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Assessment of nutritional status and malnutrition risk with different methods in surgical patients

Importance of nutrition in surgical patients

Hakan Mustafa Köksal[1], Demet Güler Yılmazer[2], Mustafa Fevzi Celayir[1]
[1]Department of General Surgery, Sisli Hamidiye Etfal Research and Training Hospital, İstanbul
[2]Department of Family Medicine, Sinop Erfelek Family Health Center, Sinop, Turkey

Abstract
Aim: Malnourished surgical patient morbidity and mortality are increased. In this study, we aimed to evaluate and improve the malnutrition status of these patients in the preoperative period.
Material and Methods: Age, gender, height, weight, body mass index (BMI), nutritional risk index (NRI) degrees, albumin, and total protein levels were determined in the first 24 hours of admission of all cases. Mini nutritional assessment (MNA) was performed for the malnutrition situation assessment.
Results: One hundred twenty patients were examined. The BMI scores were as follows: 5.8% of the cases were in the ≤ 18.5 group, 36.7% of the cases were in the 18.6-24.9 group, 45% of them were in 25-29.9 group, and 12.5% of them were in the ≥ 30 group. Albumin levels showed a significant difference according to the BMI levels ($p<0.05$). Total protein levels showed significant difference according to the NRI levels ($p <0.05$) and, total protein levels in patients with normal levels of NRI were much higher compared to the NRI severe cases ($p = 0,022$, $p <0.05$). Albumin levels were significantly different according to the NRI levels ($p <0.05$) and, the albumin levels at patients with normal levels of NRI were higher against the dangerous levels of NRI cases ($p = 0,045$, $p <0.05$).
Discussion: If malnourished patients could be well planned, their recovery time would be shorter. By simple measures, we were able to obtain precious results about the patient's health status.

Keywords
Malnutrition; Body mass index; Nutritional risk index

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Corresponding Author: Mustafa Fevzi Celayir, Department of General Surgery, Sisli Hamidiye Etfal Research and Training Hospital, İstanbul, Turkey.
E-mail: fcelayir@gmail.com GSM: +90 532 241 8245 F: +90 212 224 0772
Corresponding Author ORCID ID: https://orcid.org/0000000193538261

Introduction

Malnutrition is affecting nearly 20% of hospitalized patients. It causes depression of the immune system, impaired wound healing, and muscle wasting. Prolonged hospital stays are associated with higher treatment costs and increased mortality [1].

Malnutrition prevalence is reported to be 39% in cancer patients. The rate is 67% for pancreatic cancer, 60% for esophageal cancer, and 39% for colon cancer [2]. It could be noted that this rate is higher in Turkey. Malnutrition is usually undiagnosed and untreated. One of the most essential factors behind it is inadequate nutritional training and knowledge of staff members. Furthermore, there is a lack of adequate screening and assessment protocols [3].

There is no standardization of the methods adopted for the assessment of the nutritional status. The fact that the weight loss and a decrease in visceral and somatic proteins are actually accompanied by surgical diseases can at some point be considered "natural". Causes of malnutrition include cancer, obstruction, or fistula surgery, loss of appetite, nausea, vomiting, dysphagia, and commonly-unnoticed cases of preoperative fasting prescribed to perform various tests [4]. Since surgical patients are exposed to stress for several reasons, the main components of metabolism manifest themselves. Preoperative fasting, wounds, wound healing, and infections are the most critical factors causing stress [5]. Protein and energy malnutrition is reported in nearly 40% of patients in intensive care units [6]. We aim to show that it is easy to learn about the nutritional state of our patients through a nutritional assessment based on various easy-to-analyze parameters, such as albumin and total protein concentration, height and weight measurement, MNA and NRI.

Material and Methods

This study was planned at the General Surgery Clinic of the Sisli Hamidiye Etfal Hospital in March 2009. The permission for the study was obtained from the Ministry of Health Ethics Committee No.4 on clinical trials in Istanbul. All informed consent was received.

The study was conducted with 120 cases in total. All the patients were evaluated within the first 24 hours of their hospitalization. Age, gender, height, weight, BMI, albumin, and total protein concentrations of the hospitalized patients were recorded. The BMI was calculated based on kg/m2. This assessment revealed malnutrition for <18, the risk for malnutrition for 18 to 20, healthy nutrition for 20 to 25, and obesity for more than 30 patients. The NRI of the patients was calculated based on NRI = 1.519 × alb (gr/dl) + 41.7 × present weight/usual weight. The patients with an NRI score of > 97.5 were considered to have limited malnutrition, from 83.5 to 97.5 mild malnutrition, and < 83.5 severe malnutrition. An MNA was performed for the purpose of malnutrition assessment in patients. The patients with an MNA score of ≤ 11 were considered to suffer from malnutrition.

Mini Nutritional Assessment (MNA): The short-form MNA meets some of the aforementioned expectations. It comprises six items derived from the original MNA and correlates well with the conventional nutritional assessment. These parameters are a decrease in food intake, weight loss, mobility, psychological distress, or acute illness in the past three months, neuropsychological problems, and BMI. Should the score be 11 or below, patients are considered to have a malnutrition risk, and the long-form MNA should be performed. The sensitivity of the short form was successfully tested. The short-form MNA is intended to assess non-hospitalized patients in particular. The full-length MNA should be performed given the high prevalence of malnutrition in patients staying in nursing homes and hospitals.

As a result of the assessment, patients are classified as well-nourished, at risk, or clinically apparent malnutrition. Many studies have reported that MNA correlates well with nutritional intake, anthropometry, laboratory data, functional state, morbidity, mortality, and length of hospital stay. Based on the literature, MNA should be considered the most crucial instrument for geriatric nutrition. MNA results may vary according to the conditions. It is considered to be the best option to screen and assess elderly people living on their own in society. These people are expected to be cooperative to a nearly optimal extent. One may face challenges in nursing homes and hospitals that prevent MNA from being successfully performed. Full cooperation cannot be achieved with such patients, and testing will lead to a loss of much more time. It may not be possible to get any responses to questions about the self-assessment of patients with dementia in particular. The rate of failure to perform MNA in nursing homes or hospitals can go up to 40% [7]. The length of stay is higher for patients at risk or with malnutrition than those with a healthy MNA score [8].

Statistical analysis: NCSS Statistical Software (Utah, USA) was used for the statistical analysis of the results. Oneway Anova test was performed for the inter-group comparison of parameters with normal distribution and of quantitative data in addition to descriptive statistical methods (mean, standard deviation), and Tukey HDS test was performed to determine what group caused the difference. The Chi-square test was performed for the comparison of qualitative data. $P < 0.05$ was considered statistically significant.

Results

The study was conducted with 120 cases in total, including 40.8% (n=49) females and 59.2% (n=71) males at our clinic from March to September 2009. The age of the cases was in the range of 15-93 years, and their mean age was 50.80±18.89 years.

Among all cases, 30.8 % (n=37) were diagnosed with malignant malnutrition while 69.2 % (n=83) were diagnosed with benign. Total protein concentrations ranged from 4.55 to 8.24, and the mean concentration was 6.91±0.91. Albumin concentrations ranged from 1.97 to 4.94, and the mean concentration was 3.66 ± 0.67.The BMI scores in 5.8% of the cases (n=7) were ≤18.5, in 36.7% of the cases (n=44) ranging from 18.6 to 24.9, in 45% of the cases (n=54) from 25 to 29.9, and in 12.5% of the cases (n=15) ≥ 30 (Table 1).

Diagnoses reported a statistically significant difference in malnutrition state ($p<0.01$). The prevalence of the benign disease in cases without risk for malnutrition was significantly higher than that of malignant disease (Table 2). Malnutrition

Table 1. Distribution of general nutritional values of patients

	Min-Max	Min ± SD
Total Protein	4,55-8,24	6,91±0,91
Albumin	1,97-4,94	3,66±0,67
BMI	N	%
≤ 18,5	7	5,8
18,6 – 24,9	44	36,7
25 – 29,9	54	45
≥ 30	15	12,5
Diagnosis:		
Malignant	37	30,8
Benign	83	69,2
Malnutrition:		
Malnourished	6	5
At risk	37	30,8
No risk	77	64,2
NRI		
< 83,5	11	9
83,5 – 97,5	44	36,7
≥ 97,5	65	54,2

Table 2. Malnutrition Status Assessment (MNA) criteria

	Malnutrition			
	Malnourished (n=6) Mean ±SD	No risk (n=77) Mean ±SD	At risk (n=37) Mean ±SD	p
Age	61,83 ± 16,77	48,35 ± 18,86	54,10 ± 18,59	0,106
Total Protein	6,43 ± 1,53	7,05 ± 0,086	6,91 ± 0,91	0,061
Albumin	3,49 ± 0,78 n (%)	3,73 ± 0,69 n (%)	3,53 ± 0,59 n (%)	0,247
Sex				
Female	3 (%50)	29 (%37,7)	17 (%45,9)	0,628
Male	3 (%50)	48 (%62,3)	20 (%54,1)	
BMI				
≤ 18,5	1 (% 14,3)	0 (% 0)	6 (% 85,7)	0,010
18,6-24,9	3 (% 6,8)	26 (% 59,1)	15 (% 34,1)	
25-29,9	1 (% 1,9)	41 (%75,9)	12 (% 22,2)	
≥ 30	1 (% 6,7)	10 (% 66,7)	4 (% 26,7)	
Diagnosis				
Malignant	3 (% 50)	15 (% 19,5)	19 (% 51,4)	0,002
Benign	3 (% 50)	62 (% 80,5)	18 (% 48,6)	
NRI				
< 83,5	6 (% 54,5)	1 (% 9,1)	4 (% 36,4)	0,001
83,5-97,5	0 (% 0)	16 (% 36,4)	28 (% 63,6)	
≥97,5	0 (% 0)	60 (% 92,3)	5 (% 7,7)	

was reported in 5% (n=6) of the cases, with 30.8% (n=37) at risk, and 64.2% (n=77) at no risk. The NRI scores in 9.2% of the cases (n=11) were below 83.5, with 36.7% of the cases (n=44) ranging from 83.5 to 97.5, and 54.2% of the cases (n=65) ≥97.5 (Table 1).

Age was not statistically significant for malnutrition state (p>0.05). Total protein and albumin concentrations reported no statistically significant difference for malnutrition state (p>0.05). BMI scores reported a statistically significant difference in malnutrition state (p<0.05). The cases with a BMI score of ≤18.5 were at a higher risk for malnutrition while the prevalence of no risk was higher in other BMI scores. The proportion of benign cases with no chance for malnutrition was significantly higher than in malignant cases. Malnutrition state reported a statistically significant difference in NRI scores (p<0.01). The prevalence of malnutrition was high in cases with an NRI score below 83.5, and the risk for malnutrition was high in cases with an NRI score ranging from 83.5 to 97.5, and no risk for malnutrition was high in cases with an NRI score of ≥97.5. (Table 2).

Table 3. Results According to BMI

BMI					P
	≤ 18,5 (n=7) Mean ±SD	18,6-24,9 (n=44) Mean ±SD	25-29,9 (n=54) Mean ±SD	≥30 (n=15) Mean ±SD	
Age	55,57 ± 18,2	47,56 ± 22,7	52,01 ± 16,45	53,67 ± 14,75	0,517
Total protein	6,30 ± 18,2	6,78 ± 0,92	7,11 ± 0,82	6,80 ± 0,90	0,075
Albumin	3,14 ± 0,58	3,55 ± 0,73	3,83 ± 0,61	3,59 ± 0,55	0,030
Sex	n (%)	n (%)	n (%)	n (%)	
Female	3 (% 42,9)	17 (% 38,6)	20 (% 37)	9 (% 60)	0,440
Male	4 (% 57,1)	27 (% 61,4)	34 (% 63)	6 (% 40)	
Diagnosis					
Malignant	4 (% 57,1)	13 (% 29,5)	16 (% 29,6)	4 (% 26,7)	0,482
Benign	3 (% 42,9)	31 (% 70,5)	38 (% 70,4)	11 (% 73,3)	
NRI					
83,5	1 (% 9,1)	6 (% 54,5)	3 (% 27,3)	1 (% 9,1)	
83,5-97,5	5 (% 11,4)	16 (% 36,4)	16 (% 36,4)	7 (% 15,9)	0,176
≥ 97,5	1 (% 1,5)	22 (% 33,8)	35 (% 53,8)	7 (% 10,8)	

Post-Hoc Tukey HSD test reported that the albumin concentrations of cases with an NRI score of 25 to 29.9 were statistically higher than that of cases with an NRI score of ≤18.5 (p:0.040; p<0.05). There was no statistically significant difference among other BMI scores (p>0.05). Gender reported no statistically significant difference in BMI scores (p>0.05), diagnoses said no statistically significant difference in BMI scores (p>0.05), NRI scores reported no statistically significant difference in BMI scores, either (p>0.05) (Table 3).

Total protein concentrations reported a statistically significant difference in NRI scores (p<0.05). Total protein concentrations of cases with good NRI score were higher than that of cases with severe NRI score (p:0.022; p<0.05). Albumin concentrations reported a statistically significant difference in NRI scores (p<0.05). The albumin concentrations of cases with a good NRI score were higher than that of cases with a severe NRI score (p: 0.045; p<0.05). Gender reported no statistically significant difference. Diagnoses reported a statistically significant difference in NRI scores (p<0.01). The prevalence of malignancy was high in cases with a severe NRI score.

Discussion

Nutrition is a significant factor affecting the state of health. Malnutrition is usually undiagnosed and untreated, especially in hospitalized patients [9]. The risk of malnutrition ranges from 30 to 65% among hospitalized elderly [10]. Cereceda FC. et al. reported 20% mild and 18% severe protein-energy malnutrition

in 620 patients hospitalized for non-surgical purposes [11]. Malnutrition is reported in 39% of cancer patients. The rate amounts to 67% for pancreatic cancer, 60% for esophageal cancer, and 39% for colon cancer [12]. The risk of mortality is four times higher for malnourished patients [13].

The lack of nutritional assessment of hospitalized patients results from the lack of importance attached and time spared for this, and of the globally-acknowledged system for the nutritional evaluation [14]. The incidence of malnutrition rises unless strict attention is paid to the nutritional state of patients during their hospital stay [15]. We found that the prevalence of a benign disorder in cases with no risk of malnutrition was significantly higher than the prevalence of a malign disease ($p<0.01$). Cohendy R et al. have suggested a routine nutritional assessment for people aged 60 and above with ASA 3 or 4, as morbidity and mortality rate are higher in this age group [16]. All of the elderly patients are at risk of malnutrition [17]. The risk is even higher when it is accompanied by a chronic mental or physical disorder.

Guigoz et al. compiled the data of 21 studies (14.149 patients) in a meta-analysis of the prevalence of malnutrition in the elderly population and reported that the prevalence of malnutrition was 2%±0.1 for the elderly with no reliance on a nursing home or a medical center, and the risk for malnutrition was 24% ±0.4 [18]. Another similar study conducted based on MNA reported that 1 to 5% of the older people suffer from malnutrition or are at risk of malnutrition. However, our study indicated that age was not statistically significant for malnutrition state ($p>0.05$) [19]. The age of our cases ranged from 15 to 93, and their mean age was 50. We think that no difference was reported between malnutrition and age as the selected sample for our study was a population of rather young people. According to the results of our research, those admitted with a malignant disorder are at higher risk for malnutrition than those with benign disease. Therefore it would not be wrong to expect malnutrition in cancer patients who look healthy.

Kelly et al. used the BMI for nutritional assessment as a part of their study. They assessed 337 cases admitted to a university hospital for internal and surgical procedures. Those with a BMI score of < 18.5 kg/m² were considered to present with malnutrition, and 13% of the patients reported malnutrition. The rate rises to 18% as those with a BMI score of 18.5 to 20 kg/m² and loss of weight for more than 3 kilograms over the past three months were considered to present with malnutrition [20].

Whirter and Pennington included a total of 500 hospitalized cases from five departments, with age ranging from 16 to 64. They considered those with a BMI score of < 20 slight, < 18 mild and < 16 severe malnutrition as a part of their assessment; 27% of general surgery cases and 39% of orthopedic cases presented with malnutrition. [21] Our malnutrition rates are lower. We think that this result has to do with the fact that most of our patients did not need to stay in the hospital for more than 48 hours and were ambulant and their overall state of health was good. Among the cases in our study, 54.2% reported borderline malnutrition, with 36.7% mild, and 9.2% severe malnutrition based on the NRI; 5.8% of the cases were slim, with 36.7% of healthy weight, and 45% overweight and 12% obese based on their BMI scores.

The risk of malnutrition was higher in cases considered slim, with a BMI score of ≤ 18.5, while it was lower for any other BMI score. NRI scores reported no statistically significant difference than BMI scores in our study ($p>0.05$). However, one must keep in mind that BMI and NRI do not always give the same results. The fact that three assessments (BMI, NRI, MNA) give different results may due to using different parameters. BMI is based on height and weight, while NRI relies on albumin concentration and the ratio of actual to usual body weight. MNA, on the other hand, is performed based on responses given by a patient. The measurement of weight for BMI can be misleading in nutritional assessment. BMI score and weight of overweight people may be within normal limits despite a short-term loss of weight that amounts to more than 10% of their normal weight [22]. NRI is considered to be sensitive and specific for the estimation of complication risks followed by laparotomy or non-cardiac thoracotomy [23].

We compared albumin concentrations, MNA scores, and nutritional risk index of our patients. Both assessments revealed that the worse the nutritional state of patients was, the lower their albumin concentrations. The serum albumin concentration is a test performed to assess chronic malnutrition. Because of its long half-life, albumin concentration is an insensitive indicator to determine acute changes. It is reported that low albumin concentrations are associated with morbidity and mortality [23]. However, albumin concentration is affected by factors such as non-malnutrition inhibition and catabolism of albumin synthesis, loss of albumin in the body, and variations in the infused volume in albumin concentration. Nevertheless, low serum albumin concentration is currently a standard parameter to determine malnutrition state as it is easy and cost-effective to measure, and it is strongly associated with mortality. In our study, total protein concentrations did not report any statistically significant difference for BMI scores, whereas albumin concentrations in the cases with a BMI score of 25 to 29.9 were significantly higher than that of the cases with a BMI score of ≤18.5.

In our series, 5% of the patients presented with malnutrition. The risk becomes higher, especially in patients with malignancy. BMI, NRI, and MNA may not give similar results for nutritional assessment. Even if BMI is within normal limits, a patient may still suffer from malnutrition.

We are of the opinion that it would be better to adopt multiple methods that are cost-effective, easy, and reliable for patients to be operated. In our study, we merely determined the malnutrition prevalence of cases at the time of admission into the general surgery clinic. Therefore, our results do not indicate the malnutrition prevalence of all the surgical cases admitted to the hospital. Even though we have determined the malnutrition prevalence in the cases, we think that further studies are required to demonstrate the effects of malnutrition on anesthesia. The preoperative and postoperative nutritional supplements can be scheduled for patients. Early oral nutrition has always been preferable in surgical patients [24,25].

Conclusion:

We are of the opinion that the assessment of the nutritional state of patients to be operated would be beneficial for

patients and us in many aspects. We have concluded that it is highly convenient to adopt the aforementioned methods of assessment within the bounds of available capabilities and that one can get valuable results through simple measurements, and professionals from any discipline can perform them. Improving the nutritional status of malnourished surgical patients accelerates hospital recovery and reduces readmission. This means a severe cost reduction and satisfaction for the doctor and patient. In the end, simple evaluations will bring significant benefits to all partners.

Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest
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