

Bilateral self-expandable metallic stents for lung cancer involving the carina

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Keywords

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Introduction

Central airway obstruction is categorized in oncologic emergency, which is critical for patients with cancer and requires interventional modalities. Malignant carinal involvement is one of the most challenging scenarios requiring rigid bronchoscopic intervention under general anesthesia. However, these patients tend to be in poor condition for the strategy.

This report clarifies the less invasive strategy for such a patient, successfully treated by bilateral self-expandable metallic stents (SEMSs) using fiberoptic bronchoscopy (FOB) under topical anesthesia. Although several reports of SEMS for the salvage of one mainstem bronchus exist, this is the first report of bilateral SEMSs by “side-by-side” methods to salvage the malignant carinal involvement.

Case Report

A 91-year-old male patient with lung cancer (squamous cell carcinoma) complained of dyspnea and hemoptysis.

Abstract

Central airway obstruction needs interventional pulmonology and malignant main carinal involvement is one of the most challenging scenarios requiring rigid bronchoscopic intervention under general anesthesia. However, these patients tend to be in poor condition for such interventions. A 91-year-old male patient with lung cancer accompanied by obstructive pneumonia underwent an Ultraflex self-expandable metallic stent placement in the right mainstem bronchus. The extranodal extension of the carcinoma from mediastinal lymph nodes metastases to the carina was so fast that severe stenosis of the bilateral mainstem bronchi was observed 6 weeks later accompanied by the deterioration of dyspnea. To salvage the carina, bilateral Ultraflex covered stents were placed by “side-by-side” method using fiberoptic bronchoscopy under topical anesthesia. This strategy was quite safe and the time needed for the entire procedure was within 20 min. He never experienced dyspnea thereafter and died of a cardiac sudden death 7 months after the initial stenting.

Chest X-ray and computed tomography (CT) demonstrated a lung mass in the right upper lobe with hilar and mediastinal lymph nodes metastases causing severe stenosis of the right mainstem bronchus (RMB) accompanied by obstructive pneumonia. Since systemic administration of antibiotics was not effective and his general condition was not tolerable enough for rigid bronchoscopy such as laser treatment, mechanical debulking, and silicone stenting (including the Dumon-Y stent) under general anesthesia, SEMS (Ultraflex covered stent, 14 mm in diameter, 4 cm in length, distal release, Boston Scientific Corporation, MA, USA) was placed in the RMB. However, the tumor spread was so fast that chest X-ray, CT and FOB (Fig. 1) demonstrated the severe stenosis of the RMB, the lower trachea, and the orifice of the left mainstem bronchus accompanied by the deterioration of dyspnea 6 weeks later. Since the SEMS already placed in the RMB was an obstacle for the safe intervention by laser or electrocautery, to salvage the carina, bilateral Ultraflex covered stents (14 mm in diameter, 6 cm in length, distal release) were placed under topical anesthesia.

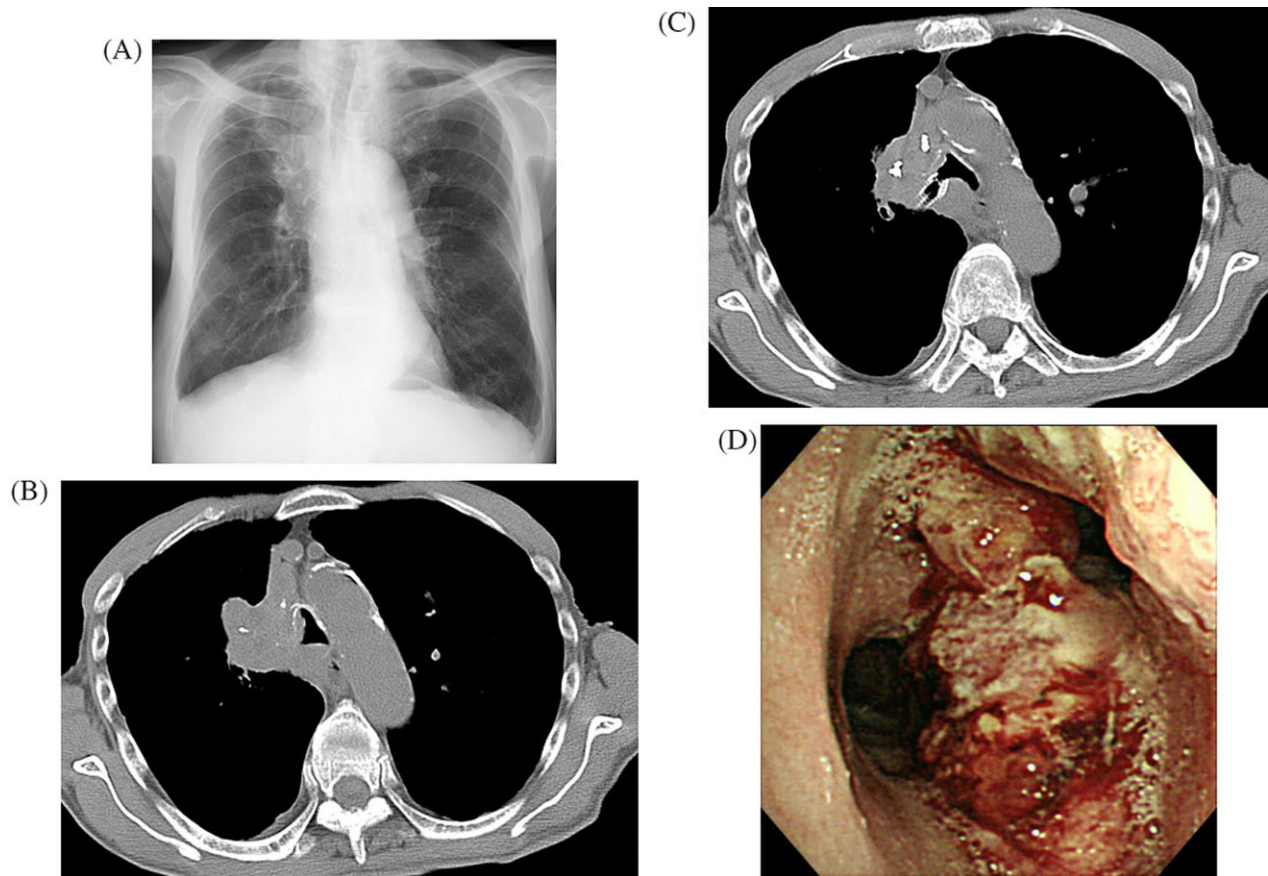


Figure 1. Chest X-ray (A), computed tomography (B, C) and fiberoptic bronchoscopy (D) 6 weeks after the initial stenting demonstrated the severe stenosis of the right mainstem bronchus (C, D), the lower trachea (B, D), and the orifice of the left mainstem bronchus (D).

After delivering 4 mL of 4% lidocaine by nebulizer, FOB was inserted and skin markers were placed at the level of carina and 3 cm rostral site. After inserting a flexible 0.035-inch guidewire (Jagwire super-stiff, Boston Scientific Corporation) into the RMB, the same guidewire was inserted into the left. After withdrawing FOB, the above-mentioned stent mounted on a delivery catheter was advanced to the RMB under fluoroscopic guidance, adjusting the proximal end to the rostral marker. Immediately, the same stent was delivered to the left, adjusting the proximal end to the right counterpart. First, the right stent was carefully released and confirming the full expansion, the left one was also released without delay adjusting the proximal end to the right counterpart. After these procedures, proximal ends of both stents were tuned in exactly by a forceps.

During the procedure, blood pressure was monitored every 2 min and heart rate, respiratory rate and SpO₂ were monitored in real time under oxygen administration at 2 L/min.

This strategy was quite safe and the time needed for the entire procedure was within 20 min. He was awake throughout the procedure.

After the treatment (Fig. 2), he never experienced dyspnea nor obstructive pneumonia. The external radiotherapy was not added after this procedure considering the bronchial perforation due to the ischemia of bronchial mucosa induced by the pressure of SEMSS. Seven months after the initial stenting, he was transferred to the emergency room, chest CT demonstrating the bilateral airway patency, and died of a cardiac sudden death.

Discussion

The most common symptoms of tumor-related central airway obstruction are dyspnea, cough, and hemoptysis, which are distressing to the patient and interventional pulmonology should be considered without delay for the palliation.

Malignant carinal involvement is considered as one of the most difficult scenarios for interventional pulmonology, which often requires rigid bronchoscopy such as laser treatment, mechanical debulking, and silicone stenting under general anesthesia [1]. However, these patients tend to be in

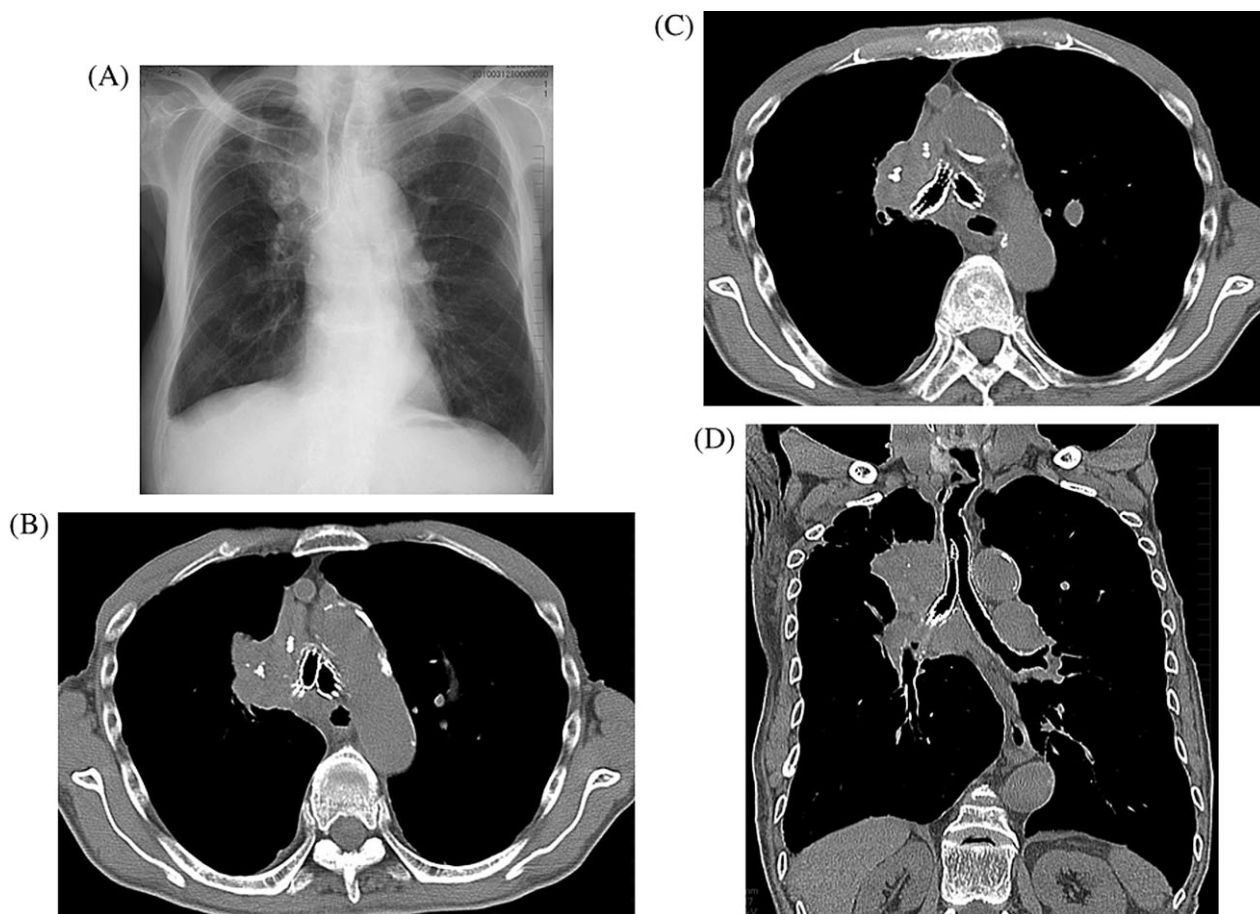


Figure 2. The images obtained 1 week after the bilateral stenting are shown: chest X-ray (A), computed tomography (B, C), and multiplanar reconstruction coronal image (D). Bilateral stents were patent and adjacent to each other (B, C), each of the proximal ends was in line with each other without migration (D).

poor condition for invasive treatments and the less invasive strategy to relieve the symptom is urgently needed.

At present, two types of stents are available: plastic and metallic. The most common plastic stent is made of silicone, and the Dumon stent has been most prevalent. The Dumon Y-stent has advantage in dealing with the malignant carinal involvement, which is easily adjusted on a case-by-case basis. Capability of repositioning or removal of the stent is considered to be advantageous; however, up to 20% of silicone stents have migrated [2]. The post-procedure sputum retention should also be considered. Furthermore, a silicone stent needs a special applicator through rigid bronchoscopy under general anesthesia.

The outstanding advantage of the SEMSs is their convenient delivery using FOB under topical anesthesia and conformability to the airway structure due to their self-expansive characteristics. However, it is difficult to remove SEMSs when they become unnecessary, and the additional therapy is limited to the progressive tumor ingrowth or

granulation tissue. Ultraflex stent made of a single thread of nitinol wire is one of the most prevalent SEMSs [2].

In order to minimize the invasiveness and post-procedure complications for the patient with malignant carinal involvement in poor condition, investigators have contrived utilization of existing SEMSs and also developed a novel metallic stent. Muro *et al.* [3] reported bilateral self-expanding nitinol stents for the malignant carinal invasion, in which the left stent was connected to the side of the right stent to form a T-shape. Hosokawa *et al.* [4] reported five patients treated by two types of spiral Z-stents at the carina, a long tapered one in the lower trachea and one main bronchus and a short straight one in the contralateral main bronchus. Chen *et al.* [5] designed windowed stents to match the tracheobronchial anatomy.

In the current report, we employed bilateral Ultraflex covered stents to avoid progressive tumor ingrowth and stent migration with minimum invasiveness. The “side-by-side” method is prevalent in the field of malignant hilar

biliary obstruction to connect the bifurcated bile ducts. We adopted this method to overcome the malignant carinal involvement, the procedure and technique of which have already been described in detail. The procedure was safe and quick with good outcome of proved long-term airway patency.

Although the additional treatment by external radiotherapy was not added considering the fragility of bronchial mucosa associated with his age, interventional pulmonology such as cryotherapy or argon plasma coagulation by FOB under topical anesthesia was applicable to the progressive tumor ingrowth, which was not documented in the current case.

Disclosure Statements

No conflict of interest declared.

Appropriate written informed consent was obtained for publication of this case report and accompanying images.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Figure S1. The entire procedure in detail: flexible 0.035-inch guidewires were carefully inserted inside of the existing stent and the left mainstem bronchus (A, B). Bilateral ultraflex covered stents were advanced over the guidewires to the bilateral mainstem bronchi and the right stent was carefully released (C). After confirming the full expansion, the left one was also released without delay adjusting the proximal end to the right counterpart (D).