Malnutrition risk frequency and independent risk factors associated with mortality in hospitalized elderly patients with COVID-19 in Turkey

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ABSTRACT

Background and Objectives: Malnutrition is common in elderly patients and is an important geriatric syndrome that increases mortality. We aim to examine the frequency of malnutrition and independent risk factors associated with mortality in hospitalized elderly patients with COVID-19. **Methods and Study Design:** Patients aged 65 years and older with COVID-19, who were hospitalized between 15th March and 30th April 2020, were included. Demographic characteristics of the patients, their comorbid diseases, medications, malnutrition, and mortality status were recorded. Nutritional Risk Screening-2002 was used as a malnutrition risk screening tool. The factors affecting mortality were analyzed using multivariate Binary Logistic regression analysis. **Results:** Of the 451 patients included in the study, the mean age was 74.8±7.46 and 51.2% of them were female. The mean number of comorbid diseases was 1.9±1.28. Malnutrition risk was 64.7%, polymorbidity rate was 57.6% and polypharmacy was 19.3%. Mortality rate was found 18.4%. The risk factors affecting mortality were presented as malnutrition risk (OR: 3.26, p=0.013), high number of comorbid diseases (OR: 1.48, p=0.006), and high neutrophil/lymphocyte ratio (OR: 1.18, p<0.001), C-reactive protein (OR: 1.01, p<0.001), and ferritin (OR: 1.01, p=0.041) in elderly patients with COVID-19. Malnutrition risk (3.3 times), multiple comorbid diseases (1.5 times), and high neutrophil/lymphocyte ratio (1.2 times) were independent risk factors that increased the mortality. **Conclusions:** The frequency of malnutrition risk and mortality in elderly patients with COVID-19 is high. The independent risk factors affecting mortality in these patients are the risk of malnutrition, multiple comorbid diseases, and a high neutrophil/lymphocyte ratio.

Key Words: COVID-19, elderly Patients, malnutrition, mortality

INTRODUCTION

Coronavirus disease (COVID-19), which is caused by a novel coronavirus (SARS-CoV-2), emerged in Wuhan, Hubei Province, China, at the end of 2019 and in a short time spread worldwide.[1,2] Although this disease may cause different clinical manifestations in the adult group, it may lead to fatal outcomes, especially in elderly patients, who are immunocompromised and have comorbidities.[3-5] COVID-19 may affect the respiratory system and the gastrointestinal tract. SARS-CoV-2 may attack the mucosal epithelium and as a result, nutritional status may worsen in elderly patients due to taste disorders, absorption problems, anorexia, nausea and vomiting.[1,4,6]

Malnutrition occurs more frequently in older adults patients, and it is an important geriatric syndrome that increases morbidity and mortality.[7] Polymorbidity concomitant diabetes mellitus, cardiovascular diseases and advanced age contribute to malnutrition and negative outcomes for elderly inpatients.8 In older adults, patients with COVID-19 may exacerbate malnutrition due to acute respiratory failure, sepsis and inflammation it causes. In these patients, morbidity and mortality will increase even further with decreased muscle mass in case of long hospitalization, intensive care, and immobility for a long time. The recognition and treatment of malnutrition in elderly patients may reduce complications and shorten the hospitalization duration.[8-10] Knowing the frequency of malnutrition in older adult patients hospitalized with COVID-19 and revealing risk factors associated with mortality will contribute significantly to the treatment and care process in these patients. There are very few studies on this topic in Turkey, which remained under-researched. Our aim in this study is to analyse the frequency of malnutrition risk and research mortality-related risk factors in elderly inpatients diagnosed with COVID-19.

MATERIALS AND METHODS

Study design and patients

Patients aged 65 years and older who were hospitalized in COVID-19 clinics in the University of Health Sciences Bakirkoy Dr. Sadi Konuk Education and Research Hospital, a tertiary pandemic center, between 15th March - 30th April 2020, were included in this cross-sectional and retrospective designed study.

At the end of the follow-up period of at least 15 days, the patients' conditions were evaluated retrospectively. The demographic characteristics of the patients, their comorbid diseases, medications and the number of medications they used were recorded.

Inclusion Criteria:

1. Inpatients aged 65 years and older diagnosed with COVID-19 (using these; clinical, laboratory and radiological findings and/or viral scanning RT-PCR (real-time polymerase chain reaction)
2. Patients who were hospitalized in COVID-19 clinics between 15th March and 30th April
3. Patients whose nutritional assessment was performed in the first 24 hours

During this period, 506 elderly patients with COVID-19 were hospitalized in our hospital. Of these, 14 patients were excluded from this study because their malnutrition assessment was incomplete and/or could not be performed and 41 patients had missing information in their files. Finally, this study included 451 patients (89%).

Ethical disclosure

Our study was approved by the University of Health Science, Bakirkoy Dr. Sadi Konuk Education and Research Hospital Ethics Committee (protocol code: 2020/163, decision number:2020-09, date: 30.04.2020). The authors assert that all procedures contributing to this work comply with the ethical standarts in Bakırkoy Dr. Sadi Konuk Training and Research Hospital and the Helsinki Decleration of 1975, as revised in 2008.

The clinical and nutritional assessment of the patients

The nutritional status of the patients was evaluated within the first 24 hours of hospitalization. Nutritional Risk Screening 2002 (NRS-2002), which is commonly used in inpatients, was performed as a malnutrition risk screening tool.[11] Accordingly, nutritional scores recorded in the hospital system were obtained and reviewed by the authors.

According to NRS-2002 scoring Nutritional status score 1: Weight loss of >5% in 3 months or food intake below 50-75% of normal requirement in preceding week; Score 2: >5% weight loss in two months or Body mass index (BMI) 18.5 – 20.5 + impaired general condition or food intake below 25-60% of normal requirement in preceding week; Score 3: >5% weight loss in one month or BMI <18.5 + impaired general condition or food intake below 0-25 % of normal requirement in preceding week. In the severity of the disease, Score 1: Hip fracture, chronic patients, in particular with acute complications: cirrhosis, COPD, chronic hemodialysis, diabetes, oncology; Score 2: Major abdominal surgery, stroke, severe pneumonia, hematologic malignancy; Score 3: Head injury, Bone marrow transplantation, intensive care patients (APACHE>10). The total score is calculated by adding the nutritional status and disease severity score. Also, in adjustment for age, 1 score point is added to the total score for those aged 70 and over. Aged-adjusted total score ≥3 points for NRS-2002 was considered malnutrition risk (MR). In our study, we scored the nutritional status of the patients according to their weight loss to be standard. Also, the disease severity was scored according to chronic diseases and severity of COVID-19 pneumonia.

Braden risk assessment scale was used to identify individuals at risk for pressure ulcers.[12] In this scale, six parameters are evaluated: sensory perception, moisture, activity, mobility, nutrition and friction/shear. Patients can have a total score between 6-23 points. The risk increases as the total score decreases.

Anthropometric measurements (height, weight) of the patients were registered. BMI (kg/m^2) was calculated using height and weight measurements.

Polypharmacy is defined as multiple drug use or/and at least one inappropriate medication use. In this study, five or more medication use was accepted as polypharmacy.[13] Two or more chronic diseases in patients were considered polymorbidity.[9]

The hospitalization period and mortality status of the patients were recorded. As the primary outcome of the patients hospitalized in the ward, their discharge status (discharged home and transferred to intensive care unit) was examined concerning the clinical course. As a secondary result, the mortality status of the patients was recorded at the end of the follow-up by controlling the Death Notification System. Finally, statistical analysis was performed for risk factors affecting mortality.

Hospitalization period was calculated by following the admission and discharge date of the patient. Laboratory values of the patients, such as white blood cell, neutrophil/lymphocyte ratio, thrombocyte/ lymphocyte ratio, albumin, C-reactive protein, ferritin, fibrinogen, D-dimer, procalcitonin, hemoglobin and oxygen saturation measured on admission, were taken from the patient files.

In addition to clinical and laboratory examinations, viral scanning RT-PCR was performed to confirm the diagnosis. Computer tomography (CT) results, which were used to determine the cases considered coronavirus-associated pneumonia on Thorax CT, were evaluated as atypical findings, mild, moderate and severe pneumonia findings.

Statistical analysis

All data were analyzed using SPSS software (SPSS Inc, Chicago, IL) designed for Windows 15.0 version. Demographic and clinical features, malnutrition, mortality and other conditions of the patients were presented as basic statistical data. Comparison of groups with and without mortality was calculated by Student's t-test for continuous variables and chi-square test for categorical variables.

First, bivariate analysis was performed with Spearman’s correlation test for mortality correlated parameters (number of comorbid diseases, C-reactive protein, procalcitonin, neutrophil/lymphocyte ratio, thrombocyte/lymphocyte ratio, ferritin, D-dimer, albumin, oxygen saturation at admission, NRS-2002 score, malnutrition risk, Braden risk score, age, sex, body mass index, smoking, hemoglobin, fibrinogen, number of medications, diabetes mellitus, chronic cardiac diseases, existence of respiratory and renal diseases, neurodegenerative and cerebrovascular diseases, malignancy, existence of polypharmacy, hospitalization period, and severity of COVID-19 pneumonia by CT) . In this one-on-one

analysis, positive and negative factors were identified, which may be associated with mortality and have a correlation coefficient of r ≥0.2.

Multivariate Binary Logistic regression analysis was performed for the factors having thought to be statistically significant. First, modeling multiple regression analysis was performed with all variables with a correlation coefficient >0.2. Then a smaller model that could be statistically significant was analyzed. The variables included in the multiple regression analysis models (Chi-square; p<0.001) were: malnutrition risk, number of comorbid diseases, neutrophil/lymphocyte ratio, C-reactive protein, and ferritin. Thus, the independent factors affecting mortality were analyzed. If the p-value was <0.05, it was considered statistically significant. Continuous values were presented as mean ± SD.

RESULTS

Of the 451 patients included in this study, the mean age was 74.8±7.46, and 51.2% (n=231) of them were female. The mean number of comorbid diseases was 1.9±1.28 (median=2; minimum=0 and maximum=6) and the mean number of medications was 2.3±1.80 (median=2; minimum=0 and maximum=12). The mean hospitalization period was 9.7±6.54 days. Demographic and clinical features of all patients are given in Table 1.

In our study, mortality rate was 18.4% (n= 83). Some 77% recovered and discharged home. Among all patients, RT-PCR test positivity rate was 44.4% (n= 200). The rate of the patients having low oxygen saturation (SaO2 <90) on admission was 17% (n=76), whereas 40.7% of the patients with COVID-19 pneumonia had mild, 33.1% of them had moderate and 14.2% of them had severe pneumonia findings according to thorax CT findings. Malnutrition risk was 64.7% (n=292), polymorbidity rate was 57.6% (n=260) and polypharmacy was 19.3% (n=87) in all patients. The rate of the medications to treat COVID-19 pneumonia was hydroxychloroquine sulfate 92.2%, favipiravir 30.8% and tocilizumab 0.7% (Table 1).

The factors that may be correlated to mortality and the independent risk factors affecting mortality in our study are shown in Table 2. Finally, the variables included in the multiple regression analysis models (Chi-square; p<0.001) were: malnutrition risk, number of comorbid diseases, neutrophil/lymphocyte ratio, C-reactive protein, and ferritin. The independent risk factors affecting mortality were presented as malnutrition risk (OR: 3.26, p=0.013), a high number of comorbid diseases (OR: 1.48, p=0.006), and high neutrophil/lymphocyte ratio (OR: 1.18, p<0.001), C-reactive protein (OR: 1.01, p<0.001), and ferritin (OR: 1.01, p=0.041) in elderly patients with COVID-19.

DISCUSSION

In this study, we examined the risk factors affecting mortality, clinical and demographic features and the frequency of malnutrition risk of 451 elderly patients with COVID-19, who were hospitalized at the time when the case numbers were highest and the severity of the illness was high in our country.

The frequency of malnutrition risk was 64.7% and mortality was 18.4% in elderly patients in this study. Also, we revealed that the independent risk factors for mortality were malnutrition risk, a high number of comorbid diseases, a high neutrophil/lymphocyte ratio, high C-reactive protein and ferritin in elderly patients with COVID-19 (Table 2). According to this, malnutrition risk increases mortality 3.3 times. While the number of comorbid diseases increases 1.5 times, a high neutrophil/lymphocyte ratio increases the mortality 1.2 times. In a study with 182 elderly patients with COVID-19, the mean age determined 68, malnutrition risk was 27% and malnutrition was 53%.[4] Usually, malnutrition frequency in inpatients ranges from 30% to 80%.[14] In another retrospective study on 141 elderly COVID-19 patients, malnutrition assessment was performed using NRS-2002 to determine malnutrition risk and the risk was 85%, which was quite high.[15] Our findings are consistent with the literature, and the number of patients (n=451) was quite sufficient. However, as mentioned above, Liu G et al.'s study, the risk of malnutrition was found to be quite high (85%). This may be because the number of patients included in the study was a small group. In addition, such differences may exist due to the application of these malnutrition risk assessment tools (especially in retrospective studies) by different individuals.

The acute phase reactants as C-reactive protein, ferritin may contribute to malnutrition by causing severe inflammation, especially in the patients who go through the illness severe. Additionally, conditions like anorexia, nausea and vomiting or diarrhea may contribute negatively to food intake and absorption. This process can be faster and lead to more adverse outcomes for individuals with advanced age and polymorbidity.[4,10,16,17] Diabetes mellitus, calf circumference and low serum albumin were independent risk factors for malnutrition.[4]

The nutritional status of patients appears to be related to the novel COVID-19. The elderly, often characterized by malnutrition, are more vulnerable to this virus. There is a prognostic relationship between the nutritional status of elderly patients and COVID-19 infection. [18] In a study of critically ill patients with COVID-19, the NUTRIC score was shown to independently predict the risk of in-hospital mortality (OR=1.197, p=0.006). Also, patients with high NRS scores were at higher risk of poor outcomes in the intensive care unit (mean age 62 years) (OR=1.880, p=0.012).[19] In a prospective study (mean age 65), poor nutritional

status, risk of sarcopenia (73%), and nutritional complaints (21% serious acute weight loss (>5 kg)) are common in patients with COVID-19 during and after hospital admission.[20] In another study (mean age 86), SARC-F score ≥4 (3.1% versus 27.1%; *p*=0.01) and MUST score ≥2 (16.4% versus 26.7%; *p*=0.04) was associated with mortality. In the logistic regression analysis, only the SARC-F score ≥4 remained the independent variable for mortality.[21] In our study (mean age 75), malnutrition risk by NRS-2002 score is an independent risk factor is increases 3.3 times the mortality. Therefore, considering morbidity and mortality, malnutrition risk should be revealed with an appropriate malnutrition screening tool and in the light of the guides.[10] We consider that starting nutritional support in the early period is beneficial.

Although the mortality rate caused by the novel type of coronavirus pneumonia (3.6%) is lower than SARS-CoV (9.6%) and MERS-CoV (34%), in elderly; individuals, mortality risk increases.[22] Elderly individuals are more sensitive to this severe virus disease because of advanced age and comorbid conditions (especially diabetes mellitus, hypertension, cardiac diseases and cerebrovascular diseases). Elderly patients' need for intensive care units is more. Thus, mortality is higher.[23] In studies conducted, mortality rate of patients aged 60 and over ranges from 5.3% to 22%.[24-27] Consistent with the findings in previous studies in the literature, the mortality frequency of 65 over individuals was presented 18.4% in our study. 77% of our inpatients were discharged home. The referral rate from clinic to intensive care unit was 16%. As the most common chronic diseases, hypertension was seen 60%, cardiac diseases 31% and diabetes mellitus 28%. As similar to our study, in of studies, the most common co-existing chronic diseases were hypertension, diabetes mellitus and cardiac diseases.[22,23]

We think that studies on risk factors for mortality in elderly individuals in the COVID-19 pandemic are very important. In a study of 140 patients with COVID-19 with a median age of 60, it was revealed that hypoxemia was an independent risk factor for mortality.[28] In our study, although mortality was high in patients with low oxygen saturation at admission, this difference did not come to the fore as a predicted factor in multiple regression analysis. The reasons for this difference may be related to the inclusion of patients under 65 years of age in other studies, the number of patients, the clinical status of the patients, the criteria for inclusion in this study, and the differences in the variables included in the modeling in multiple regression analysis. On the other hand, another study revealed that the existence of conditions, such as hypoxemia, hypotension and altered mental status, are related to negative outcomes.[27] In another study relationship between comorbid conditions and mortality is determined.[25] Similarly, in our study, the rates of cardiac diseases, chronic renal failure,

neurodegenerative disease and malignancy were statistically significantly higher in patients with mortality. In addition, we showed that the number of comorbid diseases predicted mortality 1.5 times (Table 2). Also, in a prognosis study, laboratory abnormalities, especially high levels of C-reactive protein and lymphopenia, were related to mortality.[23,27] Similarly, we showed that high neutrophil/lymphocyte ratio and high ferritin levels are also very effective on mortality in addition to the high level of C-reactive protein. Also, it was revealed that the mortality incidence was higher in patients with a D-dimer level of 2 ug/mL and higher.[29] In our study, although there was a correlation between D-dimer level and mortality (r=0.27, p<0.001), there was not any significance on multiple regression analysis. In a study conducted in elderly patients with COVID-19, the findings showed that a low Braden scale score (<15 points) at admission is an independent risk factor for mortality.[30] Similarly, a low Braden risk score (r=-0.29, p<0.001) is associated with mortality in our study. In general, these patients are immobile and fragile, and their hospitalization period is prolonged. Eventually, the frequency of mortality and morbidity increases.

In a review, RT-PCR tests used for COVID-19 infection are highly sensitive and specific, but false negativity rates range from 5-40%.[31] RT-PCR, the gold standard for diagnosing during the pandemic, positivity was just in 44% of the patients. Hence, for patients who are clinically and laboratory suspicious of COVID-19, as an early diagnostic tool thorax CT screening was commonly used. According to this, 41% of the patients had mild, 33% of them had moderate and 14% of them had severe COVID-19 pneumonia compatible findings. However, 12% of the patients did not have any pneumonia findings or atypical pneumonia findings on thorax CT. In a study in which the clinical features were examined, the disease among elderly individuals showed 29% severe pneumonia findings.[23] In another study, multiple lesions on CT were more commonly seen in the elderly group than in the young group.[22]

There are some limitations to our study. The present study is a single-center study. Clinical information and malnutrition status were obtained retrospectively from the patient files. Possibly malnutrition risks could be lower than expected. It is a limitation of this study that the data related to the food intake situation in the NRS-2002 scoring cannot be given separately.

Conclusion

The frequency of malnutrition risk and mortality in elderly patients with COVID-19 is high. Malnutrition risk is an independent risk factor predicting mortality in elderly inpatients with COVID-19. Also, the other independent risk factors affecting mortality have multiple comorbid diseases and a high neutrophil/lymphocyte ratio in our study. Finally, malnutrition needs early recognition and treatment in these patients. Elderly patients with COVID-19 should be monitored carefully and closely to reduce mortality in the presence of risk factors.

AUTHOR DISCLOSURE

The authors declare no conflict of interest.

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Table 1. Demographic and clinical features of patients (n=451)

	All patients	Mortality (Yes / No)	*p* value†
Age, Mean±SD	74.8±7.46	76.7±7.63 / 74.3±7.35	0.009
Sex, n (%),(F/M)	231 (51.2) / 220 (48.8)	36(43.4) /47 (56.6) – 195 (53) /173 (47)	0.112
Number of medication, Mean± SD	2.3±1.80	2.7±1.61 / 2.2±1.83	0.034
Number of comorbid disease, Mean± SD	1.9±1.28	2.5±1.33 / 1.8±1.23	<0.001
Hospitalization period (day), Mean± SD	9.7±6.54	8.0±7.10 / 10±6.35	0.010
Smoking, n (%)	51 (11.3)	21(25.3) / 30 (8.1)	
Discharge type from inpatient clinic, n (%)			0.057
Discharge home	347 (77)		
Transfer to intensive care unit	73 (16.2)		
Frequency of mortality, n (%)	83 (18.4)		
Chronic disease, n (%)			
Diabetes mellitus	125 (27.7)	29 (35.4) / 96 (26.1)	0.090
Hypertension	270 (59.9)	54 (65) /216 (58.7)	0.232
Cardiac diseases	139 (30.8)	34 (41.5) /105 (28.5)	0.022
Chronic respiratory diseases	49 (10.9)	9 (10.8) / 40 (10.9)	0.994
Chronic renal failure	39 (8.6)	12 (14.6) /27 (7.3)	0.034
Neurodegenerative diseases	28 (6.2)	10 (12.2) / 18 (4.9)	0.021
Cerebrovascular diseases	38 (8.4)	11 (13.6) / 27 (7.3)	0.078
Malignancy	40 (8.9)	15 (18) /25 (6.8)	0.001
Nutritional assessment			
BMI (kg/m^2), Mean± SD	27.2±4.63	26.9±5.16 / 27.2± 4.50	0.643
Weight loss (kg)	4.4±3.23	5.39±3.81 / 4.1±3.12	0.001
NRS-2002 score, Mean ± SD	3.18±1.44	3.8±1.42 / 3.0±1.41	<0.001
History of weight loss, n (%)			
No/less than 5% weight loss	154 (34.1)	19 (22.3) / 135 (36.6)	<0.001
More than 5% weight loss in the last 3 months	134 (29.7)	24 (28.9) / 110 (29.8)	0.005
More than 5% weight loss in the last 2 months	98 (21.7)	16 (19.2) / 82 (22.2)	0.012
More than 5% weight loss in the last 1 month	65 (14.4)	24 (28.9) / 41 (11.1)	0.017
Frequency of malnutrition risk, n (%)	292 (64.7)	65 (78.3) / 227 (59.2)	<0.001
Frequency of polypharmacy, n (%)	87 (19.3)	24 (29.3) / 63 (17.1)	
Frequency of polymorbidity, n (%)	260 (57.6)	57 (69.5) / 203 (55.2)	
Braden risk scale, Mean ± SD	18.5±3.34	16.1±3.96 /19.0±2.96	
Laboratory assesment			
C-reactive protein (mg/L), Mean ± SD	72.9±87.24	169.1±102.71 / 51.05±66.12	<0.001
Procalcitonin (ng/mL), Mean ± SD	1.4±6.21	5.89±13.18 / 0.45±2.13	<0.001
Neutrophil/Lymphocyte ratio, Mean± SD	6.0±7.59	14.8±3.99 / 3.99± 4.48	<0.001
Thrombocyte/ Lymphocyte ratio, Mean± SD	233.6±177.20	351.7±206.22 / 206.2±139.23	<0.001
Ferritin (ug/L), Mean± SD	419.1±942.81	1137.8±2038.87 / 271.1±312.84	0.001
Fibrinogen (ug/L), Mean± SD	483.4±123.49	515.0±137.87 / 477.0±119.55	0.037
D-dimer(ug/mL), Mean± SD	1.2±1.73	2.41±2.48 / 0.93±1.39	<0.001
Albumin (g/L), Mean± SD	32.7±5.44	29.8±6.85 / 33.37±4.85	<0.001
Low oxygen saturation (SaO2<90%), n (%)	76 (17)	30 (44.1) / 46 (13.7)	<0.001
RT-PCR positivity, n (%)	200 (44.4)	38 (46.9) / 162 (44)	0.667
Thorax Computer Tomography findings, n (%)			<0.001
None/atypical	54 (12)	9 (10.8) / 45 (12.3)	
Mild pneumonia findings	184 (40.7)	25 (30.1) / 158 (43.1)	
Moderate pneumonia findings	149 (33.1)	22 (26.5) /127 (34.6)	
Severe pneumonia findings	64 (14.2)	27 (32.5) / 37 (10.1)	
Status of medication use n (%)			
Acetylsalicylic acid	188 (41.7)	35 (42.7) / 153 (41.6)	0.854
Anticoagulant	399 (88.5)	68 (82.9) / 331 (88.9)	0.070
Hydroxychloroquine sulfate	416 (92.2)	72 (92.3) / 344 (96.9)	0.059
Azithromycin dehydrate	366 (92.2)	67 (85.9) / 299 (84.5)	0.750
Lopinavir/ritonavir	15 (3.3)	7 (9.0) / 8 (2.3)	0.009
Favipirapir	139 (30.8)	37 (47.4) / 102 (28.7)	0.001
Tocilizumab	3 (0.7)	2 (2.6) / 1 (0.3)	0.083
IVIG (intravenousimmunoglobulin)	4 (0.9)	3 (3.6) 1 (0.3)	0.021

n: number of patients; SD: Standard deviation; F: Female; M: Male; BMI: Body mass index; NRS-2002: Nutritional risk score2002
†Comparison of groups with and without mortality was calculated by Student's T test for continuous variables and by Chi-square test for categorical variables.

Table 2. Risk factors associated with mortality

	Correlation coefficient (r)	*p* value†	Odds ratio (OR)	95% Confidence interval	*p* value‡
Number of comorbid diseases	0.20	<0.001	1.48	1.120 – 1.960	0.006
C-reactive protein	0.49	<0.001	1.01	1.005 – 1.014	<0.001
Procalcitonin	0.50	<0.001			
Neutrophil/Lymphocyte ratio	0.51	<0.001	1.18	1.115 – 1.257	<0.001
Thrombocyte/Lymphocyte ratio	0.24	<0.001			
Ferritin	0.34	<0.001	1.01	1.000 – 1.002	0.041
D-dimer	0.27	<0.001			
Albumin	-0.22	<0.001			
Oxygen saturation at admission	-0.25	<0.001			
NRS-2002 score	0.29	<0.001			
Malnutrition risk	0.23	<0.001	3.26	1.286 – 8.309	0.013
Braden risk score	-0.29	<0.001			

SaO2: Oxygen saturation; NRS-2002: Nutritional risk screen-2002.

Data wasn't shown for the related factors with correlation coefficient (r) < 0.2 (age, sex, body mass index, smoking, haemoglobin, fibrinogen, number of medications, diabetes mellitus, chronic cardiac diseases, existence of respiratory and renal diseases, neurodegenerative and cerebrovascular diseases, malignancy, existence of polypharmacy, hospitalization period, and severity of Covid-19 pneumonia.

†Spearman's correlation test for bivariate analysis.

‡Multivariate Binary Logistic regression analysis.