Case Report

Minimally Invasive Treatment of Chyle Leak After Esophagectomy Using Indocyanine Green (ICG) Enhanced Fluorescence: A Case Report

De Pasqual Carlo Alberto*, Alberti Luca, Sacco Michele, Ridolfi Cecilia, Gervasi Maria Clelia, Jacopo Weindelmayer, Giacopuzzi Simone and Bencivenga Maria

Division of General and Upper GI Surgery, Department of Surgery, University of Verona, Verona, Italy

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ABSTRACT

Chyle Leak (CL) is a relative rare but deadly complication after esophagectomy. The optimal management of CL is still unclear; however, a surgical re-intervention is usually considered necessary if the daily output from the thoracic drain exceeds 1 L. In case of re-intervention, surgical ligation of the thoracic duct (TD) is often resolutive, although TD visualization can be challenging in this setting. We report the case of a 66 years old male patient submitted to total minimally invasive Mckeown esophagectomy, who in the post-operative course developed a CL. After a first unsuccessful attempt of conservative management, we decided to re-submit the patient to surgery with a thoracoscopic approach. During the procedure, we injected the indocyanine green into the inguinal lymph nodes bilaterally. The fluorescence images allowed us to: 1- visualize the thoracic duct; 2- identify the exact site of the leak; 3- to confirm (after TD selective ligation) that the leak was correctly sealed. In two subsequent esophagectomies we used the same technique to intraoperatively identify the TD, allowing its prophylactic selective ligature.

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Introduction

Chyle leak (CL) is a relative uncommon complication after esophagectomy, with a reported incidence from 1,1% to 8,6% [1, 2]. This complication is, however, associated with a severe prognosis and is often resolutive, although TD visualization can be challenging. We present the case of a 66 years old male patient who underwent a minimally invasive Mckeown esophagectomy for a locally advanced esophageal squamous cell carcinoma (stage cT3N1M0), after neoadjuvant chemo-radiotherapy (Verona Protocol [6]). The intervention was conducted through a laparoscopic, thoracoscopic and left cervicotomic approach. We performed a mediastinal standard and abdominal D1+ lymphadenectomy, without prophylactic TD ligation. A feeding jejunostomy was placed and enteral nutrition was started since 1st post-operative day (POD). On POD 2, we observed a milky-white feeding jejunostomy from the thoracic drain, with an output >3 L. Triglyceride and chylomicrons levels in the pleural fluid were elevated. These findings were highly suspicious for chyle leak. A first conservative approach was tempted: we suspended the enteral nutrition from the jejunostomy and switching to total parenteral nutrition, thus obtaining a significant reduction in drain output in the following days (Figure 1).

Clinical Case

We present the case of a 66 years old male patient who underwent a minimally invasive Mckeown esophagectomy for a locally advanced esophageal squamous cell carcinoma (stage cT3N1M0), after neoadjuvant chemo-radiotherapy (Verona Protocol [6]). The intervention was conducted through a laparoscopic, thoracoscopic and left cervicotomic approach. We performed a mediastinal standard and abdominal D1+ lymphadenectomy, without prophylactic TD ligation. A feeding jejunostomy was placed and enteral nutrition was started since 1st post-operative day (POD). On POD 2, we observed a milky-white feeding jejunostomy from the thoracic drain, with an output >3 L. Triglyceride and chylomicrons levels in the pleural fluid were elevated. These findings were highly suspicious for chyle leak. A first conservative approach was tempted: we suspended the enteral nutrition from the jejunostomy and switched to total parenteral nutrition, thus obtaining a significant reduction in drain output in the following days (Figure 1).

*Correspondence to: C A De Pasqual, General and Upper GI Surgery Division, University of Verona, Piazzale Stefani, Verona, Italy; E-mail: carlodepasqual@gmail.com; Tel: +390458123063; Fax: +390458122484

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Figure 1: Thoracic Drain output after esophagectomy.

Figure 2: Intraoperative visualization with ICG fluorescence. A: cranial portion of the thoracic duct (in the yellow circle). B-C: lymph flow from the site of leak (between the red arrows and in the red circle).

Figure 3: Selective Ligature of the thoracic duct in the site of the leak.

On POD 9 we resumed the oral intake with a soft diet with medium-chain fatty acids. Unfortunately, we observed an immediate new increase of the milky-white drain output. On POD 15 we therefore decided to submit the patient to a new thoracoscopy to ligate the TD and to seal the leak. About 30 minutes before starting the intervention, 1 ml of indocyanine green (Verdyce 0.5%, Diagnostic Green GmbH) was injected under ultrasound guide into the inguinal lymph nodes bilaterally. During the thoracoscopy, after abundant washing of the thorax, we obtained fluorescence images of lymph flow using a camera system which activates ICG with emitted light at a wavelength of 760 nm and filters out light with a wavelength below 820 nm. This system allowed a specific direct visualization not only of the thoracic duct, but also of the exact site of the leak, which was located about 2 cm above the diaphragm (Figure 2). A selective ligation of the TD was therefore performed (Figure 3), using a non-absorbable stitch and metallic clips. At the end of the procedure, ICG fluorescence visualization was used to confirm that there was not residual leak (Figure 4). The following post-operative course was uneventful. The oral intake with a soft diet was resumed on POD 3, without evidence of chyle debit from the drain, which was therefore removed on POD 5 (POD 20 from esophagectomy). The patient was discharged on POD 7 (POD 22 from esophagectomy), after confirmation of the absence of liquid in the pleural space through a thorax x-ray. After 2 more weeks, we visited the patient in an ambulatory examination. He was in good clinical conditions and able to eat a soft diet. A thorax x-ray was negative for pleural effusion.

Figure 4: Operative field at the end of the procedure (A) and confirmation with ICG fluorescence of complete leak sealing (B).

Figure 5: Identification during thoracoscopic esophagectomy of the thoracic duct (lifted by surgical graspers) using the ICG.

Discussion

Chyle leak after esophagectomy is a severe complication, with reported high rates of mortality [1]. The loss of proteins and lipids, which may lead to malnutrition and immunosuppression, the risk of respiratory failure for pulmonary atelectasis and the higher incidence of infectious complications are all factors that contribute to the severity of the prognosis [7]. Even if there is no consensus on the optical management of the CL, most of the Authors agree that, when the daily output from the thoracic drain exceeds 1 L/day, a reintervention is probably necessary to seal the leak [3, 5, 8]. Patients with a CL requiring a surgical intervention have been traditionally managed with a new thoracotomy. In the last years, however, many studies have been reporting good results of the thoracoscopic approach, in terms of both overall and pulmonary complications rates [9]. Either with an open or a thoracoscopic approach the identification of the TD during a re-intervention after esophagectomy, especially if the patients had received neoadjuvant chemo-radiotherapy, could be difficult. Reisnauer reported in 2018 a large series of 97 post-operative chylothorax after various surgical operations: in this study a ligation of the TD was necessary in 52 patients, with a success rate of 85%. However, a clear visualization of the TD and thus its selective ligation was possible only in 33 (60%) cases, while in the others 19 (40%) patients a mass ligation had to be performed [3]. To overcome these limitations, we used the ICG fluorescence to precisely identify the TD. With this technique, moreover, we did not only visualize the TD, but we were also able to identify the exact site of the leak and so to perform a precise ligation. In addition, the ICG fluorescence allowed us to confirm that the leak was correctly sealed at the end of the...
procedure. To our knowledge, this is one of the first cases reported in Literature of a thoracoscopic visualization with ICG of a CL after esophagectomy. The first experience of ICG use with this purpose was reported in 2009 Kamiya et al. they presented a case of CL after esophagectomy submitted, on 26th post-operative day, to a right thoracotomy [10]. During the exploration of the thorax the Authors were not able to identify the exact site of the fistula and only through the images obtained through ICG fluorescence the site of the leak was visualized. Kaburagi and Matsutani reported two similar cases of CL after esophagectomy [11, 12]. They both submitted the patient to a relaparotomy and, even if they couldn’t see directly the fistula (which was located in the thorax), used the ICG visualization to proceed to a mass ligation of the cisterna chyli, which was easily identified through the fluorescence images. Good results with the use of ICG fluorescence for the treatment of post-operative chylothorax were also reported after lung surgery for cancer and after paediatric surgery for esophageal atresia [13, 14].

Considering the elevated morbi-mortality related to post-esophagectomy CL, some Authors proposed to perform a routine mass ligation of the TD during the esophagectomy, to reduce the risk of developing this complication. In Literature, however, there is not a strong evidence supporting this approach [15]. A possible explanation for the incomplete success of the intra-operative ligation is that in up to 40% of patients a duplicate or triplicate TD can be observed [16]. To overcome this limitation, we used the ICG fluorescence during two subsequent thoracoscopic esophagectomy, obtaining a precise visualization of the TD and so proceeding to its selective ligation (Figure 5). To conclude, ICG fluorescence visualization seems to be a promising, un-expensive and safe tool in the minimally-invasive treatment of the CL after esophagectomy. Further studies are needed to confirm this result.

Conflicts of Interest

The authors declare that they have no conflict of interest.

Ethical Approval

The authors have no affiliations with or involvement in any organization or entity with any financial interest.

Informed Consent

No informed consent is required.

REFERENCES


