

Two-portal versus three-port video-assist thoracoscopic surgery for early stage nonsmall cell lung cancer

A retrospective study

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Abstract

This study was conducted to compare the perioperative outcomes of two-portal and three-port video-assist thoracoscopic surgery (VATS) for early stage nonsmall cell lung cancer.

In this retrospective analysis, 279 cases of two-port VATS with a single utility port and 152 cases of three-port VATS performed by our department from October 2010 to December 2014 were collected. The operative time, volume of intraoperative blood loss, number of dissected lymph nodes, volume of postoperative pleural drainage, postoperative extubation time, and duration of postoperative hospitalization were compared between these 2 groups.

No statistically significant differences on the operative time, volume of postoperative bleed, and the number of dissected lymph nodes was noted between two-port and three-port video-assist thoracoscopic surgery. Less postoperative pleural drainage, shorter extubation time, and postoperative hospitalization were observed in the two-port VATS group when compared with those of three-port VATS group.

Two-port VATS decreased operative postoperative pleural drainage and resulted in shorter extubation time and postoperative hospitalization compared with three-port VATS. Two-port VATS is a safe and feasible approach for early stage nonsmall cell lung cancer.

Abbreviations: RMB = Renminbi, TNM = tumor, node, and metastasis, VATS = video-assisted thoracoscopic surgery.

Keywords: lung cancer, single utility port, video-assisted thoracoscopic surgery (VATS)

1. Introduction

Thoracoscopic surgical techniques have the advantages of decreasing hospital stays, analgesic requirements, and postoperative pain compared with the conventional thoracotomy incision. Currently, video-assisted thoracoscopic surgery (VATS) lobectomy with systematic lymph node dissection has been widely accepted as a standard surgical procedure for early stage nonsmall cell lung cancer in the past 20 years.^[1,2] However, traditional VATS is based on the “three-port approach” and “four-port approach” and more than 50% patients treated with

video-assisted thoracoscopic surgery (VATS) had reported postoperative chest wall paresthesia related to the portal sites.^[3] To decrease these complications, conventional VATS has been modified by employing few and smaller working ports for the surgical procedure. With the development of video-assisted thoracoscopy and the advancement of surgical instruments, the application of “two-port approach,” also known as VATS with “single utility port” has gradually increased.^[4–6] However, there are few studies regarding the comparison of the outcome and the relative clinical parameters between two-port and three-port VATS.^[7,8] Therefore, the aim of the present study was to summarize our experience of two-port and three-port VATS and make comparisons between both approaches.

2. Materials and methods

This study was approved by the ethics committee of The First Affiliated Hospital of Soochow University.

2.1. Patients

A total of 431 patients diagnosed with peripheral lung cancer, who underwent either two-port VATS (279 cases) or three-port VATS (152 cases) by the same surgeon (Shaomu Chen) in our department from October 2010 to December 2014, were involved in this study. The patients were collected from the same periods, during which both two-port and three-port VATS were performed in our institute. Hence, there is no major difference between the indications of two-port and three-port VATS. In the two-port VATS group, there were 163 male and

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Table 1
Baseline characteristics and tumor distribution of patients.

	Two-port VATS	Three-port VATS
Baseline characteristics		
Male	163	81
Female	116	71
Average age	61.45 ± 6.17	61.05 ± 5.56
Tumor distribution		
Right		
Upper lobe	64	39
Middle lobe	33	14
Lower lobe	58	26
Left		
Upper lobe	61	32
Lower lobe	63	41

Data were expressed as mean ± SD.

VATS = video-assisted thoracoscopic surgery, SD = standard deviation.

116 female patients, with a mean age of 61.45 ± 6.17 years old (ranging from 41 to 78 years), whereas there were 81 male and 71 female patients, with a mean age of 61.05 ± 5.56 years old (ranging from 46 to 77 years). The baseline characteristics and tumor distribution of patients were summarized in Table 1.

The inclusion criteria in the present study were as follows: (1) peripheral lung cancer with a preoperative TNM (tumor, node, and metastasis) staging of I–II was diagnosed, (2) tumor diameter ≤ 50 mm, (3) no significant hilar or mediastinal lymphadenopathy was found in preoperative computed tomography, and (4) no history of preoperative chemoradiotherapy.

2.2. Operational techniques

2.2.1. Two-port VATS. General anesthesia combined with double-lumen endotracheal intubation was administered. Single-lung ventilation was performed on the healthy side, which was remained supine. All patients were kept in a clasp-knife position during the surgery. A 1.5-cm incision at the level of eighth or ninth intercostal space along the posterior axillary line was made for the observation hole. After implanting the trocar, exploration was performed using a 10-mm and 30° thoracoscope. According to the position of the lesion and the anatomical site of the pulmonary hilum, a 3- to 4-cm incision was made at the fourth or fifth intercostal space along the anterior axillary line as the operation hole and an incision-protection sleeve was placed. The pulmonary vein was then dissociated and ligated anterior to the hilum or the lower pulmonary ligament. Subsequently, with the employment of an endoscopic surgical stapling instrument, the bronchial branch was addressed, followed by the pulmonary artery and the incomplete lobar fissure. In the case of small vessel rupture, an absorbable vascular clip or Hem-o-lok was used for clamping prior to ligation. With a well-prepared preoperative planning and cautious intraoperative manipulation, the extent of lymph node dissection was similar to conventional thoracotomy. On the right side, group-2, 3, 4, 7, 8, and 9 lymph nodes were dissected, whereas on the left, group-5, 6, 7, 8, and 9 lymph nodes were dissected. Depending on the dissected lobes and degree of leakage, 1 or 2 intrathoracic drainage tubes were inserted after the operation.

2.2.2. Three-port VATS. Anesthesia and positioning were similar to that in the two-port VATS. A 1.5-cm incision at the level of seventh or eighth intercostal space along the midaxillary line was made for the thoracic hole. For the main operation hole and the second operation hole, a 1.5-cm long incision at the level

of fourth or fifth intercostal space between the anterior axillary line and the midclavicular line and a 1.5-cm long incision at the level of seventh or eighth intercostal space between the posterior axillary line and the infrascapular line were made, respectively. In most cases, pulmonary artery was first dissected. Ligation using a knot device, suture, blood vessel suturing instrument, or Hem-o-lok clip was performed accordingly. The bronchus was dissected with the use of an endoscopic surgical stapling instrument. The order of dissection of these 3 lobar structures could be either anterograde or retrograde, depending largely on the habit of the operator.

2.3. All the surgeries were performed by the same chief surgeon

2.3.1. Clinical evaluations. After reviewing the medical records of all the patients involved, the relative clinical parameters including operative time, volume of intraoperative bleed and postoperative pleural drainage, the number of dissected lymph nodes, extubation time, and postoperative hospitalization were collected and compared between both groups. The intensity of postoperative pain was evaluated every day after the surgery with the use of visual analog scale. The hospitalization expense was also calculated and compared between both groups.

2.3.2. Statistical analyses. Pearson's χ^2 test was used to analyze the baseline characteristics and *t*-test was used to compare the clinical parameters between both groups. Data were expressed as the mean ± standard deviation and a *P* value < .05 was considered statistically significant. The IBM SPSS 19.0 statistical software was used for data analysis.

3. Results

No significant difference of sex composition or tumor distribution was noted between these 2 groups. All patients tolerated surgeries well and no major complication was observed in these patients (*P* > .05).

As for the operative times, volume of intraoperative blood loss, and the number of dissected lymph nodes, no significant difference was noted between two-port and three-port VATS (*P* > .05). However, less postoperative pleural drainage, shorter extubation time, and postoperative hospitalization were observed in two-port VATS group when compared with those of three-port VTAS group (*P* < .05) (Table 2). As demonstrated in Table 3, average postoperative pain intensity in the two-port VATS group was less than the three-port VTAS group. However, no significant difference was noted between both groups after 3 days. Higher average hospitalization expense was noted in the

Table 2
Comparison of various clinical indicators between the 2 groups of patients.

Clinical evaluations	Two-port VATS	Three-port VATS
Operating time, min	155.38 ± 22.43	155.50 ± 24.57
Volume of intraoperative bleed loss, mL	186.26 ± 21.30	179.05 ± 23.05
Number of dissected lymph nodes	13.06 ± 0.71	13.05 ± 1.02*
Volume of pleural fluid drained postoperatively, mL	671.66 ± 98.60*	752.34 ± 125.94
Extubation time, days	3.97 ± 0.93*	4.37 ± 1.27
Postoperative hospitalization, days	7.15 ± 1.17*	8.51 ± 1.03

Data were expressed as mean ± SD.

VATS = video-assisted thoracoscopic surgery, SD = standard deviation.

*Two-port versus three-port group, *P* < .05.

Table 3**Visual analog scale scores between the 2 groups of patients.**

Visual analogue scale	Two-port VATS	Three-port VATS
Postoperative day 0	4.37 ± 0.22	6.29 ± 0.31*
Postoperative day 1	2.83 ± 0.20	3.42 ± 0.25*
Postoperative day 3	1.23 ± 0.19	1.86 ± 0.23
Postoperative day 7	0.46 ± 0.16	0.96 ± 0.18

Data were expressed as mean ± SD.

VATS = video-assisted thoracoscopic surgery, SD = standard deviation.

*Two-port versus three-port group, $P < .05$.

two-port VATS group (69851.32 RMB, Renminbi) compared with the three-port VTAS group (39390.68 RMB, $P < .05$).

4. Discussion

In recent years, thoracoscopic surgery has progressed rapidly in China and the concept of minimally invasive treatment has been widely accepted.^[9] Compared to conventional surgery, the advantages of thoracoscopic surgery, such as less intraoperative blood lost, less pain, shorter duration of hospitalization, more rapid postoperative recovery, better-preserved lung function, and milder postoperative inflammatory response, have been well recognized.^[2,10–12]

The three-port approach is most common modality adopted in conventional thoracoscopic surgery and consists of endoscopic hole, the main operational hole, and the second operational hole. The second operational hole is usually located between the posterior axillary line and the infrascapular line and the blood supply of this area is rich, making hemostasis difficult.^[13] Moreover, repeated rotation of the trocar during the operation might cause injury of the intercostal nerve, resulting in postoperative pain.^[14] Therefore, removal of the second operational hole may avoid the port-related postoperative pain and results in rapid recovery.

Two-port VATS has been performed in our department since October 2010 for the treatment of early stage lung cancer. As revealed in the present study, there were no statistically significant differences on the operating time, volume of intraoperative bleed, and the number of dissected lymph nodes between two-port and three-port VATS, suggesting that video-assisted thoracoscopic surgery with a single utility port did not increase the operating time and the volume of intraoperative bleed, and the lymph node dissection also fulfilled the requirements for the excision of radical tumors. Thus, it was recommended that the two-port VATS was safe and feasible.

Undoubtedly, VATS with a single utility port requires higher surgical skills of the surgeons and the surgeons have to be quite familiar with pulmonary anatomy and have a wealth of experience in thoracoscopic surgery. Since the second operation hole was removed, all operations had to be performed using a single operation hole and thus the simultaneous entry of multiple surgical instruments via 1 operation hole may cause interference. This difficulty can be surmounted by using a specially designed double-joint thoracoscopic surgical instrument and a rotatable operating table for surgical exposure. For some operations at special angles, the thoracoscope may be inserted into the second hole, whereas the instrument is inserted through the hole designated for the thoracoscope. It was suggested that this method was comparable to the conventional thoracotomy. Moreover, as demonstrated in this study, there is no significant difference in the lymph node dissection between the VATS with a single utility port and the “three-port approach.” It was notable

that the phrenic and recurrent laryngeal nerves should be carefully protected when the right-sided group-2, 3, 4, 7, 8, and 9 lymph nodes, the left-sided group-5, 6, 7, 8, and 9 lymph nodes, and the mediastinal lymph nodes are conventionally dissected. Instead of monopolar incision, sharp separation by scalpel should be recommended. However, VATS with a single utility port had certain advantages in terms of postoperative short-term efficacy when compared with the triportal approach. The volume of postoperative drainage was significantly lower in the single-utility-port group when compared with that in the three-port group. Correspondingly, the time that the chest tube was kept in situ and the duration of postoperative hospitalization were significantly lower than those in the three-port group. These advantages were conducive to the rapid recovery of the patients and the reduction in the hospitalization expenses.

5. Conclusions

Our experience demonstrated that two-port VATS decreased operative postoperative pleural drainage and resulted in shorter extubation time and postoperative hospitalization compared with three-port VATS. However, a prospective randomized study with large sample size is needed to confirm our preliminary findings as well as the long-term outcomes.

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