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Investigation of the Effect of the Modified Nutrition Risk in Critically Ill Score on the Length of Stay in the Intensive Care Unit

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ABSTRACT

Objective: Modified Nutrition Risk in Critically Patients is a classification scale that has been widely used all over the world recently to determine the level and degree of nutritional risk in individuals treated in intensive care units. It was analyzed whether the length of stay in the intensive care units as different in individuals classified according to the Modified Nutrition Risk in Critically score level.

Methods: In this retrospective study, which included 100 patients, the age and gender of the patients, the laboratory parameters at the time of first admission to the intensive care units, the prognostic indicators including the Acute Physiologic and Chronic Health Evaluation Score II, Sequential Organ Failure Assessment, and Modified Nutrition Risk in Critically scores calculated in the first day, the need for invasive mechanical ventilation, and if ventilated duration of invasive mechanical ventilation, intensive care units length of stay, comorbid conditions, and death rate were recorded.

Results: Sixty (60%) patients were male. The median age was 66 (48-79) years. The patients with high Modified Nutrition Risk in Critically score were 26 (26%). Intensive care units length of stay was 19 (10-38) days. Acute Physiologic and Chronic Health Evaluation II score was 18 (11-24). Mortality rate was 39%. High Modified Nutrition Risk in Critically score group had higher Acute Physiologic and Chronic Health Evaluation II score, the necessity of invasive mechanical ventilation, length of stay in the critical care unit, and death rate as compared to low Modified Nutrition Risk in Critically score group (for all $P > .05$) and need of invasive mechanical ventilation and Modified Nutrition Risk in Critically score ≥ 5 were shown to have a remarkable influence on length of stay in the critical care unit.

Conclusion: The need for invasive mechanical ventilation and Modified Nutrition Risk in Critically score ≥ 5 were shown to have remarkable influence on intensive care units length of stay.

Keywords: mNUTRIC score, intensive care unit, length of stay

INTRODUCTION

In line with diagnosis, disease severity, additional diseases, and disease processes, the patients are planned to be accepted to intensive care units (ICUs) and their treatment is carried out. Furthermore, malnutrition and related problems are frequently encountered in this group whose condition is evaluated as critically ill. It was determined that the prevalence of malnutrition in critical care units varied from 39% to 50%, depending on patient populations and nutritional scores.[1,2] The evaluation of nutritional status, creation of a nutrition plan, and providing appropriate nutritional support in ICU patients constitute an important part of the treatment and are of vital importance. Adequate and appropriate nutritional support should be given without delay in patients who be necessary to stay in the ICU for more than 2 days, and nutritional status and risk assessment should be performed within the first day after admission to the ICU.[3] Clinical, anthropometric, chemical, and immunological parameters can be used to define malnutrition in ICU patients. However, there is no ideal test that can identify malnutrition in ICU patients both sensitively and specifically. In the follow-up of nutritional therapy, many laboratory parameters (such as prealbumin) are useful, and more valuable information can be obtained with a good anamnesis and physical examination, by allocating a certain time to the patient in defining the nutritional condition of the individuals.[4,5] In 2011, Heyland and colleagues introduced the Nutrition Risk in Critically Ill (NUTRIC) score, which is specifically designed to screen for

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critically ill to state nutritional risk status and degree.[6] The NUTRIC score includes 6 important parameters: age, Acute Physiologic and Chronic Health Evaluation II (APACHE II), Sequential Organ Failure Assessment (SOFA), the number of comorbid situations, days from hospital admission to critical care unit admission, and IL-6 level. However, IL-6 used as an inflammatory marker is not routinely used in most hospitals. When calculating the NUTRIC score, if one of the parameters, IL-6, is not included in the result, the scoring tool to be obtained is called the modified NUTRIC (mNUTRIC) score. Patients are divided into low- (0-4) and high (5-9)-risk groups according to mNUTRIC score, and high mNUTRIC score is associated with poor prognosis.[7] The goal of the study is to retrospectively explore whether there is a relationship among length of stay (LOS) in the ICU, which is considered a poor prognosis for patients, and mNUTRIC score.

METHODS

This retrospective study included patients hospitalized in the tertiary ICU of a state hospital between January 2022 and August 2022. This study protocol was ratified by the ethics committee (December 9th 2022; no. 267) and since the data of the study were obtained from the old medical files, written or verbal consent was not obtained from the patients and their relatives for the use of their information. If the age of the patient planned to be included in the study was younger than 18 years and if the patient was hospitalized in the intensive care unit for less than 24 hours, the person was not included in the patient list. One hundred patients were joined in this study. Age and gender of the patients participating in the study, APACHE II, SOFA, and mNUTRIC scores which were calculated in the first day after admission to the ICU, the patient's need for invasive mechanical ventilation (IMV) and how long time the patient remained on IMV, the total ICU LOS, diagnosed chronic diseases of the patients, the status of the blood parameters taken at the first-day admission to the ICU (white blood cell (WBC), c-reactive protein (CRP), arterial lactate level, procalcitonin, albumin, and prealbumin values) and death status were recorded.

Main Points

- The mNUTRIC score is an important and easily calculated scoring tool that has been validated in terms of showing malnutrition and prognosis for patients hospitalized in the ICU.
- The advantage of mNUTRIC score is that, unlike the NUTRIC score, IL-6, which cannot be studied in every hospital, is not included in the calculation.
- In addition, the high mNUTRIC score correlates with ICU LOS.

Statistical Analysis

Shapiro–Wilk test was used to analyze the normality of continuous variables, and the data obtained were presented as median and interquartile range or mean ± SD. Mann–Whitney *U*-test was used to analyze the differences between groups for data that were not normally distributed. To compare the differences between groups of normally distributed data, statistical analysis was performed with the Student's *t*-test. Differences between percentile data identified as categorical variables were statistically analyzed using the chi-square test or Fisher's exact test. Linear regression analysis was applied to identify independent risk factors for length of stay in the critical care unit. Patients were divided into 2 groups as high and low mNUTRIC score, and the differences between each of 2 groups were analyzed for all parameters. While the data obtained in the results of the regression analysis were presented as odds ratio (OR) and 95% confidence interval (CI), *P* value less than .05 was statistically meaningful. Statistical analyses were performed with IBM Statistical Package for the Social Sciences (IBM SPSS Corp., Armonk, NY, USA) version 22.0.

RESULTS

Sixty (60%) were male and the median age was 66 (48-79) years. The patients with high mNUTRIC score were 26 (26%). Death rate was 39%. Intensive care units LOS was 19 (10-38) days. Acute Physiologic and Chronic Health Evaluation II score was 18 (11-24), and SOFA score was 5 (3-6). The need for IMV was 61 (61%) and IMV duration 7 (1-22) days. Median lactate value was 2.1 (1.4-2.9) mmol/L, CRP value 90 (67-105) mg/dL and procalcitonin was 0.6 (0.2-3) µg/L. The mean level of serum albumin on day 0 was 2.8 ± 0.6 g/L, and median serum prealbumin level on day 0 was 12 (8-19) g/dL. In this study, 30 (30%) patients had hypertension (HT), 20 (20%) patients had diabetes mellitus (DM), and 20 (20%) patients had chronic obstructive pulmonary disease (COPD). The patients with low mNUTRIC score had higher age, APACHE II score, need for IMV, procalcitonin, cerebrovascular disease (CVD), DM, IMV duration day, and death ratio as compared to the patients with low mNUTRIC score (for all $P < .05$). Sex, SOFA score, IMV duration day, WBC, lactate, CRP, albumin and prealbumin (on day 0) values, COPD, coronary artery disease (CAD), and HT were not different among patients (for all $P > .05$). High mNUTRIC score group had higher APACHE II score [25 (2-30) vs. 14 (9-21), $P=.025$], age [81 (66-85) vs. 60 (38-73), $P=.001$], need for IMV [22 (84.6%) vs. 39 (52.7%), $P=.004$], LOS in ICU [23 (10-39) vs. 15 (9-29), $P=.04$], and death ratio [17 (65.3%) vs. 22 (29.7%), $P=.009$] as compared to low mNUTRIC score group (data of the participants are shown in Table 1). The need for IMV ($P=.011$) and mNUTRIC score ≥ 5 ($P=.008$)

Table 1. Demographic and Clinical Characteristics of the Patients

Variables	Total, n = 100	mNUTRIC score ≥5, n = 26	mNUTRIC score <5, n = 74	*P*
Age (years)	66 (48-79)	81 (66-85)	60 (38-73)	**.001**
Sex, n (%)				
Male, n (%)	60 (60)	15 (57.7)	45 (60.8)	.780
Female, n (%)	40 (40)	11 (42.3)	29 (39.2)	
APACHE II score	18 (11-24)	25 (2-30)	14 (9-21)	**.025**
SOFA score	5 (3-6)	7 (5-9)	4 (2-5)	.581
Need for IMV, n (%)	61 (61)	22 (84.6)	39 (52.7)	**.004**
IMV duration, day	7 (1-22)	8 (4-20)	6 (1-23)	.256
WBC (10^3/μL)	12 (8.6-16.8)	12 (8-14.7)	13 (10-17)	.581
Lactate (mmol/L)	2.1 (1.4-2.9)	2.3 (1.4-3)	2 (1.3-2.9)	.277
CRP (mg/dL)	90 (67-105)	69 (20-162)	64 (5-134)	.905
Procalcitonin (μg/L)	0.6 (0.2-3)	1.6 (0.5-6)	0.4 (0.1-2)	**.004**
Albumin (g/dL), 0 day	2.8 ± 0.6	2.6 ± 0.6	2.8 ± 0.6	.175
Prealbumin (mg/dL), 0 day	12 (8-19)	11 (8-19)	13 (8-19)	.614
Comorbidities, n (%)				
COPD	20 (20)	6 (23.1)	14 (18.9)	.648
CAD	14 (14)	6 (23.1)	8 (10.8)	.185
HTN	30 (30)	11 (42.3)	19 (25.7)	.111
CVD	9 (9)	5 (19.2)	4 (5.4)	**.04**
DM	20 (20)	9 (34.6)	11 (14.9)	**.03**
LOS in ICU, days	19 (10-38)	23 (10-39)	15 (9-29)	**.04**
Mortality, n (%)	39 (39)	17 (65.3)	22 (29.7)	**.009**

APACHE II, Acute Physiologic and Chronic Health Evaluation; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; CRP, C-reactive protein; CVD, cerebrovascular disease; DM, diabetes mellitus; HTN, hypertension; ICU, intensive care unit; IMV, invasive mechanical ventilation; LOS, length of stay; NRS, nutritional risk screening; SOFA, Sequential Organ Failure Assessment; WBC, white blood cell; y, year.
Since the *P* values were less than 0.05 and statistically significant, these numbers were expressed in bold values.

Table 2. Linear Regression Modeling of Parameters for Length of Stay in Intensive Care Unit

Variables	Unstandardized Coefficient		Standardized Coefficient		
	B	Standard Error	Beta	*t*	*P*
Constant	30.831	13.658		2.257	.226
Age	–0.184	0.207	–0.122	–0.889	.377
APACHE II score	–0.950	0.712	–0.239	–1.334	.185
Need for IMV	18.752	7.252	0.269	2.586	**.011**
mNUTRIC score	8.008	4.256	0.470	1.881	.063
mNUTRIC score ≥5	–31.065	11.458	–0.400	–2.711	**.008**

APACHE II, Acute Physiologic and Chronic Health Evaluation; IMV, invasive mechanical ventilation; mNUTRIC, Modified Nutrition Risk in Critically Ill; OR, odds ratio.
Since the *P* values were less than 0.05 and statistically significant, these numbers were expressed in bold values.

was shown to have significant effects on LOS ICU (data of the participants are shown in Table 2).

DISCUSSION

Patients who are nutritionally deficient before hospitalization may experience worse clinical outcomes than patients who do not have nutritional problems. This relationship is more pronounced in the case of serious illness leading to ICU admission. While malnutrition status and degree of deterioration are slower in the case of lack of oral intake, it occurs more rapidly with disease severity.[8] A severe catabolic process occurs in patients in the ICU, depending on the degree of the illness compared to a normal individual. This process leads to increased calorie and protein needs. Severe deterioration of nutritional status leads to complications such as increased mortality, decreased physical function, and increased hospital stay. It is substantial to determine the risk of malnutrition to diminish the unfavorable consequences that may develop. It is no consensus on the ideal way for determining this risk, especially in the ICU. Parameters such as weight, body mass index, clinical diagnosis, laboratory findings, amount of food and energy intake, and functional status are used in these measurement methods.[9-11] These were generally defined by studying hospital inpatients outside the ICU.[12]

While there was no scale specifically developed for ICU, the NUTRIC score was evolved in 2011 with the determination of the importance of inflammation in malnutrition.[6] Since IL-6 did not make a clinically and statistically significant difference, the mNUTRIC score was formed by removing it from the original scoring. Leoni et al[13] demonstrated that diagnosed COVID-19 patients with NUTRIC score ≥ 5 have upward death ratio than same diagnosis patients with NUTRIC score < 5 (80.5% vs. 21.1%; *P* < .001). Kucuk et al[14] showed that a high mNUTRIC score poses a risk for mortality for COVID-19 patients hospitalized to critical care unit (the area under the curve value was 0.786 and *P* < .0001). In a meta-analysis by Ibrahim et al.[15] which included 4076 patients in total, it was observed that ICU LOS was prolonged in patients with high mNUTRIC score (*P* < .001). In the retrospective cohort by Zeng et al.[16] ICU LOS was found higher in patients with upward of mNUTRIC score among the patients who underwent cardiothoracic surgery. In a study conducted by Lin et al.[17] hospitalized in the surgical ICU patients who connected to IMV for at least 24 hours, ICU LOS was found higher in patients with modified NUTRIC score ≥ 5 (7.3 ± 9.5 vs. 3.4 ± 4.7, *P* < .001). Although there are many studies showing positive results between a high mNUTRIC score and the length of stay in the ICU, there are also contradictory studies. In a study conducted by Tripathi, in 115 patients with cirrhosis, there was no difference in the length of ICU stay between the patients when they were separated according to the mNUTRIC score.[18] Tseng et al[19] investigating the prognostic importance of the mNUTRIC score in patients with community-acquired pneumonia, no relationship was found between the ICU LOS and the mNUTRIC score. Considering the outcomes of our study, the ratio of malnutrition was determined as 26% according to mNUTRIC score. The patients with an mNUTRIC score > 5 were included in the malnutrition category, and both mortality and the ICU LOS were found to be higher in the malnutrition group. The ICU LOS is affected by multiple parameters. Infection status of the patients, comorbidities, need and duration of invasive mechanical ventilation, electrolyte imbalance, albumin and prealbumin values, nutritional support status, high intensive care score, and age can be included in these parameters. mNUTRIC score includes 5 of these counted parameters. Studies have found that these 5 parameters are highly correlated with the LOS in the ICU. We analyzed 4 parameters from these 5 values, and only the duration of hospitalization before admission to the intensive care unit was not examined. While the parameters alone could not be established as a risk factor for ICU LOS, the mNUTRIC score was determined as a risk factor. There were some limitations in the study. Some parameters that may affect the ICU LOS were not included in the study. Energy and protein support and requirements given to patients, the route of application of nutritional support, unquestioned diseases (such as neurological, muscle, and liver diseases), body mass index, IL-6 level, sedation and vasopressor drugs given, and renal replacement therapy can be counted. In addition, being planned in a single intensive care unit, restricted of participants, heterogeneity of the group and being a retrospective study can be included in the limitations of the study.

Although there is no gold standard for the determination of nutritional risk, the mNUTRIC score, which is determined without the need for IL-6, has been shown many times to be a reliable parameter especially in terms of determining the risk of mortality. Although studies sometimes show negative results in terms of ICU LOS, the mNUTRIC score, which has been shown to be effective in our study and has been previously validated and can be easily calculated, may be appropriate to calculate in critically ill patients.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Gazi Yaşargil Training and Research Hospital (Date: December 9, 2022, Number: 267).

Informed Consent: Informed consent from patients was not procured because of the retrospective study.

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