Hybrid approach for VATS pulmonary resection

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Abstract: Many different surgical VATS procedures are performed. In our thoracoscopic VATS, four ports are used with thoracoscopic vision alone. In our hybrid VATS, two 2-cm ports are combined with muscle-sparing mini-thoracotomy with a slightly opened metal retractor with direct vision and thoracoscopic vision. Both procedures are performed by an operator, one assistant, and a scopist. Forceps, electrocautery, and ultrasonic scissors were used. VATS segmentectomy is an ideal surgical procedure to treat primary lung cancer from the perspective of minimally invasive surgery. The most important issue in segmentectomy is to maintain a sufficient surgical margin from the tumor. We think that it is important to determine whether thoracoscopic VATS segmentectomy without direct visualization or rib spreading can achieve an adequate surgical tumor-free margin. Delicate surgery is required to keep the surgical margin in segmentectomy. Therefore, the hybrid approach seems to be reasonable for obtaining sufficient surgical margins.

Keywords: Hybrid VATS; thoracoscopic VATS; lobectomy; segmentectomy; lung cancer

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Introduction

In many institutions, many different surgical VATS procedures are performed, and this has resulted in there being no clear definition or standard for this surgical procedure. Swanson et al. (1) defined VATS lobectomy “to encompass a true anatomic lobectomy with individual ligation of lobar vessels and bronchus as well as hilar lymph node dissection or sampling using the video screen for guidance, two or three ports, and no retractor use or rib spreading.” We call this procedure thoracoscopic VATS. Conversely, Okada et al. (2) proposed the procedure of hybrid VATS, in which muscle-sparing minithoracotomy (incision, 4–10 cm) is combined with video assistance primarily using direct visualization for lung resection. We call this procedure hybrid VATS. In this article, we present the features of each procedure and introduce the usefulness of hybrid VATS procedures, especially in segmentectomy.

Thoracoscopic VATS or hybrid VATS

In our thoracoscopic VATS, four ports (three 2-cm ports at the 4th and 7th intercostal spaces at the anterior axillary line and at the incision in the 5th intercostal space at the posterior axillary line, with a 5-mm port in the 3rd or 4th intercostal space at the mid-axillary line) are used with thoracoscopic vision alone (Figures 1,2). In our hybrid VATS (Figure 3), two 2-cm ports (4th and 7th intercostal spaces at the anterior axillary line) are combined with muscle-sparing mini-thoracotomy with a slightly opened metal retractor (incision length of 4–8 cm in the 4th intercostal space at the anterior for the upper or middle lobe resection (Figures 3A,4), or in the 5th intercostal space at the posterior axillary line for the lower
lobe (**Figures 3B,5**) including segmentectomy with direct vision and thoracoscopic vision. Both procedures are performed by an operator, one assistant, and a scopist. The operator usually stands at the ventral side of the patient in thoracoscopic VATS. In hybrid VATS, the operator usually stands at the ventral side of the patient when approaching the upper or middle lobe, or at the dorsal side of the patient when approaching the lower lobe. Forceps (GEISTER Medizintechnik GmbH, Tuttlingen, Germany), electrocautery, and ultrasonic scissors (HARMONIC ACE, ETHICON ENDO-SURGERY, LLC., Cincinnati, OH, USA) were used.

VATS lobectomy has been compared with conventional open lobectomy in several studies (6,7). Since data from prospective randomized studies of VATS lobectomy and open lobectomy are lacking, several propensity score-matched studies were performed (8-11). These studies suggested that the VATS approach showed a lower incidence of complications and no inferiority in overall survival, disease-free survival, and local relapse. In our

**Figure 1** Our thoracoscopic VATS. Three 2-cm ports are placed at the 4th and 7th intercostal spaces at the anterior axillary line, as well as in the 5th intercostal space at the posterior axillary line, along with a 5-mm port in the 3rd or 4th intercostal space at the mid-axillary line.

**Figure 2** Our thoracoscopic VATS right lower lobectomy for primary lung cancer (3). Available online: http://www.asvide.com/articles/1578

**Figure 3** Our hybrid VATS. (A) Two 2-cm ports are placed in the 4th and 7th intercostal spaces at the anterior axillary line combined with muscle-sparing mini-thoracotomy with a 4- to 8-cm incision in the 4th intercostal space at the anterior axillary line for upper or middle lobe resection; (B) two 2-cm ports are placed in the 4th and 7th intercostal spaces at the anterior axillary line combined with muscle-sparing mini-thoracotomy with a 4- to 8-cm incision in the 5th intercostal space at the posterior axillary line for the lower lobe resection.
unpublished propensity score-matching analysis comparing VATS and open lobectomy, shorter operative time and duration of drainage, along with less blood loss and fewer postoperative complications, were seen with VATS, while there was no significant difference in 5-year survival between VATS and open lobectomy in cases of clinical stage I lung cancer.

With respect to hybrid VATS (direct and video vision) and thoracoscopic VATS (video vision alone), hybrid VATS has been reported to have a shorter operative time and no differences in amount of bleeding, chest tube duration, and all complications in a propensity-matched analysis (12), along with no significant differences in overall and disease-specific survivals. In their comparison of VATS with muscle-sparing thoracotomy (MST), which is similar to the hybrid VATS procedure, Kuritzky et al. (13) showed that the only differences between the groups were in operative time (favoring MST) and hospital days (favoring VATS), with no differences in major outcomes, such as postoperative complications, disease-free survival, and overall survival. In their review, Jheon et al. suggested that, in surgery for lung cancer, the most important issue is not whether the VATS technique is thoracoscopic or hybrid, but that the procedure be safe while complying with oncological standards (14).

**VATS segmentectomy**

Recently, to minimize lung resection volume without decreasing curability, curative segmentectomy has been attractive and increasingly performed to treat small non-small-cell primary lung cancers (15-18). VATS segmentectomy is an ideal surgical procedure to treat primary lung cancer from the perspective of minimally invasive surgery. Our segmentectomy procedure was previously described (19).

The most important issue in segmentectomy is to maintain a sufficient margin from the tumor. In a study by Khullar et al. (20), sublobar resection was shown to be inferior to lobectomy because of inadequate lymphadenectomy and positive sublobar resection margins. To maintain an adequate margin, Tsubota et al. (21) suggested “extended segmentectomy”, which involves placing the resection line on the segment beyond the affected one. A multicenter, prospective study confirmed that there were no positive margins when the margin distance was greater than the maximum tumor diameter (22).

Iwata et al. (19) classified segmentectomy into two types: a simple type, involving resection of only one intersegmental plane, such as superior or lingual segmentectomy; and a complicated type, involving resection of at least two intersegmental planes, such as anterior segmentectomy. The technical considerations and outcomes of thoracoscopic VATS segmentectomy for mainly the simple type have been reported by D’Amico (23). In addition, Ohtaki et al. (24) demonstrated that thoracoscopic VATS segmentectomy was less invasive than open segmentectomy. Recently, Ghaly et al. (25) showed that thoracoscopic VATS segmentectomy for clinical stage I NSCLC decreased the length of stay and pulmonary complications. Furthermore, 5-year disease-free survival and overall survival were better with VATS than with open thoracotomy. However, the median surgical margin was 1.4 (0.6–2) cm and 1.5 (0.8–2.7) cm in VATS and in thoracotomy, respectively, while the locoregional recurrence rate was 7.7% and 12.7%, respectively. In
several Japanese studies, locoregional recurrence rates were 0–5% (26-28). We think that it is important to determine whether thoracoscopic VATS segmentectomy without direct visualization or rib spreading can achieve an adequate surgical tumor-free margin, especially for complicated types (22). Delicate surgery is required to keep the surgical margin in a complicated type segmentectomy. Therefore, the hybrid approach seems to be reasonable for obtaining sufficient surgical margins.

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Footnote

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

References


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