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Case report

Extracellular matrix fistula plug for repair of bronchopleural fistula

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ABSTRACT

Introduction: Bronchopleural fistula (BPF) is a feared complication of pulmonary resection. Fistula plugs (FP) have been described as an adequate treatment in anorectal disease. We describe our early experience placing an FP in the treatment of BPF.

Materials and methods: We retrospectively reviewed 5 patients for whom a FP was placed for BPF at our institution. Demographic data, initial perioperative information, method and technique of FP placement, and success is reported.

Results: Five patients (4 male, 1 female) with a median age of 63 years (range, 57–76 years) underwent 6 FP placements for BPF. Two patients were post-pneumonectomy and 3 patients post-lobectomy. The median time to presentation following surgery was 118 days (range 22–218). Upon bronchoscopic or operative re-evaluation, 3 patients had successful cessation of their air leak at 0, 1 and 4 days. Two of three patients subsequently underwent a thoracic muscle flap placement to augment healing. One patient had a persistent air leak despite 2 separate FP placements. The air leak stopped with endobronchial valves (EBV) which were deployed proximal to the FP, 9 days after placement of the FP. Another patient had a successful muscle flap placed 80 days after FP placement. There were no complications associated with the FP. Three of five patients were deemed successfully treated with FP placement alone.

Conclusion: In patients with a postoperative BPF and pleural window, placement of a FP had a modest success rate and can be considered as a treatment modality option for BPF.

1. Introduction

A dreaded complication of pulmonary resection is the development of a bronchopleural fistula (BPF), a communication between the bronchus and pleura. The reported incidence is between 1.5 and 28% for a pneumonectomy and about 0.5% for a lobectomy [1]. The mortality rate associated with BPFs ranges from 16–72% [1,2]. Complications associated with BPF are due to loss of sterility of the pleural space via direct communication with the non-sterile airway. BPF is associated with a higher morbidity and mortality, prolonged hospital stay, and higher resource utilization [3]. For these reasons, the swift diagnosis and treatment of BPF is important for patient outcomes.

Pulmonary physicians and thoracic surgeons are tasked with the challenge of treating BPF. Treatment has historically involved re-operation aimed at revisions and reinforcing the bronchial stump. The success rate of surgical closure of BPF has been reported between 80 and 95% [4]. Multiple various bronchoscopic approaches have been attempted as an alternative to surgery [3]. Success rates vary widely, and the lack of consensus suggests that no optimal therapy is currently available. Rather, the current interventions seem to be complementary and indicate that treatment should be individualized [3].

The placement of fistula plugs (FP) is well described in the treatment of anorectal disease [5–8]. For patients with a BPF and a pleural window, the placement of a FP can be used to treat the BPF. A combined bronchoscopic and surgical approach using a FP may serve as a viable alternative to surgery alone. We report our early experience looking at the role of FP placement in the treatment of BPF.

2. Methods

We reviewed the medical records of 5 patients with FP placement for BPF at our institution between March 2016 and March 2017. The Biodesign® Anal Fistula Plug Set (Cook Medical Inc., Bloomington, Indiana, USA) was used. Demographic information, initial perioperative information, method of FP placement, and success was reported. Success of a FP placement for the treatment of BPF was defined as

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Abbreviations

BPF	bronchopleural fistula
FP	fistula plug
ETT	endotracheal tube
EBV	endobronchial valve

complete cessation of the air leak with associated clinical improvement.

2.1. Technique

The placement of the FP was performed via flexible bronchoscopy in the airway with direct visualization from the operative field. A guidewire was advanced through the BPF either antegrade (advanced through the working channel of the bronchoscope, directed through the BPF into the surgical field, and grasped by the surgeon) or retrograde (advanced into the BPF and airway from the surgical field, grasped with forceps through the working channel of the bronchoscope and, pulled out through the lumen of the endotracheal tube (ETT)). Once accomplished, one end of the guidewire exits the BPF through the operative field and the other end exits through the ETT (Fig. 1A). As previously published in another report [9], one end of a suture was tied to the guidewire exiting the ETT. The opposite end of the suture was tied to the FP creating one continuous unit composed of the FP, suture, and guidewire. From the operative field, the continuous unit was pulled through the BPF while being watched simultaneously within the airway lumen bronchoscopically and followed as it is pulled and positioned snug into the BPF (Fig. 1B and C). Within < 24 hours, the plug swells with hydration and enhances its sealing effect.

A soft bristle brush included in the FP kit can be used to intentionally cause mild bronchial mucosa irritation along the BPF tract immediately prior to placement of the FP to promote native tissue ingrowth, healing, and augment BPF closure. We applied this in one patient using an extended sheath through the working channel of the bronchoscope.

3. Results

Five patients (4 male, 1 female) with a median age of 63 years (range, 57–76 years) underwent 6 FP placements for BPF. Two patients were post-pneumonectomy and 3 patients post-lobectomy. The median time to presentation following surgery was 118 days (range, 22–218 days). After placement of the FP alone, 3 patients had complete cessation of their air leak at 0, 1 and 4 days.

One patient had a persistent air leak despite 2 separate FP placements. The air leak stopped with endobronchial valves (EBV) which were deployed proximal to the FP, 9 days after FP placement. Another patient had a successful muscle flap BPF closure 80 days after FP placement.

Two of three patients with complete cessation of their air leak subsequently underwent a thoracic muscle flap placement to augment healing. The third successfully treated patient was able to be weaned off of mechanical ventilation and transferred out of the intensive care unit shortly after FP placement. However, at 27 days post FP placement, he

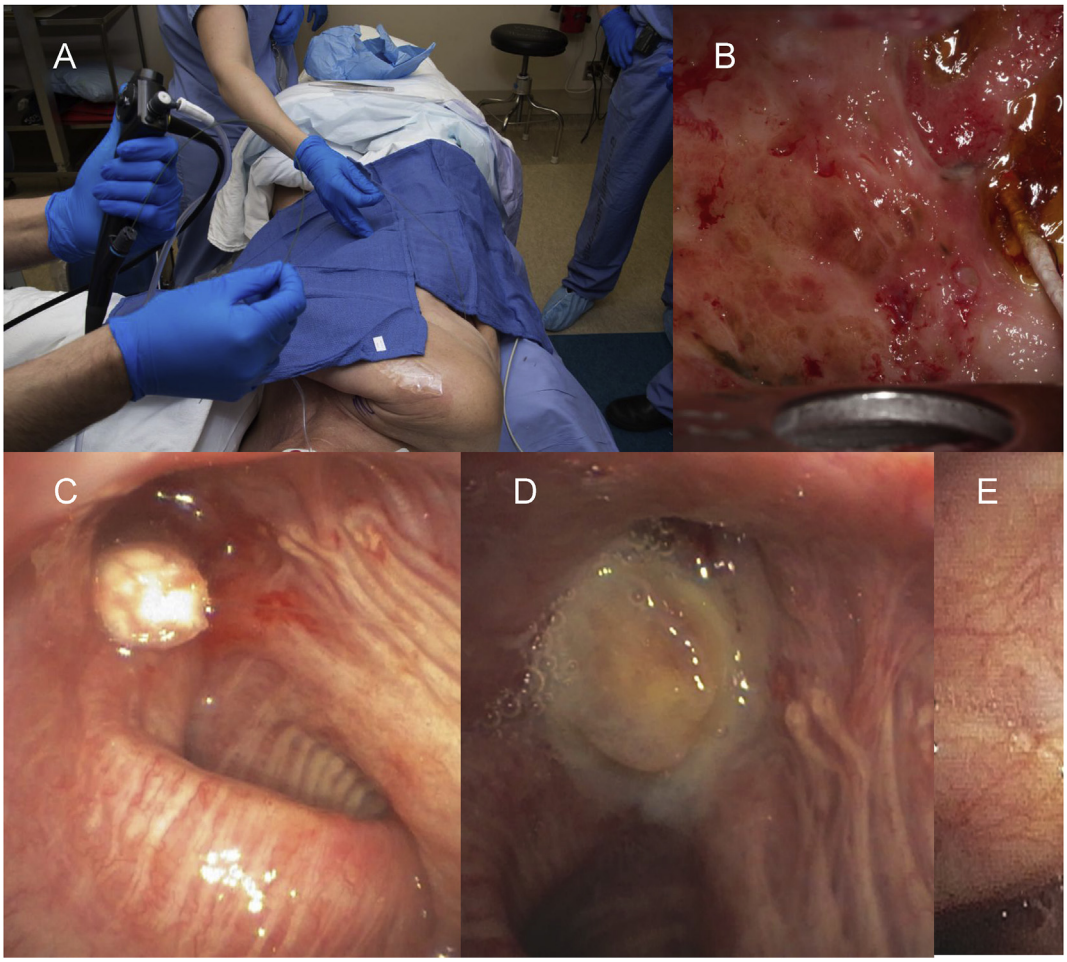

Fig. 1. (A) FP placement via bronchoscopy with direct visual guidance from the operative field. (B) FP placement secured into the BPF with BioGlue. (C–D) Bronchoscopic image of the FP on postoperative days 0, 1, and 28 days, respectively.