Surgical Technique

Microinvasive segmentectomy: a case of video-assisted thoracic surgery left S^{9+10} segmentectomy

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Submitted Jul 06, 2018. Accepted for publication Jul 10, 2018.
doi: 10.21037/jtd.2018.07.49
View this article at: http://dx.doi.org/10.21037/jtd.2018.07.49

Introduction

Different from lingual or superior segmentectomy, procedures like anterior (S^3) segmentectomy can be regarded as complicated type of segmentectomy, because of the complicated type including resection of more than one intersegmental plane. Accurate division of the planes is vital to the procedure and it relies on the accurate division of every branch of target segmental vessels and bronchi. We reported the process of a video-assisted thoracoscopic surgery (VATS) anatomical left S^{9+10} segmentectomy for a GGO lesion in a 66-year-old male.

Figure 1 Left S^{9+10} segmentectomy (1).
Available online: http://www.asvide.com/article/view/26151

Surgical technique

A GGO lesion at S^{9+10} of left lower lobe in a 66-year-old male patient was identified 12 months ago. The lesion was found increased by a follow-up CT scan. A three-dimensional (3D) reconstruction of lung by the chest CT scan was performed to identify the location of the lesion and the possible variations of the pulmonary vessels and bronchi. We made a surgical plan of a VATS Left S^{9+10} segmentectomy on this patient (*Figure 1*).

After intubated, the patient was placed in the right lateral decubitus position. A 10-mm port was placed in the 8^{th} intercostal space on the mid axillary line. Another incision of about 2 cm and an incision of about 1.5 cm were made in the 5^{th} intercostal space on the left anterior axillary line and in the 5^{th} intercostal space on the left posterior axillary line, respectively.

A^6, A^8 and A^{10} were identified and skeletonized. A^9a and A^9b+A^{10} were then identified and skeletonized. The #12 and #13 lymph nodes were dissected. All the segmental bronchi of left lower lobe were exposed. Branches of B^6, B^8 and B^{9+10} were identified before B^{9+10} was divided. The left lower lobe was then retracted ventrally. The 8–13^{th} levels of lymph nodes were dissected. The tunnel between S^6 and S^8 were also explored. S^6 and S^{8-10} were divided by an endostapler. A^{9+10} was cut and B^{9+10} was then revealed and cut. All branches of the pulmonary vein of the left lower lobe were exposed and skeletonized from surrounding pulmonary parenchyma for as long as possible. Branches V^9 and V^{10} were then identified and divided.

The whole left lung was inflated with pure oxygen and then deflated for 15 minutes. The inflation-deflation line was clear between S^8 and S^{9+10}. The intersegmental plane of S^{9+10} and S^8 was divided along the V^8b and also along the inflation-deflation border line firstly using electrocautery and then an endostapler. Intraoperative frozen sections revealed a pathological diagnosis of invasive adenocarcinoma

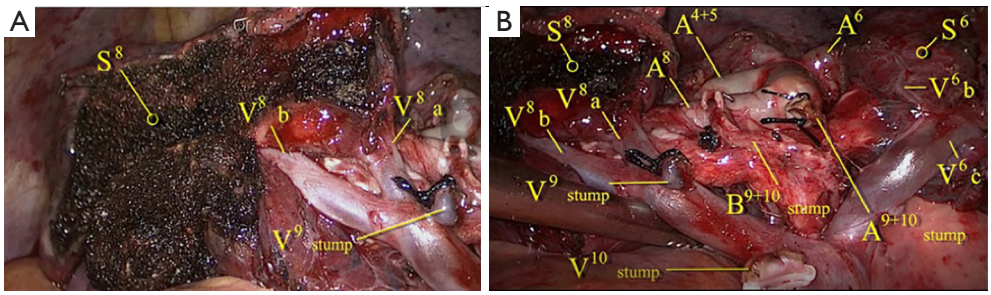

Figure 2 The view of the remnant left lower lobe after removal of S^{9+10}. (A) The intersegmental plane between S^8 and S^{9+10} divided by electrocautery; (B) after removal of S^{9+10}, V^6 and V^8 were identified and preserved on the intersegmental plane of S^6 and S^8 separately.

with no segmental lymph nodes involvement. A systematic lymph node dissection was then performed.

After S^{9+10} resection, S^8 and S^6 were separated. V^6 and V^8 were identified and preserved on the intersegmental plane of S^6 and S^8 separately (*Figure 2*).

Discussion

Several literatures have showed that segmentectomy can achieve equivalent therapeutic effect to lobectomy for stage IA lung cancer (2-4). But the major defects, such as the wrong division of segmental vessels or insufficient resection margin distance, can cause unnecessary harm to the patients and even endanger the treatment value of the procedure for the lung neoplasm. These defects should be avoided as far as possible. The S^{9+10} segmentectomy of the lower lobe is a complicated type of segmentectomy which includes division of two intersegmental planes (5). The variations of the pulmonary vessels in the lower lobe are very common. The identification of the target segment with enough resection margin distance and the complete understanding of the variation pattern before surgery are recommended for a smooth and accurate S^{9+10} segmentectomy. We referred to the preoperative 3D reconstruction of the lung by CT scan (6) to achieve these targets. In this case, we found segmentectomy of the S^{9+10} to be the proper surgery for its satisfaction of complete removal of the lesion with enough resection margin distance. We also detected the proper branching pattern of the vessels and bronchi preoperatively with this tool. We use a sculpting manner (7) to perform the biopsy of the whole lower lobe. Every important structure was compared with the 3D reconstruction image and identified before being divided. This manner helps to preclude any major default in dividing the target segmental vessels or bronchi.

In this case, we divided the intersegmental plane of S^6 and S^{9+10} using a tunnel manner by staplers. After the division, it became easy for exposure of the segmental vessels and bronchi of S^9 and S^{10}. We chose electrocautery combined with staplers for the division of the S^8 and S^9 intersegmental plane. Electrocautery has been shown to be useful for dissecting the intersegmental plane (8,9). In our opinion, combination of both manners for the division may be ideal in the complex type of segmentectomy. It may decrease the number of the staplers in the operation, preserving the intersegmental veins and ameliorating the expansion of S^8. Since the resection margin was enough according to the 3D reconstruction preoperatively we divided along the deflation-inflation plane and adjacent to the target segment by electrocautery. We inflated the remnant lung and examined the air leak after the removal of target segments. Only slight air leak was detected. In our opinion, to keep the electrocautery dividing in the target segments, adjacent to the correct intersegmental plane is vital in the plane-dividing process. And a clear intersegmental plane relies on the correctness of division of the branches of vessels and bronchi of the target segments.

Conclusions

For complicated type of segmentectomy procedures, we suggest proper surgical planning according to 3D reconstruction based on CT images. Precise identification and accurate division of the anatomical structures is fundamental to carry out this type of segmentectomy smoothly.

Acknowledgements

Dr. Yunfeng Yuan was granted the Award of Excellence

in the 2017 VATS Lobectomy & Segmentectomy Video Contest.

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 manuscript and any accompanying images.

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Cite this article as: Xue L, Yuan Y. Microinvasive segmentectomy: a case of video-assisted thoracic surgery left S^{9+10} segmentectomy. J Thorac Dis 2018;10(7):4472-4474. doi: 10.21037/jtd.2018.07.49