

Intranodal Lymphangiography to Treat Lymphatic Leakage

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Learning objectives

- To define the causes of thoracic and abdominal lymphatic leaks.
- To illustrate the role of intranodal lymphography as a diagnostic and therapeutic tool in lymphatic leaks, including chylous ascites and chylothorax.

Background

Chylous leaks are uncommon conditions resulting from leakage of intestinal lymph (chyle) outside the lymphatic system. The cause can be either traumatic or nontraumatic. Lymphatic leakage can induce local complications, such as infections or delayed wound healing, or cause severe malnutrition. Treatment has traditionally consisted with a combination of low fat enteral nutrition and somatostatin analogs, and/or surgery.

Lymphangiography (LG) is a valuable tool for the detection of various types of lymphatic leakage including chylothorax and chylous ascites. Besides the diagnostic role of identifying the lymphatic leaks, LG plays a therapeutic role for lymphatic leakage.

Findings and procedure details

Chylous leaks can occur anywhere along the pathway of chyle that begins in the intestinal lymphatic ducts and continue through the cisterna chyli (CC) and into the thoracic duct (TD). These leaks result in a diversity of clinical presentations such as chylothorax and chylous ascites, and can induce local complications, or cause severe malnutrition.

A **chylothorax** occurs when lymph fluid from the thoracic duct or its tributaries accumulates in the pleural space. The etiologies of chylothorax can be categorized as traumatic or nontraumatic (Table 1, 2). Malignancy is the leading cause of nontraumatic chylothorax. Patients with a chylothorax usually present with the typical signs and symptoms induced by the mechanical effects of a pleural effusion. A triglyceride concentration greater than 110 mg/dL (1.24 mmol/L) strongly supports the diagnosis and a concentration less than 50 mg/dL strongly suggests that a chylothorax is not present.

Chylous ascites is a milky--appearing peritoneal fluid that is rich in triglycerides. It is due to the presence of thoracic or intestinal lymph in the abdominal cavity. The most common causes in Western countries are abdominal malignancy, lymphatic abnormalities, and cirrhosis, which account for over two thirds of all cases. By contrast, infectious etiologies (ie, tuberculosis and filariasis) are responsible for the majority of cases in developing countries (Table 3). Abdominal paracentesis is the most important diagnostic tool in evaluating and managing patients with ascites. The triglyceride levels in ascitic fluid are critical in defining chylous ascites. Triglyceride values are typically above 200 mg/dL, although some authors use a cutoff value of 110 mg/dL.

The underlying cause of chylous leaks should be addressed whenever feasible. A reasonable initial approach for patients in whom the cause cannot be found or for those who do not respond to treatment of the underlying condition is to recommend a high--protein and low-fat diet with medium-chain triglycerides (MCT). Dietary restriction of long--chain triglycerides (LCT) avoids their conversion into monoglycerides and free fatty acids (FFA), which are transported as chylomicrons to the intestinal lymph ducts. By contrast, MCTs are absorbed directly into intestinal cells and transported as FFA and glycerol directly to the liver via the portal vein. Thus, a low-fat diet with MCT supplementation reduces the production and flow of chyle.

Somatostatin and octreotide have been used successfully to treat chylous effusions in patients with lymphatic leakage due to abdominal and thoracic surgery. The mechanism may involve inhibition of lymph fluid excretion through specific receptors found in the normal intestinal wall of lymphatic vessels.

Computed tomography (CT) of the thorax and abdomen is typically performed in most patients with a nontraumatic chylothorax, looking for mediastinal and retroperitoneal lymphadenopathy or masses, and also lung parenchymal diseases that may provide a clue to the etiology. In the setting of postoperative or traumatic causes of chylous leaks, it also helps in determining the extent and localization of fluid, particularly if there is a suspicion of thoracic duct injury.

Lymphangiography (LG) is a valuable tool for the detection of various types of lymphatic leakage including chylothorax and chylous ascites. Besides the diagnostic role of identifying the lymphatic leaks, recently published reports indicate LG plays a therapeutic role for lymphatic leakage (Fig 1). It was hypothesized that extravascular lipiodol induces a granulomatous reaction that can result in closure of the leak.

Traditionally, lipiodol LG entails a bilateral pedal approach that includes isolation and cannulation of pedal lymphatic vessels followed by infusion of lipiodol. Since Nadolski and Itkin demonstrated the feasibility of intranodal LG as an alternative to pedal LAG in 2013, ultrasound-guided intranodal lipiodol LG from the groin has been tried in some facilities. Because inguinal lymph nodes are easy to be identified under ultrasound guidance, and because isolation of lymphatic vessel will not be necessary, ultrasound-guided intranodal lipiodol LG from the groin has been shown to be a minimally invasive and easily performed procedure.

Lipiodol injection is observed under fluoroscopic guidance to identify the efferent lymphatic or lymph node so as to confirm the proper positioning of the needle. A total volume of 10-20 mL of Lipiodol is injected using the dedicated lymphangiogram pump or, more commonly, an advanced anesthesia injection pump is used at the injection rate of 0.2-0.4 mL/minute. Upward serial fluoroscopic spot images are obtained every 5-10 minutes over the course of Lipiodol injection. Intranodal LG is considered to be technically successful if the target lymph node is successfully selected and the lymphatic channels of interest including cisterna chyli are adequately visualized using Lipiodol.

Lymphangiography not only provides visualization of the lymphatic system and leakage site, but also allows for percutaneous embolization for leakage site through the opacified lymphatic channels. Percutaneous thoracic duct and pelvic retroperitoneal lymphatic duct embolizations for the treatment of chylothorax and chylous ascites are minimally invasive and effective treatment options alternative to surgery. The procedure involves lymphangiography followed by transabdominal needle puncture of retroperitoneal lymph ducts or thoracic duct with cannulation and embolization of leakage point (Fig 2).

Images for this section:

Esophagectomy	31
Lung resection for cancer	29
Coronary bypass	9
Thoracic aneurysm repair	6
Heart transplant	4
Trauma	4
Lung transplant	3
Aortic valve replacement	2
Mediastinal biopsy	2
Mediastinal mass resection	2
Cardiac tumor resection	2
Thyroidectomy	2
Abdominal aortic aneurysm repair	1
Aortic dissection repair	1
Aortic transection repair	1
Back surgery	1
Diaphragmatic hernia repair	1
Mitral valve replacement	1
Neck dissection for cancer	1
Neck dissection for lipoma	1
Patent ductus arteriosus ligations	1
Pericardial surgery	1
Radiation	1
Rib resection for thoracic outlet syndrome	1
Thymomectomy	1
Total	109

Table 1: Causes of Traumatic Chylous Leak.

© Chen, E. and Itkin, M. (2011). Thoracic Duct Embolization for Chylous Leaks. Seminars in Interventional Radiology, 28(01), pp.063-074.

Idiopathic	14
Lymphoma	9
Subclavian vein occlusion	2
Waldenstrom macroglobulinemia	2
Lymphangiomatosis	2
Idiopathic chylopericardium	2
Gorham disease	1
Behcet disease	1

Table 2: Causes of Nontraumatic Chyle Leak.

© Chen, E. and Itkin, M. (2011). Thoracic Duct Embolization for Chylous Leaks. *Seminars in Interventional Radiology*, 28(01), pp.063-074.

Infectious	Filariasis (<i>Whichereria bancrofti</i>) <i>Mycobacterium avium intercellulare</i> Tuberculosis
Neoplastic (common in adult)	Carcinoma (breast, colon, ovarian, pancreatic, prostate, renal, testicular) Carcinoid tumors Kaposi sarcoma Lymphangiomyomatosis Lymphoma
Cirrhosis	
Trauma	
Post-surgical	Abdominal aneurysm repair Dialysis catheter placement Nephrectomy Whipples procedure
Inflammatory	Celiac disease Constrictive pericarditis Pancreatitis Radiation Retractile mesenteritis Retro-peritoneal fibrosis Sarcoidosis Whipples disease
Others	Dilated cardiomyopathy Nephrotic syndrome Right heart failure

Table 3: Causes of chylous ascites in adults.

© Al-Ghamdi, M., Bedi, A., Reddy, S., Tanton, R. and Peltekian, K. (2007). Chylous Ascites Secondary to Pancreatitis: Management of an Uncommon Entity Using Parenteral Nutrition and Octreotide. *Digestive Diseases and Sciences*, 52(9), pp.2261-2264.

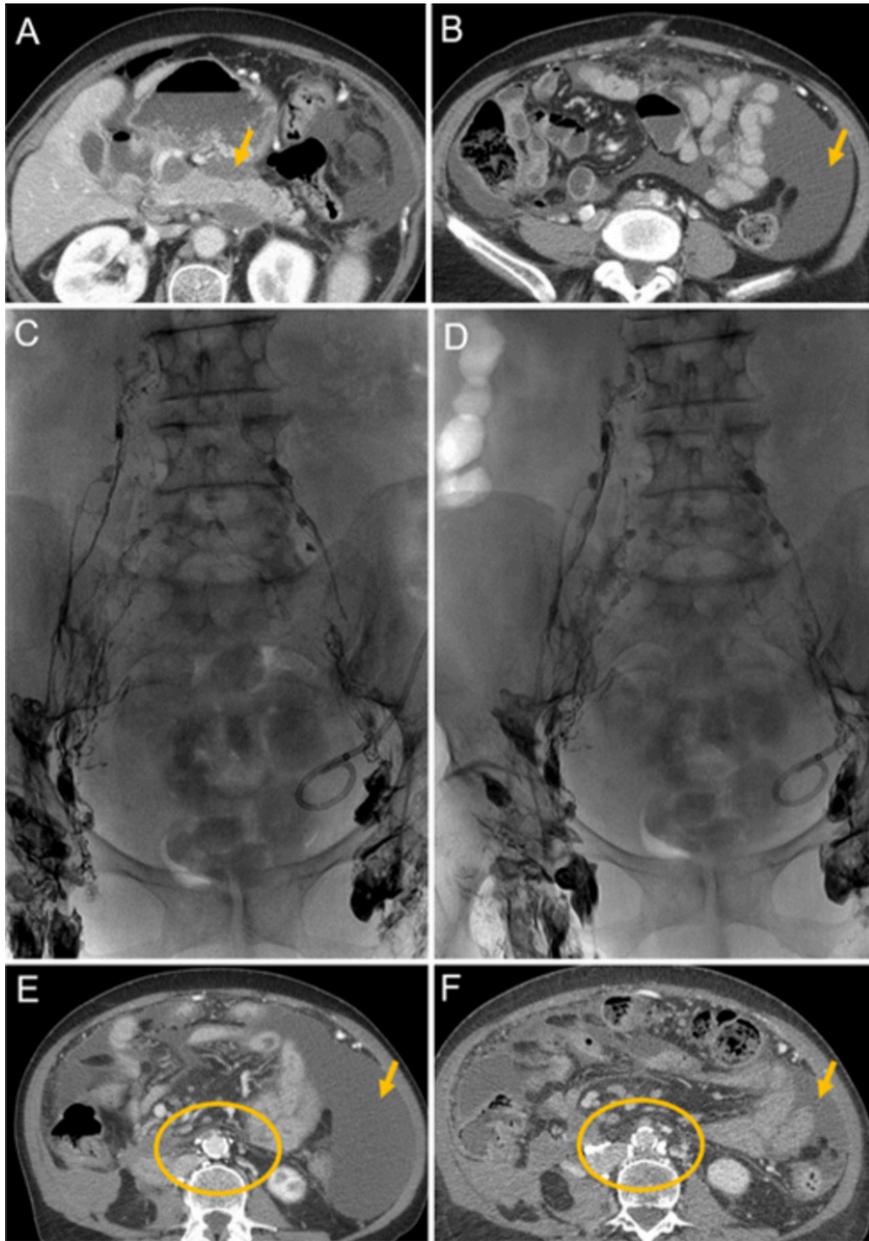


Fig. 1: Chylous ascytes secondary to acute pancreatitis. (A,B) Axial CT images demonstrating peripancreatic walled-off necrosis with associated ascite (arrow). (C,D) After the failure of the conservative measures, LG was performed with lipiodol without evidence of chylos leakage. (E,F) Axial CT images after performing LG and control three weeks later. Note the remnants of lipiodol in the retroperitoneal ganglia (circumference) and the decrease in ascitic fluid (arrows).

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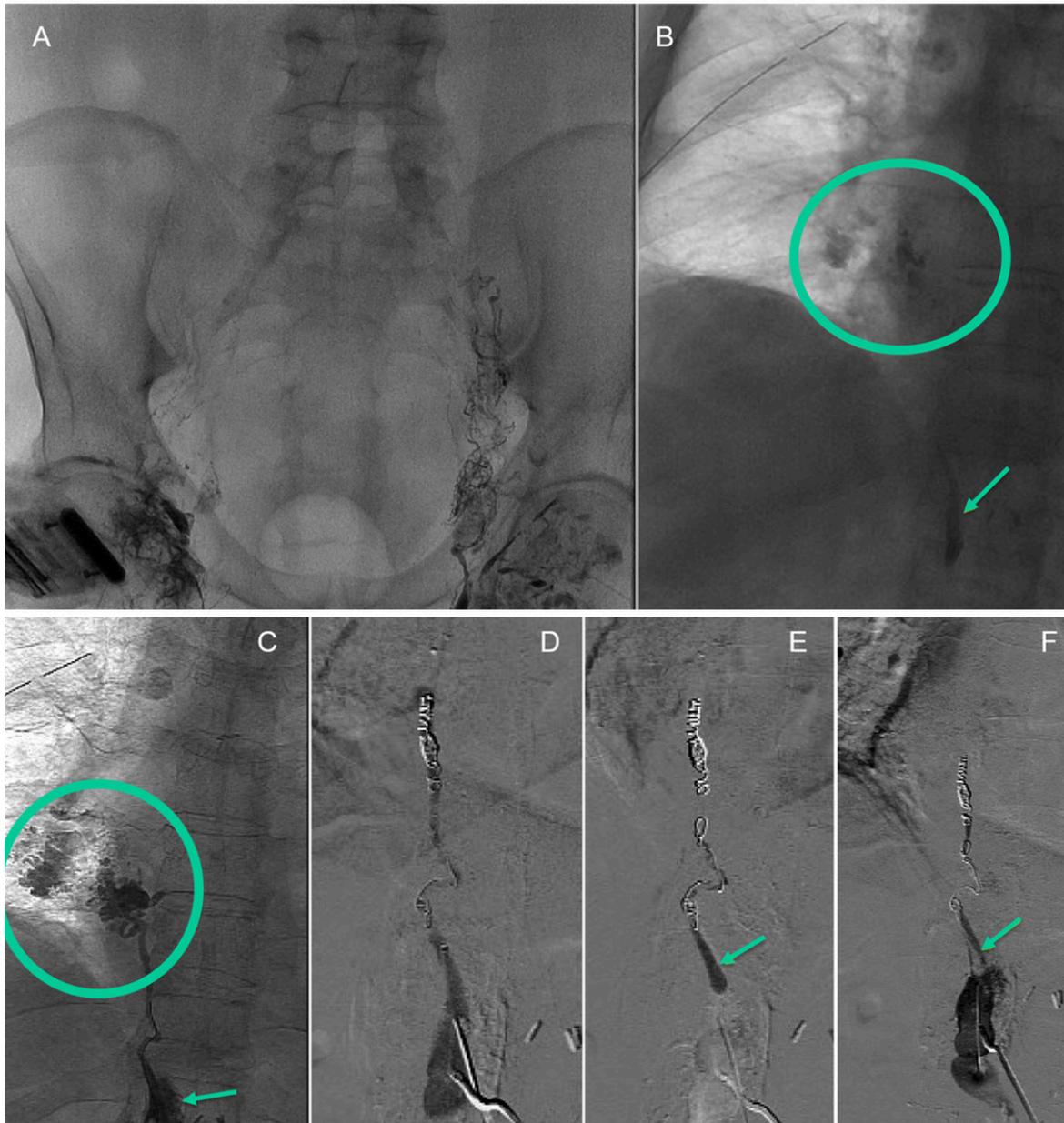


Fig. 2: (A) Ascending nodal lymphography by Lipiodol® injection into bilateral inguinal lymph nodes. (B, C) Pecquet cistern opacification (green arrow) and Lipiodol® leak to right pleural space is seen. (D-F) Embolization of the thoracic duct leak with coils and glue (arrows).

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Conclusion

Lymphangiography in conjunction with thoracic duct embolization is a relatively safe, powerful, and reliable interventional method. It enables identification of lymphatic leakage and provides complete occlusion, which results in complete resolution of one of the most devastating complications of thoraco-abdominal surgery. Due to its minimally invasive nature and its proven effectiveness, the need for reoperation and exposure to perioperative morbidity may be avoided.

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