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Nutritional assessment of intensive care unit patients aged ≥65 years using different screening tools

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ABSTRACT

Objective: The aim of the study was to evaluate the nutritional status of patients aged ≥65 years admitted to the intensive care unit (ICU), compare the compliance with the nutritional status screening tools, and determine the effect of malnutrition on mortality.

Methods: Patients who were admitted to ICU and could receive nutrition orally were included into this study. The Nutritional Risk Score 2002 (NRS-2002) and Mini Nutritional Assessment Short Form (MNA-SF) were administered, and the Nutritional Risk Index and Geriatric Nutritional Risk Index (GNRI) scores were calculated. Patients were divided into two groups according to their survival status. The nutritional status was evaluated and found to be in accordance with the screening tools.

Results: The rate of malnutrition/severe nutrition risk was found to be 28.4%–60%, and the normal nutritional status was 1.7%–33.3%. In-hospital mortality was 41.7%. The duration of stay in ICU (8.0±9.8 days; 20.5±20.0 days, p=0.03), duration of stay in hospital (16.9±14.4 days; 28.5±24.6 days; p=0.029) and mechanical ventilation duration (4.38±6.8 days; 15.56±17.2 days; p=0.01) in patients who survived were shorter than in patients those who died. The male gender, patients with an NRS-2002 score ≥5 and NRI score ≥81.2 had higher mortality rates (respectively, p=0.013, p=0.019, p=0.036). The NRS-2002 was found to have the highest sensitivity; NRI was the highest specificity screening tool.

Conclusion: The risk of malnutrition/severe nutrition risk was found to be 28.4%–60%. We found that the male gender, NRS-2002 ≥5, and NRI ≥81.2 were associated with higher mortality. The NRS-2002 was found to have the highest sensitivity; NRI was the highest specificity screening tool. We think that the usage of one screening tool for predicting malnutrition in elderly patients is not sufficient in the diagnosis of malnutrition, and these methods should be evaluated together.

Keywords: GNRI, geriatric patient, intensive care, malnutrition, MNA-SF

Introduction

Malnutrition is defined as "subacute or chronic malnutrition that causes functional capacity, lean tissue mass and cell decline as a result of malnutrition and inflammatory activity" (1). Intensive care patients are highly susceptible to the development of malnutrition. Especially when the elderly population is considered, malnutrition has many negative consequences, such as impaired muscle function, muscle weakness, bone fractures, decrease in immune function, bone mass and cognitive function, anemia, pressure sores, postoperative healing, delayed wound healing, and edema. This clinical process leads to an increase in the length of stay in the intensive care unit (ICU), as well as an increase in morbidity and mortality. Therefore, a planned and scheduled nutritional assessment should be implemented in hospitals (2, 3). However, no assessment alone has sufficient sensitivity and selectivity to determine the nutritional status (4).

The purpose of nutrition screening is to identify individuals with malnutrition or those at risk for malnutrition to achieve a more comprehensive nutritional assessment and support (5). The assessment of nutritional status in the elderly is important in defining nutritional deficiency and related diseases (6, 7). A number of screening tools have been developed to determine the risk of malnutrition in elderly patients. Some of those are the Nutritional Risk

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Screening 2002 (NRS-2002) and Mini Nutritional Assessment Short Form (MNA-SF) (8, 9).

The NRS-2002 is a nutritional assessment test used for intensive care unit (ICU) patients to determine the risk of malnutrition, to find malnourished patients, and to evaluate the adequacy of nutritional support in hospitalized patients (10).

The Nutrition Risk Index (NRI) was developed in 1991 to evaluate the effectiveness of perioperative total parenteral nutrition in patients undergoing thoracic or abdominal surgery (11).

Geriatric Nutrition Risk Index (GNRI) is an evaluation method designed especially to predict morbidity and mortality risk of elderly hospitalized patients. Since it is often difficult to evaluate the normal body weight of the elderly, this method uses the term ideal body weight instead of the usual body weight in NRI. GNRI is calculated using a special formula that uses serum albumin and body weight loss together (12).

The aim of this study was to evaluate the nutritional status of patients aged ≥65 years admitted to ICU, using the NRS 2002 and MNA-SF scales and NRI and GNRI scoring systems, to determine their usefulness as a screening test, to compare compliance, and to determine the effect of malnutrition on mortality.

Methods

This prospective study was approved by the Başkent University Non-interventional Clinical Research Ethics Committee, dated 01/19/2018 and numbered KA17/365. It was carried out in patients voluntarily admitted, aged ≥65 years, with at least 24-hour hospitalization at the Başkent University Ankara Hospital Internal and Surgical Sciences Intensive Care Unit. The patients managed by intensivists are admitted to our ICU from different departments.

Patients aged ≥65 years in who oral intake was possible, or who were receiving oral enteral nutritional support following the ICU admission, were included in the study. Patients who received the enteral nutrition support at home via gastrostomy, jejunostomy, or nasogastric tube before hospitalization were excluded from the study. However, patients who needed any nutritional intervention during their stay in the ICU were routinely evaluated by the Nutrition Support Team to provide nutritional support in accordance with the calculated energy and protein requirements of the patients. During this follow-up, oral intake was applied to patients who could not receive oral nutrition due to invasive or noninvasive mechanical ventilation support. During the follow-up, enteral/parenteral feeding was given to patients who had oral intake, but later could not receive oral nutrition because of invasive or noninvasive mechanical ventilation support.

The age, gender, height, and body weight were recorded at the ICU admission. The NRS-2002 was recommended by the European Parenteral and Enteral Nutrition Association (ESPEN), especially for nutritional assessments, were used to determine the nutritional status within the first 24 hours; the MNA-SF, recommended by the International Society for Gerontology and Geriatrics and the International Academy of Nutrition and Aging for the assessment of the nutritional status of geriatric patients, was administered at the patient's site by the study conductor (13).

NRI: [1.519×albumin g/dL)]+[41.7×(final body weight/customary body weight)×100]

GNRI: [1.489×albumin (g/L)]+[41.7×(body weight/ideal body weight)]

The patients were divided into two groups, according to their survival status and their nutritional status, and clinical characteristics were evaluated. The nutritional status of the patients was grouped according to the results of the screening tools (Table 1).

The body mass index (BMI) of the patients (kg/m^2) was calculated using their body weight and height. BMI values were grouped according to the World Health Organization classification (BMI <18.50, underweight; 18.50-24.99, normal weight; 25.00-29.99; mild overweight, ≥30.00; overweight) (14). The Acute Physiology and Chronic Health Score II (APACHE II) was calculated to determine the mortality risk of patients and physical examination was performed to collect the vital data. Patients included in the study were followed up during their stay in ICU and other wards, and their clinical characteristics were recorded. Patients' ICU and hospital stay durations, mechanical ventilation durations, need for renal replacement therapy, vasoactive drug infusion, sepsis, and septic shock were determined. Biochemical tests were performed in the Baskent University Ankara Hospital Biochemistry Laboratory. Serum albumin, hemoglobin, and C-reactive protein (CRP) levels were recorded from the laboratory findings.

Statistical analysis

In the study, the Number Cruncher Statistical System (NCSS) 2007 Statistical Software (NCSS LLC, Kaysville,

Table 1. Malnutrition ratings by screening tools	
Scanning tools	**Nutritional status/risk**
GNRI	
>98	Normal nutritional status
92≤GNRI≤98	Mild nutrition risk
82≤GNRI<92	Moderate nutrition risk
<82	Severe nutrition risk
NRI	
>100	Normal nutritional status
97.5<NRI<100	Mild nutrition risk
83.5≤NRI≤97.5	Moderate nutrition risk
<83.5	Severe nutrition risk
MNA-SF	
12–14	Normal nutritional status
8–11	Under risk for malnutrition
0–7	Malnutrition
NRS-2002	
1–2	Normal nutritional status
3–4	Under risk for malnutrition
≥5	Malnutrition

MNA-SF: Mini Nutritional Assessment Short Form; NRS-2002: Nutritional Risk Screening Test 2002; NRI: Nutritional Risk Index; GNRI: Geriatric Nutritional Risk Index

Utah, USA) was used for statistical analysis. In addition to descriptive statistical methods (mean, standard deviation, median, frequency, and ratio), the Kolmogorov-Smirnov test and box plot graphs were used for the normal distribution of quantitative data. Student's t-test was used for the comparison of the groups with normal distribution, and the Mann-Whitney U test was used for the non-normal distribution. Pearson's chi-squared test and the Fisher-Freeman-Halton test were used for the comparison of qualitative data, and diagnostic screening tests and ROC analysis were used to determine the cut-off point. The results were evaluated with a 95% confidence interval and $p<0.05$ significance level.

Results

A total of 60 patients, 28 females and 32 males aged ≥65 years, who were followed in the ICU, were included in our study. The average age of all patients was 78.3±8.6 years. The average BMI of the patients was 25.3±5.4 kg/m^2 (slightly overweight). It was determined that 40% of the patients were admitted to the Department of Chest Diseases. When the patients' admission reasons were evaluated, the first listed were respiratory causes (50.0%), and 73.3% were hospitalized for medical treatment. COPD and hypertension with 48.3% and diabetes mellitus with 41.7% were the leading comorbidities. Of the 60 patients, only 2 had no concomitant disease, while 8 had only one. Other patients had multiple comorbidities. The average APACHE II score at the ICU admission was 18.9±5.6 (Table 2).

Demographic and clinical characteristics of the patients are shown in Table 3. When evaluated in terms of in-hospital survival, 58.3% of the patients were alive (n=35), and 41.7% (n=25) were in the dying group. There was no difference between the groups in terms of gender, age, and BMI. The serum albumin levels were significantly higher in the surviving patients compared to those who died (3.0±0.6 g/dL and 2.7±0.6 g/dL, p=0.048, respectively).

The frequency of sepsis and septic shock was similar in patients who died and survived. Inotropic use was found to be higher in patients who died than those who survived (96.0% versus 28.6%, p=0.00). Invasive/noninvasive mechanical ventilation was performed in 48 patients, consisting all of dying patients (n=25) and 23 (65.7%) of surviving patients. The duration of mechanical ventilation was significantly higher in patients who died than in patients who survived (15.6±17.2 days versus 4.4±6.8 days, p=0.01).

When the two groups were examined according to the total length of hospitalization in the ICU and hospital, the mean hospitalization time of the patients who died was longer than of those who survived. According to these results, the difference between the two groups was statistically significant (p=0.03 vs. p=0.029, respectively).

Malnutrition and/or severe nutrition risk ratios of all patients included in the study were found to range between 28.4% and 60% when evaluated with GNRI, NRI, MNA-SF, and NRS-2002, and the normal nutritional status was detected to be 1.7%-33.3% (Table 4).

When evaluated according to GNRI, 28.4% of all patients, 25.7% of surviving patients, and 32% of those who died were at risk of severe nutrition and 33.3% of all patients, 34.3% of surviving patients, and 32% of those who died were found to be in normal nutritional status. The difference between the groups was not statistically significant (p>0.05).

According to NRI, 53.4% of all patients, 64% of patients who died, and 45.7% of surviving patients were at risk of

Table 2. Inpatient clinics in the name of patients in the intensive care unit, the reasons for hospitalization in intensive care unit, the treatments applied, and comorbidities

Features of patients	n =60	Features of patients	n=60
Hospitalization (%)		**Treatment (%)**	
Chest diseases	40.0	Medical	73.3
Nephrology	11.7	Surgical	26.7
General surgery	8.3	**Comorbidities status (%)**	
Oncology	6.7	COPD	48.3
Obstetrics	5.0	Hypertension	48.3
Cardiology	3.3	Diabetes mellitus	41.7
Gastroenterology	3.3	Cardiovascular disease	38.3
Urology	1.7	Chronic renal failure	35.0
Other	20.0	Cancer	13.3
Reason for hospitalization (%)		Chronic liver failure	3.3
Respiratory	50.0	APACHE II Score (average)	18.9±5.6
Postoperative	16.7		
Gastrointestinal	11.7		
Renal	10.0		
Hematologic	5.0		
Cardiovascular	3.3		
Trauma	3.3		

APACHE II: Acute Physiology and Chronic Health Evaluation II; COPD: chronic obstructive pulmonary disease

severe nutrition; and 3.3% of all patients and 5.7% of surviving patients had normal nutritional status. According to the NRI results, there were no patients in the normal nutritional status class. The difference between the groups was not statistically significant (p>0.05).

According to the MNA-SF results, 35% of all patients, 25.7% of surviving patients, and 48% of patients who died were at risk of malnutrition; and 25.0% of all patients, 37.1% of surviving patients, and 8% of those who died were classified as having normal nutritional status. The difference between the groups was statistically significant (p=0.027).

The difference between NRS-2002 scores was statistically significant (p=0.02). When NRS-2002 results were evaluated, 60% of all patients, 45.7% of surviving patients, and 80% of patients who died were at risk of malnutrition, and 1.7% of all patients and 2.9% of surviving patients were evaluated as having normal nutritional status. According to the NRS-2002 results, there were no patients in the dying group with the normal nutritional status.

The cut-off point for NRI was 81.2 and below, according to mortality. For the NRI cut-off value, sensitivity was 64%, specificity was 74.29%, positive predictive value was 64%, and negative predictive value was 74.3% (Table 5).

The cut-off point for MNA-SF was found to be 9 and below, according to mortality. For the MNA-SF cut-off value, sensitivity was 68%, specificity was 60%, positive predictive value was 54.8%, and negative predictive value was 72.4% (Table 5).

The cut-off point for NRS-2002 was found to be 5 or higher according to mortality. For the cut-off value of NRS-2002, sensitivity was 80%, specificity was 54.29%, positive predictive value was 55.6%, and negative predictive value was 79.2% (Table 5).

When NRI, MNA-SF, and NRS-2002 domains were compared in binary, there was no statistically significant difference between NRI and MNA-SF in predicting mortality (p=0.958; p>0.05). There was no statistically significant

Table 3. Demographic and clinical characteristics of patients				
	Total (n=60)	**Surviving (n=35)**	**Died (n=25)**	**p**
Female/Male %	46.7/53.3	67.9/50.0	32.1/50.0	0.162
Age (year, ave.)	78.3±8.9	78.0±8.9	78.7±9.0	0.772
BMI (kg/m^2)	25.3±5.4	24.9±4.7	25.9±6.3	0.469
Albumin, ave., g/dL	2.8±0.6	3.0±0.6	2.7±0.6	0.048*
Hemoglobin, ave., g/dL	10.6±1.9	10.4±1.9	10.8±2.0	0.367
CRP, ave., mg/L	83.1±68.0	77.8±75.7	90.5±56.3	0.482
Sepsis existence (%)	31.7	28.6	36.0	0.098
Presence of septic shock (%)	25.0	17.1	36.0	0.098
Inotropic drug use (%)	56.7	28.6	96.0	0.00**
The need for renal replacement therapy (%)	30.0	28.6	32.0	0.775
Mechanical ventilation (days, ave.)	8.9±13.2	4.4±6.8	15.6±17.2	0.01*
ICU stay (days)	13.3±16.1	8.0 ±9.8	20.5±20.0	0.03*
Hospital stay (days)	21.9±20.1	16.9±14.4	28.5±24.6	0.029*
APACHE II score, ave.	18.9±5.6	17.3±5.12	21.2±5.58	0.07

T-test, Pearson's chi-squared; *p<0.05, **p<0.001. BMI: body mass index; CRP: C-reactive protein; ICU: intensive care unit; APACHE II: Acute Physiology and Chronic Health Evaluation II

difference between NRI and NRS-2002 in predicting mortality (p=0.621; p>0.05). There was no statistically significant difference between MNA-SF and NRS-2002 in predicting mortality (p=0.593; p>0.05).

Among the factors that were shown to have univariate effects on mortality and a significance level <0.15, the effects of gender, albumin, inotropic drug use, sepsis, NRS-2002, MNA, and NRI measurements were evaluated using the logistic regression analysis (Table 6).

When the risk factors affecting mortality were evaluated using the backward logistic regression analysis, the model was found to be significant, and the model's explanatory coefficient (71.7%) was good. The ODDS ratio of male gender on mortality was 6.679 (95% CI, 1.50-29.68). The ODDS value of NRS-2002 being ≥5 was 6.093 (95% CI, 1.34-27.6) and the NRI of 81.2 and above had an ODDS of 4.281 (95% CI, 1.10-16.65). The effects of the male gender, NRS-2002, and NRI on mortality were determined as independent risk factors (Table 6).

Discussion

Aging is a progressive and irreversible physiological process that affects the structures and functions of all organs and systems. Geriatric syndromes are more common with the increase in the elderly population. Malnutrition has a high prevalence in the geriatric population and causes serious morbidity and mortality. Intensive care patients are also at risk of severe malnutrition. Therefore, although early detection and treatment planning are very important, there may be delays in diagnosis and treatment (15). The absence of a gold standard method or biochemical marker used in the diagnosis of malnutrition also makes it difficult to identify patients at risk.

In our study, we evaluated the nutritional status of patients aged ≥65 years who were admitted to ICU with screening tools, compared the compatibility of these methods with each other, and examined the relationship between malnutrition and mortality. The rate of all patients in the normal nutritional status range was 1.7%-33.3%, and the rate of malnutrition and/or severe risk of nutrition was determined as 28.4%-60%. When studies on this subject are examined, it is known that the prevalence of malnutrition varies between 30% and 50% in ICU patients (8, 13, 16). In the study conducted by Giner et al. (17), the malnutrition rate was found to be 42% in ICU patients. In a study conducted by Kaiser et al. (18) with MNA in 2010, malnutrition rates were found to be 5.8% in the elderly population, 13.8% in the elderly in a nursing home, and 38.7% in the hospitalized elderly. In a study conducted by MNA-SF in 2,327 elderly patients admitted to Hacette-

Table 4. Assessment of nutritional status of patients according to screening tests

Features of Patients	Total (n=60)	Surviving (n=35)	Died (n=25)	p
GNRI, ave. (SD)	91.3±15.8	92.5±15.2	89.5±16.8	0.471
Normal nutritional status, %	33.3	34.3	32.0	0.921
Mild nutrition risk, %	15.0	17.1	12.0	
Moderate nutrition risk, %	23.3	22.9	24.0	
Severe nutrition risk, %	28.4	25.7	32.0	
NRI, ave. (SD)	82.6±10.9	85.0±11.2	79.4±9.8	0.05
Normal nutritional status, %	3.3	5.7	0.0	0.411
Mild nutrition risk, %	5.0	5.7	4.0	
Moderate nutrition risk, %	38.3	42.9	32.0	
Severe nutrition risk, %	53.4	45.7	64.0	
MNA-SF, ave. (SD)	8.8±3.4	9.5±3.5	7.8±3.1	0.061
12–14 points normal nutritional status	25.0	37.1	8.0	0.027*
8–11 points at risk of malnutrition	40.0	37.1	44.0	
0–7 points malnutrition	35.0	25.7	48.0	
NRS-2002, ave. (SD)	4.7±1.1	4.4±1.2	5.2±0.8	0.05
1–2 normal nutritional status	1.7	2.9	0.0	0.02*
3-4 at risk of malnutrition	38.3	51.4	20.0	
≥5 malnutrition	60.0	45.7	80.0	

*p<0.05. Pearson's chi-squared, Fisher's exact test. MNA-SF: Mini Nutritional Assessment Short Form; NRS-2002: Nutritional Risk Screening Test 2002; NRI: Nutritional Risk Index; GNRI: Geriatric Nutritional Risk Index

Table 5. Diagnostic screening tests and ROC curve results for NRI, MNA-SF, NRS-2002 by mortality

	Diagnostic scan			ROC curve				
	Cut off	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Area	95% Confidence interval	p
NRI	≤81.2	64.00	74.29	64.0	74.3	0.663	0.522–0.804	0.033*
MNA-SF	≤9	68.00	60.00	54.8	72.4	0.667	0.529–0.804	0.029*
NRS-2002	≥5	80.00	54.29	55.6	79.2	0.703	0.573–0.834	0.008**

*p<0.05, **p<0.01. MNA-SF: Mini Nutritional Assessment Short Form; NRS-2002: Nutritional Risk Screening Test 2002; NRI: Nutritional Risk Index

pe University Geriatrics Unit, the risk of malnutrition was found to be 28% (19). In our study, the malnutrition rate was found to be 35% for all patients, 48% for deceased patients, and 25.7% for surviving patients with the MNA-SF evaluation, and a significant difference was found between risk groups.

In another study, GNRI and NRI scores of 113 patients aged ≥75 years were calculated, and their nutritional status was evaluated. When patients were evaluated with NRI, the risk of severe malnutrition was 67.3%, and the risk of severe malnutrition was 27.4% with GNR (20). In our study, the malnutrition rate was 53.4% in patients when the NRI method was used. In another study, anthropometric and biochemical parameters of 241 elderly patients were examined, and the nutritional status and nutritional risk were evaluated using both GNRI and MNA. Although there was no difference between malnutrition and high

Table 6. Logistic regression analysis of risk factors affecting mortality				
	p	ODDS	95% CI	
			Lower	Upper
Gender (M)	0.013*	6.679	1.503	29.682
NRS-2002 (≥5)	0.019*	6.093	1.342	27.662
NRI (≤81.2)	0.036*	4.281	1.101	16.647
*p<0.05, CI: confidence interval; NRS-2002: Nutritional Risk Screening Test 2002; NRI: Nutritional Risk Index				

nutritional risk when death, infection, and pressure sores were evaluated at the end of 6 months follow-up, it has been found that GNRI had a stronger relationship with mortality (21). Malnutrition rates may have differed from other studies due to differences in patient population, age group, concomitant chronic diseases, and screening methods included in our study.

In our study, it was observed that there was a difference in predicting malnutrition between GNRI, NRI, NRS-2002, and MNA-SF methods. When the patients were evaluated with the GNRI method, malnutrition and/or the severe nutrition risk ratio was 28.4%; 53.4% with NRI, 60% with NRS-2002, and 35% with MNA-SF. In another study, three screening tools-MNA-SF, NRS-2002, and Malnutrition Universal Screening Tool-were used to evaluate malnutrition in elderly patients, and it was found that the nutritional risk and/or malnutrition rate varied greatly between 47.2% and 97.6% (22). The inconsistencies of nutritional status screening tools to predict malnutrition suggest that a single screening tool may be inadequate to identify patients at risk.

Malnutrition causes increased morbidity and mortality in ICU patients, as well as the need for mechanical ventilation and the ICU and hospital stay duration (23). In the study conducted on the inpatients of the Internal Medicine Geriatrics Clinic of Istanbul Medical Faculty in 2010, the rate of malnutrition at the time of hospitalization was found to be 45.5%. In this study, it was found that the duration of hospitalization was longer (18.9±19.1 and 11.3±11.3 days, respectively) when the malnutrition risk group was compared with the nonrisk group (24). In a study conducted in the United Kingdom, malnutrition was found in 46% in internal diseases, 45% in chest diseases, and 27% in surgical patients during hospitalization. It was shown that the severity of malnutrition was increased in 78% of these patients during hospitalization (25).

In our study, the duration of hospital stay and mechanical ventilation was found to be longer in patients who died in ICU. As the severity of the disease increases, there is an increase in respiratory and hemodynamic requirements, and therefore, the duration of both mechanical ventilation and ICU stay are expected results. On the other hand, it has been reported that a prolonged hospital stay increases the risk of malnutrition (26). Patients are at risk of severe psychological and catabolic stress during their stay in hospital. Subsequently, a decrease in the body weight occurs due to the energy deficit resulting from malnutrition. The nutritional status of patients may worsen significantly during their stay in the ICU, usually due to many factors. Some of these are patient-related causes, and some are iatrogenic causes (27). There are two problems that affect each other negatively. We think that the duration of stay in ICU may affect malnutrition, and malnutrition may negatively affect the duration of ICU stay.

According to the nutritional status screening methods, malnutrition category may be related to a low serum albumin level, high CRP value, and active disease and inflammation. CRP levels are also increased in association with increased cytokine production with aging (28). Inflammatory cytokines in the liver (tumor necrosis factor, interleukin 1, interleukin 2, interleukin 6) promote the synthesis of acute-phase proteins and suppress the albumin synthesis. Therefore, a decrease in serum albumin concentrations may reflect inflammatory conditions in addition to nutritional status (29). Decrease in albumin levels may also be associated with long-term impaired energy balance and decreased protein stores. Therefore, it is necessary to evaluate the serum albumin level together with other nutritional status screening methods to identify individuals at risk (30). Every 2.5 g/L decrease in serum albumin increases the risk of mortality by 24%-56%. In elderly patients, the albumin level of 3.2 g/dL or lower is the determinant of morbidity and mortality (31). In our study, the serum albumin level was shown to be lower and the CRP level was higher in patients who died compared to patients who survived. Likewise, the average age of our patient group was 78.3±8.6 years, which may be associated with an increased mortality risk.

The aim of the nutrition screening tools is to identify the patient at risk of malnutrition at the right moment and ear-

ly. Therefore, the screening tool should be specific and sensitive (32). In our study, while the NRS-2002 had higher sensitivity than the MNA-SF and NRI, NRI was found to have a higher specificity than NRS-2002 and MNA-SF. In another study, the specificity of NRS-2002 was higher than that of MNA-SF, whereas the sensitivity of MNA-SF was higher than that of NRS-2002 (33). It is observed that there is a difference between tests, especially in the detection of patients at risk for malnutrition. This may make it difficult to identify patients at risk of malnutrition when we evaluate patients using a single method.

When we evaluated the risk factors affecting mortality, it was found that the male gender increased mortality 6.6 times, the NRS-2002 ≥5 increased mortality 6 times, and the NRI ≥ 81.2 increased mortality 4.2 times. In their study involving 358 patients aged 65 years and over who applied to a long-term care unit, Cereda et al. (21) found that the male gender was 1.7 times riskier in their mortality analysis using GNRI and MNA. In our study, we found that the effect of male gender factor on mortality was higher in elderly patients followed up in the ICU. We think that this rate may be higher because our sample size was limited to 60 patients, and our population consisted of intensive care patients. We think that the high effect of NRS-2002 and NRI screening method on mortality is due to the higher value of the NRS-2002 components. The APACHE II score and albumin were some of the parameters used in the calculation of the NRI score in the patient group who died.

This provides an objective evaluation with the fact that nutrition screening tools such as GNRI and NRI can be performed quickly and easily, even in non-cooperating patients. The MNA-SF and NRS-2002 are advantageous in that they do not require any biochemical tests and additional costs (24). However, considering the elderly patient group included in our study, problems such as memory loss, cooperation difficulties, and dementia make history taking difficult for the NRS-2002 and MNA-SF screening tools.

Our study had a small sample size and was single centered, so the results do not represent a general population. Another important disadvantage is that although the assessment of malnutrition in the elderly is of great importance in the assessment of sarcopenia, we could not perform the relevant measurements in patients due to lack of necessary equipment.

In conclusion, in our study, when elderly patients with oral intake admitted to the intensive care unit were evaluated with GNRI and NRI scoring system and NRS-2002 and MNA-SF screening tools, the risk of malnutrition and/or severe nutrition risk was 28.4%-60%, and the incidence of malnutrition and/or severe nutrition increased in patients who died. It was found that the male gender increased mortality 6.6 times, the NRS-2002 score ≥5 increased it 6 times, and the NRI score ≥81.2 increased it 4.2 times. Since the determination of nutritional status was accepted as the first step of malnutrition treatment, it is important to have a reliable and easy-to-implement tool in the admission of patients to ICU. In our study, while the NRS-2002 had a higher sensitivity than MNA-SF and NRI, the NRI was found to have a higher specificity than NRS-2002 and MNA-SF. However, due to the lack of a gold standard screening method and inconsistency between screening tools to predict malnutrition, it may be difficult to determine the patient nutritional status. Therefore, we think that the evaluation of the methods together and reviewing them together with biochemical and anthropometric parameters may be more effective in predicting malnutrition.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Başkent University (Date: 19.01.2018; No: KA17-365).

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