ELSEVIER

Techniques in Vascular and Interventional Radiology

Lymphangiography for Thoracic Duct Interventions

Michael S. Stecker, MD, and Chieh-Min Fan, MD

Lymph leaks resulting in chylous pleural effusions can be life-threatening. Minimally invasive thoracic duct embolization and disruption have been gaining acceptance as first-line treatment for these leaks. This review discusses the techniques for both pedal and intranodal lymphangiography in detail. It also discusses the use of lymphangiography as a means of targeting a retroperitoneal lymphatic to facilitate thoracic duct interventions for chyle leaks. Finally, outcomes and adverse events pertaining to these thoracic duct interventions are discussed.
Tech Vasc Interventional Rad 19:277-285

KEYWORDS Thoracic duct, Chyle leak, Lymphatic embolization

Noninvasive computed tomography and magnetic resonance imaging has largely replaced lymphangiography for evaluation of lymphatic abnormalities. The ability to perform lymphangiography has largely become an obsolete art, but in recent years there has been a small resurgence of its use for lymphatic targeting for interventional procedures.

Thoracic duct embolization and disruption for traumatic chylous pleural effusions has been gaining acceptance and use as first-line therapy for chylous leaks. These leaks are life-threatening and those demonstrated on lymphangiography are unlikely to close without intervention.[1] The technique has also been employed for nontraumatic chyle leaks. This review describes the technique for lower extremity and abdominal lymphangiography as well as for thoracic duct embolization and disruption.

Clinical Evaluation of the Patient

Indications

In our practice, the usual patient referred for a thoracic duct intervention has undergone recent thoracic surgery complicated by chylothorax. However, nearly every patient referred with a chyle leak is considered for treatment. These patients generally have a pleural fluid output of at least 500 mL/d, pleural fluid triglyceride level of at least 110 mg/dL, and presence of chylomicrons in the pleural fluid. These numbers are not absolutes, as patients who are not taking any nutrition enterally, with or without administration of total parenteral nutrition, and those on a low-fat diet may not meet these criteria, but still may be considered for treatment.

Contraindications

Allergy to any of the agents discussed below would contraindicate performance of lymphangiography. Other contraindications to lymphangiography that may be considered include right-to-left cardiac shunts and severe pulmonary disease, primarily because iodinated oil contrast agent eventually drains into the systemic venous circulation. In addition, radiation to the lungs and mediastinum may predispose to cerebral embolization of iodinated oil contrast agent.[2]

There are very few absolute contraindications to thoracic duct interventions, such as uncorrectable coagulopathy or presence of a lesion that should not be traversed along any potential percutaneous path from the anterior abdomen to the retroperitoneum (eg, abdominal aortic aneurysm). Review of existing or preprocedural cross-sectional imaging is very useful to evaluate for such entities.

Department of Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA.

Address reprint requests to Michael S. Stecker, MD and Chieh-Min Fan, MD, Department of Radiology, Midcampus-340, Brigham and Women's Hospital, Harvard Medical School, Boston, MA 02115. E-mail: mstecker@partners.org, cfan@partners.org

1089-2516/16/$ - see front matter
http://dx.doi.org/10.1053/j.tvir.2016.10.010

Equipment and Agents

Lymphatic Indicator Dyes

Lymphatic indicator dyes are used to identify intradermal lymphatic vessels for targeting during pedal cutdown. Isosulfan blue 1% (Mylan, Rockford, IL) is currently the preferred dye. Others, such as methylene blue (American Regent, Shirley, NY), have also been used in the past.[3]

Iodinated Oil Contrast Agents

Oil-based contrast agents are used for lymphangiography as they stay within the lymphatic system, as opposed to water-based agents that easily leak out. Lipiodol (Guerbet LLC, Bloomington, IN) is the sole iodinated oil contrast material that is available. Caution should be taken when cracking the neck of the glass vial; and because of the high viscosity, a large needle (at least 18 gauge) is needed to aspirate the contents into a polycarbonate syringe.

The dose of iodinated oil contrast agent has been recommended to be limited to 20 mL per procedure in adults to minimize the risk of complications from pulmonary artery oil embolization.[4,5] More has been used without noted adverse events, probably because of the combination of leakage from the thoracic duct injury and subsequent occlusion of the thoracic duct preventing remaining oil from entering the systemic circulation.[3] Nonetheless, the infusion should be stopped as soon as possible.

Embolization Glue

Most interventional radiologists interested in incorporating lymphatic interventions into their practice will already be familiar with use of n-butyl cyanoacrylate (n-BCA) glue (TRUFILL, Codman Neurovascular, Raynham, MA). However, a description of our technique is included here. New sterile gloves are donned before handling any materials pertaining to the glue to avoid contamination with ions that could cause the glue to begin to polymerize prematurely. The entire 1 g of glue is carefully removed from its tube and the iodinated oil drawn up into a polycarbonate syringe. They are thoroughly mixed in a sterile shot glass in a 1:1 to 1:2 ratio by volume of glue to oil, and approximately half the vial tantalum powder is added to increase the radiopacity. The mixture is drawn up into a 3-mL polycarbonate syringe through a large-bore needle. The glue is not mixed until after coil embolization is completed.

Lymphangiography Needle

When using the pedal approach, a lymphangiography needle is required. The only one of which we are aware is the lymphangiography catheter with 30-gauge needle (Cook, Bloomington, IN). It is an approximately 1-cm, 30-gauge needle with a slender 60-cm degradation-resistant tubing attached. It has a female luer lock connector hub at the opposite end (Fig. 1). It is prepared by flushing with normal saline via a 3-mL syringe, which is left attached for subsequent testing after lymphatic cannulation.

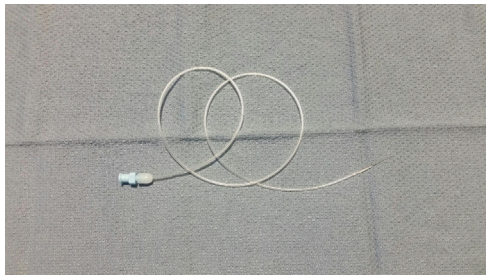

Figure 1 Lymphangiography needle. A 30-gauge needle with 60-cm extension tubing. (Color version of figure is available online.)

Nodal Access System

When using the intranodal approach, a different system is needed, as the lymphangiography needle is far too short.[6] It is very helpful to completely assemble one needle-syringe system for each side, and prime them, before making the nodal punctures (Fig. 2). To construct a needle-syringe system, the trocar is removed from a 25-gauge, 3.5-in. spinal needle. Use of a 25-gauge or smaller needle limits the rate of injection and therefore reduces the risk of extravasation and needle dislodgement.[6] The male end of a 6-in. connector tube with approximately a 0.2-mL volume is attached to the luer lock hub of the needle. The female end of the connector tube is connected to a 3-mL polycarbonate syringe filled with iodinated oil contrast agent. The contrast agent is gently injected to remove the air from the system and prime the tubing.

Thoracic Duct Access System

Any "non-vascular" access kit used for accessing the renal or biliary system can be used. It should have a 15- or 20-cm long 21-gauge trocar needle for ductal puncture. It should also include a triaxial catheter system with a metal stiffener and an inner 2.5-3.0-Fr catheter that mates to an 0.018-in. wire. The outer catheter is too large and can be discarded.

Thoracic Duct Embolization Catheters

Although many different microcatheters have been employed for thoracic duct embolization, our group

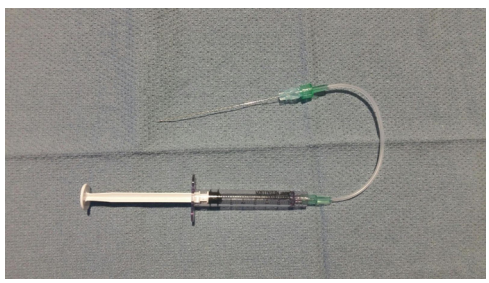

Figure 2 Intranodal needle-syringe access system. The 25-gauge spinal needle is connected to a short connector tube and a 3-mL polycarbonate syringe. (Color version of figure is available online.)