does not affect mucociliary clearance and thereby does not foster sputum retention.

CONCLUSIONS

We presented a case of postpneumonectomy BPF closed with a dumbbell-shaped closure device. We conclude that this technique might be a promising option for treating patients who are poor surgical candidates with postoperative BPF.

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EDITORIAL COMMENTARY

Minimally invasive closure of bronchopleural fistulae with novel closure devices: Fantasy or reality?

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Bronchopleural fistulae (BPFs), particularly in patients who have undergone pneumonectomy, remain a substantial, albeit infrequent, thorn in the side of thoracic surgeons. Closure of these fistulae typically requires multiple operations, including open Eloesser-style drainage procedures and subsequent procedures designed to close the bronchial defect and to either obliterate the remaining space with muscle flaps or reduce it with thoracoplasty—operations for which some patients may not be candidates or willing participants. Transpericardial closure of postpneumonectomy fistulae may be helpful, as described by Padhi and Lynn¹ using an anterior thoracotomy approach or as described by Ginsberg and colleagues² via a transsternal approach originally suggested by Mikhail Perelman.³ However, both approaches still require major operations and an adequate length of residual bronchus, which may be absent in many patients undergoing pneumonectomy.

Endobronchial methods to close fistulae have been imaginatively explored for years with minimal success. A

Bronchopleural fistula demonstrating staples eroding through the bronchial wall.

Central Message

Novel closure devices may help reduce the morbidity and mortality from bronchopleural fistulae, particularly in patients undergoing pneumonectomy, but prevention remains key.

See Article page e119.

laundry list of materials and devices have been tried, including lead shots, glues (cyanoacrylate), bioglues, Gelfoam (Pfizer, New York, NY), various modified stents, and endobronchial valves.⁴⁻¹⁰ After the introduction of patent foramen ovale and atrial septal defect closure devices, such as the Amplatzer (St. Jude Medical, St. Paul, Minn) and Occlutech Figulla (Occlutech, Helsingborg, Sweden), reports began surfacing that use these or similar individually constructed devices in the transbronchial closure of BPFs.⁹⁻¹¹ For instance, Fruchter

FIGURE 1. A, Photograph of an individually modified tracheobronchial stent that functions nearly identically to an atrial septal defect or patent foramen ovale occluder. B, Photograph of a postpneumectomy BPF clearly demonstrating intact staples eroding through the bronchial wall. Used with permission by Chae EY, Shin JH, Song HY, Kim JH, Shim TS, Kim DK. Bronchopleural fistula treated with a silicone-covered bronchial occlusion stent. *Ann Thorac Surg.* 2010;89:293-6.⁹

and colleagues¹¹ reported successful closure of BPF in 30 of 31 patients using the Amplatzer devices and vascular plugs. In the current report, Lin and colleagues¹² describe a modified “occluder” that is similar to patent foramen ovale/atrial septal defect occluders and previously reported modified nitinol stents (Figure 1, A); however, they describe a bare metal mid-portion used for better anchoring—a potential benefit. Their fistula was treated with reasonable success, but as is often the case, the patient’s short survival does not allow any solid conclusions about long-term side effects, including bronchovascular or bronchoesophageal fistulae, which may occur when nonabsorbable expanding materials are used in or around the pulmonary hilum.

Clearly, we are inching closer to the real possibility of a reliable endobronchial treatment for BPF, but the key for this devastating problem remains in prevention. Various authors have identified principles that are associated with lower rates of fistula formation, including minimizing stump length and excessive dissection that may lead to ischemia, as well as muscle flaps coverage and avoidance of postoperative ventilation. One additional area of concern is the use of certain stapling devices. The use of staplers that use a standard gauge of wire both on the lung parenchyma and on the bronchus may not be optimal. Much like a Seton suture or wire when placed under tension “pulls through” the rectal sphincter over time, bronchial staplers that use smaller-gauge wire to close large thick bronchial stumps may pull through over time, leading to a BPF. The intact staples seen eroding through the bronchial wall in Figure 1, B suggests that this may occur. Thicker-gauge wire and other stapler modification ultimately may lead to more reliable

bronchial closures and ultimately obviate the need for continued research into devices, such as that reported by Lin and colleagues.¹²

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