



Effects of Comorbid Factors on Prognosis of Three Different Geriatric Groups with COVID-19 Diagnosis

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Abstract

Coronavirus disease 2019 (COVID-19) is a new zoonotic infectious disease that was first reported to the World Health Organization (WHO) on December 31, 2019, and declared as a pandemic by WHO on March 11, 2020. Due to the increased incidence of multimorbidity in geriatric age groups, COVID-19 disease leads to more severe consequences in the elderly. We aimed to determine the effects of age, comorbidity factors, symptoms, laboratory findings, and radiological results on prognosis by dividing our patients into 3 different geriatric age groups, using a retrospective descriptive analysis method. Patients included in the retrospective study ($n = 483$) were divided into the following three different geriatric age groups: young-old (65–74 years), middle-aged (75–84 years), and the oldest-elderly (85 years and over). The length of stay in the intensive care unit of the patients between the ages of 75–84 was higher than the other two groups ($p = 0.013$). Mortality rates were lowest in patients aged 65–74 years ($p < 0.001$). The rate of ground glass opacity in thorax CT was higher in patients with mortality ($p < 0.001$). While the rate of COPD-bronchial asthma was higher in surviving patients ($p = 0.001$), malignancy ($p = 0.005$) and cerebrovascular disease ($p < 0.001$) were higher in patients who died. Patients aged between 75 and 84 (OR: 2.602; 95% CI: 1.306–5.183; $p = 0.007$) or ≥ 85 (OR: 4.086; 95% CI: 1.687–9.9; $p = 0.002$) had higher risk for mortality compared to patients aged between 65 and 74. The lowest mortality rates were observed in patients aged 65–74 years. Among the supportive diagnostic methods in 3 different geriatric age groups, PCR positivity has no effect on mortality, while the ground glass opacity on tomography is closely related to the need for intensive care and increased mortality. In patients with COPD-bronchial asthma comorbidity and those with symptoms of fatigue, dry cough, and sore throat, transfer to intensive care and mortality rates were lower, while patients who were transferred to intensive care and who developed mortality had higher malignancy and cerebrovascular disease comorbidities and dyspnea symptoms.

Keywords COVID-19 · SARS-CoV-2 · Coronavirus · Intensive care units · Geriatrics · Real-time polymerase chain reaction · Tomography · Death · Prognosis

Introduction

Coronavirus disease 2019 (COVID-19) is a new zoonotic infectious disease that was first reported to the World Health Organization (WHO) on December 31, 2019, and was declared as a pandemic by WHO on March 11, 2020 [1]. COVID-19 continues to disproportionately affect older adults, with severe patient losses, from hospitalization to increased risk of death, causing severe illness [2]. The COVID-19 pandemic has affected millions of people in more than 180 regions, and patients diagnosed with cancer, as well as older adults, appear to be particularly vulnerable to the morbidity and mortality associated with COVID-19, meaning that older adults with cancer constitute a particularly high-risk population [3]. Elderly patients with head and neck cancer can be

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expected to have significantly higher COVID-19 severity and mortality [4]. Although most people infected with SARS-CoV-2 have the potential of recovery, mortality in those who develop severe disease increases with the presence of multimorbidity and with comorbidity in the elderly [5, 6]. Higher rates of morbidity and mortality in the elderly have been associated with accompanying comorbidities, particularly cardiovascular disease, and weakness and physiological weakness that weaken the immune response [6]. Vitamin D deficiency is more common in the elderly population, and this considerably increases mortality [7]. Advances in various diagnostic approaches such as real-time polymerase chain reaction (rRT-PCR), chest radiography, and computed tomography (CT) imaging and other modern diagnostic methods for this infection have been emphasized [8]. In line with this information, we planned this study to determine the important effects of age, comorbidity factors, symptoms, laboratory findings, and radiological results on prognosis of patients with COVID-19 symptoms in 3 different geriatric age groups.

Materials and Methods

Patient Population

This study was conducted in accordance with the Declaration of Helsinki from March 2020 to June 2020 after obtaining approval from the Institutional Ethics Committee (Date of Approval-Protocol No: 03.06.2020-7/8).

This study was conducted as a single-center retrospective descriptive study by scanning the electronic health record system (SARUS) data and patient files of 483 geriatric patients aged 65 and over with COVID-19 symptoms among 3628 patients who applied to our level 3 hospital with COVID-19 symptoms. Among this group, 483 patients aged 65 and over, 278 (57.6%) consisting of women, were included into the study. Three thousand one hundred forty-five patients were excluded because they were under 65 years old. During the study period, patients aged 65 years and over who were admitted to our hospital but did not have COVID-19 symptoms were not included in the study.

Assessment

Patients included in the study ($n = 483$) were grouped into the following three different geriatric age groups: young-old (65–74 years), middle-old (75–84 years), and oldest-old (85 years and above). Among the sample patient group, 7.7% (280) were 65–74, 3.7% (133) were 75–84, and 1.9% (70) were 85 and over. In the patient group, we identified fever, fatigue, dry cough, sore throat, shortness of breath, chest pain, headache, dizziness, diarrhea, and nausea-vomiting as symptoms of COVID-19. Hypertension (HT), diabetes mellitus (DM),

chronic obstructive pulmonary disease (COPD), bronchial asthma, malignancy, cardiovascular disease, cerebrovascular disease, chronic kidney failure, chronic liver disease, heart failure, and hyperlipidemia were evaluated.

Analysis of comorbidity factors, symptoms, laboratory findings and radiological findings, and their effect on prognosis were evaluated in 3 different geriatric age groups with COVID-19 symptoms.

Statistical Analysis

Statistical analysis was made using IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, NY). The normality assumptions were controlled by the Shapiro–Wilk test. Descriptive analyses were presented using mean \pm SD, median (range), or n (%), where appropriate. Categorical data were analyzed by Pearson chi-square and Fisher's exact test. Mann–Whitney U test and Student's t test were used for analysis of non-normally and normally distributed numerical data, respectively. The Kruskal–Wallis test was used for comparison of non-parametric variables between groups, and the Bonferroni–Dunn test was used as a post hoc test for significant cases, while one-way ANOVA with post hoc Tukey HSD test was used for parametric variables. The receiver operating characteristic (ROC) curve analysis was applied to determine optimal cutoff point of age and CRP for mortality, and area under the curve (AUC), sensitivity, and specificity were calculated and reported with 95% confidence intervals. Multivariate logistic regression analysis was used to determine independent risk factors associated with mortality. Odds ratio (OR) with corresponding 95% confidence intervals (95% CIs) was reported. A p value of less than 0.05 was considered statistically significant.

Results

In a total of 3628 COVID-19 symptomatic patients, 13.3% (483) were in the geriatric group, 7.7% (280) of them were 65–74, 3.7% (133) were 75–84, and 1.9% (70) were 85 and over.

The average age of 483 patients with COVID-19 symptoms was 74.4 ± 7.94 . 42.4% (205) of the patients were male and 57.6% (278) were female. There was no significant difference in gender distribution by age groups ($p = 0.366$).

For diabetes mellitus ($p = 0.250$), COPD-bronchial asthma ($p = 0.572$), malignancy ($p = 0.101$), chronic renal failure ($p = 0.482$), chronic liver disease ($p = 0.083$), heart failure ($p = 0.288$), and hyperlipidemia ($p = 0.850$), no significant difference was observed in terms of their incidence rates.

The incidence of hypertension was higher in patients aged 75–84 (84.2%) compared to patients aged 65–74 years (61.1%) and 85 and over (68.6%) ($p < 0.001$).

The incidence of cardiovascular disease was higher in patients aged 75–84 (47.4%) compared to patients aged 65–74 (34.6%) ($p = 0.044$).

The incidence of cerebrovascular disease in patients aged 75–84 years (29.3%) was higher than patients aged 65–74 years (14.6%) and 85 years of age (15.7%) ($p < 0.001$).

Symptoms of fever ($p = 0.021$), weakness ($p = 0.001$), sore throat ($p < 0.001$), dizziness ($p = 0.001$), and myalgia ($p < 0.001$) were higher in patients aged 85 years and older.

While the frequency of dyspnea was lower in patients aged 65–74 years compared to other age groups ($p = 0.020$), the rate of chest pain was higher ($p = 0.020$).

It was determined that there was no significant difference between the age groups in terms of the incidence of dry cough ($p = 0.186$), headache ($p = 0.190$), diarrhea ($p = 0.154$), nausea-vomiting ($p = 0.974$), and no smell-taste ($p = 0.583$) (Table 1).

Although the rate of non-invasive mechanical ventilation was higher in patients aged 75–84 years, this difference was not statistically significant ($p = 0.065$).

The rate of using invasive mechanical ventilation was lower in patients aged 65–74 years compared to the other two age groups ($p < 0.001$).

The highest rate of patients discharged from the emergency department was observed in patients between the ages of 65–74, while the rate of admission to intensive care was highest in patients aged 75–84 years and over 85 years ($p < 0.001$).

The rate of patients transferred from service to intensive care was similar in all age groups ($p = 0.109$).

There was no significant difference in terms of length of stay of the patients hospitalized in the ward according to age groups ($p = 0.275$).

Table 1 Demographic characteristics of the patients

	Total (n: 483)	65–74 (n: 280)	75–84 (n: 133)	85 and over (n: 70)	<i>p</i>
Prevalence (n: 3628)	13.3%	7.7%	3.7%	1.9%	–
Age	74.4 ± 7.94	68.65 ± 2.85 ^a	79.32 ± 2.76 ^b	88.29 ± 2.6 ^c	< 0.001
Gender					
Female	205 (42.4)	112 (40)	63 (47.4)	30 (42.9)	0.366
Male	278 (57.6)	168 (60)	70 (52.6)	40 (57.1)	
The comorbidities					
Hypertension	331 (68.5)	171 (61.1) ^a	112 (84.2) ^b	48 (68.6) ^a	< 0.001
Diabetes mellitus	149 (30.8)	83 (29.6)	48 (36.1)	18 (25.7)	0.250
COPD-asthma-bronchitis	186 (38.5)	111 (39.6)	52 (39.1)	23 (32.9)	0.572
Malignancy	75 (15.5)	49 (17.5)	21 (15.8)	5 (7.1)	0.101
Cardiovascular disease	186 (38.5)	97 (34.6) ^a	63 (47.4) ^b	26 (37.1) ^{a,b}	0.044
Cerebrovascular disease	91 (18.8)	41 (14.6) ^a	39 (29.3) ^b	11 (15.7) ^a	0.001
Chronic renal failure	44 (9.1)	23 (8.2)	12 (9)	9 (12.9)	0.482
Chronic liver disease	17 (3.5)	14 (5)	3 (2.3)	0 (0)	0.083
Heart failure	63 (13)	31 (11.1)	22 (16.5)	10 (14.3)	0.288
Hyperlipidemia	12 (2.5)	6 (2.1)	4 (3)	2 (2.9)	0.850
The symptoms					
Fever	235 (48.7)	122 (43.6) ^a	71 (53.4) ^{a,b}	42 (60) ^b	0.021
Weakness	232 (48)	133 (47.5) ^a	52 (39.1) ^a	47 (67.1) ^b	0.001
Dry cough	234 (48.4)	136 (48.6)	58 (43.6)	40 (57.1)	0.186
Throat ache	189 (39.1)	115 (41.1) ^a	34 (25.6) ^b	40 (57.1) ^c	< 0.001
Shortness of breath	278 (57.7)	146 (52.3) ^a	87 (65.4) ^b	45 (64.3) ^b	0.020
Chest pain	51 (10.6)	38 (13.6) ^a	11 (8.3) ^{a,b}	2 (2.9) ^b	0.020
Headache	61 (12.6)	39 (13.9)	11 (8.3)	11 (15.7)	0.190
Dizziness	38 (7.9)	16 (5.7) ^a	9 (6.8) ^a	13 (18.6) ^b	0.001
Diarrhea	17 (3.5)	10 (3.6)	7 (5.3)	0(0)	0.154
Nausea and vomiting	32 (6.6)	18 (6.4)	9 (6.8)	5 (7.1)	0.974
Myalgia	93 (19.3)	45 (16.1) ^a	11 (8.3) ^a	37 (52.9) ^b	< 0.001
Inability to taste and smell	5 (1)	4 (1.4)	1 (0.8)	0 (0)	0.583

Data are presented as mean ± SD or *n* (%). ANOVA, Pearson chi-square test. Different lowercase letters in a row indicate statistically significant difference between groups

The length of stay in the intensive care unit of the patients between the ages of 75–84 was higher than the other two groups ($p = 0.013$).

Mortality rates were lowest in patients aged 65–74 years ($p < 0.001$).

It was determined that the mortality development time of the patients aged 85 years and over was lower than the other two age groups ($p = 0.040$) (Table 2).

The mean age of patients hospitalized in intensive care was higher than those who were not hospitalized ($p < 0.001$). There was no difference in terms of gender distribution according to intensive care admission ($p = 0.919$). There was no significant difference in the incidence of HT ($p = 0.147$), DM ($p = 0.082$), cardiovascular disease ($p = 0.391$), chronic lung disease ($p = 0.999$), heart failure ($p = 0.084$), and hyperlipidemia ($p = 0.741$).

While the frequency of COPD-bronchial asthma comorbidity was higher in patients not admitted to intensive care ($p = 0.002$), malignancy ($p = 0.004$), cerebrovascular disease ($p < 0.001$), and chronic renal failure ($p < 0.001$) were higher in patients hospitalized in intensive care.

While the rate of weakness ($p = 0.006$), dry cough ($p = 0.001$), and sore throat symptoms was higher in patients not admitted to intensive care, shortness of breath ($p < 0.001$) and dizziness ($p = 0.038$) were higher in patients admitted to intensive care.

According to ICU admission, there were no differences in terms of rates of fever ($p = 0.331$), chest pain ($p = 0.772$), headache ($p = 0.486$), diarrhea ($p = 0.560$), nausea-vomiting ($p = 0.855$), myalgia ($p = 0.877$), and odor-taste loss ($p = 0.595$).

The rate of ground glass opacity on tomography was higher in patients hospitalized in intensive care ($p < 0.001$).

There was no significant difference in terms of positivity of the 1st, 2nd, and 3rd PCR tests according to the hospitalization of the patients in intensive care ($p = 0.578$, $p = 0.492$, $p = 0.999$, respectively) (Table 3).

The mean age of the patients who died was higher than those without ($p < 0.001$). There was no difference in gender distribution according to mortality ($p = 0.734$).

There was no significant difference in terms of incidence rates of hypertension ($p = 0.692$), DM ($p = 0.427$), cardiovascular disease ($p = 0.583$), chronic lung disease ($p = 0.504$), heart failure ($p = 0.379$), and hyperlipidemia ($p = 0.700$) in patients with mortality.

Although the percentage of chronic renal failure was higher in patients who died, this difference was not statistically significant ($p = 0.051$).

While the rate of COPD-bronchial asthma was higher in surviving patients ($p = 0.001$), malignancy ($p = 0.005$) and cerebrovascular disease ($p < 0.001$) were higher in patients who died.

While the rate of fatigue, dry cough, and sore throat symptoms was higher in surviving patients ($p < 0.001$), the rate of shortness of breath was higher in patients who died ($p = 0.005$).

In patients who died, no difference was observed in terms of fever ($p = 0.886$), chest pain ($p = 0.538$), headache ($p = 0.236$), dizziness ($p = 0.101$), diarrhea ($p = 0.999$), nausea-vomiting ($p = 0.858$) myalgia ($p = 0.267$), and odor-inability to taste ($p = 0.595$) (Table 4).

In patients with mortality, values of glucose ($p = 0.027$), BUN ($p < 0.001$), creatinine ($p = 0.039$), AST ($p = 0.003$), total bilirubin ($p = 0.002$), direct bilirubin ($p < 0.001$), CRP ($p < 0.001$), WBC ($p < 0.001$), neutrophil ($p < 0.001$), monocyte ($p = 0.024$), troponin T ($p < 0.001$), prothrombin time ($p < 0.001$), INR ($p < 0.001$), D-dimer ($p < 0.001$), ferritin ($p < 0.001$), and procalcitonin ($p < 0.001$) were higher.

There was no significant difference in terms of sodium ($p = 0.194$), potassium ($p = 0.890$), ALT ($p = 0.453$), CK ($p = 0.236$), PLT ($p = 0.371$), lymphocyte ($p = 0.148$), APTT ($p = 0.375$), and sedimentation values ($p = 0.084$).

Table 2 Mechanical ventilation need and prognosis of patients

	Total (n: 483)	65–74 (n: 280)	75–84 (n: 133)	85 and over (n: 70)	p
Non-invasive mechanical ventilation	49 (10.1)	25 (8.9)	20 (15)	4 (5.7)	0.065
Invasive mechanical ventilation	71 (14.7)	24 (8.6) ^a	29 (21.8) ^b	18 (25.7) ^b	< 0.001
Prognosis					
Discharge from the emergency room	216 (44.7)	152 (54.3) ^a	43 (32.3) ^b	21 (30) ^b	< 0.001
Pandemic clinic	155 (32.1)	84 (30) ^a	50 (37.6) ^a	21 (30) ^a	
Intensive care unit	112 (23.2)	44 (15.7) ^a	40 (30.1) ^b	28 (40) ^b	
Transfer to the service and intensive care	57 (27.1)	22 (20.8)	24 (33.3)	11 (34.4)	0.109
Duration of stay (days)		5 (1–21)	5 (1–26)	4 (1–13)	0.275
Intensive care stay (days)	5 (1–75)	3 (1–46) ^a	8 (1–75) ^b	3 (1–30) ^a	0.013
Mortality	81 (16.8)	29 (10.4) ^a	34 (25.6) ^b	18 (25.7) ^b	< 0.001
Mortality time (days)	11 (1–75)	12 (1–53) ^a	13 (1–75) ^a	6 (1–38) ^b	0.040

Data are presented as median (min-max) or n (%). Kruskal-Wallis test, Pearson chi-square test. Different lowercase letters in a row indicate statistically significant difference between groups

Table 3 Characteristics of comorbidity and symptom in patients transferred from service to intensive care

	Pandemic clinic (<i>n</i> : 371)	Intensive care unit (<i>n</i> : 112)	<i>p</i>
Age	73.51 ± 7.51	77.52 ± 8.19	< 0.001
Gender			
Female	157 (42.3)	48 (42.9)	0.919
Male	214 (57.7)	64 (57.1)	
The comorbidities			
Hypertension	248 (66.8)	83 (74.1)	0.147
Diabetes mellitus	107 (28.8)	42 (37.5)	0.082
COPD-asthma-bronchitis	157 (42.3)	29 (25.9)	0.002
Malignancy	48 (12.9)	27 (24.1)	0.004
Cardiovascular disease	139 (37.5)	47 (42)	0.391
Cerebrovascular disease	53 (14.3)	38 (33.9)	< 0.001
Chronic renal failure	23 (6.2)	21 (18.8)	< 0.001
Chronic liver disease	13 (3.5)	4 (3.6)	0.999
Heart failure	43 (11.6)	20 (17.9)	0.084
Hyperlipidemia	10 (2.7)	2 (1.8)	0.741
The symptoms			
Fever	176 (47.4)	59 (52.7)	0.331
Weakness	191 (51.5)	41 (36.6)	0.006
Dry cough	195 (52.6)	39 (34.8)	0.001
Throat ache	160 (43.1)	29 (25.9)	0.001
Shortness of breath	197 (53.2)	81 (72.3)	< 0.001
Chest pain	40 (10.8)	11 (9.8)	0.772
Headache	49 (13.2)	12 (10.7)	0.486
Dizziness	24 (6.5)	14 (12.5)	0.038
Diarrhea	12 (3.2)	5 (4.5)	0.560
Nausea and vomiting	25 (6.7)	7 (6.3)	0.855
Myalgia	72 (19.4)	21 (18.8)	0.877
Smell-inability to taste	5 (1.3)	0 (0)	0.595
Ground glass opacity	157 (45.5)	88 (81.5)	< 0.001
PCR test result			
Negative	357 (96.5)	106 (95.5)	0.578
Positive	13 (3.5)	5 (4.5)	
2.PCR test result			
Negative	138 (95.8)	58 (93.5)	0.492
Positive	6 (4.2)	4 (6.5)	
3.PCR test result			
Negative	24 (92.3)	14 (93.3)	0.999
Positive	2 (7.7)	1 (6.7)	

Data are presented as mean ± SD or *n* (%). Student's *t* test, Pearson chi-square test, Fisher's exact test

The rate of ground glass opacity in thorax CT was higher in patients with mortality ($p < 0.001$). There was no significant difference in terms of positivity of the 1st, 2nd, and 3rd PCR tests of the patients with mortality ($p = 0.515$, $p = 0.999$, $p = 0.999$, respectively).

In patients who were positive in the first PCR test and negative in subsequent tests, there was no difference in the duration to yield negative according to mortality ($p = 0.200$). Likewise, the duration of the patients who became positive

when the first PCR test was negative did not differ according to mortality ($p = 0.333$).

The rate of using non-invasive mechanical ventilation and invasive mechanical ventilation was higher in patients with mortality ($p < 0.001$).

While the group of patients discharged from the emergency department and hospitalized in the service had the highest surveillance, mortality was significantly higher in those who were admitted to the intensive care unit ($p < 0.001$).

Table 4 Characteristics of comorbidity and symptom in patients with mortality

	Discharged (<i>n</i> : 280)	Died (<i>n</i> : 133)	<i>p</i>
Age	73.75 ± 7.66	77.86 ± 7.93	< 0.001
Gender			
Female	172 (42.8)	33 (40.7)	0.734
Male	230 (57.2)	48 (59.3)	
The comorbidities			
Hypertension	277 (68.9)	54 (66.7)	0.692
Diabetes mellitus	121 (30.1)	28 (34.6)	0.427
COPD-asthma-bronchitis	168 (41.8)	18 (22.2)	0.001
Malignancy	54 (13.4)	21 (25.9)	0.005
Cardiovascular disease	157 (39.1)	29 (35.8)	0.583
Cerebrovascular disease	62 (15.4)	29 (35.8)	< 0.001
Chronic renal failure	32 (8)	12 (14.8)	0.051
Chronic liver disease	13 (3.2)	4 (4.9)	0.504
Heart failure	50 (12.4)	13 (16)	0.379
Hyperlipidemia	11 (2.7)	1 (1.2)	0.700
The symptoms			
Fever	195 (48.5)	40 (49.4)	0.886
Weakness	208 (51.7)	24 (29.6)	< 0.001
Dry cough	212 (52.7)	22 (27.2)	< 0.001
Throat ache	175 (43.5)	14 (17.3)	< 0.001
Shortness of breath	220 (54.9)	58 (71.6)	0.005
Chest pain	44 (10.9)	7 (8.6)	0.538
Headache	54 (13.4)	7 (8.6)	0.236
Dizziness	28 (7)	10 (12.3)	0.101
Diarrhea	14 (3.5)	3 (3.7)	0.999
Nausea and vomiting	27 (6.7)	5 (6.2)	0.858
Myalgia	81 (20.1)	12 (14.8)	0.267
Inability to smell and taste	5 (1.2)	0 (0)	0.595

Data are presented as mean ± SD or *n* (%). Student's *t* test, Pearson chi-square test, Fisher's exact test

Patients transferred from the service to the intensive care unit had a higher mortality ($p < 0.001$). No significant difference was observed in terms of the length of stay of the patients hospitalized in the ward according to mortality ($p = 0.592$). Patients who died had higher length of stay in the intensive care unit ($p = 0.001$) (Table 5).

In multivariate logistic regression model, age, COPD-bronchial asthma, weakness, dry cough, ground glass opacity, and CRP were identified as an independent predictive factor associated with mortality. Patients aged between 75 and 84 (OR: 2.602; 95% CI: 1.306–5.183; $p = 0.007$) or ≥ 85 (OR: 4.086; 95% CI: 1.687–9.9; $p = 0.002$) had higher risk for mortality compared to patients aged between 65 and 74. Patients with COPD (OR: 0.377; 95% CI: 0.187–0.762; $p = 0.007$), weakness (OR: 0.415; 95% CI: 0.197–0.874; $p = 0.021$), and dry cough (OR: 0.479; 95% CI: 0.23–0.994; $p = 0.048$) had lower risk for mortality. Patients with ground glass opacity were 2.54 times higher risk for mortality than patients with normal CT (OR: 2.539; 95% CI: 1.163–5.543; $p = 0.019$).

Increasing CRP (C-reactive protein) (OR: 1.01; 95% CI: 1.006–1.013; $p < 0.001$) was positively associated with mortality (Table 6) (Fig. 7).

It was seen that the rate of ground glass opacity of patients who died aged 65–74 and 75–84 years was statistically higher than those who survived ($p < 0.001$, $p = 0.001$, respectively). Although it was observed that the rate of ground glass opacity in patients aged 85 years and older was higher than those who survived, this difference was not statistically significant ($p = 0.079$) (Fig. 1).

No significant difference was found in terms of PCR test positivity rates according to mortality in patients aged 65–74, between 75 and 84 years, and over 85 years ($p = 0.627$, $p = 0.161$, $p = 0.999$, respectively) (Fig. 2).

It was seen that the rate of ground glass opacity of the patients between the ages of 65–74, between the ages of 75–84, and those who were hospitalized in intensive care at the age of 85 and above was statistically higher than those without ($p < 0.001$, $p < 0.001$, $p = 0.045$, respectively) (Fig. 3).

Table 5 Laboratory findings of patients with mortality

	Survived (<i>n</i> : 402)	Died (<i>n</i> : 81)	<i>p</i>
Glucose	123.5 (11–1065)	149 (32–636)	0.027
BUN	20 (2.7–222)	29 (9–175)	< 0.001
Creatinine	1 (0.5–7.24)	1.1 (0.5–21)	0.039
Na	136 (113–157)	136 (122–180)	0.194
K	4 (2.6–44)	4 (2.7–6.3)	0.890
Calcium	9 (5.6–96)	8.3 (6.7–12.5)	< 0.001
ALT	17 (3–1129)	17 (4–1279)	0.453
AST	22 (8–1152)	28 (8–2654)	0.003
Creatine kinase	78 (7–6590)	96 (6–2195)	0.236
Total bilirubin	0.58 (0.14–6.59)	0.71 (0.16–31.78)	0.002
Direct bilirubin	0.11 (0.01–4.15)	0.2 (0.04–15.94)	< 0.001
CRP	20.7 (0.09–317.5)	75.3 (0.22–388.3)	< 0.001
WBC	10 (0.1–32.5)	12.2 (1.3–103)	< 0.001
HGB	12.2 ± 2.32	11.17 ± 2.3	0.001
HTC	37.1 (12–322)	34.9 (16.8–52.1)	0.001
PLT	236 (4–884)	271 (20–664)	0.371
NEU #	7.2 (0.1–83.5)	9.5 (0.2–90)	< 0.001
LYM #	1.35 (0.1–22.9)	1.1 (0.3–37.9)	0.148
MON #	0.7 (0–10.2)	0.9 (0.01–43.1)	0.024
Troponin T	19 (3–6350)	47 (3–1402)	< 0.001
APTT	30.7 (16.6–120.9)	30.7 (22–101.9)	0.375
Prothrombin time	12.7 (9–45.5)	13.8 (10.5–97.1)	< 0.001
INR	1.09 (0.79–4.02)	1.23 (0.91–8.13)	< 0.001
D-dimer	358 (46.3–11,826)	712 (51–25,403)	< 0.001
Sedimentation	28 (2–110)	44 (4–140)	0.084
Ferritin	96 (6.1–2656)	320 (11–3189)	< 0.001
Procalcitonin	0.11 (0.01–666.2)	0.51 (0.03–61)	< 0.001
Ground glass opacity	179 (47.9)	66 (83.5)	< 0.001
PCR Test result			
Negative	388 (96.5)	75 (94.9)	0.515
Positive	14 (3.5)	4 (5.1)	
2.PCR test result			
Negative	154 (95.1)	42 (95.5)	0.999
Positive	8 (4.9)	2 (4.5)	
3.PCR test result			
Negative	28 (93.3)	10 (90.9)	0.999
Positive	2 (6.7)	1 (9.1)	
If the first PCR test is positive, after how many days it becomes negative	6 (3–16)	23 (23–23)	0.200
If the first PCR is negative, the blood became pcr + days later	1 (1–2)	15 (15–15)	0.333
Non-invasive mechanical ventilation	22 (5.5)	27 (33.3)	< 0.001
Invasive mechanical ventilation	7 (1.7)	64 (79)	< 0.001
Prognosis			
Discharge from the emergency room	213 (53) ^a	3 (3.7) ^b	< 0.001
Service	145 (36.1) ^a	10 (12.3) ^b	
Intensive care	44 (10.9) ^a	68 (84) ^b	
Is there a transfer from the service to intensive care?	29 (16.9)	28 (73.7)	< 0.001
Duration of stay (days)	5 (1–21)	5 (1–26)	0.592
Intensive care stay (days)	3 (1–46)	8 (1–75)	0.001

Data are presented as mean ± SD, median (min-max), or *n* (%). Student's *t* test, Mann-Whitney *U* test, Pearson chi-square test. Different lowercase letters in a row indicate statistically significant difference between groups

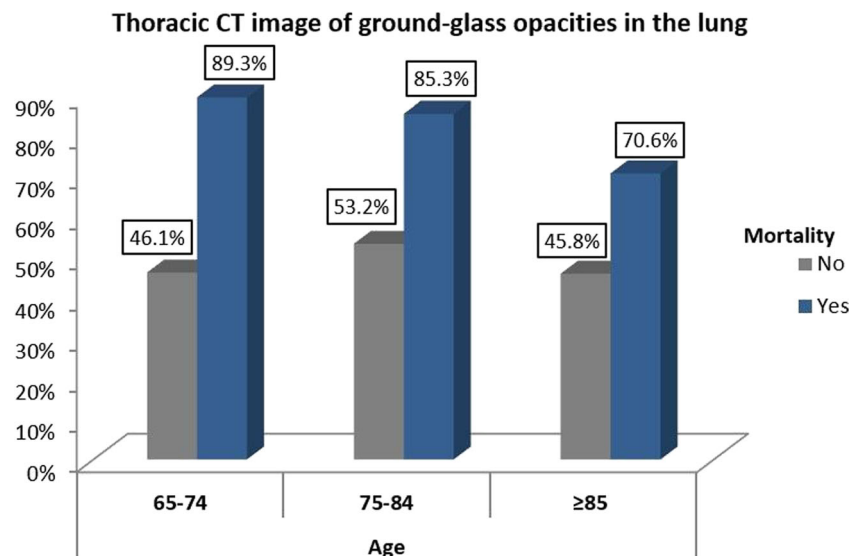
Table 6 Factors affecting mortality

	OR (95% CI)	<i>p</i>
Age		
65–74	Reference	–
75–84	2.602 (1.306–5.183)	0.007
≥ 85	4.086 (1.687–9.9)	0.002
COPD-asthma-bronchitis	0.377 (0.187–0.762)	0.007
Malignancy	1.808 (0.881–3.709)	0.106
Cerebrovascular disease	1.104 (0.549–2.22)	0.782
Chronic renal failure	1.208 (0.473–3.083)	0.693
Weakness	0.415 (0.197–0.874)	0.021
Dry cough	0.479 (0.23–0.994)	0.048
Throat ache	0.577 (0.231–1.44)	0.238
Shortness of breath	1.516 (0.78–2.947)	0.220
Ground glass opacity	2.539 (1.163–5.543)	0.019
CRP	1.01 (1.006–1.013)	< 0.001

No significant difference was found in terms of PCR test positivity rates according to mortality in patients aged 65–74, between 75 and 84 years, and over 85 years ($p = 0.999$, $p = 0.215$, $p = 0.999$, respectively) (Fig. 4).

Using ROC analysis for mortality, the optimal cutoff point for CRP according to the Youden index was ≥ 60.35 (area under the curve (AUC) = 0.712 (95% CI: 0.646–0.778, $p < 0.001$)), sensitivity 57.9%, and specificity 76.3% (Fig. 5).

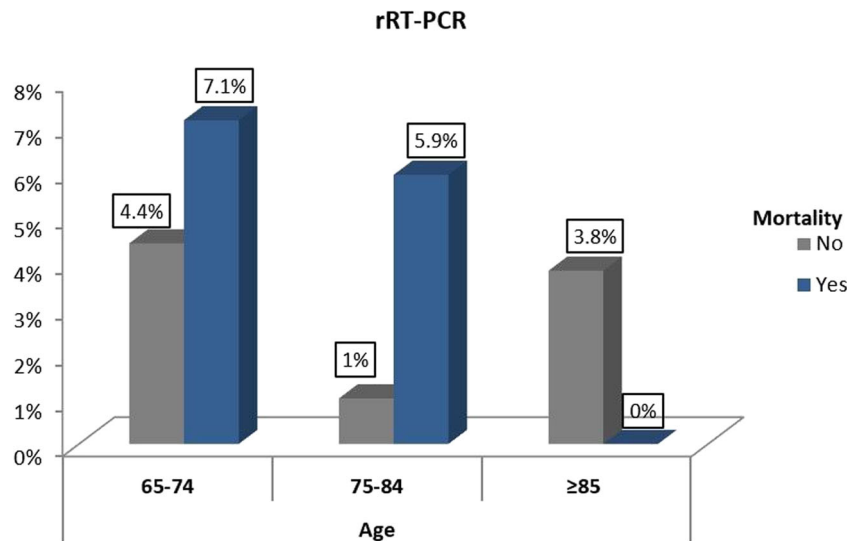
A ROC analysis of age for mortality is given in Fig. 3. AUC value for age was 0.650 (95% CI: 0.585–0.715, $p < 0.001$). The optimal cutoff value of age for mortality was ≤ 71.5 , and sensitivity and specificity were 76.5% and 50.2%, respectively (Fig. 6).

Fig. 1 Ground glass opacity distribution in patients with mortality

Discussion

Having a low rate of geriatric COVID-19 diagnosis group with 13.3% (483) of 3628 COVID-19 symptom patients who applied to the emergency department of the 3rd degree regional hospital within the specified periods is an indicator of not only the effective implementation of health policies in Turkey especially regarding the geriatric population in the COVID-19 pandemic, but it also indicates how meticulously personal protective measures are applied such as maintaining social distance, isolation at home, and using surgical masks. Nevertheless, the COVID-19 pandemic is devastating for the geriatric population, with high morbidity and mortality levels [2]. Although, in the literature, for the geriatric age groups, cardiac arrest, sepsis, and cardiovascular diseases are seen as the highest mortality cause in all three groups in intensive care [9], it is clear that COVID-19 will be included in this ranking during the COVID-19 pandemic period. In the literature, there are studies reporting that the prognosis of COVID-19 pandemic is more severe in men [10]. In our study, although the mortality rate was 59.3% (48) higher in the male geriatric group as a numerical value, no significant difference between genders was observed. In the literature, the sensitivity of tomography in the diagnosis of COVID-19 was 97.2%, while the sensitivity of rRT-PCR was only 83.3% [11]. However, it should be kept in mind that false-negative results may occur in rRT-PCR results in the geriatric patient group [12]. In our study, while the rate of transfer to intensive care and mortality results increased positively in geriatric patients with ground glass opacity on tomography, the same significant results were not obtained with the rRT-PCR results. In the light of these findings, making a diagnosis and treatment decision by only looking at rRT-PCR results and considering only rRT-PCR results in mass screening gives erroneous results and makes

Fig. 2 PCR positivity in patients with mortality



pandemic control difficult [12]. In the management of COVID-19 infection, both lung and cardiovascular complications increase significantly, especially in patients with only cardiovascular disease comorbidity [13]. In our study, there was no significant increase in mortality in patients with cardiovascular disease, and interestingly, in patients with dry cough symptoms and chronic obstructive pulmonary disease (COPD) and bronchial asthma comorbidity, ICU transfer rate and mortality appear to be low risk factors. This situation may be related to the more effective application of personal protective factors in patients with comorbidities related to the lungs, and to pneumococcal vaccination routinely applied to geriatric patients with lung disease over the age of 65 in Turkey. Studies have reported that pneumococcal and influenza vaccination reduces the mortality rate from COVID-19 in the elderly [14]. In a retrospective study in the literature, it was determined that there was a weak and positive correlation

between age and mortality in geriatric patients, while the rRT-PCR test result had no effect on mortality [15]. In our study, age, COPD-bronchial asthma, malaise, dry cough, ground glass opacity, and CRP were identified as an independent predictive factor associated with mortality. In our study, the risk of mortality increases with age, and when age is ≤ 71.5 , it predicts mortality with 76.5% sensitivity and 50.2% specificity. In our study, no significant difference was found in terms of mortality and PCR test positivity. The rate of invasive mechanical ventilation use was lower in the 65–74 age group compared to the other two age groups, and the highest rate of patients discharged from the emergency department was between the ages of 65–74, while the rate of admission to intensive care was observed to be the highest in patients between the ages of 75–84 and 85 and older. This situation is closely related to the general condition disorder induced by COVID-19, which is caused by the increase of

Fig. 3 Ground glass opacity according to age groups in patients transferred to intensive care

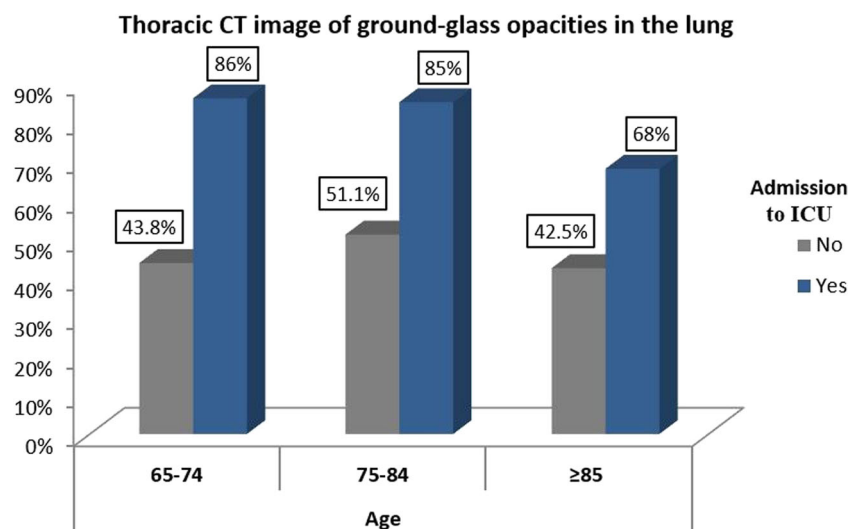
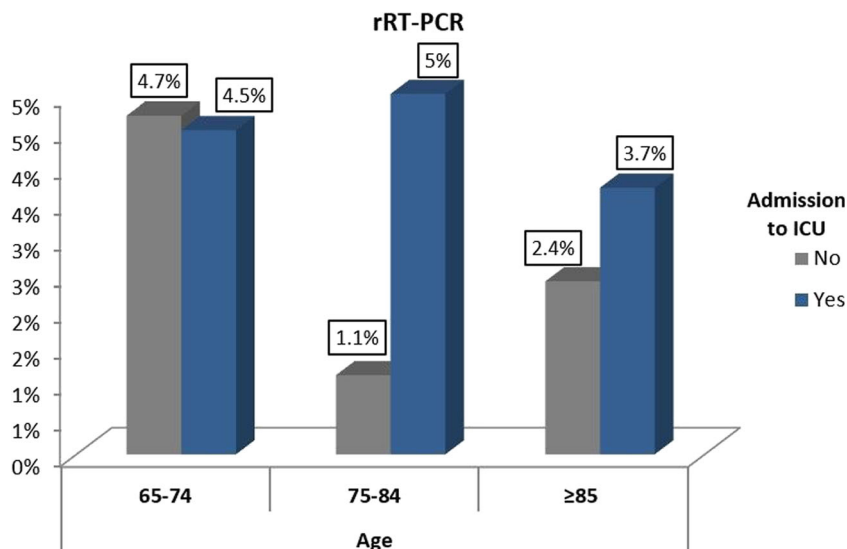


Fig. 4 PCR positivity in intensive care patients



multimorbidity in advanced age. In the literature, patients with a diagnosis of COVID-19 who received a standard dose of prophylactic anticoagulant had higher D-dimer levels in their laboratory findings, while ESR, CRP, fibrinogen, ferritin, and procalcitonin were higher in patients with thrombotic complications compared to those without [16]. Our patients were treated with Oksapar 6000 ANTI-XA IU/0.6 mL for prophylactic anticoagulation. When evaluated in terms of mortality, glucose, BUN, creatinine, AST, total bilirubin, direct bilirubin, CRP, WBC, neutrophil, monocyte, troponin T, prothrombin time, INR, D-dimer, ferritin, and procalcitonin values were observed to be higher. There was no significant difference in terms of sodium, potassium, ALT, creatine kinase, platelet, lymphocyte, APTT, and sedimentation values. When CRP is ≥ 60.35 , mortality can be predicted with 57.9% sensitivity and 76.3% specificity. In a meta-analysis study, chronic obstructive pulmonary disease (OR = 5.08) was associated with comorbidities including diabetes (OR = 3.17) in patients who needed an intensive care unit,

hypertension (OR = 2.40), coronary heart disease (OR = 2.66), cerebrovascular diseases (OR = 2.68) and malignancy (OR = 2.21), dyspnea, decreased lymphocyte and platelet counts, and increased leukocyte count; the levels of C-reactive protein, procalcitonin, lactate dehydrogenase, aspartate aminotransferase, alanine aminotransferase, creatine kinase and creatinine were determined to be significantly different, and it was also found that the morbidity and mortality rate increased for this patient group [17]. Although our study displays a low rate in the geriatric population (13.3%, 483) due to COVID-19, the COVID-19 pandemic continues to be a threat in geriatric age groups. We are of the idea that this rate will decrease even more with the spread of personal protective measures applied in geriatric age groups and close follow-up of the elderly with comorbidities in Turkey and all over the world (Fig. 7).

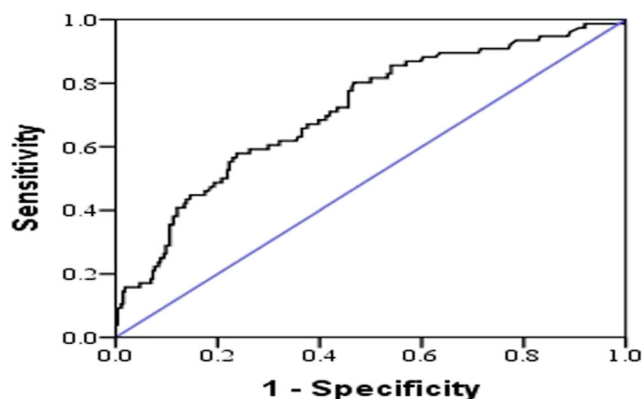


Fig. 5 ROC curve analysis for CRP to predict mortality

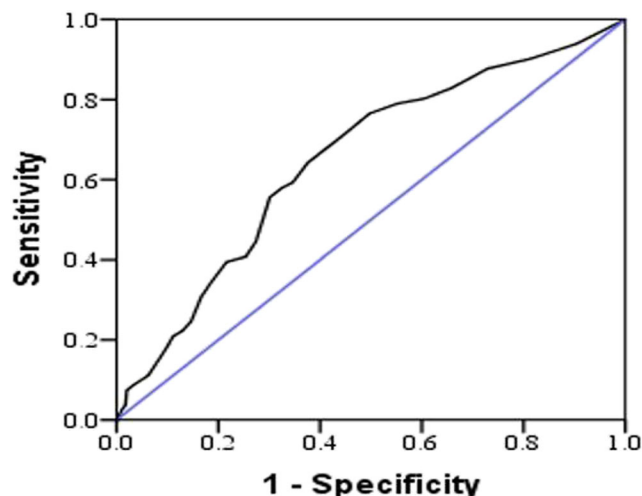


Fig. 6 ROC curve analysis for age to predict mortality

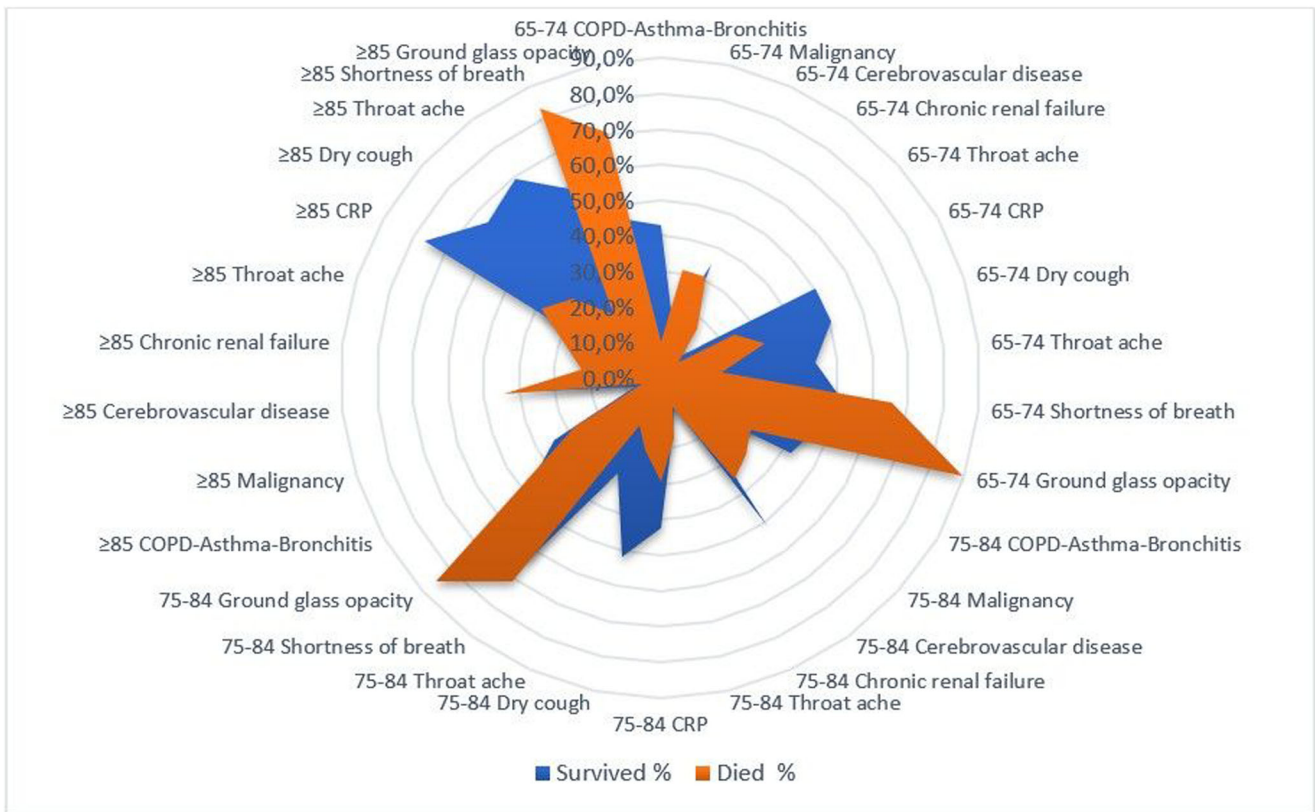


Fig. 7 Factors affecting mortality

Conclusion

Mortality rates were lowest in patients aged 65–74 years. While PCR positivity has no effect on mortality in 3 different geriatric age groups, the ground glass opacity in tomography is closely related to the need for intensive care and increased mortality. Mortality rate is high in geriatric patients who need mechanical ventilation in intensive care. In patients with COPD-bronchial asthma comorbidity and those with symptoms of fatigue, dry cough, and sore throat, transfer to intensive care and mortality rates were lower, while patients who were transferred to intensive care and developed mortality had higher malignancy and cerebrovascular disease comorbidities and dyspnea symptoms. Advanced age, dyspnea symptom, ground glass opacity in lung computerized tomography, and high CRP are among the indicators of risk factors that increase mortality in patients with COVID-19. When age is ≤ 71.5 , mortality is predicted with 76.5% sensitivity and 50.2% specificity, and when CRP is ≥ 60.35 , mortality is predicted with 57.9% sensitivity and 76.3% specificity.

Code Availability Available.

Authors' Contributions OG: Manuscript writing/editing. MD: Data collection or management.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This study was conducted in accordance with the Declaration of Helsinki from obtaining approval from the Institutional Ethics Committee (Date of Approval-Protocol No: 03.06.2020-7/8).

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