

RADIOLOGICAL EVALUATION OF LOCALIZED
MEDIASTINAL LESIONS

THESIS

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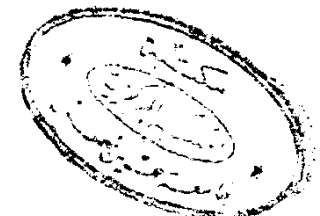
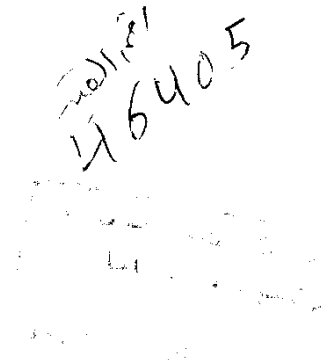
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The candidate.

INTRODUCTION

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The mediastinum is the part of the chest which lies between the parietal pleura laterally, the sternum anteriorly and the anterior aspect of the vertebral column posteriorly.

The mediastinum is divided traditionally into two major compartments, the superior and inferior compartment. The Superior compartment is defined as that area bounded superiorly by the thoracic inlet and inferiorly by an imaginary line drawn from the angle of Louis anteriorly to the intervertebral disc (D4-5) posteriorly. It has less radiological importance as a separate division. The inferior compartment is that one of radiological and clinical importance. It is furtherly subdivided into three compartments, anterior, middle and posterior. Each compartment contains anatomic structures which are unique to it (Fraser & Pare, 1978).

Due to the compartmentalized nature of the mediastinum, and variable pathological lesions arising from each structure in those different compartments, i.e, each compartment has specific lesions arising from it, consequently the study of these lesions is interesting and challenging to the radiologist to use his different diagnostic tools to reach the possible diagnosis.

In the pre-computed tomography era, the mediastinal lesions were studied by conventional x-ray methods, tomography, barium studies as well as the more invasive procedures as arteriography and venography.

The outcome was not always be satisfactory and decisive. However with the advent of new imaging modalities, the diagnosis become easier, faster and more accurate. However the definitive diagnosis may only be reached after needle biopsy, thoracotomy and histopathological studies (McCloud & Meyer, 1982).

Aim of the work:

To asses the role of radiology in diagnosing localized mediastinal lesions, and to determine the sequence of different imaging modalities in the strategy of investigating these lesions.

NORMAL RADIOLOGICAL
ANATOMY OF THE MEDIASTINUM

Radiological Evaluation of Localized Mediastinal Masses

Normal Anatomy of the mediastinum :

The space between the pleural cavities occupying the center of the thoracic cavity is known as the mediastinum. It contains the heart and great blood vessels, the oesophagus, the trachea and its bifurcation, the thoracic duct, the phrenic and vagus nerves. It is a very mobile area, as the lungs and heart being in rhythmic pulsation and the oesophagus dilating with each bolus that passes down it. Hence there is but a minimum of loose connective tissue between the mobile structures. They lie in mutual contact but the spaces between them can be distended by inflammatory fluid, neoplasms, etc. These loose spaces of the mediastinum, moreover connect freely with those of the neck.

Divisions of Mediastinum:

There is a plane of division to which the whole topography of the mediastinum can be related, namely a plane passing horizontally through the angle of Louis, i.e, the joint between the manubrium and the body of the sternum from the second costal cartilages, this plane passes backwards to

the lower border of the 4th thoracic vertebra. Above, between it and the thoracic inlet, lies the superior mediastinum. Below the plane, the inferior mediastinum is conventionally divided into three compartments by the fibrous pericardium, a part in front, the anterior mediastinum, a part behind, the posterior mediastinum and the pericardium itself, containing the heart, and the roots of the great arteries and veins.

The anterior and posterior mediastinum are in direct continuity with the superior mediastinum, their separation from it is purely descriptive not anatomical (R.J. Last, 1984).

Stuart et al., (1975), demonstrated normal mediastinal contents in subdivisions as follows:

The superior mediastinum: Contains the aortic arch and its branches, trachea, oesophagus, thoracic duct, s.v.c and main tributaries, thymus, sympathetic trunk, phrenic nerves and left recurrent laryngeal nerve.

The middle mediastinum : Contains heart and pericardium, ascending aorta main pulmonary artery and part of the phrenic nerves.

The anterior mediastinum : Contains thymus, lymph nodes and adipose tissue.

The posterior mediastinum : Contains the descending aorta and its branches, oesophagus, thoracic duct, sympathetic trunk, vagus nerve and para-aortic lymph nodes.

Contents of the superior and anterior mediastinum :

Aortic arch and its branches:

The arch of the aorta begins behind the manubrium sterni at the level of the upper border of the second right sternocostal articulation, and runs at first upward, backwards and to the left in front of the trachea, it is then directed backwards on the left side of the fourth thoracic vertebra, at the lower border of which it is continuous with the descending aorta. Its termination corresponds to the sternal extremity of the second, left costal cartilage. Its upper border is usually about the level of the middle of the manubrium sterni. From the upper aspect of the aorta, its three main branches are given off, the brachiocephalic trunk, the left common carotid and the left subclavian.

Trachea:

The trachea commences in the neck below the cricoid cartilage at the level of the lower border of the 6th cervical vertebra. Entering the thoracic inlet in the midline, the trachea lies in contact with the manubrium and is normally said to bifurcate 5cm. below its border. Its total length is thus about 6 inches. Its wall is fibro-elastic membrane whose patency is maintained by C-shaped rings of hyaline cartilage. The gaps lie posteriorly and are closed by a sheet of unstriated muscle (The trachealis muscle.) whose contraction diminishes the calibre of the tube (Last, 1984).

Oesophagus:

A muscular tube extends from the cricoid cartilage (at the level of the 6th cervical vertebra) to the cardiac orifice of the stomach (at the level of the 10th thoracic vertebra. It is 10 inches (25 cm) long.

The cervical portion of the oesophagus lying in front of the prevertebral fascia, inclines slightly to the left of the midline, but the oesophagus enters the thoracic inlet in the midline in front of the body of the 1st thoracic vertebra. Passing downwards now through the superior mediastinum the tube is slightly to the left of the midline behind the left

bronchus, which may be slightly indented. The oesophagus, all this time in contact with vertebral bodies, now inclines forward with a concavity more marked than that of the vertebral column, in front of the descending thoracic aorta, in contact with the pericardium, and pierces the diaphragm one inch to the left of the midline, opposite the body of the 10th thoracic vertebra.

Thoracic duct:

This lymphatic vessel commences in the cisterna chyli, at the level of the body of the 12th dorsal vertebra between the aorta and the vena azygos. It passes upwards to the right of the aorta between the crura of the diaphragm and comes to lie against the right side of the oesophagus. Inclining up to the left, along side the aorta, it passes behind the oesophagus to reach its left side at the superior mediastinum. It lies anterior to the intercostal branches of the aorta. Passing now vertically upwards, it finally arches forwards across the dome of the left pleura to enter the point of confluence of the left internal jugular and subclavian veins (Last. 1984).

Thymus:

The thymus is located in the superior and anterior portions of the mediastinum, extending from just above the

manubrium to the 4th costal cartilage. In some individuals small tapering extensions may reach as high as the thyroid cartilage.

Its shape is determined by the adjacent structures. Posteriorly, it molds itself against the trachea, left brachio-cephalic vein, the aortic arch and its branches and the pericardium covering the ascending aorta and the pulmonary trunk. Anteriorly, it is covered by the sternum and the medial margins of the lungs (Peterson R.R. 1980).

The thymus is derived bilaterally from the third pharyngeal pouch, it is a bilobed structure with the left lobe usually extending further inferiorly than the right. Although each lobe is enclosed in its own thin fibrous capsule, the two lobes usually make contact superiorly near the midline and then divert inferiorly (Rosai J. et al., 1976).

Superior Vena Cava:

Commences at the lower border of the first right costal cartilage by the confluence of the two brachio-cephalic veins.

It passes vertically downwards behind the right border of the sternum and pierces the pericardium, enters the border of the right atrium at the lower border of the third right costal

cartilage. Behind the angle of Louis, opposite the second right costal cartilage, it receives the azygos vein, which had arched forwards over the root of the right lung (Grey's anatomy, 1980).

Thoracic Sympathetic trunk:

Lying on the neck of the ribs, just lateral to their heads and anterior to the intercostal vessels and nerves, is the ganglionated trunk of the thoracic part of sympathetic outflow. It is described as possessing twelve ganglia, each receives a white ramus from its corresponding spinal nerve, and this emerges from the primary ramus of the nerve. After relay in the ganglion a post ganglionic grey ramus is given to each thoracic nerve, and this usually lies medial to the white ramus. The thoracic trunk is continued upwards over the neck of the 1st rib as a cervical sympathetic trunk and downwards into the abdomen by passing behind the medial arcuate ligament of the diaphragm to lie in the front of first lumbar vertebra (Last anatomy, 1984).

Phrenic Nerves:

Arising principally from C4 in the neck, the nerve passes down over the anterior scalene muscle across the dome of the pleura behind the subclavian vein. It runs through the mediastinum in front of the lung root, being in contact