

## Management of Chylothorax in Esophageal Surgery by Minimally Invasive Thoracoscopic Approach: Case Series

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### Rezumat

#### *Managementul chilotoraxului în chirurgia esofagiană prin abord minim invaziv toracoscopic*

Chilotoraxul este o complicație rară, ce apare mai ales după chirurgia esofagiană. Leziunea ductului toracic se produce în special în timpul toracic al esofagectomiei. Managementul chilotoraxului este de obicei conservator, reintervenția chirurgicală, cu ligatura ductului toracic fiind rezervată acelor cazuri refractare la acest tratament. Aducem în discuție probleme de diagnostic și atitudine terapeutică, așa cum sunt evidențiate în literatura de specialitate, deși nu a fost stabilit un consens general, cel mai probabil din cauza frecvenței scăzute a acestei complicații. Subliniem abordarea toracoscopică minim invazivă aplicată pentru două cazuri cu acest tip de complicație. O rată ridicată de suspiciune pentru leziunea ductului toracic trebuie menținută la toți pacienții după chirurgia esofagiană, orice revărsat pleural cuprinzând în diagnosticul diferențial și chilotoraxul.

**Cuvinte cheie:** esofagectomie, chilotorax, abord toracoscopic

### Abstract

Chylothorax is a rare complication, especially after esophageal cancer surgery. It may occur mainly in the thoracic stage of esophagectomy. The management of chylothorax is usually conservative, surgical reoperation with thoracic duct ligation being reserved for those cases refractory to that treatment. We discuss

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issues of diagnosis and therapeutic attitude, as evidenced by the literature, although a general consensus has not been established, most likely due to the low frequency of this complication. We emphasize the minimally invasive thoracoscopic approach, as it has been applied for two cases with this type of complication. A high rate of suspicion for thoracic duct injury should be maintained in all patients after esophageal surgery, with any pleural effusion entering the differential diagnosis of chylothorax

**Key words:** esophagectomy, chylothorax, thoracoscopic approach

## Introduction

Chylothorax is a rare complication, especially after esophageal cancer surgery. It may occur mainly in the thoracic stage of esophagectomy, although it is also found during abdominal dissection (being accompanied by chylous ascites) (1,2). The frequency of this lesion ranges from 0 to 8% and is associated with a global mortality rate of up to 18% and a major 30-day complication rate of 85% and a 30-day mortality of 1.6% (3). Although minimally invasive esophageal surgery provides an enhanced view of the operating field, facilitating the identification of the thoracic duct, accidental damage to the main duct or collateral can lead to postoperative chylothorax (4-7). Given the increased volume of lymph transported in the thoracic duct (about 4 liters/ 24 hours), the consequence of thoracic duct fistula has a severe pathogenic impact through hypoalbuminemia and lymphopenia causing malnutrition, immunosuppression, in a cancer patient with dysphagia, and treated with chemoradiotherapy (CRT) with increased risk of infection and sepsis (8,9). The diagnosis, although difficult, must be prompt, so that treatment can be quickly instituted. Prophylactically, many practitioners ligate the thoracic duct to prevent this complication. However, one study raises concerns about this practice (10).

The management of chylothorax is usually conservative with pleural drainage, dietary modification, total parenteral nutrition, or diet with medium-chain triglycerides and somato-

statin analogues (11). Surgical reoperation with thoracic duct ligation is reserved for those cases refractory to conservative treatment (persistence of chylous pleural drainage and general condition deterioration) (12). Less invasive interventional radiology methods, with embolization of the thoracic duct or chyli cisterna are newer methods that have entered the armamentarium of clinics with adequate technical equipment (13-15). Although there is a reserved prognosis for persistent chylothorax, there is no general consensus as to when the invasive approaches or interventional radiology methods should be used if conservative treatment fails (16).

## Clinical Cases

We present data for the diagnosis of chylothorax in esophageal surgery and its management by minimally invasive thoracoscopic surgery, as it has been applied for two cases with this type of complication. We discuss issues of diagnosis and therapeutic attitude as evidenced by the literature although a general consensus has not been established, most likely due to the low frequency of this complication.

In this sense, we present the experience of two cases of chylothorax solved by minimally invasive thoracoscopic surgery, suggestive as a way to approach lymphatic lesions - en block ligation vs selective ligation, ligation per primam or reintervention, commenting on the technical aspects illustrated by intra-operative images but also on the consequences of these interventions.

### Case no. 1

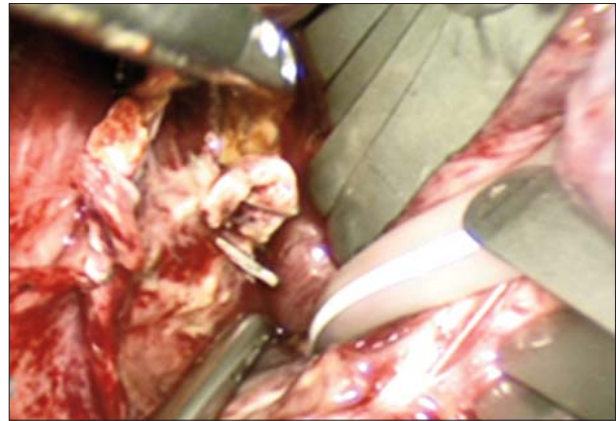
First case is a male patient D. Z., 47 y/o, diagnosed with medi thoracic and inferior squamous cell carcinoma, with neoadjuvant chemoradiation therapy (CRT) for which minimally invasive subtotal esophagectomy was performed by modified McKeown triple approach - thoracoscopic, laparoscopic and cervical, with esophageal reconstruction by gastric pull-up (Nakayama technique) and jejunostomy without intraoperative complications.

On the 5<sup>th</sup> postoperative day, massive chylothorax with a thoracic drainage flow rate of over 1800 ml/ 24 h is diagnosed, for which diagnostic thoracoscopy is performed, with three trocars, without identifying the source of the chylothorax. It is decided to ligate en block the thoracic duct at intrathoracic origin (operating time 60 minutes) (*Fig. 1*). For persistent chylothorax with a flow rate over 1200 ml / 24 h, the patient required minimally invasive thoracic reoperation on the 8<sup>th</sup> day postoperatively. Careful inspection identifies the lesion of the proximal thoracic duct, located above the sectioned arch of the azygos vein. The ligation of the thoracic duct above and below the lesion is practiced (*Figs. 2, 3*). Operating time was 90 minutes. The post-operative evolution was without the restoration of the chylothorax.

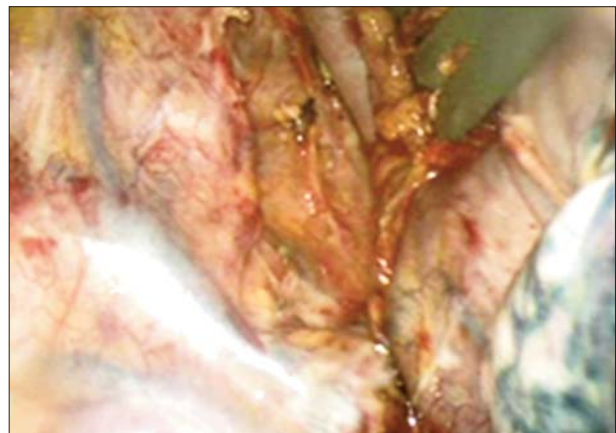
In evolution, marked by pulmonary complications, left pleural empyema, the patient develops complex eso-gastro-tracheal fistula which, despite the complex treatment in intensive care unit, led to death after 9 weeks.

### Case no. 2

The second case was a male patient B.V., 61 y/o, diagnosed with lower esophageal adenocarcinoma, with neoadjuvant CRT for which a minimally invasive subtotal esophagectomy was performed by triple modified McKeown approach - thoracoscopic, laparoscopic and cervical, with esophageal reconstruction by gastric pull-up (Akiyama technique). During thoracic stage, the chyle content is identified in the right pleural cavity and by visualizing



**Figure 1.** Thoracic duct on block clipping - case no. 1 reintervention 1



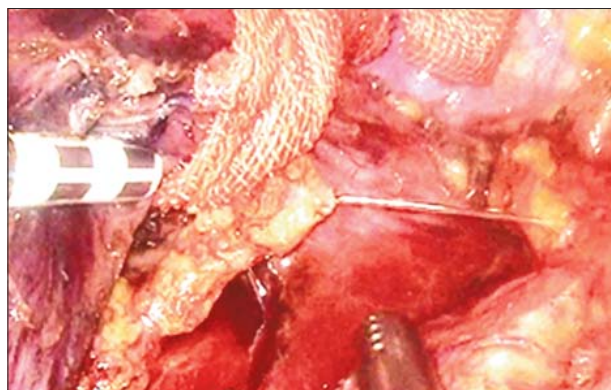
**Figure 2.** Thoracic duct injury above the azygos vein, clip was placed above the injury - case no. 1, reintervention 2



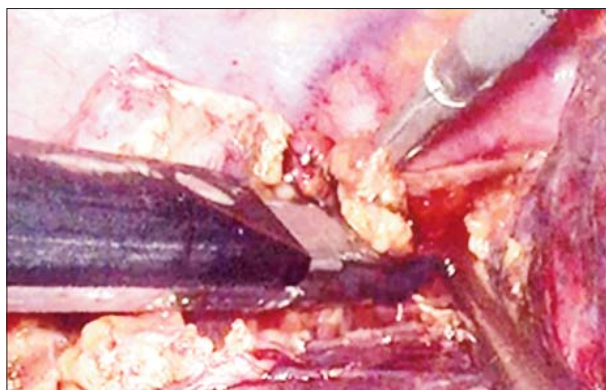
**Figure 3.** Thoracic duct fistula above the arch of azygos vein, electively clipped above and below the injury - case no. 1, reintervention 2

and following the thoracic duct, the thoracic duct fistula with an active flow is identified (*Fig. 4*), which requires elective clipping above and below the lesion (*Fig. 5*).





**Figure 4.** Injury of the thoracic duct with high flow, thoracoscopically visible - case no. 2



**Figure 5.** Elective clipping above and below the thoracic duct injury - case no. 2

In evolution, there is no postoperative chylothorax, but there is a postoperative cervical anastomotic leakage with healing by stenosis that requires dilatations, stenting and resenting with a favorable evolution with discharge on the 38<sup>th</sup> day. Late anastomotic stenosis responded favorably to subsequent repeated endoscopic dilatations.

## Results

The operative time was 60 and 90 minutes for the first case and, respectively, intraoperative with no need for reintervention for the second patient. Postoperatively, in the first patient, the high flow rate of the chylothorax determined an early surgery with the attempt to solve this complication by clipping the thoracic duct above the diaphragm.

The importance of an adequate intraoperative inspection with the detection of multiple lesions of the thoracic duct and especially of the collaterals results from the insufficient treatment by the en-block clipping of the main trunk above the diaphragm performed during the first reintervention. This determined the second reintervention with identification of the lesion located above the sectioned azygos vein arch. Instead, the evolution was burdened by other complications commonly encountered in esophageal surgery – pleuro-pulmonary and especially by the redoubtable complication – a complex eso-gastro-tracheal fistula that precipitated death. High lymphatic

loss in a dysphagic, malnourished and immunocompromised by CRT patient, exacerbates poor nutritional status and immunosuppression, so we take into account that although resolved this complication could have had an unfavorable effect on evolution.

In the second patient, the intraoperative identification of a thoracic duct lesion, an aspect facilitated by thoracoscopic surgery with magnification of the operating field, led to the lesion elective treatment by clipping. This aspect is desirable, the prophylaxis of the postoperative chylothorax being recommended to be systematically performed during the initial operation.

## Discussions

The diagnosis of chylothorax can be simple, based on the typical milky appearance of the fluid in the chest drain. However, in the recently operated patient, who is not being fed orally, a large volume of drainage or a recurrent pleural effusion may be the only sign of chylothorax. In these patients, the oral or nasogastric tube test with fatty lunch may confirm the diagnosis. More precisely, however, the evaluation of the level of triglycerides in the pleural fluid, > 110 mg / dL or the presence of chylomicrons in the pleural drainage diagnoses chylothorax. (17)

When chylothorax is diagnosed after removal of the thoracic drain and return to oral feeding, the patient may present with

dyspnea and pleural effusion with a typical milky appearance. Rarely, an atypical clinical presentation with severe hemodynamic instability secondary to mediastinal chylocele may occur (18). Once the diagnosis is confirmed, management includes discontinuation of enteral nutrition, support of parenteral nutrition, careful observation of thoracic drainage flow, administration of Octreotide, and fluid resuscitation. Short-term conservative management is justified; however, if the flow rate persists at a rate of  $> 10$  ml/ kg for five days, conservative treatment will most likely fail (19).

There is much debate about the optimal timing of surgery, with a lack of general consensus. The treatment approach largely depends on the institution or the surgeon's preference. Previously, the surgery was reserved for those who were not successful with the conservative approach. Recently, however, there has been a gradual shift towards an early surgery attitude (within 14 days of diagnosis) due to the high mortality rate associated with immunological and nutritional depletion resulting in a population of already immunocompromised and malnourished patients, with up to 90% success rates through surgery (20-22).

The definition of a high output chyle leak varies in the literature from  $> 500 - 1,000$  cc/ day. Such a flow can be detected in the first 12 hours postoperatively, even before the start of oral feeding, in patients with esophagectomy (21). This should lead to an attitude towards early invasive intervention, especially because it is the case for malnourished and immunocompromised patients (23,24).

The standard operative approach is by right thoracotomy with slight retraction of the gastric conduit and ligation of the thoracic duct. When available, a lymphangiography may be performed before surgery to identify the anatomy of the thoracic duct (25). To identify the source of the chylothorax intraoperatively, 25 cc/ hour of cream or vegetable oil, 6 hours preoperatively, associated or not with methylene blue, may be administered enterally. A high-fat diet improves the flow in

the lymphatic system. If leakage is identified, the duct should be ligated/clipped proximal and distal (26).

Currently, minimally invasive surgery (robotic or video-assisted thoracoscopy) is more commonly used to treat postoperative chylothorax with good results by obtaining a magnified intraoperative image (27,28). Failure to identify the lesion, anatomical variations of the thoracic duct, and the presence of accessory ducts could lead to surgical failure. Therefore, these cases could be treated with complete ligation of the thoracic duct to ensure successful surgical closure. The tissue between the spine and the aorta will be ligated en block, as caudally as possible in the right hemithorax, using large metal clips (20,28,29). Intraoperatively, after clipping, the site of ligation should be observed for a few minutes to ensure that the sealing was successful before the procedure is completed. The thoracic duct ligation is thus reported to be 95% successful in postoperative chylothorax (30). The arch of azygos vein can be sectioned or preserved, depending on the surgeon's preference.

Postoperative drainage should be accurately monitored postoperatively to document not only the flow but also the nature of the drained fluid. Chest drains can be removed once a high-fat diet has been resumed without any evidence of recurrent chylothorax (31). Pleurodesis can be retained as an additional procedure to prevent recurrence of effusion (32).

A new way to identify the source of chylothorax, which combines near-infrared imaging (NIR) and a fluorescent dye indocyanine green (ICG) - ICG lymphography, to improve vision during thoracoscopic minimally invasive surgery provides good results, especially by identifying collateral lesions but additional studies to validate the method are necessary (33).

In minimally invasive thoracoscopic operated patients, prophylactic ligation of the thoracic duct during esophagectomy has been shown to be effective in producing a statistically significant reduction in post-

operative chylothorax compared to those who have not (20,34).

In light of these data regarding the management of postoperative chylothorax and especially post-esophagectomy, minimally invasive thoracoscopic surgery is the way to choose to solve this rare but life-threatening complication, given the existence of an adequate technical platform and expertise in its use.

The advantages would be given especially by the magnified intraoperative image, a very important detail for the selective ligation, for the ligation of the damaged collaterals or for the en block ligation at the intrathoracic origin of the thoracic duct. (35)

## Conclusions

In esophageal cancer, mainly due to neo-adjuvant treatment, the esophagus is more adherent to the surrounding soft tissues and, consequently, damage to the thoracic duct may occur during esophageal mobilization and the periesophageal lympho-fatty atmosphere as we see in our practice.

Early or late chylothorax after radical esophagectomy can be effectively managed by a thoracoscopic approach capable of reproducing the open technique (by thoracotomy) for sealing the thoracic duct.

If the esophagectomy is performed minimally invasive, during the thoracic stage, the thoracic duct can be identified, having several technical variants that we applied in our cases: en-block clipping in the proximal segment in the vicinity of the aorta or the thoracic duct injury can be identified and elective clipping performed and also the integrity of the duct can be monitored on its entire length.

The use of enteral administration of a fatty lunch or more recently the use of ICG and NIR allows the identification of an inapparent injury that will determine the immediate repair, this technique must be validated.

However, a high rate of suspicion for thoracic duct injury should be maintained in

all patients after esophageal surgery, with chylothorax entering the differential diagnosis of any pleural effusion.

## Conflicts of Interest

The authors declare no conflict of interest.

## Ethical Statement

All procedures performed were in accordance with the ethical standards of the 1964 Helsinki Declaration and its later amendments.

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