

## Coronavirus Pandemic

# Risk factors for poor outcome of patients with Coronavirus disease 2019 (COVID-19) in Albania

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### Abstract

**Introduction:** The study aims to identify potential risk factors for the poor outcome of hospitalized patients with SARS-CoV-2 infection in Albania.

**Methodology:** A retrospective observational study on 133 consecutive hospitalized patients at “COVID 1” Hospital, University Hospital Center of Tirana. The study analyzed the correlation between potential risk factors and in-hospital mortality.

**Results:** The study included 133 patients, 65.4% of the patients were male, age  $60.46 \pm 13.53$  years. The mortality rate resulted in 22.6%. Univariate analysis revealed that early risk factors for mortality included: laboratory alterations on admission, such as lymphocytes count  $< 1.000/\text{mm}^3$  (OR = 3.30, 95% CI = 1.17-9.33), lactate dehydrogenase  $> 250$  U/L (OR = 12.48, 95% CI = 1.62-95.78) and D dimer  $> 2$  mg/L (OR = 4.72, 95% CI = 1.96-11.36); lung parenchymal involvement  $> 75\%$  on chest computed tomography on admission (OR = 54.00, 95% CI = 11.89 – 245.11). Cox proportional hazard regression showed that independent risk factors for mortality were lung parenchymal involvement  $> 75\%$  on chest computed tomography (HR = 8.31, 95%CI: 1.62-42.45) and occurrence of complications during hospital stay (OR = 10.28, 95% CI = 2.02-52.33).

**Conclusions:** The risk of poor outcome can be predicted from the early stage of COVID 19 disease, using laboratory data and chest computed tomography. Among patients with COVID 19, lung parenchymal involvement and alterations  $> 75\%$  on chest computed tomography on admission and laboratory findings, such as lymphocytopenia, and elevated lactate dehydrogenase and D dimer levels, turned out to be early risk factors for in-hospital mortality.

**Key words:** Coronavirus disease 2019; COVID-19; outcome; mortality; risk factors; complication; length of hospital stay.

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### Introduction

Since the 11<sup>th</sup> of March 2020, when WHO announced COVID-19 as a global Pandemic [1], the number of confirmed cases worldwide reached 79 129 306, with 1 680 794 COVID-19 related deaths [2].

The spectrum of illness caused by SARS-CoV-2 varies from mild, self-limiting respiratory tract illness to severe progressive pneumonia and systemic disease with multi-organ failure [3], and death [4].

Previous studies have evaluated risk factors for COVID-19 mortality and poor outcome at local level [5,6] and at a broader range, using worldwide population data [7].

Other studies have established prediction models for the severity of coronavirus disease 2019 (COVID-19) [8,9]; however, efforts to explore and identify risk factors for the progression of COVID-19 disease continue.

Since the first hospitalized confirmed patient with SARS-CoV-2 infection on the 9<sup>th</sup> of March 2020 [10, 11], the number of COVID-19 positive cases is 55 755, and the number of deaths is 1 143 in Albania [2].

Since this disease has a considerable fatality rate [12] and imposes pressure on the healthcare system [6] already fragile in Albania [11], it is of great importance to identify the risk factors for high mortality. These findings would help health care policymakers to develop appropriate strategies [12] because the burden caused by severe cases with COVID-19 disease would be an additional challenge to the health care systems [11]. Identifying patients at high risk for mortality among COVID-19 infected patients would also help health care providers make early interventions to save human lives [12,13].

There is not yet any study to explore risk factors for poor outcomes of Albanian patients with SARS-CoV-2 infection.

The study aims to identify potential risk factors for mortality, complications, and a more extended hospital stay in hospitalized patients with SARS-CoV-2 disease in Albania.

## Methodology

### *Study design and participants*

This study was a retrospective observational study on 133 consecutive hospitalized patients at COVID 1 Hospital, University Hospital Center of Tirana “Mother Theresa”. The study included adult patients aged  $\geq 18$ , laboratory-confirmed with SARS-CoV-2 infection by RT-PCR in the nasopharyngeal swab, during September-October 2020. Asymptomatic patients, patients with nasopharyngeal swab samples negative for SARS-CoV-2 infection by RT-PCR, and radiologically unconfirmed patients were excluded.

### *Data collection*

Demographic, clinical, laboratory, treatment, and outcome data were extracted from medical records.

Firstly, the clinical, laboratory, and radiological findings collected routinely on admission and the data about comorbidities were retrospectively analyzed.

Besides, all laboratory examinations measured within the first 24 hours after admission were recorded. The laboratory measurements included a complete blood count, lactate dehydrogenase (LDH) values (the upper limit 250 U/L) [14], D dimer values (the upper limit was considered the value of 2 mg/L as it was demonstrated that D dimer  $> 2$  mg/L was a risk factor associated with mortality) [13], C-reactive protein values (the upper limit was considered the value of 10 mg/L, Nurshad in a recent study showed that levels of C-reactive protein above 10 mg/L might be an early marker to predict risk for severity of COVID-19) [15], serum ferritin values (the upper limit: 300  $\mu$ g/L) [5], and fibrinogen values (the upper limit: 400 mg/dL according to the hospital laboratory references).

Chest computed tomography (CT) without intravenous contrast was performed in all patients upon hospital admission to identify and quantify lung parenchymal involvement and alterations that included pulmonary parenchymal ground-glass and consolidative pulmonary opacities.

Findings observed on the chest CT Scan were classified according to each of the five lung lobes' degree of involvement. The lung parenchymal involvement/alterations were classified as none (0% of

the lungs), minimal (1%–25% of the lungs), mild (26%–50% of the lungs), moderate (51%–75% of the lungs), and severe (76%–100% of the lungs) [16,17].

Comorbidities were considered self-reported diagnoses and current use of medication for such diagnoses. When unidentified, hypertension was defined as systolic blood pressure  $\geq 140$  mm Hg, diastolic blood pressure  $\geq 90$  mm Hg [18], while diabetes mellitus was defined as fasting plasma glucose concentration  $\geq 7.0$  mmol/L [19].

Secondly, data were collected about complications, length of hospital stay, and mortality. Arterial blood gases were recorded: PaO<sub>2</sub> – arterial oxygen levels and PaCO<sub>2</sub> – arterial carbon dioxide levels, PH and bicarbonates during the hospital stay, recording the lowest and largest values, to estimate acid-base abnormalities and also the onset of respiratory failure. Complications were considered new medical conditions during hospitalization, including respiratory failure (Type 1, hypoxemic, respiratory failure has a PaO<sub>2</sub>  $< 60$  mmHg with normal or subnormal PaCO<sub>2</sub>); (Type 2, hypercapnic, respiratory failure has a PaCO<sub>2</sub>  $> 50$  mmHg) [20], pneumothorax, pulmonary thromboembolism, lung fibrosis, and others.

The interval from symptom onset to hospital admission and length of hospital stay were evaluated. Patients were discharged when their symptoms and signs had been entirely resolved, when they had significant improvement in pulmonary function, no longer needing supportive care, and when repeated tests confirmed viral clearance for SARS-Cov-2.

### *Statistical analysis*

Categorical variables were presented as numbers and percentages, while continuous variables as mean and standard deviation. Means were compared using *t*-tests and the Mann-Whitney U test, while categorical variables were compared using the  $\chi^2$  test. Univariable analysis was used to find the correlation between possible risk factors and in-hospital mortality, emerging complications, and hospital length of stay  $\geq$  ten days.

All the variables relevant to mortality on the univariate analysis were entered in the Cox proportional hazard regression. Multivariable logistic regression methods were used to find independent risk factors for complications and prolonged hospital stay. Kaplan-Meier survival analysis was used to analyze survival, and *p*-values were given according to the Log Rank test.

A *p*-value of less than 0.05 was considered statistically significant. SPSS (version 20.0) was used for all analyses.

**Results**

The study included 133 patients, aged  $60.46 \pm 13.53$  years (range 27-90) (Figure 1). 65.4% of the patients were male.

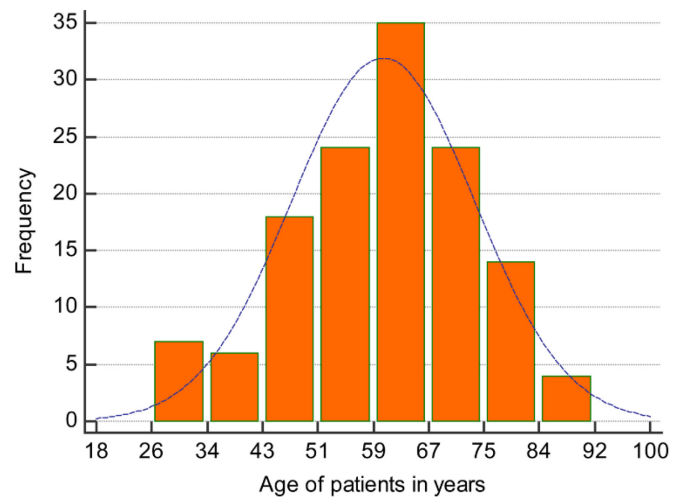
Table 1 shows the patients’ demographic and clinical data.

The average time from symptom onset to hospital admission was  $8.24 \pm 3.07$  days. Eighty-six patients had at least one underlying disease, with hypertension being the most common (42.9% of all patients), followed by diabetes mellitus (17.3% of all patients).

The most common symptoms included: cough, fever, and myalgia.

Laboratory examinations performed upon admission showed that the most common abnormalities included: increased C-reactive protein values present in 51.9% of the patients, increased values of LDH in 75.9% of the patients, and lymphocytopenia in 65.4% of the patients. Increased D dimer levels occurred in 24.81% of the patients, increased serum ferritin values

**Figure 1.** Distribution of patients according to the age in years.



in 79.69% of the patients, and increased fibrinogen values were present in 93.98% of the patients.

Findings on the chest computed tomography upon admission were as below:

- in 30 patients were observed 0-25% of the lung parenchymal involvement (none or minimal);
- in 54 patients were observed 26%-75% of the lung parenchymal involvement (mild and moderate);
- in 49 patients were observed more than 75% of the lung parenchymal involvement (severe),  $p = 0.02$ .

During the hospital stay, 42.9% of the patients developed type I respiratory failure, 6% of the patients developed lung fibrosis, 3.8% had pulmonary thromboembolism, while 1.5% developed pneumothorax. The mortality rate was 22.6%.

*Risk factors associated with mortality*

Risk factors for mortality using univariate analysis are given in Table 2.

In univariate analysis, risk factors for mortality included:

- 1 Laboratory alterations, such as lymphocytopenia and elevated LDH and D dimer levels upon admission;
- 2 More than 75% of lung parenchymal involvement on chest CT upon admission;
- 3 Complications during the hospital stay, especially pulmonary thromboembolism, and respiratory failure.

The presence of comorbidities, arterial hypertension, or diabetes mellitus were not significant risk factors for mortality.

**Table 1.** Demographic and clinical characteristics on admission, comorbidity, and outcome.

Characteristics	Number (%)
<b>Sex</b>	
Men	87 (65.40)
Women	46 (34.60)
<b>Underlying diseases</b>	
Diabetes mellitus	23 (17.30)
Obesity	7 (5.30)
Arterial hypertension	57(42.90)
HIV	1 (0.80)
<b>Symptoms and signs on admission</b>	
Fever	115 (86.46)
Chills	9 (6.76)
Cough	129 (96.99)
Dyspnea	30 (22.55)
Asthenia	36 (27.06)
Headache	4 (3.00)
Chest tightness	36 (27.06)
Sweating	18 (13.53)
Myalgia	89 (66.91)
<b>Abnormal laboratory findings on admission</b>	
Increased values of C-reactive protein ( $\geq 10$ mg/L)	69 (51.90)
Increased values of LDH ( $> 250$ U/L)	101 (75.90)
Lymphocytopenia ( $< 1.000/mm^3$ )	87 (65.40)
D dimer $> 2$ mg/L	33 (24.81)
Serum ferritin $\geq 300$ $\mu$ g/L	106 (79.69)
Fibrinogen $> 400$ mg/dL	125 (93.98)
<b>Complications during hospital stay</b>	59 (44.40)
Lung fibrosis	8 (6.00)
Pulmonary thromboembolism	5 (3.80)
Pneumothorax	2 (1.50)
Respiratory failure	57 (42.90)
<b>LOS <math>\geq 10</math> days</b>	67 (50.40)
<b>Mortality</b>	30 (22.60)

LOS: length of hospital stay; LDH: lactate dehydrogenase; HIV: human immunodeficiency virus.

Out of fifty-one patients  $\geq 65$  years old, 92.15% had at least one underlying disease, while 47.56% of the patients younger than 65 had comorbidities;  $p < 0.0001$ .

There was no difference between men and women concerning comorbidities, respectively: 64.36% & 65.21%,  $p = 0.9$ .

There was no correlation between the levels of serum ferritin, C-reactive protein or fibrinogen, and the mortality rate.

Most of the patients (72.18%) were hospitalized on the seventh day from the symptom onset or later, and this group had a mortality rate of 27.08% versus 10.81% in patients hospitalized earlier,  $p = 0.04$ . Hospital admission on the seventh day or later from symptom onset seemed to represent a greater risk for mortality (in univariate analysis: OR = 3.06, 95% CI = 0.98-9.49,  $p = 0.05$ ). Fifty-seven patients developed respiratory failure. The mortality rate among patients with respiratory failure was 45.61%, while among patients without respiratory failure 5.26%,  $p < 0.0001$ .

Fifty-nine patients had at least one complication. The mortality rate among the group of patients with at least one complication was 44.06%, while among patients with no occurrence of complications, it was 5.71%,  $p < 0.0001$ .

All significant risk factors for mortality on the univariate analysis were entered in the Cox proportional hazard regression, and it turned out that independent risk factors for mortality included: lung parenchymal involvement  $> 75\%$  on chest CT and pulmonary thromboembolism, respectively HR= 8.31, 95% CI = 1.62-42.45,  $p = 0.01$  and HR = 2.97, 95% CI = 1.02-8.65,  $p = 0.04$ .

#### *Risk factors associated with extended hospital stay*

Male patients had a longer hospital stay than female patients, respectively:  $12.32 \pm 8.88$  days and  $8.67 \pm 5.92$  days,  $p = 0.01$ .

Patients with the involvement of more than 75% of the lung parenchyma on chest CT upon admission had a longer hospital stay than patients with less than 75% of involvement of lung parenchyma on chest CT, respectively:  $13.87 \pm 11.38$  days and  $9.41 \pm 5.14$  days,  $p = 0.002$ .

Patients with complications had a longer hospital stay than patients without complications, respectively:  $18.00 \pm 14.57$  days and  $10.24 \pm 6.67$  days,  $p = 0.0006$ .

Patients with respiratory failure had a longer hospital stay than patients without this complication, respectively:  $13.15 \pm 10.13$  days and  $9.48 \pm 5.86$  days,  $p = 0.009$ .

Male patients, involvement of more than 75% of lung parenchyma on CT chest on admission, complications, and respiratory failure impacted the length of hospital stay, increasing it.

Risk factors associated with a hospital stay of ten days or longer, using univariate analysis (p-value significant), are shown in Table 3. In univariate analysis, risk factors for a hospital stay of ten days or longer included: sex (with male patients prone to longer stay), laboratory alterations such as elevated LDH and CRP levels upon admission, complications during the hospital stay, and development of respiratory failure.

All these variables with significance in univariate analysis were entered in the logistic regression analysis adjusted for confounders, and what resulted was that C-reactive protein levels  $\geq 10$  mg/L (OR = 3.15, 95% CI

**Table 2.** Univariate analysis of risk factors associated with mortality.

Variables	Survivors Number	Non- survivors Number	OR	95% CI	p-value
Age $\geq 65$ years	35	16	2.22	0.97 - 5.06	0.05
Male sex	65	22	1.60	0.65 - 3.96	0.30
Lymphocytopenia ( $< 1.000/\text{mm}^3$ )	62	25	3.30	1.17 - 9.33	0.02
LDH $> 250$ U/L	72	29	12.48	1.62 - 95.78	0.01
D dimer $> 2$ mg/L	15	18	4.72	1.96 - 11.36	0.0005
CRP $\geq 10$ mg/L	51	18	1.52	0.66 - 3.49	0.31
Fibrinogen $> 400$ mg/dL	96	29	2.11	0.24 - 17.90	0.49
Serum ferritin $\geq 300$ $\mu\text{g/L}$	79	27	2.73	0.76 - 9.80	0.12
$> 75\%$ of lung parenchymal involvement on chest CT	21	28	54.00	11.89 - 245.11	$< 0.0001$
Underlying disease	66	20	1.12	0.47 - 2.64	0.79
Arterial hypertension	42	15	1.45	0.64 - 3.28	0.37
Diabetes mellitus	16	7	1.65	0.60 - 4.49	0.32
Interval from symptom onset to hospital admission $\geq 7$ days	70	26	3.06	0.98 - 9.49	0.05
Occurrence of complications	33	26	13.78	4.44 - 42.70	$< 0.0001$
Pulmonary thromboembolism	0	5	5.12	3.60 - 7.27	$< 0.0001$
Respiratory failure	31	26	15.09	4.85 - 46.91	$< 0.0001$

CT: computed tomography; LDH: lactate dehydrogenase; OR: odds ratio, 95% CI: 95% Confidence interval; CRP: C-reactive protein.



= 1.47-6.78,  $p = 0.003$ ) and male sex (OR = 2.76, 95% CI = 1.21-6.26,  $p = 0.01$ ) represented independent risk factors for the hospital stay of ten days or longer.

*Risk factors associated with the occurrence of complications during the hospital stay*

The univariate analysis resulted that the factors associated with the development of at least one complication were: male sex (OR = 2.84; 95% CI = 1.32-6.13,  $p = 0.007$ ); laboratory alterations upon admission, such as: D-dimer > 2.0 mg/L (OR = 6.20, 95% CI = 1.80-21.24,  $p = 0.003$ ), LDH > 250 U/L (OR = 19.43, 95% CI = 4.40-85.74,  $p = 0.0001$ ), serum ferritin  $\geq 300$   $\mu\text{g/L}$  (OR = 5.58, 95% CI = 1.14-27.28,  $p = 0.03$ ), and Lymphocyte count < 1.000/mm<sup>3</sup> (OR = 2.44, 95% CI = 1.15-5.21,  $p = 0.02$ ); lung parenchymal involvement of more than 75% upon admission chest CT (OR = 8.68, 95% CI = 3.85-19.58,  $p < 0.0001$ ), and comorbidities. Thus, 51.16% of the patients with underlying diseases developed at least one complication compared to patients without comorbidities (31.91 % of them developed at least one complication) (OR = 2.23, 95% CI = 1.06-4.70,  $p = 0.03$ ).

All these variables with significance in univariate analysis were entered in the logistic regression analysis adjusted for confounders. It resulted that independent risk factors for the occurrence of complications were: elevated levels of D dimer (OR = 7.36, 95% CI = 1.23-43.80,  $p = 0.02$ ) and lung parenchymal involvement of more than 75% on chest CT (OR = 10.28, 95% CI = 2.02-52.33,  $p = 0.005$ ).

*Risk factors associated with lung parenchymal involvement of more than 75% on chest CT*

Risk factors associated with lung parenchymal involvement of more than 75% on chest CT using univariate analysis are given in Table 4.

**Table 3.** Univariate analysis of risk factors associated with hospital length of stay  $\geq 10$  days.

Variables	OR	95% CI	p-value
Male sex	3.07	1.44-6.50	0.003
LDH > 250 U/L	2.37	1.03-5.43	0.04
CRP $\geq 10$ mg/L	3.13	1.54-6.37	0.001
Complications	2.80	1.38-5.70	0.004
Respiratory failure	2.48	1.22-5.04	0.01

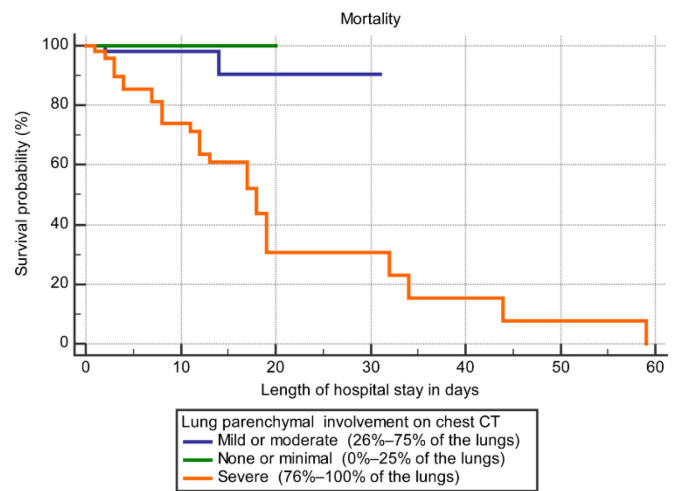
LDH: lactate dehydrogenase; CRP: C-reactive protein; OR: odds ratio, 95% CI: 95% Confidence interval.

**Table 4.** Univariate analysis of risk factors associated with lung parenchymal involvement more than 75% on chest CT.

Variables	OR	95% CI	p-value
Male sex	2.92	1.29-6.62	0.01
D-dimer > 2.0 mg/L	6.00	1.86-19.28	0.002
Granulocytes count > 6,800/ $\mu\text{L}$	2.08	1.01-4.28	0.04
LDH > 250 U/L	13.05	2.96-57.57	0.0007
Lymphocytopenia	2.46	1.10-5.48	0.02

LDH: lactate dehydrogenase; OR: odds ratio, 95% CI: 95% Confidence interval.

**Figure 2.** The association between the degree of lung parenchymal involvement on chest computed tomography and overall survival. (Kaplan-Meier survival analysis, Log Rank test,  $p = 0.0003$ ).



Regression analysis revealed that high levels of D Dimer and LDH are independent risk factors for severe alterations on the chest computed tomography with lung parenchymal involvement of more than 75%, respectively: OR = 4.23, 95% CI = 1.10-16.19,  $p = 0.03$  and OR = 14.03, 95% CI = 1.47-133.11,  $p = 0.02$ .

Patients with lung parenchymal involvement of more than 75% on chest CT had a mortality rate of 57.14%. Patients with 26-75% of lung parenchymal involvement on chest CT had a mortality rate of 3.77%, while patients with lung parenchymal involvement lower than 25% on chest CT had a mortality rate of 0%. The larger the lung parenchymal involvement on chest computed tomography, the higher the risk for mortality (Figure 2) and extended hospital stay (Figure 3).

**Discussion**

This retrospective study identified several risk factors for mortality in laboratory-confirmed COVID-19 patients admitted to the hospital.

Early risk factors associated with mortality included: lung parenchymal involvement and alterations > 75% on chest CT upon admission and laboratory findings, such as lymphocytopenia and elevated LDH and D dimer levels. Other risk factors associated with mortality included also: occurrence of complications during the hospital stay, development of pulmonary thromboembolism, and respiratory failure.

The recent study confirmed the previous findings that most of the hospitalized patients with SARS-CoV-2 infection were males [7]. Although male patients had demonstrated more complications, there seemed to be no relation between male sex and mortality, as shown in other studies [6]. The present study showed a strong association between male patients and lung parenchymal involvement of more than 75% on chest CT upon admission. It was demonstrated that male patients had a more extended hospital stay, and male sex was associated with a hospital stay of ten or more days.

One meta-analysis illustrated that the mortality rate among hospitalized patients varied from 0.6 to 61.5% in different countries [12]. Mortality rate in the present study was 22.6%, which is comparable with the rate of mortality reported in other studies. In Italy's studies, mortality was 26%, with older patients showing higher mortality than younger ones [6,21,22].

A recent study demonstrated that age and comorbid conditions were risk factors for poor prognosis in univariate analysis [23]. In the present study, older age was associated with comorbidities, and 92.15% of the elderly had at least one underlying disease; however,

there was no correlation between comorbidities and mortality. Previous studies had demonstrated that the history of chronic obstructive pulmonary disease [6], type 2 diabetes mellitus [6,7], arterial hypertension [7], and other underlying diseases were independent risk factors associated with mortality. In the present study, although comorbidities were not associated with mortality [22], they were related to the occurrence of complications; patients with underlying diseases had a greater risk for complications compared to patients without comorbidity.

The risk for deterioration of the condition can be predicted from the early stage of the disease, using laboratory data and chest computed tomography [24]. Patients with bilateral lung involvement or multiple lobes involvement on hospital admission chest CT have a greater risk for progression and development of severe pneumonia. The present study demonstrated that lung parenchymal involvement and alterations > 75% on chest CT upon admission were an independent risk factor for mortality.

Other studies have shown that chest CT has diagnostic value and can predict prognosis [23,25]. A retrospective study conducted by Surme and colleagues in 336 adult patients with COVID-19 pneumonia, demonstrated that consolidation of more than 25% of the lung parenchyma in chest tomography on admission was an independent predictor for poor prognosis in univariate analysis [23]. Another study showed that patients with lung involvement > 50% developed severe disease compared to patients with lung involvement less than 50% [25].

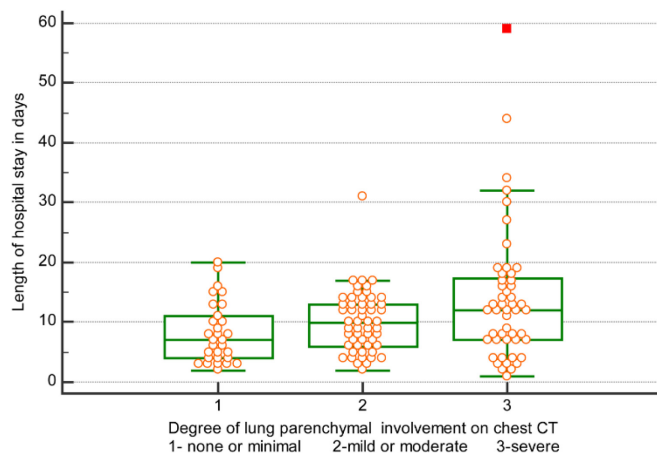
The recent study demonstrated that patients on admission had increased C-reactive protein values, increased levels of LDH, and D dimer; with lymphocytopenia being a common finding.

The presence of alterations in laboratory data, such as an increase in neutrophil count, CRP elevation, or lymphocytopenia, which are important indicators for impaired cellular immunity and usually associated with a bacterial infection, increased the risk for disease progression [24].

Our findings correlate with those of other studies, showing that lower lymphocyte count was associated with higher death odds at the univariate analysis. However, at the multivariate analysis, such findings lost their significance [5]. It was reported that the severity of disease correlates with the decrease of lymphocyte counts, and that lymph nodes were necrotic, while the spleen was atrophied in non-survivors [26].

Unlike other studies that demonstrated that higher serum ferritin levels [5] and elevated C-reactive protein

**Figure 3.** Hospital length of stay according to the degree of involvement of the lung on chest computed tomography (CT).



levels [27] were associated with higher mortality rates, the recent study failed to show any correlation between the levels of C-reactive protein or ferritin levels and mortality. However, this study demonstrated that C-reactive protein values were elevated in patients with complications and mortality [26].

The D-dimer elevation was commonly observed in SARS-CoV-2 infection [13], and recent study confirmed this finding. Like previous studies, the recent one showed that increased D-dimer concentrations had been associated with mortality [13,22,28-31]. It has been demonstrated that when high D-dimer concentrations were associated with pulmonary parenchymal damage, mortality was increased in high levels [31].

An increased D-dimer level is an indicator of increased inflammation; it signifies a hyper-fibrinolysis state [13] and is linked to a possible vascular endothelial injury and occlusions of pulmonary vasculature [31]. Micro and macro-thrombosis may spread largely, affecting lungs and other organs due to a highly activated coagulation cascade [3].

The present study is the first study in the Albanian population hospitalized with SARS-CoV-2 infection, and it gives an overview of the COVID-19 disease in this population. However, it has some limitations: retrospective design, relatively small sample size, short period, and single-center observation. Further studies are needed, including all patients with COVID-19 disease treated in Albanian hospitals.

## Conclusions

Risk factors associated with mortality included:

- Laboratory alterations upon admission, such as lymphocytopenia, elevated LDH, and D dimer levels.
- The presence of alterations on chest CT on admission, involving more than 75% of lung parenchyma.
- The occurrence of complications during the hospital stay, especially pulmonary thromboembolism and respiratory failure.

The risk of disease deterioration can be predicted using laboratory data and chest computed tomography from the early stage of COVID-19 disease.

Early identification of patients with high risk for complications and mortality is essential for preventing disease deterioration and reducing mortality.

The study identified early risk factors for deterioration of the disease; however, other studies are needed to explore how the risk factors of poor outcome act in patients with COVID-19 disease, aggravating it.

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