

COVID-19 and comorbidities: Predictors, clinical course, relationship with disease severity, and outcome

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ABSTRACT

Aim: COVID-19 disease has a broad spectrum ranging from asymptomatic course to death. While data show that the prognosis of the disease will be poor in the presence of comorbidity, we witness the death of patients with no comorbidities in our clinical practice. This study aimed to investigate the effect of comorbidity on the clinical course and mortality of COVID-19 pneumonia.

Methods: 155 Rt-PCR (+) adult patients hospitalized at İzzet Baysal State Hospital (Bolu, Turkey) diagnosed with severe and critical pneumonia between August 2020 and February 2021 were included in this single-center, retrospective study. The patients were divided into two groups with and without comorbidity, compared the severity of inflammation parameters, radiological involvement, and oxygen requirement, and evaluated their effects on mortality and hospitalization duration.

Results: There was no significant difference in the severity of the computed tomography (CT) involvement, the oxygen requirement, inflammation markers, and duration of hospitalization in patients with comorbidities compared to those without. When we evaluated the patients with comorbidities in general and their subgroups, the relationship with mortality was not significant. The severity of CT involvement, high oxygen requirement, and inflammation markers such as lymphocyte, lymphocyte ratio, LDH, CRP, troponin, ferritin levels were found to be associated with mortality.

Conclusions: In this study, we found that the presence of comorbidity did not affect mortality and duration of stay and that the severity of radiological involvement, the severity of hypoxemia, and the increase in inflammation markers were the determinants of mortality.

Key words: COVID-19, coronavirus infections, pneumonia, comorbidity, outcome, mortality.

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Introduction

The COVID-19 pandemic has been in existence since the end of 2019, and the loss of life continues. The presence of comorbidity may affect the clinical course of COVID-19.

Diseases such as type 2 diabetes mellitus (DM), hypertension (HT), atherosclerotic cardiovascular (CVS) diseases, and chronic obstructive pulmonary disease (COPD) increase the risk [1]. In some studies, HT (30%) [2] and in others, diabetes mellitus [3] is the most common comorbidity, causing high mortality rates. Although the prevalence of COPD is low, it exacerbates the clinical course and significantly increases mortality in its presence [4]. It was reported that cancer is not

common comorbidity in COVID-19 patients, and less mechanical ventilation requirement and mortality rates were reported in cancer cases [5]. In light of this information, we aimed to retrospectively investigate the frequency of comorbidities and the relationship of existing comorbidities with mortality and clinical course in Rt-PCR positive severe and critical hospitalized COVID-19 pneumonia patients.

Materials and methods

The single-center, retrospective study was performed with patients hospitalized in the inpatient clinic and intensive care unit of İzzet Baysal State Hospital. This study was approved by Abant İzzet Baysal University Ethics Committee (Date: 2021-10-06 / No:189).

One hundred fifty-five patients with severe and critical pneumonia, according to WHO interim guidance [6], among Rt-PCR (+) COVID-19 patients were included. Patients under the age of 18, pregnant and postpartum patients, patients with missing comorbidity information, CT, and laboratory parameters were excluded. Demographic, radiological (pulmonary involvement less than or above 50% in CT imaging), laboratory data, and treatment outcome of the patients were recorded retrospectively. The severity of oxygen requirement was grouped as mild (up to 5 L/min with the nasal cannula) and heavy (including mask, mask with reservoir, high flow nasal oxygen (HFNO), intubated follow up). Their comorbidities were grouped as HT, DM, DM+HT, chronic pulmonary disease (CPD), cardiovascular system diseases (CVSD), malignancy, connective tissue diseases (CDD), and other (such as goiter, chronic kidney failure, which we could not group).

The analysis of the data obtained as a result of the research was performed in the SPSS 20 statistical package program, and descriptive

statistical methods (frequency, arithmetic mean, standard deviation, cross tables) were used. Compliance with normal distribution was evaluated with the Kolmogorov-Smirnov test. The arithmetic mean of the normally distributed groups was evaluated, and the Independent Sample t-test compared two independent groups. The medians of the non-normally distributed groups were determined, and the Mann-Whitney U test compared two independent groups, and the Chi-Square test examined the relationship between categorical variables. A p-value of <0.05 was considered statistically significant.

Results

The mean age of the patients was 68 years (31-95), and the relationship between mortality and age was significant (61 years (31-95) in survivors, 70 years (48-94) in non-survivors, $p: 0.002$). The group with comorbid diseases was older (69 (35-95) vs. 57.5 (31-94) $p: 0.001$).

The overall comorbidity rate in the patients was 73%, with HT 49.7%, DM 29%, DM+HT 21.3%, CPD 14.8%, CVSD 9%, malignancy 5.2%, CDD 1.9%, and 18.7% for other diseases (few diseases we did not group, such as goiter, chronic kidney disease). The rate of non-comorbid patients was found to be 27.1%. When the patients with comorbidities were evaluated in general and according to their subgroups, the relationship with mortality was not statistically significant ($p>0.005$, Table 1). There was no significant difference in the severity of the CT involvement, the severity of the oxygen requirement, inflammation markers, and duration of stay in patients with comorbidities compared to those without ($p>0.05$, Table 2). In terms of duration of hospital stay, a significant difference was found only in the DM and DM+HT subgroups, with a shorter duration of stay.

Table 1. The relationship between the presence of comorbidity and mortality.

Parameters	Survivor (N=113) (N/%)	Non-survivor (N=42) (N/%)	Total (N=155) (N/%)	p-value
DM	37/82.2	8/17.8	45/29	0.095
Non- DM	76/69.1	34/30.9	110/71	
HT	60/77.9	17/22.1	77/49.7	0.162
Non- HT	53/67.9	25/32.1	78/50.3	
DM+HT	27/81.8	6/18.2	33/21.3	0.194
Non- (DM+HT)	86/70.5	36/ 29.5	122/78.7	
CVSD	10/71.4	4/28.6	14/9	0.896
Non- CVSD	103/73	38/27	141/91	
CPD	17/73.9	6/26.1	23/14.8	0.906
Non-CPD	96/72.7	36/27.3	132/85.2	
Malignancy	4/50	4/50	8/5.2	0.134
Non- malignancy	109/74.1	38/25.9	147/94.8	
CTD	2/66.7	1/33.3	3/1.9	0.806
Non- CT	111/73	40/27	152/98.1	
Other diseases	18/62.1	11/37.9	29/18.7	0.145
Non-other diseases	95/75.4	31/24.6	126/81.3	
Non-comorbid	31/73.8	11/26.2	42/27.1	0.877

* p<0.05 statistically significant, Chi-Square test. DM: diabetes mellitus, HT: hypertension, CVSD: cardiovascular system disease, CPD: chronic pulmonary disease CTD: connective tissue disease

Table 2. Baseline demographics, CT involvement, and laboratory parameters of the study population classified by the presence of comorbidity.

Parameters	Comorbidity (+) (N=113) (N/%)	Comorbidity (-) (N=42) (N/%)	All patients (N=155) (N/%)	p-value
Gender ¹				
Female	47/74.6	16 (25.4%)	63 (40.6%)	0.694
Male	66/71.7	26 (28.2%)	92 (59.3%)	
Oxygen requirement ¹				
Mild	45/71.4	18 (28.6%)	63 (40.6%)	0.732
Severe	68/73.9	24 (26.1%)	92 (59.4%)	
CT involvement ¹				
Below 50%	59/73.7	21 (26.3%)	80 (51.6%)	0.806
Oover 50%	54/72	21 (28%)	75 (48.4%)	
Mortality ¹				
Exitus	31/73.8	11 (26.2%)	42(27.1%) 113(72.9%)	0.877
Alive	82/27.1	31 (27.4%)		
Age ²	69 (35-95)	57.5 (31-94)	68 (31-95)	0.001
Duration of hospitalization ²	10 (1-55)	7 (3-60)	9 (1-60)	0.369
Lymphocyte ² (0.9-3.4K/uL)	900 (200-3400)	950 (200-2600)	0.90 (0.20-3.40)	0.957
Lymphocyte% ² (25-46 K/uL)	13.1 (1.9-49.3)	18 (1-36.2)	15.0 (1-49.3)	0.137
CRP ² (0-5 mg/L)	92.1 (2.2-139.4)	90.6 (7.40-132)	92.1 (2.20-139.4)	0.811
LDH (1-248U/L)	336 (127-1884)	399.5 (183-885)	351 (127-1884)	0.147
Troponin ² (12.6-20.7 ng/L)	9.9 (1.70-2327)	7 (1.6-1654)	9.4 (1.6-2327)	0.115
Ferritin ² (23.9-366.2 ug/L)	233.7 (11.3-1500)	317 (21.4-1500)	245.9 (11.3-1500)	0.327
Fibrinogen ² (170-420 mg/dL)	5.74 (1.47-10.25)	5.82 (2.79-11)	5.75 (1.47-11)	0.148
D-Dimer ² (0-0.5 mg/L)	0.38 (0.03-17.1)	0.29 (0.02-7.70)	0.37 (0.02-17.1)	0.503

CT: computed tomography. CRP: C-reactive protein. LDH: Lactate dehydrogenase.

When the survivor and the non-survivor group were compared, the severity of CT involvement, high levels of oxygen requirement, and laboratory parameters such as lymphocyte, lymphocyte ratio, lactate dehydrogenase (LDH), C-reactive protein (CRP), troponin, and ferritin were found to be associated with mortality ($p<0.05$) (Table 3).

Oxygen requirement was high in 88% of those with CT involvement above 50% and 32.5% of those with CT involvement of less than 50% ($p<0.05$). A decrease in the lymphocytes and lymphocyte ratios and an increase in LDH, CRP, troponin, ferritin, D-dimer, and fibrinogen values were found to be significant in the group with severe CT involvement group compared to the other group ($p<0.05$), Table 4).

Table 3. Baseline demographics, CT involvement, and laboratory parameters of the study population classified by the overall mortality.

Parameters	Survivor (N=113) N/%	Non-survivor (N=42) N/%	All patients (N=155) N/%	p-value
Gender¹				
Female	51/81	12/19	63/40.6	0.062
Male	62/67.4	30/32.6	92/59.3	
Oxygen requirement¹				
Mild	62/98.4	1/1.6	63/40.6	<0.001
Severe	51/55.4	41/44.6	92/59.4	
CT involvement¹				
Below 50%	75/93.7	5/6.3	80/51.6	<0.001
Over 50%	38/50.7	37/49.3	75/48.4	
Median(min-max)				
Age²	61(31-95)	70(48-94)	68 (31-95)	0.002
Duration of hospitalization²	7 (3-55)	22.5(1-60)	9(1-60)	<0.001
Lymphocyte² (0.9-3.4K/uL)	1000 (200-3400)	600(200-2000)	0.90(0,20-3.40)	<0.001
Lymphocyte%² (25-46 K/uL)	18.3(1,9-49.3)	9.45(1-30.9)	15.0 (1-49.3)	<0.001
CRP² (0-5 mg/L)	68.1 (2.2- 139.4)	123(3.5- 132.4)	92.1(2.2-139.4)	<0.001
LDH² (1-248U/L)	337 (127- 1884)	422 (192-1375)	351(127-1884)	0.001
Troponin² (12.6-20.7 ng/L)	7.7 (1.6-1654.4)	18.4 (2.2-2327)	9.4 (1.6-2327)	<0.001
Ferritin² (23.9-366.2 ug/L)	214.3 (14.8-1500)	493.9(11.3-1500)	245.9(11.3-1500)	<0.001
Fibrinogen² (170-420 g/dL)	5.67 (2.67-10.25)	5.95 (1.47-11)	5.75(1.47-11)	0.148
D-dimer² (0-0.5 mg/L)	0.39 (0.02-7.7)	0.33(0.03-17.1)	0.37(0.02-17.1)	0.123

* $p<0.05$ statistically significant, ¹Chi-Square test ²Mann-Whitney U test. CRP: C-reactive protein. LDH: Lactate dehydrogenase.

Table 4. Oxygen requirement and laboratory parameters of the study population classified by the severity of CT involvement.

Parameters	CT involvement mild (n= 80) N/%	CT involvement severe (n=75) N/%	All patients (n=155)	p-value
Oxygen requirement¹				
Mild	54/85.7	9/14.3	63/40.6	<0.001
Severe	26/28.3	66/71.7	92/59.4	
Median (min-max)				
Duration of hospitalization²	7 (3-31)	16 (1-60)	9 (1-60)	<0.001
Lymphocyte² (0.9-3.4K/uL)	1.30 (0.20-3.40)	0.70 (0.20-2.60)	0.90 (0,20-3.40)	<0.001
Lymphocyte%² (25-46 K/uL)	19.6 (1.90-49.3)	9.3 (1-30.9)	15.0 (1-49.3)	<0.001
CRP² (0-5 mg/L)	51.4 (2.20-139.4)	120.8 (3.5-133.8)	92.1 (2.20-139.4)	<0.001
LDH² (1-248U/L)	291 (172-868)	440 (127-1884)	351 (127-1884)	<0.001
Troponin² (12.6-20.7 ng/L)	7.2 (1.6-203)	12.7 (1.7-2327)	9.4 (1.6-2327)	< 0.001
Ferritin² (23.9-366.2 ug/L)	196.2(21.4-1500)	455.7 (11.3-1500)	245.9 (11.3-1500)	<0.001
Fibrinogen² (170-420 mg/dL)	5.22 (1.47-9.9)	6.4 (2.02-11)	5.75 (1.47-11)	< 0.001
D-Dimer² (0-0.5 mg/L)	0.31 (0.04-4.95)	0.46 (0.02-17.1)	0.37 (0.02-17.1)	0.014

* $p < 0.05$ statistically significant. ¹Chi-Square test. ²Mann-Whitney U test.

Discussion

In a meta-analysis including ten studies in China, the mortality rate in COVID-19 was 5% [7], while in a Chinese Center for Disease Control and Prevention report containing 72314 cases of COVID-19, the mortality was reported as 2.3%, 14.8% in patients over 80 years old, and 49% in critical cases [8]. In another study, the mortality rate in inpatient COVID-19 patients reached 28.3% [2]. The overall mortality was 27% in our study.

While the most common comorbidities in COVID-19 patients were HT (30%), DM

(19%), and coronary heart disease (8%) [2], in patients with ARDS, they were HT (27%), DM (19%), and cardiovascular diseases (6%) [9]. Uçan et al. reported in their study that 62.1% of the patients had comorbidity, and hypertension was the most common [10]. In our study, comorbidity was observed in 73% of our patients, and in order of frequency, HT was 49.7%, DM 29%, DM+HT 21.3%, CPD 14.8%, CVSD 9%, malignancy 5.2%, CDD 1.9%, other diseases (a few diseases that we did not group, such as goiter, chronic kidney failure) 18.7%, and the non-comorbid patient rate was 27.1%.

However, when we grouped the diseases as presence/absence of comorbid diseases and grouped them individually, no relation was found with mortality ($p>0.05$).

Angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARB) increase ACE2, and virus binding also increases [11,12]. The increased soluble ACE2 in the circulation can bind SARS-CoV-2, reducing its ability to damage the lungs and other ACE2-bearing organs [13]. Therefore, ACE inhibitors and ARBs may reduce the potential for patients with COVID-19 to develop acute respiratory distress syndrome, myocarditis, or acute kidney injury. ARBs have been proposed as a treatment for COVID-19 and its complications [14]. There is no evidence yet that hypertension is associated with the consequences of COVID-19 or that the use of ACE inhibitors or ARBs during the COVID-19 pandemic is harmful or, therefore, beneficial [15]. In our study, no increase was found in mortality in patients with HT. No prolongation of hospitalization was observed (8 days (1-55) in the group with HT vs. 9.5 days (3-60) in the non-HT group, $p:0.310$).

In the study of Mithal et al., 47.1% of the hospitalized COVID-19 patients had Diabetes, and it was found to be associated with severe illness and mortality. HT was reported as the most common comorbidity in patients with DM [16]. In another study, DM was reported as the most common comorbidity in COVID-19 and was associated with mortality [3]. Mortality rates of 7.3% [8] have been reported in diabetic patients in China and over 30% in Europe [17]. Although the mechanism underlying the relationship between diabetes and COVID-19 severity remains unclear, Yang et al. [18] indicated that ACE2 could be strongly expressed in pancreatic islet cells, suggesting that these cells may be targeted by SARS-CoV-

2 [19]. Metabolic disorders may impair macrophage and lymphocyte function, resulting in poor immune function [20] and may make individuals more susceptible to disease complications [21]. Diabetes COVID-19 has also been associated with increased severity of complications and symptoms [22]. This may be partly due to increased risk of endothelial dysfunction, increased systemic inflammatory response, micro- and macrovascular disease, and diabetic cardiomyopathy [23,24,35,26]. Despite the presence of DM in 31-80% of those who died due to COVID-19 in studies [16,17], DM was associated with ICU hospitalization and duration of hospitalization in the multivariate analysis, but no correlation with mortality was demonstrated [28].

In the study of Guo et al, higher CRP, ferritin, interleukin-6 (IL-6), sedimentation levels were found, and Zhu et al. found an increase in the incidence of lymphopenia, higher CRP, and procalcitonin levels in diabetic patients [29,30]. In our study, we did not determine increased mortality in patients with diabetes. At the same time, oxygen requirement was not high, and CT involvement was not more severe in this group. Also, we did not detect increased inflammation parameters. For these possible reasons, the duration of hospitalization was also found to be shorter (8 days (1-31) in the diabetes group vs. 10 days (3-60) in the non-diabetes group, $p:0.052$).

In their study, which included 1590 hospitalized COVID-19 patients, Guan et al. reported that the most common comorbidities among infected individuals were hypertension (16.9%) and diabetes (8.2%), and patients with two or more comorbidities (8.2%) [31]. In another study, 149 of 1138 patients (13.09%) had two comorbidities, and hypertension+DM was the most commonly observed comorbid disease. The co-existence of more than one

comorbidity significantly increased the risk of death. In multivariate analysis, more than four times mortality risk was observed in patients with more than three comorbidities. Age-classified analysis revealed that the effect of comorbidities on death decreased with increasing age [32]. In our study, the association of DM + HT was 21.3%, and its relationship with mortality was not significant, but the length of hospital stay was found to be significantly shorter (DM+HT co-existence 7 days (1-31) vs. non-DM+HT 10 days (3-60), $p: 0.031$). While the expected issue was the prolonged duration of hospitalization, the fact that the oxygen requirement was not high, the CT involvements were not severe, and the inflammation markers were not high in these comorbid groups may explain this result.

Although the prevalence of COPD is low in COVID-19, these patients' mortality and severe disease rates have been reported to be high [4]. Viral infections cause an increase in systemic inflammation in COPD patients [33,34]. Comorbid conditions, which are usually associated with COPD patients, may also be associated with increased hospitalization [35,36].

Questions remain about the effects of inhaled (ICS) and systemic corticosteroids, short- and long-acting β 2-agonists, and short- and long-acting muscarinic antagonists in alleviating or exacerbating COVID-19. ACE-2 expression in airway epithelial cells from patients with asthma is reduced in those receiving ICS compared to those not using ICS, raising the possibility that ICS exposure may reduce viral entry. It is not clear that the same relationship is valid in the COPD airway, which increases susceptibility to pneumonia following ICS use [37]. In our study, no significant relationship was found between the presence of COPD and mortality.

Asthma comorbidity was found to be more common in non-severe cases of COVID-19. Compared with patients with asthma, COPD patients were found to have increased mortality and a higher risk of developing severe disease and ARDS. In this study, downregulation of ACE2 protein expression in the lower airways was found in asthmatics compared to controls and patients with COPD. Besides, asthmatics with higher peripheral blood eosinophilia show lower ACE2 expression, indicating potential regulation of ACE2 expression by type 2 inflammation in asthmatics [38]. Our study created a chronic pulmonary disease category, including interstitial lung disease without distinction between asthma and COPD. In this group, no increase in mortality and no prolonged hospitalization (8 days (4-31) in the group with CPD vs. 10 days (1-60) in the group without CPD) were observed ($p>0.005$).

When patients with CVSD have COVID-19, the rate of complications such as myocardial infarction, malignant arrhythmia, mesenteric infarction, cardiovascular death, heart failure, myocardial suppression increases [39]. COVID-19 is associated with endothelitis and myocarditis [40,41]. It is believed that SARS CoV-2 can elicit an intense systemic inflammatory response, and the atherosclerotic plaque may become unstable and more prone to rupture, leading to higher myocardial infarction rates and faster systolic dysfunction and heart failure [42]. However, in our ASCVD group, which consisted of 14 patients, no increase in mortality and no prolonged hospitalization (8 days (4-19) in patients with ASCVD vs. 9 days (1-60) in patients without ASCVD) were determined ($p>0.05$).

In the study of Jarahzadeh et al., cancer was not among the most common comorbidities in confirmed COVID-19 patients [5]. A lower rate of mechanical ventilation or death has been

reported in patients with cancer infected with COVID-19 than in patients without cancer [5]. In a nationwide study including 1590 hospitalized COVID-19 patients, Guan et al. reported that 18 cases (1.1%) had a history of malignancy [31]. In another study, those with a history of malignancy were found to be 6% [43]. A meta-analysis showed that 2% of COVID-19 patients had a history of malignancy, with a higher risk of severe symptoms in the cancer group with a history of chemotherapy or surgery within one month (75% vs. 43%) [44].

In COVID-19 patients with lung cancer, higher disease severity and higher rates of intensive care admission and mechanical ventilation requirement have been reported compared to other malignancies and the general population [45]. Multicenter studies have reported a high mortality rate of 33% in thoracic malignancies [46]. In our study, patients with cancer were few, and there was no significant difference in terms of mortality and hospitalization (22.5 (3-45) days in the cancer group, 9 (1-60) days in the non-cancer group) ($p>0.05$). Although the number of our patients was low in terms of connective tissue diseases, we did not find any effect on mortality and duration of stay (9 days (1-60) in non-CDD patients vs. 24 days (14-27) in patients with CDD) ($p>0.05$).

In the study conducted by Uçan et al., the mean age was reported as 61.9 ± 20.1 years [10]. In our study, the mean age of the patients was 68 years (31-95), and the relationship between mortality and age was statistically significant (61 years (31-95) in survivors vs. 70 years (48-94) in non-survivors, $p: 0.002$). The group with comorbid diseases was older. (69 years (35-95) vs. 57.5 years (31-94), $p: 0.001$). An analysis of 77,932 patients (41510 men) infected with COVID-19 indicated that men had 1.71 times higher mortality rate than women [47]. The fact that

genetic factors or risk-increasing factors such as diabetes, hypertension, and coronary artery disease are more common in men may explain this increase [1]. The increased smoking rate in men may also be associated with increased mortality [48]. Also, the stronger immune system of women and the location of most of the genes that regulate immunity on the X chromosome may have turned this ratio in favor of women [49]. Biological gender is also related to T cells and autoimmune response; for example, women secrete higher amounts of interferon than men [50] while testosterone suppresses immunity, estrogens activate it [51]. Similar to the male dominance in the literature⁸, 59.3% of all patients in our study consisted of men. Comorbid diseases were not more common in males, and no gender difference was found in mortality rates ($p>0.05$).

In the study of Uçan et al., Ferritin, CRP, troponin, d-dimer, LDH, and neutrophil/lymphocyte ratio were found to be high in the mortal group [10]. In our study, lymphocyte, lymphocyte ratio, LDH, CRP, troponin, ferritin were also associated with mortality ($p>0.005$), but no significant correlation was found with fibrinogen and d-dimer ($p>0.05$).

Xie et al. stated that dyspnea and hypoxia despite oxygen support at admission were strong independent predictors of mortality. 99% of patients with an oxygen saturation level of 90% or more survived, while 69% of those with oxygen saturation of 90% or less despite oxygen support died [52]. In our study, it was the increase in oxygen requirement that affected mortality ($p>0.005$). Chatterjee et al. also found higher mortality in hospitalized COVID-19 patients with oxygen saturation of $<92\%$ or respiratory rate of $>22/\text{min}$ [53].

Higher CRP values were found in severe pneumonia with diffuse involvement. In these

patients, the duration of stay in the intensive care unit, ventilator support, and mortality rates was also found to be higher [54]. In our study, CT involvement of over 50% was found to be associated with mortality ($p>0.005$). Oxygen requirement was high in 88% of those with CT involvement above 50% and 32.5% of those with CT involvement of less than 50% ($p<0.05$). A decrease in lymphocytes and lymphocyte ratios and an increase in LDH, CRP, troponin, ferritin, D-dimer, and fibrinogen values were significant in the group with severe CT involvement compared to the other group ($p<0.05$).

Conclusions

Most of our patients were patients followed up with critical pneumonia (92 out of 155 patients (59.4%) had severe oxygen requirement, 75 (48.4%) had more than 50% CT involvement). We found that the presence of comorbidity did not affect mortality, while CT involvement and oxygen requirement were associated with mortality. Among the laboratory parameters, we found that lymphocyte, lymphocyte ratio, LDH, CRP, troponin, and ferritin were associated with mortality. Patients with severe CT involvement had higher oxygen requirements and higher inflammation markers. Limitations of our study are that results should be replicated with larger and more representative samples. In particular, the number of our malignancy and CDD group was low, and more extensive studies are required. Another limitation is the study population consisting of inpatients only. In terms of hospitalization, advanced age and the presence of comorbidity should be taken as criteria without hypoxemia, the severity of CT involvement, and abnormal laboratory parameters.

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Ethical statement:

The study was approved by Local Clinical Research Ethics Committee (Date and Decision Number: 10.06.2021-189), and written informed consent was obtained from each subject.

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