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

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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

DOI: 10.4328/ACAM.20241  Received: 2020-06-10  Accepted: 2020-07-21  Published Online: 2020-07-27  Printed: 2020-09-01   Ann Clin Anal Med 2020;11(5):462-466
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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. One-way 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...
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Table 1. Distribution of general nutritional values of patients

|                      | Min–Max  | Mean ±SD  |
|----------------------|----------|-----------|
| Total Protein        | 4.55-8.24| 6.91±0.91 |
| Albumin              | 1.97-4.94| 3.66±0.67 |
| BMI                  | ≤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

|                  | Malnourished | No risk | At risk | P   |
|------------------|--------------|---------|---------|-----|
|                  | Mean ±SD     | Mean ±SD| Mean ±SD|     |
| Age              | 61.83 ± 16.77| 48.35 ± 18.86| 54.10 ± 18.59| 0.106|
| Total Protein    | 6.43 ± 1.53  | 7.05 ± 0.866| 6.91 ± 0.91| 0.061|
| Albumin          | 3.49 ± 0.78  | 3.75 ± 0.69| 3.53 ± 0.59| 0.247|
| Sex              |              |         |         |     |
| Female           | 3 (%60)      | 29 (%63.7)| 17 (%64.5)| 0.628|
| Male             | 3 (%60)      | 48 (%62.3)| 20 (%65.4)|     |
| BMI              |              |         |         |     |
| ≤18.5            | 1 (%14.3)    | 0 (%0)  | 6 (%85.7)|     |
| 18.6-24.9        | 3 (%6.8)     | 26 (%59.1)| 15 (%34.1)|     |
| ≥25-29.9         | 1 (%1.9)     | 41 (%67.9)| 12 (%22.2)| 0.010|
| ≥30              | 1 (%6.7)     | 10 (%66.7)| 4 (%36.7)|     |
| 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)|     |
| 83.5-97.5        | 0 (%0)       | 16 (%56.4)| 28 (%23.6)| 0.001|
| ≥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).

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.
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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 malignant 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.

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].

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.

**Funding:** None

**Conflict of interest**

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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**How to cite this article:**

Hakan Mustafa Köksal, Demet Gürler Yılmazer, Mustafa Fevzi Celeýir. Assessment of nutritional status and malnutrition risk with different methods in surgical patients. Jpn Clin Anal Med 2020;11(5):462-466.