RADIOLOGICAL FEATURES OF BRONCHIECTASIS

THESIS

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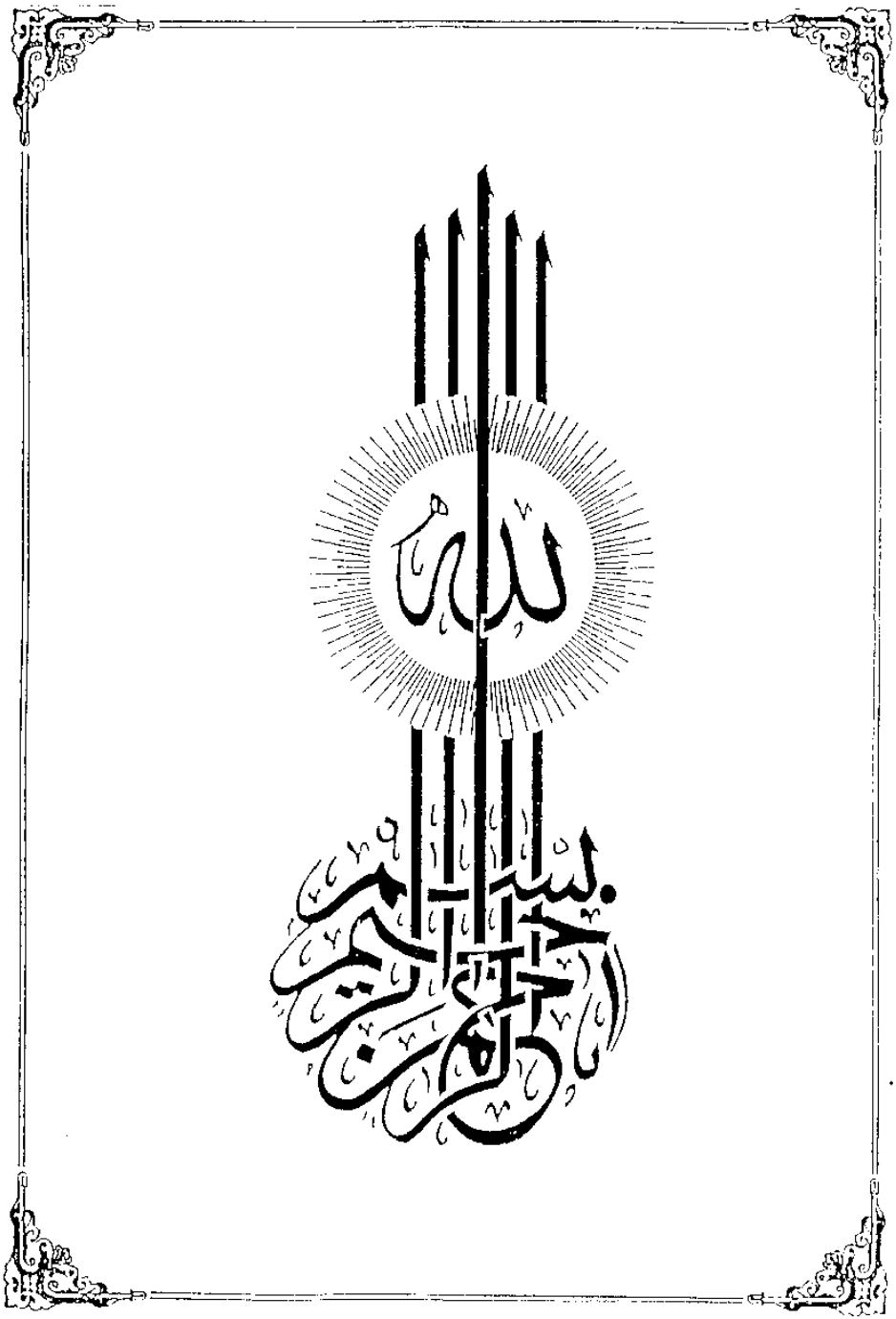

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INTRODUCTION AND AIM OF WORK

INTRODUCTION AND AIM OF WORK

The utilization of radiations in the diagnosis of medical conditions dates back to the early years of this century. From then up to recent years, medical radiological diagnostic procedures developed significant advances in methods of investigations to reach the correct diagnosis of diseases.

Such advances have taken place in diagnostic radiological equipment, techniques, positioning, and use of contrast media. This has enabled the medical profession to investigate in much detail various disease conditions in different parts of the human body.

The present thesis mainly deals with the general survey of the various radiological diagnostic procedures that are known to establish the radiological features of an important disease condition of the lungs and bronchi namely bronchiectasis.

Inspite of the fact that bronchiectasis has certain diagnostic clinical features, yet, radiological investigation have been shown to be so essential for establishing and confirming the correct diagnosis of this condition.

The present work proceeds to give a brief survey of the normal anatomy, pathology, clinical and radiological manifestations of bronchiectasis. A detailed study of twenty five cases of bronchiectasis was carried out to include complete clinical and radiological examinations. The different methodologies adopted are described. Complete documentation of all results for all cases examined are given in table form to facilitate comparison. From among the twenty five cases studied, six cases were selected as examples whose exact case histories was given together with illustrative photographs of the radiological investigations performed.

Several salient features emerged from the discussion of the results obtained in light of our existing knowledge of the anatomy and pathology of the bronchial tree and the clinical and radiological features of bronchiectasis. The role and limitations of the chest physician in the diagnosis of bronchiectasis and the specific advantages of radiological examinations to confirm and establish the final diagnosis were made evident.

The correlation of different pathological states accompanying bronchiectasis with their radiological

manifestations revealed several considerations which reflected the important radiological features of bronchiectasis.

Bronchiectasis is a disease condition which affects the bronchi and bronchioles resulting in various associated complicated pathological states. This renders the radiological investigation of bronchiectasis sometimes unhelpful in reaching the correct diagnosis. It is hoped that new research trends will facilitate some of the present difficulties, and aid in establishing radiological techniques more definite in the accurate diagnosis of bronchiectasis.

This thesis essentially aim at providing a concise survey of the salient radiological features of bronchiectasis; and discusses the correlation between the existing pathology, the clinical features and radiological manifestations.

ANATOMY OF BRONCHIAL TREE

CHAPTER I

ANATOMY OF BRONCHIAL TREE

Embryology

The right and left lung buds grow outwards into the pleural passages and divide into lobules, three appearing on the right and two on the left lung bud. These divisions are the first indication of the corresponding lobes of the lungs. Further subdivision and ramification occur to end ultimately in minute expanded extremities. After six months, the air sacs begin to make their appearance as minute pouches of these ramifications.

Three phases of differentiation are described namely, glandular, canalicular and alveolar. It is in the glandular phase where the bronchial divisions are differentiated. In canalicular phase, the respiratory parts are delineated and establish an intimate relation with the expanding blood vascular system.

The alveolar phase extends from the sixth month onwards, and new bronchi and alveoli continue to be formed after birth. The exact nature of the mechanism of alveolar destruction is uncertain; however, foetal

respiratory movements may possibly be responsible. The main expansion occurs with the onset of respiration at birth (Warwick and Williams, 1973).

Anatomical Relations.

The trachea begins at the level of the cricoid cartilage and the six or seventh cervical vertebra, and ends at the upper border of the fifth to eighth thoracic vertebra where it fiburcates into right and left main bronchi (Neschan, 1975). The trachea moves upward, on swallowing and downward during deep inspiration. The trachea adheres to the middle line except towards its termination where it deviates slightly to the right and recedes from the surface following the curvature of the vertebral column.

In infants, the trachea may normally deviate to the right, this is related to a relative redundancy at this stage, and also to some irregularity in position of thymus; and it is thought that the aortic arch may be a major cause of this occurrence. This deviation occurs normally in infants and children up to five years of age. In infants, the trachea is roughly one-third that of the adult trachea; being approximately four cm in infants and twelve cm in adults.

Bifurcation in children occurs at the level of the fourth costal cartilage. The isthmus of thyroid gland is closely connected ventrally with the trachea and usually covers the second, third and fourth tracheal rings. More caudally the trachea is close to the peritracheal lymph nodes and especially in children to thymus gland.

The innominate artery occasionally crosses the trachea obliquely at the root of the neck. The oesophagus lies dorsal to the trachea, with the inferior laryngeal nerve in between. The great vessels of the neck lie on each side of the trachea. Within the thorax, the trachea is located in the mediastinum and fixed with strong fibrous connections to the central tendon of the diaphragm. The aortic arch is in contact with the ventral surface of the trachea near the bifurcation. On the right side is the vagus nerve, arch of azygos vein, superior vena cava and mediastinal pleura. On the left side is the continuation of the aortic arch, followed by the origin of left subclavian artery and inferior laryngeal nerve. Bronchial and peribronchial lymph nodes lie caudal to the angle of bifurcation.

As the trachea descends, the oesophagus extends towards its left and dorsal aspect..

The angle which the two bronchi form with the trachea varies according to the age of the individual (Miller, 1950). The angle of divergence between the two bronchi as measured in living male and female adults ranged between 45 and 65 degrees (Alavi et al, 1970).

The anatomy of the bronchial tree was studied in details by Ewart (1889). He described the branching as dichotomus (i.e. dividing into two), and was the first to put forward the concept of the broncho-pulmonary segments. More recently important contributions to this subject were made (British Authors, 1973).

The division of the trachea into two main bronchi is repeated at each subsequent bronchial division, though in some places this dichotomous arrangement is masked by the closeness of the repeated divisions and the unequal size of the resulting branches.

From each main bronchus lateral branches are given off (Brock, 1954; Boyden, 1955).

The right main bronchus is nearly in direct line with the trachea. It is known to be shorter in length and wider in calibre than the left main bronchus. It proceeds along its course to finally give its branches.

The upper lobe bronchus emerges after 2 cm from the origin of the right main bronchus. It runs upwards and laterally for about one cm before trifurcating into anterior, apical and posterior segmental branches.

The right main bronchus runs for another three cm where it bifurcates into middle and lower lobe bronchi.

The middle lobe bronchus runs downwards, forwards and laterally for 1.5 cm and then divides into medial and lateral segmental branches.

The lower lobe bronchus gives off the branch to apical segment of the lower lung lobe just below the origin of the middle lobe bronchus and almost opposite to it. Then after a short distance it divides into the anterior, lateral, and posterior basal divisions. On the right side the medial basal (cardiac) bronchus arises from the lower lobe bronchus just above the origin of the anterior basal division (it is easily recognised in bronchogram by its curved course, the convexity being posteromedial).

The left main bronchus runs for five cm before giving the upper lobe bronchus, which runs for 1.5 cm, then bifurcates into upper and lower divisions. The former divides after 1 cm into apico-posterior and anterior segmental branches. The inferior division of upper lobe bronchus supplies the lingula and divides into superior and inferior segmental branches forming a characteristically acute angle.

The left lower lobe divisions are similar to those on the right, except that there is no cardiac segment.

Amongst the more important anomalies and variations in the bronchial anatomy are the following.

In the lower lobe on both sides a very common finding is a large subapical branch. It arises from the lower lobe bronchus about 2-3 cm below the apical branch of lower lobe bronchus and running parallel to it.

In the left upper lobe the anterior bronchus or a portion of it may be displaced proximally, thus forming a trifurcate pattern. If the displacement is more marked, the anterior bronchus will arise from a