20-171 U/L)	87.00 [11.00-614.00]	73.00 [14.00-419.00]	0.282*
CRP (0,15-5 MG/L)	**38.00 [16.00-159.00]**	4.00 [.00-39.00]	**0.000***
NEU (1,8 - 7 10^3/UL)	4.43 [.66-11.56]	3.27 [.91-16.45]	**0.037***
LDH (135-248 U/L)	**281.00[186.00-857.00]**	209.00 [139.00-406.00]	**0.000***
FERRITIN (24-336 NG/ML)	153.00 [40.00-582.00]	48.00 [4.00-437.00]	**0.000***
TROPONIN (0-17,5 PG/ML)	3.10 [2.20-36.20]	2.30 [1.00-7.60]	**0.001***
HGB (MALE 14,0 - 17,5 G/DL) (FEMALE 12,3 - 15,3 G/DL)	14.08 ± 0.48	14.09 ± 0.18	0.978**
PLT (130 - 450 10^3/UL)	209.00[144.00-335.00]	221.50 [32.00-416.00]	0.563*
HCT (40 - 52 %)	44.50 [33.60-51.90]	42.35 [4.50-52.90]	0.604*
MONO ½ (4,3 - 12,0 %)	8.40 [2.90-12.80]	9.75 [1.20-24.30]	**0.026***
MONO (0 - 1,1 10^3/UL)	0.53 [.11-1.19]	0.63 [.22-1.36]	0.133*
LYM½ (18,5 - 46 %)	29.84 ± 1.18	22.69 ± 2.17	**0.017****
LYM (1,26 - 3,35 10^3/UL)	1.55 [.64-3.78]	1.88 [.45-5.18]	0.070*
NEU/LYM (NLR)	2.49 [1.00-18.06]	1.77 [.00-16.87]	**0.012***

*: Mann – Whitney U Test ; **: T Test

It was determined that AST, ALT, LDH and Troponin levels were within normal limits, but higher in the presence of chronic disease than in those without chronic disease (p<0.05).

The prognostic parameters MONO½ and MONO levels were found to be lower in the presence of chronic disease than in those without chronic disease (p<0.05). It was determined that LYM½ and LYM levels in the presence of chronic disease were lower than those without chronic disease, but were not statistically significant (p>0.05). Ferritin levels were found to be higher in the presence of chronic disease than in those without chronic disease, but it was not statistically significant (p>0.05).

According to the results of our study, there were 24 patients (17.7%) with chronic disease and 17 (15%) with lung involvement. Pulmonary involvement was observed in 8 (33.3%) of these 24 people. Correlation analysis was performed between those with chronic diseases and those with lung involvement and it was found to be statistically significant (Phi Correlation coefficient (r = 0.27) and p<.05). Among chronic diseases, the number of people with lung chronic diseases (asthma) is two. When we examined the lung involvement of those with

chronic lung diseases, it was observed that these two people also had lung involvement.

Tablo 3. Comparison of all parameters in the presence of chronic disease and in the absence of chronic disease.

Parameter (Reference range)	In the presence of chronic disease	In the absence of chronic disease	p-value
AST (5-50 U/L)	28.00 [19.00-74.00]	22.00 [11.00-202.00]	**0.001***
ALT (5-50 U/L)	28.50 [14.00-93.00]	18.00 [7.00-266.00]	**0.001***
CK (20-171 U/L)	79.50 [26.00-614.00]	73.50 [11.00-419.00]	0.796*
CRP (0,15-5 MG/L)	**10.50 [1.00-159.00]**	4.00 [.00-129.00]	**0.015***
NEU (1,8 - 7 10^3/UL)	3.40 [.66-11.56]	3.74 [.91-16.45]	0.815*
LDH (135-248 U/L)	233.00[173.00-857.00]	209.00 [139.00-406.00]	**0.032***
FERRITIN (24-336 NG/ML)	76.00 [9.00-582.00]	50.00 [4.00-462.00]	0.071*
TROPONIN (0-17,5 PG/ML)	2.90 [2.30-36.20]	2.30 [1.00-7.60]	**0.000***
HGB (MALE 14,0 - 17,5 G/DL) (FEMALE 12,3 - 15,3 G/DL)	13.49 ± .26	14.25 ± .20	0.061**
PLT (130 - 450 10^3/UL)	206.50 [141.00-416.00]	222.00 [32.00-408.00]	0.496*
HCT (40 - 52 %)	42.35 [33.80-47.00]	43.20 [4.50-52.90]	0.112*
MONO ½ (4,3 - 12,0 %)	8.00 [1.20-24.30]	9.60 [5.70-21.10]	**0.010***
MONO (0 - 1,1 10^3/UL)	0.53 [0.11-1.05]	0.64 [0.22-1.36]	**0.024***
LYM½ (18,5 - 46 %)	27.50 ± 2.49	29.11 ± 1.20	0.545**
LYM (1,26 - 3,35 10^3/UL)	1.56 [.56-3.87]	1.82 [0.45-5.18]	0.340*
NEU/LYM	2.22 [.97-18.06]	1.87 [0.00-16.87]	0.589*

*: Mann – Whitney U Test ; **: T Test.

DISCUSSION

In this study, we aimed to investigate some blood parameter variables and the course of the disease in the light of information obtained from patients with positive diagnosis of COVID-19. With this study, we had the opportunity to examine whether there is a difference in terms of prognostic factors in male and female patients. In addition, it was observed by examining whether blood parameters can be used for the early diagnosis of COVID-19 that it may be possible to evaluate patients with COVID-19, especially outpatients, from a prognostic point of view. In our study, platelet, lymphocyte, lymphocyte % (LYM ½), monocytes % monocyte (MONO ½) and neutrophil counts, NLR, CRP, Ferritin, LDH, AST, ALT, CK,

Troponin, HTC, and HGB levels were investigated as prognostic factors.

When we compared patients with COVID-19 according to gender, it was found that male patients had higher AST, ALT, CK, LDH, Ferritin, HGB, HCT, Monocyte and Troponin levels, while PLT levels were found to be lower than female patients, and it was found to be statistically significant.

When compared with female patients, it was seen that the lymphocyte count was low, CRP, neutrophil count and NLR were high in male patients, but it was not statistically significant.

We encountered only one study in the literature comparing the prognostically important parameters of ALT, AST, CK and LDH in COVID-19 patients between genders. In this study, it was stated that ALT

levels were higher in men, and AST, CK and LDH levels were higher in women, but it was not statistically significant. The AST/ALT ratio was found to be significantly higher in female patients than in male patients. Researchers stated that AST/ALT elevation is of prognostic importance in terms of liver damage in COVID-19 patients (Yazar et al., 2020).

In a study conducted without considering the difference between genders, it was stated that COVID-19 was serious and fatal in patients with high ALT, AST, LDH, CK, Ferritin, Neutrophil and CRP, low lymphocytes and platelets (Henry et al., 2020).

There are studies suggesting that there is a relationship between an increase in CRP, Ferritin and LDH levels in patients with COVID-19 and having a severe disease (Siddiqi and Mehra, 2020; Yuan et al., 2020).

In a meta-analysis study in which 3.377 patients were evaluated in 21 studies, it was observed that leukocyte and neutrophil levels were high and lymphocyte, eosinophil and thrombocyte levels were low in those with severe disease. It was reported that low lymphocyte levels were associated with the mortality of the disease (Henry et al., 2020).

In most of the studies, the platelet count was found to be slightly low from the first admission. In addition, thrombocytopenia was determined as an indicator of the severity of the disease, and it was observed to be an independent risk factor in cases requiring intensive care and ending in mortality. In the same study, researchers suggested that the platelet count value of 150 × 109/L should be taken as the threshold value for poor prognosis (Pourbagheri-Sigaroodiet al., 2020).

According to the findings of our study and in the light of studies in the literature, it can be said that male gender may be a bad prognostic criterion in COVID-19.

According to the results we obtained in the presence of lung involvement in COVID-19, AST, Neutrophil, Ferritin, Troponin, LYM ½ , NLR, CRP and LDH levels were found to be higher than in the absence of lung involvement. We observed that ALT levels were higher in the presence of lung involvement than in the absence of lung involvement, but this elevation was not significant. One of the prognostic parameters, MONO½ levels were found to be low in patients with lung involvement. It was observed that MONO and LYM levels were lower in patients with pulmonary involvement than in patients without lung involvement, but it was not statistically significant.

In a study, it was reported that elevated ALT, AST, LDH, and CRP were associated with poor prognosis and mortality (Chen et al., 2020).

In another study, the increase in LDH, one of the frequently used tests, was associated with lung tissue damage and/or multi-organ failure in COVID-19 patients (Doğan and Devrim, 2020).

Patients who had severe COVID-19 and died were found to have significantly increased inflammatory biomarkers CRP and ferritin compared to non-severe and survivors. The markers of heart and muscle damage CK, AST and ALT, which indicate liver function, significantly increased in both severe and fatal COVID-19 patients (Henry et al.,2020).

Many studies have been conducted to investigate the contribution of changes in leukocytes and their subgroups in predicting the severity, prognosis and mortality of the infection in COVID-19, which is a systemic infection. It has also been supported by studies that there is an increase in the number of leukocytes and leukocytes and that this is due to neutrophils (Chen et al., 2020; Qin et al., 2020).

On the other hand, the decrease in the number of lymphocytes is one of the important findings. In a study conducted in China, it was suggested that the use of neutrophil-lymphocyte ratio in predicting the severity of the disease could be a biomarker for early diagnosis (Kermali et al., 2020).

According to another study, high leukocyte and neutrophil values have a high power in predicting patients' admission to intensive care unit. It has also been reported that patients with increased CRP and neutrophil counts have the highest probability of death (Elshazli et al., 2020).

According to the results of our study, AST, ALT, LDH, Troponin and CRP levels were found to be higher in the presence of chronic disease than in the absence of chronic disease. In the presence of chronic disease, Ferritin levels were determined to be higher than those without chronic disease, but it was not statistically significant. MONO½ and MONO levels of prognostic parameters were found to be lower in the presence of chronic disease than in those without chronic disease. In addition, LYM½ and LYM levels were found to be lower in the presence of chronic disease than in those without chronic disease, but it was not statistically significant.

We found only one study examining the changes in blood parameters of people who had COVID-19 in the presence of chronic disease. In this study, high ferritin levels were determined in patients with one or more comorbidities, including diabetes, thrombotic complications, and cancer. Severe acute liver injury was found to be associated with high ferritin level, and serum ferritin level was associated with the need for intensive care and mechanical ventilation. Ferritin is thought to be associated with poor prognosis and is a predictor of worsening of COVID-19 patients (Cheng et al., 2020).

In our study, correlation analysis was also performed between those with chronic diseases and those with lung involvement, and it was found to be statistically significant. In the presence of chronic disease, the rate of lung involvement in COVID-19 is high.

In the literature, there are studies showing that both the disease development and the disease progress more severely in those with comorbidities. In a report covering 72,314 patients diagnosed with COVID-19, 13% of the patients had hypertension, 5%

had diabetes mellitus, 4% had a history of cardiovascular disease (CVD), and in cases that ended in mortality, 40% of patients had hypertension, 20% had diabetes mellitus and 22% had CVD (Lang et al., 2020). In another study involving 187 patients with COVID-19 infection, mortality was 7.6% in non-CVD patients and 69% in patients with CVD (Guo et al., 2020).

There are also some limitations in our study. COVID-19 mostly causes high mortality in the older age group. Therefore, in our study, we evaluated a wide age group such as the age range of 13-87 years. Despite this, the fact that we could not reach a large number of patients constitutes the limitation of our study.

CONCLUSION

In our study, we examined the changes in blood parameters of COVID-19 disease and the differences between female and male distributions. We have observed that in early diagnosis, information about the course of the disease can be obtained by examining blood parameters. According to the results of our study, male gender may be a poor prognosis criterion for COVID-19. In addition, high AST, ALT, Ferritin, Troponin, CRP and LDH levels and low Monocyte levels can be counted as poor prognostic criteria.

Hematological and biochemical parameters can be used as predictive markers during the treatment process, both at the time of admission for diagnostic purposes and in determining the severity and prognosis of the disease, as well as the follow-up of the treatment. It directs the treatment of patients by outpatient treatment, inpatient treatment or intensive care unit treatment, and thus its benefits for reducing costs are undeniable

Conflict of interest

There are no conflict of interest.

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