Original Article

Is closed thoracic drainage tube necessary for minimally invasive thoracoscopic-esophagectomy?

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Background: Closed thoracic drainage tube (CTDT) is a conventional treatment after esophagectomy, even after minimally invasive esophagectomy. Here, we report a single-center, retrospective study to explore the safety and necessity of CTDT after thoracoscopic-esophagectomy.

Methods: From October 2015 and August 2016, 50 patients were enrolled and underwent thoracoscopic-esophagectomy in semi-prone position by same surgical team. Perioperative demographic and surgical parameters, and patients' satisfaction with or without CTDT after thoracoscopic-esophagectomy were collected and analyzed.

Results: All eligible patients (18 patients without CTDT and 32 patients with CTDT) were successfully underwent thoracoscopic procedures without conversion to open approach or major intraoperative complications and perioperative death. The two groups, with similar demographic parameters, had no statistically difference in thoracic operation time, blood loss, ICU stay, postoperative mobilization and oral feeding, and hospital stay. Also, the incidence of postoperative complications was similar with or without CTDT after esophagectomy. But, no-CTDT group had better post-operative satisfaction, including less pain scale scoring and better Norton scoring.

Conclusions: This study demonstrated that the treatment of no-CTDT after the minimally invasive thoracoscopic-esophagectomy is safe and feasible, might reduce the work intensity of medical stuff and lead to a better patients' experience.

Keywords: Esophageal cancer; thoracoscopic-esophagectomy; closed thoracic drainage tube (CTDT); perioperative surgical parameters; patients' satisfaction

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Introduction

Despite the incredible surgical progress recently, esophagectomy remains the most complex and high-risk operation procedure with high perioperative morbidity and mortality rates (1,2), even by the popular way of minimally invasive esophagectomy (MIE) approach (3,4). For now, almost all patients underwent thoracic operation had to leave a closed thoracic drainage tube (CTDT), a 11-mm diameter hard pipe, though intercostals space as the optimal treatment worldwide (5).

Although, the use of CTDT could help us access the postoperative chest situation, it also has some disadvantages

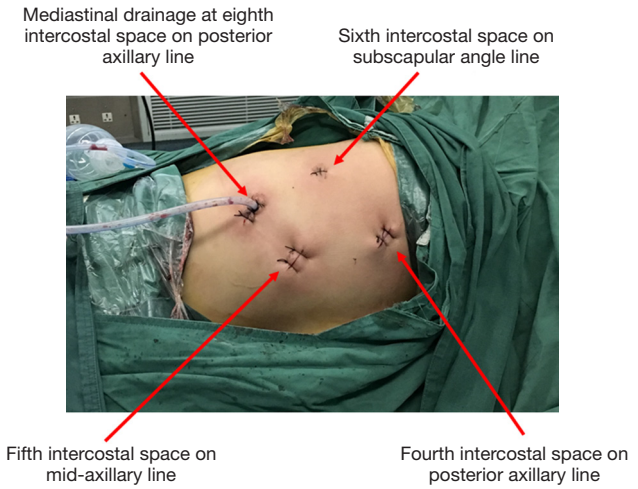

Figure 1 Photograph of the thoracoscopic operation ports. The thoracoscopic process of four-port approach was used for minimally invasive esophagectomy.

including postoperative pain and tube related complications, which might reduce the patients' satisfaction and delay the perioperative recovery (6,7). Thus, it comes a question about the necessity of CTDT after esophagectomy.

Although some studies have analyzed the application of fast-track surgery concept on esophageal cancer patients through esophagectomy (open and/or MIE approach) (8-10), few studies had focused on the perioperative effect of CTDT after thoracoscopic-esophagectomy. Thus, we report a single center, retrospective study to exam the safety and necessity of no-CTDT treatment in esophageal cancer patients underwent thoracoscopic-esophagectomy.

Methods

Patients

Candidate patients who underwent minimally invasive esophagectomy (including thoracoscopy and laparoscopy process) for esophageal squamous carcinoma in Division One of Xijing Digestive Hospital between October 2015 and August 2016 were enrolled in the study in chronological order. Every patient was evaluated carefully before anesthesia and operation. This retrospective study was approved by the Ethics Committee of Xijing Hospital (No. KY20163378-1) and all aspects of the study comply with the Declaration of Helsinki and local legislation. A written informed consent was obtained from all patients at the time of admission, with which the blood, tissue and other sample were authorized to scientific purpose.

Surgical procedures

Each patient was underwent two-lung ventilation anesthesia approach with a single-lumen endotracheal tube in the standard conventional procedure in semi-prone position. The thoracic procedure was performed by the same team of two experienced trained surgeons. The thoracoscopic process of three-port approach (fifth intercostal space on mid-axillary line for observation, fourth and eighth intercostal space on posterior axillary line respectively for thoracic procedure) was used as we described before (11). And, the fourth port as an assistant operation hole was made at sixth intercostal space on subscapular angle line if the patient had a bigger pleural space (*Figure 1*).

At the end of thoracoscopy, a 6 mm-diameter soft mediastinal drainage tube through the whole thoracic cavity from the port at eighth intercostal space on posterior axillary line was placed (*Figure 1*). The enrolled patients had been separated into two groups by chronological order, CTDT group (October 2015 to March 2016) and no-CTDT group (April 2016 to August 2016), and patients with pleural adhesions, history of pleurisy or tuberculosis, and broken pleural during thoracoscopy were excluded. Then, patients were changed to supine position for conventional standard laparoscopic and cervical procedure, and a nasal feeding tube was put into the jejunum. Nasogastric intubation and cervical drainage wasn't used as routine treatment, and abdominal drainage was used for all patients after operation (*Figure 2*).

Perioperative demographic and surgical parameter in the two groups (age, gender, smoking habit, neoadjuvant treatment, ASA classification, thoracoscopic operation time, blood loss, ICU stay, postoperative mobilization and oral feeding, postoperative TNM stages, postoperative complications and length of hospital stay, pain scale scoring and Norton scoring) on postoperative days 0, 1, 2 and 3 were carefully recorded and assessed. Also, the situation of co-morbidity (including coronary heart disease, diabetes, hypertension and COPD) was collected.

Statistical analysis

Continuous variables are expressed as the mean ± SD, or the median (range) and categorical variables as a percentage.

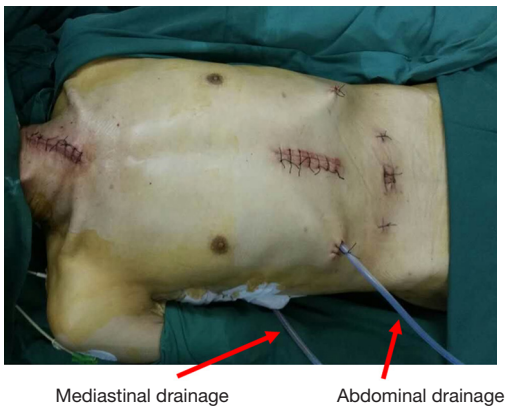

Figure 2 Treatment of drainages after the operation. After the operation, only mediastinal and abdominal drainage were applied on the patients.

A Student *t*-test or Mann-Whitney test was used for intergroup comparisons of continuous variables, whereas a χ^2 test or Fisher test was used to compare categorical data. Data were analyzed using SPSS 21.0 for Windows (SPSS Inc., Chicago, IL, USA). The P values were considered to be statistically significant at the 5% level.

Results

All patients performed esophagectomy successfully by combination of thoracoscopy and laparoscopy at Xijing Hospital of Digestive Disease, Shanxi Province, China, by the same skilled surgeons team, and it was no incidence of conversion to open thoracotomy or major complications during operation, such as aorta bleeding, tracheal and lung injury, or perioperative death.

Finally, 50 consecutive patients were enrolled, 18 patients without CTDT and 32 patients with CTDT. All patients received chest routine X-ray examine at the first three days, and the CTDT of CTDT group were removed at postoperative day 3. After the operation, the abdominal drainage was also removed at day 3 and mediastinal drainage withdraws at day 7 after assessed by upper gastrointestinal radiography test.

The epidemiologic and clinical characteristics (gender, age, smoking habit, neoadjuvant treatment, ASA classification, co-morbidity, thoracoscopic operation time, blood loss, ICU stay, pathological T and N staging, postoperative mobilization and oral feeding, postoperative hospital stay) between the two groups showed no significant difference (*Table 1*). Although two patients of no-CTDT group had postoperative complication

Table 1 Demographic characteristics of the 50 patients

Variables	No-CTDT (n=18)	With-CTDT (n=32)	P value
Gender, n (%)			0.122
Male	9 (28.1)	23 (71.9)	
Female	9 (50.0)	9 (50.0)	
Mean age	58.11±5.03	56.41±6.42	0.337
Smoking, n (%)			0.119
No	12 (66.7)	14 (43.8)	
Yes	6 (33.3)	18 (56.3)	
Neoadjuvant radiotherapy			
No	18	32	
Yes	0	0	
Neoadjuvant chemotherapy, n (%)			0.825
No	14 (77.8)	24 (75.0)	
Yes	4 (22.2)	8 (25.0)	
T stage, n (%)			0.931
1	7 (38.9)	11 (61.1)	
2	5 (38.5)	8 (61.5)	
3	6 (33.3)	12 (66.7)	
4	0 (0)	0 (0)	
N stage, n (%)			0.792
0	12 (66.7)	24 (77.4)	
1	3 (16.7)	4 (12.9)	
2	2 (11.1)	2 (6.5)	
3	1 (5.6)	1 (3.2)	
M stage			
0	18	32	
1	0	0	
Co-morbidity			0.223
Coronary heart disease	0	1	
Diabetes	2	2	
Hypertension	1	2	
COPD	0	0	
ASA classification			0.371
I	12	24	
II	5	6	
III	1	2	
IV	0	0	

CTDT, closed thoracic drainage tube; COPD, chronic obstruction pulmonary disease; ASA, American Society of Anesthesiologists.

Table 2 Comparison of the postoperative complications between the two groups

Variables	No-CTDT	With-CTDT	P value
No postoperative complications	16	23	0.163
Postoperative complications	2	9	
Pulmonary infection	1	3	
Right pneumothorax	0	1	
Atrial fibrillation	0	1	
Anastomotic fistula	0	1	
Chest chylous fistula	0	1	
Peritoneal lymphatic fistula	0	1	
Wound infection	1	1	

CTDT, closed thoracic drainage tube.

Table 3 The differences of postoperative satisfaction of patients' experience between the two groups

Variables	No-CTDT	With-CTDT	P value
Norton scoring			
Preoperative	18.72±0.46	18.59±0.50	0.368
Postoperative Day 0	16.67±0.485	14.66±0.745	0.000
Postoperative Day 1	17.39±0.50	14.88±0.61	0.000
Postoperative Day 2	18.17±0.71	15.53±0.84	0.000
Postoperative Day 3	18.72±0.46	16.25±0.98	0.000
Pain scale scoring	1.22±0.94	1.25±0.76	1.000
Preoperative	4.22±1.11	4.28±0.99	0.883
Postoperative Day 0	4.83±0.71	5.84±0.81	0.000
Postoperative Day 1	4.89±0.90	7.19±0.78	0.000
Postoperative Day 2	5.00±0.69	7.25±0.72	0.000
Postoperative Day 3	1.22±0.94	1.25±0.76	1.000

CTDT, closed thoracic drainage tube.

(one pneumonia and one wound infection), there were difference in the incidence of postoperative complications between the two groups (*Table 2*).

Compared with CTDT group, the no-CTDT group had significantly better Norton scoring and less pain scale scoring according to the Numeric Rating Scale from the first day after the operation, led to better post-operative patients' experience (*Table 3*).

Discussion

Regardless the development of MIE in esophageal cancer, patient with esophageal squamous carcinoma still forced to go through a series of dangerous perioperative treatment and terrible experience with less post-operative satisfaction (1,12).

Since the fast-track surgery (FTS) was introduced to esophageal surgery by Cerfolio *et al.* (13,14), few studies focused on the role in esophageal surgery practice. Zhao *et al.* (15) reported a result of FTS for 68 patients, in which they demonstrated FTS promote early recovery of gastrointestinal function and reduce stress reaction and postoperative insulin resistance after esophagectomy. Shewale *et al.* (16) indicated a fast-track esophagectomy protocol could reduce patients' length of hospital stay, perioperative morbidity and hospital charges. Also in Chen's research (8), FTP improved postoperative clinical recovery and effectively inhibited release of inflammatory factors after esophagectomy. And Gemmill reviewed 11 articles about FTS in esophageal resection, and the focus following esophagectomy (open or MIE approach) was early mobilization, reduction in ICU stay, early drain removal and (no) contrast swallow studies (10).

Although the FTS concept was practiced in esophageal surgery recently (17), we still believed options could be made for better and faster recovery after MIE, such as the use of CTDT. Now, none of these studies mainly explored the necessity of CTDT after esophagectomy, especially the MIE approach.

Until now, the use of CTDT seems to be one of the most significant treatments after thoracoscopy. But with the CTDT, patients often felt uncomfortable when breathing and mobilization because the drainage tube could hurt the right lung during variation of the lung volume, might lead to less satisfaction, more postoperative complication and longer hospital stay.

Here, we report the result of safety and necessity on patients without CTDT after thoracoscopic-esophagectomy. All patients underwent minimally invasive esophagectomy successfully without major complications which need convert to open thoracotomy, such as tracheal and lung injury, aorta bleeding, and perioperative mortality.

Compared to patients of with-CTDT group, patients in no-CTDT group had better post-operative satisfaction experience, less pain and better Norton scoring, with

similar perioperative surgical parameters (thoracic operation time, blood loss, ICU stay, postoperative mobilization and oral feeding and hospital stay), and there was no statistical difference in postoperative complications between the two groups. Also, the treatment of without-CTDT would reduce the work intensity of medical on patients after MIE, which might give the nursing team better work experience.

But, there are limitations in our study. Firstly, the lack of patients' accumulation in this study might be solved by the time. Secondly, a single center-based research design might lead to an uncertain amount of selection bias. Thirdly, the present study is a retrospective analysis and a well-designed randomized clinical trial should be carried out in order to avoid statistical bias.

In conclusion, the current study indicated that patients without CTDT after MIE is safe and feasible with almost the same surgical condition compared to traditional treatment, but might lead to a better post-operative experience for both patients and medical stuff.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: This retrospective study was approved by the Ethics Committee of Xi-jing Hospital (No. KY20163378-1) and all aspects of the study comply with the Declaration of Helsinki and local legislation. A written informed consent was obtained from all patients at the time of admission, with which the blood, tissue and other sample were authorized to scientific purpose.

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