

Single-port complete thoracoscopic lobectomy feasibility



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Clinical comparisons of single-port versus three-port complete thoracoscopic lobectomy for lung cancer patients

Abstract

Objective: To compare the feasibility and safety of single-port versus three-port complete thoracoscopic lobectomy for lung cancer patients.

Methods: A retrospective study was conducted on 60 lung cancer patients from June 2014 to August 2014 in Department of Thoracic Surgery, Union Hospital, Fujian Medical University. There were 30 patients in single-port complete thoracoscopic lobectomy group (single-port group) and other 30 in three-port complete thoracoscopic lobectomy group (three-port group). Total lymph node harvest, mediastinal lymph node harvest, dissection of mediastinal lymph node groups, operation time, intraoperative blood loss, extubation time, postoperative hospital stay, visual analogue scale (VAS) one day after operation, and the complication rate were thoroughly compared between the two groups.

Results: There were no significant differences in total lymph node harvest, mediastinal lymph node harvest, dissection of mediastinal lymph node groups, intraoperative blood loss, extubation time, postoperative hospital stay, and complication rate between the two groups ($p > 0.05$). However, the operation time of single-port group (209.0 ± 45.5 min) was significantly longer than that of three-port group (154.5 ± 30.9 min) ($p < 0.05$). VAS one day after operation in single-port group (3.6 ± 0.7) was significantly lower than that in three-port group (5.5 ± 1.0) ($p < 0.05$).

Conclusion: For lung cancer patients, the feasibility and safety of single-port complete thoracoscopic lobectomy is similar to three-port complete thoracoscopic lobectomy. Compared with three-port complete thoracoscopic lobectomy, the operation time of single-port complete thoracoscopic lobectomy is longer, but its postoperative pain is gentler. As the experience accumulating, single-port complete thoracoscopic lobectomy should be popularized with its merits of minimal invasiveness.

Keywords: single-port, three-port, lobectomy, lung cancer.

Introduction:

Currently, lobectomy is the prior intervention to treat early-stage non-small cell lung cancer (NSCLC) [1]. As a minimally invasive technique, thoracoscopic lobectomy has been widely used in current thoracic department [2]. Although single-port complete thoracoscopic lobectomy has been introduced to treat NSCLC, no literature was available to compare its feasibility and safety with three-port complete thoracoscopic lobectomy. Therefore, we conducted a retrospective comparison study in lung cancer patients enrolled from June 2014 to August 2014 to investigate the feasibility and safety of single-port complete thoracoscopic lobectomy.

1. Methods and materials

1.1 General information

A total of 60 lung cancer patients from June 2014 to August 2014 in Department of Thoracic Surgery, Fujian Medical University Union Hospital were included in this retrospective study. There were 30 patients in single-port complete thoracoscopic lobectomy group (single-port group) and other

30 in three-port complete thoracoscopic lobectomy group (three-port group).

All patients underwent associated examination such as thoracic computed tomography (CT), cerebral magnetic resonance imaging (MRI), skeletal emission computed tomography (ECT), and abdominal and cervical color Doppler ultrasound (CDU). Positron emission tomography-CT (PET-CT) might also need to be conducted to exclude metastasis if necessary.

Electrocardiogram, cardiac CDU, and pulmonary function test were conducted to assess cardiopulmonary function. The inclusion criteria include: 1) patients with stage I-II (cTNM classification) peripheral lung cancer; 2) no thoracic surgery history; 3) lobectomy can be tolerated by cardiopulmonary function; 4) preoperative complications have been stably controlled.

1. 2 Anesthesia and surgical procedure

Double-lumen endobronchial tubes (DLT) were used for intubation for the two groups, and the healthy lung received ventilation. All patients underwent thoracoscopic lobectomy under general anesthesia. For single-port group, a 3.5-4.5cm incision was made from the 4th intercostal space to the 5th intercostal space along the anterior axillary line. The patients underwent thoracoscopic lobectomy with video assistance. For three-port group, a 1.5cm observation port was made on the cross point of midaxillary line and the 7th intercostal space, and a 2-4cm operation port was made on the cross point of anterior axillary line and the 4th/5th intercostal space. A 1.5-2.5cm operation-aided port was made on the cross point of the 7th intercostal space and infrascapular line. For peripheral lung cancer, pulmonary wedge resection was conducted to remove the focus. Once the resection samples were confirmed as malignant tumor by fast frozen pathology, the following

standard lobectomy and mediastinal lymphadenectomy would be employed. For central lung cancer, standard lobectomy was conducted. Once the resection samples were confirmed as malignant tumor by fast frozen pathology, the following mediastinal lymphadenectomy would be employed. Electrocautery and ultrasonic scalpel were used to distract the vessels and bronchus. Suture clamps were used to fix great vessels such as pulmonary veins, pulmonary artery and so on. Hemolock, titanium clip, electrocautery, ultrasonic scalpel and silk ligation were used to handle small vessels. No definite order was made to conduct the lobectomy, which mostly depended on the development of interlobar fissure. Specimen bag was used to extract the removals preventing from contaminating the cuts, and analgesia pumps were used for the two groups. Indications for removing the drain included: 24h drainage flow was less than 100mL; postoperative lung recruitment was favorable without pleural effusion.

1. 3 Observation parameters

The observation parameters included: 1) parameters during perioperative period: operation time, intraoperative blood loss, postoperative drainage flow, postoperative thoracic cavity drainage time, visual analogue scale (VAS) one day after operation, postoperative hospital stay, death rate during perioperative period, complications during perioperative period. 2) parameters related to tumor resection: total lymph node harvest, node-positive number, node-positive rate, N1 lymph nodes, N2 lymph nodes, N2 lymph node rate, and N2 lymph node groups.

1. 4 Statistical methods

Statistical software SPSS 16. 0 was conducted to analyze the data.

Quantitative data was showed as $\bar{x} \pm s$, and independent t-test was used to test the group comparisons. Enumeration data was presented as rate, and χ^2 test was used to test group comparisons. Statistical significance was set as $P < 0. 05$.

2. Results

2. 1 Clinical characteristics

There were no significant differences in sex, age, tumor location, postoperative pathological type, tumor invasion, visceral pleura invasion, and tumor classification, respectively ($P > 0. 05$) (Table 1). In addition, there were no significant differences in total lymph node harvest, positive lymph node number, total mediastinal lymph node harvest, and dissection of mediastinal lymph node groups ($P > 0. 05$) (Table 2).

Table 1. Comparisons of pathological information between single-port group and three-port group.

	Single-port group (n= 30)	Three-port group (n= 30)	P value
Gender			0. 183
Male	9	11	
Female	21	19	
Age (year)*	25-77(61)	45-70(58)	0. 583

Tumor location			0.096
Left upper lobe	8	4	
Left inferior lobe	5	3	
Right upper lobe	8	9	
Right middle lobe	3	4	
Right inferior lobe	6	10	
Tumor type			0.341
Adenocarcinoma	25	22	
Squamous carcinoma	2	6	
Others	3	2	
Tumor invasion			0.583
Carcinoma in situ	2	0	
Micro invasion	5	6	
Invasion	23	24	

Visceral pleura invasion			0.799
No	22	21	
Yes	8	9	
TNM classification			0.989
Stage 0	1	1	
Stage Ia	14	10	
Stage Ib	6	10	
Stage IIa	2	3	
Stage IIb	3	2	
Stage IIIa	4	4	

*age: extreme value (median).

Table 2. Comparisons of lymph node harvest between single-port and three-port group.

	Single-port group (n= 30)	Three-port group (n= 30)	P value
Total lymph node harvest	23.6±11.2	25.4±7.3	0.73

Positive lymph nodes	1. 5±3. 1	1. 9±4. 9	0. 97
Total mediastinal lymph node harvest	16. 2±9. 2	17. 2±6. 5	0. 73
Dissection of mediastinal lymph node groups	4. 4±1. 0	4. 4±0. 8	0. 63

2. 2 Perioperative information

All operations were under the video-assistance of total thoracoscopic lobectomy without other assisted endoscope incision. There were no deaths during preoperative period. However, there were a total of five cases with complications, two cases (1 case of arrhythmia; 1 case of systemic infections) in single-port group (6. 7%), and another three cases (1 case of arrhythmia; 1 case of air leakage; 1 case of chylothorax) in three-port group (10. 0%). There was no significant difference in complications between the two groups ($P > 0. 05$). Additionally, no significant differences in intraoperative blood loss, postoperative extubation time and postoperative hospital stay were observed ($P > 0. 05$). However, operation time in single-port group ($209. 0 \pm 45. 5$ min) was longer than that in three-port group ($154. 5 \pm 30. 9$ min) ($P < 0. 05$). VAS one day after operation in single-port group ($3. 6 \pm 0. 7$) was lower than that in three-port group ($5. 5 \pm 1. 0$) ($P < 0. 05$). The summary information was included in Table 3.

Table 3. Comparisons of perioperative outcomes between single-port and three-port group

	Single-port group (n= 30)	Three-port group (n= 30)	P value
Operation time (min)	209. 0±45. 5	154. 5±30. 9	0. 000
Intraoperative blood loss (ml)	90. 6±49. 3	79. 5±45. 2	0. 840
Postoperative extubation time (d)	4. 0±1. 5	5. 4±3. 7	0. 256
Postoperative VAS	3. 6±0. 7	5. 5±1. 0	0. 000
Postoperative hospital stay (d)	6. 9±4. 0	8. 5±11. 8	0. 441
Postoperative complications	2	3	0. 799
Arrhythmia	1	1	
Systemic complications	1	0	
Air leakage	0	1	
Chylothorax	0	1	

3. Discussions

Single-port thoracoscopic technique was first reported to diagnose and treat non-complicated pleura-related disease in 2003[7]. In 2004, it was used in <https://assignbuster.com/single-port-complete-thoracoscopic-lobectomy-feasibility/>

pulmonary wedge resection by Rocco et al.[8]. Seven years later, single-port thoracoscopic technique was reported to conduct lobectomy and lymphadenectomy by Gonzalez et al[9]. Since then, it was applied gradually in segment resection of lung [10], total pneumonectomy [11], bronchial sleeve resection [12] and angioplasty of pulmonary arteries [13]. However, most available literature focused on the feasibility and safety of single-port thoracoscopic lobectomy, and no studies compared it with three-port thoracoscopic lobectomy. The presented study retrospectively investigated the differences of clinical outcomes between single-port thoracoscopic lobectomy and three-port thoracoscopic lobectomy for lung cancer. Jiang et al. [14] compared 160 cases of thoracoscopic lobectomy and 247 cases of conventional open surgery and found no significant differences in perioperative death (0.6% vs. 2.8%) and complication rate (9.4% vs. 11.7%) ($P > 0.05$). It is indicated that thoracoscopic lobectomy was technically safe to treat NSCLC. Similarly in our study, the complication rates were 6.7% and 10.0% for single-port group and three-port group, respectively. However, there were no deaths during perioperative period in our study. Therefore, our study indicated that single-port lobectomy was at least technically safe compared with three-port group.

The vital factor for radical resection of lung cancer by single-port thoracoscopic lobectomy was the dissection of lymph nodes. Jiang et al. [14] found no significant differences in dissection of lymph node groups (2.4 ± 1.5 vs. 2.6 ± 1.6) and lymph node harvest (9.8 ± 6.2 vs. 9.9 ± 5.9) between thoracoscopic lobectomy group and conventional open surgery group ($P > 0.05$). Similarly, Zhang et al.[15] found no significant differences in lymph node

harvests (14.6 ± 7.5 vs. 15.2 ± 4.5) between video-assisted thoracoscopic surgery group and video-assisted micro thoracoscopy group. That was to say, the lymph node dissection by thoracoscopic lobectomy was at least equivalent to that by open surgery. In the presented study, there were no significant differences in total lymph node harvest (23.6 ± 11.2 vs. 25.4 ± 7.3), mediastinal lymph node harvest (16.2 ± 9.2 vs. 17.2 ± 6.5), dissection of mediastinal lymph node groups (4.4 ± 1.0 vs. 4.4 ± 0.8) between the single-port group and three-port group. These results suggested that the lymph node harvest was at least equivalent to the previous studies. In other words, the dissection of lymph nodes by single-port thoracoscopic lobectomy was feasible in respect of radical removal of tumors. However, the long-term outcomes need further follow-up to confirm in the future.

The incision of single-port thoracoscopic lobectomy was located at the cross point of anterior axillary line and the 4th/5th intercostal spaces, which, unlike conventional three-port thoracoscopy, did not have observation port or assisted-operation port. The 4th/5th intercostal spaces were wider with less muscle and less bleeding, which might have little impact on the postoperative recover with less pain. After comparing 20 cases of three-port thoracoscopic lobectomy and 10 cases of single-port thoracoscopic lobectomy in treating interstitial lung disease, Chen et al.[16] found that postoperative one-day VAS in single-port group (4.95 ± 0.39) was significantly lower than that in three-port group (4.5 ± 0.7) ($P = 0.03$). Similarly in our study, postoperative one-day VAS in single-port group (3.6 ± 0.7) was significantly lower than that in three-port group (5.5 ± 1.0) ($P < 0.05$)

In the presented study, the operation time (209.0 ± 45.5 min) in single-port group was significantly lower than that in three-port group (154.5 ± 30.9 min). The reasons included 1) all the operating instruments and thoracoscopy went through the single port, which might interfere each other, especially when the focus was near the dorsal cavity and diaphragm. 2) single-port thoracoscopic lobectomy had a strict skill requirement of qualified camera assistant. The camera assistant was supposed to know how to cooperate with the operator, how to allocate the location within the incision, and how to keep the camera stable. Our operation team launched the single-port-thoracoscopic lobectomy since May 2014, and we believed that the operation time would be shortened as we optimized our technique gradually.

In summary, the feasibility and safety of single-port thoracoscopic lobectomy were similar to three-port thoracoscopic lobectomy for lung cancer patients. With the development of instruments, the optimization of surgical procedure, and the accumulation of surgical experience, the operation time would likely be shortened gradually. Therefore, single-port complete thoracoscopic lobectomy was supposed to be popularized with its merits of minimal invasiveness.