

# Repeat Thoracic Duct Embolization in Traumatic Thoracic Duct Injury: An Alternative to Surgical Ligation after Initial Failure

**AUTHORS:**

Philip GJ<sup>a,b,c</sup>; Foerster K<sup>a,b</sup>; Fischer KJ<sup>a,d</sup>; Grizzell B<sup>e</sup>; Rust K<sup>f</sup>

**CORRESPONDING AUTHOR:**

George J. Philip, MD, MPH  
Kansas Surgical Consultants  
3243 E. Murdock Street  
Ste. 404  
Wichita, KS 67208  
Email: gphilip@kansassurgical.com

**AUTHOR AFFILIATION:**

a. Department of Acute Care Trauma & Surgery  
Wesley Medical Center  
Wichita, KS 67214

b. University of Kansas Wichita General Surgery  
Residency  
Wichita, KS 67214

c. Kansas Surgical Consultants  
Wichita, KS 67208

d. University of Kansas School of Medicine-Wichita  
Wichita, KS 67214

e. Wichita Surgical Specialists  
Wichita, KS 67226

f. Department of Radiology  
Wesley Medical Center, Wichita, KS 67214

<b>Background</b>	Traumatic disruption or occlusion of the thoracic duct leads to chylothorax, a condition characterized by chyle leakage into the pleural space. Conservative management with dietary adjustments is often the first-line approach. However, for refractory cases, traditional surgical options include thoracic duct ligation and pleurodesis. Percutaneous thoracic duct embolization (PTDE), a minimally invasive procedure performed by interventional radiologists, offers a viable alternative to surgery. Repeat PTDE is a viable option for cases with initial embolization failure, potentially delaying or even avoiding surgical intervention.
<b>Summary</b>	An 18-year-old trauma patient transferred from another facility presented with bilateral neck and chest stab wounds. A chest tube was placed for left hemopneumothorax. Drainage transitioned to milky, seropurulent fluid, concerning for chyle. Initial conservative management was ineffective. Interventional radiology (IR) performed thoracic duct embolization (TDE), achieving an initial reduction in chest tube output, but drainage subsequently returned to pre-embolization levels. A repeat TDE was then performed, which resolved the chylothorax.
<b>Conclusion</b>	This case report describes a patient with traumatic chylothorax who exhibited treatment resistance to both conservative management and PTDE. Repeat PTDE ultimately resolved the chylothorax.
<b>Key Words</b>	trauma; chylothorax; percutaneous thoracic duct embolization

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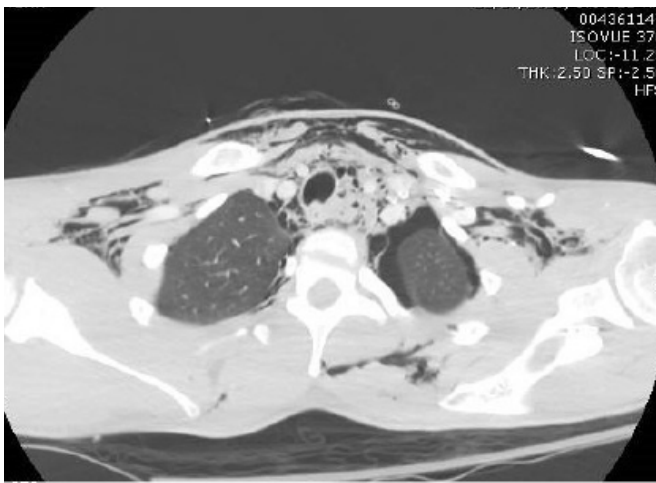
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## Case Description

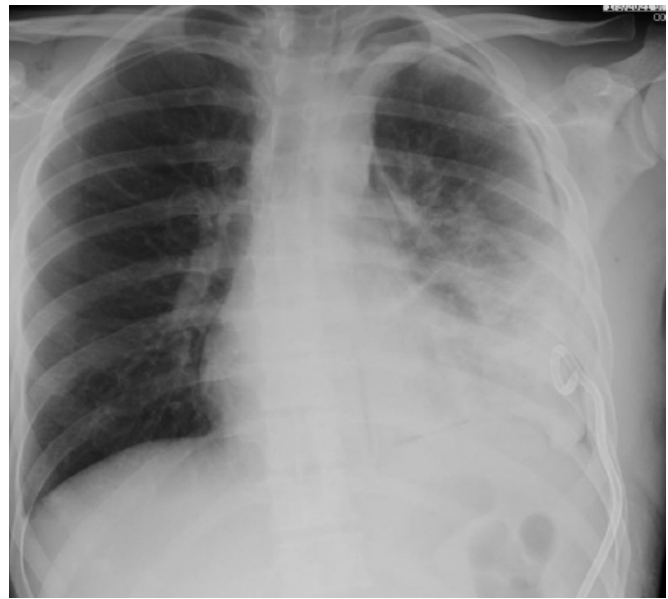
An 18-year-old male with penetrating neck and chest injuries by stab wounds presented to an outside facility. Following chest tube placement for a left hemopneumothorax, he was transferred to our Level I Trauma Center. On arrival, he had a stable Glasgow Coma Scale (GCS) score of 15 and vital signs. Admission to the surgical intensive care unit (ICU) was followed by CT angiography, which demonstrated a left lower lobe parenchymal defect with associated hematoma and pleural effusion (Figure 1).

**Figure 1.** Initial CTA Showing Pneumothorax and Soft Tissue Emphysema. Published with Permission



Initial chest tube drainage revealed serosanguineous fluid, which transitioned to a milky seropurulent effusion. A similar milky fluid was concurrently noted draining from the left neck wound. The neck wound was subsequently cleansed and drained with a Penrose drain inserted at bedside. Chemical analysis confirmed chyle with elevated triglyceride levels of 667 mg/dL in the drained fluid. Despite a seven-day trial of conservative management with NPO status and TPN, significant chyle output persisted via the chest tube, ranging from 400 to 1100 mL/day (Figure 2).

**Figure 2.** Preembolization Chest X Ray Demonstrating Left Hydropneumothorax with Chest Tube in Situ. Published with Permission

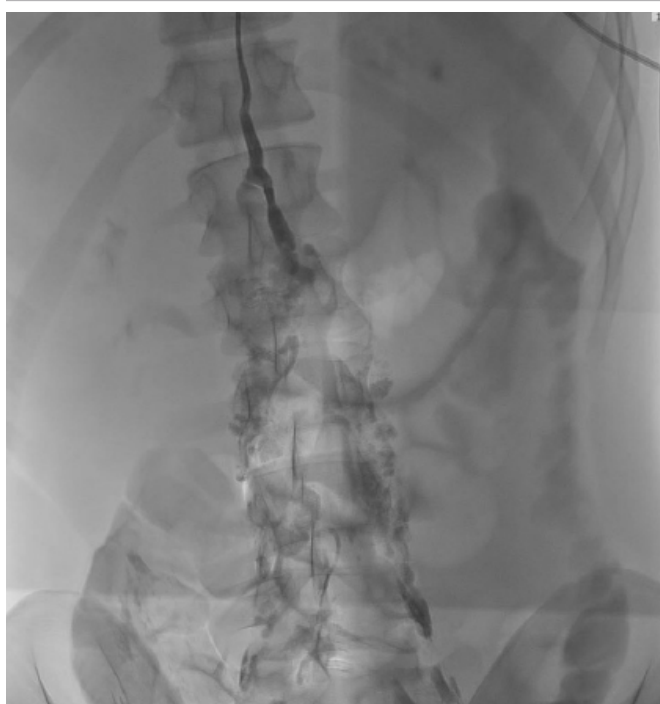


Interventional radiology performed a lymphangiogram to evaluate lymphatic drainage of the pelvic, abdominal, and thoracic regions. The study identified active extravasation from the thoracic duct near the clavicular head. The interventional radiologist then embolized the leaking segment using coils and glue (Figures 3-6). While chest tube drainage briefly declined, it returned to preprocedure levels by postoperative day 2.

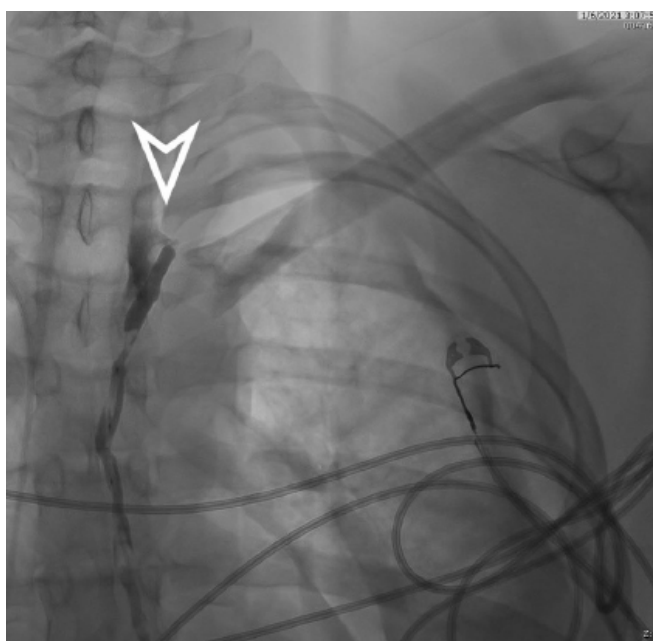
**Figure 3.** Early Filling of Cisterna Chyli over L1 (arrow). Published with Permission



**Figure 4.** Lymphangiogram via Inguinal Lymph Node Cannulation Demonstrating Opacification of Lumbar Nodes, Cisterna Chyli, and Lower Thoracic Duct. Published with Permission



**Figure 5.** Lymphangiogram: Active Contrast Extravasation (arrow). Published with Permission

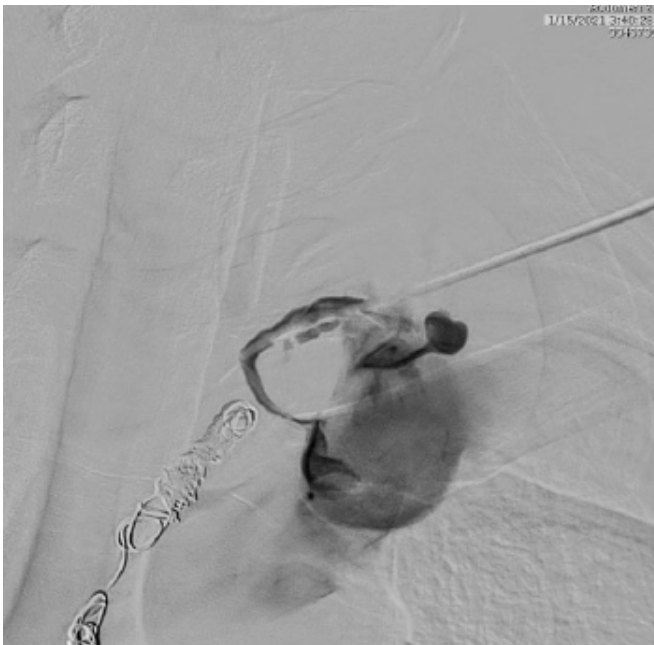


**Figure 6.** Initial Coil Placement at Defect. Published with Permission



Repeat chest CTA revealed a localized air-fluid collection in the left hemithorax, concerning for empyema. However, imaging review suggested an anatomic variant: a postero-medially positioned thoracic duct coursing along the left aorta, lateral to the vertebral column. Given this anomaly, a second IR embolization attempt was undertaken. Accessing the thoracic duct via the left neck proved challenging due to its proximity to the subclavian junction. We therefore opted for a reapproach of the previously embolized cisterna chyli through the epigastrium, followed by successful repeat embolization with glue (Figure 7, Figure 8, Figure 9, and Figure 10).

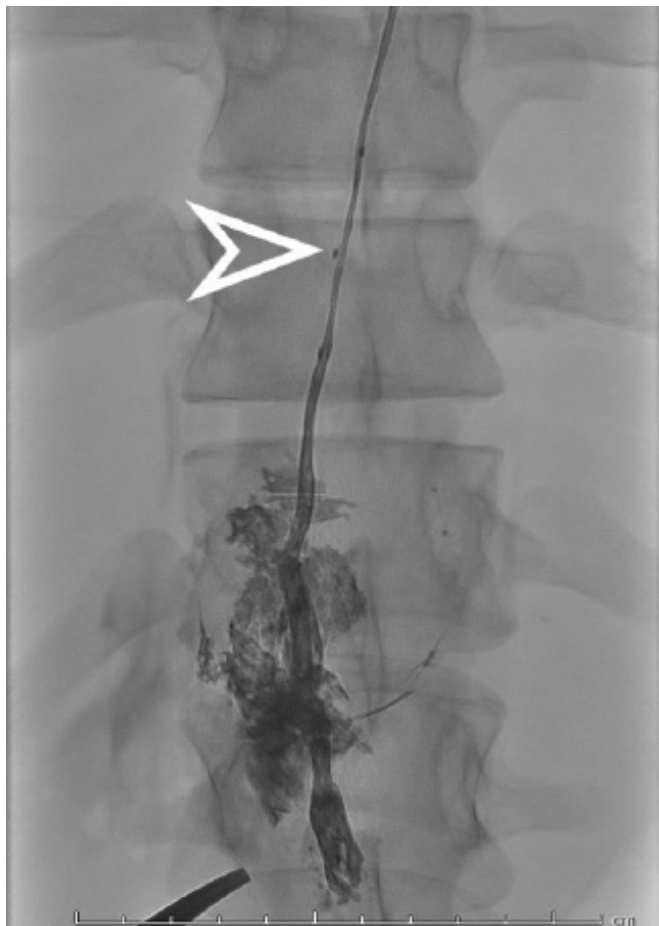
**Figure 7.** Retrograde Access to Thoracic Duct at Subclavian Junction. Published with Permission



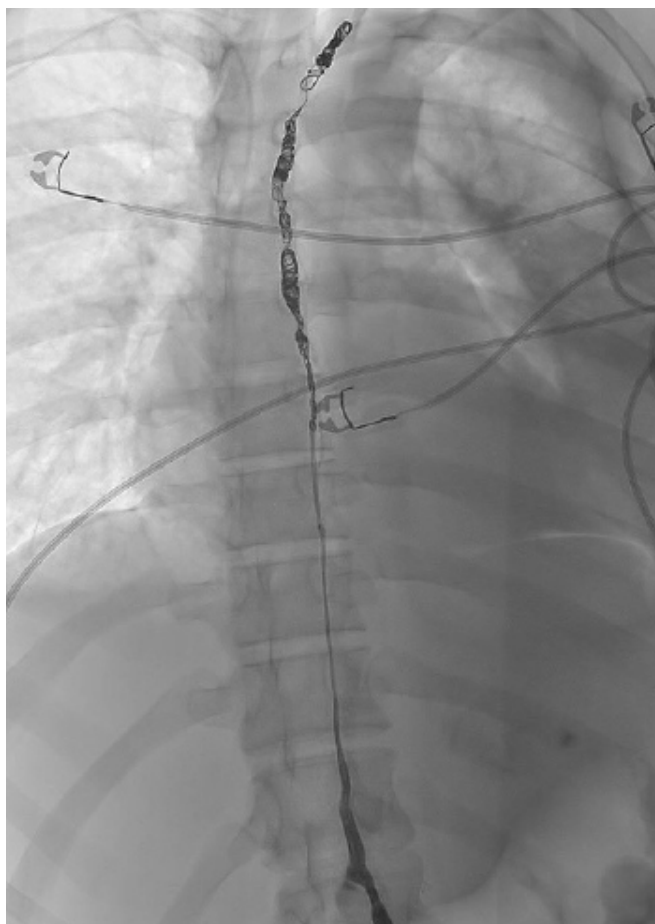
**Figure 8.** Retrograde Microcatheter Access to Thoracic Duct. Published with Permission



**Figure 9.** Repeat Access to Thoracic Duct. Published with Permission



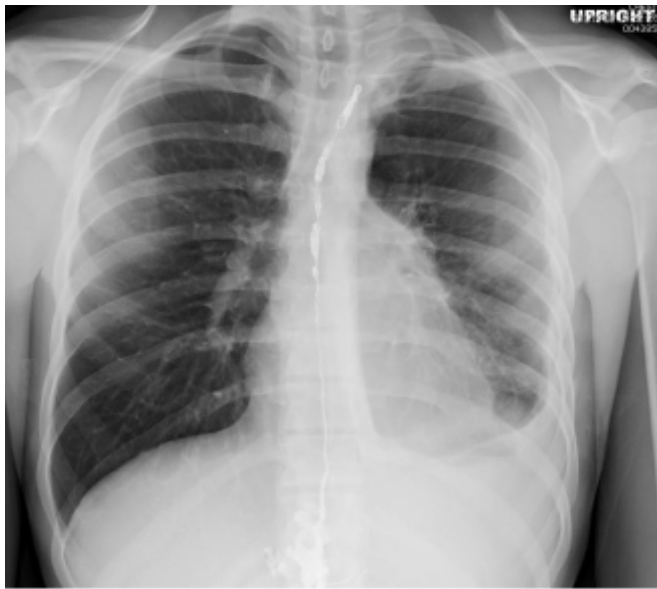
**Figure 10.** Coil Pack Positioned Within Thoracic Duct. Published with Permission





Chest tube drainage demonstrated a declining trend over the subsequent five days (Figure 11). Dietary advancement did not trigger an increase in output. Based on these findings, the chest tube was removed, and the patient was discharged home.

**Figure 11.** Chest X Ray, POD 5. Published with Permission



*Improved left pleural effusion after repeat thoracic duct embolization*

## Discussion

The thoracic duct originates at the cisterna chyli at T12-L2, which receives lymph drainage from the legs, pelvis, and abdomen. The cisterna chyli originates to the right of the aorta, runs cephalad along the right of the vertebral column, enters the thorax through the diaphragmatic hiatus, and crosses to the left at T5-6. It continues cephalad to the left of the esophagus and typically drains into the subclavian vein. Anatomic variations are common, with the typical course being present in 40% to 60% of patients. The thoracic duct can be completely right- or left-sided, duplicated, or plexiform. Variations exist in the point of termination or number of tributaries. The most common point of variation is at the lymphovenous connection, with the thoracic duct draining into the jugular vein, jugulovenous angle, or subclavian vein, through either a single or multiple entry points.<sup>1, 2</sup>

Chylothorax occurs when lymph leaks from the thoracic duct into the pleural space due to traumatic disruption or due to benign or malignant occlusion of the duct.<sup>3</sup> Common causes of traumatic chylous leaks include thoracic, esophageal, and abdominal surgeries. More rarely, traumatic chylous leaks may occur due to penetrating traumatic injury.

The treatment of chylothorax largely depends on the etiology and can be managed conservatively or surgically. Newer management techniques include the use of IR with percutaneous thoracic duct embolization.<sup>4</sup> When deciding if conservative management will be successful or if a surgical approach will need to be employed, data suggest that the chyle drained over 24 hours can be a helpful indicator.<sup>5</sup>

Conservative management consists of a non-to-low-fat diet with medium chain triglycerides (MCT), adequate fluids and electrolytes, total parental nutrition, thoracentesis, pleural drainage, or medications such as somatostatin/octreotide. In a case series by Zabeck et al., 82 cases of chylothorax were analyzed, and conservative management with nutrition alone was successful in 13 (16%) cases.<sup>5</sup> Conservative medical management, VATS, or pleurodesis were successful in 69% of the cases, with the remaining 26 cases (32%) requiring thoracotomy and thoracic duct ligation or repeat surgical procedures.<sup>5</sup>

Thoracic duct embolization has emerged as a minimally invasive alternative to surgery for chylothorax, boasting high success rates and a minimal complication profile. A case series by Itkin et al. reported a 90% success rate with TDE when the thoracic duct was successfully catheterized.<sup>6</sup> However, in cases where TDE fails, surgical intervention remains necessary. This usually entails a thoracotomy with thoracic duct ligation and pleurodesis.

Following failed initial antegrade TDE, repeat embolization via either the retrograde or antegrade approach offers a viable alternative to surgery. Recent studies suggest superior success rates when the retrograde transcervical approach is included alongside the traditional antegrade transabdominal approach for initial cannulation.<sup>7</sup> Mounting evidence from multiple studies supports the retrograde approach as both effective and safe for repeat TDE.<sup>4, 7</sup>

## Conclusion

We report a case of traumatic chylothorax that proved refractory to both conservative management and initial PTDE. Given this treatment failure, we opted for repeat PTDE instead of proceeding with surgical thoracic duct ligation. This repeat intervention successfully achieved resolution of the chylothorax.

## Lessons Learned

If percutaneous embolization is initially unsuccessful for the treatment of chylothorax, it is reasonable to attempt repeat embolization utilizing either retrograde or repeat antegrade access rather than proceeding directly to surgical ligation of the thoracic duct.

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