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Nutritional Characteristics of the Patients Followed by the Nutrition Support Team and the Relationship Between the Nutritional Therapy Applied and the Results

İsmail Hasırcı[1,2], Demet Yılmaz[1], Meltem Türkoğlu[1], Dursun Elmas[1], Zahide Betül Gündüz[1], Gülsüm Gönülalan[1], Muhammet Cemal Kızılarslanoğlu[1,3]

[1]Nutrition Support Unit, University of Health Sciences Turkey, Konya Education and Research Hospital, Konya, Turkey
[2]Department of General Surgery, University of Health Sciences Turkey, Konya Education and Research Hospital, Konya, Turkey
[3]Department of Internal Medicine, Division of Geriatrics, University of Health Sciences Turkey, Konya Education and Research Hospital, Konya, Turkey

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ABSTRACT

Objective: The aim of this study was to investigate the general characteristics, management strategies for malnutrition, and clinical outcomes in hospitals according to age groups and examine the relationships between mortality and nutritional way of the patients followed by our nutrition support team.
Methods: Totally, 411 patients were enrolled in this retrospective study. Demographic characteristics, reasons for hospitalization, comorbidities, wards the patients were staying, first day Nutritional Risk Screening 2002 scores, length of hospital stay, and clinical outcomes of the patients were recorded. Clinical parameters were compared between young patients and elders.
Results: The median age was 75 years (18-96) [54.3% male, median length of hospital stay 23 days (0-261), in-hospital mortality rate 43.6%]. The median survival was lower in elders compared to young patients (42 vs. 76 days, $P = .002$). The median survival was higher in patients with oral feeding compared to those without oral feeding (63 vs. 41 days, $P < .001$). The median survival was lower in patients with parenteral than oral and/or enteral feeding (14 vs. 48 days, $P < .001$). Age (hazard ratio: 1.028, 95% CI: 1.010-1.046), sepsis (hazard ratio 4.365, 95% CI: 1.810-10.528), malnutrition in the first day of admission (hazard ratio: 2.223, 95% CI: 1.198-4.126), parenteral nutrition (hazard ratio: 2.458, 95% CI: 1.432-4.220), oral nutrition (hazard ratio: 0.090, 95% CI: 0.045-0.182), tube feeding (hazard ratio: 1.915, 95% CI: 1.015-3.614), and feeding by gastrostomy/jejunostomy (hazard ratio: 0.113, 95% CI: 0.057-0.224) were found to be independently associated factors for hospital mortality (all parameters had $P < .05$).
Conclusion: It was shown that the study population had high hospital mortality rate, and age, malnutrition, severe infection, and nutritional ways were independently correlated factors for hospital mortality.

Keywords: Hospitalized patients, malnutrition, mortality, older adults

INTRODUCTION

Nutrition is the basic element for health in every period of life. Malnutrition can also indirectly or directly cause many diseases. Therefore, recognizing and treating malnutrition is vital, especially for improvements in clinical care. Malnutrition is a nutritional disorder that occurs with impaired physical and mental functions that lead to altered body composition (decreased lean mass) and decreased body cell mass, as well as the presence of starvation, disease, or aging, alone or in combination, accompanied by impaired clinical outcomes.[1] More than 30% of inpatients are at risk of malnutrition, which is closely related to increased mortality and morbidity, functional decline, prolonged hospital stays, and increased healthcare costs.[2,3]

By evaluating the nutritional status of each patient within the first 24 hours of hospitalization with a reliable and simple screening method, rapid identification of patients with malnutrition and malnutrition risk and arranging individualized medical nutrition therapy can improve the patient's clinical outcomes and reduce healthcare costs and mortality.[4-6]

Corresponding author: İsmail Hasırcı, e-mail: drihasirci@hotmail.com
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In this study, it was aimed to examine the general nutritional clinical characteristics of the patients who were consulted with our Nutrition Support Team while they were hospitalized and the effects of the applied nutritional treatments on the clinical outcomes. As a secondary outcome, it was also aimed to compare the data by age groups.

METHODS

A total of 411 patients, who were hospitalized at Konya Education and Research Hospital, consulted with our nutritional support team and evaluated daily, and provided with enteral and parenteral nutrition support, were included in this retrospective and observational study.

Among the general characteristics of the patients, age, gender, and underlying chronic diseases were scanned from the hospital information management system and recorded. Patients aged 65 years and over were considered to be elderly. The reasons for hospitalization were determined by examining the hospital registry system and patient files. The weight (kg) of each patient consulted to our nutrition support team was recorded by weighing with scales if possible or according to the statement of the patient or family. The height of the patients was measured, if possible, or recorded according to the statements of the patient or family. According to the recorded weight and height values, the body mass indexes of the patients were calculated in kg/m². The scores of the "Nutritional Risk Screening 2002" (NRS 2002) applied by the service nurse to determine the nutritional status of each inpatient at the time of admission were recorded, and patients with a score of 3 and above were categorized as nutritionally risky (malnutrition risk).[7] Each patient consulted to our nutrition support unit is screened for malnutrition risk, oral food consumption records are reviewed, and a treatment plan is recommended in line with European Society for Clinical Nutrition and Metabolism (ESPEN) recommendations for patients who are found to be malnourished. The dates of consultation of the patients to our nutritional support unit, the units consulted, and the wards they were hospitalized were recorded. Medical nutrition therapy plans applied to patients were recorded daily in the hospital automation system by the dietitians working in our nutrition support team. The latest status in the hospital (death, discharge, referral, and continuing hospitalization) along with their dates was recorded in the hospital information management system. Approval for this study was obtained from the Ethics Committee of Necmettin Erbakan University Meram Faculty of Medicine, Non-Pharmaceutical and Medical Device Research (decision number: 2019/1689, date: February 8, 2019). Due to the retrospective design of the study, informed consent was not taken.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences 22.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as numbers and percentages, and whether the numerical parameters were normally distributed or not was evaluated using the histogram (Kolmogorov–Smirnov tests). Normally distributed numerical parameters are expressed as mean ± SD, and non-normally distributed numerical parameters are expressed as median (minimum–maximum). The Student's *t*-test was used to compare the mean between the 2 groups, the Mann–Whitney *U*-test was used to compare the median, and the chi-square or Fisher's exact test were used to compare categorical variables. The correlation between the length of hospital stay (LOS) and other numerical parameters was analyzed by the Spearman's test. Parameters related to the length of hospitalization were evaluated with the linear regression analysis model. A *P* value of <.05 was accepted as statistical significance.

RESULTS

Of the 411 patients included in the study, 54.3% were male. The median age of the patients was 75 (minimum–maximum 18-96) years. Seventy-three percent of the patients were elderly (65 years and older). The most common reasons for hospitalization were neurological (55%), pulmonary (42.6%), and cardiological (23.1%) problems. About 49.1% of the patients had at least 1 chronic disease. The most common chronic diseases were hypertension (28.5%), diabetes (20.7%), and chronic obstructive pulmonary disease (17.8%), respectively. The units that consulted our nutrition support unit included intensive care units (57%), internal medicine clinics (35%), and surgical clinics (8%), respectively. The general characteristics of the patients are summarized in Table 1.

The proportion of patients who were found to be at risk of malnutrition on the first day of hospitalization was 68.4%. During the hospitalization, it was observed that the patients were most frequently provided with nutritional support with a nutrition tube (60.1%). Although parenteral nutrition support was applied to 40.4% of the patients, only 1.7% of the patients received parenteral nutrition therapy alone. Patients who received only parenteral nutrition (n = 7) had a shorter median hospital survival than those who received oral–enteral nutrition support (n = 404) (14 vs. 48 days; $P < .001$). Patients who were able to receive oral nutrition at any time during the follow-up period (n = 155) and patients who could

Table 1. General Characteristics, Comorbidities, and Other Clinical Properties of the Patients

Properties	
Age, years, median (minimum–maximum)	75 (18-96)
BMI, kg/m^2, median (minimum–maximum)	25 (14.7-50.78)
Gender, male, n (%)	223 (54.3)
Reason for hospitalization, n *(%)*	
Neurologic disorders	185 (55.0)
Pulmonary disorders	175 (42.6)
Cardiovascular disorders	95 (23.1)
İnfections	89 (21.7)
Endocrinological disorders	50 (12.2)
Malignancies	50 (12.2)
NRS 2002 score, median (minimum–maximum)	3 (0-7)
Length of hospital stay, days, median (minimum–maximum)	23 (0-451)
Wards the patients were staying, n *(%)*	
Intensive care unit	235 (57)
Medical wards	143 (35)
Surgery wards	33 (8)
Last status of the patients, n *(%)*	
Dead	179 (43.6)
Discharged	165 (40.1)
Still in hospital	36 (8.8)
Referred to another hospital	31 (7.5)
Nutritional support strategies, n *(%)*	
Nasogastric feeding	247 (60.1)
Total parenteral nutrition	166 (40.4)
Nutrition via percutaneous endoscopic gastrostomy	120 (29.2)
Oral nutrition support	155 (37.7)

The patients taking oral nutrition support refer to the patients supported by both oral nutritional supplements and oral nutritional regimes.
BMI, body mass index; NRS 2002, Nutritional Risk Screening 2002.

not receive any oral nutrition during the follow-up period (n=256) (patients who were fed enterally and/or parenterally and did not receive any oral nutritional support) were compared in terms of hospital survival time. The median hospital survival time was longer in patients who could be provided with oral nutritional support (63 vs. 41 days; $P < .001$). It was observed that there was no difference between young (<65 years) and elderly (65 years and older) patients in terms of the choice of administration route of nutritional therapy ($P > .05$). It was observed that percutaneous endoscopic gastrostomy/percutaneous endoscopic jejunostomy (PEJ) was applied to 120 patients, and PEJ was applied to 3 of these patients. In addition to patients who were never interrupted and who continued enteral nutrition, which was recommended to 98.3% of patients, the longest break was 31 days, with a median value of 0. The reasons for interrupting enteral nutrition are presented in Table 2.

Table 2. Reasons for Interruption of Enteral Nutrition

Reasons for interruption of enteral nutrition, n (%)	
Problems related to percutaneous endoscopic gastrostomy	50 (12.2)
Gastrointestinal system intolerance	39 (9.5)
Invasive procedures	29 (7.1)
Septic shock	14 (3.4)
Patient rejection	1 (0.2)

On the day of hospitalization, the rate of having pressure ulcers during follow-up in the hospital in patients with malnutrition risk (n=161/281; 56.9%) was higher than in those without malnutrition risk (n=44/130; 33.8%) ($P < .001$).

For the patients included in the study, the median LOS was 23 days (minimum–maximum: 0-451) and the mortality rate was 43.6%. The median hospital survival was shorter in elderly patients (42 vs. 76 days; $P=.002$). At least 1 pressure ulcer was detected in 49.6% of the patients during their hospitalization. Pressure ulcers were more common in elderly patients (55.3% vs. 34.2%, $P < .001$). When the dead patients were compared with the surviving patients, it was detected that the median age, female sex ratio, pulmonary and renal problems, pressure ulcer and sepsis rates, NRS 2002 score, and parenteral and nasogastric tube nutrition rates were found to be higher in patients who died. Detailed information is presented in Table 3. Age [hazard ratio (HR): 1.028], sepsis (HR: 4.365), risk of malnutrition on the day of hospitalization (HR: 2.223), parenteral nutrition (HR: 2.458), oral nutrition (HR: 0.090), nutritional tube feeding (HR: 1.915), and feeding with gastrostomy/jejunostomy (HR: 0.13) were found to be independent parameters associated with hospital mortality ($P < .05$ for all parameters) (Table 4).

Table 3. Comparison of Clinical Parameters According to the Hospital Mortality in the Study Population			
Parameters	**Dead Patients (n=179)**	**Alive patients (n=232)**	***P***
Age, years	78 (19-96)	70 (18-95)	**<.001**
Gender, female	83 (46.4)	105 (45.3)	.823
Reasons for hospitalization			
Neurological disorders	101 (56.4)	125 (53.9)	.607
Orthopedic problems	10 (5.6)	15 (6.5)	.712
Intoxication	2 (1.1)	3 (1.3)	1.000
Malignancy	21 (11.7)	29 (12.5)	.813
Hematological problems	5 (2.8)	5 (2.2)	.753
Infections	44 (24.6)	45 (19.4)	.206
Cardiovascular problems	44 (24.6)	51 (22.0)	.536
Pulmonary problems	90 (50.3)	85 (36.6)	**.006**
Endocrinological problems	22 (12.3)	28 (12.1)	.946
Gastrointestinal problems	14 (7.8)	24 (10.3)	.381
Renal disorders	23 (12.8)	16 (6.9)	**.041**
Comorbidities			
Coronary artery disease	7 (3.9)	12 (5.2)	.546
Asthma	6 (3.4)	7 (3.0)	.848
Chronic obstructive pulmonary disease	33 (18.4)	40 (17.2)	.753
Hypertension	50 (27.9)	67 (28.9)	.833
Chronic kidney disease	19 (10.6)	15 (6.5)	.130
Diabetes mellitus	38 (21.2)	47 (20.3)	.810
Having at least 1 comorbidity	86 (48.0)	116 (50.0)	.694
Pressure ulcer	103 (57.5)	101 (43.5)	**.005**
Sepsis	32 (17.9)	14 (6.0)	**<.001**
Wards the patients were admitted			
Surgical clinics	2 (1.1)	12 (5.2)	**<.001**
Non-surgical clinics	11 (6.1)	4.4)	
Intensive care unit	166 (92.7)	117 (50.4)	
BMI, kg/m^2	25.7 (14.7-46.3)	24.7 (14.9-50.8)	.081
Number of comorbidities	0 (0-4)	0.5 (0-4)	.974
Length of hospital stay, day	28 (1-261)	21 (0-451)	.063
NRS 2022 score	4 (0-7)	3 (0-7)	**<.001**
Malnutrition risk at the time of admission	151 (84.4)	130 (56.0)	**<.001**
Nutritional interventions			
Parenteral	96 (53.6)	70 (30.2)	**<.001**
Oral feeding	27 (15.1)	128 (55.2)	**<.001**
Nasogastric tube feeding	149 (83.2)	98 (42.2)	**<.001**
PEG/PEJ	35 (19.6)	85 (36.6)	**<.001**

BMI, body mass index; NRS 2002, Nutritional Risk Screening 2002; PEG, percutaneous endoscopic gastrostomy; PEJ, percutaneous endoscopic jejunostomy.

Table 4. Regression Analysis Results Showing Associated Factors with Hospital Mortality

Parameters	Hazard ratio	95% CI	*P*
Sepsis	4.365	1.810-10.528	**.001**
Malnutrition risk	2.223	1.198-4.126	**.011**
Parenteral nutrition	2.458	1.432-4.220	**.001**
Oral nutrition	0.090	0.045-0.182	**<.001**
Enteral nutrition (via feeding tube)	1.915	1.015-3.614	**.045**
PEG/PEJ	0.113	0.057-0.224	**<.001**
Age	1.028	1.010-1.046	**.002**

The parameters which were significantly associated with hospital mortality according to the univariate analyses including pulmonary, neurological problems, pressure ulcer, sepsis, malnutrition risk, parenteral (n = 166), oral, enteral feeding and using PEG/PEJ, and age were included in multivariate logistic regression analysis model. Backward stepwise method was used. The last step (step 7) is shown in the table. Omnibus test fort his model had *P* value <.05 and Hosmer–Lemeshow test had *P* = .235.
PEG, percutaneous endoscopic gastrostomy; PEJ, percutaneous endoscopic jejunostomy.

DISCUSSION

In this retrospective and observational study, age, malnutrition risk, severe infections, and parenteral nutrition were shown to be independently associated parameters with increased hospital mortality. On the other hand, it was determined that hospital mortality was lower in patients who could be fed orally and enterally.

In general, it has been reported that the frequency of disease-induced malnutrition is 30%-60% in hospitalized patients.[8,9] In our study, according to NRS 2002, the risk of malnutrition in the first days of hospitalization was 68.4%. The risk of malnutrition detected in this study has a higher prevalence than in the study recently conducted by Sanson et al.[10] Again, in the study of Chen et al.[11] the rate of patients who were found to be at risk of malnutrition according to NRS 2002 during admission to the hospital was lower than our result. The reason for this may be that the patients under the follow-up of the nutrition team, not the general hospital population, were included in the study; these patients were mostly hospitalized in intensive care units, and NRS 2002 was applied to a group with a higher mean age compared to the study by Chen et al.[11]

While 49.6% of the patients had at least 1 pressure ulcer during their hospitalization, pressure ulcers developed more frequently in elderly patients. In the study conducted by Lyder et al[12] in 2012, the prevalence of pressure ulcers during hospitalization was 5.8%, while pressure ulcers developing during hospitalization were found to be 16.7%. Again in this study, the mean age of patients with pressure ulcers was found to be between 75 and 84 years. According to the study conducted by Shahin et al[13] in hospitals and nursing homes in 2010, the risk of developing pressure ulcers is higher in elderly patients. The prevalence of pressure ulcers is high in patients who are elderly, have high risk of malnutrition, and long hospital stay, and who are polymorbid and immobile patients.[14-16] Since we included elderly patients having various comorbidities, malnutrition risk, and long-term hospitalization in our study, we can say that the results are similar to the literature.

While the mortality rate of the patients included in the study was 43.6%, when the patients who died and those who survived were compared, the median age, female sex ratio, pulmonary and renal problems, pressure ulcer and sepsis rates, NRS 2002 score, and parenteral and nasogastric tube feeding rates were found to be higher in patients who died. In the study of Zhang et al.[17] the NRS 2002 score was found to be an independent risk factor affecting the mortality of hospitalized geriatric patients. On the other hand, it was determined that hospital mortality was lower in patients who could be fed orally and enterally. In a study conducted by Kaegi-Braun et al in 2021,[18] the survival rate was found to be higher in patients who were fed orally alone. As a result, mortality rates are high in hospitalized patients with nutritional risk, and providing nutritional support may benefit these patients. On the other hand, in our study, it was determined that the rate of gastrostomy/jejunostomy insertion in dead patients was lower than in surviving patients. This may support the knowledge that gastrostomy or jejunostomy may not be preferred in patients with severe clinical course and low life expectancy. On the other hand, the low rate of patients who underwent gastrostomy/jejunostomy in the dead patient group may be due to the low life expectancy in this patient group.

One of the most important limitations of our study is that it was retrospective and single centered. On the other hand, it can be said as a limitation that we presented the data of a population with high mortality and critical illness and generally could not reflect the data of patients who were hospitalized and at risk of malnutrition. In this study, the data (available) of all patients who were followed in both intensive care units and inpatient services and who were in our follow-up are included. Prospectively designed studies with specific patient groups will be able to provide more detailed information on this subject.

It was observed that the patients we followed up generally consisted of a population with high hospital mortality. Age, malnutrition, severe infection, and parenteral nutrition have been shown to be parameters independently related to increased hospital mortality. It was determined that hospital mortality was lower especially in patients fed orally and with gastrostomy/jejunostomy.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Necmettin Erbakan University (Date: February 8, 2019, Number: 2019/1689).

Informed Consent: Due to the retrospective design of the study, informed consent was not taken.

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