



# Investigation and analysis of influencing factors of early activity compliance of patients after minimally invasive esophagectomy

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**Background:** Unclear assessment content is the main reason for poor early postoperative ambulation compliance of patients. This study aimed to accelerate patients' recovery by investigating the influencing factors of the early activity compliance of patients with esophageal cancer (EC) undergoing minimally invasive esophagectomy (MIE).

**Methods:** A total of 228 patients were investigated with a self-designed general information questionnaire, disease-specific questionnaire, early postoperative activity record, Social Support Rating Scale (SSRS), and the health belief model questionnaire from January 2019 to June 2020. The Mann-Whitney U test was used to analyze the influencing factors of patients with different degrees of compliance. Correlation analysis was used to analyze the relationship between social support and postoperative patient compliance.

**Results:** Among the 228 cases, 48 patients' compliance was good, 120 patients' compliance was moderate, and 60 patients' compliance was poor. The average score of compliance was  $67.89 \pm 23.26$ . The analysis of influencing factors indicated educational level, intensity of postoperative activity pain, fatigue, dizziness, and social support could greatly predict the early activity compliance.

**Conclusions:** Attention should be paid to alleviating the patients' pain, improving their nutrition, and increasing social support, which can promote patients to do the early postoperative activity and accelerate recovery.

**Keywords:** Esophageal cancer (EC); early activity compliance; influencing factors

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## Introduction

Esophageal cancer (EC) is the most common gastrointestinal malignancy in humans, with more than 450,000 new cases occurring globally every year (1). China has a high incidence of EC, with its cases comprising about half of

those worldwide. The annual incidence of EC in China is 21.62/100,000, and the mortality rate is 18/100,000, posing a serious threat to people's life and health (2). Currently, endoscopic surgery is the preferred treatment for EC (3). Endoscopic resection of EC is a minimally

invasive surgical method to complete various operations in the thoracoabdominal cavity through tiny incisions in the chest and abdominal wall with the help of a high-definition television imaging system (4). Most of the surgical methods are thoracoscopic combined with laparoscopic radical resection of EC + gastroesophageal replacement left neck anastomosis + jejunostomy, which have the characteristics of minimal trauma and early movement time out of bed. Studies have confirmed that effective activities can reduce surgical stress and complications and promote patient recovery (5). In clinical practice, the rate of early postoperative ambulation is not good. Studies have shown that unclear assessment content is the main reason for poor early postoperative ambulation compliance of patients (6).

Compliance is defined as the patient's ability to follow the nurse's instructions on early postoperative ambulation. The improvement of patients' compliance can safely and effectively assist patients to get out of bed early and accelerate their recovery. Therefore, this study innovatively aimed to investigate the status quo and influencing factors of early activity compliance of patients after thoracoscopic combined with laparoscopic radical resection of EC in order to provide a reference for medical staff to better evaluate patients, assist patients to get out of bed early more safely and effectively, and improve their activity compliance. We present the following article in accordance with the STROBE reporting checklist (available at <https://dx.doi.org/10.21037/apm-21-3643>).

## Methods

### *Participants*

Patients who underwent endoscopic radical EC surgery in the Department of Thoracic Surgery of Union Hospital in Fujian Province from January 2019 to June 2020 were recruited to this study. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study protocol was approved by the Ethics Committees of Union Hospital, Fujian Medical University (No. 2020KY002) and written informed consent was provided by all participants.

The inclusion criteria were as follows: (I) patients with EC diagnosed histopathologically and undergoing total endoscopic radical resection of EC; (II) aged  $\geq 18$  years; (III) basic communication skills; (IV) voluntary participation in the study with provision of informed consent.

The exclusion criteria were as follows: (I) patients with serious diseases of the heart, liver, kidney, or psychological

disorders; (II) unconsciousness or unclear language expression; (III) those who had previous fractures, joint deformity, and other lesions that affect normal walking activities.

Post-recruitment exclusion criteria were as follows: (I) patients with intraoperative or postoperative complications and admitted to intensive care unit (ICU) after surgery; (II) those who were unable to cooperate with the study and quit of their own accord; (III) postoperative monitoring time was more than 24 h due to bleeding or other reasons.

### *Research methods*

#### **Research tools**

##### *General information and disease-related information questionnaire*

Patients' age, gender, occupation, body mass index (BMI), lesion site, surgical method, and number of drainage tubes after surgery were included.

##### *Observation record form of postoperative patient activity compliance*

The observation record form of early postoperative patient activity compliance was established according to clinical observation of patient activity and with reference to relevant literature. The content included activity mode, activity duration, activity frequency, whether an activity plan should be completed, activity discomfort, and so on. Patients were observed within 6 h after surgery, 6–24 h after surgery, 24–72 h after surgery, and 72 h after surgery. Each item was scored on a scale of 1–4, namely, “not at all”, “occasionally”, “basically”, and “completely”, with 1, 2, 3, and 4 points, respectively. The higher the total score, the higher the patient's level of compliance with exercise prescription.

The Champion Heath Belief Model Scale (CHBMS) (7), designed by Champion on the basis of Health Belief Model (HBM), has a total of 6 dimensions and 36 indicators. In this study, the Chinese version of the scale was revised to delete some items from the original scale unsuitable for patients with EC. The scoring was based on 5 points, from completely disagree (1 point) to completely agree (5 points). The higher the score, the better the perception. According to statistics, Cronbach's A coefficient was 0.68.

The Social Support Rating Scale (SSRS) (8) consists of 10 items, including objective support, subjective support, and utilization of social support. The scoring method for items was as follows: item 1–4, 8–10, 15, select only one item for each item, and select item 1, 2, 3, and 4 to count 1, 2, 3, and 4 points, respectively; items A, B, C, D, and E were divided into total scores, with each item ranging from

“nothing” to “full support” being counted as 1–4 points, respectively. The answer “no source” was counted as 0 point, and the answer to the following sources was counted as several points. The scores for the 10 items add up to an overall score, and the higher the score, the higher the level of social support.

### Assessment methods

This study referred to relevant research literature, consulted relevant experts, comprehensively considered the health, physiological, and psychological characteristics of EC patients, defined the type, method, time, and frequency of activities in the form of an activity plan, and thus developed an activity plan for patients after total endoscopic radical resection of EC.

The researcher and the responsible nurse jointly participated in the observation and recording of the activity, evaluated whether the patient completed the corresponding activity plan, and filled in the observation record form of postoperative patient activity compliance. All participants completed the general information questionnaire, social support scale, and health belief model questionnaire one day before surgery. The part of disease characteristic data was filled in by the investigator referring to the case. The compliance rate was calculated according to whether the patient completed the activity plan = (actual compliance score/highest theoretical score of compliance × 100%), and was divided into 3 levels according to the compliance rate: high (75.0–100.0%), medium (50.0–75.0%), and low (<50.0%) (9).

### Statistical methods

The software SPSS 17.0 (IBM Corp., Armonk, NY, USA) was used for statistical processing. Statistical indicators such as mean and standard difference were used to describe the status of patients' compliance after total endoscopic radical resection of EC. The Mann-Whitney U test was used to analyze the influencing factors of patients with different degrees of compliance. Correlation analysis was used to analyze the relationship between social support and postoperative patient compliance.

## Results

### Completion of the questionnaire

A total of 249 questionnaires were sent out and 240 were recovered, with a recovery rate of 96.3% (240/249). Subsequently, 12 participants withdrew from this study due to loss of follow-up and other reasons. There were 228 valid

questionnaires, with an effective rate of 91.5% (228/249).

### General data of patients after total endoscopic radical resection of EC

#### Characteristics of population sociology

In this study, 228 patients were analyzed, including 204 males and 24 females. The average age was  $56.26 \pm 13.84$  years (45–70 years), and 94.73% were over 50 years. In terms of education, 33.2% of participants had received education at primary school or below, and 5.24% had a bachelor's degrees or above. Most of the participants were retired, accounting for 84.21%, and the rest were workers and farmers. The long-term residential areas were 38.32% in urban areas and 61.68% in rural areas. The scores of early postoperative activity compliance of patients with different demographic and sociological characteristics were compared, and the results showed that the scores of early postoperative activity compliance of patients with different educational levels were statistically significant (*Table 1*). Further pair comparison showed that the compliance score of the primary school education group was lower than that of the other groups ( $P < 0.01$ ), while there was no significant difference between the other groups ( $P > 0.05$ ).

#### Disease features

There were 144 participants in the middle thoracic segment and 84 participants in the lower thoracic segment. Serum total protein and albumin were  $(57.5-76.5) \times 10^9$  g/L [ $(60.5 \pm 7.3) \times 10^9$  g/L] and  $(28.6-35.3) \times 10^9$  g/L [ $(30.4 \pm 5.64) \times 10^9$  g/L]. The mean BMI was  $23.10 \pm 2.44$ , with a BMI <18.5 accounting for 32.5% of the total, BMI of 18.5–23.9 accounting for 54.42%, and BMI >24 accounting for 13.08% of the total. All surgical methods were neck anastomosis, accounting for 84.21% of the total, and the intraoperative blood loss was less than 150 mL. In 91.1% of patients, the number of intraoperative drainage tubes was 5, including thoracic closed drainage tube, jejunostomy tube, abdominal drainage tube, gastrointestinal decompression tube, and neck drainage tube. After analysis, there was no significant difference in early postoperative activity compliance scores among patients with different disease characteristics ( $P > 0.05$ ).

#### Statistical results of activity compliance

The early postoperative compliance score was 26–103 ( $67.89 \pm 23.26$ ) points. The lower score items were upper

**Table 1** Comparison of early postoperative compliance scores of patients with different characteristics (n=228)

Characteristics	Subgroup	Control group	Score ( $\bar{x}\pm s$ )	F	P value
Gender	Male	204	68.14 $\pm$ 21.26	0.004	0.762
	Female	24	67.36 $\pm$ 20.27		
Age	45–50 years	9	63.89 $\pm$ 10.28	3.154	0.085
	51–60 years	201	64.36 $\pm$ 23.20		
	61–70 years	18	65.34 $\pm$ 8.30		
Long-term residence	City	84	62.34 $\pm$ 20.31	4.501	0.075
	Countryside	144	64.62 $\pm$ 21.32		
Education	Primary & below	75	62.80 $\pm$ 23.33	0.49	0.004
	Middle school	54	63.45 $\pm$ 23.36		
	Senior high	48	63.34 $\pm$ 23.35		
	Junior college	39	65.32 $\pm$ 23.36		
	Undergraduate & above	12	70.20 $\pm$ 15.38		
Occupation	Farmer	30	65.29 $\pm$ 23.31	2.342	0.065
	Worker	6	63.35 $\pm$ 8.36		
	Retirement	189	66.26 $\pm$ 19.43		
	Others	3	65.38 $\pm$ 11.43		

F represents the statistical value of a statistical test, P<0.05 indicates statistical difference.

**Table 2** Analysis results of compliance level of patients in each period of postoperative activity plan

Result	Postoperative time ( $\bar{x}\pm s$ )				F	P value
	6 h	6–24 h	24–72 h	Beyond 72 h		
The total compliance rate	60.00 $\pm$ 47.06	63.80 $\pm$ 37.35	61.92 $\pm$ 35.20	75.96 $\pm$ 24.71	0.074	0.514

F represents the statistical value of a statistical test, P<0.05 indicates statistical difference.

limb joint flexion activity (1.3 $\pm$ 1.2), lower limb joint flexion activity (1.5 $\pm$ 1.1), and breathing training (1.6 $\pm$ 0.7) within 6–24 h after surgery. As shown in *Table 2*, Mann-Whitney U test analysis showed no significant difference in patients' total compliance with the activity plan within 6, 6–24, 24–72, and 72 h after surgery (P>0.05). Compliance with the activity plan did not increase significantly over time.

The compliance rate was calculated according to whether the patients completed the activity plan. A total of 48 cases were highly compliant, 120 cases were moderately compliant, and 60 cases were of low-level compliance. In the 3 groups of data, the analysis results of various factors of activity discomfort through U test are shown

in *Table 3*, among which there are 4 items with statistical significance, namely dizziness, pain, fatigue and weakness, and backache.

#### *Comparison of score of health belief and dimensions of patients after thoracoscopic combined with laparoscopic radical resection of EC*

Health belief refers to an individual's cognition of health-related knowledge, including what is health, factors affecting personal health and methods to improve health (10). The results showed that patients with high health belief scores had better compliance, but there was no statistically significant difference (*Table 4*).

**Table 3** Statistical analysis of activity discomfort univariate analysis differences

Compliance	Ache	Dizziness	PONV	Tiredness	Back pain	Palpitation and shortness of breath
High	3.17±1.66	1.74±0.66	1.14±2.36	3.14±0.65	2.14±1.78	0.44±0.12
Medium	4.14±2.36	2.15±2.66	2.04±1.68	4.09±2.66	3.25±1.45	0.24±0.22
Low	4.34±1.16	2.84±1.66	2.86±1.91	4.84±2.66	4.06±2.13	0.84±0.43
t/Z	-3.731	-6.423	-5.022	-6.894	-4.985	-2.141
P	0.000	0.0010	0.086	0.000	0.000	0.076

P<0.05 indicates statistical difference. PONV, post-operative nausea and vomiting.

**Table 4** Comparison of score of health belief and dimensions of patients after thoracoscopic combined with laparoscopic radical resection of EC

Compliance	Health belief score ( $\bar{x}\pm s$ )	F	P value
High	123.45±14.22	15.18	0.0610
Medium	121.19±12.16		
Low	119.70±11.86		

F represents the statistical value of a statistical test, P<0.05 indicates statistical difference. EC, esophageal cancer.

**Table 5** Comparison of score of social support and scores of different dimensions of patients after thoracoscopic combined with laparoscopic radical resection of EC

Compliance	Social support score ( $\bar{x}\pm s$ )	F	P value
High	56.18±8.17	3.67	0.000
Medium	48.23±6.19		
Low	42.45±6.89		

F represents the statistical value of a statistical test, P<0.05 indicates statistical difference. EC, esophageal cancer.

### *Correlation analysis of social support for patients after total endoscopic radical resection of EC*

Patients with high social support had better compliance than those with low social support, and the difference was statistically significant, as shown in *Table 5*. There was a positive correlation between social support and postoperative compliance ( $R=0.354$ ,  $P<0.05$ ), and regression analysis showed that social support had a significantly positive predictive effect on postoperative compliance.

## **Discussion**

### *Status quo of early postoperative activity compliance*

According to the concept of rapid rehabilitation surgery, early postoperative ambulation is an important optimization measure to accelerate perioperative nursing of rehabilitation surgery (11). Studies have shown that effective activities can reduce surgical stress and complications and promote patient recovery. This study showed that the compliance score of early postoperative activities was  $67.89\pm 23.26$ , accounting for 64.57% of the highest score [105]. Poor compliance included upper extremity joint flexion activities at 6 h postoperatively, lower extremity joint flexion activities, and respiratory training at 6–24 h postoperatively.

The compliance rate was calculated according to whether the patients completed the activity plan, and 21% of the patients were high in compliance, 52% were moderate in compliance, and 26% were low in compliance. Further analysis found that the compliance score of the primary school education group was lower than that of the other groups ( $P<0.01$ ), while there was no statistical significance between the other groups ( $P>0.05$ ). Therefore, when guiding and supervising early postoperative activities of EC patients, medical staff should consider the influence of education level on patient compliance, and for patients with low education level, education should be repeated to improve their compliance.

### *Analysis of influencing factors of early postoperative activity compliance*

Patients had lower activity compliance scores within 6 h after surgery. Within 6 h after surgery, due to the effect of anesthetics having not completely subsided, patients are mostly in a deep sleep, not completely awake, and cannot sufficiently complete the early postoperative activities. Therefore, medical staff should strengthen supervision and guidance, to assist patients to complete the flexion activities of upper and lower limb joints within 6 h after

surgery. That is, on the day of surgery, patients should be encouraged to move their limbs properly in bed, especially the lower limbs. From the first day after surgery, they should sit on the bed with the help of nurses and nursing assistant, and move a little. On the second day after surgery, patients should be encouraged to move out of bed. The scores of dizziness, fatigue, back pain, and pain in the 3 groups of patients with high, medium, and low compliance were statistically significant ( $P < 0.05$ ), indicating that these factors limited patients' early activities to varying degrees. Therefore, adequate analgesia is the premise of early postoperative activities. Medical staff should take effective methods to control patients' postoperative pain below 3 points. In addition, fatigue is also an important factor affecting patients to engage in early postoperative activities. As a result of the wasting of tumor, EC patients, together with the clinical symptoms such as common ache, digestive function disorder, deglutition difficulty, can bring about bodily nutrition inadequacy, the patient slants thin and often have low protein blood disease and anemia. Therefore, medical staff should strengthen the nutritional management of patients with EC and pay close attention to their nutritional status.

#### *Influence of health beliefs on early postoperative compliance*

According to the HBM, improvement of compliance depends on patients' perception of disease susceptibility and severity, trade-offs between expected barriers to behavior and expected benefits, and patients' self-efficacy (12). This study showed that patients with high health belief scores had better compliance, but there was no statistically significant difference. A large number of studies have shown that good health beliefs are conducive to the cultivation of activity compliance. Therefore, health beliefs can be used as an intervention target to improve patients' compliance with functional exercise after surgery. Medical staff should strengthen promotional material and education, improve patients' health beliefs, and stimulate their enthusiasm for functional exercise after surgery.

#### *Influence of social support on early postoperative activity compliance*

The results showed that there was a positive correlation between social support and postoperative compliance ( $R = 0.354$ ,  $P < 0.05$ ), and regression analysis showed that

social support had a significant positive predictive effect on postoperative compliance. Secondly, the subjective support of patients after EC was positively correlated with reassumption of their role. In other words, patients with better postoperative emotional experience of being respected, supported, and understood have higher compliance with early postoperative activities. Family support is the most basic form of social support. Due to surgical trauma, a large number of patients with drainage tubes after radical resection of EC often need assistance in various postoperative activities. Good family support can affect the behavior of patients. When family members provide care, it can enhance the patient's self-esteem and feelings of being loved, and play a role in coordinating and coping with the disease together. The patient's family and friends play a decisive role in helping the patient improve their ability to make life decisions and their desire to actively participate in nursing interventions. Therefore, medical staff should help patients determine and indicate the support that they need, and establish effective support on this basis (13).

#### **Conclusions**

Attention should be paid to alleviating the patients' pain, improving their nutrition, and increasing social support, which can promote patients to do the early postoperative activity and accelerate recovery. The conclusion of this exploratory study has a good reference value for accelerating the rapid recovery of minimally invasive esophagectomy in the future which is worth promoting.

#### *The limitations*

The limitation of this study was that only EC patients were investigated in the thoracic surgery department of a single class A hospital, and the sample size was limited. In the future, we will continue to expand the scope of investigation, improve the exercise plan, and further study the influencing factors of patients' activity compliance after total endoscopic radical resection of EC.

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## Footnote

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