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Relationship between nutritional status and immediate complications in patients undergoing colorectal surgery

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ABSTRACT

Introduction: several complications may occur during colorectal surgical procedures and factors, such as nutritional status, substantially contribute to this problem.
Objective: evaluate the relationship between nutritional status (determined by different tools) and the emergence of early postoperative complications, as well as analyze social parameters, lifestyle, food intake, and time to diet reintroduction.
Methods: case series study conducted in the surgical proctologic ward of the Hospital Barão de Lucena, Recife, Pernambuco, with individuals of both sexes diagnosed with colorectal cancer who underwent a surgical procedure involving at least one anastomosis. Social, demographic and clinical data, life style, dietary intake, nutritional status, and the immediate postsurgical complications were evaluated.
Results: among the 31 patients studied, there was a higher prevalence of females (74.2%), mean age of 61.9 ± 12.4 years old, and the rectum was the primary site of cancer in 54.8%. Most patients came from the countryside, were retirees, had lower education, consumed too much red meat, processed meats, and fats, with low consumption of fruits and vegetables, and were sedentary. Regarding nutritional status, nutritional risk was found in 58.1%, mean BMI of 25.7 ± 6.8 kg/m², and 54.8% had significant weight loss. Additionally, 38.7% had some of the immediate complications, particularly paralytic ileus and abdominal distension. There was a delay in the onset of renourishment, and there was no association between nutritional status and immediate complications.
Conclusion: colorectal cancer is closely related to eating habits and lifestyle. Patients with this malignancy have a marked weight loss; however, in this study, we found no association between nutritional status and the incidence of postoperative complications.

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Relação entre o estado nutricional e as complicações imediatas em pacientes submetidos a cirurgias colorretais

Palavras-chave:
Estado nutricional
Avaliação nutricional
Câncer colorretal
Complicações pós-operatórias
Cirurgia colorretal

RESUMO

Introdução: intervenções cirúrgicas colorretais estão sujeitas a diversas complicações e vários fatores, como o estado nutricional, contribuem substancialmente para essa problemática.
Objetivo: avaliar a relação do estado nutricional, determinado por diferentes ferramentas, com o surgimento de complicações pós-operatórias imediatas, bem como a análise de parâmetros sociais, estilo de vida, consumo alimentar e tempo de reintrodução à dieta.
Métodos: estudo de série de casos, conduzido na enfermaria de cirurgia proctológica do Hospital Barão de Lucena, Recife, Pernambuco, com indivíduos de ambos os sexos diagnosticados com câncer colorretal e que foram submetidos a procedimento cirúrgico envolvendo pelo menos uma anastomose. Foram avaliadas as condições sociais, demográficas, clínicas, o estilo de vida, o consumo alimentar, o estado nutricional e as complicações imediatas pós-cirúrgicas.
Resultados: dos 31 pacientes estudados, houve uma maior prevalência do sexo feminino (74,2%), média de idade de 61,9 ±12,4 anos e 54,8% apresentaram o reto como localização primária do câncer. A maioria eram procedentes do interior do estado, aposentados, baixa escolaridade e apresentaram demasiada ingestão de carnes vermelhas, embutidos e gorduras e um menor consumo de frutas e verduras e eram sedentários. Quanto ao estado nutricional, foi encontrado um risco nutricional de 58,1%, IMC médio de 25,7 ±6,8 kg/m² e 54,8% apresentaram perda ponderal significativa. Além disso, 38,7% apresentaram alguma das complicações imediatas, sendo as mais frequentes o íleo paralítico e a distensão abdominal. Houve retardo no início da realimentação e não houve associação entre o estado nutricional e as complicações imediatas.
Conclusão: o surgimento do câncer colorretal está bem relacionado com os hábitos alimentares e o estilo de vida. Pacientes com essa neoplasia apresentam uma acentuada perda ponderal, entretanto, nesse estudo, não houve associação entre o estado nutricional e a incidência de complicações pós-operatórias.

Introduction

Colorectal cancer (CRC) is the third most common cancer in the world male population and second in the female population, with increasing incidence and mortality in different countries.[1] In Brazil, the increasing incidence ranks third, excluding non-melanoma skin cancer.[2]

The development of several common forms of cancer is a result of the interaction between environmental and endogenous factors. Among the endogenous factors, the most relevant are family history of CRC and genetic predisposition to the development of chronic intestinal diseases.[2] Studies have shown that the lifestyle contribution to the emergence of disease is more common, with only 25% of patients reporting a family history. Genetic syndromes are responsible for 5% to 6% of cases.[3] As for environmental factors, the most notable is the diet (INCA, 2002), which plays an important role in the etiology of this cancer.[3] Research has shown that a diet with high consumption of fruits, vegetables, cereals and fish, as well as physical activity, are associated with low risk of developing cancer.[2] On the other hand, excessive consumption of red meat, processed meats and alcohol, smoking habit and obesity or overweight favor its ocurrence.[4]

Surgical complications of colorectal diseases involving resection and anastomosis are common and often serious,[5] mainly occurring while the patient is still in hospital.[6] They can be divided into intraoperative and postoperative complications. The main postoperative complications include wound infection, anastomotic dehiscence, paralytic ileus, and bleeding.[6] Malnutrition is among the preoperative factors favoring the emergence of anastomotic dehiscence.[7] Diabetes mellitus, chronic alcoholism, obesity, use of drains, and duration of surgery are among the risk factors that favor such problems.[5]

Malnutrition and weight loss are recurrent problems in patients with neoplastic disease, whose intensity is variable, as it depends on the location and type of cancer.[8] The Brazilian National Survey on Hospital Malnutrition (IBRANUTRI) revealed that almost half (48.1%) of the patients admitted to the public health hospitals showed some degree of malnutrition.[9] In two other Spanish studies, the prevalence of in-hospital malnutrition ranged from 23.7% to 46.9%.[10,11] In surgical patients, the reality is similar. Recent studies have shown that the prevalence of malnutrition is between 30% and 50%.[12]

It is known that malnutrition predisposes to a variety of post-operative complications (compared to healthy individuals), such as delayed wound healing, increased infection, morbidity and mortality. Consequently, malnutrition leads to longer hospital stays and increased costs.[9,13] Therefore, the

nutritional status assessment of patients undergoing surgical procedures is of utmost importance because its determination contributes to early nutritional intervention, minimizing perioperative complications.[13]

Accordingly, the aim of this study was to compare the nutritional status (EN) diagnosed by different tools with immediate complications in patients undergoing colorectal surgery involving at least one anastomosis.

Methods

Prospective, case series study, conducted at Hospital Barão de Lucena, SUS-PE, in the period from June to October 2012, involving 31 patients aged over 19 years old, of both genders, admitted for major colorectal surgery involving at least one anastomosis.

Exclusion criteria were patients unable to provide information and who were unaccompanied, pregnant women, patients with edema or ascites, amputees, and those with neurological and/or ostomized before the evaluated surgical procedure.

The study was approved by the Human Research Ethics Committee under the register SISNEP 61993.

Data collection was performed up to 48 hours after admission. Patients underwent screening for nutritional risk using the Nutritional Risk Screening (NRS), 2002, and nutritional assessment of the following parameters: classical anthropometry and adductor pollicis muscle thickness (APMT), subjective global assessment (SGA), and laboratory parameters (serum albumin and hemoglobin). An assessment of food consumption, clinical, social, and lifestyle was also performed.

Anthropometric measurements consisted of current and usual weight, height, body mass index (BMI) [weight in kg/height in square meters], percentage of weight loss (%WL), triceps skinfold (TSF), arm circumference (AC), arm muscle circumference (AMC), and APMT. Measurements of weight and height were made according to the original technique recommended by Lohman et al.[14] Patients were weighed on a platform scale (FILIZOLA™), with 150 kg capacity and 100 gram accuracy. Height was measured by stadiometer attached to the scale, with 1.90 m capacity and 5 mm variation. BMI was assessed using the classification criteria of the World Health Organization[15] for adults and according to the Pan American Health Organization[16] classification for seniors. For the evaluation of %WL, the patient was considered in the cachectic stage when there was unintentional weight loss ≥ 5% in the last 6 months or BMI < 20 kg/m² combined with a continued loss of weight ≥ 2% .[17-19] AC , TSF, and AMC were registered, calculated, and interpreted in accordance with the literature and age.[14,20-23] For age ≥ 60 years old, we used the 50th percentile for age and sex of specific tables.[23] APMT was performed in the dominant hand, according to the technique already described in other studies.[12] Arithmetic average of three measurements was recorded, and the cut-off point used was > 13.4 mm, representing eutrophic.[12]

Patients were classified by SGA[24,25] according to three criteria: well nourished (SGA-A), moderately malnourished (SGA-B), and severely malnourished (SGA-C). However, later, for statistical analysis purpose, patients classified as SGA-B and SGA-C were grouped into the malnourished criterion.

Upon admission, serum albumin and hemoglobin were measured. The cut-off points used for serum albumin were > 3.5 g/dL for normal, 3.5 to 2.4 g/dL for mild to moderate depletion, and < 2.4 g/dL for severe depletion.[26] For hemoglobin, the normal values according to gender were > 13.0 g/dL for male and > 12 g/dL for female.[27]

The clinical variables assessed were histopathological grade, tumor location, use of neoadjuvant therapy, type of surgery, and immediate complications. We also recorded the surgery duration (hours), start of liquid diet (hours), beginning of bland diet (days), and hospital stay (days). The social profile was identified by means of the search criteria of the 2010 IBGE Census, noting aspects such as age, location, occupation, and education. To determine the practice of regular physical activity, we considered the time of at least thirty minutes a day and minimum of three times per week.[28] Alcohol consumption was categorized as never, socially, or daily. Regarding smoking habit, patients were divided into non-smokers, ex-smokers, and smokers.

Food consumption was identified using a food frequency questionnaire (FFQ), adapted from a validated questionnaire for patients with CRC.[30] For consumption classification, we used the Food Guide for the Brazilian Population (*Guia Alimentar para a População Brasileira*, 2006).[31]

Immediate complications were recorded in medical records during hospitalization and up to a maximum of 8 days after surgery, if the patient remained hospitalized. All complications experienced by patients during the established period were recorded.

The database was built using Microsoft Office Excel 2007®. For statistical analyzes, the Statistical Package for Social Sciences® (SPSS) version 13.0 for Windows (USA, 1990) was used. All tests were applied with 95% confidence. To verify the existence of association, chi-square test and Fisher's exact test for categorical variables were used.

The results are presented below in tables and in the text, with their respective absolute and relative frequencies.

Results

Thirty-one patients were evaluated, with a prevalence of 74.2% female (n = 23). The average age of the sample was 61.9 ± 12.4 years old (37-85 range).

The qualitative variables related to the origin, social characteristics, lifestyle, and comorbidities are presented in Table 1. In general, the patients were from within the state of Pernambuco (PE), retirees, and had low education. When questioned about the presence of comorbidities, 54.9% of them responded that they had no comorbidities. Regarding lifestyle, less than one third of them reported consuming alcohol socially and smoking at least once a week or daily. Furthermore, when asked about the regular practice of physical activity, 93.5% reported no regular physical activity.

Table 2 shows that the eating habits before the disease process showed a high consumption of red meats, processed meats, and fats and lower consumption of fruits and vegetables. In the sample studied, it was found that 100% of patients reported consuming no whole grain products.

Table 1 – Socio-demographic and clinical characteristics and lifestyle of patients with colorectal cancer treated at the Hospital Barão de Lucena, PE, in the period from June to October 2012.

Variables	n	%
Origin[a]		
Recife	8	27.6
Metropolitan Region of Recife	5	17.2
Countryside	16	55.2
Occupation		
Active	11	35.5
Unemployed or housewives	5	16.1
Retired	15	48.4
Education		
Illiterate	7	22.6
First degree	17	54.8
High school	6	19.4
Third degree	1	3.2
Comorbidities		
DM	1	3.2
HAS	9	29.0
DM e HBP	4	12.9
No comorbidities	17	54.9
Alcohol consumption		
Never	24	77.4
Socially	7	22.6
Smoking		
Never	16	51.6
Ex-smoker	10	32.3
Smoker	5	16.1
Physical activity		
Yes	2	6.5
No	29	93.5

DM, diabetes mellitus; HBP, high blood pressure.
[a] Statistics conducted with 29 patients.

Table 2 – Dietary intake of patients with colorectal cancer treated at Hospital Barão de Lucena from June to October 2012.

Variables	n	%
Read meat		
Two or more times/day	3	9.7
Once/day	7	22.6
One to three/week	10	32.3
Four to six/ week	11	35.4
Once a month	0	0.0
Never	0	0.0
Processed meats		
Two or more times/day	1	3.2
Once/day	2	6.5
One to three times a week	9	29.0
Four to six/ week	1	3.2
Once a month	3	9.7
Never	15	48.4
Fried food		
Two or more times/day	4	12.9
Once/day	5	16.1
One to three times/week	6	19.4
Four to six times/week	15	48.4
Once a month	1	3.2
Never	0	0.0
Vegetables		
Two or more times/day	5	16.1
Once/day	9	29.0
One to three times/week	12	38.7
Four to six times/week	3	9.7
Once a month	0	0.0
Never	2	6.5
Fruits		
Two or more times/day	6	19.4
Once/day	12	38.7
One to three times/week	9	29.0
Four to six times/week	1	3.2
Once a month	0	0.0
Never	3	9.7

In our sample, the mean surgical duration was 3.9 ± 1.3 hours and the mean hospital stay was 11.6 ± 8.6 days. Time to restart the diet after surgery was 39.7 ± 47.3 hours and to achieve consistency bland diet was 6.8 ± 8.4 days.

Independent analysis showed that the variables length of hospital stay (p = 0.005) and time to reach the bland diet (p = 0.001) had a difference statistically significant, which was higher in the group of patients who developed some of the complications analyzed. The length of hospital stay and time to start the bland diet for patients with complications were 18.4 ± 10.8 and 10.9 ± 12.8 days, respectively. As for those who had no complications, hospital stay was 7.3 ± 1.6 days and time to start the bland diet was 4.2 ± 0.8 days.

Table 3 shows information on the histopathological grading, site of cancer, use of neoadjuvant therapy, surgery performed, presence and type of complication. In the study sample, there was a higher incidence of neoplasms with histopathological grading moderately differentiated and rectum as the primary site of involvement. Thus, the most common surgical procedures were those involving the rectal portion. Most patients (61.3%) had no complications. Among those who had complications, the most frequent were paralytic ileus and abdominal distension, with 25% of the individuals for each complication.

The results of variables related to patient's nutritional status and divided by age group are shown in Table 4. After statistical analyzes in both age groups, there was a difference statistically significant only in the variables NRS and APMT, with patients aged over 60 showing higher nutritional risk (p = 0.001) and malnutrition (p = 0.003). The total sample had a higher prevalence of eutrophy and overweight/obesity when classified according to BMI, AMC, serum albumin measurement, and SGA. However, there was a significant incidence of %WL and malnutrition according to the anthropometric measurements AC, TSF, and APMT. We also found a high percentage of anemia in patients evaluated.

Table 5 shows that there was no statistically significant association between the variables used to determine nutritional status and immediate postoperative complications during the hospital stay.

Discussion

In this series, the average age of 61.9 ± 12.4 years old and the highest incidence of CRC in females were comparable to those reported in the literature.[8,32-36] However, other studies have shown a higher percentage of CRC in men.[7,32,37] This finding in ours study is probably because women are more likely to seek preventative health care. Another plausible explanation

Table 3 – Characteristics of the sample according to histopathologic grading, site of cancer, use of neoadjuvant therapy, type of surgery, presence and type of complication occurring in the period from June to October 2012 in the Hospital Barão de Lucena, PE.

Variables	n	%
Histopathologic grading		
Degree of differentiation could not be evaluated	1	3.2
Well differentiated	13	41.9
Moderately differentiated	14	45.2
Poorly differentiated	3	9.7
Site of cancer		
Colon	9	29.0
Rectum	17	54.8
Colon and rectum	5	16.1
Use of neoadjuvant therapy		
Yes	12	38.7
No	19	61.3
Type of Surgery		
Total colectomy	1	3.2
Partial colectomy	9	29.0
Retossigmoidectomy	9	29.0
APR	9	29.0
RAR	3	9.8
Complication		
Yes	12	38.7
No	19	61.3
Occurred complications		
Intestinal obstruction	1	8.3
Tachycardia	1	8.3
Wound infection	2	16.7
Paralytic ileus	3	25.0
Abdominal distention	3	25.0
Pulmonary	2	16.7

APR, abdominoperineal resection; RAR, rectal anterior resection.

Table 4 – Distribution of nutritional parameters according to age group at the Hospital Barão de Lucena, PE, from June to October 2012.

Varibles	Total n (%)	Age		p
		< 60 n (%)	≥ 60 n (%)	
NRS				
Without risk	13 (41.9)	11 (84.6)	2 (11.1)	< 0.001[a]
With risk	18 (58.1)	2 (15.4)	16 (88.9)	
BMI				
Malnutrition	7 (22.6)	1 (7.6)	6 (33.3)	0.248[b]
Eutrophic	12 (38.7)	6 (46.2)	6 (33.3)	
Overweight and obesity	12 (38.7)	6 (46.2)	6 (33.3)	
% WL				
Yes	17 (54.8)	5 (38.5)	12 (66.7)	0.233[a]
No	14 (45.2)	8 (61.5)	6 (33.3)	
AC				
Malnutrition	17 (54.8)	9 (69.2)	8 (44.4)	0.237[b]
Eutrophic	11 (35.5)	4 (30.8)	7 (38.9)	
Overweight and obesity	3 (9.7)	0 (0.0)	3 (16.7)	
TSF				
Malnutrition	23 (74.2)	9 (69.2)	14 (77.8)	0.834[b]
Eutrophic	5 (16.1)	3 (23.1)	2 (11.1)	
Overweight and obesity	3 (9.7)	1 (7.7)	2 (11.1)	
AMC				
Malnutrition	11 (35.5)	4 (33.3)	7 (36.8)	1.000[b]
Eutrophic	20 (64.5)	8 (66.7)	12 (63.2)	
APMT				
Malnutrition	18 (58.1)	3 (23.1)	15 (83.3)	0.003[a]
Eutrophic	13 (41.9)	10 (76.9)	3 (16.7)	
SGA				
Malnutrition	6 (19.4)	1 (7.7)	5 (27.8)	0.359[b]
Eutrophic	25 (80.6)	12 (92.3)	13 (72.2)	
Albumin				
Normal	21 (72.5)	9 (75.0)	12 (70.6)	1.000[b]
Mild to moderate depletion	7 (24.1)	3 (25.0)	4 (23.5)	
Severe depletion	1 (3.4)	0 (0.0)	1 (5.9)	
Hemoglobin				
With anemia	21 (67.7)	8 (61.5)	13 (72.2)	0.701[b]
Without anemia	10 (32.3)	5 (38.5)	5 (27.8)	

NRS, nutritional risk screening; BMI, body mass index; WL, percentage weight loss; AC, arm circumference; TSF, triceps skinfold; AMC, arm muscle circumference; APMT, adductor pollicis muscle thickness; SGA , subjective global assessment.
[a] Chi-square.
[b] Fisher's exact test.

is the fact that estrogen hormones act as protectors to the onset of CRC. However, this protection is lost in postmenopausal women not taking hormone replacement therapy.[33,38]

Most of the study population was derived from the countryside and had a lower educational level. These data were expected because the hospital in which the survey was conducted integrates the Brazilian Unified Health System (SUS) and is a reference to colorectal surgeries. Additionally, these data corroborate the findings in the literature, which indicate in different countries, the presence of chronic morbidity in segments of lower education.[39] Regarding the increased number of retirees, our data are a reflection of the average age verified, as the incidence of this type of disease increases with age, affecting mainly the sixth and seventh decade of life.[2]

Different studies showed that a high rate of physical inactivity, overweight/obesity and/or inadequate diets are related to the onset of CRC, corroborating the present study,[37,38,40] as the example of Arafa et al.[37] in a case-control study of 220 patients with CRC who found that 81.8% of patients were sedentary. The regular practice of physical activity has been demonstrated as a measure of primary prevention for this malignancy and probably there is a concomitant effect between physical inactivity, high energy consumption, and obesity with the incident of CRC.[40] WCRF and AICR[4] found that an increase of 5 kg/m² in BMI indicates a 15% risk of developing cancer, particularly CRC.[4] This fact occurs because the accumulation of body fat directly affects the levels of many circulating hormones, such as insulin, and produces pro-inflammatory factors, circulating tumor necrosis factor (TNF), interleukin (IL-6), C-reactive protein (CRP), and leptin. Thus, this chronic inflammation may promote the development of a cancer.[4] Rouillier et al.,[41] in a case-control study of dietary patterns and adenoma-carcinoma sequence of CRC, also concluded that a diet rich in energy causes a deleterious effect.

Recent meta-analyzes established strong evidence between diet and development of CRC. Excessive consumption of red and processed meats and/or lower intake of fruits and vegetables are well related to the onset of CRC, which was also found in the present series.[4]

Table 5 – Association of nutritional parameters and immediate complications of patients undergoing colorectal surgery in the period from June to October 2012 at the Hospital Barão de Lucena, PE.

Varibles	Total n (%)	Complications		p
		Yes n (%)	No n (%)	
NRS				
Without risk	13 (41.9)	5 (41.7)	8 (42.1)	1.000[a]
With risk	18 (58.1)	7 (58.3)	11 (57.9)	
BMI				
Malnutrition	7 (22.6)	2 (16.6)	5 (26.4)	0.806[b]
Eutrophic	12 (38.7)	5 (41.7)	7 (36.8)	
Overweight and obesity	12 (38.7)	5 (41.7)	7 (36.8)	
% WL				
Yes	17 (54.8)	7 (58.3)	10 (52.6)	1.000[a]
No	14 (45.2)	5 (41.7)	9 (47.4)	
AC				
Malnutrition	17 (54.8)	6 (50.0)	11 (57.9)	0.742[b]
Eutrophic	11 (35.5)	4 (33.3)	7 (36.8)	
Overweight and obesity	3 (9.7)	2 (16.7)	1 (5.3)	
TSF				
Malnutrition	23 (74.2)	8 (66.6)	15 (78.9)	0.705[b]
Eutrophic	5 (16.1)	2 (16.7)	3 (15.8)	
Overweight and obesity	3 (9.7)	2 (16.7)	1 (5.3)	
AMC				
Malnutrition	11 (35.5)	4 (33.3)	7 (36.8)	1.000[b]
Eutrophic	20 (64.5)	8 (66.7)	12 (63.2)	
APMT				
Malnutrition	18 (58.1)	8 (66.7)	10 (52.6)	0.484[b]
Eutrophic	13 (41.9)	4 (33.3)	9 (47.4)	
SGA				
Malnutrition	6 (19.4)	3 (25.0)	3 (15.8)	0.653[b]
Eutrophic	25 (80.6)	9 (75.0)	16 (84.2)	
Albumin				
Normal	21 (72.5)	7 (58.4)	14 (82.4)	0.266[b]
Mild to moderate depletion	7 (24.1)	4 (33.3)	3 (17.6)	
Severe depletion	1 (3.4)	1 (8.3)	0 (0.0)	
Hemoglobin				
With anemia	21 (67.7)	9 (75.0)	12 (63.2)	0.697[b]
Without anemia	10 (32.3)	3 (25.0)	7 (36.8)	

NRS, nutritional risk screening; BMI, body mass index; WL, percentage weight loss; AC, arm circumference; TSF, triceps skinfold; AMC, arm muscle circumference; APMT, adductor pollicis muscle thickness; SGA , subjective global assessment.
[a] Chi-square.
[b] Fisher's exact test.

WCRF and AICR[4] recommend a weekly limit of 500 g of cooked red meat. Also according to these institutions, the intake of 100 g/day of red meat above the recommended limit increases the risk of CRC by 17%.[4] According to the same review, the intake of 100 g/day of processed meat increases the risk of bowel cancer by 36%.[4] The potential mechanisms involved in this process include the formation of carcinogenic products, such as N-nitroso compounds, heterocyclic amines, and polycyclic aromatic hydrocarbons.[38] On the other hand, the various constituents of vegetables and fruits (dietary fiber, carotene, folic acid , selenium, flavonoids, and others) have a protective effect and some are potentially antioxidants.[4] The beneficial effect of fibers on a lower incidence of CRC is associated with a number of mechanisms, which include dilution of substances in the intestinal lumen and, consequently, lower contact with the intestinal wall; modulation of tumor-suppressor gene expression (such as p53); increased satiety and, therefore, lower energy consumption; and short-chain fatty acid production, which are the main substrate for colonocytes.[38,42]

The results presented by the projects Enhanced Recovery After Surgery (ERAS) and *Acelerando a Recuperação Total Pós-operatória* (ACERTO) discuss new perspectives on early feeding of surgical patients, contributing to the lower incidence of complications, early hospital discharge, and reduced hospital costs.[43] During this period, the energy and protein needs are high due to surgical trauma itself, and fasting negatively contributes to negative nitrogen balance. As an example, ACERTO recommends that in surgeries with gastrointestinal anastomoses, enteroenteric, enterocolic or colorectal, the liquid diet should begin routinely on the first postoperative day.[44] However, our study found that the average time to renourishment was 39.7 hours. Aguiar-Nascimento et al.[45] in a study of colorectal surgery found an average time of 24 hours, with no increase in postoperative complications. This difference between studies regarding the time to restart the diet has occurred possibly due to the conduct of each surgical team. In our study, we found that the presence of some postoperative complication was not related to the start of liquid diet, but it increased the length of hospital stay, costs, and interfered with the turnover of beds, as well as affected the evolution of diet.

Regarding the histological classification of the present study, moderately differentiated adenocarcinoma was the most recurrent in 45.2% of cases, followed by 41.9% of well-differentiated lesions and 9.7% of poorly differentiated adenocarcinoma. These percentages are similar to those found in the literature.[32,36,46] As for tumor location, the most common location was the rectum, corroborating with the research by Pinho et al.[47], which found a percentage of 52.5% of rectal involvement. This finding corresponds to the fact that most surgeries involved the rectum.

Although there is no universal consensus, neoadjuvant therapy is generally regarded in some circumstances such as staging T3/T4.[48] In this study, 61.3% of patients did not receive neoadjuvant therapy, showing a disagreement between the studies in which Thoresen et al.[8] found that 85.7% of patients with CRC had received chemotherapy, not differentiating, however, if surgical procedures were performed or not. However, Mussnich et al.[36] found a percentage of 80.5% of surgeries without the use of neoadjuvant therapy.

The main postoperative complications of CRC were wound infection, anastomotic leakage, paralytic ileus, and bleeding.[6] As mentioned in this study, the most frequent complications were ileus and abdominal distention, which are somewhat related to NS. However, the early introduction of food and fluids in the postoperative period is associated with reduced postoperative complications, particularly paralytic ileus.[45,49] A research conducted by Aguiar-Birth & Goelzer[43] confirmed that oral feeding on the first day after surgery in patients with intestinal anastomoses is safe, not related to anastomotic leakage, and also favors a shorter pe-

riod of paralytic ileus. In the series discussed, the mean time for diet restart was higher than the current evidence recommend, which may have contributed to the higher incidence of paralytic ileus. However, such delay in renourishment may have been caused by the presence of abdominal distension also seen in patients.

Another frequently reported complication is wound infection. Studies suggest an incidence rate of up to 26% in patients undergoing colorectal surgery. In the present study, we found a 16.7% rate of wound infection, demonstrating the influence of the several factors involved in the development of this problem— among them, the patient himself and his current pathologies, surgical procedure, and perioperative factors.[50] Aguiar-Nascimento et al.[45] found a 7.1% percentage of infection at the surgical site in 24 patients undergoing colorectal operations.

Despite the wide variety of nutritional measures, so far there is no gold standard method to determine the nutritional status of hospitalized patients.[51] BMI has been one of the most commonly used anthropometric indicators for identifying individuals at nutritional risk due to its easy application and low cost.[52] However, because it is an indicator that provides measurement of all body compartments, its use in hospitalized patients should be limited, especially because it is necessary to experience a significant weight loss to change its values.[53]

In this investigation, we found a higher incidence of overweight and obesity, measured by BMI, and a marked weight loss (% WL) and loss of body fat mass, assessed by the anthropometric measures AC and TSF. However, patients still showed a preserved protein mass, as verified by the AMC and albumin dosage, but with decreased labor activities and reflecting even the loss of lean body mass as assessed by the parameter APMT. These findings corroborate the literature. With the use of different tools to evaluate 77 patients with CRC, Thoresen et al.[8] found a mean BMI of 26.5 kg/m², WL% of 54.6% defined by EPCRCs and malnutrition of 33.7% defined by SGA-B and C. In a study conducted by Valadão et al 2010.,[32] the authors found that weight loss (36.7%) and bleeding (32.4%) are among the most prevalent symptoms and signs for the diagnosis of CRC, which also corroborates the current study in which 67.7% had anemia on admission.

The score of NRS and APMT determined a more compromised NS in elderly patients, which may be explained by the fact that NRS adds one point for patients aged ≥ 70 years, totaling a maximum score of 7 points. As for APMT, similar to all peripheral skeletal muscle, the adductor muscle of the thumb is also consumed during catabolism and atrophied by inactivity and senescence,[54] which may explain the difference between the age groups shown in the present investigation.

The results obtained in this study with the use of different assessment tools in a small group of patients revealed a high degree of inconsistency in nutritional classification. Therefore, we stress the importance of several methods to complete a nutritional assessment.

We found no association between malnutrition and immediate postoperative complications. However, poor nutritional status preoperatively has been associated with the development of postoperative complications.[5-7,55,56] Telem et al.,[7] in their case-control study, found a statistical association between serum albumin levels and risk of anastomotic leakage, and found that albumin < 3.5 g/dL contributed to the risk of such complications. Makela et al.[56] also reported this association. Moreover, Telem et al.[7] related the surgical time with the risk of dehiscence, showing statistically significant association, and confirmed that the surgical time (≥ 200 minutes) entails a higher risk of this disorder. However, in our study, the mean surgical time of 234 minutes (3.9 hours) was not associated with increased risk of complications. Possibly, the lower complication rate in this series is related to the reduced presence of comorbidities, lower consumption of alcohol, smoking habit, incidence of preoperative malnutrition, and other factors not related to the patient, such as the fact that the hospital where the study was conducted is a reference for this type of surgical approach.

Regarding the limitations of this study, there are few papers available in the national and international literature evaluating the nutritional status assessed by different tools and postoperative complications in colorectal surgery. Another no-less important issue, was the small number of admissions during the study period, which reflected the small sample size.

Conclusion

Despite the study limitations, we found that the onset of CRC is possibly related to eating habits and life style and that patients with this malignancy have a marked weight loss. However, postoperative complications were infrequent and not related to nutritional status.

Conflict of interest

The authors declare no conflicts of interest.

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