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Predictive Level of Routine Laboratory Parameters in Hospitalized COVID-19 Patients on Severity of Illness

Hastanede Yatan COVID-19 Hastalarında Rutin Laboratuvar Parametrelerinin Hastalığın Şiddeti Üzerindeki Öngörü Değeri

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Abstract

Aim: Early prediction of Coronavirus disease 2019 (COVID-19) disease severity is important to reduce mortality. Therefore, we sought to determine the clinical correlation between these baseline routine laboratory parameters and their effects on mortality by retrospectively investigating the routine laboratory parameters of hospitalized COVID-19 patients on admission day.

Material and Method: This retrospective-observational study population consisted of 415 hospitalized COVID-19 patients. Patients were divided into three groups (mild, moderate, and severe) according to their clinical status on admission day. On admission, fifteen routine biochemical and hematological laboratory parameters of COVID-19 patients were evaluated.

Results: Aspartate aminotransferase (AST), alanine transaminase (ALT), lactate dehydrogenase (LDH), ferritin, International Normalized Ratio (INR), and d-dimer levels were higher in non-survivors than in survivors, regardless of the initial disease severity group classification. No statistically significant difference was found between the groups in terms of uric acid, monocyte, and platelet levels.

Conclusions: There is a need for an urgent scale for detecting COVID-19 severity. AST, ALT, LDH, ferritin, INR, and d-dimer levels may help predict the disease's severity in COVID-19.

Keywords: COVID-19, biochemical parameters, disease severity

Öz

Amaç: Koronavirus hastalığı 2019 (COVID-19) hastalık şiddetinin erken tahmini, mortaliteyi azaltmak için önemlidir. Bu nedenle, hastaneye yatırılan COVID-19 hastalarının rutin laboratuvar parametrelerini kabul gününde geriye dönük olarak araştırarak, bu temel rutin laboratuvar parametreleri ile mortalite üzerindeki etkileri arasındaki klinik ilişkiyi belirlemeye çalıştık.

Gereç ve Yöntem: Bu retrospektif-gözlemsel çalışma popülasyonu, hastaneye yatırılan 415 COVID-19 hastasından oluşmaktadır. Hastalar başvuru günlerindeki klinik durumlarına göre (hafif, orta ve şiddetli) üç gruba ayrıldı. Başvuru sırasında COVID-19 hastalarının on beş rutin biyokimyasal ve hematolojik laboratuvar parametresi değerlendirildi.

Bulgular: Aspartat aminotransferaz (AST), alanin transaminaz (ALT), laktat dehidrojenaz (LDH), ferritin, Uluslararası Normalleştirilmiş Oran (INR) ve d-dimer seviyeleri, başlangıçtaki hastalık şiddeti grup sınıflandırmasına bakılmaksızın, hayatta kalanlarda hayatta kalanlardan daha yüksekti. Ürik asit, monosit ve trombosit sayıları açısından gruplar arasında istatistiksel olarak anlamlı fark bulunmadı.

Sonuç: COVID-19 şiddetini tespit etmek için acil bir ölçeğe ihtiyaç vardır. AST, ALT, LDH, ferritin, INR ve d-dimer seviyeleri, COVID-19'daki hastalık şiddetini tahmin etmeye yardımcı olabilir.

Anahtar Kelimeler: COVID-19, biyokimyasal parametreler, hastalık şiddeti

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) had caused over 5 million deaths globally since the first case was identified.[1] Studies on the diagnosis and treatment of this disease continue globally. Early prediction of the severity of COVID-19 is important to reduce mortality. Biochemical and hematological laboratory parameters are among the tests that can help clinicians in this context.[2-5]

Although there are many studies that examine the clinical characteristics of COVID-19 patients, there are a limited number of studies that predict clinical surveillance and mortality according to the day of admission. Biochemical and hematological parameters can be useful in this context.

Initial laboratory tests with a high neutrophil level (>0.7 10^3/L), lymphopenia (0.8 10^3/L), increased C-reactive protein (CRP; >4.75 mg/dL), and elevated lactate dehydrogenase (LDH; >593 U/L) levels were the most important predictors of mortality in severe acute respiratory syndrome coronavirus (SARS-CoV) patients, according to previous studies.[3-6] Both severe and fatal COVID-19 patients had increased biomarkers of cardiac and muscular damage. At presentation, patients who died had significantly high cardiac troponin levels, indicating the possibility of viral myocarditis, cardiac damage from progression to multiple organ failure (MOF), and secondary cardiac injury from organ-targeted diseases (e.g., renal or liver failure). Even when laboratory parameters measured primarily at admission are combined with significant elevations in liver enzymes (alanine aminotransferase (ALT) and aspartate aminotransferase (AST), renal biomarkers (blood urea nitrogen, creatinine), and coagulation measures, a picture of MOF emerges in patients who develop the severe form of the disease.[7] In addition, the International Federation of Clinical Chemistry Working Group recommended that, the biochemical and hematological tests can be helpful in COVID-19 for the diagnosis of tissue-organ damage, the determining and monitoring the course of the disease.[8]

Therefore, we aimed to determine the clinical correlation between these baseline laboratory parameters on admission day and their effects on mortality, by retrospectively investigating the laboratory parameters of hospitalized COVID-19 patients.

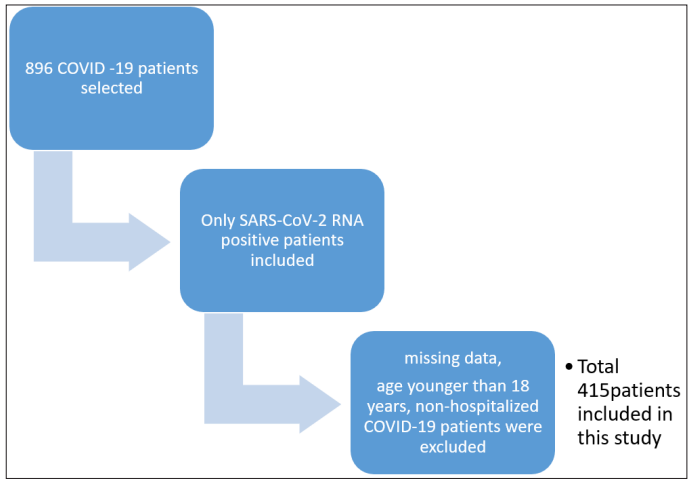
MATERIAL AND METHOD

Study Design and Participants

This retrospective-observational study was conducted at a pandemic hospital (Çanakkale Onsekiz Mart University Hospital) in Turkey. The sample size selection was not made. The patients admitted on the study date according to the exclusion and inclusion criteria were included in the study. The study population consisted of 415 confirmed COVID-19 patients who were hospitalized from March 23 to June 1, 2020. The patients were diagnosed with COVID-19 according to the World Health Organization (WHO) provisional guidelines with positive SARS-CoV-2 RNA detection. A positive result of the SARS-CoV-2 "real-time" reverse transcriptase polymerase chain reaction (RT-PCR) test in upper respiratory tract specimens of the patients as a definite case, although the SARS-CoV-2 RT-PCR test of the patient was negative, finding an appearance compatible with viral pneumonia on thoracic computed tomography (CT) together with appropriate clinical findings was defined as a possible COVID-19 patient.[9]

The exclusion criteria were missing data, age younger than 18 years, and non-hospitalized COVID-19 patients.

The comparison was made without considering some factors such as the patients' previous medical history (smoking, diabetes, hypertension, etc.). These data could not be evaluated because it was a retrospective study. The groups were selected only according to the severity of the disease at the time of the first admission.



Graph 1. Flowchart of study design.

Definitions

The study population was divided into 3 groups according to their clinical status on admission day, according to the diagnosis and treatment protocol for COVID-19 pneumonia published by the Turkish Ministry of Health's Guideline for COVID-19 Diagnosis and Treatment.

Group 1 (mild COVID-19 patients): Defined as mild clinical symptoms and no sign of pneumonia on imaging or oxygen saturation of 93% or more at rest or more than 50% lesions on thoracic computed tomography (CT).

Group 2 (moderate COVID-19 patients): Defined as fever and respiratory symptoms with radiological findings of pneumonia but without the severe or critical features.

Group 3 (severe COVID-19 patients): Defined as respiratory distress (≥30 breaths per min), oxygen saturation of 93% or less at rest, ratio of arterial partial pressure of oxygen to fractional concentration of oxygen in inspired air of 40 kPa or less, or more than 50% lesion progression over 24–48 hours in thoracic CT.

Procedures

All medical records (demographic, clinical, laboratory tests, and radiological) on admission day and outcomes (discharge or exitus) of hospitalized COVID-19 cases were reviewed retrospectively. The levels of white blood cell (WBC), neutrophil, lymphocyte, monocyte, platelet, hemoglobin (Hgb), hematocrit (HTC), AST, ALT, uric acid, International Normalized Ratio (INR), lactate dehydrogenase (LDH), ferritin, and d-dimer were evaluated. All data was entered into a case form. All laboratory tests were studied at our hospital's biochemistry and microbiology laboratories using standard procedures. The classification of severity for COVID-19 patients was made according to the clinical and radiological findings on the admission day.

Ethical approval: In carrying out the study, accordance to the principles in the Helsinki Declaration revised in 2013 was followed. The study was approved by the COVID-19 Scientific Research Evaluation Commission of the General Directorate of Health Services of the Turkish Ministry of Health on the date of April 5, 2020, and the local ethics commission of our center (date: 03.06.2020, number: 2020-08). Institutional permission was obtained from the Turkish Ministry of Health, the local ethics committee and the hospital administration to conduct the study.

Statistical Analysis

The SPSS Package Program version 20.0 was used to analyze the data (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp; 2011). Number, percentage, median, minimum, and maximum, mean and standard deviations were used in the presentation of descriptive data. Chi-Square test was used to compare categorical data. The compliance of the data to normal distribution was evaluated by Kolmogorov Smirnov test and Shapiro Wilk test. The student T test and one-way ANOVA test were used to compare variables with normal distributions, while the Mann Whitney U test and Kruskal Wallis test were used to compare variables with non-normal distributions. Tamhane's T2 correction was applied for binary comparison of variables that were found to be statistically significant in the normal distribution, and the Dunn-Bonferroni correction was applied for binary comparison of variables that did not fit. A p-value lower than 0.05 (< 0.05) was accepted as statistically significant.

RESULTS

A total of 415 patients (59.5% men) diagnosed as COVID-19 pneumoniae were included in the study (Graphic 1). Demographical characteristics of the patients are given in **Table 1**. The patients were divided into 3 groups according to the severity of the disease. There were 222 patients in Group 1, 165 patients in Group 2, and 28 patients in Group 3.

A statistically significant difference was found between the groups in terms of age (p=0.0001). The median age of Group 1 patients was lower than that of Group 2 and Group 3 patients, and this difference was statistically significant in paired comparisons (p=0.0001, p=0.0001, respectively). The median age of Group 2 patients was lower than that of Group 3 patients, and this difference was significant in paired comparisons (p=0.041). There was no significant difference in gender between the groups (p=0.216).

The evaluation of the examined laboratory parameters based on patients as follows.

a. White Blood Cell (WBC) levels: A statistically significant difference was found between the groups according to WBC levels (p=0.0001). Group 3 patients had a higher WBC median level than the other groups. This difference was statistically significant in the corrected paired comparisons (p=0.0001, p=0.0001, respectively). The median WBC of the Group 2 patients was higher than the median of the Group 1 patients, and this difference was significant in corrected paired comparisons (p=0.023).

b. Neutrophil levels: The median of neutrophils in group 3 patients was higher than the medians of group 1 and group 2 patients, and these differences were statistically significant in the corrected paired comparisons (p=0.0001, p=0.0001, respectively).

c. Lymphocyte levels: There was a statistically significant difference between the groups in terms of lymphocytes (p=0.0001). The median lymphocyte level for Group 1 patients was higher than the medians of Group 2 and Group 3 patients, and these differences were statistically significant in smoothed paired comparisons (p=0.001, p=0.0001, respectively). The median lymphocyte of group 2 patients was higher than the median of group 3 patients, and this difference was significant in corrected paired comparisons (p=0.0001). It was found that the lowest lymphocyte value was in group 3 patients.

Table 1. Age and gender characteristics of the patients.

	Group 1 (n=222)		Group 2 (n=165)		Group 3 (n=28)		p value
	mean±sd	mean (min-max)	mean±sd	mean (min-max)	mean±sd	mean (min-max)	
Age (year)	49.2±17.4	46.0 (19.0-94.0)	62.7±15.9	63.0 (21.0-93.0)	72.0±12.1	70.5 (46.0-93.0)	0.0001
	n (%)		n (%)		n (%)		p
Gender							0.216*
Female	91 (41.0)		70 (42.4)		7 (25.0)		
Male	131 (59.0)		95 (57.6)		21 (75.0)		

*mean±sd: mean±standard deviation, p *: One-Way ANOVA Test, *= p<0.05 statistically significant.

d. Monocyte and thrombocyte levels: No statistically significant difference was found between the groups in terms of the median of monocytes and platelets.

e. Hemoglobin: The median hemoglobin of Group 1 patients was higher than the median of Group 2 and Group 3 patients, and these differences were p=0.003, p=0.0001 in the corrected paired comparisons).

f. Hematocrit: There was a significant difference between the groups (p=0.0001). The hematocrit levels of group 1 patients were higher than the mean of Group 3 patients, and this difference was significant as used in the corrected paired tables (p=0.011).

g. Alanine transaminase (ALT): The median of ALT levels was higher in group 3 patients than the other groups (Group 1 and Group 2) and were istatistically significant in the corrected paired comparisons (p=0.047, p=0.004, respectively).

h. Aspartate aminotransferase (AST): The AST levels were significantly different between groups (p=0.0001). The median level of AST in Group 3 patients was higher than the medians in groups 1 and 2, and these differences were significant in corrected paired comparisons (p=0.0001, p=0.016).

I. Uric acid: There was no significant difference in uric acid medians between the groups (p=0.205).

j. Lactate dehydrogenase (LDH): There was a significantly significant difference in LDH levels between the groups (p=0.0001). The median LDH of the Group 3 patients was higher than the medians of Group 1 and Group 2 patients, and these differences were significant in paired comparison with correction (first order p=0.0001, p=0.030). The median LDH of Group 2 patients was higher than the median of Group 1 patients, and this difference was significant with corrected paired comparison (p=0.0001).

k. International Normalized Ratio (INR): There were variously significant differences in INR between the groups (p=0.0001). The median INR of Group 3 patients was higher than the median of Group 1 and Group 2 patients, and these differences were significantly significant in pairwise comparison with correction (first row p=0.0001, second row p=0.0001). The median INR of Group 2 patients was higher than the median of Group 1 patients, and this difference was significant with corrected paired comparison (p=0.006).

l. Ferritin: There was a statistically significant difference between the groups in terms of ferritin (p=0.0001). The median level of ferritin levels of Group 3 patients was higher than that of Group 1 and Group 2, and this was statistically significant in the smoothed paired comparisons (p=0.0001, p=0.0001, respectively).

m. D-dimer: There was a statistically significant difference between the groups in terms of d-dimer levels (p=0.0001). The median level of d-dimer levels of Group 2 patients was higher than the median of Group 1 patients, and this difference was significant in corrected paired comparisons (p=0.003) (**Table 2**).

Table 2. Comparison of laboratory parameters according to groups.

Laboratory parametres	Group 1 (n=222)		Group 2 (n=165)		Group 3 (n=28)		P value
	Mean ±sd	mean (min-max)	Mean ±sd	mean (min-max)	Mean ±sd	mean (min-max)	
White blood cell level, 10^9 cells per L	7305.5±3120.3	6400.0 (2700.0-19900.0)	8733.9±4794.6	7400.0 (2400.0-33700.0)	18710.7±29238.4	13750.0 (3100.0-164000.0)	0.0001
Neutrophil level, 10^9 cells per L	4587.3±2760.6	3600.0 (1000.0-17700.0)	6331.5±4565.8	4800.0 (1100.0-31800.0)	14296.4±15269.2	12600.0 (2800.0-86800.0)	0.0001
Lymphocyte level, 10^9 cells per L	1931.8±1760.1	1600.0 (100.0-24200.0	1558.2±1019.4	1400.0 (200.0-8500.0)	1735.7±4634.9	600.0 (200.0-23900.0)	0.0001
Monocyte level, 10^9 cells per L	643.6±292.1	600.0 (100.0-1900.0)	712.7±385.4	600.0 (100.0-2400.0)	2417.9±9218.7	550.0 (100.0-49499.0)	0.228
Platelet level, 10^9 cells per L	220572.7±79576.3	209000.0 (87000.0-693000.0)	237181.8±97783.4	221000.0 (36000.0-580000.0)	228857.1±102670.2	253500.0 (47000.0-375000.0)	0.216
Haemoglobin, g/dL	13.6±1.7	14.0 (8.0-17.0)	12.9±2.2	13.0 (5.0-19.0)	11.6±2.4	12.0 (8.0-16.0)	0.0001
Hematocrit g/dL	39.6±4.7	39.8 (24.5-50.7)	38.3±6.2	38.6 (13.3-52.7)	35.1±7.5	35.0 (23.2-49.3)	0.0001*
ALT (U/L)	27.6±42.3	18.9 (4.3-473.5	25.3±27.9	16.8 (4.0-239.2)	62.4±91.4	25.3 (7.8-462.6)	0.004
AST (U/L)	29.1±38.8	21.3 (9.3-425.0)	34.1±30.3	23.0 (9.4-215.9)	129.1±274.6	39.6 (14.6-1275.0)	0.0001
Uric acid (mg/dL)	5.2±2.7	4.7 (1.9-26.8)	5.5±2.2	5.3 (0.4-12.5)	5.1±2.1	5.0 (1.9-10.8)	0.205
Lactate dehydrogenase, units per L	248.2±104.4	219.0 (93.0-831.0)	308.2±142.8	265.0 (127.0-1122.0)	420.6±207.2	306.5 (193.0-921.0)	0.0001
INR	1.0±0.1	1.0 (0.8-1.5)	1.1±0.3	1.0 (0.8-3.8)	1.7±1.9	1.2 (0.9-11.5)	0.0001
Ferritin (ng/mL)	252.9±336.9	159.2 (4.2-2000.0)	343.3±388.9	197.0 (10.5-2000.0)	778.8±676.9	516.8 (54.0-2000.0)	0.0001
D-dimer (µg/mL)	0.228±0.264	0.14 (0.02-1.216)	5.21±7.38	2.78 (0.06-3.57)	1.313±1.11	1.028 (0.05-3.695)	0.0001

*mean ± sd: mean ± standard deviation, Aminotransferase (ALT), Aspartate Aminotransferase (AST), p: Kruskal Wallis Test, p *: One-way ANOVA Test, *= p<0.05 statistically significant.

Examining the relationship between mortality and laboratory parameters

A significant difference was found between patients with and without mortality in terms of WBC, neutrophil, lymphocyte, hemoglobin, hematocrit, ALT, AST, LDH, INR, ferritin, and d-dimer (p=0.0001, 0.0001, 0.004, 0.0001, 0.0001, 0.0001, 0.0001, 0.0001, 0.0001, 0.0001, 0.0001, 0.0001, 0.0001, 0.0001, respectively). However, there was no significant difference in monocyte, thrombocyte, or uric acid levels (p > 0.05) (**Table 3**).

DISCUSSION

It was thought that inflammation and heart/muscle damage biomarkers, liver and kidney function biomarkers, Interleukins 6 (IL-6), Interleukins 10 (IL-10), serum ferritin and coagulation parameters are significantly increased in both severe and fatal COVID-19 patients.[3] COVID-19 is characterized by lymphopenia, increased activation of the inflammatory cascade, and cardiac involvement, all of which have a high prognostic value. The fundamental processes, however, are still poorly understood.[10] However, the literature information on parameters other than these laboratory parameters is changing rapidly, as the global studies conducted by many different researchers, by the days of the first year of the pandemic. Our study provides a comprehensive description of COVID-19 cases using laboratory parameters, and the risk factors for severe COVID-19. In additionally, our study differs from other studies due to the evaluation of a wider range of biochemical and hematological parameters compared to the current literature. Our study is different in that it offers an evaluation with simple routine and non-complex tests that can guide the course of COVID-19.

Screening, clinical care, and the prevention of major consequences might all benefit from effective biomarkers. WBC, lymphocyte, neutrophil, platelet, eosinophil, and hemoglobin levels and neutrophil–lymphocyte ratio (NLR) are hematologic indicators used to stratify COVID-19 patients.[10] Among the main contributions of laboratory tests to the clinician are to assist the staging of COVID-19 patients, predict their prognosis, and therapeutic monitoring. Many laboratories that can help determine the risk of development of acute respiratory distress syndrome (ARDS), disseminated intravascular coagulation (DIC), multi-organ failure (MODS) and hemophagocytic lymphohistiocytosis (HLH) / Macrophage activation syndrome (MAS) / cytokine storm. parameter is available.[5]

According to literature research, there are many studies showing that the levels of WBC,[3] CRP,[5,9,11] erythrocyte sedimentation rate (ESR),[7,12] LDH,[4-9] creatine kinase (CK),[3,4,8] serum ferritin,[3] IL-6,[3,9] d-dimer,[5,8] serum amyloid A,[7] albumin,[5,9] lymphocyte,[3,5,11] platelet,[3] neutrophil,[11] total bilirubin,[3] serum potassium[5] and procalcitonin,[5,9] may have an important place in predicting the course and prognosis of

Table 3. Comparison of of laboratory parameters of survivors and non-survivors.

	Survivors (n=368)		Non-survivors (n=47)		p
	Mean ±sd	Mean (min-max)	Mean ±sd	Mean (min-max)	
White blood cell level, 10^9 cells per L	7857.7±3770.3	7000.0 (2400.0-27600.0)	14814.9±23318.5	9100.0 (3100.0-164000.0)	0.0001
Neutrophil level, 10^9 cells per L	5264.5±3534.2	4100.0 (1000.0-24200.0)	11221.3±12962.2	7700.0 (2500.0-86800.0)	0.0001
Lymphocyte level, 10^9 cells per L	1734.9±968.9	1500.0 (100.0-8500.0)	2036.2±4880.5	800.0 (200.0-24200.0)	0.0001
Monocyte level, 10^9 cells per L	670.8±329.6	600.0 (100.0-2400.0)	1731.9±7118.5	600.0 (100.0-49400.0)	0.986
Platelet level, 10^9 cells per L	239628.4±89381.2	214500.0 (36000.0-693000.0)	205510.6±83832.9	191000.0 (47000.0-375000.0)	0.147
Haemoglobin, g/dL	13.4±1.9	14.0 (8.0-19.0)	11.6±2.5	12 (5.0-17.0)	0.0001
Hematocrit g/dL	39.2±5.2	39.4 (24.5-52.7)	35.1±7.5	34.6 (13.3-49.4)	0.001*
ALT (U/L)	26.7±37.7	18 (4-473.5)	47.2±72.7	23.2 (5.0-462.6)	0.004
AST (U/L)	30.4±35.6	21.6 (9.3-425.0)	95.5±213.5	37.3 (13.3-1275)	0.0001
Uric acid (mg/dL)	5.2±2.4	4.8 (1.9-26.8)	6.1±2.9	5.8 (0.4-12.2)	0.101
Lactate dehydrogenase, units per L	266.6±111.9	233.0 (93.0-831.0)	415.9±222.0	342.0 (149.0-1122.0)	0.0001
INR	1.1±0.6	1.0 (0.8-11.5)	1.3±0.4	1.2 (0.9-3.1)	0.0001
Ferritin (ng/mL)	284.5±344.4	177.9 (4.2-2000.0)	814.9±670.0	496.1 (54.0-2000.0)	0.0001
D-dimer (µg/mL)	0.347±0.498	0.182 (0.03-0.3298)	1.430±1.194	1.024 (0.5-3695.0)	0.0001

*mean ± sd: mean ± standard deviation, Aminotransferase (ALT), Aspartate Aminotransferase (AST), p: Kruskal Wallis Test, p *: One-Way ANOVA Test, *= p<0.05 statistically significant.

COVID-19 patients. Henry et al.[3] evaluated 21 studies in which 3377 patients were included in their meta-analysis study. In this meta-analysis, while 18 studies (n=2984) compared laboratory findings between severe and non-severe COVID-19 patients, 3 studies (n=393) were found to compare survivors and deceased.[3] In our study, we compared the laboratory findings according to both disease severity and mortality development. In this meta-analysis, it was found that those with severe disease and those who died had high WBC levels and decreased lymphocyte and thrombocyte levels. In our study, increased WBC and neutrophil levels and lower lymphocyte levels were detected both in Group 3 and non-survival group. There was no significant difference in platelet levels in both comparisons.

In studies, lymphopenia has been one of the most controversial parameters associated with disease severity in COVID-19. Additionally, liver dysfunction, increasing serum inflammatory markers, serum ferritin and LDH levels related to cytokine storm, abnormal coagulation parameters such as increasing plasma d-dimer levels and troponin levels have been frequently reported in severe disease or non-survivors.[12] In a review study, 189 studies and 57,563 COVID-19 patients were evaluated. In this study, Hgb and Htc levels were found to be lower in patients such as the elderly, those with comorbidities like diabetes and hypertension, and those admitted to ICUs.[13] In our study, the lowest Hgb and Htc levels were found in both Group 3 patients and non-survival patients, and this is consistent with the literature. In addition, Group 3 patients were also found to be statistically older in our study. For these reasons, we think it is difficult to reach a full judgement.

Wendel Garcia et al.[14] have reported significantly increased CRP, creatinine, troponin, d-dimer, lactate, neutrophil, and WBC levels in ICU non survivor COVID-19 patients. Similarly, in the multivariable regression analyzes; baseline higher creatinine, d-dimer, lactate, potassium levels have been found to be significantly associated with mortality.[14]

Clinical biochemistry laboratories contribute greatly to the clinical decision with their test results. The importance of some tests that can be ordered from every patient on a routine basis has increased in this disease. Blood levels of some inflammatory markers increase due to initial or accompanying secondary infection. These markers play a role not only in the management of the disease but also in the severity classification of the disease. Although a great progress has been made in vaccination studies today, targeted treatment and follow-up is important.[14,15] For example, platelet levels has been quickly accepted as a potential biomarker for COVID-19 patients since it is a simple, inexpensive, and readily available biomarker that has been independently related with disease severity and mortality risk in ICU. The number of platelets in COVID-19 patients was reported to be considerably lower, and non-survivor patients had less platelets than survivors.[10] In another study by Sun et al.[16], patients were divided into 4 groups: mild, moderate, severe (20%), and critical (33%) according to the clinical severity of disease, similarly to our study. This study emphasized that the levels of lymphocytes were significantly lower and gamma glutamyl transferase (GGT), LDH, AST, ALT, CRP, ESR, and ferritin levels were significantly higher in severe and critically ill COVID-19 patients. In addition, CRP, lymphocyte levels, and di-dimer levels were significant and were associated with disease severity according to logistic regression analysis.[16] Another meta-analysis study including 660 articles suggested that higher CRP, LDH levels and lymphopenia are associated with disease severity in COVID-19.[17] There was no statistically significant difference between the groups in terms of uric acid, monocyte and platelet levels. In our study, AST, ALT, LDH, ferritin, INR, and d-dimer levels were higher in both Group 3 patients and non-survival patients. This finding was also consistent with the current literature.

Different studies on the relationship of di dimer value with disease severity and mortality; reported that d-dimer levels above 1-2 µg/mL at the time of admission are associated with disease severity and mortality.[18-22] In our study, the d-dimer value was> 1 µg / mL in both patients who were directly hospitalized in ICU on admission day and in patients who developed mortality, and it was found to be statistically significantly higher compared to other groups.

COVID-19 is a disease that still puts humanity in grave danger. New strains are a menace even with the vaccines. We still need an urgent scale for COVID-19 severity. Correlation between severity and AST, ALT, LDH, ferritin, INR, and d-dimer values can help predict the disease's severity.

CONCLUSIONS

There is an urgent need for inexpensive, easily accessible predictors of the disease clinical course in COVID 19. Correlation between severity and AST, ALT, LDH, ferritin, INR, and d-dimer levels can help predict the disease's severity. There is a need for markers to be used in determining the clinical course of outpatients, too.

Limitations of the study: This study has limitations such as being single-center, retrospective, and including only inpatient COVID-19 patients. Furthermore, the sample size may be a factor in the absence of meaningful results. Because of the sample size, the predicted difference between groups in terms of expected outcomes may be affected. The groups were selected only according to the severity of the disease at the time of the first admission.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was approved by the COVID-19 Scientific Research Evaluation Commission of the General Directorate of Health Services of the Turkish Ministry of Health on the date of April 5, 2020, and the Çanakkale Onsekiz Mart University Clinical Researches Ethics Committee of our center (date: 03.06.2020, number: 2020-08).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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