



Bronchopleural Fistula as a Complication in a COVID-19 Patient Managed With Endobronchial Valves

Journal of Investigative Medicine High Impact Case Reports
Volume 9: 1–3
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DOI: 10.1177/23247096211013215
journals.sagepub.com/home/hic


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Abstract

Bronchopleural fistula (BPF) is associated with high morbidity if left untreated. Although rare, the frequency of BPF in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is becoming recognized in medical literature. We present a case of a 64-year-old male with BPF with persistent air leak due to SARS-CoV-2 pneumonia treated with Spiration Valve System endobronchial valve (EBV). An EBV was placed in the right middle lobe with successful cessation of air leak. In conclusion, the use of EBVs for BPF with persistent air leaks in SARS-CoV-2 patients who are poor surgical candidates is effective and safe.

Keywords

bronchopleural fistula, endobronchial valve, COVID-19, interventional pulmonology

Introduction

Bronchopleural fistula (BPF) refers to an abnormal communication between the pleural space and bronchial tree.¹ BPF carries a high morbidity of up to 71% if left untreated.¹ Recently, BPFs have been seen as a rare but emerging complication of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection.² We present a case of BPF that was complicated by empyema in a SARS-CoV-2 patient, which was successfully treated with Spiration Valve System endobronchial valve (EBV) after chest tube management of empyema.

Case Description

A 64-year-old man with SARS-CoV-2 pneumonia was transferred to our intensive care unit from a long-term acute care facility where he was treated with recurrent right-sided empyema requiring chest tube thoracostomy. Computed tomography revealed a right middle lobe (RML) BPF and moderate-sized loculated right pneumothorax. After transfer to nursing home and Pleur-evac to -20 cm H₂O on wall suction, a large continuous air leak persisted preventing chest tube removal. Interventional pulmonary was consulted for BPF management. Flexible bronchoscopy was performed to isolate the BPF (Figure 1). On right lung examination, the right chest tube air leak was reduced to approximately 60% to 70% when a Fogarty balloon was passed through the bronchoscope working channel and occluded the RML. Next, a

9-mm Spiration Valve System EBV was placed in the RML airway (Figure 2).

The next day, air leak was still present, but the patient tolerated water seal. Repeat bronchoscopy was performed 1 week later, showing satisfactory positioning of the EBV in the RML and the patient was discharged back to his long-term care facility. Six weeks following the EBV placement, the air leak resolved and the right-sided chest tube was removed. Thirteen weeks following EBV placement, the patient underwent a third bronchoscopy for EBV removal. Valves were removed without complications.

Discussion

BPF is often a complication of necrotizing lung infections, post-lung resection, and chemoradiation therapy.³ Overall BPF mortality ranges between 25% and 71%.³ Complications

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Received February 26, 2021. Revised March 24, 2021. Accepted April 3, 2021.

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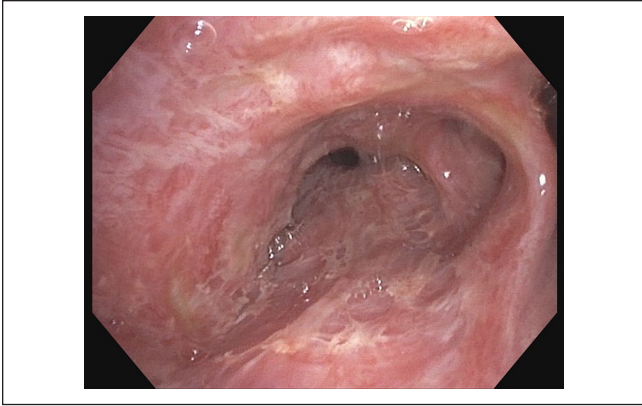


Figure 1. Bronchoscopy revealing friable inflamed right middle lobe.

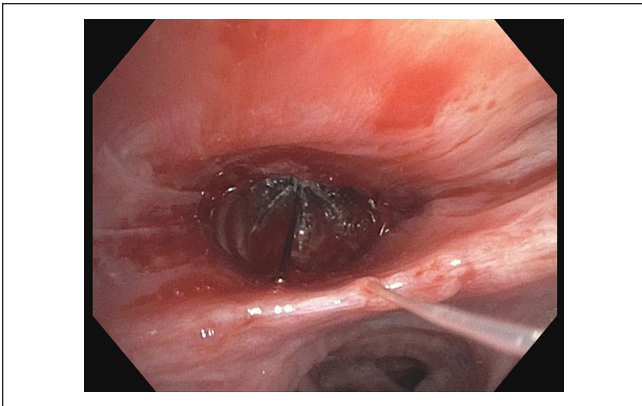


Figure 2. Endobronchial valve deployed in the right middle lobe.

of persistent air leaks include pleural space infection, hypoxia, and incomplete lung expansion.³

Contrast-enhanced chest computed tomography is the imaging modality of choice for diagnosing BPF.⁴ Bronchoscopy is the gold standard in diagnosis and localization of BPF with sequential balloon occlusion to assess location of air leaks in real time.^{4,5} Persistent BPF is usually associated with infection of the pleural cavity, so chest tube drainage and long-term antibiotics are the cornerstones of treatment.⁴ Surgical management is used for large BPFs (>8 mm in size).⁴ Endobronchial intervention is preferred in high-risk surgical candidates to avoid the risk of surgery and for management of smaller fistulas.⁵ Furthermore, patients with BPF from causes other than lung resection, like our patient with SARS-CoV-2 pneumonia, are usually treated bronchoscopically, as surgical closure of a BPF is likely to fail due to friable lung tissue.^{4,5} Additional endobronchial interventions include application of sealing compounds such as glues or autologous blood patch.⁴⁻⁶

To the best of our knowledge, this is the only and successfully treated case of BPF in a SARS-CoV-2 patient treated with EBVs. The use of EBVs for treating persistent BPF

have almost all been studied under the regulation of the institutional review board as humanitarian use devices for persistent air leak.⁷ EBVs work as a one-way valve and are placed in the area proximal to the air leak, resulting in segmental atelectasis, resolution of persistent pneumothorax, and healing of visceral pleural defects.⁷ Currently, EBV placement and management for BPF lacks a standardized approach.⁷ In our patient, the air leak from a visceral pleural defect at the RML decreased after placement of EBV allowing for transition to water seal; however, complete cessation of air leak and chest tube removal was achieved after 6 weeks.

In the era of the coronavirus disease-2019 pandemic, we have yet to foresee the extent and severity of the long-term respiratory complications and the prevalence of BPF in these patients may become more prominent in the near future. It is unclear how BPFs develop in SARS-CoV-2; however, there is now an abundance of case reports documenting cavitory lung lesions in the setting of SARS-CoV-2.⁸ One of the proposed mechanisms for cavitory lesions in the lung, which we believe likely also contributes to BPF development, suggests as supported by the autopsy results is intra-alveolar hemorrhage leading to further necrosis of parenchymal cells.⁹

Conclusion

Bronchopleural fistula is a complication of SARS-CoV-2 infection, and EBV placement is a good choice for patients with persistent air leak despite chest tube placement. We recommend repeat bronchoscopy at 1 week following initial EBV placement if there is persistent air leak in the chest tube to evaluate the valve position. Removal of EBV can be considered after 6 weeks of cessation of air leak.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethics Approval

Ethics approval to report this case was obtained from Valleywise Health Medical Center Institutional Review Board (IRB). The Valleywise Health IRB determined that a single case report, containing only de-identified data, does not produce generalizable knowledge, nor is it an investigation of an FDA regulated product. A case report is considered to be an educational activity, and extent from IRB reviewed based on the Code of Federal Regulations (CFRs) Title 45, Part 46. Date of Exemption: March 10, 2021.

Informed Consent

A written informed consent was obtained from the patient for publication of identifying data.

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