Surgical Technique

How to manage tumor located between upper division and lingular segment "S3+S4 segmentectomy and S3b+S4 segmentectomy"

Shin-Ichi Yamashita[1], Yasuhiro Yoshida[1], Daisuke Hamatake[1], Takeshi Shiraishi[1], Katsunobu Kawahara[2], Akinori Iwasaki[1]

[1]Department of General Thoracic, Breast, and Pediatric Surgery, Faculty of Medicine, Fukuoka University, Fukuoka, Japan; [2]Department of Thoracic Surgery, Kagoshima Tokushukai Hospital, Kagoshima, Japan

Correspondence to: Shin-Ichi Yamashita. Department of General Thoracic, Breast, and Pediatric Surgery, Faculty of Medicine, Fukuoka University, 7-45-1 Nanakuma, Jonanku, Fukuoka 814-0180, Japan. Email: yamashi1@fukuoka-u.ac.jp.

Abstract: Segmentectomy is one of the treatment of choice for small-sized non-small cell lung cancer (NSCLC). Although simple segmentectomy is feasible even if under thoracoscopy, complicated segmentectomy which contains more than two segmental plane divisions is difficult especially thoracoscopic surgery. We here present the case of totally thoracoscopic segmentectomy between upper division and lingular segment. In the first case, the 64-year-old female patient admitted for further examination and treatment of left lung ground glass nodule. Tumor located between upper division (S3) and lingular (S4) segment was operated by bi-segmentectomy and intraoperative frozen section pathology showed minimally invasive adenocarcinoma. Systematic nodal dissection was followed after retrieval of specimens. A3b A3a+c, and A4 was individually divided and followed by division of B3 and B4. Finally, intersegmental veins V1+2a and V1+2d was identified between segments and V3a+b was divided. In the second case, the 76-year-old female patient with left lung nodule between upper division (S3b) and lingular (S4) segment was operated by bi-segmentectomy. Since sealing test revealed air leakage from resected segmental planes, fibrin glue was applied to stop air leakage and direct suturing by 4-0 prolene between S3a+S3c and S5 was performed. Target lesion between upper division and lingular segments may be resected safely if appropriate demarcation lines are identified regardless of without highly sophisticated imaging systems.

Keywords: Lung cancer; segmentectomy; middle segment; S3 and S4

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Introduction

Video-assisted thoracic surgery (VATS) is applicable for early-stage non-small cell lung cancer (NSCLC) surgeries. We proposed that it is recommendable for VATS lobectomy for patients with clinical stage I NSCLC from Japanese association for chest surgery guide line committee (1). VATS showed better or at least equivalent outcomes regarding intra- or postoperative complications compared with thoracotomy, with less invasiveness (2). Additionally, long-term survival by VATS lobectomy was suggested to be at least equivalent to open lobectomy (3). Lobectomy is still gold standard for treatment of early stage lung cancer, however, segmentectomy is a treatment of choice for small-sized lung cancer. Although thoracoscopic segmentectomy is more complicated technique than lobectomy, we reported that thoracoscopic segmentectomy showed non-inferiority compared with thoracoscopic lobectomy for stage I NSCLC (4). Two phase III Randomized trials of lobectomy versus sublobar resection for small (≤2 cm) peripheral non-small cell lung cancer (CALGB 14053, JCOG0802) are on-going and may lead to paradigm shift. However, since segmentectomy has a risk of loco-regional recurrences, enough margin should be guaranteed especially for the tumor located at intersegmental planes. The purpose of this video is how to manage the tumors located between upper division and lingular segment (*Figure 1*).

Figure 1 How to manage the tumors located between upper division and lingular segment (5).
Available online: http://www.asvide.com/articles/1729

Surgical technique

Our surgical technique is five trocars; left side operation: operator, 4th inter-costal space (10 mm trocar) and 6th inter-costal space of the anterior-axillary line (12 mm trocar); assistant, auscultation triangle (5 mm trocar), and 7th inter-costal space of the posterior-axillary line (5 mm trocar) for access and one 12-mm trocar at the 7th inter-costal space of the mid-axillary line for thoracoscope with 30° were inserted. All procedures were performed by visualization through a television monitor, so-called complete VATS or total thoracoscopy. The segmental plane should be managed by electrocautery. Theoretically, the segmental artery is divided and ligated or stapled first, following pulmonary vein ligation, stapling or bronchus stapling. If the intraoperative examination of hilar or intralobar lymph nodes by frozen sections was positive metastasis, segmentectomy was converted to lobectomy. Segmentectomy is followed by systemic mediastinal lymph node dissection.

Case presentation

Case 1

The 64-year-old female patient admitted for further examination and treatment of left lung nodule which was incidentally identified on computed tomography (CT). Ground glass nodule between upper division (S3) and lingular (S4) segment was not diagnosed before operation and bi-segmentectomy including both segments was undertaken and intraoperative frozen section pathology showed minimally invasive adenocarcinoma. Systematic nodal dissection was followed after retrieval of specimens.

First, hilar dissection was performed by ultrasonic shears in terms of isolation of pulmonary vein (PV) branches. Interlobar (#11) and intralobar nodes (#12) were removed and confirmed as negative metastasis by frozen sections. After confirmation of encircled PV branches, interlobar segmental arteries were dissected by same manners followed by A3 subsegmental branches (A3b and A3a+c) dissections. Upper division bronchus branches were dissected between A4 and A1+2c from dorsal portion. A3b was ligated and divided and then A3a+c were divided by same manners. A4 division by endostapler was followed by lingular bronchus dissection. Superior lingular bronchus (B4) just below the lingular artery was encircled and anterior bronchus (B3) was encircled followed by branch divisions individually. Inflation and deflation methods which means that the target segments were inflated and residual segments were deflated after double-lung ventilation. Lingular vein was dissected and superior (V4) and inferior (V5) vein was dissected until periphery as much as possible. Intersegmental plane between superior and inferior lingular segments were divided by high power electrocautery. Upper division pulmonary vein was dissected along V1+2d which is located between apico-posterior (S1+2) and anterior (S3) segment. V3a+b were finally divided after V3c division. Segmental plane was divided by electrocautery. After specimen removal, upper mediastinal node dissection was followed. Subaortic (#5) and tracheobronchial nodes (#4L) were dissected by bipolar scissors or ultrasonic shears. Air leak were sealed by fibrin glue and patch sealants followed by stapling between S1+2 and S5 to avoid torsion of completely divided segments. Operation time was 380 minutes and blood loss was 35 mL. Postoperative course was good and she discharged at postoperative 14 days. Pulmonary functions were similar as predicted postoperative values. CT revealed full expanded both segments and no evidences of recurrence in 4-year later period.

Case 2

The 76-year-old female patient with left lung nodule was incidentally identified on medical check-up by CT. Ground glass nodule between upper division (S3b) and lingular (S4) segment was not diagnosed before operation and bi-segmentectomy including both subsegment and segment was undertaken and intraoperative frozen section pathology showed invasive adenocarcinoma. Since sealing test revealed air leakage from resected segmental planes, fibrin glue was applied to stop air leakage and direct suturing by

4-0 prolene between S3a+S3c and S5 was performed instead of stapler application in case 1. Operation time was 315 minutes and blood loss was 30 mL. Postoperative course was good and she discharged at postoperative 11 days. Pulmonary functions were similar as predicted postoperative values. CT revealed full expanded both segments and no evidences of recurrence in 42 months later period.

Comments

Although VATS segmentectomy is more difficult than segmentectomy by open thoracotomy (6), it has been reported in several papers, especially the comparison between open and VATS segmentectomy (7). Simple segmentectomy such as superior segmentectomy, upper division segmentectomy and lingular segmentectomy is easy and safe. However, tumor located in segmental border should be resected by bi-segmentectomy or additional subsegmentectomy by complicated technique. In this video, we showed how to manage the tumor located between upper division and lingular segment. The critical point of this methods was accurate identification of intersegmental veins and dividing of intersegmental planes by electrocautery to avoid disorientation by endostapler division technique.

Possible pitfalls in these cases are how to manage separated segments after resection of targeted segments. Preserved segments (S1+2, S5) in the first case were completely separated and fused both segments by stapling to avoid torsion of segments, especially S5. The second case was not completely divided because S5 was anchored to S1+2 by S3a. However, we sutured segmental planes between S5 and S1+2 to decrease air leakage.

Since our technique was five ports methods which makes easier than two or three-port methods, both operator and assistant can use each two hands in the similar fashion as thoracotomy. Therefore, hilar structures and intersegmental planes should be easily dissected and divided, even if the thoracoscopic segmentectomy was a little bit intriguing.

In conclusion, target lesion between upper division and lingular segments may be resected safely if appropriate demarcation lines are identified regardless of without highly sophisticated imaging systems.

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Footnote

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

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

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