Pre-operative nutritional status is an independent risk factor for gastrointestinal surgical critically ill patients

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Abstract

Aim: Malnutrition is a frequent concomitant of surgical illness, especially in gastrointestinal surgery. The purpose of the study was to evaluate the prevalence of malnutrition for intensive care unit (ICU) patients, who underwent gastrointestinal surgery and to determine the correlation with post-operative outcome.
Methods: We prospectively studied 313 post-surgical patients ≥18 years that stayed ≥4 days at the Intensive Care Unit (ICU) of the University Hospital Center "Mother Teresa" in Tirana, Albania. Patients were divided into well-nourished (NRS 2002 <3) and malnourished groups (NRS 2002 ≥ 3) according to their nutritional status. All patients were followed up clinically until discharge from ICU or death and their outcomes were recorded. Univariate and multivariate logistic regression analysis were used to identify the relationship between malnutrition and the clinical outcome.
Results: The prevalence of pre-operative malnutrition was 61.7% and for gastrointestinal cancer patients it was 80.2%. Malnutrition, as analyzed by a multivariate logistic regression model, was an independent risk factor for higher complications, higher nosocomial infections, increased mortality, and longer stay in the ventilator and ICU.
Conclusion: This study shows that malnutrition is a significant problem in surgical patients, especially in patients with gastrointestinal cancer, staying for more than four days in the intensive care unit. Malnutrition in gastro-intestinal surgery patients is an independent risk factor on increased post-operative morbidity and mortality.

Keywords: malnutrition, morbidity, mortality, nutritional status, surgical critically ill.

Introduction

Malnutrition is a frequent concomitant of surgical illness. Studies have reported 40%-50% of surgical patients to be malnourished on admission to hospital (1,2). There is a high incidence of malnutrition in hospitalized patients undergoing gastrointestinal surgery. Surgery, like any injury to the body elicits a series of reactions including release of stress hormones and inûammatory mediators, i.e. cytokines. This release of mediators to the circulation has a major impact on body metabolism. They cause catabolism of glycogen, fat and protein with release of glucose, free fatty acids and amino acids into the circulation, so that substrates are diverted from their normal purposes, e.g. physical activity, to the task of healing and immune response (3). Gastro-intestinal patients, especially with underlying malignancy, are at high risk of developing malnutrition, and surgical stress can also accentuate this catabolic problem. Patients who undergo gastro-intestinal surgery are at risk of nutritional depletion from inadequate nutritional intake; both preoperatively and postoperatively, the stress of surgery and the subsequent increase in metabolic rate.

Studies reported that up to 40% of patients were malnourished at the time of their admission and the majority of these patients continued to be nutritionally depleted throughout their hospital course (2). Malnutrition in hospitalized patients often goes unrecognized (4,5).

It is important to identify these patients and be aware of nutritionally related complications which may occur. The deleterious role of malnutrition in hospitalized patients is widely recognized (6-8). Appropriate intervention may improve nutritional status in such cases.

In Albania, there are no data about malnutrition on this group of patients, and how malnutrition can affect the clinical outcome of the surgical critically ill patients. The purpose of the present study was: i) to evaluate the prevalence of malnutrition for abdominal surgical patients (≥18 years) that stayed in the surgical and medical ICU more than four days and the factors that are related with the presence of malnutrition; ii) to determine if malnutrition was predictive for adverse outcomes.

Materials and methods

Study design and patient population

A prospective cohort study among gastrointestinal surgical patients admitted to the surgical and the medical intensive care unit (ICU) of the University Hospital Centre "Mother Teresa" in Tirana, Albania, was conducted over a two-year period: 2011-2012. Patients were eligible if they were >18 years of age, underwent abdominal surgery and stayed in the surgical/ medical ICU for ≥4 days.

Demographic and medical information

Demographic and medical information including sex, age, date of ICU admission, ICU diagnosis, Acute Physiology and Chronic Health Evaluation (APACHE II) prognosis score (9), ICU discharge, and mechanical ventilation, were collected.

Nutrition risk screening

Nutritional status on admission was assessed according to Nutritional Risk Screening 2002 (10). It contains one scale to examine nutritional status (0-3 points) and one scale to assess potential changes in stress metabolism (0-3 points.). A total score of >3 indicates that nutrition support should be initiated.

Patients were divided into well-nourished and malnourished groups, according to their nutritional status (NRS 2002 <3, and NRS 2002 ≥3, respectively).

Complications, mortality and length of ventilator and ICU stay

Complications were defined to be the appearance of a disease condition in addition to the preexisting condition which motivated ICU admission, without a specific relationship between the two. Complications can be infectious [sepsis or systemic inflammatory response syndrome (11), pneumonia, urinary tract infection, central venous catheter sepsis, and wound infection] and other complications: post-operative, metabolic disorders and organ's failure (by SOFA) (12). Length of ICU stay was measured in days, from the day of ICU admission to ICU to the time of discharge or death.

Data were collected prospectively to determine length of ventilator stay, ICU stay, rate of complications and mortality.
The study was approved by the Albanian Committee of Biomedical Ethics.

Statistical analysis

Data were presented as means, medians and ranges for numerical variables and as number or percentages for categorical variables. Postoperative morbidity, mortality, ICU length of stay (LOS), and ventilator length of stay were compared between well-nourished and malnourished groups. Linear and logistic regression was conducted to test the relation between the nutrition status and the clinical outcomes (length of ICU stay, length of ventilator stay, total complications, infectious complications and mortality). Statistical significance was considered at the level of $P \leq 0.05$. All tests were two-tailed. SPSS 15.0 used for data analysis.

Results

A total of 313 post operative patients were included in this study (Tables 1-2). The mean age was 60.5± 16.2 years (range: 18-92 years) with 55.6% (N=174) being male. According to NRS 2002, the prevalence of malnutrition at the time of ICU admission was 61.7% (N=193). The mean APACHE II score was 18.28± 6.54 (range: 8-33). ICU length of stay was 8.94± 7.97 days (range: 4-62). Mechanical ventilation lasted for 2.05±4.36 days (range: 0-25). ICU mortality was 30.4% (N=95). Cancer was present in 25.87% of the cases.

Table 1. Population characteristics (N=313)

Characteristic	Distribution
Age (years)	60.5 ± 16.2
Male (N=174)	55.6%
APACHE II	18.28 ± 6.54
ICU length of stay (days)	8.94 ±7.97
Ventilator length of stay (days)	2.05 ± 4.36
Mortality rate (N=95)	30.4%

Table 2. Major diagnoses of the total study population on ICU admission

Major diagnosis	N	Frequency (%)
GI* perforation/rupture; fistula	36	11.47
GI inflammatory disease	13	4.1
GI obstruction	11	3.5
GI bleeding	69	22.0
Pancreatitis	22	7.0
GI neoplasm	81	25.87
GI cholecystitis / cholangitis	45	14.37
Other GI disease; tromboembolitic event	36	11.5

* GI = gastrointestinal.

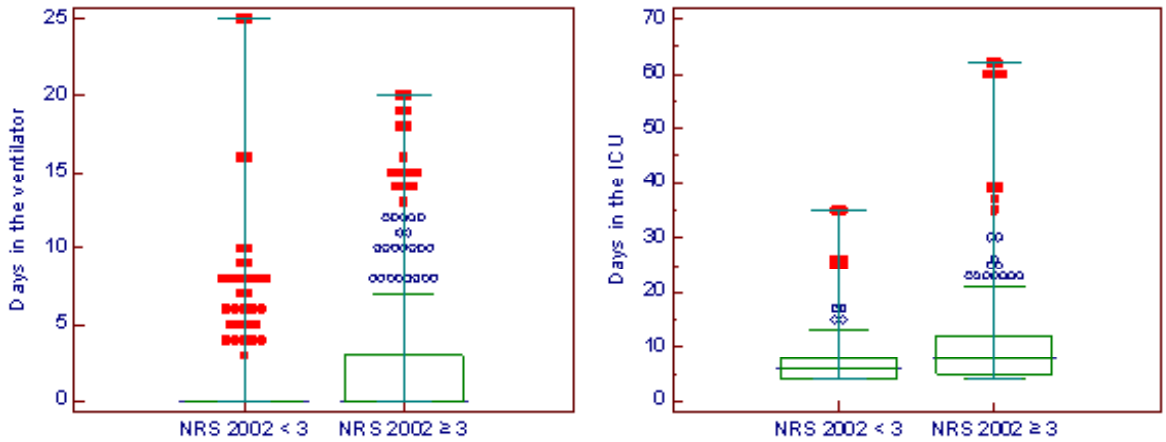
The overall incidence of complications was 50.8% (N=159), but a significantly higher percentage was present in the malnourished patients. The incidence of complications in the malnourished was 69.4% vs. 19.2% in the well nourished patients [Odds ratio (OR): 8.63; 95% confidence interval (CI): 5.04-14.7, P<0.0001].
The incidence of nosocomial infections was 30.35%

(N=95). In the malnourished group, the incidence of infectious complications was 38.3% vs. 17.5% in the well nourished patients (OR=2.93, 95%CI=1.68-5.09, P=0.0001).

Mortality in the malnourished patients was 35.8% vs. 20% in the well-nourished group (OR=2.32, 95%CI=1.36-3.97, P=0.001).

Length of ventilator stay was shorter in the well-nourished patients. Malnourished patients stayed in the mechanical ventilation for 2.45±4.48 days vs. 1.40 ±4.08 days in the well-nourished patients (P=0.03). Malnourished patients stayed in the ICU for 10.21±9.17 days vs. 6.87±4.82 days in the well-nourished (P=0.0003) [Figure 1].

Figure 1. Length of ventilator stay and intensive care stay according to the nutritional status



Malnutrition, as analyzed by a multivariate logistic regression model, adjusted for confounders, was an independent risk factor for higher complications: F=89.45, P<0.001; higher nosocomial infections: F=15.87, P<0.001; increased mortality: F=10.12, P=0.002; longer stay in the ventilator: F=4.59, P=0.03, and; longer ICU stay F=13.62, P<0.001.

About 26% of the patients (N=81) had malignant diseases, of whom 65 patients (80.2%) were with malnutrition on admission in the ICU. Presence of malignancy, as analyzed by a logistic regression model, was an independent risk factor for malnutrition: OR=3.06; 95%CI=1.58-5.91, P=0.0003.

Patients with malignant disease had a higher risk for malnutrition compared to the patients without malignant disease: RR=2.53, 95%CI=1.44-4.44, P=0.001.

Malnutrition in patients with malignant disease, as analyzed by a multivariate logistic regression model adjusted for confounders, was an independent risk factor for higher complications (OR=3.06, 95%CI=0.83-11.25) and increased mortality (OR=2.08, 95%CI=0.51-8.49).

APACHE II score greater than 15 was an independent risk factor for malnutrition OR=4.03, 95%CI=2.47-6.58, P<0.0001.

Average age was significantly higher in those with malnutrition compared to those without malnutrition (63.06±15.52 and 56.56±16.71, respectively, P=0.0005).

About 67% of the patients above 50 years old had malnutrition, vs. 45% of the patients younger than 50 years old. Around 83% of the malnourished patients were above 50 years old.

Risk factors for malnutrition in multivariate regression analysis adjusted for potential confounders were: age above 50 years, APACHE II score above 15 and the presence of gastrointestinal cancer (Table 3).

Multivariate logistic regression model adjusted for confounders revealed other important risk factors of mortality (Table 4): APACHE II score above 15 (OR=3.61, 95%CI=2.00-6.50, P<0.0001); nosocomial infections (OR=2.01, 95%CI=1.21-3.35, P=0.007); overall complications (OR=2.85, 95%CI=1.71-4.75, P<0.0001), and; mechanical ventilation (OR=1.11, 95%CI=1.05-1.18, P=0.0001).

Mortality was not related to age, presence of malignant disease, or urgent hospital admission.

Table 3. Relationships between malnutrition and clinical data

Risk factors	Malnutrition (%)	Odds ratio	95% CI	P-value
Gender				
Female/Male	64/59.7	1.19	0.75-1.89	0.44
Type of hospitalization				
Urgent/elective surgery	63.8/60.7	1.14	0.69-1.88	0.60
Presence of malignancy	80.2	3.06	1.58-5.91	0.0003
APACHE II >15 / ≤15	73.5/40.7	4.03	2.47-6.58	< 0.0001
Age >50 years / ≤50 years	66.6/45.2	2.42	1.42-4.13	0.001

Table 4. Factors independently associated with mortality

Risk factors	Odds ratio	95% CI	P-value
Malnutrition	2.28	1.33 - 3.89	0.001
APACHE II >15	3.61	2.00-6.50	< 0.0001
Nosocomial infection	2.01	1.21-3.35	0.007
Complications	2.85	1.71-4.75	< 0.0001
Mechanical ventilation	1.11	1.05-1.18	0.0001

Discussion

The prevalence of 61.7% of malnutrition in gastrointestinal surgical patients and of 80.2% in gastrointestinal cancer patients staying for more than four days in intensive care unit confirms the severity of this problem.

A high prevalence of preoperative malnutrition is observed, ranging from 20 to 46% depending on the definition of malnutrition (13). Using SGA classifications, previous investigators have shown that 37-50% of the patients admitted to the medical (14,15) and surgical ICU (16) were malnourished. In the present study, the prevalence of malnutrition was higher because we considered only the patients that stayed more than four days in the ICU, and not all the patients admitted.

The nutrition risk score (NRS 2002) is a simple way of identifying patients at risk of malnutrition, which is applicable to all patient categories and ages (10). In our study, we found that age and malignancy were independent risk factors for malnutrition. Elderly patients admitted to the ICU are an exceptionally vulnerable patient population. Often, these patients have several conditions that impede oral intake and impair nutritional status. When coupled with an acute disease process, it is likely that elderly patients requiring ICU admission are at exceptional risk for nutritional decline.

In a study there was found that 23-34% of elderly patients were malnourished at the time of admission to the medical or surgical ICU (14).

The present study supports previous investigations because malnutrition was evident in 66.6% of the patients above 50 years of age at the time of ICU admission.

Malnutrition is associated with adverse outcomes in surgical patients. Although it is difficult to establish a causal relationship, it is known that poor pre-operative nutritional status has been linked consistently to an increase in post-operative complications and poorer surgical outcomes (6).

The inûuence of nutritional status on postoperative morbidity and mortality has been well-documented, first by Studley et al. (17) which observed a direct relationship between preoperative weight loss and operative mortality rate, and was followed by many other studies (18-22).

Numerous studies have clearly demonstrated that protein-calorie malnutrition is a significant risk factor for postoperative complications in patients undergoing major abdominal surgery or gastric cancer surgery (23-28).

Our results do not differ from the results of other studies in gastrointestinal surgery about complications, including infectious complications (6,29-31).

Malnutrition is frequently observed in 60%-85% of surgical patients with an upper gastrointestinal cancer and is an independent predictor of postoperative morbidity and mortality, leading to increased length of hospital stay and hospital costs (7,32-34).

In the present study, 25.87% of the patients had gastrointestinal cancer and 80.2% of them were malnourished upon admission at the ICU. The median age of cancer patients was 60± 12 years (range: 26-82 years) and 59% of the patients were men. These results are comparable with those published by Pirlich et al. (35) where the median age of cancer patients was 63± 14 years and 56% of the patients were men. On the other hand, the prevalence of malnutrition in our study (80.2%) was much higher than in this prior study (37.6%) because we considered only patients that stayed in the ICU for more than four days and not all of the hospitalized cancer patients. Many reviews have highlighted the high prevalence of malnutrition in cancer patients and the relation with adverse effects on the clinical outcomes (7,36).

Our study supports the theory that malnourished patients undergoing surgery have higher rates of morbidity and mortality, as well as longer hospital stays compared with adequately nourished patients (29,37).

In contrary to these findings, a recent study by Bisschop et al. has demonstrated that major upper gastrointestinal tract surgery elicits a catabolic response characterized by increased inflammation, glucose production and protein breakdown, but this catabolic response does not seem to be influenced by the preoperative nutritional status (38).

Documentation of nutritional state is very important. McWhirter and Pennington (4) showed that 50% of the malnourished patients in their study lacked nutritional information in their case notes. In our study, such information lacked in all medical records, which had no diagnoses related to malnutrition in their discharge notes, which indicates a better awareness about the importance of this issue.

Conclusion

This study shows that malnutrition is still a significant issue in hospitalized patients. It is also a significant problem in surgical patients, especially in patients with malignancy, staying for more than four days in the intensive care unit.

Malnutrition, particularly among gastro-intestinal surgery patients, may cause ongoing energy deficits in the postoperative period, resulting in an increased risk for infectious complications and poorer clinical outcomes.

Nutritional assessment should be routinely performed upon admission in an attempt to reduce nutrition-related complications. Improved education of medical staff is needed, and screening for malnutrition should be mandatory.

Conflicts of interest: None declared.

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