A case of thoracoscopic-assisted tracheal tumor resection and tracheal reconstruction

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Abstract
Primary tracheal tumor is a disease with low morbidity and poor prognosis. Surgical resection is the main treatment. It is difficult to treat tracheal tumors, while involving tracheal reconstruction operations are more complicated. We report a case of tracheal tumor patient. The large tumor was located above the tracheal carina and the opening of the left main bronchus. The lumen of the left main bronchus was significantly narrowed. The patient was received thoracoscopic-assisted tracheal tumor resection and tracheal reconstruction under general anesthesia. The patient recovered healthy after operation without serious complications. Thoracoscopic-assisted tracheal tumor resection provides a flexible surgical option for the treatment of this disease.

Keywords: Tracheal tumor resection; Tracheal stenosis; Tracheal reconstruction; Thoracoscopy-assisted.

Background
Primary tracheal tumors are rare disorders which accounting for 0.2% of respiratory tumors, about 0.1-0.2/100,000 people, [1,2]. Squamous cell carcinoma and adenoid cystic carcinoma are the main pathological types. Most of the tracheal tumors are malignant, with insidious progression and lack of specific clinical manifestations in the early stage. Hemoptysis, irritating cough are the common clinical manifestations [3]. Tracheal stenosis, significant dyspnea, even life-threatening will be caused with development of the tumor [4]. Surgical resection and tracheal reconstruction are the main treatment for tracheal tumors. Other treatment, such as chemoradiotherapy and bronchoscopy techniques, provide palliative care but are incurable. Patients are at risk of tumor recurrence or distant metastases after chemoradiotherapy and therapeutic bronchoscopy techniques [3]. Most tracheal tumors are diagnosed late, and whether or not to operate depends on the anatomical structure of the trachea and the location of the tumor. At present, the 5-year survival rate of tracheal tumors is only 27% [5]. Traditional tracheal surgery is based on the right thoracotomy or median thoracotomy. In recent years, with the development of laparoscopic technology, thoracoscopy has been choice for tracheal tumor resection and tracheal reconstruction [6]. We used thoracoscopic-assisted techniques with less surgical trauma and clearer surgical field, combined with the surgical plan of transthoracic tracheal intubation, which fully ensured the intraoperative life safety of the patient and perfectly realized the patient’s tracheal tumor removal and tracheal reconstruction.

Case report
A 58-year-old male were admitted to the Affiliated Changzhou No. 2 People’s Hospital of Nanjing Medical University, for “episodic dry cough for 2 months”. He had no accompanying symptoms such as sputum, hemoptysis, and dyspnea during coughing. After taking oral “roxithromycin and azithromycin” by
himself, there was no recovery. He has a history of smoking and “coronary atherosclerosis”, and underwent “coronary stenting” in our hospital 6 years ago. After admission, a chest computed tomography scan showed a mass located in the tracheal carina and left main bronchus, with a size of about 1.5 cm × 2 cm, and the formation of bullae in the middle lobe of the right lung (Figure 1a,b). Fiberoptic bronchoscopy revealed a prominent tumor in the tracheal carina and left main bronchus, almost completely obstructing the left main bronchus (Figure 1c,d). The lumen is severely narrowed and the distal end cannot be accessed. Bronchoalveolar lavage, brushing, and bronchoscopic biopsy suggested tracheal malignancy. Pulmonary function, electrocardiogram, and echocardiography were checked before operation, and contraindications to surgery were excluded. After obtaining the patient’s informed consent, it was decided to perform thoracoscopy-assisted tracheal tumor resection and tracheoplasty.

After admission, the patient was connected to a monitor with HR 100 beats/min, BP 140/90 mmHg, RR 16 beats/min, and oxygen was administered by face mask with SpO2 98% to 99%. After induction of anesthesia, the patient was placed in the left lateral position, and an incision of approximately 10 cm was made in the 4th intercostal space in the right anterior axillary line and 1.5 cm in the 7th intercostal space in the midaxillary line. The thoracoscope was inserted and the thoracic cavity was accessed. Bronchoalveolar lavage, brushing, and bronchoscopic biopsy suggested tracheal malignancy. Pulmonary function, electrocardiogram, and echocardiography were checked before operation, and contraindications to surgery were excluded. After obtaining the patient’s informed consent, it was decided to perform thoracoscopy-assisted tracheal tumor resection and tracheoplasty.

**Figure 1:** Preoperative examination (a) chest CT-enhanced scan shows a tracheal mass of approximately 1.5 cm × 2 cm in size, located at the tracheal carina and the opening of the left main bronchus; (b) coronal computed tomography scan shows a tracheal mass with lung bullae formation in the middle lobe of the right lung; (c,d) bronchoscopy shows a new organism at the tracheal carina and the opening of the left main bronchus, with almost complete obstruction of the left main bronchus.

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The authors declare that surgery [5]. Currently, surgery is the main treatment for tracheal tumors, and other treatment methods include bronchoscopy, chemotherapy and radiation therapy. Tracheal transplantation and tracheal bioengineering are also developing rapidly and may become a viable option in the future as well [3].

Classical tracheectomy is performed through a right-sided open-chest approach or median sternal split, and thoracoscopic-assisted tracheal tumor resection has not been studied much [6]. The first thoracoscopic video-assisted tracheal mass resection and tracheal reconstruction in a spontaneously breathing non-intubated patient was reported by Li et al. in 2016 [8]. Although the procedure is very innovative, the indications for anesthesia and the requirements for anesthesiologists and operators are also extremely demanding. Therefore, we chose to perform tracheal surgery on the patient with the assistance of thoracoscopy. We took incisions at the 4th intercostal space in the right anterior axillary line and the 7th intercostal space in the mid-axillary line in the right chest, breaking the conventional open tracheal surgery and minimizing the surgical trauma to the patient. At the same time, the surgical field is fully exposed and the surgical area is clearly visible, which is conducive to fine surgical operation in a narrow surgical space and improves the accuracy of tracheal anastomosis. Intraoperatively, we need to apply tracheal intubation, thoracoscopic intubation, mechanical ventilation and other devices to fully ensure the safety of the patient, to be able to properly manage surgery-related complications, and to reduce the risks associated with anesthesia and surgery. We confirmed the feasibility of thoracoscopic-assisted tracheal tumor resection and tracheoplasty. This surgical approach places a higher technical demand on the operator, but the patient is the greatest beneficiary. The thoracoscopic-assisted surgery time is significantly shorter and the surgical approach is more minimally invasive. In addition to this, it reduces postoperative pain and speeds up the recovery time for patients [9]. The patient’s tumor was completely resected with no peripheral and distant metastases by our surgical approach, but considering the patient’s pathological and immunohistochemical findings, combined with reports about tracheal neuroendocrine carcinoma with distant lung metastases even after treatment [10], we strongly recommend the patient to receive comprehensive treatment such as postoperative adjuvant radiotherapy and regular follow-up review to obtain better long-term survival rate.

With the development of thoracoscopic techniques, more and more tracheal tumors will be treated by minimally invasive surgery. Thoracoscopic-assisted tracheal tumor resection provides a flexible surgical option for the treatment of this disease. More patients will benefit from it in the future.

**Declarations**

**Statement of conflict of interest:** The authors declare that they have no competing interests.

**Consent for publication:** Not applicable.

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**Data availability:** The metabolomic datasets generated during the current study are available from the corresponding author on request.
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References