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ORIGINAL ARTICLE

Clinical Characteristics Predicting Mortality Risk in Hospitalized Geriatric Patients with COVID-19 Pneumonia: a Retrospective Study

Ege Gulec-Balbay [1], M. M. Bekir Altundal [1], M. Kemal Kaypak [1], Sengul Cangur [2], Sare Kaya [3]

[1] *Department of Chest Disease, Duzce University, Duzce, Turkey*
[2] *Department of Biostatistics and Medical Informatics, Duzce University, Duzce, Turkey*
[3] *Department of Microbiology, Duzce University, Duzce, Turkey*

SUMMARY

Background: **Coronavirus disease 2019 (COVID-19) is a global pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Geriatric patients with COVID-19 are more likely to progress to severe disease, and they are at increased risk of hospitalization and mortality. In this study we aimed to investigate the risk factors for predicting mortality in geriatric patients with COVID 19 by reviewing the clinical data of survivors and non-survivors.**

Methods: **This was a retrospective study of 189 geriatric patients with COVID- 19 pneumonia who were hospitalized in pulmonology clinic, in Duzce University, Medical Faculty Hospital between March 2020 and January 2021 in Turkey.**

Results: **In the study, 60.3% (n = 114) of the patients were male and the median age was 75. 80.4% (n = 152) of the patients were discharged. The presence of cardiovascular disease, chronic renal failure, malignancy, increased number of comorbidities, complaints of anorexia, no fever, decreased oxygen saturation value, increased pulse rate, high values of maximum (max) D-dimer, aspartate aminotransferase, urea, creatinine, troponin, lactate dehydrogenase (LDH), max LDH, ferritin and max ferritin, C-reactive protein (CRP), max CRP, procalcitonin, max procalcitonin, potassium values and low albumin values, complications as bacterial infection, cardiac disease, acute respiratory distress syndrome, liver function tests failure, arrhythmia and shock, the need for corticosteroid and pulse corticosteroid therapy increased the mortality. According to multiple logistic regression model, the development of cardiac disease, acute respiratory distress syndrome, bacterial infection, the need for pulse steroids, and the max ferritin value increased the risk of mortality by between 1.001 and 28.715 times.**

Conclusions: **Both clinical and laboratory parameters predicting mortality in geriatric patients with COVID-19 pneumonia should be monitored very carefully. Complications that develop should be evaluated and multidisciplinary and necessary treatments should be initiated without delay.**

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Correspondence:
Ege Gulec-Balbay
Department of Chest Disease
Duzce University
81620 Duzce
Turkey
Phone: +90 5332528794
Fax: +90 3805421387
Email: egegulecbalbay@gmail.com

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KEY WORDS

COVID-19, geriatric, mortality, risk factors

INTRODUCTION

The World Health Organization (WHO) officially declared Coronavirus disease 2019 (COVID-19) a global pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) on March 11, 2020 [1,2].

Age is believed to be a significant determinant of the clinical outcome, severity, and prognosis of the disease [3]. While elderly patients are at high risk of fatality, research concerning COVID-19 has largely been done on clarifying the clinical features. Many reports indicate that geriatric patients with COVID-19 are more likely to progress to severe disease and they are at increased risk of hospitalization and mortality compared to young and middle-aged patients [3-5]. Elderly people with underlying diseases as diabetes, hypertension, cardiovascular disease (CVD), and cerebrovascular disease are more susceptible [3].

Geriatric patients can be very frail due to their chronic age-related diseases. Systemic low-level inflammation is strongly associated with frailty [6]. In a report from Italy, the mean number of pre-existing comorbidities was 2.7 in patients who died with COVID-19 [7]. In another study from United States, deaths were 12 times higher among patients with reported comorbidities (19.5%) compared with those without reported comorbidities [8].

In this study we aimed to investigate and identify the risk factors for predicting mortality in geriatric patients with COVID-19 by reviewing the clinical data of survivors and non-survivors.

MATERIALS AND METHODS

Study Population

This was a retrospective study of 189 geriatric (65 years old or older) patients with COVID-19 pneumonia who were hospitalized in pulmonology clinic, in Duzce University, Medical Faculty Hospital between March 2020 and January 2021, in Turkey. All geriatric patients with COVID-19 pneumonia who were hospitalized and followed up in the pulmonology clinic between these dates were included in the study. Patients followed in the intensive care unit were not included in the study. The characteristics of the study population are shown in Figure 1.

Demographic, clinical, and laboratory data were extracted from electronic medical records. Ethics committee approval was received for this study from the ethics committee of Duzce University (2021-08).

Polymerase chain reaction (PCR) method

Combined nasopharyngeal-oropharyngeal swab, sputum, or tracheal aspirate samples were collected from suspected cases of COVID-19. Nucleic acid extraction was performed manually using Bio-speedy viral nucleic acid extraction buffer (Bioeksen R&D Technologies, Turkey). Real time PCR testing was then performed using a SARS-CoV-2 (2019-nCoV) RT-qPCR detection kit (Bioeksen R&D Technologies, Turkey) and Montania® Real-Time PCR instruments (Anatolia Geneworks, Turkey). PCR test results were evaluated and reported by the laboratory manager.

Data collection

Demographic data, application complaints, comorbidity, medication use (corticosteroid, tocilizumab and antibiotics) were extracted from electronic medical records retrospectively. Blood parameters were recorded on admission, and also the maximum (max) values of C-reactive protein (CRP), lactate dehydrogenase (LDH), D-dimer, procalcitonin and ferritin levels were recorded. Oxygen saturation (SpO2) values and other vital parameters were recorded on admission from the patient files. All patients were managed and treated according to the guidelines of the Ministry of Health of Turkey [9]. The mortality and discharge rates were evaluated.

Statistical analysis

IBM SPSS 22 program was used for statistical evaluations. While categorical variables were given as numbers and percentages, median and interquartile range (IQR) values were calculated for quantitative variables. The normality assumption of continuous quantitative variables was examined using the Shapiro-Wilk test. The Mann-Whitney U test was used for the intergroup comparison of variables that did not provide the parametric test assumptions. Pearson's chi-squared (post hoc Bonferroni test) and Fisher's exact tests were used for comparison of categorical variables. Mantel-Haenszel test statistics and Simple Logistic Regression analysis were applied for the Odds Ratio (OR) predictive values and 95% confidence intervals of all risk factors found to be significant. Backward Wald Binary Logistic Regression analysis was applied to simultaneously examine the effects of each risk factor found significant in univariate analyses on mortality. A p-value below 0.05 was considered statistically significant ($p < 0.05$).

RESULTS

In the study including a total of 189 patients with COVID-19 pneumonia, 60.3% (n = 114) were male and 39.7% (n = 75) were female. The median age was 75 [IQR: 11]. All patients were classified following WHO severity classification at admission [10]. Among the patients, 67 (35.4%) were moderate, 79 (41.8%) were severe, and 43 (22.8%) were critical (Figure 1). The COVID-19 PCR tests were positive in 72.9% of the patients. While 80.4% (n = 152) of the patients were discharged, 19.6% (n = 37) of them died. Gender and age distributions of the patients were homogeneous according to the last status ($p = 0.528$, $p = 0.314$). The most common comorbidities are hypertension (76.7%), CVD (48.7%) and chronic obstructive lung disease (19.6%). The distribution of patients with non-survivors and discharged COVID-19 pneumonia according to their comorbidities is given in Table 1. No significant difference was found in terms of all comorbidities except CVD, chronic renal failure (CRF), presence of malignancy, and the number of comorbidities in non-survivors and survivors ($p > 0.05$) Table 1. In patients with

Table 1. Comorbidities and clinical presentation in patients with COVID-19 pneumonia.

Comorbidities		Non-survivors n (%)	Survivors n (%)	Total n (%)	p	OR (95% CI)
Diabetes	yes/no	17 (45.9)/20 (54.1)	54 (35.5)/98 (64.5)	71 (37.6)/ 118 (62.4)	0.241	
Hypertension	yes/no	28 (75.7)/9 (24.3)	117 (77)/35 (23)	145 (76.7)/ 44 (23.3)	0.867	
CVD	yes/no	24 (64.9)/13 (35.1)	68 (44.7)/84 (55.3)	92 (48.7)/97 (51.3)	0.028	2.281 (1.081 - 4.813)
CeVD	yes/no	6 (16.2)/31 (83.8)	16 (10.6)/135 (89.4)	22 (11.7)/166 (88.3)	0.391	
CRF	yes/no	13 (35.1)/24 (64.9)	20 (13.2)/132 (86.8)	33 (17.5)/156 (82.5)	0.002	3.575 (1.570 - 8.138)
CLD	yes/no	1 (2.7)/36 (97.3)	1 (0.7)/151 (99.3)	2 (1.1)/187 (98.9)	0.354	
COPD	yes/no	9 (24.3)/28 (75.7)	28 (18.4)/124 (81.6)	37 (19.6)/152 (80.4)	0.417	
Asthma	yes/no	3 (8.1)/34 (91.9)	12 (7.9)/140 (92.1)	15 (7.9)/174 (92.1)	0.999	
Malignancy	yes/no	8 (21.6)/29 (78.4)	12 (7.9)/140 (92.1)	20 (10.6)/169 (89.4)	0.031	3.218 (1.208 - 8.574)
Comorbidity	yes/no	35 (94.6)/2 (5.4)	143 (94.1)/9 (5.9)	178 (94.2)/11 (5.8)	0.999	
Number of comorbidities *		3 [2]	2 [2]	2 [2]	0.002	1.515 (1.155 - 1.987)
Clinical presentation						
Fever	yes/no	2 (5.7)/33 (94.3)	35 (23.3)/ 115 (76.7)	37 (20)/148 (80)	0.019	0.199 & (0.045 - 0.872)
Cough	yes/no	24 (66.7)/12 (33.3)	96 (64)/54 (36)	120 (64.5)/66 (35.5)	0.764	
Sputum	yes/no	20 (55.6)/16 (44.4)	61 (40.7)/89 (59.3)	81 (43.5)/105 (56.5)	0.106	
Anorexia	yes/no	13 (36.1)/23 (63.9)	28 (18.8)/121 (81.2)	41 (22.2)/144 (77.8)	0.025	2.443 (1.103 - 5.407)
Dyspnea	yes/no	30 (81.1)/7 (18.9)	98 (65.3)/52 (34.7)	128 (68.4)/59 (31.6)	0.065	
Diarrhea	yes/no	0 (0)/37 (100)	2 (1.3) 148 (98.7)	2 (1.1)/185 (98.9)	0.999	
Nausea	yes/no	3 (8.1)/34 (91.9)	13 (8.7)/137 (91.3)	16 (8.6)/171 (91.4)	0.999	
Chest pain	yes/no	6 (16.2)/31 (83.8)	15 (10.1)/134 (89.9)	21 (11.3)/165 (88.7)	0.381	
Headache	yes/no	2 (5.4)/35 (94.6)	9 (6)/141 (94)	11 (5.9)/176 (94.1)	0.999	
SpO_2 *		83 [6]	87.5 [10]	86 [11]	< 0.001	0.922 & (0.881 - 0.966)
Fever *		36.5 [0.2]	36.5 [0.4]	36.5 [0.3]	0.139	
Pulse *		92 [25]	90 [19]	90.0 [18]	0.011	1.033 (1.012 - 1.054)
SBP *		130 [24]	130 [24]	130.0 [23]	0.727	
DBP *		71 [16]	75 [13]	75.0 [15]	0.072	

*** - Median [Interquartile Range], OR - odds ratio, CI - confidence interval, CVD - cardiovascular disease, CeVD - cerebrovascular disease, CRF - chronic kidney disease, CLD - chronic liver disease, COPD - chronic obstructive lung disease, SpO2 - oxygen, SBP - systolic blood pressure, DBP - diastolic blood pressure, & - inverse effect, saturation.**

COVID-19 pneumonia, the presence of CVD, CRF, malignancy and increased number of comorbidities increased the mortality risk by 1.515 to 3.575 times.

The most common presenting symptoms are dyspnea (68.4%), cough (64.5%) and sputum (43.5%). The distribution of patients COVID-19 pneumonia according to their clinical findings is shown in Table 1. No significant difference was found between non-survivors and survivors in terms of all clinical findings except the presence of fever, anorexia, SpO_2, and pulse values ($p > 0.05$) Table 1. Patients with COVID-19 pneumonia had complaints of anorexia, no fever, decreased SpO_2 value, increased pulse rate, and the mortality risk increased by 1.033 to 5.025 (1/0.199) times.

Max D-dimer, aspartate aminotransferase (AST), urea, creatinine, troponin, LDH, max LDH, ferritin, max ferritin, CRP, max CRP, procalcitonin, max procalcitonin, except for albumin and potassium values, showed no significant difference between the laboratory findings of those non-survivors and survivors ($p > 0.05$) Table 2. In patients with COVID-19 pneumonia, high values of max D-dimer, AST, urea, creatinine, troponin, LDH, max LDH, ferritin and max ferritin, CRP, max CRP, procalcitonin, max procalcitonin, potassium values, and low albumin values increased the mortality risk by 1.001 to 2.976 (1/0.336) times (Table 2).

The distribution of the patients according to complications and additional treatments required during the period of hospitalization is given in Table 3. Bacterial infection, cardiac disease, acute respiratory distress syndrome (ARDS), liver function tests (LFT) failure, arrhythmia and shock, and the need for corticosteroid and

Table 2. Laboratory findings in patients with COVID-19 pneumonia.

	Non-survivors	Survivors	Total	p	OR (95% CI)
	Median [IQR]	Median [IQR]	Median [IQR]		
D-dimer	1.1 [1.7]	0.8 [1.1]	0.8 [1.2]	0.080	
$D\text{-dimer}_{max}$	6.3 [15.3]	1.2 [1.7]	1.4 [2.9]	< 0.001	1.161 (1.092 - 1.234)
AST	39 [42]	29 [18.6]	32.3 [21.7]	0.002	1.002 (1.000 - 1.008)
ALT	23.4 [19.5]	18 [15.5]	19.5 [15.9]	0.149	
Urea	60.7 [41]	42.8 [29.1]	44.2 [30.3]	0.003	1.014 (1.003 - 1.024)
Creatinine	1.2 [0.8]	1 [0.5]	1.0 [0.5]	0.013	1.432 (1.000 - 2.129)
Creatine kinase	103 [134]	92.5 [116]	93.0 [124]	0.585	
Creatine kinase-MB	31 [39]	28.2 [22]	29.0 [25]	0.297	
Troponin	0.11 [0.19]	0 [0.11]	0 [0.12]	0.005	1.401 (1.001 - 2.225)
LDH	440 [299]	337.5 [159]	360.0 [197]	0.001	1.004 (1.002 - 1.006)
LDH_{max}	691 [387]	350 [195]	389.5 [272]	< 0.001	1.007 (1.005 - 1.009)
Ferritin	604 [649]	330.3 [433]	362.0 [500.9]	0.001	1.001 (1.000 - 1.002)
$Ferritin_{max}$	873 [1,043]	379.5 [476]	448.0 [561.6]	< 0.001	1.001 (1.000 - 1.002)
CRP	10.2 [10.9]	7.1 [10.8]	7.9 [10.3]	0.004	1.025 (1.000 - 1.062)
CRP_{max}	17.1 [9.6]	9.2 [11]	10.8 [12]	< 0.001	1.080 (1.041 - 1.120)
Procalcitonin	0.3 [0.3]	0.1 [0.2]	0.1 [0.3]	0.004	1.007 (1.002 - 1.065)
$Procalcitonin_{max}$	0.8 [2.6]	0.1 [0.3]	0.2 [0.5]	< 0.001	1.150 (1.039 - 1.272)
Albumin	3.3 [0.4]	3.6 [0.6]	3.5 [0.6]	0.005	0.336 [&] (0.148 - 0.766)
Total protein	6.7 [0.7]	6.8 [0.7]	6.8 [0.7]	0.818	
Sodium	135 [8]	135.0 [6]	135.0 [6]	0.651	
Potassium	4.4 [0.8]	4.3 [0.7]	4.3 [0.8]	0.020	1.774 (1.030 - 3.058)
Calcium	8.7 [0.6]	8.7 [0.6]	8.7 [0.6]	0.968	
Magnesium	2 [0.4]	2 [0.4]	2.0 [0.4]	0.769	
WBC	7.9 [6.4]	7.6 [5.1]	7.6 [5.3]	0.465	
Neutrophil	7.1 [6]	5.7 [4.9]	6 [5.1]	0.101	
Lymphocyte	0.86 [0.46]	0.93 [0.71]	0.9 [0.61]	0.060	
Monocyte	0.45 [0.38]	0.47 [0.34]	0.46 [0.35]	0.317	
Eosinophil	0.01 [0.03]	0.01 [0.05]	0.01 [0.04]	0.711	
Thrombocyte	212 [143]	205 [108.5]	205 [112]	0.955	
Hemoglobin	11.9 [2.3]	12.6 [2.3]	12.5 [2.4]	0.087	
PT	10.9 [2.4]	10.8 [3.3]	10.8 [3.2]	0.870	
INR	1.2 [0.3]	1.2 [0.3]	1.2 [0.3]	0.859	
aPTT	34.9 [8.1]	33.4 [11]	33.6 [10.1]	0.446	

*** - Median [Interquartile Range], OR - odds ratio, CI - confidence interval, [&] - inverse effect, max - maximum, AST - aspartate aminotransferase; ALT - alanine aminotransferase, LDH - lactate dehydrogenase, CRP - C-reactive protein, WBC - white blood cell, PT - prothrombin time, INR - international normalized ratio, aPTT - activated partial thromboplastin time.**

pulse corticosteroid therapy increased the mortality risk by 5.423 to 869.167 times during the hospitalization in patients with COVID-19 pneumonia.

As a result of univariate analysis, odds ratio (95% CI) values of clinical and laboratory findings affecting mortality in patients with COVID-19 pneumonia are as in Figure 1. The Backward Wald multiple logistic regression model and model significance information, which were obtained by taking all the clinical and laboratory findings affecting mortality in patients with COVID-19 pneumonia, are given in Table 5. This model correctly classifies patients with COVID-19 pneumonia (survivors and non-survivors) at a rate of 93.3%. According to this model, in patients with COVID-19 pneumonia, the

Table 3. Complications and additional treatments required.

		Non-survivors n (%)	Survivors n (%)	Total n (%)	p	OR (95% CI)
Bacterial infection	**yes/no**	**20 (54.1)/17 (45.9)**	**23 (15.2)/128 (84.8)**	**43 (22.9)/145 (77.1)**	**< 0.001**	**6.547 (2.989 - 14.344)**
Cardiac disease	**yes/no**	**30 (81.1)/7 (18.9)**	**14 (9.2)/138 (90.8)**	**44 (23.3)/145 (76.7)**	**< 0.001**	**42.245 (15.706 - 113.631)**
ARDS	**yes/no**	**24 (64.9)/13 (35.1)**	**9 (5.9)/143 (94.1)**	**33 (17.5)/156 (82.5)**	**< 0.001**	**29.333 (11.304 - 76.117)**
LFT failure	**yes/no**	**11 (29.7)/26 (70.3)**	**11 (7.2)/141 (92.8)**	**22 (11.6)/167 (88.4)**	**< 0.001**	**5.423 (2.130 - 13.808)**
Arrhythmia	**yes/no**	**35 (94.6)/2 (5.4)**	**3 (2)/149 (98)**	**38 (20.1)/151 (79.9)**	**< 0.001**	**869.167 (139.890 - 5,400.318)**
Shock	**yes/no**	**37 (100)/0 (0)**	**2 (1.3)/150 (98.7)**	**39 (20.6)/150 (79.4)**	**< 0.001**	**-**
Corticosteroid	**yes/no**	**34 (91.9)/3 (8.1)**	**98 (64.5)/54 (35.5)**	**132 (69.8)/57 (30.2)**	**0.001**	**6.245 (1.832-21.286)**
Pulse corticosteroid	**yes/no**	**23 (62.2)/183 (97.3)**	**26 (17.1)/126 (82.9)**	**49 (25.9)/140 (74.1)**	**< 0.001**	**7.962 (3.624-17.493)**
Tocilizumab	**yes/no**	**2 (5.4)/35 (94.6)**	**3 (2)/148 (98)**	**5 (2.7)/183 (97.3)**	**0.255**	
Antibiotic	**yes/no**	**34 (91.9)/3 (8.1)**	**138 (90.8)/14 (9.2)**	**172 (91)/17 (9)**	**0.999**	

OR - odds ratio, CI - confidence interval, LFT - liver function tests, ARDS - acute respiratory distress syndrome.

Table 4. The results of Backward Wald multiple logistic regression model.

	B	SE	Wald	df	p	OR	95% CI for OR	
							Lower	Upper
Constant	**-5.552**	**0.935**	**35.274**	**1**	**< 0.001**	**0.004**		
Cardiac disease (+)	**3.357**	**0.677**	**24.609**	**1**	**< 0.001**	**28.715**	**7.621**	**108.192**
ARDS (+)	**1.925**	**0.656**	**8.604**	**1**	**0.003**	**6.853**	**1.894**	**24.801**
Pulse corticosteroid (+)	**1.708**	**0.676**	**6.381**	**1**	**0.012**	**5.518**	**1.466**	**20.767**
Bacterial infection (+)	**1.546**	**0.688**	**5.050**	**1**	**0.025**	**4.695**	**1.219**	**18.090**
$Ferritin_{max}$	**0.001**	**0.001**	**4.952**	**1**	**0.026**	**1.001**	**1.000**	**1.002**
Model's Significance and Fit	**χ^2 = 114.362 df = 4 p < 0.01 Nagelkerke R^2 = 0.74 χ^2_{HL} = 5.047 df = 8 p = 0.753**							

B - regression coefficient, SE - standard of error, OR - odds ratio, CI - confidence interval, df - degree of freedom, HL - Hosmer Lemeshow test.

development of cardiac disease, ARDS, bacterial infection, the need for pulse steroids and the max ferritin value increased the risk of mortality by between 1.001 and 28.715 times.

DISCUSSION

This study investigated the risk factors for predicting mortality in geriatric patients with COVID-19 pneumonia. Many studies have shown that older age is associated with increased mortality [7,11-13]. The mortality rate of our geriatric patients (65 years or older) was 19.6%.

A recent multicenter study about the predictors of COVID-19 mortality in a nationwide cohort of Turkish patients was reported. In that study group of 1,500 patients, death occurred in 67 patients corresponding to a mortality rate of 4.5%. Various factors, including male gender and age ≥ 65 years were positively associated with mortality [14]. In a study from China, the mortality rates were 8% and 15% in patients aged 70 - 79 years and 80 years or older, respectively [11].

In our study, no significant difference was found between mortality and gender. A study aimed to identify potential risk factors for mortality in older patients with coronavirus disease COVID-19 on admission, found no significant relationship between gender and mortality like our study [15]. In a study from Turkey mortality rate was higher in male patients than female patients [16]. In a meta-analysis by Becham et al., although there was no difference in the proportion of males and females with COVID-19, males had higher mortality rates (OR = 1.39; 95% CI: 1.31, 1.47) compared to fe-

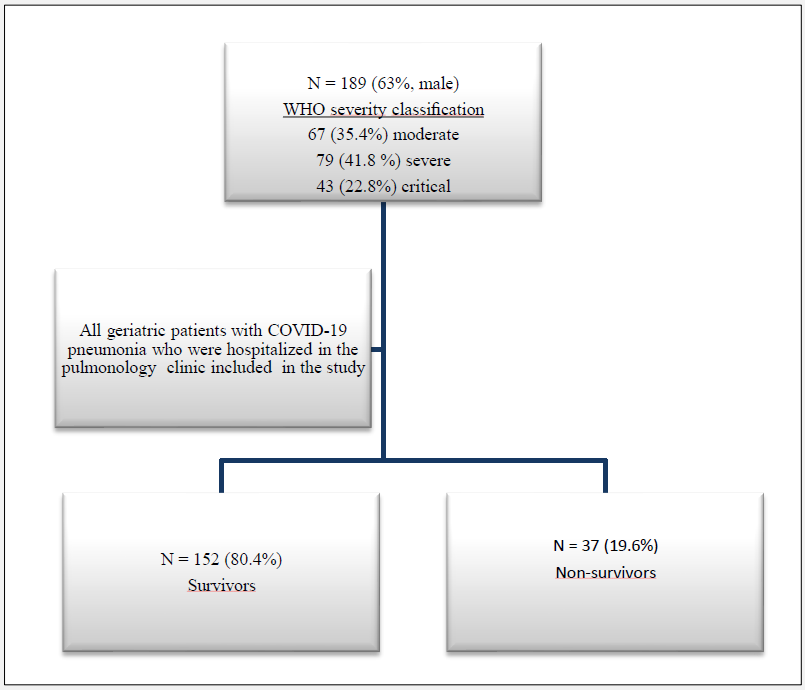

Figure 1. Characteristics of the study population.

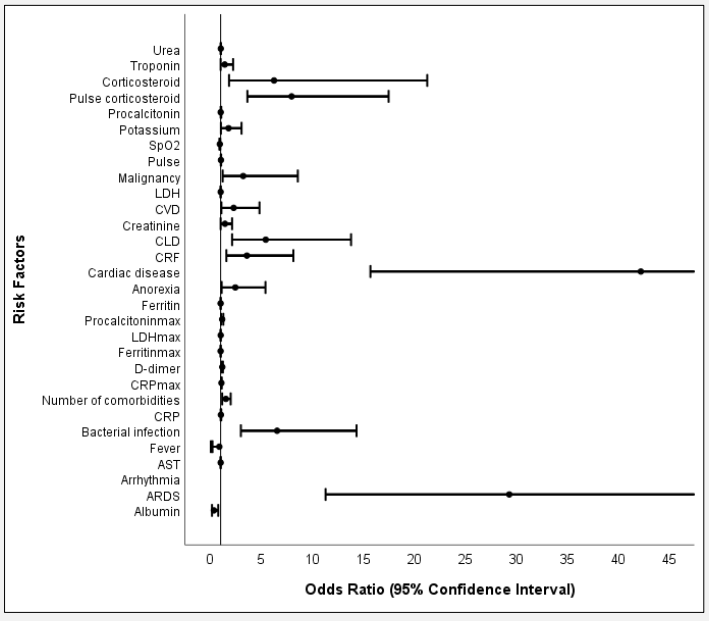

Figure 2. The plot of odd ratios along with the corresponding 95% confidence intervals for risk factors.

SpO_2 - oxygen saturation, LDH - lactate dehydrogenase, CVD - cardiovascular disease, CLD - chronic liver disease, CRF - chronic renal failure, max: maximum, CRP - C-reactive protein, AST - aspartate aminotransferase, ARDS - acute respiratory distress syndrome.

males [17]. A study aimed to identify potential risk factors for mortality in older patients with coronavirus disease COVID-19 on admission, found no significant relationship between gender and mortality like our study [15].

Comorbidities that are defined as having a significant association with risk of severe COVID-19 illness are cancer, cerebrovascular disease, chronic kidney disease, COPD (chronic obstructive pulmonary disease), diabetes mellitus, heart conditions (such as heart failure, coronary artery disease, or cardiomyopathies), obesity (BMI $\geq$ 30 kg/m^2) [18]. In our study, the presence of CVD, CRF, and malignancy increased the risk of mortality in patients with COVID-19 pneumonia. Also, the increase in the number of comorbidities was significantly associated with mortality (OR = 1.515, 95% CI: 1.155 - 1.987, p = 0.002). A meta-analysis of observational studies that analyzed the risk factors for mortality in patients with COVID-19 infection found that hypertension, CVDs, diabetes, COPD, and malignancies were associated with greater risk of death from COVID-19 infection [19].

A study of 159 hospitalized geriatric patients with COVID-19 found that dyspnea was more commonly seen in deceased patients as in the present study. Moreover, the authors speculated that the prominent fever in surviving patients was likely due to the lower baseline body temperature observed in elderly which translated to a lower maximum temperature of fever [20]. Similarly, the absence of fever symptoms was associated with an increased risk of mortality in our study. In contrast to the present study, a retrospective cohort study of 103 ventilated COVID-19 patients discharged from the ICU or who died were included. They identified ICU hyperthermia as predictive of mortality [21]. An observational study that investigated the body temperature at the emergency department as a predictor of mortality in patients with bacterial infection found that hypothermia was associated with increased risk for 30-day in-hospital mortality [22]. Based on this, it is not surprising that the prevalence of bacterial infection was higher in patients who did not survive in our study. Furthermore, when defining a COVID-19 case in geriatric patients, it should be kept in mind that fever complaints may not be present. Some patients with COVID-19 also experienced gastrointestinal symptoms, such as anorexia, nausea, vomiting, diarrhea. The incidence of anorexia was 38.8% and also occurred frequently in a meta-analysis of 3,062 COVID-19 patients [23]. Significant difference and increased the mortality risk was found between non-survivors and survivors for anorexia in our study.

There are many biochemical and hematological laboratory parameters that have been shown to be associated with mortality in COVID-19 [24-25]. We also investigated laboratory predictors in this study. Laboratory predictors of mortality in geriatric COVID-19 patients were, high D-dimer$_{max}$, LDH, LDH$_{max}$, ferritin and ferritin$_{max}$, CRP, CRP$_{max}$, procalcitonin, procalcitonin$_{max}$, potassium values, and low value of albumin in our study.

The most prominent tissue damage marker associated with mortality in COVID-19 is lactate dehydrogenase (LDH). The increased LDH reflects the tissue destruction and is regarded as a sign of lung damage in pneumonia induced by SARS-CoV-2 [25]. In our study LDH (OR = 1.004, 95% CI: 1.002 - 1.006) and LDH$_{max}$ (OR = 1.007, 95% CI: 1.005 - 1.009) were the predictors of mortality in COVID-19 patients.

Using the Backward Wald multiple logistic regression, it was determined that the highest value of ferritin was associated with mortality in our study. Serum ferritin is a biomarker of iron deficiency and also an acute-phase-protein exhibiting elevated serum concentration in various inflammatory diseases. As in our study, serum ferritin was described to be relevant for assessing the disease severity and mortality in patients with COVID-19 in many studies [25,27].

High D-dimer levels have been associated with mortality in geriatric patients hospitalized with COVID-19 similar to our study [15]. Studies have shown that the risk of both arterial and venous thrombosis increases in relation to the severity of the disease [25,28].

Concerning the inflammatory markers associated with the COVID-19, a meta-analysis observed higher levels of CRP and procalcitonin among severe and expired patients with COVID-19 [27]. In our study CRP, procalcitonin and bacterial infection were the predictors of mortality in patients with COVID-19 pneumonia.

Increases in liver and kidney function test levels were observed prominently in severe and mortal cases. Similarly, hypoalbuminemia is common in severe cases [25, 28]. Liver and kidney function test failures and also hypoalbuminemia increased mortality in our study.

A study reviewing the clinical features of COVID-19 in elderly patients found significant difference in the prevalence of ARDS, acute heart, liver and kidney function injuries between young and middle-aged, and elderly patients [3]. Complications such as cardiac disease, arrhythmia and shock, and ARDS increased mortality in our study. Major complications during hospitalization including ARDS, arrhythmia, and shock in patients with severe disease were shown in the study of 138 patients [30].

In our study, mortality was higher in geriatric patients who were given steroid and pulse steroid therapy. In line with the guidance recommendations of our Ministry of Health for patients who needed oxygen therapy, 6 mg dexamethasone or 0.5 - 1 mg/kg prednisolone treatment was initiated, and in patients whose need for oxygen therapy or acute phase reactants increased within 24 hours despite this treatment, pulse steroid (250 mg/kg/day, methyl prednisolone) treatment was given [9].

The limitations of our study were that it was a retrospective study in a single center with a limited number of patients in each group. All data extracted from electronic medical records retrospectively may be lacking. Our study needs to be supported by prospective studies.

CONCLUSION

In this single-center study of 198 hospitalized geriatric patients with COVID-19 pneumonia mortality was 19.6%. As determined in many studies, we determined many parameters that can predict mortality in our study. Both clinical and laboratory parameters predicting mortality in geriatric patients with COVID-19 pneumonia should be monitored very carefully. Complications that develop should be evaluated by a multidisciplinary approach and necessary treatments should be initiated without delay.

Declaration of Interest:
The authors have no conflict of interest to declare.

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