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Case Report

# Thoracic Duct Embolization Using Direct Hybrid Angiography/Computed Tomography-Guided Cisterna Chyli Access for the Treatment of Chylous Leak Secondary to Partial Glossectomy and Neck Dissection


## Abstract

Thoracic duct embolization (TDE) is a minimally invasive alternative to surgery for the treatment of postoperative chylous leaks that fail conventional medical management. TDE can be a technically challenging procedure that requires real-time image guidance to visualize the thoracic duct. This case report describes using hybrid angiography/computed tomography technology to perform TDE through direct access of the cisterna chyli, potentially eliminating the need for intranodal lymphangiography, and reducing procedure length.


**Keywords:** *Chylous leak, cisterna chyli, hybrid angiography/computed tomography, thoracic duct embolization*


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## Introduction

Thoracic duct embolization (TDE) is a technically challenging and time intensive procedure that relies on the successful cannulation of the TD for direct visualization of chylous leakage and endolymphatic into inguinal lymph nodes followed by a variable waiting period to opacify the cisterna chyli (CC) to facilitate the fluoroscopic puncture. For intranodal lymphangiography, mean transit time until the visualization of target lymphatic is 79 min, with a mean total procedure time of 125.8 min.[1] While techniques have been described to accelerate the transit of ethiodized oil through the abdominopelvic lymphatics (i.e., sequential compression devices), this waiting period often remains the rate-limiting step for the procedure. In this report, we present the use of hybrid angiography/computed tomography (Angio-CT) to perform direct access of the CC for TDE without the need for intranodal lymphangiography.

## Case Report

A 57-year-old male with left tongue squamous cell carcinoma underwent partial glossectomy and bilateral neck dissection. Surgery was intraoperatively complicated by a chylous leak for which a surgical drain was placed in the left neck. Postoperatively, chylous output was >1000 ml/day for 10 days with maximum daily chylous output of 1850 ml despite optimal medical management with total parenteral nutrition and octreotide. Triglycerides were elevated at 285 mg/dL (normal range: 30–149 mg/dL). TDE was performed in a room equipped with an Angio-CT system (Infinix-I 4DCT, Canon, Tustin, CA) using local anesthesia and conscious sedation. Angio-CT incorporates multidetector CT and fluoroscopy into a single unit, making both modalities readily available to the operator. Given this functionality, an initial plan was formulated to perform direct access of the CC using CT without intranodal lymphangiography with ethiodized oil, followed by fluoroscopic access into the TD. Simultaneous access of two inguinal nodes with ethiodized oil was also performed to initiate conventional lymphangiography in the event technical failure with the CT-guided approach occurred.

A diagnostic CT of the abdomen was performed to identify the CC posterior to the aorta and anterior to the L1 vertebral body [Figure 1]. Next, a 22-G needle was used to puncture through



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and through the CC (i.e., Seldinger technique) through a right transabdominal approach under intermittent CT guidance [Figure 2]. Then, under fluoroscopy, the needle was slowly withdrawn while injecting contrast to confirm appropriate needle placement within the CC. An 0.018" wire (GT® wire, Terumo Interventional Systems, Somerset, NJ) was advanced through the needle and positioned within the thoracic lymphatic duct. The needle was exchanged for a 0.018" Quick-Cross catheter (Philips Healthcare, Andover, MA).

Ascending lymphangiography was performed to detect the site of chyle leak [Figure 3]. The TD was subsequently embolized with a combination of one 4-mm and five 6-mm pushable coils (Nester coils, Cook, Bloomington, Indiana), and ethylene vinyl alcohol copolymer [Figure 4]. A completion CT was performed to document the treatment success and confirm the absence of complications. In addition, spot radiographs of the abdomen demonstrated that the ethiodized oil injected through the inguinal lymph nodes had only progressed into the pelvis [Figure 5]. The total procedure time was 125 min with fluoroscopy time of 18 min and air kerma of 252.6 mGy. Postprocedurally, there were no adverse events and output from the patient's cervical drain decreased to <30 ml/day. He was transitioned to tube feeds through his gastrostomy tube before the discharge.

## Discussion

Although direct CT-guided puncture of the CC with sclerosis has been reported, it was described as a method to perform direct CC sclerosis with ethanol due to inability to access the thoracic duct.[2] In the presented case, Angio-CT allowed for both direct access and subsequent catheterization of the CC without ethiodized oil. The availability of CT facilitated noncontrast puncture of the CC while conversion to fluoroscopy allowed for live catheterization of the TD. This expedited the procedure as the process for opacifying the CC is traditionally used to allow fluoroscopic puncture of the CC, which requires a prolonged time for transit of the contrast agent from

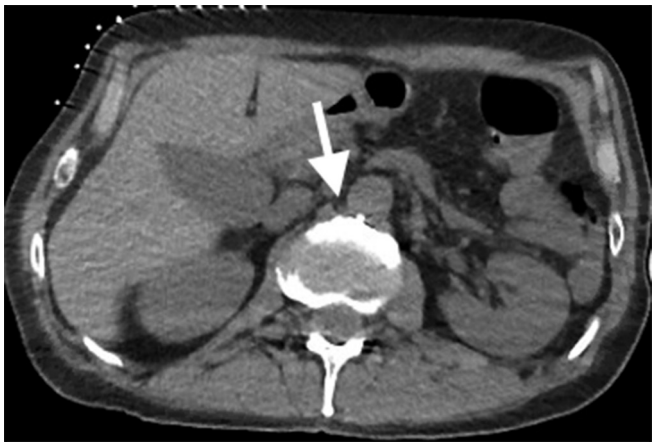

**Figure 1: Diagnostic angiography/computed tomography performed prior to needle insertion to visualize the cisterna chyli (arrow)**

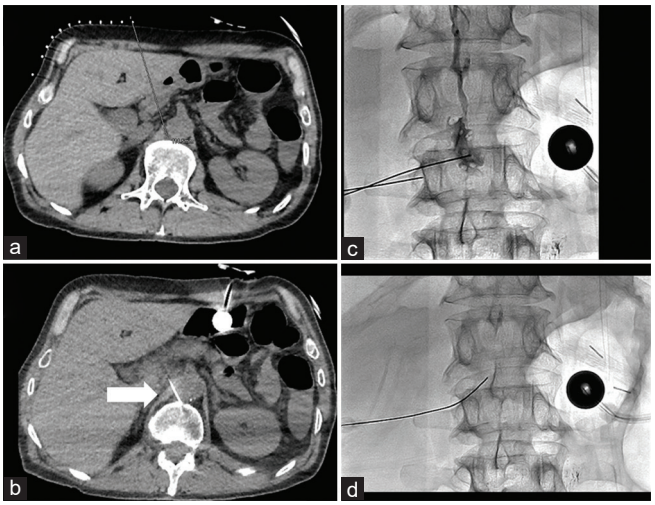


**Figure 2: (a) Localizer function marks trajectory of needle. (b) Real-time computed tomography confirms needle positioning (arrow) and prevents potential collateral injury. (c) Quick transition to fluoroscopy facilitates contrast injection to verify lymphatic access. (d) Wire advanced within the thoracic duct**

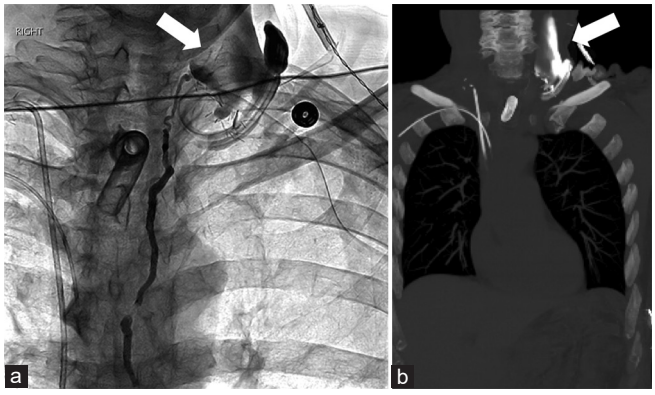


**Figure 3: (a) Fluoroscopy identifies active contrast leakage (arrow) within the cervical thoracic duct with adjacent postsurgical changes. (b) Coronal angiography/computed tomography shows contrast extravasation in the same region of the left neck (arrow), confirming diagnosis of iatrogenic thoracic duct transection**

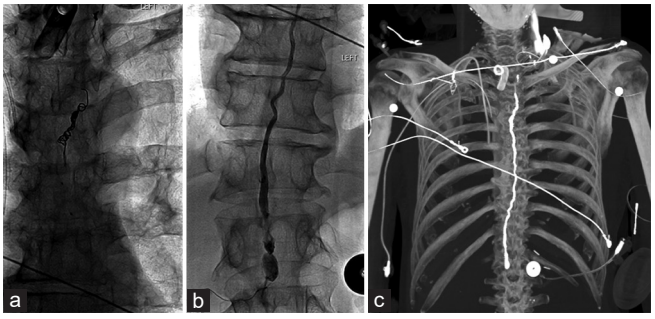


**Figure 4: (a) Thoracic duct embolization performed using micro-nestor coils and onyx.(b) Postembolization lymphangiogram shows stasis of contrast within the lymphatic system with no extravasation.(c) angiography/computed tomography three-dimensional reconstruction verifies successful thoracic duct embolization without complications**


**Figure 5: Radiograph after completion of embolization shows slow migration of initially injected ethiodized oil within the pelvic lymphatic system**

the inguinal nodes through the abdominopelvic lymph chain into the CC.[1,3] This method using Angio-CT may allow the operators to bypass this time-intensive step to directly access the CC for TDE if visible on CT. Other potentially time-sparing methods to access the TD include an endovenous approach through the subclavian vein, and direct retrograde transcervical access using either ultrasound or fluoroscopy.[4-6] However, some of these have met with low-reported rates for technical success.[4,5]

Traditional C-arm fluoroscopy uses cone-beam CT technology to obtain CT such as images, whereas Angio-CT incorporates fan-beam CT technology and inherently has higher contrast resolution, larger field of view, fewer artifacts, and faster scan speeds, making it ideal for complex interventions.[7] This distinction is critical in the discussion of using Angio-CT for TDE, since the cure rate of chyle leak has been shown to be directly related to the ability to catheterize the lymphatic system, with a cure rate of 90% in cases of successful catheterization.[3] In the presented case, the CC was readily visualized and successfully directly cannulated using a 22-G needle under Angio-CT due to rapid, diagnostic quality CT images at the level of interest. Direct puncture of the CC is normally not performed due to its difficulty and associated risk of chyle leakage if done incorrectly.[8] Moreover, precise real-time CT and fluoroscopic needle guidance during CC cannulation prevent injuries related to vascular and nonvascular structures such as inferior vena cava and right renal vein thrombosis and development of perinephric lymphatic collections.[9]

While Angio-CT has shown benefit in interventional oncology, its application for lymphatic procedures is not well described.[7] A limiting factor of its implementation has been its high cost, which is approximately double that of traditional C-arm fluoroscopy.[3] This technique is also dependent on CT visualization of the CC, which has been reported to be seen in only 16% of patients undergoing diagnostic CT examination s.[10] Nonetheless, this report suggests that Angio-CT may have a role to improve the efficiency of TDE for treating postoperative chylous leaks.

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### Conflicts of interest

There are no conflicts of interest.

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