Masters of Cardiothoracic Surgery

Uniportal robotic-assisted thoracic surgery pneumonectomy

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Clinical vignette

A 47-year-old female, who recently quit smoking, presented with intermittent hemoptysis, and was diagnosed with a left upper lobe pulmonary tumor with central-hilar adenopathy. She has a history of total thyroidectomy for cervical goiter. Clinical evaluation and standard paraclinical investigations confirmed the lung tumor and the fitness for left pneumonectomy. She was proposed for left upper radical uniportal robotic lobectomy.

Surgical technique

Preparation

Like in every robotic thoracic surgery, the instruments for video-assisted thoracic surgery (VATS) and open thoracic surgery were prepared in the operating room. The patient was placed in right lateral decubitus and the right lung was ventilated. The robot was docked on the patient's backside, with arms No. 1, 2, and 3 active and arm No. 4 deactivated.

Exposition

A 4 cm intercostal incision was placed in the 7th intercostal space, between the anterior and middle axillary lines.

Operation

First, the two pulmonary veins were identified with the intention of a left upper lobectomy. The tumoral invasion of the lung hilum was evaluated, and due to pulmonary artery invasion from the anterior mediastinum towards the fissure by the bulky intrapulmonary adenopathy, the left pneumonectomy was imposed.

From the anterior mediastinum, the superior vein was first prepared, encircled with a vessel loop using the "tip-up" instrument, and then stapled; afterwards the pulmonary artery was approached in the same manner. The inferior vein was dissected and stapled after sectioning the pulmonary ligament, and last the left main bronchus was dissected and stapled; the lung was extracted in an endobag. Oncological resection was completed with the mediastinal lymph node dissection in the subaortic, paraaortic, subcarinal and pulmonary ligament stations (5, 6, 7 and 9).

Completion

Hemostasis was performed and bronchial stump integrity was verified under saline. For safety reasons, a hemostatic absorbable material was placed in the subcarinal region, where an extended dissection and complete lymphadenectomy were performed. The 24Ch drain was placed, exteriorized at the posterior part of the surgical wound, and attached to water-seal drainage. The patient was extubated in the operating room and transferred to the intensive care unit (routine for major surgeries at our hospital).

A right tension pneumothorax developed on the first

postoperative (PO) day, imposing emergent drainage, which led to complete and persistent right lung expansion. Post-pneumonectomy space drainage was suppressed on the 2nd PO day. The rest of the PO period was uneventful on the ward. The right chest drainage was extracted on the 4th PO day and the patient was discharged on the 6th PO day.

Pathology shows a G3 lung adenocarcinoma pT3N1M0 L1 R0 STAS+, stage pIIIA, EGFR negative, ALK negative and PD-L1 positive.

Comments

Clinical results

At four months follow-up the patient was professionally active, under systemic treatment, with PET-CT at three months PO showing absence of pathological uptake and a normal post-pneumonectomy aspect.

Advantages

The minimally invasive thoracic surgery (MITS) pneumonectomy was approached with caution by thoracic surgeons worldwide, mainly due to the concern of losing central vascular control (especially the pulmonary artery), the difficulties of exposing and dissecting in the presence of large central tumors and the trouble of extract an entire lung containing the tumor through a small incision (1,2). The uniportal robotic-assisted thoracic surgery (U-RATS) can successfully address all these concerns, as presented.

We state again that pneumonectomy is to be avoided, especially on the right side and especially after chemotherapy for cancer; a lung-sparing lung resection is the best option, when possible (3-5). However, if entire lung resection is necessary, the most accurate dissection and best intrathoracic three-dimensional (3D) views are obtained by robotic thoracic surgery, of which, the least invasive approach is U-RATS.

During U-RATS pneumonectomy, the dissection is very precise, smooth and fine in the pulmonary hilum, and the robotic instruments are especially comfortable when hilar adhesions due to post-induction treatment are present (chemotherapy, irradiation, immunotherapy or combined). In the case of pleural adhesions, the camera angle must be flipped up.

In U-RATS pneumonectomy the "tip-up" instrument is extremely useful, being long and blunt enough to dissect the hidden part of the vessels and bronchus and pass around as safely as possible (3,4). The "tip-up" with its robotic wrist successfully and satisfactorily replaces the VATS/open dissector, especially for the main pulmonary artery and bronchus; robotic surgeons can safely use this instrument after getting used to the lack of haptic feedback.

In cases when lymph node dissection is necessary, the deep 3D robotic view and the fine, precise and clean dissection with the robotic instruments make the uniportal robotic radical pneumonectomy an excellent option for uniportal surgeons.

To date, we performed four cases of U-RATS pneumonectomy—three left and one right. In three cases with malignancies, the entire lung resection was initially planned to be avoided, but the particularities of each case imposed the pneumonectomy. The fourth case was a left intrapericardial completion pneumonectomy for incontrollable hemoptysis, caused by a chronic benign inflammatory pathology.

U-RATS pneumonectomy should be considered as an alternative to other minimally invasive or open pneumonectomies for any pathology.

Caveats

The most important benefit of the U-RATS in pneumonectomy is, that on the left side, it allows for optimal exposure and stapling of the main bronchus, as proximal as possible; the shorter bronchial stump is possible because the angle of stapling is more appropriate compared to U-VATS, as the U-RATS intercostal incision is placed lower (seventh intercostal space).

For low-experienced robotic surgeons, special attention must be drawn to the lack of tactile feedback and the risk of vascular injury, especially to the main pulmonary artery.

Regardless of surgical experience, both VATS and open surgery instruments need to be prepared in the operating room. In U-RATS, the undocking is fast, and the conversion to open surgery is rapidly performed if needed.

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Footnote

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

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