

Modified Montage-Type Bronchoplasty with Complete Pulmonary Preservation

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Citation: Yoshio Tsunetzuka, Ryo Nangoya, Yoshitaka Tanaka and Syusei Endo (2023) Modified Montage-Type Bronchoplasty with Complete Pulmonary Preservation. J Case Rep Stud 11(1): 105

Received Date: May 22, 2023 **Accepted Date:** June 22, 2023 **Published Date:** June 26, 2023

Abstract

Among surgical cases of bronchoplasty with complete pulmonary preservation, those that require anastomosis of three stomas are rare. Usually, a double-barrel type reconstruction is performed by suturing two distal bronchi together and then anastomosing them to the proximal bronchus. However, the procedure is technically difficult because of the difference between the stomal diameter of the proximal bronchus and that of the two distal bronchi, and the tension at the anastomosis site is imbalanced. Herein, we present a rare surgical case of a bronchoplasty with complete pulmonary preservation in whom we performed an anastomosis between three stomas using a modified Montage-type technique. The advantage of this technique is that it allows free trimming of the anastomosed side-to-side stoma before anastomosis with the third bronchus, thus decreasing the tension at the anastomosis site and improving the outcome. We believe, this technique is superior to the other known techniques.

Keywords: Montage-Type Bronchoplasty; Pulmonary Preservation; Bronchoplasty; Carinoplasty; Sleeve Lobectomy

Introduction

Sleeve lobectomy is a widely accepted surgical approach for salvaging lung parenchyma. Several articles and case reports have demonstrated the value of main bronchial sleeve resection with pulmonary conservation for the treatment of limited bronchial tumors [1,2]. Among them, an anastomosis between the stomas of the main stem, upper bronchus, and intermedius/lower bronchus was rare and technically difficult [2]. Usually, a double-barrel type reconstruction or Montage-type bronchoplasty is performed. We present a case of adenoid cystic carcinoma at the right main stem and extending to the intermedius bronchus.

In this case, we performed a new modified Montage-type bronchoplasty with complete pulmonary preservation.

Case Report

Patient

A 73-year-old man presented with a 3-month history of cough and dyspnea on exertion. Routine investigations revealed an elevated blood level of prostate-specific antigen. Hence, a diffusion-weighted whole-body magnetic resonance imaging with background body signal suppression was performed, which revealed the presence of a mass in the right main bronchus. Computed tomography showed a mass 2.6X 2.4X 1.5cm in size in the right main bronchus in the membranous portion, and bronchoscopy revealed a lesion-like submucosal tumor with a smooth surface and a broad base extending from the posterior wall of the main bronchus to the intermedius bronchus. No necrosis or hemorrhage from the tumor was observed. The main bronchial lumen was 90% stenosed, but the bronchoscope was passable (Figure 1A). The central edge of the tumor was close to the carina, and the middle and upper bronchi were open.

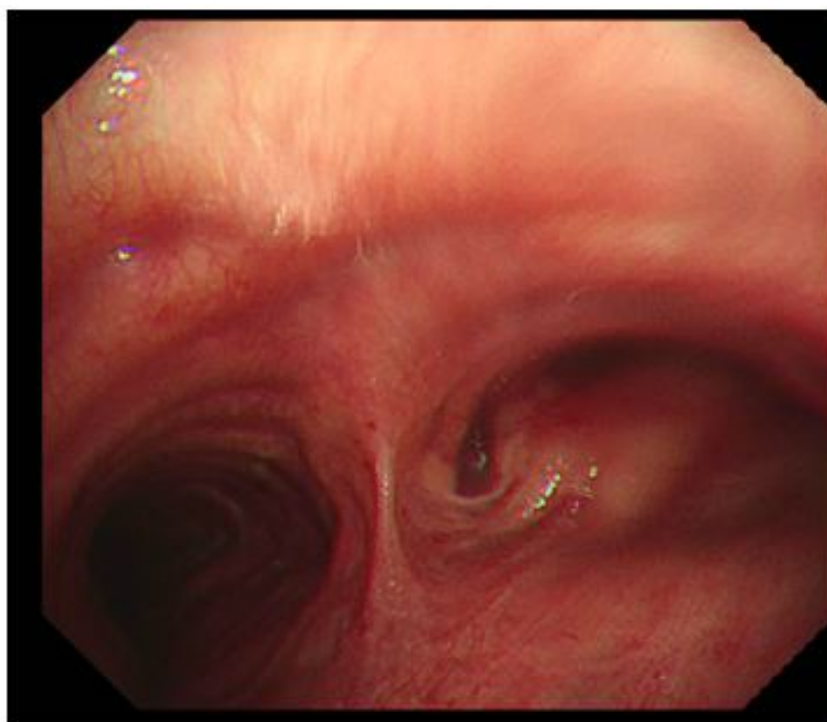


Figure 1(A): Preoperative Bronchoscopy

Surgical Technique

The patient was placed in the lateral decubitus position. After general anesthesia and double-lumen endotracheal intubation, a lateral incision was made at the fifth intercostal space (ICS). A 12 mm scope port was placed at the seventh ICS along the posterior axillary line. There was an adhesion between a part of the lung and mediastinal pleura. The inferior pulmonary ligament was divided and loosened, and hilar release was performed in the pericardium at the bottom of the inferior pulmonary vein with a U-shaped incision to reduce tension at the anastomosis. The superior and posterior mediastinal pleurae were opened to expose the trachea and right bronchus.

The right main, intermedius, and upper bronchi were revealed and taped. The feeding bronchial arteries were preserved as much as possible to ensure the blood supply of the anastomosis. The other vessels that flowed into the resected bronchus wall were cut using LigaSure™ Maryland Jaws with Nano-Coating (Valleylab Inc. USA). Proximal (main bronchus) and distal (intermedius bronchus) margins of at least 0.5 cm were transected with the assistance of intraoperative bronchoscopy, and the upper bronchus was cut after bifurcation. First, endo-to-endo anastomosis between the right main bronchus and intermediate bronchus was performed with 4-0 Prolene continuous sutures, with two-thirds of the circumference at the deepest site. Additional cartilage was trimmed from the remaining one-third of the circumference of the right main bronchus. Trimming of the partial tracheal wall and peripheral intermediate bronchus was performed. However, trimming of the peripheral bronchus was limited because the middle bronchus was near the resected line. The newly trimmed bronchial stoma was anastomosed to the right upper bronchus. The right upper bronchus was anastomosed to the new bronchial stoma using 4-0 Prolene continuous sutures (Figure 2). A U-shaped suture was not required. Thoracic flushing was performed, and no leakage was observed at the anastomotic site. The bronchial anastomosis was not wrapped with pericardial fat, pleura, or pedicled intercostal muscles. Lymph node dissection of tracheal bifurcation (#7), pulmonary ligament (#9) and hilar region (#10) was performed. A 20 Fr chest tube was then placed for drainage. Intraoperative and postoperative histological studies revealed adenoid cystic carcinoma, the tumor was white in color. There were no metastases in the lymph nodes. Postoperative bronchofiberscopy revealed no stenosis or fistula (Figure 1B). The thoracic drain was removed on the second postoperative day, and the patient was discharged after bronchoscopy on the fifth day showed no abnormality at the bronchial anastomosis.

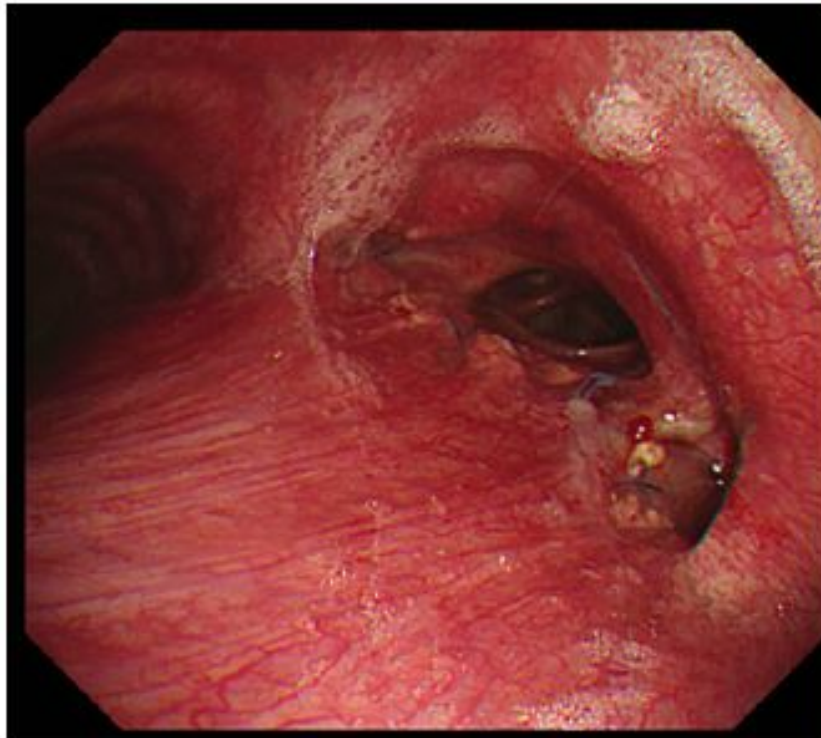


Figure 1(B): Postoperative Bronchoscopy

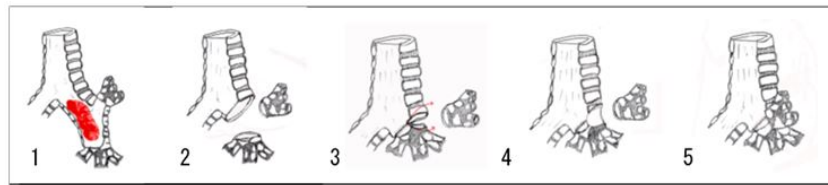


Figure 2: Diagram of the modified Montage-type method. End-to-end anastomosis was performed between two-thirds of the circumferences of the main stem and bronchus intermedius followed by trimming of the lateral one-third of the circumferences of the main stem and bronchus intermedius before anastomosis with the upper bronchus

Discussion

Among the reported cases of bronchial sleeve resections, *there are only a few* with complete pulmonary preservation [3,4]. The surgical procedure of bronchial reconstruction with complete pulmonary preservation can be a simple type of sleeve resection with end-to-end anastomosis or a complicated type of multiple barrel side-to-side and end-to-side anastomoses. Technically, the simple type is easy and postoperative complications are rare, but the complicated type is difficult and associated with complications such as a postoperative bronchial fistula or anastomotic stenosis caused by the tension at the anastomosis, twisting of the bronchus, and decreased blood supply to the anastomosis.

Usually, in a complicated case such as the present one, a side-to-side suturing between the upper bronchus and intermediate bronchus is performed, followed by an end-to-end suturing between the double barrel and the main stem bronchus [2]. However, this procedure has some challenges, such as the difference in diameter between the double barrel and main stem and the strong side-to-side tension of the double barrel induced by the unnatural location of the bronchus.

In the present case, we applied one of the several known procedures of carinal resection and construction. Carinal reconstruction was first reported by [5], and it involved complete pulmonary preservation, end-to-end anastomosis between the trachea and right main bronchus, and end-to-side anastomosis between the left main bronchus and the side of the right intermediate bronchus. In 1966, Mathy et al. reported a double-barrel type carinal reconstruction and side-to-side anastomosis of the right and left bronchi followed by end-to-end anastomosis with the trachea [6]. However, this anastomosis causes severe tension at the lateral aspect of the side-to-side anastomosis between the right and left bronchi [7]. Therefore, this procedure is used only after resection of a small segment of the airway. In addition, the anastomosis between the trachea and anastomosed bronchi can be difficult when their diameters are different because the right and left bronchi are first connected at the side and the caliber and shape of the section are restructured. Miyamoto et al. reported a novel carinal reconstruction technique in 2007 [8,9]. We applied this technique to the reconstruction procedure in this case. In this method, two-thirds of the circumferences of the trachea and left main bronchus are anastomosed end-to-end, and the remaining one-third of the circumferences of the trachea and the left main bronchus are trimmed and modified to form an oval or circular shape, followed by side-to-end anastomosis with the right bronchus. This method compensates for several disadvantages because the tension at the newly constructed anastomosis is dissipated in three directions.

We performed carinal resection using this procedure, since it is possible to change the caliber of the new carina by bronchial trimming. This trimming is important for creating sufficient anastomotic holes to prevent postoperative bronchial stenosis. In particular, the peripheral bronchus wall is thin and weak and is prone to stenosis at the anastomosis.

In the present case, the caliber of the upper bronchus was large, and trimming the main bronchus (part of the trachea) and intermediate bronchus helped in matching the anastomotic caliber of the upper bronchus. However, unlike carinal resection, the available peripheral length for trimming is limited, because the middle bronchus is near the resection line. In contrast, a significantly longer length of tissue may be trimmed towards the tracheal side because the tracheal side has enough tissue for trimming freely.

This procedure resembles the double-barrel type reconstruction, but the key difference in this method is the trimming of the bronchus. It may be said that this method resembles the Montage-type method for the creation of a new anastomosis. Therefore, we have termed this procedure as a modified Montage-type bronchoplasty.

Conclusion

In this rare surgical case of a bronchoplasty with complete pulmonary preservation, we performed an anastomosis between three stomas using a modified Montage-type technique. The advantage of this technique is that it allows free trimming of the anastomosed side-to-side stoma before anastomosis with the third bronchus, thus decreasing the tension at the anastomosis site and improving the outcome.

Disclosure Statement

The authors declare no conflicts of interest requiring disclosure in relation to this manuscript.

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