



Ruijin robotic thoracic surgery: S¹⁺²⁺³ segmentectomy of the left upper lobe

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Abstract: Robotic-assisted thoracic segmentectomy is a minimally invasive option for the treatment of the resectable lung cancer. Its advantages over conventional video-assisted thoracic surgery include a clear and magnified three-dimensional operative field and the flexible multi-joint arms. This technical article presents a case from our center to share some surgical techniques for this procedure.

Keywords: Segmentectomy; robotic-assisted thoracic surgery

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Clinical data

A 65-year-old woman was admitted because of pulmonary nodules for 1 month detected by computed tomography (CT). Chest CT (*Figure 1*) showed ground glass opacity (GGO) in the S¹⁺²⁺³ segment of the left upper lobe. The patient's complaints did not include chest tightness, shortness of breath, cough, expectoration, low fever, chills, night sweats or hoarseness. Cardiopulmonary function, blood gas analysis and laboratory tests were normal. There was no positive sign or supraclavicular lymph node enlargement in physical examination. She had no past medical history.

Operation steps

Anesthesia and body position

The patient received general anesthesia by double-lumen endotracheal intubation and was placed in the lateral decubitus position and in a jackknife position with single-lung (right) ventilation (*Figure 2*).

Ports

A 1.5-cm camera port (for a 12-mm trocar) was created in

the 8th intercostal space (ICS) at the left mid axillary line, and three separate 1.0-cm working ports (for 8-mm trocars) were made in the 6th ICS (#1 arm) at the left anterior axillary line, the 8th ICS (#2 arm) at the left posterior axillary line, and the left 7th ICS (#3 arm), 2 cm from the spine. An auxiliary port (for a 12-mm trocar) was made in the 8th ICS near the costal arch (*Figure 3*).

Installation of the surgical arms

The robot patient cart was positioned above the operating table and then connected. The #1 arm was connected to a unipolar cautery hook and the #2 arm was connected with bipolar cautery forceps. An incision protector was used in the auxiliary port.

Surgical procedure

See *Figures 4-18*.

Postoperative condition

Postoperative treatments included anti-inflammatory and phlegm-resolving treatments. The thoracic drainage tube was withdrawn 2 days after surgery, and the patient

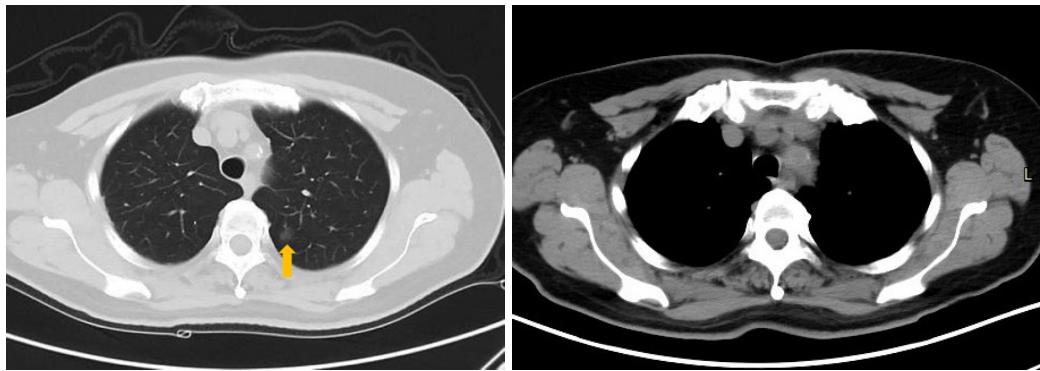


Figure 1 Preoperative CT showed GGO in the S¹⁺²⁺³ segment of the left upper lobe. GGO, ground glass opacity.

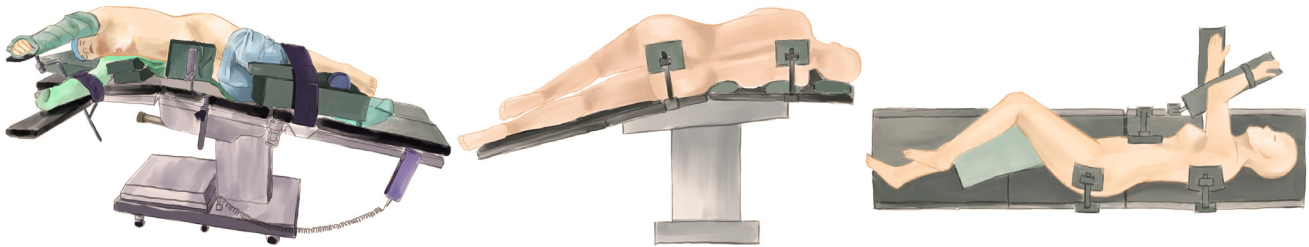


Figure 2 Jackknife position.

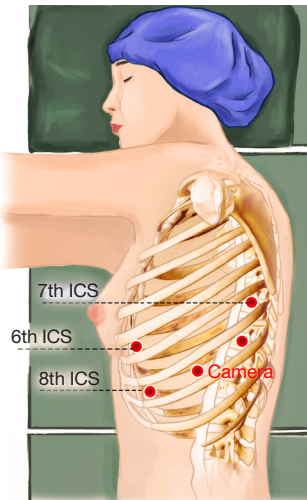


Figure 3 Ports in the 6th, 7th, and 8th ICS. ICS, intercostal space.

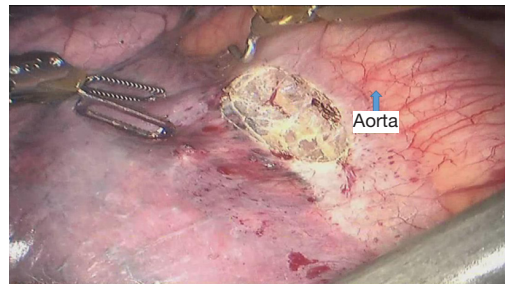


Figure 4 The mediastinal pleura was opened.

Discussion

The segmental dissection of the left upper lobe is a major challenge in robotic surgery because of the thin segmental vessels and bronchus. In addition, it is not easy to determine the segmental plane. The many arterial branches in the left upper lobe should be identified carefully when dissociating and pulling, especially the short branch A³. For that reason, the surgeon should be familiar with the fine anatomy of the vessels and bronchus. The robot has a clear and magnified field of view and flexible arms, which make dissection and use of Endo-GIA stapler easier compared with the thoracoscope. The #3 arm can help the

was discharged 3 days after surgery. No complications were observed during hospitalization. Pathological diagnosis was atypical adenomatous hyperplasia (AAH) at local alveolar epithelium of the S¹⁺²⁺³ segment of the left upper lobe.

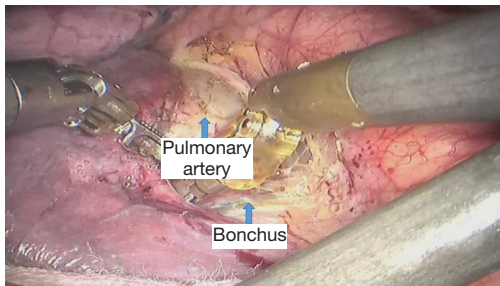


Figure 5 Lymph nodes of the bronchus and pulmonary artery were dissected, and the pulmonary artery was exposed.

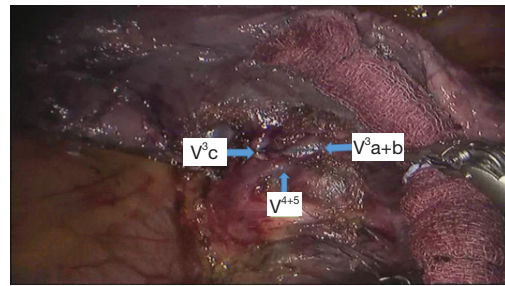


Figure 9 Vein V^3c was skeletonized and ligated to cut.

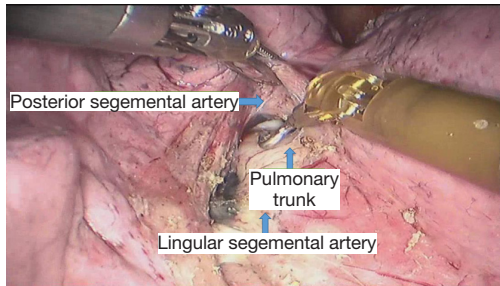


Figure 6 The pulmonary artery was dissected from the interlobar fissure, and a tunnel was formed to open the posterior interlobar fissure.

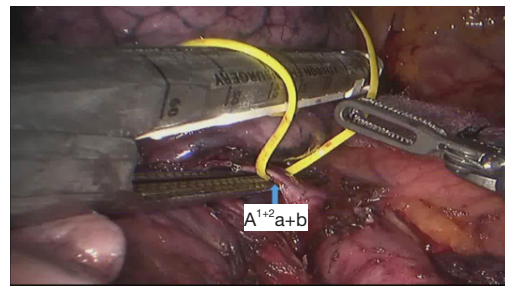


Figure 10 Pulmonary artery $A^{1+2}a+b$ was skeletonized and cut with Echelon flex.

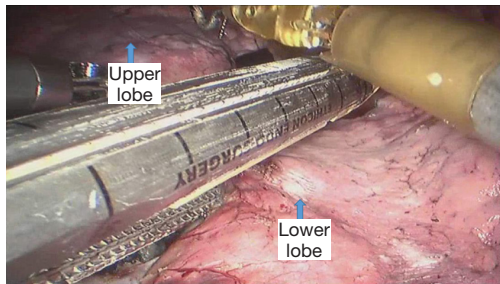


Figure 7 The posterior interlobar fissure was transected with the Echelon flex.

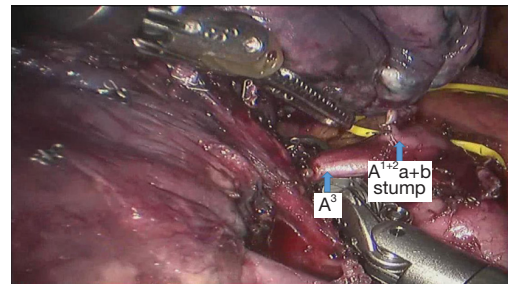


Figure 11 Artery A^3 was skeletonized and dissociated.

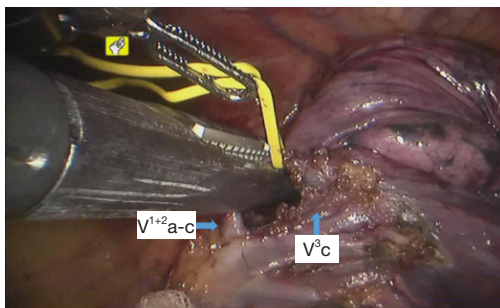


Figure 8 Pulmonary vein $V^{1+2}a-c$ was skeletonized and cut with Echelon flex.

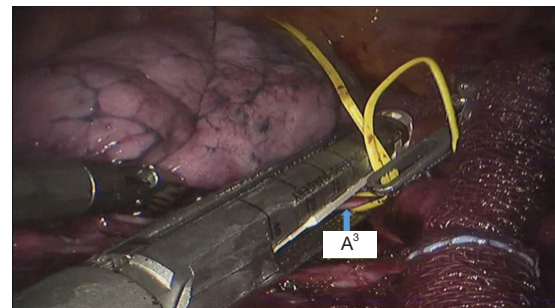


Figure 12 Artery A^3 was cut with Echelon flex.

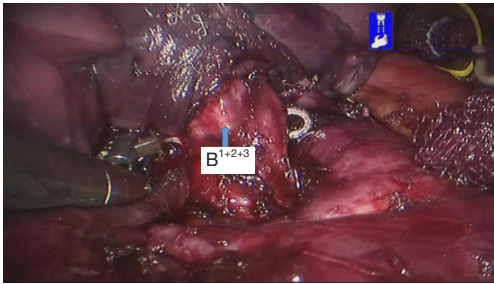


Figure 13 Bronchus B¹⁺²⁺³ was dissected.

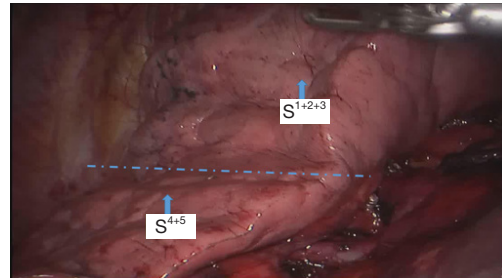


Figure 16 Ventilating the lung to expose intersegment plane.

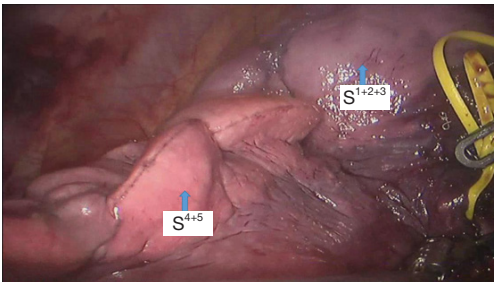


Figure 14 Bronchus B¹⁺²⁺³ was clamped, and the lung was ventilated to expose the plane of the S¹⁺²⁺³ segment.

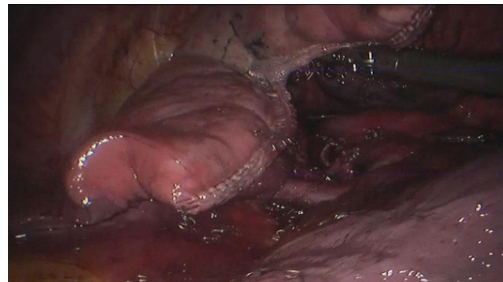


Figure 17 Segment S¹⁺²⁺³ was cut along the intersegmental plane with the Echelon flex.

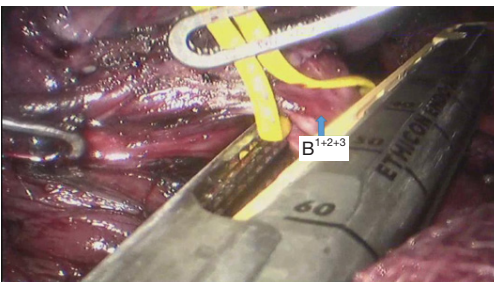


Figure 15 Bronchus B¹⁺²⁺³ was cut with Echelon flex.

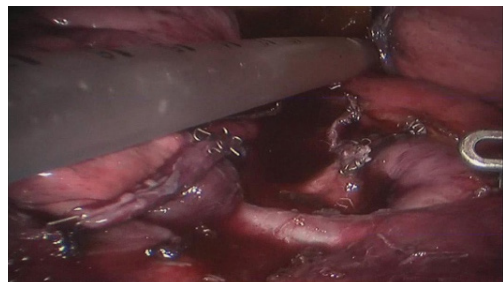


Figure 18 The lung was filled with water and checked for air leaks.

surgeon to find the pulling location, which reduces the work of the assistant. In all surgeries, we dissect the hilum using a posterior approach and expose the pulmonary artery, which improves safety. We inject CO₂ before removing the specimen of lung lobe to form a closed space, which keeps the operation field clear (1-5).

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Footnote

Conflicts of Interest: The authors have completed the

ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/amj.2017.01.12>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this

manuscript and any accompanying images.

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