RADIOLOGY AND IMAGING TECHNIQUES OF NORMAL CHEST

THESIS

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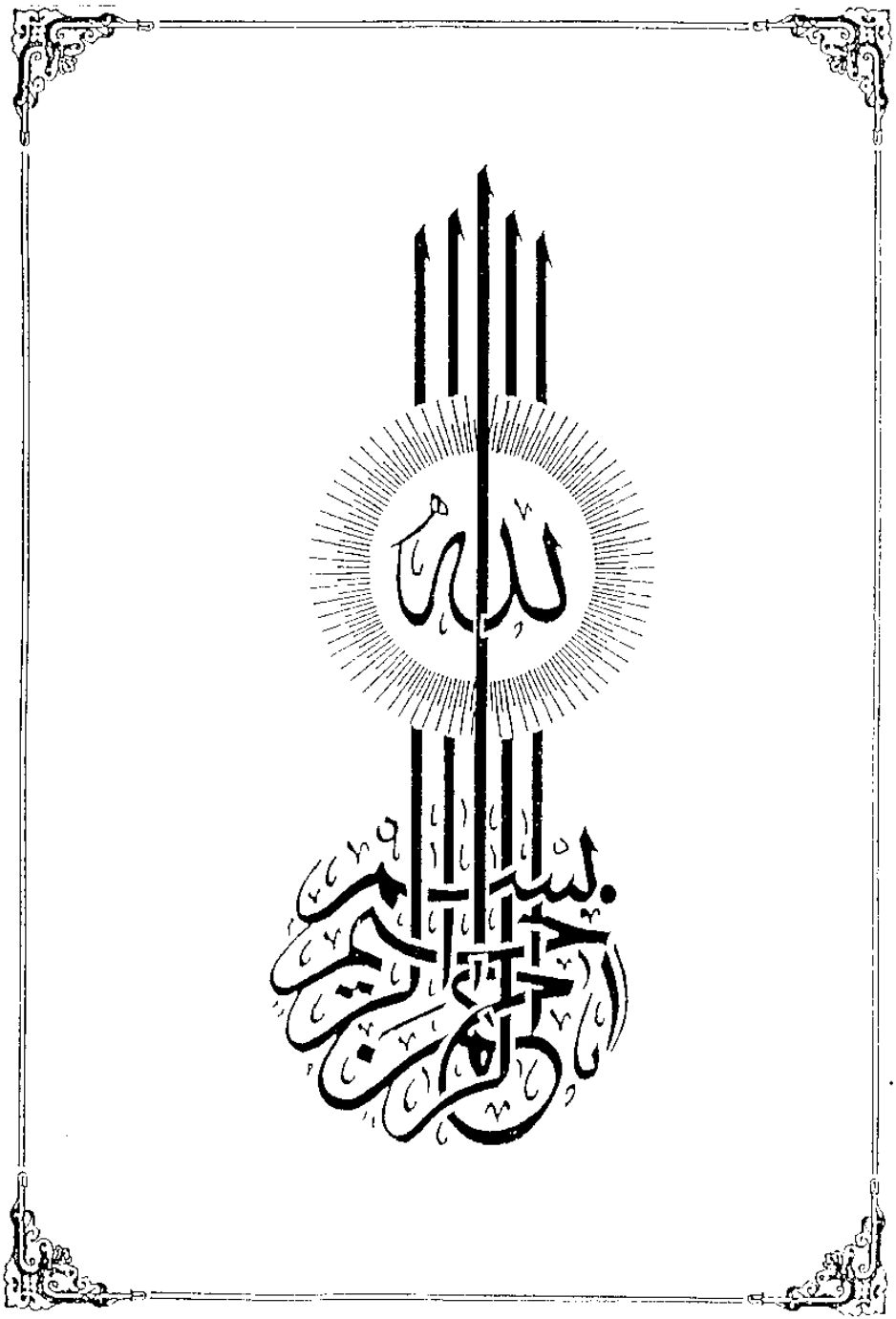

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INTRODUCTION & AIM OF WORK

In patients with symptoms such as dyspnea, unexplained weight loss, cough, fever, haemoptysis or pain in the chest, chest radiographs are essential. The examination is also of value in assessing the spread of malignant disease and in the follow - up of such patients. Radiological investigation is also of particular importance if surgical treatment of the disease is contemplated.

The aim of this work is to review the normal radiological anatomy of the chest & to explain the various radiological methods of investigating the chest and clarifying the value of each of them.

RADIOLOGICAL ANATOMY OF CHEST

RADIOLOGICAL ANATOMY OF NORMAL CHEST

which include chest walls lung fields.

Chest wall: which include the soft tissues & bony cage.

Soft tissues
- Muscle shadows
- Companion shadows
- Breast shadows

Muscle shadows:

There are two muscles which commonly cast individual shadows visible in the postero-anterior view of chest , the sternomastoid and the pectoralis major. The edge of the sternomastoid is often visible as a vertical line running upwards and slightly outwards from the inner end of the clavicle and this may cause some confusion when it overlies the apex of the lung.

The pectoralis major is principally responsible for the increased shadowing seen over the middle and upper parts of the chest and when absent this may give rise to hypertranslucency and thus to a misleading impression of emphysema, (Sutton, 1980).

Unilateral loss of the pectorales major on one side produces hypertranslucency of the affected side. The commonest cause of loss of the pectoralis major is a radical

mastectomy. The rarest cause is congenital absence of the muscle on one side. Between these are Poliomyelitis and amputation of the arm. (Shanks & Kerely , 1973).

Companion shadows:

This is a term used to describe certain soft tissue shadows which run closely parallel to parts of the bony cage. A reflection of the skin over the clavicle may often be seen running parallel with its upper margin. Companion shadows are very often visible parallel to the inferior margin of the first and second ribs. Sometimes a narrow linear shadow of soft tissue density may be seen running from the costo phrenic angles upwards along the inner margins of the rib cage.(Sutton , 1980).

Breast shadows:

The shadows cast by the female breast are very variable in size and shape are often asymmetrical. In P.A. view the breast shadows may obscure the bases and costo-phrenic angles. The nipple normally casts a rounded opacity about 5-10 m.m. in diameter. The nipple shadows vary in density and are often asymmetrical in position. If there is any asymmetry in the size or shape of the breast one nipple may appear more opaque, more distinct or in a different position than the other

The radiographic quality of the nipple shadow often closely resembles that of a small metastasis though usually the outline of the shadow cast by the nipple is more readily visible and closely defined on its lateral aspect, the medial half of the shadow often being difficult to see. Should there be any difficulty in distinguishing one from the other, a marker should be placed around the nipple and a pair of films on inspiration and expiration taken (Sutton , 1980).

The bony cage:

- The clavicles
- The sternum
- The ribs
- The dorsal spine.

The clavicles:

The epiphysis at the inner end of the clavicle does not fuse until around the age of 22 and this small lenticular shadow may be projected over the lung fields and simulate a lung focus. The inferior aspect of the medial end of the clavicle often shows what appears to be an irregular errosion but this is a normal anatomical appearance, the rhomboid fossa.

The sternum:

If the manubrium sterni is wide its shadow can project over the lung fields and cause confusion straight or scalloped lines running vertically, parallel with the mediastinum. In cases of emphysema or in children with certain congenital heart lesion, the sternum may show a marked forward bowing. In children the separate centres of ossification of the sternum may produce confusing shadows over the lung fields particularly in an A.P. projection or if slightly rotated, (Sutton,1980).

The ribs:

The ribs run roughly parallel, the posterior halves horizontal or slightly downwards, the anterior ends curving downwards and inwards. The slopes of the ribs varies in kyphosis, scliosis or sternal depression.
The degree of calcification of the costal cartilages is of no clinical significance and the age at which this appears is subject to wide variation. In many cases there appears to be a difference in the site of the calcification between the sexes, the calcification being single and central in women, and double arising from the rib margins in males. The calcified shadows may on occasion cause difficulty when they overlie the lung fields, particularly in the first costal cartilage as the opacities may then resemble intra-pulmonary lesions. A check should always be made to see

whether there are similar shadows on the other side. (Sutton , 1980).

The Dorsal spine:

In the lateral view the shadow of the dorsal spine normally becomes increasingly traslucent from above downwards, until the diaplnagm is reached. Should any abnormality such as collapse or consolidation of a lower lobe, a tumour, or a pleural effusion overlie the spine, this progressive increase in translucency doesnot take place, and the whole length of the spine may appear to be equally radio-opaque.

Deformities of the dorsal spine- kyphosis, lordosis and scoliosis- distort the contour of the chest and can be recognized on standard P.A. and lateral chest radiograph. Overpenetrated grid films are necessary accessory techniques. Occasionally the spinal deformity produces thoracic distortion of such severity that cardio-respiratory failure may result, (Sutton , 1980).

The Lung Fields

Normal Landmarks.

Postero-anterior Projection

In P.A. Projection the lung fields are bounded by the ribs, the diaphragm and the heart, and mediastinal shadow. The position of the contents of the thorax are in health remerakably constant and provides useful normal landmarks, the followings are the most important.

- The trachea.
- The heart and mediastinum.
- The diaphragm, (Sutton, 1980).

The trachea

The trachea consists of a framework of cartilaginous C.shaped rings that are connected posteriorly by a dense layer of connective tissue and muscle. The cartilage present marked irregularities and they may be partially fused with adjoining cartilage rings. The carinal cartilage is formed by the fusion of tracheal and left bronchial cartilages and the carina tracheae is a prominent ridge running antero posteriorly across the bottom of the trachea between the origin of the bronchi.

The trachea begins at the level of the cricoid cartilage (sixth or seventh cervical vertebra). It extends downward

through the neck into the superior mediastinum and ends at the upper border of the fifth to the eighth thoracic vertebra by bifurcating into the right and left bronchi. Bifurcation is lower in the adult than in the child in which it usually occurs at the level of the fourth costal cartilage,(Digram 1). The trachea moves upward upon swallowing and downward in deep inspiration.

The trachea adheres to the midline, except toward its termination where it deviates slightly to the right. As it passes downward it recedes from the surface following the curvature of the vertebral column from which it is seperated by the oesphagus.

In the infant the trachea may normally deviate to the right and tracheal shift in the infant must be interpreted with great caution. This is related to a relative redundancy of the trachea at this stage and also to some irregularity in the position of the thymus. Lateral deviation of the trachea at the thoracic inlet occurs normally in infants and children up to 5 years of age. Since the deviations to the right is opposite the aortic arch, it is thought that the aortic arch too may be a major cause of this occurrence. The trachea in the infant is roughly one-third the length of the adult's growing from approximately 4 cm in the infant to 12 cm. in the adult,(Meschan, 1975).

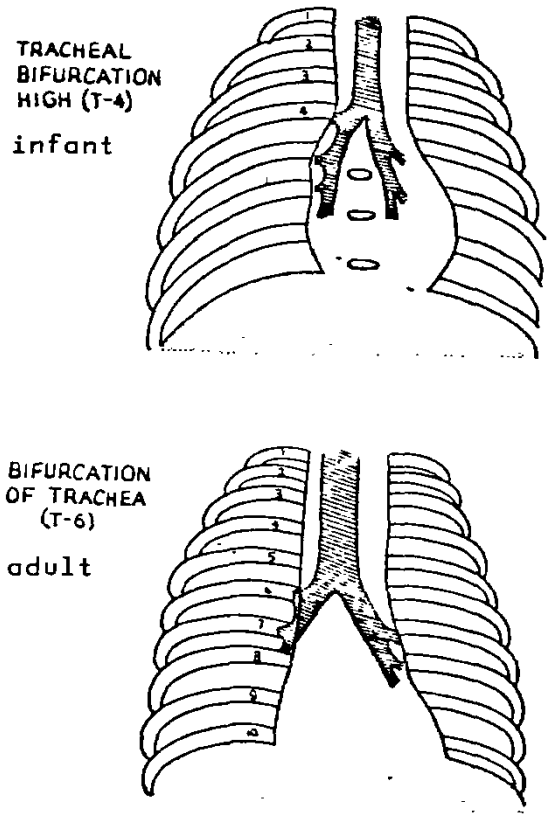

Diagram 1; Comparison of level of bifurcation of trachea in adult and child ;
After Caffey, 1922

The isthmus of the thyroid gland is closely connected ventrally with the trachea usually covering the second, third and fourth cartilages of the trachea. More caudally, the trachea is close to the peritracheal lymph nodule and espically in children to the thymus gland. The innominate artery occasionally crosses the trachea obliquely in the root of the neck.

On the dorsal aspect of the trachea is the esophagus. The great vessels of the neck lie on each side of the trachea and the inferior laryngeal nerve lies between the esophagus and 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 innominate and left common carotid arteries are in close proximity to the trachea, at first ventral and then lateral to it. The left innominate vein and the thymus are situated farther away ventrally. The aortic arch is in contact with the ventral surface of the trachea near the bifurcation. On the right is the vagus nerve, the arch of the azygos vein, the superior vena cava and the mediastinal pleura. On the left the arch of the aorta continues, followed by the origin of the left subclavian artery and the inferior laryngeal nerve. Bronchial and peribronchial lymph nodes lie caudal to the angle of the bifurcation. As it descends, the esophagus