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Higher Score of Patient-Generated Subjective Global Assessment is a Risk Factor for Upper Gastrointestinal Cancers in Newly Diagnosed Patients

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ABSTRACT

Background: Malnutrition or risks of malnutrition can be detected with the Patient-Generated Subjective Global Assessment (PG-SGA), a tool widely used to detect malnutrition. Debilitating diseases such as cancer cause serious physical, mental, and social harm. The relationship between malnutrition with cancer has been investigated and the existence of this relationship has been proven. This study aimed to determine the relationship between malnutrition or risks of malnutrition based on PG-SGA score and esophageal and gastric cancers. **Methods**: A case-control study was conducted, including 120 patients with upper GI cancers as cases and 120 patients with orthopedic, ear-nose-throat (ENT), and neurologic disorders as controls group. These patients have been newly diagnosed using endoscopy, imaging, or biopsy techniques. The general and PG-SGA questionnaires were completed by the participants. **Results**: The mean ± SD of PG-SGA score was 69.2% and 43.3% in cases and controls, respectively. Cancer was significantly associated with the higher PG-SGA score, family history of cancer, poor economic level, and lower household employed people (P<0.05). **Conclusion**: These results suggest that a higher PG-SGA score may contribute to the incidence of upper GI cancers.

Keywords: PG-SGA; Body Mass Index; Upper Gastrointestinal Neoplasms

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INTRODUCTION

The term cancer refers to the uncontrolled growth of cells in the body that can damage the physique, social and psychological aspects as well, as contributing to various individual and social harms (1, 2). In recent years, cancer is becoming a more important cause of death (3). After cardiovascular diseases, cancer ranks second in terms of mortality in the world (4). Malignant tumors of the upper gastrointestinal tract (GI) such as the stomach, esophagus, esophagogastric junction (OGJ) account for a substantial number of cancer-related deaths worldwide. They are one of the five most common cancers in Iran (5).

Between 40 and 80 percent of cancer patients are malnourished. An increase in infections, treatment toxicity, and healthcare costs, and decreased response to treatment, quality of life, and life expectancy is associated with malnutrition (6-13). Hence, the health implications of malnutrition have to be considered (14).

There are no longer only biomedical indicators used to evaluate medical care, and today, there is a focus on broader tools such as nutritional assessment (8). One nutritional assessment tool in cancer patients is Patient-Generated Subjective Global Assessment (PG-SGA) (15). As a nutritional assessment tool, the scored PGSGA was developed and validated and has become a standard tool for assessing the nutrition status of cancer patients (8, 16-18). In a study among cancer patients using the PG-SGA to evaluate nutritional status in patients with cancer, cancer patients had significantly higher malnutrition prevalence (19). In the context of nutrition assessment in cancer patients, PG-SGA is widely regarded as the gold standard (16). A clinical and weight history, evaluation of treatment-related symptoms and activities, food intake, and a physical examination are included, and patients are categorized into three different groups: (A) Healthy and well-fed, (B) possibility of malnourishment, and (C) malnourishment (15). A numerical score is also assigned to the patients. When the PG-SGA score is nine or more, nutrition intervention is necessary (15).

In cancer patients, very little data are available on the prog-

nostic importance of the PG-SGA in GI cancer. Still, recent research by Grutsch et al. investigated the predictive value of PG-SGA in patients with advanced colorectal cancer (ACRC), and also found that patients with a high PG-SGA score were significantly more likely to death (20).

Based on increasing malnutrition and upper GI tract cancers among Iranians, and the possibility of a relationship, this study was conducted to investigate the association between PG-SGA score and upper GI cancers in newly diagnosed patients.

MATERIAL AND METHODS

Study Participants

A case-control study was conducted at Imam Khomeini Hospital, Tehran, Iran, from January to December 2013. One hundred twenty patients newly diagnosed with upper GI tract cancers at the Central Institute of Cancer surgical ward were included in the case group. There were 120 patients at one of the orthopedics, ear-nose-throat (ENT) and, neurology departments in the control group who did not have cancer. Two groups were matched based on age, sex, and residence (Tehran, the surrounding area of Tehran, and other cities). Inclusion criteria were patients with upper GI cancer with a diagnosis period of fewer than six months. Exclusion criteria were psychiatric disorders, age less than 21 years, mental illness, psychosis, and disabilities affecting the ability to remember, cooperate, or answer (Alzheimer's, amnesia, etc.).

Data Collection

All of the participants completed PG-SGAquestionnaires by interviewing. The Persian version of the PG-SGA questionnaire and the check list were used already (21).

The scored PG-SGA is an adaptation of the validated nutrition assessment tool, Subjective Global Assessment (SGA), and has been specifically designed for use in the cancer population (8, 22). This is a nutrition assessment tool that can identify and prioritize malnutrition in cancer patients (8). According to previous studies, the PG-SGA score was related to a variety of objective parameters such as percentage weight loss, body mass index (BMI), rate of morbidity, and mortality, and has a high degree of inter-rater reproducibility and comparing to other validated nutritional assessment tools; it has a high degree of inter-rater reproducibility and high sensitivity and specificity (16, 23, 24). For the convenience of participants, the PG-SGA questionnaire was translated into Persian. In a previous study of Iranian non-hematological cancer patients, this questionnaire was previously used and validated, which demonstrated its high reliability based on a Cronbach's alpha of 0.7543. (21).

The check list included questions about age, sex, residential area, economic levels, ethnicity, education levels, health insurance, history of GI ulcer, family history of cancer, BMI, family size, number of children, marital status, history of smoking at six months consecutively, and history of specific diseases including diabetes, heart disorders, hypertension. Upper GI cancers are diagnosed via endoscopy, imaging, or biopsy/cytology. In order to clarify the research perspectives, nigh teen newly diagnosed patients underwent a pilot study prior to the start of the study. To estimate economic status, nine items were accounted for: owning a car, house, dishwasher, side by side refrigerator, handwoven carpet, computer or laptop, and a microwave oven are among the most common options. The three economic levels were low/poor (< 3 items), moderate (4-6 items), and good/wealthy (>7 items) (25).

PG-SGA's first section was completed by the patients and involved an assessment of weight loss history at six months and a month before the interview. Nutritional impact symptoms, functional capacity, and changes in food intake were also assessed. In the second section, data collected during the clinician's visit, such as diagnosis, age, physical examination, and metabolic stress, are examined. Physicians or dietitians conducted the physical examination, which included assessing muscle and fat stores. A lower score represents a poorer nutritional status for each section. In general, the score ranges between 1 and 40. In general, a total score of nine or more indicates a patient in need of nutritional intervention and diet consulting.

The BMI was calculated using the weight and height obtained from medical records (BMI <18.5 kg/m2, 18.5-24.99 kg/m2, 25.0-29.99 kg/m2, and ≥30 kg/m2 as underweight, normal, overweight, and obese, respectively). To identify the risk factors of upper GI cancer, conditional logistic regression models were used. Among the individual elements that matched students, age, gender, and residence area were considered. Data analysis was performed using Stata11SE. The findings would be described using mean, and standard deviation. The Kolmogorov-Smirnov test will be used to evaluate the normality of quantitative data. Inter-group comparisons would be performed using the independent t-test and Mann-Whitney test for abnormal quantitative variables. Chi-square and Fisher tests will be used to compare the distribution of qualitative variables between the study groups. Statistical significance was defined as P-value <0.05. To identify potential risk factors for upper GI cancer, multivariate logistic regression was used to analyze the significant factors identified by the univariate model.

RESULTS

The total number of patients was 240 (144 men, 96 women), aged 71.1 + 32.6 years. 79 (55 men and 24 women), 30 (10 men and 20 women), and 11 (7 men and 4 women) patients had cancers of the stomach, esophagus, or both. Neurological, orthopedic, and ENT disorders affected 33 (13 men and 20 women), 51 (35 men and 16 women), and 36 (24 men and 12 women) patients, respectively. 27.5%, 11.7%, and 60.8% of the residual areas were in Tehran's center, the surrounding neighborhoods, and other locations, respectively. Cases and controls each had mean ± standard deviation (SD) of age, weight, and height 60.23±11.48 yr and 60.42±11.99 yr, 59.71±12.53 kg and 67.67±9.72 kg, and 163.19±9.64 cm and 166.96 ± 8.18 cm, respectively. The mean ± SD of PG-SGA scores for controls and patients were 16.44 ± 8.142 and 3.63 ± 2.692, respectively. There were significant differences in the score of the PG-SGA questionnaire, economic status, education status, ethnicity, health insurance status, GI ulcer history (gastric or duodenal), family history of cancer, body mass index, family size, household dimension, and numbers of household employed people between two groups, based on the univariate conditional logistic regression model. The majority of cancerous patients were in a score of PG-SGA questionnaire, lower economic levels, non-Fars ethnicity, illiterateness, family size≥3 peoples, GI ulcer history or family history of cancer, and health insurance coverage status and more household dimension and

Table 1. Comparing various factors between patients with upper GI cancers and non-cancerous controls

Factors		Cases N (%) or Mean (SD)	Controls N (%) or Mean (SD)	OR (95% CI)	P-value*
Economic level	Medium/High	24 (20)	41 (34.2)	1.00	0.014
	Low	96 (80)	79 (65.8)	2.07 (1.15, 3.72)	
Ethnicity	Persian	22 (18.3)	68(56.7)	1.00	0.001
	Non-Persian	98 (81.7)	52 (43.3)	5.82 (3.24, 10.47)	
Level of education	Literate	59(49.2)	77(64.2)	1.00	0.020
	Illiterate	61(50.8)	43(35.8)	1.85 (1.10, 3.10)	
Having health insurance	No	6 (5)	20 (16.7)	1.00	0.006
	Yes	114 (95)	100 (83.3)	3.8 (1.46, 9.83)	
History of gastric ulcer	No	100 (83.3)	111 (92.5)	1.00	0.033
	Yes	20 (16.7)	9 (7.5)	2.46 (1.07, 5.66)	
Family history of cancer	No	76 (63.3)	96 (80)	1.00	0.005
	Yes	44 (36.7)	24 (20)	2.31 (1.29, 4.14)	
Family size	1-2 persons	31 (25.8)	56 (46.7)	1.00	0.001
	≥3 persons	89 (74.2)	64 (53.3)	2.51 (1.45, 4.32)	
Marital status	Married	110 (91.7)	107 (89.2)	1.00	0.512
	Single/widowed/ divorced	10 (8.3)	13 (10.8)	0.74 (0.31, 1.77)	
History of smoking for ≥6 months	No	85 (70.8)	94 (78.3)	1.00	0.183
	Yes	35 (29.2)	26 (21.7)	1.48 (0.82, 2.67)	
History of specific diseases	No	78 (65)	70 (58.3)	1.00	0.289
	Yes	42 (35)	50 (41.7)	0.75 (0.44, 1.27)	
Score of PG-SGA questionnaire#		16.44(8.142)	3.63(2.692)	-	<0.001
Body Mass Index		22.4 (4.4)	24.2 (2.8)	-	<0.001
Household dimension#		4.0 (1.8)	2.9 (1.2)	-	<0.001
Numbers of household employed peoples#		1 (1.1)	1.7 (1.0)	-	<0.001

* Conditional logistic regression (individually matched for sex, age, and residential area). # Independent sample t-test.

fewer numbers of the household employed people than a control group. Additionally, there were no significant differences between the two groups regarding marital status, smoking history, or history of specific diseases (Table 1). Finally, PGSGA Score, family history of cancer, poor economic situation, and fewer household employed people were the most critical risk factors associated with upper GI cancers (Table 2).

DISCUSSION

The means of PG-SGA score was higher in the upper GI cancer group compared with the control group. Opanga et al. reported that the prevalence of severe malnutrition based on means of PG-SGA score was highest among participants with digestive organ cancers, and there was moderate to severe malnutrition among participants in stage four (26). Furthermore, a previous study in newly diagnosed esophageal cancer patients in Iran demonstrated a high prevalence of malnutrition based on the PG-SGA score (27). PG-SGA score predicts nutritional status strongly, has high sensitivity and was able to identify malnourished patients with 98% sensitivity (28, 29).

Higher PG-SGA score, family history of cancer, poor economic level, and lower numbers of household employed people were the most relevant risk factors for upper GI tract cancers. The cancer odds ratio in people with higher PG-SGA scores, family history of cancer, poor economic level, and lower numbers of household employed people were 1.55, 0.55, 1.28, and 1.9 times, respectively.

In society, access to adequate food is directly related to income, and people with higher incomes have more food options. In contrast, those with lower incomes have fewer (2, 30). Previous studies in Iran and other countries indicate a higher incidence of adenocarcinoma and squamous cell carcinoma of the esophagus with low socioeconomic status (31-33). Iranians with higher incomes were less likely to suffer from esophageal and gastric cancers in coastal areas (34). Furthermore, a higher PG-SGA score was associated with malnutrition, and malnutrition could be increased by reducing the economic level (35). Several factors contribute to malnutrition, including lifestyle, loneliness, social isolation, marital status, level of education, socioeconomic status, and place of residence (36, 37). Lastly, it was found that a high economic level protects against malnutrition (38).

Gastric cancer and large tumors are related to a family history of cancer (39). In addition, an increased risk of gastric cancer (cardia and non-cardia) is associated with an increased family history of digestive tract cancer. However, the risk of esophageal cancer is not increased.

Table 2. Risk factors for upper GI cancers using multiple conditional logistic regression (individually matched for sex, age, and residential area)

Factors	Cases N (%) or Mean (SD)	Controls N (%) or Mean(SD)	OR (95% CI)	P-value*
PGSGA Score	16.44 (8.142)	3.63(2.692)	1.557 (1.335, 1.817)	0.014
Poor Economic Level	1 (1.1)	1.7 (1.0)	0.554 (0.345, 0.887	0.001
Level of education	96 (80.0 %)	79 (65.8 %)	1.283 (1.023, 1.183)	0.020
Having health insurance	44 (36.7 %)	24 (20.0 %)	1.934 (1.302, 2.893)	0.006

* Adjusted for economic levels, ethnicity, education levels, health insurance, history of GI ulcer, family history of cancer, BMI, family size, household dimension and Numbers of household employed peoples.

The risk of both esophageal and gastric cancers is significantly increased by a family history of breast cancer (40). There is a significant increase in the risk of esophageal cancer in families with mouth cancer, oral cavity cancer, stomach cancer, and pharynx cancer (41). Families with a history of esophageal cancer in the first degree have a higher risk for the disease in Iran (42). In contrast, a family history of either esophageal cancer or stomach cancer was not a risk factor for esophageal carcinoma among first-degree relatives. Nonetheless, first-degree relatives of those with stomach adenocarcinomas have a moderately higher risk of developing the disease (43). Perhaps this is due to differences among populations, as well as specific conditions that may cause it.

There were no significant associations between ethnicity, education level, health insurance, history of GI ulcer, BMI, family size, marital status, history of smoking, and history of specific diseases in the study.

Several previous studies found an inverse relationship between BMI and the risk of upper GI cancers, in contrast to this study (44, 45). Before cancer occurrence, the weight and BMI of patients were not known.

During the past few decades, upper GI cancers have been changing drastically in terms of their demographics. Various factors determine its occurrence, including socioeconomic status, body mass index history of gastrointestinal ulcers, smoking, and underlying diseases. Developing a deeper understanding of upper GI cancer etiology and epidemiology will affect averting and screening of high-risk populations (46).

The findings of this study could not confirm Some risk factors of upper GI cancers, including Helicobacter pylori infection, eating habits, obesity before cancer occurrence, lymphoma of the stomach, gastric reflux disease, Barrett's esophagus, achalasia, tylosis, syndrome of Plummer-Vinson, occupational exposures, esophageal injuries, and some viral infections. Patients may selectively reveal or suppress information, which can cause a bias in reporting. However, the statistical methods partly addressed this.

The strengths of this study include case-control design, obtaining informed consent from all participants (in Persian), selecting the newly diagnosed cancer patients, individually matching by age, gender, and residence, conducting a pilot study before starting the study, and general health care services were available.

This study has several limitations, including self-reporting, limited type of upper gastrointestinal cancer, slow patient recruitment because of eligibility criteria, single-center performance, and lack of cooperation by some patients, leading to patients being replaced.

This work has implications for practice and research because of the selection of controls, the problem of learning accurately about an individual's exposure status over time, the difficulty of finding newly diagnosed cancer patients, the poor mental health, and the impatience of some cancer patients, and their expectations of financial support.

CONCLUSION

In patients with GI cancer, the PG-SGA score was high. An increased risk of upper GI cancer may be associated with poor economic status, high PG-SGA scores, and a family history of cancer. When the health effects of high PG-SGA scores are recognized and understood, the burden will be reduced. There is still a need for additional studies to discover if the PG-SGA score is associated with other cancers. In future studies, a picture of the PG-SGA score must be drawn by assessing the PG-SGA score in different Iranian provinces and by investigating the diseases associated with it.

ETHICAL CONSIDERATION

This study was approved by the ethics committee of Tehran University of Medical Sciences (RegNo.139). An informed written consent form was provided by the participants before data collection.

CONFLICT OF INTRESETS

The authors declared no potential conflicts of interest concerning the research, authorship, and, or publication of this article.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available from the corresponding author at reasonable request.

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Author Contribution: ADM, MDM conceived and designed the study. MDM, MBF participated in the organization of the activities. MDM, MBF, SJM managed the activities and collected the data. MH and MDM analyzed and interpreted the data. ADM, MBF, SJM, MP, MH, MDM drafted the article. ADM, MBF, SJM, MP, MH, and MDM revised the manuscript critically for important intellectual content. All authors read and approved the final article.
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