COMPUTED TOMOGRAPHY OF CHEST WALL LESIONS

THESIS

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BY

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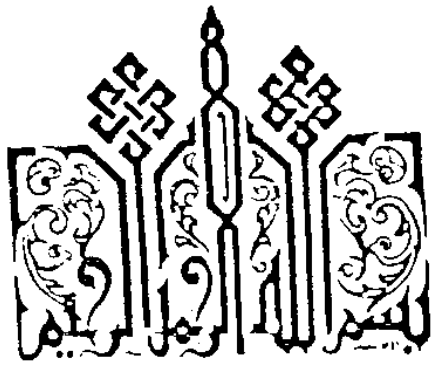

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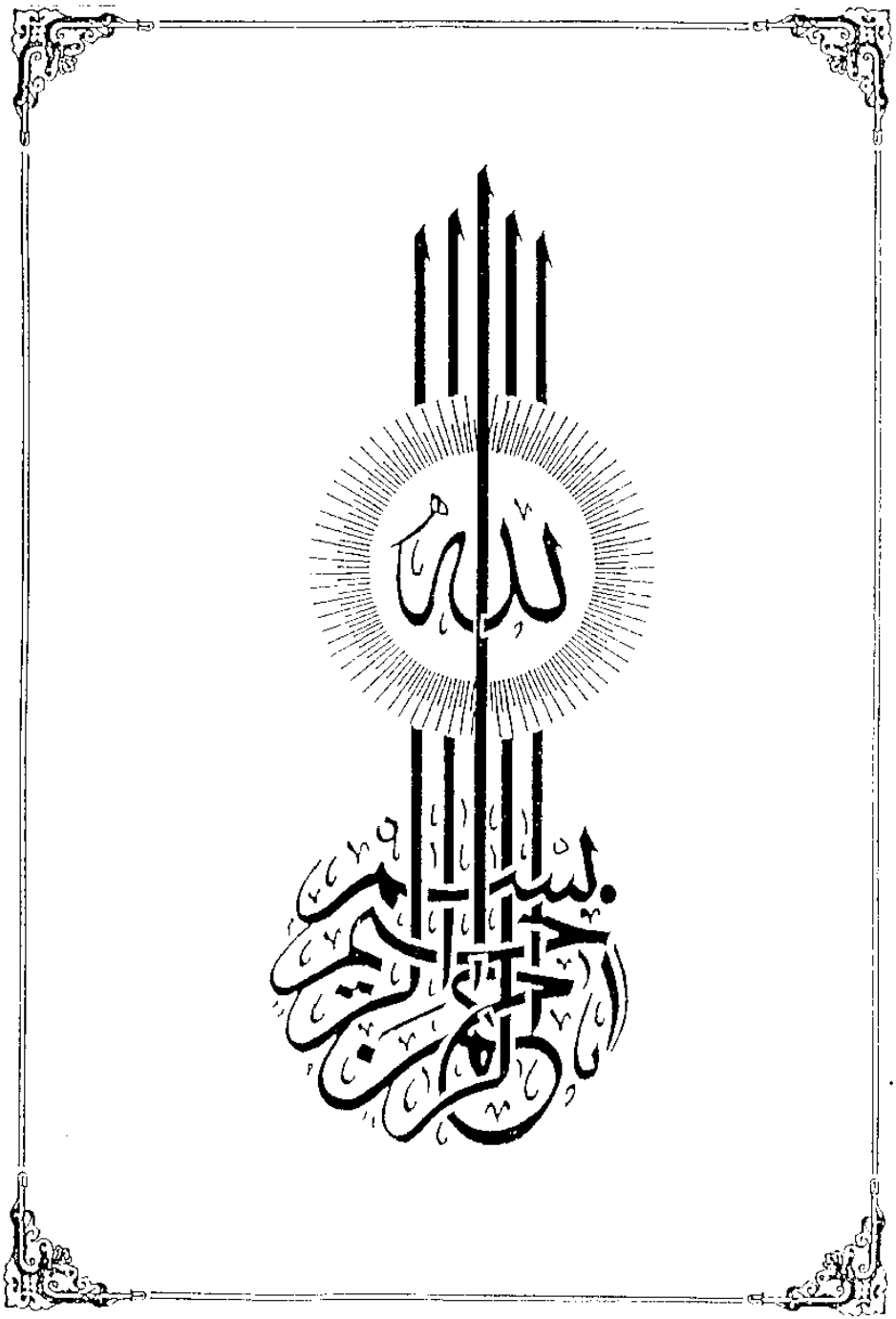

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INTRODUCTION AND AIM OF WORK

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While many authors have discussed the contribution of computed tomography to the evaluation of mediastinal, pleural, and parenchymal disease (Kollins, 1977 and Kreel, 1978; Lee et al, 1989). Little emphasis has been placed on the importance of CT in the evaluation of the chest wall.

In patients with primary or secondary lesions involving the chest wall, demonstration of the total extent of the disease can affect the choice between medical treatment, surgery, radiotherapy or palliative treatment. Thus a precise knowledge of the normal and pathological anatomy of the chest wall is of particular importance (Haggar et al., 1987).

CT provides images of the chest wall that are superior to those produced by other methods because of better contrast sensitivity, the elimination of superimposed structures and the full deliniation of the location and extent of various lesions (Jafri et al, 1989).

The aim of this work is to demonstrate the value of CT in the diagnosis of chest wall lesions and to emphasize the impact of CT on the management and treatment of these patients.

ANATOMY

ANATOMY OF THE CHEST WALL

The thorax is the shape of a truncated cone which tapers superiorly to the root of the neck and expands inferiorly to surround the superior part of the abdominal cavity from which the cavity of the thorax is separated by the dome-shaped diaphragm. The chest wall is formed by boney thorax and soft tissue compartment (Romanes, 1976).

THE BONY THORAX

The skeleton of the thorax is an osseocartilagenous cage which contains and protects the principle organs of respiration and circulation. It is conical in shape, narrow above and broad below, flattened from before backwards, and longer behind than in front (Davies and Coupland, 1967).

Boundaries (Fig. 1)

Posteriorly: by the 12th thoracic vertebrae and posterior parts of ribs.

Anteriorly: sternum, anterior ends of ribs and the costal margin.

Laterally: convex formed by the ribs (Davies and coupland, 1967).

The sternum: (Fig. 2)

Long flat bone forming the median portion of the anterior wall of the thorax. Its average length is 17 cm and rather greater in male than in female. Its upper border support the clavicle and its margin articulate with cartilage of first seventh pairs of ribs. It consists of three parts named from above downwards. the manbrium, the body and xiphoid process (Davies and Coupland, 1967).

Manbrium:

Is of a somewhat triangular form lies opposite third and fourth dorsal vertebrae. Its anterior surface on each side gives attachment to the

sternal origin of the pectoralis major and sternocleidomastoid. Its posterior surface gives origin to the sternothyroid opposite the first costal cartilage (Davis and Coupland, 1967).

The body:

Lies opposite the fifth to ninth tharocic vertebrae. The body of the sternum is narrower but longer than the manubrium. The inferior part of the second rib and the third through seventh anterior ribs articulates with the lateral margin of the body. The sternal body joins the xiphoid process at the xiphasternal junction (Stark and Jaramillo, 1986). Its anterior surface gives attachment on each side to the articular capsules of the sternocostal joints and to the sternal origin of the pectoralis major (Davies and Coupland, 1967).

Xiphoid process:

Lies in the epigastric region. Its anterior surface gives insertion to the most medial fibres of the rectus abdominis and to the aponeuroses of the external and internal obliques. Its lower end gives attachment to the linea alba and its border to the aponeuroses of the internal oblique and transversus abdominis. Its posterior aspect gives origin, on each side, to some of the fibres of the diaphragm, and is related to the anterior surface of the liver (Davies and Coupland, 1967).

Sterno clavicular joint:

This synovial joint is between the shallow notch at the superolateral angle of the manubrium of the sternum and the larger medial end of the clavicle. A complete articular disc intervenes. The joint also extends on to the superior surface of the first costal cartilage. The articular capsule is attached close to the articular margins of the bones. It is thickened

anteriorly and posteriorly to form the anterior and posterior sternoclavicular ligaments.

The articular disc is a nearly circular plate of fibrocartilage attached at its margins to the articular capsule and dividing the joint into two separate synovial cavities (Romanes, 1976).

The ribs: (Fig. 3)

The ribs are elastic arches of bone which are connected behined with the vertebral column and form a large part of the skeleton of the thorax. They are twelve in number on each side, but this number may be increased by the development of a cervical or a lumbar rib or may be reduced to eleven. The first seven are connected in front, through the intervention of the costal cartilage with the sternum, they are called true ribs. The remaining five are false ribs, of these the cartilage of the eighth, ninth and tenth are joined each to the cartilage of the rib immediatly above, the eleventh and twelefth are free at their anterior ends and are often termed floating ribs (Davies and Coupland, 1967). Each typical rib has a posterior and an anterior end, and an intervening portion, the shaft.

The anterior end: can be distinguished by the presence of a small cup-shaped depression, which receives the lateral end of the costal cartilage (Davies and Coupland, 1967).

The posterior or vertebral end: possesses a head, a neck and a tubercle. The head presents two facets, separated by a transverse ridge, named the crest. The lower facet, articulate with the body of the numerically corrosponding vertebra; the upper facet articulates with the vertebra above and the crest of the head is placed opposite the

intervertebral disc. The neck is the flattened portion which succeeds the head; it lies in front of the transverse process of the numerically corroesponding vertebra. The tubercle is placed on the outer surface of the posterior part of the rib, at the junction of the neck with the shaft.

The shaft:

Is thin and flattened with an external and an internal surface, a superior and an inferior border. It is curved with convexity outwards. The external surface is convex and smooth. The internal surface is smooth and is marked along its lower border by a groove the costal groove (Davies and Coupland, 1967).

The costal cartilages:

Are bars of hyaline cartilage which extend forwards from the anterior ends of the ribs and contribute very materially to the elasticity of the walls of the thorax. The first seven pairs are connected with the sternum; the eighth, ninth, and tenth are articulated each with the lower border of the cartilage immediately above; the lower two are pointed, and end in the muscular wall of the abdomen. In old age the costal cartilages are prone to undergo superficial ossification losing their pliability and becoming brittle (Davies and Coupland, 1967).

The thoracic vertebrae (Fig. 4)

Twelve in number, show a gradual increase in size from above downwards. All are distinguished by the presence of facets on the sides of the bodies, and all but the last two (sometimes three) by facets on the transverse processes; the former articulate with the heads of the ribs and the latter with the tubercles of the ribs (Davies and coupland, 1967).

The body of a typical thoracic vertebra resembles in shape a conventional heart and its anteroposterior and transverse measurements are nearly equal. On each side it bears two costal facets: superior and inferior. The spinous process is long and is directed downwards and backwards. The superior articular process are thin plates of bone which project upwards at the junction of the laminae and pedicle. The inferior articular processes are fused to the lateral ends of the laminae. the transverse process is a substantial, club-shaped projection which spring from the vertebral arch at the junction of the lamina and pedicle. It is directed laterally and backwards.

Muscles of the walls of the thorax:

These are divided into:

I. Muscles connecting the upper limb with the anterior and lateral thoracic walls.
II. Muscles connecting the upper limb with the vertebral column.
III. Muscles of the thorax. (Davies and Coupland, 1967). (Fig. 5,6,7)

I. Muscles connecting the upper limb with anterior and lateral thoracic walls. (Fig. 5,6)

. Pectoralis major:

Is a thick, triangular muscle situated at the upper and front part of the chest. It arises from the anterior surface of the sternal half of the clavicle: from half the breadth of the anterior surface of the sternum, as low down as the attachment of the cartilage of the sixth or seventh rib: from the cartilage of all the true ribs, with the exception, frequently of the first, or seventh, or both from the ventral extremity of the sixth rib, and from the aponeurosis of the obliques externus abdominis. It is inserted by

a flat tendon into the lateral lip of the intertubercular sulcus of the humerus.

. **Pectoralis minor:**

Is a thin, triangular muscle, situated at the upper part of the thorax, deep to the pectoralis major. It arises from the upper margins and outer surfaces of the third, fourth and fifth ribs, and from the fascia covering the external intercostals. It is inserted into the medial border and upper surface of the coracoid process of the scapula (Davies and Coupland, 1967).

. **Subclavius**

Is a small, triangular, muscle placed between the clavicle and first rib. It arises from the junction of the first rib and its costal cartilage. It is inserted into the groove on the under surface of the intermediate third of the clavicle (Davis and Coupland, 1967).

. **Serratus anterior:**

Is attached to the upper eight ribs along a curved line on the side of the thorax. Its lower four attachments interdigitate with the upper four attachments of the obliques externus abdominis (Davis and Coupland, 1967).

II. Muscle connecting the upper limb with the vertebral column: (Fig. 7)

. **Trapezius.**

Arise from the medial third of the superior nuchal line, the external occipital protuberance, the ligamentum nuchae, and the spines of the seventh cervical and all the thoracic vertebrae. The upper fibres sweep downwards to the lateral third of the clavicle and form the curve of the shoulder. the middle fibres run horizontally towards the shoulder, and are inserted into the medial edge of the acromion and the superior

margin of the crest of the spine of the scapula. The lower fibres ascend, and terminate in a small flat tendon which slides on a bursa separating it from the root of the scapular spine, and is inserted into the medial part of the upper margin of its crest (Romanes, 1976).

. **Latissimus Dorsi:**

Arises from the lower six thoracic spines and the supraspinous ligaments between them, deep to trapezius, from the thoraco lumbar fascia; from the posterior part of the iliac crest; from the lower three or four ribs; and from the inferior angle of the scapula is inserted into the intertubercular groove of the humerus (Romanes, 1976).

III. Muscles of the thorax

Intercostal muscles and membranes:

Each intercostal space contains two layers of muscle the external and internal muscles) and an incomplete third layer internal to both, which consists of three muscles: Transversus thoracis, subcostals, and the innermost intercostals (Romanes, 1976).

. **External intercostal muscles**

These muscles run obliquely downwards and forwards between the adjacent borders of two ribs. They extend from the tubercle of the ribs posteriorly, to the begining of the costal cartilage anteriorly. Anterior to this (in the upper spaces) each is replaced by an external intercostal membrane which reaches the anterior extremity of the intercostal space (Romanes, 1976).

. **Internal Intercostal muscles: (fig. 8)**

These are similar to the external intercostal muscles, but their fibers run postero-inferiorly from the floor of the costal groove of one rib to the