The THAI Journal of SURGERY 2010;31:43-47.
Official Publication of the Royal College of Surgeons of Thailand

Original Article

Minithoracotomy with Video-assisted Thoracic Surgery for Spontaneous Pneumothorax: Results of Subtotal Parietal Pleurectomy Versus Pleural Abrasion

Montien Ngodngamthaweesuk, MD*
Narumol Kijjanon, RN**
Pornpimol Masnaragorn, RN**

**Division of Cardiothoracic Surgery, Department of Surgery, **Department of Nursing, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand*

Abstract

Background: **This study aimed to compare two pleurodesis strategies: subtotal parietal pleurectomy and pleural abrasion by using minithoracotomy with video-assisted thoracic surgery, and to assess which one should be used for the treatment of spontaneous pneumothorax.**

Materials and Methods: **A retrospective study was carried out to include 18 cases of spontaneous pneumothorax treated by minithoracotomy with video-assisted thoracic surgery at our institution between July 2004 to May 2007. Eight cases (Group A) had eight operations for pleural abrasion. Ten cases (Group B) had eleven operations for subtotal parietal pleurectomy. All patents (Groups A and B) had pleurodesis after resection of lung blebs or blind apical resection. Clinical features of these patients were analyzed.**

Results: **In both groups, there were no significant differences in term of preoperative factors (age and sex, underlying diseases, site of spontaneous pneumothorax, indication for operation, and onset and symptoms), intra-operative factors (duration of operation, blood loss), postoperative factors (chest tube removal), pathological reports and complication (reoperation). However, exposure attributable risk (EAR) for reoperation of Group A (pleural abrasion) was 0.125. None in both groups were dead and required blood transfusion. Two patients with COPD in Group A needed mechanical ventilation after operation. A patient with COPD in Group A needed reoperation due to prolonged air leakage from a new small ruptured lung bleb at right middle lobe.**

Conclusions: **Minithoracotomy with video-assisted thoracic surgery is a reliable and safe method to treat spontaneous pneumothorax. In surgical pleurodesis, subtotal parietal pleurectomy may be better than pleural abrasion because it can reduce recurrent spontaneous pneumothorax.**

Keywords: **Minithoracotomy, pleurectomy, pleurodesis, spontaneous pneumothorax. video-assisted thoracic surgery (VATS)**

Correspondence address : *Montien Ngodngamthaweesuk, MD, Division of Cardiothoracic Surgery, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok 10400, Thailand; Telephone: +66 2201 1315; Fax: +66 2201 1316; E-mail: ramnn@mahidol.ac.th.*

INTRODUCTION

Gaensler and colleagues[1] reported the first series of patients with recurrent spontaneous pneumothorax in whom parietal pleurectomy was done. Deslauriers and colleagues[2] reported a modified form of a trans¢ axillary approach for reducing postoperative morbidity and achieving prompt restoration of working capacity. In the past years, many thoracoscopic procedures such as ablating blebs or emphysematous bullae by stapling, suture ligation, electrocautery and pleurodesis by pleural abrasion[3], instillation of talc[4] were done.

This report described lung blebs or bullae resection and sutures and subsequently pleurodesis (subtotal parietal pleurectomy or pleural abrasion) by using minithoracotomy with video-assisted thoracic surgery. The aim of this study was to compare two possible pleurodesis strategies: subtotal pleurectomy and pleural abrasion using minithoracotomy with video-assisted thoracic surgery, in order to assess which one was better adapted for the treatment of spontaneous pneumothorax.

PATIENTS AND METHODS

This retrospective study was performed by reviewing medical records between July 2004 and May 2007 at Ramathibodi Hospital, Mahidol University, Bangkok. Patients diagnosed with spontaneous pneumothorax who received surgical treatment (minithoracotomy and video-assisted thoracic surgery) were divided into 2 groups. The first group (group A) had 8 cases with eight operations of pleural abrasion and another group (group B) had 10 cases with eleven operations of subtotal parietal pleurectomy after resection of lung blebs or blind apical resection when no obvious lesions had been identified.

Pre-operative and intra-operative factors, pathological reports and post-operative complications were analyzed with chi-square and fisher's exact test (when count was less than 5) and Mann-Whitney test with statistical significance when $P < 0.05$.

Techniques

All procedures were performed in the operating room by a thoracic surgeon during general anesthesia using a double-lumen endotracheal tube that allowed ventilation of the contralateral lung while the ipsilateral lung remained in atelectasis. The patient was placed in the lateral decubitus position. The chest and trunk were bent. If a chest tube was in place before operation it was removed before preparation. There were three mini incision sites (Figure 1).

The first incision started on the anterior border of the latissimus dorsi muscle and extended anteriorly for 5 to 7 cm in length (Figure 2). A small thoracic retracter was used to access the pleural space and lung. The second incision was done at the eighth intercostal space in the midaxillary line followed by the introduction of a 10-mm rigid thoracoscope with a 30 degree lens. The third incision (1.5-2.0 cm. in length) was done at the fourth intercostal space in the anterior axillary line under direct thoracoscopic visualization. The lung was explored via the first incision (minithoracotomy) while it was grasped with sponge-holding forceps through the third incision (Figure 3). If there was lung adhesion, it would be lysed by an electrocautery under direct thoracoscopic visualization. All lung bullae or blebs (Figure 4) were resected by Kelly clamps and Metzenbaum scissors and repaired with continuous and interrupted 2-0 dexon without endostaplers. If there was no lung bulla (e), the apical lung would be resected. At the end of the procedure,

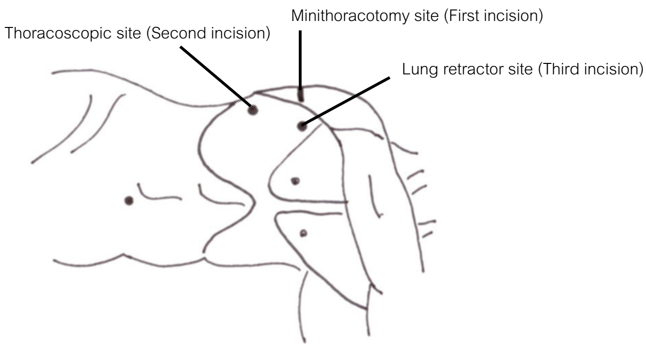

Figure 1 Three mini incision sites

Figure 2 The first incision (Minithoracotomy)

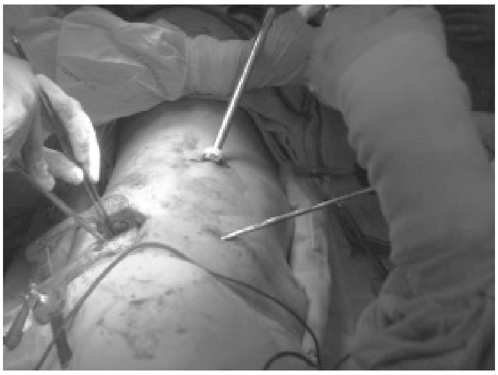

Figure 3 The lung was explored via three incisions

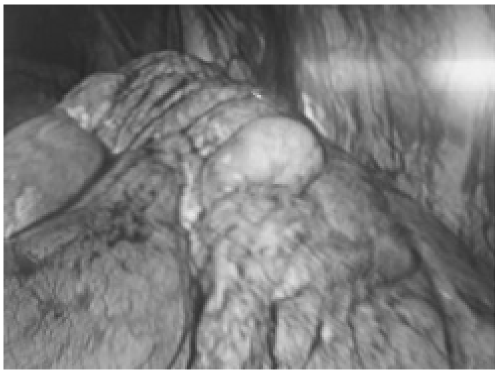

Figure 4 Lung bleb

we divided all patients into two groups. The first group (Group A) was pleural abrasion which was done by dry gauzes or electrocautery cleaners. The second group (Group B) was subtotal parietal pleurectomy which was done by sponge-holding forceps and dissector. If there was another air leakage or bronchopleural fistula during underwater test, it would be repaired with interrupted 2-0 dexon. Then a 28-French silicone chest tube was placed through the second incision (the thoracoscopic site) toward the apex of the pleural cavity and connected to an underwater seal suction with a negative pressure of 10 cm water. Expansion of the lung was reconfirmed by chest x-ray. The chest tube was removed when air leakage had ceased and pleural fluid was less than 100 mL per day.

Results

Details of patients' characteristics in Group A (8 cases) and Group B (11 cases) were shown in Table 1.

None of the patients in both groups were dead or required blood transfusion. Two patients with chronic obstructive pulmonary disease (COPD) in Group A needed mechanical ventilation after operation. One patient with COPD in Group A needed reoperation due to prolonged air leakage. His pathological report showed focal interstitial fibrosis with emphysematous change at apical segment of right upper lobe after blind apical resection. Reoperative finding showed a new small ruptured lung bleb at right middle lobe.

Discussion

Surgical management of spontaneous pneumothorax has two objectives: 1) the underlying cause should be treated either by resection of blebs, suture of apical perforations or even blind apical stapling when no obvious lesion has been identified; 2) to create diffuse lung adhesions to prevent further recurrence. Recurrent rate of pneumothorax after simple chest tube drainage of a first episode range from 10% to 20%; recurrence after a second episode is about 50% and close to 80% after a third episode[5,6]. According to the risk of recurrence, indications for operative intervention have been recognized to follows: 1) second ipsilateral recurrence, 2) first contralateral recurrence, 3) bilateral simultaneous pneumothorax, 4) persisting pneumothorax (air leaks > 7 days), 5) spontaneous hemopneumothorax, and 6) professions at risk (eg. pilots, scuba divers).

Minimal invasive techniques can shorten hospital stay, reduce physical disability and lower the cost of treatment, while yielding at least comparable long-term results in comparison with standard open procedures. Weeden D et al (1983) demonstrated a slight advantage of pleurectomy over abrasion: the recurrent rate was 0.4% after pleurectomy and 2.3% after abrasion[7]. In chemical pleurodesis; the recurrent rate was 36% after simple drainage, 13% after tetracycline pleurodesis, and 8% after talc poudrage[8]. However, most surgeons prefer pleural abrasion or pleurectomy because granuloma formation from chemical pleurodesis is considered excessive. In contrast, patchy distribution of talc may fail to prevent recurrences and require a subsequent thoracotomy in technically critical conditions. Fibrin glue also had unacceptably high recurrent rate of 25% with high cost and biologic risks of this material[9].

The most complications are related to the patient's status rather than the thoracotomy itself. Postoperative hemothorax occurred more after pleurectomy (0% to 4% of cases)[7]. Recurrent rate of pneumothorax after

Table 1 Demographic characteristics in spontaneous pneumothorax (SP) (Chi-square and fisher's exact test)

	Group A (Pleural abrasion)	**Group B (Pleurectomy)**	**P**
Number (operation)	8	11	0.269
Preoperative Factor			
Age (mean ± SD years)	41.75 ± 15.62 (19-68)	40.64 ± 21.28 (15-65)	0.269
Sex (F/M)	2/6	1/10	0.376
Underlying disease			
History of smoking	5	6	0.551
Chronic obstructive pulmonary disease (COPD)	3	4	0.663
Malignant neoplasm	1 (Squamous cell carcinoma of larynx)	1 (Undifferentiated carcinoma of arm)	0.678
Heart disease	-	1 (Wolff Parkison-White Syndrome)	0.579
Connective tissue disease	1 (Marfan syndrome)	-	0.421
Chronic hepatitis B	-	1	0.579
Hypertension	1	1	0.678
Dyslipidemia	-	1	0.579
Site of SP			
Right / Left sided SP	7/1	8/3	0.426
Indication for surgery			
Prolong air leakage (> 5 days)	4	5	0.605
Second ipsilateral recurrence	4	3	0.506
Bilateral simultaneous pnemothorax	-	2	0.624
First contralateral recurrence	-	1	0.579
Symptoms			
Duration of onset (mean ± SD, hours)	58.29 ± 36.28	117.00 ± 118.57	0.548
Chest pain	4	3	0.297
Dyspnea	2	3	0.664
Chest pain and Dyspnea	-	4	0.494
No symptom	-	1	0.579
Intraoperative Factors			
Operative time (mean ± SD, minutes)	106.25 ± 33.25	114.55 ± 22.52	0.206
Blood loss (mean ± SD, mL)	105 ± 70.71	185 ± 129.2	0.961
Postoperative Factors			
Chest tube removal* (mean ± SD, hours)	90 ± 40.06	111.27 ± 43.30	0.142
Pathological reports			
Subpleural blebs with inflammation	3	1	0.177
Subpleural blebs with emphysematous change	1	6	0.082
Focal interstitial fibrosis with emphysematous change	3	3	0.506
Metastatic malignant tumor	1	1	0.678
Complication			
Reoperation	1	0	0.421 (EAR = .125)**

*When pleural fluid <100mL/days and no air leak

**EAR (Exposure attributable risk)

Table 2 Comparative duration of postoperative chest tube drainage

Authors	Country	Drainage	
		VATS	Thoracotomy
Dumont et al[13]	France	6.5 days	8 days
Mouroux et al[14]	France	5 days	-
Bernard et al[15]	France	5 days	-
Bertrand et al[11]	France	4.4 days	5.6 days
Inderbitzi et al[5]	Switzerland	46 hours	-
Yim and Ho[16]	Hong Kong	2 days	-

VATS procedure was higher than thoracotomy (6% vs 0.4%)[10]. The lower success rate of VATS may be explained by 1) fewer blebs are recognized and treated during VATS[11], 2) some blebs are deflated together with the lung and therefore missed, and 3) lower degree of tissue trauma and less intense biological reaction[12].

Duration of drainage is one of the main determinants of hospital stay after thoracic surgery (Table 2). In this studies showed 90 ± 40.06 hours in pleural abrasion group and 111.27 ± 43.30 hours in pleurectomy group.

In this study, there were no difference between two groups in term of age, sex, underlying diseases, site of SP, onset and symptoms of SP, indications for operation, duration of operation and chest tube placement, amount of blood loss, underlying pathology and complications (re-operation). However, exposure attributable risk (EAR) of reoperation for pleural abrasion group was 0.125. One patient with COPD in Group A needed reoperation due to prolonged air leakage and pathological report showed focal interstitial fibrosis with emphysematous change. Operative finding showed a new ruptured lung bleb at right middle lobe. No patient in both groups was dead and required blood transfusion. Two patients with COPD in Group A (abrasion) needed mechanical ventilator after operation.

In conclusion, the present study revealed that minithoracotomy and pleurodesis (subtotal parietal pleurectomy or pleural abrasion) for the management of spontaneous pneumothorax offered substantial saving in cost. While subtotal parietal pleurectomy may be better than pleural abrasion because it can reduce recurrent spontaneous pneumothorax, blood loss and recovery duration of subtotal parietal pleurectomy are higher than pleural abrasion. We recommend minithoracotomy with subtotal parietal pleurectomy in all patients of spontaneous pneumothorax. Nevertheless, future clinical trials are needed to validate these results.

REFERENCES

1. Gaensler EA. Parietal pleurectomy for recurrent spontaneous pneumothorax. Surg Gynecol Obstet 1956;102:293-308.
2. Deslauriers J, Beaulieu M, et al. Transaxillary pleurectomy for treatment of spontaneous pneumothorax. Ann Thorac Surg 1980;30:569-74.
3. Clark TA, Hutchinsion DE, Deaner RM, Fitchett VH. Spontaneous pneumothorax. Am J Surg 1972;124:728-31.
4. Guérin JC, Champel F, Biron E, Kalb JC. Talcage pleural par thoracoscopie dans le traitement du pneumothorax. Etude d'une s'erie de 109 cas trait'es en 3 ans. Rev Mal Respir 1985;2:25-9.
5. Inderbitzi RGC, Leiser A, Furrer M, Althaus U. Three years experience in video-assisted thoracic surgery (VATS) for spontaneous pneumothorax. J Thorac Cardiovasc Surg 1994;107:1410-5.
6. Cran IR, Rumball CA. Survey of spontaneous pneumothorax in Royal Air Force. Thorax 1967;22:462-5.
7. Weeden D, Smith GH. Surgical experience in the management of spontaneous pneumothorax, 1972-82. Thorax 1983;38:737-43.
8. Almind M, Lange P, Viskum K. Spontaneous pneumothorax: comparison of simple drainage, talc pleurodesis, and tetracycline pleurodesis. Thorax 1989;44:627-30.
9. Gúerin JC, Van Der Schueren RG. Traitement des pneumothorax recidivants par application de colle de fibrine sous endoscopie. Rev Mal Respir 1989;6:443-5.
10. Naunheim KS, Mack MJ, Hazelrigg SR, et al. Safety and efficacy of video-assisted thoracic surgical techniques for the treatment of spontaneous pneumothorax. J Thorac Cardiovascu Surg 1995;109:1198-204.
11. Bertrand PC, Regnard JF, Spaggiari L, et al. Immediate and long-term results after surgical treatment of primary spontaneous pneumothorax by VATS. Ann Thorac Surg 1996;61:1641-5.
12. Gebhard FT, Becher HP, Gerngross H, Bruckner UB. Reduced inflammatory response in minimal invasive surgery of pneumothorax. Arch Surg 1996;131:1079-82.
13. Dumont P, Diemont F, Massard G, Toumieux B, Wihlm JM, Morand G. Does a thoracoscopic approach for surgical treatment of spontaneous pneumothorax represent progress? Eur J Cardiothorac Surg 1997;11:27-31.
14. Mouroux J, Elkaim D, et al. Video-assisted thoracoscopic treatment of spontaneous pneumothorax: technique and results of one hundred cases. J Thorac Cardiovasc Surg 1996;112:385-91.
15. Bernard A, Bélichard C, Goudet P, Lombard JN, Viard H. Pneumothorax spontane'. Comparaison de la thoracoscopic et de la thoracotomie. Rev Mal Respir 1993;10:433-6.
16. Yim AP, Ho JK. One hundred consecutive cases of video-assisted thoracoscopic surgery for primary spontaneous pneumothorax. Surg Endosc 1995;9:322-6.