original article

Comparison of nutritional risk status assessment tools in predicting 30-day survival in critically ill COVID-19 pneumonia patients

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BACKGROUND: Few clinical studies have addressed nutritional risk assessment in patients with COVID-19 pneumonia admitted to the intensive care unit (ICU).

OBJECTIVES: Assess the nutritional risk status of the critically ill COVID-19 pneumonia patients admitted to the ICU, and compare the nutritional risk screening tools.

DESIGN: Medical record review

SETTINGS: Tertiary critical care unit

PATIENTS AND METHODS: We included adult (age >18 years) PCR-confirmed critically ill COVID-19 pneumonia cases admitted to the ICU between August 2020 and September 2021. Scoring systems were used to assess COVID-19 severity and nutritional status (mNUTRIC: modified Nutrition Risk in Critically Ill, NRS2002: Nutritional Risk Screening 2002). The 30-day mortality prediction performance of nutritional scores and survival comparisons between clinical and demographic factors were assessed.

MAIN OUTCOME MEASURES: Compare the nutrition risk tools

SAMPLE SIZE: 281 patients with a mean (SD) age of 64.3 (13.3) years; 143 (50.8%) were 65 years and older.

RESULTS: The mean mNUTRIC score of the cases was 3.81 (1.66) and the mean NRS-2002 score was 3.21 (0.84.), and 101 (35.9%) were at high risk of malnutrition according to the mNUTRIC score and 229 (81.4%) according to the NRS 2002 score. In cases at high risk of malnutrition by the mNUTRIC score there was a greater need for invasive mechanical ventilation, vasopressors, and renal replacement therapy (P<.001 for all comparisons). The mNUTRIC score was superior to the NRS-2002 score in estimating 30-day mortality. In patients who died within 30 days, the mNUTRIC score and NRS-2002 score on the day of hospitalization were significantly higher (P<.001), and the proportion of patients with NRS-2002 score ≥3 and mNUTRIC score ≥5 was significantly higher in the non-surviving group (P<.001). In addition, patients with a high risk of malnutrition had a shorter survival time. The mNUTRIC score was an independent and important prognostic factor for 30-day mortality, and patients with an mNUTRIC score ≥5 had a 6.26-fold risk for 30-day mortality in the multivariate Cox regression.

CONCLUSION: One third of critical COVID-19 pneumonia cases hospitalized in the ICU due to acute respiratory failure have a high risk of malnutrition, and a high mNUTRIC score is associated with increased mortality.

LIMITATIONS: Single center retrospective study.

CONFLICT OF INTEREST: None.

A critical illness characterized by life-threatening respiratory failure can develop in approximately 14.1-33.0% of novel coronavirus disease 2019 (COVID-19) pneumonia patients.[1] Acute respiratory distress syndrome (ARDS) is one of the major complications in critically ill COVID-19 pneumonia patients, and is the main cause of the death.[1-3] ARDS, which is one of the most important causes of acute respiratory failure requiring mechanical ventilation support, is a hypercatabolic process that can cause a systemic inflammatory response, multi-organ dysfunction, hypermetabolism, malnutrition, and infectious complications. Hypercatabolism may lead to significant malnutrition and protein catabolism. Therefore, in patients with ARDS, standard supportive treatment should include adequate nutritional support.[4-6]

Approximately 30-50% of hospitalized patients have signs of malnutrition. Similarly, it has been shown that 30% of patients who need mechanical ventilation have reduced oral intake and clinical signs of malnutrition, and 3% of the cases have weight-loss findings.[7] Malnutrition negatively affects pulmonary functions by causing a decrease in respiratory muscle strength, changing the ventilation capacity, and causing deterioration in immune system functions. More importantly, malnutrition is associated with increased mortality and morbidity in critically ill patients.[6-8] For this reason, nutritional risk assessment and early initiation of appropriate nutritional support constitute an important step in patient management in all critically ill patients admitted to the intensive care unit (ICU).[5,9]

In the literature, the number of clinical studies on nutritional risk assessment in patients with COVID-19 pneumonia admitted to the ICU is limited. The present study aimed to assess the nutritional risk status of critically ill COVID-19 pneumonia patients admitted to the ICU due to acute respiratory failure, and investigate the comparison of the nutritional risk assessment scores in predicting 30-day survival in critically ill COVID-19 pneumonia.

PATIENTS AND METHODS

This single-center retrospective chart review included adult (>18 years) critically ill COVID-19 pneumonia patients admitted to a 14-bed adult tertiary COVID-19 ICU of Malatya Training and Research Hospital, Malatya, Turkey between August 2020 and September 2021. The definition of a confirmed COVID-19 case was a symptomatic patient with positive SARS-CoV-2 real-time reverse transcription-polymerase chain reaction from a nasopharyngeal and/or oropharyngeal swab, or lower respiratory tract sample. A COVID-19 pneumonia case was defined as a symptomatic confirmed COVID-19 patient with the typical pulmonary infiltrates on the computed tomography (CT) of the thorax. We used the Acute Physiology and Chronic Health Evaluation-II (APACHE-II) and Sequential Organ Failure Assessment (SOFA) scores for the assessment of the COVID-19 severity during the ICU admission. These scoring systems were calculated based on the worst laboratory and clinical findings observed during the first 24 hours following admission.[10,11] The protocol was approved by the Clinical Ethics Committee of Inonu University School of Medicine and fulfilled the Declaration of Helsinki (protocol no:2021/2460). We did not obtain informed consent due to the retrospective nature of the study.

The nutritional status of patients was assessed according to the modified Nutrition Risk in Critically Ill (mNUTRIC) score and the Nutritional Risk Screening 2002 (NRS 2002) score within the first 48 hours of ICU admission. The mNUTRIC score includes the following six variables: age, number of the comorbidities, days from hospital to ICU admission, APACHE-II score, and SOFA score. Patients with mNUTRIC scores ≥5 were defined as at high nutritional risk.[12] The NRS 2002 score includes nutritional status, the severity of the disease, and advanced age. The patients with NRS2002 score ≥3 indicate a potential nutritional risk and patients with NRS2002 score ≥5 indicate high nutritional risk.[13-15] We collected and analyzed all demographic and clinical data, scores of the APACHE-II, SOFA, mNUTRIC, and NRS-2002, laboratory findings, types of respiratory support, types of nutrition support, ICU admission source, treatment options, hospital length of stay (LOS) before ICU admission, ICU length of stay (LOS) and 30-day mortality status. We followed up with all critically ill COVID-19 pneumonia patients during their ICU stay or until they died in the ICU. We have collected all 30-day mortality data from the hospital electronic medical record system.

Statistical analyses were performed by using IBM SPSS version 22 (Armonk, New York, United States: IBM Corp). The distribution of the variables was evaluated by the Skewness-Kurtosis test. Normal and homogeneously distributed variables are given as mean and standard deviation (SD); otherwise, the data are given as median (min-max) values. The categorical variables are expressed as numbers and percentages. In the analysis of parametric data, the *t* test was used for independent variables, the Mann-Whitney-U test was used for non-parametric data, and the chi-square test was used for categorical data. The 30-day mortality prediction performances of the nutritional risk assessment tools were evaluated by calculating the area under

(AUC) the receiver operating characteristic (ROC) curve. Kaplan-Meier analysis was used for the survival analysis with comparisons between groups tested for statistical significance using the log rank (Mantel-Cox) analysis. Cox regression analysis was used for the multivariate survival analysis. The results were evaluated at the 95% confidence interval and a value of $P<.05$ was accepted as statistically significant.

RESULTS

Of 283 critically ill COVID pneumonia patients admitted to our 14-bed tertiary COVID-19 ICU from August 2020 to September 2021, two were excluded due to pregnancy, leaving 281 patients in the analysis, including 167 (59.4%) males and 114 (40.6%) females (**Table 1**). The mean age was 64.3 (13.3 years) and 143 (50.8%) patients were 65 years of age or older. At least one comorbid disease was present in 229 (81.5%) patients, including hypertension (70.8%), diabetes mellitus (42.3%), and coronary artery disease (CAD) (36.2%). The COVID-19 ward (63.3%) was the most frequent source of admission to the ICU. The mean (IQR) hospital length of stay before the ICU admission was 2.0 (4) days. Laboratory findings are shown in **Table 2**. Twenty-two (7.8%) patients received invasive mechanical ventilation support in the first 24 hours, and the prone position was applied in 121 (43.1%) patients.

The nutritional risk assessment of the patients was performed within the first 48 hours of admission to the ICU. The mean mNUTRIC score was 3.81 (1.66) and the mean NRS-2002 score was 3.21 (0.84) (**Table 3**). According to the mNUTRIC scores, 101 (35.9%) patients were at high risk for malnutrition (mNUTRIC score ≥5). According to the NRS-2002 score, 229 (81.4%) patients were at potential malnutrition risk (NRS-2002 score ≥3), while 44 (15.6%) patients were at high risk for malnutrition (NRS-2002 score ≥5). More importantly, it was determined that in cases with high nutritional risk (NRS2002 score ≥5 and mNUTRIC score ≥5), the requirement of invasive mechanical ventilation, vasopressor, and renal replacement therapy developed more frequently ($P<.05$) (**Table 4**).

Within the first 30 days after ICU admission 142 (50.5%) patients died with statistically significant differences between the survivors and the non-survivors by age, hospital LOS before ICU admission, APACHE-II and SOFA score on the day of ICU admission, serum levels of albumin, and ferritin, and lactate ($P<.05$) (**Table 1 and 2**). mNUTRIC score and NRS-2002 scores on the day of ICU admission were significantly higher in patients who died within 30 days ($P<.001$ for both comparisons). The proportion of the patients with NRS-2002 score ≥3, NRS-2002 score ≥5, and mNUTRIC score ≥5 were higher in the non-survivors group ($P<.001$ for both comparisons) (**Table 3**).

For ICU mortality prediction, the mNUTRIC score was superior to the NRS-2002 score (**Figure 1**). Assessment of the factors affecting 30-day overall mortality in the univariate survival analysis showed that patients of older age and with hypoalbuminemia, an NRS-2002 score ≥3, an NRS-2002 score ≥5, and an mNUTRIC score ≥5 had statistically significant shorter survival times (**Table 5**) (**Figure 2**). Also, multivariate Cox regression survival analysis revealed that mNUTRIC score and NRS-2002 were significant and independent prognostic factors for 30-day overall mortality in critically ill COVID-19 patients ($P<.001$, $P=.020$). Patients with NRS-2002 ≥3 and mNUTRIC score ≥5 were associated with 2.30 and 6.22-fold higher 30-day mortality rate (**Table 5**).

DISCUSSION

In the present study, 101 (35.9%) critical COVID-19 cases admitted to the ICU were at high nutritional risk (mNUTRIC score ≥5). In addition, mNUTRIC score was superior to the NRS-2002 score in estimating 30-day mortality in critically ill COVID-19 pneumonia cases. More importantly, it was shown that the mNUTRIC score was an independent and important prognostic factor for 30-day mortality, and cases with mNUTRIC score ≥5 were at a 6.22-fold higher risk for 30-day mortality in a multivariate analysis.

Pneumonia is the most serious and most common clinical manifestation of COVID-19 and can develop in approximately 15-20% of COVID-19 cases, while ARDS is an important complication of COVID-19 pneumonia and the main cause of mortality. Since it has been shown that severe pneumonia cases are at risk of protein-energy malnutrition, which causes deterioration in contractility of respiratory muscles and immune system functions, appropriate nutritional support is an important part of critical management in this patient group. In addition, critical COVID-19 cases hospitalized in the ICU or those who died are at high risk of malnutrition due to a marked increase in metabolic rate resulting from the high viral load and increased inflammatory response.[2,3,16,17]

Nutritional support is an important part of the treatment during the long treatment period in critical COVID-19 cases. Nutritional support reduces cellular oxidative damage, regulates the immune response, and can prevent the negative effects of metabolism on the disease, as well as meeting the macronutrient needs of the patient.[9,16] For this reason, screening for risk of mal-

Table 1. Baseline characteristics of critically ill COVID-19 pneumonia patients.

	All patients (n=281)	Survivors (n=139)	Non-survivors (n=142)	*P* value
Mean age (years)	64.3 (13.3)	60.0 (12.8)	68.4 (12.4)	**<.001**
Aged ≥65 years				
Yes	143 (50.8)	54 (38.8)	89 (62.6)	**<.001**
No	138 (49.2)	85 (61.2)	53 (37.4)	
Gender				
Male	167 (59.4)	77 (55.3)	90 (63.3)	.173
Female	114 (40.6)	62 (44.7)	52 (36.7)	
At least one comorbidity				
Yes	229 (81.5)	103 (74.1)	126 (88.7)	**.002**
No	52 (18.5)	36 (25.9)	16 (11.3)	
Comorbid disease				
Hypertension	199 (70.8)	83 (59.7)	116 (81.6)	**<.001**
Diabetes mellitus	119 (42.3)	59 (42.4)	60 (42.2)	.974
Coronary artery disease	102 (36.2)	35 (25.1)	67 (47.1)	**<.001**
Chronic obstructive pulmonary disease	45 (16.0)	16 (11.5)	29 (20.4)	**.042**
Dementia	37 (13.1)	11 (7.9)	26 (18.3)	**.010**
Chronic heart failure	35 (12.4)	16 (11.5)	19 (13.3)	.635
Arrhythmia	24 (8.5)	11 (7.9)	13 (9.1)	.710
Cerebrovascular disease	19 (6.7)	9 (6.4)	10 (7.0)	.850
Chronic kidney disease	14 (4.9)	7 (50.3)	7 (4.9)	.967
Rheumatological diseases	13 (4.6)	6 (4.3)	7 (4.9)	.807
Malignancy	8 (2.8)	3 (2.1)	5 (3.5)	.492
Median hospital LOS before ICU admission (days)	2.0 (4.0), 0-19	2, 0-19	1, 0-17	**.029**
Admission source				
COVID-19 ward	178 (63.3)	79 (56.9)	99 (69.8)	**.025**
Hospital emergency department	103 (36.7)	60 (43.1)	43 (30.2)	
APACHE-II scores	17.50 (4.27)	15.24 (3.36)	19.71 (3.91)	**<.001**
SOFA score	4.43 (1.32)	3.91 (1.05)	4.94 (1.36)	**<.001**

APACHE-II: acute physiology and chronic health evaluation II, SOFA: sequential organ failure assessment, mNUTRIC: modified the nutrition risk in critically ill, NRS2002: nutritional risk screening 2002

Data are n (%) or mean (standard deviation) or median (interquartile range) and range.

Table 2. Baseline laboratory findings.

	All patients (n=281)	Survivors (n=139)	Non-survivors (n=142)	*P* value
Hemogram				
Hemoglobin (g/dL)	12.9 (1.96)	12.86 (1.85)	12.93 (2.06)	.778
Hematocrit (%)	38.80 (21.70-57.40)	38.80 (22.90-50.10)	38.90 (21.70-57.40)	.735
White blood cells (10^3/μL)	11.96 (6.01)	11.39 (5.94)	12.51 (6.04)	.118
Neutrophils (10^3/μL)	10.67 (5.09)	9.69 (4.68)	11.63 (5.30)	**.001**
Lymphocytes (10^3/μL)	0.88 (0.70)	0.96 (0.66)	0.80 (0.74)	**.073**
Platelets (10^3/μL)	260 (112)	268 (109)	253 (115)	.262
Biochemical parameters				
Glomerular filtration rate (mL/min/1.73 m^2)	89.79 (89.99)	103.83 (121.60)	76.05 (35.01)	**.009**
Aspartate aminotransferase (U/L)	43 (10-1672)	42 (10-1672)	47 (12.570)	**.032**
Alanine aminotransferase (U/L)	32 (6-814)	30 (6-814)	34 (6-620)	.268
Creatine kinase (U/L)	114 (14-1705)	101 (14-1705)	123 (23-1542)	**.024**
Lactate dehydrogenase (IU/L)	621.67 (309.95)	560.61 (261)	681.43 (310.90)	**.001**
Total bilirubin (mg/dL)	0.57 (0.07-4.22)	0.51 (0.10-2.01)	0.60 (0.07-4.22)	**.070**
Albumin (g/dL)	2.74 (0.45)	2.83 (0.47)	2.66 (0.41)	**.001**
Troponin (ng/mL)	0.32 (0.78)	0.28 (0.65)	0.36 (0.90)	.395
N-terminal prohormone of brain natriuretic peptide (pg/mL)	1046 (1-35000)	781 (1-35000)	1274 (44-35000)	**.003**
Coagulation and inflammation parameters				
International normalized ratio	1.20 (0.79-3.40)	1.19 (0.82-3.40)	1.22 (0.79-3.11)	**.006**
Fibrinogen (ng/dL)	512.05 (188.22)	509.53 (185.59)	514.53 (191.38)	.824
D-dimer (μg/mL)	1.28 (0.01-34.20)	1.13 (0.01-21.30)	1.37 (0.01-34.20)	.144
Ferritin (ng/dL)	852.62 (637.19)	719.81 (603.65)	983.55 (644.33)	**<.001**
C-reactive protein (mg/dL)	12.71 (8.40)	12.11 (9.00)	13.30 (7.77)	.236
Procalcitonin (ng/mL)	0.23 (0.02-8.46)	0.19 (0.02-3.40)	0.32 (0.02-8.46)	**.002**
ABG analysis				
pH	7.42 (0.49)	7.43 (0.07)	7.42 (0.07)	.261
PO_2, (mmhg)	86.47 (31.99)	90.70 (37.17)	82.32 (25.38)	**.028**
PCO_2, (mmhg)	35.60 (8.42)	36.19 (9.09)	35.03 (7.70)	.250
HCO_3, (mEq/L)	23.70 (10.90-42.00)	24.60 (12.20-42.00)	23.30 (10.90-37.80)	**.032**
Lactate, (mmol/L)	1.80 (0.40-16.00)	1.70 (0.40-4.70)	2.00 (0.60-16.00)	**.001**
SaO_2, (%)	95 (45.00-100.00)	95 (45.00-100.00)	94 (62.00-99.00)	**.002**

Data are n (%) or mean (standard deviation) or median (interquartile range).

Table 3. Nutrition risk assessment and nutrition support.

	All patients (n=281)	Survivors (n=139)	Non-survivors (n=142)	*P* value
mNUTRIC score	3.81 (1.66)	2.91 (1.47)	4.71 (1.32)	**<.001**
NRS-2002 score	3.21 (0.84)	2.91 (0.76)	3.50 (0.81)	**<.001**
Median (min-max) body mass index (kg/m^2)	26.6 (18.0-43.2)	26.8 (18.0-38.1)	26.3 19.5-43.2)	.143
NRS-2002 score ≥3				
Yes	229 (81.4)	97 (69.7)	132 (92.9)	**<.001**
No	52 (18.6)	42 (30.3)	10 (7.1)	
NRS-2002 score ≥5				
Yes	44 (15.6)	10 (7.2)	34 (24.0)	**<.001**
No	237 (84.4)	129 (92.8)	108 (76.0)	
mNUTRIC score ≥5				
Yes	101 (35.9)	13 (9.3)	88 (61.9)	**<.001**
No	180 (64.1)	126 (90.7)	54 (38.1)	

Data are n (%) or mean (standard deviation) or median (interquartile range). mNUTRIC: modified Nutrition Risk in Critically Ill, NRS2002: Nutritional Risk Screening 2002

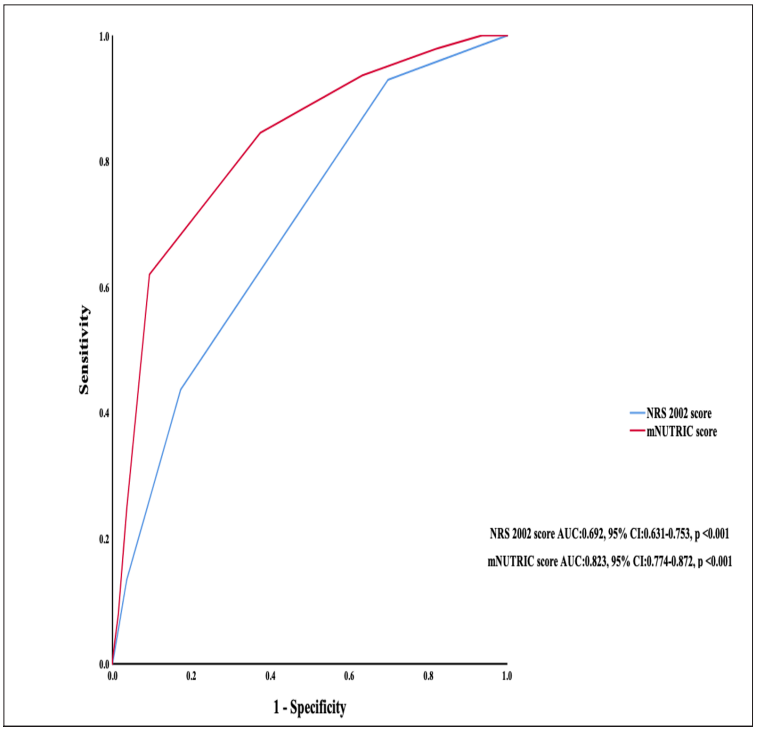

Figure 1. Receiver operating characteristic (ROC) curves of NRS-2002 and mNUTRIC scores predicting 30-days ICU mortality. AUC: area under curve, NRS-2002: nutritional risk screening 2002, modified Nutrition Risk in Critically Ill, NRS2002: Nutritional Risk Screening 2002.

nutrition is recommended to determine the need for appropriate nutritional support in cases of COVID-19 pneumonia.[18] In the present study, 101 (35.9%) patients were at high risk of malnutrition (mNUTRIC score ≥5) according to the mNUTRIC score, while 229 (81.4%) patients were at potential malnutrition risk (NRS-2002 score ≥3) according to the NRS-2002 score and 44 (15.6%) patients were at high risk (NRS-2002 score ≥5) of malnutrition. Defining malnutrition in critically ill patients has always been difficult. However, the nutritional risk is easily identified by evaluating the patient's basal nutritional status and determining the severity of the disease. Therefore, all hospitalized patients should be screened for nutritional risk within 48 hours of admission. Critically ill patients with high nutritional risk should be evaluated in detail in terms of nutritional risk. Although many screening tools are used to evaluate nutritional status, only NRS-2002 and mNUTRIC scores help to determine both nutritional status and disease severity in critically ill patients and can be used to detect nutritional risk. The NRS-2002 or mNUTRIC scores are recommended to determine the nutritional risk status of all critically ill patients admitted to the ICU and to determine which patients are likely to benefit from early enteral nutrition.[9,19-22] On the other hand, the European Society for Clinical Nutrition and Metabolism (ESPEN) guide, published in 2019, emphasized that there is no standard method to identify the patient at risk for malnutrition and the critically ill patient with malnutrition. It is recommended that a general clinical evaluation including history, weight loss, or decrease in physical performance before admission to the ICU, physical examination, and evaluation of muscle mass and strength should be performed until a best practice is developed by ESPEN to determine the nutritional status of critically ill patients.[5]

Few clinical studies have evaluated the nutritional risk status and its relationship with mortality in criti-

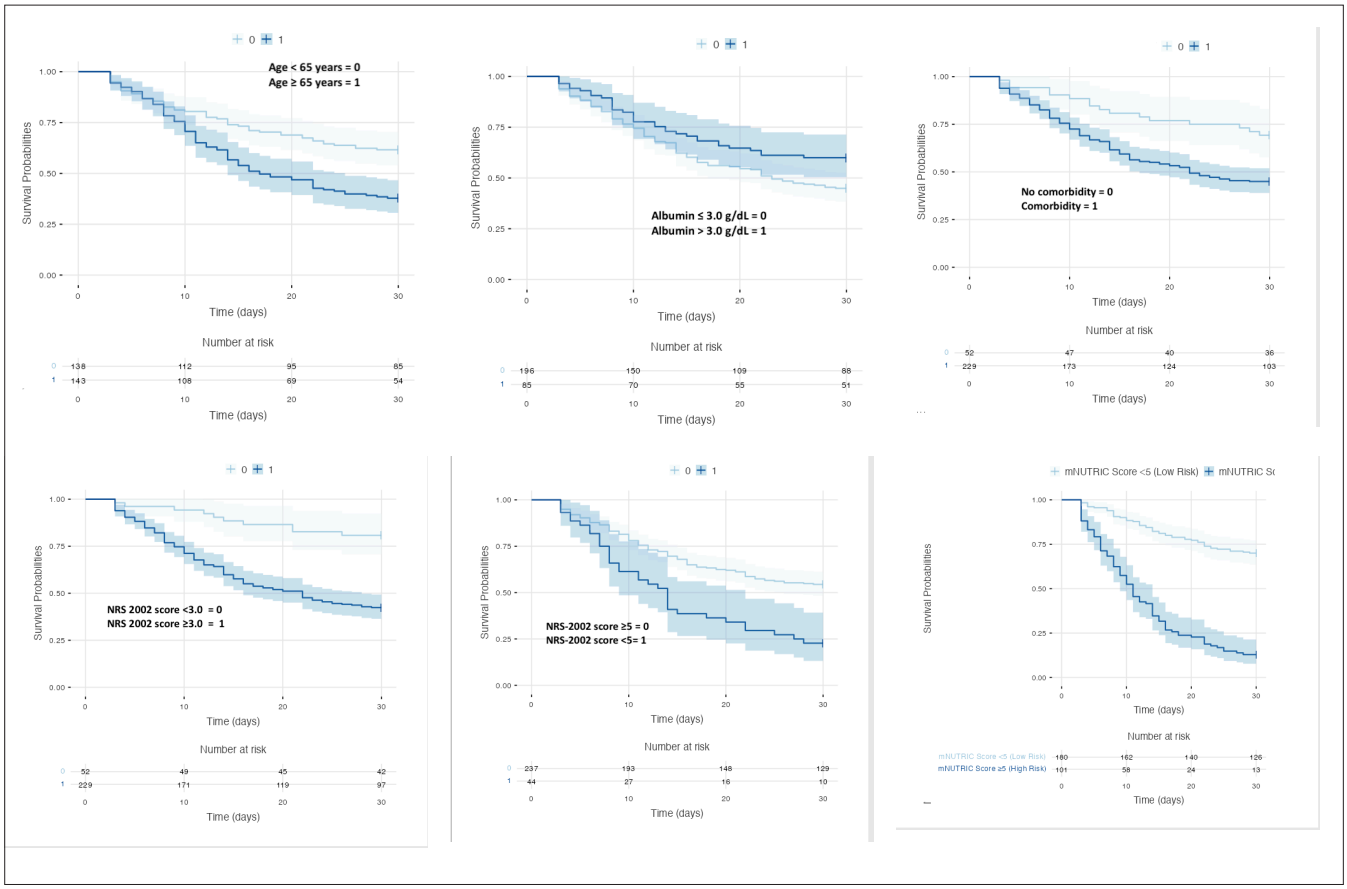

Figure 2. Kaplan–Meier curves (95% confidence limits) for survival time for critically ill COVID-19 pneumonia patients (comparison by log rank test). The effect of patient age (P<.001), serum albumin (*P*=.031), presence of comorbidity (*P*=.002), NRS-2002 score <3 (*P*<.001), NRS-2002 score <5 (P<.001) and mNUTRIC score (*P*<.001). NRS-2002: Nutritional Risk Screening 2002, mNUTRIC: modified the Nutrition Risk In Critically Ill.

Table 4. Association between nutritional risk status of the patients and treatment options.

	Requirement of invasive mechanical ventilation			Use of vasopressor			Requirement of renal replacement therapy		
	Yes	No	*P* value	Yes	No	*P* value	Yes	No	*P* value
mNUTRIC score									
≥5	68 (76.4)	21 (23.6)	**<.001**	83 (82.1)	18 (17.9)	**<.001**	17 (16.8)	84 (83.2)	**<.001**
<5	64 (37.4)	107 (62.6)		65 (36.1)	115 (63.9)		5 (2.7)	175 (97.3)	
NRS-2002 score									
≥3	124 (59.6)	84 (40.4)	**<.001**	7 (7.3)	88 (92.7)	**<.001**	20 (8.7)	209 (91.3)	.187
<3	8 (15.3)	44 (84.7)		141 (75.8)	45 (24.2)		2 (3.8)	50 (96.2)	
NRS-2002 score									
≥5	27 (69.2)	12 (30.8)	**.012**	33 (75.0)	11 (25.0)	**.001**	8 (18.1)	36 (81.9)	**.005**
<5	105 (47.5)	116 (52.5)		115 (48.5)	122 (51.5)		14 (5.9)	223 (94.1)	

Data are n (%). mNUTRIC: modified Nutrition Risk in Critically Ill, NRS2002: Nutritional Risk Screening 2002

Table 5. Univariate and Cox multivariate survival analysis of the factors.

	Univariate analysis			Multivariate analysis					
	Mean survival time (days)	95% CI	*P* value	Coefficient (B)	SE	Wald	Hazard ratio	95% CI	*P* value
Age									
<65 years	22.95 (0.85)	21.28-24.62	**<.001**	-0.680	0.232	8.623	0.507	0.322-0.798	**.003**
≥65 years	18.83 (0.84)	17.18-20.49							
NRS-2002 score									
≥3	19.48 (0.68)	18.14-20.83	**<.001**	0.833	0.357	5.448	2.301	1.143-4.634	**.020**
<3	26.90 (0.97)	24.98-28.82							
NRS-2002 score									
≥5	15.88 (1.47)	12.99-18.77	**<.001**	0.031	0.223	0.020	1.032	0.667-1.597	.888
<5	21.78 (0.65)	20.49-23.07							
mNUTRIC score									
≥5	13.26 (0.87)	11.54-14.98	**<.001**	1.829	0.231	62.825	**6.227**	3.962-9.787	**<.001**
<5	25.12 (0.62)	23.89-26.35							
At least one comorbidity									
Yes	19.88 (0.68)	18.53-21.22	**.002**	0.332	0.278	1.427	1.393	0.809-2.401	.232
No	25.17 (1.18)	22.84-27.50							

mNUTRIC: modified Nutrition Risk in Critically Ill, NRS2002: Nutritional Risk Screening 2002

cal cases of COVID-19 pneumonia. In clinical studies evaluating the nutritional risk status in critical COVID-19 cases it has been shown that 38.9-66% of the cases are at high malnutrition risk (mNUTRIC score ≥5 points) according to the mNUTRIC score at admission to the ICU. In addition, it has been shown that a high risk of malnutrition (mNUTRIC score ≥5 points) on admission to ICU in critical COVID-19 cases is associated with increased mortality.[16,23,24] Zhao et al evaluated the relationship between nutritional risk status and clinical outcomes in severe and critical COVID-19 cases and reported that 92% of the cases were at malnutrition risk (NRS-2002 ≥3 points), and 16% were at high malnutrition risk (NRS- 2002 ≥5 points). They also showed that critical COVID-19 cases with a high NRS-2002 score have a higher risk of mortality and a longer hospital stay. More importantly, they showed that each point increase in the NRS-2002 score caused a 1.23-fold increase in mortality.[25] Similarly, Li et al reported that severe and critical COVID-19 cases were at high risk of malnutrition, COVID-19 cases with a high NRS-2002 score were at a higher risk of poor survival outcomes, and the mNUTRIC score was an independent predictor of the risk of mortality and length of stay in the ICU in critical COVID-patients.[16] In addition, critical COVID-19 pneumonia cases with high malnutrition risk during admission to the ICU have a higher need for invasive mechanical ventilation support and vasopressor use.[24] In our study, 101 (35.9%) critical COVID-19 patients admitted to the ICU were at high risk for malnutrition according to the mNUTRIC score (mNUTRIC score ≥5), while 44 (15.6%) patients were at high risk for malnutrition according to the NRS-2002 score (NRS-2002 score ≥5). More importantly, the mNUTRIC score and NRS-2002 score on the day of ICU admission were significantly higher in patients who died within 30 days. In addition, NRS-2002 ≥3 and mNUTRIC score ≥5 were associated with 2.30 and 6.22-fold higher 30-day mortality rates, respectively. In the present study, we found that one-third of critical COVID-19 pneumonia cases admitted to the ICU due to ARDS had a high risk of malnutrition. Higher nutritional risk was associated with an increased risk of 30-days of ICU mortality in critically ill COVID-19 pneumonia patients. In addition, the mNUTRIC score was the most significant and independent prognostic factor in critically ill COVID-19 pneumonia patients. Therefore, the mNUTRIC score can be used for the assessment of nutritional risk status and prediction of prognosis. Our study was limited in that it was a single-center retrospective chart review and the sample size, not predetermined a priori, was relatively small. Also, the impact of nutrition support on survival was not evaluated in the present study.

Author contributions

US KASAPOGLU, L ACUN DELEN, A GOK contributed to the conception and design of the study, analysis, and interpretation of data, and writing the manuscript. AB OZER contributed to the review and approval of this article's final version.

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