

Thoracoscopic Ligation of the Thoracic Duct

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ABSTRACT

Objective: When nonoperative treatment of chylothorax fails, thoracic duct ligation is usually performed through a thoracotomy. We describe two cases of persistent chylothorax, in a child and an adult, successfully treated with thoracoscopic ligation of the thoracic duct.

Methods: A 4-year-old girl developed a right chylothorax following a Fontan procedure. Aggressive nonoperative management failed to eliminate the persistent chyle loss. A 72-year-old insulin-dependent diabetic man was involved in a motor vehicle accident, in which he sustained multiple fractured ribs, a right hemopneumothorax, a right femoral shaft fracture, and a T-11 thoracic vertebral fracture. Subsequently, he developed a right chylothorax, which did not respond to nonoperative management. Both patients were successfully treated with thoracoscopic ligation of the thoracic duct.

Results: The child had significant decrease of chyle drainage following surgery. Increased drainage that appeared after the introduction of full feedings five days postoperatively was controlled with the somatostatin analog octreotide. The chest tube was removed two weeks after surgery. After two years' follow-up, she has had no recurrence of chylothorax. The adult had no chyle drainage following surgery. He was maintained on a medium-chain triglyceride diet postoperatively for two weeks. The chest tube was removed four days after surgery. After six months' follow-up, he has had no recurrence of chylothorax.

Conclusions: Thoracoscopic ligation of the thoracic duct provides a safe and effective treatment of chylothorax and may avoid thoracotomy and its associated morbidity.

Key Words: Chylothorax, Thoracic duct, Ligation, Thoracoscopy, Child, Adult.

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INTRODUCTION

Chylothorax can occur spontaneously, in association with malignancy, and most commonly following surgery and trauma.¹⁻⁶ Chylothorax has been reported in cases of blunt and penetrating trauma and as a complication after almost every known thoracic procedure. Postoperative chylothorax is most commonly seen following cardiovascular and esophageal surgery. Chylothorax can be a life-threatening condition because it can cause severe respiratory, nutritional and immunological problems.¹⁻⁷

The presence of chylothorax demands prompt diagnosis and treatment in order to avoid serious complications. Nonsurgical management consists of thoracentesis, chest tube drainage, dietary manipulations and total parenteral nutrition. Surgical treatment is reserved for failures of medical management and consists of thoracic duct ligation and/or ligation of the chylous fistula if one can be identified. Other forms of surgical treatment, such as pleurodesis and pleuraperitoneal shunts, are less popular.¹⁻⁹

In the present report, we describe two cases of persistent chylothorax treated successfully with thoracoscopic ligation of the thoracic duct, in a child and an adult who did not respond to aggressive medical management.

REPORT OF CASES

Case 1

A 4-year-old girl with a single ventricle and tricuspid atresia developed a right chylothorax six weeks after a Fontan procedure. She was initially treated with chest tube drainage and a medium-chain triglyceride diet for two weeks. She did not respond to this treatment and was subsequently managed with fasting and total parenteral nutrition for two more weeks. Despite this treatment, she continued to drain over 400 mL of chyle daily. She was successfully treated with thoracoscopic ligation of the thoracic duct.

Case 2

A 72-year-old insulin-dependent diabetic man was

involved in a motor vehicle accident, in which he sustained multiple rib fractures, a right hemopneumothorax, a right femoral shaft fracture and a fracture of the body of the 11th thoracic vertebra. A right chest tube was initially placed for drainage of the hemopneumothorax. He drained 2 L of serosanguineous fluid daily for the first two days. He was started on a regular diet three days after his injury. Following the introduction of food, he developed massive chylous output, with drainage of 7 L of chyle daily. After the diagnosis of chylothorax was established, he was treated with fasting and total parenteral nutrition. Despite this treatment, he continued to drain over 6 L of chyle daily. The large chylous drainage made his diabetes difficult to control. Because of the failure of conservative management, he was taken to the operating room ten days later. A successful thoracoscopic ligation of the thoracic duct was performed.

Surgical Technique

Preoperative preparation included the administration of oral intralipid. The adult received 50 mL and the child 10 mL by nasogastric tube four hours before surgery. This maneuver facilitated visualization of the chyle leak and identification of the thoracic duct. The procedure was performed with the patient under general endotracheal anesthesia. In the child, a single lumen endotracheal tube was used. The lung was collapsed with the use of carbon dioxide administration at a pressure of 6 to 8 mm Hg. Three 5-mm ports were used: the port positions included the mid-axillary line 5th intercostal space, anterior axillary line 7th intercostal space, and posterior axillary line 7th intercostal space. The latter position allowed for triangulation of the instruments. In the adult, a similar port position was used, in addition to a 12-mm port needed for the introduction of the automatic stapler (Endo TA 30-2.5; U.S. Surgical Corporation, Norwalk, CT). He was intubated with a double-lumen endotracheal tube to allow for left lung ventilation with collapsing of the right lung to facilitate exposure and to avoid the use of carbon dioxide.

The inferior pulmonary ligament was divided. The pleura between the azygos vein and the spine was opened. In the adult, the 11th thoracic vertebral fracture and the leaking thoracic duct at that level were clearly identified. In the child, the thoracic duct was also visualized. The next step was to identify the esophagus. The placement of an 18 oral-gastric tube in the child and a 50 French Maloney bougie in the adult facilitated identification of

the esophagus. The esophagus was retracted anteriorly, and the aorta was identified, with the dissection kept as low as possible in the chest, close to the diaphragmatic hiatus. En masse ligation of all tissue between the azygos vein and the aorta was performed. In the child, four Endoclips were used; in the adult, one single pass of the automatic stapler accomplished interruption of the thoracic duct. A chest tube was applied. The thoracic ports were closed in the usual manner.

RESULTS

In both patients, the drainage significantly decreased following ligation of the thoracic duct. The child developed increasing chest-tube drainage after the introduction of a regular diet five days postoperatively. This drainage was controlled with the use of the somatostatin analog octreotide. The chest tube was removed two weeks after surgery. After two years of follow-up, she has had no recurrence of the chylothorax. The adult ceased to drain chyle immediately following ligation of the thoracic duct. He was started on a regular medium-chain triglyceride diet two days postoperatively; this diet was continued for a total of two weeks. The chest tube was removed four days after surgery. After six months of follow-up, he has had no recurrence of the chylothorax.

DISCUSSION

Postoperative and post-traumatic chylothorax should be suspected whenever a persistent pleural effusion develops following trauma to the chest and thoracic spine and after thoracic surgery, especially cardiovascular and esophageal surgery.¹⁻⁹ Chronic and profuse loss of chyle can produce malnutrition and electrolyte, fluid and acid base imbalance. In addition, it can cause severe immunological compromise because of prolonged T-cell depletion.

The diagnosis of chylothorax should be confirmed by the characteristics of the fluid. The presence of chylomicrons is pathognomonic of chylothorax.^{1,9} Chyle contains long-chain triglycerides. Medium-chain triglycerides are hydrolyzed in the intestine and pass directly into the portal system as free fatty acids.¹ Chyle is usually alkaline and creamy; it is odorless, sterile and bacteriostatic. The specific gravity ranges from 1.012 to 1.025. It contains fat globules that stain with Sudan III. The lymphocyte count varies from 400 to 6800 cells/mL and the erythrocyte count from 50 to 600 cells/mL; the pro-

tein content ranges between 20 to 60 g/L.^{1-3,9}

After the diagnosis has been established, prompt treatment must be instituted. Drainage of the pleural cavity can be done by repeated thoracentesis or most commonly by chest-tube drainage. Supportive treatment with fluid and electrolyte replacement is extremely important. A medium-chain triglyceride diet should be started early; if there is no improvement after one week of diet, then all oral intake should be stopped and total parenteral nutrition should be implemented. If loss of chyle persists, surgical treatment should be considered.

The majority of cases of chylothorax resolve with non-operative management.^{1,2,5,6,9} If no response to such management is seen after two to three weeks, most authors recommend surgery. Surgical treatment is generally recommended in cases in which drainage exceeds 1500 mL per day in adult patients and over 100 mL per year of age daily in pediatric patients for more than seven days.^{1,6-9}

Surgical techniques reported in the literature include parietal pleurectomy, pleurodesis, ligation of leaking lymphatics, pleuroperitoneal shunts, thoracic duct-venous anastomosis and ligation of the thoracic duct.¹⁻¹² Because of our previous clinical experience, we have favored low ligation of the thoracic duct, with mass ligation of all tissue between the aorta and azygos vein just above the diaphragmatic hiatus.¹ Traditionally, ligation of the thoracic duct has been done by open thoracotomy, and perhaps the morbidity associated with a major thoracic procedure has discouraged the timely implementation of this modality of treatment and favored a prolonged period of nonoperative management.

Recent reports have documented the safety and effectiveness of the thoracoscopic approach in the treatment of chylothorax.¹³⁻¹⁶ As demonstrated in the two cases described in the present report, thoracoscopy is a safe and effective alternative in the treatment of chylothorax. It avoids the morbidity associated with a major thoracotomy. In addition, compared to the open procedure, the minimally invasive thoracoscopic approach causes less pain and fosters rehabilitation and faster recovery time.¹³⁻¹⁶

It is possible that use of early thoracoscopic intervention may avoid an unnecessarily prolonged period of nonoperative treatment, thus preventing the excessive morbidity and mortality associated with protracted chylothorax.

CONCLUSIONS

The diagnosis of chylothorax should be established as soon as possible, and nonoperative treatment should be instituted without delay. When nonoperative treatment fails, surgical intervention must be implemented before severe complications of chylothorax ensue. Patients with chylothorax are often debilitated, malnourished, and immunologically depleted and have compromised cardiovascular function. Thoracoscopic ligation of the thoracic duct provides safe and effective treatment and may avoid use of thoracotomy and the problems associated with a major thoracic procedure.

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