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Evaluation of patients treated by nutrition support teams and its effect on treatment cost

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ABSTRACT

Objective: Malnutrition is a condition that increases morbidity and mortality in patients, prolongs hospital stay, and increases treatment costs. The incidence of malnutrition remains a major problem in hospitalized patients despite improvements in nutritional support therapies. Previous studies have shown that treatment standardization can be achieved by using a multidisciplinary team that consists of doctors, pharmacists, nurses, and dieticians, which positively affects hospital costs and patients' health. In this study, we aimed to investigate the effect of nutritional support teams on treatment cost in our hospital.

Methods: A nutrition support team was established in April 2017 at our hospital and all patients who consulted the team between April 2017 and December 2018 were investigated retrospectively. In this period, the patients were evaluated for incidence of mortality, body mass index, changes in NRS-2002 score, enteral and parenteral nutrition rates, nutritional changes, and annual enteral and parenteral product costs and the effect of multidisciplinary nutrition on these parameters was assessed. Results of quantitative variables were defined as mean, median, and standard deviation. Qualitative variables were represented by frequency and percentage.

Results: A total of 511 patients were enrolled in the study. The mean age of the patients was 68.6 years (18–99) and 49.5% of them were female. Out of 511 subjects, 251 patients were hospitalized in intensive care units and 260 were in wards. Enteral nutrition was recommended in 275 patients, oral nutrition in 71 patients, and parenteral nutrition in 70 patients. The mortality rate was 61.6% in high-risk patients with an NRS2002 score >5 and 38.4% in moderate-risk patients with a score of 3–5. A total of 164 patients who received inappropriate parenteral nutrition were switched to oral or enteral nutrition. The NRS-2002 score was maintained in 267 patients and was decreased in 202 patients. The number of patients receiving parenteral nutrition was 8783 in 2016, which decreased to 6104 in 2018 with a decreasing rate of 30.5%. The number of patients receiving enteral nutrition were 4376 in 2016, which increased to 7582 in 2018 with an increasing rate of 42.2%. The total cost of enteral and parenteral products was decreased.

Conclusion: Giving the nutritional support to malnourished patients or those at high risk of malnutrition could have positive effects on many parameters such as reduction the NRS-2002 scores and hospital costs and choosing the correct nutritional route.

Keywords: Cost effectiveness, malnutrition, nutrition therapy, nutritional, support

Introduction

Although obesity is the main focus of health policy and research, malnutrition continues to be an important and common health problem even in developed countries. Malnutrition has been detected in about one-third of hospitalized patients in developed countries. If untreated, it has been shown to cause significant clinical outcomes including prolonged hospital stay, increased newly developing infection, mortality, and a 30-day re-admission rate. It has also been reported that the prevalence of malnutrition can reach up to 85% in long-term care centers (1).

In many sources, malnutrition has been defined as the inequality between consumed nutrients and differing metabolism requirements, and the need to diagnose and treat different populations with different screening tests has been proposed (2). Correct diagnosis and treatment in patients with malnutrition is critical to minimize the negative consequences associated with malnutrition. The screening methods used today are Subjective Global

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Assessment, Nutritional Risk Index, Mini Nutritional Assessment, Malnutrition Universal Screening Tool, and Nutritional Risk Screening-2002 (NRS-2002). In addition to these screening methods, it has been reported that 10% loss of body weight in the last 6 months should be considered as malnutrition (2).

The NRS-2002 screening test was developed by Kondrup et al. (3) for screening of malnutrition. NRS-2002 is based on the relationship between disease severity and nutritional status and is calculated by variables such as body mass index (BMI), weight loss, food intake, and general status. A nutritional plan is recommended in patients with an NRS-2002 score of ≥3, assuming the presence of risk of malnutrition.

Studies have shown that the screening of nutrition in hospitals is not done adequately and even in the centers where it is applied, many patients with malnutrition or malnutrition risk are not given adequate nutritional support treatment. The reasons for this situation are the inadequacies in screening, evaluation and treatment, deficiencies in the training of the relevant health personnel, and lack of necessary awareness (4). In recent years, the term "nutritional support" for patients with malnutrition has become an indispensable part of treatment rather than a method that supports treatment. Provision of nutritional support by a coordinated and multidisciplinary team has enabled standardization of treatment and a decrease in the incidence of complications (5).

The nutritional support team (NST) requires a multidisciplinary constitution including doctors, dietitians, nurses, and pharmacists. NST plays an active role in the assessment of nutrition and determination of nutritional requirements, making recommendations for correct nutritional therapy, and choosing the nutritional support pathway (6). The aim of this study was to determine the route of nutritional support treatment, changes in NRS-2002 scores according to age, and the effect of the recommendations on enteral and parenteral product usage and treatment costs.

Methods

Ethical approval was obtained from the ethics committee of the Faculty of Medicine of Kütahya University of Health Sciences with the decision number 2019/03 dated 27 February-2019.

In this study, NST was performed in a tertiary education research hospital with 443 beds, 79 of which were intensive care beds. The change in the number of inpatients remained constant over the years. In April 2017, a NST consisting of nurses, dietitians, pharmacists and physicians was established as a requirement by the Ministry of Health to increase the quality standards in healthcare. The aim of the NST team was to screen patients for the risk of malnutrition during their stay in the hospital and to regulate the treatment of patients at risk of malnutrition according to nutritional guidelines. Another aim of the team was to increase the nutritional care quality by monitoring the patients receiving total parenteral nutrition (TPN) and enteral nutrition (EN) treatment. For this purpose, the nurses working in intensive care and wards were introduced to the NRS-2002 form, which is used in the screening of malnutrition, and training was provided to teach them how to fill the forms correctly. In addition, the importance of nutrition, EN, and TPN administration was explained and protocols were established.

Patients over 18 years old who were hospitalized between April 2017 and January 2019 were included in the study. Pediatric patients, pregnant women, and patients hospitalized for less than 48 hours were excluded from the study. Malnutrition screening was performed on the first day of hospitalization with NRS-2002. The patients who were hospitalized for more than 48 hours, who had an NRS-2002 score ≥3, and who were referred to NST were followed-up and the patient-related data were recorded. Follow-up patients were re-evaluated by the NST team with NRS-2002 score at a maximum of one-week intervals. Age, gender, BMI, mean NRS-2002 score, recommended feeding route, NRS-2002 score, and mortality rates according to age groups were analyzed. Patients with BMI (kg/m²) <18.5 kg/m² were considered as undernourished; between 18.5–24.9 kg/m² was considered as normal; between 25–29.9 kg/m² was overweight; and patients with BMI ≥30 kg/m² were considered as obese. Age evaluation was made in six groups as 18–24, 25–34, 35–44, 45–54, 55–64, and 65+ years. The data used in the study were obtained from the team records.

Data on the types and costs of nutritional products used in service and intensive care units were obtained from hospital pharmacy unit records. The cost was calculated separately for each product and obtained by multiplying the number of products and unit price. Ready-to-use nutritional products were included in the enteral product cost and ready-to-use three-chamber bag systems containing amino acid, glucose, and fat emulsions were included in the TPN cost. The daily energy intake target of the patients was 25–30 kcal/kg/day, the protein target was 1.2–1.5 g/kg/day, and the protein target of the patients with renal failure who did not receive hemodialysis treatment was 0.8 g/kg/day.

Statistical analysis

IBM Statistical Package for the Social Sciences (IBM SPSS Corp.; Armonk, NY, USA) 20.0 package program was used for analysis. Results of quantitative variables were defined as mean, median, and standard deviation. Frequency and percentage (%) values were used for categorical variables.

Results

The rate of patients screened by NRS-2002 was 49.4% in 2017 and 91.3% in 2018. The rates of patients with malnutrition was calculated as 7.44% in 2017 and 7.48% in 2018 (Table 1). Although the number of patients screened increased, the rate of malnourished patients did not change. A total of 46.2% of patients with an NRS-2002 score of 3 or higher were treated by the NST. The number of patients who were followed-up was 511, with 251 (49.1%) being in intensive care. The number of patients who consulted the NST was 180 (35.2%) from internal services and 80 (15.7%) from surgical services. The patients from the surgical services were mostly admitted for cardiovascular surgery (n=24) and orthopedic (n=22) surgery, and the internal patients were mostly admitted for palliative (n=100) services. A total of 49.5% of the patients were female and the mean age was 68.5±19.2 years. The mean NRS-2002 score of all the patients consulted was 5.1±1.8, the mean NRS-2002 score of the patients consulted in intensive care units was 5.7±1.2, the mean NRS-2002 score of the patients consulted in surgical services was 4.5±1.5, and the mean NRS-2002 score of the patients consulted in internal services was found to be 4.6±1.4 (Table 2). The nutritional risk scores of the inpatients in the ICU was detected to be significantly higher (p=0.043) as compared to the scores of inpatients in other services. The number of patients recommended for enteral nutrition was 275 (53.8%) and the number of patients recommended for parenteral nutrition was 70 (13.6%). The recommendations of NST caused a 77% product change and 51% nutrition change in the physician's initial treatment plan. In terms of the risk of malnutrition, an NRS-2002 score of 3–5 was considered to be moderately risky, and patients with NST greater than 5 were considered at high risk of malnutrition. These high-risk patients were more likely to be in internal medicine and in palliative wards (Table 3). When the patients who were followed-up were classified according to their ages, the groups with the highest NRS-2002 score were between 18–24 and >65 years (Table 4). When compared with the follow-up score, the number of patients with NRS-2002 regression was 202 (39.5%). When the patients were grouped according to their BMI and NRS-2002 scores, it was found that the groups with the highest mortality rate were the groups with BMI between 18.5–24.9 and the group with NRS-2002 score >5 (Table 5).

The number of patients using TPN decreased from 7872 in 2016 to 5968 in 2018, with a decrease of 24.1% between the two years. The number of TPNs used decreased from 8783 in 2016 to 6104 in 2018, with a decrease of 30.5%. The number of patients using enteral products increased

Table 1. Screening and malnutrition ratios of hospitalized patients

Year	Total number of patients accepted for hospitalization	Number of inpatients >48 hours	Number of patients undergoing NRS-2002 malnutrition screening=n (%)	Number of patients at risk of malnutrition with NRS-2002 ≥ 3=n (%)
2017	15125	9426	4663 (49.4)	347 (7.44)
2018	19255	16155	14756 (91.3)	1104 (7.48)

NRS-2002: Nutritional Risk Screening-2002

Table 2. Age, gender and NRS-2002 scores of the patients

	Intensive Care	Internal services	Surgical services
Number of patients (n/%)	251/49.1	180/35.2	80/15.7
Female gender=n (%)	144 (28.2)	89 (17.4)	27 (5.3)
Age (Mean±SD)	65.9±22.7	71±26.7	80±18.7
NRS-2002 (Mean±SD)	5.7±1.2	4.6±1.4	4.5±1.5
Mortality rate=n (%)	75 (29.8)	32 (17.7)	5 (6.2)

NRS-2002: Nutritional Risk Screening-2002; SD: standard deviation

from 4376 in 2016 to 7582 in 2018, showing an increase of 42.2%. The number of enteral products used increased from 16,838 in 2016 to 25,753 in 2018, with an increase of 34.6%. The number of TPN use in the internal intensive care unit, which had the highest rate of consultation with the NST decreased from 1312 in 2016 to 192 in 2018. The number of TPNs used in the palliative service decreased from 2218 in 2016 to 959 in 2018. The total cost of enteral products and TPNs were found to decrease from 470,537,45 Turkish lira (TL) in 2016 to 416,306,03 TL in 2018. The cost of only TPN products was calculated as 429.714.38 TL in 2016 and 314.500.64 TL in 2018. In this calculation, the costs of the catheter operation and catheter-related developing complications were not added (Table 6).

Table 3. Grouping of inpatients according to the risk of malnutrition

	Moderate risk (NRS 3–5) Number of patients=n	High risk NRS >5 Number of patients=n
Internal medicine	42	11
Palliative	84	16
Oncology	7	2
Infection	6	0
Gastroenterology	2	0
Hematology	0	2
Cardiology	6	2
Cardiovascular surgery	21	3
orthopedics	20	2
General surgery	15	2
Thoracic surgery	6	3
Brain and nerve surgery	3	4
Ear nose throat	1	0

NRS: Nutritional Risk Screening

Table 4. NRS-2002 score of patients according to age groups

Age Group (years)	Average NRS-2002	The number of patients=n (%)
18–24	5.5	11 (2.2)
25–34	4.3	13 (2.7)
35–44	4.2	22 (4.3)
45–54	4.7	36 (7.1)
55–64	4.7	83 (16.4)
65+	5.3	346 (67.3)

NRS-2002: Nutritional Risk Screening-2002

Table 5. Mortality rate of patients according to body mass index

Body mass index (kg/m²)	Mortality rate
<18.5	20.5%
18.5–24.9	41.1%
25–29.9	23.2%
>30	15.2%

Table 6. Annual product use and change in cost

	Year 2016	Year 2017	Year 2018
Number of patients using TPN in hospital	7872	7258	5968
Number of TPNs used in hospital	8783	7893	6104
Number of patients using enteral products in hospital	4376	5790	7582
Number of enteral products used in hospital	16.838	22.237	25.753
Enteral + parenteral product cost (Turkish Lira)	470.537,45	445.095,16	416.306,03
Nutritional cost per patient (Turkish Lira)	38.41	34.10	30.72
TPN cost (Turkish lira)	429.714,38	394.096,86	314.500,64
Number of TPNs used in internal medicine intensive care unit	1312	1275	192
Number of TPNs used in palliative service	2218	1715	959

TPN: total parenteral nutrition

Discussion

The screening rate for determining the risk of malnutrition in hospitalized patients increased from 49.4% in 2017 to 91.3% in 2018. After the establishment of NST, the team explained the necessity of screening for malnutrition risk and the importance of clinical nutritional support to the health personnel, especially nurses, via an all-day training process. In addition to this training, the number of patients screened increased as a result of educating them about the need for NRS-2002 screening. Although the number of patients screened for malnutrition risk increased, there was no change in the proportion of patients at risk of malnutrition or malnutrition. The proportion of patients with malnutrition risk in inpatients did not change compared to the previous year (7.4%). In the literature, the malnutrition rate of hospitalized patients was found to be 15–60% and could be as high as 38–72% in ICU patients or elderly patients (7). The malnutrition rate in our hospital was found to be lower than what has been reported in the literature.

Nutritional status tends to deteriorate in hospitalized patients. Malnutrition is a condition that can cause both deterioration of the clinical outcome of the patient and increase the health costs as a result of the disease (8, 9). Studies have been shown that screening patients with malnutrition and providing adequate nutritional support may decrease the rate of complications and death due to nutrition and shorten the length of hospital stay. Evidence suggests that nutritional support should be initiated immediately to improve the clinical outcome of patients who are malnourished or at risk of malnutrition (10). The European Society for Parenteral and Enteral Nutrition recommends that nutritional risk screening (NRS-2002) should be performed in all hospitalized patients to determine the risk of malnutrition.

Nutritional support is indicated in medical situations where the disease-related risk of malnutrition increases, and even in cases of surgery or trauma. Reducing or preventing malnutrition is only possible with correct nutritional support therapy. It has been shown in the studies that when nutritional support is given by NST, the complications and treatment costs decrease (5). It was recommended that nutritional support should be managed under the supervision of a team of doctors, dietitians, pharmacists, and nurses (11). Enteral or parenteral nutrition was recommended for the patients at risk of malnutrition in the form of protein supplements in doses of 25–30 kcal/kg/day and 1.2–1.5 g/kg/day while taking the stress factors related to the disease into consideration.

In addition to providing the necessary nutrients, enteral nutrition helps to maintain intestinal structure and function and prevents bacterial translocation and stress ulcers. When determining the feeding route, enteral nutrition should be the first choice in patients with a functional gastrointestinal system (GIS) (12). Parenteral nutrition (PN) supplementation may need to be started or added in patients whose GIS cannot be used or if the daily target calories cannot be reached by enteral feeding (12, 13). The guidelines recommend that enteral nutrition should be the first choice because of its effectiveness in strengthening immune functions and lowering the cost of nutritional therapy. Enteral nutrition was the most commonly recommended feeding route in 53.8% of the patients that we followed. The second recommendation is oral supplementation to close the target calorie deficit needed for daily energy. PN support was initiated in patients who could not tolerate enteral nutrition. Enteral or PN therapy was not recommended in 34 (6.6%) patients with unstable hemodynamic status.

Because of the role of nutrition and enteral products in the etiology and progression of the disease, we need to consider the cost and value of nutritional interventions. Improving health care by providing optimal nutrition can contribute to the effectiveness and sustainability of healthcare systems. Studies have shown that the annual cost of medical nutrition employed in the treatment of malnutrition resulting from non-implementation of optimal nutrition management, including the use of food, chalks up to billions (14). The enteral feeding method has been shown to be more cost-effective than the parenteral feeding method (13). In our study, the number of patients using parenteral products and total cost was decreased as compared to the previous year. Under the guidance of the NST recommendations, it was found that the number of enteral products used and the number of patients using enteral products eventually increased as compared to the previous year.

When the mortality rates of the patients under follow-up were compared with NRS-2002 scores, it was found that the mortality rate was higher in patients with higher NRS-2002 scores. Although the NRS-2002 malnutrition screening test is not used as a marker of mortality, the high mortality rate of high scoring patients may be an important parameter for the newly developed indexes used as prognostic factors. In a study conducted by Gundogan et al. (15) in 2011, it was reported that the mortality rate was high in patients with high NRS-2002 score. They associated the high mortality rates with the inability to determine and treat malnutrition risk in inpatients. It is stated that this problem is mainly caused by the inadequacy of screening, evaluation, and application algorithms and nutritional education of hospital staff (15). In another study

evaluating the relationship between NRS-2002 score elevation and mortality, Maciel et al. (16) reported that the mortality rate in patients with moderate malnutrition with an NRS-2002 score of 3–5 was lower than the mortality rate in malnourished patients with an NRS-2002 score >5. In our study, the mortality rate was 38.4% in patients with NRS-2002 score 3–5 and 61.6% in patients with >5 score. Consistent with the results of other studies, a relationship between NRS-2002 and mortality was detected, where mortality increased as the NRS-2002 score increased.

van Schaik et al. (17), reported a decrease in the number of patients receiving TPN by 29% and a 40% reduction in TPN-related costs compared to the previous year as a result of monitoring of patients receiving TPN by dietitians. The findings of our study are in accordance with this result, as it was found that the rate of TPN used in hospital decreased by 30.5% compared to the previous year. Our results support previous studies in terms of the reduction of hospital costs by arranging proper nutrition for the patients under the guidance of NSTs (18). In addition, a decrease in TPN-related complications and associated costs can be expected. As our hospital records were not sufficient, this cost evaluation could not be performed. The decrease in the use of TPN was more pronounced in the palliative service and internal intensive care unit, where consultation with the nutrition team was greater.

The first limitation of our study was the collection of single-centered data. This resulted in a relatively small number of patients being followed-up. Although a hospital-wide NST was performed, the study did not include all patients with an NRS score of 3 or higher, as the nutritional support team was consulted according to the physician's request. Therefore, it is not possible to generalize the results.

In conclusion, conducting patient follow-ups according to the NST recommendations can positively influence many factors such as choosing the correct feeding route and an overall decrease in treatment costs. Considering these positive factors, it is recommended that NST should be expanded and nutritional support should be offered with a multidisciplinary approach to patients at risk of malnutrition.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Kütahya Health Sciences University (February 2019).

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

Peer-review: Externally peer-reviewed.

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