

Nonintubated thoracoscopic segmentectomy—left upper lobe trisegmentectomy

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Introduction

Enhanced computed tomography screening protocols have recently identified increasing numbers of small lung tumors in patients with high surgical risks (1). Consequently there has been increasing interest in minimally invasive surgical approaches, including thoracoscopic approaches, parenchyma-sparing resection, and less invasive anesthesia for management of lung tumors (2). The role of thoracoscopic segmentectomy is therefore increasingly reevaluated, not only as a traditional parenchyma-sparing procedure in high-risk patients with compromised medical conditions but also in patients with non-small cell lung cancer less than 2.0 cm (1).

From 2009, we started a nonintubated thoracoscopic surgery program for patients who were reluctant or unsuitable to have a conventional intubated single lung ventilation during thoracic surgery (3). With a combination of target-controlled sedation and regional anesthesia—either by thoracic epidural anesthesia or intercostal nerve blocks with intrathoracic vagal blockade—the results of nonintubated thoracoscopic surgery are encouraging (2-5). In the current video, we demonstrate how a nonintubated technique was applied in thoracoscopic segmentectomy and mediastinal lymphadenectomy to treat a patient with early stage lung cancer (*Video 1*).

Clinical vignette

A 74-year-old man, who had undergone a total gastrectomy for gastric cancer in a different institution in 2003, was

transferred to our hospital for management of an incidentally discovered left upper lobe lung nodule. Computed tomography-guided biopsy of the tumor revealed a primary pulmonary adenocarcinoma. Preoperative pulmonary function tests showed that he had a mild obstructive defect with forced expiratory volume in one second being 84.9% of predicted. Considering his age and reduced lung function, lingual-preserving left upper lobectomy (left upper lobe trisegmentectomy) was planned instead of left upper lobectomy to preserve more lung parenchyma after surgery.

Surgical techniques

Preparation

After standard monitoring, the patient was induced with target-controlled infusion of propofol. The patient spontaneously breathed oxygen through a ventilation mask. Depth of sedation and respiratory rate were monitored by bispectral index and capnography, respectively. The patient was then placed in the right lateral decubitus position.

Exposition

Thoracoscopic segmentectomy was performed using a 3-port method. The operative lung was deflated gradually after creation of an iatrogenic pneumothorax.

Operation

Under thoracoscopic guidance, we first performed

intercostal nerve blocks by infiltration of 0.5% bupivacaine from the third to the eighth intercostal nerve under the parietal pleura, 2 cm lateral to the sympathetic chain. Vagal block was also produced at the level of the aortopulmonary window to prevent triggering of cough reflex. After identifying the tumor site, incomplete interlobar fissures to the affected segment was divided. Hilar dissection was then performed to isolate and divide the apicoposterior segmental artery, upper division of left superior pulmonary vein and upper division of left upper bronchus with endoscopic stapling devices. The resected segment was removed in a protective bag through the utility port. Mediastinal lymph node dissection was then performed.

Completion

At the end of the surgery, the operated lung was manually ventilated through the mask to check air leakage. A 28 F chest tube was placed through the lowest incision.

Comments

Using regional anesthesia—either by thoracic epidural anesthesia or intercostal nerve blocks—with intrathoracic vagal blockade and target-controlled sedation, we had performed 51 cases of nonintubated thoracoscopic segmentectomies, including anterior and apicoposterior segmentectomy of right upper lobe, lingulectomy and apical trisegmentectomy of left upper lobe, and superior segmentectomy of the lower lobes of both sides.

Clinical results

There were 44 patients with primary or metastatic lung cancer and 7 patients with benign tumors. No patients required conversion to a thoracotomy or lobectomy. However, one patient required conversion to intubated one-lung ventilation because of vigorous mediastinal and diaphragmatic movement. The mean duration of postoperative chest tube drainage and mean hospital stay were 2.2 and 4.8 days, respectively. Operative complication was only developed in one patient who had an air-leak for more than five days after surgery. No death or major complications occurred.

Advantages

The reasons to use nonintubated technique for thoracoscopic

surgery are mainly to avoid adverse effects associated with general anesthesia and endotracheal intubation for single-lung ventilation. In our cohort, nonintubated patients reported less postoperative nausea and vomiting, early recovery of oral intake and clear consciousness, and better postoperative analgesia in comparison with intubated patients (2-4). In high-risk patients, such as the elderly, this technique also has fewer overall complication rates, compared to intubated general anesthesia (5).

Caveats

Although nonintubated thoracoscopic anatomical segmentectomy was feasible and safe in our cohort (2), further investigations are still necessary to clarify its efficacy and true benefits in different groups of patients, such as medically compromised patients or those with early stage lung cancer. For readers who hope to use this technique, we suggest a cooperative and well-communicating thoracic surgical team, including the thoracic surgeon and anesthesiologist. Patients should be carefully selected in the early learning phase. Obese patients often use significant abdominal effort during respiration, associated with vigorous diaphragmatic movement after iatrogenic pneumothorax, which makes invasive hilar dissection difficult. Although intrathoracic vagal blockade may be effective to attenuate a cough reflex, surgeons are still reminded to retract the lung and manipulate the hilum gently. In cases of dissection of subcarinal lymph nodes, the contralateral main bronchus can be occasionally irritated, which might induce transient coughing. Oxygenation is usually satisfactory after supplemental oxygen during spontaneous one-lung breathing but mild to moderate hypercapnia may occur because of carbon dioxide rebreathing. Although the incidence of conversion to intubated general anesthesia or thoracotomy is low, a conversion protocol in cases of failed nonintubated method should be prepared in advance.

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