Brief Report on Thoracic Surgery

Uniportal video-assisted thoracic surgery—the experiences of Shanghai Pulmonary Hospital

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Abstract: Uniportal video-assisted thoracic surgery (VATS) is getting recognized in thoracic surgery, especially in China. Although surgeons from some part of the world are still skeptic, those in China have witnessed its breathtaking growth, along with the development of the specialty of thoracic surgery. By introducing the history and experiences of one specialty hospital—Shanghai Pulmonary Hospital (SPH), we show the feasibility and safety of uniportal VATS, and illustrate the technical details of this procedure with the example of right middle lobectomy (RML).

Keywords: Uniportal VATS; right middle lobectomy (RML); lung resection

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Introduction

The concept of uniportal video-assisted thoracic surgery (VATS) is relatively new to thoracic surgeons (1). But ever since its birth over a decade ago, this surgical procedure has experienced rapid development. Now, the indications for uniportal VATS are already similar to those for three-port VATS (2-4). All over the world, more and more surgeons are changing their minds and beginning to accept this technique. This trend is more obvious in China.

Shanghai Pulmonary Hospital (SPH) was established in 1933, during the time when modern medicine was first introduced into China. She was a TB sanitarium in the beginning. But, later, as TB is getting controlled in Shanghai, and the incidence of lung cancer is growing rapidly, she has become one focusing on various diseases of the lung and mediastinum. The Department of Thoracic Surgery in SPH has been going through an unprecedented growth in recent years. Since the beginning of the 21 century, the annual number of surgeries has been growing at an astonishing speed, with less than 3,000 major surgeries in 2010, but almost 7,000 in 2014 and over 8,000 last year. VATS is prevalent in SPH, and almost half of all the surgeries are VATS lobectomies, now.

In retrospection of history, the development of VATS operation in SPH dated back to early 1990s. The first VATS operation in SPH was performed in 1994 for pneumothorax. The first VATS lobectomy in SPH was performed in 1999. In Europe, Rocco was one of the pioneers in uniportal VATS (1). In 2013, he published his 10-year experiences on over 600 cases of various surgeries performed by uniportal VATS (5). But Gonzalez was the first to accomplish an anatomical lobectomy by uniportal VATS (6). In 2012, we performed our first uniportal VATS operation in SPH. Now the uniportal technique has become mature and widely accepted in China.

In order to prove the safety and efficacy of this procedure, we carried a retrospective study of all the operations performed by uniportal VATS in SPH from May 2012 to May 2014 (7). The total number was 1,063, including 27 simultaneous bilateral operations. Lobectomy was performed in 569 patients, segmentectomy in 162, wedge resection in 264, mediastinal tumor resection in 54, and other types of operation were rare. The total conversion rate was 4.6%. The average operation time was 135±31 minutes, and the average blood loss was 117±47 mL. There were fifteen intraoperative vascular injuries. There was no operative death, and operative complications occurred in

59 patients (5.6%). The 1-year overall survival and 1-year disease free survival for the primary lung cancer group were 98% and 96%, respectively.

Our experiences proved that uniportal VATS was a safe and efficient procedure, just as the traditional three-port VATS. To illustrate how the procedure was performed, we hereby take right middle lobectomy (RML) as an example. Due to the characteristics of uniportal VATS, RML has its unique difficulties. The distance from incision to hilum is so short that the manipulation of stapler is restricted. The algorithm for the management of the main structures needs to be adjusted accordingly.

Patient selection and workup

Patients with solitary pulmonary nodules were included. These were either diagnosed with lung cancer by needle biopsy before surgery or highly suspected of having lung cancer based on computed tomography (CT) scan.

Pre-operative preparation

Thorough preoperative examination was performed in each patient. Distant metastasis or mediastinal lymph node involvement were excluded by CT scan, bone single photon emission computed tomography (SPECT), endobronchial sonography (E-BUS), or positron emission tomography (PET)-CT. Cardiopulmonary function of all the patients were within normal range. Comorbidities that would incur considerable dangers were not found.

Equipment preference card

(I) Video system: IMAGE1 HD system (Karl Storz, Inc., Germany);
(II) Ultrasonic scalpel: Harmonic (Ethicon Endo-Surgery, LLC, Puerto Rico, USA);
(III) Stapler: Endo GIA Ultra Universal Stapler (Covidien, LLC., MA, USA).

Procedure

General anesthesia with double lumen endobronchial intubation was routinely adopted for each patient. The patient was laid in a left-sided lateral position, with the right hemithorax slightly over extended, so that the intercostal spaces could be expanded to facilitate the operation.

A single incision of about 4 cm long was made along the fifth intercostal space just anterior to the mid-axillary line. A wound protector instead of rib spreader was used to keep the small incision open. Extra-long instruments specially designed for uniportal VATS by SHP were used in each operation.

After exploration and identification of the lesion in the right middle lobe, the dissection began from the venous branches from the middle lobe. Depending on the completeness of the major and minor fissures, the order of the management of the main structures should be adjusted accordingly.

The conventional order of performing a middle lobectomy starts from the vein or artery and ends with the bronchus. This can be achieved under uniportal VATS when both fissures are complete. But unfortunately, this is seldom the case.

When only the major fissure was complete, it was easier to dissect the arterial branches within. Then the inferior border of the vein was automatically exposed, making the management of the vein an easy job. The vein could be passed by the stapler either antero-superiorly or postero-inferiorly, depending on the relative position and direction of the vessel to the incision. The arterial branch in the major fissure could be divided by stapler, electric hook or ultrasound knife, depending on its size and direction. There were not many differences whether to divide the vein or the artery in the major fissure first. After the vein was severed, the middle lobe bronchus, which lied posteriorly was exposed. The parabronchial lymph nodes were removed to allow encirclement of the bronchus with a right angle clamp. After stapling the bronchus, there was, beneath the horizontal fissure, almost always one or two arterial branches which could be divided in the same fashion as the one in the major fissure. The horizontal fissure, which was rarely complete, was then cut open with ease (*Figure 1*).

When neither fissure was complete, we started from the middle lobe vein. There was usually no problem dissecting the vein, but passing a stapler through could be challenging, for the vein was usually too close to the incision for the stapler to have a satisfactory angulation. To overcome this inconvenience, the anterior end of the major fissure needed to be opened by a stapler, electric hook or ultrasound knife. The inferior border of the middle lobe vein was thus completely exposed. In most cases, the stapler could be passed through the vein without too much difficulty in this way. For the same reason, the anterior

Figure 1 RML with a relatively complete major fissure, when the artery within was divided first, and the one under the minor fissure was divided by Harmonic (8). RML, right middle lobectomy.
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Figure 2 RML with incomplete major fissure, and the artery was divided after the vein and bronchus (9). RML, right middle lobectomy.
Available online: http://www.asvide.com/articles/865

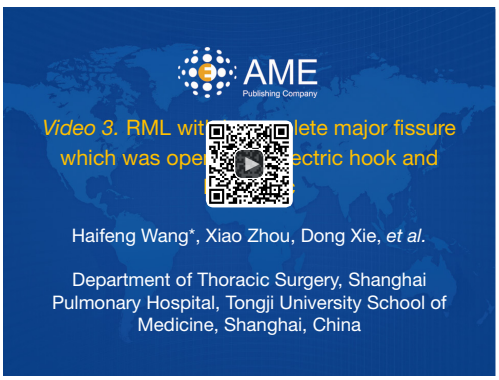

Figure 3 RML with incomplete major fissure which was opened by electric hook and Harmonic (10). RML, right middle lobectomy.
Available online: http://www.asvide.com/articles/866

part of the major fissure should be dissected to the degree so that it did not stand in the way while passing a stapler through the bronchus. After the bronchus was divided, the arterial branches to the middle lobe were easily exposed and divided. The remaining steps were the same as illustrated in the previous paragraph (*Figures 2,3*).

Post-operative management

One chest tube of 28 F was placed to the apex of the thorax. Another 18 F soft tube was left to the most dependent part of the thorax for drainage. No extra incision was made for drainage. Both chest tubes were connected to a water-seal drainage system without suction. The 28 F tube was removed 48 hours after surgery when there was no air-leak and the lung expanded well. The 18 F tube was kept until discharge when the drainage was less than 200 mL/d.

Tips, tricks and pitfalls

An incision at the 5th intercostal space is preferred so that the incision was not to close to the vein to increase difficulty in passing a stapler through and the operation could be performed in one direction. We would avoid making the incision too anteriorly, either, otherwise the stapler could be thwarted, while passing through the vein, by the bronchus posteriorly and the subcarinal lymph nodes would be more difficult to expose.

We would leave the minor fissure to the last, after exposing and dividing the artery beneath it. In this fashion, not only the difficulties of operation but also airleak afterwards could be decreased.

When passing the stapler through the vein, we stopped pulling the lung so that the stapler could push the relaxed middle lobe vein anteriorly and pass in front of the branches from the upper lobe.

Dissection of hilar lymph nodes would help identify the main structures and accelerate the operation.

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Footnote

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

References

1. Rocco G, Martin-Ucar A, Passera E. Uniportal VATS wedge pulmonary resections. Ann Thorac Surg 2004;77:726-8.
2. Gonzalez-Rivas D, de la Torre M, Fernandez R, et al. Video: Single-incision video-assisted thoracoscopic right pneumonectomy. Surg Endosc 2012;26:2078-9.
3. Gonzalez-Rivas D, Delgado M, Fieira E, et al. Single-port video-assisted thoracoscopic lobectomy with pulmonary artery reconstruction. Interact Cardiovasc Thorac Surg 2013;17:889-91.
4. Gonzalez-Rivas D, Fernandez R, Fieira E, et al. Uniportal video-assisted thoracoscopic bronchial sleeve lobectomy: first report. J Thorac Cardiovasc Surg 2013;145:1676-7.
5. Rocco G, Martucci N, La Manna C, et al. Ten-year experience on 644 patients undergoing single-port (uniportal) video-assisted thoracoscopic surgery. Ann Thorac Surg 2013;96:434-8.
6. Gonzalez D, Paradela M, Garcia J, et al. Single-port video-assisted thoracoscopic lobectomy. Interact Cardiovasc Thorac Surg 2011;12:514-5.
7. Xie D, Wang H, Fei K, et al. Single-port video-assisted thoracic surgery in 1063 cases: a single-institution experience†. Eur J Cardiothorac Surg 2016;49 Suppl 1:i31-i36.
8. Wang H, Zhou X, Xie D, et al. RML with a relatively complete major fissure, when the artery within was divided first, and the one under the minor fissure was divided by Harmonic. Asvide 2016;3:110. Available online: http://www.asvide.com/articles/864
9. Wang H, Zhou X, Xie D, et al. RML with incomplete major fissure, and the artery was divided after the vein and bronchus. Asvide 2016;3:111. Available online: http://www.asvide.com/articles/865
10. Wang H, Zhou X, Xie D, et al. RML with incomplete major fissure which was opened by electric hook and Harmonic. Asvide 2016;3:112. Available online: http://www.asvide.com/articles/866

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