Three Cases of Chylothorax following Resection for the Esophageal Carcinoma

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Summary

Between March 1973 and December 1994, we performed 346 esophagectomies for primary esophageal carcinoma, and encountered three patients (0.8%) of chylothorax that developed following esophagectomy.

All three patients were successfully treated by surgical procedure.

Case 1: A 51-year-old male. A total thoracic esophagectomy was carried out through a right thoracotomy, laparotomy and cervical incision. On the 22th postoperative day, for the postoperative chylothorax, ligations of the leaking portions of thoracic duct and supradiaphragmatic ligation of the thoracic duct was performed through the previous right thoracotomy incision.

Case 2: A 59-year-old male. A total thoracic esophagectomy was carried out through a right thoracotomy, laparotomy, and cervical incision. On the 7th postoperative day, for the postoperative chylothorax, a thoracic duct ligation and convergence ligations of lymphatic duct around the aorta was carried out through the previous laparotomy incision.

Case 3: A 63-year-old male. A total thoracic esophagectomy was carried out through a right thoracotomy, laparotomy and cervical incision. The right chest drainage tube was removed on the 9th postoperative day, and enteral nutrition was started. A chest X-ray showed a right hydrothorax on the 16th postoperative day. On the 22th postoperative day, for postoperative chylothorax, a thoracic duct ligation and convergence ligations of lymphatic duct around the aorta was carried out through the previous laparotomy incision.

Our experience suggest that if conservative treatment is not effective, surgical treatment should be positively applied, and it is important to ligate the thoracic duct just above the diaphragm for prevention of postoperative chylothorax following resection of the esophageal carcinoma.

Introduction

Chylothorax is a condition that chyle leak from the thoracic duct accumulate in pleural cavity. The etiologies of chylothorax are considered to be as spontaneous cases, thoracic duct

Key words: Chylothorax, Esophageal carcinoma.
obstruction resulting from congenital abnormality, neoplasm and infection of the thoracic duct, thoracic duct injury resulting from blunt trauma, operative procedure and so on. The management of chylothorax remains unsettled partially because of the variety of causes and the variable results from different method of treatment. Chylothorax following operation for cardiovascular organ, lung, mediastinum and esophagus is a relatively rare complication. It usually results from injuries to the intrathoracic portion of the thoracic duct, once the development of chylothorax occurs, this is a serious and often life-threatening clinical entity.

In our department, between March 1973 and December 1994, 346 patients underwent esophagectomy for primary esophageal carcinoma, and three patients (0.8%) developed postoperative complications of chylothorax (Table 1). Three cases of management for chylothorax following an operation for esophageal carcinoma will be reported and discussed, along with relevant literatures.

**Case Reports**

Case 1: The patient is a 51-year-old male, who was admitted to our department with 2 months history of foreign body sensation in swallowing and a weight loss of 4 kg in the past two weeks. A type 3 lesion measuring 10 cm and locating from Lu to Im of the esophagus was recognized by upper GI tract and endoscopic examination. Preoperative radiation therapy (total dose of 30 Gy) was undertaken, and a total thoracic esophagectomy through a right thoracotomy, laparotomy and cervical incision was carried out. The esophageal cancer had invaded to aorta and trachea. Pathologic findings showed a well differentiated squamous cell carcinoma, n3 (+), ly (+),

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<td>51</td>
<td>lu &gt; lm 10.0cm</td>
<td>1. irradiation 30 Gy 2. chemotherapy CDDP: 50mg</td>
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<td>1. well diff SCC 2. a1 (Aorta, Trachea) 3. n1(-), n2(+), n3(+) 4. Grade 1</td>
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<td>2. S.O</td>
<td>59</td>
<td>lm 4.5cm</td>
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<tr>
<td>3. T.S</td>
<td>63</td>
<td>Ei 5.0cm</td>
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Fig. 1 Chest X-ray, on the 8th postoperative day, showing marked development of pleural effusion in the right chest.

Fig. 2 CT scan, on the 15th postoperative day, showing large collection of chyle.

v (+), irradiated Grade 1 (Table 1). On the second postoperative day, about 2000 ml of serous semitranslucent effusion was recognized, but the Sudan III staining test showed a negative result. On the third postoperative day, enteral nutrition was started, but was interrupted on the 9th postoperative day because of a milky, slightly yellow pleural effusion that had increased in volume from 2100 ml up to 3500 ml per day. A chest X-ray demonstrated an accumulation of fluid in the right chest (Fig. 1). On the 14th postoperative day, enteral nutrition by medium-chain triglyceride (MCT) milk was begun, but the pleural effusion increased further in volume up to 4700 ml per day (Fig. 2, 3). Serum total protein was extremely reduced to 4.5 g/dl on the 18th postoperative day despite the administration of fresh frozen plasma (FFP) and intravenous hyperalimentation (IVH). Exploration was performed on the 22th postoperative day through the previous right thoracotomy incision. To make it easy to identify the leaking portion, the patients was given milk with methylene blue via a feeding tube about three hours before the operation. Several leakage portion of cloudy chyle were indentified between vertebra and aorta, these were picked up with forceps and ligated, and the thoracic duct was ligated just above the diaphragm. Postoperatively, discharge from chest drain was dramatically decreased (Fig. 3, 4).

The patient developed the cancer metastasis of face, neck and mediastinum and died on 2 months and 20 days after esophagectomy.

Case 2: The patient is a 59-year-old male with 3 months history of a feeling of something sticking in swallowing food, who consulted a nearby hospital. He was pointed out the lesion measuring 4.5 cm in 1m of the esophagus through upper GI examination. The patient
Fig. 3 Case 1. Postoperative clinical course and treatment. op 1: esophagectomy. op 2: a thoracic duct ligation through the right thoracotomy. EN: enteral nutrition. MCT: medium-chain triglyceride milk. FFP: fresh frozen plasma. IVH: intravenous hyperalimentation.

Fig. 4 Chest X-ray, on the 5th postoperative day of re-operation, showing improvement of the right pleural effusion.

Fig. 5 Chest X-ray, on the third postoperative day, showing right pleural effusion.
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was referred to and admitted to our department. Preoperative radiation therapy (total dose of 40 Gy) was performed, and a total thoracic esophagectomy through a right thoracotomy, laparotomy and cervical incision was carried out. Pathological findings showed a well differentiated squamous cell carcinoma, a1, n2 (+), ly (+), v (+), Grade 1. Postoperatively from the first to third day, there was persistent drainage of more than 1300 ml (1300~1800 ml) of serous fluid from the right chest drain each day and chest X-ray showed persistent right pleural effusion (Fig. 5). On the fourth postoperative day, enteral nutrition was started. A milky pleural effusion drained from the chest drain on the fifth postoperative day. A Sudan III staining test of the effusion showed a positive result. A chest X-ray on the 6th postoperative day showed an

Fig. 6 Chest X-ray, on the third postoperative day of re-operation, showing improvement of the right pleural effusion.

![Graph showing discharge (ml) over time](image)

Fig. 7 Case 2. Postoperative clinical course and treatment. op. 1: esophagectomy. op. 2: A thoracic duct ligation and convergence ligations of the lymphatic ducts around the aorta through laparotomy.

![Graph showing pulse and total protein (T.P) over time](image)
accumulation of fluid in the right chest. On the 7th postoperative day, exploration was performed through the previous upper midline laparotomy incision. The patient was given milk with methylen blue via a feeding tube about three hours before the operation. A swelling thoracic duct was detected in the right side of the aorta just below the diaphragm. A thoracic duct ligation and convergence ligations of the lymphatic duct around the aorta was carried out. A discharge from the chest drain ceased immediately and the chest tube was removed on the 6th postoperative day of re-laparotomy (Fig. 6, 7).

Postoperative radiation therapy (total dose of 60 Gy) was performed, and the patient was discharged on 3 months and 16 days postoperatively and died due to recurrence on 2 years and 11 months after esophagectomy.

Case 3: The patient is a 63-year-old male, who consulted a nearby hospital. He had a one month history of a dysphagia and was pointed out the esophageal carcinoma in the lower esophagus through upper GI and endoscopic examination. He was referred to and admitted to our department. Preoperative radiation therapy (total dose of 40 Gy) was performed, and a total thoracic esophagectomy through a right thoracotomy, laparotomy and cervical incision was carried out. The clinical course after operation was good and chest drainage tube was removed on the 9th postoperative day. Enteral nutrition started on the 10th postoperative day. On the 16th postoperative day, the patient become markedly short of breath and a chest X-ray showed a right pleural effusion. The right chest drain inserted through the 7th intercostal space discharged a large quantity
of milky effusion. On the 21th postoperative day, pleural effusion increased in volume up to 4800 ml per day and serum total protein was extremely reduced to 4.1 g/dl in spite of the administration of FFP and IVH. On the 22th postoperative day, re-laparotomy was performed through the previous upper midline laparotomy incision. A thoracic duct ligation just below the diaphragm and convergence ligation of lymphatic duct around the aorta was carried out. Discharge from the chest drain ceased remarkably and the chest tube was removed on the 12th postoperative day of re-laparotomy (Fig. 8).

On the two months after operation, as the bone metastasis of cervical, thoracic and lumbar vertebrae was recognized by CT scan and bone scintigram, postoperative chemotherapy (CDDP, 5-Fu) was performed, and after that a sepsis due to MRSA infection developed. The patient showed improvement on antibiotics therapy and was discharged on 7 months and 13 day postoperatively. The patient died due to recurrence on one year and two months after esophagectomy.

Discussion

The thoracic duct is the main collecting trunk of the lymphatic system. The intestinal trunk joins the bilateral lymphatic trunks at the cisterna chyli in the right posterior side of the abdominal aorta at the level of the second lumbar vertebra. In general, thoracic duct begins at the upper border of cisterna chyli, which ascends along with the right posterior side of abdominal aorta, enters the thoracic cavity through the aortic hiatus of the diaphragm, ascends between the thoracic aorta and the azygous vein, gradually turns to left side, passes through the posterior side of the esophagus and goes out the left side of the esophagus at the level of the third thoracic vertebra, and receives left jugular lymphatic trunk and left subclavian lymphatic trunk between the left common carotid and the subclavian artery, enters into the region of the angle formed by the junction of the left subclavian and internal jugular vein.

Although this is a standard anatomical pattern of the thoracic duct, wide anatomical variations may exist in lymphaticovenous communications, so it is necessary to consider about the possibility of the thoracic duct in the operation of mediastinum. In our department, recently, we usually performed the supradiaphragmatic ligation of the thoracic duct in the operation for esophageal carcinoma.

Traumatic chylothorax was first described, according to Olsen and Wilson, by Bartelet in 1633. A postoperative chylothorax was first described by Blalock et al in 1936. They noted chylothorax following superior vena caval ligation. In 1942, Crandall et al successfully treated a thoracic duct fistula in the neck by thoracic duct ligation. Lampson's report, in 1948, on chylothorax treated by ligation of the thoracic duct in the chest marked the turning point in the treatment of this condition. Prior to Lampson's report of successful control of traumatic chylothorax by direct ligation of thoracic duct, the mortality rate for this condition was 45%; nontraumatic chylothorax carried a 100% mortality rate. For these result, Milson commented that the treatment at that time consisted of thoracocentesis and/or tube thoracostomy and possibly a low fat diet. Goorwichts's review of chylothorax from 1948 to 1954, in 1955, he collected 31 cases and demonstrated no death among 15 patients treated operatively and 19% mortality rate among 16 patients treated nonoperatively. He concluded that chylothorax persisted despite adequate thoracocentesis or closed drainage, the thoracic...
duct should be ligated before the condition on the patients begun to deteriorate\(^{14}\). Bressler et al\(^{19}\), in 1953, described as the first report which successfully treated by repeated thoracocentesis or continuous closed drainage by intercostal tube to keep the hemithorax free of fluid and the lung expanded for the traumatic chylothorax following the resection of esophageal carcinoma through the left thoracotomy approach. In Japan, in 1965, Ishida et al\(^{15}\) reported the two cases of chylothorax following radical esophagectomy for the esophageal carcinoma, which were successfully treated by thoracocentesis and drainage, and were cured on 24th and 30th postoperative day respectively.

The incidences of chylothorax following resection of the esophageal carcinoma were reported as; Oohashi et al\(^{16}\), 8 in 360 cases (2.2%); Mitomi et al\(^{17}\), 3 in 285 cases (1.0%); Ishida et al\(^{18}\), 2 in 100 cases (2.0%); and Lam et al\(^{14}\), 3 in 580 cases (0.5%). Okita et al\(^{19}\) described that the incidences of chylotholax following resection of the esophageal carcinoma with preoperative radiation therapy were relatively higher tendency than the cases without preoperative irradiation. All our three cases (in 115 cases of preoperative radiation therapy) underwent preoperative radiation therapy.

Diagnosis of chylothorax is usually suspected when a large milky pleural effusion developed\(^{14}\). A chest X-ray examination showed a typically unencapsulated pleural effusion which when removed appears creamy and opalescent and when left standing separate into three layers. A smear of the fluid shows predominantly lymphocytes, and culture is sterile. Thoracic duct lymph contains of fat, and 60 to 70% of ingested fat is conveyed to the blood stream by way of the thoracic duct. So the chyle shows a milky appearance with creamy layer on standing and positive fat globules stain with Sudan III. But when feeding is not given due to postoperative status, it is not always a milky effusions and is not always positive Sudan III staining. Case 1 showed a semifluorescent effusion and negative Sudan III staining, whereas case 2 showed the milky appearance and positive Sudan III staining after beginning of enteral nutrition.

Lam\(^{14}\) described that lymphangiography not only establishes the diagnosis, but the site and degree of extravasation were also demonstrable and, in addition, repeating the investigation allowed assessment of the prognosis and assisted in the decision to preserve with conservative treatment.

As a rule, conservative treatment should be tried first\(^{8}\). Conservative treatments are

1. restriction of oral and tube feeding, and nutritional supply by intravenous hyperalimentation to replace loss of fluid and electrolyte, along with plasma and lipids\(^{9}\).

2. complete and continuous removal of chylous fluid to allow reexpansion of the lung and apposition of the pleura\(^{20,21}\).

3. to seal the mediastinal pleura against the chyle leakage, and to decrease the dead space of the thoracic cavity by positive end-expiratory pressure (PEEP)\(^{22}\).

A method that accelerates the pleural adhesion by using talc suspension\(^{8}\), or by using tetracycline with OK-432\(^{18,23}\) injected through a thoracotomy tube has been reported.

It is generally known that medium-chain triglyceride (MCT), a small number of carbon in the fat is absorbed from intestine, and dose not enter into the thoracic duct but enter into the portal vein, so administration of MCT milk is considered to be useful as a point of nutritional support for the management of chylothorax. But in case 1, administration of MCT milk was
discontinued, due to further increase of chyle discharge from the chest drainage tube.

In regard to indication for operation, Sell et al. described that the transthoracic ligation of the thoracic duct is indicated when: a) the average daily chyle loss has exceeded 1500 ml in adults or 100 ml per year of age in children for 5-day period.

b) the chyle flow has not diminished while approaching 14 days in duration.

c) nutritional complications appear imminent.

Robinson described that if conservative therapy (eg., aspiration or drainage with restriction of oral intake and intravenous replacement) is not successful after two to three weeks, surgical treatment is necessary and efficacious. On the other hand, Theur described that non-operative therapy should be employed for 3 to 4 weeks before consideration is given to thoracic duct ligation.

For surgical management, as a rule, the ligation of leaking portion of thoracic duct is performed through a right thoracotomy and if the leaking portion cannot be detected, supradiaphragmatic thoracic duct ligation and convergence ligations including around the thoracic duct is performed.

In case 1, the ligations of leaking portion of thoracic duct and supradiaphragmatic thoracic duct through the right thoracotomy was performed. In cases 2 and 3, the infradiaphragmatic thoracic duct ligation and convergence ligations of lymphatic duct around the aorta were performed through laparotomy.

Ohashi et al. reported the successfully treated case of chylothorax following esophageal resection for carcinoma of the esophagus, which did not show the improvement of condition in spite of the ligation of thoracic duct through right thoracotomy on 19th postoperative days, therefore, the convergence ligations of lymphatic vessels around the abdominal aorta were underwent through the laparotomy on 45th postoperative day of esophageal resection.

**Conclusion**

346 patients underwent esophagectomy for primary esophageal carcinoma, and three patients (0.8%) developed postoperative complications of chylothorax.

In one patient, ligations of the leaking portion of thoracic duct and supradiaphragmatic thoracic duct was performed through right thoracotomy. In two patients, infradiaphragmatic thoracic duct ligation and convergence ligations of lymphatic duct around the aorta were performed through laparotomy.

If conservative therapy is not effective, surgical treatment should be positively applied, and it is important to ligate the thoracic duct just above the diaphragm for the prevention of post-operative chylothorax following resection of esophageal carcinoma.

**References**


9) Olsen AM & Wilson GT: Chylothorax. J Tho-