

Optimal Timing for Surgical Treatment to Prevent Recurrence of Spontaneous Pneumothorax

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Abstract

Purpose. Persistent air leakage and recurrence are the most common indications for the surgical treatment of spontaneous pneumothorax; however, the optimal timing for surgery is still unclear.

Methods. The subjects of this study were 90 patients treated for either primary spontaneous pneumothorax (PSP; $n = 58$) or secondary spontaneous pneumothorax (SSP; $n = 32$). We compared the incidence of prolonged air leak, the rate of recurrence of pneumothorax, the time from the first episode of pneumothorax to recurrence, and the postoperative complications in the two groups. We also analyzed the recurrence rate after treatment with observation and tube drainage versus surgery.

Results. Seventy-three patients were treated with tube thoracostomy or oxygen therapy for the first episode of pneumothorax. Surgery was performed in 32 patients; for the first episode of pneumothorax in 17 and for the second or third episode in 15. Postoperative complications developed in six (18.7%) patients and 24 of 73 patients who did not undergo thoracotomy suffered recurrence. The incidence of a second episode was 32.9% and the incidence of a third episode in the 18 patients who suffered recurrence after conservative treatment was 61.1%. None of the patients who underwent surgery suffered recurrence.

Conclusions. Tube thoracostomy is still the treatment of choice for first-time spontaneous pneumothorax. However, because the incidence of a third episode of pneumothorax after conservative treatment is high, surgical treatment should always be considered for patients with recurrence. In short, surgical intervention is safe and effective and minimizes the chance of recurrence of both PSP and SSP.

Key words Spontaneous pneumothorax · Recurrence · Surgery

Introduction

The primary goals of treatment for spontaneous pneumothorax are to eliminate intrapleural air retention and to prevent of recurrence; however, the treatment strategy is still controversial. The development of recurrence is the main factor in determining the best treatment approach for pneumothorax. Thus, we evaluated the incidence of spontaneous pneumothorax recurrence according to treatment, in our clinical experience.

Materials and Methods

We reviewed the medical records of 90 patients treated for spontaneous pneumothorax at İnönü University, Turgut Özal Medical Center, Department of Thoracic Surgery between January 1999 and December 2004. Follow-up was done by telephone or by clinical examination in our outpatient department. We based our evaluation of postoperative condition and general health status on interviews with the patients or their relatives.

We divided the 90 patients into two groups: the primary spontaneous pneumothorax (PSP) group and the secondary spontaneous pneumothorax (SSP) group (Table 1). We compared the patients' ages, sex, incidence of prolonged air leakage, surgical indications, operative procedures, postoperative complications, recurrence rate, the time from the first episode of pneumothorax to recurrence for PSP and SSP, and the recurrence rate of pneumothorax after observation and tube drainage versus surgery. Asymptomatic patients with collapse of less than 20% of the total ipsilateral

Table 1. Patients with spontaneous pneumothorax (first episode)

| | No. of patients | Treatment | | |
|-----------------------------|-----------------|-------------|---------------|---------|
| | | Observation | Tube drainage | Surgery |
| PSP | 58 | 14 | 35 | 9 |
| SSP | | | | |
| Underlying disorder | | | | |
| Tuberculosis | 6 | 1 | 4 | 1 |
| Pneumonia | 6 | 2 | 4 | — |
| Bullous disease of the lung | 4 | — | 2 | 2 |
| COPD | 8 | 1 | 5 | 2 |
| Malignancy | 3 | — | 2 | 1 |
| Behçet's disease | 3 | — | 3 | — |
| Hydatid cyst rupture | 2 | — | — | 2 |
| Total | 90 | 18 | 55 | 17 |

PSP, primary spontaneous pneumothorax; SSP, secondary spontaneous pneumothorax; COPD, chronic obstructive pulmonary disease

Table 2. Indications for surgery

| Indications | No. of patients | | Total |
|--------------------------|-----------------|-----|--------------------|
| | PSP | SSP | |
| Recurrence | 12 | 3 | 15 ($P = 0.204$) |
| Prolonged air leak | 6 | 6 | 12 ($P = 0.424$) |
| Hydatid cyst of the lung | | 2 | 2 |
| Bilateral pneumothorax | 3 | | 3 |
| Total | 21 | 11 | 32 |

lung field as measured on a chest X-ray film did not undergo tube thoracostomy, but were treated with oxygen therapy alone. Chest tube thoracostomy was performed as the initial treatment in all the other patients. The tube was attached to a closed bottle drainage system with suction for up to 10 days. If the air leakage stopped within 10 days, the suction was continued for 1 more day and the tube was clamped for 1 day. After confirming that there was no collapse of the lung on a chest X-ray film, the tube was removed and the patient was discharged after 1 day of observation. An air leak lasting longer than 10 days was defined as prolonged and an indication for surgery; in the form of axillary thoracotomy, minithoracotomy, or video-assisted thoracoscopy (VATS). Surgery was also performed for patients with recurrent spontaneous pneumothorax, cystic disease of the lung, or bilateral pneumothorax (Table 2).

The comparisons of prolonged air leak, recurrence rate, operation and postoperative complications for PSP and SSP, and the recurrence rate after the different treatments were analyzed using the chi-square test and

Fisher's exact test, as appropriate. The comparisons of time to recurrence of pneumothorax after PSP and SSP were analyzed using the Kaplan–Meyer method and the long-rank test. P values of less than 0.05 were considered significant.

Results

The 90 patients comprised 13 women and 72 men, aged from 16 to 92 years (mean, 38.5 years), 72 (80%) of whom were smokers. The pneumothorax was on the left side in 44 (48.9%) patients, on the right side in 43 (47.8%), and on both sides in 3 (3.3%). Fifty-eight patients had PSP and 32 had SSP. Seventeen patients underwent surgery for their first episode of pneumothorax and 73 recovered after treatment with tube drainage or oxygen therapy; however, 24 patients (32.9%) patients suffered a second episode of pneumothorax. The second episode of pneumothorax was treated by surgery in 6 of these 24 patients and by tube drainage or oxygen therapy in 18. Eleven (61.1%) of these 18 patients suffered a third episode, which was treated by surgery in 9 patients. Two patients refused an operation and were again treated with tube drainage (Table 3). One of these patients has been well for 17 months and the other for 3 months.

Six (10.3%) of the patients with PSP and 6 (18.8%) of those with SSP underwent surgery because of a prolonged air leak (>10 days). There was no significant difference in the incidence of a prolonged air leak between the two groups ($P = 0.424$, odds ratio 0.50, 95% confidence interval [CI] 0.13–1.98).

Twenty (83.3%) of the patients who suffered recurrence had a history of smoking. Among the 49 patients

Table 3. Recurrence rates after the different treatments

| | No. of Patients (<i>n</i>) | Observation | | Tube drainage | | Surgery | |
|----------------|---------------------------------|-------------|------------|---------------|------------|----------|------------|
| | | <i>n</i> | Recurrence | <i>n</i> | Recurrence | <i>n</i> | Recurrence |
| First episode | 90 | 18 | 12 (66.7%) | 55 | 12 (21.8%) | 17 | — |
| Second episode | 24 | 1 | 1 | 17 | 10 (58.8%) | 6 | — |
| Third episode | 11 | — | — | 2 | — | 9 | — |

with PSP and the 24 with SSP who did not undergo surgery for their first episode, recurrence developed in 19 (38.8%) and 5 (20.8%), respectively ($P = 0.204$, odds ratio 2.41, 95% CI 0.69–8.86). The time from the first episode of pneumothorax to recurrence was 18.2 months, on average. The average interval between the first episode and recurrence was 28.7 months for PSP and 18.8 months for SSP. Recurrence developed within 2 years in 18 (75%) patients. The probability of a recurrence within 2 years was 28.0% for PSP and 18.5% for SSP, without a significant difference ($P = 0.57$). Among the patients who did not undergo surgical intervention for their second episode, 9 (64.3%) of 14 with PSP and 2 (50%) of 4 with SSP suffered a third episode (Table 3).

Recurrence developed in 12 (21.8%) of 55 patients managed with tube thoracostomy and in 12 (66.7%) of 18 managed conservatively ($P = 0.001$, odds ratio 0.14, 95% CI 0.04–0.51). The average time from the first episode to recurrence was 26 months (median, 5 months) after tube thoracostomy and 6.7 months (median, 5 months) after conservative treatment.

Of the total 90 patients, 32 (35.6%) underwent surgery (Table 2). The procedures performed were limited thoracotomy in 22 patients, axillary thoracotomy in 3, and VATS in 7. Thus, 21 (36.2%) patients with PSP and 11 (34.4%) patients with SSP were managed surgically ($P = 0.955$, odds ratio 1.08, 95% CI 0.40–2.96). Surgery was performed for PSP and SSP at the first episode in 9 and 8 patients; at the second episode in 5 and 1 patient; and at the third episode in 7 and 2 patients, respectively. Postoperative complications developed in 6 (18.8%) patients; as prolonged air leakage in 4, thoracic empyema in 1, and incision site infection in 1. The rate of postoperative complications was 9.5% (2 patients) for PSP and 36.4% (4 patients) for SSP ($P = 0.15$, odds ratio 0.18, 95% CI 0.02–1.61). One of the patients with SSP and severe emphysema died of cardiorespiratory failure resulting from a prolonged postoperative air leak and empyema. The hospital stay ranged from 8 to 62 days (mean, 10 days) and the follow-up period ranged from 4 to 71 months (mean, 25.6 months). None of the patients who underwent surgery suffered a recurrence. The recurrence rates after surgery and conservative treatment were significantly different ($P = 0.0005$).

Discussion

Spontaneous pneumothorax is a disabling disorder, which can occur in young, healthy persons (PSP) or as a complication of underlying lung disease (SSP). PSP tends to occur in younger patients, whereas SSP more often develops in older patients. A male predominance has been found in many series,^{1–3} as in ours. Smoking is clearly implicated in the development of initial pneumothorax.^{1,2} Most studies show that 80%–83% of patients are smokers.

The generally accepted treatment strategy for an initial episode of spontaneous pneumothorax is pleural drainage, and for selected patients there is a “wait-and-see” policy.^{4–6} Simple observation is the preferred treatment option, particularly in patients who are not dyspneic and have collapse of less than 20% of the total ipsilateral lung field. The main operative indication is a prolonged air leak after an initial episode of spontaneous pneumothorax. Chest tube drainage results in air leaks stopping within 48 h in about 82% of patients with PSP and 60% of those with SSP.^{4,7} In our study, the rate of prolonged air leak (>10 days) was 10.3% for PSP and 18.8% for SSP; however, there was no significant difference between the two groups. Most clinicians decide that surgery is indicated when the air leak persists for longer than 7–10 days.⁸ However, according to one report the air leak stopped within 15 days in 100% of patients with PSP cases, and 79% of those with SSP.² They suggest that surgery for a persistent air leak should be deferred for up to 14 days for both PSP and SSP, although this strategy does not result in the anticipated complications of prolonged chest tube insertion and hospitalization.² Accordingly, we did not encounter any complications of long-term observation, but operated on patients if an air leak persisted for longer than 10 days.

The rate of recurrence after the first episode ranges from 20% to 50%,^{1,3,4} but increases to more than 50%⁹ after the second episode. Most recurrences occur within the first 2 years. In our series, the recurrence rate was 32.9% of the patients followed up after the first episode, and 61.1% of those followed up after the second episode. It has been suggested that recurrence is unrelated to the physical constitution of the patient, the initial size

of the pneumothorax, and the type of non-surgical treatment.³ However, we found that more patients managed with observation or oxygen therapy suffered recurrence than those managed with chest tube drainage. A recurrence rate of 30% after 11 ± 10 months for PSP and 30% after 10 ± 10 months for SSP was reported.⁷ Similarly, the incidence of recurrence did not differ significantly between the PSP and SSP groups in the present study.

It has been reported that almost 50% of patients with spontaneous pneumothorax require surgery at some point; for persistent leakage or recurrence.^{10,11} In the present series, 35.6% of the patients required surgery. However, the timing of invasive surgery for spontaneous pneumothorax remains controversial. It has been suggested that VATS is very effective for patients with first-time PSP, with lower morbidity and cost than conservative therapy.¹⁰⁻¹² Those who support VATS as a treatment advocate definitive treatment at the first episode. On the other hand, it was suggested that the shorter hospital stay counterbalances the costs of the disposable materials used for VATS.¹³ Cole et al. concluded that VATS should not be considered as the initial treatment for spontaneous pneumothorax because it has similar postoperative complications to an open procedure, and less impressive long-term results.¹⁴ The incidence of recurrence was reported to range from 0% to 6.8%¹⁵⁻¹⁷ in patients treated with minithoracotomy or axillary thoracotomy and from 3% to 13.7% for patients managed with VATS.^{10,16-18} If VATS is performed with a flexible scope¹⁹ and by an experienced surgeon the results improve; however, the incidence of postoperative complications is related more to the patient's status than to the choice of surgical procedure and the reduced hospital stay is not always attributable to a different operative approach.¹³ Mouroux et al. reported that the complication rate was 6.6% for PSP versus 27.7% for SSP in a series of pneumothoraces treated by video-assisted thoracoscopy.²⁰ In our study, although the difference was not significant, the complication rate for SSP was higher.

In conclusion, the primary approach to treating spontaneous pneumothorax, especially the first episode, is chest tube thoracostomy. Surgery may be deferred until the second episode since conservative treatment seems to be effective in approximately 65% of patients. However, because the rate of recurrence of pneumothorax after conservative treatment is higher than 50%, the option of an initial operation should be considered. In summary, surgical treatment is associated with low recurrence, morbidity rates, and mortality rates, and is an effective and reliable method of managing selected patients with PSP or SSP.

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