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Prevalence of malnutrition in general surgery applying the nutritional risk screening 2002

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Abstract

Background and aims: *Malnutrition in hospitalized patients remains an important issue, even in high standard health care systems, with a prevalence ranging between 20-50%. Despite the fact that malnutrition is associated with a higher rate of postoperative complications and mortality, also resulting in longer hospital stays and increased health care costs, it remains often unrecognized and inadequately treated. This study investigated the prevalence of malnutrition and associated risk factors in patients admitted to the general surgical wards of a university hospital in order to raise awareness and to finally improve nutritional practice.*

Methods: *A series of 221 consecutive patients were prospectively enrolled in this study. Body weight and height were measured on the day of admission and the nutritional risk was assed using the NRS-2002 score. Preexisting medical conditions, social factors and intended surgery were registered and correlated to the overall nutritional risk.*

Results: *A nutritional risk according to NRS-2002 was present in 78 patients (35.3%). Old age had the strongest association with malnutrition (OR 3.3 and 12.4 for age ≥ 60 or 70, respectively, p [each]< 0.001), followed by cancer (OR 7.7, p < 0.001), liver disease (OR 3.1, p < 0.001) and cardiac disease (OR 2.9, p=0.001). There was no significant association between the number of preexisting medical conditions and the presence of a nutritional risk (p=0.414). Serum albumin levels did not provide a significant correlation with malnutrition (p=0.105).*

Conclusion: *Malnutrition is likely present in about one third of patients admitted to surgical wards. Old age, cancer, liver, and cardiac disease are associated with a significantly increased risk for malnutrition. These results depict the importance of a standardized screening program in surgical patients - especially in view of the aging populations in western societies and the increasing complexity of surgical interventions.*

Keywords: *malnutrition, NRS 2002, general surgery*

Introduction

Malnutrition is a common but still underestimated problem in hospitalized patients and represents a significant health risk. It increases the rate of postoperative complications and mortality accompanied by longer hospital stays and causes a higher rate of re-admissions within 15 days. It is further associated with higher costs for the corresponding healthcare system [1-5]. Upon hospital admission, malnutrition can range from 20 to 50 % and worsens during hospital stay with the greatest weight loss in those patients, who are initially most malnourished [6-9]. Thus, especially in disciplines in which extensive surgical procedures are performed, patients should have sufficient physical conditions and reserves to be able to recover from the operative trauma [10]. Overall, an insufficient treatment of malnutrition is an avoidable risk factor for a poor outcome after well-performed surgery [11-13]. Therefore, it is important to detect patients who are at risk of malnutrition at the time of hospitalization to be able to counteract the resulting negative effects.

The key prerequisite to improve the perioperative nutritional status of surgical patients is the ability to recognize malnourishment or a substantial nutritional risk in the corresponding patients early. Unfortunately, a main cause for insufficient nutritional support is a lack of nutritional knowledge among health care workers. Malnutrition is hence often not recognized and only less than half of the patients in whom malnutrition has been diagnosed receive adequate nutritional treatment [14-16]. Several risk factors for the occurrence of malnutrition could be identified in the past including old age, malignant disease, liver and gastrointestinal disease, depression, dementia and polypharmacy [3,4,17]. Additionally, certain types of surgery such as esophageal and gastric cancer surgery, as well as pancreatic surgery, severely aggravate preexisting malnutrition [18-20]. Nevertheless, there is still no standardized definition of malnutrition despite a new suggestion of The European Society for Clinical Nutrition and Metabolism (ESPEN), which has recently been introduced and includes the parameters low BMI, weight loss and fat free mass index (FFMI) [21].

In our current study, the Nutritional Risk Screening 2002 (NRS-2002) was used, which is recommended by ESPEN for the detection of patients at risk for malnutrition [22]. A high NRS-2002 score has been described to be a major predictor of SIRS, sepsis and death [23]. Furthermore, the NRS-2002 has a positive predictive power in estimating the mortality risk in general surgical patients and in estimating the postoperative complication risk in

patients undergoing major surgery [24]. The aim of this study was to determine the prevalence of patients at risk for malnutrition by the time of admission to the general surgical ward of our tertiary care center and to determine the corresponding risk factors in order to improve nutritional practice overall.

We found, that about one third of the patients admitted to our general surgical wards was at risk for malnutrition, thus depicting the importance of a standardized screening method.

Patients and methods

Data in this study was collected prospectively during a six weeks period from March to April 2013. During that time, all patients admitted to the general surgical wards at the University of Regensburg medical center were included in this study. Patients, who were admitted to the general surgical wards were surveyed on the day of admission and body weight and height were measured. The Body Mass Index (BMI) was calculated in kg/m^2. Patients were excluded from the study, if they were discharged or transferred to another, non-general surgical ward at the day of admission to the hospital. Admission diagnosis, intended surgery, pre-existing medical conditions and social factors were assed via a standardized questionnaire. These findings were supplemented with available medical reports. Additionally, serum albumin levels and creatinine values were registered.

Nutritional risk screening

For evaluation of malnutrition the Nutritional Risk Screening 2002 (NRS-2002) was used [25]. The NRS-2002 consists of an initial screening, which includes the following questions: Is BMI <20? Has the patient lost weight within the last 3 months? Is the patient severely ill (e.g. in intensive therapy)? Has the patient had a reduced dietary intake in the last week?

If any of these questions was answered with "yes", the main screening was performed, in which the nutritional status (evaluating reduced food intake, low BMI and weight loss >5% within three months) and the severity of the disease as a marker for increased nutritional requirements were assessed. Both categories are subdivided into "absent" (score 0), "mildly" (score 1), "moderate" (score 2) and "severe" (score 3). The scores were added and one additional point was given for patients aged 70 years or older. Patients with a score of three or more are defined as nutritionally at risk.

Statistics

Statistical analysis was performed using IBM SPSS Statistics, Version 20.0 for Windows. For independence testing of categorical variables the Chi-square test was used. Furthermore, Student´s t-test was used for hypothesis testing. In case of continuous, non-normally distributed data non-parametric tests were applied. Statistical significance was assumed when $p < 0.05$.

Results

Patient population

In total, 221 patients were included in this study. Within this collective 136 patients (61.5%) were male and 85 were female (38.5%). The average age was 53.2 ± 17.3 years (males 54.6 ± 0.7 years, females 51.0 ± 0.8 years). The Body Mass Index (BMI) averaged at 27.1 ± 5.4 kg/m2. Malignancy was detected in 74 patients (33.5%), whereas in 140 patients (63.3%) benign disease was found to be the cause for admission to the surgical ward. In seven patients (3.2%), the dignity of the disease could not be assessed, as histological findings remained unclear at the time of analysis (compare Table 1). Diseases of the thyroid gland were the most common among the pre-existing medical conditions (n=78, 35.3%), followed by liver diseases (n=52, 23.5%), cardiac diseases (n=47, 21.3%), diabetes mellitus (n=28, 12.7%), kidney diseases (n=27, 12.2%), inflammatory bowels disease (IBD, n=19,8.6%) and respiratory diseases (n=18, 8.1%) - this representing the case mix of our tertiary referral center. Furthermore, 21.3% (n=47) were actively smoking and 14.0% (n=31) were drinking alcohol on more than five out of seven days per week.

Surgery performed consisted of hepatobiliary (n=46, 20.8%), colorectal (n=43, 19.5%), thyroid (n=30, 13.6%), esophago-gastro-duodenal (n=15, 6.8%), hernia (n=15, 6.8%), kidney (n=4, 1.8%), pancreatic (n=4, 1.8%) and splenic surgery (n=2, 0.9%). In the remaining cases (n= 54, 24.4%), other operations (including adrenal surgery, lymph node dissections, biopsies etc.) were performed. Eight patients (3.6%) underwent conservative treatment (compare table 2).

Results of the NRS-2002

The correlation between patients with a BMI < 20.5 kg/m2, weight loss within three months, reduced dietary intake, severe illnesses and the presence of malnutrition was highly significant with p[each] < 0.001 (NRS 2002, Initial Screening, Questions 1-4). In the final screening, 69 patients presented with an impaired nutritional status. Out of this group, 36 patients (52.2%) were assessed as mildly, 24 patients (34.8%) as moderately, and nine patients (13.0%) as severely impaired in terms of their nutritional status. The severity of disease was judged mild in 44 (31.4%) patients, moderate in 86 patients (61.4%) and severe in ten patients (7.1%). According to NRS-2002 the overall prevalence of patients in our institution at risk for malnutrition with a score ≥ 3 was 35.3% (n=78). 36.2% (n=80) had a normal nutritional status and normal nutritional requirements (score 0). 63 patients (28.5%) reached a score of 1 or 2 and thus were considered not to be at risk for malnutrition.

Risk factors for malnutrition based on the results of NRS 2002

The prevalence of patients at risk for malnutrition increased significantly with age. In the age group of 60 years or over 50.5% of the patients were at risk for malnutrition compared with 23.4% in the age group younger than 60 years (OR 3.3). Patients with malignant diseases presented with a significantly increased risk for malnutrition compared to patients with benign diseases (64.9% vs. 19.3%, OR 7.7). Malignancies included tumors of the upper and lower GI tract, hepatobiliary and pancreatic tumors, thyroid cancer, as well as lymph node metastases from malignant melanoma. Pre-existing liver and heart diseases were associated with an increased risk for malnutrition (OR 3.1 and 2.9, respectively), in contrast to patients with thyroid disease, which had a reduced risk for malnutrition (OR 0.5, p=0.012).

There was no increased risk for malnutrition in patients with IBD, respiratory disease, kidney disease or diabetes. Patients, who were smoking or drinking alcohol on more than 5 days per week did not show an increased risk for malnutrition (Table 3). There was no statistically significant correlation between the number of pre-existing medical conditions (0, 1-2, 3-4, ≥5 risk factors) and a NRS-2002 score ≥ 3 (p=0.414). Female gender and ethnicity were not associated with an increased risk for malnutrition in the present cohort (p=0.7 and 0.4, respectively). Albumin and creatinine levels showed no significant correlation with malnutrition (p=0.105 and 0.158, respectively).

Total number of patients	221
Sex	
Male	136 (61.5%)
Female	85 (38.5%)
Age (y)	53.2 ± 17.3
BMI (kg/m²)	27.1 ± 5.4 kg/m²
Cause for admission to the surgical ward	
Malignant disease	74 (33.5%)
Benign disease	140 (63.3%)
Other	7 (3.2%)

Table 1. *Patient data*

Surgery	**N (%)**
Hepatobiliary	46 (20.8)
Colorectal	43 (19.5)
Thyroid	30 (13.6)
Hernia	15 (6.8)
Upper Gastrointestinal Tract	15 (6.8)
Vascular	15 (6.8)
Pancreatic	4 (1.8)
Kidney	4 (1.8)
Spleen	2 (0.9)
Other[1]	39 (17.6)
Conservative treatment	8 (3.6)

[1] i.e. adrenal surgery, small bowel resections, lymph node dissections, biopsies

Table 2. *Surgical details*

	Odds Ratio	P-value
Female	1.1	n.s.
Nationality[1]	0.6	n.s.
Age ≥ 60	3.3	<0.001
Diabetes	1	n.s.
Heart disease	2.9	0.001
Inflammatory bowel disease	1.7	n.s.
Kidney disease	1.3	n.s.
Liver disease	3.1	<0.001
Malignant disease	7.7	<0.001
Respiratory disease	0.7	n.s.
Thyroid disease	0.5	0.012
Smoking	1	n.s.
Alcohol[2]	0.6	n.s.

n.s. = not significant;
[1]other than German
[2]on more than 5 out of 7 days a week

Table 3. *Risk factors for malnutrition based on the results of the NRS 2002*

Discussion

Our study confirms the existence of a significant group of patients at risk for malnutrition in a high standard health care system in a Western society. It further describes risk factors that contribute to this issue. Recent studies have shown that every fourth to every third inpatient is affected, although the problem had been addressed for many years already [9,26]. To this day, there is a lack of knowledge among healthcare workers with respect to the recognition and treatment of malnutrition, which embraces not only a poor nutritional status, but also an imbalance of nutritional intake and dietary requirements [14-16,20].

Surgical patients suffering from malnutrition have a higher rate of postoperative complications, hospital re-admissions, and a higher mortality rate compared to well-nourished patients or malnourished patients receiving nutritional support [11,12]. Patients thus benefit greatly from perioperative nutritional support when assessing later nutritional status and quality of life. Additionally, fewer infectious and non-infectious complications, fewer re-hospitalizations and a reduced length of hospital stay have been reported [11,13]. A recently published guideline recommends avoiding long periods of preoperative fasting, re-establishment of oral feeding as soon as possible after surgery (fast-tracking) and a start of nutritional therapy immediately after a nutritional risk becomes obvious [27]. These recommendations should be specifically applied to patients, in whom extensive surgery is planned. Without a sufficient nutritional concept, these patients will be subject to a higher morbidity and mortality.

Here, we confirm these previous findings in a new cohort and demonstrate, that 35.3% of the patients admitted to our department for surgery in a tertiary referral center in Germany were nutritionally at risk at the time of admission. Recently published studies including surgical patients showed rates of malnutrition ranging from 24 up to 40% [3,4,7,20]. According to the literature, age is an important factor contributing to malnutrition [3,4,28]. In our study, 50.5% of the patients aged 60 years or older were nutritionally at risk, which corresponds to a threefold increase in that age group compared with patients below 60. Moreover, malignant diseases were also strongly associated with an increased risk for malnutrition (OR 7.7), as well as heart and liver diseases (OR 2.9 and 3.1 respectively). These results assort well with previous studies [3,4,29].

Thyroid diseases, however, were associated with a reduced risk for malnutrition. An explanation could be the low prevalence of malignancies in this group, which mostly consisted of patients with benign nodular goiter. Preoperative hypoalbuminemia as an independent risk factor for a higher complication rate after surgery is also associated with malnutrition [28,30]. In our study, serum albumin levels at the time of admission were not significantly different in patients with and without a nutritional risk.

Relating to the main risk factors addressed in our study it would be a modest approach in daily routine to take a closer look, especially at patients older than 60 years and cancer patients with regard to malnourishment, and to implement nutritional therapy if necessary. To address this concern in daily routine, screening tools for malnutrition and the necessary nutritional support should be integrated in an ERAS protocol (Enhanced Recovery After Surgery). ERAS protocols as a consistent further development of the fast-track surgery principles were first implemented in the field of colorectal surgery and have been transferred to most other parts of surgical oncology. ERAS programs are associated with a significant reduction in the length of hospital stay and a reduction in overall morbidity rates and might even reduce the 5-year cancer-

specific survival after colorectal cancer surgery [31, 32].

However, without the ability to identify patients who are nutritionally at risk and struggling to calculate exact energy requirements, it is unlikely that nutritional practice will become more effective [15,16]. Therefore, the importance of an appropriate education of health care workers and the implementation of a standardized screening program in every hospital has to be reemphasized - particularly in view of the fact that western societies are increasingly aging. As the risk of developing cancer is rising with age, an adequate diagnosis and treatment of malnutrition will gain even more importance than today.

In conclusion, malnutrition is present in between one fourth and one third of patients admitted to surgical wards. Especially oncologic surgical patients and patients older than 60 years are highly at-risk. Nutritional risk screenings should be used more frequently to detect patients, who are nutritionally at risk at the time of hospital admission. Nutritional support should be improved in these patients in order to reduce mortality, complication rates and healthcare costs. Furthermore, healthcare workers should be trained in recognition and therapy of patients with malnutrition and should thereby improve nutritional practice overall.

References

1. Burgos R, Sarto B, Elio I, et al. Prevalence of malnutrition and its etiological factors in hospitals. *Nutr Hosp.* 2012; 27:469-476.
2. Correia MI, Waitzberg DL. The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis. *Clin Nutr.* 2003; 22:235-239.
3. Thomas MN, Kufeldt J, Kisser U, et al. Effects of malnutrition on complication rates, length of hospital stay, and revenue in elective surgical patients in the G-DRG-system. *Nutrition.* 2016; 32:249-254.
4. Pirlich M, Schutz T, Norman K, et al. The german hospital malnutrition study. *Clin Nutr.* 2006; 25:563-572.
5. Lim SL, Ong KC, Chan YH, et al. Malnutrition and its impact on cost of hospitalization, length of stay, readmission and 3-year mortality. *Clin Nutr.* 2012; 31:345-350.
6. Norman K, Pichard C, Lochs H, et al. Prognostic impact of disease-related malnutrition. *Clin Nutr.* 2008; 27:5-15.
7. Liang X, Jiang ZM, Nolan MT, et al. Nutritional risk, malnutrition (undernutrition), overweight, obesity and nutrition support among hospitalized patients in beijing teaching hospitals. *Asia Pac J Clin Nutr.* 2009; 18:54-62.
8. Vidal A, Iglesias MJ, Pertega S, Ayucar A, Vidal O. Prevalence of malnutrition in medical and surgical wards of a university hospital. *Nutr Hosp.* 2008; 23:263-267.
9. McWhirter JP, Pennington CR. Incidence and recognition of malnutrition in hospital. *BMJ.* 1994; 308:945-948.
10. Horowitz M, Neeman E, Sharon E, et al. Exploiting the critical perioperative period to improve long-term cancer outcomes. *Nat Rev Clin Oncol.* 2015; 12:213-226.
11. Zhong JX, Kang K, Shu XL. Effect of nutritional support on clinical outcomes in perioperative malnourished patients: A meta-analysis. *Asia Pac J Clin Nutr.* 2015; 24:367-378.
12. Yeh DD, Fuentes E, Quraishi SA, et al. Adequate nutrition may get you home: Effect of Caloric/Protein deficits on the discharge destination of critically ill surgical patients. *JPEN J Parenter Enteral Nutr.* 2016; 40:37-44.
13. Starke J, Schneider H, Alteheld B, et al. Short-term individual nutritional care as part of routine clinical setting improves outcome and quality of life in malnourished medical patients. *Clin Nutr.* 2011; 30:194-201.
14. Kondrup J, Johansen N, Plum LM, et al. Incidence of nutritional risk and causes of inadequate nutritional care in hospitals. *Clin Nutr.* 2002; 21:461-468.
15. Meijers JM, Halfens RJ, van Bokhorst-de van der Schueren MA, et al. Malnutrition in dutch health care: Prevalence, prevention, treatment, and quality indicators. *Nutrition.* 2009; 25:512-519.
16. Mowe M, Bosaeus I, Rasmussen HH, et al. Insufficient nutritional knowledge among health care workers? *Clin Nutr.* 2008; 27:196-202.
17. Konturek PC, Herrmann HJ, Schink K, et al. Malnutrition in hospitals: It was, is now, and must not remain a problem! *Med Sci Monit.* 2015; 21:2969-2975.
18. Heneghan HM, Zaborowski A, Fanning M, et al. Prospective study of malabsorption and malnutrition after esophageal and gastric cancer surgery. *Ann Surg.* 2015; 262:803-807.
19. Kang J, Park JS, Yoon DS, et al. A study on the dietary intake and the nutritional status among the pancreatic cancer surgical patients. *Clin Nutr Res.* 2016; 5:279-289.
20. Rasmussen HH, Kondrup J, Staun M, et al. Prevalence of patients at nutritional risk in danish hospitals. *Clin Nutr.* 2004; 23:1009-1015.
21. Rondel AL, Langius JA, de van der Schueren MA, et al. The new ESPEN diagnostic criteria for malnutrition predict overall survival in hospitalised patients. *Clin Nutr.* 2016.
22. Kondrup J, Allison SP, Elia M, et al. ESPEN guidelines for nutrition screening 2002. *Clin Nutr.* 2003; 22:415-421.
23. Dizdar OS, Baspinar O, Kocer D, et al. Nutritional risk, micronutrient status and clinical outcomes: A prospective observational study in an infectious disease clinic. *Nutrients.* 2016; 8:124.
24. Karateke F, Ikiz GZ, Kuvvetli A, et al. Evaluation of nutritional risk screening-2002 and subjective global assessment for general surgery patients: A prospective study. *J Pak Med Assoc.* 2013; 63:1405-1408.
25. Kondrup J, Rasmussen HH, Hamberg O, et al. Nutritional risk screening (NRS 2002): A new method based on an analysis of controlled clinical trials. *Clin Nutr.* 2003; 22:321-336.
26. Coats KG, Morgan SL, Bartolucci AA, et al. Hospital-associated malnutrition: A reevaluation 12 years later. *J Am Diet Assoc.* 1993; 93:27-33.
27. Weimann A, Braga M, Carli F, et al. ESPEN guideline: Clinical nutrition in surgery. *Clin Nutr.* 2017; 36:623-650.
28. Bozzetti F, Gianotti L, Braga M, et al. Postoperative complications in gastrointestinal cancer patients: The joint role of the nutritional status and the nutritional support. *Clin Nutr.* 2007; 26:698-709.
29. Agra Bermejo RM, Gonzalez Ferreiro R, Varela Roman A, et al. Nutritional status is related to heart failure severity and hospital readmissions in acute heart failure. *Int J Cardiol.* 2017; 230:108-114.
30. Hennessey DB, Burke JP, Ni-Dhonochu T, et al. Preoperative hypoalbuminemia is an independent risk factor for the development of surgical site infection following gastrointestinal surgery: A multi-institutional study. *Ann Surg.* 2010; 252:325-329.
31. Gustafsson UO, Oppelstrup H, Thorell A, et al.. Adherence to the ERAS protocol is associated with 5-year survival after colorectal cancer surgery: A retrospective cohort study. *World J Surg.* 2016; 40:1741-1747.
32. Greco M, Capretti G, Beretta L, et al. Enhanced recovery program in colorectal surgery: A meta-analysis of randomized controlled trials. *World J Surg.* 2014; 38:1531-1541.

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