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# Assessment of the nutritional status with the nutritional risk screening-2002 in surgical patients: Single-center, descriptive study

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## ABSTRACT

**Objective:** Malnutrition is common among surgical patients. It decreases surgical treatment, leads to poor clinical outcome, and especially substantially affects morbidity and mortality. This study aimed to assess nutritional risk in surgical patients.

**Methods:** This study was prospectively conducted in general surgery clinic. Patients aged above 18 years or more were included. Post-admission, data collection also included information on nutritional support and diagnosis of patients. A nutritional risk screening system (NRS-2002) was applied to all patients, and it was weekly repeated in patients with hospital stays more than one week.

**Results:** We enrolled 624 patients. Among them, 296 were male (47.4%), and 328 were female (52.6%). The mean age was 53.13±16.63 years. The route for nutrition was oral in 59.6% and enteral/parenteral in 4.8%. However, 35.6% of the patients received no nutritional support. Nutritional risk was recorded for 304 patients (73.4%) in first week and 46 patients (22.1%) in second week. Nutritional risk increased with age ($p<0.05$). There was nutritional risk in 193 patients (62.7%) with major abdominal surgery and 50 patients (46.7%) with hypertension. Additionally, there was nutritional risk in 162 patients (54.9%) who received oral diet.

**Conclusions:** Nutritional risk in the first week was very high in the patients. High nutritional risk was related to age, major abdominal surgery, and hypertension.

**Keywords:** Major abdominal surgery, malnutrition, minor abdominal surgery, nutritional risk screening

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## Introduction

Malnutrition is defined as the structural deficiencies and organ dysfunctions related to deprivation of macronutrients and micronutrients that are the main requirement of tissues (1, 2). It is directly related to clinical outcomes such as delayed wound healing, impaired immune system, regression in cognitive functions, and reduced functional capacity. Depending on these, it can be seen that the healing period is prolonged, which causes an increase in health costs (long-term hospital stay, re-hospitalizations, primary care visits etc.) (3, 4).

The surgical patients from the groups at nutritional risk are noteworthy. Despite the favorable improvements in anesthesia and pre-operative care, malnutrition negatively affects 27-50% of patients. In surgical patients, hypermetabolism caused by surgical stress, failure to pay attention to increasing nutritional requirements due to catabolic status and insufficient nutritional support, the belief that the patient should be fasted for operation in the pre-operative period, and that oral intake in the post-operative period is longer than seven days are important factors in the development of malnutrition. Malnutrition is an independent negative predictive factor in the outcome of surgery and complications. It directly affects the success of surgical treatment, and leads to complications such as increased risk of infection in post-operative period, delay in wound healing, hypoproteinemic edema, decreased intestinal motility, susceptibility to hemorrhagic shock, bone marrow depression, and multiple organ failure. Thus, malnutrition prolongs hospital stay and increases morbidity and mortality (5-11).

The success of the surgical treatment depends on knowledge and experience of the surgeon, as well as on adequate nutri-

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tion of the patient during the pre-operative and post-operative periods. In particular, there is evidence that adequate nutritional support can avoid post-operative complications. Therefore, the nutritional status of the patient should be closely monitored and evaluated in terms of nutritional risk. Many screening methods have been developed. However, there is no consensus on the best screening tool to determine the nutritional risk in surgical patients. A retrospective analysis of 128 randomized controlled trials of nutritional support documented in the nutritional risk screening-2002 method (NRS-2002) method is more reliable and useful than other methods to determine patients with increased risk of post-operative complications of surgical patients, with more weight loss in the hospital, and length of hospital stay due to malnutrition (12-16).

Although malnutrition directly affects mortality and morbidity in patients undergoing surgical intervention, most clinics ignore it. Complete assessment of nutritional status is important to prevent adverse events before and after surgery. Efforts should be made to minimize malnutrition to minimize hospital stay and to ensure a better quality of life for the patient after surgery.

## Methods

This study was prospectively performed in general surgery clinic. The study included 624 patients aged 18 years and above in the general surgery clinic. Patients were included in the study within 48 hours after admission. Pregnant-breastfeeding and transplanted patients were excluded. All patients were informed about the purpose of the study, and their consent was obtained.

Age, gender, and body mass index (BMI) of the patients were recorded. Diagnosis, comorbidity, major/minor operation, and nutritional route (oral, enteral, parenteral) were recorded. Major abdominal surgeries were gastric cancer, colon cancer, rectal cancer, pancreatic cancer, esophageal cancer, choledochus tumor, and pyloric stenosis. And minor surgery was accepted as Crohn's disease, pancreatitis, Fournier gangrene, cholelithiasis, diaphragmatic hernia, appendicitis, liver cyst hydatid, gastroesophageal reflux, umblical hernia, splenomegaly, anal fistula, hemorrhoid, bridectomy, and diverticulosis. Mass in the breast, granulomatous, morbid obesity, and adrenal mass surgeries were accepted as other surgical diseases.

The oral diet types of the patients included in the study were also examined, and the regimen 1 diet with the clear liquid diet was determined only as water. Combined diet was considered that regimen 2 and parenteral nutrition or regimen 2 and enteral nutrition.

For nutritional risk during hospital stay, patients were screened using the NRS-2002 form. First step of NRS-2002 form contains BMI>20.5, weight loss in the last three months, decreased food intake in the previous week, and presence of a severe disease. Patients with changes in at least these criteria were included in the study in the following weeks. In assessment, if at least one of first step is yes, then the second stage is passed. Three points and above is mean nutritional risk in second step of NRS-2002. Patients with nutritional risk were repeatedly screened during their hospitalization period.

### Statistical analysis

Statistical analysis was performed using the IBM Statistical Package for the Social Sciences Statistics (IBM SPSS Statistics Corp.; Armonk, NY, USA) 22 program. Student t-test was used for comparison of means, and chi-square test was used for categorical data. A value of $p<0.05$ was considered significant.

## Results

In this study, 624 patients were included. There were 296 (47.4%) male and 328 (52.6%) female patients. The mean age of the patients was 53.13±16.63 years. A total of 414 patients (66.3%) in the first week and 208 patients (33.4%) in the second week were screened for nutritional risk. The patients were hospitalized with minor abdominal surgery (36.7%), major abdominal surgery (33.8%), and other surgical diseases (29.5%). The most common comorbidity disease was hypertension (47.3%), diabetes mellitus (29.6%), and coronary artery disease (11.3%) (Table 1).

The route for nutrition was oral diet in 59.6% and enteral/parenteral nutrition in 4.8%. However, 35.6% of the patients received no nutritional support. In the first week, 54.8% of the patients received oral diet, and 39.4% received no nutritional support. Of the 210 patients screened in the second week, 69.0% (145 patients) received oral diet, 28.1% (59 patients) received no nutritional support, and 2.9% (6 patients) received enteral/parenteral nutrition. (Table 2). Table 3 shows the oral diet types of patients. The majority of patients (44.9%) who received oral diet received regimen 3 normal diet.

In the first week, 73.4% of patients had nutritional risk; and in the second week, 22.1% (46 patients) had nutritional risk. The NRS-2002 scores of the patients in weeks are shown in detail in Table 4. Nutritional risk of patients according to various variables (age, diet, diagnosis, comorbidity) is shown in Table 5. It was observed that the nutritional risk increases with age.

Among the patients with nutritional risk, 62.7% (193 patients) had major abdominal surgery, and 36.7% (113 patients) had minor abdominal surgery ($p<0.05$). A rate of 32.5% of the patients had comorbidity. The highest nutritional risk was seen in patients with hypertension (46.7%). Also, 35.5% of the patients with diabetes mellitus, 7.5% of the patients with asthma, bronchitis or chronic obstructive pulmonary disease (COPD) had nutritional risk ($p<0.05$).

A total of 54.9% (162 patients) of patients who received oral diet, 42.1% of patients who received no nutritional support, and 27.6% (8 patients) of patients who parenteral nutrition had nutritional risk.

**Table 1. Demographic characteristics of patients**

| Variable | Value |
|---|---|
| Age, mean±SD | 53.13±16.63 |
| **Gender, n (%)** | |
| Male | 296 (47.4) |
| Female | 328 (52.6) |
| BMI, mean±SD | 23.68±5.30 |
| **Weeks, n (%)** | |
| Week 1 | 414 (66.3) |
| Week 2 | 208 (33.4) |
| **Diagnosis, n (%)** | |
| Major abdominal surgery | 211 (33.8) |
| Minor abdominal surgery | 229 (36.7) |
| Other surgical disease | 184 (29.5) |
| **Comorbidity, n (%)** | |
| Diabetes mellitus | 60 (29.6) |
| Hypertension | 96 (47.3) |
| Coronary artery diseases | 23 (11.3) |
| Pulmonary diseases (COPD, bronchitis, asthma, etc.) | 14 (6.8) |
| Neurological diseases (Epilepsy, cerebrovascular disease, etc.) | 4 (2.0) |
| Other (gastritis, etc.) | 6 (3.0) |

*Mean±SD stands for Mean±Standard Deviation. BMI: body mass index; COPD: chronic obstructive pulmonary disease

## Discussion

Malnutrition is a common clinical problem, and it is associated with high mortality and morbidity in surgical patients. In our study, nutritional risk was determined as 73.4% in the first week and 22.1% in the second week after hospitalization. The prevalence of nutritional risk rate in general surgery ranges from 6% to 30% (17-21).

As per KEPAN (Turkish Society of Clinical Enteral and Parenteral Nutrition), using the NRS-2002 scoring system, in our

**Table 3. Oral diet type of patients**

| Diet | n | % |
|---|---|---|
| Clear liquid diet (regimen 1) | 11 | 3 |
| Full liquid diet (regimen 2) | 94 | 25.3 |
| Regimen 3 normal diet | 167 | 44.9 |
| Regimen 3 saltless diet | 34 | 9.1 |
| Diabetic diet | 48 | 12.9 |
| High potassium diet | 4 | 1.1 |
| Combined diet* | 14 | 3.8 |
| Total | 372 | 100.0 |

*Stand for regimen 2 and parenteral nutrition or regimen 2 and enteral nutrition.

**Table 2. Nutritional support of patients in screening weeks**

| | Weeks | | | | | |
|---|---|---|---|---|---|---|
| | Week 1 | | Week 2 | | Total | |
| **Variable Route for nutrition** | **n** | **%** | **n** | **%** | **n** | **%** |
| Oral | 227 | 54.8 | 145 | 69.0 | 372 | 59.6 |
| Enteral/parenteral | 24 | 5.8 | 6 | 2.9 | 30 | 4.8 |
| No nutritional support | 163 | 39.4 | 59 | 28.1 | 222 | 35.6 |
| Total | 414 | 100.0 | 210 | 100.0 | 624 | 100.0 |

country, a multicenter study of 29,139 general surgery patients, nutritional risk was found to be 8.6% in 2005-2006 (22). Since the diagnosis of the patients is differently classified, the rate of nutritional risk obtained in other studies is different.

Jia et al. (23) evaluated the nutritional risk in 5042 surgical patients with NRS-2002. In the study, 10 kcal/kg/day energy intake was considered sufficient for the patients, and patients were followed in the general surgery clinic during their hospitalization. Nutritional risk was found in 19.2% of the patients. Although the patient groups included in the study were similar to those in our study, the nutritional requirements suggested in this study were lower than those predicted in our study. Therefore, different rates of nutritional risk were found. Among the factors affecting the incidence of malnutrition, the characteristics and age of the disease are important. Elderly patients are reported to have a high nutritional risk, especially due to physiological factors (23-25). In our study, nutritional risk was higher in elderly patients than in other age groups.

A total of 33.8% of patients who underwent major abdominal surgery had nutritional risk. Also, this group had a higher nutritional risk than other surgical patients. In multicenter prospective study, Sorensen et al. (20) screened 5052 patients in terms of nutritional risk in accordance with the classification of major and minor abdominal sur-

**Table 4. NRS-2002 score of patients in screening week**

| | Week 1 | | Week 2 | |
|---|---|---|---|---|
| **NRS-2002 Score** | **n** | **%** | **n** | **%** |
| 0 | 1 | 0.2 | 90 | 43.3 |
| 1 | 42 | 10.1 | 50 | 24.0 |
| 2 | 67 | 16.2 | 64 | 30.8 |
| 3 | 177 | 42.8 | 4 | 1.9 |
| 4 | 91 | 22.0 | 0 | 0.0 |
| 5 | 31 | 7.5 | 0 | 0.0 |
| 6 | 5 | 1.2 | 0 | 0.0 |
| Total | 414 | 100.0 | 208 | 100.0 |
| **Total score** | | | | |
| NRS≤2 | 110 | 26.6 | 162 | 77.9 |
| NRS≥3 | 304 | 73.4 | 46 | 22.1 |
| Total | 414 | 100.0 | 208 | 100.0 |

NRS-2002 nutritional risk screening-2002.

**Table 5. Nutritional risk of patients characteristic**

| | No Nutritional risk | | Nutritional risk | | Total | |
|---|---|---|---|---|---|---|
| **Variable** | **n** | **%** | **n** | **%** | **n** | **%** |
| **Age** | | | | | | |
| 19-28 | 31 | 9.8 | 19 | 6.2 | 50 | 8.0 |
| 29-38 | 57 | 18.0 | 29 | 9.4 | 86 | 13.8 |
| 39-48 | 63 | 19.9 | 47 | 15.3 | 110 | 17.6 |
| 49-58 | 66 | 20.9 | 52 | 16.9 | 118 | 18.9 |
| 59-68 | 70 | 22.2 | 64 | 20.7 | 134 | 21.5 |
| 69+ | 29 | 9.2 | 97 | 31.5 | 126 | 20.2 |
| **Diagnosis** | | | | | | |
| Major abdominal surgery | 18 | 5.7 | 193 | 62.7 | 211 | 33.8 |
| Minor abdominal surgery | 116 | 36.7 | 113 | 36.7 | 229 | 36.7 |
| Other surgical disease | 182 | 57.6 | 2 | 0.6 | 184 | 29.5 |
| **Comorbidity** | | | | | | |
| Diabetes mellitus | 22 | 22.9 | 38 | 35.5 | 60 | 29.6 |
| Hypertension | 46 | 47.9 | 50 | 46.7 | 96 | 47.4 |
| Coronary artery diseases | 14 | 14.6 | 9 | 8.4 | 23 | 11.3 |
| Pulmonary diseases (COPD, bronchitis, asthma, etc.) | 6 | 6.3 | 8 | 7.5 | 14 | 6.9 |
| Neurological diseases (Epilepsy, cerebrovascular disease, etc.) | 2 | 2.0 | 2 | 1.9 | 4 | 1.9 |
| Other (gastritis, etc.) | 6 | 6.3 | 0 | 0.0 | 6 | 2.9 |
| **Route for nutrition** | | | | | | |
| Oral | 210 | 63.8 | 162 | 54.9 | 372 | 59.6 |
| Enteral | 0 | 0.0 | 1 | 0.3 | 1 | 0.2 |
| Parenteral | 21 | 6.4 | 8 | 2.7 | 29 | 4.6 |
| No nutritional support | 98 | 29.8 | 124 | 42.1 | 222 | 35.6 |

COPD: chronic obstructive pulmonary disease

geries in NRS-2002. In 44% of patients who underwent major abdominal surgery, 22% of patients who underwent minor abdominal surgery were detected with nutritional risk. Nutritional risk was reported in 44%-50% of patients in most studies that evaluated the nutritional risk in patients with major abdominal surgery (26, 27).

Surgical patients who received nutritional support had lower nutritional risk than those who did not receive nutritional support. And it is stated that the rates range from 14.7% to 25%. However, in our study, patients who received nutritional support were at a higher nutritional risk (28, 29).

There were some limitations in our study. According to NRS-2002, it did not contain sufficient and detailed information to classify diseases. In addition, nutritional risk above three points may not be considered as standard, and may be adapted to the disease.

Due to the existing disease of the patient and the complications that may arise due to this disease, malnutrition is a common condition among hospitalized patients. Nutritional deficiency has a significant effect on treatment and survival. All surgical patients who have had an operation and will undergo the operation are patients with high risk of malnutrition. In such patients, care should be exercised more carefully during nutritional assessment, and should be frequently repeated during hospitalization. The nutritional status of the patient should be first determined by using an effective and reliable method for the application of a proper nutrition program. The effective and reliable method depends on the high sensitivity and sensitivity of the evaluation method. The method to be used should be insightful in terms of criteria such as the patient's condition, disease severity, previous nutritional status, weight loss, anthropometric measurements, and comorbidities. It is thought that NRS-2002, which is an evaluation method that includes all these parameters, can give good results in evaluating nutritional status in all hospitalized patients.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the ethics committee of Erciyes University School of Medicine (Date: 02.06.2009; No: 09/299).

**Informed Consent:** Verbal informed consent was obtained from all patients who participated in this study.

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## References

1. Bozkurt N. Enteral ve parenteral beslenmenin önemi. Enteral Paren-teral Beslenme, Türkiye Diyetisy-enler Derneği Yayını. 1995: 1-5.
2. Meier R, Stratton R. Basic concepts in nutrition: epidemiology of malnutrition. Eur J Clin Nutr Metabol 2008; 3: e167-e70. [Crossref]
3. Başoğlu S, Karaağaoğlu N, Erbaş N, Ünlü A. Enteral-parenteral beslenme. Türkiye Diyetisyenler Derneği Yayını. 1995; 8.
4. Gündoğdu RH. Nütrisyon Desteğinin Ekonomik Yönü. Turkiye Klinikleri J General Surg Special Topics 2015; 8: 92-8.
5. McWhirter JP, Pennington CR. Incidence and recognition of malnutrition in hospital. BMJ 1994; 308: 945-8. [Crossref]
6. Hill G, Pickford I, Young G, Schorah CJ, Blackett R, Burkinshaw L, et al. Malnutrition in surgical patients: an unrecognised problem. Lancet 1977; 309: 689-92. [Crossref]
7. Lemone P, Burke K. Nursing care of clients with nutritional disorders. Medical Surgical Nursing: Critical Thinking in Clint Care 3rd ed New Jersey: Pearson. 2004: 523-39.
8. Ledger D. Nutrition-Produced in conjunction with the British Association for Parenteral and Enteral Nutrition-Ensuring Your Patients Eat Enough-Diane Ledger outlines some simple steps for preventing. Nursing Times 2000; 96: 2-3.
9. Bisgaard T, Kehlet H. Early oral feeding after elective abdominal surgery-what are the issues? Nutrition 2002; 18: 944-8. [Crossref]
10. Levraut J, Jambou P, Grimaud D, editors. Effect of postoperative complications on nutritional status: therapeutic consequences. Ann Fr Anesth Reanim 1995; 14(Suppl 2): 66-74. [Crossref]
11. dos Santos Junqueira JC, Soares EC, Corrêa Filho HR, Hoehr NF, Magro DO, Ueno M. Nutritional risk factors for postoperative complications in Brazilian elderly patients undergoing major elective surgery. Nutrition 2003; 19: 321-6. [Crossref]
12. Ozkalkanli MY, Ozkalkanli DT, Katircioglu K, Savaci S. Comparison of tools for nutrition assessment and screening for predicting the development of complications in orthopedic surgery. Nutr Clin Pract 2009; 24: 274-80. [Crossref]
13. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M. ESPEN guidelines for nutrition screening 2002. Clin Nutr 2003; 22: 415-21. [Crossref]
14. Lipkin EW, Bell S. Assessment of nutritional status: the clinician's perspective. Clin Lab Med 1993; 13: 329-52. [Crossref]
15. Malnütrisyon KS. hastaların beslenme durumlarının değerlendirilmesi enteralparenteral beslenme. Türkiye Diyetisyenler Derneği Yayını, Ankara 1996: 6-16.
16. Corish CA. Pre-operative nutritional assessment. Proc Nutr Soc 1999; 58: 821-9. [Crossref]

17. Waitzberg D, Ravacci G, Raslan M. Hospital hyponutrition. Nutr Hosp 2011; 26: 254-64.
18. Tangvik RJ, Tell GS, Guttormsen AB, Eisman JA, Henriksen A, Nilsen RM, et al. Nutritional risk profile in a university hospital population. Clin Nutr 2015; 34: 705-11. [Crossref]
19. Sungurtekin H, Sungurtekin U, Balci C, Zencir M, Erdem E. The influence of nutritional status on complications after major intraabdominal surgery. J Am Coll Nutr 2004; 23: 227-32. [Crossref]
20. Sorensen J, Kondrup J, Prokopowicz J, Schiesser M, Krähenbühl L, Meier R, et al. EuroOOPS: an international, multicentre study to implement nutritional risk screening and evaluate clinical outcome. Clin Nutr 2008; 27: 340-9. [Crossref]
21. Correia M, Caiaffa WT, da Silva AL, Waitzberg DL. Risk factors for malnutrition in patients undergoing gastroenterological and hernia surgery: an analysis of 374 patients. Nutr Hosp 2001; 16: 59-64.
22. Korfalı G, Gündoğdu H, Aydıntuğ S, Bahar M, Besler T, Moral AR, et al. Nutritional risk of hospitalized patients in Turkey. Clin Nutr 2009; 28: 533-7. [Crossref]
23. Jia ZY, Yang J, Tong DN, Peng JY, Zhang ZW, Liu WJ, et al. Screening of nutritional risk and nutritional support in general surgery patients: a survey from Shanghai, China. Int Surg 2015; 100: 841-8. [Crossref]
24. Wu G, Liu Z, Zheng L, Quan Y, Wu Z. Prevalence of malnutrition in general surgical patients: evaluation of nutritional status and prognosis. Zhonghua Wai Ke Za Zhi 2005; 43: 693-6.
25. Pirlich M, Lochs H. Nutrition in the elderly. Best Pract Res Clin Gastroenterol 2001; 15: 869-84. [Crossref]
26. Rasmussen HH, Kondrup J, Staun M, Ladefoged K, Kristensen H, Wengler A. Prevalence of patients at nutritional risk in Danish hospitals. Clin Nutr 2004; 23: 1009-15. [Crossref]
27. Jie B, Jiang ZM, Nolan MT, Zhu SN, Yu K, Kondrup J. Impact of preoperative nutritional support on clinical outcome in abdominal surgical patients at nutritional risk. Nutrition 2012; 28: 1022-7. [Crossref]
28. Kondrup J, Johansen N, Plum L, Bak L, Larsen IH, Martinsen A, et al. Incidence of nutritional risk and causes of inadequate nutritional care in hospitals. Clin Nutr 2002; 21: 461-8. [Crossref]
29. Li JS, Jiang ZM, Chen W, Zhan WH, Jiang ZW, Jiang H. Nutrition risk screening In China's large hospitals of metropolitans: a preliminary report of multi-centers survey. JPEN J Parenter Enteral Nutr 2006; 30: S56-7.