

Spontaneous pneumothorax: the sharp rib syndrome

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Stephenson, S. F. (1976). *Thorax*, 31, 369–372. **Spontaneous pneumothorax: the sharp rib syndrome.** Of 49 patients undergoing operation for benign spontaneous pneumothorax, 28 (57%) were found to have a sharp first or second rib. In a series of 100 patients undergoing thoracotomy for other conditions, only eight (8%) were found to have a sharp rib. The association between sharp ribs, apical scars and bullae, and spontaneous pneumothorax is discussed.

Spontaneous pneumothorax in patients without generalized lung disease occurs mainly in young people but may occur at any age. Some of these patients are treated by open operation and the operative findings are often characteristic. At or near the apex there is a flat scar on the surface of the lung, and adjacent to the scar may be one or more bullae or cysts, and an air leak from this area may be evident. The cause of these lesions has remained unknown despite much conjecture. Repeated trauma, caused by friction of the lung against the chest wall during breathing and coughing, is a possible factor. A finding which supports this is the frequent presence of a sharp inner border of the first or second rib, and this is often related to the site of the lung scar or cyst formation. This has not been previously reported, and to find out how often this occurs, the upper ribs have been regularly palpated at operation both in cases of spontaneous pneumothorax and at thoracotomy for other diseases.

Rib sharpness is difficult to define or measure, but the examining finger may appreciate three types of rib margin. Palpation within the normal chest reveals a smooth apex to the pleural cavity bounded by inferior rib surfaces and taut intercostal structures, and the inner borders of the first two ribs are palpable but not prominent or sharp. In some subjects, however, a rib border may be prominent but rounded, and in others it is prominent and sharp in the sense that the anterior border of the tibia is sharp as felt through the overlying skin.

To illustrate these types of rib margin, moulds of the apex of the pleural space have been made,

using bone cement, and photographs of moulds are shown in Figures 1–3. The posterior surface of the mould is seen in profile on the left of each figure. In Fig. 1, the posterior surface is smooth; in Fig. 2, it shows a groove caused by a prominent but rounded second rib; and in Fig. 3, the indentation of a relatively sharp first rib is shown.

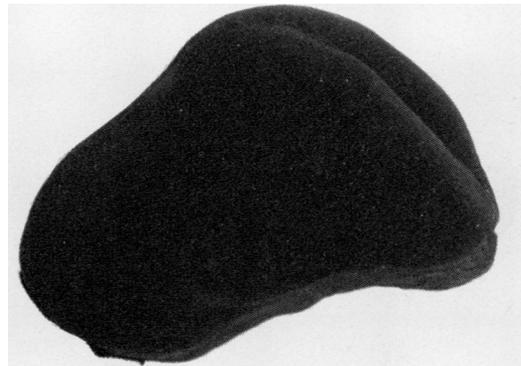


FIG. 1. Mould of apex of pleural cavity showing smooth posterior surface (on left).

MATERIAL

Between 1962 and 1976 inclusive, 62 patients underwent operation for spontaneous pneumothorax. Thirteen were found to have generalized lung disease and are excluded from further consideration. The remaining 49 patients were treated by suture of bullae and air leaks, if present, and

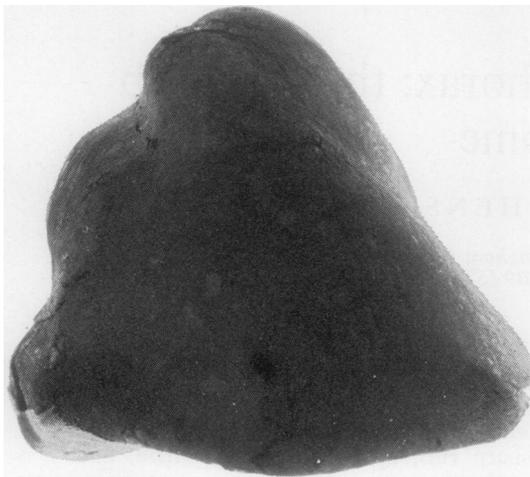


FIG. 2. Mould showing a groove on the posterior surface caused by a prominent, rounded second rib. The lower groove is not relevant.

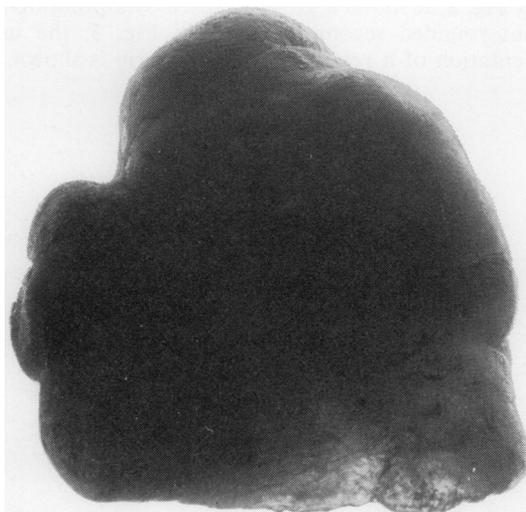


FIG. 3. Mould showing a groove on the posterior surface caused by a relatively sharp first rib.

upper pleurectomy to cause pleurodesis. The indications for operation were failure of intercostal intubation to effect expansion of the lung or the presence of recurrent pneumothorax. It was usual to recommend operation after the third attack in unilateral disease or after the second attack on one side in bilateral disease.

The findings at operation included 41 patients with flat scars at or near the apex, and 22 patients with single or multiple cysts adjacent to a scar in 17 and without a visible scar in five. Several patients had local emphysematous changes without sizeable bullae.

RESULTS

Forty-nine patients without generalized lung disease underwent operation for spontaneous pneumothorax. The upper ribs were palpated at operation in 34 patients, of whom 28 were found to have a sharp inner border to the first or second rib. In 15 patients, the state of the ribs is not known for a variety of reasons; four had a haemopneumothorax, the bleeding being probably due to the tearing of apical adhesions, six were over the age of 50 and were thought at the time to be outside the scope of this investigation, and in the other five, the rib palpation was either omitted or not noted in the operation report. However, these 15 patients all had a benign pneumothorax, and apical scars or bullae were present in 13 of them; they are, therefore, included in the survey and assumed not to have sharp ribs. Thus, at least 28 out of 49 patients undergoing operation for spontaneous pneumothorax had a sharp rib (57%) (Table I).

TABLE I
PATIENTS WITH SPONTANEOUS PNEUMOTHORAX
AND SHARP RIBS

	No. of Cases	Patients with Sharp Ribs	%
Spontaneous pneumothorax	49	28	57
Other thoracotomies	100	8	8

The upper ribs were also palpated in 100 patients undergoing thoracotomy for conditions other than pneumothorax, and eight of these were found to have a sharp rib (Table I).

The sharpness was usually limited to the neck or posterior half of the rib. Of the pneumothorax cases, the first rib was sharp in 18 patients, the second rib was sharp in nine patients, and both ribs were sharp in one patient.

The sex and age distribution was as follows:

In the pneumothorax cases, there were 36 males and 13 females, and their ages ranged between 17 and 82, with an average of 37 years. In the other thoracotomies, which may loosely be called con-

trols, there were 75 males and 25 females, and their ages ranged between 16 and 74, with an average of 55 years (Table II).

TABLE II
AGE AND SEX DISTRIBUTION

	No. of Cases	Male	Female	Age (years)	
				Range	Average
Pneumothorax	49	36	13	17-82	37
Controls	100	75	25	16-74	55

The patients in the control series were on average 18 years older than those with spontaneous pneumothorax. It might, therefore, be thought possible that sharp ribs become less prominent with advancing age, but 16 of these controls were under the age of 50 and contained only one sharp rib (6%), while 84 were over the age of 50 and included seven with a sharp rib (8.5%).

The difference in incidence of sharp ribs in patients with spontaneous pneumothorax (57%) and without spontaneous pneumothorax (8%) is highly significant ($P < 0.01$).

DISCUSSION

Kjaergaard (1932) first described benign pneumothorax in which there is no generalized lung disease and the lesions consist only of apical bullae or local emphysematous areas with or without superficial scars. The aetiology of these lesions has caused much speculation. Hyde (1963) and other authors have noted that the patients were often male, young, tall, and thin. A congenital origin for the cysts or an abnormally thin pleura with a deficient supporting elastic layer was suggested by Brock (1948). Withers *et al.* (1964) commented on the poor blood supply to the apex of the lung and suggested that the cyst formation was due to local ischaemia, adding that 'wear and tear on such blebs may cause rupture and spontaneous pneumothorax', thus implying that trauma might be a causative factor. Lichter and Gwynne (1971) reported on 20 patients subjected to thoracotomy and wedge resection of the lesions, and gave the first full report of the histology. Microscopy in their cases revealed gross disorganization by fibrosis, atelectasis, formation of cysts lined by fibrous tissue, focal emphysema, chronic non-specific inflammation, alveolar and bronchiolar proliferation, pigment deposition, and endarteritis. They came to no conclusions on aetiology but pointed

out that if the cysts are congenital, the subpleural scars are not explained, and if trauma is the cause, there is no real evidence of organizing haematoma. They comment that 'the curious localization of the lesions and their occurrence predominantly in young males are obscure features which suggest some local inherent predisposition'. The description of their material suggests that the histological changes could indeed be due to chronic trauma and the 'local inherent predisposition' might be the presence in many patients of a sharp inner rib border. West (1972) showed that the stresses and strains within the lung are greatest at the apex. It follows that the distortion of lung tissue adjacent to apical scars would more readily lead to cystic changes here than in other parts of the lung.

The position and relationships of the ribs themselves explain why it is only the upper ribs which traumatize the lung and why patients who develop pneumothorax are often tall and thin. In contrast to the lower ribs, the surfaces of which lie in the vertical plane, the upper ribs lie horizontally so that their inner borders, as well as their inferior surfaces, are related to the pleura and lung. Normally the apex of the lung scarcely rises above the neck of the first rib. It is prevented from doing so by the suprapleural membrane (Sibson's fascia) which is a fan-shaped sheet of fibrous tissue attached below to the inner border of the first rib and costal cartilage and above to the transverse process of the seventh cervical vertebra. The membrane is deficient posteriorly (Last, 1972) and there is thus a potential recess above the neck of the first rib. Although the inner border of the first rib is usually sharper in front than behind, the anterior sharpness is hidden by the firm attachment of Sibson's fascia, and in the 28 patients with sharp ribs, sharpness was only twice felt anteriorly. Below the neck of the first rib there is also a potential recess bounded externally by the intercostal membrane and the external intercostal muscle, supported by the posterior spinal muscles. If the space above or below the first rib is recessed outwards, the rib borders will be prominent or sharp. One would expect this to be commoner in those who are tall and thin, whose ribs are further apart, and who have less muscle to fill and support the space between, but the physique of the patients was not recorded in the present series.

The results given here show an association between sharp ribs and spontaneous pneumothorax. They do not necessarily show an association between pneumothorax and apical scars and bullae,

the cause of which remains unproven. Scars may indeed be the result of the constant friction of respiration, and of coughing when the lung apex is pushed forcibly into the narrowing thoracic inlet. Jansveld and Dijkman (1975) have shown that patients with spontaneous pneumothorax smoke more on average than normal people, and they may, therefore, be expected to cough more. But scarring and cyst formation at the apex are so common in adult lungs and so variable in extent that other factors, such as local ischaemia and degeneration, may take part in their causation. Whatever the cause of these lesions, pneumothorax is a likely complication only when a rib margin is sharp.

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