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Video-assisted thoracic surgery right upper lobe bronchial sleeve resection

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Background: Video-assisted thoracic surgery (VATS) is a new technology for nearly 30 years in the field of thoracic surgery most watched. However, there are still some controversy concerning the technical difficulties, operation duration, the extent of lymph node dissection and perioperative complications for VATS sleeve bronchial lobectomy when handling the locally advanced central lung cancer (involving the trachea and/or main bronchus).

Methods: A 66 years old man was admitted for coughing for 2 months. He had smoked for 30 years, 20 packs a day. Chest computed tomography (CT) revealed a 2.5 cm × 4.5 cm mass in the right upper lobe. Bronchoscopy demonstrated the tumor obstructing the right upper lobe bronchus and involved the right main bronchus and bronchus intermedius. Pathology was squamous cell carcinoma. His pulmonary function result was forced expiratory volume in 1 second (FEV_1): 1.91 L (64.7% predicted), forced vital capacity (FVC): 4.36 L. He received general anesthesia with double-lumen endotracheal intubation and left lung ventilation. Left lateral decubitus position was chosen. The first 1.5 cm incision was selected in the eighth intercostal space in the midaxillary line, and was used for the camera. A 4 cm long incision was made in the 3rd intercostal space in the preaxillary line. A third 1.5 cm incision was performed in the 9th intercostal space in the postaxillary line for assistant. Pulmonary ligament and the entire right hilum were mobilized. Pulmonary vein is the most forward hilar structure, sometimes immediately prior pulmonary trunk. The right upper lobe vein was transected with a vascular stapler. Truncus and posterior ascending pulmonary artery were then divided and transected with a vascular stapler. Major and minor fissures were stapled by 60 mm green linear stapler. Following clearance of the mediastinal lymph nodes of level 7, 4R and 2R, the bronchial sleeve resection and reconstruction began. The distal right main bronchus and bronchus intermedius were fully mobilized to ensure adequate surgical exposure. Traction sutures were routinely placed on the lateral walls and to reduce tension. Interrupted sutures were chosen for bronchial anastomosis. Bronchial membrane was sutured first, and then circumference end-to-end anastomoses were carried out using 3-0 absorbable sutures.

Results: There were no complications and the patient was discharged 8 days postoperatively.

Conclusions: The 3rd intercostal space of the anterior axillary line was suggested for right upper lobe bronchial sleeve resection. This incision can reduce the distance and angle between the anastomosis to the incision, providing convenient conditions for easy anastomosis. And avoid the operator fatigue for keeping the posture for a long time. Clearance of the mediastinal lymph nodes before cutting the bronchus was helpful for satisfied explosion of the right main bronchus, the upper lobe bronchus and bronchus intermedius. And this would avoid pulling bronchial anastomosis for mediastinal lymph nodes clearance. Interrupted suture was safe and effective for VATS bronchial anastomosis.

Keywords: Lung cancer; thoracoscopic surgery; sleeve lobectomy

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Introduction

Lung cancer is the most commonly diagnosed cancer as well as the leading cause of cancer death in males worldwide (1). Surgery for patients with non-small cell lung cancer (NSCLC) involving proximal bronchi can be challenging. Pneumonectomy is associated with high rates of complications, especially for patients with compromised pulmonary function. Sleeve lobectomy was introduced as an alternative to pneumonectomy (2). As a result, noninvolved lung parenchyma can be preserved for improving quality of life postoperatively. In 1952, Allison performed the first successful right upper lobe sleeve lobectomy for a patient with bronchogenic carcinoma (3). With the development of video-assisted thoracic surgery (VATS), locally advanced lung cancer, has been adapted for thoracoscopic lung resection and has obtained worldwide acceptance (4-10). However, a thoracoscopic approach is most commonly used for peripheral lesions (11,12). Central lung cancer was still considered a contraindication of thoracoscopic surgery. Thoracoscopic bronchial sleeve resection has only been reported in limited studies (13-16). This report describes a minimally invasive technique for VATS right upper lobe bronchial sleeve resection.

Methods

Clinical summary

A 66 years old man was admitted for coughing for 2 months. He had smoked for 30 years, 20 packs a day. Chest computed tomography (CT) revealed a 2.5 cm × 4.5 cm mass in the right upper lobe (*Figure 1*). Bronchoscopy demonstrated the tumor obstructing the right upper lobe bronchus and involved the right main bronchus and bronchus intermedius. Pathology was squamous cell carcinoma. He received two cycles of neoadjuvant chemotherapy (gemcitabine 2.0 g day 1, 8 + cisplain 40 mg day 1–3). The lesion's size reduced to 2.5 cm × 1.0 cm (*Figure 2*). There were no positive past medical history and co-morbidities. His pulmonary function result was forced expiratory volume in 1 second (FEV_1): 1.91 L (64.7% predicted), forced vital capacity (FVC): 4.36 L.

Pre-operative assessment

Pneumonectomy is associated with high rates of complications, especially for patients with compromised pulmonary function (2). Sleeve lobectomy was an alternative to pneumonectomy. This patient's lesion was located in the right upper lobe and was selected to be candidate for VATS sleeve resection. Preoperative workup included clinical history, physical examination, chest CT scan with intravenous contrast no more than 1 month before resection, pulmonary function test, blood gas analysis, cardiac evaluation, bronchoscopy and basic examinations as usual. Abdominal B-ultrasound, cerebral magnetic resonance imaging (MRI) and isotopic bone scanning were examinations to exclude metastatic disease. Fluorodeoxyglucose-position emission tomography (FDG-PET) was employed to exclude N2 disease.

Anaesthesia and positioning

This patient received general anesthesia with double-lumen endotracheal intubation and left lung ventilation. Left lateral decubitus position was chosen. His arms extended to 90° and the elbows flexed to 90°. And the operative table was flexed to maximize the intercostal space.

Technique

The first 1.5 cm incision was selected in the eighth intercostal space in the midaxillary line, and was used for the camera (30 degree 10 mm high definition video thoracoscope). A 4 cm long incision was made in the 3rd intercostal space in the preaxillary line (*Figure 3*). A third 1.5 cm incision was performed in the 9th intercostal space in the postaxillary line for assistant (*Figure 4*).

First, pulmonary ligament and the entire right hilum were mobilized with combination of sharp and blunt dissection. Second, pulmonary vein is the most forward hilar structure, sometimes immediately prior pulmonary trunk. The right upper lobe vein was transected with a vascular stapler (ETHICON 45 mm white stapler). Third, truncus and posterior ascending pulmonary artery were then divided and transected with a vascular stapler. Injury of the adjacent structures like azygos vein, phrenic and recurrent laryngeal nerves must be avoided during this step. Fourth, major and minor fissures were stapled by 60 mm green linear stapler.

Following clearance of the mediastinal lymph nodes of level 7, 4R and 2R, the bronchial sleeve resection and reconstruction began. Excision of these lymph nodes will facilitate exposure of the bronchus. The distal right main bronchus and bronchus intermedius were fully mobilized to ensure adequate surgical exposure. Traction sutures were routinely placed on the lateral walls and to reduce tension.

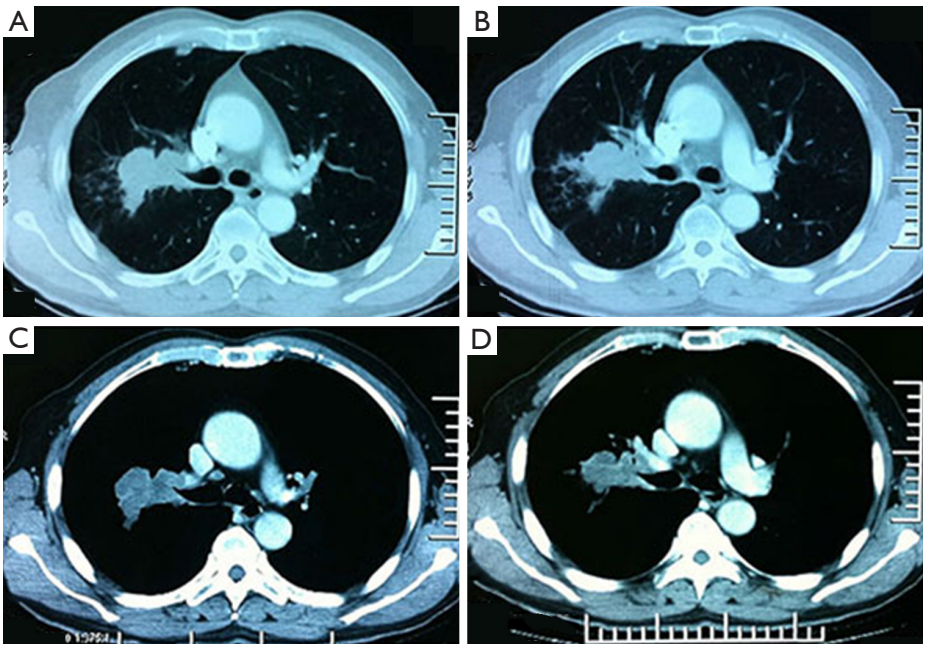

Figure 1 Chest computed tomography (CT) revealed a 2.5 cm × 4.5 cm mass in the right upper lobe.

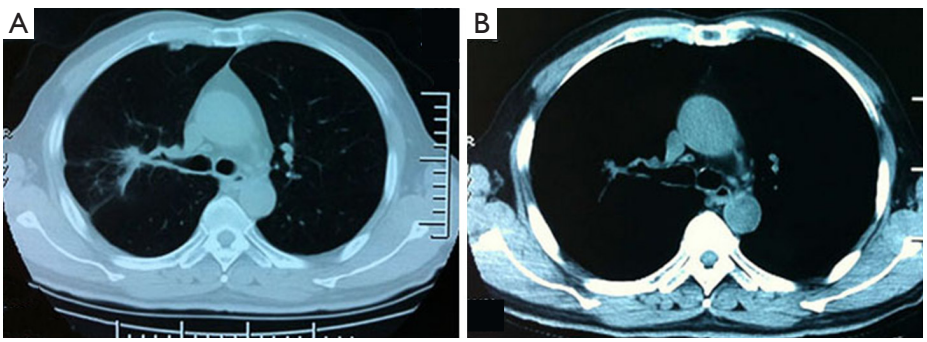

Figure 2 The lesion's size reduced to 2.5 cm × 1.0 cm after two cycles of neoadjuvant chemotherapy.

Figure 3 A 4 cm long incision was made in the right 3rd intercostal space in the preaxillary line.

Figure 4 Video-assisted thoracic surgery (VATS) right upper lobe bronchial sleeve resection (17).
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Attention was then turned to bronchial anastomosis. The key point is to retract the two rings gently and allow the bronchus intermedius to the right main bronchus. Interrupted sutures were chosen for bronchial anastomosis. Bronchial membrane was sutured first, and then circumference end-to-end anastomoses were carried out using 3-0 absorbable sutures. The specimen was removed with a bag, and the two side of the bronchial resection margin were confirmed negative by frozen pathology. Afterwards, level 4R, 2R, and 3A were cleared. Bronchial anastomosis was confirmed without air leakage by water test. Finally, a 32F chest tube was placed 1.5 cm incision (8^{th} intercostal space in the midaxillary line). Final pathology revealed T3N0M0 stage IIA squamous carcinoma.

Results

Post-operative management

Chest X-ray showed right middle and lower lobe reexpanded. Analgesia, antibiotics are used for three days postoperatively. There were no complications and the patient was discharged 8 days postoperatively.

Conclusions

The 3^{rd} intercostal space of the anterior axillary line was suggested for right upper lobe bronchial sleeve resection. This incision can reduce the distance and angle between the anastomosis to the incision, providing convenient conditions for easy anastomosis. And avoid the operator fatigue for keeping the posture for a long time. Clearance of the mediastinal lymph nodes before cutting the bronchus was helpful for satisfied explosion of the right main bronchus, the upper lobe bronchus and bronchus intermedius. And this would avoid pulling bronchial anastomosis for mediastinal lymph nodes clearance. Interrupted suture was safe and effective for VATS bronchial anastomosis.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The study was approved by the institutional ethical committee. Written informed consent was obtained from the patient. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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