Radiology and CT of Solitary Lung Nodule

Thesis

Submitted for Partial Fulfilment of

Master Degree in Radiodiagnosis

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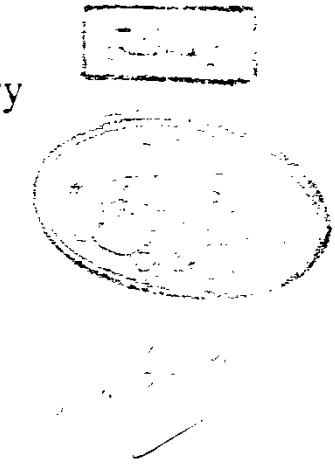

Faculty of Medicine
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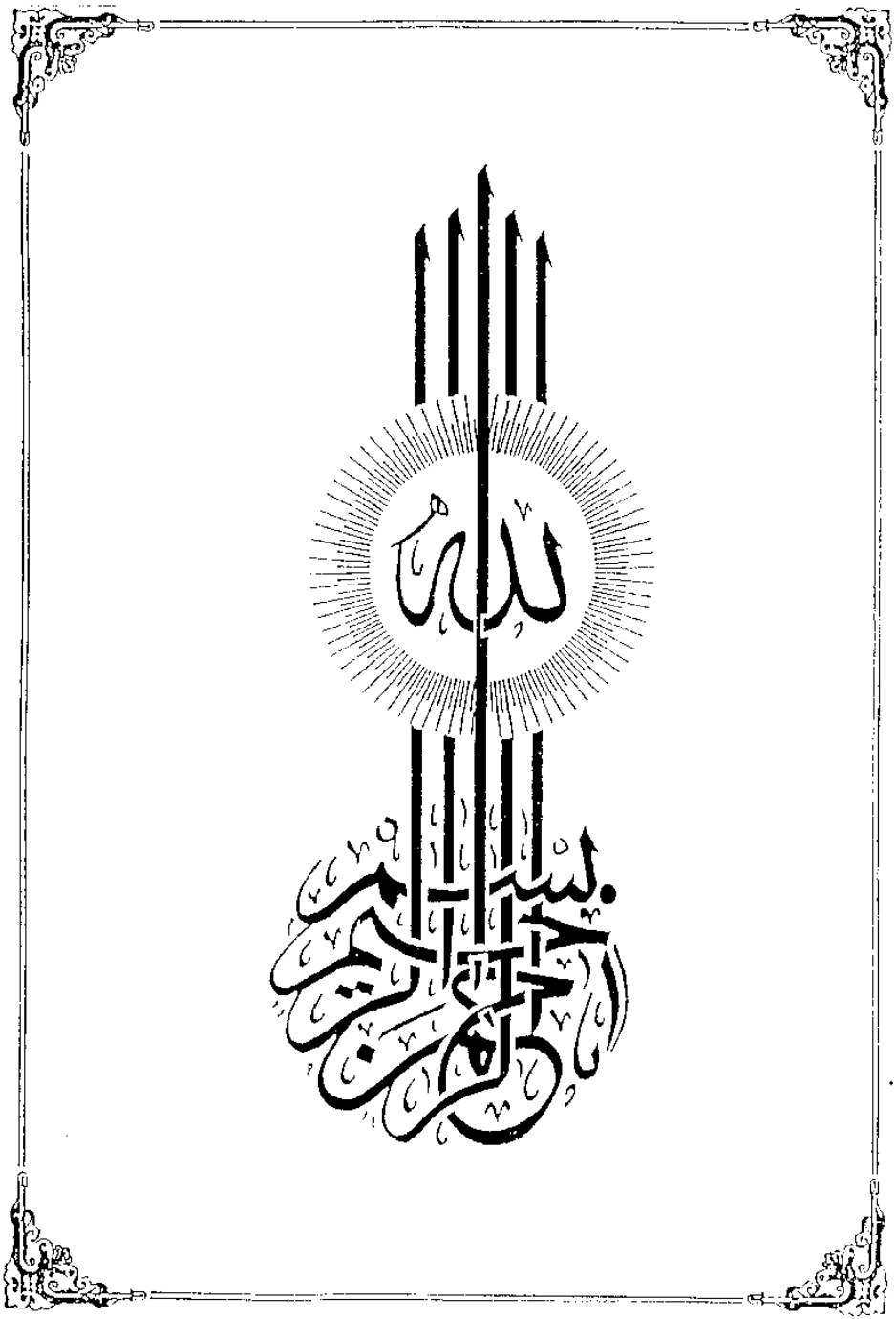
To..

My Mother

And

My Father



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Introduction & Aim of The Work

Introduction and Aim of Work

The solitary pulmonary nodule is a frequent challenge in radiology. The radiographic approach to solitary lung nodule includes mainly conventional radiology (plain films and tomography), and computed tomography.

A solitary pulmonary nodule is defined as a discrete, single focus in the lung with margins that are sharp enough to permit measurement of the diameter; a size of more than 1 cm but not greater than 6 cm, Including lesions that contain visible calcification, and lesions with cavitation, unless the cavity occupies almost all of the volume of the lesion.
In addition to lesions of solitary pulmonary nodule even when other disease is present in the lungs as long as solitary pulmonary nodule is distinguishable (Godwin, 1983; Trunk et al, 1974).

The aim of this work is to throw light on the subject of solitary lung nodule in terms of radiological and CT study, to try to characterize the main points of differentiation between benign and malignant nodules, to determine the role of CT in examination of such cases and its advantages over conventional radiography, and finally to lay out a scheme for investigation of solitary pulmonary nodule as a guide to proper management.

Radiological & CT Anatomy of the Lung

Radiological And CT Anatomy Of The Lung

1. Trachea and bronchial tree:

The trachea is a midline structure, that occasionally deviates very slightly to the right after entering the thorax (Meschan, 1987).

It begins at the level of the cricoid cartilage and the sixth or seventh cervical vertebra. It ends at the upper border of the fifth to eighth thoracic vertebra, where it bifurcates into right and left main bronchi (Meschan 1985).

The carinal angle on inspiration is of 60 - 75 degrees (Sultton, 1987).

The trachea is anterior to the oesophagus as it passes through the inlet of thorax, with the thyroid and parathyroid glands anterior and lateral to it on either sides (Meschan, 1975).

The trachea may be regarded as the center around which the major arteries are distributed as they arise from the arch of the aorta, which lies first anterior to the trachea and then to its left as it arches over the root of the left lung. The brachiocephalic artery at first is anterior to the trachea, then to

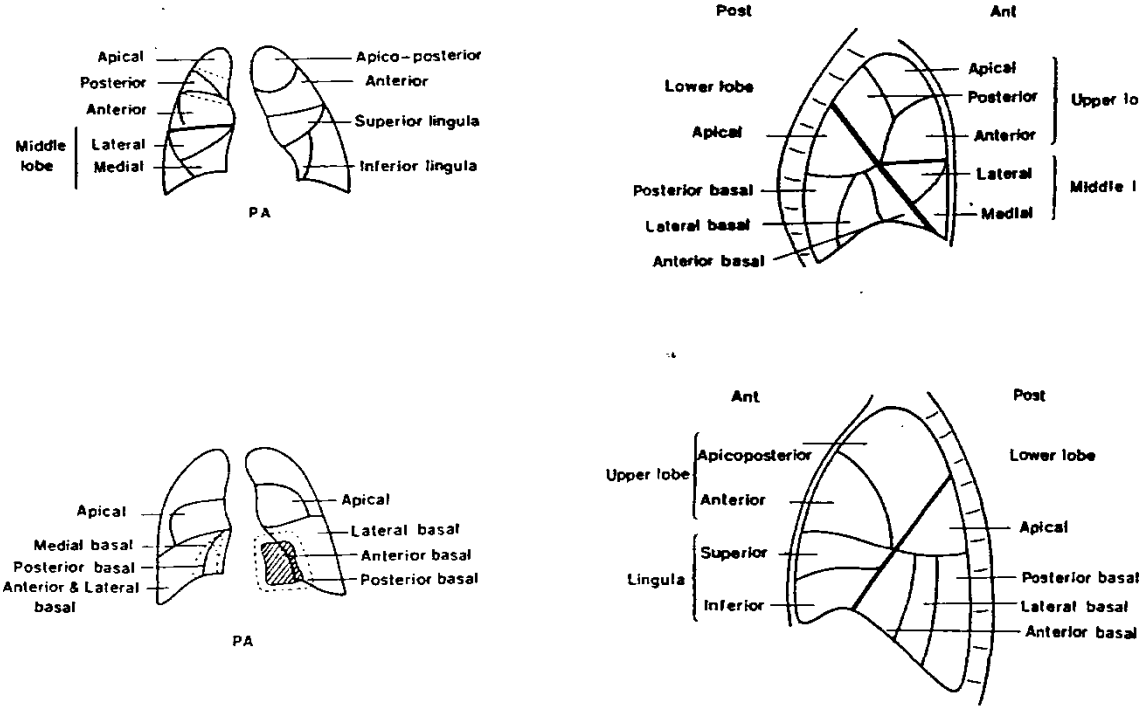

Fig. (1): Diagrams illustrating the approximate positions of the pulmonary segments as seen on the PA and lateral radiographs.

(From: Sutton: A Textbook of Radiology and Imaging. Churchill Livengstone, 1987).

its right side, before dividing into its two final branches: right common carotid and right subclavian arteries. Anterior and to the left of the trachea lies the left common carotid artery. Anterior to the semicircle of arteries are the major venous channels draining the head and neck. These veins include the left brachiocephalic vein and the jugular and subclavian veins more laterally (Meschan, 1987).

As we have mentioned, at the level of the fifth to the eighth thoracic vertebrae, the trachea bifurcates into right and left main bronchi.

The bronchus to the right upper lobe arises approximately 3 cm. from the carina and divides at about 1 cm. from its origin, most commonly into 3 main branches - apical, posterior and anterior. The intermediate bronchus continues for about 3 to 4 cm from the origin of the right upper lobe bronchus, then it bifurcates to become the bronchi to the middle and lower lobes. The middle lobe bronchus gives rise to 2 segmental bronchi - medial and lateral. The lower lobe bronchus gives rise to five main branches as follows, the superior segment, the medial basilar, and the three additional basilar bronchi - The anterior, lateral, and posterior, Fig. (1) (Meschan, 1987).

The left bronchus is anterior to the oesophagus. It forms a smaller angle with the trachea than does the right, averages 5 cm in length. approximately I cm from its origin the

bronchus to the left upper lobe arises in either a bifurcated or trifurcated pattern. The upper division separates into 2 segmental bronchi, an apico-posterior and an anterior. The lower division (lingular bronchus) separates into superior and inferior segmental bronchi. The left lower lobe contains 4 segmental bronchi, the only difference in the distribution of bronchi of the left lower lobe and the right is the fact that the anterior and medial portions of the left lower lobe are supplied by one antero-medial bronchus instead of 2 separate segmental bronchi of the right lower lobe, Fig. (1) (Meschan, 1987).

Routine CT scans performed with contiguous 10 mm. thick sections demonstrate 70% of segmental bronchi. The segmental bronchi can be grouped by shape, the simplest segmental bronchi to visualize are those that run parallel to the plane of section, and thus are seen as tubular structures. These include the right upper lobe bronchus and its anterior and posterior segmental bronchi, the left upper lobe bronchus and its anterior and posterior segmental bronchi and the superior segmental bronchi to the right and left lower lobes. Bronchi that course perpendicular to the plane of section (cephalad to caudad) are readily seen as circular structures. These include the apical segmental bronchus of the right upper lobe, the apicoposterior segmental bronchus of the left upper lobe, the bronchus intermedius and both lower lobe bronchi, and their proximal segmental bronchi. The lingular bronchus and its segmental bronchi run obliquely, and are difficult to see

Fig. (2): (From: Bechi and Wise: Segmental Anatomy of the Lung in Cross Section. Eastman Kodak Company, 1985).

routinely; when visualized they are oval structures; at times the middle lobe segmental bronchi follow a similar pattern. Other segmental bronchi may less frequently be variable; for instance, the lower lobe segmental bronchi to the posterior and lateral segments can run obliquely posterior (Haaga and Alfidi, 1988). We can divide the trachea and bronchial tree into 6 zones as follow: Fig. (2).

1. Apical Zone:

In this zone the trachea is seen as thin walled air containing structure, Fig. (3).

2. Aortic Arch Zone:

At this zone the bronchus to the apical segment of the right upper lobe is identified as a circular structure. (Haaga and Alfidi 1988), Fig. (4)

3. Carinal Zone:

At the carinal zone, or just below the carina but above the level of right pulmonary artery, the right upper lobe bronchus is seen as a tubular structure. Since it is eparterial the right upper lobe bronchus is seen 1 to 2 slices cephald to the left upper lobe bronchus. The origin of the apical segmental bronchus is seen as a rounded segment superimposed on the main right upper lobe bronchus. The anterior and posterior segmental bronchi are seen at the same level, or next lower level separated by the right upper lobe pulmonary vein. The left lung is similar

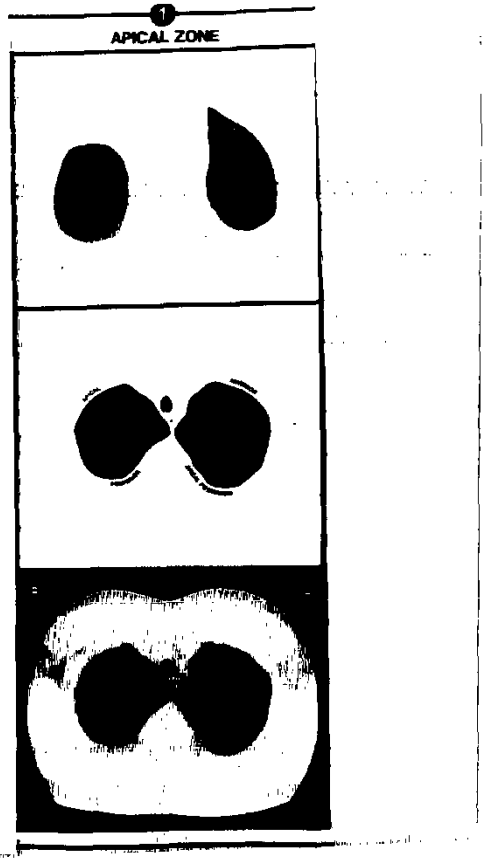

Fig. (3)

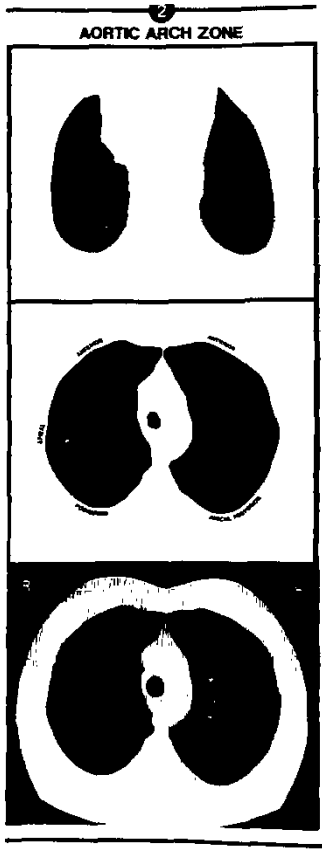

Fig. (4)

Fig. (3, 4): (From: Bechi and Wise: Segmental Anatomy of the Lung in Cross Section. Eastman Kodak Company, 1985).