

## Outcome of Video-assisted Thoracoscopic Surgery for Spontaneous Secondary Pneumothorax

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**Background:** Conventional treatment (i.e. chest tube insertion and chemical pleurodesis) still remains standard for patients with secondary spontaneous pneumothorax because the risk of surgical bullectomy is deemed high in this subset. However, it has been suggested that surgical treatment using thoracoscopy may expedite postoperative recovery and, thus, may reduce hospital stay. **Materials and Methods:** Retrospective review of 61 patients with secondary spontaneous pneumothorax, who underwent conventional treatment (n=39) or video-assisted thoracoscopic surgery (VATS) (n=22) between January 2007 and December 2009, was performed. Talc was used for chemical pleurodesis in both groups. **Results:** Hospital stay of conventional treatment group and VATS group was  $14.2 \pm 14.2$  days (4~58 days) and  $10.6 \pm 5.8$  days (5~32 days), respectively, with statistically significant difference ( $p=0.033$ ). Recurrence rate of conventional treatment group was also significantly higher (12/39, 30%) compared to VATS group (1/22, 4.5%) ( $p=0.016$ ). **Conclusion:** In selected patients with secondary spontaneous pneumothorax with continuous air leak or inadequate lung expansion, thoracoscopic surgery with chemical pleurodesis using talc results in shorter hospital stay and lower recurrence rate compared to conventional approach.

Key words: 1. Pneumothorax  
2. Thoracoscopy  
3. Pleurodesis

### INTRODUCTION

Differing from primary spontaneous pneumothorax, secondary spontaneous pneumothorax is characterized by the association of underlying parenchymal lung lesions and multifocal bullae, which are not confined to the upper lobes but involving multiple lobes [1]. Affecting elderly patients [2] whose

pulmonary function is frequently compromised, secondary pneumothorax has been thought to have a higher risk for surgical treatment [3]. However, conventional approach (i.e. chest tube insertion and chemical pleurodesis) may be associated with persistent air leak, severe pain from repeated chemical irritation, prolonged hospital stay and high complication rate [4,5]. Recently, it has been suggested that vid-

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eo-assisted thoracoscopic surgery (VATS) may result in lower morbidity and mortality even in patients with underlying parenchymal lung diseases. In this study, we sought to determine the outcome of VATS for secondary spontaneous pneumothorax in comparison to conventional approach.

## MATERIALS AND METHODS

Retrospective review of 61 senile patients (age > 50 years) with secondary pneumothorax, who underwent conventional treatment (n=39) or video-assisted thoracoscopic surgery (VATS) (n=22) between January 2007 and December 2009, was performed. Conventional treatment group consisted of patients whose air leak through the chest tube ceased after one or two episodes of chemical pleurodesis, and VATS group consisted of selected patients with good general condition who were considered as having a higher probability of conventional treatment failure, such as persistent air leak for more than 5 days, inadequate lung expansion, and multiple bullae on chest computed tomography. In the VATS group, surgical technique was utilized to excise only the air-leaking bullae, and chemical pleurodesis using talc (2 g) was performed. Under general anesthesia with double lumen endotracheal tube (Robertshaw<sup>®</sup>) for one-lung ventilation, a trocar (11.5 mm) was placed in the previous chest tube site, and thoracoscopy was introduced through the trocar. Once air-leaking bullae were identified, the two additional trocars (11.5 mm and 5 mm) were placed according to the location of the target bullae. Because of the multiplicity of bullous lesion in these patients, resection of all bullae is not technically feasible, and, thus, we attempted to excise only air-leaking bullae by wedge resection using staplers. When pleural adhesion near the air-leaking bullae was severe, extensive adhesiolysis was performed so as not to cause inadvertent tear of the surrounding visceral pleura upon the wedge resection. Chemical pleurodesis using talc was performed prior to chest closure. In conventional treatment group, talc was introduced into the chest tube(s) after adequate lung expansion was ascertained on chest X-ray. Data are presented as frequencies or means with standard deviations. For the comparison of the two groups (Table 1), variables such as age, sex, height, body weight, body mass index, smoking history, hospital

**Table 1.** Characteristics of patients

Variable	Conventional treatment group	VATS group	p-value
No. of patient	39	22	N.A.
Sex			0.848
Male	36	20	
Female	3	3	
Age	71.8±9.16	61.3±8.46	< 0.001
Height (cm)	165±5.8	166.4±7.5	0.751
Weight (kg)	55.2±9.6	61.6±9.7	0.017
Body mass index	20.1±2.9	22.2±3.1	0.010
Laterality			0.851
Left	15	9	
Right	24	13	
Smoking (pack-years)	26.5±21.5	20.2±21.8	0.280
Pneumothorax episodes	1.5±1.1	1.4±0.5	0.580
Underlying disease			N.A.
COPD	17	18	
Tbc	21	3	
DILD	1	1	

VATS=Video-assisted thoracoscopic surgery; COPD=Chronic obstructive pulmonary disease; Tbc=Tuberculosis; DILD=Diffuse interstitial lung disease; N.A.=Not applicable.

stay, recurrence of air leak, morbidity and mortality, were included for analysis. Chi-square test was used for categorical variables, and student t-test was used for continuous variables. Statistical analysis was conducted using SPSS (Version windows 18.0; SPSS Inc., Chicago, USA), and a p-value of less than 0.05 was considered statistically significant.

## RESULTS

There were 56 men and 5 women: 36 men among 39 patients in the conventional treatment group and 20 men among 22 patients in the VATS group. Underlying lung diseases were chronic obstructive pulmonary disease (COPD) in 35 (35/61, 57.3%), pulmonary tuberculosis (Tbc) in 24 (24/61, 39.3%), and diffuse interstitial lung disease (DILD) in 2 (2/61, 3.4%): 17 COPD, 21 Tbc, 1 DILD in the conventional treatment group and 18 COPD, 3 Tbc, 1 DILD in the VATS group. Age at treatment was 68.1±10.2 years (51~89 years): 71.8±9.16 years (53~89 years) in the conventional treatment group and 61.3±8.4 years (51~82 years) in the VATS group.

**Table 2.** Comparison of the treatment outcome between the two groups

Variable	Conventional treatment group	VATS group	p-value
Hospital stay (days)	14.2±14.2	10.6±5.8	0.033
Recurrence	12 (30.7%)	1 (4.5%)	0.016
Morbidity	0	0	—
Mortality	2 (5%)	0	0.280

VATS=Video-assisted thoracoscopic surgery.

Smoking history was 26 pack-years (0~60) in the conventional treatment group and 20 pack-years (0~60) in the VATS group. In the VATS group, no patient underwent open thoracotomy conversion from initial VATS trial, and no post-operative complication was noted. Air leak in the chest tube was noted for 4.0±2.0 days preoperatively and 2.2±1.8 days (0~7 days) postoperatively in the VATS group. Hospital stay was 14.2±14.2 days (4~58 days) in the conventional treatment group and 10.6±5.8 days (5~32 days) in the VATS group, with significant inter-group difference ( $p < 0.033$ ). Recurrence of pneumothorax was noted in 12 patients (12/39, 30%) in the conventional treatment group and 1 patient (1/22, 4.5%) in the VATS group. There were 2 deaths in the conventional treatment group: 1 hospital death due to the acute exacerbation of DILD and 1 late death due to the progression of COPD (Table 2).

## DISCUSSION

Spontaneous pneumothorax is classified as primary or secondary based on the absence or presence of parenchymal lung disease. Differing from primary pneumothorax which is prevalent among young population, secondary pneumothorax occurs more frequently in the elderly. Most common underlying parenchymal lung diseases have been COPD [6] in western countries and pulmonary tuberculosis [7,8] in the East, but the incidence of spontaneous pneumothorax complicating pneumocystis carinii pneumonia has increased recently in western countries due to the prevalence of acquired immune deficiency syndrome [9]. Other etiologies include idiopathic pulmonary fibrosis [10], ankylosing spondylitis [11], multiple sclerosis [12], and cystic fibrosis [13]. While ther-

apeutic algorithm for primary spontaneous pneumothorax has been well-established [14], treatment of secondary pneumothorax has remained to be defined. Because of the marginal pulmonary reserve in this setting [15,16], victims of secondary pneumothorax tend to show severe symptoms, and, thus, need urgent chest tube insertion [17,18]. Furthermore, preponderance of this condition in the elderly with poor general condition may preclude surgeons from performing early surgical intervention, which in turn results in higher incidence of treatment failure, complication, and mortality [18]. Although spontaneous pneumothorax is mostly treated by thoracoscopic approach, VATS necessitate temporary one-lung ventilation, which may be poorly tolerated in patients with underlying parenchymal lung disease. Thus, conventional approach (i.e. chest tube insertion with chemical pleurodesis) has long been regarded as the treatment of choice for secondary pneumothorax [3]. However, there might be a subset of patients with underlying lung disease who would benefit from early surgical intervention. We deem that following patients with secondary pneumothorax would best benefit from VATS: patients in good clinical condition, patients with prolonged air leak longer than 5 days due to inadequate lung expansion, and patients with bullae on chest computed tomography. In our series, no patient developed complication or recurrence by employing these inclusion criteria. Because secondary pneumothorax is frequently associated with diffuse bullous lesion, complete resection of the bullae is difficult. To minimize surgical insult and operation time, we selectively removed bullae with profuse air-leak on air-leakage test upon VATS procedure. We also used talc [19] for chemical pleurodesis, which was conducted under thoracoscopic guidance. Talc pleurodesis should be performed with caution because this procedure may be associated with various complications, from mild complications such as temporary fever within 2 or 3 days after the procedure to severe ones such as acute respiratory distress syndrome [20], none of which was observed in our series.

Clinical implication of our study may be undermined by retrospective nature of the research and patient selection bias in favor of patients with good clinical condition. Nevertheless, reasonably low morbidity and mortality after VATS for secondary pneumothorax in our series may rationalize the appli-

cation of surgical approach for selected patients. Further research to determine the efficacy of VATS for secondary pneumothorax may be mandatory.

## CONCLUSION

In treating secondary spontaneous pneumothorax, thoroscopic bullae resection and chemical pleurodesis using talc may reduce hospital stay and recurrence compared to conventional treatment.

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