

Epidemiology of Spontaneous Pneumothorax in Women*

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An epidemiologic study was done on spontaneous pneumothorax in women. Six hundred sixty-four patients with spontaneous pneumothorax comprising 409 with idiopathic pneumothorax (61.6 percent), and 255 with secondary pneumothorax (38.4 percent) were studied. By age, idiopathic pneumothorax had its peak incidence in the 20s and secondary pneumothorax the 30s. Secondary pneumothorax included iatrogenic pneumothorax resulting from acupuncture treatment. The female patients were not so thin and tall as the male patients. The percentage of positive

In terms of sex, spontaneous pneumothorax occurs predominantly in men, and this is true for both idiopathic and secondary pneumothorax. The incidence figures break down with female subjects accounting for from 7.7 percent to 20 percent of all patients, and, despite this considerable scatter among the various reports,^{1,2} it is clear that the incidence of spontaneous pneumothorax among women is extremely low compared with that in men.

Catamenial pneumothorax³ has attracted particular attention as a mechanism for the development of the condition specific to women. In Japan, there has been a whole series of publications on this subject in recent years, so that the condition is under careful study. Diffuse pulmonary hamartoangiomyomatosis⁴ is another form of pneumothorax that affects relatively young women, with all cases reported in Japan having been women. It is not clear why this process develops in women. As no evidence has been obtained suggesting the reason why this incidence is high in male and low in female subjects, the Pneumothorax Study Squad in Japan has collected data and investigated these case records to study the epidemiologic conditions by carefully evaluating the pneumothorax data for women.

MATERIALS AND METHODS

The Pneumothorax Study Squad consists of the 20 respiratory

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family history among the female patients was 4.42 percent in the idiopathic type and 0.45 percent in the secondary type. The percentage in the male idiopathic type of pneumothorax was 2.29 percent. Catamenial pneumothorax and pneumothorax with pulmonary hamartoangiomyomatosis are well known as specific in female subjects, but the cases are rare. Nonetheless, attention should be paid to female-specific rare types, for the etiology of idiopathic pneumothorax.

specialists belonging to the national hospitals which are distributed in all Japanese areas and two advisers in epidemiology and clinical medicine.

We gathered all spontaneous pneumothorax data accumulated for 5,536 patients with spontaneous pneumothorax during the past eight years for all Japanese areas. For idiopathic pneumothorax, the number was 3,895 cases (70.4 percent), for secondary pneumothorax, the number was 1,641 cases (29.6 percent).

The records collected on female patients refer to a total of 664 cases. These records showed that 409 (61.6 percent) of the patients had been diagnosed as having idiopathic pneumothorax with no known previous disease. The remaining 255 patients (38.4 percent) had a well-known record of previous illness, and included cases of secondary, iatrogenic, and traumatic pneumothorax. A comparative study of the epidemiologic factors was carried out on the women with idiopathic pneumothorax and the women with nonidiopathic pneumothorax. These were also compared with the male sample of pneumothorax cases.

RESULTS

Age Distribution (Fig 1)

As shown in Figure 1, the relative incidences of idiopathic pneumothorax and secondary pneu-

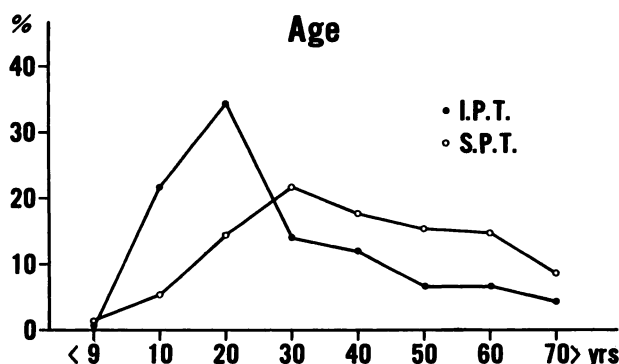
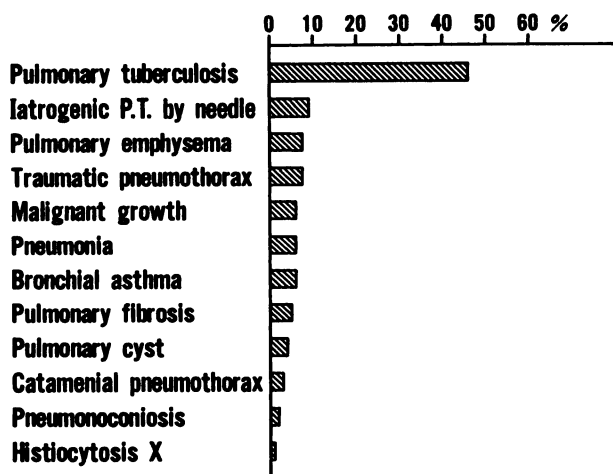


FIGURE 1. Age distribution of patients with idiopathic spontaneous pneumothorax and secondary spontaneous pneumothorax in females.



etiologic disease	cases	rate
Pulmonary tuberculosis	115	54.0%
Pulmonary emphysema	19	8.9%
Malignant growth	15	7.0%
Pneumonia	14	6.6%
Bronchial asthma	14	6.6%
Pulmonary fibrosis	13	6.1%
Pulmonary cyst	12	5.6%
Catamenial pneumothorax	6	2.8%
Pneumoconiosis	4	1.9%
Histiocytosis X	1	0.5%
Total	213	100.0%

FIGURE 2. Etiologic classification of secondary pneumothorax in females. Lower: Cases and rate of secondary pneumothorax in females except for iatrogenic pneumothorax and traumatic pneumothorax.

mothorax have been arranged with respect to age brackets. The 20-year age bracket reveals the highest incidence of 34.47 percent, presenting a high-rise

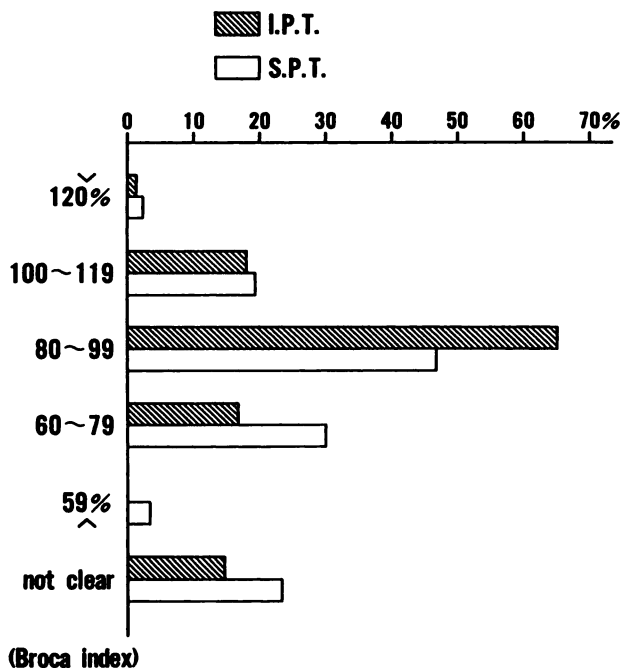


FIGURE 3. Physical constitution.

single-peak curve. From the age of 30, the curve shows a moderate fall with advancing years.

Secondary pneumothorax occurred in the 30-year age bracket at a relatively high incidence of 21.9 percent. The curve has a single-peak path exhibiting a moderate rising trend from the age of 10, falling off slowly from the age of 40.

Etiologic Diseases in the Secondary Pneumothorax Group

As shown in Figure 2, the etiologic diseases in the secondary pneumothorax group included pulmonary tuberculosis at the highest frequency, accounting for 45.1 percent. An unexpectedly high incidence of 9.0 percent, equivalent to 23 patients, was found for iatrogenic pneumothorax cases due to acupuncture treatment, while traumatic pneumothorax affected 19 patients, corresponding to an incidence of 7.5 percent. Except for the acupuncture and traumatic pneumothorax cases, the comparison is as shown in the lower peak of the Figure 2.

Breakdown by Occupation

Secondary pneumothorax is relatively frequent among housewives, cleaning women, and farming women. Idiopathic pneumothorax has a high incidence among office employees and students. It is estimated that, for the different pneumothorax groups, the above incidence is associated with differences in the female patients' ages.

Physical Constitution and Smoking Habits

A further differentiation was introduced in terms of the patients' physical constitution (obesity) on the basis of the Broca index and smoking habits on the basis of the Brinkmann index. The various groups were compared, and it was found that there was a significantly larger number of idiopathic pneumothorax patients with a Broca index of 80 to 99 percent as compared with the number of patients with a Broca index of less than 79 percent greater for secondary pneumothorax. This is attributed to the fact that marantic conditions, such as pulmonary tuberculosis, pulmonary tumors, and malignant tumors, are frequent among the etiologic diseases of secondary pneumothorax (Fig 3). There was no significant difference found in smokers.

Familial History

Whether there had been a history of pneumothorax in the family was investigated. It was found that 4.42 percent of the idiopathic pneumothorax patients had a familial history. This compares with only 0.45 percent in the secondary pneumothorax group. This difference is statistically significant (Fig 4) ($X^2 = 8.439$, $p < 0.005$).

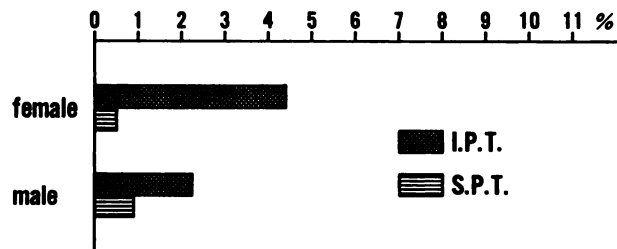


FIGURE 4. Family history of pneumothorax.

Fatality Incidence

The incidence of a fatal outcome in idiopathic pneumothorax has been low, with only two patients dying. One of these two patients died not directly from pneumothorax, but from apoplexy. In the secondary pneumothorax group, 29 patients died, so that incidence of fatality in this group was high, amounting to 11.37 percent. The etiologic diseases were lung cancer in nine cases, pulmonary tuberculosis in seven, pulmonary fibrosis in six, pulmonary emphysema in four, and pneumoconiosis, chronic bronchitis, and pneumonia in one patient each.

Breakdown of Idiopathic Pneumothorax Case by Sex

When comparing the incidence of pneumothorax for the different age groups on the basis of sex (Fig 5), both males and females present the highest incidence in the 20 to 29 year age group. However, in terms of the incidence in the 10 to 19 year age group only, female subjects are more prone to the condition than male subjects. This suggests that the idiopathic form of the disease manifests itself at a younger age in women as compared to men, indicating that there is possibly a sex-differentiated mechanism for the development of the disease.

Let us now compare the sex breakdown against the physical constitution of the patients using the Broca index. For a Broca index of 100 percent or more, females report a higher incidence, but for an obesity index of 80 percent to 99 percent, the incidence is higher in males. For a constitutional (Broca) index of 79

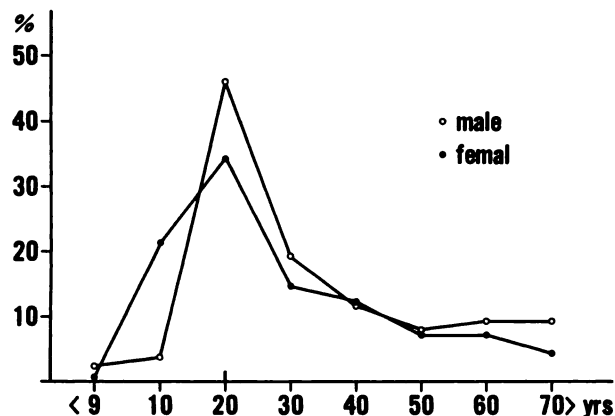


FIGURE 5. Age distribution of patients with idiopathic spontaneous pneumothorax in males and females.

percent or less, however, both male and female subjects reveal the same incidence (Fig 6).

This indicates that it is rarer for female patients with idiopathic pneumothorax to have a thin and tall body frame (build) than for men. In the same manner, it would appear that the disease mechanism differs depending on sex. The incidence of smoking is lower for women than for men.

Familial History

In terms of whether a record of pneumothorax exists in the family, it has been observed that the incidence in women is roughly double that in men, 4.42 percent vs 2.29 percent. This is a statistically significant difference ($X^2 = 346.80$, $p < 0.005$).

The incidence of female patients with a familial history is thus significantly higher, a fact that may imply that women may have a hereditary predisposition to idiopathic pneumothorax, indicating that there is a difference in the disease mechanism from men. This may be one piece of evidence of the bias observed in the sex differentiation for idiopathic pneumothorax toward men, inasmuch as the incidence of smoking is lower among women (Fig 4).

DISCUSSION

With the increase in the number of spontaneous pneumothorax cases, there has also been an increasing number of reported cases of catamenial pneumothorax as a specifically female condition. The mechanism for the development of this condition is being argued at present. In contrast to the normal or general form of idiopathic pneumothorax, this condition has come to be treated as a special form of the disease. The nature of catamenial pneumothorax is associated with ectopic endometritis through the spread of endometritis through the pelvic canal. The data collected by the Study Squad suggest that, in the breakdown of the idiopathic pneumothorax patients, no more than six had catamenial pneumothorax, so that this frequency cannot be considered high.

Hamartoma angiomyomatosis⁴ too, is predominant among women and tends to occur preferentially in young- to middle-aged women. The frequency of occurrence of pneumothorax can be considered high, but the data gathered did not contain a single patient with this form of the disease. Its incidence on the whole, therefore, is low.

Progesterone, one of the ovarian steroids in females, is active in the endometrium. The action of estrogen is to arrest endometrial productivity, which usually results in the effusion of blood from the uterus with desquamation of the endometrium. The extragenital action of progesterone is similar to that of a corticoid, having a water- and salt-retaining action and a protein-dissimilation action. In the male, progesterone is

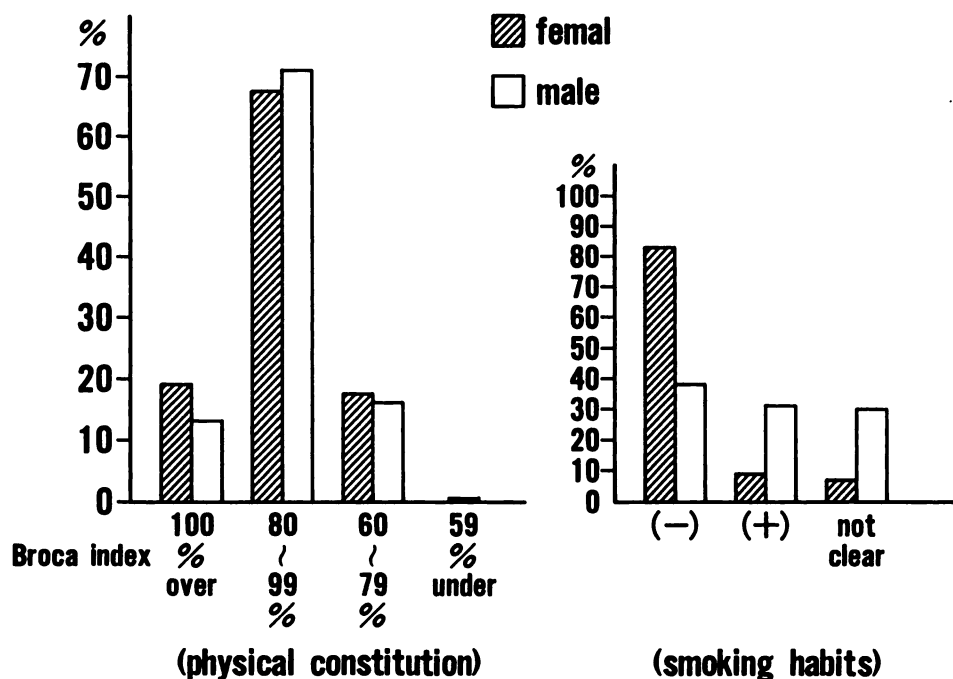


FIGURE 6. Physical constitution and smoking habits of patients with idiopathic spontaneous pneumothorax in males and females.

secreted from the adrenal cortex, and during the development of idiopathic pneumothorax in males, the secretion of progesterone is low, so that the disease is etiologically supported by a hypofunction of the adrenal cortex. Moreover, it has been reported that when experimental pulmonary emphysema is generated, the progress of emphysema can be inhibited by the administration of progesterone.⁵ It is thus possible to administer small doses of progesterone to inhibit the progress of male idiopathic pneumothorax following emphysema in the same way as for pulmonary emphysema. In the same manner as alpha-antitrypsin and pulmonary surface-active lipoproteins, progesterone inhibits the activity of proteolytic enzymes such as elastase and collagenase in the pathologic development of pulmonary emphysema.

"Cysts of alveolar origin" is used as a general term, while the description "emphysematous bullae" includes bullae, blebs, and pneumatoceles. However, the operation of a check-valve mechanism and the development of vascular occlusion (relative ischemia) are vascular factors that may intervene in the formation of blebs. Thus, loculated circulatory failure manifests itself in the form of atrophic fibrosis of the alveolar walls. Assuming that the expansion and adhesion of groups of alveoli result from the collateral respiratory failure associated with Cohn's obstruction and the valve-mechanism of the bronchioles causes development of blebs, it is also legitimate to suppose that this accounts for the development of pulmonary loculated obstructive emphysema as well.

One of the recent theories concerning the disease

mechanism for pulmonary emphysema favors the view that chemical mediators such as histamine, prostaglandin F_{2α}, etc, are released from the lymphoid tissue and mast cells due to the action of such factors as air pollution,⁶ smoking,⁷ and infections of the bronchial passages, resulting in inflammation of the bronchus associated with a cleaning activity of the air passages and a low resistance to infections. Due to this inflammation, neutrophil and macrophage infiltration will occur, leading to an elevated activity level of elastase, collagenase, and other enzymes and to the formation of pulmonary emphysema due to the destruction of the alveolar walls, producing vascular wall lesions.

Prostaglandin F_{2α} will cause bronchial leiomyosculus spasms. However, Rossi and Goplerud speculated that the development of catamenial pneumothorax is due to severe spasms of the bronchial pathways and pulmonary blood vessels from prostaglandin F_{2α}. This may be a causative factor for the rupture of pulmonary alveoli under the local action of prostaglandin F_{2α} during the menses when ectopic endometritis is present in the subpleural region.

In this investigation, we have studied 664 female pneumothorax patients. In terms of the incidence of this disease according to sex, a clearly defined wave crest has been found for the age group 20 to 29 both for male and female subjects. However, the incidence of the disease in the 10- to 19-year age bracket shows a very marked difference for the two sexes, with an incidence of 3.41 percent for male and 21.27 percent for female subjects. Thus, idiopathic pneumothorax develops earlier in female than in male subjects. This

suggests that there may be some different mechanism of the disease for female as compared to male subjects to account for the onset in the young patient group.

Idiopathic pneumothorax frequently occurs in young people with a tall, thin body build. However, our study of female patients indicates that for a Broca index of 100 percent, the incidence was 17.47 percent, somewhat higher than the 13.69 percent incidence recorded for males. This means that the disease occurs not only in people with a slender, tall body build. We have also studied the relevance of familial history, and it was found that the incidence of familial history is higher for women, roughly double that for men. This suggests that many of the patients had genetic predispositions to the etiologic diseases of pneumothorax.

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