Video-assisted thoracoscopic left upper lobe sleeve lobectomy combined with pulmonary arterioplasty via two-port approach

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Abstract: Here we report a case of left upper lobe sleeve lobectomy with pulmonary arterioplasty via video-assisted thoracoscopy surgery (VATS) two-port approach. A squamous cell carcinoma with stage T3N1M0 was identified on pathological examination. The bronchial anastomosis was performed using running suture with a 3-0 prolene. Two bulldog clamps were used to gain adequate vascular control. Partial pulmonary artery resection was achieved tangentially with a stapler. The postoperative course was uneventful.

Keywords: Lung cancer; thoracoscopic; lobectomy

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Introduction

Locally advanced lung cancer, even with major artery involvement, has been adapted for thoracoscopic lung resection and obtained worldwide acceptance (1). In some patients, a resection and reconstruction of the pulmonary artery has been increasingly accepted as an alternative to total pneumonectomy as being less invasive. This technique allows patients to preserve more pulmonary function similar to the effect of bronchial sleeve lobectomy. However, vascular arterioplasty is considered a contraindication for the video-assisted thoracoscopy surgery (VATS) approach, even for experienced thoracoscopic surgeons for the high operative risk. This report describes a minimally invasive technique for VATS left upper sleeve lobectomy with pulmonary arterioplasty via the two-port approach.

Operative techniques

A 64-year-old male, nonsmoker with a 4 cm mass located in the left upper lobe was diagnosed with squamous cell carcinoma with clinical stage IIIa. He had no other comorbidities. The bronchus and the arterial branches of the upper lobe were involved. Before the operation, the pulmonary function test, blood gas analysis, cardiac evaluation and basic examinations were within normal limits.

The patient received general anesthesia with dual-lumen endotracheal intubation. He was positioned in the lateral decubitus position with the bed flexed to increase the intercostal spacing. A 1.5-cm-long incision at the 7th intercostal space of the mid-axillary line was placed as camera port; the other incision, 4 cm long, was made in the 4th intercostal space in the anterior position between latissimus dorsi and pectoralis major for utility access. The mass was confirmed in the upper lobe and the arterial branches for the apical segment were involved. The surgical procedure of arterioplasty is described below. Bronchial sleeve lobectomy and anastomosis was then carried out (*Figure 1*).

According to our practice, we released the inferior pulmonary ligament to allow sufficient mobility, retracted the lung superiorly with orbicular-ovate grasping forceps, followed by dissection of the posterior and anterior wall of the hilum. Dissection of lymph nodes in the stations of 7, 10, 4, 5 and 11 was undertaken. The anterior fissure was divided and the posterior fissure was stapled and divided. The branche of the artery for lingular segment were dissected and ligated with silk and divided with ultrasonic scalpel, and then followed by mobilization and transection of the left superior pulmonary vein using a 2 mm stapler (EndoGIA™ 30 mm, Covidien, USA).

Figure 1 Video-assisted thoracoscopic left upper lobe sleeve lobectomy combined with pulmonary arterioplasty via two-port approach (2). Available online: http://www.asvide.com/articles/394

The mass was confirmed in the upper lobe and several ascending arterial branches for the apical segment were involved. Before the surgical procedure for the pulmonary vessels, the bronchus was encircled and then divided. The long scissors were used to transect the bronchus proximal and distal to the tumor over a length about 3 cm.

For the sake of security, the main pulmonary artery and the interlobar artery were dissected to gain adequate vascular control, and then two bulldog clamps (45 mm) were used to occlude them. Single 1-0 silk suture was used around the pulmonary artery trunk (encircled twice) and then the suture was tightened to control the proximal pulmonary artery, followed by application of the bulldog clamps to occlude the main pulmonary artery and the interlobar artery respectively. The instrumentation was inserted through the utility port. Both clamps were placed by orbicular-ovate forceps parallel to the mediastinum to facilitate instrumentation and observation.

Next, long scissors were used to carefully dissect the interspace between pulmonary artery and tumor and the arterial branch was ligated and divided with the ultrasonic scalpel. After further dissection, the branches were deemed impossible to divide directly due to insufficient space. We utilized a 30 mm stapler through the utility port to occlude the branches at their origin with part of the pulmonary artery wall. The thoracoscope was adjusted to confirm an adequate. The lobe was completely disconnected. The sutures and the bulldog clamps were removed to ensure hemostasis of the stapled pulmonary artery sidewall. The specimen was then removed in a glove.

Bronchial reconstruction with the anastomosis between the left main bronchus and lower lobe bronchus was performed subsequently, and long curved suction apparatus and long needle holder were used mainly to finish exposure and suture. The main and lower bronchus were then joined together using complete continuous suture with single 3/0 prolene (Ethicon, Johnson & Johnson, USA). First we used a 1-0 silk suture to retract the pulmonary artery up and forward to get a good visual field, and maneuvered the ends of the bronchus by long curved suction apparatus to facilitate the suture running. We started from the anterior wall of the pars cartilaginea with continuous suture. The knot was made at the posterior wall of the bronchus. Leak testing was conducted following the anastomosis. No leakage was detected up to an airway pressure of 25 cm H_2O. The bronchial anastomosis was covered with an anterior mediastinal fat flap.

Total surgery time was 230 min; the pulmonary artery clamping time was 20 min and estimated blood loss was 200 mL. Postoperative chest X-rays showed no signs of atelectasis. The chest tube was removed on the 5th postoperative day. The patient was discharged on the 7th postoperative day with no complication. A 4 cm squamous cell carcinoma with pathological stage IIb was identified on pathological examination with single bronchial lymph node involvement, while a total of 18 nodes from stations 4, 5, 7, 9, 10 and 11 were clear of tumor.

Discussion

Sleeve resection by VATS has been viewed as an absolute contraindication and few studies have been reported (3). This kind of procedure was increasingly accepted after the first report of a VATS sleeve lobectomy was described by Santambrogio *et al*. in 2002 (4). Nevertheless, in our review, we have found few reports of sleeve lobectomy combined with pulmonary artery arterioplasty performed through a two-port approach. Most of the cases of pulmonary arterioplasty published were performed by using 3-4 incisions, with the vascular clamps inserted through additional incisions (5). Two-port or even single-port VATS for advanced procedures such as vascular arterioplasty can be performed (6). Surgeons and more patients may be more willing to accept the minimally invasive surgery rather than open.

The methods of pulmonary arterioplasty were different. According to the literature, typically the main pulmonary artery and interlobar artery were occluded followed by artery repair using continuous non-absorbable sutures (7). As for this case report, the use of a stapler has not previously been

reviewed and further studies and experience are required.

VATS artery reconstruction and bronchial sleeve lobectomy are all minimally invasive approaches for thorough removal of tumor lesions while sparing normal lung tissue. However, the combined procedure of the two high-risk and technically demanding procedures should be performed only by experienced VATS surgeons.

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