ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Features and Predictors of Mortality in Geriatric COVID-19 Patients in Intensive Care Unit: Retrospective Clinical Study

Yoğun Bakım Ünitesindeki Geriatrik COVID-19 Hastalarının Özellikleri ve Mortalite Prodüktörleri: Retrospektif Klinik Çalışma

Behiye Deniz KOSOVALI[a], Gül Meral KOCABEYOĞLU[a], Özlem Balkız SOYAL[b], Nevzat Mehmet MUTLU[a]

[a]Clinic of Critical Care, Ankara City Hospital, Ankara, Türkiye
[b]Clinic of Anesthesiology and Reanimation, Ankara City Hospital, Ankara, Türkiye

This study was presented as an oral presentation at the Turkish Thoracic Society 24th Annual National Toraks Congress, December 17-21, 2021, Antalya, Türkiye.

ABSTRACT Objective: Although coronavirus disease-2019 (COVID-19) is seen in all age groups, the disease may progress more severely in adults with geriatric patients and comorbidities. We aimed to determine mortality rates and factors that may affect mortality by comparing the demographic, clinical, laboratory and radiological characteristics of different geriatric age groups. **Material and Methods:** A total of 444 COVID-19 intensive care unit (ICU) patients aged ≥65 years who were diagnosed with COVID-19 (real-time polymerase chain reaction positive) were included in the study. The patients were classified into 3 groups according to their age: younger-aged (65-74 years old), middle-aged (75-84 years old) and advanced-aged (≥85 years old) and the groups were compared. **Results:** The most common hospital admission symptom of total of 444 (73.2%) patients was dyspnoea. There was a statistical difference between genders in three groups (p<0.001). There was no difference between the mortality rates of the 3 groups (p=0.097). According to multiple logistic regression analysis, age ≥85 years, lactate dehydrogenase (LDH), procalcitonin and myalgia/joint pain were determined to be the risk factors that may affect mortality (p values 0.01, 0.025, 0.033 and 0.01, respectively). **Conclusion:** In geriatric COVID-19 ICU patients, advanced-age (≥85 years), male gender, laboratory parameters (e.g., interleukin-6, ferritin, procalcitonin, LDH) and, dyspnoea are the risk factors that increased mortality. Mortality rate was similar in geriatric groups.

Keywords: Geriatry; COVID-19; intensive care unit; mortality

ÖZET Amaç: Koronavirüs hastalığı-2019 [coronavirus disease-2019 (COVID-19)], tüm yaş gruplarında görülse de ileri yaş ve komorbiditeleri olan erişkinlerde hastalık daha ağır seyredebilir. Farklı geriatrik yaş gruplarının demografik, klinik, laboratuvar ve radyolojik özelliklerini karşılaştırarak, mortalite oranlarını ve mortaliteyi etkileyebilecek faktörleri belirlemeyi amaçladık. **Gereç ve Yöntemler:** Çalışmaya, COVID-19 (gerçek zamanlı polimeraz zincir reaksiyonu pozitif) tanısı almış 65 yaş ve üzeri 444 COVID-19 yoğun bakım ünitesi (YBÜ) hastası dâhil edildi. Hastalar yaşlarına göre genç yaşlı (65-74), orta yaşlı (75-84) ve ileri yaşlı (≥85) olmak üzere 3 gruba ayrıldı ve gruplar karşılaştırıldı. **Bulgular:** Toplam 444 hastanın en sık hastaneye başvuru semptomu dispne (%73,2) idi. Üç grup arasında cinsiyetler açısından istatistiksel fark vardı (p<0,001). Üç grubun ölüm oranları arasında fark yoktu (p=0,097). Çoklu lojistik regresyon analizine göre yaş ≥85, laktat dehidrogenaz (LDH), prokalsitonin ve miyalji/eklem ağrısı mortaliteyi etkileyebilecek risk faktörleri olarak belirlendi (p değerleri sırasıyla 0,01, 0,025, 0,033 ve 0,01). **Sonuç:** Geriatrik COVID-19 YBÜ'de ileri yaş (≥85), erkek cinsiyet, laboratuvar parametreleri (örneğin interlökin-6, ferritin, prokalsitonin, LDH) ve dispne mortaliteyi artıran risk faktörleridir. Mortalite oranı geriatri gruplarda benzerdi.

Anahtar Kelimeler: Geriatri; COVID-19; yoğun bakım ünitesi; ölüm

Coronavirus disease-2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), first appeared in Wuhan, China, in December 2019 and became a pandemic. Due to COVID-19's speed and ease of transmission, millions of patients all over the world were infected, and many of them died. The first case of COVID-19 in Türkiye was reported on March 11, 2020 by the Ministry of

Correspondence: Behiye Deniz KOSOVALI
Clinic of Critical Care, Ankara City Hospital, Ankara, Türkiye
E-mail: kosovalideniz@yahoo.com

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Health on the day the World Health Organization declared the COVID-19 pandemic.[1] After that, strict measures were taken to minimise the risk of transmission of the disease.

Many studies have reported that although COVID-19 is seen in all age groups, it usually causes asymptomatic or mild clinical disease in children and young people, and that the disease may progress more severely in adults of geriatric and with comorbidities.[2,3] Data in China, where COVID-19 first emerged at the beginning of the pandemic, showed that geriatric people were most severely affected by the disease.[4] When the disease spread to other continents, studies whose results were consistent with those of Chinese studies were published in Europe and North America.[5,6] Hypertension (HT), cardiovascular diseases, smoking, diabetes mellitus (DM), chronic kidney disease, malignancies and chronic obstructive pulmonary disease (COPD) were reported in meta-analysis as the most common comorbidities accompanying COVID-19.[7] It is also known that the severity of COVID-19 and the risk of death increase with age and the number of accompanying comorbidities.[8] In the literature, studies have compared geriatric and younger patients diagnosed or suspected of COVID-19 or the clinical and laboratory results of geriatric patients admitted to the hospital with COVID-19.[8,9]

In this study, geriatric patients followed in the intensive care unit (ICU), whose diagnosis of COVID-19 was confirmed by a positive polymerase chain reaction (PCR) test, were divided into age groups (younger-aged, middle-aged, and advanced-aged patients). We aimed to determine the mortality rates and the factors that may affect mortality by comparing the demographic, clinical, laboratory and radiological characteristics of the groups.

MATERIAL AND METHODS

In our study, total of 1,882 COVID-19 patients hospitalised in ICU between 19 March 2020 and 31 August 2020 were scanned retrospectively through the hospital information management system and recorded after approval by the ethics committee (Clinic of Intensive Care, Ankara City Hospital, date: March 3, 2021, no: E1-21-1598) and the study was conducted in accordance with the principles of the Declaration of Helsinki. COVID-19 ICU patients aged 65 years and over who were diagnosed with COVID-19 [real-time (RT)-PCR positive] were included in the study after the detection of SARS-CoV-2 with a deep tracheal aspirate or nasopharyngeal swab sample using a PCR-RT technique. Patients younger than 65 years of age with a diagnosis of COVID-19 (PCR-RT positive) and PCR-RT negative patients were excluded from the study.

COVID-19 ICU patients aged 65 and over were classified into 3 groups according to their age: younger-aged (65-74 years old), middle-aged (75-84 years old) and advanced-aged (≥85 years old). Patients' gender, age, Acute Physiology and Chronic Health Evaluation II score (APACHE II), symptoms on hospital admission, comorbidities, supportive treatments [nasal cannula/face mask, high flow nasal oxygen (HFO), noninvasive mechanical ventilator, invasive mechanical ventilator, vasopressor/inotropic support, hemodiafiltration and continuous renal replacement therapy], need for intensive care, chest computed tomography (CT) findings before admission to intensive care [for COVID-19: typical, atypical/indeterminate, negative or no CT scan), the duration of mechanical ventilation and the COVID-19 ICU were recorded. Laboratory parameters at the time of admission to the ICU, leukocyte, lymphocyte and platelet counts, haemoglobin, interleukin-6 (IL-6), urea, creatinine, albumin, D-Dimer, fibrinogen, ferritin, lactate dehydrogenase (LDH), aspartate transaminase, alanine transaminase, procalcitonin, C-reactive protein (CRP), arterial blood gas values (pH, arterial oxygen pressure and carbon dioxide pressure (PaO_2, $PaCO_2$)], bicarbonate value (HCO_3) and lactate values were also taken.

The demographic, clinical and radiological characteristics and laboratory values of the groups were compared. The factors affecting mortality were also determined.

STATISTICAL ANALYSIS

The SPSS 26.0 package programme (SPSS Statistics for Windows, Version 26.0. IBM Corp., Armonk,

NY, USA) was used in the analysis of the data obtained in the study. Depending on the results of the normality tests of the variables specific to groups (Shapiro-Wilk and Kolmogorov-Smirnov), the Student's t test and the Mann-Whitney U test were used for comparisons between 2 independent groups, while the One-Way Analysis of Variance (ANOVA) test and/or the Kruskal-Wallis test were used to compare more than 2 independent groups for continuous variables. Chi-square and Fisher's exact tests were used to test the distribution of categorical variables between groups, and univariate and multiple logistic regression analyses were applied to determine risk factors affecting mortality. While establishing the multiple models, the relationship structures between the variables were examined with the Pearson correlation coefficient, and it was paid attention not to include the variables that were observed to be correlated higher than 0.6 into the model together. The results of multiple analyses performed with the Backward LR method are summarized with Odds ratios and 95% confidence intervals. In addition, the results obtained in the study were summarized using descriptive statistics such as mean±standard deviation and median (minimum-maximum), while frequency distributions and percentages were used in categorical variables. $p<0.05$ was accepted as the statistical significance limit. At the beginning of the study, we determined the sample size calculation according to the small effect size of 0.15 for the distribution of mortality, which is our primary outcome variable, for 3 different age groups, according to the following parameters. So, for the 3x2 contingency table design; a sample size of 429 achieves 80% power to detect an effect size (W) of 0.15 using a 2 degrees of freedom chi-square test with a significance level (alpha) of 0.050.

RESULTS

Between 19 March 2020 and 31 August 2020, 444 (23.6%) of 1,882 patients aged ≥65 years were hospitalized in the ICU with COVID-19, as confirmed by a positive PCR test. Of these 444 patients, 225 (50.7%) were females. The mean age of the patient population was 77.45 years, and the mean APACHE II score was 16.96. The most common hospital admission symptoms of all the patients were dyspnoea (73.2%), fever (32.2%) and cough (29.3%). In total, 50% of the patients had a known contact history. In the patient population, the most common comorbidities were HT (62.4%), DM (40.8%), coronary artery disease (31.8%) and COPD (13.7%.), and the most frequent supportive treatment applied in the ICU was oxygen theraphy (nasal cannula/face mask) (71.85%). CT findings of 69.6% of the 444 patients were compatible with COVID-19, whereas those of 10.6% of the patients were not compatible with COVID-19. The mean duration of mechanical ventilation (MV) of all patients was 5.6 days and the ICU length of stay was 11.14 days (Table 1).

When the patients were divided into different age groups, 38.96% were aged 65-74 (younger aged) years, 42.8% were aged 75-84 (middle aged) years, and 18.24% were aged ≥85 years (advanced-aged). There were more males (62.43%) in the 65-74 year-old age group and more females (67.9%) in the ≥85 year-old age group, with a significant difference in gender between groups ($p<0.001$). The APACHE II scores and hospital admission symptoms of the patients in the 3 age groups were similar. There were significant differences between the groups according to the comorbidities, coronary heart failure (CHF), COPD, Alzheimer's disease, Parkinson's disease and dementia ($p=0.043$, $p=0.007$, $p<0.001$, $p=0.009$ and $p=0.013$, respectively). Among supportive treatments applied in the ICU, there was a significant difference only in HFO therapy, which was applied mostly in the younger-aged group ($p=0.001$).

The highest number of patients (41.98%) requiring nursing care was in the advanced-aged group ($p<0.001$). The radiological findings in all 3 age groups were similar. The longest duration of MV was in the middle-aged group (7.08 days), and there was no significant difference in the duration of MV among the groups ($p=0.140$). There were also no differences among the groups in terms of the length of stay in the ICU ($p=0.456$). There was no difference in the mortality rate in the three groups ($p=0.097$) (Table 1).

When the groups were compared in pairs, there was no significant difference in mortality between the

TABLE 1: Demographic and clinical characteristics of the patients in the three age groups.

Variables	Total n=444	Years 65-74 n=173	Years 75-84 n=190	Years ≥85 n=81	p value
Gender					
Female n (%)	225 (50.7)	65 (37.57)	105 (55.26)	55 (67.9)	**<0.001**
Male n (%)	219 (49.3)	108 (62.43)	85 (44.74)	26 (32.1)	
APACHE II (mean±SD) (minimum-maximum)	16.96±9.26 (3-54)	14 (3-54)	15 (3-50)	15 (4-43)	0.164
Symptoms n (%)					
Dyspnoea	325 (73.2)	125 (72.25)	139 (73.16)	61 (75.31)	0.877
Fever	143 (32.21)	64 (36.99)	56 (29.47)	23 (28.4)	0.223
Chills/shivering	32 (7.21)	13 (7.51)	17 (8.95)	2 (2.47)	0.165
Cough	130 (29.3)	58 (33.53)	46 (24.21)	26 (32.1)	0.124
Sore throat	14 (3.15)	7 (4.05)	4 (2.11)	3 (3.7)	0.545
Myalgia/joint pain	21 (4.73)	11 (6.36)	8 (4.21)	2 (2.47)	0.359
Chest pain	48 (10.81)	22 (12.72)	18 (9.47)	8 (9.88)	0.584
Nausea	30 (6.76)	15 (8.67)	12 (6.32)	3 (3.7)	0.323
Vomiting	18 (4.05)	10 (5.78)	6 (3.16)	2 (2.47)	0.326
Stomach ache	15 (3.38)	9 (5.2)	3 (1.58)	3 (3.7)	0.159
Diarrhoea	13 (2.93)	9 (5.2)	3 (1.58)	1 (1.23)	0.075
Altered consciousness	43 (9.68)	13 (7.51)	18 (9.47)	12 (14.81)	0.185
Headache	12 (2.7)	6 (3.47)	6 (3.16)	0 (0)	0.248
Loss of muscle weakness	9 (2.03)	5 (2.89)	3 (1.58)	1 (1.23)	0.578
Syncope	5 (1.13)	2 (1.16)	3 (1.58)	0 (0)	0.529
Speech disorder	4 (0.9)	2 (1.16)	1 (0.53)	1 (1.23)	0.769
Known contact history	223 (50.23)	88 (50.87)	92 (48.42)	43 (53.09)	0.763
Comorbidities n (%)					
HT	277 (62.4)	101 (58.38)	121 (63.68)	55 (67.9)	0.306
DM	181 (40.8)	70 (40.46)	80 (42.11)	31 (38.27)	0.837
CAD	141 (31.8)	54 (31.21)	59 (31.05)	28 (34.57)	0.834
CHF	36 (8.1)	7 (4.05)	20 (10.53)	9 (11.11)	**0.043**
Arrhythmia	31 (7)	13 (7.51)	12 (6.32)	6 (7.41)	0.892
COPD	61 (13.7)	14 (8.09)	37 (19.47)	10 (12.35)	**0.007**
Asthma	31 (7)	13 (7.51)	8 (4.21)	10 (12.35)	0.052
Kidney failure	51 (11.5)	18 (10.4)	24 (12.7)	9 (11.11)	0.786
Malignancies	39 (8.8)	19 (10.98)	12 (6.32)	8 (9.88)	0.271
Previous CVE	42 (9.5)	15 (8.67)	20 (10.53)	7 (8.64)	0.802
Alzheimer's disease	37 (8.3)	5 (2.89)	18 (9.47)	14 (17.28)	**<0.001**
Parkinson's disease	10 (2.3)	1 (0.58)	9 (4.74)	0 (0)	**0.009**
Dementia	19 (4.3)	2 (1.16)	14 (7.37)	3 (3.7)	**0.013**
Other neurological diseases	4 (0.9)	2 (1.16)	2 (1.05)	0 (0)	0.634
Rheumatological diseases	6 (1.4)	3 (1.73)	2 (1.05)	1 (1.23)	0.85
Psychiatric diseases	3 (0.7)	2(1.16)	1(0.53)	0(0)	0.546
Liver diseases	4 (0.9)	3 (1.74)	0 (0)	1 (1.23)	0.203
Thyroid diseases	22 (5)	14 (8.09)	6 (3.16)	2 (2.47)	**0.05**
Supportive treatments in the ICU n (%)	319 (71.85)	126 (72.83)	132 (69.47)	61 (75.31)	0.579
Oxygen therapy (nasal cannula/face mask)					
Nasal high flow	183 (41.22)	91 (52.6)	65 (34.21)	27 (33.33)	**0.001**
NIMV	63 (14.19)	24 (13.87)	24 (12.63)	15 (18.52)	0.440
MV	264 (59.46)	96 (55.49)	113 (59.47)	55 (67.9)	0.172
Vasopressors/inotropes	215 (48.42)	73 (42.20)	96 (50.53)	46 (56.79)	0.071
Haemodialysis	215 (48.42)	38 (21.97)	46 (24.21)	16 (20)	0.729

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TABLE 1: Demographic and clinical characteristics of the patients in the three age groups (continued).

Variables	Total n=444	Years 65-74 n=173	Years 75-84 n=190	Years ≥85 n=81	p value
CRRT	3 (0.68)	1 (0.58)	2 (1.05)	0 (0)	0.613
Need for nursing care	107 (24.1)	20 (11.56)	53 (27.8)	34 (41.98)	**<0.001**
Thorax CT findings n (%)					
Typical compatible	309 (69.6)	128 (73.99)	131 (68.95)	50 (61.73)	0.077
Atypical/indeterminate	53 (11.9)	14 (8.09)	21 (11.05)	12 (14.81)	
Negative	47 (10.6)	13 (7.51)	28 (14.74)	12 (14.81)	
No CT	35 (7.9)	18 (10.4)	10 (5.26)	7 (8.64)	
Duration of MV (days) (mean±SD)	5.60±11.02	3.96±8.26	7.08±13.65	5.63±8.64	0.140
ICU length of stay (days) (mean±SD)	11.14±9.06	9.95±7.43	12.11±10.17	11.44±9.28	0.456
Mortality n (%)	271 (61.03)	102 (58.96)	111 (58.42)	58 (71.6)	0.097

APACHE II: Acute Physiology and Chronic Health Evaluation II score; SD: Standard deviation; HT: Hypertension; DM: Diabetes mellitus; CAD: Coronary artery disease; CHF: Chronic heart failure; COPD: Chronic pulmonary disease; CVE: Cerebrovascular event; ICU: Intensive care unit; NIMV: Non-invasive mechanical ventilation; MV: Mechanical ventilation; CRRT: Continues renal replacement therapy; CT: Computed tomography.

younger-aged group and the advanced-aged group or between the younger-aged group and the middle-aged group, but there was a significant difference in mortality between the middle-aged and advanced-aged groups (p=0.052, p=0.917 and p=0.04, respectively).

In terms of the laboratory findings, haemoglobin, fibrinogen, ferritin, urea, albumin, CRP, LDH, pH and $PaCO_2$ values differed in the 3 age groups (p=0.01, p=0.039, p=0.003, p=0.001, p=0.003, p=0.032, p 0.001, p=0.001 and p=0.005, respectively) (Table 2).

In the univariate logistic regression analysis, the factors affecting mortality were age ≥85 years, male gender and laboratory values of IL-6, ferritin, procalcitonin and LDH (p=0.042, p=0.020, p=0.001, p=0.001, p=0.008 and p<0.001, respectively). The symptoms associated with mortality were dyspnoea and myalgia/joint pain (p=0.003 for both) (Table 3). According to the multiple logistic regression analysis, age ≥85 years, LDH and procalcitonin values and myalgia/joint pain appeared to be risk factors for mortality (p=0.01, p=0.025, p=0.033 and p=0.01, respectively) (Table 4).

DISCUSSION

In Türkiye, the proportion of the geriatric population relative to the total population continues to grow due to an increase in average life expectancy and a decrease in the fertility rate.[10] This places a burden on society due to a greater proportion of the population having a high number of comorbidities and requiring care. To enable geriatric individuals to continue to live in the community, care has to be provided either by family members or dedicated care centres. Thus, the COVID-19 pandemic, where transmission prevention depends on social isolation, has had severe effects on the geriatric population. In the present study, we investigated the characteristics of geriatric COVID-19 ICU patients and the factors affecting mortality in this patient population. Although individuals of all ages are at risk of COVID-19 disease, geriatric patients have an increased risk of hospitalization and ICU admittance. In this study, almost a quarter of the COVID-19 patients admitted to the ICU at the time of hospitalization consisted of patients aged ≥65 years.

In the present study, the number of males and females admitted to the ICU differed according to age groups, in contrast to the findings of a previous study.[8] A number of factors may explain the discord. The geriatric COVID-19 patient population in our study consisted only of individuals admitted to the ICU. In addition, there were more community-dwelling females than males in the advanced-age group (i.e. ≥85 years), and mortality was higher among males. Having more female in the advanced-age group also increases the incidence of COVID-19 and hospitalization in the ICU. This was reflected in

our study as the higher number of women in the advanced-age group.

In a previous study, the most common presenting symptoms of COVID-19 patients

TABLE 2: Laboratory findings in the 3 age groups.

	Age 65-74		Age 75-84		Age ≥85		p value
Leukocytes, 10^9/L	10.51±20.01	8.08 (0.12-264.8)	9.98±6.85	8.35 (2.13-67.71)	9.64±8.16	7.57 (1.8-59.24)	0.503
Lymphocytes, 10^9/L	1.67±10.31	0.66 (0.01-134.3)	1.04±2.02	0.73 (0.14-27.73)	0.94±0.75	0.75 (0.13-4.78)	0.097
Hb, g/dL	12.68±2.14	13 (7.2-20.3)[a]	12.29±2.14	12.2 (5.9-16.9)[a]	11.56±2.24	11.2 (6.8-16.5)[b]	**0.001**
PLT, 10^9/L	239.96±97.19	242 (23-581)	248.03±112.44	226.5 (60-823)	233.6±93.07	217 (46-574)	0.708
D-dimer, mg/L	4.55±7.41	1.7 (0.2-35.2)	6.66±10.97	2.1 (0.2-80)	9.51±46.64	1.95 (0.4-412)	0.076
Fibrinogen, g/L	5.33±1.64	5.16 (1.32-9)[a]	4.97±1.79	4.78 (0.83-8.92)[ab]	4.48±1.46	4.47 (1.64-7.83)[b]	**0.039**
Ferritin, µg/L	1432.81±3607.6	614 (15-38199)[a]	1209.16±3855.54	435 (15-36085)[ab]	577.78±586.52	357 (11-3283)[b]	**0.003**
IL-6, pg/mL	192±294.86	78.4 (5.8-1688)	150.3±241.48	56.1 (3.68-1000)	139.55±234.56	49.1 (5.96-1000)	0.187
Urea, mg/dL	69.35±44.09	58 (15-265)[a]	90.49±63.53	73 (21-419)[b]	76.38±47.74	67 (15-255)[a]	**0.001**
Creatinine, mg/dL	1.4±1.84	0.98 (0.27-18.08)	1.64±1.45	1.12 (0.43-9.32)	1.3±0.87	1.08 (0.22-5.72)	0.158*
Albumin, g/L	34.58±4.4[a]	35 (24-47)	34.88±4.7[a]	36 (22-46)	32.42±5.46[b]	33 (21-44)	**0.003***
CRP, g/L	0.14±0.09	0.13 (0-0.76)	0.12±0.08	0.11 (0-0.35)	0.11±0.06	0.11 (0-0.34)	**0.032**
Procalcitonin, µg/L	2.99±16.83	0.23 (0.01-197.9)	6.14±42.1	0.31 (0.02-511.41)	2.64±9.62	0.23 (0.03-78.01)	0.402
AST, U/L	92.63±230.64	51(9-2814)	77.2±175.29	44 (3-1759)	52.7±40.98	39 (7-207)	0.056
ALT, U/L	59.39±108.21	31(1-1105)	45.82±91.45	25 (3-882)	32.7±30.53	22 (5-203)	0.004
LDH, U/L	589.94±256.36	556(228-1910)[a]	521.16±280.25	440 (133-2235)[a]	413.18±148.13	388 (218-965)[b]	**0.001**
PH	7.4±0.11[a]	7.42 (6.83-7.6)	7.37±0.13[b]	7.4 (6.73-7.56)	7.36±0.11	7.39 (6.9-7.56)[b]	**0.001***
$PaCO_2$, mmHg	37.13±11.16[a]	35.65 (14.6-124.1)	40.97±15.91[b]	38.35 (22.7-180.7)	41.55±12.88	37.8 (17.9-84.5)[b]	**0.005***
PaO_2, mmHg	51.43±27.33	43.5 (18.5-199.9)	55.69±31.75	46.8 (17.1-207)	56.02±33.96	44.35 (22.5-256.9)	0.434
HCO_3, mmol/L	22.46±4.67	22.65 (8.7-34.8)	22.67±4.78	22.3 (6.1-38)	22.83±5.44	22.7 (10.6-34.7)	0.821
Lactate, mmol/L	2.32±1.41	2.01 (0.62-10.77)	2.24±1.46	1.84 (0.44-14.17)	2.1±1.2	1.79 (0.7-6.63)	0.160

Mean±SD-Mean (minimum-maximum); *From an ANOVA. All other p values were calculated from a Kruskal-Wallis test. [a,b,ab]Means/medians marked with the same indices, such as those with the same different letter, are statistically different.

Hb: Haemoglobin; PLT: Platelet; IL-6: Interleukin-6; CRP: C-reactive protein; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; LDH: Lactate dehydrogenase; $PaCO_2$: Partial pressure of carbon dioxide; PaO_2: Partial pressure of oxygen; HCO_3: Bicarbonate; SD: Standard deviation.

TABLE 3: Factors affecting mortality according to a univariate logistic regression analysis.

						95% CI	
Variables		**B**	**Standard error**	**p value**	**OR**	**Lower limit**	**Upper limit**
Age	<74						
	75-84	-0.563	0.291	0.053	0.570	0.322	1.007
	≥85	-0.585	0.287	**0.042**	0.557	0.317	0.978
Gender	Male	0.278	0.195	**0.020**	1.321	0.901	1.937
Lymphocytes		0.020	0.031	0.525	1.020	0.960	1.083
IL-6		0.002	0.001	**0.001**	1.002	1.001	1.004
Ferritin		0.001	0.000	**0.001**	1.001	1.001	1.002
Procalcitonin		0.133	0.050	**0.008**	1.142	1.035	1.260
LDH		0.003	0.001	**<0.001**	1.003	1.001	1.005
Dyspnoea		0.646	0.217	**0.003**	1.903	1.246	2.920
Myalgia/joint pain		-0.982	0.460	**0.033**	0.374	0.152	0.923

OR: Odds ratio; CI: Confidence interval; IL-6: Interleukin-6; LDH: Lactate dehydrogenase.

TABLE 4: Multiple logistic regression analysis of the risk factors affecting mortality.

Variables		B	Standard error	p value	OR	95% CI	
						Lower limit	Upper limit
Age	**<74**						
	75-84	0.039	0.402	0.922	1.040	0.473	2.287
	≥85	1.664	0.644	**0.010**	5.282	1.496	18.652
Procalcitonin		0.601	0.268	**0.025**	1.824	1.078	3.087
LDH		0.002	0.001	**0.033**	1.002	1.000	1.005
Myalgia/joint pain		-1.885	0.731	**0.010**	0.152	0.036	0.636

OR: Odds ratio; CI: Confidence interval; LDH: Lactate dehydrogenase.

hospitalized in the community were fever, cough and shortness of breath.[11] In this study, the symptoms of the patients on admission to the hospital were the same as those reported in the literature, although the frequency and presenting order of these symptoms differed as compared to those reported in the literature, with dyspnoea the most common symptom, followed by a fever and a cough.[11] Our study population comprised geriatric patients. This may explain why fever was the second most common symptom, as the fever response changes with age. In the geriatric patients, infection may impair thermoregulation, which may lead to reduced sudomotor and vasomotor responses. In addition, the production of endogenous pyrogens, such as tumor necrosis factor, IL-1, IL-6, which are active in COVID-19 and increase in the cytokine storm period, may lead to changes in systemic responses and suppress the fever response in geriatric patients.[12] Other reasons why a fever was the second most common presenting symptom in our study may be that some of the patients admitted to the ICU were transferred from other centres and that some of the patients required intensive care at the time of admission. At this stage, respiratory distress, not fever, may have been the predominant symptom. Unlike a previous research, the symptoms at presentation did not differ among various age groups. Although not significant, in our study, fever was more common in the younger-aged group than in the other age groups, similar to the results of the previous study.[8]

Due to the neurotrophic effects of SARS-CoV-2, alteration of consciousness and hypoxemia may occur. According to some theories, the SARS-CoV-2 virus reaches brain tissue by haematogenous spread through a neuronal retrograde pathway from the olfactory epithelium in the nose or the respiratory epithelium in the respiratory tract or as a result of endothelial and pericyte damage in the brain tissue and disruption of the blood-brain barrier. When this occurs, clinically, various neurological symptoms, such as a headache, loss of smell, confusion and a coma may develop.[13]

Although restrictions were imposed on social activities and social contacts during the pandemic, many geriatric people require care and live in the same house with family members or in nursing homes with other geriatric residents. Given the speed at which COVID-19 disease can be transmitted through human contact, geriatric patients can be expected to become infected as a result of interactions with close contacts (i.e. family members or other geriatric residents and nursing care staff). In this study, half of all patients had a known contact history (PCR positivity in family members, other geriatric residents in nursing homes or nursing care staff). These data emphasize the importance of isolation in preventing the transmission of the disease.

In studies on geriatric patients at the beginning of the pandemic, the most common reported comorbidities accompanying COVID-19 were atherosclerotic cardiovascular diseases, HT and chronic lung diseases.[14,15] Another geriatric study reported that HT was the most common comorbidity in all patients.[9]

Among the supportive treatments applied in the ICU for geriatric patients, the need for HFO was

higher in the younger-aged group than in the other groups. In addition to the better compliance of younger patients to HFO, the need for HFO was less in middle and advanced-age groups due to the higher need for mechanical ventilators in these groups.

In the present study, patients who need for nursing care at the time of the study were followed up in single isolated rooms in the ICU. Thus, measures were taken to reduce the risk of disease transmission to medical staff and other health care workers responsible for patient care needs in the hospital. Therefore, the ratio of patients who need for nursing care was higher in advanced-age group.

Previous studies reported that mortality increases with age in individuals with COVID-19.[16,17] The present study was conducted in a geriatric patient population. The mortality rate was the highest in the advanced-aged group (i.e. ≥85 years). Thus, advanced-age was a risk factor for mortality. These findings explain the high reported mortality rate in geriatric patients with COVID-19 disease.[16,17]

In COVID-19, lymphopenia is a characteristic laboratory finding, with studies reporting that it is an indicator of a poor prognosis.[9,18] Although we didn't find any statistically significant difference in the lymphocyte counts of the different groups, lymphopenia appeared to worsen with advanced-age group. CRP, which is used as a marker of viral infections, has been reported to be related with disease severity and the prognosis in COVID-19.[19] Elevated IL-6 levels are known to be associated with a poor prognosis. In the present study, IL-6 levels were found to be associated with mortality.[20]

The limitations of this study are that it is single-center and retrospective. A higher number of patients could have helped us obtain more meaningful results. The geriatric group was compared within itself. Not being compared with the young population can be considered as another limitation.

CONCLUSION

In geriatric COVID-19 patients admitted to the ICU, demographic characteristics such as ≥85 years of age and male gender, as well as the typical symptom of dyspnea and laboratory parameters such as IL-6, ferritin, procalcitonin and LDH are the risk factors for respiratory failure and mortality.

According to these results, the need for care in the geriatric age group has increased due to the COVID-19 pandemic, and care centers should be screened more frequently to prevent the transmission of COVID-19.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Behiye Deniz Kosovalı, Nevzat Mehmet Mutlu;* ***Design:*** *Behiye Deniz Kosovalı, Nevzat Mehmet Mutlu;* ***Control/Supervision:*** *Behiye Deniz Kosovalı, Gül Meral Kocabeyoğlu, Nevzat Mehmet Mutlu;* ***Data Collection and/or Processing:****Gül Meral Kocabeyoğlu, Behiye Deniz Kosovalı;* ***Analysis and/or Interpretation:*** *Behiye Deniz Kosovalı, Özlem Balkız Soyal, Nevzat Mehmet Mutlu;* ***Literature Review:*** *Behiye Deniz Kosovalı, Özlem Balkız Soyal;* ***Writing the Article:*** *Behiye Deniz Kosovalı, Özlem Balkız Soyal;* ***Critical Review:*** *Nevzat Mehmet Mutlu, Behiye Deniz Kosovalı;* ***References and Fundings:*** *Behiye Deniz Kosovalı, Gül Meral Kocabeyoğlu, Nevzat Mehmet Mutlu;* ***Materials:*** *Behiye Deniz Kosovalı, Özlem Balkız Soyal, Nevzat Mehmet Mutlu.*

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