



Non-intubated uniportal video-assisted thoracoscopic lobectomy: expanding the boundaries of minimally invasive surgery while mindful of patient safety

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The rapid evolution of surgical instrumentation and high-resolution video technology over the last two decades created a special momentum that allowed the refinement of video-assisted thoracoscopic surgery (VATS) lobectomy to a universal, feasible, and safer procedure that is widely used (1). In fact, minimally invasive surgery became the preferred approach for curative treatment of early-stage lung cancer and may be considered the gold standard when performed at an experienced center (2-4). Minimally invasive surgery has resulted in major improvements in postoperative pain control and decreased morbidity and mortality with faster recovery (5-7).

Although VATS lobectomy is usually performed through multiple ports, the first single-port VATS lobectomy [uniportal VATS (U-VATS)] was described in 2011 as a natural evolution of VATS techniques to reduce the number of thoracic incisions (8-10). The rapid adoption of U-VATS lobectomy in Asia and Europe has been primarily based on the potential benefits of shortened recovery as compared with multiport VATS techniques (11). The success of minimally invasive surgery has led to increased interest in even less invasive surgical methods, such as non-intubated VATS. The goal of non-intubated VATS is to avoid the adverse effects associated with general anesthesia and single-lung ventilation, such as ventilation-induced lung injury, intubation-related airway damage, nausea, and vomiting (12-14).

Thoracic operations without general anesthesia are not a novelty. In the 1950s, Buckingham and colleagues reported 617 major thoracic procedures (397 thoracoplasties, 64 pneumonectomies, 58 lobectomies, and 98 others) performed under epidural anesthesia and sedation (15). Unfortunately, this paper does not describe surgical outcomes in these patients, and all these surgeries occurred prior to the advent of the single-lung ventilation technique. Non-intubated VATS emerged in 1997 with a retrospective study of lung resections performed under local anesthesia. In this study, 34 patients with spontaneous pneumothorax underwent wedge resection of blebs, with 2 patients requiring conversion to general anesthesia and thoracotomy due to the development of empyema and intraoperative dyspnea. When compared with 38 patients placed under general anesthesia, the results favored surgery with local anesthesia, because local anesthesia was associated with a shorter hospital stay (mean 4.5 *vs.* 5.8 days, $P < 0.05$) (16).

The first non-intubated U-VATS lobectomy was reported in 2014. The patient underwent a right middle lobectomy for a 1.5-cm nodule. A laryngeal mask was used to control the airway, and no epidural anesthesia was used. Pain management in the skin and intercostal space that was satisfactory for surgery was achieved by infiltration of levobupivacaine. The surgical procedure was successful, and the patient was discharged 36 hours after the surgery (17).

Numerous studies have demonstrated that non-

intubated VATS procedures have positive short-term outcomes, including reduced postoperative fasting times, shorter hospital stays, and lower complication rates (18,19). However, the potential long-term impacts must be considered, as these procedures pose a greater challenge to an oncologically sound resection due to spontaneous ventilation during lung resection and lymph node dissection. Further research is needed through multi-center randomized clinical trials with extended follow-up periods to confirm the long-term efficacy of this approach (20,21).

In 2020, Wang and colleagues published a surgical technique description and video of non-intubated uniportal VATS left lower lobectomy and systemic lymph node dissection in the *Journal of Thoracic Disease* (22). The publication detailed the clinical case of a 37-year-old woman with a 4-cm tumor and no suspicion of hilar or mediastinal disease in a computed tomography (CT) scan. The airway was controlled with ventilation through a laryngeal mask. According to the authors, a key element to achieving adequate exposure and making the procedure safe is performing selective intercostal nerve blocking and spraying local anesthetic on the surface of the pleura to abolish the cough reflex. They present a nice video of lung resection with lymph node dissection, demonstrating how feasible the technique is in the hands of experienced surgeons and anesthesiologists (22).

The adoption of emerging techniques, such as non-intubated U-VATS lobectomy, by surgeons at academic centers is generally planned, with a strategy to implement the new procedure with all outcomes measured and controlled. Patient safety is of paramount importance when developing new surgical techniques, and a step-wise plan helps ensure safe implementation. To achieve proficiency, where the highest safety parameters are met and sound surgical principles are maintained according to international guidelines, an apprenticeship period must be surpassed.

Because patient safety is an essential consideration during surgery, it is imperative to develop an emergency intubation plan before starting non-intubated thoracic surgery. To minimize the patient's risk, the team must develop alternative strategies for the surgery and anesthesia in case of any complications or surgical difficulties, and should not hesitate to change to general anesthesia if necessary (22). Contraindications for non-intubated major pulmonary resection using VATS can vary among medical teams. Some common contraindications, based on the experience of Gonzalez-Rivas and colleagues, include

anticipated difficulty with airway management as evaluated by anesthesiologists, body mass index (BMI) greater than 30, an inexperienced surgical team, persistent coughing, extensive pleural adhesions or prior pulmonary resections, hypoxemia [partial pressure of oxygen (PaO₂) <60 mmHg] or hypercarbia [partial pressure of carbon dioxide (PCO₂) >50 mmHg], and procedures requiring isolation of the contralateral lung (12).

The publication of Wang and colleagues provides a valuable description of a surgical technique to perform a non-intubated uniportal VATS for a lobectomy and lymph node dissection that will help surgeons improve their outcomes and benefit patients. We appreciate the invitation to comment on this technical report and congratulate the authors for their work thus far. We hope their publication will stimulate more robust studies on this subject, which are vital for patients undergoing surgery for lung cancer.

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