Chylothorax in two post-esophagectomy patients treated with percutaneous embolization of the thoracic duct

Lanny Dunham, MD
Stephen Kel Muckleroy, MD
Exempla Saint Joseph Hospital
Denver, Colorado

Objectives

- To describe the current management of chylothorax
- To provide support for treating chylothorax with percutaneous embolization of the thoracic duct as an alternative to surgical ligation
- To present two cases from our institution treated with percutaneous embolization after failing other management
Case #1

- 61 year-old male with distal adenocarcinoma of the esophagus
- Surgery: laparoscopic and thorascopic esophagectomy, pyloroplasty, and cervical esophagogastrostomy, jejunostomy
- Drains: right chest tube, JP in the neck, RUQ Blake

POD #5: 2.5 L from Blake drain
- Increased pleural effusion, dyspnea, oxygen requirement, leukocytosis, and fever
- Blake drain output turned purulent and grew GNR; thus, a pyloroplasty leak was suspected
- POD #6: Taken to OR for revision of pyloroplasty with placement of bilateral chest tubes
- POD #7-10: chest tube and JP drainage increased to 3 L/day
- JP drainage triglyceride level 1275 (nl<110)
Chylothorax

- Caused by injury to the thoracic duct
- Milky pleural fluid with triglyceride level greater than 110 mg/dL
- Chylomicrons in the pleural effusion
- Chylous leak into pleural cavity documented by identifying the leak during surgery for attempted correction or lymphangiography

Chylothorax

- Presents 1 to 2 weeks post op as dyspnea or increasing effusion
- High-output chylothorax has output greater than 1 L/day
- Serious loss of protein, fat, electrolytes, and T lymphocytes
- Mortality as high as 11.8% from sepsis and malnutrition
Chylothorax

- Seen most frequently following esophageal surgery
- Post-esophagectomy incidence 2.7%
- Seen surgically following operations for lung cancer, mediastinal masses, and thoracic aorta aneurysms
- Caused by injury to the thoracic duct

Thoracic duct

- Thoracic duct: 2-4mm in diameter, arises from cisterna chyli in upper abdomen & empties into left jugular or subclavian vein
- Thoracic duct is single duct above T8 but frequently is 2-3 channels below this
- Cisterna chyli is a sac of variable size (2-16mm diameter) and is the easiest target for cannulation but is present in only 50-80% of the population
Chylothorax

- Conservative management: chest tube, TPN, NPO, medium-chain triglyceride diet

- Successful in 28% of patients

- Most successful if output less than 500 mL/day
Surgical management

- Thoracic duct ligation
- Indications: 1.5 L/day for more than 7 days or failed conservative management
- Mortality 2 to 16%
- Surgical failures: thoracic duct frequently is 2-3 channels below T8 and the appropriate branch is not ligated
Additional therapies

- Somatostatin: broad spectrum of inhibitory actions
- Inhibits the secretion of several gastrointestinal hormones as well as GI motility
- Speculated to decrease formation and flow of lymph

Video-assisted thoracoscopic surgery (VATS)

- Clips are applied to the thoracic duct at the aortic hiatus or site of injury
- May also be used for chemical pleurodesis, fibrin glue application, or high-frequency ultrasonic coagulation
- Less invasive with lower morbidity than open thoracotomy
- Conversion to open thoracotomy is often necessary because of difficulty visualizing the thoracic duct due to thick pleural adhesions
Percutaneous embolization of the thoracic duct via the cisterna chyli

- Technique: Inject contrast into the toes to opacify lymphatics in the calf
- Subsequently opacify intraabdominal lymphatics
- Opacification of the cisterna chyli
- Cannulate the cisterna chyli percutaneously via a transhepatic approach
- Identify the thoracic duct leak
- Embolize the leak using coils or liquid embolics

3cc of methylene blue was injected into the web spaces between the right toes to opacify the lymphatics

Cut down was over the lymphatics in the calf and was easily cannulated
Spot radiographs showing migration of ethiodol from leg into pelvis

The thoracic duct could not be visualized. Fluoroscopy over the chest revealed rapid deposition of Ethiodol in the thoracostomy suction drain. The drain was then clamped.
Percutaneous embolization

Radiograph showing the extent Ethiodol ascended into the paravertebral lymphatic structures.

The instrument is pointing to a lymph node and the arrows show an opacified lymphatic vessel.

The thoracic duct became faintly visualized after clamping the drain.

The cysterna chyli was successfully punctured with a 25 cm length/21 gauge Chiba needle but the thoracic duct could not be cannulated.

The duct was embolized via the cisterna chyli with 3cc Onyx followed by 2 cc cyanoacrylate.
Follow up

- Successful embolization POD #12
- Chest tube output was 100 cc/day on POD#13
- Chest tube removed and patient discharge 3 weeks later
- No further recurrence of chylothorax

Percutaneous embolization

- 58 patients over 5 years with chylothorax failing conservative management
- Able to embolize leak in 43 patients (74%) with elimination of the leak and no mortality
- Of the 15 failing embolization, 7 had successful thoracic duct ligation and the remaining 8 died

Case #2

- 74 year-old male with distal adenocarcinoma of the esophagus
- Surgery: transhiatal esophagogastrectomy, cervical esophagogastric anastomosis, pyloroplasty, and jejunostomy
- Drains: bilateral chest tubes

Post operative course

- 6 days post op developed hypotension with signs of cardiac compression
- CT showed mediastinal fluid collection
- Taken to OR for mediastinal exploration with 400cc serosanguineous was removed
Post operative course

- 2 weeks post op: 2 L/day of chest tube output with triglyceride level > 200 mg/dL
- Treated with TPN and antibiotics
- Four weeks post op: Taken to OR for repair of the thoracic duct
- Six weeks post op: Chest tube output 3.5 L/day, dyspnea, and hypoxia

Post operative course

- Underwent transhepatic percutaneous embolization of the thoracic duct
- The thoracic duct was cannulated via the cisterna chyli and embolized with Nester coils
- Chest tube immediately reduced to < 1 L/day
- Discharged home 2 weeks later
Conclusions

- We feel that if conservative management of post op chylothorax fails, the next step should be correction of the leak via percutaneous embolization.
- If successful, it is less invasive with no mortality.
- If this fails, then surgical ligation of the thoracic duct should be considered.

Contributors

Lanny Dunham Jr. M.D. a, Daniel Brown M.D. b, Stephen Johnson M.D. c, Erick Ratzer M.D. a, Shawn Young M.D. d, and Stephen Kel Muckleroy M.D. a

a Department of Surgery- Exempla Saint Joseph Hospital, Denver, CO
b Department of Radiology- Oakwood Hospital and Medical Center, Dearborn, MI
c Department of Radiology - Exempla Saint Joseph Hospital, Denver, CO
d Department of Surgery- Presbyterian/St. Luke’s Hospital, Denver, CO