

Thoracoscopic tracheal resection and reconstruction: video-assisted thoracoscopic surgery as a “tool” toward minimally invasive surgery

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Technological innovations in endoscopic cameras and surgical instruments such as stapling devices have enabled thoracic surgeons to perform major lung resections by video-assisted thoracoscopic surgery (VATS) safely. VATS may potentially provide several advantages over open thoracotomy such as reduced postoperative pain, lower morbidity, better preservation of pulmonary function and shorter hospital stay. Today, more than two decades after its introduction, VATS has been widely accepted as a minimally invasive approach to perform lobectomy for early-stage lung cancer (1). In addition, VATS has been more widely employed by some experienced surgeons as a feasible approach to perform extended lung resections such as lobectomy following induction therapy for locally advanced lung cancer and sleeve lobectomy with broncho-plasty and/or vascular-plasty for hilar lung cancer (2).

In an article published in the *Journal of Thoracic Disease*, Dr. Li and coworkers from the First Affiliated Hospital of Guangzhou Medical University (GMU) reported a successful case of tracheal resection and reconstruction by VATS in the management of low-grade adenocarcinoma originating from the middle portion of mediastinal trachea (3). Tracheal circumferential resection and reconstruction by VATS had been first reported by Dr. Nakanishi and Kuruma in 2005 (4), and only a small number of cases have been reported mostly from Chinese institutes including the GMU hospital (3,5,6). The GMU team also employs VATS for more complex

procedures such as carinal reconstruction (6,7), which had been first reported by Dr. Nakanishi *et al.* in 2013 (8).

The most commonly employed approach to the mediastinal trachea is right thoracotomy, as median sternotomy with dissection between the superior vena cava and aorta may be an alternative. Through open thoracotomy, however, the operation field for the upper-to-middle portion of the mediastinal trachea may be limited as it is located near the apex of pleural cupula. VATS approach may have an advantage of providing better and magnified of the operation field other than that of minimally invasiveness. To complete VATS tracheal resection and reconstruction safely, some modifications of operation procedures, which have been traditionally employed during open thoracotomy, may be necessary or helpful. First, a single continuous suture, instead of interrupted suture, shall be employed for tracheal anastomosis to avoid any tangling of the sutures in a restricted operation field. Second, cross-field ventilation by tubing via pleural cavity is usually employed to maintain favorable oxygenation, but may interfere with the operation field, especially in case of VATS. Alternatively, high-frequency jet ventilation (HFJV) may be useful during tracheal reconstruction. Thanks to these technical challenges, VATS tracheal resection and reconstruction may become a practical surgical procedure, as the GMU team and coworkers reported feasible results with a mean operation time of 224 minutes, a mediana

blood-loss of 100 mL, a mean hospital stay of 12.5 days, and no perioperative mortality or major morbidity (6). Here, we shall pay attention to a “publication bias”, and unsuccessful cases with fatal events during VATS behind successful cases may not be reported or published. Robotic-assisted surgery has been introduced as a new platform of minimal invasive surgery for lung resections. As compared with VATS, robotic-platform has more technical advantages such as three-dimension imaging and dedicated wristed instruments enabling surgeons to perform tracheal surgery, especially reconstruction with anastomosis, with enhanced vision and precise control (9), and might be predominantly adopted for tracheal surgery.

Despite several encouraging reports of successful cases, there remain several critical issues before adopting VATS approach for tracheal resection and reconstruction. First, VATS tracheal resection and reconstruction should be performed only by experienced surgeons. Due to the rarity of tracheal tumors, the majority of thoracic surgeons may have no sufficient experience of tracheal surgery (10). Alternatively, surgeons shall be sufficiently experienced both in VATS lobectomy and in open extended resections such as sleeve lobectomy and carinal resection, before planning thoracoscopic tracheal surgery. Anesthesiologist also plays important roles in airway management that is a critical issue in tracheal surgery. The training and commitment of every member involved in the surgery including surgeon, anesthesiologist and nurse is essential. Second, careful patient selection is the key for success of VATS tracheal surgery. The optimal surgical approach for tracheal tumor may depend on experience of the surgical team as well as tumor characteristics such as the size, location, extent of invasion and grade of malignancy. VATS procedure may be preferably indicated for benign or low-grade malignant tumors with a shorter extent (6). Finally, surgeons must be aware of ethical issues in introducing new surgical techniques such as VATS tracheal surgery, and consider the balance between possible risk and potential benefit to the patient. Taking proper informed consent after approval by the ethics committee is also essential before performing the operation.

In conclusion, VATS can be an alternative procedure to perform tracheal resection and reconstruction, only for selected patients and only by a “highly” experienced thoracic surgical team. Here, it should be emphasized that the primary reason for the adoption of VATS to perform tracheal resection and reconstruction is not to complete VATS tracheal surgery itself but to provide minimally

invasiveness to the patient. In other word, VATS is a tool to realize minimally invasive surgery, and the use of invasive procedure such as extracorporeal membrane oxygenation (ECMO) to complete VATS tracheal surgery may not be justified as is not minimally invasive.

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Footnote

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

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