HAYDARPAŞA NUMUNE MEDICAL JOURNAL

DOI: 10.14744/hnhj.2023.00821
Haydarpasa Numune Med J 2024;64(2):133–137

hnhtipdergisi.com

ORIGINAL ARTICLE

Evaluation of the Nutritional Status of COVID-19 Patients Treated in the Intensive Care Unit

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Abstract

Introduction: Covid-19 presents with a wide variety of clinical manifestations, and these patients are also admitted to intensive care units (ICU). Long ICU stays, gastrointestinal involvement, and prolonged hospital stays can result in hypomotility and ischemia of the intestines, which may further result in increased mortality. In severe ARDS cases, the prone position is applied to the patients. In patients in the prone position, deep sedation with muscle relaxants and parenteral nutrition is generally preferred. We aimed to evaluate the Nutritional Risk Screening (NRS 2002) score at first hospitalization, the nutritional status of the patients, and their relationship with mortality in patients followed up for Covid-19.

Methods: In this study, after the approval of the ethics committee (FSMEAH-KAEK2021/28), patients aged 18 years and over who had Covid-19 PCR test positivity and who were hospitalized in the ICU for more than 24 hours between 01.03.2020-28.02.2022 were included. Demographic data, APACHE II, SOFA, SAPS II, NRS 2002 scores, comorbidities, need for mechanical ventilation (MV), non-invasive MV or high-flow oxygen therapy, length of stay, enteral, parenteral, or oral nutrition and durations, need for prone positioning, time of first nutrition, inotrope requirement, discharge from the ICU, and mortality were recorded. SPSS v20.0 was used for statistical analysis.

Results: Sixty-nine patients were studied in the study (35 male (50.7%), 34 female (49.3%)). The mean age of the patients was 72.2±12.3. The prone position was applied in 87% of patients on invasive mechanical ventilators, 30.4% of patients on non-invasive mechanical ventilators, and 7.2% of patients on high-flow oxygen therapy. Enteral nutrition rate was 89.9%, parenteral nutrition rate was 43.5%. Time to first nutrition was 1.4±0.6 days, and time to first enteral nutrition was 1.7±1.0 days. The number of patients who used vasopressor agents was 52 (75.4%), and the mortality rate was 69.6%. The mean NRS 2002 score was 4.2±0.9. SOFA score, IMV, NIMV, prone positioning, and vasopressor agent use were high in the mortality group.

Discussion and Conclusion: The presence of extrapulmonary involvement, associated dysmotility, deep sedation, the use of muscle relaxants, and the resulting intolerance affect the complications of ICU admissions and ICU discharge in Covid-19 disease. Therefore, ICU management and the nutritional state of Covid-19 patients can influence ICU discharge and mortality.

Keywords: Covid-19; Intensive Care; Mechanical Ventilation; Nutrition.

COVID-19 is an important disease that had global effects with the pandemic caused after its emergence in 2019[1]. The disease can present with different clinical conditions ranging from asymptomatic cases to mild or moderate symptoms. The disease course can also be severe, especially in the elderly with chronic diseases such as diabetes, cardiovascular diseases, obesity, or cancer[1,2]. Among the extrapulmonary system complications, gastrointestinal system complications such as hypomotility, intestinal ischemia, increased transaminase levels, and ileus may be

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Submitted Date: 14.12.2022 **Revised Date:** 07.02.2023 **Accepted Date:** 24.02.2023
Haydarpaşa Numune Medical Journal

observed in cases of severe COVID-19 disease[3,4]. The risk of malnutrition is high in patients with severe COVID-19 treated in the intensive care unit (ICU). Prone position and sedatives are frequently applied in severe ARDS that can develop during the course of the disease. The risk of gastroparesis and vomiting is also increased in patients placed in prone position. Malnutrition, refeeding syndrome, and sarcopenia are also frequent in severe COVID-19 cases[5]. Therefore, nutritional risk screening and nutritional support have been recommended for critically ill COVID-19 patients[6].

In this study, we aimed to evaluate the relationship between the Nutritional Risk Screening (NRS 2002) score at admission, the nutritional status of the patients, and mortality in patients treated for COVID-19.

Materials and Methods

Our study retrospectively included patients over the age of 18 who were hospitalized for more than 24 hours between March 1, 2020, and February 28, 2021, in the ICU of the University of Health Sciences Fatih Sultan Mehmet Hospital. Approval was obtained from the Ethics Committee of our hospital (FSMEAH-KAEK2021/28). Our clinic is a 23-bed tertiary care center. Patients who were hospitalized for more than 24 hours were included in the study based on their first admission time. Patient demographics and risk scores routinely used in our practice, including APACHE II (Acute Physiology and Chronic Health Evaluation II) score, SAPS II (Simplified Acute Physiology Score II), SOFA (Sepsis-Related Organ Failure Assessment), and NRS 2002 score on the first day of hospitalization were recorded. Presence and duration of invasive mechanical ventilation (IMV), noninvasive mechanical ventilation (NIMV), high-flow nasal cannula oxygen (HFNC), duration of hospitalization, duration of prone positioning, duration of enteral and parenteral nutrition, time to first feeding, use of vasopressor agents, number of vasopressor agents, type of discharge from the intensive care unit, and mortality were also recorded. The study was conducted in accordance with the Declaration of Helsinki. SPSS 20.0 software package (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Categorical (dichotomous) variables are given as numbers and percentages. The chi-squared test or Fisher's Exact Test was used to analyze dichotomous variables. Continuous variables were given as mean±standard deviation if with normal distribution and as median, minimum, and maximum values if without normal distribution. Continuous variables were analyzed using the Student's t-test or the Mann-Whitney U test. $p<0.05$ was accepted as statistically significant.

Results

A total of 69 patients (35 (50.7%) male, 34 (49.3%) female) were included in the study. The mean age was 72.2±12.3 years. The mean APACHE II, SAPS II, SOFA, and NRS 2002 scores on the first day of hospitalization are shown in Table 1. Invasive mechanical ventilation was applied in 87% of the patients, noninvasive mechanical ventilation in 30.4%, and HFNC in 7.2%. The prone position was applied in 24.6% of

Table 1. Nutritional scores, ventilation parameters, application of prone position, nutritional status, time to first nutrition, vasopressor use and mortality in study patients

	n (%)	
Male Gender	35 (50.7)	
Age (years)		72.2±12.3
Hospitalization Duration (days)		9 (2-73)
SOFA score		6 (1-24)
APACHE II score		19.3±6.4
SAPS II score		35.8±11.9
NRS 2002 score		4.2±0.9
IMV	60 (87)	8 (1-61)
NIMV	21 (30.4)	2 (1-12)
HFNC	5 (7.2)	1 (1-3)
Prone positioning	17 (24.6)	1 (1-7)
Enteral Nutrition	62 (89.9)	6 (1-70)
Parenteral Nutrition	30 (43.5)	4 (1-12)
Oral Nutrition	5 (7.2)	2 (1-11)
Oral and Parenteral Nutrition	4 (5.8)	4 (1-10)
First Feeding Time (days)		1.4±0.6
First Enteral Nutrition Time (days)		1.7±1
Vasopressor use	52 (75.4)	3 (1-32)
Number of vasopressor agents		0.8±0.5
Mortality	48 (69.6)	

Table 2. Comorbidities

Comorbidity	n	%
Hypertension	38	55.1
Diabetes Mellitus	20	29
Chronic Obstructive Pulmonary Disease	14	20.3
Renal Failure	11	15.9
Dementia	10	14.5
Coronary Artery Disease	9	13
Cerebrovascular Disease	7	10.1
Heart Failure	6	8.7
Hypothyroidism	4	5.8
Other	3	4.2

APACHE II: Acute Physiology and Chronic Health Evaluation II; SAPS II: Simplified Acute Physiology Score II; NRS 2002: Nutritional Risk Screening 2002; IMV: Invasive Mechanical Ventilation; NIMV: Noninvasive Mechanical Ventilation; HFNC: High Flow Nasal Cannula Oxygen.

Table 3. Comparison of patients with and without mortality for demographic parameters, hospitalization duration, risk scores, ventilation parameters, nutritional parameters, and vasopressor use

	Mortality (-) n=21(%30.4)	Mortality (+) n=48 (% 69.6)	p
Male Gender	12 (34.3)	23 (65.7)	0.48
Age (years)	70.6±13.7	72.9±11.7	0.49
Hospitalization Duration (days)	17.8±20	12.2±11.1	0.14
SOFA score	4.67±3.3	7.6±4.3	**0.007***
APACHE II score	17.9±6.5	19.9±6.3	0.24
SAPS II score	34.3±10.5	36.4±12.5	0.52
NRS 2002 score	4.3±0.9	4.2±0.9	0.42
IMV	12 (20)	48 (80)	**0.0001***
NIMV	10 (47.6)	11 (52.4)	**0.04***
HFNC	1 (20)	4 (80)	0.59
Prone positioning	2 (11.8)	15 (88.2)	**0.05****
Enteral Nutrition	17 (27.4)	45 (72.6)	0.1
Parenteral Nutrition	9 (30)	21 (70)	0.94
Oral Nutrition	3 (60)	2 (40)	0.14
Oral and Parenteral Nutrition	4 (100)	0	**0.002***
Vasopressor Use	8 (15.4)	44 (84.6)	**0.0001***
IMV duration	20.7±21.5	10.8±11.5	**0.03***
NIMV duration	3.3±3	2.55±3.2	0.59
HFNC duration	1	1.5±1	0.68
Prone positioning duration	2.5±2.1	2.3±2.1	0.88
Enteral nutrition duration	16.1±21	9.2±11.5	0.1
Parenteral nutrition duration	4±3	4.6±2.8	0.62
Oral Nutrition Duration	5±5.3	2	0.5
Oral and Parenteral Nutrition Duration	4.75±3.8	NA	NA
First Feeding Time (days)	1.2±0.4	1.5±0.6	0.07
First Enteral Nutrition Time (days)	1.6±0.9	1.7±1	0.55
Vasopressor Use Duration	4.8±2.7	5.1±6.6	0.87
Number of vasopressor agents	0.3±0.4	1±0.4	**<0.0001***

SOFA: Sepsis-Related Organ Failure Assessment; APACHE II: Acute Physiology and Chronic Health Evaluation II; SAPS II: Simplified Acute Physiology Score II; NRS 2002: Nutritional Risk Screening 2002; IMV: Invasive Mechanical Ventilation; NIMV: Noninvasive Mechanical Ventilation; HFNC: High Flow Nasal Cannula Oxygen; *:p<0,05, **:p=0,05.

the patients. The enteral and parenteral nutrition rates were 89.9% and 43.5%, respectively. The mean first feeding time was 1.4±0.6 days, and the mean first enteral feeding time was 1.7±1 days. Vasopressor agents were used in 75.4% of the patients. Mortality was observed in 48 (69.6%) patients. The ventilation parameters, nutritional status, and vasopressor requirements of the patients are given in Table 1.

The most common comorbidity seen in patients was hypertension. Patient comorbidities are presented in Table 2. When the patients with and without mortality were compared, there was no difference concerning the demographic parameters, comorbidities, APACHE II, NRS 2002, SAPS II mean scores, and length of hospitalization. IMV requirement, NIMV requirement, and vasopressor use were more frequent, and the mean SOFA score and number of vasopressor agents were higher in the group with mortality. The rate of prone position application was also higher in patients with mortality with borderline significance (p=0.05). The rate of combined administration of oral and parenteral nutrition was higher in patients without mortality. In both groups, the rate of use of HFNC, administration of enteral, parenteral, or oral nutrition, duration of NIMV and HFNC, application of prone positioning, first feeding time, mean enteral feeding days, and duration of vasopressor agent use were similar (Table 3).

Discussion

In our retrospective study in which we evaluated the nutritional status of the patients we treated in the ICU with the diagnosis of COVID-19 on the first day of hospitalization with NRS 2002, the rate of enteral nutrition was 89.9%, the rate of parenteral nutrition was 43.5%, the mean first feeding time was 1.4±0.6 days, and the mean first enteral feeding time was 1.7±1 days. We found that the SOFA score, the rates of IMV and NIMV application, and the rate of vasopressor use were higher and that the duration of oral and parenteral nutrition and IMV application were lower in patients with mortality. We observed a borderline significant higher rate of prone position application in cases with mortality. We did not detect a difference in the mean NRS 2002 scores.

In the retrospective study by Liu et al.[7], in which the nutritional and clinical status of 141 patients over 65 years of age who were treated for COVID-19 were examined using the NRS 2002, Malnutrition Universal Screening Tool (MUST), Mini Nutritional Assessment Shortcut (MNA-sf), and Nutritional Risk Index (NRI), patients in the higher risk group had significantly longer hospitalization duration, higher hospital costs (except for MNA-sf), higher rate of anorexia, more severe disease course, and greater weight change (in kg) than normal patients after adjusting for confounding factors.

In the cross-sectional study by Li et al.[8], in which they evaluated the nutritional status of 182 elderly patients treated for COVID-19 with the Mini Nutritional Assessment (MNA) score and grouped the patients as without malnutrition, patients at risk of malnutrition, and patients with malnutrition according to the MNA score, they found that body mass index (BMI), the presence of diabetes, calf circumference, albumin, hemoglobin, and lymphocyte counts were different among the three groups, and further regression analysis revealed that the presence of diabetes, low calf circumference, and low albumin levels were independent risk factors. In our study, there was no difference in terms of the NRS 2002 score and comorbidities in patients with and without mortality. We attribute this to the small sample size in this study.

Prone positioning has a history of use in patients with ARDS that extends prior to the ongoing pandemic. In the fight against respiratory failure due to COVID-19 disease, the prone position is applied not only in patients undergoing mechanical ventilation but also in patients undergoing noninvasive mechanical ventilation[9]. Casetti et al.[10] found that long-term (more than 16 hours) prone position applications were effective and safe in COVID-19 patients in their study with a small patient group. In our study, we applied the prone position to 17 patients. Our mean duration of prone position application was 1 day, which was more than 16 hours, similar to the results of Casetti et al.[10]. Although the rate of prone positioning was significantly higher in patients who died, there was no difference in the duration of prone positioning. We think that this is due to the application of prone positioning more frequently in more severe patients. If there is no contraindication in prone position applications, it is recommended to continue enteral feeding. However, since we apply prone position in clinically severe patients, the average application time is one day, and we apply muscle relaxants, the tendency of our clinic is to feed the patients parenterally during prone position applications. We also fed 17 patients in whom we applied prone position parenterally. No complications were observed in any of the patients during the application.

Extrapulmonary system involvement is often observed in COVID-19 patients. Kaafarani et al.[4] defined gastrointestinal complications in patients with severe COVID-19 in 141 patients and found that the rate of patients with at least one gastrointestinal complication was 73%. In their study, mechanical ventilation was applied in 91% of patients, and the median SOFA score at ICU admission was 5. They also observed complications related to hypomotility in half of the patients. Almost all patients with gastrointestinal complications required a nasogastric or orogastric tube. They observed diarrhea in 28.8%, constipation in 39.4%, and abdominal distension in 34.5% of patients during admission to the ICU. El Moheb et al.[3], in a study in which they investigated the gastrointestinal complications of patients with COVID-19 and without COVID-19, observed that patients with COVID-19 developed more gastrointestinal complications and ileus than patients without COVID-19. In our study, 89.9% of our patients were fed enterally, 43.5% parenterally, 7.2% orally, and 5.8% with a combination of oral and parenteral nutrition. The mean first feeding time was 1.4±0.6 days, and the mean first enteral feeding day was 1.7±1 days. Enteral nutrition was started within the first 24-48 hours after admission to the intensive care unit. In our patients, when enteral nutrition was applied and target values could not be reached, it was supported with parenteral nutrition.

El Moheb et al.[3], in their study examining gastrointestinal complications and nutritional status in patient groups with and without COVID-19, compared both patient groups. However, the retrospective nature of our study and the fact that we only examined COVID-19 patients limited our study. Li et al.[11] evaluated the nutritional risk and prognosis of critical COVID-19 patients in their study of 523 patients. They evaluated the nutritional risk on the first day of hospitalization with the NUTRIC and NRS 2002 scores in 211 patients admitted to the ICU. They found that NUTRIC, NRS 2002, SOFA, and APACHE II scores were higher in patients with mortality, and concluded that the NUTRIC score can independently predict mortality. They also reported that patients who survived received mechanical ventilation and invasive mechanical ventilation treatment at a higher rate than patients with mortality, and that the rate of parenteral nutrition was higher and the time to start nutritional therapy was longer in patients with mortality compared to patients without mortality. In our study, the SOFA score, rates of invasive and noninvasive mechanical ventilation, prone position application, and use of vasopressor agents were higher, and the duration of invasive mechanical ventilation was longer in patients with mortality. Initial feeding and enteral feeding times were similar in both groups. We believe that a difference could have been detected in these parameters if the number of our patients was higher.

The limitations of our study are the small patient size, its retrospective nature, and the lack of examination of laboratory measurements related to nutrition such as albumin, prealbumin, and lymphocyte counts. We believe that the results may differ with larger patient numbers.

Conclusion

The prone position, vasopressor agents, and invasive and non-invasive mechanical ventilation strategies are utilized in the management of severe COVID-19 cases. We believe that the nutritional status of the patients and the scores evaluated during the intensive care period may be important in determining the prognosis.

Ethics Committee Approval: Our study retrospectively included patients over the age of 18 who were hospitalized for more than 24 hours between March 1, 2020, and February 28, 2021, in the ICU of the University of Health Sciences Fatih Sultan Mehmet Hospital. Approval was obtained from the Ethics Committee of our hospital (FSMEAH-KAEK2021/28).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: A.Y.A., Ö.D., Y.Y., H.A.B.; Design: A.Y.A., Ö.D., Y.Y., H.A.B.; Supervision: A.Y.A., Ö.D.; Fundings: A.Y.A., Ö.D., H.A.B.; Materials: A.Y.A., Ö.D.; Data Collection or Processing: A.Y.A., Ö.D., Y.Y., H.A.B.; Analysis or Interpretation: A.Y.A., Ö.D., Y.Y., H.A.B.; Literature Search: A.Y.A., Ö.D., Y.Y.; Writing: A.Y.A., Ö.D., Y.Y.; Critical Review: A.Y.A., Ö.D., Y.Y., H.A.B.

Use of AI for Writing Assistance: Not declared.

Conflict of Interest: None declared.

Financial Disclosure: The authors declared that this study received no financial support.

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