RESEARCH COMMUNICATION

Video-assisted Thoracic Surgery Versus Thoracotomy for Non-small-cell Lung Cancer

Tie-Wen Pan*, Bin Wu, Zhi-Fei Xu, Xue-Wei Zhao, Lei Zhong

Abstract

Video-assisted thoracic surgery (VATS) has been recommended as more optimal surgical technique than traditional thoracotomy for lobectomy in lung cancer, but it is not well defined. Here, we compared VATS and traditional thoracotomy based on clinical data. From November 2008 to November 2010, 180 patients underwent lobectomy for non-small-cell lung cancer (NSCL) identified by computerized tomography. Of them, 83 cases were performed with VATS and 97 by thoracotomy. Clinical parameters, consisting of blood loss, operating time, number of lymph node dissection, days of pleural cavity drainage, and length of stay were recorded and evaluated with t test. No significant difference was observed between the VATS and thoracotomy groups in the average intraoperative blood loss, number of lymph node dissections, and days of pleural cavity drainage. While the average operating time in the VATS group was significantly longer than that in thoracotomy group, recurrence was only present in one case, as opposed to 7 cases in the thoracotomy group In conclusion, similar therapeutic effects were demonstrated in VATS and thoracotomy for NSCL. However, VATS lobectomy was associated with fewer complications, recurrence and shorter length of stay.

Keywords: Video-assisted thoracic surgery - thoracotomy - length of stay - recurrence

Asian Pacific J Cancer Prev, **13**, 447-450

Introduction

Lung cancer is the leading cause of cancer-related death worldwide. Conventional thoracotomy has been widely adopted as standard surgical approaches for treatment of lung cancer. However, it often requires dissection of several major chest wall muscles and the use of rid spreaders, both of which may lead to serious postoperative morbidity, like chronic pain and compromised pulmonary function (Moffatt et al., 2002). More recently, video-assisted thoracoscopic surgery (VATS) has been demonstrated as a safe and feasible alternative for the treatment of lung cancer with the advantage of minimally invasive, less pain, less blood loss and faster recovery (Flores et al., 2009). Nevertheless, this approach is still not popular among thoracic surgeons in China because of the technical difficulties and operative risks. VATS also constituted only 20% of lobectomies performed between 1999 and 2005 by high-level practitioners in the United States as represented by the Society of Thoracic Surgeons (STS) General Thoracic Surgery database (Boffa et al., 2008). Importantly, the long-term oncological validity of VATS is still under study (Thomas et al., 2002; Sakuraba et al., 2007; Yang et al., 2009). Therefore, the objective of this study is to further confirm the superiority of VATS lobectomy for non-small-cell lung cancer (NSCLC) to thoracotomy.

Materials and Methods

Clinical data

We retrospectively analyzed results in our patients who underwent VATS lobectomy (83 cases) and thoracotomy lobectomy (97 cases) between November 2008 and November 2010. Mean postoperative follow-up was 13.2 months with the range from 3 to 27. Preoperatively, all the patients were diagnosed with lung cancer through routine examination of the tumor location, tumor size, lymph node status and the adjacent relations. Pre-, peri-, and postoperative patient details and outcome variables, including blood loss, operating time, number of lymph node dissection, days of pleural cavity drainage, and length of stays, were collected by means of clinical assessment. The detail preoperative clinical data was listed in table 1 (Table 1).

Operative technique

The lobectomy is performed under general anesthesia with single-lung ventilation, which may be accomplished with double-lumen endotracheal tubes. The patient is placed in the full lateral decubitus position with the upper arm suspended on a crossbar. Three incisions were performed to accomplish this procedure: A 4 cm utility incision was placed in the fourth intercostal space at mid axillary line using standard thoracic instruments without

*Department of Thoracic Surgery, Shanghai Changzheng Hospital, Shanghai, China *For correspondence: pantiewenpanda@gmail.com*

Table 1. Preoperative Clinical Data in Two Groups

Clinical data	VATS group	Thoracotomy group
Cases	83	97
Sex		
Male	45	51
Female	38	46
Age (years)	54.3±7.8	55.6±11.1
Lobectomy		
Right upper lobe	15	21
Right middle lobe	11	17
Right lower lobe	14	20
Left upper lobe	13	19
Left lower lobe	30	20
Tumor size (cm)	3.2±1.1	4.8±1.3
pTNM stage		
Ia	18	14
Ib	20	22
Iia	24	24
IIb	18	23
IIIa	3	14
Histologic type		
Adenocarcinoma	25	32
Bronchioloalveolar carcinoma	36	26
Squamous carcinoma	22	39

rib spreading; a 1 cm anterior thoracostomy port was obtained at the eighth intercostal space at the anterior axillary line for camera; a 1-cm posterior port was used for retraction and stapler insertion (Yang et al., 2009). Subcutaneous tissue and muscle bundles were shoved off by incision retractor to enable the easy entrance of surgical instruments. Anterograde or one way lung vessel and bronchus treatment were performed to dissect the lung lobe.

Statistical analysis

All data were analyzed by SPSS17.0 and the results were measured by average ± standard deviation (±s). All the peri-, and postoperative clinical parameters between these two groups were evaluated with t test. $P < 0.05$ was considered as statistically significant.

Results

No significant difference was observed between VATS group and thoracotomy group in the average intraoperative blood loss, number of lymph node dissection, and days of pleural cavity drainage (Table 2). The average operating time in VATS group was significantly longer than that in thoracotomy group, but otherwise in the length of stays. Besides, in VATS group, one case showed incision metastasis and one case of III a patient with lung cancer recurrence. In thoracotomy group, recurrence was present in 7 cases.

Discussion

Lung cancer is the most common cause of cancer death in the developed world and the incidence is rising steeply in the developing world, such as China (Saunders et al., 1997). Therefore, the accurate diagnose and treatment of lung cancer is critical for reducing the death rate. Because of lack of clinical symptom, chest computerized tomography (CT) scan is highly preferential for early diagnose of lung cancer (Swensen et al., 2005; Bach et al., 2007). However, studies show high frequency of missed diagnose and misdiagnose in CT scan (Porte et al., 1999; Swensen et al., 2002). High-cost and limited equipment popularity of position emission tomography (PET) and single photon emission computerized tomography (SPECT) also results in their confined application in clinic (Pieterman et al., 2000). Percutaneous core needle biopsy (PCNB) and fibrobronchoscopy also seem not to be applicable for lung cancer diagnose due to isolated and minute lesion. Moreover, it is unacceptable for patients and clinician to perform exploratory thoracotomy owing to high invasiveness (Debevec et al., 2006). However, recent researches have demonstrated that VATS could overcome all the above shortcomings, and significantly improve the diagnose rate of isolated small nodule concurrently removing the corresponding lesions. Thus, it is more acceptable for patients and clinician.

In this study, all the patients were diagnosed as malignant lung cancer through CT scan and postoperative pathologic study. Therefore, it is essential to carry out operative treatment to remove the lesion (VATS or thoracotomy). Postoperatively, we found no significant difference was present between VATS group and thoracotomy group in the average intraoperative blood loss, number of lymph node dissection, and days of pleural cavity drainage. These results indicate the similar effect between VATS and thoracotomy treatment, which both could minimize the trauma.

Nevertheless, VATS incision is obviously smaller than that in thoracotomy, not affecting latissimus dorsi, serratus anterior, and pectoralis major, not cutting and shoving off the rib, but only dividing the intercostals and supracostal. Thus, VATS treatment could cause less pains, shorter hospital stays, and reduced the respiratory comorbid illness (Demmy et al., 2008). These advantages have also been demonstrated in our study. Our results indicated the length of stays was significantly shorter than that in thoracotomy group. After VATS treatment, the upper limbs activities and function in injury side could restore to normal within a month. And the wound is relatively perfect. Therefore, VATS is, in particular, suitable for the young patients and older patients with marginal lung function. Further, the less time in bed after VATS treatment

Table 2. Peri- and Postoperative Clinical Parameters in Two Groups

Clinical parameters	VATS group	Thoracotomy group	T value	P value
Intraoperative blood loss (ml)	178±56	245±79	-1.832	0.098
Operating time (min)	176±68	124±81	1.312	0.046
Lymph node dissection(number)	16±5	18±8	-0.095	0.756
Postoperative pleural cavity drainage (day)	3.6±1.2	4.8±2.7	-0.156	0.395
Postoperative stays (day)	7.5±1.9	9.5±2.3	-2.451	0.043

made the patient vigorously coughing and spitting which decrease the complication occurrence of lung infection and atelectasis. However, some reports indicated the reduced complication is only present within two weeks after surgery, and this superiority would weaken after two weeks (Muraoka et al., 2006).

Importantly, major trauma could lead to serious acute phase response which may damage the organism immune system and cause decreased anti-tumor ability. Griag et al showed that VATS pulmonary lobectomy is associated with reduced peri-operative changes in acute phase responses compared with thoracotomy, with significant lower expression of C-reactive protein (CRP) interleukin (IL)-6, tumour necrosis factor (TNF) receptors (TNF-sR55, TNF-sR75) and P-selectin (Craig et al., 2001). Whitson et al. (2008) also proposed that VATS lobectomy for NSCL cancer was associated with less impairment of cellular cytotoxicity, as compared with thoracotomy. This less immune damage after VATS may lay a better basis for quicker recovery and further treatment.

For example, patients undergoing thoracoscopic lobectomy had significantly fewer delayed and reduced chemotherapy doses (Petersen et al., 2007). Nicastri et al. (2008) showed VATS lobectomy could improve the improved tolerance of chemotherapy. The overall survival rates 5 years after surgery were 85% and 90% in the thoracotomy and VATS groups, respectively (Sugi et al., 2000). Recent study also revealed that VATS could significantly improve the quality of life for the patients. Patients in VATS group had higher scores in physical functioning and emotional role in Medical Outcomes Study Short Form 36 (SF-36) Health Survey. Moreover, the results for chest pain, arm/shoulder pain and peripheral neuropathy scores were better preserved in the VATS group (Baysungur et al., 2011).

Besides, in our study, one case developed incisions metastasis. We predicted the reason may be that the incision was so small that iatrogenic dissemination and incision implanting due to broken tumor and lymph nodes transfer during removing the tumor process. McKenna et al also found 5 patients developed incisions metastasis in 1,100 case (McKenna Jr et al., 2006). Therefore, we suggest careful operation and endo-pouch should be used when removing the tumor.

Shiraishi et al found VATS lobectomy for c-stage I NSCLC may have no survival disadvantage over thoracotomy procedures. It might, however, increase the risk of local recurrence when used to treat pathologically N1 or N2 node-positive disease (Shiraishi et al., 2008). Identically, in this study, we found one case of IIIa patient with recurrence after thoracoscopic lobectomy, but seven cases after thoracotomy. Thus, caution should be used when treating those cases with thoracoscopic surgery.

The need for conversion to a thoracotomy is possible after VATS. Our result found conversion to a thoracotomy occurred in 6 patients, which seemed to be in accordance with previous study (approximately 10%) (Walker, 1998; Shennib et al., 2005). The major causes for conversion were bleeding, adhesion of calcified lymph node and carcinoma invasion to the adjacent organs (Sagawa et al., 2002; Ohtsuka et al., 2004).

In conclusion, we suggest VATS is effective and irreplaceable for early diagnosis and treatment of lung cancer. Although similar therapeutic effect exists after VATS and thoracotomy, VATS could significantly reduce the postoperative complication and length of stay, minimize the trauma, and improve the quality of life.

References

Bach PB, Jett JR, Pastorino U, et al (2007). Computed tomography screening and lung cancer outcomes. *JAMA*, **297**, 953-61.

Baysungur V, Tezel, Okur E, et al (2011). Quality of life assessment six months after lobectomy for lung cancer: video-assisted thoracoscopic surgery versus thoracotomy. *Turkish J Thorac Cardiovasc Surg*, **19**, 207-12.

Boffa DJ, Allen MS, Grab JD, et al (2008). Data from the Society of Thoracic Surgeons General Thoracic Surgery database: the surgical management of primary lung tumors. *J Thorac Cardiovasc Surg*, **135**, 247-54.

Craig SR, Leaver HA, Yap PL, Pugh GC, Walker WS (2001). Acute phase responses following minimal access and conventional thoracic surgery. *Eur J Cardiothorac Surg*, **20**, 455-63.

Debevec L, Er en J, Debeljak A, Crnjac A, Kova V (2006). Exploratory thoracotomy and its influence on the survival of patients with lung cancer. *Wiener Klinische Wochenschrift*, **118**, 479-84.

Demmy TL, Nwogu C (2008). Is video-assisted thoracic surgery lobectomy better? Quality of life considerations. *Ann Thorac Surg*, **85**, S719-28.

Flores RM, Park BJ, Dycoco J, et al (2009). Lobectomy by video-assisted thoracic surgery (VATS) versus thoracotomy for lung cancer. *J Thorac Cardiovasc Surg*, **138**, 11-8.

McKenna Jr RJ, Houck W, Fuller CB (2006). Video-assisted thoracic surgery lobectomy: experience with 1,100 cases. *Ann Thorac Surg*, **81**, 421-6.

Moffatt SD, Mitchell JD, Whyte RI (2002). Role of video-assisted thoracoscopic surgery and classic thoracotomy in lung cancer management. *Curr Opin Pulm Med*, **8**, 281-6.

Muraoka M, Oka T, Akamine S, et al (2006). Video-assisted thoracic surgery lobectomy reduces the morbidity after surgery for stage I non-small cell lung cancer. *Jpn J Thorac Cardiovasc Surg*, **54**, 49-55.

Nicastri DG, Wisnivesky JP, Litle VR, et al (2008). Thoracoscopic lobectomy: report on safety, discharge independence, pain, and chemotherapy tolerance. *J Thorac Cardiovasc Surg*, **135**, 642-7.

Ohtsuka T, Nomori H, Horio H, Naruke T, Suemasu K (2004). Is major pulmonary resection by video-assisted thoracic surgery an adequate procedure in clinical stage I lung cancer? *Chest*, **125**, 1742-6.

Petersen RP, Pham DK, Burfeind WR, Hanish SI, Toloza EM, Harpole DH (2007). Thoracoscopic lobectomy facilitates the delivery of chemotherapy after resection for lung cancer. *Ann Thorac Surg*, **83**, 1245-50.

Pieterman RM, van Putten JWG, Meuzelaar JJ, et al (2000). Preoperative staging of non-small-cell lung cancer with positron-emission tomography. *N Engl J Med*, **343**, 254-61.

Porte HL, Ernst OJ, Delebecq T, et al (1999). Is computed tomography guided biopsy still necessary for the diagnosis of adrenal masses in patients with resectable non-small-cell lung cancer? *Eur J Cardiothorac Surg*, **15**, 597-601.

Sagawa M, Sato M, Sakurada A, et al (2002). A prospective trial of systematic nodal dissection for lung cancer by video-assisted thoracic surgery: can it be perfect? *Ann Thorac*

Surg, **73**, 900-4.
Sakuraba M, Miyamoto H, Oh S, et al (2007). Video-assisted thoracoscopic lobectomy vs. conventional lobectomy via open thoracotomy in patients with clinical stage IA non-small cell lung carcinoma. *Interact Cardiovasc Thorac Surg*, **6**, 614-7.
Saunders M, Dische S, Barrett A, et al (1997). Continuous hyperfractionated accelerated radiotherapy (CHART) versus conventional radiotherapy in non-small-cell lung cancer: a randomised multicentre trial. *Lancet*, **350**, 161-5.
Shennib H, Bogart J, Herndon I, et al (2005). Video-assisted wedge resection and local radiotherapy for peripheral lung cancer in high-risk patients: the Cancer and Leukemia Group B (CALGB) 9335, a phase II, multi-institutional cooperative group study. *J Thorac Cardiovasc Surg*, **129**, 813-8.
Shiraishi T, Hiratsuka M, Yoshinaga Y, et al (2008). Thoracoscopic lobectomy with systemic lymph node dissection for lymph node positive non-small cell lung cancer-is thoracoscopic lymph node dissection feasible? *Thorac Cardiovasc Surg*, **56**, 162-6.
Sugi K, Kaneda Y, Esato K (2000). Video-assisted thoracoscopic lobectomy achieves a satisfactory long-term prognosis in patients with clinical stage IA lung cancer. *World J Surg*, **24**, 27-31.
Swensen SJ, Jett JR, Hartman TE, et al (2005). CT screening for lung cancer: five-year prospective experience1. *Radiology*, **235**, 259-65.
Swensen SJ, Jett JR, Sloan JA, et al (2002). Screening for lung cancer with low-dose spiral computed tomography. *Am J Respir Crit Care Med*, **165**, 508-13.
Thomas P, Doddoli C, Yena S, et al (2002). VATS is an adequate oncological operation for stage I non-small cell lung cancer. *Eur J Cardiothorac Surg*, **21**, 1094-9.
Walker WS (1998). Video-assisted thoracic surgery (VATS) lobectomy: the Edinburgh experience, *Semin Thorac Cardiovasc Surg*, **10**, 291-9.
Whitson BA, D'Cunha J, Andrade RS, et al (2008). Thoracoscopic versus thoracotomy approaches to lobectomy: differential impairment of cellular immunity. *Annals Thorac Surg*, **86**, 1735-44.
Yang X, Wang S, Qu J (2009). Video-assisted thoracic surgery (VATS) compares favorably with thoracotomy for the treatment of lung cancer: a five-year outcome comparison. *World J Surg*, **33**, 1857-61.