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Nutritional risk among surgery patients and associations with hospital stay and postoperative complications

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Abstract

Introduction and Objectives: **Nutritional Risk Screening (NRS 2002) is employed to identify nutritional risk in the hospital setting and determine which patients would benefit from nutritional support. The aim of the present study was to identify nutritional risk in patients admitted to the surgery ward and determine possible associations with hospital stay and postoperative complications.**

Methods: **Three hundred fifteen surgery patients were evaluated in the first 24 hours since admission. Evaluations involved the calculation of the body mass index, the determination of weight loss ≥ 5% in the previous six months and the assessment of nutritional risk using the NRS 2002. Hospital stay (in days) and postoperative complications were also recorded.**

Results: **A total of 31.1% of the patients were classified as being "at risk", among whom 98.3% had food intake 50% lower than habitual intake, 65.9% had weight loss ≥ 5% in the previous six months, 64.7% had a diagnosis of neoplasm, 59.9% were aged ≥ 60 years and 59.9% were candidates for non-elective surgery. Postoperative complications were recorded in 4.4% of the overall sample and were more frequent in patients at nutritional risk (p < 0.000). Hospital stay was also longer among the patients at nutritional risk (p < 0.01).**

Conclusion: **A high percentage of surgery patients were at nutritional risk in the present study and associations were found with age ≥ 60 years, a diagnosis of neoplasm, non-elective surgery of the gastrointestinal tract, a reduction in habitual food intake and weight loss. Patients at nutritional risk had a greater frequency of postoperative complications and a longer hospital stay.**

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EL RIESGO NUTRICIONAL EN PACIENTES DE CIRUGÍA Y LAS ASOCIACIONES CON LA ESTANCIA HOSPITALARIA Y LAS COMPLICACIONES POSTOPERATORIAS

Resumen

Introducción y objetivos: **El test de valoración nutricional (NRS 2002) tiene como objetivo detectar la presencia de riesgo nutricional en los hospitales y identificar los pacientes que se beneficiarán de el apoyo nutricional. El objetivo de este estudio fue identificar lo riesgo nutricional y relacionarlo con el tiempo de hospitalización y complicaciones en los pacientes hospitalizados en la Clínica de Cirugía General.**

Métodos: **315 pacientes quirúrgicos fueron evaluados en las primeras 24 horas de ingreso en el hospital, de acuerdo con el índice de masa corporal, la pérdida de peso ≥ 5% en los últimos seis meses y el riesgo nutricional por el NRS 2002. Duración de la estancia hospitalaria, en días, y las complicaciones postoperatorias también se recogieron.**

Resultados: **el 31,1% de los pacientes que se encuentran en situación de riesgo. De éstos, el 98,3% tenían la ingesta de alimentos <50% de lo normal, 65,9% de pérdida de peso ≥ 5% en los últimos 6 meses, el diagnóstico de cáncer en 64,7%, 59,9% con edad ≥ 60 años, y 59,9% candidatos a cirugías no electivas. Las complicaciones fueron documentados en el 4,4% de los pacientes y fueron significativamente más frecuentes en los pacientes con riesgo nutricional (p <0,000). En cuanto a la duración de la hospitalización fue encontrado que los pacientes en riesgo de desnutrición tuvieron estancia hospitalaria más prolongada (p <0,01).**

Conclusión: **En este estudio, un alto porcentaje de pacientes quirúrgicos estaban en riesgo de desnutrición. El riesgo nutricional se asoció con edad ≥ 60 años, el diagnóstico de cáncer, la cirugía no electiva del tracto gastrointestinal, disminución de la ingesta habitual y la pérdida de peso. Los pacientes con riesgo tenían una mayor prevalencia de complicaciones postoperatorias y la duración de la estancia hospitalaria más larga.**

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Palabras clave: *Riesgo nutricional. Valoración nutricional. NRS 2002. Cirugía.*

Abbreviations

NRS 2002: Nutritional Risk Screening

Introduction

Studies carried out around the world indicate that malnutrition is found in 20 to 50% of hospitalized patients, depending on the population studied and method employed to determine nutritional status[1,2,3,4,6,7,9]. The prevalence of malnutrition is apparently higher among surgery patients, with the rate ranging from 35 to 60%[2]. According to data from the Brazilian Hospital Nutritional Assessment Inquiry (2001), the prevalence rate of malnutrition is among hospitalized patients in Brazil is 48.1%, especially among candidates for gastrointestinal surgery[3,4].

The association between preoperative weight loss and postoperative complications is well described in the literature[5]. Malnutrition has consistently been associated with adverse clinical outcomes, slow healing, increases in infection and mortality rates, longer hospital stay, higher hospital costs and higher costs related to rehabilitation before patients can return to their normal activities[2,4]. In the hospital setting, a lack of nutritional screening upon admission, highly restrictive, non-supplemented diets for long periods, missed meals due to clinical procedures and the failure to monitor patient food intake and appetite contribute toward weight loss and malnutrition[6].

Nutritional screening is a simple process administered to patients and family members to determine nutritional risk within the first 72 hours after admission[6,7]. Nutritional Risk Screening (NRS 2002) is employed to detect malnutrition and the risk of developing malnutrition in the hospital setting. The NRS 2002 was developed based on the presupposition that the severity of malnutrition and an increase in nutritional needs stemming from the underlying disease indicate the need for nutritional support[8]. The NRS 2002 has received approval from the European Society for Parenteral and Enteral Nutrition for use in the hospital setting[8,9]. It is easy to administer in daily clinical practice and offers satisfactory reliability and reproducibility[10].

Although not previously employed in prospective studies involving surgery patients, the NRS 2002 has demonstrated satisfactory results in predicting postoperative outcomes[11,12]. According to Gutzniller et al.[13], patients at nutritional risk who are submitted to elective colorectal surgery have higher hospital morbidity and mortality rates. Indeed, nutritional risk is an independent predictor of postoperative complications[14].

The aim of the present study was to identify nutritional risk in patients admitted to the surgery ward and determine possible associations with hospital stay and postoperative complications.

Materials and Methods

Study population

A prospective, cross-sectional study was carried out involving 315 male and female patients aged 18 years or older admitted to the surgery ward of the Federal University of Pernambuco hospital (Brazil) between March and August 2013. The exclusion criteria were pregnancy, lactating mothers, coma, being under palliative care, having undergone chemotherapy/radiotherapy in the previous 12 months, having been hospitalized in the previous six months and an inability to answer the questionnaire or being without an oriented accompanier.

Study model

All data were collected by a single researcher. Nutritional risk was always determined within the first 24 hours after hospital admission as well as prior to surgery. This study received approval from the Human Research Ethics Committee of the Center for Health Science of the Federal University of Pernambuco (Brazil). All patients signed a statement of informed consent.

Nutritional status

Weight and height were determined using a scale with a stadiometer (Filizola®; capacity: 150 Kg; precision: 0.1 Kg) for the calculation of the body mass index (BMI). The criteria of the World Health Organization for adults and elderly individuals were used for the classification: < 18.5 Kg/m^2 = malnutrition; 18.5 to 24.9 Kg/m^2 = ideal range; 25 to 29.9 Kg/m^2 = overweight; and ≥ 30 Kg/m^2 = obesity[15].

The percentage of weight loss in the previous six months was calculated. Weight loss greater than 5% was classified as clinically significant and suggestive of malnutrition or nutritional risk[16].

Assessment of nutritional risk

The NRS 2002 was used for the determination of nutritional risk. This questionnaire is divided into two steps:

- 1st step (initial screening): Four items addressing BMI, weight loss in the previous three months, food intake and stress stemming from the underlying health condition;
- 2nd step (final screening): Items addressing nutritional status and severity of the underlying health condition (only used if one of the answers in the 1st step was affirmative).

The final NRS 2002 score ranges from 0 to 6 points. Age > 70 years was considered an additional risk factor. Thus, 1 point was added to the final score in such cases. The cutoff point for the diagnosis of nutritional risk was ≥ 3 points[8].

Hospital stay and postoperative complications

Hospital stay was recorded in days from admission to discharge. Postoperative complications were monitored daily and recorded on the patient charts.

Statistical analysis

The SPSS version 20 (SPSS Inc, Chicago, USA) was used for the statistical analysis. Bivariate analysis involved the chi-square test and the calculation of prevalence ratios with respective 95% confidence intervals. Categorical variables were expressed as number of patients and percentage values. The Kolmogorov-Smirnov test was used to determine the distribution of the data. Continuous variables with normal distribution were expressed as mean and standard deviation values, whereas those with non-normal distribution were expressed as median and interquartile intervals. The chi-square test and Mann-Whitney U test were used for the comparisons. Non-parametric tests were employed when appropriate. Spearman's correlation coefficients were calculated to determine the strength of the correlation between median hospital stay and nutritional risk. A p-value < 0.05 was considered statistically significant.

Results

Three hundred fifteen patients were analyzed. Mean age was 51.1 ± 15.37 years. BMI ranged from 14 to 38.4 Kg/m² (median: 25.7 Kg/m². Median weight loss was 5 Kg (range: 5 to 46 Kg).

A total of 54.9% were submitted to elective surgery, among whom 50.3% underwent hernioplasty, 46.3% underwent cholecystectomy and 4.4% underwent hemorrhoidectomy. A total of 45.1% were submitted to non-elective surgery of the gastrointestinal tract, among whom 27.2% underwent gastrectomy, 19.1% underwent enterectomy, 14.1% underwent esophagectomy, 10.7% underwent laparotomy, 9.9% underwent cephalic gastroduodenopancreatectomy, 9.9% underwent pancreatectomy and 9.1% hepatectomy (table I). Most of these cases were due to tumors (table I).

A total of 31.1% of the patients were classified as being "at risk", among whom 98.3% had food intake 50% lower than habitual intake, 65.9% had weight loss ≥ 5% in the previous six months, 64.7% had a diagnosis of neoplasm, 59.9% were aged ≥ 60 years and 59.9% were candidates for non-elective surgery

Table I
Characterization of sample according to demographic, anthropometric and clinical characteristics and clinical variables

Variables	*N*	*%*	*$CI_{95\%}$**
Gender			
Female	165	52.4%	46.7 - 57.9
Male	150	47.6%	42.0 - 53.2
Age			
< 60 years	214	67.9%	62.4 - 73
≥ 60 years	101	32.1%	27.0 - 37.5
Surgery			
Elective	173	54 .9%	49.24 - 60.48
Non-elective	142	45.1%	39.52 - 50.76
Neoplasm			
Present	105	33.3%	28.21 - 38.88
Absent	210	66.7%	39.52 - 50.76
BMI†			
Malnourished	40	12.7%	9.33 -17.01
Ideal range	121	38.4%	33.06 - 44.05
Overweight	87	27.6%	22.83 - 32.97
Obesity	67	21.3%	16.97 - 26 .29
Weight loss			
Present	127	40.3%	34.9 - 45.98
Absent	188	59.7%	54.02 - 65.1
Nutritional risk			
Present	98	31.1%	26.1- 36.59
Absent	217	68.9%	63.41- 73.9

*CI: confidence interval; † BMI: body mas s index

(table II). Most patients at nutritional risk were classified as being within the ideal BMI range (p = 0.000) (table III).

An association was found between the incidence of nutritional risk and neoplasm. A significantly greater number of patients hospitalized for cancer surgery were at nutritional risk (69.4%) table II displays the absolute data. The mean NRS 2002 score was 5 points for patients with cancer and 2 points for the remaining patients (p = 0.01).

Complications were documented in 4.4% of the patients, among whom 35.7% had infections, 21.5% had ileus, 21.5% had gastrointestinal hemorrhage, 7.1% had pancreatitis, 7.1% had pulmonary embolism and 7.1% died. Postoperative complications were significantly more frequent among the patients at nutritional risk (71.4%) (p < 0.00).

In the overall sample, median hospital stay was two days (range: 1 to 42 days). Median hospital stay

Table II
Association between nutritional risk and demographic, anthropometric

Variables	Nutritional risk					
	Present		Absent		PR*	CI95%†	p-value‡
	n	%	n	%			
Gender							
Female	48	(29.1%)	117	(70.9%)	0.87	0.62-1.21	0.417
Male	50	(33.3%)	100	(66.7%)	1.00		
Age							
< 60 years	57	(26.6%)	157	(73.4%)	1.00	2.01-3.36	<0.000**
≥ 60 years	70	(69.3%)	31	(30.7%)	2.6		
Neoplasm							
Yes	68	(64.7%)	37	(35.3%)	4.5	3.16-6.49	<0.000**
No	30	(14.2%)	180	(85.8%)	1.00		
Type of surgery							
Elective	13	(7.5%)	160	(92 .5%)	1.00	1.07-1.21	<0.000**
Non-elective	85	(50.8%)	57	(40.1%)	1.2		
Weight loss							
≥ 5%	62	(65.9%)	32	(34.1%)	5.05	3.3-7.7	<0.000**
< 5%	21	(13.1%)	140	(86.9%)	1.00		
Food intake							
< 50%	57	(98.3%)	1	(1.7%)	6.16	4.64-8.17	<0.000**
≥ 50%	41	(15.9%)	216	(84.1%)	1.00		
Complications							
Yes	10	(71.4%)	4	(5.6%)	2.44	1.67-3.55	<0.000**
No	88	(29.3%)	213	(70.7%)	1.00		

*PR: prevalence ratio; †CI: confidence interval; ‡chi-square test; **statistically significant.

was one day (range: 1 to 8 days) among patients not at nutritional risk and 5.5 days (range: 2 to 42) among those at nutritional risk ($p < 0.01$). A strong correlation was found between hospital stay and nutritional risk (Spearman's correlation coefficient: 0.85 (figure 1).

Discussion

In the present study, nutritional risk was found in 31.1% of surgery patients evaluated upon admission using the NRS 2002, which is similar to prevalence rates reported in the literature[6,17,18,19]. Studies carried out at hospitals around the world report various rates of malnutrition and nutritional risk upon admission[17,19]. A study involving three hospitals in Denmark reports that approximately 20% of individuals in the surgery ward were at nutritional risk upon admission, as determined using the NRS 2002[20]. In a multinational study carried out in 12 European countries and involving 5051 patients, the rate of nutritional risk was 32.6%, which is similar to the rate reported herein[9]. In a study involving the evaluation of 500 individuals at hospitals in Beijing (China) using the NRS 2002, the prevalence of nutritional risk was 51%[21]. The literature reports rates ranging from 13% to 100%, which demonstrates the heterogeneity of populations of patients in different regions and submitted to various types of specialized treatment[20].

There is consensus in the literature that the nutritional status of hospitalized patients is influenced by different factors, including the diagnosis upon admission. This is particularly true for adverse health conditions of the gastrointestinal tract, which alter the metabolic rate[4]. Moreover, such patients often experience nausea, vomiting, diarrhea and dysphagia, with consequent reductions in food intake, digestion and the absorption of nutrients[22]. Almeida et al.[2] evaluated 300 surgery patients using the NRS 2002 and found that 58% of candidates for gastrointestinal surgery were at risk. This is in agreement with the findings of the present study, in which the prevalence rate in this pop-

Table III
Association between BMI classification and nutritional risk

*BMI classification**	*Nutritional risk*		*Total*	*p-value†*
	Present	*Absent*		
Malnourished	29 (67.5%)	14 (32.5%)	43 (13.6%)	
Ideal range	49 (39.5%)	75 (60.5%)	124 (39.4%)	0.000**
Overweight	13 (15.6%)	70 (84.4%)	83 (26.3%)	
Obesity	12 (18.4%)	53 (81.6%)	65 (20.7%)	

*BMI: body mass index; †chi-square test; **statistically significan!

ulation was 59.8%. Correia et al. (2001)[4] report similar data among a group of 374 surgery patients with gastrointestinal conditions, 60.2% of whom were at nutritional risk.

Evaluating nutritional risk among 1086 surgery patients, Jie et al.[19] found that a reduction in habitual food intake in the week prior to admission was the most sensitive indicator for identifying individuals in need of nutritional support. Silva et al.[6] found that 58.9% of clinical patients who reported food intake < 50% of habitual intake in the previous week were at nutritional risk. In the present study, 98.3% of individuals who reported food intake < 50% of habitual intake were at nutritional risk ($p < 0.000$).

Nutritional risk and malnutrition are more common in patients with cancer[23]. In the present study, nutritional risk was found in 69.4% of cancer patients. This figure is higher than the rates reported by Schiesser et al.[23] (40%) and Almeida et al.[2] (37%) among cancer patients scheduled for surgery.

Age is another aspect that exerts an influence on nutritional status, as elderly individuals exhibit a number of factors besides disease that affect nutrition, such as a diminished production gastrointestinal secretions, deficient dentition, social isolation and psychological disorders, such as depression[24,25,26]. At the same hospital ward studied herein, Silva et al. (2010)[6] detected nutritional risk in 51.3% of elderly male and female patients using the NRS 2002. This is lower than the rate reported in the present investigation, in which 69.3% of patients aged 60 years or older were at nutritional risk ($p < 0.000$).

Most of the patients at nutritional risk had a BMI within the ideal range. As the NRS 2002 addresses oth-

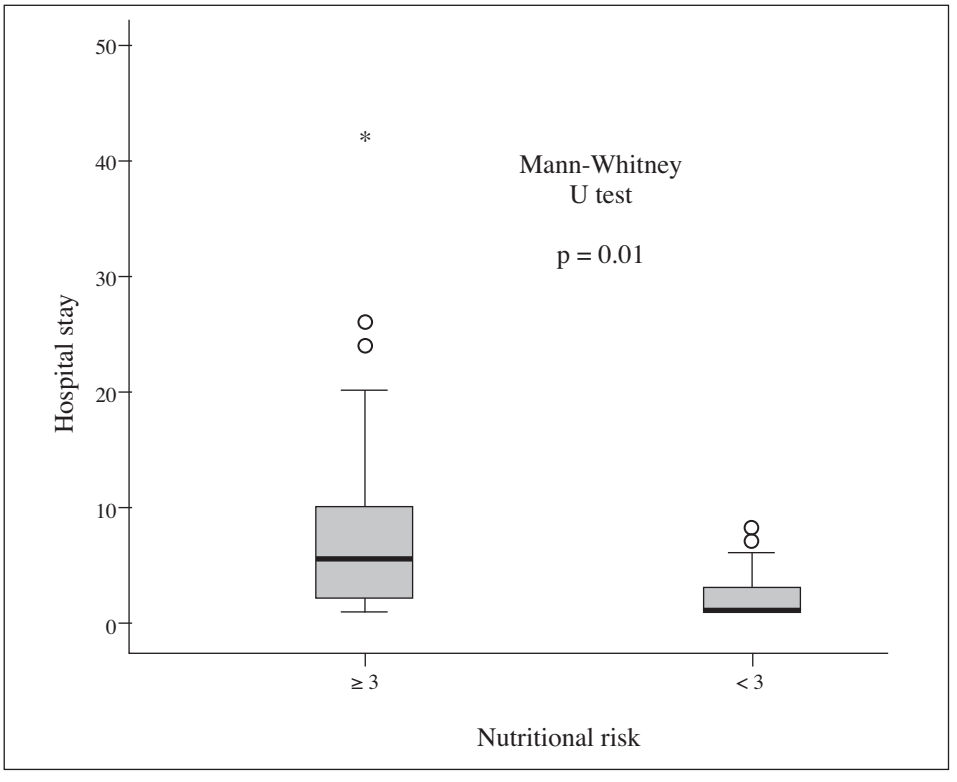

Fig. 1.—Correlation between nutritional risk and hospital stay.
Boxplots: median and interquartile interval using cutoff of 3 points on NRS 2002 for diagnosis of nutritioual risk.

er nutritional parameters in conjunction with the underlying health condition, individuals within the ideal BMI range can exhibit other nutritional alterations, such as weight loss and/or diminished food intake, or may have a disease that affects their nutritional needs and are therefore classified as being at nutritional risk.

Weight loss ≥ 5% in the previous six months proved to be an effective screening variable for the identification of patients at nutritional risk. There is evidence that unintentional weight loss of 5 to 10% can have a negative impact on physiological functions[2]. In a study involving the diagnosis of nutritional risk in 300 surgery patients using the NRS 2002, weight loss ≥ 5% alone proved to be a reliable nutritional variable with higher sensitivity and specificity in comparison to the NRS 2002[2].

Patients at nutritional risk had a longer hospital stay in comparison to those not at risk ($p < 0.000$). Similar findings are described in a multi-center study carried out at 26 hospitals in Turkey, in which 32.6% of patients were at nutritional risk based on the NRS 2002 and had more complications, a longer hospital stay and a higher mortality rate in comparison to patients not at risk[20]. Schiesser et al.[23] found also a significant association with median hospital stay, which was 10 days among patients at nutritional risk in comparison to four days among patients not at risk[23]. Moreover, a longer hospital stay increases the odds of the deterioration of one's nutritional status[4].

Levine et al.[27] found that 45% of patients diagnosed with malnutrition upon admission had more postoperative complications and a longer hospital stay in comparison to those not at risk. Likewise, Reilly et al.[28] found that malnourished patients had more severe postoperative complications in comparison to those with an adequate nutritional status[3]. In the present study, nutritional status was associated with the incidence of postoperative complications. Among the overall sample, 4.4% experienced complications and 71.4% of these patients were at nutritional risk ($p < 0.00$). However, high rates of postoperative complications and mortality cannot be attributed exclusively to malnutrition. The type and extent of surgery, blood transfusions, experience of the medical team and type of anesthesia also play important roles in postoperative events[22,29,30]. Studies have shown that blood loss during surgery is the most important factor associated with the development of postoperative complications[4]. Thus, the influence of other variables can hinder the demonstration of statistical significance regarding the association between malnutrition and postoperative complications.

The present study has limitations that should be addressed. The use of the NRS 2002 alone does not provide detailed information on co-morbidities, events occurring during surgery or anesthetic care, which can influence the incidence of postoperative complications.

In the present study, a high percentage of surgery patients were at nutritional risk, which is similar to findings described in the literature. Nutritional risk was associated with age ≥ 60 years, a diagnosis of neoplasm, non-elective surgery of the gastrointestinal tract, a reduction in habitual food intake and weight loss. Patients at nutritional risk had a greater frequency of postoperative complications and a longer hospital stay. These findings underscore the importance of nutritional screening in the first 24 hours after admission, which can substantially contribute to the prevention of malnutrition and/or the maintenance of adequate nutrition, with consequent reductions in both postoperative complications and hospital costs.

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