



Case report

Refractory chylothorax following COVID-19: Successful surgical management of a rare complication; a case report

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ABSTRACT

Introduction and importance: Chylothorax is an uncommon complication linked to COVID-19. The fundamental pathophysiology and most effective management strategy are still uncertain.

Case presentation: A 72-year-old man presented with worsening dyspnea and fatigue one month post-COVID-19. Imaging demonstrated a significant right pleural effusion, with thoracentesis confirming the presence of chylothorax. Despite the implementation of conservative interventions, the effusion remained unresolved. During the right thoracotomy procedure, a 1 cm (about 0.39 in) perforation in proximity to the Azygos vein, encircled by hypertrophic lymph nodes, was identified. Surgical intervention successfully alleviated the symptoms.

Clinical discussion: This case implies that mediastinal lymphadenopathy because of COVID-19 could potentially obstruct and interfere with the thoracic duct. This emphasizes the significance of considering chylothorax as a crucial diagnostic possibility in individuals presenting with new onset pleural effusions following COVID-19. Although conservative approaches are typically the first line of management, persistent cases may necessitate surgical intervention to target the root cause.

Conclusions: Additional research is imperative to elucidate the intricate pathways connecting COVID-19 and chylothorax, as well as to ascertain the most effective diagnostic and therapeutic approaches.

1. Introduction and importance

Chylothorax is characterized by an accumulation of chyle in the pleural space caused by obstructions or disruptions of the thoracic ducts. Chyle, a lymphatic fluid rich in many components, aids in diagnosis by increasing triglycerides or detecting chylomicrons in the pleural fluid [1,2]. Surgical interventions or injuries may cause this infrequent pleural effusion, but malignancies or congenital lymphatic disorders may also cause it [3,4].

Managing chylothorax effectively requires understanding the underlying etiology. Chylothorax symptoms include dyspnea, cough, chest discomfort, weight loss, and fatigue. Notably, chyle's bacteriostatic nature spares patients from fever and chest pain. Long-term complications may manifest as malnourishment, electrolyte imbalances, lymphopenia, hypogammaglobulinemia, and immunosuppression [4].

Diagnosing chylothorax involves analyzing the pleural fluid, which typically looks milky. Gold standard markers include chylomicrons and

TGA < 110 mg/dl. While typical chylothoraxes are present as lymphocytic exudates, atypical presentations as transudates may occur. Imaging techniques such as chest X-rays and CT scans aid in diagnosis, while lymphoscintigraphy and MR lymphangiography visualize the lymphatic system, helping identify chyle leaks [2,5–8].

Management of chylothorax is multifaceted and emphasizes conservative measures initially, including low-fat diets and medium-chain triglycerides. Surgery such as thoracic duct ligation and pleurodesis and interventional radiology such as thoracic duct embolization may be considered in refractory cases. There are factors such as drainage volume and individual patient characteristics that determine the choice between these interventions [1,9].

To highlight the complexities of chylothorax management, we present a case involving a 58-year-old man with a history of recent COVID-19. His gradual onset of dyspnea and fatigue led to a large right-sided pleural effusion. Despite initial suspicion of a pulmonary embolism, imaging confirmed a chylothorax. Surgical intervention emphasizes the

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complexity of diagnosis and treatment [9].

This case serves as a prime example of the significance of adopting a holistic approach towards chylothorax, considering its diagnostic complexities and the array of therapeutic modalities available.

2. Case presentation

A 72-year-old gentleman was admitted to the surgical ward of the hospital, presenting with a primary complaint of dyspnea persisting for 15 days. After a recent COVID-19, the patient experienced dyspnea both during physical exertion and at rest. Upon admission to the surgical department, the absence of fevers or chills was noted. Furthermore, he denied experiencing night sweats, chest pain, palpitations, cough, hemoptysis, nausea, or vomiting. However, he did report suffering from fatigue and weakness the preceding week.

The initial physical assessment unveiled tachypnea (24 breaths per minute), an oxygen saturation level of 89 %, and fever (temperature: 39.2 °C). Upon chest auscultation, diminished breath sounds were noted in the left lung fields, while heart sounds remained within normal parameters.

The patient had a medical background in hypertension and was prescribed insulin for managing diabetes. Significantly, he had been hospitalized and managed in the infectious disease unit of the same medical facility two weeks earlier, where a positive COVID-19 diagnosis was confirmed through PCR testing.

The chest X-ray and CT scan conducted during the patient's COVID-19 hospitalization unveiled a substantial pleural effusion on the right side and extensive ground-glass opacities in the left lung (Figs. 1 & 2). These observations indicated an estimated 75 % lung involvement due to COVID-19.

Subsequently, a chest tube was inserted, draining approximately 500 ml of milky secretions. Analysis of the pleural fluid (Table 1) demonstrated higher glucose levels in the pleural fluid compared to serum glucose, ruling out empyema. Moreover, the pleural LDH levels were lower than serum LDH levels, diminishing the likelihood of malignancy-induced pleural effusion. Noteworthy levels of triglycerides (174) and cholesterol (30) were detected in the pleural fluid. An elevated gold standard is a triglyceride level exceeding 110 mg/dl strongly suggesting the presence of chylothorax, with elevated amylase levels further supporting this diagnosis. A diminished albumin level (0.1 g/dl) provided additional evidence for chylothorax.

Despite initial treatment with total parenteral nutrition and NPO



Fig. 2. In this image from the CT scan, a prominent ground glass opacity is evident in the left hemithorax, while a pleural effusion is visible on the right side of the chest.

Table 1

Analysis of the pleural fluid and serum from a patient exhibiting exudative pleural effusion revealed features of chylothorax.

	Plural fluid	serum
Color	Red, turbid	
Glucose	240	1.8
protein	30	7.5
LDH	450	225
Amylase	22	-
Cholesterol	30	-
Triglycerides	174	-
Albumin	0.1	-

status, the drainage from the chest tube surpassed 800 ml, gradually increasing over 4 days. Considering the unyielding drainage and deteriorating clinical condition, a right thoracotomy was performed to locate



Fig. 1. The X-ray reveals a significant pleural effusion on the right side.

the origin of the milky secretions (Fig. 3). Surgical exploration unveiled a persistent milky discharge and a puncture approximately 1 cm (about 0.39 in) in size near the azygos vein, encircled by numerous lymph nodes. The puncture was repaired, a lymph node biopsy was conducted, and a chest tube was reintroduced.

Sequential examination of the pleural fluid (as outlined in Table 2) revealed a progressive decline in both cholesterol (mg/dl) and triglyceride concentrations. Although the pathological findings were inconclusive, no indications of malignancy were detected.

Remarkably, within a week, the patient experienced substantial amelioration in dyspnea and other symptoms. The cessation of milky discharge ensued, leading to the subsequent removal of the chest tube (Fig. 4).

Upon discharge, the patient was provided with a regimen consisting of clindamycin capsules (to be taken every 8 h) and levofloxacin tablets (500 mg daily), in conjunction with a high-protein, low-fat dietary plan. A chest radiograph conducted one month following discharge validated the full resolution of the pleural effusion.

The work has been reported in line with the SCARE criteria [10].

3. Discussion

Chylothorax, characterized by the accumulation of chyle in the pleural space due to disruption of the thoracic duct, is an infrequent cause of pleural effusion [1,2]. The scenario pertains to a 72-year-old gentleman who, following a recent bout of COVID-19, manifested symptoms of dyspnea and fatigue. Subsequent investigation revealed the presence of chylothorax, which was confirmed via thoracentesis. Surgical intervention via thoracotomy successfully alleviated the symptoms, underscoring chylothorax as a rare complication of COVID-19 warranting surgical intervention.

In a case report by Francesco Satriano et al., a 78-year-old male with confirmed SARS-CoV-2 infection experienced respiratory distress, dry cough, and severe fatigue, with diagnostic imaging showing right pleural effusion identified as chylothorax. The authors propose that SARS-CoV-2 induces a cytokine storm leading to systemic inflammation, arterial and venous vasculopathy, and a prothrombotic state. They suggest thrombosis, especially at the origin of the superior vena cava, may impair lymphatic drainage, implicating the lymphatic system in the disease's progression. The case highlights the unpredictable nature of COVID-19 and its potential impact on the vascular and lymphatic systems, emphasizing the need for further investigations into underlying mechanisms using advanced imaging Techniques [11].

In critically ill patients, inflammation triggers coagulation abnormalities, leading to disseminated intravascular coagulation (DIC) and multiorgan failure [12–14]. Thrombosis, often found in COVID-19 patients, is driven by SARS-CoV-2-induced inflammation, hypoxia, and

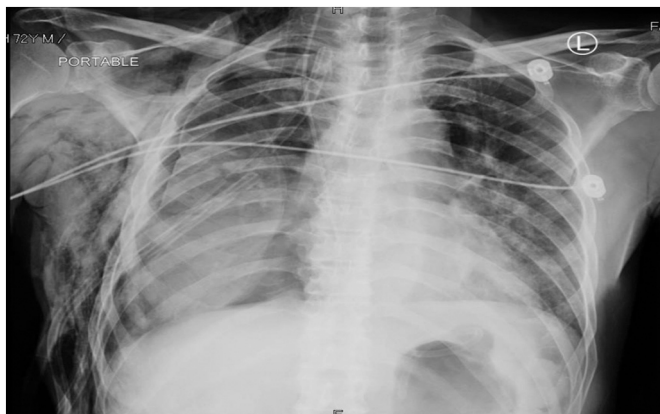


Fig. 3. Chest X-ray displaying a right thoracotomy procedure undertaken to identify the origin of the milky discharge.

Table 2

Successive examination of the pleural fluid exhibited a progressive decrease in cholesterol and triglyceride levels post-surgical intervention.

Plural fluid analysis	2 days after surgery	4 days after surgery
Cholesterol	13	11
Triglycerides	19	10

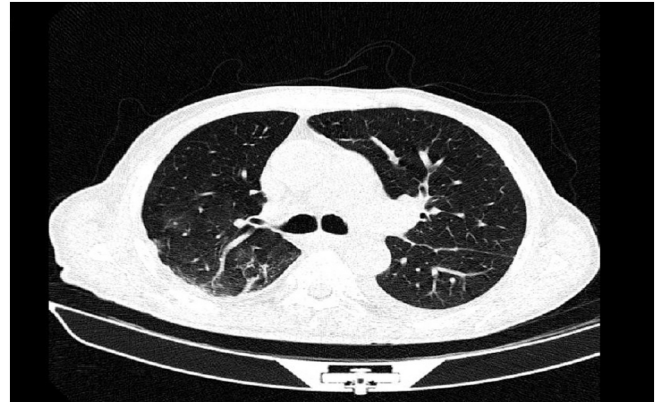


Fig. 4. In this CT scan of the patient, a substantial volume of pleural effusion was drained, following which the chest tube was subsequently removed.

DIC [15,16]. Pulmonary intravascular coagulation (PIC) describes lung-specific clots causing infarction and hypertension [17,18]. Endothelial cells play a key role in this process by contributing to both inflammation and coagulation [19,20]. Additionally, SARS-CoV-2 may activate toll-like receptors (TLR3, TLR4) [21,22], further promoting coagulation, with its spike protein potentially involved in COVID-related coagulopathy [23].

Lymphangiography was not performed before surgery in this case due to the rapid clinical deterioration and the increasing chest tube output, which necessitated urgent surgical intervention. Given the severity of the patient's condition and the high volume of drainage, it was critical to identify and address the source of the chyle leak immediately. While lymphangiography could have provided additional information on the lymphatic system, the need for timely action in this acutely worsening scenario outweighed the potential benefits of a pre-operative imaging study [24].

Regarding thoracic duct embolization (TDE), it is indeed a minimally invasive option that has shown success in recent studies for managing chylothorax. However, the decision to proceed with thoracotomy was driven by the substantial drainage, suggesting a significant leak requiring direct surgical repair. Thoracic duct embolization may not have been feasible given the extent of the chyle leakage identified intraoperatively. Nonetheless, TDE remains a promising technique in cases where the chyle leak is less severe or when conservative management fails. In future cases, especially with earlier detection or slower progression, TDE could be considered as a less invasive alternative [25].

We hypothesize that our patient has developed enlarged mediastinal lymph nodes as a complication of COVID-19. Over time, these inflamed lymph nodes obstructed and ruptured the thoracic duct, leading to chylothorax. This case illustrates a rare but serious consequence of mediastinal lymphadenopathy due to coronavirus. By reporting this, we aim to increase awareness of this potential post-viral complication and its manifestations. Prompt recognition and treatment of chylothorax are important to prevent further morbidity.

Franco Ernesto León-Jiménez et al. reported a 58-year-old man, one-month post-COVID-19, experienced progressive dyspnea and developed right pleural effusion. CT angiography ruled out pulmonary embolism, and thoracentesis confirmed chylothorax. Despite chest tube drainage and total parenteral nutrition, the effusion persisted. Surgical

exploration via right thoracotomy revealed a 1 cm thoracic duct leak, which was repaired, resulting in the resolution of symptoms. This case emphasizes chylothorax as a rare complication linked to recent COVID-19, suggesting inflammation/disruption of the thoracic duct without thrombosis evidence. It underscores the need for alternative diagnoses when pulmonary embolism is ruled out and advocates for multimodal therapies, including surgery, for refractory chylothorax, addressing underlying thoracic duct pathology alongside drainage and nutrition modifications [12].

Furthermore, we observe in our case and most of the cases report that this complication tends to manifest in the elderly. While this observation may not lend itself to statistical analysis, it is worth noting.

In another unique instance, Arthur Bouche, et al. reported a case of a 52-year-old man with follicular lymphoma and recent COVID-19 who developed symptomatic bilateral chylothorax. Imaging revealed left brachiocephalic vein thrombosis. Despite conservative measures, the effusion persisted. The patient underwent minimally invasive endovascular recanalization and stenting of the thrombosed vein using a dual brachial and femoral venous approach. This approach involved passing a guidewire antegrade via the brachial vein and snaring it from the femoral vein to establish access, followed by venoplasty and stenting [13].

In contradistinction to prior instances associating chylothorax with direct COVID-induced thoracic duct pathology, this account delineates chylothorax stemming from central venous thrombosis. Rather than resorting to surgery, the application of endovascular stenting proved efficacious in resolution. The article further characterizes chylothorax as an infrequent, yet severe complication linked to COVID-19, susceptible to inflammatory and prothrombotic processes, thereby warranting multimodal therapeutic strategies, encompassing interventional radiology.

While numerous parallels exist among these cases concerning clinical presentation and diagnostic indicators, the disparities in etiology and therapeutic responses underscore the intricate nature of COVID-19-induced chylothorax. To enhance patient outcomes, a dynamic and individualized approach to diagnosis and treatment is imperative.

In our case, the conservative management primarily focused on total parenteral nutrition (TPN) and NPO status, which is a standard approach for reducing chyle production in chylothorax. Neither pleurodesis nor octreotide was administered during the initial phase of conservative treatment. Pleurodesis is generally considered when conservative measures fail, and our patient showed improvement following thoracotomy and repair of the thoracic duct without the need for additional pleurodesis. Octreotide, a somatostatin analogue that reduces lymphatic flow, was also not utilized in this case as the surgical intervention effectively addressed the underlying ductal leak.

However, both pleurodesis and octreotide are recognized options in the management of refractory chylothorax. Pleurodesis works by causing inflammation and fibrosis of the pleural space to prevent fluid accumulation, while octreotide can reduce chyle output, potentially avoiding the need for surgical intervention in some cases. We chose a direct surgical approach due to the increasing volume of drainage and the patient's deteriorating clinical condition, which warranted immediate repair of the ductal injury. These options are indeed valuable, but in this instance, the surgery was curative.

Moreover, our case underscores the significance of acknowledging chylothorax as a plausible yet uncommon complication of COVID-19. Noteworthy insights encompass contemplating chylothorax within the spectrum of differentials for emerging pleural effusions exhibiting congruent fluid analysis results, even in the absence of conventional risk factors such as trauma or malignancy. To achieve favorable treatment outcomes, heightened awareness, prompt drainage, and the implementation of diverse therapeutic modalities are imperative.

4. Conclusion

This case accentuates chylothorax as an infrequent complication of COVID-19, presumably stemming from inflammatory lymphadenopathy inflicting harm upon the thoracic duct. Timely diagnosis and individualized, incremental therapeutic interventions are paramount, spanning from conservative strategies to surgical interventions or interventional radiology for recalcitrant scenarios. Enhanced awareness and systematic documentation of such instances can propel the progress of our comprehension and handling of this intricate condition.

Ethical approval

An Ethics Committee for the publication of this Case Report was not applicable; however, all management methods were in line with relevant guidelines.

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Author contribution

Dr. Nasrin Rahmani Ju and Dr. Kiana Rezvanfar: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Masoud Saadat Fakhri and Dr. Fatemeh Khosravi: Designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Poorya Gholami Coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content.

Guarantor

Nasrin Rahmani Joo.

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N/A.

Abbreviations

COVID-19 Coronavirus disease 2019
SARS-CoV-2 Severe Acute Respiratory Syndrome Coronavirus 2
CT scan Computed Tomography Scan
LDH Lactic Dehydrogenase
NPO (Nil Per Os) Nothing by Mouth

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Consent to participate

Patient consent was obtained prior to the surgery.

Conflict of interest statement

The authors declare that they have no competing interests.

Data Availability

Data sharing is not applicable to this article as no datasets were

generated or analyzed during the current study.

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