



Case Report

Successful early elemental diet nutritional support in an esophageal cancer patient

Pei-Chun Chao ^{a, b, c, *}, Cheau-Feng Lin ^c^a School of Health Diet and Industry Management, Chung Shan Medical University, Taiwan^b Department of Nutrition, Chung Shan Medical University Hospital, Taiwan^c Department of Parenteral Nutrition, Chung Shan Medical University Hospital, Taiwan

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ABSTRACT

Our case involved a 58-year-old man with a medical history of moderately differentiated esophageal squamous cell carcinoma. Positron emission tomography (PET) and computed tomography (CT) scan revealed a tumor in the upper two-thirds of the esophagus, with a maximal length of 14.4 cm and at least 6 enlarged lymph nodes. Concurrent chemoradiotherapy (CCRT) was performed on June 12, 2015, and a chest CT 2 weeks later revealed partial tumor response and shrinkage of the right upper paratracheal lymph node. The patient (cT3N3MO, stage III c) underwent esophagectomy with gastric tube reconstruction, lymph node dissection, and jejunostomy on July 6, 2015. Bodyweight (BW) loss occurred because of inadequate calorie intake. The nutrition support team (NST) commenced an intervention and estimated the patient's malnutrition status from the BW loss (>8% in 3 months), body mass index (BMI, 21 kg/m²), triceps skinfold thickness (TSF, 5.7 mm), arm circumference (AC, 20 cm), and serum albumin level (2.7 g/dL). The NST administered an enteral nutrition formula with an elemental diet (Peptamen) through enterostomy feeding, and provided meals according to the patient's digestive ability. The Scored Patient-Generated Subjective Global Assessment (PG-SGA) improved from 13 to 5, and energy support increased from 10 to 30 kcal/kg BW, with the BMI rising from 21 to 22 kg/m², TSF from 5.7 to 7.0 mm, AC from 20 to 21.7 cm, and serum albumin level from 2.7 to 3.1 g/dL. The patient's wound healed completely.

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1. Introduction

For decades, cancer has been the leading cause of death in Taiwan.¹ In 2012, esophageal cancer was the eighth most common cancer globally, with 456,000 new cases presenting that year.² Esophageal cancer caused approximately 400,000 deaths in 2012, up from 345,000 in 1990.^{2,3} Rates vary widely among countries, with approximately 50% of all cases occurring in China. Esophageal cancer is approximately 3 times more common in men than in women.²

The esophagus is a muscular tube that moves food and liquids from the throat to the stomach. In esophageal cancer, malignant (cancer) cells form in the esophageal tissues. The 2 main types of esophageal cancer, squamous cell carcinoma and adenocarcinoma,

have different sets of risk factors.⁴ Squamous cell carcinoma is associated with lifestyle-related factors such as smoking and alcohol.⁵ By contrast, adenocarcinoma is associated with the effects of long-term acid reflux.⁵ Tobacco, which is more commonly used by men and those older than 60 years,⁶ is a risk factor for both types.⁴

The treatment course for esophageal cancer depends on the tumor location, size, and stage. Certain patients undergo esophagectomy followed by chemotherapy or chemoradiation, whereas others receive neoadjuvant chemotherapy and radiation before esophagectomy.⁷ Certain patients with extensive disease, who are not candidates for aggressive treatment, receive palliative therapy to improve dysphagia, so that they can eat.⁸ Such patients may undergo percutaneous gastrostomy or jejunostomy to enable the

* Corresponding author. School of Health Diet and Industry Management, Chung Shan Medical University, No.110, Sec.1, Jianguo N. Rd., Taichung City 40201, Taiwan.

E-mail address: cschc029@csn.org.tw (P.-C. Chao).

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Scored Patient-Generated Subjective Global Assessment (PG-SGA)

Patient ID Information

History (Boxes 1-4 are designed to be completed by the patient.)

1. Weight (See Worksheet 1)

In summary of my current and recent weight:

I currently weigh about _____ pounds

I am about _____ feet _____ tall

One month ago I weighed about _____ pounds

Six months ago I weighed about _____ pounds

During the past two weeks my weight has:

☐ decreased ⁽ⁿ⁾ ☐ not changed ⁽ⁿ⁾ ☐ increased ⁽ⁿ⁾ Box 1

2. Food Intake: As compared to my normal intake, I would rate my food intake during the past month as:

☐ unchanged ⁽ⁿ⁾

☐ more than usual ⁽ⁿ⁾

☐ less than usual ⁽ⁿ⁾

I am now taking:

☐ normal food but less than normal amount ⁽ⁿ⁾

☐ little solid food ⁽ⁿ⁾

☐ only liquids ⁽ⁿ⁾

☐ only nutritional supplements ⁽ⁿ⁾

☐ very little of anything ⁽ⁿ⁾

☐ only tube feedings or only nutrition by vein ⁽ⁿ⁾ Box 2

3. Symptoms: I have had the following problems that have kept me from eating enough during the past two weeks (check all that apply):

☐ no problems eating ⁽ⁿ⁾

☐ no appetite, just did not feel like eating ⁽ⁿ⁾

☐ nausea ⁽ⁿ⁾

☐ constipation ⁽ⁿ⁾

☐ mouth sores ⁽ⁿ⁾

☐ things taste funny or have no taste ⁽ⁿ⁾

☐ problems swallowing ⁽ⁿ⁾

☐ pain; where? ⁽ⁿ⁾ _____

☐ other** ⁽ⁿ⁾ _____

** Examples: depression, money, or dental problems

Box 3

4. Activities and Function:

Over the past month, I would generally rate my activity as:

☐ normal with no limitations ⁽ⁿ⁾

☐ not my normal self, but able to be up and about with fairly normal activities ⁽ⁿ⁾

☐ not feeling up to most things, but in bed or chair less than half the day ⁽ⁿ⁾

☐ able to do little activity and spend most of the day in bed or chair ⁽ⁿ⁾

☐ pretty much bedridden, rarely out of bed ⁽ⁿ⁾

Box 4

Additive Score of the Boxes 1-4 A

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The remainder of this form will be completed by your doctor, nurse, dietitian, or therapist. Thank you.

Scored Patient-Generated Subjective Global Assessment (PG-SGA)

Worksheet 1 - Scoring Weight (Wt) Loss

To determine score, use 1 month weight data if available. Use 6 month data only if there is no 1 month weight data. Use points below to score weight change and add one extra point if patient has lost weight during the past 2 weeks. Enter total point

Wt loss in 1 month	Points	Wt loss in 6 months
10% or greater	4	20% or greater
5-9.9%	3	10-19.9%
3-4.9%	2	6-9.9%
2-2.9%	1	2-5.9%
0-1.9%	0	0-1.9%

Numerical score from Worksheet 1

Additive Score of the Boxes 1-4 (See Side 1) A

5. Worksheet 2 - Disease and its relation to nutritional requirements

All relevant diagnoses (specify) _____

Primary disease stage (circle if known or appropriate) I II III IV Other _____

One point each:

☐ Cancer ☐ AIDS ☐ Pulmonary or cardiac cachexia ☐ Presence of decubitus, open wound, or fistula

☐ Presence of trauma ☐ Age greater than 65 years ☐ Chronic renal insufficiency

Numerical score from Worksheet 2 B

6. Worksheet 3 - Metabolic Demand

Score for metabolic stress is determined by a number of variables known to increase protein & calorie needs. The score is additive so that a patient who has a fever of > 102 degrees (3 points) and is on 10 mg of prednisone chronically (2 points) would have an additive score for this section of 5 points.

Stress	none (0)	low (1)	moderate (2)	high (3)
Fever	no fever	>99 and <101	≥101 and <102	≥102
Fever duration	no fever	<72 hrs	72 hrs	> 72 hrs
Corticosteroids	no corticosteroids	low dose (<10mg prednisone equivalents/day)	moderate dose (≥10 and <30mg prednisone equivalents/day)	high dose steroid (≥30mg prednisone equivalents/day)

Numerical score from Worksheet 3 C

7. Worksheet 4 - Physical Exam

Physical exam includes a subjective evaluation of 3 aspects of body composition: fat, muscle, & fluid status. Since this is subjective, each aspect of the exam is rated for degree of deficit. Muscle deficit impacts point score more than fat deficit. Definition of categories: 0 = no deficit, 1+ = mild deficit, 2+ = moderate 3+ = severe

Muscle Status:	0	1+	2+	3+
clavicles (pectoralis & deltoids)				
interosseous muscles				
thigh (quadriceps)				
Global muscle status rating				
orbital fat pads				
triceps skin fold				
Global fat deficit rating				

Clinician Signature _____ RD RN PA MD DO Other _____ Date _____

Worksheet 5 - PG-SGA Global Assessment Categories

Category	Score 0	Score 1	Score 2	Score 3
Weight	Well nourished	Mildly malnourished	Moderately malnourished	Severely malnourished
Nutrient intake	No deficit	No deficit	Definite decrease in intake	Severe deficit in intake
Nutrition Impact	No deficit	No deficit	Present of nutrition impact	Present of nutrition impact
Functioning	No deficit	No deficit	Moderate functional deficit	Severe functional deficit
Physical Exam	No deficit	No deficit	Evidence of mild to moderate loss of muscle mass	Obvious signs of malnutrition

Nutritional Triage Recommendations: Additive score is used to define specific nutritional interventions including patient & family education, symptom management including pharmacologic intervention, and appropriate nutrient intervention (food, nutritional supplements, enteral, or parenteral triage).

First line nutrition intervention includes optimal symptom management.

Triage based on PG-SGA point score

0-1 No intervention required at this time. Re-assessment on routine and regular basis during treatment.

2-3 Patient & family education by dietitian, nurse, or other clinician with pharmacologic intervention as indicated by symptom survey (Box 3) and lab values as appropriate.

4-8 Requires intervention by dietitian, in conjunction with nurse or physician as indicated by symptoms (Box 3). Indicates a critical need for improved symptom management and/or nutrient intervention options.

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Fig. 1. The Scored Patient-Generated Subjective Global Assessment (PG-SGA) sets the standard of and is the well-known factor of interdisciplinary patient assessment (weight, intake, symptoms, functional status, disease state, metabolic stress and nutritional physical examination) in oncology and other chronic catabolic conditions.

patients to receive nutrition directly into the stomach or the intestine, and to allow for soft and liquid food intake.⁹

Malnutrition is common among patients with esophageal cancer. Cancer-associated malnutrition has numerous consequences, including increased infection risk, poor wound healing, reduced muscle function, and poor skin turgor, which result in skin breakdown.¹⁰ The Scored Patient-Generated Subjective Global Assessment (PG-SGA) score, which can be used as an objective measure for demonstrating the outcome of nutrition intervention and the SGA¹¹ have been developed specifically for use in the cancer population.¹² They include the following: (1) Patients complete the medical history component, thereby saving time; (2) the PG-SGA contains more nutrition impact symptoms, which are crucial to patients with cancer; and (3) the SGA has a scoring system that allows patients to be triaged for nutritional intervention (Fig. 1).

The PG-SGA is used by registered dietitians (RDs), who counsel cancer patients and screen for potential malnutrition risks. The PG-SGA includes 4 patient-generated historical components (Weight History, Food Intake, Symptoms, and Activities and Function), a professional part (Diagnosis, Age, Metabolic Stress, and Physical Exam), Global Assessment (A = well nourished, B = moderately malnourished or suspected malnutrition, and C = severely malnourished), a total numerical score, and nutritional triage recommendations. Typical scores range from 0 to 35. Nutritional recommendations in relation to the score are as follows: 0–1, nutritional input not required; 2–3, specialist nutritional education required; 4–8, specialist nutritional intervention required; and ≥ 9 , symptom management with specialist nutritional intervention critically required.

Compared with other digestive and nondigestive forms of cancer, the highest incidence of malnutrition (79%) was observed in patients with esophageal cancer.¹³ The side effects caused by esophageal cancer treatment are major contributors to malnutrition and wasting syndrome, which typically present in these patients. Jejunostomy feeding may be used because of the patient's

inability to use the mouth, stomach, or esophagus for feeding because of dysfunction. Nutritional problems resulting from jejunostomy feeding are due to the lower digestive tract of the small intestine, which causes diarrhea. This leads to the malabsorption of essential nutrients in the small intestine, thus leading to malnutrition and weight loss.¹⁴ The elemental diet is an ingestion diet used during jejunostomy feeding of liquid nutrients in an easily assimilated form. The formula also contains carbohydrates, fats, vitamins, and minerals. Many patients require special nutritional support after surgery, and elemental diets may aid in the management of such patients.¹⁵ A peptide-based formula is recommended to preserve and restore gut integrity during periods of illness, and helps prevent the consequences of tube-feeding intolerance to improve outcomes.¹⁶

Whenever inadequate nutritional intake is observed after different treatment modalities, nutrition support options must be evaluated. We evaluated the outcome of early enteral elemental diet feeding through an enterostomy tube in a esophageal cancer patient who underwent concurrent chemoradiotherapy and subsequent esophagectomy with gastric tube reconstruction.

2. Case report

Our case involved a 58-year-old man (height: 168 cm, weight: 59.5 kg) who smoked tobacco (20 cigarettes per day for 20 years), but did not drink alcohol. With a medical history of esophageal squamous cell carcinoma (moderately differentiated), he presented at our hospital (Chung Shan Medical University Hospital, Taichung, Taiwan) with dysphagia as the major complaint, which progressed over the past 3 months. Since the onset of dysphagia, his weight gradually decreased.

Positron emission tomography (PET) and computed tomography (CT) revealed a tumor in the upper two-thirds of the esophagus with a maximal length of 14.38 cm and at least 6 enlarged lymph nodes. Complete computer-controlled radiation therapy was performed on June 12, 2015, and a chest CT 2 weeks later revealed

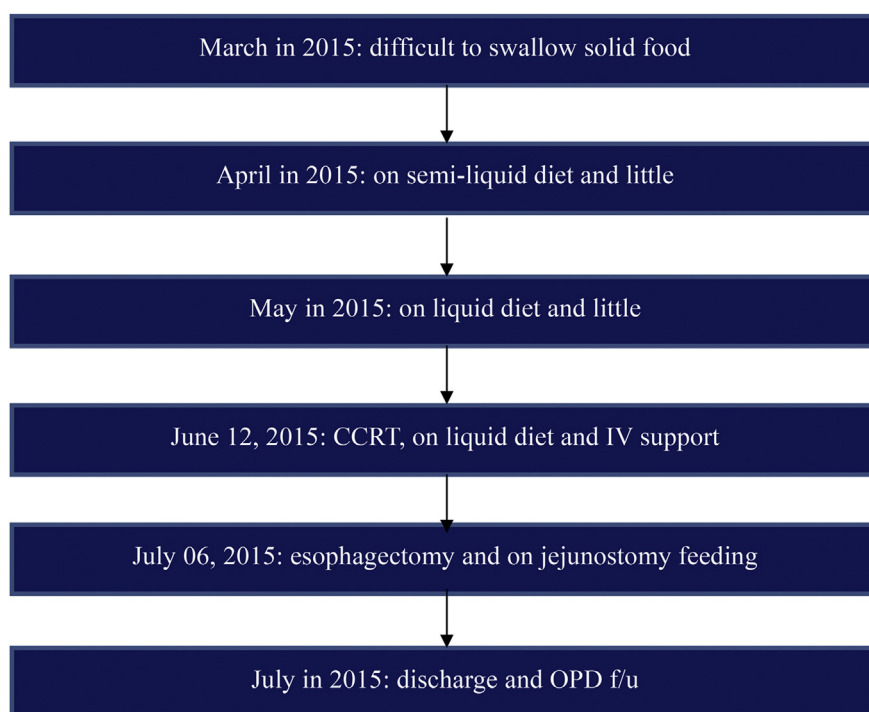


Fig. 2. Hospital course about nutrition support.

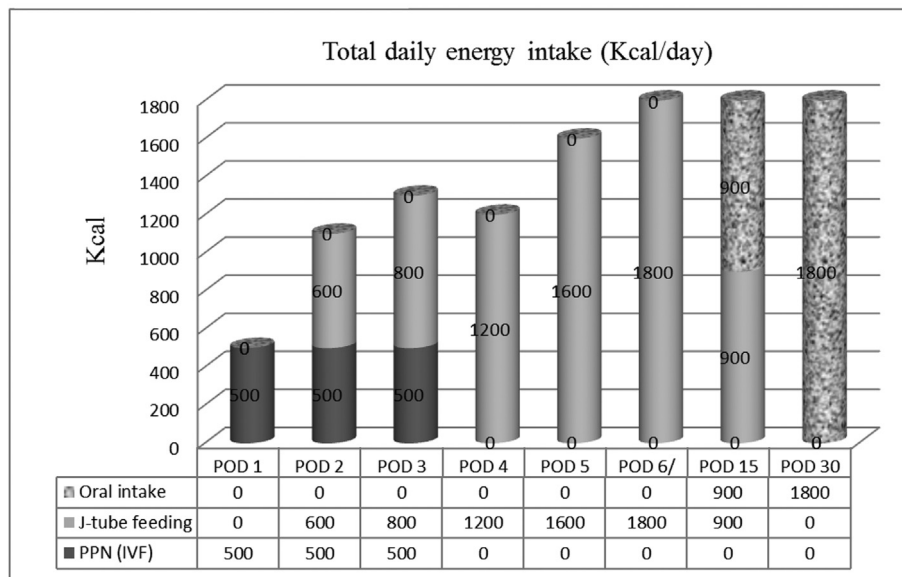
partial tumor response and shrinkage of the right upper paratracheal lymph node. The patient (cT3N3MO, stage III c) underwent esophagectomy with gastric tube reconstruction, lymph node dissection, and jejunostomy (J tube) for enteral nutrition (EN) on July 6, 2015 (Fig. 2).

The nutrition support team (NST) estimated his nutritional status and began the intervention. An inadequate calorie intake (due to swallowing difficulty) induced malnutrition in the patient; his bodyweight (BW) loss exceeded 8% in 3 months, his body mass index (BMI) was 21 kg/m², triceps skinfold thickness (TSF) was 5.7 mm, arm circumference (AC) was 20 cm, the serum albumin level was 2.7 g/dL, the PG-SGA¹² was 13, and poor

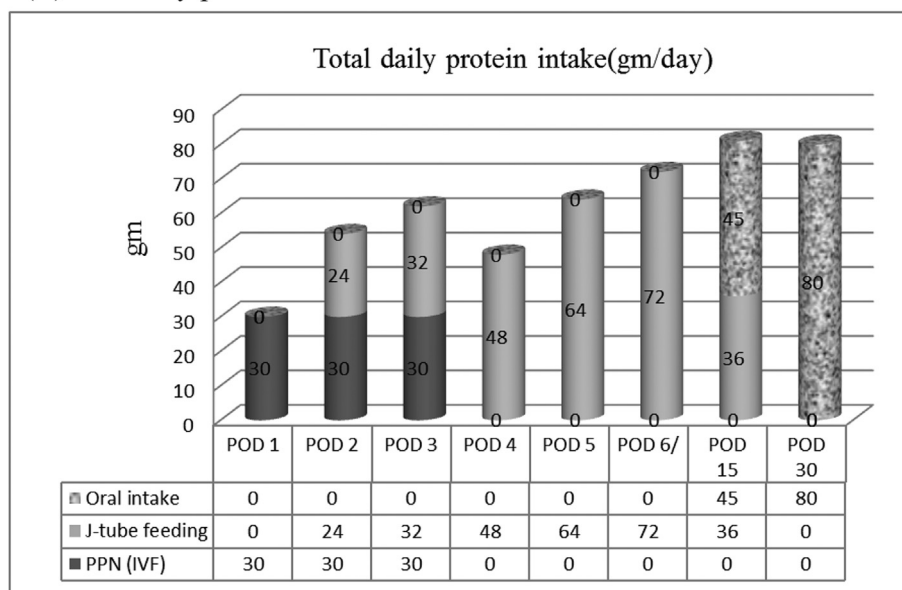
nutrient intake reduced the patient's food intake to approximately 10 kcal/kg BW.

While surgery remains the primary option for operable esophageal cancer cases, early postoperative enteral feeding and various routes of feeding remain debatable topics. The NST administered an EN formula with an elemental diet (Peptamen) through the jejunostomy tube (J tube) and provided meals according to the patient's digestive status. For nutritional adequacy and the intestinal tolerance of a balanced peptide-based elemental diet, enteral feeding by gravity was set at 120 mL of the formula/meal, 5 meals per day (600 kcal/600 cc/d or 10 kcal/kg BW), and was gradually increased to 300 mL of the formula/meal, 6 meals per day (1800 kcal/1800 cc/

(A) total daily energy intake



(B) total daily protein intake



POD: postoperative day

Fig. 3. Calculate average daily energy (A) and protein (B) support postoperative combination of enteral and peripheral parenteral nutrition within 1 month.

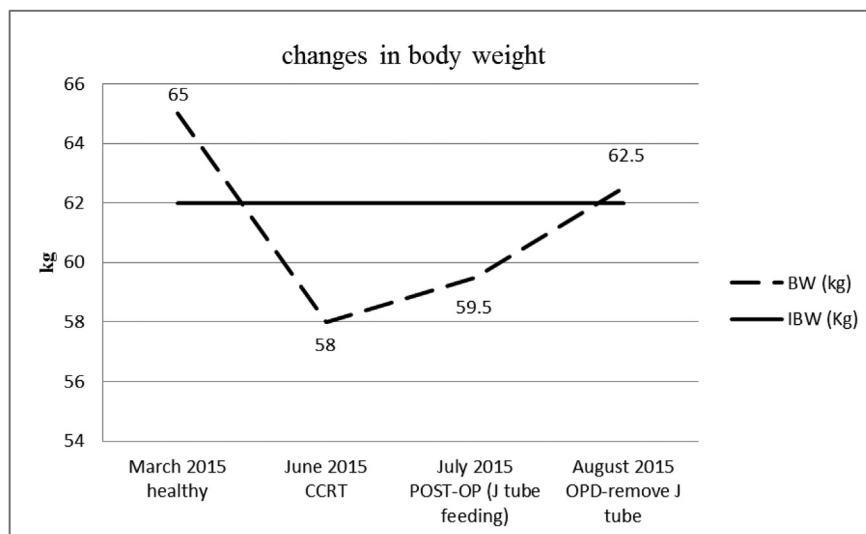


Fig. 4. Bodyweight changes of healthy, untreated, and postoperative with early jejunostomy feeding during the whole experimental period.

d or 30 kcal/kg BW). Within 1 month, the feeding rate was gradually increased from 200 to 1800 cc/d over a 4–6-day period. The patient relied on tube feeding for the majority of the nutrition requirements during treatment, and we found that his swallowing function improved within weeks, and he regained the ability to eat certain soft solid and liquid foods (Fig. 3).

After 1 month, his PG-SGA score improved from 13 to 5, and the total energy intake (including oral feeding) was increased from 10 to 30 kcal/kg BW. His BMI increased to 22 kg/m² (BW = 62.5 kg) (Fig. 4), TSF to 7.0 mm, AC to 21.7 cm, and serum albumin level to 3.1 g/dL. His wound healed completely. Intensive nutritional support improved PG-SGA scores from 13 to 5 by improving his dietary intake, quality of life, and BW, and the Global Assessment grade improved from B to A.

3. Discussion

Most epidemiological studies have identified smoking tobacco and drinking alcohol as the main risk factors for esophageal squamous cell carcinoma or unspecified esophageal cancer,^{17–19} usually with a monotonic and strong dose–response relationship.²⁰ Prevention includes smoking cessation and eating a healthy diet.^{2,21} Avoiding tobacco and alcohol is one of the best approaches to limiting the risk of esophageal cancer. In our case, the patient expressed a desire for smoking cessation and to learn more about a healthy diet.

Traditional postoperative care for patients undergoing major gastrointestinal (GI) surgery involves bowel rest and the avoidance of enteral feeding (nil via oral). Early EN after major GI surgery has recently received considerable attention. Sagar et al (1979) examined the enteral diet in the early postoperative period against conventional therapy after major GI surgery,²² and found that EN group patients fared considerably better compared with conventional group patients, both clinically and metabolically, and these patients lost less weight. The authors strongly recommended an early enteral diet for quicker recovery and a shorter hospital stay.

Semi-elemental formulas contain peptides of varying chain lengths and fat primarily as medium chain triglycerides (MCT).²³ The di- and tripeptides of semi-elemental formulas have specific uptake transport mechanisms and are thought to be absorbed more efficiently than individual amino acids or whole proteins, the nitrogen sources in elemental and polymeric formulas respectively.²⁴

Silk et al²⁵ found that individual and free amino acid residues, as found in elemental formulas, were poorly absorbed while amino acids provided as dipeptides and tripeptides were better absorbed.

A simple nutritional assessment program and early counseling by a dietitian are necessary to guide nutritional support and alert physicians regarding the need for EN. The goals of EN include nutritional repletion, hydration, weight maintenance or gain (as appropriate), energy level improvement, and postoperative wound healing. Our patient tolerated early enteral feeding well, and his recovery was satisfactory. We employed an elemental diet (Peptamen), and the daily total energy intake increased from 10 to 30 kcal/kg BW.

A randomized study reported that EN definitely reduces infection-related and other postoperative complications.²³ In a meta-analysis, Lewis et al concluded that early EN was beneficial compared with delayed EN in relation to postoperative complications, hospital stay, and mortality.²⁴ Although many challenges exist when caring for esophageal cancer patients at our hospital, Registered dietitians (RDs) follow patients during hospitalization through scheduled clinic visits. RDs choose a peptide-based elemental formula that is fed at a low rate through a bag, and advance the feeding rate gradually over several days to prevent feeding complications. Our patient tolerated early enteral feeding well, and recovery was satisfactory, as shown by the improvements in BMI, TSF, AC, serum albumin, and PG-SGA score.

Nutritional supplements should be supplied along with appropriate dietary advice. Enteral tube feeding is not exclusive, and can be used in combination with oral intake, and should be used on a long-term basis for regular monitoring and reassessment.

A limitation of this study was that only one patient was examined, and retrospective analysis may have been based on incomplete medical records. Therefore, our findings may not be applicable to the general population.

Conflict of interest

The Authors declare that there are no conflicts of interest.

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