ORIGINAL ARTICLE

doi: 10.5455/medarh.2014.68.263-267

Published online: 31/07/2014
Published print: 08/2014

Med Arh. 2014 Aug; 68(4): 263-267
Received: May 25th 2014 | Accepted: July 25th 2014
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Malnutrition at the Time of Surgery Affects Negatively the Clinical Outcome of Critically Ill Patients with Gastrointestinal Cancer

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ABSTRACT

Introduction: Malnutrition is a frequent concomitant of surgical illness, especially in gastrointestinal cancer surgery. The aim of the study was to assess the prevalence of malnutrition in the GI cancer patients and its relation with clinical outcome. We also examined associations between the energy balance and clinical outcomes in these patients. **Methods:** Prospective study on 694 surgical patients treated in the ICU of the UHC of Tirana.Patients were divided into well-nourished and malnourished groups according to their nutritional status. Multiple regression analysis was used to analyze the effect of malnutrition and cumulated energy balance on clinical outcome. **Results:** The prevalence of pre-operative malnutrition was 65.3% for all surgical patients and 84.9% for gastrointestinal cancer patients. Malnutrition, as analyzed by a multivariate logistic regression model, is an independent risk factor for higher complications, infections, and mortality, longer stay in the ventilator and ICU. Also this model showed that cumulated energy balance correlated with infections, and mortality and was independently associated with the length ventilator and ICU stay. **Conclusion:** This study shows that malnutrition is a significant problem in surgical patients, especially in patients with gastrointestinal cancer. Malnutrition and cumulated energy deficit in gastro-intestinal surgery patients with malignancy is an independent risk factor on increased post-operative morbidity and mortality.
Key words: surgical critically ill, malign disease, nutritional status, cumulated energy deficit, morbidity, mortality.

1. 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. Gastrointestinal patients, especially with underlying malignancy, are at high risk of developing malnutrition, and surgical stress can also accentuate this catabolic problem. Malnutrition can occur in gastrointestinal (GI) cancer due to increased metabolic demands, insufficient nutrient intake, or nutrient loss (3). Many patients with gastrointestinal cancers will require surgical intervention, which imposes further metabolic demands and compounds preexisting nutritional disorders. Patients who undergo gastrointestinal 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. If a gastrointestinal cancer patient requires surgery during treatment, their metabolic condition should be optimal at the time of intervention (3).

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). In general, surgery-related causes of malnutrition are hypercatabolism, postoperative fasting, prolonged ileus, fistula, malabsorption syndrome, intestinal obstruction, and gastric atony (4). Malnutrition in hospitalized patients often goes unrecognized (5, 6).

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 (7-9). Routine evaluation of nutritional status allows the identification of patients who are at risk of complications, particularly in the postoperative setting (10, 11). These patients should be targeted for specific nutritional support (12).

The aim of the study was to assess the prevalence of malnutrition in the GI cancer patients and its relation with clinical outcome. We also examined associations between the energy balance and clinical outcomes in these patients.

2. MATERIALS AND METHODS

2.1. Study design and patient population

A prospective cohort study in surgical patients with GI cancer admitted to the surgical and the medical intensive

care unit (ICU) of the University Hospital Centre "Mother Teresa" of Tirana, Albania was conducted over a 3 year period: 2011-2013. Patients were eligible if they were > 18 years of age, underwent abdominal surgery and stayed in the surgical/ medical ICU for more than 24 hours.

2.2. 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 (13), ICU discharge, mechanical ventilation, were collected.

2.3. Nutrition risk screening

Nutritional status before surgery was assessed according to Nutritional Risk Screening 2002 (14). 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 ≥ 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).

2.4. Nutritional data and calculations

Determination of energy requirements: As in our clinic is not available indirect calorimetry (15), and predictive equations often over- or underestimate requirements (16), energy target was set at 25 kcal/kg/day, as is recommended by ESPEN (17,18).

Energy delivery: total delivery includes energy from enteral and parenteral feeds, from non-nutritional sources (glucose and gluco-saline infusions used for drug dilution and fluid support).

Energy balance was calculated as energy delivery – energy target, on daily basis. Data were collected on the cumulated energy balance on discharge from ICU.

2.5. 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 ICU-acquired infections (sepsis or systemic inflammatory response syndrome (19), pneumonia, urinary tract infection, central venous catheter sepsis, and wound infection) and other complications: post-operative, metabolic disorders and organ's failure (by SOFA) (20). 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.

2.6. Statistical analysis

Data are presented as means, medians and ranges for numerical variables and as number or percentages for categorical variables. 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). Also, this model was used to analyze the effect of cumulated energy balance on 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 statistical package used to analyze the data.

3. RESULTS

A total of 694 post operative patients admitted to the ICU were studied. The mean age was 63.06 ± 14.63 years old (range: 18-91) with 54.5% (n = 378) being male. According to NRS 2002 the prevalence of malnutrition before surgery was 65.3% (n = 453). The mean APACHE II score was 17.13 ± 5.71 (range: 8-32). ICU length of stay was 8.44 ± 7.06 days (range: 4-62); Mechanical ventilation lasted 1.76 ± 3.75 days (range: 0-20). ICU mortality was 33.0% (n = 229).

25.8% of the patients (n = 179) were with malignant disease, their median age was 61.89 ± 12.2 years (range 26-82) and 58.7% of patients were men. 152 patients (84.9%) were with malnutrition before surgery (figure 1). Prevalence of malnutrition was higher in the surgical patients with malignancy than in patients without malignancy (84.91% vs. 57.28% respectively, $p < 0.0001$.

Risk factor for malnutrition in the gastrointestinal surgical patients

Presence of malignancy, as analyzed by logistic regression model, is an independent risk factor on malnutrition: OR = 3.28; 95% CI 2.14 – 5.02; $p < 0.0001$.

Average age was significantly higher in those with malnutrition compared to those without (64.93 ± 13.87 and 59.68 ± 15.37, respectively). As analyzed by logistic regression model, age ≥ 65 years is an independent risk factor on malnutrition: OR = 1.50, 95% CI: 1.10-2.05; $p = 0.01$.

Presence of APACHE II score ≥ 15, as analyzed by logistic regression model, is an independent risk factor on malnutrition: OR = 2.18; 95% CI 1.58 – 3.01; $p < 0.0001$.

Severely ill, elderly patients who underwent surgery for gastrointestinal malignancy are a group of patients particularly in risk for malnutrition. Malnutrition was not related to the type of hospital admission (emergency or elective) or to the gender.

No one of the patients did receive nutritional support at least one week before surgery; no one did receive immunonutrition in perioperative period, as is commonly recommended in recent guidelines.

Effects of malnutrition and cumulated energy balance on the post-operative outcome of gastrointestinal surgical patients with malignancy

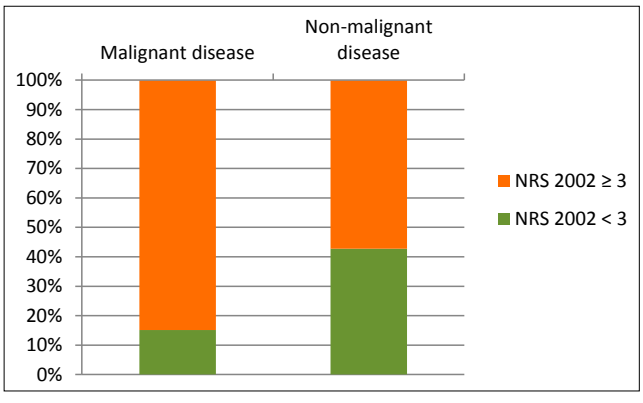

Figure 1. Prevalence of malnutrition according to the presence of malignant disease

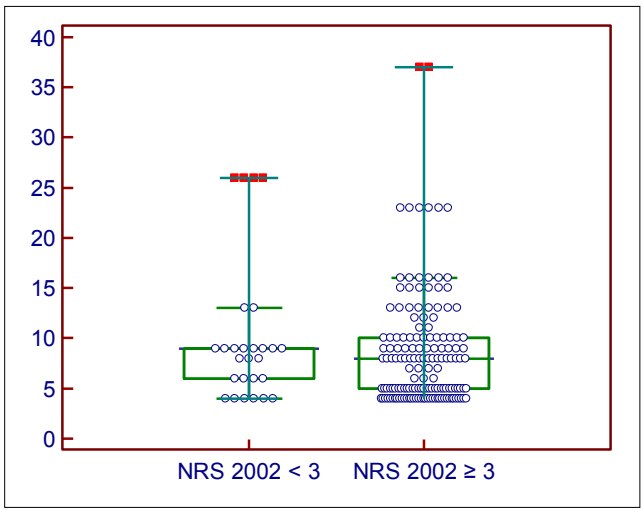

Figure 2. Length of post-operative intensive care stay (ICULOS) according to the nutritional status of surgical patients with malignancy

Malnutrition in gastrointestinal surgical patients with malignancy, as analyzed by a multivariate logistic regression model, is an independent risk factor for higher complications: OR = 6.07, 95% CI: 4.27-8.64, P < 0.0001, higher nosocomial infections: OR = 3.14, 95% CI: 2.13-4.64, P < 0.0001, increased mortality: OR = 2.08, 95% CI : 1.44-2.99 ; P < 0.0001, longer stay in the mechanical ventilation: F = 29.96, P < 0.001 and longer ICU stay F = 24.54, P < 0.001.

All the patients had a negative energy balance at the end of their ICU stay [(- 9062.01) ± (- 4856.17) kcal].

The regression analysis identified cumulated energy deficits during the ICU stay as being independently associated with infectious complications (OR = 2.98, 95% CI: 2.42-3.68, p < 0.0001) and with mortality (OR = 1.43, 95% CI: 1.22-1.69, P < 0.0001. Energy deficit during the ICU stay correlated with ICU length of stay: F = 695.49, P < 0.001; and the length of stay on mechanical ventilation: F = 108.06, P < 0.001. It did not find any association of negative energy balance with the total number of complications (OR = 1.13, 95% CI: 0.97-1.32, p = 0.09).

4. DISCUSSION

Malnutrition is a common problem, affecting a high percentage of cancer patients, it is frequently observed in 60-85% of surgical patients with an upper gastrointestinal cancer (21).

The prevalence of malnutrition in gastrointestinal surgical patients (65.3%) and in gastrointestinal cancer patients (84.9%) admitted to the intensive care unit confirms the severity of this problem in the Albanian clinical settings.

Previously, the presence of cancer was reported as an independent risk factor for malnutrition (22), also in the present study we confirmed this correlation.

Elderly patients admitted to the ICU are an exceptionally vulnerable patient population and age ≥ 65 years is an independent risk factor for malnutrition. Often these patients have several conditions that impede oral intake and impair nutritional status. When coupled with an acute disease process, it is likely elderly patients requiring ICU admission are at exceptional risk for nutritional decline. In a study was found that 23-34% of elderly patients were malnourished at the time of admission to the medical or surgical ICU (23), in the present study the prevalence of malnutrition in the elderly patients was 68.87%. The prevalence of malnutrition in the present study is much higher, perhaps because we considered only surgical patients that stayed more than 24 hours in ICU, not all the patients admitted to the ICU.

Despite improved surgical techniques, post-surgical complications in gastrointestinal patients remain high. Surgery may be associated with complications, such as pain, asthenia, anorexia, and disorders in digestion processes, which interfere with a patient's normal intake patterns (24).

Numerous studies have clearly demonstrated that protein-calorie malnutrition is a significant risk factor of postoperative complications in patients undergoing major abdominal surgery or gastric cancer surgery (25-30). Our results do not differ from the results of other studies in gastrointestinal surgery about complications, including infectious complications (8,31-33).

Many reviews have highlighted the high prevalence of malnutrition in cancer patients and the relation with adverse effects on outcome (9, 34).

Our study supports the data that malnourished patients undergoing surgery have higher rates of morbidity and mortality as well as longer hospital stays compared with adequately nourished patients (31, 35).

Malnutrition is associated with poor tolerance to treatment, decreased quality of life, and increased health care costs (36). Patients with or at risk of malnutrition should receive the most appropriate nutritional support (3,12).

Our study documented low rates of "optimal" use of nutrition support in the surgical patients with malignancy. Furthermore, all the patients that received nutrition support were in negative balance at the end of their stay in the ICU.

Some factors that contributed in the inappropriate nutrition practice in our ICU were underestimation of energy requirements, delay in starting nutrition support and interruptions in parenteral or enteral feeding (37-39). The delayed/no nutrition support in these patients is consequence of depressed gastrointestinal activity during the first days after injury or surgery and the delay of restoration of organ function.

No one of the patients did receive nutritional support at least one week before surgery; no one did receive immunonutrition in perioperative period, as is commonly recommended in recent guidelines (12,40). The present study indicates that the gap between recommended nutrition care and practice regarding it still exists. Some recent studies had shown that infectious are a classical complication of malnutrition and underfeeding (41,42). The present study as other studies (41), confirms that negative energy balance cumulated during inadequate nutrition support was associated with a higher rate of infections, complications, mortality, and longer ICU stay.

5. CONCLUSION

This study shows that malnutrition is still a significant issue in hospitalized patients, it is a significant problem in

surgical patients, especially in patients with malignancy treated in the ICU.

Malnutrition, particularly in gastro-intestinal cancer surgery patients, may cause ongoing energy deficits in the postoperative period, resulting in an increased risk of infectious complications and poorer clinical outcome. Poor nutritional status coupled with delayed and inadequate post-operative nutrition practices are associated with worse clinical outcomes. Our findings suggest the need for implementation of Nutritional Risk Screening and Guidelines for nutrition support in the perioperative period for the patients with GI malignancy.

CONFLICT OF INTEREST: NONE DECLARED

REFERENCES

1. Torosian MH. Perioperative nutrition support for patients undergoing gastrointestinal surgery: critical analysis and recommendations. World J Surg. 1999; 23: 565-569.
2. Beattie AH, Prach AT, Baxter JP, Pennington CR. A randomized controlled trial evaluating the use of enteral nutritional supplements postoperatively in malnourished surgical patients. Gut. 2000; 46: 813-818.
3. Mariette C, De Boton ML, Piessen G. Surgery in esophageal and gastric cancer patients: what is the role for nutrition support in your daily practice? Ann Surg Oncol. 2012; 19: 2128-2134.
4. Senesse P, Assenat E, Schneider S, Chargari C, Magne N, Azria D, Hebuterne X. Nutritional support during oncologic treatment of patients with gastrointestinal cancer: who could benefit? Cancer Treat Rev. 2008; 34: 568-575.
5. McWhirter JP, Pennington CR. The incidence and recognition of malnutrition in hospital. BMJ. 1994; 308: 945-948.
6. Potter JM, Klipstein K, Reilly JJ, Roberts MA. The nutritional status and clinical course of acute admissions to a geriatric unit. Age Ageing. 1995; 24: 131-136.
7. Bozzetti F, Gianotti L, Braga M, Di Carlo V, Mariani L. Postoperative complications in gastrointestinal cancer patients: The joint role of the nutritional status and the nutritional support. Clin Nutr. 2007; 26: 698-709.
8. Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease-related malnutrition. Clin Nutr. 2008; 27(1): 5-15.
9. 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(3): 235-239.
10. Van Cutsem E, Arends J. The causes and consequences of cancer-associated malnutrition. Eur J Oncol Nurs. 2005; 9 suppl 2: S51-63.
11. Kondrup J, Allison SP, Elia M, Vellas B, Plauth M. ESPEN Guidelines for Nutrition Screening 2002. Clinical Nutrition. 2003; 22(4): 415-421.
12. Weimann A, Braga M, Harsanyi L, et al. ESPEN guidelines on enteral nutrition: surgery including organ transplantation. Clin Nutr. 2006; 25: 224-244.
13. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med. 1985; 13(10): 818-829.
14. Kondrup J, Rasmussen HH, Hamberg O, Stanga Z. Nutritional risk screening (NRS 2002): a new method based on an analysis of controlled clinical trials. Clin Nutr. 2003; 22(3): 321-336.
15. Stapleton RD, Jones N, Heyland DK. Feeding critically ill patients: what is the optimal amount of energy? Crit Care Med. 2007; 35: S535-S540.
16. Zauner A, Schneeweiss B, Kneidinger N, Lindner G, Zauner C. Weight-adjusted resting energy expenditure is not constant in critically ill patients. Intensive Care Med. 2006; 32: 428-434.
17. Kreymann KG, Berger MM, Deutz NEP, Hiesmayr M, Jolliet P, Kazandjiev G, et al. ESPEN guidelines on enteral nutrition: intensive care. Clin Nutr. 2006; 25: 210-223.
18. Singer P, Berger MM, Van den Berghe G , Biolo G, Calder Ph, Forbes A, et al. ESPEN Guidelines on Parenteral Nutrition: Intensive care. Clin Nutr. 2009; 28: 387-400.
19. Bone RC, Balk RA, Cerra FB. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee. American College of Chest Physicians/Society of Critical Care Medicine. Chest. 1992; 101: 1644-1655.
20. Vincent JL, de Mendonca A, Cantraine F, Moreno R, Takala J, Suter PM, et al. Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units: results of a multicenter, prospective study. Working group on sepsis-related problems of the European Society of Intensive Care Medicine. Crit Care Med. 1998; 26: 1793-1800.
21. Stratton R. et al. Prevalence of disease-related malnutrition. In: Stratton RJ, Green CJ, Elia M, eds. Disease-related malnutrition: An evidence-based approach to treatment. CABI Publishing, Wallingford, Oxon. 2003: 35-92.
22. Waitzberg DL, Caiaffa WT, Correia MITD. Hospital Malnutrition: The Brazilian National Survey (IBRANUTRI): A study of 4000 patients. Nutrition. 2001; 17: 573-580.
23. Sheean PM, Peterson SJ, Gurka DP, Braunschweig CA. Nutrition assessment: the reproducibility of subjective global assessment in patients requiring mechanical ventilation. Eur J Clin Nutr. 2010; 64(11): 1358-1364.
24. Moore FA. Effects of immune-enhancing diets on infectious morbidity and multiple organ failure. JPEN J Parenter Enteral Nutr. 2001; 25 (Supl 3): S36-42; discussion S42-3.
25. Allison SP. Malnutrition, disease, and outcome. Nutrition 2000; 16: 590-593.
26. Putwatana P, Reodecha P, Sirapongam Y, et al. Nutrition screening tools and the prediction of postoperative infectious and wound complications: comparison of methods in presence of risk adjustment. Nutrition. 2005; 21: 691-697.
27. Sungurtekin H, Sungurtekin U, Balci C, et al. The influence of nutritional status on complications after major intraabdominal surgery. J Am Coll Nutr. 2004; 23: 227-232.
28. Dannhauser A, Van Zyl JM, Nel CJ. Preoperative nutritional status and prognostic nutritional index in patients with benign disease undergoing abdominal operations. J Am Coll Nutr. 1995; 14: 80-90.
29. Gil-Rendo A, Hernandez-Lizoain JL, Martinez-Regueira F, et al. Risk factors related to operative morbidity in patients undergoing gastrectomy for gastric cancer. Clin Transl Oncol. 2006; 8: 354-361.
30. Gibbs J, Cull W, Henderson W, et al. Preoperative serum albumin level as a predictor of operative mortality and morbidity: results from the National VA Surgical Risk Study. Arch Surg. 1999; 134: 36-42.
31. Braga M, Gianotti L, Nespoli L, Radaelli G, Di Carlo V. Nutritional approach in malnourished surgical patients: a prospective randomized study. Arch Surg. 2002; 137(2): 174-180.
32. Mullen JL, Buzby GP, Matthews DC, Smale BF, Rosato EF. Re-

duction of operative morbidity and mortality by combined preoperative and postoperative nutritional support. Ann Surg. 1980; 192(5): 604-613.
33. Senkal M, Zumtobel V, Bauer KH, Marpe B, Wolfram G, Frei A, et al. Outcome and cost-effectiveness of perioperative enteral immunonutrition in patients undergoing elective upper gastrointestinal tract surgery: a prospective randomized study. Arch Surg. 1999; 134(12): 1309-1316.
34. Nitenberg G, Raynard B. Nutritional support of the cancer patient: issues and dilemmas. Critical Reviews in Oncology Hematology. 2000; 34: 137-168.
35. Lim S, Ong K, Chan Y, Loke W, Ferguson M, Daniels L. Malnutrition and its impact on cost of hospitalisation, length of stay, readmission, and 3-year mortality. Clin Nutr. 2012; 31(3): 345-350.
36. van Bokhorst-de van der Schueren MA. Nutritional support strategies for malnourished cancer patients. Eur J Oncol Nurs. 2005; 9(Suppl 2): S74-83.
37. Barr J, Hecht M, Flavin KE, Khorana A, Gould MK. Outcomes in critically ill patients before and after the implementation of an evidence-based nutritional management protocol. Chest. 2004; 125(4): 1446-1457.
38. Kyle UG, Genton L, Heidegger CP, Maisonneuvre N, Karsegard VL, Huber O, et al. Hospitalized mechanically ventilated patients are at higher risk of enteral underfeeding than non-ventilated patients. Clin Nutr. 2006; 25: 727-735.
39. Marshall AP, West SH. Enteral feeding in the critically ill: are nursing practices contributing to hypocalorik feeding? Intensive Crit Care Nurs. 2006; 22: 95-105.
40. Braga M, Ljungqvist O, Soeters P, Fearon K,Weimann A, Bozzetti F. ESPEN guidelines on parenteral nutrition: surgery. Clin Nutr. 2009; 28: 378-386.
41. Villet S, Chiolero R, Bollmann M, Revelly J, Cayeux M, Delarue J, et al. Negative impact of hypocaloric feeding and energy balance on clinical outcome in ICU patients. Clin Nutr. 2005; 24(4): 502-509.
42. Rubinson L, Diette GB, Song X, Brower RG, Krishnan JA. Low caloric intake is associated with nosocomial bloodstream infections in patients in the medical intensive care unit. Crit Care Med. 2004; 32: 350-357.