



## Implementation and Effectiveness of Early Chest Tube Removal during an Enhanced Recovery Programme after Oesophago-gastrectomy

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### ABSTRACT

**Introduction:** Oesophageal resection were notoriously complicated and produces a cohort of patients prone to postoperative complications and here we would like to focus on the implementation and effectiveness of early chest tube removal in ERAS after oesophago-gastrectomy considering the various aspect like pleural effusion and reducing the length of hospital stay which ultimately lead to reducing the economic burden on patient.

**Methods:** An ERAS programme was devised and implemented with the support of a dedicated in-hospital task-force. The patients underwent esophago-gastrectomy were randomly divided into two groups: the ERAS group and the control group (non-ERAS). The ERAS group was treated with early removal of the chest tube after surgery, and the control group was treated with traditional way and outcomes were compared between them.

**Results:** The length of hospital stay and the cost of hospitalization in the ERAS group were significantly lower than those in the control group ( $p < 0.05$ ). However, there was no statistical significant difference in the incidences of pleural effusion between the two groups ( $p > 0.05$ ).

**Conclusions:** The introduction of early chest tube removal as an ERAS programme after oesophago-gastrectomy would not increase the risk of pleural effusion and would not increase the total length of stay and cost of hospitalisation without jeopardising patient safety or clinical outcomes.

**Keywords:** chest tubes; ERAS; Oesophago-gastrectomy.

### INTRODUCTION

Enhanced Recovery After Surgery (ERAS) is a healthcare programme that combines a range of simple evidence-based interventions aimed at improving post-operative recovery for patients undergoing major surgery.<sup>1</sup> ERAS is a model-based perioperative treatment, and the purpose is to reduce the impact of surgery often referred to as "fast-track surgery" and "multimodal rehabilitation."<sup>2</sup> The incidence of esophageal cancer is increasing faster than the other cancers in the US.<sup>3</sup>

Esophageal resection remains the treatment standard for resectable esophageal cancer and for some benign esophageal conditions.<sup>4</sup>

In ERAS programme, early chest tube removal to

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alleviate the sufferings of the patients. The patients with esophageal cancer who underwent oesophago-gastrectomy had early chest drain removal and its effectiveness in terms of security, length of hospital stay and cost of treatment had been reported.

## METHODS

A prospective study was carried out for the implementation and effectiveness of early chest removal in enhanced recovery programme on patients suffering from oesophageal cancer. Data were collected from 60 patients over a period of one and half year; from January 2012 - September 2013 at the cardio-thoracic surgery unit at The people's first hospital of Jingzhou affiliated with Yangtze University with oesophageal cancer resection.

Inclusion criteria were patients aged <70 years<sup>5</sup>. Resectable tumour confined without distant metastasis along with thoracic or abdominal oesophagus involvement after preoperative endoscopy, chest and abdominal CT examination. Oesophagus 5cm below epiglottis; preoperative physiological status issues, no serious complications; did not undergo preoperative chemotherapy; informed consent to participants.

Exclusion criteria were Intraoperative findings of tumour invaded to surrounding vital organs; persistent postoperative pulmonary air leaks; postoperative hemothorax underwent secondary thoracotomy; postoperative chylothorax; anastomotic fistula; perioperative mortality.

All patients were treated by the left thoracotomy. Anaesthetist was fully in charge of his maintaining patent airway and also maintaining positive airway pressure for lung expansion, after confirming no leakage from lung upon fluid immersion, select 32F silicone chest tube placed in the left mid-axillary line in-between 8<sup>th</sup>-9<sup>th</sup> intercostal space , proximal side draining hole of chest tube is 2cm from chest wall, remote access water-sealed drainage bottles. On first post-operative day bedside chest X-ray was done to determine the

full expansion of the lung. Regular post-operative chest drain output along with, colour and nature of fluid was observed. ERAS group when daily chest drainage reached <250ml the chest tube was removed. When the control group (non-ERAS), daily chest drainage reached <50ml the chest tube was removed. Two groups of patients both were screened by chest X-ray on the third day after chest tube extubated to determine pleural effusion. Extubation time, differences in the incidence of pleural effusion, hospital stay and cost of treatment were compared.

Statistical analysis was performed using SPSS13.0, measured information data expressed as  $\bar{x} \pm s$ , W test normal, the Levene test for homogeneity of variance t test, count data using Pearson  $\chi^2$  test,  $p < 0.05$  indicates statistical significance.

## RESULTS

The patients were randomly divided into two groups, namely ERAS group and control group (non-ERAS),  $n = 30$ . The basic two groups of patients were compared ( $p > 0.05$ ) (Table 1).

ERAS groups of patients were extubated earlier than the control group, the difference was statistically significant ( $p < 0.05$ ), the incidence of pleural effusion was no significant difference ( $p > 0.05$ ), ERAS group hospitalization and treatment costs were lower than the control group. The difference was statistically significant ( $p < 0.05$ ) (Table 2).

**Table 1. Patients Characteristics.**

Characteristics	ERAS group	Control group
Age(years)	54.33 ± 7.31	56.32 ± 8.22
Gender(M/F)	19/11	17/13
Weight(kg)	63.2 ± 3.8	62.7 ± 2.9
Operative time(min)	268 ± 11.32	255 ± 10.46

**Table 2. Comparison between the two groups of patients after surgery.**

Groups	Extubation Time(days)	Pleural effusion (cases)	Length of hospital stay(days)	Cost of hospitalization (10,000 Yuan)
ERAS	3.5 ± 0.9	6	9.0 ± 1.1	4.0 ± 0.3
Control	5.5 ± 1.1	4	11.5 ± 1.2	4.2 ± 0.2
Statistic	t = -7.810	$\chi^2 = 0.480$	t = -8.435	t = -2.135
P value	<0.05	>0.05	<0.05	<0.05

## DISCUSSION

In 1997, a professor at the University of Copenhagen, Denmark, Henrik Kehlet first proposed the concept of ERAS,<sup>6</sup> which is a multi-disciplinary collaboration in diagnosis and treatment, through rapid rehabilitation team of nurses, surgeons and anaesthesiologists jointly cooperate to achieve optimal therapeutic effect with minimal trauma and pain. Postoperative pain caused by stress, lead to functional changes in respiratory, circulatory, gastrointestinal, and skeletal muscle. Patients cannot take deep breath because of the pain lead atelectasis and reduced patient activity, leading venous stasis, thrombosis. Pain can also stimulate the release of catecholamine, causing vasospasm, hypertension, stroke, and myocardial infarction.

Chest tube cause postoperative pain and postoperative risk factors for infection.<sup>7</sup> In addition, chest tube for pleural effusion may also cause an increase in the amount of pleural fluids leads to additional body fluid loss. Due to a series of negative impact of chest tube for postoperative rehabilitation, chest tube will not only cause postoperative discomfort, but also may prolong hospital stays and increased medical costs. Some scholars have proposed some forms abdominal surgery conventional shunt placement is not necessary in order to achieve rapid recovery.<sup>8,9</sup> However, due to the special nature of thoracic surgery, postoperative drainage of pleural fluid in addition to air discharge to maintain negative intra-thoracic pressure, placement of chest tube in thoracotomy is unavoidable. However, under the premise of safety early removal of chest tube after thoracic surgery has become key issues facing health care needs. Previously, when pleural fluid drains less than 100ml per day, chest tube removal was considered. Recently, more and more studies show that chest drain

removal is safe when drainage is more than the above criteria. Younes et al reported; after thoracotomy when pleural fluid drainage less than 200ml per day chest tube removal is safe,<sup>6</sup> McKenna et al reported fully assisted VATS (c-VATS) when chest drainage no more than 300ml extubation is safe,<sup>10</sup> while Bryant considers ,after thoracic surgery drainage less than 450ml per day is safe for extubation.<sup>11</sup> Our goal is also to explore the feasibility of postoperative early chest drainage tube removal. Relatively large thoracic-oesophageal surgical wound, we choose relatively conservative extubation indicators. Early removal of chest tube does not increase the risk of pleural effusion, except the patients associated with persistent pulmonary air leaks, progressive hemothorax, circumstances under chylothorax and complications such as anastomotic leakage, which were not included in our study. A few cases of pleural effusion after extubation occurs may be caused by mediastinal lymphnode dissection during surgery, which could be managed through the aspiration with syringe or drainage with smaller size chest tube, pleural fluid can be removed and subsequent healing occurs.

## CONCLUSIONS

Early postoperative chest drain removal is safe and feasible, not only to reduce postoperative pain but also to reduce length hospital stays and save the total cost of treatment, so that patients can benefit, and for the perioperative esophageal cancer rapid rehabilitation provides valuable evidence-based treatment.

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