Successful management of malignant carinal involvement by “side-by-side” method of self-expandable metallic stents followed by chemotherapy

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Introduction
Malignant main carinal involvement is a challenging scenario that requires immediate interventional pulmonology. However, patients with severe cardiac complications tend to be in poor condition for rigid bronchoscopic intervention under general anesthesia.

This report clarifies a less invasive, but efficient, strategy for these cases: bilateral self-expandable metallic stents (SEMSs) by fiberoptic bronchoscopy (FOB). In this report, bilateral SEMSs were placed using a “side-by-side” method to salvage the carina after which the patient’s condition improved and allowed for additional chemotherapy.

Case Report
A 73-year-old male patient with severe angina pectoris was introduced to our department with a SpO₂ scoring of 88% in room air. He underwent chest X-ray (Fig. 1A) and enhanced CT scan (Fig. 1B and C) that demonstrated a mass in the right upper lobe with hilar and mediastinal lymph nodes metastases that invaded the lower trachea and carina. These images also showed that he had an occluded right mainstem bronchus (RMB). FOB demonstrated squamous cell carcinoma at a clinical stage of cT4N2M0, stage IIIB. The cardiologists concluded that Y stent placement by rigid bronchoscopy under general anesthesia was unsuitable considering the severe status of his coronary arteries. Due to the critically urgent respiratory state, Ultraflex covered stents were placed in the RMB (white arrow in Fig. 1D; 14 mm in diameter, 4 cm in length, Boston Scientific Corporation, MA) and in the lower trachea (Fig. 1E; 16 mm in diameter, 4 cm in length) on the following day. However, the tumor progressed quickly and resulted in severe stenosis of the carina after 2 weeks.

Key Clinical Message
Bilateral self-expandable metallic stents may be useful in the management of malignant carinal involvement and may improve the performance status of patients. This strategy may allow patients with poor performance status to receive additional chemotherapy.

Keywords
Antiplatelet therapy, bilateral self-expandable metallic stents, chemotherapy, malignant main carinal involvement, side-by-side method.
As the respiratory status was brittle with a SpO₂ scoring of 91% under oxygen administration at 6 L/min, a less invasive technique was required. Therefore, bilateral Ultraflex covered stents (14 mm in diameter, 6 cm in length) were placed under topical anesthesia (Fig. 2).

A fiberoptic bronchoscope was first inserted (Fig. 2A) followed by the insertion of a flexible 0.035-inch guidewire into the RMB. A similar guidewire was subsequently inserted into the left mainstem bronchus (Fig. 2B). The stent was then loaded into a delivery catheter and advanced into the RMB under fluoroscopic guidance. A similar stent was immediately delivered to the LMB (Fig. 2C). The right stent was carefully released and followed immediately by the left stent. The proximal end of the right counterpart was adjusted by forceps (Fig. 2D).

The time required for the entire procedure was <20 min. Soon after the procedure, the respiratory status dramatically improved and oxygen administration became unnecessary.

The improved performance status allowed him to undergo a combination treatment of carboplatin and paclitaxel 5 days after stenting and resulted in good partial response after two cycles of chemotherapy (Fig. 3A–D). After four cycles of chemotherapy, he was progression-free for 6 months. However, he later died of sudden cardiac death.

**Discussion**

Symptoms of tumor-related central airway obstruction are distressing to the patient and require urgent intervention for palliation. These symptoms are usually found during regular medical check-ups following the diagnosis of cancer and allow enough time for the preparation of interventional pulmonology. However, some patients

![Figure 1](image1.png)

**Figure 1.** Chest X-ray (A) and enhanced CT (B, C) demonstrated a lung mass in the right upper lobe with hilar and mediastinal lymph nodes metastases invading the lower trachea and carina. They also showed occluded right mainstem bronchus andatelectasis of the right lung. Fiberoptic bronchoscopic images of the lower trachea after the Ultraflex covered stent placement in the right mainstem bronchus (white arrow) demonstrated a deformed and stenosed lower trachea (D). After stent placement in the lower trachea (E), the deformity ameliorated.
present with incipient symptoms of malignant main carinal involvement that tends to be in advanced stages.

Malignant main carinal involvement is one of the most challenging scenarios for interventional pulmonology and is often treated with rigid bronchoscopy under general anesthesia [1].

Rigid bronchoscopic intervention under general anesthesia is considered unsuitable for patients with severe cardiac complications. Electrocautery or laser through FOB may be used to reduce tumor volume in cases with severe stenosis; however, these procedures may jeopardize the stenosed airway tract by inducing edema and hemorrhage that result in the total obstruction of the airway. Furthermore, these methods under antiplatelet therapy may lead to uncontrollable and life-threatening hemorrhages. Therefore, a less invasive and simple strategy is required.

The advantage of SEMSs is their convenient delivery and conformability to the airway structure due to their self-expansive characteristics that repress the hemorrhagic sites caused by stent insertion. As it is difficult to remove SEMSs when they become unnecessary, the implantation of SEMSs in patients with benign diseases is not recommended due to a longer follow-up period [2]. Therefore, the application of SEMSs to malignant main carinal involvement may be inappropriate when it can be resolved by chemoradiotherapy, and other strategies, such as silicon stent (Dumon Y stent) or electrocautery, should be considered depending on the nature and site of the lesion [3].

Based on our patient’s condition, we concluded that the advantage of SEMSs would surpass the risks of other techniques. Ultraflex stents, a common SEMSs [4], made from a single thread of nitinol wire were selected.

In order to minimize the invasiveness and postprocedure complications for patients with malignant main carinal involvement in poor condition, investigators have used existing SEMSs and also developed novel metallic stents [5–7].
In this case, for antiplatelet therapy, we adopted a “side-by-side” method using bilateral SEMSs over the carina [8]. The “side-by-side” method is often adopted for the treatment of malignant hilar biliary obstruction [9]. We previously reported this method as a maneuver for palliative care in a patient with lung cancer that proved to be safe and quick and allowed for long-term airway patency [8].

As additional external radiotherapy sometimes causes bronchial perforation due to ischemia of bronchial mucosa induced by the expanding pressure of SEMSs, chemotherapy was performed to minimize tumor size and allows for longer overall survival. After four cycles of chemotherapy, the tumor shrank and improvements in QOL were achieved. He was progression-free for 6 months without any stent-related complications.

**Conclusion**

Bilateral SEMSs strategy using a “side-by-side” method was useful in the management of malignant carinal involvement and improved the performance status of our patient. This allowed the patient to receive additional chemotherapy that led to prolonged overall survival.

**Authorship**

TT: drafted the manuscript. MT: performed the imaging and approved the manuscript. HI, MS, and ST: approved the manuscript.

**Conflict of Interest**

The authors declare no conflicts of interest.

**References**

1. Dutau, H., B. Toutblanc, C. Lamb, L. Seijo. 2004. Use of the Dumon Y-stent in the management of malignant disease involving the carina. A retrospective review of 86 patients. Chest 126:951–958.

2. Chung, F. T., H. C. Chen, C. L. Chou, C. T. Yu, C. H. Kuo, H. P. Kuo, et al. 2011. An outcome analysis of self-expandable metallic stents in central airway obstruction: a cohort study. J. Cardiotorac. Surg. 6:46.

3. Chhajed, P. N., S. Somandin, F. Baty, A. J. Mehta, A. Azzola, J. Leuppi, et al. 2010. Therapeutic bronchoscopy for malignant airway stenoses: choice of modality and survival. J. Cancer. Res. Ther. 6:204–209.

4. Ibrahim, E. 2006. Bronchial stents. Ann. Thorac. Med. 1:92–97.
5. Muro, K., H. Mizuno, K. Yanagihara, M. Kurata. 1997. Self-expanding nitinol stents for treatment of bilateral main bronchial stenosis caused by esophageal cancer. Nihon Kyobu Geka Gakkai Zasshi 45:1183–1188.

6. Hosokawa, Y., I. Tsujino, K. Kiyofuji, T. Koura, T. Shoda, A. Horikoshi, et al. 2006. Placement of two types of spiral Z-stents at the bronchial carina for the treatment of terminal lung cancer—a new method. J. Int. Med. Res. 34:556–562.

7. Chen, C., and S. Jiang. 2008. A novel anatomy-conforming metallic stent for tracheobronchial stenosis. Ann. Thorac. Surg. 85:2100–2103.

8. Takeda, T., H. Itano, S. Fukita, M. Saitoh, and S. Takeda. 2013. Bilateral self-expandable metallic stents for lung cancer involving the carina. Respirol. Case Rep. 1:48–51.

9. Naitoh, I., K. Hayashi, T. Nakazawa, F. Okumura, K. Miyabe, S. Shimizu, et al. 2012. Side-by-side versus stent-in-stent deployment in bilateral endoscopic metal stenting for malignant hilar biliary obstruction. Dig. Dis. Sci. 57:3279–3285.