



**RESOLUTION OF A LIFE-THREATENING POST-PNEUMONECTOMY BRONCHOPLEURAL FISTULA ASSOCIATED WITH EMPYEMA**

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**ABSTRACT**

The management of a post-pneumonectomy bronchopleural fistula associated with empyema is still a challenging issue for Thoracic Surgeons. A new multimodal technique is presented: surgical closure of the bronchial stump with a costal cartilage graft covered by a muscular pedicle flap and endoscopic positioning of a fully-covered self-expandable metallic stent.

**Key words:**

Bronchopleural fistula, surgical complications, cartilage, fully-covered self-expandable metallic stent

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**INTRODUCTION**

Post-pneumonectomy bronchopleural fistula (PPBPF) represents a severe complication, with a reported incidence varying from 1.5 to 28% and consequent mortality rates ranging between 18 and 50% (1). The appropriate technique is generally chosen according to the size and the features of the fistula. Several endoscopic therapeutic options have been proposed to close the fistula: fibrin and acrylic glues, demineralized human donor spongiosa sclerosant agents, silver-human albumin complex (2-5). However, none of them have proved able to provide a high success rate when considering fistulas with a diameter >5 mm (1). The treatment of PPBPF larger than 5 mm (range 6-11mm) with the use of airway stents (silicon stent, self-expandable metallic stent and Amplatzer occluder) with variable efficacy have been reported (6-8). However, open surgery is often required for fistulas with a diameter larger than 10 mm or for late PPBPF with empyema.

The standard approach includes the use of autologous muscle/adipose/soft tissue flaps, an open wound thoracostomy and an antiseptic packing, enduring the treatment for several weeks or months (1). Most recent surgical techniques include the debridement of the pleural space followed by the suture of the bronchial stump buttressed with omentum or a muscular flap (9) or closure of the fistula using a matrix seeded with patient-derived mesenchymal stem cells (3).

An original technique for the treatment of a major PPBPF associated with empyema based on a hybrid approach: a combined surgical and endoscopic procedure.

**MATERIALS AND METHODS**

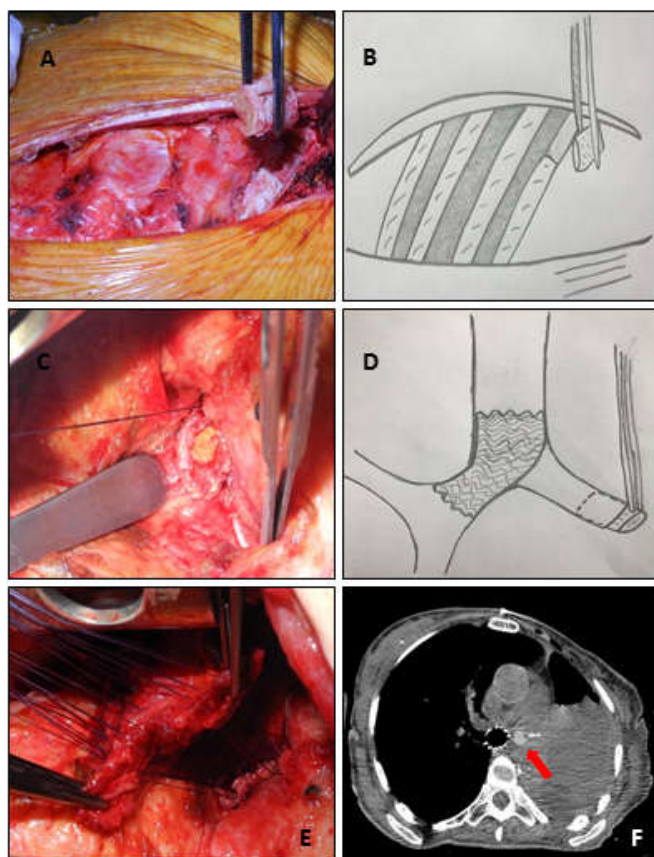
A 67-year-old women, who underwent to a left pneumonectomy for a stage IIB lung adenocarcinoma (pT2b pN1, 2015 WHO classification), presented a CT-scan evidence of major PPBPF with sepsis, empyema and significant weight loss including muscular hypotrophy 78 days after surgery.

The patient underwent to a first-stage urgent surgery performed in the supine decubitus position. Using the Efer-Dumon rigid bronchoscope (Efer Medical, Cedex, France) with the patient maintained in spontaneous ventilation, a conical fully covered self-expandable nitinol stent

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(Tracheobronxane Silmet®, Novatech SA, France) with a proximal diameter (tracheal) of 22 mm, a distal diameter (bronchial) of 16 mm and a length of 50 mm was implanted. The proximal end of the prosthesis was in the lower trachea and the distal end in the main contra-lateral bronchus. The polyester cover of the stent was partially ablated by neodymiumdoped yttrium aluminium perovskite laser (Lokki Lis Laser—Bryan Corporation) leaving intact the nitinol support, in order to allow the ventilation of the right upper lobe (as previously reported) (4). The proximal end of the conical self-expandable stent was fixed to the tracheal mucosa with 5 mm titanium helical tacks. The stent was placed with the aim of excluding the fistula from the airflow and protecting the controlateral bronchial tree from a potential passage of purulent material from the left emithorax.



Afterwards, the patient was turned to a lateral decubitus position, with 90 degrees abducted arm. A redo-thoracotomy was performed on the left fifth intercostal space. A total dehiscence of the left main bronchus with an associated empyema affecting the chest wall muscular plane including the latissimus dorsii muscle was observed. Firstly, a pleural cavity toilette with sampling of the purulent material for the microbiological laboratory test was performed; then debridement of the bronchial stump and drainage of the pleural space was performed associated with an open window thoracostomy, thoracic cavity lavage with a 0.05% sodium hypochlorite solution and a topic treatment with gauzes soaked with antibiotic solution (gentamicin 320 mg, rifamycine 1 g, fluconazole 400 mg) let to fill the entire pleural cavity up to the skin.

A flexible bronchoscopy and a Broncho-Alveolar-Lavage (BAL) associated to a thoracostomy surgical revision with changing dressing was performed every 48 hours.

The patient underwent to a first-stage urgent surgery performed in the supine decubitus position. Using the Efer-Dumon rigid bronchoscope (Efer Medical, Cedex, France) with the patient maintained in spontaneous ventilation, a conical fully covered self-expandable nitinol stent (Tracheobronxane Silmet®, Novatech SA, France) with a proximal diameter (tracheal) of 22 mm, a distal diameter (bronchial) of 16 mm and a length of 50 mm was implanted. The proximal end of the prosthesis was in the lower trachea and the distal end in the main contra-lateral bronchus. The polyester cover of the stent was partially ablated by neodymiumdoped yttrium aluminium perovskite laser (Lokki Lis Laser-Bryan Corporation) leaving intact the nitinol support, in order to allow the ventilation of the right upper lobe (as previously reported) (4). The proximal end of the conical self-expandable stent was fixed to the tracheal mucosa with 5 mm titanium helical tacks. The stent was placed with the aim of excluding the fistula from the airflow and protecting the controlateral bronchial tree from a potential passage of purulent material from the left emithorax.

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## DISCUSSION

PPBPF represents serious life threatening complications that often require redo-operation with high perioperative mortality risk (1).

Experiences with devices that allow to occlude the bronchial stump dehiscence using endoscopic approaches have showed a significant increase in the probability to obtain permanent fistula closure. The endobronchial use of the Amplatzer® occluder, generally employed for the endovascular treatment of interatrial defect, has proved to be one of the most reliable option in this setting (5). Furthermore, also the placement of endobronchial one-way valves has allowed successful treatment of fistula under 1 cm in diameter (6).

The use of airway stents has been reported, principally for PPBPF with variable efficacy (7-8). It has been reported the successful use of conical to obtain a total exclusion of the fistula in a variety of situations related to ischemic damage of the bronchus, either after pneumonectomy or after lobectomy (10).

The case here reported is the first one describing the combined use of fully-covered self-expandable metallic stent, autologous

costal cartilage graft and muscular flap to close a major PPBPF associated with empyema.

The choice of using the costal cartilage to fill into the bronchial stump was due to the thin muscular flap of the patient, affected by muscular hypotrophy. The latissimus dorsi muscle was not used because of its involvement by the empyema. Furthermore, an omentoplasty was not performed because the patient underwent previous abdominal surgery.

In conclusion, a major PPBPF with a total dehiscence of the bronchial stump and empyema in a patient with muscular hypotrophy and previous abdominal surgery could be successfully treated with the proposed multi-modal hybrid approach based on the surgical closure of the bronchial stump with an autologous costal cartilage graft and muscular pedicle flap associated with an endoscopic positioning of a fully-covered self-expandable metallic stent.

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#### Conflicts of Interest Statement

Conflict of interest: none declared.

#### Pictorial Stories

**Figure 1.** Step-by-step surgical procedure. (A,B) The fourth anterior costal cartilage was harvested after the incision of the anterior perichondrium; (C,D) The costal cartilage was filled into the bronchial stump and then grafted; (E) The transposition of the muscular flap was ended by its anchoring with interrupted 4/0 Vicryl suture to the bronchial stump; (F) CT scan showed the costal cartilage (red arrow) and the self-expanding stent in place with complete closure of the fistula and patency of the right main bronchus and the right upper lobe bronchus.

#### References

1. Regnard JF, Alifano M, Puyo P, Fares E, Magdeleinat P, Levasseur P (2000): Open window thoracostomy followed by intrathoracic flap transposition in the treatment of empyema complicating pulmonary resection. *J Thorac Cardiovasc Surg*, 120(2):270-5.
2. Andreetti C, D'Andrilli A, Ibrahim M, Poggi C, Maurizi G, Vecchione A, Venuta F, Rendina EA (2010): Submucosal injection of the silver-human albumin complex for the treatment of bronchopleural fistula. *Eur J Cardiothorac Surg*, 37:40-3.
3. Aho JM, Dietz AB, Radel DJ, Butler GW, Thomas M, Nelson TJ, Carlsen BT, Cassivi SD, Resch ZT, Faubion WA, Wigle DA (2016): Closure of a Recurrent Bronchopleural Fistula Using a Matrix Seeded With Patient-Derived Mesenchymal Stem Cells. *Stem Cells Transl Med*, 5(10):1375-1379.
4. Andreetti C, D'Andrilli A, Ibrahim M, Ciccone AM, Maurizi G, Mattia A, Venuta F, Rendina EA (2012): Effective treatment of post-pneumonectomy bronchopleural fistula by conical fully covered self-expandable stent. *Interact Cardiovasc Thorac Surg*, 14:420-3.
5. Kramer MR, Peled N, Shitrit D, Atar E, Saute M, Shlomi D, Amital A, Bruckheimer E (2008): Use of Amplatzer device for endobronchial closure of bronchopleural fistulas. *Chest*, 133:1481-4.
6. Ferguson JS, Sprenger K, Van Natta T (2006): Closure of bronchopleural fistula using bronchoscopic placement of an endobronchial valve designed for the treatment of emphysema. *Chest*, 129(2):479-81.
7. Datau H, Breen DP, Gomez C, Thomas PA, Vergnon JM (2011): The integrated place of tracheobronchial stents in the multidisciplinary management of large post-pneumonectomy fistulas: our experience using a novel customised conical self-expandable metallic stent. *Eur J Cardiothorac Surg*, 39(2):185-9.
8. D'Andrilli A, Andreetti C, Menna C, Rendina EA (2017): Successful endoscopic treatment of severe ischemic damage of the bronchus. *J Thorac Cardiovasc Surg*, pii:S0022-5223(17)30419-1.
9. D'Andrilli A, Ibrahim M, Andreetti C, Ciccone AM, Venuta F, Rendina EA (2009): Transdiaphragmatic harvesting of the omentum through thoracotomy for bronchial stump reinforcement. *Ann Thorac Surg*, 88(1):212-5.
10. Menna C, Poggi C, Ibrahim M, D'Andrilli A, Ciccone AM, Maurizi G, Cassiano F, Baccarini AE, Massullo D, Venuta F, Rendina EA, Andreetti C (2017): Coated expandable metal stents are effective irrespective of airway pathology. *J Thorac Dis*, 9(11):4574-4583.

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