

# Port-access thoracoscopic bisubsegmentectomy of right upper lobe posterior and anterior segments

Hirohisa Kato, Hiroyuki Oizumi, Jun Suzuki, Akira Hamada, Hikaru Watarai, Kenta Nakahashi, Mitsuaki Sadahiro

Division of Thoracic Surgery, Department of Surgery 2, Yamagata University, Faculty of Medicine, Yamagata City, Japan

Correspondence to: Hirohisa Kato. Division of Thoracic Surgery, Department of Surgery 2, Yamagata University, Faculty of Medicine, 2-2-2 Iida-Nishi, Yamagata 990-9585, Japan. Email: h-kato@med.id.yamagata-u.ac.jp.

**Abstract:** A 64-year-old woman was admitted to our hospital with a 16-mm non-solid tumor with pure ground-glass nodule (GGN) contents in the posterior segment near the anterior segment of her right upper lung lobe that was suspicious of adenocarcinoma *in situ* (AIS). Three-dimensional computed tomography (3DCT) simulation was performed to identify the subsegmental artery and vein pre- or intra-operatively. Port-access thoracoscopic bisubsegmentectomy of the right upper lobe was performed. A frozen section revealed AIS. The tumor size was 13 mm and the surgical margin from the tumor edge to cutting line was more than 20 mm. The surgical time was 191 minutes and bleeding was 101 mL. The chest tube duration was 3 days and the post-operative hospital stay was 6 days.

**Keywords:** Pulmonary subsegmentectomy; three-dimensional computed tomography (3DCT); ground-glass nodule (GGN); thoracoscopy

Submitted Mar 23, 2017. Accepted for publication Jun 18, 2017.

doi: 10.21037/jtd.2017.07.65

View this article at: <http://dx.doi.org/10.21037/jtd.2017.07.65>

## Introduction

The incidence of small-sized lung cancer with ground-glass nodule (GGN) components has recently increased. In these lung cancers, anatomical segmentectomy has been widely performed; thoracoscopic surgery is also greatly in demand as minimally invasive surgery. However, there are some cases in which segmentectomy is an excessive resection for smaller nodules with pure GGN and wedge resection cannot secure the sufficient surgical margin for nodules located near the pulmonary hilum. In these cases, it is reasonable to assume that anatomical subsegmentectomy is preferred to preserve pulmonary function and secure adequate surgical margins. Three-dimensional computed tomography (3DCT) simulations are reportedly useful for thoracoscopic surgery. Here, we demonstrate our technique with our video: port-access thoracoscopic bisubsegmentectomy of anterior and posterior segments on the upper lobe for a small sized GGN using 3DCT simulations (*Figure 1*).

## Case presentation

A 64-year-old woman was admitted to our hospital with a 16-mm pure GGN in the posterior segment near the anterior segment of her right upper lung lobe. The nodule was suspicious of adenocarcinoma *in situ* (AIS). She was clinically diagnosed with lung cancer at stage IA2 (T1bN0M0). We performed port-access thoracoscopic bisubsegmentectomy of anterior and posterior segments on the upper lobe in order to diagnose and cure the indeterminate tumor.

## Operative techniques

The procedure was performed under general anesthesia with bilateral lung ventilation. The patient was placed in the lateral decubitus position. The surgeon stood on the ventral side of the patient, facing a monitor. The assistants stood on the dorsal side, facing another monitor positioned to provide an inverted image. One 20-mm utility flexible port



**Figure 1** Thoracoscopic bisubsegmentectomy of posterior and anterior segments on the right upper lobe (1).

Available online: <http://www.asvide.com/articles/1733>

and three 5-mm ports were placed on the fourth intercostal space and sixth intercostal space, respectively. The 5-mm, 30-degree endoscope was controlled by an assistant surgeon.

First, subsegmental arteries (A2b, A3a) were identified between the right upper pulmonary lobe and the right middle and lower pulmonary lobe based on 3DCT simulation, and divided using an endoscopic clip (Hem-o-lock, TeleFlex Medical, USA) and an ultrasonically activated device (UAD: Harmonic, JJMC, USA). An intersegmental vein (V2c) was identified and divided using the UAD.

Second, subsegmental bronchi (B2b, B3a) were dissected and closed with the slip-knot using a monofilament suture (4-0 prolene, JJMC, USA) to visualize an intersubsegmental inflation-deflation line after both lungs were inflated. The inflation-deflation line could be gradually identified as the intersegmental line. These subsegmental bronchi were then ligated with an endoscopic clip (Hem-o-lock, TeleFlex, USA) and divided with an endoscopic scissors.

Third, the divided subsegmental bronchi on the resection side were pulled with assistant forceps; consequently, the intersubsegmental veins were gradually identified on the inflation-deflation line. Based on a 3D image, the intersubsegmental veins were confirmed and preserved. The parenchyma was dissected along the inflation-deflation line using electrocautery. The peripheral parenchyma that included the nodule was divided with a sufficient margin (>2 cm) using endostaplers (ECR60D, JJMC, USA).

Finally, resected bisubsegments were removed from the thoracic cavity via the 20-mm port site and a fibrin glue was sprayed on the cut surface of the remaining right upper lobe. Microscopic examination of a frozen section revealed AIS. The tumor size was 13 mm and the surgical margin from the

tumor edge to the cutting line was sufficient at more than 20 mm. The surgical time was 191 minutes and bleeding was 101 mL. Postoperative pathological exam diagnosed AIS stage IA2 (pT1bN0M0). The chest tube duration was 3 days and the postoperative hospital stay was 6 days.

## Comments

Pulmonary segmentectomy has increased in recent years because pulmonary nodules with GGN have often been found at smaller sizes due to the recent spread of high-resolution CT. For a small-sized pulmonary nodule, limited resection such as segmentectomy or wedge resection has been generally acceptable if these procedures have secured sufficient surgical margins. However, in the case of a tumor that is located near the pulmonary hilum or in the intersegmental line, it is sometimes necessary to perform an extended segmentectomy, such as segmentectomy combined with adjacent subsegmentectomy, in order to secure sufficient surgical margins. On the other hand, for smaller pulmonary nodules located in the deep parenchyma, subsegmentectomy is sometimes preferred to wedge resection or segmentectomy; this is because it is difficult to perform a wedge resection for hilum nodules located in the deep parenchyma and segmentectomy may be an excessive resection for smaller nodules. Therefore, the technique of anatomical subsegmentectomy has been needed in recent years.

The most important technical process of anatomical subsegmentectomy is the precise identification of subsegmental artery and veins and the division along the intersubsegmental line. The visualization of subsegmental artery, veins and intersubsegmental line is, therefore, a key process in the subsegmentectomy.

Accordingly, an essential tool in thoracoscopic subsegmentectomy is 3DCT simulation for the anatomical information. 3DCT simulation provides useful information for thoracoscopic surgery (2,3). We previously reported on port-access thoracoscopic anatomic lung segmentectomy and subsegmentectomy using 3DCT simulation for small lung nodules (4,5). The use of CT is rapidly being replaced by multidetector CT to facilitate easier visualization of the anatomy using 3D images. 3DCT simulation can facilitate the precise identification of these vasculatures pre- and intra-operatively.

Another essential process of subsegmentectomy is the creation of the intersubsegmental line. Although some methods of visualizing the intersegmental line (i.e., selective air supply using a bronchoscope, or injection of

dye into the target segmental bronchus using a needle) have been reported, these processes may be possible in open thoracotomy, but impossible in thoracoscopic surgery. In recent years, minimally invasive surgery such as thoracoscopic surgery is widely performed because thoracoscopic surgery offers the advantages of reduced postoperative pain and pulmonary function preservation; it can also reduce the operative risk in patients who have poor respiratory function or heart disease preoperatively. However, the subsegmental bronchus is very thin, and the working space during thoracoscopic surgery is limited. Therefore, it is assumed that the delineation of an intersubsegmental line with conventional methods in thoracoscopic surgery is more difficult. In order to carry out thoracoscopic subsegmentectomy, it is necessary to overcome the difficulties of creating the intersubsegmental plane. We, therefore, applied the slip-knot method to create an intersubsegmental line during thoracoscopic subsegmentectomy (6). The slip-knot method did not need any special devices, unlike jet ventilation or injection of a dye solution into the target subsegmental bronchus, and it did not demand any other techniques, such as bronchoscopy or needle puncture. The essential device in this method is only a slip-knot made from a monofilament suture, and the essential technique is only pulling the slip-knot after bilateral lung ventilation. Therefore, it is considered that our method is simpler, easier and lower-cost than any other conventional method.

Port-access thoracoscopic bisubsegmentectomy using 3DCT simulations and the slip-knot method can be performed safely and secure adequate surgical margins.

### Acknowledgements

Dr. Hirohisa Kato was awarded “The Master of Thoracic Surgery” and was granted the Award of Great Potential in

the 2016 Masters of Thoracic Surgery—Uniportal VATS Lobectomy & VATS 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.

### References

1. Kato H, Oizumi H, Suzuki J, et al. Thoracoscopic bisubsegmentectomy of posterior and anterior segments on the right upper lobe. *Asvide* 2017;4:419. Available online: <http://www.asvide.com/articles/1733>
2. Akiba T. Utility of three-dimensional computed tomography in general thoracic surgery. *Gen Thorac Cardiovasc Surg* 2013;61:676-84.
3. Ikeda N, Yoshimura A, Hagiwara M, et al. Three dimensional computed tomography lung modeling is useful in simulation and navigation of lung cancer surgery. *Ann Thorac Cardiovasc Surg* 2013;19:1-5.
4. Oizumi H, Kanauchi N, Kato H, et al. Anatomic thoracoscopic pulmonary segmentectomy under 3-dimensional multidetector computed tomography simulation: a report of 52 consecutive cases. *J Thorac Cardiovasc Surg* 2011;141:678-82.
5. Kato H, Oizumi H, Inoue T, et al. Port-access thoracoscopic anatomical lung subsegmentectomy. *Interact Cardiovasc Thorac Surg* 2013;16:824-9.
6. Oizumi H, Kato H, Endoh M, et al. Slip knot bronchial ligation method for thoracoscopic lung segmentectomy. *Ann Thorac Surg* 2014;97:1456-8.

**Cite this article as:** Kato H, Oizumi H, Suzuki J, Hamada A, Watarai H, Nakahashi K, Sadahiro M. Port-access thoracoscopic bisubsegmentectomy of right upper lobe posterior and anterior segments. *J Thorac Dis* 2017;9(9):3293-3295. doi: 10.21037/jtd.2017.07.65