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THE USE OF BOVINE SERUM ALBUMIN AND ZEPHYR ENDOBRONCHIAL VALVES FOR MANAGING A BRONCHIAL-BILIARY FISTULA: A NOVEL APPROACH

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ABSTRACT

Introduction: A bronchobiliary fistula (BBF) is a rare pathological communication between the biliary tract and the bronchial tree. It is most often associated with hepatic tumours, infections or trauma. The diagnosis can be challenging; management strategies vary and include conservative, surgical and endoscopic approaches.

Case description: A 61-year-old woman with metastatic colorectal cancer to the liver –managed with hepatic resections and ablation – presented with progressive dyspnoea and a productive cough. She had a recent history of pyogenic liver abscess treated with antibiotics. A computed tomography (CT) scan revealed a persistent hepatic abscess with a fistulous tract to the right middle lobe. Bronchoscopy confirmed bilious secretions from the right middle lobe. Initial management with endobronchial BioGlue application resulted in temporary improvement; however, recurrence occurred within eight days. A bronchoscopy was then repeated with additional BioGlue applied, and a 5.5 Zephyr endobronchial valve was deployed into the right middle lobe. The proximal orifice of the valve was sealed with BioGlue to ensure occlusion. This combined approach resulted in improved oxygenation and cessation of air leak from the biliary drain. Despite successful fistula closure, the patient succumbed to candida fungemia.

Conclusion: BBF remains a challenging condition with no standardised management guidelines. This case represents the first reported use of BioGlue® in combination with a Zephyr® endobronchial valve for successful endobronchial closure of a bronchobiliary fistula. Our experience highlights the potential of innovative bronchoscopy interventions as minimally invasive alternatives to surgery in select patients.

KEYWORDS

Bronchobiliary fistula, BioGlue, Zephyr valve

LEARNING POINTS

- The differential diagnosis of pneumonia in patients with hepatic malignancy and/or abscess should include bronchobiliary fistula.
- BioGlue® and Zephyr® valves are an option for treating bronchobiliary fistulas.
- Innovative bronchoscopy therapy is an option for treating bronchobiliary fistulas.

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INTRODUCTION

First described by Peacock in 1850, a bronchobiliary fistula (BBF) is a pathologic connection between the biliary tract and the bronchial tree[1]. It is a rare entity, mostly encountered in patients with primary or metastatic tumours of the liver. Other risk factors include infections, biliary tree stenosis or obstruction, and trauma[2]. The hallmark of this disease is the coughing up of bile secretions, also known as biliptysis. Diagnosis is usually established based on imaging studies showing the fistula tract; however, due to the lack of guidelines and standardisation, managing a BBF can be challenging. Therapeutic options include conservative management, minimally invasive procedures or surgical interventions[2]. We report a BBF treated with BioGlue® (Artivion, Inc., Kennesaw, Georgia) and the Zephyr® endobronchial valve (Pulmonx Corporation, Redwood, California) placement.

CASE DESCRIPTION

A 61-year-old female diagnosed with metastatic colon cancer to the liver, managed with wedge resection, microwave ablation and partial hepatectomy all within four years prior to her admission, presented with shortness of breath and a cough productive of yellow phlegm. Three months prior to her admission, she was diagnosed with a pyogenic liver abscess, for which she received a prolonged course of antibiotics.

Her computed tomography (CT) scans revealed persistent hepatic abscess with a formation of a fistulous connection with the right middle lobe, in addition to bilateral ground glass opacities *(Fig. 1)*. A CT scan-guided percutaneous drain of the abscess was placed; however, due to the worsening of her respiratory status, the patient was intubated, and a flexible bronchoscopy revealed bilious secretions in the bronchus intermedius originating from the right middle lobe *(Fig. 2)*. BioGlue® (Artivion Inc., Kennesaw, Georgia) was applied to occlude both segments of the right middle lobe *(Fig. 2)*, resulting in an improvement in the patient's respiratory status and oxygen requirements. Additionally, air was no longer noted in the percutaneous biliary drain. Eight days after the procedure, the oxygen requirements increased again; air was noted in the drain. Another bronchoscopy was performed, and it was noted that the BioGlue® occluding the lateral segment of the right middle lobe had dislodged. Therefore, another layer was applied to fully occlude the right middle lobe again, followed by deployment of a 5.5 Zephyr® endobronchial valve (Pulmonx, Redwood, California). BioGlue® was utilised again to occlude the proximal end of the endobronchial valve *(Fig. 3)* as well. This was followed by improvement of the patient's status and oxygen requirements. However, later during the admission, the patient succumbed to candida fungemia.

DISCUSSION

BBF is usually divided into congenital or acquired fistulas. The mechanisms behind the acquired fistulas are various and depend on the state of the pleural space. Biliary obstruction can lead to the retention of bile, resulting in the formation of a biloma and inflammation in the subdiaphragmatic area, which may subsequently erode the diaphragm, potentially leading to fistulation into the bronchial space. Such obstruction could be due to gallstones, strictures, tumours, iatrogenic or inflammatory conditions[2]. On the other hand, in the absence of biliary obstruction as in cases related to echinococcal or pyogenic abscesses, the lesion itself erodes the liver parenchyma and diaphragm, and – when adhesions are present in the pleural space – eventually the bronchial tree, creating a biliary-bronchial tract.

Biliptysis, defined as coughing up bile, is pathognomonic for BBF, but is not always evident. In addition to the symptoms of the underlying pathology, non-specific symptoms such as fever, jaundice, abdominal pain or chest pain are typically present[2]. Overall, the clinical presentation of the disease varies from a chronic indolent form that mimics recurrent pneumonia to a fulminant acute respiratory distress syndrome (ARDS) picture caused by the disruption of the type II alveolar cell membrane and permeability by bile

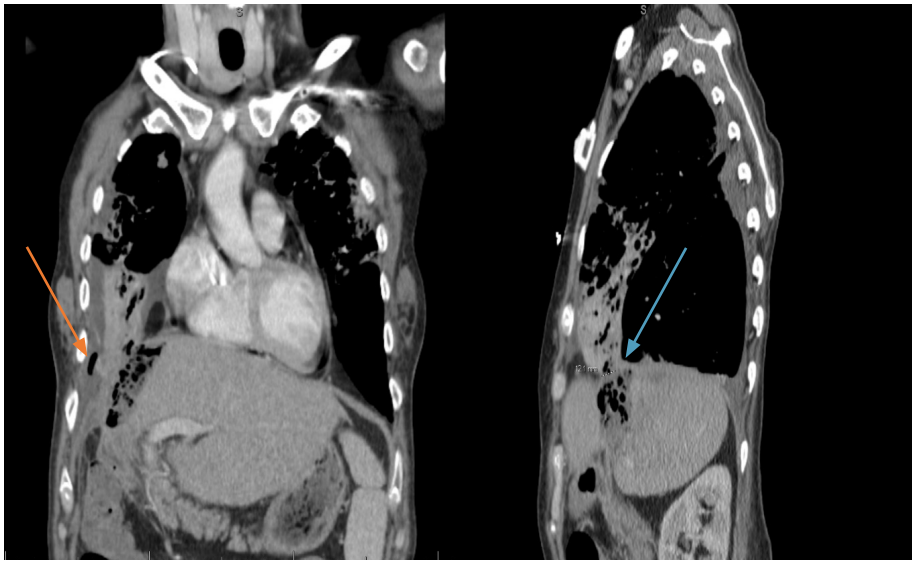


Figure 1. *CT scan showing the bronchobiliary fistula (arrows).*

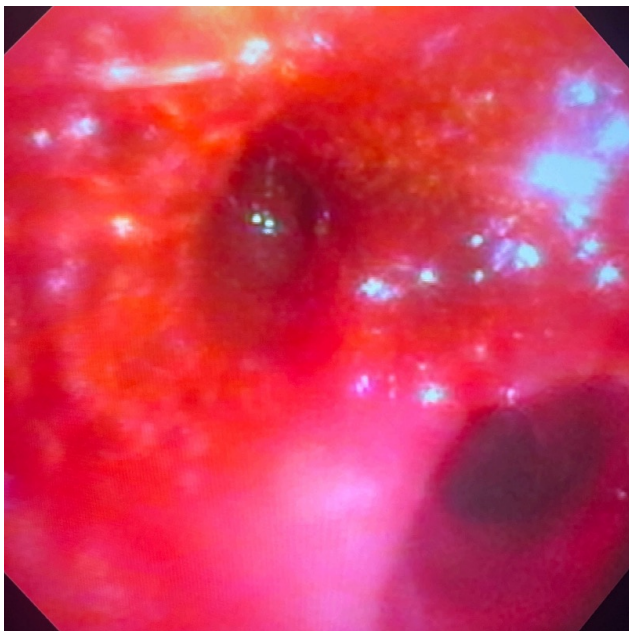


Figure 2. BioGlue® was used to occlude the right middle lobe.

acids, in addition to the destruction of the mucosal barrier and the surfactant layer[3]. Laboratory workup typically reveals an elevated white blood cell count, inflammatory markers and, in cases of biliary obstruction, an elevated bilirubin level.

The diagnosis of BBF requires a high level of suspicion and is usually based on radiological evidence. However, due to the rarity of this entity, there is no consensus regarding the diagnostic approach. Endoscopic retrograde cholangiopancreatography or percutaneous transhepatic cholangiogram are considered the most accurate diagnostic tests[4]. However, a CT scan is usually the first and most commonly used modality. It typically exhibits signs of the underlying hepatic pathology, as well as biliary dilation, bilomas, pneumobilia and, in some cases, the fistula itself. On the other hand, magnetic resonance imaging, including magnetic resonance cholangiopancreatography, has a high accuracy for identifying biliary pathologies and can yield a definitive diagnosis when compared to CT scans. A hepatobiliary iminodiacetic acid scan is another imaging approach that could be utilised to facilitate the diagnosis[5].

For management, non-surgical and conservative measures should be employed if feasible. Most importantly, the biliary tree should be decompressed and the bile drained to maintain low pressure within the fistula, thereby facilitating its healing process. This can be achieved by endoscopic retrograde cholangiopancreatography or a percutaneous transhepatic cholangiogram. In patients who fail conservative management or in those with traumatic BBF, surgical interventions are preferred[2]. On the contrary, there is insufficient evidence to support the sole use of octreotide in managing BBF.

Interestingly, bronchoscopy interventions have been described in managing BBF. Kim et al. successfully embolised a BBF using Histoacryl® under bronchoscopy guidance[6]. Goldman and colleagues successfully obliterated a tract using micro coiling and n-butyl cyanoacrylate via an endoscopic approach[7]. Other reports describe the use of silicone spigots or Amplatzer™ devices[8].

To our knowledge, the utilisation of BioGlue® (Artivion Inc., Kennesaw, Georgia) and Zephyr® endobronchial valves (Pulmonx, Redwood, California) for managing BBF has never been reported in the literature. BioGlue® was FDA-approved in 2001 as an adjunct method to achieve haemostasis during surgical and vascular repair. It is composed mainly of bovine serum albumin in addition to glutaraldehyde, which binds the former molecules to each other and to the organic tissues upon application[9]. On the other hand, Zephyr® endobronchial valves were FDA-approved in 2018 for bronchoscopic lung volume reduction in specific subsets of chronic obstructive pulmonary disease patients with severe hyperinflation of the lungs[10]. After deployment, the one-way valve allows air to escape from the targeted segment while preventing air from entering, leading to atelectasis and volume reduction. In this report, the application of both BioGlue® and a Zephyr® valve with an occluded proximal end successfully obliterated the BBF tract and improved the patient's respiratory status; however, the patient succumbed to candida fungemia.

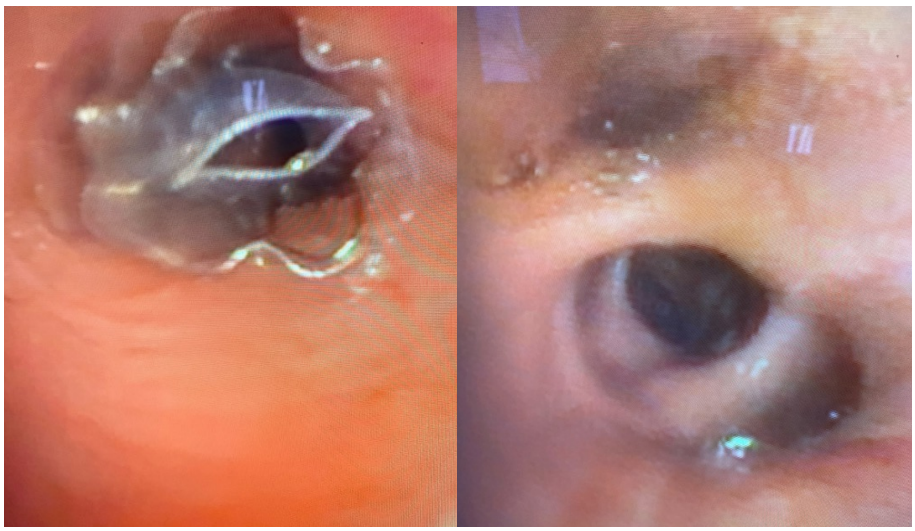


Figure 3. Showing the Zephyr® valve deployed in the right middle lobe (left), followed by BioGlue® application at the proximal end (right) to occlude the lobe.

CONCLUSION

Despite the lack of standardisation and consensus regarding the management of bronchobiliary fistulas, endoscopic approaches are increasingly utilised. This report describes the first endobronchial closure of bronchobiliary fistula using BioGlue® and Zephyr® valves.

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