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Original Article

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The Validity of Malnutrition Universal Screening Tool (MUST) for Nutritional Screening in Hemodialysis Patients

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Abstract

Objective: Wasting and malnutrition are problems frequently encountered in patients undergoing hemodialysis that may increase morbidity and mortality. The malnutrition universal screening tool (MUST) is a quick and easy-to-use nutritional screening tool. The aim of this study was to determine the validity of MUST by comparing two accepted nutritional screening methods in hemodialysis patients.

Materials and Methods: The MUST, malnutrition inflammation score (MIS), and nutritional status according to the International Society of Renal Nutrition and Metabolism (ISRNM) report were applied to 88 hemodialysis patients. Albumin, pre-albumin, C-reactive protein levels, body mass index, and calf circumference were measured in all patients.

Results: Malnutrition was identified in 14.78% of patients according to MUST, 10.22% according to MIS, and 13.63% according to the ISRNM report. The sensitivity of MUST was 22.2% using the MIS criteria, and 50% using the ISRNM report. Specificity was 86.1% according to MIS and 90.8% according to the ISRNM report.

Conclusion: Although not sensitive, the MUST is a specific nutritional screening tool in patients undergoing hemodialysis according to the MIS and ISRNM report.

Keywords: Hemodialysis, malnutrition, nutritional assessment, sensitivity, specificity

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INTRODUCTION

Malnutrition is one of the most important parameters negatively affecting the course and recovery of chronic diseases (1). It is highly prevalent in patients undergoing hemodialysis, resulting in a poor quality of life and worse prognosis (2, 3). Besides the decrease in oral intake, many factors may contribute to nutritional deprivation in these patients (4). The reasons leading to malnutrition in these groups include inflammation, oxidative stress, acidemia, nutrients lost into dialysate, altered responses to anabolic hormones, increased levels of unexcreted toxins, and blood loss (5, 6).

Many nutritional screening tools have been developed for general purposes and for specific conditions to detect patients at risk for malnutrition. The Dialysis Malnutrition Score and the Malnutrition Inflammation Score (MIS) are screening tests used in patients with kidney diseases, and they were developed from the Subjective Global Assessment (SGA), which is a semi-quantitative older tool used in nephrology practice (7-9). The MIS incorporates the patient's past medical history (change in end dialysis dry weight, dietary intake, gastrointestinal symptoms, nutritionally related functional capacity and co-morbidities, including the number of years on dialysis); physical exam-

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ination (decreased fat stores or loss of subcutaneous fat tissue and signs of muscle wasting); body mass index (BMI); and laboratory parameters (serum albumin and serum total iron binding capacity) (9). In 2008, the Internal Society of Renal Nutrition and Metabolism (ISRNM) convened an expert panel for the nomenclature and diagnosis of malnutrition in kidney disease. It was suggested that at least three out of the four different categories (biochemistry, body mass, muscle mass, and dietary intake) must be satisfied for a diagnosis of kidney-disease-related malnutrition (5). However, there is no gold standard screening method as yet, and studies have shown controversial data in this regard (10-12). The Malnutrition Universal Screening Tool (MUST) is a simpler nutritional screening tool and valid for any adult patient. It was developed by the British Association for Parenteral and Enteral Nutrition and was initially used in a community setting, then extended to in hospitalized patients (13). It consists of three independent components to determine the overall risk for malnutrition: current weight status measured by BMI, unintentional weight loss, and acute disease effect resulting in no nutritional intake for 5 days (Table 1).

To the best of our knowledge, there has only been one study investigating the validity and reliability of the MUST for malnutrition screening of HD patients (14). The aim of the current study was to evaluate the effectiveness of MUST for malnutrition screening on maintenance HD outpatients, using MIS and the ISRNM recommendations as reference standards.

MATERIALS AND METHODS

Subjects

All patients undergoing hemodialysis at our hospital outpatient hemodialysis center were evaluated in July 2017. Informed consent form received from the patients who participated in this study. The study included willing patients aged ≥18 years, who had been receiving hemodialysis for at least 3 months, 3 times a week. Exclusion criteria were the presence of malignancy, a history of gastrointestinal surgery that may lead to malabsorption, or any pregnant or lactating female patients. Laboratory tests were applied before the mid-week session of hemodialysis via venous samples in a fasting state. The weight and anthropometric measurements of the patients were taken 10 minutes after the mid-week session of hemodialysis by a trained dietitian. The study protocol was conducted in accordance with the ethical principles stated in the Declaration of Helsinki and was approved by the Antalya Training and Research Hospital Research Ethics Committee (Ref. date and no; 24.03.2016, 76/19).

Table 1. Parameters of malnutrition universal screening tool

Parameters		Score
1- BMI (kg/m^2)	>20	0
	18.5-20	1
	<18.5	2
2- Unplanned weight loss in the past 3-6 months (%)	<5	0
	5-10	1
	>10	2
3- If patient is acutely ill, and there has been or is likely to be no nutritional intake for >5days	2	

BMI: Body Mass Index

Assessment of Nutritional Parameters

All three screening tools were applied by a trained dietitian, as described in references. Patients were classified as those with normal nutrition (score 0-1) and at risk of malnutrition (score ≥2) according to the MUST score (13), and normal nutrition (score 0-5) and at risk of malnutrition (score ≥6) according to the MIS score (10). According to the ISRNM report, patients with albumin <3.8 g/dL as the serum chemistry marker, BMI <23 kg/m^2 as the body mass marker, and calf circumference (CC) <31 cm as the muscle mass marker were accepted as malnourished (5). The CC used to determine the muscle mass was measured on the right leg at the point of maximal circumference, 10 minutes after the hemodialysis session. Measurements were accepted as abnormal according to the definitions from the European Working on Sarcopenia in Older Patients (EWGSOP) report (15).

Statistical Analysis

Statistical analysis was made using Statistical Package for the Social Sciences (SPSS) for Windows, version 22.0 (IBM Corp., Armonk, NY, USA). Fisher's exact test and Pearson's chi-square analysis were performed for categorical variables. The normality assumptions of the analysis of the two-group measurement differences were controlled by the Shapiro–Wilk test. The differences between the two groups were evaluated with Student's

Table 2. Demographic characteristics, laboratory test result levels, and anthropometric measurements of patients

		(n=88)
Age (years), mean±SD		52.63±15.9
Gender, n(%)	Male	58 (65,9)
	Female	30 (34,1)
HD duration (months), median (min-max)		66 (6-396)
MIS score, median (min-max)		2 (1-11)
Albumin (gr/dL), median (min-max)		3.9 (2-4.7)
Prealbumin (mg/dL), mean±SD		28.7±7.8
CRP (mg/L), median(min-max)		7.8 (0.42-10.2) n=60
BMI (kg/m^2), mean±SD		23.6±4.7
Calf circumference (cm), mean±SD		30.7±4.5

HD: Hemodialysis; CRP: C-Reactive Protein; BMI: Body Mass Index; MIS: Malnutrition Inflammation Score

t-test for normally distributed data or the Mann–Whitney U test for non-normally distributed data. The receiver operating characteristic (ROC) curve analysis was applied to evaluate diagnostic performance of MUST on determining malnutrition in patients and area under the curve (AUC), sensitivity, specificity, and negative and positive predictive value (NPV–PPV) were calculated and reported with %95 confidence intervals (CI). Data are expressed as n (%), the mean±standard deviation (SD), or median (min–max), as appropriate. p<0.05 were considered statistically significant.

RESULTS

A total of 107 patients undergoing hemodialysis were evaluated, and 88 were included in the study. These 88 patients comprised 30 (34.1%) females and 58 (65.9%) males with a mean age of 52.63±15.9 years. The median hemodialysis duration was 66 (6-396) months, and the median MIS score of all the patients was 2 (2-11). The median albumin was measured as 3.9 (2-4.7) gr/dL (normal range, 3.5-5.2 gr/dL), mean pre-albumin was measured as 28.7±7.8 mg/dL (normal range, 20-40 mg/dL), and median CRP was measured as 7.8 (0.42-10.2) mg/L (normal range, 0-5

Table 3. Evaluation of patients according to MUST score

		MUST Score		
		0-1 (n=75)	≥2 (n=13)	p
Age (years), mean±SD		53.6±15.6	47.1±17.25	0.175
Gender, n (%)	Male	52 (69.3)	6 (46.2)	0.122
	Female	23 (30.7)	7 (53.8)	
HD duration (months), median (min-max)		60 (6-228)	120 (24-396)	0.058
Albumin (gr/dL), median (min-max)		3.9 (2-4.4)	3.7 (3.5-4.7)	0.500
Prealbumin (mg/dL), mean±SD		28.9±7.7	27.5±8.7	0.532
CRP (mg/L), median (min-max)		8.2 (0.42-10.2)	4.3 (1.2-10.2)	0.558
BMI (kg/m^2), median (min-max)		23.7 (17.7-38.6)	17.3 (13.5-27.9)	<0.001
Calf circumference (cm), mean±SD		31.4±4.04	26.3±4.4	<0.001
MIS score, median (min-max)		2 (1-11)	4 (2-9)	0.006

MUST: Malnutrition Universal Screening Tool; HD: Hemodialysis; CRP: C-Reactive Protein; BMI: Body Mass Index; MIS: Malnutrition Inflammation Score

Table 4. Prevalence of malnutrition according to MUST, the ISRNM report, and MIS in patients undergoing hemodialysis

		ISRNM		MIS		
		No (n=76)	Yes (n=12)	0-5 (n=79)	≥6 (n=9)	Total
MUST, n (%)	0-1	69 (90.8)	6 (50)	68 (86.1)	7 (77.8)	75 (85.2)
	≥2	7 (9.2)	6 (50)	11 (13.9)	2 (22.2)	13 (14.8)

MUST: Malnutrition Universal Screening Tool; MIS: Malnutrition Inflammation Score; ISRNM: International Society of Renal Nutrition and Metabolism

Table 5. The AUC, sensitivity, specificity, PPV, and NPV of the ISRNM report and MIS in comparison with MUST

	ISRNM	95% CI	MIS	95% CI
AUC	0.704	0.597-0.797	0.541	0.432-0.648
Sensitivity	50	21.1-78.9	22.2	2.8-60.0
Specificity	90.8	81.9-96.2	86.1	76.5-92.8
PPV	46.2	19.2-74.9	15.4	1.9-45.4
NPV	92.0	83.4-97.0	90.7	81.7-96.2

ISRNM: International Society of Renal Nutrition and Metabolism; MIS: Malnutrition Inflammation Score; AUC: Area Under Curve; PPV: Positive Predictive Value; NPV: Negative Predictive Value

mg/L). The mean BMI was calculated as 23.6±4.7 kg/m^2, and the mean calf circumference was 30.7±4.5 cm (Table 2).

The MUST score was 0-1 in 75 patients (85.22%) and ≥2 in 13 patients (14.78%). When patients were separated according to the MUST score <2 and ≥2, there was no difference between the groups in terms of age, gender, HD duration, albumin levels, pre-albumin levels, and CRP levels (p>0.05). The median BMI (23.7[17.7-38.6] kg/m^2 vs. 17.3[13.5-27.9] kg/m^2, p<0.001) and mean calf circumference (31.4±4.04 cm vs. 26.3±4.4 cm, p<0.001) values of patients in the lower MUST score group were significantly higher than those in the higher MUST score group. The median MIS score of the patients with a MUST score of ≥2 group was significantly higher than that of the group with a MUST score 0-1 (2[1-11] vs. 4[2-9], p=0.006) (Table 3).

A MUST score of ≥2 was determined in 6 of 12 patients (50%) who were malnourished according to the ISRNM report criteria, and in 2 of 9 patients (22.2%) who were malnourished according to MIS (score of MIS ≥6) (Table 4). The area under curve value of MUST was 0.704 (95% confidence interval CI: 0.597 to 0.797) according to the ISRNM report and 0.541 (95% CI: 0.432 to 0.648) according to MIS. The sensitivity, specificity, PPV, and NPV of MUST are summarized in Table 5.

DISCUSSION

It is important to identify patients and take the necessary precautions during the at-risk period before malnutrition is fully established. Nutritional management during this period and interventions that modify nutritional indicators have been recognized as having an important impact on the survival of patients undergoing hemodialysis (16). MUST is a quick and easy-to-use screening tool, which does not require any laboratory parameters. In the current study, 14.78% of the patients undergoing hemodialysis were at risk for malnutrition according to MUST. There was no significant difference between the groups of higher and lower MUST scores in respect of albumin and pre-albumin levels. However, the BMI and calf circumference values of patients with a MUST score ≥2 were significantly lower than those of the patients with lower MUST scores. Lawson et al. (14) assessed the validity and reliability of the MUST in renal in-patients, and 38.8% of the patients were found to be malnourished with MUST. The third step of MUST gives 2 points if the patient is acutely ill or is likely to have no nutritional intake for >5 days, and this can explain the higher prevalence of malnutrition in the Lawson et al. (14) study, which included hospitalized patients. Various clinical variables were compared in patients with a lower and higher MUST score in the Lawson at al. (14) study, and the findings were compatible with those from the present study.

In the present study, the prevalence of malnutrition according to MIS was 10.22%, and 13.36% according to the ISRNM report. MIS is a chronic kidney disease-specific nutritional screening method which has been found to be associated with the prognosis at various stages of kidney failure (17-19). Ruperto et al. (20) researched the predictive power of malnutrition according to the ISRNM report, and it was found to be useful for the assessment of nutritional-inflammatory status and added predictive value to the traditional indicators in patients undergoing hemodialysis. Although the sensitivity and PPV of MUST were low, the specificity and NPV of MUST were higher according to the MIS and ISRNM report in the present study. Therefore, malnutrition is unlikely to be present in patients with a lower MUST score (0-1). In the Lawson et al. (14) study, the sensitivity of MUST was 53.8% according to SGA, which was in accordance with our study findings. In another study, Yamada et al. (10) investigated five different nutritional screening tools (MUST, mini nutritional assessment-short form, nutritional risk score, malnutrition screening tool, and geriatric nutritional risk index [GNRI]) on patients undergoing hemodialysis through a comparison with MIS results as the reference standard. MUST was found to be less effective in discriminating the nutritional risk, and the GNRI was seen to be the best screening tool for this purpose in that study (10). Consistent with the findings of the studies by Lawson et al. (14) and Yamada et al. (10), the current study results indicate that MUST is not a good nutritional screening test in patients undergoing hemodialysis.

The etiology of malnutrition in patients undergoing hemodialysis is very complex, although we can say that the limitation of this study is that we did not examine the relationship of MUST with more nutritional parameters. Other limitations of the study are that the number of patients was relatively low for a screening and validity study and that the relationship between MUST and the clinical outcomes of patients was not examined. The CRP value of all patients could not be measured also as a limitation. Nevertheless, this is the first study to have assessed the validity of MUST with a comparison with MIS and the ISRNM report in patients undergoing hemodialysis.

CONCLUSION

The results of this study suggest that MUST is not a sensitive screening method for nutritional status in outpatients undergoing hemodialysis. However, because of its high specificity and NPV, it can be assumed that the malnutrition risk is lower if the MUST score is low. Further studies with larger samples are required to evaluate the validity of MUST in patients undergoing hemodialysis.

Ethics Committee Approval: Ethics Committee approval was received for this study from the Ethics Committee of Antalya Training and Research Hospital (Ref. date and no; 24.03.2016, 76/19).

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