High Kilovoltage Oblique Roentgenography of the Chest: Its Advantage in Differential Diagnosis in Diseases of the Lung and the Pleura

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Roentgenographic differentiation between lobar and segmental pathology of lung on the one hand and pleural effusion or thickening on the other, does not usually present difficulties. The conventional posteroanterior and lateral roentgenograms of the chest and fluoroscopy are usually sufficient to detect and localize intrathoracic shadows. Moreover, they are usually sufficient for the differential diagnosis of lobar and segmental collapse, pleural effusion and other intrathoracic lesions.1-4 A lateral decubitus roentgenogram has the advantage of detecting small amounts of pleural effusion.7 Difficulty arises, however, when pleural effusion* (or thickening) acquires an atypical arrangement; infralobular effusion may resemble opacity of the lower lobe. On the right side, interlobar effusion may resemble atelectasis of the middle lobe.

The lobar and segmental boundaries of the lung converge towards the hilum like spokes of a wheel. Thus each segment resembles a pyramid with its base “sitting” on the pleural surface; its sides converge towards the apex of the pyramid in the hilum of the lung.8 Similarly, all the blood vessels of the lung converge towards the hilus which are located on the posterolateral aspect of the heart. Therefore, the oblique view of the chest is used to examine the pulmonary veins in heart disease.6 In the left anterior oblique projection, the converging segmental and main trunks of the right pulmonary artery and veins are actually seen superimposed on the heart shadow, whereas those from the left lung are distinguishable with difficulty. The opposite is true in the right anterior oblique projection. Oblique projections are also utilized to display the bronchial tree in bronchography. During collapse, the sides of the pyramid move towards one another as in the closing of a fan, while the apex always remains at the hilus.4•

If we look at the hilus of the lung through the heart shadow, using high voltage oblique roentgenography of the chest, the collapsed lobe or segment may appear as a dense triangle with its apex at the hilus. The vessels of the remaining parts of the lung appear spread apart to fill the space evacuated by the collapsed lobe or segment. In the oblique view, the edge between the opaque collapsed lower lobe or middle lobe and the translucent lung may

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Figure 1: Left anterior oblique high kilovoltage showing triangular shadow with its base at the posterior part of the right diaphragm.
appear sharper and better defined than in the conventional chest roentgenograms. The root of the right lung is viewed in the left anterior oblique projection, and that of the left, in the right anterior oblique projection. This technique usually enables us to decide if an opacity in the lung parenchyma is due to collapse or other causes not segmental in distribution.

Pleural effusion on the other hand, usually spills towards the costophrenic and cardiophrenic sinuses. The oblique roentgenogram of the chest shows a density adjacent to the diaphragm with a concave border. The shadow cast by pleural effusion does not resemble a triangle with its apex at the hilus. Even cases of effusion in the interlobar fissures present no diagnostic difficulties, provided that both oblique projections are done.

**Case Reports**

**Case 1**

This woman of 61 years was referred for examination because of hemoptysis. The posteroanterior roentgenogram shows lowering of the right hilus with a density in the lower lung field adjacent to the heart shadow. The right lateral roentgenogram shows the density in the lower lobe. The high kilovoltage left anterior oblique projection (Fig. 1) shows a triangular shadow with its base at the posterior part of the right diaphragm and its apex at the right hilus. Oblique tomography shows an obstruction of the lower lobe bronchus with atelectasis of the lower lobe. Operation disclosed a tumor obstructing the orifice of the lower lobe bronchus, sparing the middle lobe bronchus. Biopsy showed the tumor to be an adenoma.

**Comment:** In this case, the triangular shadow was caused by atelectasis of the right lower lobe.

**Case 2**

This boy of 16 years was hospitalized in his childhood because of “recurrent attacks of pneumonia.” At that time, a shadow was demonstrated at the base of the left lower lobe. Presently he was sent to the hospital with the diagnosis of pneumonia. On admission, clinical examination disclosed no abnormality. X-ray examination showed opacity at the base of the left lower lobe. High kilovoltage oblique roentgenogram showed a somewhat circular shadow in the posteromedial part of the base of the lung. Few circular radiolucencies were seen in the shadow; sequestration was suspected. Radiolucenties were seen with better advantage in tomography. Aortography confirmed the diagnosis of sequestration of the lung.

**Comment:** The shadow has been seen since childhood during “recurrent pneumonias.” Bronchiectatic collapse lobe could explain the clinical course. Since the shadow, as seen in the oblique roentgenogram, did not resemble a triangle, bronchography was not done. Aortography confirmed the diagnosis.

![Figure 2a: Posteroanterior roentgenogram of the chest, opacity in lower half of right hemithorax.](image-url)
CASE 3

This man of 24 years was hospitalized after a stab wound in the right side of the chest, which resulted in hemopneumothorax. He was treated with suture of the wound and drainage of the pleural space, antibiotics and tetanus antitoxin injections. Five days later his temperature rose. It subsided after a pleural puncture. He left the hospital in good condition. Follow-up roentgenographic examination of the chest done five weeks later (Fig. 2a) showed homogenous opacity at the right base which merged above with the normal translucent lung shadow. The right lateral roentgenogram of the chest (Fig 2b) showed opacity above the right hemidiaphragm; the shadow of the upper border of the diaphragm was not seen since it merged with the above-mentioned opacity. The upper border of the opacity was convex. Both anterior and posterior sinuses were obliterated. In both oblique projections, a homogenous opacity was seen in the right base with a clearcut concave upper border, obliterating the cardiophrenic and costophrenic angles, hence the opacity was pleural in origin. In the high kilovoltage left anterior oblique projections (Fig. 2c) no triangular opacity with apex at the right hilum was seen; thus there was no lobar or segmental pathology. The blood vessels of the right lung were seen to be normally distributed.

Comments: In this case, the lateral decubitus could not demonstrate the fluid in the pleural space because of the adhesions after hemothorax.

CASE 4

This man of 69 years was admitted because of congestive heart failure. A posteroanterior chest roentgenogram (Fig. 3a) shows congested hili, opacity in the lower half of the right hemithorax, opacity in the base and costophrenic sinus on the left side. Right lateral roentgenogram (Fig. 3b) showed homogenous opacity in the lower half of the right lung; the upper border being the minor and the upper half of the major interlobar fissure. High kilovoltage left anterior oblique roentgenogram (Fig. 3c) shows opacity in the lower half of the right side, filling both the costophrenic and the cardiophrenic sinuses and extending through the interlobar fissures. The lower and middle lobes were seen partially aerated. The patient was treated with digitalis and diuretics. A few days later, the opacity disappeared leaving the costophrenic sinus opaque.

Comment: The posteroanterior and lateral roentgenograms gave an appearance resembling opacity of the middle and lower lobes. The left

Figure 2b: Lateral; opacity above the right hemidiaphragm. Figure 2c: Left anterior oblique, high kilovoltage, homogenous opacity in right base with clearcut concave upper border, no triangular opacity with apex at hilus.
anterior oblique roentgenogram showed clearly that the opacity was pleural in origin. Had the lateral decubitus film been done in this case, it would also have shown the presence of pleural effusion.

CASE 5

This man of 43 years, was admitted because of "recurrent pneumonia" of the right middle lobe. (For the last five years his roentgenogram has shown opacity of the middle lobe). Presently his posteroanterior, lateral and oblique roentgenograms show opaque contracted middle lobe (Fig. 4). Oblique tomography shows patent bronchi to the lobe. The lobe is opaque and contracted; few small circular translucencies were seen in the shadow.

Comment: In this case, left anterior oblique roentgenogram showed the contracted middle lobe more clearly than the lateral one.

DISCUSSION

In 1954, the advantage of supervoltage roentgenography of the chest was demonstrated, especially in the study of mediastinal shadows.\(^1\) It is also useful for the study of portions of the lung concealed by the cardiac and diaphragmatic shadows.

The combination of high kilovoltage with oblique roentgenography gives us an additional tool in the differentiation be-
between segmental pathology of the lung and other processes in the chest. This method is most useful in pathology of the lower part of the chest (as seen in cases 1, 2, 3, 4). In most cases, the posteroanterior and lateral roentgenograms are sufficient for the examination of the right middle lobe. However, the left anterior oblique roentgenogram shows the upper and lower borders of the middle lobe better (Case 5). In Case 4, only the left anterior oblique roentgenogram could show the middle and lower lobes being partially aerated while the opacity was due to pleural effusion, infra-lobar and interlobar.

High kilovoltage oblique roentgenography cannot replace tomography or bronchography, neither does it replace the conventional roentgen-ray examinations; but it is a useful tool in the examination of the chest.

By trial it was found that the best position is 25 - 30° rotation from the posteroanterior in the examination of the left lung; in the right lung the rotation is 35 - 40°.

**FIGURE 4:** Left anterior oblique, high kilovoltage; triangular shadow, apex at right hilus, corresponding to right middle lobe.

**Summary**

The lobar and segmental boundaries of the lung converge towards the hili, like the spokes of a wheel; similarly all blood vessels and bronchi converge towards the hili, which are located in the posterolateral aspect of the heart. The plane of the wheel is neither sagittal nor coronal; it is oblique. High kilovoltage oblique roentgenogram of the chest enables us to look at the hili through the shadow of the heart. Since the segments of the lungs resemble pyramids with their apex always at the hilus, lobar and segmental pathology, including atelectasis, may be seen as a triangular shadow, with its apex at the hilus.

This method, viz. high kilovoltage oblique roentgenography of the chest, does replace any of the conventional methods. It is a useful adjunct in the examination of the chest. As with any method, it has its advantages and limitations.

**Resumen**

Las divisiones lobares y segmentarias del pulmón convergen hacia los hilios como los radios de una rueda. Asimismo los vasos sanguineos y bronquios convergen hacia los hilios, que están situados junto al aspecto posterolateral del corazón.

El plano de la rueda no es sagital ni coronal sino oblicuo. Los roentgenogramas de alto kilovoltage oblicuos del tórax no permiten observar los hilios a través de la sombra cardíaca. Como los segmentos pulmonares tienen el aspecto de pirámides con el ápice hacia el hilio las alteraciones patológicas lobares y segmentarias, incluyendo la atelectasia, aparecen como sombras triangulares con ápice hilar.

Este procedimiento de radiografías oblicueas de alto kilovoltage del tórax no suplanta a ningún otro de los métodos usuales, sino que debe ser considerado como una adición útil al examen radiológico del tórax. Como cualquier otro método, presenta sus ventajas y limitaciones.

**Résumé**

Les limites des lobes et des segments du poumon convergent vers le hile comme les rayons d'une roue. De la même façon tous les vaisseaux et les bronches convergent vers le hile qui se situe à la partie postéro-latérale du coeur. Le plan de la roue n'est ni sagittal ni en couronne, il est oblique. Les radiographies obliques à voltage élevé du thorax permettent de percevoir le hile à travers l'ombre du coeur. Alors que les seg-
REFERENCES


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SERUM PRECIPITINS IN BAGASSOSIS

Precipitins against 11 different extracts of crude bagasse were demonstrated in the sera of 48 bagassosis patients. The most antigenically potent extract was prepared from a specimen of very old moldy bagasse and reacted with the sera of 81 to 100% of patients, depending on their place of residence.

Precipitins to 6 of the 11 extracts were demonstrated in the sera of bagasse workers who had never had clinical bagassosis.

Precipitins to bagasse extracts were found in only a very occasional individual who had never had known contact with bagasse dust.

Extracts of fresh bagasse, autoclaved material and dust from boards that had been manufactured from bagasse showed a pronounced decrease in antigenicity.

It is postulated that antigenic substances are formed in bagasse by the action of fungi and these substances may play an important role in the pathogenesis of bagassosis.