

# Delayed Complications following Technically Successful Thoracic Duct Embolization

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## ABSTRACT

**Purpose:** Thoracic duct (TD) embolization (TDE) has become a universally accepted treatment of chylous pleural effusion. However, the long-term sequelae of occlusion of the TD are unknown. The objective of the present study was to determine the rate of delayed complications after technically successful TDE.

**Materials and Methods:** A total of 169 patients underwent TDE for symptomatic chylous effusion between January 1, 1994, and June 11, 2010. In 106 of 169 cases (63%), TDE embolization was technically successful. Retrospective review of these charts was performed, and patients were interviewed to determine the development of lower-extremity edema, diarrhea, abdominal swelling, and other symptoms.

**Results:** Follow-up information was available in 78 of 106 patients (73.6%). Mean length of follow-up was 34 months. During follow-up, 32 patients (41%) died of causes unrelated to TDE, and 46 (59%) were alive at the end of follow-up. The families of three deceased patients were available for interview. Four of 49 patients (8%) had chronic leg swelling that was probably related to the procedure, three (6%) had abdominal swelling, and six (12%) had chronic diarrhea. In four of these six cases, diarrhea was considered “probably related” to the procedure. Overall, a 14.3% rate of probably-related long-term complications after TDE was recorded.

**Conclusions:** Chronic diarrhea and lower-extremity swelling may be related to TDE and should be part of informed consent before the procedure. A prospective follow-up study is needed to further establish these relationships.

## ABBREVIATIONS

TD = thoracic duct, TDE = thoracic duct embolization

Chylothorax is a leakage of intestinal lymph into the pleural cavity and is a result of traumatic (penetrating or nonpenetrating) or nontraumatic (eg, idiopathic, malignancy, systemic disorders) injury to the thoracic duct (TD). Interruption of the TD by surgical ligation has been safely practiced for many years (1,2). TD embolization (TDE) is a percutaneous intervention to treat chylothorax that represents a less invasive approach compared with surgical TD ligation (3). TDE involves a diagnostic pedal lymphangiogram to identify the TD leak, followed by transabdominal catheterization of the cisterna chyli/TD and embolization of the TD caudal to the leak with glue and/or coils. There is a concern

that blockage of significant flow in the TD could result in complications related to the redistribution of this flow, such as leg swelling and chylous ascites (2,4,5). Development of protein-losing enteropathy has also been demonstrated in experimental studies after TD ligation (6). The objective of this retrospective study was to establish if there are long-term complications after TDE related to obstruction of the TD.

## MATERIALS AND METHODS

Health Insurance Portability and Accountability Act permission and institutional review board approval for this retrospective review were obtained before the study was initiated.

Radiology department electronic records, including radiology information system, quality assurance database (Hi-IQ; ConexSys, Woonsocket, Rhode Island), and examination logbooks were reviewed to identify all patients who underwent TDE between January 1, 1994, and June 11, 2010. Hospital and radiology department electronic information systems were then reviewed to capture laboratory, pathologic, operative, and clinical findings related to the procedure and outcomes from the procedure.

One hundred sixty-nine patients in whom TDE was at-

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**Patient Questionnaire:**

Date of Review:

1. Have you had any new symptoms after the procedure? If yes, when did the symptoms start?
2. Did you have leg swelling after the procedure? If yes, when did the symptoms start?
3. Did you have any abdominal swelling after the procedure? If yes, when did the symptoms start?
4. Did you have stomach problems, such as diarrhea after the procedure? If yes, when did the symptoms start?

**Figure.** Questionnaire for the telephone survey of patients after TDE for the treatment of chylous effusions.

tempted were identified. One hundred six of the 169 patients (63%) underwent technically successful TDE, which was defined as successful embolization of the TD regardless of clinical outcome. These 106 patients formed the cohort of patients we attempted to contact. Follow-up information was available for 78 of these 106 patients (73.6%).

## Survey

The patient database was crosschecked with the Social Security database to identify patients who died during the covered period. The contact information of the study subjects and their referring physicians was acquired through the radiology and hospital databases. An attempt to contact each of the patients who underwent technically successful TDE was performed at least twice. Patients contacted were asked to consent to a telephone survey and then subjected to a standard survey to inquire about their postoperative status (Fig). In cases in which patients reported new-onset symptoms after the procedure, attempts were also made to contact their primary care physicians or specialist providers to see if the symptoms had been managed or worked up.

The symptoms were evaluated and were labeled to be “probably related” or “unrelated” to the TDE. The symptom was labeled as probably related if there were no other causes of this symptom based on consensus of the research team with the input of the clinical team.

## RESULTS

One hundred sixty-nine TDE procedures were attempted between 1994 and 2010. TDE was technically successful in 106 of the patients, and 99 of these technically successful TDE procedures were clinically successful as well, leading to resolution of chylous effusion. Follow-up information was available for 78 of 106 patients (73.6%). Thirty-two patients (41%) died from causes unrelated to TDE, and 46 (59%) were alive after the follow-up period and available for interview. For three of the 32 deceased patients (9.4%), we were able to conduct interviews with family members, bringing the total number of conducted interviews to 49 of 106. This group of patients constitutes our patient population, which consisted of 23 men and 26 women with an

**Table 1.** Causes and Frequency of Chylous Leaks

Cause	Cases
Mediastinal surgery	16
Lung surgery	11
Cardiac surgery	6
Head and neck surgery	6
Aortic surgery	4
Idiopathic	3
Lymphoma	2
LAM	1
Total	49

Note.—LAM = lymphangioliomyomatosis.

average age of 58 years. The causes of chylous leaks in this group of patients are listed in Table 1. Nineteen of 49 patients presented with chylous effusions on the right, 17 with chylous effusions on the left, and seven with bilateral chylous effusions. Six patients had chylous leak after neck dissection. The procedure was successful clinically in 48 of 49 patients (98%). Mean length of follow-up in this group was 34 months (range, 2–134 mo).

Each symptom in each patient was evaluated and was labeled to be probably related or unrelated to TDE (Table 2). Four of 49 patients (8%) reported chronic leg swelling that started after TDE. In all these patients, it was decided that the swelling was probably related to the procedure in view of the absence of other causes.

Three of 49 patients (6%) reported abdominal swelling without evidence of anasarca or ascites. In all these patients, swelling was considered to be unrelated to the procedure. Only one patient described swelling as severe. The other three cases were self-reported as mild to moderate by the patients.

Six patients (12%) experienced chronic diarrhea. In two patients with diarrhea—both after esophagectomy—diarrhea was attributed to the presence of “dumping syndrome” by the patients’ physicians and was considered as unrelated to TDE. In the remaining four cases, diarrhea was considered to be probably related to the procedure because of the onset of diarrhea days or weeks after the procedure. Three of four probably-related cases involved esophageal cancer treated with esophagectomy before TDE. However, none of these patients, nor the involved primary care physicians, attributed the diarrhea to esophagectomy and dumping syndrome. Two of four probably-related cases were in patients evaluated for, and found not to have, protein-losing enteropathy (based on normal serum albumin and protein laboratory values). However, they were included in this group because of the onset of diarrhea close to the procedure. Two of the four cases of probably-related diarrhea were severe and required medication, with one patient reporting daily use of four tablets of loperamide. One of the severe cases and two of the milder cases of diarrhea were tested for protein-losing enteropathy, and the results of testing were negative.

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