Customised Y-shaped self-expandable covered metallic stent with a dead end for the treatment of bronchopleural fistula

Yahua Li,1 Yiyang Liu,2 Kewei Ren,1 Xinwei Han,1 Jianzhuang Ren1

A 54-year-old male patient underwent right middle and lower lobectomy due to squamous cell carcinoma of the lung. He recovered well, and the thoracic drainage tube was removed. However, he developed a cough and severe fever (39.5°C) 8 days post-surgery. Sputum culture suggested Klebsiella pneumoniae infection. Piperacillin tazobactam and voriconazole were administered according to drug sensitivity results. Bronchoscopy (figure 1A) and CT demonstrated the formation of an intermediate bronchial fistula. Pneumothorax was not observed. A residual cavity with a small volume of empyema associated with the intermediate bronchi was detected on CT tracheal reconstruction imaging (figure 1B). A customised Y-shaped self-expandable covered metallic stent with a dead end was planned to occlude the fistula under the guidance of fluoroscopy.1,2 According to our experience, the diameter of the stent was designed to be 15%–20% larger than the corresponding airway. Based on the measurement of the corresponding bronchi, the diameter and length were determined to be 16 mm and 20 mm in the right main bronchus, 10 mm and 15 mm in the right upper bronchus, and 10 mm and 10 mm in the intermediate bronchus. The customised stent was labelled Han’s stent and manufactured using a single NiTi alloy wire by Micro-Tech, Nanjing, Jiangsu, China. Five days later, the customised stent was ready for placement.

During the procedure, a catheter was introduced into the intermediate bronchi through the mouth, and contrast agent was injected to show the residual cavity (figure 1C). Then, a customised Y-shaped self-expandable covered metallic stent with a dead end (figure 1D) was placed to occlude the intermediate bronchi (figure 1E). Bronchoscopy suggested that the intermediate bronchial fistula was successfully occluded by the stent (figure 1F). The residual cavity disappeared on CT tracheal reconstruction imaging (figure 1G). With the application of antibiotics, the symptoms of cough and fever were controlled. There was no obvious empyema detected on ultrasound examination; thus, the drainage tube was not placed. According to previous experience, the stent should be removed within 3 months to avoid severe granulation hyperplasia. Three months later, the Y-shaped self-expandable covered metallic stent with a dead end was removed under the guidance of fluoroscopy (figure 1H–J). Bronchography showed no contrast agent flow to the pleural cavity (figure 1K). CT tracheal reconstruction imaging indicated that the fistula had healed (figure 1L). At the 3-year follow-up, the patient had no residual issues and was living a normal life.

Figure 1 Representative image of the placement and removal of a Y-shaped self-expandable covered metallic stent with a dead end. (A) Representative images of the bronchopleural fistula; (B) the residual cavity is connected to the intermediate bronchus (white arrow) on CT tracheal reconstruction; (C) bronchography demonstrates the connection of the intermediate bronchi and residual cavity; (D) representative images of the customised Y-shaped self-expandable covered metallic stent with a dead end; (E) a customised Y-shaped self-expandable covered metallic stent with a dead end (white arrow) is placed in the bronchus. The main body is in the right main bronchus, and another branch is in the right upper bronchus; (F) representative images of the fistula after stenting; (G) the residual cavity disappears on tracheal reconstruction imaging, and a Y-shaped self-expandable covered metallic stent with a dead end is visible (white arrow); (H) the guide wire is introduced into the intermediate bronchus; (I) a 14Fr sheath and removal hook are introduced to hook the body of the stent; (J) the stent (white arrow) is removed with the aid of a hook. (K) 3 months poststent, the Y-shaped self-expandable covered metallic stent with a dead end was removed. Bronchography shows that the right upper bronchus and main bronchus are patent, and no contrast agent is observed in the pleural cavity (white arrow); (L) tracheal reconstruction imaging indicates that the fistula has healed (white arrow).
Bronchopleural fistula after lobectomy is a life-threatening condition. The reported devices to occlude the fistula include the endobronchial valve, ventricular septal occluder, atrial septal occluder and covered tracheal stent. However, only tracheal stents were available in our hospital. According to previous experiences regarding the treatment of large bronchopleural fistula, we chose the customised Y-shaped self-expandable covered metallic stent with a dead end, which was removed within 3 months to avoid long-term stent placement-induced granulation hyperplasia. In this case, the application of a Y-shaped self-expandable covered metallic stent with a dead end successfully occluded the fistula and facilitated its healing.

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ORCID iD Yahua Li http://orcid.org/0000-0001-6871-1544

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