Research Article / *Araştırma Makalesi*

Ege Journal of Medicine / *Ege Tıp Dergisi* 2019; 58 (3): 274-281

Comparison of revised mini nutritional assessment-short form with the three most popular malnutrition screening tools in hospitalized elderly patients

Revize mini nütrisyonel değerlendirme-kısa form ile sık kullanılan üç malnütrisyon tarama aracının hastanede yatan yaşlı hastalarda karşılaştırılması

Sumru Savaş

Section of Geriatrics, Department of Internal Medicine, Faculty of Medicine, Ege University, Izmir, Turkey

Abstract

Aim: There is no gold standard to identify nutritional risk (NR) at the hospitals for geriatric population. Mini Nutritional Assessment-Short Form (MNA-SF) is widely used at hospitals where body mass index (BMI) measurements are not applicable for most of patients. Thus, revised MNA-SF (rMNA-SF) including calf circumference (CC) instead of BMI may be an alternative. There are a few studies investigating efficacy of rMNA-SF in this group. The aim of this study was to evaluate nutritional status (NS) in hospitalized elderly patients with MNA-SF and revised form, NR Screening–2002 (NRS-2002), and Malnutrition Universal Screening Tool (MUST), and to compare the results.

Materials and Methods: Elderly patients hospitalized in Internal Medicine Department were enrolled in the study retrospectively assessing NS with four nutritional screening tools (NST). from hospital records.

Results: A hundred patients (≥65 years) were enrolled in the study. Any NR varied greatly, ranging from 18.4% to 86%. When malnutrition and risk of malnutrition were evaluated together, NSTs showing the highest frequency of NR to the lowest were rMNA-SF, MNA-SF, NRS-2002, and MUST, respectively. While there was strong agreement between MNA-SF and rMNA-SF ($\kappa = 0.861$, $P < 0.001$), agreements between MUST and both NRS-2002 ($\kappa = 0.509$, $P < 0.001$) and rMNA-SF ($\kappa = 0.322$, $P = 0.003$) were moderate-poor.

Conclusions: Nutritional risk was variable depending on the NST, and rMNA-SF may be a practical alternative for bedridden elderly patients and/or when BMI measurements are lacking at hospital. It should be kept in mind that NR might be overestimated.

Keywords: Malnutrition, hospitals, elderly, nutrition assessment.

Öz

Amaç: *Geriatrik popülasyonda hastanede nütrisyonel riski (NR) tanımlamak için altın standart bir yöntem bulunmamaktadır. Mini Nütrisyonel Değerlendirme-Kısa Form (MNA-SF) hastanelerde sık olarak kullanılmaktadır, bu gruptaki hastaların çoğunda vücut kitle indeksi (VKİ) ölçümleri yapılamamaktadır. Bu yüzden, baldır çevresi (BÇ)'ni VKİ yerine kullanan revize MNA-SF (rMNA-SF); pratik bir alternatif olabilir. Revize MNA-SF'un hastanede yaşlı hastalarda etkinliğini araştıran az sayıda çalışma mevcuttur. Bu çalışmanın amacı, hastanede yatan yaşlı hastaların nütrisyonel durumlarını (ND) MNA-SF ile revize formu, Nütrisyonel Risk Taraması (NRS-2002) ve Malnütrisyon Universal Tarama Aracı (MUST) ile değerlendirmek ve sonuçları karşılaştırmaktır.*

Gereç ve yöntem: *İç hastalıkları Servisi'nde yatan yaşlı hastalar retrospektif olarak çalışmaya alınarak, ND hastane verilerinden dört nütrisyonel tarama testi (NTT) ile değerlendirildi.*

Corresponding Author: Sumru Savaş
Section of Geriatrics, Department of Internal Medicine, Faculty of Medicine, Ege University, Izmir, Turkey
E-mail: *esumrusavas@yahoo.com*
Received: 25.05.2018 Accepted: 09.08.2018

Bulgular: *Yüz ≥ 65 yaş ve üzeri hasta çalışmaya alındı. Farklı tanımlarla NR %18.4 ile %86 arasında değişen oranlarda bulundu. Malnütrisyon ve malnütrisyon riski birleştiririlerek beraber değerlendirildiğinde, NR oranını en yüksekten en aza doğru gösteren NTT'leri sırasıyla; rMNA-SF, MNA-SF, NRS-2002 ve MUST idi. MNA-SF ve rMNA-SF arasında güçlü bir uyum mevcut iken (κ = 0.861, P < 0.001), MUST ile NRS-2002 (κ = 0.509, P <0.001) ve rMNA-SF (κ = 0.322, P = 0.003) arasında da orta-zayıf uyum saptandı.*

Sonuç: *Hastanede yatan yaşlı hastalarda NR kullanılan NTT'e bağlı olarak oldukça değişkendir ve rMNASF; yatağa bağımlılarda ve/veya VKİ ölçümü yapılamayanlarda pratik bir alternatif olabilir. Ancak NR'i yüksek olarak tahmin edebileceği akılda tutulmalıdır.*

Anahtar Sözcükler: *Malnütrisyon, hastane, yaşlı, nütrisyonel değerlendirme.*

Introduction

Elderly patients represent most of the hospitalized adults and nearly more than half of all healthcare costs are spent on hospitalization (1). Older adults are at risk for increased nutritional risk (NR) associated with changes in normal aging. Besides, older patients generally have several comorbid chronic illnesses, a longer length of stay at the hospital and higher malnutrition risk which lead to higher mortality and costs (2,3). In the studies investigating acute hospitalization of elderly patients, it is reported that up to 71 percent are at malnutrition risk or malnourished (4). Inpatient assessment or screening of nutritional status (NS) and identifying nutritional deficiencies in older patients and subsequent nutritional follow-up may decrease mortality (5). There are several nutritional screening tools (NST) which have been developed for identifying NR such as Mini Nutritional Assessment-Short Form (MNA-SF), NR Screening–2002 (NRS-2002), and Malnutrition Universal Screening Tool (MUST) (6-13). Besides, new criteria for the diagnosis of malnutrition have been proposed by American Society for Parenteral and Enteral Nutrition in 2012, and by the European Society of Clinical Nutrition and Metabolism (ESPEN) in 2015 (6-8). However, there is no gold standard to identify NR. Furthermore, the variety of NSTs leads to problems in reproducibility, comparability, and efficacy of the studies. There is need for a valid and reliable NST for use in hospital setting, especially in the elderly population. Among NSTs, MNA-SF is designed and suggested for the elderly population to screen NR (7,8), and it is widely used in clinical practice at the hospitals (10,11). However, this tool has several disadvantages. Possible unavailability of body mass index (BMI) measurements in most of the hospitalized bedridden elderly patients is an important limiting factor for this tool. Revised MNA-SF (rMNA-SF) which includes calf circumference (CC) instead of BMI may be a practical alternative at hospitals especially for bedridden elderly patients. However, there are a few studies investigating rMNA-SF at the hospitals for the elderly population (12). Besides, to the best of our knowledge, the efficacy of rMNA-SF for Turkish inpatient population is also questionable. So, the aim of this study was to evaluate NS in hospitalized elderly Turkish patients with different NSTs such as rMNA-SF, and the original MNA-SF, NRS-2002 and, MUST, and to compare the results, and the tools.

Material and Methods

Subjects

Patients ≥65-years of age, hospitalized in Internal Medicine Department between May and July 2015 were enrolled in the study retrospectively. Patients with malignancies and nasogastric tube feeding were excluded, if the patient was unable to respond to questions and the information was not eligible from care givers, they were also excluded. Finally, a hundred consecutive elderly patients were enrolled.

Anthropometric measurements and nutrition screening tools

Each patient's anthropometric measurements and assessments of NS with the four NST were performed within the first 24 hours after admission. Measurements of BMI was computed as weight (kg) divided by height (meters squared). Calf circumference values were measured and used to calculate the final rMNA-SF score. The MNA is used to look for undernutrition and the risk of undernutrition for the elderly in home-care programmes, nursing homes and hospitals (9,10).

The MNA-SF uses six questions of full MNA (11), and rMNA-SF includes CC substituted for BMI values. For both rMNA-SF and MNA-SF; points equal to and between 8–11 were determined as 'at risk of malnutrition' and points ≤7 were as 'malnourished', and >11 as 'normal NS' (12). The MUST is mainly recommended for the adults in the community by ESPEN to screen NR (10). The tool has been extended to other healthcare settings such as hospitals. Scoring is assessed as low, medium and high risks of NS, and the scores were recorded as 0, 1, and 2 in the present study, with regard to the NST MUST (14). The NRS-2002 system is recommended by ESPEN to screen the presence of undernutrition and the risk of developing undernutrition in the hospital setting (10,13). A score of <3 indicates 'normal NS', ≥3 scores point 'nutritionally at risk' patients for NRS-2002 (13).

For three category groups (MNA-SF, rMNA-SF, and MUST); patients were classified into two NS groups as 'normal NS' and 'NR' groups as well. 'NR' group comprised of 'at risk of malnutrition' plus 'malnourished' groups. Low, medium and high risks of NS for MUST were accepted as in 'normal NS, at risk of malnutrition, and malnourished', respectively, and then reclassified into two groups where appropriate.

Statistical analysis

Numeric variables were shown as mean ± SD or median (interquartile range) where appropriate. Comparison of numeric variables between groups was analyzed with Mann- Whitney-U. Categoric data were compared with Chi-square test. Spearman Correlation analysis was used to analyze correlations among numeric variables. Agreement between the NST was assessed by Cohen's kappa analysis. Results of P <0.05 were accepted as statistically significant. Data were analyzed using the statistical package SPSS (SPSS Inc., Chicago, IL, USA), version 18.0 for Windows.

Results

A hundred consecutive ≥65-year-old patients were enrolled in the study over three months. Sixty-six percent of the patients were younger than 75 years of age and 34% of the patients were 75 years old and over. The patients admitted to hospital for geriatric syndromes were 10% of all, 13% was admitted for endocrinologic problems, 24% for nephrology related,18% hematologic,15% rheumatologic, and 20% for other diseases. None of the patients had BMI <20 kg/m^2, and 58% of the patients had loss of weight within the last 3 months. Characteristics of the patients are shown in Table-1. Patients with normal NS, at risk of malnutrition or malnourished according to MNA-SF, rMNA-SF, MUST and NRS-2002 are shown in Table-2, and Figure-1.

Table-1. Characteristics of the patients. Continuous variables are given as mean ± standard deviation (range) if not stated.

Parameters	Total (n = 100)
Age, years	72.7 ± 6.2 (65 – 87)
Age group ≥75, n (%)	34 (34)
Female, n (%)	52 (52)
Weight, kg	71.9 ± 12.8 (50 – 123)
BMI, kg/m^{2*}	27.1 ± 4.7 (20 – 44)
BMI <22, n (%)	10 (10.2)
BMI ≥30, n (%)	26 (26.5)
Calf circumference, cm	28.8 ± 4.4 (23 – 45)
Albumin, gr/dL	3.6 ± 0.5 (2.3 – 5)
hs-CRP, mg/dL	6.5 ± 8.1 (0.1 – 32.9)
MNA-SF*	8.8 ± 2.3 (2 – 13)
rMNA-SF	8.7 ± 2.4 (1 – 14)
MUST*	0.72 ± 0.75 (0 – 2)
NRS-2002*	3.0 ± 0.9 (1 – 5)

BMI: body mass index; hs-CRP: high-sensitivity CRP; MNA-SF: Mini Nutritional Assessment Short-Form; rMNA-SF: revised MNA-SF; MUST: Malnutrition Universal Screening Tool; NRS-2002: Nutritional Risk Screening–2002. *Missing value.

Table-2. Nutritional status of the patients with nutritional screening tools.

	NS			
	Normal NS, n (%)	At risk of malnutrition, n (%)	Malnourished, n (%)	NR*, %
MNA-SF†	18 (18.4)	50 (51)	30 (30.6)	81.6
rMNA-SF	14 (14)	58 (58)	28 (28)	86
MUST†‡	44 (44.9)	36 (36.7)	18 (18.4)	55.1
NRS-2002†§	26 (30.2)	60 (69.8)		69.8

NS: nutritional status; NR: nutritional risk; MNA-SF: Mini Nutritional Assessment Short-Form; rMNA-SF: revised MNA-SF; MUST: Malnutrition Universal Screening Tool; NRS-2002: Nutritional Risk Screening–2002. *At risk of malnutrition' plus 'malnourished' or medium plus high risks of nutritional status. † Missing value. ‡Low, medium and high risks of nutritional status for MUST were shown in 'normal NS', 'at risk of malnutrition', and 'malnourished' columns, respectively. § NRS-2002 was evaluated in two groups; 'Normal NS' and 'nutritionally at risk' patients, 'nutritionally at risk' group in NRS-2002 was shown in 'at risk of malnutrition' column.

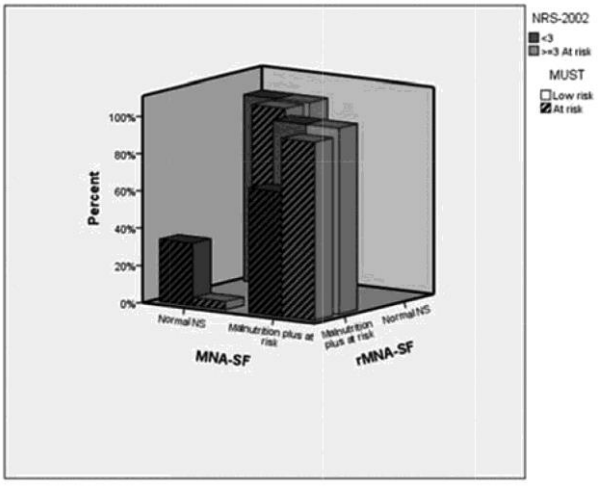

Figure-1. Nutritional status (NS) of the patients with nutritional screening tools classified in two groups as 'normal NS' and 'at risk2' groups ('at risk2 group' comprised of 'at risk' plus 'malnutrition' groups for both MNA-SF and rMNA-SF or 'medium' plus 'high' risk groups for MUST).

We categorized the BMI values into three groups (BMI <22; 22≤BMI<30; and BMI ≥30). As there were pretty few patients with a low BMI of <22, analyses for the percentages of BMI groups in both MNA-SF and rMNA-SF could not be performed. For NRS-2002 and MUST, BMI groups were similar in patients with normal NS and NR groups (P = 0.75, P = 0.18, respectively). According to ESPEN consensus and guidelines, only 4 elderly patients were malnourished which were ≥70 years of age and with low BMIs <22 kg/m^2. We also compared the patients with low CC values with the cut-off points of 33, and 31 cm, we report that the percentage of the patients with low CC values of both cut-off points were similar (P > 0.05).

For numeric variables of age, BMI, serum albumin, and hs-CRP levels; those were similar in NR and normal NS groups according to MNA-SF (data not shown). For rMNA-SF; median serum albumin level was lower and median serum hs-CRP level was higher in the NR group than the patients with normal NS (P = 0.01, P <0.0001, respectively). Likewise, the median serum albumin level was lower and median serum hs-CRP level was significantly higher in the NR group than the patients with normal NS with MUST (P = 0.003, P = 0.003, respectively). Only age was significantly higher in the patients with malnutrition risk with NRS-2002 [73 (8) vs. 67 (4), P <0.0001].

When the patients were classified as normal NS and NR groups; there was strong agreement between MNA-SF and rMNA-SF (κ = 0.861, P < 0.001), also other agreements between MUST and both NRS-2002 (κ = 0.509, P < 0.001) and rMNA-SF (κ = 0.322, P = 0.003) were moderate and poor, respectively.

Discussion

The prevalence of malnutrition in the hospitals is high and associated with increased morbidity, mortality, hospital readmissions and length of hospital stay (14). Though there is no gold standard for malnutrition screening and assessment, MNA-SF is widely used in clinical

practice especially for the geriatric patients at the hospitals. Thus, rMNA-SF which uses CC measurements instead of BMI values may be a practical alternative for hospitalized elderly patients which are bedridden or without available BMI measurements. To date, studies investigating the efficacy of rMNA-SF in this special group are insufficient. Furthermore, to the best of our knowledge, validation of rMNA-SF for Turkish geriatric population at the hospitals is also questionable. Therefore, we evaluated NS in hospitalized elderly patients using rMNA-SF, and the original form of MNA-SF, NRS-2002, and MUST, and compared the results, also studied the agreements between the tools. We report that a very high percentage of hospitalized patients were at NR, and NSTs showing the highest frequency of NR to the lowest were rMNA-SF, MNA-SF, NRS-2002, and MUST, respectively. There was an almost perfect agreement between rMNA-SF and MNA-SF, where there was a fair agreement between MUST and rMNA-SF. Besides, there was a moderate agreement between MUST and NRS-2002.

It is well known that malnutrition occurs in 20–60% up to 71% of hospitalized patients (4,6,15-16). The wide range of the prevalence of malnutrition or the risk may be because of the use of different NSTs, and/or differences in the population included (14). In addition, different criteria of 'at risk', and/or malnutrition groups, and different cut off points also complicate the results. Likely, in a study of six NST evaluating malnutrition in the hospitalized elderly, poor NS (risk of malnutrition and/or malnutrition) varied greatly, ranging from 47.2 to 97.6% (17). In another recent study in post acute geriatric care in admission for rehabilitation; all of patients were at risk by MNA-SF where 19 patients fulfilled the ESPEN basic definition of 102 eligible inpatients (18). With a median age of 60 years, in 1146 inpatients comparing the results with ESPEN new criteria; 27.9% and 14.9% of hospitalized patients were found to be at moderate/high risk of malnutrition by NRS-2002, and MUST, respectively; where 11.3 of the patients were malnourished with new ESPEN criteria (14). Consistent with those results, any NR ranged from 18.4% to 86% with different tools, in the present study. Such a wide range shows the necessity of standardization of the methods, and the criteria for malnutrition (6). As, using various NSTs with different criteria leads to hinder the comparison of studies, and to draw conclusions. In our study group, there was no patient with a low BMI <20 kg/m^2, and there were pretty few patients with low BMIs of the cut off value 22 for the ≥70 age group. Besides, fat-free mass index values were not available. So, the new ESPEN criteria were not applied.

Weight and height measurements may not be applicable in bedridden patients in most of the hospitalized elderly patients which are needed for MNA-SF's components, and for almost all of NSTs. Several formulations such as knee height exist, however, those methods do not take into account factors such as vertebral osteoporotic degenerative changes, and kyphosis. Besides, a screening tool should be easy, quick and practical (19). The use of such formulations might complicate screening procedure. The use of CC instead of BMI in rMNA-SF, may be a practical alternative for such situations. Revised MNA-SF was revised and revalidated in 2009, showing good sensitivity compared with full MNA (12), Values <31 cm get no point, and values 31≥ cm get 3 points for rMNA-SF (12). However, cut-off points may differ among different nations. Using population specific BMIs or CC values for elderly people living in community, and institutions in Taiwan; the authors reported that adoption of population specific BMI cut-off points improved the predictive ability of MNA-SF, whereas replacement of BMI with CC further improved the predictive ability of the scale (20). Besides, recently Bahat et al. suggested that cut-off point specific to Turkish people for CC should be 33 cm for both sexes (21). In this study, the older reference population was recruited from the patients admitting to geriatric outpatient clinic, and the authors have reported that they were not very ill or fragile patients which may have represented the general community-dwelling population to some extent (21). As, the percentage of patients with low CCs were similar with both cut-off points, we made the comparisons with the original suggested criteria. So further investigations with national data should be performed.

The associations of NS with albumin and hs-CRP were widely studied previously which were mostly compatible with our results of higher inflammation and lower albumin levels in poor NS for rMNA-SF and MUST (22). Those associations will not be further discussed, as they are not in the scope of this study.

The almost perfect agreement of MNA-SF and rMNA-SF in our study is in concordance with the study of Kaiser et al. (12). Likewise, in a study of older people living in the community and in nursing homes in Turkey, the correlation between MNA-SFs and full MNA was strong, and both MNA-SFs had similar high sensitivity and selectivity in both settings (23). In another validation study of MNA full form and MNA-SF in Turkish older patients, by Sarikaya et al., the study was carried out in the geriatric medicine outpatient clinic, and CC was used as a determinant of sarcopenia, not as a part of MNA-SF (24). Thus, the data for rMNA-SF is lacking in this study. So, to the best of our knowledge, there is no study evaluating the validity and reliability of rMNA-SF at the hospitals in Turkey. This is more substantial in the presence of recently suggested national cut-off values. In the absence of semi-gold standards of malnutrition, we could not provide those data. This is essential for the Turkish geriatric population, as it is such an important test that is used worldwide where MNA and MNA-SF are considered to be the most appropriate tools for elderly patients (15). Besides, in most of the studies investigating several NSTs, the data about using CC instead of BMI is missing (17,25). Furthermore, there are a few studies investigating validation of rMNA-SF at the hospitals for elderly population in the literature. In a very recent review about the validity of NSTs for older adults in the community and healthcare settings in 2018, including 74 articles, and 119 validation studies of 34 NSTs for the elderly, it was reported that criterion validity of the revised version has been tested in all settings, however for the inpatient population at the hospitals, there seems to be only one study reported (12,19). Finally, in this review, Power et al. reported that; rMNA-SF (MNA-SF-Version 2) was validated against a nutritional assessment tool that contained all components of the screening tool MNA full form; and this standard is not considered appropriate as incorporation bias is introduced. So, this kind of bias is present in most of the studies with MNA-SF (12,19, 23, 26), and in the present study, as well. For MNA-SF, values for sensitivity ranged from 95 to 100% and for specificity from 41 to 79% in the hospital setting in the review by Power et al.; however, only one study had used an accepted reference standard with fair specificity (53%), suggesting that the MNA-SF might overestimate malnutrition risk in the hospital setting (19). This might be applicable for our study too, in which the highest frequency of any degree of NR was with rMNA-SF and MNA-SF, respectively. So further studies exploring the MNA-SF and rMNA-SF is warranted.

The agreement between MUST and NRS-2002 was moderate, where the agreement with MUST and rMNA-SF was poor in the present study. Likewise, in a multicentre study in which NRS-2002, Subjective Global Assessment (SGA), MUST, and MNA were compared using SGA as the gold standard, NRS-2002 and MUST were found to perform equally well in the hospitalized patients with a mean age of 67.4 (28). In another study by Poulia et al. investigating the efficacy of six NSTs to predict malnutrition in the elderly upon admission to the hospital with a combined index; NRS-2002 had the highest in sensitivity (99.4%), where MNA-SF and MUST seemed to have better validity (17). However, they did not mention neither CC, and the use of it in MNA-SF, nor agreements between the tools. Besides, kappa values were quite low to be considered substantial in the present study for the relations between MUST and both NRS-2002 and rMNA-SF. In a recent systematic review of NSTs for hospital setting, MNA performed fair to good for the elderly, for the adults MUST performed fair to good where SGA, NRS-2002, and MUST performed well in predicting outcomes in approximately half of the studies reviewed in adults, but not in older patients (26). On the other hand, in a recent cross-sectional, multicenter study investigating whether using validated NST associates with better nutritional care in hospitalized patients in a sample of 5255 patients or not, it was reported that nutritional screening with validated tools in hospitalized patients remains poor, yet suggesting that using them leads to better nutritional care and lower malnutrition prevalence rates in hospitalized patients (29). Besides, Power et al. reported that validation results differed significantly between the tools, and studies at different settings. Likewise, in the study by van Bokhorst-de van der Schueren, the authors suggested that the most worthwhile studies are those applying different tools in the same population, because those avoid bias due to different patient populations (26).

Conclusion

Not one single screening/assessment tool is capable of adequate and reliable nutritional screening as well as predicting outcomes. The very first step to fight malnutrition is to screen with any method. In this study, NR was high and variable with the investigated tools in hospitalized elderly Turkish patients, and there was strong agreement between MNA-SF and rMNA-SF. Revised MNA-SF may be a practical alternative for bedridden elderly patients and/or when body weight and height cannot be measured accurately. However, further studies for validation and reliability of this tool is warranted in all settings, especially for the Turkish elderly patients according to the validated national cut-off points with an appropriate semi-gold standard for malnutrition. Additionally studies applying different tools in the same patient population allowing comparison of the tools is needed in the future.

Acknowledgments

I would like to acknowledge Merve Yilmaz for her contributions to the assessments.

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