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Increased postoperative fasting time aggravates the nutritional status in patients with gastrointestinal tract neoplasia

El aumento del tiempo de ayuno posoperatorio agrava el estado nutricional en pacientes con neoplasia del tracto gastrointestinal

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ABSTRACT

Surgical patients with gastrointestinal cancer often suffer from malnutrition. This study aimed to evaluate the influence of fasting time on the nutritional status of patients hospitalized with preoperative and postoperative gastrointestinal tract neoplasms. Observational, longitudinal, and prospective study conducted in the surgical unit at a public-school hospital. The patients were divided into groups: upper (UGIT) and lower (LGIT) gastrointestinal tract. Follow-up started within 72 h of hospitalization with reassessment 72 h after surgery. Data collected: sex, age, type and duration of surgery, preoperative (compared with 8 h) and postoperative (compared with 24 h) fasting time, food acceptance, Subjective Global Assessment, anthropometry, and laboratory tests. Analyses: Student t, Wilcoxon, and chi-square tests. Fifty-one patients were followed up, 29 (57%) UGIT and 22 (43%) LGIT. The preoperative fasting time was 8.2±2.8 h in UGIT and 8.1±2.2 h in LGIT groups, respectively; however, postoperative fasting times in UGIT (60.4±40.7 h) and LGIT groups (57.6±38.2 h) were longer than 24 h (P<0.001). Although eutrophic in the preoperative period, in the postoperative most patients in the UGIT and LGIT groups presented, respectively, malnutrition (71%; 59%; P<0.001), severe weight loss (79%; 80%), a significant correlation between triceps skinfold and postoperative fasting time (r= -0.306; P= 0.03), and hemoglobin and albumin values (r= 0.633; P<0.001), additionally low dietary acceptance, especially in the UGIT group. Prolonging postoperative fasting time worsened the nutritional status of surgical patients, especially in the UGIT group.

Key words: Gastrointestinal neoplasms; Gastrointestinal surgical procedure; Malnutrition; Nutritional status; Postoperative fasting.

RESUMEN

Los pacientes quirúrgicos con cáncer gastrointestinal a menudo sufren desnutrición. El objetivo de este estudio fue evaluar la influencia del tiempo de ayuno en estado nutricional de pacientes hospitalizados con neoplasias del tracto gastrointestinal preoperatorio y posoperatorio. Estudio observacional, longitudinal y prospectivo realizado en unidad quirúrgica de un hospital escolar público. Los pacientes fueron divididos en grupos: tracto gastrointestinal superior (UGIT) y inferior (LGIT). El seguimiento se inició dentro del 72 h de la hospitalización con reevaluación 72 h después de la cirugía. Datos recolectados: sexo, edad, tipo y duración de la cirugía, tiempo de ayuno preoperatorio (comparado con 8 h) y postoperatorio (comparado con 24 h), aceptación de dieta, Evaluación Subjetiva Global, antropometría y pruebas de laboratorio. Análisis: pruebas de T, Wilcoxon y chi-cuadrado. Se siguió 51 pacientes, 29 (57%) en UGIT y 22 (43%) en LGIT. El tiempo de ayuno preoperatorio fue $8,2 \pm 2,8$ h (UGIT) y $8,1 \pm 2,2$ h (LGIT); sin embargo, los tiempos de ayuno posoperatorio en UGIT ($60,4 \pm 40,7$ h) y LGIT ($57,6 \pm 38,2$ h) fueron superiores a 24 h ($P < 0,001$). Aunque eutróficos en preoperatorio, en postoperatorio la mayoría de los pacientes (UGIT y LGIT, respectivamente) presentaron desnutrición (71%; 59%; $P < 0,001$), pérdida de peso severa (79%; 80%), correlación significativa entre pliegue cutáneo del tríceps y tiempo de ayuno posoperatorio ($r = -0.306$; $P = 0.03$), valores de hemoglobina y albúmina ($r = 0,633$; $P < 0,001$), y baja aceptación de dieta, especialmente del UGIT. La prolongación del ayuno postoperatorio empeoró el estado nutricional de los pacientes quirúrgicos, especialmente del UGIT. Palabras clave: Ayuno postoperatorio; Desnutrición; Estado nutricional; Neoplasias gastrointestinales; Procedimientos quirúrgicos gastrointestinales.

INTRODUCTION

The gastrointestinal (GI) tract is comprised of the upper (mouth, pharynx, esophagus, and stomach) and lower (small and large intestines, rectum, and anus) GI tracts¹. GI tract neoplasms are a major cause of mortality worldwide. In Brazil, with the exception of non-melanoma skin cancer, in males, bowel (8.1%) and stomach (6.3%) cancers are, respectively, the third and fourth most prevalent, falling behind prostate (31.7%) and lung (8.7%) cancers. In females, bowel cancer (9.4%) is second only in prevalence to breast cancer (29.5%)².

Patients with GI cancer often suffer from malnutrition and cachexia caused by inflammatory processes due to malignancy and therapeutic intervention³. When submitted to resection and anastomosis surgery, worsening postoperative malnutrition^{4,5} may be associated with increased infections, longer hospital stays, morbidity, and mortality^{6,7}.

In addition, during the perioperative period, prolonged fasting may be associated with a higher risk of malnutrition. Established by Mendelson⁸, a 6–8 hour preoperative fast was proposed to prevent pulmonary complications associated with vomiting and gastric aspiration during anesthetic induction. Throughout the 1950s, the practice was extended to elective surgery^{8,9,10}. However, there are no reports on the exact time of postoperative refeeding and previously depended on the appearance of air-fluid noises and gas elimination, which may end up prolonging fasting by two days¹¹. This increase can cause complications in bodily functions and metabolic conditioning, increasing hunger, thirst, and nausea, and may trigger biochemical reactions, such as gluconeogenesis, lipolysis, and proteolysis, contributing to increased blood glucose and longer hospital stays^{12,13,14}.

Since the 1990s, the prolongation of pre- and postoperative fasting has been disputed. Following evidence-based medicine, fast-track or multimodal protocols

such as the Enhanced Recovery After Surgery (ERAS) and Aceleração da Recuperação Total Pós-operatória (ACERTO) programs have combined several perioperative interventions to hasten postoperative recovery^{15,16}. They have shown that abbreviation of the preoperative fast with clear fluid intake within 2 h before the anesthetic procedure and postoperative 24-h refeeding in the presence of hemodynamic stability do not pose risks to the patient¹⁷. Highly respected guidelines, such as the American Society of Anesthesiologists¹⁸, also recommend these practices, as there are no scientific reasons for prolonged fasting.

Due to the high prevalence of malnutrition in surgical and neoplastic patients and the consequent worsening of their nutritional status through practices such as prolonged preoperative and postoperative fasting, as well as the lack of updated protocols for postoperative fasting, the objective of this study was to evaluate the influence of fasting time on the nutritional status of patients hospitalized with preoperative and postoperative GI tract neoplasms.

METHODS

Study design and ethical considerations

This was an observational, longitudinal, prospective study conducted among patients admitted to the surgical unit of a public teaching hospital in central Rio Grande do Sul, Brazil from August 2018 to March 2019. This study included female and male patients, aged ≥ 18 years, admitted to surgical units for elective surgery of the upper and lower GI tract for neoplasms, such as coloproctology, digestive, cancer and general surgeries; patients who received oral, enteral, or parenteral diet; and lucid patients. Regarding the exclusion criteria, patients at the head and neck, cardiovascular, traumatology, thoracic, and urology clinics; patients without neoplasms; with unmarked surgeries; discharged or death before reassessment; and patients who underwent chemotherapy and radiotherapy treatment less than 30 days before surgery were excluded.

Experimental design

Data were collected through interviews with patients or caregivers and electronic medical record review. Follow-up started within 72 h after hospital admission, and re-evaluation was performed 72 h after the surgical procedure. The patients were divided into upper and lower GI tract groups (UGIT and LGIT, respectively).

The following data were collected: sex (male and female), age (adult and elderly (≥ 60 y))¹⁹, surgical duration refers to the length of this procedure (II – from 2 to 4 h, III – from 4 to 6 h), and type of surgery performed. Preoperative fasting time was counted from midnight before surgery to the beginning of the anesthetic procedure according to the routine of the service and compared with the traditional fasting time of 8 h⁹. Postoperative fasting time was calculated from the end of surgery to the first meal offered to the patient (liquid, pasty, or solid) or initiation of Enteral Nutrition Therapy (ENT), and compared with the 24 h period established by modern guidelines²⁰. Serum infusion and oral water intake were not considered.

Nutritional risk screening was performed by Subjective Global Assessment (SGA), which is considered the gold standard by the ACERTO Project, validated for evaluation of surgical patients and subsequently applied and adapted to other clinics¹⁶. Patients were evaluated 72 h after postoperative and classified as well-nourished and malnourished^{21,22}.

Anthropometric evaluation including triceps skinfold thickness (TST, mm) and subscapular skinfold thickness (SST, mm) was performed with a measuring tape and scientific plicometer (Cescorf[®]). Perioperative body mass index (BMI) was classified as adult²² and elderly²³. BMI was not calculated postoperatively because most patients had intracellular edema. A percentage of involuntary weight loss (%WL) $>10\%$ of usual weight was classified as severe²⁴. Regarding nutritional status, the adductor pollicis muscle (APM), which is the measure of the muscle between the hand index finger and thumb, was performed to check for skeletal muscle depletion. The percentage of APM (%APM) was classified as no depletion (100%), mild depletion (90%–99%), moderate depletion (60%–90%), and severe depletion ($<60\%$)²⁵.

Oral hospital acceptance was assessed by means of a 24-h food recall, twice preoperatively and twice postoperatively. It was not possible to perform three recalls, as most patients were hospitalized 2 d before surgery. Home recall was not used because there is no comparative acceptance pattern. Meals were divided into snacks (breakfast, morning snack, afternoon snack, and supper), lunch, and dinner. Acceptance was classified as good (when the patient consumed more than half), medium (half), or low (less than half), compared with what was offered by the hospital's nutrition service. For patients using ENT, volume adequacy was assessed²⁶, and adequacy $\geq 80\%$ of volume was considered satisfactory in both groups²⁷. All patients on ENT received high-calorie and high-protein diets, as prescribed by the nutrition team. In addition, no patient received immunonutrition.

Preoperative and postoperative hemoglobin values were

classified according to the WHO²⁸ for males and females, respectively: >13 g/dL and >12 g/dL, no anemia; 12.9–11 g/dL and 11.9–11 g/dL, mild anemia; 10.9–8 g/dL and 10.9–8 g/dL, moderate anemia; <8 g/dL and <8 g/dL, severe anemia. Preoperative and postoperative total lymphocyte counts (TLC) were performed using lymphocyte values (%) and classified as follows: >1500 cells/mm³ no depletion, 1200–1500 cells/mm³ mild depletion, 800–1199 cells/mm³ moderate depletion, and <800 cells/mm³ severe depletion²⁹. Preoperative albumin was classified by severity: >3.5 g/dL no depletion, 3.5–3.0 g/dL mild depletion, 2.9–2.4 g/dL moderate depletion, and <2.4 g/dL severe depletion³⁰. Preoperative serum creatinine levels varied by sex: in males from 0.8 to 1.3 mg/100 ml and in females from 0.6 to 1.0 mg/ml³¹.

Statistical analysis

Collected data were tabulated and stored in Excel (Microsoft) and analyzed with Statistical Package for the Social Sciences (SPSS) version 25. Initially, normality was analyzed by using the Shapiro-Wilk test. Then, one-sample and paired t-tests were applied to continuous variables; Wilcoxon and chi-square tests were used for categorical variables. Pearson and Spearman correlations were applied to quantitative variables and nonparametric correlations, respectively; results were considered statistically significant at $p < 0.05$.

Ethical considerations

Informed consent was requested from patients to participate in the research in writing. This research is in compliance with regulations on bioethics research and was authorized by the Research Ethics Committee of the Universidade Franciscana (UFN), No. 1.369.154.

RESULTS

In total, 58 patients underwent elective GI tract surgeries. Nevertheless, seven patients were excluded in the postoperative period because two patients were discharged and two patients died before postoperative reassessment, two patients were in anasarca, and one patient was not submitted to surgery. Therefore, 51 patients were followed up preoperatively and postoperatively: 29 (57%) UGIT patients and 22 (43%) LGIT patients.

Table 1 demonstrate the clinical characteristics of the population. In the UGIT group, 55.2% (n= 16) were elderly and 75.9% (n= 22) were male; in the LGIT group, 72.7% (n= 16) were elderly and 54.5% (n= 12) were female. The average age in both groups was 62 ± 12.8 years (20–82 years). Most patients were admitted for digestive surgery (62.1%) in the UGIT group and coloproctology (68.2%) in the LGIT group. The most frequently performed surgery and most prevalent neoplasia was gastrectomy on account of malignant stomach neoplasia in the UGIT group (41.4%) and colectomy on account of malignant colon cancer in the LGIT group (50.0%). Surgical duration refers to the time of the procedure; in the UGIT group, 79.3% (n= 23) were size III, and in the LGIT group, 50.0% (n= 11) were size III and 50.0% (n= 11) size II.

Table 1. Clinical characteristics of patients in the preoperative and postoperative periods of the upper and lower gastrointestinal tract groups.

Patient characteristics	UGIT (N= 29)	LGIT (N= 22)
Sex (N, %)		
Male	22 (75.9)	10 (45.5)
Female	07 (24.1)	12 (54.5)
Age range (N, %)		
Adult	13 (44.8)	6 (27.3)
Elderly (≥ 60 y)	16 (55.2)	16 (72.7)
Smoker (N, %)		
Yes	4 (13.8)	02 (9.1)
Ex-smoker	14 (48.3)	12 (54.5)
No	11 (37.9)	08 (36.4)
Alcoholic (N; %)		
Yes	10 (34.5)	04 (18.2)
Ex-alcoholic	11 (37.9)	07 (31.8)
No	08 (27.6)	11 (50.0)
Ethnicity (N, %)		
White	25 (86.2)	21 (95.5)
Black	04 (13.8)	01 (4.5)
Reason for hospital stay (N, %)		
Digestive surgery	18 (62.1)	03 (13.6)
Coloproctology	09 (31.1)	01 (4.6)
Cancer surgery	01 (3.4)	15 (68.2)
General surgery	01 (3.4)	03 (13.6)
Neoplasia	Type of Surgery	N (%)
UGIT (N= 29)		
Malignant neoplasm of the stomach	Gastrectomy	12 (41.4)
Malignant neoplasm of the esophagus	Esophageal resection	08 (27.6)
Malignant neoplasm of the liver	Hepatectomy	07 (24.0)
Malignant neoplasm of the small bowel	Small bowel resection	01 (3.5)
Malignant neoplasm of the pancreas head	Pancreaticoduodenectomy	01 (3.5)
LGIT (N= 22)		
Malignant neoplasm of the colon	Colectomy	11 (50.0)
Malignant neoplasm of the rectum	Rectosigmoidectomy	09 (41.0)
Adenocarcinoma of the rectum	Amputation of rectum	01 (4.5)
Malignant neoplasm of the retroperitoneum	Retroperitoneum resection	01 (4.5)

UGIT: upper gastrointestinal tract; LGIT: lower gastrointestinal tract.

The preoperative fasting time in the UGIT group was 8.2 ± 2.8 h and in the LGIT group, 8.1 ± 2.2 h, predicted according to the traditional 8-h fast⁹. However, the postoperative fasting time in the UGIT group was 60.4 ± 40.7 h and in the LGIT group it was 57.65 ± 38.2 h, significantly higher ($P < 0.001$) in both groups compared to the fasting time of up to 24 h, in relation to the modern guidelines of the ACERTO project¹⁶.

According to the SGA classification (Table 2), most patients in both groups had malnutrition in the preoperative and postoperative periods. In the UGIT group, there was an increase in malnourished patients in the postoperative period compared with preoperative period ($P < 0.001$). In the LGIT group, there was a predominance of malnourished patients in the preoperative and postoperative periods ($P < 0.001$).

Through preoperative BMI classification, 48% ($n = 14$) of the patients in the UGIT group and 45% ($n = 10$) of the

patients in the LGIT were eutrophic. However, 45% ($n = 13$) of the patients in the UGIT group and 41% ($n = 9$) of the patients in the LGIT group had severe preoperative weight loss. Even though the anthropometric data (Table 3) were not statistically significant, there was a tendency for SST and APM to decrease postoperative period in the UGIT group, and for APM to decrease postoperative period in the LGIT group. In addition, a significant correlation was observed between TST and postoperative fasting time ($r = -0.306$; $p = 0.03$).

Food acceptance in the UGIT group was performed with 17 patients in the preoperative period and 16 in the postoperative period, since the remaining patients used ENT. In the LGIT group, acceptance was performed with 20 patients in the preoperative and postoperative periods. In the preoperative period of the UGIT group, most patients had good acceptance of all evaluated meals (snacks= 76%;

Table 2. Classification of the Subjective Global Assessment preoperative and postoperative in the upper and lower gastrointestinal tract groups.

Groups	SGA classification	Preoperative (n %)	Postoperative (n %)	P value
UGIT (N= 28)	Malnutrition	16 (57)	20 (71)	<0.001
	Well-nourished	12 (43)	08 (29)	
LGIT (N= 22)	Malnutrition	13 (59)	13 (59)	<0.001
	Well-nourished	09 (41)	09 (41)	

UGIT: upper gastrointestinal tract; LGIT: lower gastrointestinal tract; SGA: subjective global assessment.

*Pearson chi-squared test.

Table 3. Preoperative and postoperative anthropometric evaluation in the upper and lower gastrointestinal tract groups.

Variables	UGIT			LGIT		
	Pre operative	Post operative	P value	Pre operative	Post operative	P value
TST (mm)	13.5 ± 8.0	14.0 ± 8.1	0.367	14.8 ± 5.8	14.9 ± 5.7	0.776
SST (mm)	16.2 ± 8.9	15.9 ± 9.2	0.052	17.5 ± 8.6	17.1 ± 8.4	0.184
APM (mm)	15.6 ± 4.2	14.9 ± 4.0	0.063	14.0 ± 4.5	13.8 ± 4.6	0.099
APM (%)	133.7 ± 34.6	129.0 ± 33.7	0.130	126.8 ± 34.5	125.2 ± 35.2	0.120

UGIT: upper gastrointestinal tract; LGIT: lower gastrointestinal tract; TST: triceps skinfold thickness; SST: subscapular skinfold thickness; APM: adductor pollicis muscle.

*Wilcoxon test.

lunch= 71%; dinner 65%). However, there was a decrease in acceptance postoperative period, with average acceptance of lunch (44%) and dinner (44%) by most of patients, and good acceptance reported only for snacks (44%). The LGIT group presented better postoperative acceptance than the UGIT group, since most patients in the LGIT group had good acceptance at all meals in the preoperative (snacks= 70%; lunch= 60%; dinner= 70%) and postoperative periods (snacks= 50%; lunch= 45%; dinner= 45%).

ENT was observed only in the UGIT group, in which four patients used it in the preoperative period and 11 patients in the postoperative period. In the preoperative period, 50% (n= 2) of the patients presented satisfactory adequacy (>80%) and 50% (n= 2) unsatisfactory adequacy (<80%). However, in the postoperative period 82% (n= 9) of the patients presented unsatisfactory adequacy, and just 18% (n= 2) presented satisfactory adequacy.

According to laboratory tests, most patients in the UGIT group had mild anemia in the preoperative period (44.5%; n= 12) and moderate anemia postoperative period (63.0%; n= 17). Comparing preoperative hemoglobin (11.9±1.9 g/dL) with the postoperative hemoglobin (10.2±1.2 g/dL) in the UGIT group, a statistically significant decrease was observed (p= 0.001). In the LGIT group, most patients had moderate anemia in the preoperative and postoperative periods, although with no statistically significant difference (10.6±1.8 g/dL; 9.9±1.1 g/dL; p= 0.12). In addition, a significant correlation (r= 0.334; p= 0.02) between hemoglobin and APM was observed in the preoperative period.

Preoperative serum albumin values were obtained in 16 patients in the UGIT group and seven in the LGIT group. According to the classification, most patients presented some degree of protein depletion, predominantly mild depletion in 41% (n= 9) in the UGIT group and 57% (n= 4) in the LGIT group. There was also a significant correlation between hemoglobin and albumin values in the preoperative period (r= 0.633; p<0.001).

According to the TLC in the preoperative period, most patients did not present depletion in the UGIT (33.3%; n= 8) and LGIT groups (43.7%; n= 7). However, in the postoperative period, most patients presented severe depletion in the UGIT group (50.0%; n= 12) and moderate depletion in the LGIT group (43.7%; n= 7). In addition, regarding serum creatinine levels, 72% (n= 18) of patients in the UGIT group and 74% (n= 14) in the LGIT group presented values within the normal range in the preoperative period.

DISCUSSION

Among the malignant neoplasms, the stomach is the fifth most diagnosed, the colon and rectum are the third most diagnosed, and the esophagus is the eight most frequent^{32,33}. These data corroborate our study, in which the most prevalent malignancies in the UGIT were gastric and esophageal, and those in the LGIT were colonic and rectal.

The postoperative fasting time in the UGIT and LGIT groups was longer than 24 h. Although traditional

postoperative refeeding is offered after the return of peristalsis, in order words, by the appearance of airborne noises and gas elimination¹¹, the patients' refeeding in the present study was considered a cause for concern, since the fasting time was longer than two days. According Aguilar et al.¹³, most Brazilian hospitals prolong their fasting time by adopting these traditional fasting guidelines. These data are in accordance with our results, since the postoperative fasting was based on traditional guidelines, through the appearance of airborne noises and gas elimination, thereby increasing the fasting time; although there are modern guidelines currently exist that demonstrate the benefits of early refeeding in surgical patients¹⁷. Early oral or enteral intake in the postoperative period minimizes the risks that worsen the nutritional status of surgical patients, such as excessive weight and muscle mass loss^{3,17}.

Even though in the preoperative period, patients were eutrophic according to their BMI, most of them presented malnutrition according to the SGA classification, with severe weight loss, muscle depletion, anemia, hypoalbuminemia, which worsened in the postoperative period. These data are associated with higher surgical risk, as well as prolonged fasting time³⁴. In addition, the use of isolated BMI is not adequate to identify the nutritional status of patients³⁵, therefore it is important to evaluate these patients through the association of SGA, laboratory tests and food acceptance. Hypoalbuminemia is a risk factor in wound healing³⁶ and anemia is associated with increased morbidity and mortality in surgical patients³⁷. Additionally, weight loss and anorexia are frequently observed symptoms of malignant neoplasm^{3,17}, as observed in our study, especially in the UGIT group, which, associated with prolonged postoperative fasting time, further aggravates the nutritional status of these patients. Another factor that may contribute to nutritional impairment in these patients is low postoperative food acceptance, observed in the present study in the UGIT group. Low food acceptance may be related to prolonged fasting time, as this factor increases the feeling of thirst, hunger, nausea, vomiting and negatively impacts the response to surgical trauma^{13,38,39}.

Scientific evidence^{20,40} indicates that prolonged fasting worsens the nutritional status of surgical patients, especially when they are malnourished, increasing the length of hospital stay and contributing to morbidity and mortality. The same authors asserted that postoperative oral or enteral refeeding should be early, even in cases of digestive anastomosis, within 24-h postoperatively, provided that the patient is hemodynamically stable. In addition to being safe, refeeding decreases the compromise of nutritional status and length of stay, favors the healing of intestinal anastomosis, and improves the well-being of patients receiving a diet^{41,42}.

CONCLUSIONS

In conclusion, the results of this study indicate that prolonging postoperative fasting worsens the nutritional status of surgical patients, especially those of UGIT

patients. Thus, monitoring by the multidisciplinary team and the incorporation of new multimodal protocols based on scientific evidence, such as ACERTO, can minimize perioperative complications and improve the nutritional status of patients undergoing GI tract surgery.

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