Right Lower Sleeve Bilobectomy for Lung Cancer with Posteparterial Tracheal Bronchus

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A 42-year-old man was diagnosed with cancer of the right lower lung lobe with a posteparterial type of tracheal bronchus, in which the posterior segmental bronchus of the right upper lobe arose from the distal bronchus intermedius. A mass involved the distal bronchus intermedius, requiring a right lower bilobectomy with an additional posterior segmental resection of the right upper lung lobe. Thus, we performed a right lower bilobectomy and sleeve Anastomosis of the posterior segmental bronchus of the right upper lobe to the proximal bronchus intermedius, sparing the pulmonary parenchyma of the same lobe.

Key words: 1. Lung cancer, surgery
2. Trachea
3. Bronchi
4. Respiratory system abnormalities

Case report

A 42-year-old man with symptoms including cough and sputum was diagnosed with squamous cell carcinoma of the right lower lobe (RLL) of the lungs, and referred to Samsung Medical Center for further evaluation and management. Chest computed tomography (CT) showed a 6.5-cm malignant morphologic mass in the superior segment of the RLL, invading the bronchus intermedius (BI) (Fig. 1), and a sign of obstructed pneumonitis distal to the mass. Bronchoscopy revealed that only 2 segmental bronchi arose from the right upper lobar bronchus, and an accessory bronchus arose from the lateral wall of the middle of the BI (Fig. 2). The abnormal bronchus was presumed to be a posterior segmental bronchus of the right upper lobe (RUL), indicating a posteparterial tracheal bronchus. A huge necrotic mass originating from the RLL protruded to the distal BI. Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) was performed for lymph node stations 4R and 7 because his chest CT also revealed mediastinal lymphadenopathy in these stations; the EBUS-TBNA results were negative for both stations. Thus, the disease was evaluated as clinical T3N0M0, and staged as clinical stage IIB. His pulmonary function test result was sufficient for him to undergo a further operation. For the preoperative risk evaluation, we performed a lung perfusion scan with 99mTc macroaggregated albumin, and the result showed a perfusion defect in the RLL and no abnormalities in other areas.
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Fig. 1. Chest computed tomography. (A, B) A malignant morphologic mass in the superior segment of the right lower lobe invades the bronchus intermedius. (C) A 3-dimensionally-reconstructed computed tomography of airway shows postarterial tracheal bronchus (arrow) originating from bronchus intermedius.

Fig. 2. Bronchoscopy. (A) Only two segmental bronchi arose from right upper lobar bronchus. (B) The tumor obstructed the origin of right lower lobe and an accessory bronchus (arrow) arose from the lateral wall of the middle of the bronchus intermedius.

The operation was initiated with a right posterolateral thoracotomy incision of the fifth intercostal space. As expected from the bronchoscopy results, the posterior segmental bronchus of the RUL arose from the distal BI, not from the right upper lobar bronchus (Fig. 3). The RLL mass involved the distal BI; therefore, a right lower bilobectomy was inevitable. The right lower and middle lobar veins were both stapled with a Proximate Reload TX Linear Stapler XR30V (Johnson & Johnson, Cincinnati, OH, USA) and then divided. The common basal artery and right middle lobar artery were divided with a single surgical stapler. The posterior segmental bronchus of the RUL was so close to the mass that we planned to perform sleeve anastomosis instead of sacrificing it.

Fig. 3. The right upper lobar bronchus (black arrow) arose from right main bronchus, and the posterior segmental bronchus (white arrow) arose from bronchus intermedius.
Fig. 4. Illustration of the sleeve anastomosis. (A) Red dashed-lines represented resection sites. The proximal bronchus intermedius (①) and the proximal right upper posterior segmental bronchus (②) were transected. (B) Then, the anastomosis was performed.

The proximal BI was resected first, followed by the proximal posterior segmental bronchus of the RUL. Frozen biopsy results of the proximal margin of the BI and the distal margin of the posterior segmental bronchus of the RUL were both negative. An anastomosis between the BI and the posterior segmental bronchus of the RUL was completed by multiple interrupted sutures with both 4-0 and 3-0 Vicryl (Fig. 4). An additional systematic mediastinal lymph node dissection was performed at lymph node stations 2R, 4R, and 7, and then sleeve right lower bilobectomy with mediastinal lymph node dissection was completed.

The patient recovered without significant complications. On postoperative day 10, the follow-up bronchoscopy showed an intact anastomosis site; thus, he was discharged. Pathologic results documented a 4.5-cm squamous cell carcinoma mass with a pathologic TNM (tumor, node, metastasis) stage of pT2aN1M0; therefore, he is now being treated with adjuvant chemotherapy. No further follow-up bronchoscopy was done. Eighteen months after the operation, follow-up CT showed neither evidence of tumor recurrence nor stenosis of the anastomosis site (Fig. 5).

Discussion

In 1785, Sandifort and colleagues described tracheal bronchus as an RUL bronchus originating from the trachea [1]. However, the term ‘tracheal bronchus’ now refers to various bronchial anomalies that origi-

Fig. 5. A 3-dimensionally-reconstructed computed topography of airway at 18 months after the operation shows posteparterial tracheal bronchus (arrow) anastomosed to the second carina of right lung.

nate from the trachea or main bronchus and are directed towards the upper lobe area [2]. Previous bronchographic and bronchoscopic studies have demonstrated a prevalence of 0.1% to 2.0% for right tracheal bronchus, and 0.3% to 1.0% for left tracheal bronchus [2,3].

According to the modified nomenclature proposed by Boyden [4] and Kubik and Müntener [1] to clarify the classification of aberrant bronchi directed towards
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Fig. 6. Aberrant bronchi to the upper lobes. Figure shows prearterial (①), preeparterial (②), postarterial (③), eparterial (④, ⑤), prehyparterial (⑥), and posthyparterial (⑦) bronchi. LLLB, left lower lobar bronchus; RULB, right upper lobar bronchus; PA, pulmonary artery; RLLB, right lower lobar bronchus; RML, right middle lobar bronchus.

the upper lobes (Fig. 6), the normal RUL bronchus is ‘eparterial’ since it ascends above the right pulmonary artery. The normal left upper lobe bronchus is ‘hyparterial’ since it descends below the left pulmonary artery. An anomalous bronchus arising before the origin of the upper lobe bronchus is described as ‘preeparterial’ on the right side, and ‘eparterial’ or ‘prehyparterial’ on the left side. Meanwhile, an anomalous bronchus arising after the origin of the upper lobe bronchus is described as ‘posteparterial’ on the right side, and ‘posthyparterial’ on the left side [5]. Generally, tracheal bronchus is of no clinical significance in adult patients and is only diagnosed incidentally when bronchoscopy or other investigations are performed.

In this case, the patient had a posteparterial tracheal bronchus directed towards the posterior segment of the RUL. This aberrant bronchus seemed displaced rather than supernumerary because the bronchoscopic finding showed only 2 segmental bronchi arising from the right upper lobar bronchus [5]. Further, the patient had a mass involving the distal BI; therefore, lower bilobectomy could not be avoided. Because of the proximity between the tumor and the tracheal bronchus, an additional pulmonary resection of the RUL seemed necessary. However, by performing sleeve anastomosis of the tracheal bronchus, we were able to spare the pulmonary parenchyma.

Some cases have been reported of surgical resection, including sleeve resection, of cancer of the tracheal bronchus in the literature [6,7]. However, to the best of our knowledge, this is the first case in which sleeve anastomosis of an abnormal bronchus to a normal bronchus was performed to preserve the pulmonary parenchyma.

According to Carilli et al. [8], an aberrant bronchus might be associated with regional ventilation and perfusion abnormalities. In this study, we did not perform a radionuclide ventilation scan preoperatively, but a lung perfusion scan was performed, and showed a perfusion defect in the RLL. However, this finding cannot be fully explained only by pulmonary artery compression by the tumor. The decreased perfusion might also be explained in some extent based on reflex vasoconstriction secondary to relative right lung base hypventilation and hypoxia. Despite the absence of a ventilation scan, the normal perfusion in the posterior segment of the RUL might have indicated the absence of significant tracheal bronchus ventilation abnormalities.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

References

1. Kubik S, Muntener M. Bronchus abnormalities: tracheal, eparterial, and pre-eparterial bronchi. Fortschr Geb Rontgenstr Nuklearmed 1971;114:145-63.
2. Remy J, Smith M, Marache P, Nuyts JP. Pathogenetic left tracheal bronchus: a review of the literature in connection with four cases (author’s transl). J Radiol Electrol Med Nucl 1977;58:621-30.
3. Ritsema GH. Ectopic right bronchus: indication for bronchography. Am J Roentgenol 1983;140:671-4.
4. Boyd EA. Segmental anatomy of the lungs: a study of the patterns of the segmental bronchi and related pulmonary vessels. New York (NY): Blakiston Division, McGraw-Hill; 1955.
5. Ghaye B, Szapiro D, Fanchamps JM, Dondelinger RF. Congenital bronchial abnormalities revisited. Radiographics 2001;21:105-19.
6. Kim J, Park C, Kim H, Lee KS. Surgical resection of lung
cancer originating in a tracheal bronchus. Ann Thorac Surg 1998;66:944-6.

7. Okubo K, Ueno Y, Isobe J. Upper sleeve lobectomy for lung cancer with tracheal bronchus. J Thorac Cardiovasc Surg 2000;120:1011-2.

8. Carilli AD, The SH, Agress H Jr, Shin D, Budin JA. Tracheal bronchus with regional ventilation and perfusion abnormalities. Chest 1980;78:343-6.