

Mediastinum & Esophagus: Case Report

High-Output Chylothorax: Novel Imaging Techniques Provide Specific Treatment



Lynn Verrelst, MD,¹ Thomas Jardinet, MD,²
 Martin Ruppert, MD,^{1,3}
 Paul Van Schil, MD, PhD,⁴
 Annemiek Snoeckx, MD, PhD,^{2,5}
 Guy Hubens, MD, PhD,^{1,3,5} and
 Michiel F. G. de Maat, MD, PhD^{1,3}

Postesophagectomy chylothorax is a therapeutic dilemma. Understanding anatomy and leakage site is essential, although imaging techniques for thoracic lymphatics are challenging and not always available. We describe a patient with a left-sided thoracic duct and chylothorax after esophagectomy. We performed intranodal Lipiodol lymphangiography, computed tomography lymphangiography, and fluorescence-guided thoracic duct ligation with robot-assisted thoracic surgery. These techniques are useful in the postoperative setting but may also be used as preventive strategies to reduce morbidity and mortality from chylothorax after any thoracic surgery.

(Ann Thorac Surg Short Reports 2023;1:152-156)

© 2022 The Authors. Published by Elsevier Inc. on behalf of
 The Society of Thoracic Surgeons. This is an open
 access article under the CC BY-NC-ND license
 (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Radical surgery for esophageal adenocarcinoma encompasses en bloc resection of the thoracic duct (TD) compartment.¹ Despite standard TD ligation above the hiatus, postesophagectomy chylothorax still occurs with an incidence up to 21%.² In the past, mortality due to chylothorax exceeded 50%. Nowadays, because of additional management strategies (ie, parenteral feeding), morbidity and mortality are reduced.³ Surgical reexploration is not frequently performed in these frail patients as it is difficult to determine the site

of leakage and underlying cause without appropriate imaging studies, especially when there is high prevalence (up to 40%) of anatomic TD variants.⁴ We suggest a proactive approach with innovative imaging and therapeutic modalities, which may lead to tailored reinterventions with the potential of significantly reducing mortality and morbidity observed in TD injuries.

A 78-year-old man with Siewert I adenocarcinoma (cT3 N2 M0) underwent robot-assisted subtotal esophagectomy with left-sided cervical lymphadenectomy after completing 4 cycles of neoadjuvant chemotherapy (fluorouracil, leucovorin, oxaliplatin, and docetaxel [FLOT]). Reconstruction by gastric conduit, pyloroplasty, and hand-sewn cervical anastomosis was followed by placement of a feeding jejunostomy. During the procedure, the TD compartment was dissected from the aorta and clipped just above the hiatus, yet no duct lumen was seen after transection. A Jackson-Pratt (JP) tube and chest tube were placed in the right thorax; the chest tube was removed on the first postoperative day (POD).

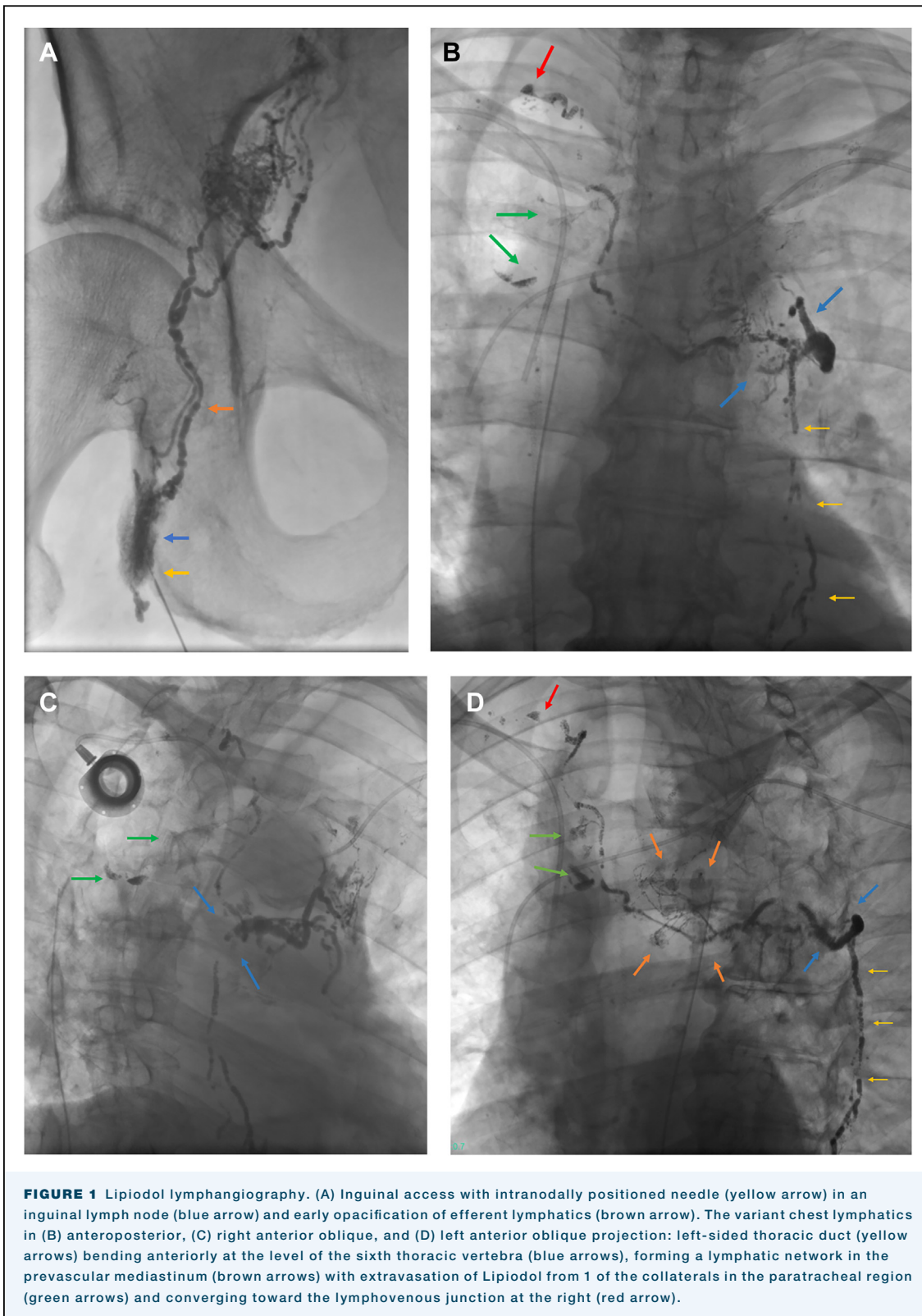
As enteral nutrition (Intestamin; Fresenius Kabi) was started on POD 1 and gradually increased to a total of 1500 mL/24 h (Intestamin and Peptamen [Nestlé] combined 50/50) on POD 6, daily fluid production from the JP tube increased as well to 600 mL/24 h. Triglyceride count (66 mg/dL) was low, yet enteral nutrition and fluid production were related, being highly suggestive of chylous leakage. A low-fat, medium-chain triglyceride (MCT) diet (Vivonex; Nestlé) was started, and diagnostic lymphangiography was performed. Lymphatic access was obtained as described by Nadolski and Itkin.⁵ Ethiodized oil (Lipiodol; Guerbet) was then injected (total of 20 mL), and its progression through retroperitoneal lymphatics, cisterna chyli, and chest lymphatics was observed. This showed an aberrant left-sided TD with extravasation of Lipiodol in the right hilar region (Figure 1). A higher Lipiodol dose was not feasible because of a patent lymphovenous junction. Further management consisted of nothing by mouth and total parenteral nutrition with somatostatin (6 mg/24 h). Drainage volumes subsequently dropped to 200 mL/24 h. A second Lipiodol lymphangiography procedure on POD 25 did not succeed in further lowering the daily volume.

On POD 31, our patient deteriorated, and blood cultures revealed multiple bacteria and yeasts. Abdominal computed tomography (CT) showed colitis. Antifungal

Accepted for publication Nov 14, 2022.

¹Department of Abdominal, Pediatric and Reconstructive Surgery, Antwerp University Hospital, Edegem, Belgium; ²Department of Radiology, Antwerp University Hospital, Edegem, Belgium; ³e-SONAR, Esophageal Surgical Oncology Network Antwerp Region, Antwerp, Belgium; ⁴Department of Thoracic and Vascular Surgery, Antwerp University Hospital, Edegem, Belgium; and ⁵Faculty of Medicine and Health Sciences, University of Antwerp, Antwerp, Belgium

Address correspondence to Dr Verrelst, Department of Abdominal, Pediatric and Reconstructive Surgery, Antwerp University Hospital, Drie Eikenstraat 655, 2650 Edegem, Belgium; email: lynnverrelst@gmail.com.



and antibiotic treatment was given. Tube feeding (Vivonex) was restarted to strengthen the intestinal barrier; unfortunately, chylous leakage rose to 900 mL/24 h.

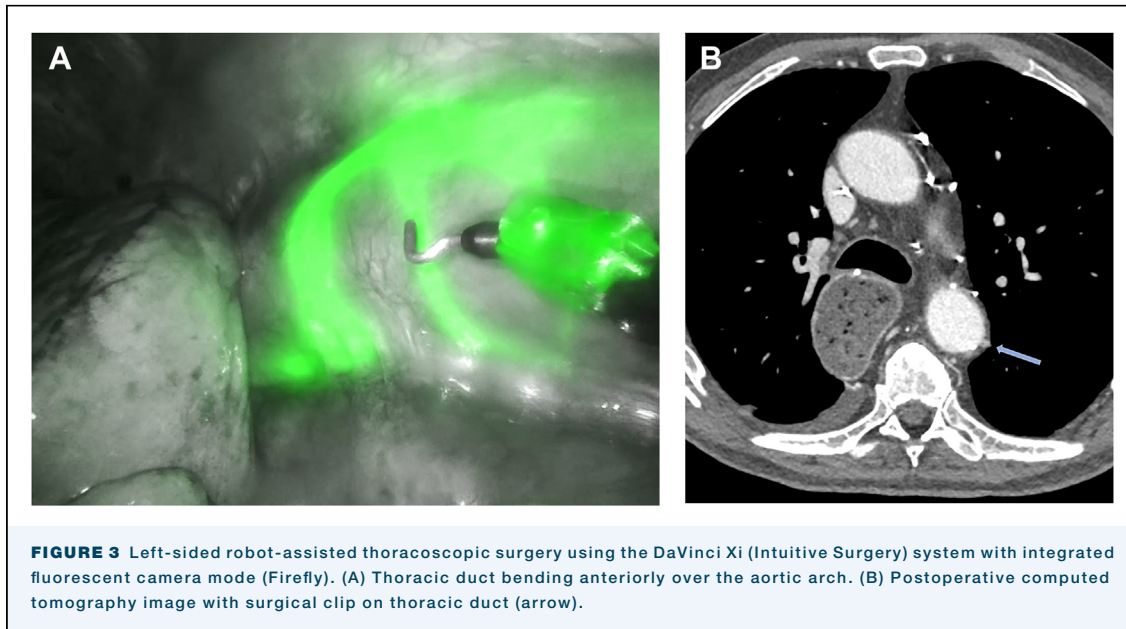
To assess feasibility of surgical ligation of the left-sided TD, CT lymphangiography was performed on POD 41. After inguinal lymphatic access was again



obtained, water-soluble iodine contrast medium (Iomeron 350) was injected slowly. When the column of contrast material reached the retroperitoneal lymphatic trunks, a CT scan of the chest and abdomen was performed. CT lymphangiography showed the TD traversing between the descending aorta and parietal pleura, where it could be reached surgically (Figure 2). Percutaneous TD embolization by direct puncture of the cisterna chyli was deemed impossible as they were located at the posterior side of the aorta, thus making surgery the only remaining option. On POD 45, we performed a left-

sided robot-assisted thoracoscopy, with use of indocyanine green (ICG) fluorescence-guided TD visualization, as described by Jardinet and co-workers⁶ and illustrated in Figure 3. After clipping of the TD, an abrupt stop sign of the ICG fluorescence confirmed successful ligation.

Postoperatively, total parenteral nutrition with somatostatin was restarted. After TD ligation, daily volume dropped to 100 mL/24 h; tube feeding (Vivonex) was gradually reintroduced, and 14 days after TD ligation, the JP tube could be removed. On POD 62, per oral MCT diet was restarted. The patient recovered well,



continued following the MCT diet, and was discharged 68 days after initial esophagectomy.

COMMENT

High-output chylous leakage may initially be treated conservatively, reserving surgery for patients with refractory chylothorax.² However, high morbidity, mortality, and lengthy hospitalization associated with high-output chylothorax^{2,3} warrant a proactive approach in applying diagnostic and therapeutic modalities. Our case demonstrates the risk of a prolonged conservative treatment as it gave rise to an immunocompromised state with inactivity of the intestinal barrier, resulting in severe colitis.

Intranodal Lipiodol lymphangiography was performed early as it is relatively simple and informative with therapeutic potential due to embolic or sclerosing effect at the site of leakage, yet it was not successful in this case. The effect can increase with higher Lipiodol dosages as stated by Jardinet and colleagues,⁷ but this was deemed unsafe because of the patent lymphovenous junction. Early use of imaging studies can also confirm adequate TD ligation at the level of the diaphragm, whereas identification of a leak here prompts direct surgical exploration.

In our case, surgical intervention was necessary as minimally invasive strategies were not successful or deemed impossible. CT lymphangiography provided anatomic landmarks for surgery by showing the aberrant TD and its relation to the surrounding structures.

An important aspect of CT lymphangiography is the ultrasound-guided needle placement. The hilar position in a lymph node in or close to an efferent lymph vessel allows administration of high volumes of contrast agent or dye, which enables faster migration and filling of the TD.

CT lymphangiography may increase our knowledge of aberrant TD anatomy and it could be of value in standard preoperative workup. In case of aberrant TD anatomy, perioperative ICG fluorescence lymphangiography can additionally be used for safer TD identification, dissection, or ligation. CT and ICG lymphangiography may be less successful when there is extensive retroperitoneal lymphovenous shunting, when there is extreme dilution in the cisterna chyli in patients with extensive visceral lymph production (eg, patients with cirrhosis), or when no identifiable inguinal lymph node is found on ultrasound.

In conclusion, use of CT and ICG lymphangiography may reduce the incidence of high-output chylothorax and contribute to lowering its significant morbidity and mortality.

FUNDING SOURCES

The authors have no funding sources to disclose.

DISCLOSURES

The authors have no conflicts of interest to disclose.

PATIENT CONSENT

Obtained.

REFERENCES

1. Corsini EM, Mitchell KG, Zhou N, et al. Modified en bloc esophagectomy compared with standard resection after neoadjuvant chemoradiation. *Ann Thorac Surg.* 2021;111:1133-1140.
 2. Weijs TJ, Ruurda JP, Broekhuizen ME, et al. Outcome of a step-up treatment strategy for chyle leakage after esophagectomy. *Ann Thorac Surg.* 2017;104:477-484.
 3. Nair SK, Petko M, Hayward MP. Aetiology and management of chylothorax in adults. *Eur J Cardiothorac Surg.* 2007;32:362-369.
 4. Johnson OW, Chick JF, Chauhan NR, et al. The thoracic duct: clinical importance, anatomic variation, imaging, and embolization. *Eur Radiol.* 2016;26:2482-2493.
 5. Nadolski GJ, Itkin M. Feasibility of ultrasound-guided intranodal lymphangiogram for thoracic duct embolization. *J Vasc Interv Radiol.* 2012;23:613-616.
 6. Jardinet T, Niekel MC, Ruppert M, et al. Fluorescence-guided thoracic duct dissection in robotic en bloc esophagectomy. *Ann Thorac Surg.* 2022;113:e465-e467.
 7. Jardinet T, Van Veer H, Nafteux P, et al. Intranodal lymphangiography with high-dose ethiodized oil shows efficient results in patients with refractory, high-output postsurgical chylothorax: a retrospective study. *AJR Am J Roentgenol.* 2021;217:433-438.
-