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## X-ray findings in spontaneous pneumothorax suggesting bleb formation

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### 自然気胸における bleb の X 線像

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自然気胸の原因の大部分は bleb の破裂によるものであるが、その際における bleb の X 線像は判っていない。著者は16例の自然気胸のうち11例に bleb および bleb を示唆する X 線所見を認めた。一般に bleb は bullae と異なり、気胸のない胸部 X 線像で発見することは困難である。一旦

気胸を生じると、破裂のない残った bleb の像が切線像として直接みられると同時に、bleb の存在を示唆する肺肋膜下の板状の透亮帯がこの部の気腫像としてみられる。また bleb および肋膜下気腫は肋膜そのものに不規則な凹凸、二重輪郭、硬化および肥厚の像を与える。

According to the report of Leach (1945), Ehrenhaft (1955), Baronofsky (1957), Lindskog (1957), and Dricoll (1961), the cause of pneumothorax is mostly a rupture of a bleb. According to Gobbel (1963), surgical resection of the bleb was carried out in 9 of 119 cases of spontaneous pneumothorax. Among 110 remaining cases, relapse occurred in 57. Surgical resections of the bleb was carried out in 9 of 57 cases. In the remaining 48 cases, 30 experienced the third relapse and surgical resection of the bleb was done in 13. Among 17 remaining cases, 4th relapse occurred in 14.

We examined 16 cases of spontaneous pneumothorax, and in 11 cases of this series blebs were radiographically suggestive. In present paper these findings were reported and discussed.

#### Case

Table 1. summarized 11 cases of spontaneous pneumothorax. No disease of the lung responsible for the episode was found in any case.

##### 1. Age

Six patients were in the 20s, 2 in the 30s, and 3 above 40. According to Ehrenhaft (52 cases), Gobbel (119 cases), Lindskog (72 cases), and Driscoll (56 cases), patients in the 20s and 30s are mainly affected with the average age of onset between 25 and 34.

##### 2. Sex

Among 11 cases, there were 10 males and 1 female. Lindskog found 62 males (86%) in 72, Ehrenhaft

Tab. 1. 11 cases of the X-ray findings suggesting bleb

No.	age	sex	symptom	side of occurrence	intensity of pneumothorax	period	recurrence
1	21	♂	+	R	perfect collapse	2 M	(—)
2	51	♂	+	L	"	1.5M	(—)
3	38	♂	±	R L	marginal pn. thorax	2.5M	(+)
4	25	♂	+	L	"	1 M	(—)
5	25	♂	+	R	perfect collapse	1 M	(—)
6	22	♂	+	L	marginal pn. thorax	1 M	(—)
7	64	♀	+	L	"	1 M	(—)
8	23	♂	+	L	"	2 M	(—)
9	23	♂	+	L	"	1 M	(+)
10	49	♂	+	R L	"	1 M	(—)
11	30	♂	+	L	valvular pn. thorax	2 M	(—)

43 males (82%) in 52 cases, and Kircher 34 males in 35 (97%).

### 3. Symptoms

In 4 of these 11 cases, the date of onset is unknown. In 4 cases, the onset was seen during mild exercise (running or defecation), while the cause was entirely unknown in the remaining 7 cases. Symptoms mainly consist of chest pain and dyspnea with rare complaints of cough, feeling of compression over the chest, and palpitation.

### 4. Side of occurrence

Among 11 cases, the involvement was on the left side in 7, right side in 2, and bilateral in 2. Multiple occurrence of blebs and tendency of ready rupture was suggested in cases with bilateral involvement. According to Ehrenhaft, the disease occurred on the right side in 24, left side in 23, and bilaterally in 5. According to Leach, the disease occurred on the right side in 76 cases, left side in 50 cases, and bilaterally in 1. No right-left difference was noted.

### 5. Type of pneumothorax

As for the types in 11 cases of pneumothorax, marginal pneumothorax was found in 7, collapse pneumothorax in 3 and valvular pneumothorax in 1. In general, mild pneumothorax is more frequently encountered than in other causes. Valvular pneumothorax was only rarely encountered.

### 6. Period required for healing

Reexpansion of the lung appears rather rapidly. Among 11 cases, healing occurred in 6 cases in one month, and in 5 other cases within 3 months. As for complications, hydrothorax (pleural effusion) was seen in 2 and pneumomediastinum in 2.

### 7. Tendency to recurrence and choice of treatment

In 3 of 11 cases, history of pneumothorax was noted. According to the literature, the rate of recurrence was 10—60%. Consequently, the accurate treatment of spontaneous pneumothorax consists of surgical resection of the bleb.

## X-ray Findings

### 1. X-ray findings of pneumothorax

In pneumothorax, a translucent zone is noted between the lung and thoracic cavity due to air re-

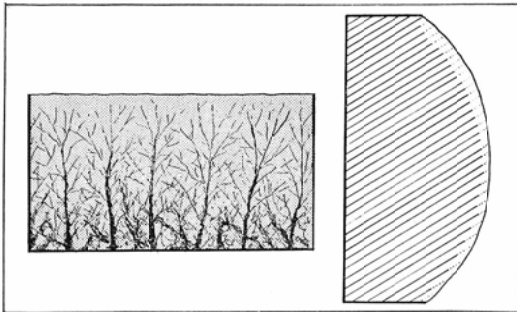


Fig. 1 Normal margin of the lung in the pneumothorax.

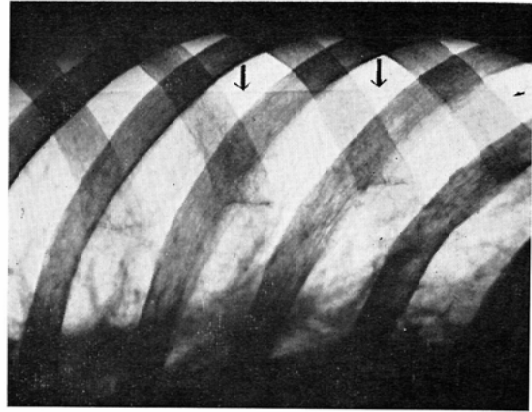


Photo. 1 23 year old male. Pneumothorax: normal margin of the lung, appearing as a smooth linear density (Fig. 1).

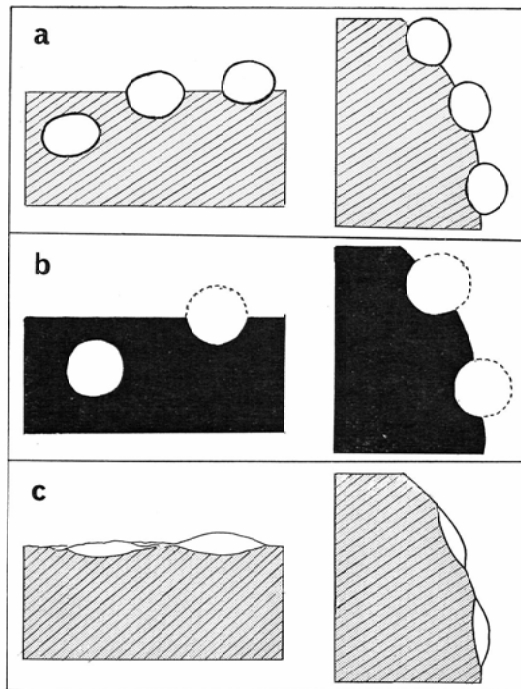


Fig. 2, a. b. c. X-ray pictures of the blebs.

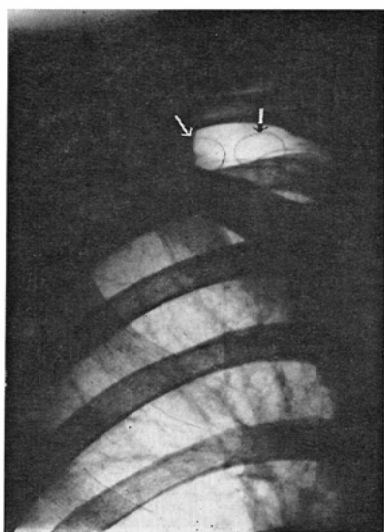


Photo. 2, a. 21 year old male. Typical X-ray picture of the blebs (Fig. 2, a.).

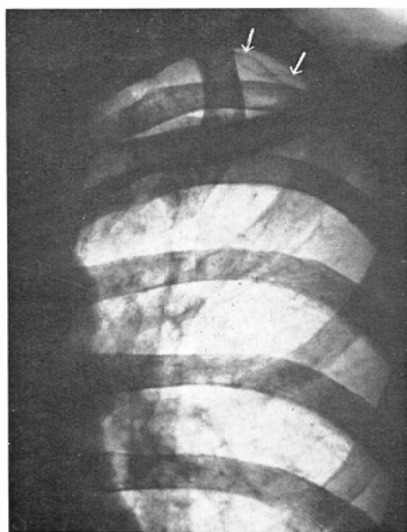


Photo. 2, c. 22 year old male. Blebs as a spindle-shaped translucency (Fig. 2, c.).



Photo. 2, b. 30 year old male. Blebs as a punched out lesion (Fig. 2, b.).

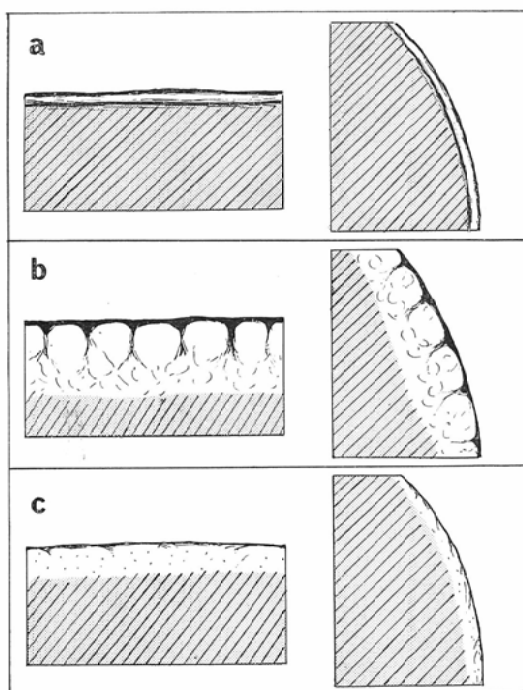


Fig. 3, a. b. c. X-ray pictures suggesting the presence of bleb.

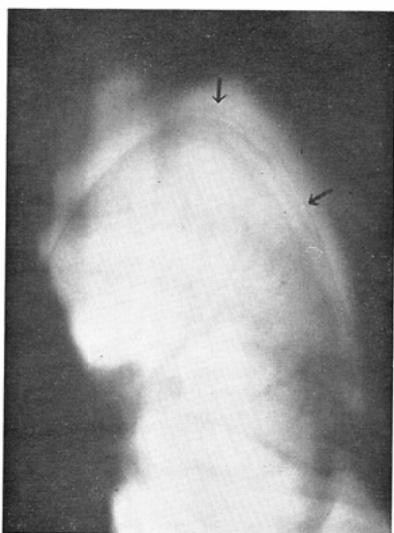


Photo. 3, a. 23 year old male. Plate-like translucent zone (Fig. 3, a.).

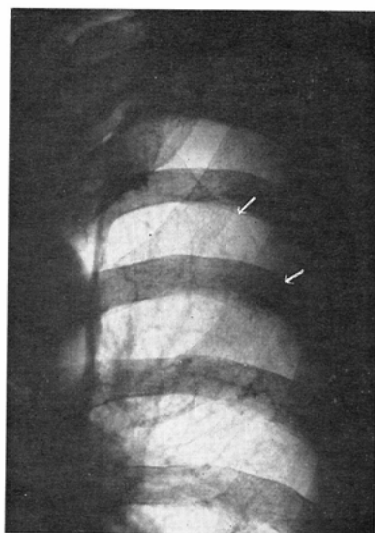


Photo. 3, c. 49 year old male. Subpleural emphysema (Fig. 3, c.).

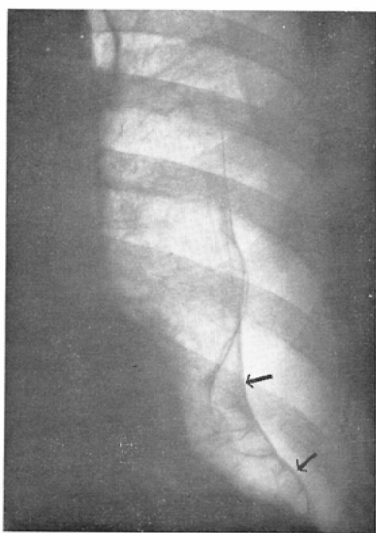


Photo. 3, b. 64 year old female. Emphysema is found directly beneath the pleura (Fig. 3, b.).

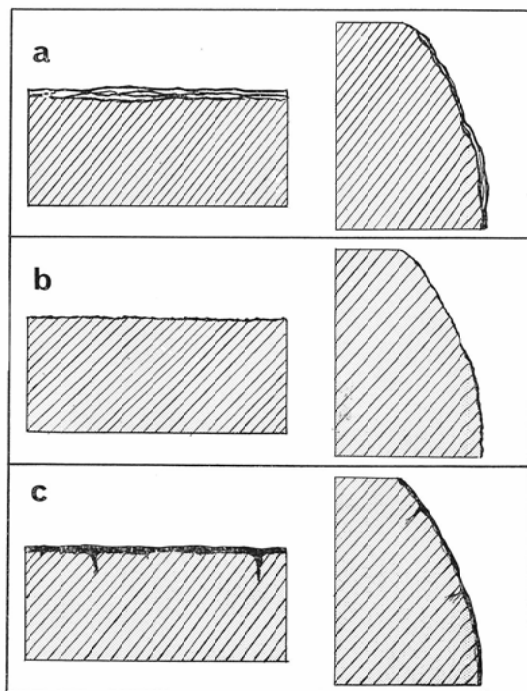


Fig. 4, a. b. c. Changes of pleura due to blebs.

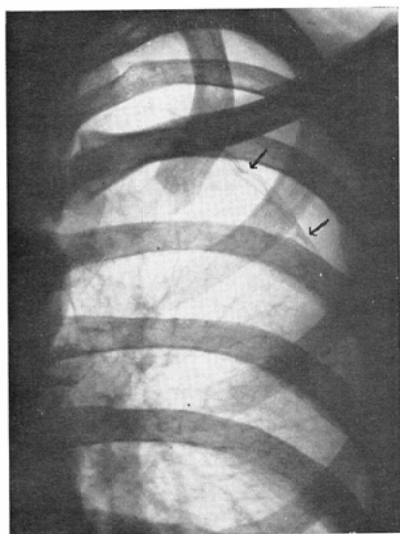


Photo. 4, a. 22 year old male. Double contour due to the wrinkle of visceral pleura(Fig. ,4 a.).

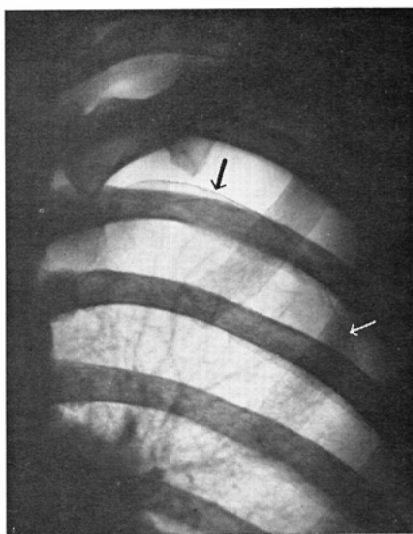


Photo. 4, b. 23 year old male. Fine indentations indicating the sclerosis of pleura(Fig. 4, b.).

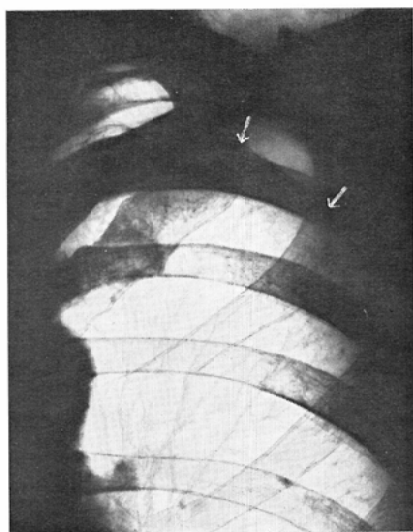


Photo. 4, c. 38 year old male. Thick linear density indicating thickened pleura. (Fig. 4, c.).

tention within the pleural cavity. The edge of the lung lobe shows a linear density representing visceral pleura. The radiographic density of the lung is influenced by the degree of collapse. In an intense collapse, homogeneous density seen in atelectasis is noted, with air bronchogram within the density. Each lung lobe is shown as a circuloid protrusion from the hilus to the periphery. When adhesion is present, a cordlike connection is seen between lung lobe and thoracic wall. Fig. 1 and Photograph 1 shows the edge of the lung without a bleb in pneumothorax, appearing as a smooth linear density.

## 2. X-ray picture suggesting bleb

Generally speaking, bleb, unlike bullae, is hard to find in ordinary chest X-ray film. However, in pneumothorax, it is recognized on the basis of the following X-ray findings: 1) 2) 3).

### 1) Appearance of bleb

The picture of bleb is shown in Fig. 2a, b, c and photo 2, a, b and c. **a** appears as a typical circuloid ring like density, **b** appears as a punched out lesion, doubled within the lung field, and **c** appears as a spindle-shaped translucency. In the pathological aspect of its development, bleb is present directly beneath the pleura, but is not always projected at the margin, as is readily understood from the X-ray axis.

### 2) A picture suggesting the presence of bleb

An example is shown in Fig. 3, a, b, c and photo 3, a, b, c. In **a**, a plate-like translucent zone is found between the visceral pleura and the lung, while emphysema is found directly beneath the pleura in **b** and **c**. Such subpleural emphysema is produced by the same mechanism which produced the bleb and the presence of subpleural emphysema indicates the presence of blebs.

### 3) Changes of pleura due to blebs

This phenomenon is shown in Fig. 4a, b, c and photo 4, a, b, c. In **a**, it appears as a double contour due to the wrinkle of visceral pleura in **b**, as fine indentations indicating the sclerosis of pleura in **b**, and as a thick linear density indicating thickened pleura in **c**. These findings in **a**, **b** and **c** are frequently encountered in the pleura with blebs.

## Conclusion

Most of the pneumothorax develop as the result of rupture of blebs. However, the X-ray picture of the bleb at this occasion has not been made clear. The author showed the X-ray picture of bleb in spontaneous pneumothorax, providing important findings in the selection of indication for surgical treatment.

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