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- Arzu YILDIRIM AR<sup>1</sup>
- Öznur DEMİROLUK<sup>1</sup>
- Yıldız YİĞİT KUPLAY<sup>1</sup>
- Yücel MERİÇ<sup>1</sup>
- Güldem TURAN<sup>1</sup>

#### CORRESPONDANCE

Arzu YILDIRIM AR  
Health Sciences University Fatih Sultan  
Mehmet, Health Research and Application  
Center, Intensive Care Unit, Istanbul, Turkey

Phone: +9021655783030  
e-mail: dr.arzuyildirim@hotmail.com

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<sup>1</sup> Health Sciences University Fatih Sultan  
Mehmet, Health Research and Application  
Center, Intensive Care Unit, Istanbul, Turkey.

#### RESEARCH

## THE ASSOCIATION BETWEEN MODIFIED NUTRITION RISK IN CRITICALLY ILL SCORE AND MORTALITY IN GERIATRIC PATIENTS

### ABSTRACT

**Introduction:** The intensive care unit (ICU) course of geriatric patients differ in various ways from that of younger patients. Geriatric patients admitted to the ICU often have several comorbidities with multiple drug uses. Evaluation of the nutritional status upon initial admission is vital for the geriatric patient. This study aims to retrospectively investigate the association between modified NUTRIC score at first admission with mechanical ventilation duration and mortality in the geriatric patients which constitute the majority of our ICU patients.

**Materials and Method:** We retrospectively investigated patients admitted to our clinic in 2017 aged above 65 for their age, modified NUTRIC scores, days under invasive and non-invasive ventilation, and comorbidities. Patients under low risk of malnutrition with a modified NUTRIC Score of 0 to 4 comprised Group A while patients with a high risk of malnutrition and a score of 5 to 9 comprised Group B. Both groups were investigated for days under ventilation and mortality.

**Results:** 14.6% of patients were diagnosed with primary respiratory insufficiency, 34.1% with secondary respiratory insufficiency, 9.8% with intracranial pathologies, 35.4% with postoperative ICU requirement, 4.8% with cardiac arrest and CPR, 0.8% with trauma and 0.5% with malignancies. An association between an increase in modified NUTRIC score and days under mechanical ventilation was not observed. Mortality was significantly higher in Group B. (p<0.001) Cut-off value for mortality was defined as 6 for Group B.

**Conclusion:** We believe the routine use of the modified NUTRIC score for the ICU patients will be beneficial.

**Keywords:** Nutritional Status; Geriatrics; Malnutrition; Intensive Care Unit

#### ARAŞTIRMA

## GERİATRİ YAŞ GRUBUNDAKİ HASTALARDA KRİTİK HASTALIK MODİFİYE BESLENME RİSK SKORU İLE MORTALİTE ARASINDAKİ İLİŞKİ

### Öz

**Giriş:** Yaşlı hastaların yoğun bakım süreçleri genç hasta grubuna göre çeşitli açılardan farklılık göstermektedir. Yoğun bakıma yatan geriatric hastaların çoklu hastalıkları ve beraberinde çoklu ilaç kullanım bulunmaktadır. Bununla birlikte ilk yatışta nutrisyon değerlendirmesi de önemli bir parametredir. Çalışmada; yoğun bakım ünitesinde yüksek bir sıklık oluşturan 65 yaş üstü hastalarda retrospektif olarak ilk yatıştaki modifiye NUTRIC skorları ile mekanik ventilasyon gün sayısı ve mortalite ilişkisinin incelenmesi amaçlandı.

**Gereç ve Yöntem:** Retrospektif olarak klinikte 2017 yılında yatan, 65 yaş üstü hastaların, modifiye NUTRIC skorları, ventilasyon günü (invaziv, non-invaziv), beraber görülen hastalıkları incelendi. Modifiye NUTRIC skoru 0-4 malnütrisyon açısından düşük risk taşıyan hastalar; A grubu, 5-9 arasında malnütrisyon riski yüksek olan hastalar B grubu olarak tanımlandı. Her iki grubun parametreleri, ventilasyon gün sayısı ve mortalite ile ilişkisini incelendi.

**Bulgular:** Hastaların tanıları; %14.6 primer, %34.1 sekonder solunum yetmezliği, %9.8 intrakraniyal, %35.4 postoperatif, %4.8 post CPR, %0.8 travma, %0.5 malignite idi. Modifiye NUTRIC skorun artması ile mekanik ventilasyon gün sayısında artış kaydedilmedi. Grup B'de mortalitede istatistiksel olarak anlamlı artış bulundu (p<0.001). Grup B'de mortalite için cut off değeri 6 olarak belirlendi.

**Sonuç:** Modifiye NUTRIC skorun yoğun bakım hastalarında rutin kullanımda yer alması yararlı olacaktır.

**Anahtar sözcükler:** Beslenme Durumu; Geriatri; Malnütrisyon; Yoğun Bakım Ünitesi



## INTRODUCTION

There has been an increase in the number of elderly patients who receive therapy in the hospital and intensive care unit due to increase in the elderly population in the community. There has also been an increase in the rate of admission to the hospital, and thereby, to the intensive care unit (1). The course of elderly patients in intensive care differs in various aspects from that of young patients. The prevalence of chronic diseases is higher and organ reserves are diminished in these patients; they also use multiple medications. Mortality rates are higher than those of patients hospitalized the regular ward (2). However, assessment of the nutritional status on initial admission is also an important parameter (3-5). Functional status and particularly nutritional status are very important in geriatric rehabilitation and hospital admission of elderly patients (6). The evaluation of the nutritional status of patients in intensive care on a regular basis in Turkey and quality standards by the ministry of health documentation that is being requested in the light of a parameter.

Different methods and scores are used to assess nutritional risk (7). The Nutrition Risk in Critically ill (NUTRIC) score is the first scoring system dedicated to intensive care unit patients, developed by Heyland et al (Table 1) (8). Although several other scoring systems and assessments also evaluate nutritional risk, they have not been designed specifically for intensive care unit patients. The NUTRIC score predicts 28-day mortality using acute fasting, chronic fasting, acute inflammation, and chronic inflammation markers (age, Acute Physiology and Chronic Health Evaluation [APACHE II] score, Sequential Organ Failure Assessment [SOFA] score, number of comorbidities, time from hospital to intensive care unit admission, IL-6 level). It is recommended that intensive care patients should be used to evaluate the risk of malnutrition. High scores (6–10) indicate high risk of mortality, whereas low scores (0–5) indicate low malnutrition risk. The parameters in the NUTRIC score are easy to use and are frequently used in daily practice, except IL-

6. Because routine follow-up of the IL-6 level is not always possible, the adjusted NUTRIC score without IL-6 has been termed modified NUTRIC (mNUTRIC) score. In this scoring system, scores of 5–9 are defined as high scores and those of 0–4 are defined as low scores (3,5,8).

The aim of the present study was to retrospectively evaluate the association between mNUTRIC scores on initial admission and the number of days on mechanic ventilation and mortality in geriatric patients aged 65 years and older who have high rate of admission to our intensive care unit.

## MATERIALS AND METHOD

After obtaining the approval of the Scientific Committee of our hospital (17073117-050.99), the data of 396 patients aged over 65 years hospitalized in the Intensive Care Unit of the University between 1 January 2017 and 31 December 2017 were retrospectively evaluated. Our Centre is a tertiary referral hospital with a 20-bed intensive care unit. Patients who were hospitalized for longer than 24 hours were included in the study based on initial admission time. The diagnoses of the patients on initial admission were classified as primary respiratory failure, secondary respiratory failure, neurological causes, postoperative care, post-cardiopulmonary resuscitation, post-traumatic causes and malignancy. Group A comprised patients with mNUTRIC scores of 0–4 and those at a low risk for malnutrition on admission, and Group B comprised patients with mNUTRIC scores of 5–9 and those at a high risk for malnutrition on admission. Demographic data; Acute Physiology and Chronic Health Evaluation (APACHE II) score, Simplified Acute Physiology Score (SAPS 2), mNUTRIC score, Nutrition Risk Score (NRS 2002) and Glasgow Coma Scale (GCS) score averages; number of hospitalization days; number of comorbidities; whether renal replacement therapy was received; mechanical ventilation (invasive, non-invasive) and mortality rates were recorded. The correlation

between the mNUTRIC score and NRS 2002 was assessed in both groups. The correlation between mechanical ventilation time and mortality was evaluated. The correlation between the mNUTRIC score and mortality was examined in both groups.

### Statistical analysis

Statistical analysis was performed using SPSS 23.0 statistical software package. Normal distribution of data was tested by the Shapiro–Wilk test. The Mann–Whitney U test was used to compare data without normal distribution between the groups. The relationships between variables were analyzed using Spearman’s correlation coefficients. Pearson’s chi-square test, Fisher’s exact chi-square test and Fisher–Freeman–Halton test were used in the analysis of categorical data. The level of significance ( $\alpha$ ) was set to 0.05.

## RESULTS

Age; APACHE II, SOFA, SAPS II and GCS scores; number of comorbidities and number of hospitalization days were significantly higher in Group B than in Group A (Table 2). There was a difference in primary diagnoses between the groups (Table 3). There was no difference between the groups in terms of the use of renal replacement therapy. There was no correlation between invasive or non-invasive mechanical ventilation times and mNUTRIC scores in both groups. Although there seemed to be a correlation between the NUTRIC score and NRS 2002 in Group A, this association was found to be insignificant and negligible due to a low correlation coefficient. In Group B, there was no significant correlation between the NUTRIC score and NRS 2002. There was no difference in the NUTRIC score between survivors and non-survivors in Group A, whereas NUTRIC scores were different between survivors and non-survivors in Group B (Table 2). NUTRIC score distribution of both groups in Table 4. The cut-off value for mortality in Group B was set as 6 (AUC value =0.674, sensitivity: 42.74%, specificity: 84.15% (Figure 1).

## DISCUSSION

One of the considerations that should be taken into account for the increasing rate of hospitalization to intensive care units in geriatric patients is that nutritional status of these patients differs from that in younger patients. Therefore, a scoring system used to assess nutritional status in intensive care unit patients must include age, comorbidities and mortality scores. The NUTRIC and mNUTRIC scores are nutritional assessment tools bearing these parameters. In our retrospective review of geriatric patients aged over 65 years, we evaluated the association between the mNUTRIC score on initial admission and mortality, and we found a significant correlation between high NUTRIC scores and mortality.

In a validation study of 401 Asian patients, Mukopadhyay et al. found an association between the mNUTRIC score; body mass index (BMI) and use of mechanical ventilation, vasopressor drugs and renal replacement therapy and 28-day mortality. They also measured energy intake and nutritional adequacy (energy received / recommended energy) and concluded that 28-day mortality can be reduced in patients with a high mNUTRIC score by increasing nutritional adequacy (4). We were unable to obtain 28-day mortality data because this study was designed as a retrospective study. Therefore, the 28-day mortality rate was not included in our study results. However, in our study, the mortality rate was higher in patients with high mNUTRIC scores and the cut-off value for mNUTRIC scores for mortality was set as 6.

In a study conducted by Rahman et al, high NUTRIC scores were significantly associated with 6-month mortality rates in 1199 patients. High mortality rates were also observed in patients who received 25% less than the adequate calorie intake (5) ( $p < 0.0001$ ).

Mendes et al. considered patients with an mNUTRIC score above 5 as having high nutritional risk in a multi-center observational study



of Portuguese patients and investigated 28-day mortality after admission, number of hospitalization days as well as mechanical ventilation time; they concluded that 28-day mortality risk and length of hospital stay increases and number of days without mechanical ventilation decreases in patients with high NUTRIC scores (9). The mean NUTRIC score was 4.4 in their study. The mean score in the original validation study by Heyland et al. was 4.7. Rahman et al. reported a mean score of 5.5. This value was attributed to the more advanced age of patients and high APACHE II and SOFA scores, as well as the presence of two or more comorbidities (5). In our study, we classified patients with NUTRIC scores of 5 as having a high risk and those with NUTRIC scores below 5 as having a low risk. The mean NUTRIC score in our study was 4.6, and this was similar to those reported in other studies. However, unlike other studies, our study results could not observe a correlation between days of mechanical ventilation and mNUTRIC score.

Kalaiselvan et al. conducted a prospective, observational study on 678 patients who underwent mechanical ventilation for more than 48 hours. They found that the length of hospital stay and mortality rate are higher in patients with higher nutritional risks (mNUTRIC score  $\geq 5$ ) than in patients with lower mNUTRIC scores. We also found a similar correlation between mNUTRIC score and mortality in our study (10).

The rate of nutritional risk (NUTRIC score  $\geq 5$ ) was found to be 42.5% in the study by Kalaiselvan et al. and 48.6% in the study by Mendes et al. (9-10). In our study, this rate was 50.25%, consistent with those observed in other studies. We consider that the rate in the present study being close to but higher than those reported in other studies might be caused by the inclusion of geriatric patients aged 65 years and older.

Ozbilgin et al. evaluated subjective global assessment (SGA), Nutritional Risk Index, Nutritional Risk Score (NRS) 2002, Mini Nutritional Assessment, Charlson Comorbidity Index and NUTRIC score;

anthropometric measurements and serum total protein, serum albumin and lymphocyte levels to predict morbidity and mortality in 152 patients who were admitted to the postoperative care unit. They found that the NUTRIC score is an important indicator of mortality and morbidity in postoperative surgical patients (11).

In a study of 475 patients conducted in the Netherlands, Viries et al. compared the prognostic performance of the mNUTRIC score with that of the MUST score, which is calculated considering BMI, weight loss in the last 3–6 months and acute disease effect score, to evaluate the nutritional status of non-intensive care unit patients, but which is also commonly used in the intensive care unit. They found that the mNUTRIC score has better prognostic performance than the commonly used MUST score. In our study, the correlation between NUTRIC score and NRS2002 was examined in both groups, but no significant difference was found (12).

Coltman et al. investigated the nutritional status of 294 patients in the intensive care unit using three different scoring systems (NUTRIC score, SGA and the routinely used measurement method at the hospital). Nutritional risk or malnutrition was detected using at least one method in 47% (139 patients) of the patients, and malnutrition risk or malnutrition was found in 63% of the patients by the routinely used method in the institute, in 80% of the patients by SGA and in 26% of the patients by the NUTRIC score. Only nine patients were positive for malnutrition using all the three methods. Patients with malnutrition and a high risk of malnutrition had a lower grip strength, lower BMI and lower body weight. Patients at risk for malnutrition had longer stay in the hospital and intensive care unit and higher in-hospital mortality. The mortality rate was higher in patients with a higher risk as determined by the NUTRIC score (13). Because the NUTRIC score includes the APACHE-2 and SOFA scores, the increase in these values also increases the NUTRIC score. Age; APACHE II, SOFA, SAPS II and GCS scores; number of comorbidities and number of

hospitalization days were significantly increased in parallel with higher mNUTRIC scores (mNUTRIC score  $\geq 5$ ) between the two groups. We think that this is due to the presence of age; APACHE II and SOFA scores and number of comorbidities in the mNUTRIC score calculation criteria. When we examined our results in terms of primary diagnoses, the rates of postoperative patients were higher among patients with low mNUTRIC scores. However, most of the patients with a malignancy were postoperative patients who were admitted after surgery for malignancy. Nowadays, the risk of malnutrition can decrease, the success rate of surgery can increase and the length of stay in the intensive care unit after surgery can decrease by paying attention to the importance of nutrition before and after cancer surgery. Due to these, the general surgery clinic of our hospital prepares patients well in terms of nutritional status in the preoperative period and nutrition is started as soon as possible postoperatively. Reasons, we consider that postoperative patients with a high rate have lower mNUTRIC scores. One of the limiting factors of our study was the retrospective evaluation. Detailed

evaluation of nutritional status of geriatric patients in intensive care hospitalization is important and the results of prospective studies may be guiding. Another limiting factor is the absence of long-term mortality results for at least 30 days. Evaluation of long-term mortality results is especially important for geriatric patients.

In conclusion, the NUTRIC score is suitable for use in daily practice in the evaluation of the nutritional status of geriatric intensive care patients, due to parameters included in this scoring system. Awareness of basal nutritional status of geriatric patients is effective in the treatment and care processes of patients. It can also provide additional information on predicted mortality rates besides standard scoring systems such as APACHE II. The results of our study show that NUTRIC scoring can be an important indicator in predicting mortality and length of hospital stay in geriatric patients aged 65 years and older.

#### Competing interests

The authors declare that they have no competing interests.

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