

Lung: Case Report

Treatment of Bronchopleural Fistulas in Coronavirus Disease 2019 With Coils, Glue, and an Amplatzer Vascular Plug



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This case report describes a novel endoscopic approach to manage a bronchopleural fistula (BPF) of a patient with coronavirus disease 2019. A 66-year-old man with multiple comorbidities presented with coronavirus disease 2019 pneumonia that required prolonged ventilatory support, and developed BPFs. Bronchopleural valves caused large pleural airspace and empyema. Lung filling expanded after decortication, but the BPF reoccurred. Medical management and blood patch failed. Surgical options were limited due to the complexity of the BPF and the patient's high surgical risk. The patient's BPF was ultimately treated bronchoscopically with bare-platinum coils, TRUFILL *n*-butyl cyanoacrylate glue (Cerenovus), and an Amplatzer Vascular Plug (Abbott).

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Bronchopleural fistulas (BPFs) are communications between the pleural space and the bronchial tree. They are challenging to manage and associated with high morbidity and mortality rates, prolonged hospital stays, and increased medical expenses.¹ The most common cause is surgical procedures.² Recently, BPFs

have been recognized as a complication of coronavirus disease 2019 (COVID-19) pneumonia.² The prevalence of BPF in cases of COVID-19 is unknown. Proposed explanations for the etiology are excessive use of mechanical ventilation, long duration of steroids, and secondary bacterial infections.³ Because of the severe amount of pulmonary disease associated with COVID-19, BPF in these patients can be extremely challenging to treat.

Treatment options of BPF include surgical procedures as well as medical therapy in the form of endobronchial intervention. Treatment success is variable and depends on the underlying disease and proximity and size of the fistula.¹ Endobronchial intervention can be performed with sclerosis agents, coil and fibril glue, stenting, endobronchial valves, plugs, and blood patches. The complexity of BPFs in severely ill COVID-19 patients makes standard approaches less successful.

We report a case of a 66-year-old man with complicated bilateral bronchopleural fistulas caused by COVID-19 associated with severe bullous disease, empyema, and respiratory compromise, which was successfully treated with a novel use of coils, TRUFILL *n*-butyl cyanoacrylate glue (Cerenovus), and an Amplatzer Vascular Plug (AVP; Abbott).

A 66-year-old man with the past medical history of hypertension, hyperlipidemia, gastroesophageal reflux disease, and anxiety was admitted for acute hypoxic respiratory failure secondary to COVID-19. This admission required oxygen supplementation with a high-flow nasal canula and was complicated by pneumomediastinum and left-sided pneumothorax. These were monitored with serial imaging, and medical management.

A right-sided hydropneumothorax was found 4 days after discharge. The patient was intubated and a chest tube was placed. Owing to a persistent air leak, the patient was transferred. Interventional pulmonology found air leaking from multiple bronchi and placed 2 standard-profile valves within the right lower lobe of the lung. This significantly reduced the air leak, and he was extubated.

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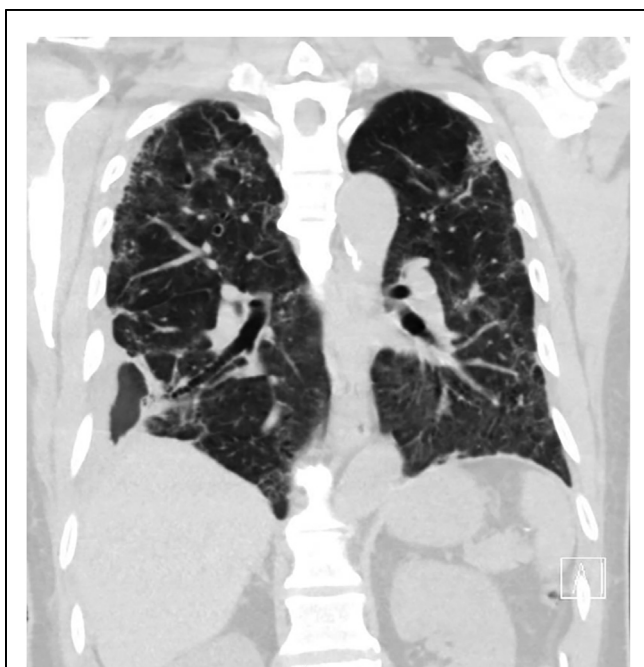


FIGURE 1 Computed tomographic image of bronchopleural fistula tract.

A left-sided pneumothorax occurred 8 days later that required pigtail catheter placement and talc pleurodesis 2 days later. The left chest tube was removed 6 days after insertion because the BPF had healed. The right lung had a significant right hydropneumothorax, which was treated



FIGURE 2 Chest roentgenogram after endobronchial embolization with multiple coils, glue, and an Amplatzer Vascular Plug.

with a chest tube. The patient was discharged to rehabilitation.

The patient presented again 4 days later and was admitted for a right-sided empyema. A chest tube was placed, and thoracic surgery was consulted. Both endobronchial valves were removed, and a right video-assisted thoracoscopic surgery with decortication and lysis of adhesions was performed. The thick fibrous peel was removed from the apex of the right upper lung to the diaphragm of the right lower lung. At the time of surgery, the basilar portion of the right lower lung was densely adherent to the diaphragm and unable to be freed. The lung reexpanded and there was no air leak after the operation.

An air leak of the right lung developed 2 days after the operation with enlarging air space, and a third chest tube was placed.

The patient was treated with chest tubes and antibiotics for his BPF and empyema. The empyema resolved, but the air leak continued. The BPF was thought to be in the right lower lung in the area that was known to be densely adhered to the diaphragm. Conservative management continued, and he was discharged to rehabilitation with 1 chest tube.

Approximately 1 month later, the patient was readmitted with a dislodged chest tube. This was replaced and drained purulent fluid with an air leak. A computed tomographic chest scan demonstrated a right lower lobe BPF and associated pneumothorax (Figure 1).

A blood patch was placed without improvement. Interventional radiology then performed endobronchial embolization using multiple peripheral occlusive devices (POD) packing coils, and glue. There continued to be an air leak in the right lower lobe with multiple collateral airways and no feasible means of occluding.

Talc pleurodesis was used 2 weeks later. The patient had an inflammatory response and severe coughing episodes that caused him to cough out talc fluid and the coils.

Three-weeks later, interventional radiology performed repeat endobronchial embolization of 2 subsegmental peripheral bronchi of the right lower lobe under fluoroscopic and bronchoscopic guidance using multiple POD packing coils and glue. This time an Amplatzer Vascular Plug (AVP), was used to “cap” the bronchi to prevent unraveling of the coils (Figure 2). A postembolization bronchogram demonstrated complete closure of 1 BPF and nearly complete closure of the second subsegment, with no associated air leak.

The chest tube was removed 2 months later, and the patient was discharged the following week. The patient has remained clinically stable and required no additional intervention after 12 months.

COMMENT

We observed a patient with a BPF caused by COVID-19 and report its successful treatment through interventional bronchoscopy with multiple coils, glue, and an AVP after multiple interventions, including surgery, pleurodesis, bronchopleural valves, and coils.

Martinelli and colleagues⁴ found that a pneumothorax develops in ~1% of patients admitted with COVID-19. Specifically in ventilated patients, the rate of barotrauma, for pneumothorax and pneumomediastinum, is 15%.⁴ The lungs of patients with COVID-19 are physiologically small, with low compliance and reduced elastance, similar to patients with acute respiratory distress syndrome.⁵ Pathologic findings of edema, proteinaceous exudates, vascular congestion, and inflammatory changes support this observation.⁶ Therefore, overinflation and elevated positive end-expiratory pressure can cause alveolar damage or rupture in fibrotic and hypoplastic lungs.⁵

In our case report, chest tubes, endobronchial valves, blood patches, and medical management

failed in this patient. The patient was not a candidate for further surgical intervention.

The AVP comes from the family of Amplatzer septal occluders, originally designed for the treatment of congenital heart malformations.^{7,8} The only study reporting treatment of BPF with Amplatzer devices and AVP was done by Fruchter and colleagues.⁸ They had 31 patients with BPF, primarily secondary to surgical intervention, and found that 96% of patients had immediate symptomatic relief after treatment with Amplatzer occluders and maintained this relief at follow-up times.

The treatment of BPFs remains challenging and requires a multidisciplinary approach and novel ideas with thoracic surgery and interventional pulmonology.

In conclusion, we report the successful treatment of a BPF using coils, glue, and a vascular plug, which could be implemented to treat other patients with BPF.

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DISCLOSURES

The authors have no conflicts of interest to disclose.

PATIENT CONSENT

Obtained.

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