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Nutritional status assessment in colorectal cancer patients

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Abstract

The present study intended to evaluate the nutritional status of Portuguese colorectal patients and associated it with surgery type as well as quality of life outcomes.

Malnutrition can affect up to 85% of cancer patients and specifically 30-60% in colorectal cancer and can significantly influence health outcomes.

A sample of 50 colorectal cancer patients was evaluated in what refers to several anthropometric measures, food intake, clinical history, complications rate before and after surgery procedure. The sample was divided between convention and fast-track procedures.

Most of the individuals were overweight or obese but had lost weight on the past six months. Despite mild, there were signs of malnutrition in this sample with high losses of fat free mass, weight and also fat mass during the hospitalization period.

These results reinforce the importance of malnutrition assessment in colorectal patients as well as consider weight loss on the past months and body composition in order to complement nutritional status evaluation.

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Key words: *Colorectal. Cancer. Food intake. Malnutrition. Quality of life.*

ESTADO NUTRICIONAL DE LOS PACIENTES DE CANCER COLORRECTAL

Resumen

El presente estudio pretende evaluar el estado nutricional de enfermos de cáncer colorectal portugueses teniendo en cuenta el tipo de cirugía y indicativos de calidad de vida.

La malnutrición suele afectar hasta 85% de los enfermos de cáncer y 30-60% entre los de cáncer colorectal y puede afectar significativamente las mejorías de salud.

Se ha completado una evaluación antropométrica de 50 individuos admitidos en un hospital portugués para cirugía incluido también ingestión alimentaria, historia clínica, complicaciones antes y después de la cirugía. La muestra ha sido dividida entre el procedimento quirúrgico convencional y el fast-track.

La mayoría de los individuos era obesa ó tenía sobrepeso pero había perdido peso en los últimos 6 meses antes de entrar en el hospital. Aunque poco severas, tenían señales de malnutrición con grandes pérdidas de masa magra, peso y también grasa corporal durante el período en el hospital.

Estés resultados han reenfocado la importancia de una evaluación nutrición en enfermos de cáncer, sobretodo colorectal teniendo en cuenta el peso perdido pero también la composición corporal para que se complete el protocolo de evaluación nutricional.

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Introduction

According to global statistics there were 945 000 new cases worldwide of rectal and colon cancer (CRC) in 2000 which represents 9.4% of the worldwide yearly new cancer cases.[1,2] It had been considered an important burden, leading to high mortality rates and with a profound impact in public health in over the world.[3]

Previous studies had shown that cancer has a profound physical and physiological impact in patients, especially in what concerns to their nutritional status.[4] Cancer related malnutrition had been considered quite frequent, affecting up to 85% of the patients[5] and multiple causes had been considered like systemic effect of tumor, host response or secondary effects of anticancer therapies.[6]

Gastrointestinal cancers had shown higher malnutrition prevalence; 30 to 60% of colorectal patients had been considered malnourished.[7,8] This can result in longer hospital stay, reduced response to therapies, increased complications to therapy and surgery proceedings, poor survival and higher care costs.[9–12]

Specific cancer drug therapies and surgery procedures could be an important factor affecting nutri-

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tional status of hospitalized patients. Several improvements had been done including in what refers to minimally invasive surgery techniques like the so called fast-track. Current data on this method for colonic surgery had shown improved body composition as well as oral energy and protein intake, when compared with conventional methods. Additionally fast-track surgery had been associated with less surgical stress, lower complications rate and decreased hospital stays which could contribute to earlier rehabilitation.[13]

The present study intended to evaluate the nutritional status of colorectal patients before and after surgery, comparing fast track and conventional surgery methods and establishing a possible associated between nutritional status and quality of life.

Materials and methods

Study ethical aspects

The present observational study was conducted from June to December 2008 in Oncology Portuguese Institute Surgery Service, Lisbon facilities.

Study design and procedures were conducted after the ethical commission approval according to Portuguese legislation and the Declaration of Helsinki from World Medical Association. Data were obtained under informed consent.

Sample, inclusion and exclusion criteria

The sample included 50 patients with colon or rectal cancer diagnosed, both sexes, with diagnosed rectal or colon cancer admitted during the six months the research was conducted and were evaluated when admitted in the hospital and before being discharged.

Patients with other neoplastic lesions and/or other pathologies like kidney failure, diabetes, hyperglycaemia, HIV, bowel inflammatory diseases such as Crohn disease and lung disease were excluded. Those who were submitted to major surgery on the past year, pregnant, or where under 18 years old people and/or with any medication that could alter basal metabolic rate (corticoid or thyroid hormone therapy) were also excluded.

Clinical data

Medical history included the following information: surgery conducted (date, location, conventional or fast track), collateral antineoplastic therapies (chemotherapy or radiotherapy), diagnosis date, tumour location and stage. Disease duration was defined considering the interval between diagnosis, with histological confirmation and study inclusion.

Patients discharge date was considered as well as food intake, nutritional support needed, post-surgery fasting period, secondary post-surgery complications occurrence and type.

Nutritional status evaluation

Nutritional status evaluation had consisted in anthropometric assessment, electric bioelectrical impedance analysis (BIA) and skinfold measurement.

Anthropometric assessment and Skinfold measurement

Anthropometric variables included height, weight, tricep skinfold and arm circumference. Height was measured using an ultrasonic stadiometer (Model MZ10020) and patients were weighted in BIA scale.

Tricep skinfold measurement (TSM) was taken using a calliper in the non-dominant, pending arm, half distance within olecranon and acromial points. Arm circumference (ACM) was taken in the sample place with a flexible tape. Both were taken three times and the average value was taken in consideration.

Bioelectrical impedance analysis

Body fat mass, fat free mass, total body water and segmental lean mass which was taken on the non-dominant arm were measured through bioelectrical impedance using TANITA BC-418MA which uses a low amplitude (550 mA) and high frequency (50 Hz) electrical current.

Classification of nutritional status

Non intentional weight loss was the first criteria to identify a possible risk of malnutrition – 10% on the last six months, 5 to 10% on the past three months and/or 5% on the last month before being admitted in the hospital.

Additionally, body mass index (BMI) was also considered an accountable variable and it was calculated through the quotient between weight and height squared. Garrow criteria stated that if BMI was below 20,0 kg/m^2 is a malnutrition sign while if BMI is within 20 e 24,9 kg/m^2 the patient has a normal and healthy weight. BMI values between 25 and 30 kg/m^2 indicate overweight and over 30kg/m^2 means that the patient is obese (WHO 1995).

Food intake assessment

A validated semi-quantitative food frequency questionnaire[15] was conducted in all patients and food

intake was assessed collecting data like serving size, cooking methods and food variety within several food groups. Data collected through this questionnaire were analyzed using PIABAD software.

Scored Patient Generated-Subjective Global Assessment (PG-SGA)

PG-SGA has proven to be a good malnutrition diagnosis test adequate to be used in cancer patients and hospital environment.[16] This assessment tool had included clinical history, food intake and physical examination as well as involuntary weight loss, changes in food intake, symptoms that could affect nutritional status and functional capacity changes which should be answered by the patient. Then, the health professional completes the questionnaire about diagnosis and the relationship with nutritional needs, as well as the physical examination.

Each item had been given a score which sum had result in a nutritional status score classified as: A – well-nourished B - moderate malnutrition C – severe malnutrition.[17]

After these screening had been done, patients with special nutritional needs were identified and classified according to the attention needed: 0-1 points: food education; 2-3 points: modular supplements; 4-8 points: other supplements; > 9 points: artificial enteral or parenteral nutrition.

Statistical analysis

All statistical analysis procedures were conducted using SPSS software (V15.0 for Windows).

In order to evaluate the evolution of nutritional status variables during the three evaluation periods, an ANOVA repeated measure analysis was done. Every time a non-normal distribution was found, data were compared by Friedman non parametric test. If esphericity was not found, MANOVA test was chosen and the Bonferroni test when to identify which pair or pairs differed within each other.

Food intake variables, PG-SGA were compared through t-Student test except for Alcohol, Vitamin C and Vitamin E in which Wilcoxon non parametric test was used.

The descriptive univariated analysis was conducted to study the correlation between these scales and nutritional status within pre and post surgery periods. The following variables were eliminated: diarrhea, dyspnea and vomits. Global health status, physical functioning, emotional and fatigue were considered as qualitative variables while the rest were considered quantitative.

Finally, a repeated measure ANOVA was conducted in order to evaluate if the surgery type affected the nutritional status scores.

Table I
Average weight among individuals

Sample	*Male patients*	*Female patients*
66.48 ± 12.4	66.76 ± 13.4	65.94 ± 13.4

Results

Sample social and demographic characteristics

Within the 50 individuals, 33 were male and 17 were female. This sample was in average 66 ± 12 years old, like presented in table I male were older than female patients. The youngest patient (40 years old) and the oldest (89 years old) were both male.

Clinical data – surgeries and treatment

Like presented in table II, patients were submitted to several different surgical procedures, most had a anterior rectal resection (38%) or a right hemicolectomy (28%). Within this sample two different surgery methods were also considered, in 28 individuals the fast track method was chosen while 22 were submitted to the conventional procedure.

Most patients were not submitted to collateral antineoplastic treatments (66%), those who were had received a quimiotherapy/radiotherapy treatment (30%) or radiotherapy only (4%).

Nutritional status

Anthropometric assessment before and after surgery

More than half of the sample (60%) had shown 5 to 10% unintended weight loss in the month before the surgery, while 40% had lost up to 5%. Considering six months before the surgery, 10% had lost more than 10% and 56% had lost 5 to 10%. It was not possible to relate collateral treatments with severe weight loss considering that individuals, who had a higher weight loss percentage, were not receiving and drug therapy.

Table II
Sample distribution according to surgery procedure type

	Number of patients
Anterior resection	19 (38%)
Right hemicolectomy	14 (28%)
Sigmoid colectomy	11 (22%)
Abdominoperitoneal resection	2 (4%)
Total colectomy	3 (6%)
Cecus atypical resection	1 (2%)

Table III
Anthropometric characteristics of patients before and after the surgery

	Before surgery			*After surgery*			*p*
	Total	*Male*	*Female*	*Total*	*Male*	*Female*	
Weight (kg)	74.1 ± 13.8	75.3 ± 15.3	71.7 ± 10.1	70.4 ± 13.6	71.4 ± 13.6	68.1 ± 13.6	< 0.001
BMI (kg/m^2)	27.3 ± 4.6	26.2 ± 4.6	29.5 ± 3.6	25.9 ± 4.4	24.9 ± 4.5	28.1 ± 4.4	< 0.001
Fat mass (kg)	20.2 ± 9.0	16.9 ± 8.3	26.7 ± 6.4	16.3 ± 9.6	14.5 ± 8.5	20.0 ± 10.8	< 0.001
Fat free mass (kg)	52.7 ± 12.7	56.6 ± 13.6	45.1 ± 5.3	45.8 ± 19.6	50.8 ± 18.6	36.1 ± 18.6	< 0.001
Tricep skinfold (mm)	12.5 ± 5.8	9.5 ± 3.8	18.3 ± 4.3	9.9 ± 5.8	8.1 ± 3.6	13.3 ± 7.2	< 0.001
Arm circunference (cm)	25.2 ± 3.8	24.7 ± 4.2	26.2 ± 2.8	21.8 ± 8.0	22.2 ± 6.5	20.9 ± 10.4	< 0.001

Table IV
Scored Patient Generated-Subjective Global Assessment (PG-SGA) before and after surgery

	Well nourished	*Moderate malnutrition*	*Severe malnutrition*
Before surgery	92%	8%	0%
After surgery	96%	2%	2%

Table resumes all the anthropometric measures and body composition variables taken before and after the surgery. When comparing body composition variables – fat mass and fat free mass and all the taken anthropometric measures – weight, tricep skinfold and arm circumference had decreased significantly ($p < 0.001$).

Classification of nutritional status according to PG-SGA

When the first evaluation was conducted, 92% of the patients were considered well-nourished and 8% had moderate level of malnutrition. Only 46 individuals were evaluated after surgery and from these one (2%) showed severe malnutrition, other had moderate malnutrition signs and the rest were considered well-nourished.

Taking into account this there were four new cases of malnutrition during hospitalization considering that from the four individuals which had shown malnutrition signs on the first evaluation; three maintained these scores after being admitted.

Before surgery, there was not found any significant difference between fat mass and lean body mass between patients with moderate malnutrition and well-nourished, classified according to SGA ($p = 0.08$). However, after surgery, average body fat mass was significantly different between moderate malnutrition and well-nourished status ($p = 0.01$) and the same had happen to fat free mass ($p = 0.037$). This comparison is presented in table V.

Table V
Average body fat mass, body mass index, fat free mass, tricep skinfold and arm circumference according to PG-SGA classification

	PG-SGA	*Before surgery AVG ± SD*	*After surgery AVG ± SD*
Weight (kg)	A	75.0 ± 13.2	71.6 ± 12.4
	B	63.9 ± 17.2	43.6 ± 13.8
BMI (kg/m^2)	A	27.8 ± 4.1	26.3 ± 4.0
	B	21.9 ± 5.7	17.6 ± 6.9
Fat mass (kg)	A	21.2 ± 8.1	19.2 ± 7.6
	B	13.4 ± 12.0	6.1 ± 6.5
Fat free mass (kg)	A	54.0 ± 10.4	52.7 ± 9.8
	B	50.6 ± 8.1	37.5 ± 7.3
Tricep skinfold (mm)	A	12.8 ± 5.7	11.2 ± 4.9
	B	8.3 ± 5.4	5.5 ± 4.9
Arm circumference (cm)	A	25.4 ± 3.65	24.4 ± 2.8
	B	21.8 ± 4.73	16.5 ± 4.9

Fast track or conventional surgery: effect on anthropometric measures

The effect of surgery type was compared to several variables: BMI ($p = 0.872$), tricep skinfold ($p = 0.444$), arm circumference ($p = 0.886$), body fat mass ($p = 0.295$), lean body mass ($p = 0.387$), lean mass in right and left arm ($p = 0.229$ *vs* $p = 0.314$), fat mass in right and left arm ($p = 0.835$ *vs* 0.658), trunk lean and fat mass ($p = 0.256$ *vs* $p = 0.688$). Despite no significant differences were found it is interesting to note that fast track patients had lost more weight and had shown lower fat free mass, tricep skinfold and arm circumference values.

Food intake before and after surgery

Within the sample, only 33 patients had answered the food frequency questionnaire. As presented in table VII, there were not found any significant differences between energy, macronutrient and micronutrient intake before and after the surgery.

Table VI
Anthropometric measures comparison before and after surgery considering fast-track and conventional methods

	Before surgery		*After surgery*	
	Fast track	*Conventional*	*Fast track*	*Conventional*
Weight (kg)	72.8 ± 11.8	75.9 ± 15.7	69.1 ± 12.0	72.0 ± 15.3
BMI (kg/m^2)	27.3 ± 4.3	27.3 ± 4.7	25.8 ± 4.5	26.0 ± 4.6
Tricep skinfold (mm)	12.8 ± 5.4	12.0 ± 6.3	11.1 ± 5.1	10.8 ± 4.9
Arm circumference (cm)	24.5 ± 3.8	25.8 ± 3.7	24.1 ± 3.4	24.0 ± 3.3
Fat mass (kg)	20.5 ± 7.8	20.8 ± 9.6	18.8 ± 7.2	18.2 ± 9.2
Fat free mass (kg)	52.4 ± 9.8	55.5 ± 10.7	50.4 ± 9.5	54.2 ± 10.5

Table VII
Energy, macro and micronutrient intake before and aftger the surgery

	Before surgery	*After surgery*
Energy (kcal)	1,757 ± 768	1,716 ± 876
Protein (g)	104 ± 57	102 ± 55
Total carbohydrate (g)	226 ± 90	240 ± 128
Mono and dissacharides (g)	87 ± 37	95 ± 41
Polyssacharides (g)	138 ± 86	145 ± 100
Total fat (g)	40 ± 24	38 ± 27
Saturated fat (g)	16 ± 10	15 ± 10
Monounsaturated fat (g)	14 ± 8	13 ± 10
Polynsaturated fat (g)	7 ± 5	8 ± 6
Dietary fiber (g)	35 ± 20	39 ± 20
Alcohol (g)	10 ± 25	6 ± 14
Cholesterol (mg)	133 ± 79	140 ± 62
Sodium (mg)	2,594 ± 1,470	2,249 ± 1,234
Potassium (mg)	3,604 ± 1,566	3,695 ± 1,486
Calcium (mg)	791 ± 396	802 ± 401
Iron (mg)	13 ± 7	12 ± 6
Selenium (mg)	0.05 ± 0.04	0.05 ± 0.03
Vitamin A (mg)	237 ± 173	351 ± 335
Vitamin C (mg)	106 ± 157	101 ± 80
Vitamin E (mg)	10 ± 6	9 ± 9

An excessive energy intake was reported among 30 individuals on the first assessment while almost the same number reported lower energy intakes after the surgery. Average protein, fat and energy intake had decreased while carbohydrate intake had increased.

Dietary fiber, calcium and potassium intake had increased while vitamin C and vitamin E intake had decreased, however their reported intake was below the Dietary Reference Intake values.[18]

The vast majority of the patients (95.8%) did not received any specific nutritional support, 2% had received parenteral and 2% enteric nutritional support.

Available data revealed that 52% had a post-surgery fasting period less than 24h, 22% fasted during 24 h, 18% during 48 h and 4% during 72 h.

Days spend in the hospital and complications

The minimum days spent in the hospital were 4 and the maximum days spent were 63, the average number of days in the hospital was 11.

There were found expected significant differences considering both types of surgery, conventional surgery patients spent in average 15 days in the hospital and in the fast-track patient group the average was 8 days.

Regarding complications, 52% of the patients had surgery complications and most were in conventional surgery group. The majority (71.4%) of the fast-track surgery sample (n = 20) did not revealed any surgery complication while 72.7% from the conventional procedure group had shown problems.

Discussion

In the present study, some malnutrition signs had appeared reinforcing the nutritionist role in offering specific nutritional support and assess nutritional status in colorectal cancer patients.

Overweight and obesity was considerably present in the studied sample and according to PG-SGA, most were well-nourished. These results were not in accordance with previous studies which had associated malnutrition with this form of cancer.[7,19] However, overweight and obesity are important risk factors for cancer such as colorectal cancer[20,21] and breast cancer.[22]

Results from body composition assessment had revealed that these patients had shown a severe depletion and fusion of lean body mass with an excess of body fat mass, which had reflected a sarcopenic obesity.[23,24]

However, after the surgery all the anthropometric measures - weight, BMI, tricep skinfold and arm circumference as well as in body composition determined by BIA had significantly decreased. It is especially important to note the considerable loss of fat free mass in this period. Higher losses were mainly related to two specific surgeries – rectal anterior resection and abdomen peritoneal resection, conducted in 38 and 4%, respectively which addresses to the need of special attention in these specific patients.

Food habits evaluated were considerable different from nutritional guidelines regarding to a Mediterranean food pattern, which is frequently recommended in order to prevent several cancers including colon and rectal cancer.[25]

Food intake assessment before the surgery had shown a dietary pattern quite different from nutritional recommendations for colon cancer prevention. Epidemiologic, prospective and experimental studies had shown a protective effect of fiber in colorectal cancer.[26–28]

Several factors contribute to the worseness of colon cancer patient's nutritional status. Anatomical changes due to tumor growth are a natural cause but several

symptoms had been addressed also to metabolic changes like lower insulin sensitivity which alter carbohydrate metabolism. Energy expenditure had been shown to increase but food intake had seem to be progressively lower which conducts to weight loss exacerbated by stress, pain, infection and surgical proceedings.[4]

Although these clinical features could ultimately worsen patient's outcome, quality of life is also a main concern in this cases.

Considering this, it had become especially important to assess nutritional status in colon cancer patients and address a personalized nutritional intervention.[12]

Despite fast track surgery patients had shown fewer complications and had a shorter hospital stay, weight and fat free mass loss was higher in these patients which are in accordance with other results considering this method.

With the present results, it is important to conclude that despite overweight and obesity had been frequently observed in colorectal patients, malnutrition risk should be considered due to the main physiological and clinical changes due to cancer growth and specific surgery procedures. These concerns address to the need of nutritional status screening since cancer diagnosis, during hospitalization and which should consider also surgery procedures conducted.

Executive summary

- Malnutrition does not seem to be frequent in this type of cancer but malnutrition signs are quite frequent during hospitalization due to medical conditions.
- Food intake analysis revealed a low intake of fiber which could be a risk factor.
- Fast-track surgery seems to promote a better outcome and is association with a shorter stay in the hospital.
- Nutritional support given to these patients should address to control malnutrition but have to consider possible excessive weight conditions.

Conflict of interest

The authors wish to confirm that there were no conflicts of interest associated with the present work and that they are in full control of primary data which can be reviewed if needed.

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