The Lateral Projection of the Chest

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One of the most important fundamental principles in roentgenography is the making of two projections at right angles of any part of the body to be examined. This method gives one a true three dimensional study of the part under investigation. The advantages of this procedure in the analysis of any abnormal changes are self-evident and it was naturally adopted in practically all x-ray examinations. In addition to the above there was also introduced the principle of stereoscopy, known as stereoroentgenography, which consists in taking two pictures from slightly different positions. When these are placed in a stereoscopic apparatus one obtains the perception of objects in relief.

The stereoscopic method of examination has achieved great popularity among roentgenologists and was accepted wholeheartedly by physicians and surgeons to the extent that it is now considered to be almost an act of heterodoxy on the part of anyone who expresses doubt as to its value. Without entering into a ful discussion of the merits or demerits of either method I will relate some facts in my own experience and will try to prove by several representative illustrations the superiority of the first method over the second in the great majority of chest examinations.

My first big opportunity to examine chests on a large scale was during the first World War. I found that stereoscopic views of the chest in the anteroposterior position alone added hardly any more information than that obtained from a single view. However, when the patient was examined fluoroscopically from every possible angle it was possible, in the presence of an abnormal shadow in the lung field, to determine more accurately its exact location, shape, size and relationship to the surrounding structures and its probable nature. It has also been found that some abnormal shadows are entirely obscured in the antero-posterior position because of their situation in the course of the cardiovascular shadow. These also are rendered accessible to sight in the oblique or lateral positions.

With the above experience before me the next logical step was to take roentgenograms in the lateral positions. Contrary to the general opinion, which is held by many roentgenologists, the technic is not difficult to acquire by the average technician. In my laboratory lateral views of the chest have been taken routinely
under all kinds of conditions by myself or my technicians with satisfactory results. The only necessary requisite is the application of common sense in x-ray technic. After twenty-five years, during which time the use of the lateral view of the chest was more or less ridiculed, it is indeed a great satisfaction to see that many more illustrations of the lateral view are found in the roentgen literature. This is obvious evidence that its value is finally being appreciated.

A number of cases have been chosen for a more or less detailed description illustrating lesions of the respiratory organs in the anterior and lateral positions. It is hoped that even a casual glance at the roentgenograms will convince any skeptically minded physician of the superior value of this technic in the study of chest affections.

Bronchiectasis usually involves the lower bronchial branches which are often obscured by the heart and diaphragm. The diaphragm, as will be recalled, is not on the same plane through its entire expansion, but gradually slopes down from before backwards and laterally, so that its posterior attachment is on a much lower level than the anterior. Under such conditions the lower region of the lung is more or less obscured when the chest is viewed in the anteroposterior direction, but when the same is observed laterally any changes affecting the pulmonary bases, bronchi, pleura and diaphragm may readily be seen.

CASE REPORTS

Case 1: The anterior view (Fig. 1A) shows nothing remarkable in the lung fields with the exception of calcified nodules in the hilar region. In the lateral view (Fig. 1B) there are noted several irregular dense shadows, some of which show horizontal fluid levels, located in the retrocardiac space above the posterior half of the diaphragm. The bronchial branches extending to the hilum are thickened. The diagnosis of bronchiectasis was later confirmed by the injection of lipiodol. The above recalls other cases of small pleuritic effusion and diaphragmatic pleurisies which were recognized in the lateral view although the anteroposterior view was apparently negative.

Calcified glands are frequently seen in the course of the trachea and bronchial tree in the anterior projection, but when they occupy a position within the boundaries of the cardiovascular shadow they usually escape notice. If this applies to such opaque shadows, it is even more true in the case of soft shadows when they happen to be in similar locations. It is quite obvious that their recognition is difficult and some other method must be used such as the lateral projection.

Case 2: The anterior view (Fig. 2A) show emphysematous lungs with a low diaphragm. No other abnormal changes are noted, however, in
Fig. 1A. Normal heart and lungs. Several calcified nodules in hilum. (Ant. View.)—Fig. 1B. Horizontal fluid levels in several dense irregular shadows located behind heart and diaphragm due to bronchoclesis. (Lat. View.)
Figure 2A
Calcified glands along the course of the trachea and upper bronchi, not seen in the anterior view (Lat. View).

Figure 2B
Normal heart and great vessels with emphysematous lungs (Ant. View).
Fig. 3A: Normal heart and great vessels. Lungs are clear. (Ant. View.)

Fig. 3B: Metastatic tumor displacing the trachea forward which disappeared under x-ray treatment. (Lat. View.)
Fig. 4A: Consolidation of the right upper lobe due to pneumonia. (Ant. View).—Fig. 4B: Note the typical configuration of the right upper lobe with straight boundaries representing the oblique and horizontal interlobar fissures. (Lat. View).
Fig. 5A. Consolidation of the right upper lobe due to a pulmonary tumor. Its lower boundary is convex. (Ant. View)

Fig. 5B. The margins representing the interlobar fissures are convex giving the mass a globular shape. (Lat. View)
the lateral view (Fig. 2B). Several large calcified glands are seen in the course of the trachea and hilar regions.

**Case 3:** In the anterior view (Fig. 3A) nothing remarkable is noted about the cardiovascular or pulmonary structures, but in the lateral view (Fig. 3B) the trachea is displaced forward by a soft mass. In view of the history of an operation for teratoma testis the lesion was considered to be of metastatic nature and was treated accordingly with x-ray. This resulted in complete disappearance of the nodule with restoration of the trachea to its normal position.

As a rule, the x-ray diagnosis of lobar pneumonia is not difficult to make even on a single anterior view; however, at times a pulmonary tumor or pleurisy with effusion may simulate in its appearance the shadow of a consolidated lobe. The differentiation depends upon the configuration of the shadow. In case the shadow is due to a consolidated lobe its shape will conform both in the anteroposterior and lateral views to the anatomical lobe. In case of a tumor the shadow assumes a globular or irregular appearance and in pleurisy with effusion it is variable.

**Case 4:** The anterior view (Fig. 4A) shows a uniform dense shadow in the region of the right upper lobe. The lower boundary is sharply defined and corresponds to the horizontal fissure between the upper and middle lobe. In the lateral view (Fig. 4B) the shadow is bounded posteriorly by the oblique interlobar fissure between the upper lobe and apex of the lower lobe. Below and anteriorly it is bounded by the horizontal fissure. The configuration of the shadow both in the anterior and lateral views corresponds exactly to the shape of the upper lobe. Hence the lesion is due to a pneumonic consolidation.

**Case 5:** The anterior view (Fig. 5A) shows a dense uniform shadow in the region of the right upper lobe. The lower boundary of the shadow is somewhat convex. In the lateral view (Fig. 5B) the lower and posterior boundaries are also more or less convex instead of being straight as in the previous case. Because of the general globular outline of the shadow the diagnosis of a pulmonary tumor was made and was proven to be correct.

**Case 6:** The anterior view (Fig. 6A) presents a dense shadow in the region of the middle lobe. The upper margin is sharply defined and corresponds to the horizontal fissure between the upper and middle lobes. In the lateral view (Fig. 6B) the dense shadow is triangular in shape. The upper horizontal margin corresponds to the interlobar fissure between the upper and middle lobes. The lower margin is oblique and corresponds to the interlobar fissure between the middle and lower lobes. The anterior vertical margin is parallel to the anterior chest wall. The configuration of the shadow both in the anterior and lateral views corresponds to the shape of the middle lobe and is, as a rule, only found in pneumonic consolidation. If stereoscopy would do what some think it can do one should see the triangular shadow of the consolidated lobe in the anteroposterior position but in actual experience this is found to be impossible.
Figure 6A: Pneumonic consolidation of the middle lobe. Upper boundary is sharp and corresponds to the horizontal fissure. (Ant. View). — Fig. 6B: Triangular dense shadow corresponding in shape to middle lobe. The boundaries are the horizontal and oblique interlobar fissures. (Lad. View).
Figure 7A: Dense shadow in region of middle lobe. Upper boundary is poorly defined. (Ant. View.)—
Fig. 7B: The dense shadow is oval-shaped and is in the course of the interlobar tissue between middle and lower lobes due to an interlobar pleurisy. (L. Ant. View.)
Figure 8B: The dense shadow is located anteriorly along the course of the horizontal fissure due to a pleuro-pulmonary lesion.

Figure 8A: A dense irregular shadow in the region of the right hilum (Ant. View).

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Fig. 9A. Circumscribed oval-shaped shadow on the right side of the chest due to an encapsulated empyema (Ant. View).

Fig. 9B. The shadow is located posteriorly on the right side of the chest due to an encapsulated empyema (Lat. View).
Fig. 10A. Circumscribed dense shadow with fluid level in right lung thought to be due to an abscess. (Ant. View.) — Fig. 10B. The dense shadow is located in the course of the oblique interlobar fissure and is due to an encapsulated empyema. (Lateral View.)
Case 7: The anterior view (Fig. 7A) shows a dense shadow in the region of the middle lobe. In the lateral view (Fig. 7B) the dense shadow is oval shaped and is located along the oblique interlobar fissure between the lower and middle lobes. Its configuration is not that of the middle lobe but is due to a collection of fluid between the lobes due to an interlobar pleurisy.

Case 8: The anterior view (Fig. 8A) is of special interest because it was misinterpreted by many stereoscopic enthusiasts who thought that the dense shadow on the right side originated from the hilum. They were very much dismayed to see the lateral view (Fig. 7B) which showed the shadow located anteriorly adjacent to the horizontal interlobar fissure. Apparently it was due to a pneumo-pleuritic lesion.

The accurate location of an encapsulated empyema is absolutely essential for obvious reasons. The most satisfactory method is by means of the anteroposterior and lateral positions.

Case 9: The anterior view (Fig. 9A) shows an oval shaped shadow of uniform consistence in the right lung field along the right cardiovascular border. The patient recovered from a pneumonia but soon afterwards developed symptoms suggestive of an abscess or empyema. Stereoscopic views in the anterior position were taken elsewhere but in spite of these they were unable to determine the exact location or the true nature of the shadow. On fluoroscopic examination the patient was turned on the side and in a moment it was quite evident to everyone present that the shadow was located posteriorly and was related to the interlobar fissure as shown in the lateral view (Fig. 9B). The diagnosis of an encapsulated empyema was confirmed by operation.

Case 10: The anterior view (Fig. 10A) shows a circumscribed dense shadow with a horizontal fluid level in the right lung. It was considered to be a pulmonary abscess because of the fluid level. In the lateral view (Fig. 10B) the shadow lies along the course of the oblique interlobar fissure and is sharply defined. The interlobar fissure below the shadow is thickened and apparently adherent preventing the fluid from extending toward the base. The air within the shadow was undoubtedly due to attempts at aspiration of the fluid. The immediate recovery after operation fully confirmed the fact that the lesion was due to an encapsulated empyema rather than a pulmonary abscess.

The importance of correct localization of pulmonary abscesses is just as valid as in the case of encapsulated empyema and its accomplishment is attained in the same manner.

Case 11: The anterior view (Fig. 11A) shows a dense shadow with a fluid level in the region of the middle lobe. In the lateral view (Fig. 11B) the shadow of the abscess is located just behind the anterior chest wall and to the right of the sternum. It would seem that the localization of the abscess ought to have satisfied any surgeon, but to my surprise a request was made for stereoscopic views in the anterior position. These were made but in spite of them the surgeon could not find the abscess. The reason, as I found out later, was due to the fact that the incision was made at the periphery of the chest instead of medially near the sternum where the abscess was shown to be located. I am still puzzled.
Fig. 11A: Dense shadow with fluid level in region of middle lobe due to an abscess. (Ant. View.) — Fig. 11B: The abscess is located anteriorly behind anterior chest wall to right of sternum. (Lat. View.)
**Figure 12A**

*Fig. 12A:* Dense shadow with fluid level in the region of middle lobe due to an abscess. (Ant. View).

**Figure 12B**

*Fig. 12B:* The abscess is located not in the middle lobe, but posteriorly in the lower lobe to right of the spine. (Lat. View).
**Figure 13A**

*Fig. 13A:* Dense shadow along the left cardiac border, the nature of which is uncertain. (Ant. View).

**Figure 13B**

*Fig. 13B:* Dense shadow with fluid level located to the left of spine and obscured completely by the heart. (Lat. View).
as to why the surgeon got such a wrong impression from the stereo-
scopic views when the true location was so evident. When attention was
again called to the exact location, the operation proceeded without
interruption and terminated successfully.

Case 12: The anterior view (Fig. 12A) shows a circumscribed dense
shadow with a fluid level due to a pulmonary abscess. It is located, as
in the previous case, in the region of the middle lobe, but in the lateral
view (Fig. 12B) the shadow is seen to be located posteriorly on the right
side of the spine in the lower lobe.

Case 13: The anterior view (Fig. 13A) shows nothing unusual except
a dense narrow shadow along the left border of the heart, the nature
of this is uncertain. In the lateral view (Fig. 13B) a dense shadow with
a fluid level is seen overlapping the spine and is due to an abscess in
the left lower lobe. It was completely obscured by the heart shadow.

The diagnosis of pulmonary tumors is, generally speaking, not
difficult; however, as mentioned before, when they are entirely
obscured by the cardiovascular shadow, a lateral projection is
necessary. Even when located in the lung field their exact local-
ization is essential for a more accurate diagnosis so again the
lateral view is necessary.

Case 14: In the anterior view (Fig. 14A) a dense circumscribed shadow
is seen in the region of the right upper lobe which appears to involve
most of the lobe, but in the lateral position (Fig. 14B) the shadow is
located posteriorly and involved only the posterior one-third of the
parenchyma.

Case 15: The anterior view (Fig. 15A) shows a small nodule above the
left diaphragm and to the left of the cardiac border. In the lateral view
(Fig. 15B) the shadow is located in the mid-axillary line in the left
lower lobe and is adherent to the diaphragm. Above there are noted
dense striae extending to the hilum. With a knowledge of the exact
location of the tumor it was possible to do an aspiration biopsy which
proved the malignancy of the nodule. On operation the hilar region was
found to be involved and it was considered to be inoperable.

Case 16: The anterior view (Fig. 16A) shows an area of greater density
in the region of the right cardiophrenic angle. The outline of the dia-
aphragm is more or less obscured by the shadow. In the lateral view (Fig.
16B) the dense shadow appears to be limited to the anterior portion
of the lower lobe. Above, the shadow extends to the hilum. The diagnosis
of a new growth was confirmed by operation at which time it was found
to be inoperable.

I find no special advantage in taking a lateral view of an early
or moderately advanced pulmonary tuberculosis. The superposi-
tion of the lungs more or less obscures the parenchymatous
changes, but in advanced cases it was found that the lateral
view often gives more accurate information of the state of the
pathological process. It also often helps to determine the exact
lobe or lobes which are involved.
Fig. 14A: Dense circumscribed shadow in the right upper lobe due to a tumor. (Ant. View).

Fig. 14B: The tumor involves the posterior portion of the upper lobe. (Lat. View).
Figure 15A: Dense shadow at the base of left lung due to a tumor. (Ant. View) — Fig. 15B. The tumor is located in the middle of thorax and is adherent to diaphragm extending also to hilum. (Lat. View)
Figure 16A: Dense shadow in the region of the cardio-phrenic angle on the right side due to a tumor. Ant. View. (Fig. 16B: The tumor invades the inferior portion of lower lobe, not being sharply separated from the upper lobe by the oblique fissure. Lat. View.)
Figure 17A: Pulmonary tuberculosis of the right upper lobe, and apparently the left lower lobe. (Ant. View).—Fig. 17B: The lower lobes of each lung are clear. The lower segment of the left upper lobe is involved. (Lat. View).
**Figure 18A**

Fig. 18A: The left upper lobe shows a tuberculous process. The great vessels are displaced to the left. (Ant. View).

**Figure 18B**

Fig. 18B: The oblique interlobar fissure is displaced forward on account of atelectasis of the upper lobe. The lower lobe is emphysematous. (Lat. View).
The middle mediastinal structures are displaced to left due to atelectasis of the left lower lobe, while the upper lobe is markedly emphysematous and occupies the entire retro-sternal space. (Lat. View).

The heart and vessels are also displaced backward due to atelectasis of the lower lobe. (Ant. View).

Fig. 19B: The lateral projection of the chest
Fig. 20A. Right diaphragm is elevated and its excursions are limited. (Ant. View) — Fig. 20B. The posterior costophrenic angle is clear and is lower than the anterior. This is due to an enlarged liver. (Lat. View).
Case 17: The anterior view (Fig. 17A) shows parenchymatous infiltration of a tuberculous nature in the right upper and left lower lobe. However, in the lateral position (Fig. 17B) the lower lobes of both lungs are clear. The upper lobe of the left lung shows involvement along its posterior boundary. The boundary of the oblique interlobar fissure is sharply outlined which nicely illustrates its exact position as it bisects the lung diagonally into two equal parts.

Case 18: The anterior view (Fig. 18A) shows marked involvement of the left upper lobe apparently as a result of a chronic pulmonary tuberculosis. The great vessels are shifted somewhat to the left and their borders are obscured by the dense pulmonary shadow. In the lateral view (Fig. 18B) the interlobar fissure is shifted forward as a result of partial atelectasis of the upper lobe, while the parenchyma of the lower lobe is emphysematous and its size is increased to compensate for the collapse of the upper lobe.

Case 19: The anterior view (Fig. 19A) shows complete displacement of the cardiovascular shadow to the left apparently as a result of atelectasis of the lower left lobe. In the lateral view (Fig. 19B) the heart and great vessels are also displaced backward and the apex of the heart is pointing toward the spine. The anterior clear space is greatly enlarged due to emphysema of the upper lobe. Could anyone imagine the existence of the above changes without the lateral view?

Attention has already been called to the normal position of the diaphragm both in the anterior and lateral projections. Under abnormal conditions the diaphragm may be found to be elevated or displaced downward. The most frequent and important finding is elevation of the right diaphragm which may be due either to an enlarged liver or a subphrenic abscess. It is evident that the differentiation between the two conditions is of utmost importance. The two following cases will help in making such a diagnosis.

Case 20: The anterior view (Fig. 20A) shows elevation of the right diaphragm. Its mobility was found to be limited. In the lateral view (Fig. 20B) the diaphragmatic arc is greatly increased, but the posterior costophrenic angle is not obliterated and the relative heights of the anterior and posterior attachments remain constant. As a rule, such changes are found frequently as a result of an enlarged liver, increased intra-abdominal pressure or phrenic paralysis. In this case it was due to an enlarged liver.

Case 21: The anterior view (Fig. 21A) shows elevation of the right diaphragm with impaired mobility as in the previous case, but in the lateral view (Fig. 21B) the posterior costophrenic angle is completely obliterated and the post-diaphragmatic attachment appears to be on a higher level than the anterior. The whole diaphragmatic surface appears to be flattened giving one the idea of a plateau, hence it is called the plateau sign of subphrenic abscess which is the lesion very often found in the presence of such a diaphragmatic configuration. The importance of this sign has been demonstrated in a number of cases as confirmed by operation; although the clinical, physical and the usual x-ray findings were indefinite.
Fig. 21A: Right diaphragm is elevated and its excursions are limited. (Ant. View) — Fig. 21B: The posterior costo-phrenic angle is obliterated. The diaphragm is flattened. This is frequently found in subphrenic abscess. (Lat. View).
CONCLUSION

The application or use of anterior and lateral projections in the study of the chest in many thousands of cases has convinced me that its value is of no less importance than in the examination of an extremity for a possible fracture or dislocation. By their use one obtains a more accurate knowledge of the position, shape, size and relationship of abnormal shadows than is ever possible by stereoscopy taken in one direction alone. The information thus obtained leads one to a more accurate diagnosis which is the goal of every examination.

REFERENCES

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