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Evaluation of the Nutritional Status of Inpatients by Using Different Malnutrition Screening Methods in a Palliative Care Center: A Cross-Sectional Study

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ABSTRACT

Objective: Patients receiving treatment and care in a palliative care center are at high risk of malnutrition. This study aimed to determine the malnutrition status of patients hospitalized in a palliative care center using different scales and to compare them with the results of the Global Leadership Initiative on Malnutrition criteria.
Methods: The geriatric nutritional risk index, prognostic nutritional index, Mini-nutritional Assessment—Short Form, Nutritional Risk Screening-2002, and Global Leadership Initiative on Malnutrition criteria were used for the evaluations of nutritional status. A questionnaire to recognize the sociodemographic characteristics of the participants and the modified Charlson comorbidity index was administered to the patients.
Results: A total of 120 patients were included in the study. The mean age of the participants was 69.9 ± 15.9 years; 47.5% were women and 60.8% were married. According to the Global Leadership Initiative on Malnutrition criteria, 83.3% of the participants had malnutrition. There was no statistically significant relationship between malnutrition and gender, marital status, and having a caregiver (formal or informal) ($P = .462$, $P = .358$, and $P = .098$, respectively). Patients with malnutrition were older and had higher modified Charlson comorbidity index scores ($P = .010$ and $P = .001$, respectively). Geriatric nutritional risk index, prognostic nutritional index, Mini-nutritional Assessment—Short Form, and Nutritional Risk Screening-2002 tests showed malnutrition risk in 72.5%, 95%, 98.3%, and 84.2% of the participants, respectively. In the receiver operating characteristic curve analysis performed using the Global Leadership Initiative on Malnutrition criteria, the area under the curve values for geriatric nutritional risk index, prognostic nutritional index, Mini-nutritional Assessment—Short Form, and Nutritional Risk Screening-2002 were 0.797, 0.749, 0.927, and 0.781, respectively. The cutoff value of Mini-nutritional Assessment—Short Form tool to indicate malnutrition risk was ≤5 points, with 85% sensitivity, 90% specificity, and 54.5% negative predictive and 97.7 positive predictive values.
Conclusion: Although each screening test showed a high agreement with the Global Leadership Initiative on Malnutrition criteria, a Mini-nutritional Assessment—Short Form score of ≤5 points had the highest sensitivity and specificity to diagnose malnutrition risk in palliative care ward.

Keywords: Diagnosis, inpatient, malnutrition, palliative care

INTRODUCTION

According to the definition of the World Health Organization, palliative care aims to relieve the physical, psychosocial, and spiritual symptoms of patients through a comprehensive assessment and treatment as well as to support caregivers and alleviate their suffering.[1] Patients receiving treatment and care in a palliative care center are at high risk of developing malnutrition (MN). Studies have shown that patients with appropriate nutrition support have shorter hospital length of stay and decreased nosocomial infections and complications.[2] Regular nutritional risk screening during hospitalization will provide awareness, early diagnosis, and effective treatment. A nutritional assessment tool should be cost-effective, reliable, easily applicable, and reproducible and should have high sensitivity and specificity rates to diagnose MN. Early detection of MN and providing appropriate treatment will increase the quality of life.[3]

There are many screening tools that can be used to determine nutritional risk in patients receiving palliative care. However, although it is not known which test is the most accurate, the appropriate screening tool should be used in

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line with the recommendations of evidence-based sources. Accordingly, nutrition treatment is given correctly, and the patient's well-being is sustainable.[4] Among the MN screening tools, the most frequently used are Mini-nutritional Assessment—Short Form (MNA-SF), Nutritional Risk Screening-2002 (NRS-2002), and malnutrition universal screening tool. On the other hand, some formulas used for MN screening are available in the literature such as geriatric nutritional risk index (GNRI) and prognostic nutritional index (PNI), and new studies are emerging every day. The Global Leadership Initiative on Malnutrition (GLIM) criteria on MN, created by the nutrition committees in the recent past, are seen as a global MN diagnosis and screening tool. While the previous criteria aimed to screen for MN and identify patients at risk, a consensus has now been reached to diagnose MN with these GLIM criteria.[5]

Although there are some studies on screening for MN in patients hospitalized in palliative care units, those designed with GLIM criteria are few. On the other hand, studies examining the compatibility of different MN assessment tools with each other in this patient group are also limited. To the best of our knowledge, there is no study that compared the GLIM criteria with the other MN screening tools in the palliative care unit. Therefore, our study aimed to determine the nutritional status of patients hospitalized in a palliative care center using the GNRI, PNI, MNA-SF, and NRS-2002 tests and to compare these results with the GLIM criteria.

METHODS

This study was a descriptive and cross-sectional design and was carried out in the Palliative Care Center of Konya City Hospital.

Ethical Statements

Patients were informed about the procedures, and they signed written consent forms. The approval of the ethics committee was obtained before initiation of the study (Health Sciences University, Hamidiye Scientific Research Ethics Committee, meeting date: March 11, 2022, decision number: 22/120). All procedures involving human participants were in accordance with the ethical standards specified by the institutional and national research committee and with the Helsinki Declaration and its later amendments or comparable ethical standards. Verbal and written informed consents were obtained from the patient or his/her relatives before including them in the study.

Main Points

- Patients in palliative care center are at high risk of malnutrition.
- Palliative care patients should be screened at regular intervals using malnutrition screening tests.
- The malnutrition screening tools evaluated in this study were in good consistency with the GLIM criteria.
- MNA-SF is the most compatible screening test with GLIM criteria.

Sample Size and Study Population

The sample size was calculated with the OpenEpi v3.01 program. Based on the number of beds in the palliative care center (15 beds) and the time period determined for data collection (3 months), the sample size should include at least 73 patients at 5% significance level, 95% CI, and 95% power. A total of 120 patients were included in the study.

The GNRI, PNI, MNA-SF, NRS-2002 tests, and GLIM criteria were evaluated. In addition, a questionnaire form was used to recognize the sociodemographic characteristics of the individuals. Patients who did not want to participate in our study for any reason and whose anthropometric measurements could not be performed (because of amputation or wounds) were excluded from the study.

Anthropometric Measurements

Middle upper arm circumference

In a standing upright position, the arm was bent 90° from the elbow, the midpoint between the acromial process on the shoulder and the olecranon process on the elbow was marked, and the circumference was measured with a tape measure. Patients who could not stand were measured in a sitting or lying position. The cutoff points were taken as 23.95 cm in men and 23.9 cm in women.[6]

Calf circumference

Calf circumference (CC) was measured with a tape measure from the widest part of the calf in sitting position. In bedridden patients who could not sit, it was measured with a tape measure from the widest part of the calf while lying down. The cutoff points were taken as 30.75 cm in men and 29.45 cm in women.[6]

Assessment Tools

Sociodemographic form

It was a questionnaire in which individual variables such as age, gender, occupation, income status, educational status, marital status, disease history, where and with whom the patient lives, and the status (formal or informal) of caregiver were asked.

Nutritional evaluation scales

1. Global Leadership Initiative on Malnutrition criteria: First, risky patients are identified using one of the

validated screening tests. Then, the second step is done to diagnose MN. The second step included involuntary weight loss, low body mass index (BMI), and low muscle mass in the phenotypic criteria, and decreased food intake and severity of the underlying disease that is associated with the MN as the etiological criteria. Among these criteria, percentage of weight loss, low BMI, and decreased muscle mass are accepted as phenotypic criteria, while decreased food intake or digestion and severity of disease/inflammation status are accepted as etiological criteria. According to GLIM, at least 1 phenotypic criterion and 1 etiological criterion are required for the diagnosis of MN. It has also been accepted by European Society of Clinical Nutrition and Metabolism (ESPEN) and American Society for Parenteral and Enteral Nutrition (ASPEN) that the GLIM criteria can be used in screening patients with MN.[5]
Patients who could stand up were weighed with standard scales and those who could not were weighed with patient beds with weighing feature. Height was measured with a standard tape measure. Body mass index was expressed as kg/m^2 in weight/height^2. Middle upper arm circumference (MUAC) and CC were measured to determine decreased muscle mass. Less than expected values for at least one of these measurements were considered low muscle mass. Measurements were made primarily on the right limbs (left limbs in amputation, etc.) with a standard 1.5-m tape measure. Inflammation, within the GLIM criteria, was evaluated according to the C-reactive protein value (evaluated according to laboratory reference values) or according to the presence of acute disease/injury or chronic diseases (conditions accompanied by inflammation such as rheumatic disease, malignancy, and COPD).

2. Geriatric nutritional risk index: The GNRI is used to assess the nutritional status of elderly bedridden care patients. Geriatric nutritional risk index is calculated using the height, weight, and serum albumin values of the patients: GNRI = [1.489 × albumin (g/L)] + [41.7 × (body weight/ideal body weight)]. The GNRI falls into 4 categories. A GNRI score <82 indicated severe MN risk, between 82 and 92 indicated moderate MN risk, between 92 and 98 indicated mild MN risk, and over 98 indicated normal nutritional status.[7]
3. Prognostic nutritional index: The PNI is calculated according to the following formula:
[10 × serum albumin (g/dL) + 0.005 × total lymphocyte count (per mm^3)]
According to this formula, a score ≥50 was considered as normal, between 45 and 49.9 was considered as mild MN risk, between 40 and 44.9 was considered moderate MN risk, and <40 was considered severe MN risk.[8,9]
4. Mini-Nutritional Assessment—Short Form: The MNA-SF consists of 6 questions including anthropometric measurements of individuals (BMI), food intake, weight loss, mobility, psychological stress, and neuropsychological problems. According to MNA-SF, 12-14 points are defined as normal nutritional status and <11 points are defined as MN risk.[10]
5. Nutrition Risk Screening-2002: The scoring system consists of 2 parameters as "nutritional status" and "disease severity" and provides scoring as "no problem," "mild," "moderate," and "severe" MN risk. Scoring is made between 0 and 3 for each section. For patients over 70 years of age, 1 more point is added to the score due to age. Those with a total score of ≥3 was MN risk.[11]

Parameters related to hospitalization in the palliative care unit

The comorbidities of the patients, the reasons for hospitalization in the palliative care unit, and the number of drugs used were also noted. Comorbidities were scored according to the Modified Charlson comorbidity (MCC) index.[12]

Statistical Analysis

Statistical Package for Social Sciences (IBM SPSS Corp., Armonk, NY, USA) 26.0 program was used for statistical analysis. Frequency (n), percentage (%), mean ± SD, minimum–maximum, and median values from descriptives were used for statistical evaluation. The normal distribution of the data was evaluated with the Kolmogorov–Smirnov test. For the median comparison in 2 independent groups, the Mann–Whitney *U*-test was used, and Kruskal–Wallis tests were used in more than 2 groups. Interdata correlation analysis was performed with Spearman correlation test. Categorical data were expressed as numbers and percentage. The chi-square test was used to compare categorical data. Receiver operating characteristic (ROC) curve analyses were performed by using the MedCalc software program to screen tools according to the GLIM criteria, and the strengths of those MN screening tools were compared. A *P*-value <.05 was accepted as statistical significance.

RESULTS

A total of 120 patients, 57 females (47.5%) and 63 males (52.5%), were included in the study. The mean age of the participants was 69.9 ± 15.9 years. Table 1 shows the sociodemographic characteristics of the participants.

According to the GLIM criteria, 83.3% of the participants had MN. The GNRI, PNI, MNA-SF, and NRS-2022 tests showed MN risk in 72.5%, 95%, 98.3%, 84.2% of the participants, respectively (Table 2).

Table 1. Sociodemographic Characteristics of the Participants

Parameters	Number	%
Gender		
Female	57	47.5
Male	63	52.5
Marital status		
Married	73	60.8
Single	47	39.2
Chronic disease		
Present	114	95.0
Absent	6	5.0
	Median	(Minimum–maximum)
Age, years	74	19-95
Height, cm	165.0	150-185
Weight, kg	65.5	40-105
BMI, kg/m^2	23	15.0-38.0
Albumin	29	16-44
Charlson comorbidity index	10	3-16

BMI, body mass index.

Table 2. Evaluation of the Nutritional Status by Different Scales

According to	n (%)
GLIM criteria	
Normal nutritional status	20 (16.7)
Malnutrition	100 (83.3)
MNA-SF	
Normal nutritional status	2 (1.7)
MN risk	118 (98.3)
GNRI	
Normal nutritional status	33 (27.5)
Mild MN risk	45 (37.5)
Moderate MN risk	12 (10.0)
Severe MN risk	30 (25.0)
PNI	
Normal nutritional status	6 (5.0)
Mild MN risk	13 (10.8)
Moderate MN risk	23 (19.2)
Severe MN risk	78 (65.0)
NRS-2002	
Normal nutritional status	19 (15.8)
Malnutrition risk	101 (84.2)

GLIM, Global Leadership Initiative on Malnutrition; GNRI, geriatric nutritional risk index; MN, malnutrition; MNA-SF, Mini-nutritional Assessment—Short Form; NRS-2002, Nutritional Risk Screening-2002; PNI, prognostic nutritional index.

There was no statistically significant relationship between MN and gender, marital status, education level, presence of chronic disease, and closeness of the caregiver ($P=.462$, $P=.358$, $P=.909$, and $P=.261$, $P=.098$, respectively). Patients with MN were older and had higher MCC index scores ($P=.010$ and $P=.001$, respectively). The comparison of sociodemographic characteristics according to nutritional status is shown in Table 3.

In the ROC analysis performed using the GLIM criteria, the area under the curve (AUC) values for GNRI, PNI, MNA-SF, and NRS-2002 were 0.797, 0.749, 0.927, and 0.781, respectively (Table 4). Accordingly, the cutoff value of score 5 for MNA-SF had 85% sensitivity, 90% specificity, 54.5% negative predictive value, and 97.7% positive predictive value in predicting the MN risk.

DISCUSSION

In this study which compared different nutritional screening scales with the GLIM criteria, MNA-SF was the most appropriate screening test in palliative care setting with the highest sensitivity and specificity (85% and 90%, respectively). Other screening tools were also well compatible with the GLIM criteria at the specified cutoff values. In this study population, the frequency of MN was 83.3% according to the GLIM criteria.

The need for palliative care centers is increasing due to aging and higher prevalence of cancer and other chronic diseases in the population. Early diagnosis and the treatment of MN and effective fight against MN can increase the quality of life of patients and their relatives in need of palliative care, reduce the formation of pressure sores, and provide positive effects in terms of prognosis.[13] In a study conducted with patients who received palliative care services by using inpatient and home care services, the MN risk rate with MNA-SF was 57.4%.[14] In our study, 98.3% of the participants had MN risk according to MNA-SF. This may be due to the fact that patients with MN need more inpatient palliative care.

Table 3. Comparison of Sociodemographical Characteristics by Malnutrition Status

	Malnutrition		Normal nutritional status		
	Number	%	Number	%	*P*
Gender					
Female	46	80.7	11	19.3	.462
Male	54	85.7	9	14.3	
Marital status					
Married	59	80.8	14	19.2	.358
Single	41	87.2	6	12.8	
Chronic disease					
Present	96	84.2	18	15.8	.261
Absent	4	66.7	2	33.3	
	Median	Minimum–maximum	Median	Minimum–maximum	
Age, years	76	20-95	64.5	19-81	.001
BMI, kg/m^2	22	15.0-38.0	26	21.0-33.0	.001
Charlson comorbidity index	10	3-16	6.5	3-12	.001

BMI, body mass index.

The musculoskeletal system, immune system, respiratory system, cardiovascular system, and nervous system are adversely affected in patients with MN.[15] In a study, it was reported that sarcopenia, tendency to infections, pressure sores, acute renal failure, and increased mortality were observed more frequently in malnourished patients.[16] In our study, no significant relationship was found between the presence of chronic diseases and MN. This may be due to the fact that palliative care patients mostly have multimorbidity and at least one chronic disease.

Table 4. ROC Analysis Results for Nutritional Assessment Scales

Parameters	AUC	Cutoff	*P*	Sensitivity	Specificity	NPV	PPV
GNRI	0.797	≤94	<.001	76	75	38.5	93.8
MNA-SF	0.927	≤5	<.001	85	90	54.5	97.7
PNI	0.749	≤38.2	<.001	62	80	29.6	93.9
NRS-2002	0.781	>3	<.001	65	80	31.4	94.2
GNRI vs. MNA-SF			.027				
GNRI vs.NRS-2002			.827				
GNRI vs. PNI			.452				
MNA-SF vs. NRS-2002			.004				
MNA-SF vs. PNI			.003				
NRS-2002 vs. PNI			.697				

AUC, area under the curve; GNRI, geriatric nutritional risk index; MNA-SF, Mini-nutritional Assessment—Short Form; NPV, negative predictive value; NRS-2002, Nutritional Risk Screening-2002; PNI, prognostic nutritional index; PPV, positive predictive value; ROC, receiver operating characteristic.

There are many different nutritional screening scales in the literature; however, there is no consensus on their effectiveness in the studies.[17] Nutritional Risk Screening-2002 has been validated in case–control studies in hospitalized patients, and it is shown among the tests that can be used by ESPEN to screen inpatients and to select patients who can benefit from nutritional support in line with the data obtained.[11] In a study comparing the scales used for nutritional assessment in hospitalized patients, it was found that GLIM and NRS-2002 and GLIM and Subjective Global Assessment showed good agreement (κ=0.784 and κ=0.804, respectively).[18] In another study, the NRS-2002 and Royal Free Hospital Nutritional Prioritizing Tool (RFH-NPT) scales were compared with GLIM, and it was found that the RFH-NPT showed better compliance (k=0.64; AUC=0.823).[19] In a study evaluating the nutritional status of patients with liver cirrhosis, MNA-SF was the most compatible scale with the GLIM criteria (sensitivity 88% and specificity 97%).[20] In our study, similar to this finding, MNA-SF was the most compatible test with GLIM, with 85% sensitivity and 90% specificity. A study evaluating the nutritional status of geriatric patients and comparing GLIM with MNA-LF and MNA-SF showed the AUCs as 0.92 and 0.90, respectively, and it was concluded that the short form can also be used for ease of administration.[21]

Malnutrition was evaluated in hospitalized elderly patients using the MNA-SF and GLIM criteria. According to MNA-SF, 34% of the patients were found to be at risk of MN and 18% were malnourished. Afterward, these patients were also evaluated with the GLIM criteria, and 33% of them had MN.[22] In a study conducted with geriatric oncology patients, the GLIM criteria and MNA-SF were compared, and the AUC for MN risk was 0.75 and the cutoff value was 11. The cutoff values for MNA-SF and MNA-LF were above the original cutoff values of the scales. This difference may point out that MNA-LF and MNA-SF are more rigorous than the GLIM criteria in indicating MN risk.[23] In our study, on the contrary, the cutoff value for MNA-SF was found to be 5, and it was below the original cutoff value of 7. This difference may be due to the fact that the other study was conducted on oncological patients.

Our research has some limitations. It was conducted in a single center, and since it was conducted in a palliative care center, the number of patients with normal nutritional status was low, which may have caused the results to be insignificant in statistical comparisons with the sociodemographic data. Multicenter studies with larger case series are needed. In addition, the fact that we used MUAC and CC values for the evaluation of muscle mass within the scope of GLIM criteria is a limitation, considering that the study population is palliative care patients. Because this patient group often have poor nutritional status and peripheral edema. If muscle mass measurements were made with ultrasonography, computed tomography, or magnetic resonance imaging methods, it could be evaluated with more objective data. In laboratory evaluation, albumin, which is a negative acute-phase reactant, may not be sufficient because most of these patients have inflammation and concomitant infections.

As a result, the AUC value in predicting MN diagnosis of each scale was at the desired level when compared to the GLIM criteria in the ROC analysis performed in our study. Accordingly, MNA-SF has a significantly higher AUC value than other scales. In addition, each evaluated scale shows high compliance with the cutoff values specified with the GLIM criteria, which can be used for nutritional assessment in suitable patients.

Ethics Committee Approval: Ethics committee approval was received for this study from Hamidiye Scientific Research ethics committee of Health Sciences University (Date: March 11, 2022, Number: 22/120).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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