

Uniportal video-assisted thoracoscopic right upper lobectomy and systemic mediastinal lymph nodes dissection

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Abstract: Along with the progresses that have been made in techniques and instruments, uniportal video-assisted thoracoscopic surgery (VATS) became more and more popular. Here, we present the operation video of a 52-year-old female with early stage lung cancer in the right upper lobe (RUL), who underwent uniportal VATS right upper lobectomy and systemic mediastinal lymph nodes dissection performed by our team. The video demonstrated the Uniportal VATS techniques of hilar anatomy, bronchus and blood vessel separation, mediastinal lymph node areas exploration and en-bloc dissection. Once the vision angle is properly adapted, techniques and instruments are mastered, and the patients are well selected, uniportal VATS approach can be an alternative to the conventional VATS for early stage lung cancer.

Keywords: Uniportal; thoracoscopy; lobectomy; operation technique; lung cancer

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Introduction

After over 20 years of improvements, video-assisted thoracoscopic surgery (VATS) has come to be accepted worldwide, becoming the standard approach for treating early lung cancer (1,2). In the trend towards minimally invasive thoracic surgical techniques, some surgeons have become dissatisfied with the 3 or 4 incisions used in conventional VATS lung cancer operations and have started to try single-incision approaches. Increasing numbers of studies have proved the feasibility and safety of uniportal VATS lobectomy (3,4), and its advantages are being researched. Several recent studies of uniportal VATS pulmonary resection reported reduction in postoperative pain and paresthesias and some other surgeons have even reported advantages such as improved geometry for instrumentation and exposure during surgery (5-8). Currently, uniportal VATS approaches performed at centers with experienced staff can allow wedge resection, lobectomy and radical mediastinal lymph node dissection (9,10), or even more difficult procedures like sleeve lobectomy. Once the uniportal vision angle, which is different from

the conventional VATS angle, is well adapted, techniques and instruments are mastered, and good patient selection processes established, uniportal VATS approach may become an alternative to the conventional VATS for early-stage lung cancer (9,10). As shown in the operation video accompanied with this article, we are trying to demonstrate the uniportal VATS techniques of hilar anatomy, bronchus and blood vessels separation, mediastinal lymph node areas exploration and en-bloc dissection (*Figure 1*). In this article, we would also like to discuss our opinions regarding choosing between different telescopes, different staplers under uniportal approaches, and to explain our mediastinal lymph nodes dissection techniques.

Clinical summary

A 52-year-old female patient presented with a ground glass opacity (GGO) in her right upper lobe (RUL) by routine CT check-up after thyroidectomy due to thyroid papillary carcinoma. She was followed up with thoracic surgery clinic for 8 months, during which the lesion grew bigger (1.0 cm in maximum diameter). Past medical history



Figure 1 Uniportal VATS right upper lobectomy and systemic mediastinal lymph nodes dissection (11).

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included hysterectomy and thyroidectomy. Co-morbidity was hypertension controlled with medication.

PET/CT showed very mild hypermetabolism of the GGO (SUV_{max} 1.1) and no lymphatic or distant metastasis. Bronchoscopy showed normal bronchial tree.

Lung function test (FEV1 2.83, act/pred 116.8%) and EKG showed normal pulmonary and cardiac functions.

Anesthesia and positioning

The patient was placed in the lateral decubitus position with her arms extended to 100°–120° to give surgeons more space, because both the operator and the assistant stand at the patient's ventral side. To maximize the intercostal spaces, the operation table was flexed to raise the waist bridge.

General anesthesia was induced and double lumen endotracheal intubation was achieved, which allowed independent lung ventilation of either side.

Technique

An incision approximately 3.6 cm in length was made in the fifth intercostal space between mid and anterior axillary lines. A soft port was used to protect the wound from contamination of tumors and lymph nodes, and also to ease the entrance of instruments.

We used a 0 degree 10 mm telescope. Thorough exploration showed no adhesions or effusions in pleural cavity, and the lesion was at the anterior segment of RUL. A wedge resection was performed and the frozen biopsy result came back as lung adenocarcinoma.

Because the tumor has already been removed, the radical

dissection started with inferior mediastinal lymph nodes. First, the inferior pulmonary ligament was separated and no enlarged lymph nodes were found. Second, the lungs were pushed anteriorly and posterior mediastinal membrane was opened towards the lower border of azygos vein. Third, to reveal the subcarinal area, the assistant pushed the lungs anteriorly with a sponge stick as far as possible in order to extend the right main bronchus anteriorly to the greatest extent. The operator used the suction tip to lift the esophagus and vagus nerve posteriorly. The anterior margin of the esophagus from carina level to inferior pulmonary vein level was separated, which renders it easily lifted posteriorly, and then the whole area of sub-carina was visible. To dissect the subcarinal lymph nodes en bloc, we tried not to clamp, or squeeze the lymph nodes, using the suction tip alone to push, to press and to lift the lymph nodes, which created just enough space for mono-polar electric hook or Harmonic scalpel to separate the lymph nodes along their margins.

The next part of the operation video is the lobectomy. The order of RUL hilum anatomy for lobectomy is apex-anterior artery, posterior segment artery, the right upper bronchus and superior branch of superior pulmonary vein in sequence. There were several reasons for this order. First, the tumor had already been wedge resected, so there was no need to manage superior pulmonary vein first (according to tumor-free principle), which is much more difficult with apex-anterior artery lying posteriorly. Second, the vision angle of uniportal VATS is similar to the angle of thoracotomy, which makes the separation of the fissure and exploration of posterior segment artery easier than it would be in 3-port VATS. Third, the staplers we used in this case did not have adjustable articulations, and this order makes it easier to manage the stapler passing through every vessel. The process of anatomizing and separating the RUL hilum was also accompanied by hilar lymph nodes dissection. Then, the horizontal fissure was separated and the whole RUL was resected. An endo-bag was used to remove it.

The final part is superior mediastinal lymph nodes dissection. The mediastinal membrane of the triangle composed of vagus nerve, azygos vein and SVC (Superior Vena Cava) was opened and the lymph nodes were explored. First, the margin between SVC and the lymph nodes was separated. In order to explore the lymph nodes entirely, the site where the azygos vein joins the SVC was pulled anteriorly and inferiorly. We used the harmonic scalpel to raise the lymph nodes from the base and dissected them en-bloc.

The mediastinal membrane in front of SVC was also

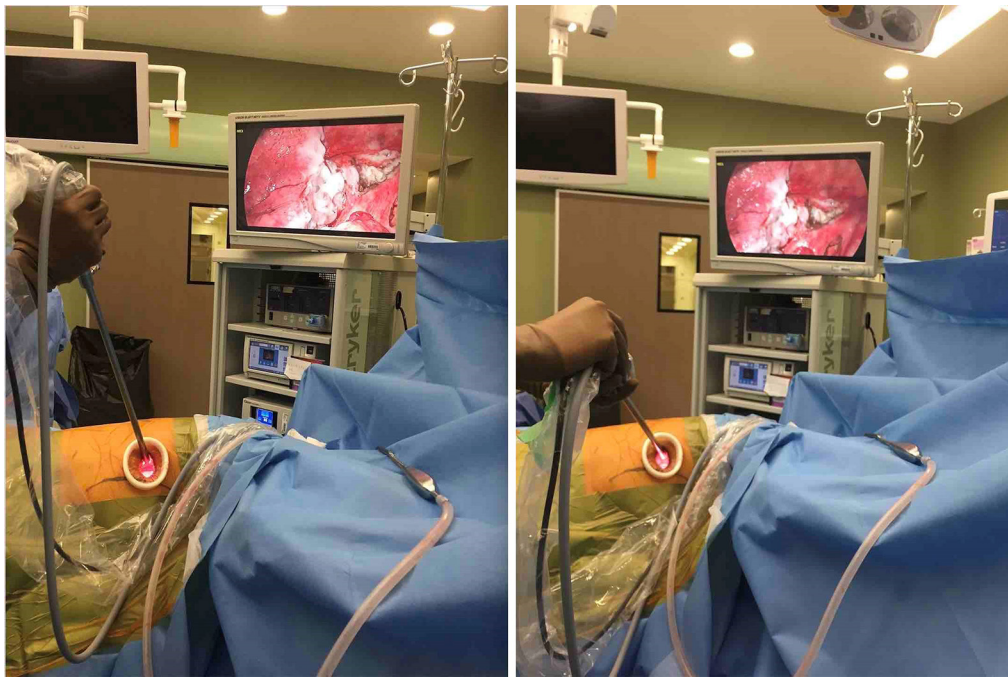


Figure 2 Comparing the difference between a 0-degree telescope (left) and a 30-degree telescope (right).

opened to explore level 3A lymph nodes area, where non was found in this case.

Pleural irrigation and lung expansion showed no air leakage or active hemorrhage. A 28F chest tube was place right through the incision.

Post-operation management

Nebulizer therapy, mucolytic agents and bronchodilator were routinely used for sputum excretion. Analgesia, physical therapy and breathing exercises were used for better lung re-expansion. The patient underwent routine post-operative chest X-ray on post-operation day (POD) 2, which showed very good lung re-expansion and no effusions. The chest tube was removed on POD 3 and the patient was discharged.

Discussion

In conventional VATS surgery, the 30-degree telescope favored for two main reasons: first, the visual port confines the moving range of the telescope lens; second, the direction of the telescope is much different from the direction of the instruments, so turning the 30-degree lens will make the visual plane coincide with the operating plane.

Uniportal VATS approaches are not subject to these two problems. Because the telescope enters a bigger incision, it has more mobility; and the direction of the telescope is almost the same with that of the instruments, which means the coinciding of visual plane and operating plane does not require the lens to be turned. Moreover, to acquire the same vision angle, a 0-degree telescope must be lifted about 30 degrees higher than a 30-degree one, which happens to leave more space for the instruments to enter underneath the telescope lens (as shown in *Figure 2*). Another advantage of 0-degree telescopes is that they are much easier to be managed with one hand, leaving the assistant able to help exploration with the other hand. In our opinion, 0 degree telescope can be used at all Uniportal VATS lung resections, including wedge resection, lobectomy and mediastinal lymph nodes dissection. For procedures like thymectomy, bullectomy and sympathectomy, because the incisions are much smaller and the telescopes will intrude much deeper into thoracic cavity, the mobility of the telescope will be confined as it is under conventional (2–3 port) VATS procedures, for which 30-degree telescope will be better.

The choice of staplers is important in uniportal VATS lobectomy. The ones with articulation, which provides more flexibility while being placed through certain angles of anatomic structures, would be preferred. Those new staplers

featured with curved tip at the distal end of the anvil can provide enhanced visibility and maneuverability around the target vessels. However, in this video, we used endoscopic staplers without articulation. With the surgeons' delicate and thorough separation of the hilar anatomy structure and the careful maneuver with the staplers, the surgery can still be managed with staplers without articulation.

Mediastinal lymph node dissection is crucial to lung cancer surgery. As more techniques are developed and surgeons become more experienced, such procedure can be performed well using uniportal VATS approaches. The maneuver we used in the video to explore the subcarinal area makes it possible to visualize it in a fashion similar to open thoracotomy. And the effect is even better with the magnification of the telescope. To fully reveal the subcarinal area, first, the posterior mediastinal membrane was fully opened from inferior pulmonary vein to azygos vein; second, the anterior margin of esophagus at this area was fully separated; third, the lungs were pushed anteriorly by the assistant with a sponge stick and the main bronchus was stretched anteriorly; fourth, the esophagus was lifted with the suction tip and the subcarinal area was fully explored. The techniques of pushing, pressing and lifting the lymph nodes with the suction tip curved at the distal end, leave enough space for monopolar electric hook or harmonic scalpel to separate them along their margins. Without clamping, grasping or squeezing the lymph nodes, en-bloc dissection can be performed, preventing the lymph nodes tattered and scattered during the process. The right upper mediastinal lymph nodes dissection maneuver was more or less the same as in conventional 3-port VATS surgery.

As shown in the video, with certain maneuvers and techniques, the exploration under uniportal VATS approach is as good as under conventional 3-port approach, and in some mediastinal areas it is even better. Uniportal VATS lobectomy and systemic lymph node dissection is a promising alternative for early stage lung cancer. Still, the long-term effect of uniportal VATS approach comparing with conventional VATS needs more studies to reveal.

Acknowledgements

None.

Footnote

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

Informed Consent: Written informed consent was obtained from the patient for publication of this article and any accompanying images.

References

1. Walker WS, Codispoti M, Soon SY, et al. Long-term outcomes following VATS lobectomy for non-small cell bronchogenic carcinoma. *Eur J Cardiothorac Surg* 2003;23:397-402.
2. Naidoo R, Windsor MN, Goldstraw P. Surgery in 2013 and beyond. *J Thorac Dis* 2013;5 Suppl 5:S593-606.
3. Gonzalez-Rivas D, Paradela M, Fernandez R, et al. Uniportal video-assisted thoracoscopic lobectomy: two years of experience. *Ann Thorac Surg* 2013;95:426-32.
4. Rocco G. One-port (uniportal) video-assisted thoracic surgical resections--a clear advance. *J Thorac Cardiovasc Surg* 2012;144:S27-31.
5. Jutley RS, Khalil MW, Rocco G. Uniportal vs standard three-port VATS technique for spontaneous pneumothorax: comparison of post-operative pain and residual paraesthesia. *Eur J Cardiothorac Surg* 2005;28:43-6.
6. Tamura M, Shimizu Y, Hashizume Y. Pain following thoracoscopic surgery: retrospective analysis between single-incision and three-port video-assisted thoracoscopic surgery. *J Cardiothorac Surg* 2013;8:153.
7. Tam JK, Lim KS. Total muscle-sparing uniportal video-assisted thoracoscopic surgery lobectomy. *Ann Thorac Surg* 2013;96:1982-6.
8. Bertolaccini L, Rocco G, Viti A, et al. Geometrical characteristics of uniportal VATS. *J Thorac Dis* 2013;5 Suppl 3:S214-6.
9. Wang BY, Tu CC, Liu CY, et al. Single-incision thoracoscopic lobectomy and segmentectomy with radical lymph node dissection. *Ann Thorac Surg* 2013;96:977-82.
10. Chung JH, Choi YS, Cho JH, et al. Uniportal video-assisted thoracoscopic lobectomy: an alternative to conventional thoracoscopic lobectomy in lung cancer surgery? *Interact Cardiovasc Thorac Surg* 2015;20:813-9.
11. He J, Ma D, Li S. Uniportal VATS right upper lobectomy and systemic mediastinal lymph nodes dissection. *Asvide* 2017;4:256. Available online: <http://www.asvide.com/articles/1565>

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