Original Article

A systematic review and meta-analysis of nursing effect of fast-track recovery surgery on patients undergoing total endoscopic resection of esophageal cancer: fast-track recovery surgery *vs.* nursing care as usual

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Background: Esophageal cancer (EC) is the 6th leading cause of cancer-related deaths worldwide, and the morbidity and mortality of EC have continued to increase in recent years. The results of the clinical application of the Fast-track recovery surgery (FTS) concept in nursing interventions for EC patients after total endoscopic esophagectomy are unconvincing. This study sought to evaluate the nursing effect of the fast-track recovery surgical nursing model on patients with EC after total cavity endoscopic esophagectomy.

Methods: We searched for articles on case-control trials about nursing interventions after total endoscopic esophagectomy. The search time was set from January 2010 to May 2022. The data were independently extracted by 2 researchers. RevMan5.3 statistical software (Cochrane) was used to analyze the extracted data. All the articles included in the review were assessed for risk of bias using the Cochrane Handbook 5.3 (https://training.cochrane.org/).

Results: Ultimately, 8 clinical controlled trials, comprising 613 cases, were identified. A meta-analysis was conducted of the extubation times, and the results showed that the study group's extubation times were remarkably shorter. In relation to the exhaust times, the study group had significantly shorter exhaust times than control group (P<0.05). In relation to the time, it took patients to leave bed, patients in the study group left bed in a considerably shorter time compared with controls (P<0.00001). In relation to the hospitalization time, a remarkable reduction in the length of hospital stay was observed in the study group (P<0.00001). The analysis of the funnel plots showed a small number of asymmetries, suggesting that the number of articles included was small due to the heterogeneity of the studies (P<0.00001).

Conclusions: FTS care is effective at accelerating patients' postoperative recovery. This model of care needs to be further validated in the future by higher-quality and longer follow-up studies.

Keywords: Total endoscopic resection; esophageal cancer (EC); concept nursing of fast-track recovery surgery

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Introduction

Esophageal cancer (EC) is the 6th leading cause of cancer-related deaths worldwide, and the morbidity and mortality of EC have continued to increase in recent years (1). It is estimated that China has the world's highest incidence and mortality rates for EC (1). The number of new EC cases each year in China accounts for more than 1/2 of the world sum, and there are 160,000–200,000 EC-related deaths in China each year (2,3). The pathological types of EC vary greatly across different geographical locations (4). In China, the high prevalence of EC occurs mostly in males aged >40 years, and the ratio of EC is approximately 20:1 between men and women (4). EC is most frequently found in the mid-thoracic segment (52.69–63.33%) and least frequently in the upper thoracic segment (2.80–14.10%) (4). Risk factors for EC include inappropriate dietary habits, nitrosamines, long-term chronic esophageal inflammation, micronutrient deficiencies, and genetic factors (5).

At present, surgery-based multidisciplinary comprehensive treatment is the main treatment of EC. The anatomical position of the esophagus is special, as the esophagus passes longitudinally through the neck, chest and abdomen, and is horizontally adjacent to the trachea and spine. This particular anatomical location complicates the surgical treatment of EC. The surgical approaches for EC currently include the left thoracic approach (Sweet operation), right thoracic approach (McKeown Ivor-Lewis operation) and non-thoracotomy (through the mediastinum and esophageal hiatus). The resection of EC using the right thoracic approach has become the preferred surgical treatment for EC (6,7). Despite continued advances in esophageal surgery, the overall postoperative recurrence and metastasis rates for EC patients remain high, and the overall survival rate for EC patients remains low (8,9). In terms of their long-term prognosis, EC patients may suffer from recurrence and lymph node metastasis, with lymph node metastasis accounting for 21–37.5% of patients (10).

With the standardized treatment of EC and the development of surgical techniques, especially improvements in minimally invasive extraesophageal techniques, thoracic surgeons have begun to pay more and more attention to total lumen esophagectomy (TLE). The advantages of TLE include that it results in less postoperative complications, less organ damage, and can protect the respiratory function of patients. It can also enhance the life quality of patients, and its safety and efficacy have been confirmed in a number of clinical studies (11,12). For instance, Yang *et al.* (13) described the clinical characteristics, treatment outcomes, and survival of surgical treatment in patients with esophageal cancer in Shanghai Chest Hospital (SCH). They revealed important surgical treatment effects of esophageal cancer patients and contributes to improvement of clinical management and future treatment development (13). However, patients may experience surgical trauma during the operation, which can lead to limited postoperative recovery. Thus, corresponding nursing measures need to be adopted in a timely manner to promote patients' postoperative recovery (14).

Traditional nursing measures require patients to fast and stay in bed after the operation, which may lead to postoperative malnutrition, and even thrombus, infection, and other complications. As the concept of Fast-track recovery surgery (FTS) has gained acceptance, many different surgical procedures have been adapted to it. FTS mainly includes peri-operative optimization measures for patients, such as preoperative health education, the intraoperative control of infusion volume, postoperative enhanced enteral nutrition, and rehabilitation, which can reduce the physiological and psychological stress reactions caused by surgery (15). A previous case-control study have confirmed that nursing interventions based on the FTS concept can significantly facilitate the postoperative recovery of patients undergoing total endoscopic resection for EC (15). However, the conclusions drawn by different studies are not entirely consistent, and there is considerable variation in the design and evaluation metrics of the various studies. The results of the clinical application of the FTS concept in nursing interventions for EC patients after

Highlight box

Key findings

- Fast-track recovery surgery (FTS) care is effective at accelerating patients' postoperative recovery.

What is known and what is new?

- Esophageal cancer (EC) is the 6th leading cause of cancer-related deaths worldwide, and the morbidity and mortality of EC have continued to increase in recent years. The results of the clinical application of the FTS concept in nursing interventions for EC patients after total endoscopic esophagectomy are unconvincing.
- This study evaluated the nursing effect of the fast-track recovery surgical nursing model on patients with EC after total cavity endoscopic esophagectomy.

What is the implication, and what should change now?

- This model of care needs to be further validated in the future by higher-quality and longer follow-up studies.

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total endoscopic esophagectomy are unconvincing. Thus, in order to collect related information, we conducted a meta-analysis to evaluate the effectiveness of the nursing intervention of the FTS concept in patients after total endoscopic esophagectomy. We present the following article in accordance with the PRISMA reporting checklist (available at https://jgo.amegroups.com/article/view/10.21037/jgo-23-101/rc).

Methods

Sources and retrieval methods for documents

All articles on case-control trials about nursing interventions after total endoscopic esophagectomy published in PUBMED, EMBASE, MEDLINE and Cochrane libraries between January 2010 and May 2022 were searched by computer. The relevant data from the case-control trials in nursing interventions based on the concept of fast-track recovery surgery in patients with EC after total endoscopic esophagectomy were extracted. We searched for the articles using the following keywords: total endoscopic resection; EC; perioperative period; nursing intervention; effect analysis

Fast-track recovery surgical nursing model: On the basis of traditional nursing measures, FTS also mainly includes perioperative optimization measures for patients, such as preoperative health education, intraoperative infusion volume control, postoperative intestinal nutrition enhancement, rehabilitation, etc., which can reduce the physiological and psychological stress reactions caused by surgery.

Inclusion and exclusion criteria

Inclusion criteria

To be eligible for inclusion in this meta-analysis, the articles had to meet the following inclusion criteria: (I) concern a case-control study examining a nursing intervention based on fast-track recovery surgery in patients who had undergone complete endoscopic resection for EC; (II) include subjects who met the diagnostic criteria in the guidelines for the standardized diagnosis and treatment of EC (16), who had their EC diagnoses confirmed by pathological examinations, who had clinical stages of 0–III, who agreed to undergo video-assisted thoracoscopic surgery, who had no contraindications, conscious, and who had no cognitive impairments; (III) include a control group who received a routine nursing intervention, and a study group who received a fast-track recovery surgery concept nursing intervention; and (IV) report on >1 of the following outcome indexes: hospital stay, extubation time, the time out-of-bed activity, exhaust time, Riker Sedation-Agitation Scale (SAS) score (from January 2010 to May 2022), Severity of Dependence Scale (SDS) score and postoperative complications (from January 2010 to May 2022).

Exclusion criteria

Articles were excluded from the meta-analysis if they met any of the following exclusion criteria: (I) did not concern a case-control study; (II) had unavailable data due to insufficient data reports; (III) concerned a repeated study, in which case the most recent research was included; (IV) have study results that did not examine remarkable curative effects; and/or (V) concerned a review of a related article.

Quality evaluation and data extraction

The Cochrane System Review Manual 5.3 (https://training.cochrane.org/) was recommended using a risk-of-bias assessment tool to evaluate the bias risk.

The article screening and data extraction was conducted by 2 researchers independently, who reviewed the articles. Several steps were taken to extract, evaluate, and cross-check the data. Any differences in opinions between the researchers were resolved by a third researcher who assisted them to make a decision. The following information was collected: in the data extraction: (I) basic information; (II) intervention measures (i.e., plan and treatment); (III) outcome data; and (IV) outcome indicators (i.e., hospital stay, extubation time, out-of-bed time, exhaust time, SAS score, SDS score, and postoperative complications). For SAS score and SDS score, they were measured in the included articles.

Cochrane operation procedure: Risk of bias was determined by two reviewers using the Risk of Bias 2 (RoB 2) tool for randomized controlled trials (RCTs). The following bias: selection bias, performance bias, detection bias, attrition bias, reporting bias and other bias were included. Discrepancies were discussed with a third reviewer.

Statistical processing

The meta-analysis was conducted using RevMan5.3 software (https://training.cochrane.org/). The counting data were indexed by the relative risk [odds ratio (OR)], and

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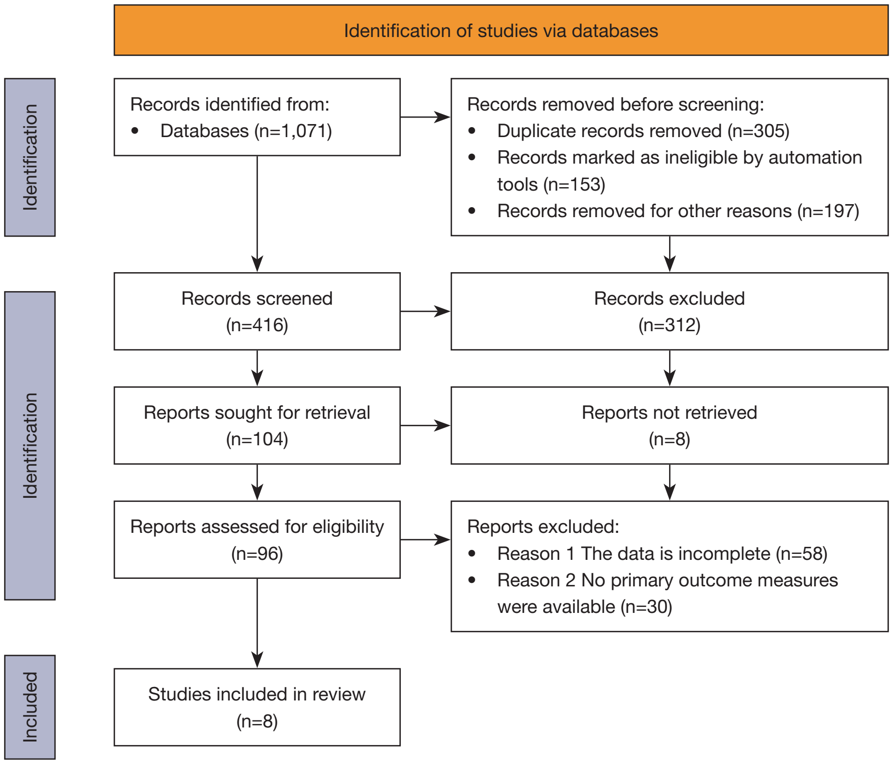

Figure 1 Illustration of the article screening process.

the measurement data were indexed by the mean difference (MD). Point estimates and 95% confidence intervals (CIs) were provided for each effect. Heterogeneity test and meta-analysis were carried out by means of RevMan 5.3 software. Heterogeneity was assessed using I^2 and the χ^2 test. The fixed effect model and random effect model were carried out to analyze the data. First, statistical heterogeneity analysis was performed. $I^2<50\%$ means that no statistical heterogeneity among the studies, or the heterogeneity was small, and the fixed effects model was used to combine the data. $I^2>50\%$ thought that there was some heterogeneity among the studies, and the random effects model was carried out to combine the effect sizes. If heterogeneity is found, a sensitivity analysis or subgroup analysis is carried out to estimate the source of heterogeneity. If more than 10 studies were included for an outcome indicator, the inverted funnel plot was used to analyze whether there was publication bias. In this study, relative risk (RR) was carried out as the effect scale for dichotomous variables, and mean discrepancy (MD) was used for measurement data with the same unit and measurement methods. If the measurement methods are different or the units are not consistent, standardized mean discrepancy (SMD) is used. 95% confidence interval (CI) is also given, P<0.05, suggesting statistically remarkable discrepancy between the two groups. A P value <0.05 was considered statistically significant. Eggers's test was used to test for funnel plot asymmetry. The trim-and-fill correction method was used if the P value for the test was <0.1 when adjusting for potential publication bias in the funnel plot.

Results

General information of articles

Based on a reading of the titles and abstracts of the articles, we retrieved 416 of the 1,071 articles from a computer database. Among these, 655 articles were removed as the studies were did not meet the inclusion criteria, and 312 other articles were removed based on a reading of the titles and abstracts. Of the 104 remaining articles, 96 lacked complete data and failed to highlight the main findings; thus, ultimately 8 controlled trials comprising 613 samples were included in the meta-analysis (*Figure 1* and *Table 1*) (17-24). For these studies, rehabilitation includes extubation time, exhaust time, the out-of-bed time for activity,

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Table 1 Details of the included articles

First author	Publication year	Sample size		Intervention measures		Research type	Grouping method	Outcome indexes
		Control group	Research group	Control group	Research group			
Gao M (17)	2020	35	35	Routine nursing	Concept nursing of fast-track recovery surgery	Prospective study	Random-number table method	(a) (b) (c) (d) (e)
Mei K (18)	2020	47	47	Routine nursing	Concept nursing of fast-track recovery surgery	Prospective study	Random-number table method	(a) (b) (d) (e) (f) (g)
Liu Y (19)	2022	34	34	Routine nursing	Concept nursing of fast-track recovery surgery	Prospective study	Drawing method	(a) (b) (c) (d)
Du H (20)	2018	39	39	Routine nursing	Concept nursing of fast-track recovery surgery	Prospective study	Admission-sequence grouping	(a) (b) (c) (d)
Yan H (21)	2020	40	40	Routine nursing	Concept nursing of fast-track recovery surgery	Prospective study	Double-simulation method	(a) (b) (c) (d) (e)
Liu J (22)	2020	35	35	Routine nursing	Concept nursing of fast-track recovery surgery	Prospective study	Random grouping	(d) (e) (f) (g)
Yang L (23)	2019	28	28	Routine nursing	Concept nursing of fast-track recovery surgery	Prospective study	Different perioperative intervention methods	(f) (g)
Lin Z (24)	2015	49	48	Routine nursing	Concept nursing of fast-track recovery surgery	Prospective study	Different perioperative intervention methods	(a) (b) (d) (e)

(a) Extubation time; (b) Exhaust time; (c) Get-out-of-bed time; (d) Hospitalization time; (e) Complication; (f) SAS score; (g) SDS score. SAS, sedation-agitation scale; SDS, severity of dependence scale.

hospitalization time, pulmonary rehabilitation, muscle strength training, aerobic exercise, exercise instruction, nutritional therapy and so on.

Article evaluation of the methodological quality

The 8 case-control studies included in this meta-analysis. All of the articles detailed the interventions and randomization methods used. Among the 8 trials, none described in detail how many subjects had missed interviews or withdrawn. The quality of the included literature was independently assessed by 2 reviewers using the Risk of Bias 2 (RoB 2) tool. The tool consists of five modules: bias generated during randomization, bias away from established interventions, bias with missing outcome data, bias with outcome measurement, and bias with selective reporting of results. According to the signal problem and path map of each module, the researchers gave bias judgments, and the judgment results were "low risk bias", "possible risk bias" and "high risk bias". The overall risk assessment was judged as "Low risk of bias", "Unclear risk of bias" and "High risk of bias" according to each module. Two people independently evaluate and compare the results. If there is any difference, negotiate to solve the problem. The two researchers compared the bias risk of each module, discussed the differences, reached a consensus, and judged the overall bias risk of the paper based on this. If no consensus can be reached, an evidence-based medical or epidemiological and health statistics professional should be invited to evaluate the article and use this as a conclusion to determine the overall risk of bias. *Figures 2,3* illustrate the results of the risk of bias analysis.

Meta-analysis results

Extubation time

An analysis of the extubation time was conducted. According to these studies, extubation time was improved to 1d-2d after Fast-track recovery surgical nursing. The heterogeneity test results were as follows: Chi^2=10785.33, degree of freedom (df)=5, P<0.00001, I^2=100%. Thus, there was a significant degree of heterogeneity in our study (P<0.05, *Figure 4*). The extubation time in study group was remarkably shortened than that in the control group.

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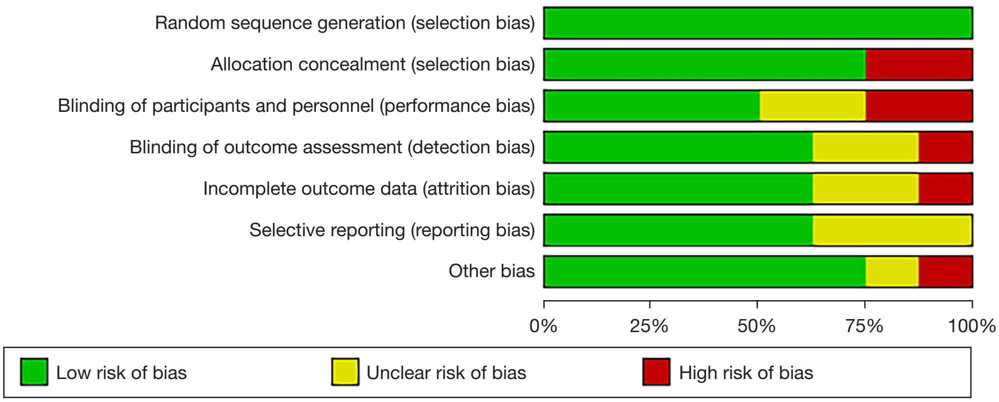

Figure 2 Risk of bias results.

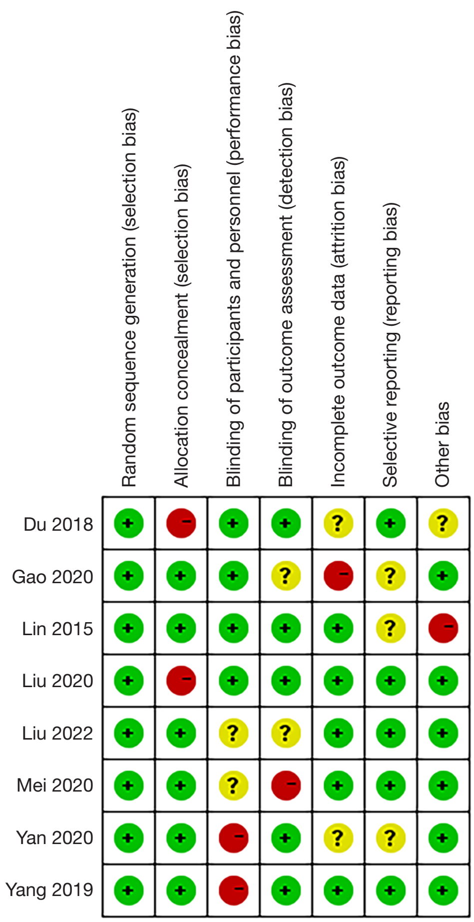

Figure 3 Summary chart of risk bias. Green: Low risk of bias; Yellow: Unclear risk of bias; red: High risk of bias.

Exhaust time

A meta-analysis of the exhaust time was conducted. According to these studies, exhaust time was improved to 30–40 h after Fast-track recovery surgical nursing. The heterogeneity test results indicated that there was a significant degree of heterogeneity among the 6 studies (*Figure 5*). An impressive reduction in the exhaust time was observed in the research group.

The out-of-bed time for activity

A meta-analysis of the time it took patients to leave bed was conducted. According to these studies, the out-of-bed time for activity was improved to around 1.5 d after Fast-track recovery surgical nursing. The heterogeneity test results revealed that there was significant heterogeneity in the included studies. It seems to us that the concept of FTS encourages people to leave bed early; therefore, the out-of-bed time for activity may be used to verify how well FTS was performed. In the study group, the out-of-bed time for activity was significant reduced according to the random-effects model analysis (*Figure 6*).

Hospitalization time

A meta-analysis was performed of the hospitalization time. According to these studies, hospitalization time was improved to around 8.3 d after Fast-track recovery surgical nursing. The heterogeneity test results showed that the included studies contained significant heterogeneity, and thus a random-effects model was used (*Figure 7*).

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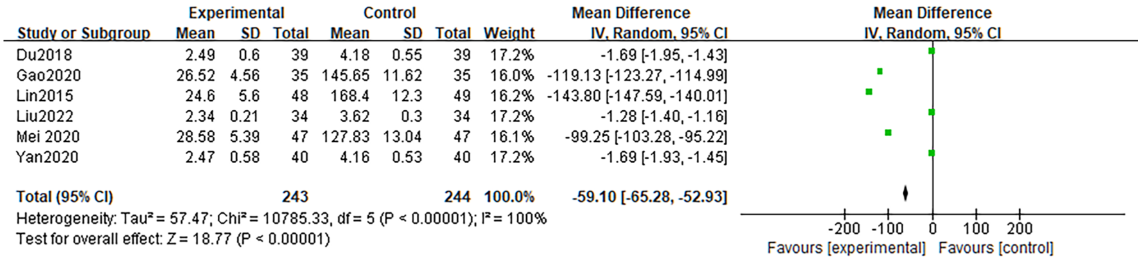

Figure 4 Forest map of extubation time.

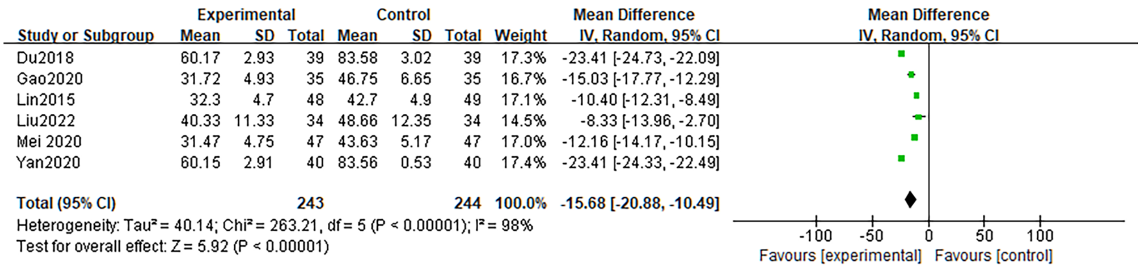

Figure 5 Forest map of exhaust time.

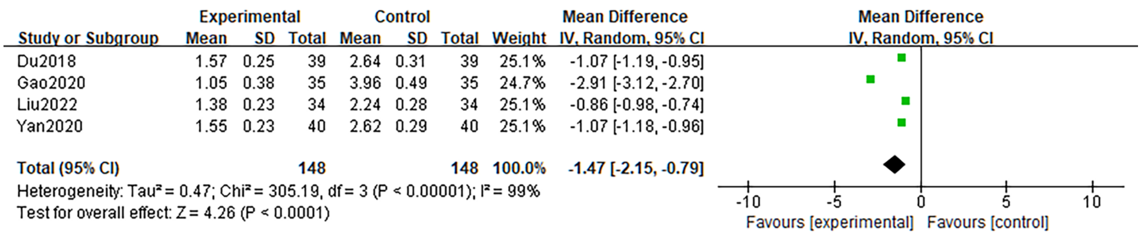

Figure 6 Forest map of out-of-bed time for activity.

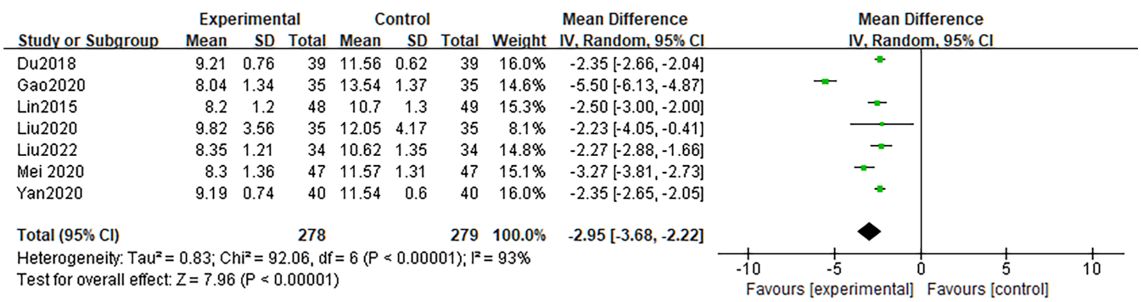

Figure 7 Forest map of the hospitalization time.

The length of hospital stay was significantly shorter for participants in the study group than for those in the control group (P<0.05).

SAS and SDS scores

There were 8 clinical controlled studies comprising 613 samples in this study, and analyses of the SAS and

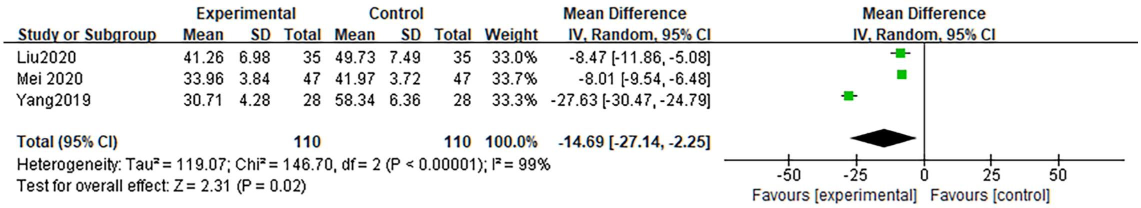

Figure 8 Forest map of SAS scores. SAS, sedation-agitation scale.

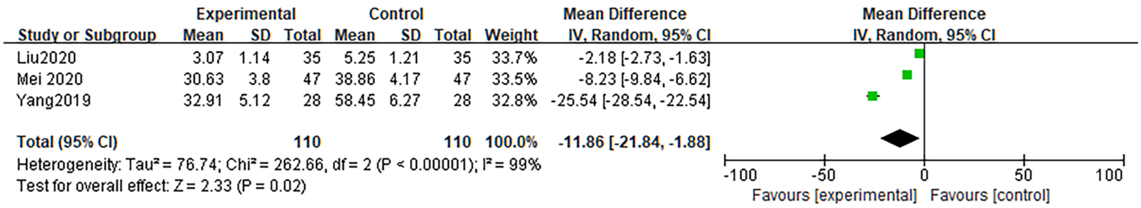

Figure 9 Forest map of SDS scores. SDS, severity of dependence scale.

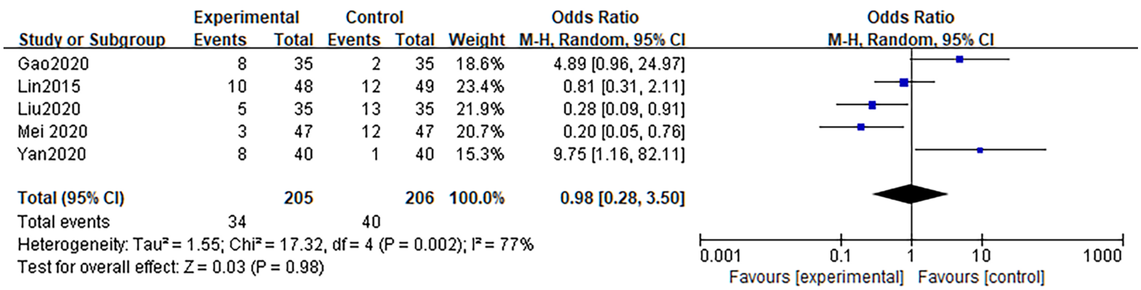

Figure 10 Forest analysis map of comparison of postoperative complications.

SDS scores were conducted in the relevant paper. The heterogeneity test results were as follows: SAS score: Chi^2=146.70, df=2, P<0.00001, I^2=99% (*Figure 8*); and SDS score: Chi^2=262.66, df=2, P<0.00001, I^2=99% (*Figure 9*). The study group had extremely low SAS and SDS scores.

Postoperative complications

A meta-analysis was performed on the incidence of postoperative complications. The heterogeneity test results revealed that the included studies showed a significant degree of heterogeneity. There was no significant difference in the incidence of postoperative complications and the incidence of preoperative complications according to the random-effects model analysis (*Figure 10*).

Publication bias analysis

Funnel plots were drawn based on the patients' extubation time, exhaust time, get-out-of-bed time, hospitalization time, SAS score, SDS score, and incidence of postoperative complications. A publication bias analysis was performed (see *Figures 11-17*). Almost all the funnel charts were symmetrical; however, there was a small percentage of asymmetrical funnel charts, which suggest that this study was heterogeneous, and the included articles had a publication bias.

Discussion

EC is a common tumor of the esophagus. It has been reported that the incidence and mortality of EC ranks 4th among all malignant tumors in China in those aged >60 years (25). The etiology of EC has not yet been fully clarified, but it is mostly associated with bad eating habits, long-term smoking, and excessive drinking (26).

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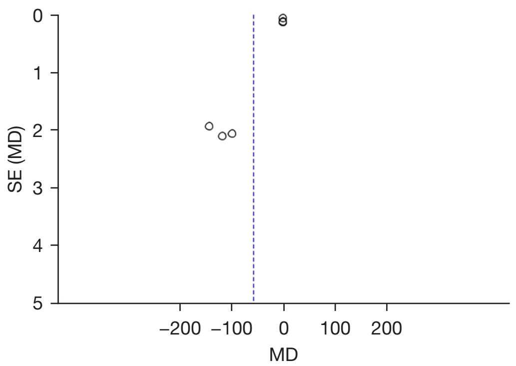

Figure 11 Funnel diagram based on extubation time.

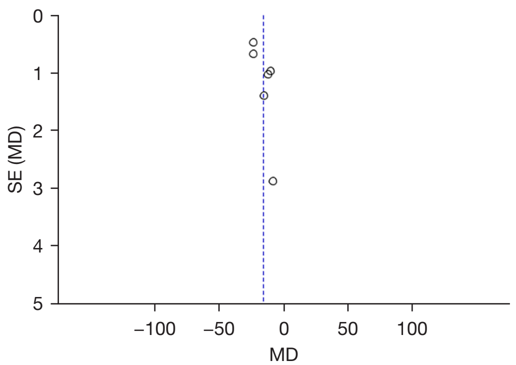

Figure 12 Funnel diagram based on exhaust time.

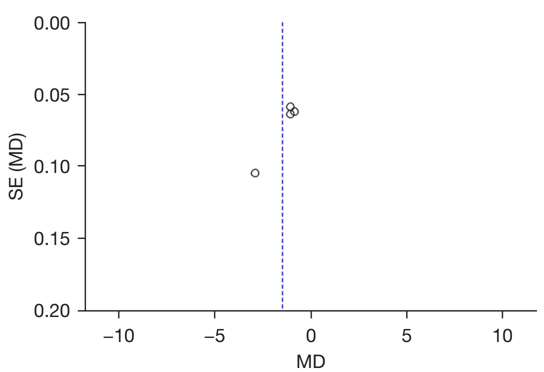

Figure 13 Funnel chart with the following bedtime as the benchmark.

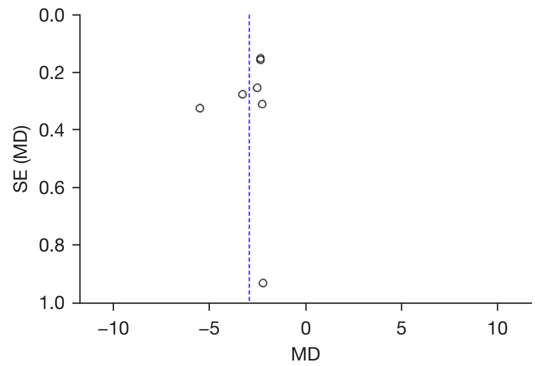

Figure 14 Funnel chart based on the length of hospital stay.

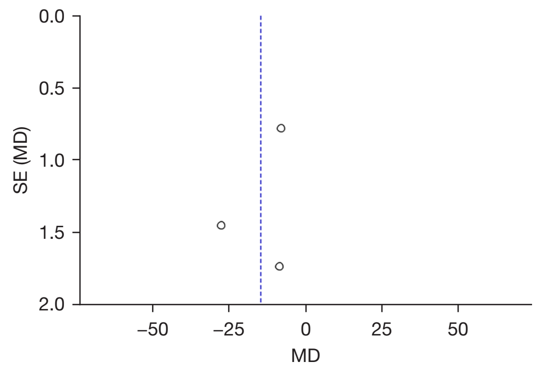

Figure 15 Funnel plot based on SAS score. SAS, sedation-agitation scale.

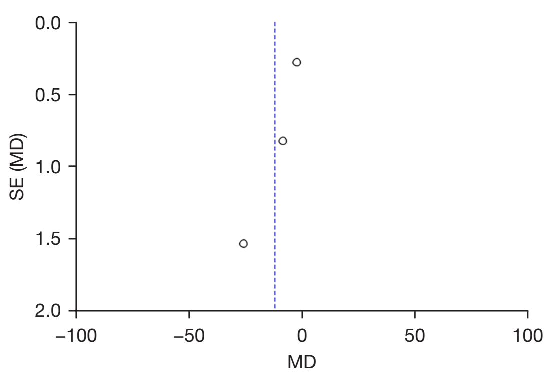

Figure 16 Funnel chart based on SDS score. SDS, severity of dependence scale.

Most patients with EC are treated with thoracoscopic surgery. Thoracoscopic surgery can reduce the surgical trauma; however, most patients with EC have symptoms, such as malnutrition and low immunity before surgery. Postoperative infections and other complications require appropriate nursing interventions (27). Traditional care mostly requires bed rest and fasting after surgery, which can exacerbate malnutrition, affecting the homeostasis of

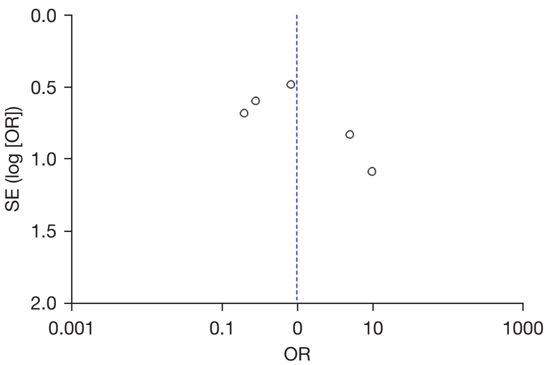

Figure 17 Funnel chart based on postoperative complications.

the patient's internal environment. Thus, more reasonable and effective nursing interventions are needed for the postoperative rehabilitation of patients with EC.

Accelerated recovery surgery is an evidence-based postoperative management strategy (28). In addition to reducing surgical trauma, pain, and physical and psychological stress, this method can improve the recovery process of patients, shorten hospital stays, and decrease hospital expenses (28). It is a scientific perioperative management program (28). This type of perioperative medical collaboration combines surgery, anesthesiology, nursing, and rehabilitation. Under fast-track surgery, the rapid administration of anesthesia, minimally invasive surgery, adequate analgesic protocols, and the early initiation of postoperative feeding are conducive to safe and rapid patient recovery.

Perioperative medical and nursing interventions can be incorporated into tissue fixation system (TFS) to help patients progress through the perioperative period safely and quickly. Early study has shown that there is no remarkable difference in the joint range of motion, muscle strength, and stability between patients undergoing rehabilitation under the guidance of accelerated rehabilitation programs and conventional rehabilitation programs, but the advantages, such as the shorter rehabilitation time, are remarkable (29). When implementing care under the FTS concept, it is necessary to assess the patient's situation before the implementation of the intervention and to develop specific measures to ensure the relevance and effectiveness of the nursing intervention. Nursing intervention can minimize the discomfort of patients, relieve their negative emotions, improve their physical and mental levels, and promote the recovery of patients.

In this study, there were 8 case-control studies comprising 613 samples. A meta-analysis was performed of the extubation time, exhaust time, out-of-bed time for activity, and hospitalization time. Compared to the control group, the extubation time, exhaustion time, and time spent in the hospital were all remarkably shorter in the study group than that in the control group. This may be due to a number of reasons. First, rapid recovery programs shorten the duration of preoperative water fasting without bowel preparation and reduce dehydration and hypoglycemia caused by prolonged water fasting. The stimulation of gastrointestinal function through early bedtime activities and nutritional support also promotes deflation and reduces surgical stress. Second, adequate nursing preparation allows for the standardization of the nursing protocol. Third, the patient's immune system is boosted to shorten the recovery time so that the catheter can be removed as soon as possible (30,31). Fourth, the application of the surgical concept of rapid recovery also speeds up the patient's postoperative recovery, which is the aim of implementing this model of care. It also reduces medical costs, eases the financial burden on patients, and establishes a good doctor-patient relationship, which is the most obvious difference between the rapid recovery care model and the traditional care model.

The concept of rapid recovery has an important place in perioperative health guidance. Medical staff inform the patient of the diagnosis, treatment, and precautions before the procedure. These basic practices of care can also alleviate patient preoperative stress and improve compliance with treatment. A recent study found that effective psychological counselling can relieve subjective symptoms and anxiety, improve patients' tolerance of surgery and diminish their postoperative stress, thereby decreasing the risk of complications and speeding up recovery (32). In addition, effective psychological care can reduce the patient's sympathetic nerve excitation and speed up the recovery of gastrointestinal function. According to the meta-analysis, the study group had significantly lower SAS and SDS scores compared with control group. The concept of rapid recovery care is recommended for patients undergoing total thoracic laparoscopic surgery to alleviate anxiety and depression through optimized clinical care measures.

Under the rapid recovery surgical concept of care, the recovery process of patients can be accelerated. The traditional model of healthcare is disease centered and pays little attention to the patient's subjective feelings and

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psychological wellbeing. Conversely, the fast-track recovery surgery concept of nursing is patient centered and focuses on the patient's physical health and psychological wellbeing. The relationship between psychological wellbeing and disease recovery is balanced, thereby reducing the patient's negative emotions.

The results of the meta-analysis suggest that the nursing intervention of rapid recovery had no significant effect on postoperative complications in patients undergoing total thoraco-laparoscopic EC surgery. The reason for this may be the short observation period in some of the studies included in this meta-analysis. The follow-up observation of postoperative complications is a long-term process. Accelerated rehabilitation surgery may be effective at reducing postoperative complications in patients during the long-term follow-up, but the actual effect still needs to be confirmed by a large number of studies.

Several case-control studies have demonstrated that nursing interventions based on the FTS concept can significantly promote postoperative recovery in patients undergoing EC total endoscopic resection (15). However, the conclusions of different studies are not completely consistent, and there are considerable differences in the design and evaluation indicators of different studies (33,34). The clinical application of FTS concept in nursing intervention of EC patients after esophagoendoscopic total resection is not convincing. Therefore, in order to collect relevant information, we conducted a meta-analysis to evaluate the effectiveness of the FTS concept in patient care interventions after total endoscopic esophagotomy.

This study had a number of limitations. Notably, only a small number of articles were included in the meta-analysis, and the heterogeneity was not analyzed in great detail in the subgroups. In addition, the analysis of the outcomes in terms of patient prognosis had some limitations due to the inconsistent follow-up times across the included studies.

Conclusions

FTS care is effective at accelerating postoperative recovery. It also remarkably reduces the length of hospital stay, eases the financial burden, and relieves negative emotions without increasing the risk of postoperative complications in EC patients. This model of care should be replicated in clinical practice, and higher-quality studies with longer follow-up periods need to be conducted in the future to further validate our findings.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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