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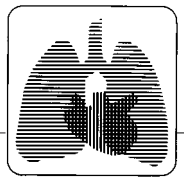
Chest 2000;118;235-238
DOI: 10.1378/chest.118.1.235



minimally invasive techniques

The Results of Thoracoscopic Surgery for Primary Spontaneous Pneumothorax*

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Objective: **To review our experience of video-assisted thoracoscopic surgery for the treatment of primary spontaneous pneumothorax.**
Design: **Longitudinal cohort study following up consecutive patients for 3 to 4.3 years.**
Setting: **Thoracic Surgery Department, Chest Diseases Hospital, Kuwait.**
Patients and intervention: **Seventy-two consecutive patients undergoing thoracoscopy for primary spontaneous pneumothorax from January 1994 to June 1996.**
Results: **The mean age of the patients was 25 years (range, 15 to 40 years), and 67 were men (93%). All patients were successfully treated using video-assisted thoracoscopic technique. Recurrent pneumothorax was the most frequent indication for surgery, occurring in 49 patients. The most common method of management was stapling of an identified bleb, which was done in 56 cases. Pleurodesis was achieved by gauze abrasion (n = 39) and apical pleurectomy (n = 33). Postoperative prolonged air leak occurred in five patients (6.9%). There were no deaths attributable to the procedure. The mean (±SD) postoperative hospital stay was 4 ± 2 days. Mean follow-up is 42 months (range, 36 to 54 months) for all patients. Pneumothorax recurred in four patients (5.5%) in whom pleural abrasion was done. The recurrences occurred in the first year of follow-up, three required a reoperation, and one healed by rest without pleural drainage.**
Conclusions: **Video-assisted thoracoscopic surgery is a safe procedure in the treatment of primary spontaneous pneumothorax. Apical pleurectomy is a more effective way of producing pleural symphysis. Long-term follow-up did not increase the rate of recurrence.**
(CHEST 2000; 118:235–238)

Key words: pleurodesis; spontaneous pneumothorax; thoracoscopic surgery.

Abbreviations: SP = spontaneous pneumothorax; VATS = video-assisted thoracoscopic surgery

Spontaneous pneumothorax (SP) can be divided into primary SP resulting from rupture of subpleural blebs, and secondary SP, which is related to the presence of an underlying lung disease (*eg*, emphysema). The indications for surgical treatment include persistent air leak, recurrent SP, contralateral SP, and SP in a high-risk occupation, such as pilot or diver.[1] The aims of surgical treatment are to close the site of the air leak, to allow full reexpansion of the lung, and to prevent future recurrence.[1] The standard surgical treatment of SP is through a thoracotomy approach, with very low recurrence rate.[2] Recently, video-assisted thoracoscopic surgery (VATS) has been used as an alternative to thoracotomy in the treatment of recurrent or persistent SP to avoid morbidity associated with a thoracotomy approach.[3–5] Long-term results of the VATS procedure are not well known in many studies.[6–7] The aims of this study were to describe our experience in Kuwait and to report on the long-term follow-up of 72 consecutive patients with primary SP treatment by the VATS technique.

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Supported by the Ministry of Health, Kuwait, and the faculty of Medicine, Kuwait University, Kuwait.
Manuscript received September 28, 1999; revision accepted November 29, 1999.
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Materials and Methods

The study was conducted at Chest Diseases Hospital in Kuwait, which is the only center for the surgical treatment of chest disorders in Kuwait. From January 1994 to June 1996, 72 patients with persistent or recurrent primary SP were treated by VATS; these patients compromise this study. Preoperative investigations included a chest radiograph, CBC count, serum electrolytes, and renal function tests.

Operative Technique of VATS

With the patient under general anesthesia using a single-lumen endotracheal tube, the patient received ventilation with reduced tidal volume throughout the procedure. The patient was placed in a posterolateral thoracotomy position. A 10-mm trocar was introduced through 1.5-cm skin incision in the eighth intercostal space at midaxillary line for insertion of a 0° videothoracoscope (Karl Storz; Tuttlingen, Germany). Two additional ports were then inserted under direct vision: a 12-mm trocar through the fifth intercostal space on the anterior axillary line, and a 12-mm posterior trocar through the fifth intercostal space near the tip of the scapula. Bullae or blebs were identified and grasped with an empty sponge stick. When no blebs were visible, a small portion of the apical upper lobe was resected. The excision was done by using an ENDO-GIA stapling device (Auto Suture Company; United States Surgical Corp; Norwalk, CT). Then, a parietal pleural abrasion by gauze or apical pleurectomy was performed. A 28F chest tube was inserted through the inferior incision in the eighth intercostal space and connected to an underwater seal suction with a negative pressure of 20 cm H_2O. One patient required extension of the inferior trocar site to control bleeding from the intercostal blood vessel.

Postoperative Care

All patients were extubated in the operating room and transferred to the thoracic surgery ward. Antibiotic in the form of cefoxitin was given to all patients. An analgesic, pethidine, was administered IM every 4 to 6 h according to the patient request, and an oral analgesic (acetominophen) was given as needed. The intercostal drain was removed when the underlying lung was fully expanded with no air leakage and < 100 mL pleural fluid drained through the tube for 24 h. All patients were discharged the day after removal of the chest tube.

Postoperative Assessment

Data recorded for all patients included the number of episodes of pneumothorax, the operative time, and the presence of blebs or bullae.

The output and duration of pleural drainage after operation, the amount of analgesia given in the first 24 h after the operation, length of hospital stay, postoperative air leak, and recurrences were also recorded. The follow-up chest radiograph was done at intervals of 1 week, 1 month, and 3 months, and then the patients were followed up with a telephone communication for this study. The recurrence was proved by chest radiography during the follow-up period.

Statistical Analysis

Data are expressed as mean (±SD). The unpaired Student's *t* test and the standard χ^2 were used to assess the significant difference between means and categorical variables, respectively, using appropriate software (Stat View 4.02; SAS Institute; Cary, NC). The level for significance was taken as $p < 0.05$.

Results

This series included 67 male and 5 female patients (age, 25 ± 6 years; range, 15 to 40 years). Forty-nine patients (68.1%) were operated on after a recurrent episode of pneumothorax. In 23 patients (39.9%), VATS was done because of persistent air leak for > 7 days. VATS was unilateral in all cases, and all procedures were performed by the same surgeon, on the right side in 50 cases (69.4%) and on the left side in 22 cases (30.6%).

The operative time was 56 ± 11 min (range, 30 to 90 min). Subpleural blebs or bullae were present in 56 cases (77.8%), and they were resected by an endoscopic stapler. In the absence of an identifiable lesion, the apex of the upper lobe was excised; this was done in 16 cases (22.2%). Pleural procedures performed included gauze abrasion in 39 cases (54.2%) and apical pleurectomy in 33 cases (45.8%). The clinical data on these procedures are shown in Table 1.

The mean amount of postoperative analgesia in the form of pethidine was 84 ± 44 mg in the first 24 h.

The duration of chest tube drainage was 3 ± 2 days (range, 2 to 12 days). Five patients (6.9%) had an air leak lasting > 5 days. These patients required prolonged pleural drainage for 7 to 12 days, and

Table 1—*Results in Patients With Primary SP Treated by Pleural Abrasion or Apical Pleurectomy

Parameters	Pleural Abrasion (n = 39)	Apical Pleurectomy (n = 33)	p Value
Operative time, min	50.7 ± 10.2	61.8 ± 9.2	< 0.0001
Postoperative pleural drainage, mL	148.3 ± 75.1	169.6 ± 69.8	0.2
Analgesia requirement, mg	79.7 ± 43.4	89.3 ± 45.1	0.3
Chest tube duration, d	3.5 ± 2	3 ± 1	0.1
Hospital stay, d	4.5 ± 2.1	4.1 ± 1	0.2
Postoperative air leak	4	1	0.2
Recurrence	4	0	0.05

*Data are presented as mean ± SD or No.

none required a reoperation. Air leak occurred in 3 of 16 patients in whom no blebs were identified, and 2 of 56 occurred in patients with visible blebs. The difference is statistically significant ($p < 0.05$).

The postoperative hospital stay ranged from 3 to 13 days (mean, 4 ± 2 days). There were no deaths in this series, and no patients required monitoring in the ICU.

All patients in this study were followed regularly (mean follow-up time, 42 months; range, 36 to 54 months). Recurrent ipsilateral pneumothorax occurred after 4 of the 72 procedures (5.5%). These occurred at 2, 3, 4, and 48 weeks after the original VATS procedure. Three of these recurrences occurred in patients in whom no blebs were identified (3 of 16 patients; 18.7%), and one occurred in patient with a visible lesion (1 of 56 patients; 1.8%). The difference is statistically significant ($p < 0.01$). These recurrences had occurred after pleural abrasion procedures. Three patients underwent a reoperation by thoracotomy; excision of the air leak site and partial pleurectomy was performed. One patient who had recurrence at 48 weeks after the original procedure healed by rest without drainage.

Discussion

Thoracoscopic surgery can be carried out safely and effectively in the treatment of recurrent or persistent SP. The technique can be performed without single lung ventilation.[8] Low tidal volume ventilation was employed in all cases of this series while dissection or manipulation was performed. This degree of ventilation facilitates the identification of bullae. Bullae or blebs, which are the cause of SP, are easily managed by VATS with excellent results. The bullae are usually located on the apical portion of the upper lobe in patients with SP. VATS allows inspection of the entire lung, identification of bullae, and resection of the bullous disease. Many surgical techniques have been described for resecting the blebs or bullae. One way is wedge resection using an endoscopic stapler.[9] Other methods, such as the endoscopic loop technique, electrocoagulation, laser coagulation of blebs, or a combination of different methods, are favored by different authors.[9–11] We have used a stapled excision of the diseased part or blind wedge excision of the apex of the lung if no blebs or bullae were found.

Short-term results from this series were comparable with those reported in the literature.[4,5,8,9] The duration of postoperative chest tube drainage is determined by the presence of complete expansion of the lung and the absence of air leak. In the literature, the duration of postoperative drainage is variable. Inderbitzi and associates[9] reported a mean duration of 1 day, Waller and coworkers[8] reported 2.4 days, and Bertrand and colleagues[12] reported 4.4 days. We report a mean of 3 days (range, 2 to 12 days).

The postoperative hospital stay is determined mainly by the duration of the pleural drain. Other factors of importance are postoperative pain and early mobilization. We have reported a short hospital stay: a mean of 4 days (range, 3 to 13 days). The use of small incisions in VATS procedure has shown a trend toward decreased postoperative analgesia requirements.[7] Thus, these patients were mobilized faster and had a shorter hospital stay. Hazelrigg et al[13] have reported a mean hospital stay of 2.9 days, Passlick and colleagues[5] reported 5 days, and Bertrand et al[12] reported 6.9 days.

The point of controversy is the need and the method of promoting pleural adhesion. Methods of pleurodesis have included mechanical abrasion with gauze or Marlex mesh (Davol, Inc; Cranston, RI),[3,5,10,14] instillation of tetracycline,[15] pleural irritation with laser or cautery,[3] and instillation of talc.[3] In our series and in the data reported from previous studies,[3–5] there were no significant differences observed concerning the duration or output of chest tube drainage, rate of postoperative air leak, postoperative hospital stay, and the dose of analgesics administered as a function of the mode of pleurodesis.

There were no intraoperative or postoperative deaths in this series. The most frequent postoperative complication was prolonged air leak lasting > 5 days.[4,9,16] Five patients (6.9%) in this series had prolonged air leak. Naunheim et al[4] have reported an 8% incidence, and two patients (1.7%) required a second operation to treat this complication. Bertrand and colleagues[12] found that 3.6% had prolonged air leak and two required a reoperation. The cause of the air leak problem is either an air leak on the row of staples or missed bullous areas. Thus, the resection of the bullous area has to be done with care, and the entire lung should be inspected for other blebs or bullae.

Our long-term recurrence rate is 4 of 72 patients (5.5%). Three of these recurrences occurred within 3 months after the intervention and required a reoperation. One reason for recurrence is failure to recognize the site of the leak in the absence of blebs. Unrecognized blebs or inadequate resection of the diseased portion of the lung may also contribute. Another factor is inadequate pleurodesis, especially in between the trocar sites. These failures suggest that gauze pleural abrasion is probably less effective than apical pleurectomy. Like Mouroux et al[3] and Naunheim et al,[4] we found that the recurrences were more frequent in patients in whom no blebs or bullae

were identified. It is such patients for whom apical pleurectomy may be indicated, and this will probably provide more pleural adhesion with a decreased subsequent recurrence rate. Our recurrence rate is comparable to those reported in the literature after thoracoscopy, which vary from 3 to 10%.[5,9,13,16]

In the study of Naunheim and colleagues,[4] two factors predicted recurrence. When no bleb was seen, the recurrence was 27.3%, while if one or multiple blebs were identified, the recurrence rate was 0% and 2.7%, respectively. Apical excision reduced the recurrence to 1.8% compared with 23% when no excision was done. Mouroux et al[3] had an overall recurrence rate of 3%: 20% in patients without stapling of the apex vs 1.5% in patients in whom this was done. The combination technique of resection of blebs and pleural adhesive procedure for primary SP is therefore advocated. Inderbitzi and colleagues[9] considered that isolated ligation of bulla has a recurrence rate of 11.5%, while that of pleurectomy and resection is 5.6%.

Most series report medium-term follow-up with a mean range from 6 to 30 months of follow-up.[3,4,12] Our mean duration of follow-up was 42 months (range, 36 to 52 months). Most recurrences occurred within the first month of the operation. Long-term follow-up in our study did not add to the rate of recurrence.

In conclusion, thoracoscopic surgery can be done safely in the treatment of primary SP. The procedure is well tolerated and allows early discharge in 4 days. VATS wedge excision and apical pleurectomy represents a satisfactory treatment modality, especially in patients in whom no blebs or bullae were identified. The long-term follow-up of the patients did not increase the number of recurrences.

References

1 Parry GW, Juniper ME, Dussek JE. Surgical intervention in spontaneous pneumothorax. Respir Med 1992; 86:1–2

2 Murray KD, Matheny RG, Howanitz EP, et al. A limited axillary thoracotomy as primary treatment for recurrent spontaneous pneumothorax. Chest 1993; 103:137–142

3 Mouroux J, Elkaim D, Padovani B, et al. Video-assisted thoracoscopic treatment of spontaneous pneumothorax: technique and results of one hundred cases. J Thorac Cardiovasc Surg 1996; 112:385–391

4 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 Cardiovasc Surg 1995; 109:1198–1204

5 Passlick B, Born C, Haussinger K, et al. Efficiency of video-assisted thoracic surgery for primary and secondary spontaneous pneumothorax. Ann Thorac Surg 1998; 65:324–327

6 Kim KH, Kim HK, Han JY, et al. Transaxillary minithoracotomy versus video-assisted thoracic surgery for spontaneous pneumothorax. Ann Thorac Surg 1996; 61:1510–1512

7 Waller DA, Forty J, Morrit GN. Video-assisted thoracoscopic surgery versus thoracotomy for spontaneous pneumothorax. Ann Thorac Surg 1994; 58:372–377

8 Waller DA, Forty J, Soni AK, et al. Videothoracoscopic operation for secondary spontaneous pneumothorax. Ann Thorac Surg 1994; 57:1612–1615

9 Inderbitzi RGC, Leiser A, Furrer M, et al. Three years' experience in video-assisted thoracic surgery (VATS) for spontaneous pneumothorax. J Thorac Cardiovasc Surg 1994; 107:1410–1415

10 Liu HP, Lin PJ, Hsieh MJ, et al. Thoracoscopic surgery as a routine procedure for spontaneous pneumothorax: results from 82 patients. Chest 1995; 107:559–562

11 Nathanson LK, Shimi SM, Wood RAB, et al. Videothoracoscopic ligation of bulla and pleurectomy for spontaneous pneumothorax. Ann Thorac Surg 1991; 52:316–319

12 Bertrand PC, Regnard JF, Spaggiari L, et al. Immediate and long-term results after surgical treatment of primary spontaneous pneumothorax. Ann Thorac Surg 1996; 61:1641–1645

13 Hazelrigg SR, Landreneau RJ, Mack M, et al. Thoracoscopic stapled resection for spontaneous pneumothorax. J Thorac Cardiovasc Surg 1993; 105:389–393

14 Yim APC, Ho JK, Chung SS, et al. Video-assisted thoracoscopic surgery for primary spontaneous pneumothorax. Aust N Z J Surg 1994; 64:667–670

15 Waterworth PD, Kallis P, Townsend ER, et al. Thoracoscopic bullectomy and tetracycline pleurodesis for the treatment of spontaneous pneumothorax. Respir Med 1995; 89:563–566

16 Massard G, Thomas P, Wihlm JM. Minimally invasive management for first and recurrent pneumothorax. Ann Thorac Surg 1998; 66:592–599

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