



Clinical manifestation, risk factors and managements for postoperative chylothorax after thoracic esophagectomy

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Provenance: This is an invited Editorial commissioned by the Section Editor Shuangjiang Li (Department of Thoracic Surgery and West China Medical Center, West China Hospital, Sichuan University, Chengdu, China).

Comment on: Ohkura Y, Ueno M, Shindoh J, *et al.* Risk Factors for Postoperative Chylothorax After Radical Subtotal Esophagectomy. *Ann Surg Oncol* 2018;25:2739-46.

Submitted Jan 28, 2019. Accepted for publication Feb 13, 2019.

doi: 10.21037/jtd.2019.02.31

View this article at: <http://dx.doi.org/10.21037/jtd.2019.02.31>

Introduction

In thoracic esophagectomy, chylothorax is usually the result of unrecognized surgical injury to the main or branches of thoracic duct. Postoperative chylothorax is mostly an uncommon complication of esophagectomy and occurs only in 0.6% to 4.0% of esophagectomy (1-6). In thoracic esophagectomy, complications of chylothorax resulted in hypoproteinemia, lipid loss, and respiratory failure due to atelectasis (7-9).

In previous studies which included only a small number of patients and had variable results, risk factors and its optimal treatments strategies were discussed. Although there are several approaches regarding the best clinical practice toward postoperative chylothorax (10,11), the most common initial management approach is conservative treatment with thoracic drainage together with total parental nutrition. However, conservative treatment could be effective only for minor chyle leakage, with significant amount of effusions lasting for several weeks. Moreover, in case with the amount of pleural effusion is excessive and prolonged, such conservative treatment is unlikely to succeed.

There are several risk factors for the postoperative chylothorax after esophagectomy. Most of these reported risk factors were somewhat related with the vulnerability and misidentification of thoracic duct. Regarding the non-invasive treatment strategy, somatostatin (12,13) and its synthetic analogue octreotide (14) has been successfully

tried to treat postoperative chylothorax in adults and children (9). The clinical efficacy of octreotide for treating postoperative chylothorax in thoracic esophagectomy for esophageal cancer has well examined (15). Moreover, recent research demonstrated that thoracic duct lymphangiography and subsequent embolization (TDE) was effective treatment strategy for postoperative chylothorax after esophagectomy.

The clinical manifestations of chylothorax after esophagectomy

Chylothorax after esophagectomy is not uncommon but potentially critical complication, with previous reported incidence of 0.4–4% (16,17). Some reports demonstrated higher incidences of thoracic duct injury with transhiatal approach in the comparison with transthoracic esophagectomy, whereas other reports demonstrated almost equal incidence of chylothorax regardless the surgical approach. In our institution, 3.8% of patients were diagnosed as postoperative chylothorax after thoracic esophagectomy among 521 patients regardless the thoracic approach (18).

The amount from chest drain is the initial sign to the diagnosis of chylothorax. Injury of thoracic duct or its tributaries usually shows in the early postoperative day as an excessive amount of fluid or cream-colored liquid from the chest tube. Physical and biochemical character of this specific sign help to differentiate between chylous from

non-chylous fluid. It has been reported that there are rich in lymphocyte, fat and triglycerides in chyle. Usually, the levels of triglyceride are known less than 50 mg/dL in non-chylous fluid, whereas the level of triglycerides are higher than 110 mg/dL in the fluid in cases of chylothorax.

Chylothorax usually related to injury to main thoracic duct or its tributaries. Physiologically, thoracic duct is known to transport up to 4,000 mL/day of chyle, where rich in fluid, protein, lymphocytes, and lipid (19). Therefore, prolonged loss of chyle can result in hypovolemia, malnutrition, which lead negative impact on postoperative course after esophagectomy. Thus, chylothorax was related with higher rates of infectious complications and arrhythmia, resulted in a longer hospital stay. Previous reports revealed that chyle leakage could lead to pneumonia (20) and possible associated with surgical site infections.

Risk factors for postoperative chylothorax after esophagectomy

There have been several reports demonstrated the risk factors for chylothorax after esophagectomy. Miao *et al.* demonstrated that patients with body mass index (BMI) less than 25 had a risk for chylothorax in thoracic esophagectomy (20). However, risk of BMI has not been fully discussed. Recent meta-analysis investigated on BMI reported opposite results. Patients with high BMI was associated with a decreased incidence of chylothorax in esophagectomy (21). A possible explanation of decreased incidence is possible protection effect of fatty tissue surrounding the tumor and esophagus. More fatty tissue could result in better protection of thoracic duct during surgery.

Esophageal squamous cell carcinoma (SCC) was reported to be another risk factor for postoperative chylothorax (17). In that report, the incidence of chylothorax in histological type SCC was 2.7% in comparison with that of chylothorax in adenocarcinoma was 0%. Another report using multivariate analysis also suggested that SCC histological type, body mass index and age-adjusted Charlson Comorbidity Index score were independent risk for postoperative chylothorax (17). However, we could not claim clear conclusion due to the small number of patients in this study.

The oncological and anatomical factors were reported as possible risk for postoperative chylothorax. Certain tumor location and extent and location of lymph node metastasis were identified as risk factors in previous studies. Indeed,

recent report suggested that difficult mediastinal dissection during esophagectomy in middle thoracic esophageal cancer may lead to risk to thoracic duct injury, which support above hypothesis.

On the other hand, based on the analysis with dominant histological type of SCC, post-chemoradiotherapy and higher amount of intraoperative fluid balance are possible predictors of chylothorax in esophagectomy (22). Regarding intraoperative fluid balance, there were certain consideration about the reason. Most of the reason of typical severe chylothorax to be intraoperative damage of the main stream of thoracic duct or rupture of thoracic duct at thoracic duct. Intraoperative higher infusion volume could induce the status of more risk to be rupture thoracic duct in patients with fragile tissue in case of post-chemoradiation.

Efficacy of octreotide for postoperative chylothorax

Octreotide has been reported to be a possible, effective treatment for chylothorax after thoracic surgery. Octreotide is a somatostatin analogue with antisecretory properties similar to those of somatostatin (23). Octreotide has inhibitory actions by the releasing various hormones, such as insulin and on lymph fluid excretion (23). In previous studies, somatostatin markedly compress the diameter and decreased the flow of thoracic duct (24). Rimensberger *et al.* firstly reported that clinical efficacy of somatostatin to treat chylothorax (13). After this report, subsequent clinical trials suggested that octreotide was effective for primary chylothorax or surgically-related chylothorax in children (25). In adults, recent study revealed the efficacy of octreotide for postoperative chylothorax after thoracic surgery in adults, particularly after esophagectomy (18). In this study, octreotide treatment effectively decreased chest drain output and chest drains could be removed in 86.6% of patients. Importantly, treatment was successful for 50% of patients with drain amount before treatment that exceeded 1 L daily. Therefore, the former recommendation that surgical ligation is necessary if the amount of chest drain output is more than 1 L/day may need to be reconsidered in view of the efficacy of octreotide.

Because the treatment with octreotide is safe and non-invasive, it could be considered as a first-line treatment for postoperative chylothorax in esophagectomy. However, there are potentially other invasive effective option, such as thoracic duct embolization.

Efficacy of thoracic duct embolization for postoperative chylothorax

Thoracic duct lymphangiography with embolization (TDE) is a novel, less invasive, and potentially equally efficacious treatment method. Catheter cannulation and embolization technique used by Cope (26) to treat chylothorax was effective in patients with thoracic duct laceration. However, its reproducibility and success rates have not high and varied in different reports. Recent report demonstrated thoracic duct embolization or disruption with very good effect in patients with chyle leak after thoracic surgery (27). Subsequently, Litherland *et al.* described case report where CT guided disruption of the lymphatics had good effect in the management of high output chylothorax (28). Moreover, Asian group performed lymphangiography on patients that were unlikely to respond to conservative measures. They found that lymphangiography not only identified the site of the leak but also led to successful treatment of leak in all cases (29). Taken together, these reports commend early lymphangiography in cases with postoperative chylothorax which unlikely to be cured by conservative treatment.

The safety and feasibility of percutaneous thoracic duct embolization or interruption have been reported. Recent report reviewed the existing literatures on percutaneous embolization treatment of chylothorax (30). The authors found 5 case series and 3 case reports inclusive of ninety patients in whom percutaneous embolization treatment for chylothorax was attempted between 1998 and 2004. Percutaneous embolization resulted in success in 69% of the cases. This report concluded that percutaneous embolization treatment for chyle leak is safe and feasible, with low morbidity rates and satisfactory results. Another review paper investigated the indications, technical approach, and clinical outcomes of percutaneous embolization treatment for thoracic duct in 105 patients with postoperative chylothorax (31). The overall success treatment rate of this procedure was satisfactory in this series (79%). Thus, the report concluded that percutaneous embolization techniques are safe and effective as first-line minimally invasive treatments for thoracic duct injuries after surgery.

Thoracic duct embolization is relative reproductive, and its success rate is satisfactory (60–70%), there this procedure should be considered before the surgical ligation procedure.

Conclusions

In conclusion, although incidence of chylothorax is

relatively low, surgeons have to be careful during surgery particularly patients with their tumor or lymph nodes closely located to the main stream of thoracic duct. In case with chylothorax, prompt diagnosis and the optimal treatment strategy is required. If the initial conservative treatment such as administration of octreotide is not effective with any chylous output is large and persistent, percutaneous thoracic duct embolization should be considered, before the surgical ligation of thoracic duct.

Acknowledgements

We thank the members of the Division of Gastrointestinal Oncology for their critical discussion of this study. We also appreciate the members of the Division of Clinical Radiology for providing us with information about the imaging examinations.

Footnote

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

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Cite this article as: Fujita T, Sato T, Sato K, Hirano Y, Fujiwara H, Daiko H. Clinical manifestation, risk factors and managements for postoperative chylothorax after thoracic esophagectomy. *J Thorac Dis* 2019;11(Suppl 3):S198-S201. doi: 10.21037/jtd.2019.02.31