



# Innovating customized stents for the treatment of bronchopleural fistula

Oren Fruchter

The Pulmonary and Respiratory Intensive Care Division, Wolfson Medical Center and Tel Aviv University, Holon, Israel

*Correspondence to:* Oren Fruchter. Director, The Pulmonary and Respiratory Intensive Care Division, Wolfson Medical Center and Tel Aviv University, Holon, Israel. Email: orenf@wmc.gov.il.

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*Comment on:* Han X, Yin M, Li L, *et al.* Customized airway stenting for bronchopleural fistula after pulmonary resection by interventional technique: single-center study of 148 consecutive patients. *Surg Endosc* 2018;32:4116-24.

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Central bronchopulmonary fistulae (BPF) are associated with high morbidity and mortality (1,2). They occur as an uncommon, but often severe, complication of surgical procedures involving pulmonary resection, in particular pneumonectomy, with an estimated incidence ranging between 3% up to 28% (3,4). The incidence of BPF following lobectomy is significantly lower (0.5%) (3). The mortality rate associated with BPF ranges from 16% to 72% (3,4). This complication is significantly more common in patients with malignancy, poor nutritional status, and prior chemotherapy or radiotherapy.

Treatment for central BPF includes a range of surgical and medical techniques, chest drains, Eloesser muscle flap, omental flap, transsternal bronchial closure, thoracoplasty, and prolonged antibiotic regimens (3,5). Endoscopic treatment of BPF is based on the delivery of biological glue, coils, covered stents, and sealants to the BPF site (6-12). The degree of success is variable, and depends on, the underlying disease and the proximity and size of the fistulae, with larger fistulae having poor closure rates.

Our group, was among the first to describe our experience in closure of BPF using Amplatzer atrial septal defect (ASD) or patent ductus arteriosus (PDA) devices (13-15). Moreover, we also used Ampazer vascular plugs to occlude small central and peripheral BPF (16).

The use of stents to occlude BPF has already been described (11,12). The major drawback of stents is that in many scenarios the design of the metallic endobronchial

stent does not fit the fistula adequately, and consequently the BPF closure is unsatisfactory.

Han *et al.* (17) describe their experience in occluding post-surgical BPF using customized stents in 148 patients who had pulmonary resection mostly due to lung cancer (68%) or tuberculosis (14%). The median time from surgery (70% right or left pneumonectomy) to stenting was 38 days (range: 0–7 years). The authors designed and patented a series of airway stents for dedicated BPF occlusion. The stent used in each patient was customized on the basis of measurements derived from chest CT, bronchoscopy, and airway radiography (with water-soluble contrast injected via the catheter), if necessary. These covered metallic stents had a bullet head or a special part that served to occlude the fistula. The stents had various shapes, for example, hinged self-expandable covered metallic stent with a bullet head, a Y-shaped, or an L-shaped stent, determined mainly by the shape and length of the BPF. All procedures were performed under conscious sedation using fluoroscopy. Following stent placement the pleural space was evacuated and the chest drain was removed, if possible. Patients were followed up to 7.5 years (range: 1–91 months). Immediate success rate (at 30 days) was impressive—143 patients (96%) had significant improvement in clinical manifestation. In 5 patients initial stent placement was unsuccessful and required additional procedure. In 73 patients (50%), stents were removed following cure of BPF with a mean time to removal of 3 months. During follow-up, 75 patients died, 52% due to

infection and 20% due to underlying malignancy. Of the remaining 67 patients (45%) who survived, about two-thirds (36 patients) had significant pleural cavity obliteration, and the remaining 26 patients had complete closure of the fistula and resolution of the infected pleural space. Success rate (both short and long-term) was mainly determined by the original operation (lobectomy versus pneumonectomy). No major complications were reported, however most patients required additional bronchoscopic interventions for stent maintenance.

Two points deserve special consideration: although the authors briefly describe that in nearly 50% of patients' metallic stents were removed, world literature on this topic is alarming. Removal of metallic stents in the airways is a complicated and tedious procedure (18,19). Although it is feasible [as we (20) and others describe], the procedure is associated with high rate of complications ranging from airway perforation to significant hemorrhage and even death. In the current report only 2 cases of major hemorrhage during stent removal were reported. The practice of temporary stenting for BPF may be better addressed by using easily removed and customized silicone stents, rather than customized metallic stents. The major drawback of silicone stent is that they require rigid bronchoscopy under general anesthesia.

The second point that deserves consideration is that stent placement was performed by interventional radiologists under fluoroscopy without real-time airway inspection. Most experts would recommend continuous bronchoscopic control during airway stenting (for example by small diameter bronchoscope parallel to the stent delivery catheter or within the stent) (21). Real-time endoscopic observation is likely to increase the rate of successful stent deployment and sealing of the BPF and decrease post-placement migration due to incorrect placement.

The manuscript by Han *et al.* is impressive considering the large number of patients and the long-term follow up duration. It is likely to have an impact on the practice and clinical management of this devastating complication of lung resection surgeries.

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### Footnote

*Conflicts of Interest:* The author has no conflicts of interest to

declare.

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