

Differences between Right and Left Lateral Chest Radiographs

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Differences between 150 normal right lateral chest teleroentgenographs and 150 left laterals (infants, children, and adults) were evaluated and determined to be greater than has been generally appreciated. On the left lateral view the left leaf is distinguished from the right leaf by the following generalizations: anteriorly the left leaf is lower; posteriorly it is higher as is its costophrenic sulcus; it intersects the relatively flattened right leaf near the posterior heart border; the stomach bubble and/or colon are immediately subjacent; there is no segmental obliteration by the inferior vena cava as there often is with the right leaf; in adults the outline of the left leaf is often sharper. When both major fissures can be identified, the left almost always intersects its diaphragmatic leaf posterior to and more vertically than the right fissure.

Radiologists have tended to evade differences between right and left lateral chest radiographs, using the general term lateral view only. It is generally thought that on routine radiographs the difference between the two is insignificant. We have analyzed the magnitude and significance of these differences using both in vivo and simulation studies (see Appendix). Since most of them center on the appearance of the leaves of the diaphragm, this investigation enabled recognition of some features associated with a specific view. Recognition of the differences in the leaves allowed more accurate determination of the anatomy of the lung bases and costophrenic sulci.

The literature on lateral view differences is surprisingly scant. Only Rabin [1] observed that the leaf farther from the film is projected lower on lateral view due to beam divergence with correct beam centering above the diaphragm. Many investigators described diaphragmatic abnormalities seen on lateral view and discussed relationships of the diaphragm to the heart and inferior vena cava without specifying which lateral view was used.

Materials and Methods

A prospective study of upright 183 cm (6 feet) chest films interpreted as normal was undertaken. Significantly rotated lateral views were not included. Three separate age groups (50 each) were considered: infants less than 1 year, children from 1 to 12 years, and adults. Neonates and patients over 70 were not included. For adults, both lateral views were taken on the same patient. For infants and children, only one lateral view was taken and groups of 50 different patients compared. Both lateral studies were taken as identically as possible. Radiographic features of the 150 right and 150 left lateral chest films were compared.

TABLE 1

Radiographic Features of Right and Left Lateral Views

Criterion	Right Lateral View %	Left Lateral View %
Leaf of diaphragm seen best through heart:		
Right	93	63.3
Left	3	22
Equal or undetermined	3	14.7
Higher leaf anteriorly:		
Right	98	68
Left	2	24.7
Equal	0	7.3
Higher leaf posteriorly:		
Right	85.3	14.7
Left	11.3	78.7
Equal	3.3	5.3
Obliteration of segment of right leaf by IVC:		
Yes	14	52
No	86	48
Dense caval triangle present ..	8.7	19
Arch of posterior leaves:		
Concentric	68	48.7
Right flatter	6	50.7
Left flatter	26	0.6
Sharper leaf:		
Right	52.7	4
Left	3.3	35.3
Equal	44	60.7
Identification of major fissure:		
Right	60.7	40.7
Left	17.3	26
Both	23.3	19.3

Note—IVC = inferior vena cava.

In distinguishing between right and left diaphragmatic leaves, subjacent gas in the stomach and colon was utilized most often. Prior to this study we observed other distinguishing features: the leaf closer to the film was higher, more convex, and more sharply delineated. A segment of the right leaf was often obliterated by the inferior vena cava. The few cases in which there was doubt about the identity of the leaves were not included.

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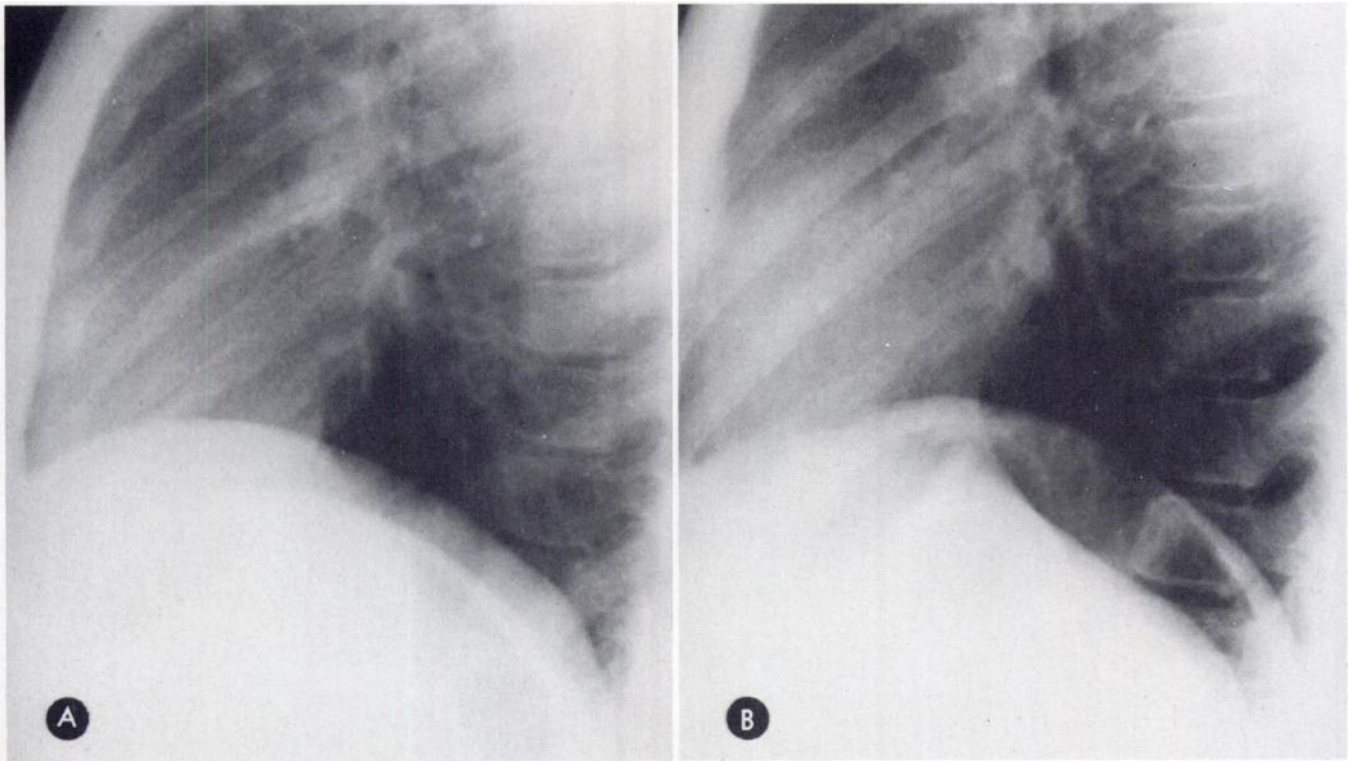


Fig. 1.—Typical right lateral (A) and left lateral (B) view; 12-year-old girl.

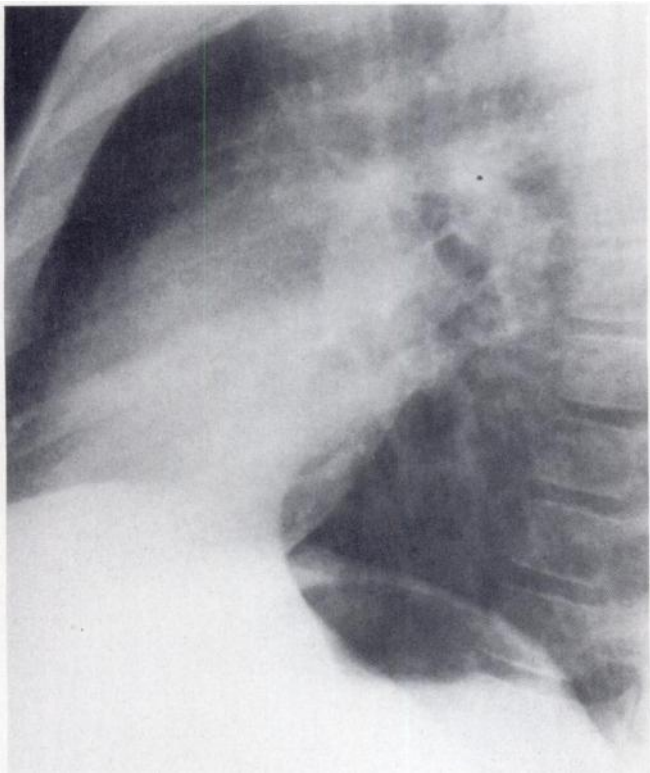


Fig. 2.—Left lateral view showing obliteration of segment of right leaf near inferior vena cava. Note relative density above segment that could simulate abnormality.

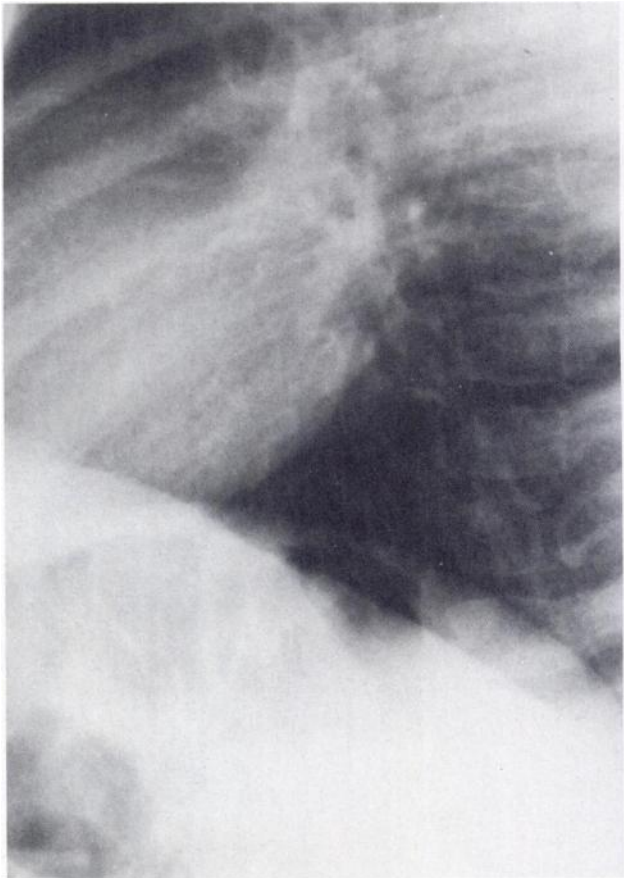


Fig. 3.—Left lateral view showing flattened posterior arch of right leaf.

Results

The findings are summarized in table 1 and typical views shown in figure 1.

Radiographic Features of Diaphragmatic Leaves

Leaf seen best through heart. It is often said that the right hemidiaphragm can be distinguished "on lateral" by the fact that it extends through the heart shadow to the anterior chest wall. We found that this statement is not applicable to the left lateral view since in 37% the left leaf was seen better or as well as the right leaf through the heart.

Level of leaves. In general the leaf and its posterior sulcus nearer the film are higher because of beam divergence. An exception is seen on the left lateral view where anteriorly the right leaf is often higher. In this case the divergence effect is diminished since the heart depresses and often obliterates the shadow of the anterior part of the left leaf, allowing the anterior portion of the right leaf to be projected higher.

Obliteration of right hemidiaphragm. On the left lateral view, half of the cases showed obliteration of a segment of the right leaf in the region of the inferior vena cava and its pericardial and pleural attachments. This finding is infrequently seen on the right lateral since the diverging beam strikes the right leaf at a different tangent (i.e., further from the inferior vena cava). Many of the cases that demonstrate this obliteration effect also have an associated triangular density above the obliterated segment (fig. 2). We think this relative density is caused by the lateral convexity of the inferior vena cava bulging into the surrounding lung as it enters the heart. This could simulate an infiltrate, atelectasis, or infarction in the medial basal segment of the right lower lobe if one were not aware of this normal radiographic image.

Flattening of posterior leaves. Due to the divergent beam striking each posterior leaf at different tangents, the posterior part of the leaf farther from the film appears to have a relatively flattened arch (fig. 3). This effect is seen in over half the cases on the left lateral view.

Unsharpness of leaves. Particularly in adults, the leaf farther from the film often appears less sharp than its mate; this is a manifestation of magnification unsharpness.

Identification of major fissures. The right major fissure is identified more often than the left on both lateral views and, as expected, this tendency is more pronounced on the right lateral. Of the 64 cases (on both lateral views) in which we identified both fissures, the right major fissure was anterior to the left major fissure near the diaphragm in all but one. In addition, when both were seen, the right major fissure usually intersected its respective leaf less vertically than the left (fig. 4).

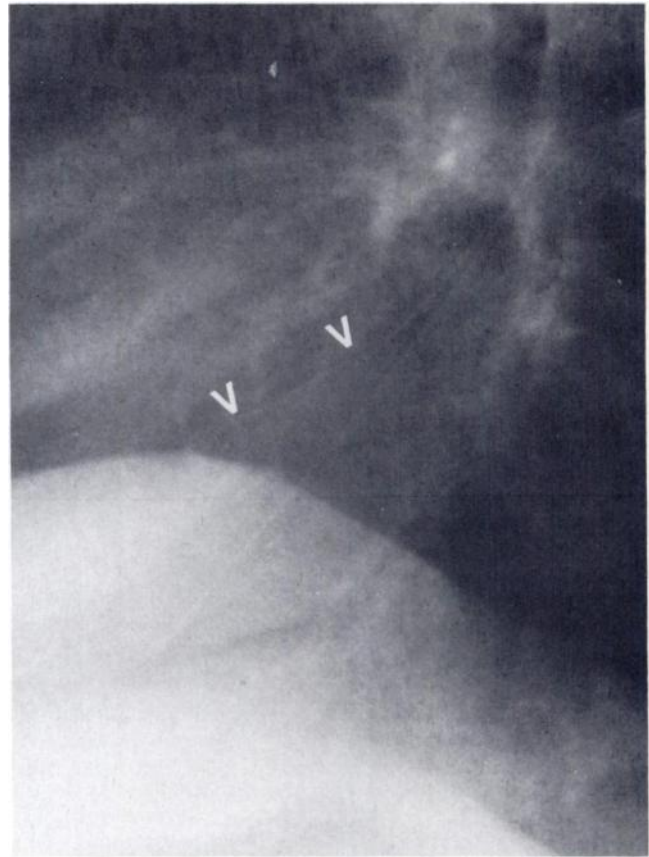


Fig. 4.—Right lateral view with major fissures evident. Right fissure is more anterior and intersects its leaf more obliquely (arrows).

Other Findings

The posterior rib margins farther from the film were more posterior, less sharp, and more magnified. In female adults the breast closer to the film appeared to be more posterior, denser, smaller, and to have a sharper outline. In infants the clavicle nearer the film was lower than its partner since beam centering was below the clavicle.

Discussion

In general, the differences in the two lateral views were greater and more consistent in adults than in infants. Differences were easier to appreciate in a larger chest than a smaller one. On the upright posterioranterior view the right leaf tended to be consistently higher than the left in all infants, so that on the left lateral the anterior right leaf often remained the higher one in spite of divergence.

The described characteristics of each lateral view are generalizations only. They cannot be expected to apply to elderly patients with diseased lungs or to cases in which a somewhat rotated lateral view is obtained. Some of our "normal" cases (about 5%) had appearances quite the opposite to that expected. Factors that tend to distort, negate, or reverse the characteristic

appearance are beam-centering errors (either horizontal or vertical), patient rotation, patient lean, and abnormal existing levels of the diaphragmatic leaves. Even slight rotation will significantly distort the diaphragmatic leaves in patients who have a steep vertical slope of the posterior diaphragm. If films are taken at less than 183 cm, involving greater beam divergence, differences between the lateral views are accentuated.

ACKNOWLEDGMENT

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APPENDIX

Simulation Study

Prior to the study we simulated the diaphragmatic leaves by placing two adjacent inverted soup bowls at equal levels in front of a cassette. Each bowl was designated by left (L) and right (R) lead markers. Radiographs were taken at a 183 cm distance through these bowls and differences observed caused by changes in tube centering and reversal of bowl position relative to the cassette.

The equilevel bowls were projected on the radiographs as equilevel when the beam was centered on the bowls (fig. A1, B). With centering 12.7 cm above the bowls, that one closer to the cassette was projected about 2 cm higher than its mate (fig. A1, A and C). The radiographic image of the bowl and lead marker farther from the cassette was more magnified and its outline less sharp. It also appeared less dense.

From these findings we calculated that there is approximately an 8.5% difference in the degree of magnification in the length of the outline of the diaphragmatic leaves on 183 cm teleroentgenograms in the average adult. Diaphragmatic leaves at equal levels should be projected apart by approximately 2 cm on a properly centered lateral radiograph.

REFERENCE

1. Rabin CB: *Radiology of the Chest. Golden's Diagnostic Roentgenology*, vol. 2. Baltimore, Williams & Wilkins, 1964

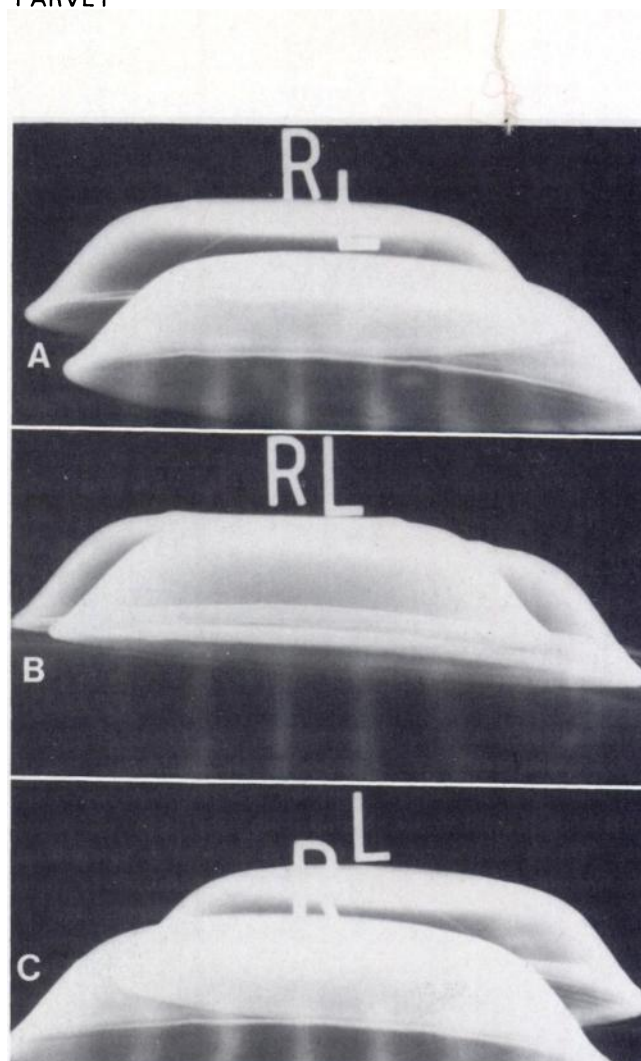


Fig. A1.—A. Simulated right lateral view with beam centered 12.7 cm above bowls. Right bowl is higher, smaller, and sharper. B. Equilevel bowls projected as equilevel with beam centered on bowls. Note L marker is more magnified and less sharp. C. Simulated left lateral view with centering 12.7 cm above bowls. Right "leaf" is more magnified, lower, and less sharp.