Association of nutritional status and functional capacity in gastrointestinal cancer patients

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Abstract

Objective: *To determine the nutritional status and its association with functional capacity in patients with digestive tract cancer.* **Methods:** *We retrospectively studied all adult patients hospitalized who were diagnosed as having a cancer of the digestive tract. Nutritional status and functional capacity were assessed. Descriptive statistic and odds ratio were used to determine the association in SPSS 14.0.* **Results:** *57 patients were included, 96% had weight loss. Using subjective global assessment (SGA) as a method of screening, 82.5% of the patients were found malnutrition and by biochemical and immunological test 82% and 65% respectively. Functional capacity was assessed by Karnofsky index, finding that 75.5% of the patients have some activity limitation. Results show an association between malnutrition by SGA and limitation in functional capacity ($\chi 2 = 1.56$; $p = 0.212$; OR: 2.46; 95% confidence interval [95% CI]: 0.581-10.465). In addition, we observe an association between the total lymphocyte count and limitation in functional capacity ($\chi 2 = 6.94$; $p = 0.008$; OR: 5.23; 95% CI: 1.441-19.025).* **Conclusions:** *Malnutrition in patients with digestive tract cancer was associated with limitation in functional capacity.*

KEY WORDS: *Subjective global assessment. Malnutrition. Karnofsky index. Functional capacity. Cancer.*

Introduction

Cancer is a chronic, disabling disease with high mortality. The World Health organization (WHO) estimates that, by the year of 2030, around 12 million people will die owing to this condition[1], with gastrointestinal (GI) tract tumors standing out[2]. In Mexico, changes in alimentary habits have walked hand in hand with an increase of these neoplasms, out of which gastric cancer is at first place, followed by colon and rectum cancer[3].

Malnourishment in the cancer patient results from multiple factors that are often associated with anorexia, cachexia and early satiety sensation, which are often experienced by individuals with cancer. Both are closely related, so that the disease can cause malnourishment and this, in turn, can negatively influence on the disease[4]. If malnourishment is not opportunely treated, it can entail increasing emaciation, weakness, reduced protein synthesis and loss of muscular mass, whereby it directly affects the cancer patient quality of life and increases mortality[5-7].

There are different tools designed for nutritional screening and evaluation. The Subjective Global Assessment (SGA), developed in the 1980's at the Toronto General Hospital, has been shown to be a highly reliable and easily reproducible tool, with even higher sensitivity and specificity than traditional parameters such as albumin and transferrin values to assess the nutritional status[8,9]. The Karnofsky index (KI) was first used in the decade of 1950 to assess the performance status in cancer patients undergoing chemotherapy. Ever since, it has been used in different clinical trials to assess the functional capacity, as a predictor of

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evolution, survival and even as a quality of life indicator[10-12].

The KI score has been associated with the Quetelet index (QI) in cancer patients, with a survival increase being observed the higher the latter is[13]. Some studies show an association between malnourishment and the occurrence of complications associated with changes in functional capability. Weight loss has also been described as a poor prognosis indicator in these patients, with it being related to functional capability reduction, which suggests a possible direct relationship with the presence of malnourishment[2,3]. The purpose of this study was to find out the nutritional status and its association with functional capacity in patients with GI cancer.

Methods

This was a retrospective, analytical, observational study carried out in adult patients admitted to the oncology hospitalization area of a federal reference hospital of Mexico City during the years 2011 and 2012. Patients from both genders, with a GI tract cancer initial diagnosis; i.e., less than one year since the onset of symptoms at diagnosis and no previous oncologic treatment, were included. Patients with incomplete data were excluded.

Study variables were the nutritional status and functional capacity, assessed at patient admission. Anthropometrics, albumin and total lymphocyte count were also determined. Demographic variables were age, gender, level of education, smoking, alcoholism and comorbidity.

Nutritional status was determined by means of the SGA, which was obtained from the records of the nutritional support unit, since SGA is systematically applied to all patients within 24-72 hours of admission. This method combines patient history aspects (weight loss, changes in alimentary intake and changes in functional capacity) and physical examination findings (loss of fat and muscle mass, presence of sacral edema or ascites). Patients were classified in three different nutritional situations: well-nourished, moderate malnourishment and severe malnourishment[14].

Functional capacity was measured by means of the KI. Scores of the scale range from 0 to 100, where a high score means that the patient has better capacity to perform daily activities (10: moribund patient; 100: patient able to lead a normal life, independent and without assistance). Patients were classified in two groups: without functional limitation (KI $\geq$ 80) and with functional limitation (KI $\leq$ 70)[10,11].

Recorded anthropometric measurements included height (cm) and weight (kg), QI (kg/m^2) and weight loss in the previous 6 months, which was calculated with the formula:

$$\text{Weight loss}\,(\%) = \frac{\left(\begin{array}{l}\text{Current weight} - \\ \text{usual weight}\end{array}\right) \times 100}{\text{Usual weight}}$$

Nutritional biochemical and immunological parameters complemented the nutritional assessment and were obtained from patient records. Considering albumin values, patients were classified as: no malnourishment (> 3.5 g/dL), with mild malnourishment (3.5-2.8 g/dL), with moderate malnourishment (2.1-2.7 g/dL) and with severe malnourishment (< 2.1 g/dL). The cutoff points considered for classification according to lymphocyte total count [(lymphocyte % x leukocyte)/100] were > 1500 mm^3 for normal, 1200-1500 mm^3 for mild malnourishment, 800-1199 mm^3 for moderate malnourishment and < 800 mm^3 for severe malnourishment.

Data analysis was carried out using the SPSS statistical package, version 14.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics was used. Qualitative variables were analyzed by means of frequencies and percentages; quantitative variables, with means and standard deviations. The tests used to analyze the association between nutritional status and functionality were the odds ratio and the chi-square test. The level of significance adopted for comparisons was = 5%. The study was approved by the Ethics and Research Committee with institutional registry number HJM2013/11R.

Results

Fifty-seven GI tract cancer-diagnosed patients were finally evaluated. Average age was 57.8 ± 14.5 years, with 54% being men and 46% women. Weight loss was referred by 96% of patients, and it was estimated at an average of 13.18 ± 8.73%. A weight loss of 11-20% from usual weight was experienced by 35% of the population, with 17% of the population referring weight loss of 20-30% and 34% having a weight loss of 1-10%; only 4% of the study population had no weight loss recorded. Demographic characteristics are shown in table 1.

Table 1. Demographic characterization of the study population

Characteristic	Global (n = 57)	No malnourishment (n = 10)	With malnourishment (n = 47)
Age (years)	57.8 ± 14.5	54.9 ± 5.71	58.43 ± 14.4
Gender (M/F)	31/26	4/6	27/20
Weight loss (%)	13.18 ± 8.73	5.9 ± 6.9	14.7 ± 8.33
QI (kg/m^2)	22.6 ± 3.8	21.3 ± 3.4	22.8 ± 3.8
Active smoking	27 (47.4%)	7 (70%)	20 (42.5%)

QI: Querelet Index.

Predominating types of cancer were colon (35%), gastric (23%), pancreas (9%), esophagus (7%), small bowel (2%) and others (24%). Most patients (94.8%) were at clinical stages II and III of disease; only 1.7% was at clinical stage I and 3.5% at clinical stage II.

Malnourishment, as measured by SGA, affected 82.5% of the population, out of which 21% had moderate malnourishment and 61.5% severe malnourishment. By biochemical parameters, such as albumin, 18% was classified within normal, 24% with mild, 21% with moderate and 37% with severe depletion, with an average of 3.2 ± 0.79 g/dL. When immunological parameters were considered, such as lymphocyte total count, 65% had malnourishment: had 14% mild malnourishment, 21% moderate malnourishment and 30% severe malnourishment.

With regard to KI-determined functional capacity, 24.5% of the population was carrying out its activities practically normally, whereas 75.5% had some activity limitation. When a sub-analysis as an overall indicator of self-sufficiency was made, out of that 75.5%, we found that 35% had some limitations, with scores of 80; 35% had limited activity, i.e., had scores ranging from 50 to 70; and 5.5% were unable of self-care and had scores ranging from 10 to 40.

The association between nutritional status by SGA and functional capacity of the population is shown in table 2. Of the patients who showed malnourishment, 78.7% had activity limitations (χ^2 = 1.56; p = 0.212). Table 3 shows the association between nutritional status, classified by lymphocyte total count, and functional capacity. Of those who showed malnourishment, 56.1% had activity limitations (χ^2 = 6.94; p = 0.008).

Table 4 shows the relationships between functional capacity and study predictor variables.

Table 2. Association between nutritional status by SGA and functional capacity according to KI

Functional capacity	Nutritional status		Total
	No malnourishment	With malnourishment	
Not limited	4	10	14
Limited	6	37	43
Total	10	47	57

x^2=1.56 (p = 0.212).
OR: 2.46 (95% CI : 0.581-10.465).

Table 3. Association between nutritional status by immunology tests (lymphocyte total count) and functional capacity according to KI

Functional capacity	Nutritional status		Total
	No malnourishment	With malnourishment	
Not limited	9	5	14
Limited	11	32	43
Total	20	37	57

x^2=6.94 (p = 0.008).
OR: 5.23 (95% CI: 1.441-19.025).

Table 4. Relationships between functional capacity and biochemical and clinical variables

Característica	r	p
Cholesterol	0.174	0.490
Albumin	0.400	0.826
Lymphocyte	0.255	0.055
Cancer stage	0.489	0.001

Discussion

Malnourishment in cancer patients is a reality, and weight loss has been an indicator thereof. Some studies have shown that, at diagnosis, 80% of patients with GI cancer have already experienced significant weight loss, generally of at least 10% of body weight over a period of 6 months[4,5,15]. In our study population, we reported a higher percentage of patients with weight loss, with average losses higher than 10% in 6 months. Most part of our patients had colon cancer,

followed by gastric cancer, which may account for this higher weight loss. This, reinforced by findings of Moon et al.[16], together with reduced intake, dysphagia and mucositis that are even accentuated during cancer treatments, mainly with chemotherapy[17].

When patients were assessed my means of the QI, we observed that although more than half had a normal or even higher index, when SGA is applied, we see that more than two thirds of the population had some degree of malnourishment. Tolentino et al.[18] reported, in their study in cancer patients, that although weight loss is quite common, QI decreased mainly in the presence of GI tumors in comparison with non-GI tumors. In our study, we determined that, although QI was similar in both groups, weight loss was higher in the group with SGA-determined malnourishment. Therefore, QI is not a sensitive indicator to detect malnourishment. The use of SGA continues to be a practical method that enables to distinguish between well-nourished and malnourished patients, without the need to resort to anthropometric or laboratory measurements.

Malnourishment, as a deficiency of multiple nutrients, alters functions that the immune system is implied with. For this purpose, the determination of total leukocyte and different white cell numbers is a simple procedure that allows for useful information to be obtained and that has been associated with cancer porognosis[19-21]. Even neutrophil/lymphocyte and platelet/lymphocyte ratios have been studied as predictors of both aggressiveness and poor prognosis, since neutrophils are a source of endothelial growth factor, which participates in angiogenesis and increases the capability of the tumor to spread. In addition, elevation of systemic inflammation markers is associated with lymphocytopenia and T-cell altered anti-tumor response[22-24].

Considering that immune system cell functions are influenced by antioxidant and pro-oxidant substances, and that cancer cells undergo disturbances in electron energy balance, we determined leukocyte total values as a malnourishment marker and observed that more than half the patients had some degree of malnutrition, in addition to finding a clear association with functional capacity, which is something we didn't verify in other biochemical biomarkers such as albumin or cholesterol.

Nutritional status alterations are worrisome in the cancer patient, especially malnourishment, since different studies have associated it with tolerance to treatments, quality of life and survival. To assess nutritional status impact and its possible association with functional capacity, we used the KI. Although there are different scales to measure functional capacity, the KI has been classified as the best method owing to its survival predicting power, which enables to determine the level of activity and dependence of patients with regard to their medical care[25,26]. The Eastern Cooperative Oncology Group (ECOG)/WHO Functional Scale, first applied in 1960 to patients receiving chemotherapy, has shown high correlation with KI. Spearman correlation coefficient-obtained values were 0.85 ($p > 0.0001$) in the study by Loperinzi et al.[26], and 0.87 ($p > 0.0001$) in the study by Buccheri et al.[27]. The Palliative Care Functional Scale is a functional capacity measuring scale specifically designed for patients on palliative care, just as Edmonton Functional Assessment Tool. The Palliative Care Functional Scale is a modification of KI and, therefore, is has high correlation (Spearman coefficient of 0.94). In our study we observed that, although KI values are not as low as those reported in other series, patients already have some degree of limitation and certain dependence; thus, only 5.5% had a KI < 50, with expected survival of less than 6 months[28,29]. In addition, we observed an association between nutritional status by SGA and functional capacity by KI. This is related to the fact that malnourishment associated with the disease, with its stage, and even with the treatments received by the patient, produces a decrease in fat mass and muscular strength, which have an immediate effect of physical activity and functional capacity reduction in these patients. Ottery[30], in a study of patients with GI cancer, identified that nutritional status, disease evolution and tumor location were independent factors on functionality and quality of life.

The scales to assess functional capacity have shown its survival predictive power, which can be attributed to clinical estimates. Although Maltoni et al.[1] have called this claim into question, in our study we observed a negative correlation between functional capacity and cancer clinical stage, so that it depends on patient evolution, and the more advanced the disease is, the better the prognostic estimate based on functional capacity measurement will be.

Baseline nutritional status identification and nutritional intervention influence on antineoplastic treatment success and general prognosis of a cancer patient. Although nutritional support contributes to normalize nutritional status, improve functionality and quality of life, the therapeutic approach should not be

forgotten in those patients at early and locally advanced stages, whereas in those at advanced or metastatic stages, focus should be on symptom control, quality of life improvement and overall survival increase[32-34].

Finally, it is necessary for our centers to have nutritional assessment tools available, which enable opportune identification of those patients at risk of or with malnourishment; in addition, having a performance status and quality of life assessment scale is also required, since it is indispensable from the therapeutic point of view according to its purposes.

Conclusions

The prevalence of malnutrition in our setting is high in patients with GI cancer. Nutritional status determined by SGA and by total leukocyte count is associated with functional capacity.

Conflicts of interests

There are no conflicts of interests. There is no economic, personal, political or academic relationship, nor have benefits of money, goods, hospitality or subsidies been received from any source that might influence on the presentation of the results of this study.

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