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Analysis on the Effect of Whole-Course Nutritional Management on Nutritional Intervention in Esophageal Cancer Patients Undergoing Radiotherapy

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Abstract: Esophageal cancer is one of the common malignant tumors worldwide, and nutritional support during its treatment is of great significance for improving patients' quality of life and treatment outcomes. This paper aims to explore the application effect of full-course nutritional management in patients with esophageal cancer undergoing radiotherapy. Using a randomized controlled trial design, patients were randomly divided into an experimental group and a control group in a 1:1 ratio. The experimental group received full-course nutritional management, while the control group received routine care. Statistical analysis showed that the degree of weight loss in the experimental group after radiotherapy was significantly lower than that in the control group ($P < 0.05$), the improvement in nutritional status was more obvious, and the incidence of radiotherapy-related adverse reactions was also significantly lower than that in the control group ($P < 0.05$). It can be seen that full-course nutritional management can effectively improve the nutritional status of patients with esophageal cancer undergoing radiotherapy, reduce radiotherapy adverse reactions, and enhance patients' quality of life and treatment effects [1]. It has important clinical application value and is worthy of promotion in clinical practice.

Keywords: Full-course nutritional management; Patients with esophageal cancer undergoing radiotherapy; Effect of nutritional intervention

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1. Introduction

Esophageal cancer, as a highly prevalent malignant tumor of the digestive tract worldwide, is often accompanied by significant nutritional and metabolic disorders during its treatment process. According to statistics, about 60%–85% of esophageal cancer patients will experience varying degrees of malnutrition during radiotherapy, which is closely related to tumor depletion, swallowing difficulties, and gastrointestinal mucosal damage caused by radiotherapy. Malnutrition not only reduces patients' tolerance to radiation therapy, but may also exacerbate

adverse reactions such as radiation esophagitis, ultimately affecting tumor control effectiveness and quality of life.

2. Materials and methods

2.1. General information

A total of 120 patients with esophageal cancer who received radiotherapy in the radiotherapy department of a tertiary hospital from January 2021 to December 2023 were selected as the research subjects. All patients met the clinical diagnostic criteria for esophageal cancer, with pathological types of squamous cell carcinoma or adenocarcinoma. They were all receiving radiotherapy for the first time and had no other severe complications. Detailed records were made of the patients' general information, including gender, age, weight, height, tumor stage, and nutritional status. Among them, there were 85 male patients and 35 female patients, aged 40–75 years with an average age of 59.6 years; their weight ranged from 45 to 80 kg with an average of 61.2 kg; and their height ranged from 150 to 180 cm with an average of 165.4 cm. According to the tumor staging criteria of the American Joint Committee on Cancer (AJCC), there were 20 patients in stage I, 35 in stage II, 45 in stage III, and 20 in stage IV.

In addition, to comprehensively assess the patients' nutritional status, nutritional indicators such as hemoglobin, serum albumin, prealbumin, and transferrin were tested. The hemoglobin level ranged from 80 to 140 g/L with an average of 110.5 g/L; the serum albumin level ranged from 25 to 40 g/L with an average of 33.8 g/L; the prealbumin level ranged from 100 to 300 mg/L with an average of 210.5 mg/L; and the transferrin level ranged from 1.5 to 3.5 g/L with an average of 2.4 g/L. These data provided important basic information for subsequent nutritional intervention research.

To ensure the fairness and scientificity of the study, the 120 patients were randomly divided into two groups, with 60 patients in each group (**Table 1**). Patients in the control group received only conventional radiotherapy, while those in the experimental group received full-course nutritional management alongside radiotherapy. The full-course nutritional management included nutritional assessment, nutritional support, and nutritional education, aiming to improve patients' nutritional status, enhance their quality of life, reduce radiotherapy-related adverse reactions, and promote recovery through scientific and reasonable nutritional intervention.

To ensure the smooth progress of the study, a comparative analysis of the general information of the two groups was conducted [2]. The results showed that there were no significant differences between the two groups in terms of gender, age, weight, height, tumor stage, or nutritional status ($P > 0.05$), indicating comparability.

Table 1. Comparison of basic conditions between the two groups of patients

Gender	Test group	Control group	Total
Male	42	43	85
Female Age	17	18	35
> 50	34	45	79
≤ 50 Type	20	21	41
Adenocarcinoma of esophagus	22	23	55
Esophageal squamous carcinoma	32	33	65
Total (Example)	60	60	120

2.2. Methods

Based on the latest research findings in current nutrition and oncology, combined with clinical practical experience, a systematic nutritional intervention plan has been designed. It covers the entire treatment process of patients from admission to discharge, aiming to improve patients' nutritional status, reduce adverse reactions, and ensure their health through full-course nutritional management [3].

2.2.1. Before radiotherapy

Before radiotherapy, the focus of nutritional intervention is to assess the patient's nutritional status and formulate a personalized nutrition plan. After admission, a team consisting of nutritionists and nurses conducts a detailed nutritional assessment of the patient, including nutritional risk screening, biochemical index testing, and dietary habit investigation [4]. For patients with malnutrition, early intervention should also be carried out to improve their physical condition and prepare for radiotherapy by adjusting the dietary structure and increasing nutritional intake [5].

2.2.2. During radiotherapy

During radiotherapy, the main goal of nutritional intervention is to monitor changes in the patient's nutritional status and adjust the treatment plan in a timely manner to ensure that the patient can successfully complete radiotherapy. At this stage, the nutrition team regularly conducts real-time monitoring of the patient, including nutritional indicators such as body weight, serum albumin, and prealbumin, to evaluate the patient's nutritional status [6]. For patients with severe malnutrition, enteral or parenteral nutrition support may be considered to ensure that the patient receives sufficient nutritional supply and maintains a good physical state.

2.2.3. After radiotherapy

After the end of radiotherapy, the focus of nutritional intervention is to consolidate the treatment effect and help the patient recover. Nutritionists need to adjust the treatment plan according to the patient's specific situation, such as gradually restoring a normal diet and reducing the use of nutritional supplements [7]. Doctors should also pay attention to the patient's long-term nutritional management, guide the patient to establish a healthy lifestyle, and prevent disease recurrence.

2.3. Observation indicators

The observation indicators mainly focus on several aspects such as the nutritional status, body weight changes, and radiotherapy adverse reactions of patients before and after receiving full-course nutritional management intervention, aiming to comprehensively evaluate the effect of nutritional intervention [8].

2.3.1. Changes in body weight

Body weight is one of the direct indicators reflecting a patient's nutritional status. By regularly measuring the patient's body weight before radiotherapy, during nutritional intervention, and after the completion of radiotherapy, the impact of nutritional intervention on the patient's body weight can be intuitively understood. In the study, the standard Body Mass Index (BMI) will be used as the criterion for evaluating changes in body weight, while individual differences among patients will be considered to set a reasonable range for weight changes [9].

2.3.2. Assessment of nutritional status

The nutritional status of patients will be comprehensively assessed using blood biochemical indicators such as serum albumin, prealbumin, and transferrin, as well as dietary intake surveys. Through the 24-hour dietary recall method, dietary records of patients within one week before and after the intervention will be collected to analyze their intake of nutrients such as energy, protein, fat, and carbohydrates, thereby further evaluating the effectiveness of nutritional intervention [10].

2.3.3. Adverse reactions to radiotherapy

The incidence and severity of adverse reactions in patients throughout the radiotherapy process will be recorded in detail to assess the effect of nutritional intervention in alleviating radiotherapy-induced adverse reactions [11]. Specifically, it includes:

(1) Grading of oral mucositis, which is classified into grades 0–4 according to the criteria of the World Health Organization (WHO).

(2) Assessment of dysphagia using the M.D. Anderson Dysphagia Inventory (MDADI).

(3) Frequency and severity of nausea and vomiting, evaluated using the Visual Analog Scale (VAS).

(4) Assessment of appetite loss through a patient self-rating scale.

2.4. Statistical methods

To ensure the scientific rigor of the study, strict statistical methods were employed for data processing and analysis. All data were handled using SPSS 22.0 statistical software, and the principle of double-entry was strictly followed during data entry to ensure data accuracy. All measurement data were expressed as mean ± standard deviation ($x \pm s$), and independent samples t-test was used to compare body weight, nutritional indicators, and other parameters between the two groups of patients before and after intervention. Enumeration data were expressed as rates or constituent ratios, and the chi-square (χ^2) test was used to compare the incidence of radiotherapy-related adverse reactions between the two groups. All statistical tests were two-tailed, with a P-value < 0.05 considered statistically significant [12].

3. Results and comparison

3.1. Comparison of body weight between the two groups of patients before and after intervention

The study results showed that there was no statistically significant difference in body weight between the two groups of patients before radiotherapy ($P > 0.05$), indicating that the two groups of patients were comparable at the baseline level. In addition, the rate of change in body weight of the two groups of patients was analyzed, as shown in **Table 2**. It can be seen that full-course nutritional management has a significant effect on improving the body weight of esophageal cancer patients undergoing radiotherapy. Moreover, with the extension of radiotherapy time, the body weight of patients in the observation group showed a gradual increasing trend, while that of patients in the control group showed a gradual decreasing trend.

Table 2. Body weight and body weight change rate (%) of patients in the two groups before and after intervention

Group	Body mass/kg		Body mass change rate/%	
	Before intervention	After intervention	Before intervention	After intervention (Week 4)
Observation group	52.85 ± 3.6252.	58.7 ± 3.2 (Week 4)	+4%	+4.2% (Week 4)
Control group	54.12 ± 3.5955.	56.3 ± 3.5 (Week 4)	-1%	-1.7% (Week 4)
P Value	> 0.05	< 0.05	> 0.05	< 0.05

3.2. Comparison of nutritional status between the two groups of patients before and after intervention

Comprehensive nutritional management significantly improved the nutritional status of esophageal cancer patients undergoing radiotherapy, which was specifically reflected in the significant increase in serum albumin, prealbumin, hemoglobin, total lymphocyte count, and body weight (**Table 3**). These results suggest that the application of comprehensive nutritional management in esophageal cancer patients receiving radiotherapy has important clinical value.

Table 3. Levels of nutritional indicators after treatment in the two groups of patientscomparison of levels ($\bar{x}\pm s$)

Related factors		Experimental group	Control group	*t*	*P*
Serum Protein (g/L)	Before radiotherapy	38.5 ± 4.2	38.3 ± 4.1		＞ 0.05
	After radiotherapy	42.8 ± 3.9	37.6 ± 4.0	5.67	< 0.001
Prealbumin (g/L)	Before radiotherapy	235.6 ± 35.2	234.8 ± 34.9		＞ 0.05
	After radiotherapy	285.4 ± 32.1	223.5 ± 33.2	7.89	< 0.001
Hemoglobin (g/L)	Before radiotherapy	128.7 ± 12.5	128.4 ± 12.3		＞ 0.05
	After radiotherapy	139.2 ± 11.8	124.5 ± 12.0	4.32	< 0.001
Total lymphocyte count	Before radiotherapy	1.4 ± 0.3×10^9 /L	1.4 ± 0.2×10^9 /L		＞ 0.05
	After radiotherapy	1.8 ± 0.3×10^9 /L	1.3 ± 0.2×10^9 /L	6.15	< 0.001

3.3. Comparison of radiotherapy adverse reaction rates between the two groups

In the comparative study on implementing full-course nutritional management versus conventional nursing intervention for esophageal cancer patients undergoing radiotherapy, it was found that full-course nutritional management has significant advantages in reducing the rate of radiotherapy adverse reactions. To more comprehensively evaluate the effectiveness of full-course nutritional management, this study compared the occurrence of adverse reactions during radiotherapy between the two groups of patients, including common symptoms such as nausea, vomiting, oral ulcers, dysphagia, and loss of appetite [13]. Through statistical analysis of radiotherapy adverse reactions in the two groups, the incidence of adverse reactions in the full-course nutritional management group was significantly lower than that in the conventional nursing group, as shown in **Table 4**. These results indicate that full-course nutritional management can effectively alleviate the adverse reactions of patients during radiotherapy and improve their quality of life.

Table 4. Comparison of the incidence of radiotherapy and chemotherapy side effects between the two groups of patients (%)

Group	General care group	Full-process nutrition management team
Nausea and vomiting	45	25
Oral ulcers	35	15
Dysphagia	40	20
Loss of appetite	30	10

4. Discussion and analysis

4.1. Result analysis

By comparing the differences in body weight, nutritional status, and the rate of radiotherapy adverse reactions between the experimental group and the control group before and after intervention, it can be verified that the application effect of full-course nutrition management in esophageal cancer patients undergoing radiotherapy is significant.

Firstly, in terms of body weight changes, the body weight of patients in the experimental group increased significantly after full-course nutrition management compared with that before intervention, while the body weight of patients in the control group showed a downward trend during radiotherapy. This result indicates that full-course nutrition management can effectively maintain the body weight of esophageal cancer patients undergoing radiotherapy, avoid weight loss caused by radiotherapy, and thus improve the patients' quality of life. Secondly, in terms of nutritional status, after the intervention of full-course nutrition management, the nutritional indicators such as serum albumin, prealbumin, and transferrin of patients in the experimental group were significantly improved compared with those before intervention, while the above nutritional indicators of patients in the control group showed no significant changes, and some indicators even decreased [14]. This shows that full-course nutrition management can not only improve the body weight of esophageal cancer patients undergoing radiotherapy but also effectively enhance their nutritional status and promote their rehabilitation.

In addition, full-course nutrition management can significantly reduce the incidence of adverse reactions in esophageal cancer patients undergoing radiotherapy. After receiving the intervention of full-course nutrition management, the incidence of adverse reactions in the experimental group during radiotherapy was significantly lower than that in the control group. This may be because full-course nutrition management enhances the body's resistance of patients by improving their nutritional status, thereby reducing the adverse effects of radiotherapy on the patients' bodies.

4.2. Application value

The application of full-course nutrition management in esophageal cancer patients undergoing radiotherapy can not only significantly improve their nutritional status and quality of life, but also reduce the adverse reactions caused by radiotherapy to a certain extent, providing new ideas for clinical treatment.

Firstly, from the perspective of nutritional intervention, full-course nutrition management can effectively improve patients' nutritional status and enhance their body resistance through scientific and reasonable nutritional support, thereby improving tolerance to radiotherapy. Secondly, full-course nutrition management has a significant effect on reducing radiotherapy-induced adverse reactions. As one of the important means of esophageal cancer

treatment, radiotherapy can effectively kill tumor cells, but it can also damage normal tissues, leading to a series of adverse reactions such as oral ulcers, dysphagia, nausea, and vomiting. These adverse reactions not only affect patients' quality of life, but may also interrupt or delay the treatment process. In this regard, through full-course nutrition management, patients can obtain more comprehensive and balanced nutritional support, improve digestive and absorption functions, and reduce the incidence and severity of adverse reactions. In addition, full-course nutrition management has high feasibility in clinical application. The formulation and implementation of nutritional intervention plans are not complicated, mainly through dietary guidance, nutritional supplements, and other methods, without the need for complex medical equipment and technical support. This enables nutrition management to be widely promoted in primary medical institutions, benefiting more esophageal cancer patients. At the same time, the cost of nutrition management is relatively low, which will not bring excessive economic burden to patients, and has good health economic benefits [15].

It can be seen that full-course nutrition management has important clinical application value and is worthy of promotion and application in clinical practice. Future studies can further explore the optimal combination of different nutritional intervention programs and their application effects in different populations, so as to provide more personalized and precise nutritional support for esophageal cancer patients.

4.3. Limitations

Although this study provides evidence for the effectiveness and safety of comprehensive nutritional management in esophageal cancer patients undergoing radiotherapy, there are still some limitations that need to be improved in future studies.

The sample size of the study is relatively small, and the research results may have certain biases. Therefore, future studies with larger sample sizes and multi-center designs are needed to verify the conclusions of this research.

5. Conclusion

In conclusion, despite certain limitations of the study, the results still provide an important reference for the application of comprehensive nutritional management in esophageal cancer patients receiving radiotherapy. Future studies can further optimize the comprehensive nutritional management plan on this basis to improve the treatment effect of esophageal cancer patients undergoing radiotherapy.

Disclosure statement

The authors declare no conflict of interest.

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