Spontaneous Pneumothorax: A Review of 71 Cases

ROBERT G. STANEK, M.D. *, JOHN L. WILSON, M.D., F.C.C.P. **
and WILLIAM L. ROGERS, M.D., F.C.C.P. †
San Francisco, California

Spontaneous pneumothorax is generally described as pneumothorax occurring in an apparently healthy individual without antecedent history of pulmonary disease or trauma. In most instances, it is a benign, self-limiting condition with full recovery following bed rest alone. Because of the long morbidity and the high incidence of recurrence associated with conservative methods of treatment, more vigorous modes of therapy have been advocated and employed. This paper is a review of 71 cases of spontaneous pneumothorax that have been treated at the San Francisco Veterans Administration hospital over the 12-year period from June, 1947 through June, 1959.

Etiology

For many years spontaneous pneumothorax was considered pathognomonic of pulmonary tuberculosis. From 60 to 90 per cent of cases were attributed to this disease. Kjaergaard, in 1932, was the first to report that the incidence of spontaneous pneumothorax was no greater among patients with tuberculosis than it was in the general population. Since that time numerous investigators have reported similar findings. It is now recognized that most cases of spontaneous pneumothorax are secondary to the rupture of congenital or acquired subpleural blebs with the escape of air into the pleural space or into mediastinal structures. It may occur as a complication of infectious processes, such as pneumonia or tuberculosis. It is occasionally encountered in patients with either primary or secondary pulmonary neoplastic processes. It is not infrequently seen in traumatic injuries of the thoracic cage.

Material

Over the 12-year period from June, 1947 through June, 1959, 67 patients were treated at the San Francisco Veterans Administration Hospital for 71 episodes of spontaneous pneumothorax. Not all were the so-called simple or idiopathic type. However, all are included in this review since various modes of therapy used at this facility are being evaluated.

From Table 1, it is seen that of the 71 cases, associated pulmonary conditions were present in 15 patients, as determined by the history, physical examination, or by x-ray film studies. Of the remaining 56, pleural blebs were demonstrated at thoracoscopy or thoracotomy in 13. In the absence of other positive findings, rupture of a pleural bleb was assumed to be the etiology in the remaining 43 patients.

Clinical Features

Age: All of the patients in this series were men ranging from 19 to 77 years of age. Seventy per cent were between 19 and 40 years.

*Formerly Resident in Surgery, Veterans Administration Hospital.
**Chief of Surgery, Veterans Administration Hospital.
†Consultant to Veterans Administration Hospital.
TABLE 1—71 CASES OF SPONTANEOUS PNEUMOTHORAX

<table>
<thead>
<tr>
<th>Associated Pulmonary Conditions:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>None identified (pleural blebs assumed)</td>
<td>43</td>
</tr>
<tr>
<td>Pleural blebs demonstrated by thoracoscopy</td>
<td>56</td>
</tr>
<tr>
<td>Emphysema, marked</td>
<td>5</td>
</tr>
<tr>
<td>Asthma</td>
<td>2</td>
</tr>
<tr>
<td>Healed tuberculosis</td>
<td>2</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>15</td>
</tr>
<tr>
<td>Pulmonary fibrosis, marked</td>
<td>1</td>
</tr>
<tr>
<td>Cystic disease of lung</td>
<td>1</td>
</tr>
<tr>
<td>Bronchogenic carcinoma</td>
<td>1</td>
</tr>
<tr>
<td>Metastatic carcinoma (from teratoma of testis)</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
</tr>
</tbody>
</table>

Symptoms: Pain, dyspnea, cough and weakness were the symptoms most frequently noted. Ninety per cent complained of pain or dyspnea—79 per cent had both pain and dyspnea. Pain, dyspnea, and cough were encountered as a triad in 24 per cent of the cases.

Previous Pneumothorax: Nineteen (28 per cent) of the patients in this review gave histories of 40 previous episodes of spontaneous pneumothorax. In only two of these patients was the pneumothorax on the contralateral side.

Relation to Activity: With respect to activity at onset, 25 were engaged in some form of active exertion, such as lifting, walking, coughing, or running. The others were at rest. Four awoke with pain and five noted onset of symptoms while getting out of bed. One complained of symptoms following an asthmatic attack.

Smoking: While a definite relationship between smoking and spontaneous pneumothorax has not been demonstrated, some authors feel that the chronic bronchitis and cough resulting from excessive smoking may aggravate focal emphysema. Of the 67 patients in this review, 67 per cent smoked between one-half and two packs of cigarettes per day, while only three were non-smokers.

Laboratory Findings

Pneumothorax was confirmed by x-ray film inspection in all except one (Table 2). Of the 67 patients, 25 had the tuberculin test, of whom eight reacted. The observations at thoracoplasty in 29 patients are recorded in Table 3.
TABLE 3—FINDINGS AT THORACOSCOPY

<table>
<thead>
<tr>
<th>Finding</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>13</td>
</tr>
<tr>
<td>Blebs</td>
<td>9</td>
</tr>
<tr>
<td>Adhesions</td>
<td>3</td>
</tr>
<tr>
<td>Leak</td>
<td>4</td>
</tr>
</tbody>
</table>

Treatment and Early Results

Methods of treatment are summarized in Table 4.

TABLE 4—METHOD OF TREATMENT

<table>
<thead>
<tr>
<th>Method</th>
<th>Cases</th>
<th>Average for Expansion</th>
<th>Average Hospital Stay</th>
<th>Failures</th>
<th>Recurrences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed rest</td>
<td>17</td>
<td>17 days</td>
<td>22 days</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Intercostal suction</td>
<td>39</td>
<td>2 days</td>
<td>12.5 days</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Needle aspiration</td>
<td>7</td>
<td>7 days</td>
<td>12.5 days</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Water seal</td>
<td>1</td>
<td>(Expired at 33 days of bronchogenic carcinoma)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical pleurisy</td>
<td>1</td>
<td>46 days</td>
<td>61 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumoperitoneum</td>
<td>1</td>
<td>15 days</td>
<td>5 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thoracotomy</td>
<td>5</td>
<td>days</td>
<td>42 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bed rest: The initial treatment in 19 was bed rest in whom expansion failed to occur in two after 11 and 15 days and intercostal suction was, therefore, instituted. The remaining 17 were treated successfully with bed rest alone. Expansion required an average of 17 days and the average period of hospitalization was 22 days. The time for expansion was markedly influenced by the original degree of collapse as is shown in Table 5.

TABLE 5—DEGREE OF PNEUMOTHORAX AND PERIOD FOR EXPANSION

<table>
<thead>
<tr>
<th>Per cent Pneumothorax</th>
<th>Cases</th>
<th>Average for Expansion</th>
<th>Extremes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20</td>
<td>8</td>
<td>10.5 days</td>
<td>8-15 days</td>
</tr>
<tr>
<td>20 to 50</td>
<td>5</td>
<td>23 days</td>
<td>12-60 days</td>
</tr>
<tr>
<td>More than 50</td>
<td>4</td>
<td>24 days</td>
<td>17-33 days</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Intercostal Catheter with Suction: There were 39 (55 per cent of this series) treated by this method, according to a standardized technique as follows:

1. Pneumothorax is confirmed by x-ray films.
2. Thoracoscopy is performed under local anesthesia in the operating room through second anterior interspace in midclavicular line.
3. Through the thoracoscope sheath a No. 18 F Foley catheter (5 ml. bag) is inserted; the bag is inflated and withdrawn to the chest wall. The catheter is secured to the skin with a single stitch. If thoracoscopy is not performed, the catheter is inserted through a trocar.
4. Negative pressure (25 cm. water) is immediately applied to catheter and a chest x-ray film is obtained.
5. Suction (25 cm. of water) is continued for three days with patient at bed rest. X-ray film of chest is then repeated.

6. If lung is completely expanded, suction is discontinued and the catheter is placed on water-seal drainage for two days. At the end of this period, chest x-ray film is repeated. If the lung has remained expanded, the catheter is removed and the patient is discharged in one or two days. If pneumothorax has recurred, suction on the catheter is resumed and the above cycle repeated.

7. Resume normal activity after one week.

The average time for expansion by the above procedure was two days and the hospital stay averaged 12.5 days. In five patients, pneumothorax recurred during the period of water-seal drainage necessitating further suction. Intercostal suction was used only in those with a significant degree of pneumothorax.

Intercostal catheter suction failed to expand the lung in four patients. Thoracotomy was required because of persistent air leak from blebs in two of these patients. The remaining two failures of the method were in complicated cases; one had extensive pulmonary fibrosis and the other terato-carcinoma of the lung with chronic pneumothorax.

**Needle Aspiration:** In seven patients, most of whom had collapse of more than 20 per cent, the lung expanded after one or more needle aspirations. In three additional patients, needle aspiration failed and intercostal catheter suction resulted in prompt relief.

**Thoracotomy:** Five underwent thoracotomy. Two of these, as noted above, represent failures with intercostal catheter suction. Two others were operated upon when they entered with their third and fourth recurrences. The remaining patient underwent thoracotomy when progression of the pneumothorax occurred with rest, needle aspiration, and water seal.

**Complications and Deaths**

The only complications in this series were in two patients treated with intercostal catheter suction. Both of them developed pneumonitis on the involved side; however, in neither was the length of hospitalization increased. The systemic reaction to intercostal catheter suction was minimal in all other cases. Formerly, antibiotics were administered prophylactically to patients during suction treatment, but this proved unnecessary and is no longer our practice.

Eight patients in this series died during their period of hospitalization, (from a variety of conditions: carcinomatosis, cerebrovascular accidents, etc.). In none could the method of treatment used be considered a primary or contributing cause of death.

**Recurrence**

After discharge from the hospital there were five known recurrences in a group of 24 patients treated by bed rest and needle aspiration. In the group of 39 treated by intercostal suction there were four recurrences, Table 4. However, the follow-up information available is inadequate to permit valid conclusions regarding the relative merits of intercostal catheter suction in the prevention of recurrent pneumothorax.
In a definitive group of 29 patients following more than six months, there were four recurrences after bed rest or needle aspiration in nine and two recurrences after intercostal catheter suction in 20. Applying the appropriate statistical test (Chi square) which includes the correction factor for the small number of cases, the differential rates of recurrence between intercostal catheter suction and bed rest do not differ significantly from chance (P=.15).

Discussion

The aims of treatment in spontaneous pneumothorax are: (1) to alleviate symptoms, (2) to prevent complications, (3) to reduce morbidity and economic loss, and (4) to prevent recurrences. While there are several effective methods of therapy, obviously no one is suited to all cases. Since, as has been shown, a pneumothorax of less than 20 per cent will resolve on bed rest alone in eight to 15 days, treatment by bed rest alone should be used for all pneumothoraces of minor degree. If, however, expansion does not occur with bed rest, one must resort to other means to obtain expansion and to prevent the complications resulting from chronic pneumothorax.

Intercostal catheter suction is a safe and effective means of treating spontaneous pneumothorax. Symptoms are promptly relieved, complications are avoided, and morbidity is less than with other forms of therapy. For spontaneous pneumothorax exceeding 20 per cent, or where expansion does not occur with more conservative measures, intercostal catheter suction is the treatment of choice. During the past year, several patients have been treated successfully by applying suction to a small plastic catheter introduced into the pleural space through a No. 13 needle. However, with a large, persisting pleural leak it may be necessary to introduce a catheter in the manner outlined to produce complete expansion.

Some authors feel that thoracoscopy is a time consuming and unrewarding procedure. Yet, as was noted in this review, positive findings were reported in 16 of the 29 cases in which it was done (Table 3). If blebs were visualized on thoracoscopy, this might be a factor in determining the form of treatment to be used if the patient should develop recurrent pneumothorax. Done at the time of insertion of the intercostal catheter, thoracoscopy is a simple procedure adding but a few minutes to the entire operation.

SUMMARY

1. Seventy-one instances of spontaneous pneumothorax have been reviewed, not all of which were the simple or idiopathic type.
2. Nineteen (28 per cent) had prior pneumothorax.
3. Of 19 treated with bed rest alone, there were two failures and four known recurrences. The average hospital stay was 22 days.
4. Of 39 treated with intercostal catheter suction, the average hospital stay was 12.5 days. There were four failures and four recurrences.
5. There was no significant complication associated with treatment by intercostal catheter suction.
6. Thoracoscopy was done in 29 and positive findings were recorded in 16. We believe thoracoscopy in addition to x-ray an important aid in determining whether to recommend open thoracotomy or an initial trial with catheter suction.
7. With an initial spontaneous pneumothorax of less than 20 per cent, in the absence of demonstrable large peripheral blebs, bed rest may be the treatment of choice. When it exceeds 20 per cent and initial open thoracotomy does not seem justifiable, intercostal catheter suction therapy, as described, has proven to be a safe and effective method of treatment in a high percentage of our cases.

RESUMEN

1. Setenta y un casos de neumotorax espontaneo se revisan. No todos ellos fueron del tipo simple idiopatico.
2. Diecinueve (20 por ciento) habian tenido antes neumotorax.
3. De los 19 tratados con solo reposo en cama hubo dos fracasos y cuatro recurrencias conocidas. El tiempo medio de permanencia en el hospital fue de 22 dias.
4. De 30 tratados con cateter intercostal y succion, el tiempo de permanencia en el hospital fue de 12 dias. Hubo cuatro fracasos y cuatro recurrencias.
5. No hubo complicacion de importancia después del tratamiento con cateter.
6. La toracoscopia se hizo en 29 y hubo hallazgos positivos en 16.
7. Con neumotorax de menos de 20 por ciento el reposo en cama es el tratamiento de eleccion. Cuando es mayor de 20 por ciento o bien si otros métodos fallan el tratamiento con el cateter y aspiracion es seguro y efectivo.
RESUME

1. L'auteur passe en revue 71 cas de pneumothorax spontané. Certains d'entre eux n'étaient pas du type simple ou idiopathique.
2. 19 cas (28%) avaient eu antérieurement un pneumothorax.
3. Sur les 19 traités par le repos au lit seul, il y eut deux échecs et quatre rechutes. Le séjour moyen à l'Hôpital fut de 22 jours.
4. Sur 30 cas traités par aspiration à l'aide d'une sonde interpleurale, le séjour moyen à l'Hôpital fut de 12.5 jours. Il y eut quatre échecs et quatre rechutes.
5. Il n'y eut pas de complication nettement en rapport avec le traitement par aspiration.
6. Une thoracotomie fut faite dans 20 cas et des constatations positives furent enregistrées dans 16 cas.
7. Avec un pneumothorax qui entraîne une diminution respiratoire de moins de 20%, le repos au lit est le traitement de choix. Lorsque la diminution dépasse 20% ou lorsque les autres méthodes de traitement échouent, l'aspiration par sonde est une méthode de traitement sans danger et efficace.

ZUSAMMENFASSUNG

2. 19 (28%) hatten bereits früher einen Pnth.
5. Durch die Behandlung mit Intercostalkatheter wurden keine besonderen Komplikationen verursacht.
6. In 20 Fällen wurde eine Thorakoskopie durchgeführt, durch die bei 16 Patienten ein Befund erhoben werden konnte.
7. Bei einem Pneumothorax von weniger als 20% ist Bettruhe die Methode der Wahl. Wenn er 20% übersteigt oder andere Behandlungsmethoden versagen, stellt das Absaugen der Luft durch Intercostalkatheter eine sichere und wirksame Methode dar.

REFERENCES