RADIOLOGIC NOTES IN CARDIOLOGY

Left Anterior Oblique View for Evaluation of Left Atrial Size

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SUMMARY
The left anterior oblique film of the chest provides a sensitive and accurate gauge of left atrial enlargement. The posterior wall of the atrium, which distends when the chamber enlarges, is seen in profile in this view. Dilatation of the left atrium is almost always reflected by this segment which assumes a convexly curved contour. This finding is independent of most of the conditions that can alter the other roentgen signs of left atrial enlargement.

Additional Indexing Words:
Mitral stenosis Mitral insufficiency

ENLARGEMENT of the left atrium can be reflected on films of the chest in several ways. To achieve the greatest accuracy in detecting enlargement of this chamber, it is necessary to view the heart in multiple projections because no single roentgen sign will be positive in every case. The left anterior oblique view of the heart is of considerable use in evaluating left atrial size because the posterior wall of the atrium forms a part of the heart border in this view and is clearly outlined by the adjacent radiolucent lung. As the atrium enlarges, its posterior wall bulges outward. This can be detected with relatively minor degrees of dilatation of the chamber, even when other roentgen signs of left atrial enlargement are inconclusive.

When viewed in the frontal projection, the left atrium is completely hidden within the cardiac silhouette except for its appendage, which forms a small segment of the left heart border (fig. 1, left). The normal atrium lies mostly within the left chest but does extend far enough to the right to cross the midline. The greater portion of the posterior wall of the left atrium is in contact with posterior mediastinum, and their roentgen shadows blend with each other. The contour of this part of the atrial wall can be evaluated only indirectly, by its effect on the anterior wall of the barium-filled esophagus. The left portion of the posterior atrial wall extends beyond the border of the posterior mediastinum and abuts against the lower lobe of the left lung. It is this region of the atrial wall that can be seen, silhouetted against the air-containing lung, when the patient is viewed in the left anterior oblique position (fig. 1, right).

In the left oblique view, the lower one half to two thirds of the left border of the heart is formed by the left ventricle, and the upper portion, by the posterior wall of the left atrium. Rarely, a notch can be identified in this border, indicating the position of the atrioventricular sulcus between the two chambers. Most commonly, the left border of the
Mitral stenosis and insufficiency with pulmonary hypertension. (Left) Frontal film. The left atrium is considerably dilated but lies almost completely within the boundaries of the cardiac silhouette. The increased density produced by the left atrium is obvious; its border (arrowheads) demarcates the double density within the shadow of the right side of the heart. A small segment of the left border of the heart (between white arrows) is formed by the left atrial appendage. The bulge of the appendage appears minimal despite the considerable size of the atrium because it is partially obscured by the concomitant enlargement of the left ventricle. (Right) Left anterior oblique projection. The left portion of the posterior wall of the left atrium is seen in profile (arrow) and is outlined by the adjacent lung. The convex contour of this segment indicates enlargement of the left atrium. The left main bronchus (L) is elevated by the atrium and forms less of an obtuse angle with the trachea (T) than in the normal.

The left main bronchus normally courses through the middle mediastinum above and slightly behind the left atrium. The bronchus is usually separated from the shadow of the left atrium in the left anterior oblique view (fig. 2, left). However, it is possible, by turning the patient into different degrees of obliquity, to project the bronchus over the upper border of the atrium (fig. 2, right). This has no significance in terms of left atrial enlargement. It is true that a large left atrium can come in contact with and elevate the left main bronchus. However, when this occurs, the tracheobronchial angle becomes narrowed as the bronchus is pushed toward the horizontal.

The left anterior oblique view is obtained by turning the patient to an angle of about

Figure 1
Figure 2

Appearance of the normal heart in the left anterior oblique view. (Left) Patient 1. The left atrial segment (arrows) forms the upper half of the left border of the heart and is essentially straight. In this moderately steep oblique view, the shadow of the left main bronchus (L) is completely separated from the atrium. (Right) Patient 2. The left atrial segment is straight (arrows). The left main bronchus (L) appears to be in contact with the upper border of the left atrium. However, the bronchus is not elevated and the tracheobronchial angle is normal. T = trachea.

45° relative to the plane of the film, with his left shoulder in contact with the cassette. If the degree of obliquity is too slight, the left atrium remains hidden within the cardiac silhouette. When the obliquity is too great, the portion of the posterior left atrial wall in contact with the left lung is projected over the other cardiac structures and no longer forms part of the border. The midportion of the atrial wall now comes into profile and cannot be identified because its shadow blends with that of the posterior mediastinum.

The position of the esophagus in relation to the cardiac shadow varies with the degree of obliquity. Frequently, when the patient is properly positioned for the left anterior oblique view, the esophagus will be aligned with the posterior border of the left atrium. If the esophagus is opacified first, it will completely obscure the left atrial contour (fig. 3). For this reason, when a cardiac series is being made, the left oblique view should be obtained first, before the patient is given barium for the other films.

A double density within the right cardiac border, dilatation of the left atrial appendage, and an indentation on the anterior aspect of the esophagus are often considered to be the sine qua non for the radiologic diagnosis of enlargement of the left atrium. This is not completely valid. On occasion, all three findings may provide only equivocal diagnostic information. Posterior bulging of the left atrium as seen in the left oblique view is a sensitive and relatively constant indicator of left atrial enlargement and, in certain instances, is more reliable than the other roentgen signs.
margin to be identified. In addition, false-positive results are not rare. The lateral margin of the confluence of the right pulmonary veins is often seen within the right heart border and can mimic the appearance of the double density indicative of left atrial enlargement.

Dilatation of the left atrial appendage produces a bulge along the left border of the heart viewed in the frontal projection, between the curves of the main pulmonary artery segment and the left ventricle. However, if the left ventricle is also enlarged, the accentuated curve of the atrial appendage may simply blend with that of the ventricle (fig. 4, left). The sign may not be applicable in the study of the postoperative heart because the appendage is usually removed at the time of mitral surgery. Another type of error can be made from the appearance of the left atrial appendage, usually in patients with a narrow anteroposterior chest diameter. The heart is flattened between the sternum and the spine causing the appendage to protrude from the left cardiac border even though the atrium is normal in size (fig. 5, top left).

Posterior displacement of the esophagus is an accurate sign of left atrial enlargement but, at times, can be misleading. In some cases, as the atrium enlarges, the esophagus slips to one side or the other and may appear undistorted in the lateral view. In other cases, when the esophagus is partially fixed to the descending aorta by connective tissue, and if the aorta is tortuous or buckled, the esophagus will appear to be displaced. On occasion, the retracted esophagus may assume the same type of curve as the esophagus that is displayed by an enlarged left atrium. In other instances, the esophagus is drawn away from the atrium by the aorta and does not show any indentation even though the atrium reaches considerable size.

The appearance of the left atrium in the left oblique view usually provides an accurate indication of the true size of the chamber (fig. 5, top right and bottom). It is valid in the postoperative patient as well as in the presence of left ventricular enlargement (fig.

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**Figure 3**

Left anterior oblique film of a patient with mitral stenosis with considerable left atrial enlargement (seen in other views). The opacified esophagus obscures and obscures the left atrial contour and makes this film relatively useless for evaluation of the size of the left atrium.

One of the least useful signs of left atrial enlargement is the double density along the right heart border. Not uncommonly, the shadow of the right side of the heart appears homogeneous on the frontal film, even in the presence of considerable dilatation of the left atrium. In many cases, the fault lies with the technique of filming. If the exposure factors are the same as those used for a routine chest film, the heart will be underpenetrated and the double density, although present, cannot be detected. On the other hand, even when an adequate film is available, a double density may not be seen if the shape of the enlarged left atrium is such that it does not protrude sufficiently behind the right atrium to allow its
Figure 4

Combined mitral and aortic valvular disease. (Left) Frontal projection. The axis of the heart is elongated downward and to the left indicating enlargement of the left ventricle. The portion of the cardiac contour formed by the left atrial appendage (arrow) is flat; there is no evidence of dilatation of the atrium. (Right) Left anterior oblique projection. Despite the enlargement of the left ventricle, the convex contour of the posterior wall of the left atrium (arrow) is evident, indicating concomitant dilatation of this chamber. This patient was given barium to drink by error. Fortunately, the esophagus is incompletely distended and the atrial contour can still be seen.
Figure 5

Pectus excavatum with resultant narrowing of the chest. (Top left) Frontal film. The prominence of the left atrial appendage (arrow) was detected on this routine chest film. A full cardiac series was advised to confirm the presence of the left atrial enlargement. (Top right) In the left anterior oblique view, the atrial contour is slightly concave (arrow) and shows no evidence of enlargement of this chamber. (Bottom) The lateral film demonstrates the backward displacement of the lower portion of the sternum and the narrowed anteroposterior diameter of the chest.

4, right). A normal left atrial contour can sometimes be seen in this view in the presence of atrial enlargement but this is definitely the exception to the rule. In some of these cases, the bulging atrial contour can be demonstrated if the patient is refilmed in a slightly different degree of obliquity. In general, false-positive results are rare. This is certainly true if the questionable cases, in which there is only a minimal convexity to the left atrial segment, are excluded.
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