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## Case report

## Tension chylothorax following pneumonectomy

Hemang Yadav<sup>a</sup>, Matthew E. Nolan<sup>a</sup>, Francis C. Nichols III<sup>b</sup>, Craig E. Daniels<sup>a,\*</sup><sup>a</sup> Division of Pulmonary and Critical Care Medicine, Mayo Clinic, Rochester, MN, USA<sup>b</sup> Division of General Thoracic Surgery, Mayo Clinic, Rochester, MN, USA

## A B S T R A C T

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Post-pneumonectomy chylothorax is an uncommon complication following surgery, with an estimated incidence of less than 0.7%. Post-pneumonectomy tension chylothorax, where rapid accumulation of chyle in the post-pneumonectomy space results in hemodynamic compromise, is exceedingly rare, with just 7 cases previously reported. All prior cases of tension chylothorax were managed operatively with decompressive chest tube placement followed by open thoracic duct repair. Our case is the first reported tension chylothorax to be managed conservatively by thoracostomy drainage coupled with a period of parenteral nutrition followed by a medium chain triglyceride-restricted diet.

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## Introduction

Post-pneumonectomy chylothorax is an uncommon complication following surgery, with an estimated incidence of less than 0.7% [1]. Post-pneumonectomy tension chylothorax, where rapid accumulation of chyle in the post-pneumonectomy space results in hemodynamic compromise, is exceedingly rare, with just 7 cases previously reported [2–5]. All prior cases were managed with immediate thoracostomy followed by surgery for operative thoracic duct repair. Our case is the first reported tension chylothorax to be managed conservatively by thoracostomy drainage coupled with a period of parenteral nutrition followed by a medium chain triglyceride-restricted diet.

## Case presentation

A previously healthy 60-year-old female was referred for further management of newly diagnosed T2b, N1, M0 (Stage IIb) squamous cell carcinoma of the right lung. Following appropriate preoperative staging, she underwent surgical resection which required pneumonectomy and mediastinal lymphadenectomy. Final tumor stage was IIb (T2b, N1, M0). Post-operative recovery was unremarkable and she was discharged home on post-operative day 4.

On post-operative day 9, she presented to her local emergency room with progressive dyspnea. She denied cough, wheezing, chest pain or fevers. She was transferred to our institution for further management. En route, she had progressive respiratory distress requiring emergency intubation by paramedics. She was directly admitted to the intensive care unit.

On arrival to the intensive care unit she was intubated and sedated. She was hypotensive and tachycardic. The right pneumonectomy wound site appeared to be healing well without evidence of infection. The right thorax was dull to percussion with absent right-sided breath sounds. The cardiac point of maximal impulse was shifted toward the left. There was tracheal deviation towards the left. Cardiac auscultation was normal. There was right lower extremity leg swelling. The remainder of the clinical examination was unremarkable.

A right internal jugular central line was placed, and the initial central venous pressure was 18 cm H<sub>2</sub>O. Laboratory studies revealed several abnormalities including elevated leukocytes ( $26.3 \times 10^9/L$ , with neutrophil predominance), a mild normocytic anemia (hemoglobin of 11.1 g/dL), and creatinine of 1.8 mg/dL (previously normal) with mild hyperkalemia (5.8 mmol/L). Lactate was elevated at 3.7 mmol/L. Troponin was undetectable.

Chest radiograph showed complete right hemithorax opacification. Computed tomography pulmonary angiogram study of the chest showed complete opacification of the right hemithorax with left-shift of the mediastinum (Fig. 1). A moderate left pleural effusion was also noted. There was no pulmonary embolus. Trans-thoracic echocardiogram showed severe biatrial compression, without tamponade, restrictive physiology, or pericardial effusion. Right and left ventricular function was normal by echo. Lower

\* Corresponding author. Division of Pulmonary and Critical Care Medicine, Mayo Clinic, 200 First Street S.W. Rochester, MN 55905, USA. Tel.: +1 (507) 284 2957; fax: +1 (507) 266 4372.

E-mail address: [daniels.craig@mayo.edu](mailto:daniels.craig@mayo.edu) (C.E. Daniels).



**Fig. 1.** CT Chest on admission (post-operative day 9). There is nearly complete opacification of the right hemithorax, exerting significant mass effect on mediastinal structures. There is marked biatrial compression.

extremity ultrasound noted a right distal leg deep venous thromboses.

The patient underwent urgent bedside decompressive chest tube placement. In the presence of bilateral effusions, and to avoid contaminating the right post-pneumonectomy hemithorax, the left chest was initially drained. Pleural fluid was milky white, and had elevated triglycerides of 1729 mg/dL. Following initial decompressive chest tube through the left chest, the patient's hemodynamics and gas exchange rapidly improved. She came off pressors, and was successfully extubated. A diagnosis of tension chylothorax was made. Lymphangiography did not identify a site of thoracic duct leak.

Over the next two days, the volume of left-sided pleural drainage was less than 500 cc/day. With the patient's clinical status improved, left chest tube drainage low, and without obvious right-sided lymphatic leakage, surgical exploration was not indicated. The right chylothorax remained large, and despite the negative lymphangiogram, on-going or recurrent lymphatic leakage remained a concern. Therefore, a pigtail catheter was placed in the right chest with aseptic technique. This stepwise approach was adopted to minimize the risk of introducing infection into the post-pneumonectomy space. To further reduce the chance of developing a post-pneumonectomy empyema, the right hemithorax was irrigated daily with a liter of an institutionally derived antibiotic solution (20 mg gentamicin and 500,000 units of polymyxin B in 1 L of 0.9% sodium chloride solution).

The right-sided chylothorax was felt to be secondary to lymphatic leakage related to the mediastinal lymphadenectomy performed at the time of pneumonectomy. The left-sided

chylothorax was secondary to mediastinal transit of chyle under pressure. The patient was started on complete parenteral nutrition (CPN), and chest tube drainage was monitored. Over several days, chest drain output decreased. On hospital day 10, chest tube fluid output was minimal and serous. The patient was transitioned to a medium chain triglyceride diet. There was no increase in chest drain output. On hospital day 13, the right pigtail catheter removed. The left chest tube was removed the following day and she was discharged home on hospital day 17.

A notable complication of her inpatient stay was a right leg deep venous thrombosis noted on admission. This was initially treated with intravenous heparin. She subsequently developed a pulmonary embolism and was diagnosed with heparin-induced thrombocytopenia with thrombosis necessitating alternative parenteral anticoagulation and the placement of a retrievable inferior vena cava filter. She ultimately discharged home on rivaroxaban.

At four-month follow-up, she was tolerating a regular diet without evidence of recurrent chylothorax. Additionally, she completed her recommended adjuvant chemotherapy.

## Discussion

We report an exceedingly rare case of post-pneumonectomy tension chylothorax managed conservatively by thoracostomy drainage coupled with a period of parenteral nutrition followed by a fat-restricted diet. Following pneumonectomy, it typically takes around 2 weeks for 50% filling of the post-pneumonectomy space, and around 6 weeks for 90% filling. Early rapid filling of the post-pneumonectomy space can raise suspicion for hemorrhage, as

well as excessive lymphatic leakage, particularly when a mediastinal lymphadenectomy has been performed. In contrast to lobectomy or lesser lung resections, there commonly is no chest tube placement following pneumonectomy. Therefore, the milky white characteristic drainage of a chylothorax will not be seen. Additionally, patients often have reduced caloric intake and a lower fat diet in the immediate post-operative period resulting in decreased chyle production. Consequently, patients can leave the hospital prior to diagnosis. If chylothorax is suspected, a diagnostic thoracentesis should be performed. A pleural fluid triglyceride level of greater than 110 mg/dl is highly suggestive of a chylous effusion. Pleural fluid triglyceride level between 50 mg/dl and 110 mg/dl is equivocal and lipoprotein analysis demonstrating the presence of chylomicrons is needed to confirm the diagnosis of chylothorax. Pleural fluid triglyceride levels of less than 50 mg/dl are very unlikely to represent chylothorax [6]. The lipid analysis of the pleural fluid may not be readily available, therefore the appearance of the pleural fluid, particularly if the patient has been on a regular diet, is very important.

The management of post-pneumonectomy chylothorax is initially non-surgical. Chyle production occurs in the small intestine following metabolism of ingested long chain triglycerides (LCTs) into chylomicrons prior to transport into intestinal lymphatics. In contrast, medium chain triglycerides (MCTs) are directly absorbed into the bloodstream. Consequently, substituting dietary LCTs for MCTs, or initiating total parenteral nutrition to bypass the small intestine entirely, results in marked reduction of chyle production. Reduced chyle flow may allow the excessive chyle production from disrupted lymphatics to heal without operative intervention, and LCTs can be gradually reintroduced into the diet. No comparative effectiveness studies have been performed comparing complete parenteral nutrition with an MCT-restricted diet.

In cases refractory to conservative therapy, other options exist. Recent advances with lymphangiographic embolization techniques have resulted in a growing role for thoracic duct embolization in the management of chyle leak. Complication rates are relatively low, and procedure success is estimated at between 70 and 90% [7].

However, the procedure can be technically challenging and is only available in limited centers. Other therapeutic options include surgical thoracic duct ligation and, if there is remaining ipsilateral lung, talc chemical pleurodesis.

In summary, chylothorax development under tension is an exceedingly rare and life-threatening surgical complication. This case highlights that following initial decompressive chest tube insertion, and in the absence of a compelling indication for surgery, a conservative non-surgical approach for tension chylothorax management is an acceptable initial alternative to surgical repair.

### Ethics

This de-identified case report was determined to be exempt from formal review by the Institutional Review Board at Mayo Clinic. The patient gave verbal informed consent to this publication.

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