



# Uniportal Video-Assisted Thoracoscopic Left Upper Lobectomy with “Reverse Direction” Technique

Xuanyu Lou<sup>1</sup> · Lijian Huang<sup>1</sup> · Yimin Wu<sup>1</sup> · Ying Chai<sup>1</sup>

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## Abstract

The uniportal access video-assisted thoracic surgery has now become an increasingly popular approach to manage thoracic surgical diseases. Among all lobes, left upper lobectomy is considered a difficult procedure via a single incision. Although there are many reports on this technique, standard procedure has not come to an agreement yet. A 50-year-old woman was admitted to our hospital for finding of a left upper lobe lesion for 2 months. No abnormal signs were observed in physical and laboratorial tests. A ground-glass opacity nodule was detected on the left upper lobe on computed tomography. No enlarged lymph nodes or distant metastasis was detected. Early-stage lung cancer was initially diagnosed in this patient. Contrast with traditional uniportal left upper lobectomy procedures, our procedure has a reversed order of dissection. The arterial branches were divided first; then, the upper bronchus, the apicoposterior artery, and upper vein was stapled together at last. On our observation and experience, this procedure can simplify the uniportal left upper lobectomy procedure and reduce operation time potentially. Additionally, we would like to introduce our improved closure technique for uniportal video-assisted thoracic surgery: double-embedding stitching method.

**Keywords** Uniportal surgery · Video-assisted thoracic surgery (VATS) · Left upper lobectomy · Lung neoplasm

## Abbreviations

VATS	Video-assisted thoracic surgery
NSCLC	Non-small-cell lung carcinoma
CT	Computed tomography
MRI	Magnetic resonance imaging
LUL	Left upper lobectomy

## Introduction

Since firstly reported in 1990s, video-assisted thoracic surgery (VATS) in lung cancer has become the first choice for operable non-small-cell lung carcinoma. With the development of surgical instruments and surgical techniques, VATS technique level seems to have reached the extreme. Clinician has

devoted continuously to find a more minimally invasive and quicker postoperative recovery with better operation effect. In this context, a single incision (uniportal) with potentially better cosmesis and reduced access trauma has sprung up. Uniportal VATS was initially described by Rocco for minor thoracic and pulmonary procedures [1]. At present, uniportal VATS has evolved into a proven technique of performing most complex thoracic procedures. Among all lobes, left upper lobectomy is considered a difficult procedure via a single incision [2]. Although there are many reports on this technique, standard procedure has not been achieved yet. Having done some exploration in this area, herein we would like to introduce our procedure as well as our improved closure technique for uniportal VATS left upper lobectomy: double-embedding stitching method.

A 50-year-old lady presented with a finding of a left upper lobe lesion for 2 months. On physical examination, no abnormal signs were found, and no remarkable abnormalities were detected on laboratorial tests. High-resolution computed tomography (CT) imaging revealed a 12 mm × 11 mm ground-glass opacity and central type nodule in the left upper lobe. No enlarged lymph nodes or distant metastasis was detected on contrast-enhanced CT, brain magnetic resonance

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Xuanyu Lou and Lijian Huang contributed equally to this work.

✉ Ying Chai  
chaiy@zju.edu.cn

<sup>1</sup> Department of Thoracic Surgery, the Second Affiliated Hospital, College of Medicine, Zhejiang University, # 88 Jiefang Road, Hangzhou 310009, China

imaging (MRI), bone scintigraphy, and ultrasonic testing. This patient was primary diagnosed with early-stage lung cancer.

## Materials and Methods

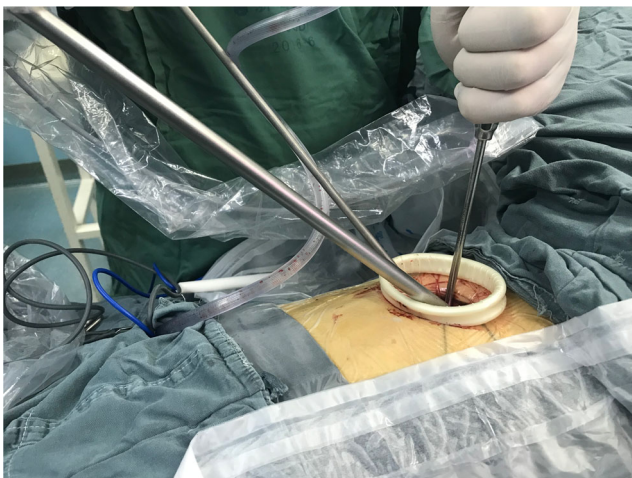
### Anesthesia and Incision

After general anesthesia in one lung ventilation and inserting a double-lumen endotracheal tube, the patient took the right lateral position. The surgeon and the assistant stood in front of the patient (Fig. 1). A 4-cm-long incision was made in the 5th intercostal space in the anterior position. A plastic wound protector was used to keep the utility wound open and prevent the lung from expanding when suction was applied. For most of the surgical steps, a 30°, high-definition, 10-mm thoracoscope was usually placed at the posterior part of the utility incision working with the instruments in the anterior part.

### Left Upper Lobectomy

Uniportal VATS wedge pulmonary resection was firstly performed. The frozen section examination confirmed lung adenocarcinoma, and then, left upper lobectomy with systematic mediastinal lymph node dissecting was performed.

Firstly, the interlobar fissure was divided straightway. This step is always comfortable as the interlobar fissure can be exposed fully through the uniportal incision. Identification of the artery is the most important in order to avoid fierce vascular bleeds in this step. The 10th and 11th group lymph nodes could be cleared in this step.



**Fig. 1** The position instruments in the incision. The thoracoscope was placed at the posterior part of the utility incision working with the instruments in the anterior part

Secondarily, after identifying the left upper lobe artery, finding out, and isolating the segmental arteria, the lingular artery and anterior artery were divided by a stapler (Fig. 2a, b). Meanwhile, asking the assistant to pull the upper lobe up in order to find a better angle for the stapler is the most suggested tip.

In the third step, isolating the left upper lobe bronchus until it was exposed well, it was divided by a stapler (Fig. 2c). Vertical distraction of the upper lobe according to the surgeon's demand could make this step easier.

In the last step, the upper lobe vein and the apicoposterior artery were stapled together (Fig. 2d).

### Radical Mediastinal Lymphadenectomy

The specimen was removed in a protective bag. Systemic mediastinal lymphadenectomy was executed after lung cancer had been confirmed by intraoperative pathological examination. The scope of the lymph node dissection including mediastinal lymph nodes (groups 4L, 5, 6, 7, 8, and 9) and pulmonary lymph node (groups 10–14).

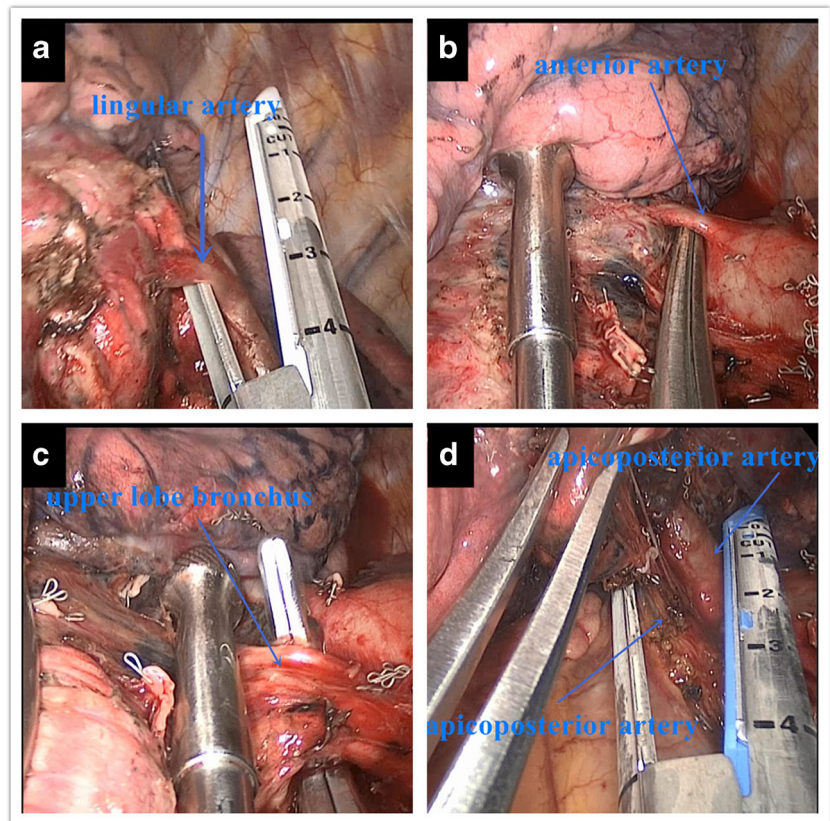
### Closure Technique for Uniportal VATS

Before placing the chest tube, we embedded a 2-0 absorbable suture in the muscle layer around the chest tube site, with one end of the suture extending out of the incision (Fig. 3a), the other end knotted with other muscle layer suture. In the subcutaneous (intra-dermal) layer, a 3-0 absorbable suture was embedded around the chest tube with one end of the suture similarly extending out of the incision. The two-line threads extending from the incision were tied together (Fig. 3b) and tightened slightly to reduce leakage around the tube. After the removal of the chest tube, the muscle and skin layers were sealed by tightening the two knotted lines (Fig. 3c, d), which could be secured on the skin with tape and removed from the surface of the skin after 3–5 days.

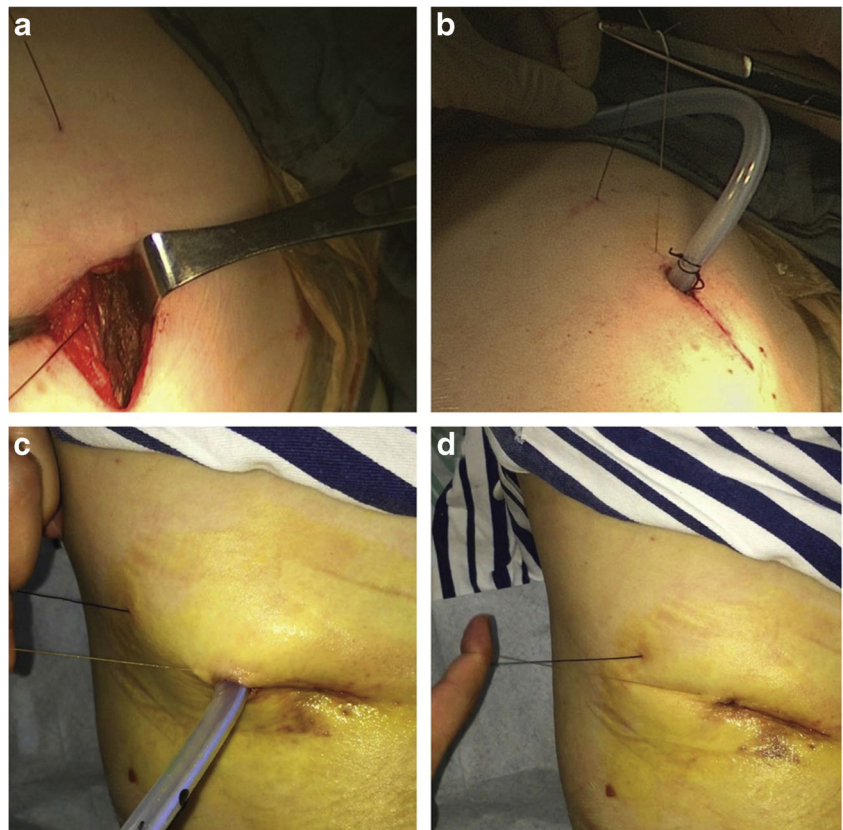
## Results

The operative time was 105 min. The amount of blood loss was 60 ml. Drainage days after operation was 1 day. Chest tube was removed 2 days after the operation when the daily chest tube drainage was < 100 mm with no air leakage and sufficient lung expansion on chest X-rays. And, the postoperative wound healed very well. Postoperative hospitalization time was 6 days. Final pathology revealed a pT1aN0M0 stage I<sub>A1</sub> minimally invasive adenocarcinoma. No postoperative complication was observed during the follow-up for 20 months.

**Fig. 2** **a, b** The second step: freeing and dividing the lingual artery and anterior artery. The upper lobe was pulled up by the assistant in order to find a better angle for the stapler. **c** The third step: bluntly dissecting the adhesion between left superior lobar bronchus and surrounding tissues with a right angle clamp. **d** The fourth step: dividing the anterior segment artery and left superior pulmonary vein at the same time



**Fig. 3** **a** During embedding the suture in the muscle layer. **b** After embedding two lines, they were tied together. **c** During chest tube removal and **d** after tube removal



## Discussion

Left upper lobectomy (LUL) through a single incision is difficult among all the lobes [2]. Most surgeons are accustomed to deal with the pulmonary hilum from anterior aspect, first the apical-anterior arterial, then the upper vein, then the posterior artery, last the bronchus. However, usually, the apical-anterior trunk is too short to be stapled first and sometimes it may be obstructed by the superior pulmonary vein. Surgeons have to divide the superior pulmonary vein preferentially on this occasion. However, finding an optimal angle for stapling the superior vein is also quite difficult sometimes.

Contrast with traditional uniportal LUL procedures, our procedure has a reversed order of dissecting and has the following advantages: (1) the pulmonary lobes do not need to be turned around during the surgery so that the assistant does not need to reposition the thoracoscope frequently; (2) leaving the division of apical-anterior arterial and the upper vein for last, our procedure is safer and simpler; (3) it is more convenient to insert the stapler, and there are no obstructions behind the vessels and bronchus to be processed.

Similar procedure has been reported before [3]. However, we intend to provide a systematic description of the procedure and focus on two difficulties. Dividing the fissure is the first difficulty. As the fissure usually clings to the pulmonary hilum, the hilar vessels may be hurt easily when it was divided. In view of this, we recommend dividing a bit of fissure and the arterial branches of upper lobe be well exposed. Then, it is much easier to deal with the segmental arteries from the bottom (usually the lingular artery) to the top along the pulmonary artery trunk. Freeing upper lobar bronchus is another focal point, especially when it closely attached to the upper lobe vein. In order to avoid injuring the superior vein, bluntly dissecting with a right angle clamp is advocated in this case.

Therefore, limitations of this new procedure are similar to that of multiple-port surgery, such as incomplete interlobe fissure or serious adhesion between upper lobar bronchus and lobe vein. This surgical method should be chosen deliberately for such cases.

Besides, peritubular leakage and cosmesis are problems caused by a single incision. Generally, there are two approaches to insert the drainage tube. One is moving the incision site down to the rib surface and used nylon for tube fixation that is anchored through the subcutaneous suture, which may cause additional operational inconvenience in some patients [4]. And, the other is placing the drainage tube within the intercostal space above the incision, which may cause damage to two intercostal nerves [5]. In our double-embedding approach, the two-line threads extending from the incision were tied together and tightened slightly to reduce

leakage around the tube. After the removal of the chest tube, the muscle and skin layers were sealed by tightening the two knotted lines. We found this method is better in solving the problems of peritubular leakage and cosmesis of the incision after uniportal VATS.

## Conclusions

Having successfully finished the operation of 13 cases, we find that this procedure is a feasible way for left upper lobectomy and it takes a potential advantage in the operation time. We hope this procedure will be a promising alternative approach for LUL in the future.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

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