Masters of Cardiothoracic Surgery

Uniportal robotic-assisted thoracic surgery lung-sparing carinal sleeve resection and reconstruction

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Clinical vignette

A 64-year-old female with a previous medical history of coronary artery disease and active smoking was admitted with intermittent hemoptysis. A computed tomography (CT) scan showed wall thickening in the right main bronchus. Fibrobronchoscopy revealed a 1.5-cm squamous cell carcinoma of the right main bronchus extending to the main carina. The patient was proposed for an uniportal robotic-assisted thoracic surgery (U-RATS) carinal resection. She signed the informed consent. Peripheral extracorporeal membrane oxygenation (ECMO) support was decided to be used due to her previous history of coronary artery disease.

Surgical technique

Preparation

The patient was intubated and ECMO was placed. Then she was placed in lateral decubitus on the left side, with the right arm aside from the thorax, as in any intercostal uniportal access into the thorax. The instruments for video-assisted thoracic surgery (VATS) and open thoracic surgery were prepared in the operating room. The robot was docked on the back side of the patient, with active arms No. 2, 3, and 4, and arm No. 1 canceled.

Exposition

A 3-cm incision was placed in the right seventh intercostal space, between the anterior and middle axillary lines. A wound protector was placed. After the insertion of the camera, it was observed that the lateral wall of the superior vena cava was injured while placing ECMO and was repaired during the surgery by U-RATS. Thereby, the azygos vein was transected, and the distal stump was fixed to the posterior chest wall alongside the pleura and peritracheal tissue to create an optimal exposure.

Operation

The "nodes first" technique was performed—thorough lymphadenectomy of subcarinal lymph nodes was carried out, for both exposure and oncological reasons. The trachea, the right main bronchus, and then the left main bronchus were dissected. The right main bronchus was encircled with a tape and distally sectioned at the level of the upper and bronchus intermedius. The trachea was taped and sectioned obliquely, then the left main bronchus was sectioned, but without disconnecting the trachea from the left main on the lateral side. The carina was excised and sent for frozen section; the proximal resection was widened due to positive margins. The airway was restored by performing a complex carinal reconstruction. First, the bronchus intermedius was

sutured to the medial side of the left main bronchus then the right upper bronchus was connected to the trachea, using a running suture (3/0 barbed suture, 25 cm, with two needles). No air leak was observed after the underwater test. Immediate postoperative bronchoscopy confirmed the anastomosis being congruent, intact, and non-stenotic.

Completion

The patient was extubated in the operating room and transferred to the intensive care unit, where she stayed for one day. She did not present any postoperative complications during her hospital stay. The chest tube was removed on the third postoperative day, and the patient was discharged on the fourth postoperative day. At the time of submission, the patient has a three-month follow-up with very good evolution. The pathological report showed a 1.2-cm squamous cell carcinoma with free margins; all subcarinal lymph nodes were negative for malignancy.

Comments

Clinical results

Here we present the first reported case of carinal resection and reconstruction by uniportal RATS. The surgical and oncological evolution at three months is excellent.

Advantages

Carinal resection is one of the most complex thoracic surgeries. First reports of carinal resections were published by Grillo in the 1950s (1) through thoracotomy. Then the minimally invasive approaches were used. As an alternative to traditional minimally invasive approaches (2), robotic surgery has been shown to offer several interesting features, such as a three-dimensional (3D) view, a greater range of motion for the instrumentation, and more precise movements, all of which have the potential to be translated into safer procedures, a more comfortable environment for the surgeon, and potentially lower risk of bleeding and shorter postoperative stays (3).

In previous publications, robotic-assisted thoracic surgery (RATS) carinal resections were performed through a multiport approach (4,5). However, since the introduction of the U-RATS technique, this procedure can be performed by using a single incision with the help of robotic technology. In this article, we show how uniportal RATS is a safe and feasible technique that can be used to perform complex resections and reconstructions of the airways. With the robotic system's 3D vision and endo-wrist technology, which makes it easy to move instruments, the surgeon can almost do this operation in a similar way as using his hands in open surgery, without the need for a thoracotomy (4). However, for the uniportal approach, the arms must be placed in a specific location in order to avoid collision, as presented in the video. In the case of localized tumors, complete surgical resection is the best option, with increased survival compared to other therapies such as radiation or ablative treatments. The length of the trachea to be resected should be carefully assessed in order to avoid tension into the anastomosis and keep the resection as safe as possible, besides the oncological objective (1).

Carinal resection with reconstruction is challenging even during open surgeries, and many dangerous complications occur even when being performed by expert surgeons (1). Carinal surgery decreases the mortality rate in cases of lung-sparing carinal reconstruction more than carinal pneumonectomy. Due to the excellent 3D view and precision of the robot, some of the principles of tracheal surgery can be easily managed during robotic surgery: avoiding extensive lateral dissection to not cause devascularization, tension-free anastomosis, and free margins (4).

Caveats

For U-RATS, previous experience with both the uniportal approach and robotic technology is mandatory to ensure patient safety. The instruments for VATS and open thoracic surgery must be prepared in the operating room. The main advantage of U-RATS is the rapid undocking in case of an uncontrolled event. For the surgeon, the U-RATS approach to the carina offers excellent maneuverability, precision, and accessibility in cases with indication for carinal resection and reconstruction.

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Footnote

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

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