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Length of hospital stay and risk factors associated with prognosis in COVID-19 patients: surprising results

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Abstract. – OBJECTIVE: In this study, we aimed to investigate the risk factors that may affect the prognosis and length of hospital stay of COVID-19 patients, particularly immunoglobulin A.

MATERIALS AND METHODS: Patients admitted to the relevant department or intensive care unit with a diagnosis of COVID-19 between April 2020 and January 2021 were included in the study. Demographic characteristics of the patients and blood type, immunoglobulin A (IgA), C-reactive protein, D-dimer, procalcitonin, ferritin, troponin I, complete blood count, biochemical, and COVID-19 (SARS-CoV-2) reverse transcription polymerase chain reaction test results were evaluated retrospectively from the hospital files and data system.

RESULTS: A total of 164 COVID-19 patients were included in this study. The median age was 72 (range: 30-95) years and the gender distribution of women and men was 66/98 (40.2% *vs.* 59.8%, respectively). There was no statistically significant relationship between blood type and hospitalization time or mortality (p=0.497 and p=0.923, respectively). There was furthermore no statistically significant relationship between Rh group and the duration of hospitalization or prognosis (p=0.198 and p=0.827, respectively). There was no statistically significant correlation between IgA level and hospitalization time or prognosis (p=0.066, r=0.144). In the analysis of defined risk factors independently associated with death, the following were found to be significant indicators of mortality: leukopenia [beta: -2.973, OR (95% CI): 0.051 (0.003-0.891), p=0.041], glucose [beta: 0.014, OR (95% CI): 1.014 (1.001-1.028), p=0.037], D-dimer [beta: 0.001, OR (95% CI): 1.001 (1.000-1.001), p=0.023], duration of hospitalization [beta: -0.218, OR (95% CI): 0.804 (0.708-0.913), p=0.001], and duration of stay in the intensive care unit [beta: 0.348, OR (95% CI): 1.416 (1.186-1.690), p<0.001].

CONCLUSIONS: In our study, no relationship was found between IgA level and hospitalization time or mortality among COVID-19 patients. However, leukopenia and increased glucose, D-dimer, neutrophil count, urea, and durations of hospital and intensive care stays were found to be important predictors of mortality.

Key Words:
COVID-19, Immunoglobulin A, Blood type, Risk Factor, Length of hospital stay.

Introduction

Coronavirus disease 2019 (COVID-19), which first appeared in China and is caused by the SARS-CoV-2 virus, was identified by the World Health Organization as a pandemic. There are studies in the literature investigating the risk factors associated with the severity of COVID-19 that may affect the course of the disease[1]. Among these, many studies[2,3] have suggested that blood types may be associated with certain viral infections. Human blood types have been used as genetic markers. By studying the relationship between human blood types and viral infections, it may be possible to determine the susceptibility of people with different blood types to specific viruses[2]. Other parameters investigated in the literature are immunoglobulins. It has been shown that immunoglobulin M (IgM), immunoglobulin G (IgG), and immunoglobulin A (IgA) are produced by all patients with COVID-19 and can be detected early in the course of the infection[3]. IgA is located on mucosal surfaces[4], and it is an antibody that makes initial contact with antigens in infections targeting mucosal tissues. IgA performs this task by binding to bacteria, viruses, and toxins and preventing them from attaching to epithelial cells[5]. It has been reported that the production of secretory IgA, which is located on

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mucosal surfaces and is involved in infections targeting mucosal tissues, on the respiratory tract mucosa and intestinal mucosa is impaired in cases of COVID-19. For this reason, some scholars[5] have been analyzed the relationship between COVID-19 disease and selective IgA deficiency. However, there are not many studies showing the effects of IgA levels on the clinical course of the disease, length of hospitalization, and mortality. In this study, we aimed to investigate the risk factors, and especially IgA level, that may affect the prognosis and duration of hospital stay among COVID-19 patients.

Materials and Methods

Patients admitted to the intensive care unit and the relevant department after admission to the Adıyaman University Education and Research Hospital (Adıyaman, Turkey) between January 4, 2020, and April 31, 2021, were included in this study. The demographic characteristics of the patients and their blood types, Rh groups, IgA, C-reactive protein (CRP; mg/dL), D-dimer, procalcitonin, ferritin, troponin I, complete blood count, biochemical, and polymerase chain reaction (PCR) test results were scanned retrospectively from the hospital's files and data system. The patients' first-day laboratory parameters were also evaluated. DNR/AND orders were not applied for patients hospitalized in intensive care and the wards. The study included patients with positive results for COVID-19 (SARS-CoV-2) *via* reverse transcription PCR tests based on combined throat and nasopharynx swab samples taken from the respiratory tract. Those who had negative test results were excluded from the study. The parameters chosen were studied using equipment from Roche (Mannheim, Germany), Bio-Rad (CA, USA), Qiagen (Amsterdam, Netherlands), and RTA (Ankara, Turkey). Statistical analysis was performed using IBM SPSS Statistics 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as mean±standard deviation (minimum-maximum) and number (percentage). Chi-square and Fisher exact tests were used to compare categorical data. The Kolmogorov-Smirnov test was applied to determine whether continuous data showed normal distribution. The independent Student's *t*-test was used to compare continuous data showing normal distribution. Data that did not show normal distribution were expressed as median (minimum-maximum) and were compared with the Mann-Whitney U test. Continuous data with non-normal distribution were also compared with the Mann-Whitney U test. The Pearson correlation test was used to evaluate the relationship between IgA level and hospitalization time. In order to determine the independent risk factors associated with mortality, multiple logistic regression analysis (backward LR model) was used. One-way analysis of variance (ANOVA) was used to evaluate the relationship between blood types, duration of hospitalization, and prognosis. Values of $p<0.05$ were considered statistically significant.

Results

The mean age of the 164 COVID-19 patients included in this study was 72 (30-95) years, and the gender distribution of women and men was 66/98 (40.2% vs. 59.8%, respectively). Regarding blood type, 51 (31.1%) of them had type O, 68 (41.5%) had type A, 30 (18.3%) had type B, and 15 (9.1%) had type AB. Furthermore, while 25 (15.2%) of them were Rh-negative, 139 (84.8%) were Rh-positive. The average total length of stay was 12 (1-54) days, the average length of stay in the ward was 7 (0-45) days, and the average length of stay in the intensive care unit was 4 (0-51) days. While 96 (58.5%) of the patients survived, 68 (41.5%) died (Table I).

There were no statistically significant relationships between blood type and duration of hospitalization or mortality ($p=0.497$ and $p=0.923$, respectively) (Table II). There was no statistically significant relationship between Rh groups and duration of hospitalization or prognosis ($p=0.198$ and $p=0.827$, respectively) (Table III). There was also no statistically significant correlation between IgA level and hospitalization time ($p=0.066$, $r=0.144$) (Table IV).

Through the evaluation of factors associated with mortality, statistically significant relationships were found between mortality and age over 65 ($p=0.44$), leukocyte count ($p=0.003$), neutrophil count ($p<0.001$), elevated levels of glucose, urea, and creatinine ($p=0.025$, $p<0.001$, and $p=0.002$, respectively), decreased albumin ($p=0.001$), decreased albumin/globulin ratio ($p=0.049$), elevated aspartate aminotransferase (AST; $p=0.014$), elevated CRP ($p=0.014$), elevated procalcitonin ($p=0.002$), and elevated D-dimer ($p<0.001$). While the number of days spent hospitalized in the ward

Table I. Demographic, laboratory, and clinical data.

	N (%), mean±SD, median (minimum-maximum)
Age (years)	72 (30-95)
Sex (female/male)	66/98 (40.2/59.8)
IgA level	254.5 (68.3-702.0)
Blood groups	
0	51 (31.1)
A	68 (41.5)
B	30 (18.3)
AB	15 (9.1)
Rh -	25 (15.2)
Rh+	139 (84.8)
WBC	9,080 (1,230-38,000)
HB	12.9 (6.0-19.7)
PLT	230,000 (30,000-632,000)
RDW	13.6 (10.1-22.2)
Neutrophil	7335 (1,330-34,500)
Lymphocyte	1,000 (140-9,110)
Glucose	134 (46-510)
Creatinine	0.84 (0.39-10.00)
Albumin	2.7 (1.8-21.0)
Globulin	3.3 (2.4-27.0)
Ast	35.0 (9.0-549.0)
Alt	26.5 (6.0-942.0)
Crp	10.3 (0.5-195.0)
Procalcitonin	0.18 (0.12-92.0)
D-Dimer	1045 (102-40,300)
Ferritin	3,01 (23-1849)
Troponine	0.15 (0.00-6.40)
Patient with high Troponin	19 (11,6)
Service/Intensive care	45/119 (27.4/72.6)
Intubation	74 (45.1)
Length of Hospitalization	12 Days (1-54)
Number of days on the ward	7 (0-45)
Number of days in intensive care	4 (0-51)
Mortality	
Survived	96 (58.5)
Exitus	68 (41.5)

was lower among deceased patients, the number of days spent in intensive care was higher ($p<0.001$ for both). The numbers of patients with high troponin levels and high troponin levels were found to be higher among the surviving patients than the deceased patients ($p=0.004$ and $p=0.003$, respectively). The number of intubations was also found to be higher among deceased patients than survivors ($p<0.001$) (Table V).

In the analysis of defined risk factors independently associated with mortality, the following were found to be significant indicators of mortality: leukopenia [beta: -2.973, OR (95% CI): 0.051 (0.003-0.891), $p=0.041$], glucose [beta: 0.014, OR (95% CI): 1.014 (1.001-1.028), ($p=0.037$)], D-dimer [beta: 0.001, OR (95% CI): 1.001 (1.000-1.001), $p=0.023$], duration of hospitalization [beta: -0.218, OR (95% CI): 0.804 (0.708-0.913), $p=0.001$], and duration of stay in the intensive care unit [beta: 0.348, OR (95% CI): 1.416 (1.186-1.690), $p<0.001$] (Table VI).

In the analysis of independent risk factors of mortality, age [beta: 0.017, OR (95% CI): 1.017 (0.993-1.041), $p=0.163$] and comorbidities [beta: -0.270, OR (95% CI): 0.763 (0.405-1.437), $p=0.403$)] were not found to be statistically significant. However, neutrophil count [beta: 0.00, OR (95% CI): 1000 (1000-1000), $p=0.032$], urea [beta: 0.025, OR (95% CI): 1025 (1003-1048), $p=0.025$], duration of hospital stay [beta: -0.185, OR (95% CI): 0.831 (07.36-0.938), $p=0.003$], and duration of stay in the intensive care unit [beta: 0.129, OR (95% CI): 1.138 (1.019-1.271), $p=0.021$] were found to be statistically significant (Table VII).

There was no statistically significant correlation between general IgA levels and mortality or between mortality and high IgA and normal IgA in the group of patients over the age of 65 ($p=0.147$ and $p=0.176$) (Table VIII). There was also no statistically significant relationship between IgA levels among patients over the age of 65 and duration of hospitalization ($p=0.477$) (Table IX).

There was no statistically significant correlation between general IgA levels and mortality or between mortality and high IgA and normal IgA in the group of patients under the age of 65 ($p=0.283$ and $p=0.508$) (Table X). There was also no statistically significant relationship between IgA levels among patients under the age of 65 and duration of hospitalization ($p=0.755$) (Table XI).

Table II. Relationships between blood groups and length of hospitalization and prognosis.

	0 (n=51)	A (n=68)	B (n=30)	AB (n=15)	p
Length of hospitalization[a]	12 (2-45)	13 (1-54)	13 (5-43)	10 (2-30)	0.497
Mortality[b]	21	30	11	6	0.923

[a]Using the One-Way ANOVA test; [b]Using the chi-square test.

Table III. Relationships between Rh groups and length of hospitalization and prognosis.

	Rh-negative (n=25)	Rh-positive (n=139)	p
Length of hospitalizationc	11 (3-45)	13 (1-54)	0.198
Prognosisd (exitus)	11	57	0.827

[c]Using the Mann-Whitney U test; [d]Using the chi-square test.

Table IV. Relationships between Rh groups and length of hospitalization and prognosis.

	r	p
IgA level-length of hospitalization	0.144	0.066

[c]Using the Mann-Whitney U test; [d]Using the chi-square test.

There was no statistically significant relationship between IgA level and IgA classification for the subgroups of patients over the age of 65 and under the age of 65 (p=0.249 and p=0.077) (Table XII).

Comparing patients treated in the ward and in the intensive care unit, Rh positivity (p=0.016), neutrophil count (p=0.013), urea (p=0.028), creatinine (p=0.008), alanine transaminase (ALT; p<0.001), D-dimer (p=0.003), duration of hospitalization (p=0.005), number of intubations (p<0.001), and mortality rate (p<0.001) were all found to be statistically higher in the intensive care group, while albumin levels (p<0.001) and globulin values (p=0.049) were found to be lower (Table XIII).

Discussion

In our study, there were no significant relationships between blood type, Rh group, and IgA level and hospitalization time or mortality. There was also no significant relationship between age-related IgA levels and mortality. However, leukopenia, glucose, D-dimer, neutrophil count, urea, duration of hospitalization, and duration of intensive care were found to be statistically significant as mortality indicators among COVID-19 patients.

In many studies, it has been revealed that ABO blood types are important independent risk factors for venous thromboembolism and cardiovascular disease[6,7]. Other studies[8,9] have shown a relationship between COVID-19 infection and coagulopathy. Therefore, the relationship between ABO blood types and COVID-19 infection is becoming more important. Cheng et al[10] showed that there may be an association between ABO blood type and SARS-CoV-2 infection, and Zhao et al[11] found that patients with blood type A had a higher risk of mortality than patients with the O blood type. In a meta-analysis, it was found that blood types A and B were associated with an increased risk of COVID-19 compared to blood type O, and Rh-positive individuals were more susceptible to COVID-19 than Rh-negative individuals[12]. In the present study, the number of patients with Rh positivity was higher among those treated in intensive care than those who did not require intensive care. In our study, however, there was no significant relationship between blood type and hospitalization time or prognosis. This may be due to the fact that only the blood types of the patients whose IgA was studied were noted, the number of samples was insufficient, and the blood types were not homogeneous.

Recent studies[13] have shown that severe respiratory infections can occur in 20-30% of people with IgA deficiency. Other studies[4,14] have shown that secretory IgA antibodies can bind to toxins, neutralize viruses, and prevent bacteria from sticking to mucosal surfaces. Currently, the diagnosis of COVID-19 is possible by detecting SARS-CoV-2 RNA, and IgM and IgG antibodies specific for SARS-CoV-2 are currently studied. For example, Ma et al[15] showed that evaluating IgA in the early stage can help improve the diagnostic process. IgM and IgG levels were found to be higher among moderate and severe cases of COVID-19 compared to mild cases, and IgA levels were found to be higher in severe cases compared to mild and moderate cases of COVID-19.

Table V. Analysis of mortality and related risk factors.

	Surviving (n=96)	Exitus (n=68)	p
Age (years)	70 (30 – 95)	72 (30 – 89)	0.268
Age over 65/under 65	64/32	55/13	**0.044***
Sex (female/male)	43/53	23/45	0.158
Blood group			0.923
0	30	21	
A	38	30	
B	19	11	
AB	9	6	
Rh group			0.780
Rh negative	14	11	
Rh positive	82	57	
Comorbidity	53	42	0.426
IGA normal/ IGA high	26/70	13/55	0.238
Lymphocyte level	1,030 (140 – 9,110)	927 (188 – 3,299)	0.460
Lymphopenia (with/without)	35/61	23/45	0.728
Leukocyte count	8,050 (1,780 – 28,500)	10,600 (1,230 – 38,000)	**0.003***
Leukopenia (with/without)	12/84	4/64	0.190
Hemoglobin	12.9 (7.5 – 19.7)	12.9 (6.0 – 19.6)	0.948
Platelet	226,500 (42,000 – 632,000)	232,000 (30,000 – 525,000)	0.385
RDW	13.3 (10.1 – 18.9)	13.9 (10.3 – 22.2)	0.134
Neutrophil	6,100 (1,330 – 24,500)	92,62 (2,290 – 34,500)	**<0.001***
Glucose	129 (58 – 510)	150 (46 – 464)	**0.025***
Urea	39 (12 – 160)	50 (5 – 243)	**<0.001***
Creatinine	0.80 (0.39 – 10.00)	0.98 (0.49 – 5.76)	**0.002***
Albumin	2.9 (1.8 – 3.9)	2.7 (1.8 – 4.0)	**0.001***
Globulin	3.6 (2.4 – 5.9)	3.7 (2.5 – 6.6)	0.488
Albumin/globulin ratio	0.8 (0.3 – 1.6)	0.7 (0.4 – 1.3)	**0.049***
AST	34 (9 – 549)	39 (15 – 208)	**0.014***
ALT	26 (6 – 942)	27 (6 – 242)	0.652
CRP	8.57 (0.50 – 99.00)	11.80 (0.50 – 42.40)	**0.014***
CRP classification			0.089
Normal	1	1	
Up to 4-fold	14	4	
4-10-fold	14	5	
More than 10-fold	66	57	
Procalcitonin	0.15 (0.12-69.00)	0.28 (0.12-92.00)	**0.002***
D-dimer	936 (102-13900)	1540 (275-40300)	**<0.001***
Ferritin	298 (23-1849)	328 (24-500)	0.145
Troponin	0.00 (0.00-1.30)	0.00 (0.00-6.40)	**0.004***
The patient with high troponin	4 (4.2)	15 (22.1)	**0.003***
Service/ICU	42/54 (43.8/56.2)	3/65 (4.4/95.6)	**<0.001***
Intubation	6 (6.3)	68 (100)	**<0.001***
Length of hospitalization	13 (2-46)	12 (1-54)	0.271
Length of stay on the ward	10 (0-45)	3 (0-22)	**<0.001***
Length of stay in intensive care	2 (0-19)	9 (0-51)	**<0.001***

*$p<0.05$; Categorical data were compared with the chi-square and Fisher exact tests, and non-normally distributed data using the Mann-Whitney U test.

Table VI. Multiple logistic regression analysis (backward LR model) of independent mortality-related risk factors.

	Beta	OR (95%CI)	p
Leukopenia	-2.973	0.051 (0.003-0.891)	0.041*
Glucose	0.014	1.014 (1.001-1.028)	0.037*
D-dimer	0.001	1.001 (1.000-1.001)	0.023*
Length of hospitalization	-0.218	0.804 (0.708-0.913)	0.001*
Length of stay in intensive care	0.348	1.416 (1.186-1.690)	<0.001*

*$p<0.05$

Table VII. Multiple logistic regression analysis (forward LR model) of independent mortality-related risk factors.

	Beta	OR (95%CI)	p
Age	0.017	1.017 (0.993-1.041)	0.163
Comorbidity	-0.270	0.763 (0.405-1.437)	0.403
Neutrophil	0.000	1.000 (1.000-1.000)	**0.032***
Urea	0.025	1.025 (1.003-1.048)	**0.025***
Length of hospitalizasyon	-0.185	0.831 (0.736-0.938)	**0.003***
Length of stay in intensive care	0.129	1.138 (1.019-1.271)	**0.021***

Table VIII. The relationship between IgA levels and mortality in the over-65 age group.

	Survived (n=64)	Exitus (n=55)	p
IgA level	282±119	323±155	0.147
IgA normal/IgA high	16/48	8/47	0.176

Table IX. The relationship between IgA elevation/normality in the over-65 age group.

	IgA normal	IgA high	p
Length of hospitalization	14.6±10.5	16.3±10.4	0.477

Table X. The relationship between general IgA levels and mortality in the over-65 age group.

	Survived (n=32)	Exitus (n=13)	p
IgA level	260±113	306±158	0.283
IgA normal/IgA high	10/22	5/8	0.508

Table XI. The relationship between IgA elevation/normality and length of hospitalization in the over-65 age group.

	IgA normal	IgA high	p
Length of hospitalization	13.0±6.2	13.8±8.4	0.755

Table XII. Relationships between IgA levels and IgA classifications between the over-and under-65 age groups.

	Over 65 (n=119)	Under 65 (n=45)	p
IgA value	301±138	274±128	0.249
IgA normal/IgA high	24/95	15/30	0.077

Table XIII. Comparison of demographic, clinical and laboratory data in patients hospitalized in service and intensive care units.

	Non-ICU (n=45)	ICU (n=119)	p
Age (years)	69 (30-95)	72 (30-94)	0.175
Age over 65/under 65	28/17	87/32	0.185
Sex (female/male)	21/24	45/74	0.373
Blood group			
0	17	34	0.604
A	16	52	
B	9	21	
AB	3	12	
Rh group			
Rh negatif	12	13	**0.016***
Rh pozitif	33	106	
Comorbidity	24	71	0.483
IGA level	247.0 (90.2-599.0)	265.0 (68.3-702.0)	0.529
IGA normal/ IGA high	9/36	30/89	0.543
Lymphocyte level	1,030 (529-9,110)	955 (140-8,900)	0.242
Lymphopenia (with/without)	36/9	100/19	0.626
Leukocyte count	8,020 (2,740-28,500)	9,380 (1,230-38,000)	0.088
Leukopenia (with/without)	5/40	11/108	0.770
Hemoglobin	13.1 (7.8-15.7)	12.7 (6.0-19.7)	0.303
Platelet	225,000 (101,000-632,000)	232,000 (30,000-525.000)	0.215
RDW	13.1 (11.5-18.6)	13.6 (10.1-22.2)	0.259
Neutrophil	6,020 (1,860-23,500)	8,360 (1,330-34,500)	**0.013***
Glucose	128 (77-510)	140 (46-464)	0.141
Urea	39 (21-92)	45 (5-243)	**0.028***
Creatinine	0.78 (0.55-1.45)	0.90 (0.39-10.00)	**0.008***
Albumin	3.0 (2.0-3.9)	2.7 (1.8-4.0)	**<0.001***
Globulin	3.9 (2.5-5.9)	3.6 (2.4-6.6)	**0.049***
Albumin/globulin ratio	0.8 (0.3-1.3)	0.8 (0.4-1.6)	0.738
AST	27 (6-242)	26 (6-942)	0.638
ALT	7 (1-19)	12 (6-195)	**<0.001***
CRP	11.05 (1.10 – 39.80)	10.30 (0.50-99.00)	0.921
CRP classification			
Normal	1	3	0.198
Up to 4-fold	4	14	
4-10-fold	9	10	
More than 10-fold	31	92	
Procalcitonin	0.13 (0.12-92.00)	0.21 (0.12-69.00)	0.114
D-dimer	917 (102-13,000)	1,205 (275-40,300)	**0.003***
Ferritin	275 (34-1,500)	322 (23-1,849)	0.186
Troponin	0.05 (0.00-1.00)	0,00 (0.00-6.40)	0.350
High troponin	1 (2.2)	18 (15.1)	0.192
Length of stay	11 (3-37)	14 (1-54)	**0.005***
Intubation	3	71	**<0.001***
Prognosis (exitus)	3	65	**<0.001***

IgA can pass from plasma to damaged lung tissues *via* a pathway called transduction, independently of the receptor. However, no significant correlation was found between bronchoalveolar lavage (BAL) and serum-specific antibody levels[16].

Especially strong dimeric forms of IgA secreted from mucosal surfaces provide important protection and, in parallel, vaccines administered *via* mucosal surfaces can cause a strong IgA response[17]. Studies have been conducted along these lines both clinically and physiopathologically, revealing the importance of IgA. However, in our study, it was found that there was no statistically significant difference between the IgA levels of patients in the ward and those in intensive care. This may have been due to the fact that cases were not classified as mild, moderate, and severe. There was similarly no significant relationship between IgA and mortality.

Many factors that may affect the clinical course and mortality of COVID-19 have been proposed, but they have not yet been fully elucidated. As mentioned above, there are studies in the literature on the role of secretory IgA in the defense of mucosal surfaces in infections and its mechanism of action because, based on that mechanism of action, IgA-based serological tests can be used in the diagnostic process[18]. However, there are not many studies on IgA levels and the clinical courses and outcomes of COVID-19 patients. This is an important point that warrants more research.

Other well-known risk factors are comorbidities and age, as widely reported in the literature. In a meta-analysis of 14 studies[19], it was determined that patients with severe COVID-19 were statistically significantly older and had more comorbidities than the non-severe group. This suggests that age and comorbidities may be risk factors for a poor prognosis[19]. However, age and comorbidities were not found to be risk factors in the present study. In this study, the two groups analyzed were similar in terms of age and comorbidities.

Previous studies[20-25] have shown that high levels of glucose, urea, CRP, D-dimer, procalcitonin, ferritin, white blood cell count, neutrophil count, AST, and ALT and low levels of albumin may be associated with mortality in cases of COVID-19. In our study, leukocyte count, neutrophil count, glucose, urea, creatinine, AST, CRP, D-dimer, and procalcitonin values were higher and albumin values were lower among non-surviving patients compared to the surviving group. Among the patients admitted to the intensive care unit, neutrophil count, urea, creatinine, ALT, and D-dimer values were higher and albumin values were lower compared to those patients who did not require intensive care. The reason for this difference between the surviving patients and non-survivors and between the groups treated or not treated in the intensive care unit may be due to the fact that some of the intensive care patients clinically improved and the indications for intensive care hospitalization were not accurate. A global review of intensive care indications could help prevent a shortage of intensive care beds.

Troponin increases as a result of acute plaque rupture or as a result of increased oxygen demand due to stresses such as hypoxia, hypoperfusion, and tachycardia[26]. It was reported in a previous study[27] that troponin can be used to predict prognosis in cases of COVID-19. In our study, troponin levels were found to be statistically significantly higher among deceased patients than in the surviving group. There was no significant relationship between intensive care and non-intensive care patients; however, this may be due to different physicians interpreting the criteria for intensive care admission differently.

The duration of ward hospitalization was found to be longer among surviving patients, while the duration of intensive care hospitalization was higher among non-survivors. The duration of hospitalization, the number of intubations, and the mortality rate were found to be higher among patients admitted to the intensive care unit than non-intensive care patients.

Our study has some limitations. It was retrospective and a wider range of patients is needed, especially for evaluations of the effects of blood type.

Conclusions

There was no relationship between blood type and IgA, hospitalization time, or prognosis among the COVID-19 patients in the present study. However, leukopenia, glucose, D-dimer, neutrophil count, urea, total hospitalization time, and intensive care hospitalization time may be valuable in predicting mortality and, accordingly, prognosis. In the future, more broad-based prospective studies on the clinical course of COVID-19, including hospitalization time and prognosis, will be needed.

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Conflicts of Interest
The authors declare no conflicts of interest.

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