A New Radiologic Sign of Subpulmonic Effusion*

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A new radiologic sign of subpulmonic effusion is described. That is obliteration of the intrapulmonary blood vessels which are seen below the level of the diaphragmatic dome. One hundred normal chest films are reviewed as well as nine patients with subpulmonic effusions. In three of the patients with subpulmonic effusions, this sign was the first evidence of pleural effusion.

The importance of recognizing pleural effusion on chest roentgenogram need not be stressed. However, when fluid accumulation is small, and becomes trapped between the base of the lung and the diaphragm, ie the subpulmonic location, it may be overlooked. With fluid in this location the costophrenic angle is often well preserved. It is known that in the absence of significant pleural adhesions fluid normally begins to accumulate in the subpulmonic location, and that large amounts may collect before filling of the costophrenic angle occurs.1 This report describes a new radiographic sign of subpulmonic effusion.

DESCRIPTION OF THE SIGN

Close inspection of the standard posterior-anterior chest roentgenogram in normal individuals reveals that intrapulmonary blood vessels are seen coursing below the level of the diaphragmatic dome on both the left and right sides in the great majority of cases (Fig 1). In normal individuals, abrupt termination of vascular shadows at the level of the diaphragm is rarely seen. The pathologic causes for this include pneumonia or atelectasis of the lower lobes and various intra-abdominal conditions such as subphrenic abscess, hepatic abscess, hepatomegaly, ascites, and large renal masses. To this list of pathologic conditions which result in obliteration of these vascular shadows, subpulmonic pleural effusion is added.

PATIENTS AND METHODS

Chest roentgenograms of 100 normal individuals were independently examined by both of us. The distance that vessels were seen coursing below the diaphragmatic dome was recorded and averaged. In addition, factors were analyzed to explain the wide differences in visualization of these vessels in normal subjects. Finally, chest roentgenograms of patients with documented subpulmonic effusions were evaluated for the presence of this sign.

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RESULTS

On the right side, the range from which blood vessels could be seen coursing below the diaphragm was 0 to 6.0 cm with an average of 2.1 cm. On the left, the range was 0 to 4.5 cm with an average of 1.5 cm. The most likely reason for this difference is that the cardiac shadow and gastric gas pattern in most roentgenograms occupied at least the medial half of the left hemidiaphragm, making delineation of vascular structures in that location more difficult. Therefore, it was necessary to survey the lateral half of the diaphragmatic shadow, at which point the vessels assume a more tangential course in reference to the diaphragm with less penetration downward below the diaphragm.

There were nine patients in whom the vessels on the right side were obliterated completely, as compared to only two patients on the left side. The obliteration of the vascular shadows on the right side was due to subpulmonic pleural effusion in two patients, subphrenic abscess in two, and hepatomegaly in one patient. There were no patients in whom the obliteration of the vascular shadows on the left side was due to subpulmonic effusion. This suggests that subpulmonic effusion is a more common cause of obliteration of intrapulmonary blood vessels than is subphrenic abscess or hepatomegaly.

FIGURE 1. Normal chest roentgenogram with arrows demonstrating visualization of vessels below the diaphragms.
Figure 2. Chest roentgenogram of patient with postoperative coronary bypass procedure demonstrating abrupt termination of vessels at the level of the diaphragm. Lateral decubitus films taken at the time demonstrated bilateral subpulmonic effusions.

the right side could be seen less than 1 cm below the level of the diaphragm; there were ten patients in whom the vessels on the left could be seen less than 0.5 cm. The causes for this were readily apparent. Inadequate penetration, i.e., films appearing "light" with inability to distinguish intervertebral disc spaces, could be implicated in most instances. Similarly, roentgenograms of obese patients and those with large breasts often gave the appearance of underpenetration. The same difficulty was occasionally encountered in patients whose diaphragmatic contours assumed a relatively flat appearance.

Chest roentgenograms of nine patients with subpulmonic effusion were evaluated. Vascular structures ended abruptly at the supposed diaphragmatic level ("pseudodiaphragm") in all cases, and in three instances this was the only radiographic sign of subpulmonic effusion (Fig 2 and 3). Lateral decubitus films and pleurocenteses verified the presence of pleural fluid in all subjects.

Figure 3. Close up view of right diaphragm demonstrating loss of subdiaphragmatic vessels.

Discussion

Subpulmonic effusion is defined as the accumulation of fluid between the base of the lung and the diaphragm. Early, the costophrenic angle is usually well-preserved. This accumulation of fluid may go undetected until it becomes so large as to cause a discrepancy between the apparent levels of the hemidiaphragm. In fact, the diaphragm is either at its normal level or depressed, with the abnormal shadow ("pseudodiaphragm") caused by fluid trapped between the base of the lung and the diaphragm in the subpulmonic location.

The first description of subpulmonic pleural effusion was made in 1936 by Rigler, who considered this location to be "atypical." His original observation was not widely accepted and it was not until the late 1940s that other reports further characterizing such effusion appeared in the literature. A list of other conditions which could simulate subpulmonic effusion, by causing a true elevation of the hemidiaphragm, was developed. Included were subdiaphragmatic abscess, enlarged liver, paralysis and eventration of the diaphragm, and asites. Subsequently, Hessen described a radiographic sign which he thought would allow one to suspect subpulmonic effusion in the presence of relatively small amounts of fluid. He noted that with subpulmonic effusion the pseudodiaphragmatic contour is often peaked, with the peak being more lateral than that of the normal diaphragm. More recently, Peterson described another sign of subpulmonic effusion. Concentrating on the lateral chest roentgenogram he demonstrated "without exception" a thin fluid density tapering superiorly in the region of the major fissure and a "straight-line" contour of the anterior portion of the pseudodiaphragmatic shadow. He commented that Hessen's sign was present in a minority of his 25 patients.

Vascular structures can readily be seen coursing below the hemidiaphragms in the large majority of normal chest roentgenograms. These vessels may not be well visualized when films are underpenetrated, in obese patients, those with large breasts, or those in whom the hemidiaphragms assume a relatively flat contour. These conditions should be readily recognized. Lower lobe atelectasis and pneumonia can also be readily identified through the use of clinical and radiographic signs. Subdiaphragmatic pathology must be considered and should rarely cause confusion. When all of the above conditions have been excluded, and there is no explanation for the abrupt termination of vascular shadows at the apparent level of the diaphragm, subpulmonic effusion must be strongly suspected and can be readily confirmed by lateral decubitus roentgenograms.

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radiologic sign may be the earliest evidence of sub-pulmonic fluid accumulation.

REFERENCES
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A Luminary of Modern French Culture

Georges-André Malraux was born on November 3, 1901, in Paris. The French look upon André Malraux as a remarkably multiple man. He is invariably classified first as a high adventurer, being to the French a heroic fugitive from the commonplace, a modern romantic who is at home only at the altitude of dangerous events. In the second place comes the Malraux who is internationally best known—the writer and Goncourt Prize winner who created a virile and violent type of novel about modern man’s fate. The third Malraux is the intellectual obsessed with action, who took part in a revolution on the other side of the globe, flew a plane in a neighboring civil war and fought in the French Resistance. Fourth is Malraux the political agnostic, who, long since having lost hope in yesterday’s experimental Communism, after the Liberation believed in the Social Renovation of France under General de Gaulle. Fifth, and most recent, is the Malraux who has summed up the experiences of his senses in The Voices of Silence, a book on his theories of art which has established him on both sides of the Atlantic as a new interpreter of universal humanism.

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