

Case Report

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

Zehui Shi^{1,2}; Xiao Jiang²; Xuejiao Li^{1,2}; Ziwei Guo^{1,2}; Qiyong Wu^{1*}

¹Department of Thoracic and Cardiac Surgery, The Affiliated Changzhou No. 2 People's Hospital of Nanjing Medical University, Changzhou, China.

²Graduate School of Dalian Medical University, Dalian, China.

*Corresponding Author: Qiyong Wu

Department of Thoracic and Cardiac Surgery, The Affiliated Changzhou No. 2 People's Hospital of Nanjing Medical University, Changzhou 213004, China.

Email: wqyxycxy@aliyun.com

ORCID ID: 0000-0002-6281-5622

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.

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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 thoracoscopic-assisted tracheal tumor resection and tracheoplasty.

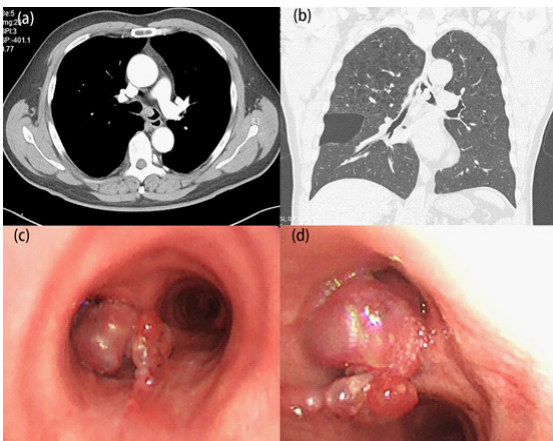


Figure 1: Preoperative examination (a) chest CT-enhanced scan shows a tracheal mass of approximately 1.5 cm × 2 cm in size, located at the tracheal carina and the opening of the left main bronchus; (b) coronal computed tomography scan shows a tracheal mass with lung bullae formation in the middle lobe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

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 explored. A mass of about 2 cm in size was seen above the tracheal carina and the opening of the left main bronchus. The mass protruded into the lumen and showed infiltrative growth, and the lumen of the left main trachea was obviously narrowed. The paratracheal and tracheal carina lymph nodes were slightly enlarged and did not invade other surrounding organs. We opened the mediastinal pleura with an electric hook, and then freed and ligated the odd vein. After fully exposing the intact main trachea, tracheal carina, left and right main bronchi, and clearing the surrounding lymph nodes, we disconnected the patient from the ventilator and used the electric hook and ultrasonic knife to cut the right main bronchus 0.5 cm from the

opening of the right main bronchus, and the left main bronchus 1.5 cm from the opening of the left main bronchus. The main trachea was dissected 1 cm above the carina, and the carina and tumor were resected. No cancer involvement was seen visually at the surgical margins (Figure 2a). The tracheal tumor specimen was sent for pathological examination (Figure 2c). At this time, mechanical ventilation could not maintain normal oxygenation, so we placed a tracheal tube in the left main bronchus through the thoracotomy field to maintain ventilation for the patient. After the rapid pathology results showed no cancerous tissue at the cut edge, tracheoplasty and tracheobronchial anastomosis were performed. At the time of anastomosis, bronchoscopic exploration and measurement of the proximal and distal disconnected trachea were performed. Since the length exceeded the length of the tracheal tube and normal ventilation could not be maintained, it was decided to insert a tube changer. The two tracheal tubes were extended and modified and replaced with 7.0 mm tubes. The transthoracic tracheal tube was removed and the anterior end of the modified tracheal tube was sent to the distal left main bronchial incision margin as a support for the anastomosis of the left main bronchus with the main trachea (Figure 2b), and the posterior wall membrane was closed with continuous 3-0 prolene sutures and the anterior wall cartilage ring was closed with intermittent 3-0 buckwheat sutures. As the patient had lung bullae, we removed the right lung bullae using a cutter closure, and at the same time released the inferior pulmonary ligament, opened the pericardium to release the right hilum, opened the lateral wall of the main trachea above the main trachea-left main bronchus anastomosis, and end-lateral anastomosis of the right main bronchus stump with the main trachea (Figure 2b), with continuous sutures of 3-0 prolene suture in the lower half and interrupted sutures of 3-0 buckwheat suture in the upper half. Sputum was aspirated during the whole procedure to avoid blood and secretions from entering the lung tissue. After the tracheal suture was closed, the wound was adequately hemostatic, the chest cavity was flushed, and the bulging lung was examined without active bleeding or anastomotic leakage. Bronchoscopy was performed to confirm tracheal patency (Figure 2d), closed chest drainage was placed, and the chest was closed at various levels. To relieve post-tracheoplasty tension, sutured mandibular traction was used to keep the patient in a cervical flexion position. The operative time was 4 h. Intraoperative bleeding was about 100 ml, and the patient was transferred to the intensive care unit after surgery and recovered well. On the 8th postoperative day, the drainage was removed and mechanical ventilation was stopped, oxygen saturation was maintained at 98-100%, and the patient was transferred to a general ward with a low head for 2 weeks. Postoperative CT and bronchoscopy showed tracheal patency (Figure 3a, b and c), and the patient was discharged 20 days after surgery. Pathological results showed large cell neuroendocrine carcinoma (Figure 3d), no tumor tissue was found in any of the tracheal marginal sites, and no tumor metastasis was seen in lymph nodes. Immunohistochemistry: CKp (+), Syn (+), CgA (+), Ki-67 (+, 60%), TTF-1 (+), CK7 (+), NapsinA (-), P63 (-), P40 (-), CK5/6 (-). Combined with the patient’s postoperative pathology, the patient was advised to undergo a combination of postoperative treatment, including radiotherapy, and regular review.

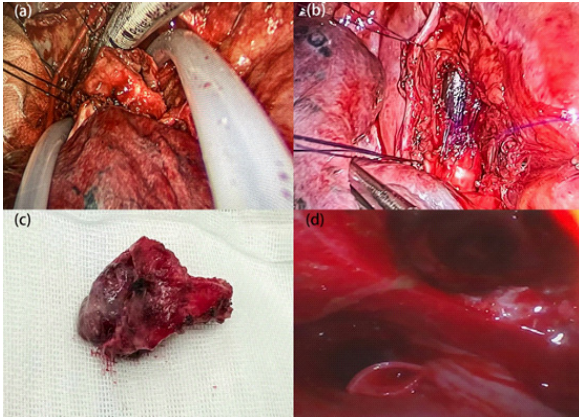


Figure 2: Surgical procedure: (a) clearance of the surrounding lymph nodes, complete exposure of the tumor, incision of the left and right main bronchi and main trachea, removal of the tracheal carina and tumor; (b) end-to-end anastomosis of the right main bronchus with the main trachea under modified tracheal intubation with absorbable sutures after removal of the tumor; (c) tracheal tumor: A section of the trachea was 2.5 cm long and 2 cm in diameter, a bulging type mass was seen in the lumen, size 1.5*1.3*0.6 cm; (d) Intraoperative bronchoscopy after tracheal reconstruction: The tracheal anastomosis was clear and no tumor was seen in the left main bronchus.

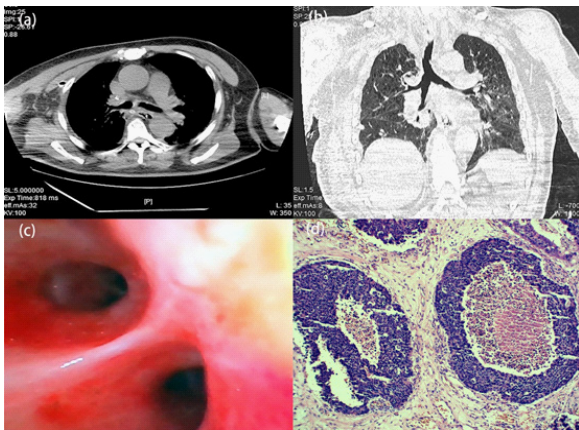


Figure 3: Postoperative examination of the patient: (a,b) postoperative CT scan of the chest showing patency of the trachea; (c) bronchoscopy showing patency of the right and left main bronchi; (d) pathological findings: large cell neuroendocrine carcinoma.

Discussion

Primary tracheal tumors are less common, mostly secondary to direct invasion or bloodstream dissemination, with squamous cell carcinoma and adenoid cystic carcinoma as the main pathological types [3]. Large cell neuroendocrine carcinoma, as the third most common pathological subtype after squamous cell carcinoma and adenoid cystic carcinoma, has better prognosis [7]. The onset of tracheal tumors is insidious and lacks specific clinical manifestations, and most patients first seek medical attention with symptoms such as cough, wheezing and dyspnea, but they are easily misdiagnosed as asthma or bronchitis, leading to delayed diagnosis and affecting treatment [3]. Due to the special anatomical structure of the trachea, symptoms only appear when the obstruction of the tracheal lumen exceeds 50%, and can lead to tracheal stenosis and significant dyspnea when it exceeds 75%, which can be life-threatening when airway obstruction is severe [4]. Therefore, when many patients are diagnosed, it is already difficult to ensure complete surgical removal of the lesion, or even lose the opportunity of surgery [5]. Currently, surgery is the main treatment for trache-

al 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 trachelectomy 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.

Author contributions: Conceived and reported: Zehui Shi; Constructed figure and table: Xuejiao Li; translated: Xiao Jiang. Article correction: Ziwei Guo.

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