Original Article

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The Relationship between Nutritional Status and Early- and Mid-term Mortality of Geriatric Patients Admitted to the Emergency Internal Medicine Unit

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Abstract

Aim: The need for bodily energy in the elderly may decrease due to physical activity limitations, while it may increase with the effects of the disease. The most common screening tool developed for the geriatric population is the Mini Nutritional Assessment, and lower scores are associated with higher mortality predictions. We aimed to correlate the nutritional status of patients admitted to the emergency department with mortality.

Materials and Method: Among the geriatric patients admitted to our emergency internal medicine unit between October 1, 2019, and March 1, 2020, 289 patients were included in this cross-sectional study. The Nutritional Risk Screening-2002 and Mini Nutritional Assessment tests were administered to all patients.

Results: The number of patients at risk of malnutrition was 49.4% (n=143). The median follow-up was 312 days for all patients, and the mortality rate was 42.5% (n=123) for all our patients, and 50.4% (n=72) of the patients who died were male. Diabetes was high in our geriatric patients, as in all age groups, and its effect on mortality was observed, and cancer patients had an almost three-fold higher malnutrition rate. Seventy patients were transferred from the internal medicine service to the intensive care unit, and 61 of these patients (87.14%) died.

Conclusion: The Mini Nutritional Assessment is a non-complex and sensitive method that can be used to predict early and mid-term mortality in geriatric patients admitted to the emergency department.

Keywords: Malnutrition, nutritional assessment, nutritional surveys, emergency medicine

Introduction

The size of the geriatric age group, defined as 65 and over by the World Health Organization, is rapidly increasing in our country and all over the world. By 2050, it is estimated that the global elderly population, which was 900 million in 2015, will reach 2 billion, and in Turkey by 2080, it is predicted to be 25.6% (1,2). This increase will result in rising healthcare service use and costs due to chronic diseases (3,4).

The need for bodily energy in the elderly may decrease due to physical activity limitations, while it may increase with the effect of disease (5). Since malnutrition can occur not only in thin people but also in obese people, it is recommended that all geriatric patients be screened routinely for nutritional evaluation during hospital admissions and followed up regularly (3 months/yearly), depending on the patient's detected nutritional status.

The average minimum energy requirement of a geriatric patient is considered to be between 25 and 30 kcal/kg (5,6). The most common screening tool developed for the geriatric population is the Mini Nutritional Assessment (MNA) (7). An observational study revealed that lower MNA scores are associated with higher mortality predictions (8). Another 5-year mortality study showed that the detection of malnutrition in hospitalized patients

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with acute causes and different comorbidities effectively predicts all-cause mortality (9). In a study in Portugal, it was determined that the results of 456 patients who underwent short and long MNA tests were compatible, and even by adding two questions, the nutritional status could be better demonstrated (10).

However, the relationship of the MNA with early and mid-term mortality in emergency internal medicine referrals of the geriatric population has not been studied. This study aimed to evaluate the effect of the nutritional status of geriatric patients receiving inpatient treatment in emergency internal medicine clinics on early and mid-term mortality.

Methods

Study Design

The ethics committee of University of Health Sciences Turkey, Kartal Dr. Lutfi Kirdar City Hospital approved the study on 06.12.2019 with the number 2019/514/167/23, and it was performed following the 1964 Declaration of Helsinki and its later amendments. An informed consent form was approved by all patients. Among the geriatric patients admitted to our emergency internal medicine unit between October 1, 2019, and March 1, 2020, 289 hospitalized patients were prospectively included in the study. Clinical and laboratory information was obtained from electronic records, and the patients were evaluated with the MNA following the nutrition risk screening in 2002 (NRS-2002) (11). Body mass index (BMI) is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2). A BMI of less than 18.5 means a person is underweight.

A BMI of between 18.5 and 24.9 is ideal. A BMI of between 25 and 29.9 is considered overweight, and over 30 is obese. The detailed study inclusion and exclusion criteria are indicated in Figure 1.

Nutritional Assessment

NRS-2002 aims to identify people who will benefit from nutritional therapy due to increased nutritional needs resulting from malnutrition and/or disease. The screening form includes an initial scan and a final scan. A final screening is performed if the answer to any of the four questions in the first screening is "yes". Patients with a total score of three or more are considered to be at nutritional risk.

MNA was developed as a reliable screening test to determine whether nutrition is adequate in aged people (7). With questions and anthropometric measurements, the nutritional status of patients can be easily estimated even without laboratory data (12). Although the parameters used are not crucial for diagnosis, they are generally essential for follow-up. The first part consists of six questions and is a quick screening test. The total score is obtained by asking in the second part an additional 12 questions of those who scored lower in the first part. A total score of 23.5 and above is considered normal nutritional status, a score between 17 and 23 is a risk of malnutrition, and a score <17 is considered malnutrition. There is not yet a specific laboratory test that can be used to diagnose malnutrition.

The NRS-2002 test and the first part of the MNA were administered to all patients. The long MNA was not applied to those with adequate nutrition, but by evaluating the scores from the first part, those who did not have sufficient nutrition were evaluated with the long MNA.

Chronic disease and malignancy diagnoses of the patients were determined, and the NRS and MNA tests were performed. As per the MNA score, patients with malnutrition and those at risk of malnutrition were evaluated as having nutritional deficiencies, and their nutrition was arranged according to their nutritional status. Within one year after discharge, follow-up and mortality data were provided using hospital and telephone visits or a national registry system.

Statistical Analysis

Numerical variables are represented by median and interquartile-ranges (25^{th}-75^{th}), Wilcoxon rank-sum test used for the comparisons. For the discrete data, frequencies and absolute numbers are given as frequencies. For comparison, Pearson chi-squared was used. For the correlation analysis of numerical variables, the Spearman test was used.

Outcome variable: All-cause mortality until one year of follow-up.

Multivariable Cox regression was used to find all-cause mortality predictors. The plausible predictors of the multivariable regression model were selected according to the literature, and our main variable (MNA). The Kaplan-Meier curve and the log-rank test were used for the group comparison. A two-tailed p-value <0.05 was set as the significance level. The statistical analyses were performed using R version 4.01 software (Vienna, Austria) with the "rms", "survival", "ggplot", and "desctool" packages.

Results

A total of 289 elderly patients who applied to emergency services were included in our study, of whom 48.4% (n=140). The prevalence of malnutrition and patients at risk of malnutrition was 49.4% (n=143), while nutritional deficiency was found in 49.6% (n=71) of this group. The comorbid diseases found were hypertension (72.2%; n=203), ischemic heart disease (50.8%; n=147), diabetes mellitus (35.2%; n=102),

chronic renal failure (32.8%; n=95), malignancy (25.2%; n=73), neuropsychiatric disease (22.8%; n=66), chronic obstructive pulmonary disease (19.03%; n=55), and chronic liver disease (9.6%; n=28) (Table 1). In relation to the reasons for hospitalization, 11.1% (n=32) of the patients were hospitalized for gastrointestinal system diseases, 14.9% (n=43) decompensated heart failure, 26% (n=75) renal diseases, 5.5% (n=16) electrolyte imbalance and diabetic coma, 9.3% (n=27) hematological and rheumatologic diseases, 18% (n=52) upper gastrointestinal bleeding and inflammatory bowel diseases, and 15.2% (n=44) supportive treatment.

The median follow-up was 312 days for all patients, and the mortality rate was 42.5% (n=123) for all our patients, and 50.4% (n=72) of the patients who died were male. Seventy patients were transferred from the internal medicine service to the intensive care unit (ICU), and 61 of these patients (87.14%) died.

When the MNA scores were evaluated, mortality occurred in 67 (72.8%) of 92 people with a score of <17 indicating malnutrition, and in 25 (49.01%) of the 51 people at risk of malnutrition with a score between 17 and 23. These two patient groups were considered to have a nutritional deficiency. The number of patients in the group with good nutrition, i.e., with a score of 23.5 and above, was 146 (50.5%), and 31 (21.2%) of them died. BMI results included six people (4.2%) with a BMI<18.5 kg/m² and 81 people (56.6%) with a BMI in the range of 18.5-25 kg/m², and the mean BMI was lower in the deceased group with a range of 24.2 (22-26) (p<0.001) (Table 2).

Univariable Cox proportional regression analysis showed that the MNA, NRS, C-reactive protein, BMI, and albumin were associated with mortality (Table 3). Multivariable Cox regression analysis revealed that the MNA, the NRS, and albumin were associated with mortality 0 vs. 2, [hazard ratio (HR) 2.64 95% confidence interval (CI) 1.56-4.45], 0 vs. 1 [HR 2.11 (95% CI 1.22–3.68)], 0 vs. 2 [HR 1.56 (95% CI 1-2.44)], 0 vs. 1 [HR 0.54 (95% CI 0.38-0.78)] respectively. The other results are presented in Table 3.

The Kaplan-Meier curve showed higher mortality in the score <17 and score between 17 and 23 groups when compared to the score of 23.5 and above groups, with a p-value <0.0001 in the log-rank test (Figure 2).

Table 1. Baseline clinical and laboratory variables comparison alive and deceased

Variables	Alive (n=166)	Deceased (n=123)	p-value
Age	75 (70-81)	78 (71-84.5)	0.055
Gender n, (%) (female)	72 (43.4)	68 (55.3)	**0.04#**
Diabetes mellitus n, (%)	60 (36.1)	42 (34.1)	0.72
Hypertension n, (%)	131 (78.9)	72 (62.6)	**0.002#**
Coronary artery disease n, (%)	86 (51.8)	61 (49.6)	0.71
Chronic obstructive pulmonary disease n, (%)	30 (18.1)	25 (20.3)	0.63
Malignancy n, (%)	22 (13.3)	51 (41.5)	**<0.001#**
Chronic kidney disease n, (%)	46 (27.7)	49 (38.9)	**0.03#**
Chronic liver disease n, (%)	11 (6.6)	17 (13.8)	**0.004#**
Neuropsychiatric disorders n, (%)	34 (20.5)	32 (26.0)	0.26
Albumin	3.2 (2.9-3.68)	2.7 (2.4-3.05)	**<0.001***
C-reactive protein	20.3 (4.22-76)	47.7 (13.9-101)	**<0.001***
Lymphocyte	1300 (900-1700)	900 (650-1400)	**<0.001***
Intensive care unit stay n, (%)	9 (5.4)	61 (49.6)	**<0.001***
Total cholesterol	168 (136-205)	142 (124-184)	**<0.001***
HbA1c	6 (5.6-6.57)	5.7 (5.2-6.65)	0.08
Follow-up duration	356 (319-396)	48 (17-231)	**<0.001***
Body mass index	25.4 (24.2-26.9)	24.2 (22-26)	**<0.001***
Nutritional risk screening n, (%)	22 (13.3)	56 (45.9)	**<0.001***
Mini nutritional assessment n, (%)			
0 (<17) 1 (17-23) 2 (>23.5)	25 (15.1) 26 (15.7) 115 (69.3)	67 (54.5) 25 (15.3) 31 (25.2)	**<0.001#**

#Chi-square test, * Wilcoxon -signed-rank test; MNA score was worse in deceased group p<0.001.
MNA: Mini Nutritional Assessment

Discussion

Our study showed that the MNA, which calculates malnutrition status, was independently associated with early and mid-term mortality and. In our study, in which the nutrition and survival of 289 geriatric inpatients admitted to the emergency department and followed up were evaluated, nutritional status was a strong determinant of survival. At their 12-month follow-up, mortality was not observed in 51 (35.6%) of 143 people (49.4%) with malnutrition and malnutrition risk. All-cause mortality was high in our patients with nutritional deficiency and malignancy (p<0.001). Mortality occurred in 61 (87.1%) of our patients admitted to the ICU. When concomitant diseases were evaluated, hypertension was the most common, and liver diseases were seen the least.

In a randomized controlled study in Ireland, when 353 elderly patients admitted to the emergency room were evaluated with the MNA test, it was found that more than one third were at risk of malnutrition or malnutrition. This was associated with a longer stay in the emergency department, a decrease in functional capacity and quality of life, and an increased risk of hospitalization. Patients defined as malnourished in the emergency department were more than four times more likely to report a decline in quality of life and mortality was higher than patients defined as having a normal nutritional status (13).

Table 2. Demographic and nutritional data comparison according to MNA status

	MNA (≥23.5)	MNA (≤23.5)	p-value
Age			
65-74 years	68 (46.6%)	58 (40.6%)	0.137
75-84 years	55 (37.7%)	49 (34.3%)	
≥85 years	23 (15.8%)	36 (25.2%)	
Body mass index			
<18.5	0 (0%)	6 (4.2%)	**<0.001#**
19-24.9	30 (20.5%)	81 (56.6%)	
25-29.9	102 (69.9%)	51 (35.7%)	
>30	14 (9.6%)	5 (3.5%)	
Malignancy	29 (19.9%)	44 (30.8%)	**0.03#**
Gender (female)	69 (47.3%)	71 (49.7%)	0.68

#Categoric comparison made with chi-square, MNA (≥23.5) group was higher body mass index than MNA (≤23.5) p<0.001.
MNA: Mini Nutritional Assessment

Malnutrition has emerged as a major problem among the aged. Different mechanisms, such as gastrointestinal and endocrine system disorders, decreased appetite, loss of taste and smell, and malnutrition due to both disease states and psychosocial factors, are involved in the

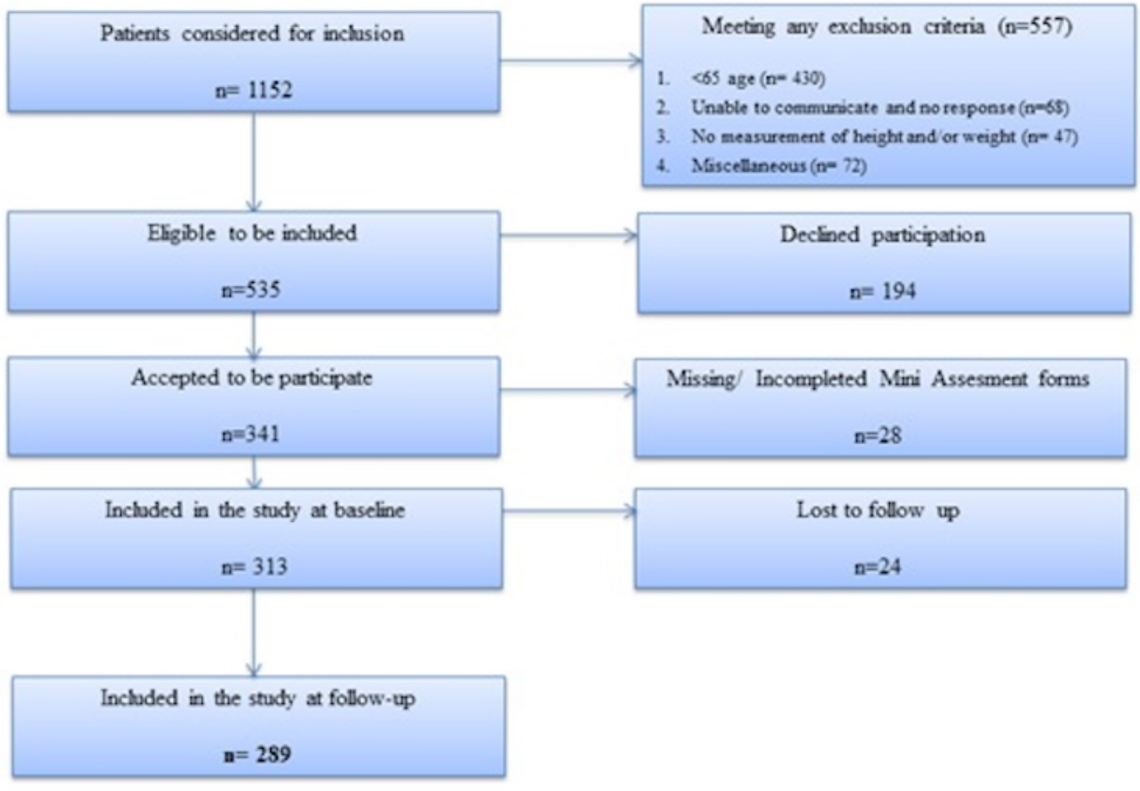

Figure 1. Flow chart of inclusion and exclusion criteria

Table 3. Univariate and multivariable Cox proportional hazard regression analysis				
Variables	**Univariate HR, CI 95%**	**p-value**	**Multivariate HR, CI 95%**	**p-value**
Age (per 1-year increase)	1.02 (1.00-1.05)	0.029	1.00 (0.98-1.03)	0.679
Gender (male reference)	1.41 (0.919-2.01)	0.058	1.67 (1.13-2.47)	**0.01§**
Diabetes mellitus	1.00 (0.69-1.45)	0.98	0.94 (0.67-1.47)	0.796
Hypertension	0.608 (0.42-0.87)	0.006	0.69 (0.43-1.09)	0.111
Coronary artery disease	0.91 (0.64-1.30)	0.600	1.16 (0.76-1.77)	0.505
COPD	1.10 (0.71-1.71)	0.675	1.25 (0.79-1.97)	0.348
Malignancy	2.51 (1.75-3.60)	<0.001	2.46 (1.62-3.73)	**<0.001§**
Chronic kidney disease	1.58 (1.10-2.27)	<0.001	1.94 (1.28-2.94)	**0.002§**
Chronic liver disease	1.77 (1.06-2.95)	0.03	1.61 (0.93-2.78)	0.091
Neuropsychiatric disorders	1.43 (0.96-2.14)	0.082	1.49 (0.96-2.29)	0.072
MNA 0 vs. 2* MNA 1 vs. 2*	5.39 (3.51-8.28) 3.03 (1.79-5.14)	<0.001 <0.001	2.64 (1.56-4.45) 2.11 (1.22-3.68)	**<0.001§** **0.008§**
NRS-2002	3.52 (2.46-5.04)	<0.001	1.56 (1.001-2.44)	0.049§
CRP (per 1 unit increase)	1.001 (1.000-1.002)	0.03	1.00 (0.99-1.001)	0.42
Albumin (per 1 unit increase)	0.39 (0.29-0.52)	0.005	0.54 (0.38-0.78)	**0.001§**
BMI (per 1 unit increase)	0.83 (0.78-0.89)	<0.001	0.86 (0.80-0.93)	**<0.001§**
25-OH D3 (per 1 unit increase)	1.001 (0.99-1.01)	0.70	1.00 (0.99-1.01)	0.34

*MNA 0: Score <17, MNA 1: 18-23, MNA 2: >23.5
§Cox regression analysis significant result. Both MNA 0 and 1 associated worse outcome than MNA 2; [2.64 (1.56-4.45) p<0.001, 2.11 (1.22-3.68) p=0.008 respectively].
COPD: Chronic obstructive pulmonary disease, CRP: C-reactive protein, BMI: Body mass index, MNA: Mini Nutritional Assessment, NRS-2002: Nutritional Risk Screening-2002, CI: Confidence interval, HR: Hazard ratio

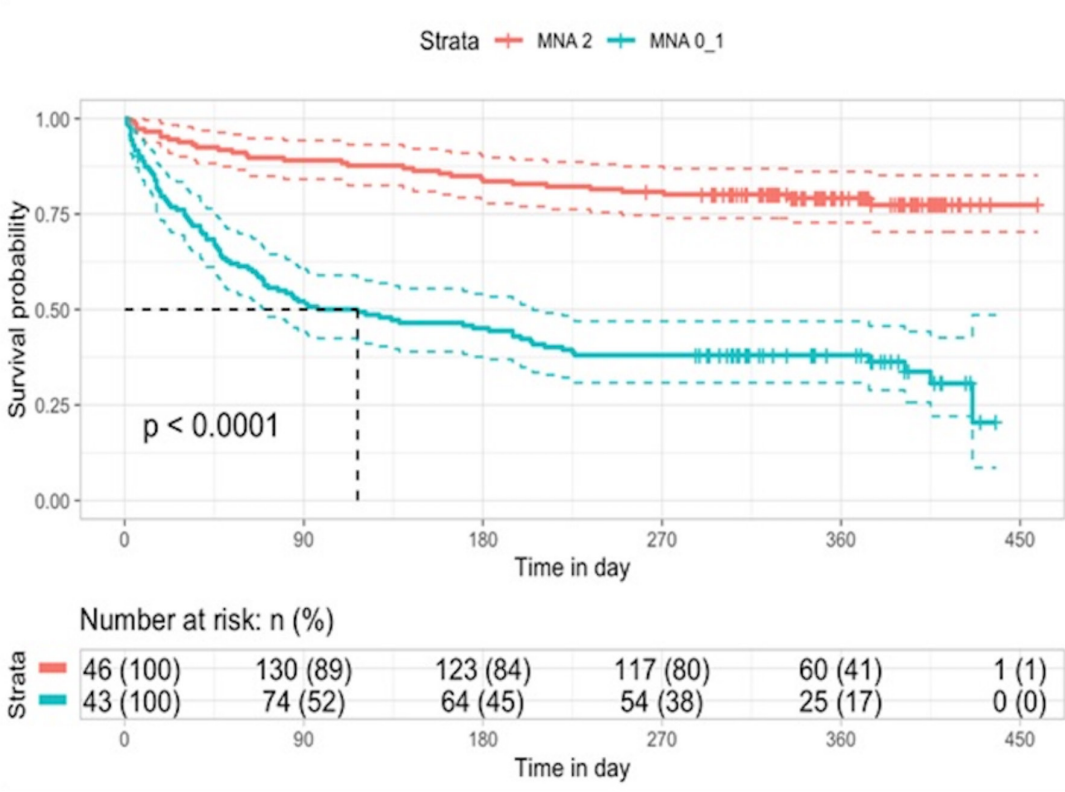

Figure 2. Kaplan-Meier curve comparison between MNA 2 and MNA 0-1
MNA: Mini Nutritional Assessment

development of malnutrition in the elderly (14). Therefore, it is crucial to support a diet containing food and liquid with adequate and appropriate nutrition to prevent and treat malnutrition.

Obesity is an increasing problem in the elderly as well as the general population, and it currently affects 18% to 30% of the world's population aged 65 and over (14). The mean BMI of our patients who did not die was 25.4 (24.2-26.9) kg/m², and as the BMI increased to be in the range of 25-30, a lower risk of death was found compared to the elderly patients with a BMI in the normal range.

In a study conducted by Kaiser et al. (15), the MNA was recommended as a screening test to be used as the basis of nutritional assessment, especially due to its predictive characteristics for early detection and assessment of malnutrition risk in the elderly population and the regulation of nutrition. In their study, the malnutrition rate in the elderly in the community was 5.8%, 13.8% in those living in nursing homes, and 38.7% in hospitalized patients (15). The malnutrition rate was significantly high in our study, with a value of 49.4%; therefore, the elderly population should be evaluated in terms of nutrition and those with malnutrition or at risk of malnutrition should be monitored periodically.

Our study showed a diabetes prevalence of 35.2% and a 41.17% in mortal cases, which is higher than our country's data. In the Turkish Diabetes Epidemiology Study, one of the largest data-based studies, the prevalence of type 2 diabetes was found to be 7.2% in individuals aged 20-60, while it was 20% in individuals over 60 years old (16). Diabetes was high in our geriatric patients, as in all age groups, and its effect on mortality was observed. Malnutrition is considered a hallmark of advanced malignant disease in cancer patients who have an almost three times higher rate of malnutrition (17). Anorexia-cachexia is seen in cancer patients. This situation occurs as a result of complaints such as nausea, vomiting, and early satiety and leads to results such as poor quality of life, poor prognosis, and loss of functional status. In our study, 30.8% (n=44) of the cancer patients had low MNA scores. A recent study found the malnutrition status of geriatric patients followed in the ICU affected the duration of hospital stay, post-discharge care, and mortality. In the study, 331 geriatric patients were followed up, and their nutrition scores with the NRS and the MNA were found to be in the range of 23-34% (18). In our study, mortality (87.14%) was high in those transferred to the ICU, and 32 (52.4%) of these patients had nutritional deficiencies.

Considering the data in our study, age, comorbidities, BMI, and mortality were associated with malnutrition. Various physiological and psychological changes in advanced age lead to decreased hunger, insufficient food intake, metabolic inefficiency, and impaired nutrition. As demonstrated in our study, malnutrition associated with internal emergency diseases is a significant risk factor, especially in terms of mortality. Therefore, it should be kept in mind as an additional evaluation parameter in the elderly population.

Study Limitations

The limitation of the study is the data from a single-center analysis, resulting in the regression analysis's low causal inference. Investigations from different centers are needed to confirm the data. Our study's strength consists of geriatric patients who were followed up, admitted to the tertiary referral and oncology center's emergency room and hospitalized.

Conclusion

Nutritional status in geriatric patients admitted to the emergency internal medicine service was associated with mortality for up to one year regardless of other causes, and age, comorbidities, BMI, and mortality were associated with malnutrition. The MNA is a non-complex and sensitive method that can be used to predict early and mid-term mortality in geriatric patients admitted to the emergency department.

Ethics

Ethics Committee Approval: The ethics committee of University of Health Sciences Turkey, Kartal Dr. Lutfi Kirdar City Hospital approved the study on 06.12.2019 with the number 2019/514/167/23.

Informed Consent: An informed consent form was approved by all patients.

Authorship Contributions

Concept: A.C.I., S.A., Design: B.B., O.K., Data Collection or Processing: A.C.I., A.K., Analysis or Interpretation: A.C.I., A.K., Literature Research: A.C.I., A.K., Writing: A.C.I., A.K., S.A. A.O.

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