Investigating the Quality of Life and Nutritional Status in Patients with Esophageal Cancer: A Cross-sectional Study

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ARTICLEINFO	ABSTRACT
Article type: Research Paper	**Introduction**: Nutritional issues can negatively impact cancer patients' quality of life (QoL). The current study aimed to evaluate the quality of life and nutritional status of patients diagnosed with esophageal cancer.
	Methods: This cross-sectional study was conducted on newly diagnosed esophageal cancer patients between February 2015 and February 2016. Demographic and disease-related data were collected. Quality of life was assessed using the EORTC Core Quality of Life questionnaire (EORTC QLQ-C30). At the same time, nutritional status was evaluated through the Patient-Generated Subjective Global Assessment (PG-SGA) questionnaire, anthropometric measurements, dietary intake, and laboratory tests. Physical performance was assessed using handgrip strength and the Karnofsky Performance Scale.
	Result: A total of 124 patients with esophageal cancer participated in the study. The mean age of participants was 66.84 ± 11.95 years. The mean physical function score was 79.67 ± 25.78, and the mean emotional function score was 65.50 ± 26.02. The average PG-SGA score was 13.15 ± 5.79, with 94% of participants scoring >3. More than half of the participants experienced moderate to severe weight loss. A significant difference was observed in the mean scores across various dimensions of QoL, except cognitive function, between patients with severe and non-severe malnutrition. Additionally, significant relationships were found between anorexia and financial (p = 0.016) and role functions (p = 0.028); living location and emotional function (p = 0.012) and social function (p = 0.001); dysphagia and physical function (p = 0.039); and global function (p < 0.001).
	Conclusion: A significant relationship was found between different aspects of QoL and malnutrition in patients with esophageal cancer. Therefore, these patients require nutritional interventions to improve their nutritional status and quality of life.

Introduction

Esophageal cancer is a common gastrointestinal tumor that has seen a progressive increase in incidence over recent decades. In 2020, it ranked eighth in terms of prevalence and sixth in mortality worldwide, with 600,000 new cases reported (1-3). This disease represents a significant health challenge, as it ranks fourth in terms of disability-adjusted life years (DALY) among all malignancies. Patients with esophageal cancer face various complications, including physical function disorders related to the disease and its treatment, as well as psychological, social, and emotional challenges and malnutrition. These complications contribute to a deterioration in the patient's health-related quality of life (QoL) and mental well-being. The highest rates of cachexia are observed in gastrointestinal (GI) and upper GI cancers (4-6).

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Esophageal cancer, known for its aggressive nature and challenging treatment, significantly impacts an individual's ability to maintain adequate nutritional intake, which in turn affects their nutritional status. The disease commonly presents with symptoms such as dysphagia, odynophagia, and unintended weight loss, all of which contribute to malnutrition, reduced food intake, and altered body composition. Additionally, the physiological and metabolic changes associated with cancer lead to nutritional imbalances, presenting a complex set of challenges that directly influence the well-being and nutritional status of individuals diagnosed with esophageal cancer (7-10).

The relationship between nutritional status and quality of life in patients with esophageal cancer is complex. Both malnutrition and cachexia impair physical strength and immune function while also negatively affecting mental and emotional health, ultimately reducing the overall quality of life for individuals undergoing cancer treatment (4, 11-13). Previous studies have demonstrated a significant correlation between food consumption, nutritional status, and quality of life in cancer patients (2, 10, 14). One study found that reduced food intake is associated with an increase in symptoms such as anorexia and digestive issues (14). Another investigation revealed that malnourished patients experience a lower quality of life compared to those with adequate nutritional status (15).

Although various studies have explored the relationship between quality of life and nutritional status in cancer patients, few have specifically focused on those with esophageal cancer. This study aims to investigate this relationship further.

Materials & Methods

This cross-sectional study was conducted from February 2017 to February 2019 at the Reza Radiotherapy Oncology Center (RROC), focusing on newly diagnosed patients with esophageal cancer. Cancer diagnoses were confirmed through histological examination for all participants, with the date of the histology report serving as the official diagnosis date. The Ethics Committee of Mashhad University of Medical Sciences granted the study's ethical approval under the ethics code IR.MUMS.fm.-REC.1395.111. All participants met the established inclusion and exclusion criteria.

Inclusion criteria included newly diagnosed patients aged 18 years or older with pathological confirmation of esophageal neoplasm. Patients with a history of prior cancer treatment were excluded from the study. Patients with distant parenchymal metastasis (M1, stage IV) or invasive tumors affecting adjacent organs (T4) were also excluded.

The demographic information collected included age, gender, marital status, education level, occupation, and economic status. The economic status of participants was assessed using a scale from Payab et al., which consists of 9 items. These items were categorized into low, medium, and high economic status based on ownership of 1-3, 4-6, and 7-9 items, respectively. The items included furniture, handmade carpets, vacuum cleaners, dishwashers, washing machines, side-by-side refrigerators or freezers, microwaves, personal computers, and automobiles (16).

A calibrated scale with a maximum capacity of 150 kg and an accuracy of 0.5 kg was used to measure body weight (Seca 510 scale, Germany). Patients were instructed to stand on the scale with bare feet and in light clothing. The patients' height was measured using a stadiometer (Seca 206 stadiometer, Germany) fixed to the wall, following standard protocol. Body mass index (BMI) was calculated by dividing the patient's weight (in kilograms) by the square of their height (in meters). Mid-arm circumference was measured using a flexible tape. Patients were asked to bend their left arm, and the midpoint between the olecranon and acromion processes was marked with a pencil. The tape was then wrapped around the marked point, with the patient's arm hanging straight, and the mid-upper arm circumference (MUAC) was measured.

Body composition was assessed using a bioelectrical impedance analyzer (Tanita BC-418, Japan), which measured fat and lean mass in kilograms and as a percentage of total body mass. Patients were asked to wear light clothing and stand barefoot on the machine while firmly holding the handles. The fat-free mass index (FFMI) was calculated by dividing the fat-free mass (in kilograms) by the square of the patient's height (in meters). A reduced muscle mass was defined as an FFMI of less than 17 kg/m² for men and less than 15 kg/m² for women (17).

A trained nutritionist used the PG-SGA questionnaire to assess the nutritional status of

patients (18, 19). This questionnaire has also been validated in Persian. It covers various factors, including recent weight loss intensity, food intake, nutrition-related complications, physical performance, the impact of diseases on nutrition, the presence of fever, corticosteroid use, loss of fat and muscle, and edema. The triage scoring for the PG-SGA is as follows: a score of 0-1 indicates no need for intervention; a score of 2-3 requires patient and family education along with symptom management; a score of 4-8 calls for intervention by a nutritionist to manage symptoms; and a PG-SGA score greater than 8 indicates a critical need for nutritional intervention and symptom management (20).

To evaluate the patient's physical performance, muscle strength was measured using handgrip strength with a dynamometer (Jamar, USA). The results were compared with locally validated cutoffs based on age and gender. The Karnofsky performance scale was also utilized (21).

The dietary intake of patients was assessed using a 24-hour food recall method over 3 days. The macronutrient content of their diet was analyzed using Nutritionist 4 software (version 7, N-squared Computing, OR, USA). Energy and protein requirements were calculated based on the guidelines provided by the European Society for Parenteral and Enteral Nutrition (ESPEN), which recommend a daily intake of 30 kcal/kg and 1.2 g/kg, respectively (22). Inadequate intake was defined as less than 85% of the recommended energy intake (24 kcal/kg/day) and less than 1.2 g/kg/day of protein. Additionally, patients were asked about the availability of food, their ability to independently prepare and consume meals, including shopping, cooking, and eating, and whether they required assistance with food preparation.

The QLQ-C30 is a comprehensive questionnaire consisting of 30 items, which include six single items, three symptom domains (fatigue, nausea/vomiting, and pain), and five functional domains (physical, role, emotional, cognitive, and social). Scores range from 0 to 100 on a scale. For both the global quality of life (QoL) scale and the five functional scales, a higher score indicates better functioning or a higher global QoL. In contrast, a higher score on the symptom scales and single items reflects more severe symptoms or difficulties. Sociodemographic characteristics included in the study were age, marital status, employment status, and education level (23, 24). A blood sample was collected after a 12-hour fasting period for nutritional-related biochemical measurements. The biomarkers tested included complete blood count (CBC) (Sysmex KX-21N, Japan), urea, creatinine, aspartate aminotransferase (AST), alanine aminotransferase (ALT), total protein, serum albumin, cholesterol, triglycerides (measured using an autoanalyzer device, Alpha Classic-AT Plus), and quantitative C-reactive protein (CRP) (measured by immunoturbidimetric test, Pars Azmun, Iran).

The sample size was calculated based on the study by Khoshnevis et al. (18), resulting in 140 cases. All data were analyzed using SPSS version 26 (SPSS Inc., Chicago, IL, USA). The normality of the data was assessed using the Kolmogorov-Smirnov test. Descriptive statistics were reported as mean ± standard deviation or median (25th, 75th percentiles). Parametric and non-parametric tests were applied as appropriate, with a p-value of <0.05 considered statistically significant.

Result

A total of 186 esophageal cancer patients were included in the study. More than half of them (51.6%) were men, and their average age was 66.84 ± 11.95 years. The most common tumor location was the lower part of the esophagus (53.8%), and 167 patients (89.8%) had squamous cell carcinoma (SCC) (Table 1). Table 2 presents the mean scores for each domain in the quality of life questionnaire.

Table 1. Baseline characteristics of the subjects (n=186)

Characteristics	Mean ± SD or N (percentage)
Sex	
Male	96 (51.6)
Female	90 (48.4)
Mean age (years)	66.84±11.95
Marital status	
Single	37 (19.9)
Married	149 (80.1)
Education Level	

Characteristics	Mean ± SD or N (percentage)
Illiterate	124 (66.7)
Under diploma	51 (27.4)
Diploma	8 (4.3)
Undergraduate	3 (1.6)
Tumor site	
Upper	18 (9.7)
Middle	68 (36.6)
Lower	100 (53.8)
Tumor pathology	
Squamous cell carcinoma (SCC)	167 (89.8)
Adenocarcinoma	16 (8.6)
Undifferentiated	3 (1.6)
Economic Status	
Low	141 (75.8)
Moderate	34 (18.3)
High	11 (5.9)
Occupation	
Housewife	55 (29.6)
Farmer	53 (28.5)
Worker	16 (8.6)
Self-employed	7 (3.8)
Employee	8 (4.3)
Retired	47 (25.3)
Food availability	
No need for assistance	116 (62.4)
Has somebody for food preparation	69 (37.1)
Needs help, but nobody is available	1 (.5)

Table 2. Quality of life score in patients

Variable	mean±SD
Physical Function	79.67±25.78
Role Function	82.34±25.18
Emotional Function	65.50±26.02
Cognitive Function	88.97±16.78
Social Function	81.00±24.14
global Function	48.25±25.31
Fatigue	26.76±25.42
Nausea	7.34±16.97
Pain	20.96±25.92
Dyspnea	11.29±19.85
Insomnia	10.57±22.23
Anorexia	19.35±31.69
Constipation	32.07±29.07
Diarrhea	1.79±10.24
Financial	37.45±39.06

All variables ranged from 0 to 100, except Cognitive Function, which ranged from 33.33 to 100

Table 3 presents the anthropometric indices, PG-SGA score, and laboratory tests. The mean BMI was 21.67 ± 5.08, and nearly 52% of patients had lost more than 5% of their body weight in 1 month or more than 10% in 6 months. The mean PG-SGA score was 13.15 ± 5.79, and 94.6% of patients reported a PG-SGA score >4, indicating the need for nutritional interventions. Table 4 shows the relationship between the PG-SGA score and components of quality of life. A significant relationship was found between emotional function, physical function, role function, social function, and subjective quality of life with the intensity of malnutrition. Symptoms such as fatigue, nausea, pain, dyspnea, anorexia, and constipation had significant relationships with the PG-SGA score (p-values = <0.001, 0.040, <0.001, 0.030, <0.001, <0.001, respectively).

Table 3. Anthropometric indices, PG-SGA score, and laboratory tests in participants.

Variables	Mean ± SD or N (percentage)	Range
BMI (kg/m2)	**21.67±5.08**	**12 – 40**
weight loss category		
Low	89 (47.8)	
Moderate	53 (28.5)	
Severe	44 (23.7)	
PG-SGA score	**13.15±5.79**	**2 – 29**
0-1	0(0)	
2-3	10(5.4)	
4- 8	30(16.1)	
> 8	146(78.5)	
Karnofsky performance score	***80 (70, 90)**	**30 – 100**
Hand grip strength (Kg)		
Reduced muscle strength	25(14)	0 – 107
Normal	153(86)	
Fat mass percentage (%)	**21.97±10.85**	**1.8 – 50.9**
Fat-free mass index (Kg/m2)		
Reduced muscle mass	68(38.9)	10.85 - 23.41
Normal	107(61.1)	
Calorie intake		
Kcal/day	948.96±550.51	**00 – 3099
Kcal/kg/day	17.67±10.43	00 – 58.82
Protein intake		
g/day	30.83±21.16	00 – 109.67
g/kg/day	0.57±0.39	0- 2.08
CRP (mg/dL)	14.37±18.74	0 – 120
Hb (g/dL)	12.726±1.78	8.7 – 18.9
Albumin (g/dL)	3.90±0.41	2.4– 4.8
Total Protein (g/dL)	7.26±0.54	6 – 8.5
RDW (%)	13.81±1.93	10.9 – 24.5
Total Lymphocyte count	27.29±11.1	5– 76

BMI: Body Mass Index, CRP: C-reactive protein, HB: Hemoglobin, RDW: Red Blood Cell Distribution Width, PG-SGA: Patient-Generated Subjective Global Assessment
* Reported as median (25th, 75th percentile)
** Actual calorie intake in several people was still zero after double-checking
Weight loss category defined as Low: < 5% in 1 month or 10% in 6 months; Moderate: 5-10% in 1 month or 10- 20% in 6 months; Severe:>10% in 1 month or >20% in 6 months

Table 4. Comparing the average domains of quality of life dimensions according to the PG-SGA score

Quality of life dimensions	PG-SGA≤8	PG-SGA>8	P value*
Emotional Function	74.58±24.23	63.01±26.02	0.005
Physical Function	94.66±11.01	75.57±27.14	0.001
Role Function	95.00±11.44	78.88±26.78	<0.001
Cognitive Function	92.91±11.86	87.89±17.78	0.182
Social Function	90.83±16.42	78.31±25.24	0.002
Subjective quality of life	4.72±1.51	3.92±1.73	0.008

PG-SGA: Patient-Generated Subjective Global Assessment
* Independent T-test

Table 5 highlights the factors that had a significant relationship with the components of quality of life. Emotional function and social function were significantly related to living place, while physical function was associated with dysphagia. Global function had a significant relationship with role function, and financial status was significantly associated with anorexia. Additionally, cognitive function had a significant relationship with the Karnofsky performance scale.

Table 5. Association between quality of life components and related factors

QoL components	Associated factors (P value) *
Emotional Function	Living place (0.012)
Physical Function	Dysphagia (0.039)
Role Function	Anorexia (0.028)
Cognitive Function	r. Karnofsky (0.018)
Social Function	Living place (0.001)
global Function	Dysphagia (<0.001)
Financial	Anorexia (0.016)

QoL: quality of life
* Correlation test

Discussion

Improving the quality of life is one of the main goals for cancer patients, and nutritional status has a significant impact on quality of life, particularly in patients with esophageal cancer. This study observed diminished quality of life across several domains, specifically in global and emotional functions. The fatigue, pain, and constipation scores were also high among patients. Additionally, 94% of patients required nutritional interventions (PG-SGA > 3). More than half of the patients experienced moderate to severe weight loss. In these patients, the scores for various dimensions of quality of life (emotional function, physical function, role function, social function, and subjective quality of life) showed a significant relationship with severe malnutrition (PG-SGA > 8).

Malnutrition negatively affects the clinical symptoms of cancer patients. Our study also found that 78.5% of patients had a PG-SGA score greater than 8, indicating compromised nutritional status and the need for nutritional interventions. Furthermore, 28.5% of patients experienced moderate weight loss, 23.7% experienced severe weight loss, and 38.9% showed decreased fat-free mass index (Kg/m²).

The findings were consistent with those of Gandhi et al., who conducted research involving 100 patients with advanced, incurable head-and-neck cancer undergoing palliative radiation. These patients experienced numerous symptoms, including pain, insomnia, loss of appetite, and fatigue, all of which affected their daily functioning. Emotional functioning was impaired in 50% of patients, while physical functioning was affected in almost 23% of the remaining 50% (25).

In terms of quality of life, our patients experienced common symptoms such as fatigue, pain, anorexia, and constipation. Similar findings were reported in a study by Lagergren et al., which investigated esophageal cancer patients before surgery. Most quality of life dimensions, including emotional, physical, role, cognitive, and social functions, showed similar scores to those observed in our study. However, there were differences in the scores for insomnia, with Lagergren et al. reporting a score of 26 ± 2.5 compared to our study's score of 10.57 ± 22.23. Lagergren et al. reported a score of 11 ± 2 for constipation, while our study showed 32.07 ± 29.07. Additionally, financial problems were reported with a score of 11 ± 1.75 in their study, whereas our study reported a higher score of 37.45 ± 39.06 (26). Melo Filho et al. reported similar quality of life dimensions results in a study on head and neck cancer patients before receiving antineoplastic treatments. However, differences were observed in certain areas, such as insomnia (27.5 ± 35.8 vs. 10.57 ± 22.23), financial problems (25.5 ± 36.4 vs. 37.45 ± 39.06), and fatigue (17.0 ± 23.3 vs. 26.76 ± 25.42) when compared to our study (27). We interpret these differences as being due to the higher prevalence of advanced dysphagia and rural residency in our study population, which may lead to higher levels of constipation and financial problems.

In 2024, a cohort study was conducted on 24 patients with esophageal cancer, both before and after esophagectomy. The average BMI of these patients was 27.3, and the average weight was 82.9 kg. Additionally, 59% of these patients required nutritional intervention. In contrast, our study found that 94% of patients needed nutritional intervention, and the average BMI was 21.67. The results of this cohort study differed from ours in two quality-of-life domains: role function and social function. There were also notable differences in the symptoms reported, including fatigue, nausea, dyspnea, insomnia, anorexia, constipation, and diarrhea (28).

The strengths of this study include assessing newly diagnosed patients at the beginning of

treatment and utilizing a relatively large sample size. For future studies, exploring the relationship between nutritional interventions and quality of life is recommended to provide valuable insights into improving patient outcomes. A limitation of this study was the lack of considering the effects of cancer treatments, such as chemotherapy, radiotherapy, or surgery, on nutritional status, body composition, and physical performance. Since these treatments can significantly affect patients' overall health, future studies should incorporate treatment-related variables to understand better their impact on nutritional status and quality of life.

Conclusion

Based on the results, esophageal cancer significantly affects the quality of life of patients. Furthermore, a significant relationship was observed between the nutritional status and quality of life. Thus, Nutritional intervention is essential to improve nutritional status and overall quality of life.

Declarations

Funding Sources

Authors' Contribution

The research was designed by SM, AN, MST, AM, SE, MGM, MN, ME, and FFH. SM, PZ, and MS conducted the study and data entry. SM, NP, AN, MST, SE, ME, MGM, and HKM performed the library search, wrote the manuscript, and contributed to the drafting and editing of the manuscript. SM, ME, and HKM designed the tables. SM and ME participated in the statistical analysis. All authors read and approved the final manuscript.

Ethics Considerations and Consent to Participate

The study was approved by the Ethics Committee of Mashhad University of Medical Sciences (ID: 941765; IR.MUMS.fm REC.1395.111). The Human Research Ethics Committee of Mashhad University of Medical Sciences (MUMS) reviewed and approved the study protocol. Written informed consent will be obtained from all participants, with each component of the agreement explained in detail to ensure participants fully understand and agree to the terms of the study.

Artificial Intelligence (AI)

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest.

Acknowledgments

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