# Application of Teach-back Health Education Model in Nutritional Support Management During Radiotherapy for Patients with Locally Advanced Esophageal Cancer

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## 1. Abstract

**1.1. Aim:** To explore whether the teach-back health education model can reduce the incidence of malnutrition during radiotherapy in patients with locally advanced esophageal cancer.

**1.2. Methods:** A historical study design was used to compare the incidence of malnutrition during radiotherapy between the traditional education model and the teach-back health education model interventions in patients with locally advanced esophageal cancer who received radiotherapy. Patients who were admitted from May 2013 to June 2018 were traditional education group, and patients who were admitted from July 2018 to October 2020 were teach-back education group. The traditional education group was practiced the original routine care while the teach-back education group was given the standardized nutrition support management health education based on the guidelines. Body weight changes, Patient-Generated Subjective Global Assessment (PG-SGA) scores and other related indexes before and after radiotherapy were collected from the two groups, respectively.

**1.3. Results:** A total of 102 patients with locally advanced esophageal cancer were included in this study, including 51 patients in the traditional education group and 51 patients in the teach-back education group. with a median age of 61.7 and 62 years, respectively in the two groups. The weight change rate in the teach-back group was less than that in the traditional education group ($Z = 2.811$, $P < 0.05$), which traditional education group PG-SGA score was $Z = -3.345$, $P < 0.05$ while teach back education group before and after radiotherapy PG-SGA score was $Z = -0.489$, $P = 0.625$.

**1.4. Conclusion:** The teach-back health education model is beneficial for maintaining weight stability during radiotherapy in patients with locally advanced esophageal cancer and reducing the incidence of malnutrition risk.

## 2. Introduction

The incidence of locally advanced esophageal cancer in China has obvious regional differences, and the mortality of locally advanced esophageal cancer is high. It has been reported that there are 604100 (3.1%) new cases and 544076 (5.5%) deaths from locally advanced esophageal cancer worldwide in 2020.China has a higher incidence of locally advanced esophageal cancer, which is mostly seen in men and mostly in the middle-aged and elderly people. In China, the incidence of locally advanced esophageal cancer has decreased in recent years, but the mortality rate has been ranked in the top four [1-4]. Studies have shown that at present, the most common treatment modality for patients with locally advanced esophageal cancer is the combination of surgery and chemoradiotherapy, with surgery

predominating in the early to middle stages, and chemoradiotherapy predominating in the late stages. Chemoradiotherapy can improve the local control rate and long-term survival of patients with locally advanced esophageal cancer [5]. However, radiotherapy also brings about corresponding side effects, which cause some damage to the digestive tract mucosa, affecting patient eating and the digestion and absorption of nutrition. Many patients experienced different degrees of malnutrition in the late stage of radiotherapy, which seriously affected the efficacy of treatment and the quality of life of patients. Therefore, a direct and objective manifestation of malnutrition, lost of weight in cancer, as assessed by involuntary weight loss > 5% in the previous 3-6 months is necessary, as significantly weight loss will lead to a disorder in the body function of patients and have a serious impact on the quality of life [6, 7], and the heavy patients can lead to the interruption or termination of radiotherapy, therefore, nutritional risk screening of patients with locally advanced esophageal cancer radiotherapy is required to identify patients at nutritional risk as early as possible and to give timely intervention.

With the development of modern nursing medicine, the nursing model has changed from the traditional disease-centered functional nursing model to the holistic patient-centered nursing model. People's need for health has not simply stayed on eliminating the pain and sustaining life but has been constantly promoting and maintaining health [8], improving the quality of survival. Health education is an important component of nursing work and can help patients better understand the relevant knowledge of the disease, thereby improving patient compliance with treatment. The mode of health education mainly includes two aspects of knowledge dissemination and behavioral intervention, and the teach-back health education model is to make patients repeat or demonstrate the learned relevant information through their own language after the implementation of health education to patients by health care workers, which can improve the mastery rate of the information [9, 10]. Tech-back, as a safe and effective method of health preaching, has been widely used by foreign scholars for patients' health preaching, which improves patients' self-care ability and reduces readmission rates [11]. In this study, the tech back health education model was intended to be used to teach nutrition health to locally advanced esophageal cancer patients who received radiotherapy, compared with the traditional conventional care method, to explore whether the tech-back health education model could effectively reduce the occurrence of malnutrition in locally advanced esophageal cancer patients treated with radiotherapy, and to verify its application value in the nutrition support management of patients with locally advanced esophageal cancer radiotherapy.

## 3. Materials & Methods

The Institutional Review Board of the Sixth Affiliated Hospital at Sun Yat-sen University approved this retrospective study. The study protocol was approved by the Central Ethics Committee of The Sixth Affiliated Hospital, Sun Yat-sen University (Guangzhou, Chi-

na) (No. 2021ZSLYEC-209).

### 3.1. Patient selection

We conducted a retrospective study of consecutive patients with biopsy-proven, locally advanced, non-metastatic locally advanced esophageal cancer patients who received radiotherapy from the Sixth Affiliated Hospital of Sun Yat-sen University between May 2013 and October 2020 rectal cancer (Figure 1). A total of 119 patients were initially identified, and a total of 102 patients were selected, met the following inclusion criteria: (a) patients who were pathologically diagnosed and confirmed as locally advanced esophageal cancer;(b) age≥18 years; (c) received radiotherapy regimens as (IMRT) GTV 50-60 Gy in 25-30 fractions; and (d) no severe acute severe malnutrition or other diseases that affected nutrition.

### 3.2. Research group

A historical controlled study design was used, in which patients who were admitted from May 2013 to June 2018 were the traditional education group, and patients who were admitted from July 2018 to October 2020 were the teach-back education group. The traditional education group practiced the original routine care, and the teach back education group gave the standardized nutrition support management health education model based on the guidelines administered [12].

### 3.3. Intervention content

The traditional education group performed original nutrition management protocols in the hospital, mainly including: a) Nutritional Risk Screening 2002(NRS 2002) was performed at admission, and patients with a screening score ≥ 3 on the NRS 2002 were offered a nutritional assessment by PG-SGA at the same time [13-15]; b) monitoring of weekly weight change; and c) the radiologist selected five ladder nutrition therapy according to the patient's own nutrition status (Supplementary Table 1).

The teach back education group included patients screened weekly for NRS 2002 nutritional risk based on the guideline using the teach-back mode, and those with an NRS 2002 screening score ≥ 3 were also monitored for nutritional assessment with PG- SGA, weight change monitoring, and weekly bedside nutritional debriefing at the time of the ward for those at nutritional risk. A suitable nutrition education management plan for patients undergoing radiotherapy for locally advanced esophageal cancer was devised. A nutrition team was established with regular specialized training of the group's personnel (doctors and nursing staff); A teach back propaganda sheet for locally advanced esophageal cancer health education (Supplementary Table 2), and a nutrition related knowledge propaganda feedback sheet (Supplementary Table 3). A teach back mode was adopted to screen patients weekly for NRS 2002 nutritional risk, and patients with a screening score ≥ 3 on NRS 2002 were offered a nutritional assessment with PG-SGA at the same time. Bedside, individualized nutrition clinic on Tuesday based on the results of the patients' nutrition screening and assessment are conducted every

Tuesday according to the results of nutritional screening and evaluation of patients. A five-step nutrition therapy based on the patient's intake status and energy gap if necessary, and centralized education is prescribed to newly admitted patients or those with existing nutritional problems once a week.
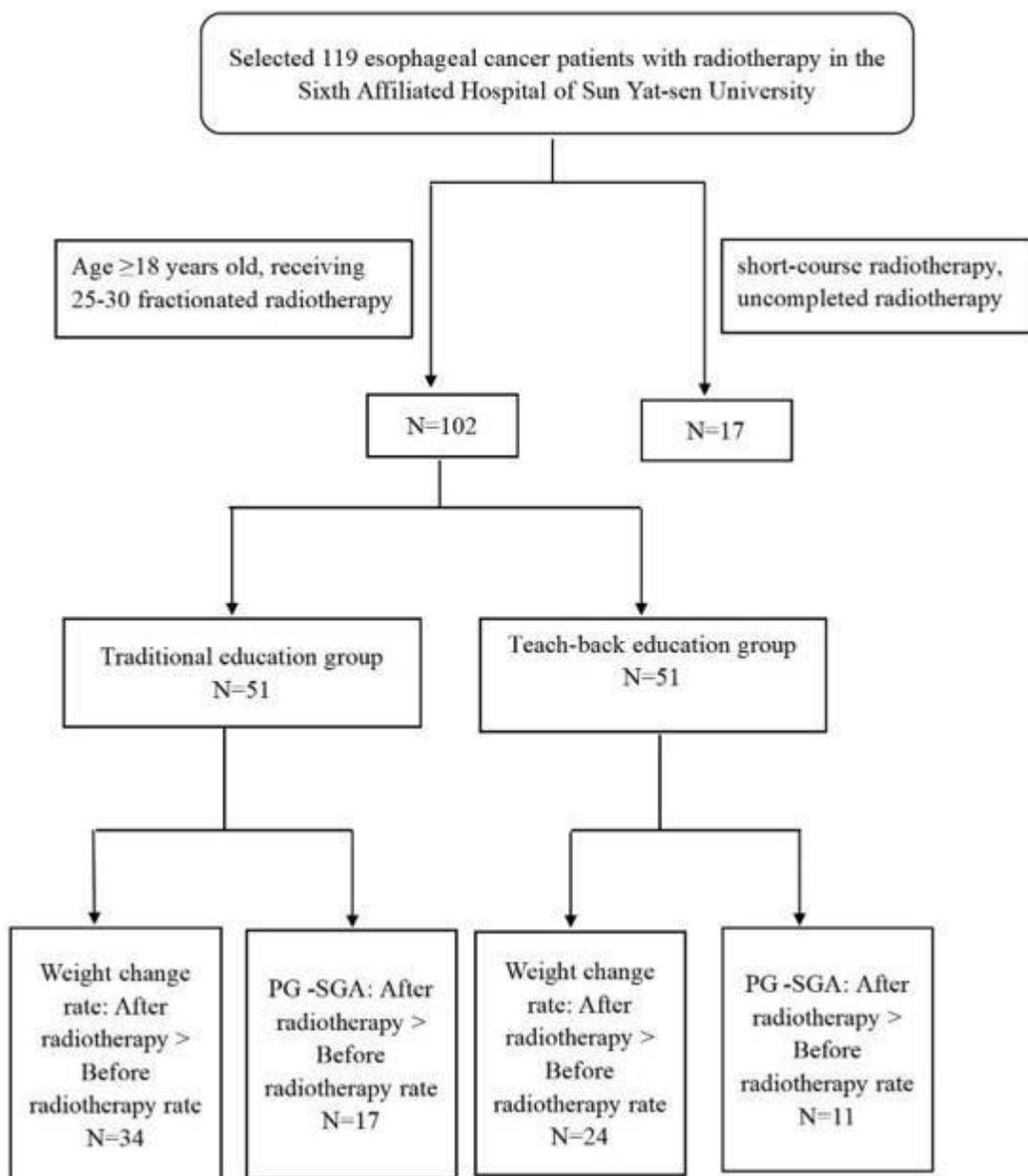


**Figure 1:** Teach-back health education flowchart for escophageal cancer

**Supplementary Table 1:** Five-step nutrition therapy

| | Score value | | 1 point | 2 points | 3 points | 4 points | 5 points |
|---|---|---|---|---|---|---|---|
| Ingestion status | Energy intake | Total (kcal) | <300 | 300-600 | 600-900 | 900-1200 | 1200-1500 |
| | | Kcal/kg | <5 | 05-Oct | Oct-15 | 15-20 | 20-25 |
| | Protein intake | Total (g) | <15 | 15-30 | 30-40 | 40-50 | 50-60 |
| | | g/kg | <0.25 | 0.25-0.5 | 0.5-0.65 | 0.65-0.8 | 0.8-1.0 |
| The energy gap | | Weight: 80kg | 1400 | 1200 | 900 | 600 | 600 |
| | | Weight: 75kg | 1300 | 1100 | 800 | 500 | |
| | | Weight: 70kg | 1200 | 1000 | 700 | 400 | |
| | | Weight: 65kg | 1100 | 900 | 600 | 300 | |
| | | Weight: 60kg | 1000 | 800 | 500 | | |
| | | Weight: 55kg | 900 | 700 | 400 | | |
| | | Weight: 50kg | 800 | 600 | 300 | | |
| | | Weight: 45kg | 700 | 500 | | | |
| | | Weight: 40kg | 600 | 400 | | | |

| Treatment principles | Nutrition education ±ONS+SPN or TPN or TF or EEN | Nutrition education ± ONS +SPN or TF or EEN | Nutrition education ±ONS+SPN | Nutrition education ±ONS | Nutrition education ±ONS |
|---|---|---|---|---|---|

\*: ONS = oral nutrition supplement, SPN = supplemental parenteral nutrition, EEN = oral total enteral nutrition, TF = tube feeding enteral nutrition, TPN = total parenteral nutrition.

**Supplementary Table 2:** Esophageal cancer health education teach-back education leaflet

| Medical terminology | Daily expression | Ways to ask questions | Health education content |
|---|---|---|---|
| Ingestion status | Types and quantities of food | What staple food did you eat for three meals today, how much did you eat, and did you eat fruits and vegetables? | Assessment of intake status: Maintain a balanced energy intake of three meals a day. Patients with nausea, vomiting and loss of appetite inform the medical staff in advance. |
| The energy gap | Is there malnutrition | Did you weigh today and did your weight change this week? | Nutritional status assessment: Calculate whether the patient has an energy gap based on the patient's weight and nutrition score. |
| Nutrition education | Nutrition and health education | Do you know when you need to supplement oral nutrition powder? | Nutrition education: Nutrition education for patients according to the energy gap combined with the doctor's advice, and take ORAL ONS or supplementary enteral nutrition (SPN) if necessary. |
| Review the indication | What situation needs to be reviewed? | Can you tell me what I need to pay attention to when I leave the hospital? | Discharge guidance: maintain stable weight, strengthen nutrition, record daily intake, and review on time. |

**Supplementary Table 3:** Feedback form on nutrition-related knowledge education

| Project | Content | evaluate | Do you master it? |
|---|---|---|---|
| Weight changes | Weight change in one month≥3kg | Do you know the range of weight fluctuations in January? | Yes □ |
| | Weight change in one month <3kg | | No □ |
| Dietary care | Maintain more than 2500ml of drinking water per day | If nausea and vomiting do not occur, how many milliliters of drinking water should I drink every day? | Yes □ |
| | Eat appropriate amount vegetables and fruits every day | | No □ |
| | Eat fish, meat, eggs, milk, and other foods | | |
| Mixing of nutritional preparations | Warm water flushing | How many tablespoons of nutrition powder do you take at a time? How many degrees is the water temperature controlled? | Yes □ |
| | Mixing ratio of nutrient powder to warm water | | No □ |
| Oral care | Soft hair toothbrush brushes teeth | Can you tell me when I need to clean my mouth? | Yes □ |
| | Brush your teeth after meals and before going to bed | | No □ |
| | Light salt water or tea contains gargle | | |

### 3.4. Statistical analysis

Wilcoxon signed ranks test and T test are used for statistical analysis the weight changes and PG-SGA score changes before and after radiotherapy in the traditional education group and the teach back education group. Z value represents the difference between the median difference between the two sets of data and 0, which is of statistical significance, P value less than 0.05 was considered statistically significant. Statistical analyses were performed with SPSS (version 22.0; SPSS, Inc, Chicago, IL).

## 4. Results

The gender, age, tumor location and CTV volume of the traditional education group are at the same baseline level as the teach back group. The number of patients who did not have mucositis after 30 fractionated of radiotherapy in the traditional education group was 38 (74.5%), while the number of patients who did not have mucositis in 30 fractionated of radiotherapy in the teach back education group was 22 (43.1%). The number of cases of one degree mucositis in 30 fractionated was 13 (25.5%), while the number of patients who had one degree mucositis in 30 fractionated of radiotherapy in the teach back group was 23(45.1%). The number of patients who had two degrees mucositis in 30 fractionated radiotherapy in the traditional education group was 0, while the number of patients with two degree mucositis in 30 fractionated radiotherapy in the teach back education group was 6(11.8%), respectively (P = 0.007) (Table 1).

The nutritional status before radiotherapy in the traditional education group and the teach-back education group was before radiotherapy at the same baseline (z = -1.826, P = 0.068). There was a difference in PG-SGA score between pre- and post radiotherapy in the traditional education group (Z = -3.345, P = 0.001), While the PG-SGA score remained stable between pre- and post radiotherapy in the teach-back education group, (z = -0.489, P = 0.620) (Table 2).

In the traditional education group, 17 locally advanced esophageal cancer patients with radiotherapy remained stable or gained weight, accounting for 33.3% of the group, and 12 patients lost weight from 5% to 10%, accounting for 23.5% of the total group. 27 (52.9%)

locally advanced esophageal cancer patients with radiotherapy in the teach back education group maintained stable or increased weight, and 6 (11.8%) patients lost 5%-10% of the total group. There was a significant difference in the weight changes between the traditional education group and the teach back education group (Z = 2.811, P = 0.005) (Table 3).

There was a significant difference in the red blood cell (RBC) percentage and hemoglobin (HB) changing rates before and after radiotherapy between the traditional education group and the tech back education group respectively (P = 0.004, P = 0.106, P = 0.236) (Table 4).

**Table 1:** Basic information for patients with esophageal cancer

| | | Traditional education group N=51 | Teach-back education group N=51 | P |
|---|---|---|---|---|
| Gender | Man | 43 | 41 | 0.622 |
| | Woman | 8 | 10 | |
| Age | ＜60 years old | 26 | 19 | 0.856 |
| | ≥60 years old | 25 | 32 | |
| Tumor location | Top | 17 | 19 | 0.272 |
| | Middle | 23 | 17 | |
| | Bottom | 11 | 15 | |
| CTV | 0-200 | 20 | 4 | 0.804 |
| | 201-400 | 26 | 32 | |
| | ＞400 | 5 | 15 | |
| Number of patients with mucositis after 10 fractionated of radiotherapy | Not have | 45 | 36 | 0.243 |
| | I | 6 | 11 | |
| | II | 0 | 4 | |
| Number of patients with pneumonia after 10 fractionated of radiotherapy | Not have | 42 | 40 | 0.069 |
| | I | 3 | 2 | |
| | II | 6 | 9 | |
| Number of patients with dysphagia after 10 fractionated of radiotherapy | Not have | 27 | 9 | 0.731 |
| | I | 21 | 40 | |
| | II | 3 | 2 | |
| Number of patients with mucositis after 30 fractionated of radiotherapy | Not have | 38 | 22 | 0.007 |
| | I | 12 | 23 | |
| | II | 0 | 6 | |
| Number of patients with pneumonia after 30 fractionated of radiotherapy | Not have | 35 | 37 | 0.744 |
| | I | 3 | 5 | |
| | II | 13 | 9 | |
| Number of patients with dysphagia after 30 fractionated of radiotherapy | Not have | 23 | 10 | 0.378 |
| | I | 25 | 38 | |
| | II | 3 | 3 | |

**Table 2:** PG- SGA score before and after 30 fractionated of radiotherapy

| | | PG -SGA rating | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0-1 point | 2-8 points | ≥ 9 points | Z | P | Z | P |
| Traditional education group (N=51) | Before radiotherapy | 48 -94.10% | 3 -5.90% | 0 | -3.345 | 0.001 | -1.826 | 0.068 |
| | After radiotherapy | 34 -66.70% | 8 -15.70% | 9(17.6%) | | | | |
| Teach-back education group (N=51) | Before radiotherapy | 45 -88.20% | 1 -2% | 5(9.8%) | -0.489 | 0.625 | | |
| | After radiotherapy | 40 -78.40% | 6 -11.80% | 5(9.8%) | | | | |

Note: A PG -SGA score of 0-1 was classified as good nutrition, Scores of 2-8 were classified as moderate malnutrition and ≥ 9 as severe malnutrition

**Table 3:** Comparison of the weight change rate of the two groups of patients from the starting and 30 fractionated of radiotherapy

| | | Weight change rate | | | | | |
|---|---|---|---|---|---|---|---|
| | | Maintain a stable or growing weight | Weight loss<5% | Weight loss≥5%, ≤10% | Weight loss >10% | Z | P |
| Traditional education group | Number of people | 17 | 21 | 12 | 1 | 2.811 | 0.005 |
| | Percentage | 33.30% | 41.20% | 23.50% | 2% | | |
| Teach-back education group | Number of people | 27 | 17 | 6 | 1 | | |
| | Percentage | 52.90% | 33.30% | 11.80% | 2% | | |

Note: < 5% for mild weight loss; 5% - 10% as moderate weight loss; > 10% for heavy weight loss.

**Table 4:** Analysis of blood indicators

| | HB | RBC | Albumin |
|---|---|---|---|
| Traditional education group (average ± standard deviation) | | | |
| Before radiotherapy | 111.38±19.67 | 3.65±0.70 | 41.3±7.56 |
| After radiotherapy | 97.85±19.35 | 3.47±0.92 | 54.29±19.93 |
| Teach-back education group (average ± standard deviation) | | | |
| Before radiotherapy | 114.98±20.55 | 3.77±0.70 | 38.82±4.90 |
| After radiotherapy | 97.66±22.05 | 3.20±0.86 | 39.26±12.18 |
| P | 0.236 | 0.106 | 0.004 |

## 5. Discussion

Radiotherapy is currently the main treatment for the advanced locally advanced esophageal cancer. While killing tumor cells, radiotherapy can also damage normal tissues. With the increase of radiotherapy time and the accumulation of doses, the serious complications of radiotherapy will increase the pain of patients and may even lead to the interruption of radiotherapy [17]. In this experiment, there was little difference in mucositis, pneumonia, and dysphagia during radiotherapy, which may be compared with the changes in condition and the overall sample size during radiotherapy. Less relevant; In this study, we focused on comparing the nutritional changes before and after radiotherapy in the traditional education group and the teach back education group. Malnutrition is the most common complication in patients with locally advanced esophageal cancer. The incidence rate ranks first among all malignant tumor, 60% to 85% [18]. The occurrence of malnutrition will increase the side effects of radiotherapy, reduce the accuracy, sensitivity, and therapeutic effect of radiotherapy [19], leading to poor prognosis, severe patients and even death. After teaching back health education for patients with locally advanced esophageal cancer, the change rate of significant weight loss decreased from 66.7% to 47.1%, and the rate of moderate and above malnutrition after radiotherapy decreased from 33.3% to 21.6%; before and after radiotherapy in the teach back education group HB and RBC also remain relatively constant, so the teach back education model is conducive to reducing the incidence of nutritional risks. However, due to the small number of samples and insufficient differences, this experiment can be further studied.

Health education is not only a means of publicity, but also a way of treatment and care. It is a health education activity for patients and their families. Targeted health education can improve the quality of life of patients [20]. Strengthening the health education of patients during radiotherapy can enhance understanding and trust in the content of education [21]. At present, health education for patients is mainly exported one-way by medical staff to patients, which will lead to deviation in patients' understanding of the content of education and low mastery of patients. Studies have confirmed that the knowledge imparted by medical staff is not the same as that mastered by patients, and it is one of the most important tasks of nursing to let patients master the knowledge of propaganda. The teach back health education model helps patients better and more comprehensively understand medical information through four steps: explaining, evaluating mastery, clarifying, and correcting misinformation, and evaluating and retelling. The limitation of this study was that the follow-up rate was low, and lacked the long-term observation of the nutritional status of patients. In the further prospective study, the follow-up can be strengthened to better reflect the clinical observation effect.

## 6. Conclusion

The teach-back health education model was beneficial for maintaining weight stability during radiotherapy in patients with locally advanced esophageal cancer and reducing the incidence of malnutrition risk.

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