RADIOLOGICAL STUDY OF MILIARY SHADOWS IN THE LUNGS.

THESIS SUBMITTED FOR PARTIAL-FULFILMENT
FOR THE MASTER DEGREE OF RADIODIAGNOSIS

By

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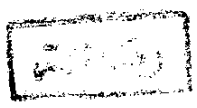

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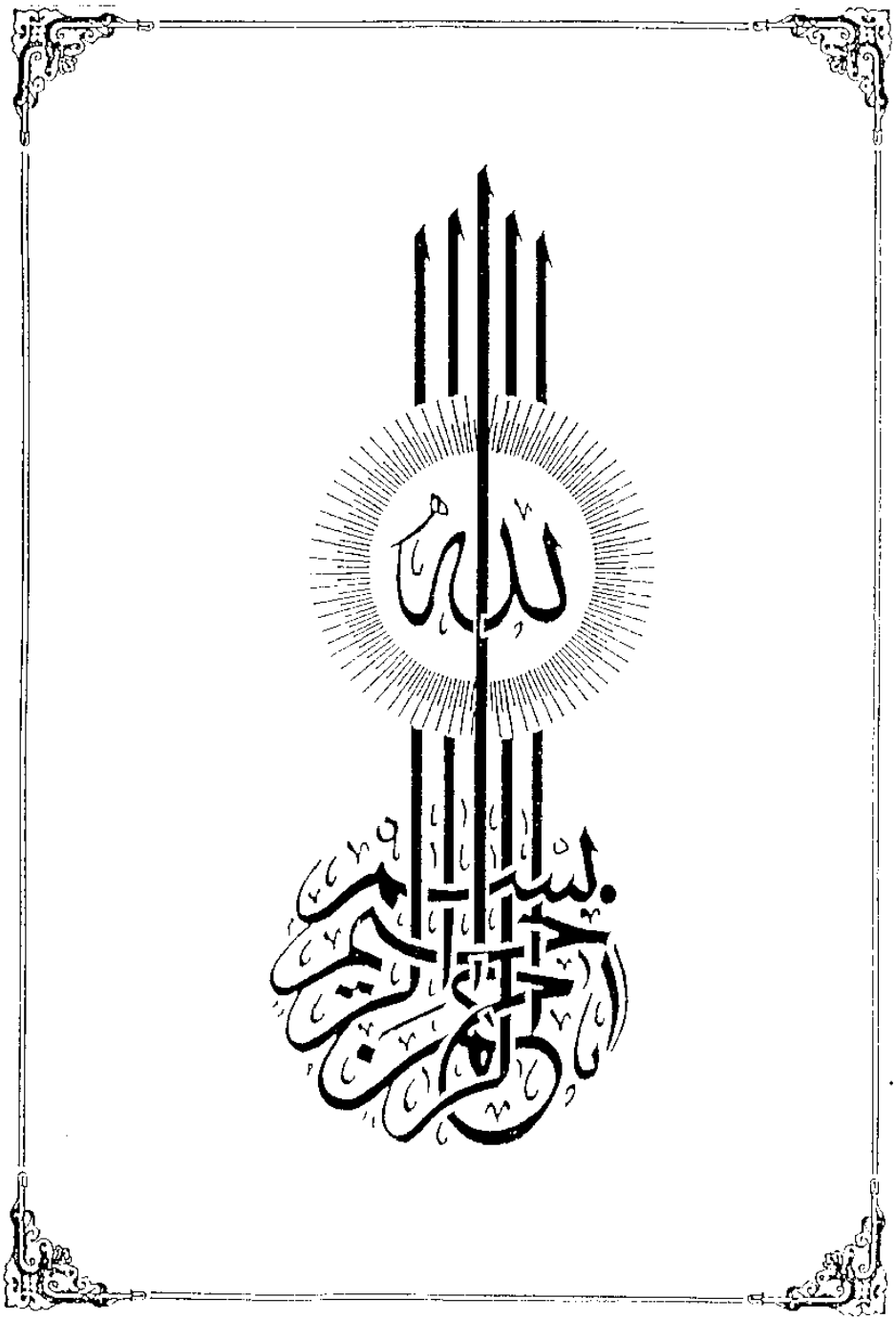

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Of

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INTRODUCTION & AIM OF THE WORK

The miliary shadows in the lungs with variable causes have variable pathological natures. The pathological nature of the disease reflects the rodiological manifestations of each disease. As the pathological nature of each disease is different from the other., the radiological manifestations of the diseases are variable some what, but they all share in the presence of small disseminate small nodular shadows in the lungs. The aim of this work is to study the radiological manifestations of miliary shadows in the lungs and to emphasize that radiology still plays an important role in the diagnosis of miliary shadows.

RADIOLOGICAL ANATOMY OF THE LUNGS

In the postero-anterior projection of the normal individual the lung fields are bounded by the ribs, the diaphragm and the mediastinal shadow. (Sutton 1980)

In infants the thymic shadow is superimposed on the great vessels and until this gland shrinks the superior mediastinal shadow is much wider and the aortic, innominate, and subclavian shadows are invisible. In normal postero-anterior projection the hilar shadow is composed of 98% pulmonary artery, 1.5% upper lobe pulmonary veins-the inferior pulmonary veins enter the heart well below the hila-0.5% bronchial glands. The normal glands are not visible because they are superimosed on the artery. The normal main bronchi lie inside the mediastinal shadow. The right lower lobe bronchus can be seen as a tubular translucency running downwards between the lower lobe artery and the heart shadow. Its walls and subdivisions are invisible.No other bronchus running longitudinally or abliquely is visible. (Shanks & Kerley 1973).

The size of the hilar shadows:-

The size of the right normal hilum is best assessed from the size of the right basal artery which can be clearly identified in the routine radiograph and with certainty in a tomogram . As the artery width may taper before it devides into the basal segmental arteries, a convenient measuring point is a half way down the artery and from its lateral wall to the clearly defined transradiancy of the intermediate branchus. The measurements therefore include the

bronchial wall but this is only about 2 mm. and is fairly constant. In normal middle aged adults the width of the right artery including the bronchial wall varies between 7-9mm. The left basal artery when it can be clearly seen is either the same size or 1-2 mm. smaller than the right. Another useful measurement is from the transradiancy of the distal end of the left main bronchus to the upper surface of the left pulmonary artery as it arches over the bronchus. In normal adults this is 18-32 mm. Apparent enlargement of one hilum may be seen in a normal person if the heart is displaced for example, by scoliosis or rotation of the patient when the absence of cover of the heart shadow may cause the hilar vessels on one side to appear unduly conspicuons. Arather large left main artery as it curves over the bronchus may cast such a large shadow that it is mistaken for a neoplasm. (Simon 1978).

The shape of the hilar shadow:-

The normal hilar shape is derived from the upper lobe vessels meeting the basal artery. Ignoring any small mid-lateral vessels, it is therefore concave laterally or like a Y lying on its side, thus ≻ laterally.

The left dome is lower than the right and thus the left lung length is greater than the right, On the other hand the heart occupies more of the left hemithorax than the right with the result that the valume of the left lung is often less than the right. This is reflected in a blood flow ratio of 55% of the cardiac output going to the right lung and 45% to the left lung which will cause left basal artery little smaller than the right, (Simon 1978).

The position of the hilar shadows:-

The most lateral upper lobe vein must be identified, and where this vessel meets the shadow of the basal artery is a convenient reference point for measuring the transhilar diameter and for identifying the level of each hilum. Using this method the centre of the right hilum is opposite the horizontal fissure which meets the sixth rib in the axilla, or is roughly at the level of the third rib anteriorly on deep inspiration. On the left side the centre of the hilum is some 0.5 to 1.5 higher. The centre will be 2-3 cm higher in upper lobe shrinkage and 1-2 cm . lower in lower lobe shrinkage. (Simon 1978).

Anatomically the lung roots are both on the same level and the apparent difference is due to the fact that on the right the epiarterial bronchus arises from the right main bronchus and lies above the pulmonary artery whereas on the left side the pulmonary artery lies above the bronchus. As the bronchus on the right casts no shadow, the upper limit of the right hilum is determined radiographically by the pulmonary artery, and thus the hilar shadow on the right appears to lie lower than the left. (Sutton 1980).

The vascular pattern: (Diagram 1)

The arborising shadows in the lung fields of a normal person (the lung markings) are without doubt in the main due to pulmonary arteries and veins. (Simon) 1978. The arteries banch dichotomously and synchronously with the bronchi to their second and third divisions.Beyond that, wide variations occur. Simple dichotomous devisions are

replaced by multiple eccentric dividing branches like those of the tree. (Shanks & Kerley 1973).

The arteries of the second and third degrees can be identified easily on the right side in the postero- anterior view and can be used for segmental localisation up to a point In the right upper lobe, the anterior and apical arteries are easily identified, the posterior upper lobe artery is running directly backwards. The middle lobe artery, running rather a long way before bifurcation is still more easily seen. The main lower lobe artery is still obvious, its posterior and dorsal divisions run directly backwards and are end-on in the postero-anterior view, while the anterior and lateral divisions are running forwards and are visible for a long way (Shanks & Kerley 1973).

On the left side the anteior artery is obvious while the posterior and apical are running obliquely backwards and are seldom clearly visible. The lingular artery has a charcteristic curve, convex outwards. The posterior dividons of the lower lobe artery are concealed by the heart shadow, the lateral and anterior divisions are very easily identified because they diverge and divide outwards, unlike the lingular vessels which converge and divide inwards. The smaller peripheral devisions cannot be observed in any great detail unless they are absent and obliterated or overfilled. The normal pulmonary veins have totally different distribution from the arteries or bronchi. They are thinner and less dens, wider and with fewer bifurcations. In the most normal individuals the upper lobe veins are rarely visible. (Shanks & Kerley 1973)

In the upper lobes the veins lie lateral to the arteries (Sutton 1980).

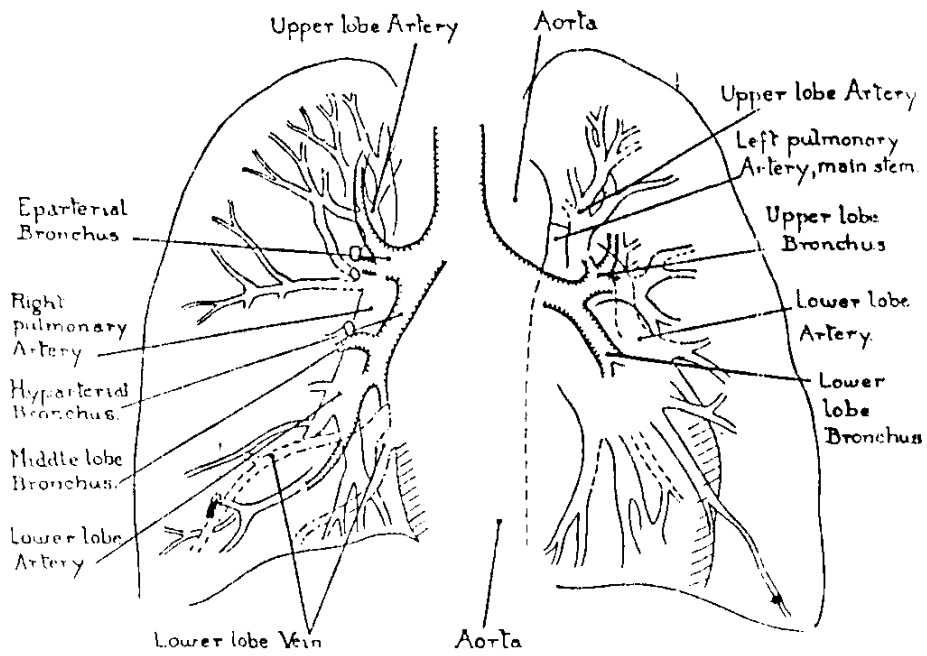


Diagram (1)

Diagram of the lung vessels

(After British Authrors)

(1973)

The right inferior pulmonary vein is clearly visible, running either obliquely upwards from the diaphragm or at a right angle to the artery and entering the heart well below the hilum. It usually has two devisions which joins just short of the heart shadow, occasionally there is only one large channel visible and rarely there are three divisions. On the left side the inferior pulmonary vein usually consists of two large branches which can only be seen on grid views behind the heart shadow. They run almost straight upwards from the diaphragm untill they disappear into the left auricle. The upper lobe veins if distended are easily identified because they are short, wide, and run sharply upwards towards the apex with only one bifurcation. Non of the normal segmental arteries takes this course. In the lateral views at the point where the veins join the left auricle they appear as round or ovoid opacities 1-1.5 cm. in diameter. (Shanks & Kerley 1973).

The Bronchial Arterial Circulation:-

Like the liver the lung has a double arterial blood supply, delivering two different qualities of blood through two entirely different arterial trees. The bronchial arteries are very small vessels, thin thread like structures arising from the antero lateral aspect of the thoracic aorta, immediately distal to the origin of the left subclavian artery,at the level of D_5 vertebra. The right bronchial artery arises from an upper right intercostal artery, the left bronchial artery is often represented by two or even three small vessles. They run a very tortuous course in close relation to the main bronchi.(Sutton 1980).

Bronchial arteries in the hilum are large 0.5 or even 1cm in diameter. They have a worm like appearance and do not pulsate like the normal pulmonary arteris.

(Shanks & Kerley 1973)

Within the lung the small bronchial arteries branch with the bronchi they supply with arterial blood, there are precapillary and capillary anastomosis with the pulmonary arterial circulation. The majority or even all of the bronchial arterial blood destributed within the lung is returned via the pulmonary veins to the left atrium. The principal function of the bronchial arteries is to supply oxygenated blood for the nutrition of the bronchi, nerves and parynchyma of the lung. As bronchial arterial blood is fully oxygenated, it can play no part in improving oxygenation of the body under normal circumstances.(Sutton 1980).

The bronchial arteries enlarge under well defined conditions:-

1 - To supply abnormal tissue arising from the bronchi as bronchial carcinoma and chronic inflamatory tissue of bronchiectasis.

2 - To compensate for an absent or diminutive pulmonary arterial supply to the lung e.g Mcleod's disease.

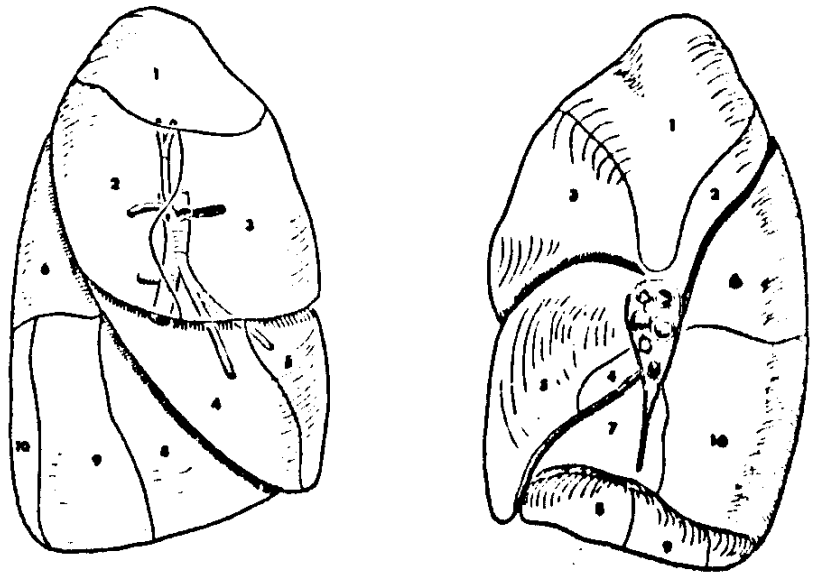
3 - To improve pulmonary gasceous exchange. This is only relevent if the blood of the bronchial arteries is partially desatureted as in cyanotic congenital heart disease with right to left shunt. Very large bronchial arteries are seen in palmonary artery atresias preudo-truncus arteriosus, and severe Follot's tetralogy. (Sutton 1980).

The lungs and lobes:- Diagram 2

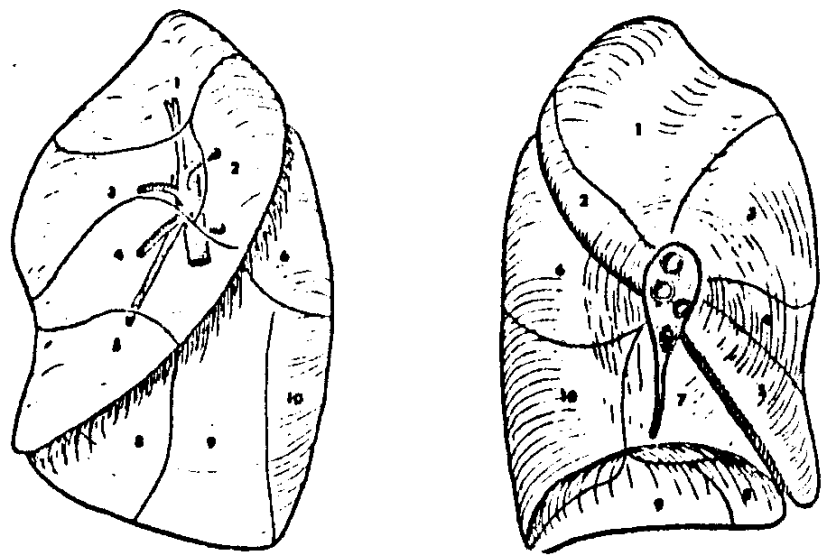
Each lung is divided into lobes which are separted by the reflexions of the visceral pleura, the right into upper, middle, and lower lobes. The lift into upper and lower lobes only. On the left side the equivalent of the right middle lobe is the lingula which is usually a segment of the upper lobe though occasionally it may be separated by a horizontal fissure as on the right.

(Sutton 1980).

In the frontal plain only the lesser fissure demarcating the middle from the upper lobe is seen. It is usually at about the level of the fourth rib anteriorly but this is variable depending on the phase of respiration. The correct way to localise it is in relation to the hilum. It normally approaches the hilum at a point between upper and middle thirds. Mostly it is seen as a thin horizontal white hair line slightly convex upwards. Occusionally in kyphotic individuals it runs slightly downwards at an oblique angle. In about 10% of normal individuals it is invisible because it lies completely behind a rib. On the left side no normal fissure is visible in the postero-anterior view. The normal greater fissure can be seen on good lateral views. They begin at the level of D_3 or D_4 as a straight or slightly convex line to the level of the hilum and then extends forwards as slightly concave or straight line to touch the diaphragm. The left fissure touches the diaphragm fairly far forwards while the right touches the diaphragm farther back about 2-3 inches behind the sternum. The lesser fissure in the lateral view runs from the hilum straight to the anterior chest wall. When the film is slightly oblique and not true lateral the line of the lesser fissure may appear



THE LATERAL AND MEDIAL SURFACES OF THE RIGHT LUNG TO SHOW THE BRONCHO-PULMONARY SEGMENTS AND THE [illegible] OF THE UPPER AND MIDDLE LOBE BRONCHI AND THE POSTERIOR ORIGIN OF NO. 6 SEGMENTAL BRONCHUS.



THE LATERAL AND MEDIAL SURFACES OF THE LEFT LUNG TO SHOW THE BRONCHO-PULMONARY SEGMENTS AND THE [illegible] OF THE UPPER LOBE AND LINGULAR BRONCHI AND THE POSTERIOR ORIGIN OF NO. 6 SEGMENTAL BRONCHUS.

Rirht lung:	Left lung
Upper lobe.	Upper lobe
1. Apical	1. Apico-posterior
2. Posterior	2.
3. Anterior	3. Anterior
Middle lobe	Lingular lobe
4. Lateral	4. Superior
5. Medial	5. Inferior
Lower lobe	Lower lobe
6. Apical (superior)	6. Apical (superior)
7. Medial basal	7. Medial basal
8. Anterior basal	8. Anterior basal
9. Lateral basal	9. Lateral basal
10. Posterior basal	10.Posterior basal

(After Anatomy Regional & Applied 1979)

Diagram 2