

The usefulness of two-port video-assisted thoracoscopic surgery in low-risk patients with secondary spontaneous pneumothorax compared with open thoracotomy

Kyoung Taek Park

Department of Thoracic and Cardiovascular Surgery, Pusan Paik Hospital, College of Medicine, Inje University, Gimhae, Korea

Address for correspondence:

Dr. Kyoung Taek Park,
Department of Thoracic and Cardiovascular Surgery,
Pusan Paik Hospital,
College of Medicine,
Inje University,
Gaegeum-dong,
Pusanjin-gu,
Pusan, Korea 633-165.
E-mail: ktpark@paik.ac.kr

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Abstract:

BACKGROUND: Secondary spontaneous pneumothorax is difficult to treat and has been thought to have high morbidity and mortality rate due to the underlying diseases and presence of comorbidities in the patients. However, early surgical intervention will be beneficial if it is tolerable by the patient. In the surgical approach for treating pneumothorax, video-assisted thoracoscopic surgery (VATS) may reduce the postoperative drainage period and hospital stay compared with open thoracotomy.

MATERIALS AND METHODS: A retrospective review of the clinical data of 40 patients with secondary spontaneous pneumothorax who underwent open thoracotomy ($n = 20$) or two-port VATS ($n = 20$) between January 2008 and December 2012 was performed.

RESULTS: Postoperative drainage period of open thoracotomy group and two-port VATS group was 9.85 ± 5.28 and 6.75 ± 2.45 , respectively, with a significant inter-group difference. Postoperative hospital stay was 11.8 ± 5.12 in the open thoracotomy group and 8.25 ± 2.88 in the two-port VATS group, with a significant inter-group difference. Recurrence rate and postoperative complication rate were not significant between the two groups.

CONCLUSION: In selected patients with secondary spontaneous pneumothorax treated with surgical approach, two-port VATS resulted in shorter postoperative drainage period and hospital stay compared with open thoracotomy.

Key words:

Secondary spontaneous pneumothorax, open thoracotomy two-port video-assisted thoracoscopic surgery

Secondary spontaneous pneumothorax (SSP) is caused by any underlying parenchymal lung disease such as pulmonary emphysema, interstitial pneumonitis, or pulmonary tuberculosis. As patients usually have compromised pulmonary functions, associated comorbidities such as diabetes mellitus, cerebral infarction, ischemic heart disease, and secondary pneumothorax result in long periods of hospitalization and high morbidity and mortality. Although SSP needs to be treated by surgical approach, it has remained difficult due to precluding factors such as marginal pulmonary reserves, poor general condition, and comorbidities.^[1-9] Thus, conventional approach such as closed thoracotomy with pleurodesis has been preferred for the treatment of SSP.^[10] However, surgical approach is the treatment of choice in tolerated patients. Surgical approaches are represented by conventional open thoracotomy and video-assisted thoracoscopic surgery (VATS). In this study, we determine the usefulness of two-port VATS compared with open thoracotomy for SSP.

Materials and Methods

We retrospectively reviewed the clinical records of 40 patients with who underwent open thoracotomy ($n = 20$) and two-port VATS ($n = 20$) between January 2008 and December 2012. In this study, patients with forced expiratory volume in one second (FEV1) $>60\%$ and diffusing capacity (DLco) $>60\%$ were treated using surgical interventions. Open thoracotomy group consisted of patients who were admitted before March 2011, and two-port VATS group consisted of patients who were admitted after March 2011. The median follow-up period in each group varied from 20 to 48 months and from 5 to 21 months, respectively (median 32.1 vs. 12.2 months). Data were presented as frequencies or means with standard deviations. For comparison of the two groups [Table 1], variables such as age, gender, laterality, localization of blebs or bullae, comorbidities, postoperative drainage period, postoperative hospital stay, recurrence, and complication rate were included for analysis. Fisher's exact test

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Table 1: Characteristics of patients with secondary spontaneous pneumothorax

Variable	Open thoracotomy	Two-port VATS
No. of patients	20	20
Male/female	20/0	20/0
Age (years)	65.5±8.08	58.2±11.11
Laterality: right/left	15/5	12/8
Blebs or bullae		
Confined to one lobe	10	9
Existed in more than one lobe	10	11
Main comorbidity in addition to emphysema		
Hypertension	6	9
Diabetes mellitus	2	2
Old tuberculosis	4	6
Ischemic heart disease	1	1
Cerebral infarction	–	1
Chronic renal failure	–	1

was used for categorical variables, and Student's *t*-test for continuous variables. Statistical analysis was conducted using SPSS version 18.0 for Windows (SPSS Inc., Chicago, IL, USA). For all analyses, statistical significance was set at $P < 0.05$.

Surgical technique

All patients were relieved from acute dyspnea by closed thoracotomy before surgery. Preoperative chest computed tomography scan and pulmonary function tests were performed after a certain amount of re-expansion was achieved. At the start of anesthesia, double-lumen endotracheal tube was inserted for all patients. A surgical adhesive was applied to every stapled line. Inferior pulmonary ligament in hemithorax was divided in all cases for assisting lung expansion. Mechanical or chemical pleurodesis was not performed.

Open thoracotomy

A 10-12 cm long serratus anterior muscle sparing thoracotomy was performed at midaxillary line and the pleural cavity was entered through the 5th intercostal space. After the parietal pleura was detached and resected from the chest wall, any visible bullae or blebs were stapled with Autosuture-TA instrument (Covidien, Norwalk, CT, USA) with reinforcement of the staple lines using synthetic suture materials. A 28 Fr chest tube was inserted through 7th intercostal space in the midaxillary line and advanced to the apex of hemithorax.

The two-port VATS

All procedures were accomplished through a minimally invasive technique. The XX-small wound protector (U-tractor®) was inserted in the 6th intercostal space port incision at the midaxillary line and a 10 mm, 30° thoracoscope was used. Under the visualization of thoracoscope, a 1-cm-sized utility incision at the 3rd intercostal space was made, avoiding adhesions, and then X-small wound protector (Alexis, Applied Medical Inc. Rancho Santa Margarita, CA, USA) was inserted. After blunt detachment of the parietal pleura from the chest wall using a blunt cherry dissector, endoscopic electrocautery, and endoscopic harmonic scalpel, any visible

blebs or bullae were stapled with Endo-GIA instrument (Covidien, Norwalk, CT, USA) through port incision. Reinforcement of the staple line using synthetic materials was not performed routinely. Bio-absorbable felt (Neoveil®) was used for reinforcing possible air leakage of the stapling region. After the procedures were done, a 24 Fr chest tube was inserted through the port incision.

Results

There was no mortality or switching from two-port VATS to open thoracotomy.

Primary end points

Postoperative drainage period and hospital day

The mean postoperative chest tube drainage period was 9.85 ± 5.28 days in the open thoracotomy group and 6.75 ± 2.45 days in the two-port VATS group, with a significant inter-group difference. The mean postoperative hospital stay was 11.8 ± 5.12 days in the open thoracotomy group and 8.25 ± 2.88 days in the two-port VATS group. There was a significant difference between the two groups.

Recurrence rate

Recurrence of pneumothorax was noted in two patients in the open thoracotomy group and one patient in the two-port VATS group. There was no significant difference between the two groups.

Postoperative complication rate

Postoperative complication rate was noted in seven patients in the open thoracotomy group and two patients in the two-port VATS group [Table 2]. There was no significant difference between the two groups.

Discussion

SSP is difficult to treat due to the presence of any underlying parenchymal lung disease, such as pulmonary emphysema, interstitial pneumonitis, and pulmonary tuberculosis, or the presence of various comorbidities in the patient.^[1-9] Air leakage persists with the conventional treatment alone in 30-40% of these patients, and therefore, further treatment, such as surgical pulmonary resection, is required.^[11] We believe that patients will benefit from early surgical intervention if they are tolerant to it. In the surgical approach, open thoracotomy for the treatment of SSP is associated with high perioperative mortality and the postoperative hospital stay tends to be longer. Postoperative pain and frozen shoulder

Table 2: Complication rates in the two groups

Variable	Open thoracotomy	Two-port VATS	P-value
Complication rate: <i>n</i> (%)	7 (35%)	2 (10%)	0.64
Reoperation for postoperative bleeding	3		
Wound dehiscence	2	1	
Postoperative pneumonia	1		
Additional thoracotomy*	1	1	

*Additional closed thoracotomy was done when chest X-ray showed the air space remaining, but operative chest tube was non-functioning

are associated mainly with spreading the ribs and bending the operation table in open thoracotomy. VATS offers the benefit of minimal invasive access. VATS helps the patients resume quickly the activities of daily living postoperatively, and is reported to shorten the postoperative drainage period and length of hospital stay after surgery.^[12-18] The conventional VATS for pneumothorax is accomplished through three small incisions made on the chest wall.^[19] There is a close relationship between the number of port incisions and postoperative pain. Low cosmetic satisfaction also would not help. Furthermore, inattentive inlaying trocar damages the thoracic musculature. The two-port VATS described in this study is a modification of the conventional thoracoscopic technique, which is a three-port VATS procedure. Trocar disuse could reduced the chest wall muscle damage. By using wound protectors to prevent bleeding, smooth entry of the endo-stapler was achieved. The wandering, sanguineous dirt-free thoracoscope also reduced the hassle of frequent cleaning. Single-port VATS is under development. However, vision of the pleural cavity and operative manipulations are limited to the apex of the thorax through the uniport.^[20] With regard to the effectiveness of two-port VATS on pneumothorax, Foroulis *et al.* reported extensive resection of the parietal pleura is more important in secondary pneumothoraces using VATS. Two-port VATS allows better visualization of the apical parietal pleura. The main advantage of two-port VATS over axillary minithoracotomy is better patient satisfaction with treatment, associated mainly with immediate postoperative full dependent-arm mobilization as well as faster full recovery and return to activities.^[21] In conclusion, the application of two-port VATS on SSP is considered to shorten the postoperative drainage period and hospital stay in SSP patients.

Limitations

The limitation of the study is its relatively short follow-up period (less than 48 months), considering that most recurrences occur within the first 12 months after the surgical procedures for pneumothorax.^[22,23] Although our study may be undermined by the retrospective research and patients' selection bias with good clinical condition, reasonably short postoperative drainage period and hospital stay in two-port VATS group may offer rationale for the application of two-port VATS to SSP patients. Further research on the efficacy of two-port VATS for treatment of SSP is recommended.

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References

- Zhang Y, Jiang G, Chen C, Ding J, Zhu Y, Xu Z. Surgical management of secondary spontaneous pneumothorax in elderly patients with chronic obstructive pulmonary disease: Retrospective study of 107 cases. *Thorac Cardiovasc Surg* 2009;57:347-52.
- Waller DA, Forty J, Soni AK, Conacher ID, Morrill GN. Videothoracoscopic operation for secondary spontaneous pneumothorax. *Ann Thorac Surg* 1994;57:1612-5.
- Nakajima J, Takamoto S, Murakawa T, Fukami T, Yoshida Y, Kusakabe M. Outcomes of thoracoscopic management of

- secondary pneumothorax in patients with COPD and interstitial pulmonary fibrosis. *Surg Endosc* 2009;23:1536-40.
- Luh SP, Tsai TP, Chou MC, Yang PC, Lee CJ. Video-assisted thoracic surgery for spontaneous pneumothorax: Outcome of 189 cases. *Int Surg* 2004;89:185-9.
- Shaikhrezai K, Thompson AI, Parkin C, Stamenkovic S, Walker WS. Videoassisted thoracoscopic surgery management of spontaneous pneumothorax-long-term results. *Eur J Cardiothrac Surg* 2011;40:120-3.
- Mouroux J, Elkaïm D, Padovani B, Myx A, Perrin C, Rotomondo C, *et al.* Video-assisted thoracoscopic treatment of spontaneous pneumothorax: Technique and results of one hundred cases. *J Thorac Cardiovasc Surg* 1996;112:385-91.
- Passlick B, Born C, Häussinger K, Thetter O. Efficiency of video-assisted thoracic surgery for primary and secondary spontaneous pneumothorax. *Ann Thorac Surg* 1998;65:324-7.
- Rieger R, Woisetschlager R, Schrenk P, Wayand W. Thoracoscopic bleb resection selectively combined with pleurectomy for complicated spontaneous pneumothorax. *Eur J Surg* 1998;164:333-8.
- Andrés B, Luján J, Robles R, Aguilar J, Flores B, Parrilla P. Treatment of primary and secondary spontaneous pneumothorax using videothoracoscopy. *Surg Laparosc Endosc* 1998;8:108-12.
- Tanaka F, Itoh M, Esaki H, Isobe J, Ueno Y, Inoue R. Secondary spontaneous pneumothorax. *Ann Thorac Surg* 1993;55:372-6.
- Elfeldt RJ, Schroeder D, Meinicke O. Spontaneous pneumothorax considerations on aetiology and therapy. *Chirurg* 1991;62:540-6.
- Waller DA, Forty J, Morrill GN. Video-assisted thoracoscopic surgery versus thoracotomy for spontaneous pneumothorax. *Ann Thorac Surg* 1994;58:372-7.
- Balduyck B, Hendriks J, Lauwers P, Van Schil P. Quality of life evolution after surgery for primary or secondary spontaneous pneumothorax: A prospective study comparing different surgical techniques. *Int Cardiovasc Thorac Surg* 2008;7:45-9.
- Horio H, Nomori H, Fuyuno G, Kobayashi R, Suemasu K. Limited axillary thoracotomy vs video-assisted thoracoscopic surgery for spontaneous pneumothorax. *Surg Endosc* 1998;12:1155-8.
- De Giacomo T, Rendina EA, Venuta F, Ciriaco P, Lena A, Ricci C. Video-assisted thoracoscopy in the management of recurrent spontaneous pneumothorax. *Eur J Surg* 1995;161:227-30.
- Crisci R, Coloni GF. Video-assisted thoracoscopic surgery versus thoracotomy for recurrent spontaneous pneumothorax. A comparison of results and cost. *Eur J Cardiothrac Surg* 1996;10:556-60.
- Jiménez-Merchán R, García-Díaz F, Arenas-Linares C, Girón-Arjona JC, Congregado-Loscertales M, Loscertales J. Comparative retrospective study of surgical treatment of spontaneous pneumothorax. Thoracotomy vs thoracoscopy. *Surg Endosc* 1997;11:919-22.
- Shen KR, Cerfolio RJ. Decision making in the management of secondary spontaneous pneumothorax in patients with severe emphysema. *Thorac Surg Clin* 2009;19:233-8.
- Henry M, Arnold T, Harvey J. on behalf of the BTS pleural disease group, a subgroup of the BTS standards of care committee (2003) BTS guidelines for the management of spontaneous pneumothorax. *Thorax* 58 (Suppl II):1139-52.
- Salati M, Brunelli A, Xiume` F, Refai M, Sciarra V, Soccetti A, *et al.* Uniportal video-assisted thoracic surgery for primary spontaneous pneumothorax: Clinical and economic analysis in comparison to the traditional approach. *Interact Cardiovasc Thorac Surg* 2008;7:63-6.
- Foroulis CN, Anastasiadis K, Charokopos N, Antonitsis P, Halvatzoulis HV, Karapanagiotidis GT, *et al.* A modified two-port

thoracoscopic technique versus axillary minithoracotomy for the treatment of recurrent spontaneous pneumothorax: A prospective randomized study. *Surg Endosc* 2012;26:607-14.

22. Kim KH, Kim HK, Han JY, Kim JT, Won YS, Choi SS. Trans axillaryminithoracotomy versus video-assisted thoracic surgery for pontaneous pneumothorax. *Ann Thorac Surg* 1996;61:1510-2.
23. Horio H, Nomori H, Fuyuno G, Kobayashi R, Suemasu K. Limited axillary thoracotomy vs. video-assisted thoracoscopic

surgery for spontaneous pneumothorax. *Surg Endosc* 1998;12:1155-8.

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