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Role of CT in evaluation of Mediastinal masses

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Abstract
Background: Mediastinal masses are the rare cases which are likely to found more in male then female. Computed Tomography is an important modality for imaging mediastinal masses, and certain CT attenuation features (fat, calcium, or water attenuation, contrast enhancement) are well known to suggest specific diagnoses.
Objectives: To determine the sensitivity and specificity of computed tomography in evaluation of mediastinal masses. To determine the localization and the common age group exposed to mediastinal masses.
Methods: A retrospective cross-sectional study was conducted reviewing 40 patients request and reports that had CT chest scan with history of mediastinal masses. The information obtained was recorded on a self-designed data capture sheet.
Results: A total of Fourty (40) patients of the age range of 20-69 were referred for CT scan of the chest to the department of radio diagnosis with a clinical suspicion of a mediastinal mass or who had an abnormal chest radiograph suggestive of mediastinal mass during the study period. Twenty six (26) of the patients were males while fourteen (14) were females.
Majority of the patients that fall within the age group with the highest patients i.e. 40 -49 years were males.
Conclusion: Although Chest X ray is the initial modality in suspected cases of mediastinal mass, their further evaluation needs computed tomography for their accurate localization, analyzing their morphology, involvement of adjacent structures and associated findings in lungs, pleura and chest wall.
In the present study, overall, anterior mediastinum is the most common compartment involved followed by middle and posterior compartment.

Keywords: mediastinal, Fourty, compartment, anterior

Introduction
The mediastinum is an important region of the body located between the lungs. Structures that lie in this region include the heart, the esophagus, the trachea, and large blood vessels including the area. The mediastinum is also home of lymph nodes.
There are many conditions that can affect the mediastinum or the mediastinum lymph nodes, including cancer, benign tumors, infections, and more. Understanding the different parts of the mediastinum is very helpful in determining the causes of abnormalities in this region.

Structure
The mediastinum can be thought of as having two regions, the top and bottom. The bottom (inferior) half is divided into three main regions. Even though this may sound like a boring description of anatomy, understanding the structures that lie in each of these areas is very important in diagnosis medical conditions in this region.

- **Anterior**: The anterior mediastinum is present only on the left side and contains some small arteries as well as lymph nodes.
- **Middle**: The middle mediastinum is the largest portion, contains the heart, blood vessels including those that travel from the lung to the heart, and lymph nodes.
- **Posterior**: The posterior mediastinum contains the esophagus, many blood vessels and nerves, and mediastinum lymph nodes.

Mediastinal Masses
Mediastinal masses are often first noted when a scan is done to evaluate symptoms related to the chest, such as a cough, shortness of breath, or other symptoms. Most masses in the mediastinum are small and do not have any symptoms. When they are large they can cause respiratory insufficiency (difficulty breathing or getting enough oxygen to the tissues) as well as heart problems, such as a drop in blood pressure or decreased blood flow.
The age of an individual and the location of a mediastinal mass are important in considering a diagnosis. In children, mediastinal masses occur most often in the posterior mediastinum and are often benign (non-cancerous.) In contrast, mediastinal masses in adults are more common in the anterior mediastinum and often malignant (cancerous.)
Some causes of mediastinal masses based on location include:

- **Anterior Mediastinum:** Tumors in this regions may include thymomas (tumors of the thymus, an organ in the chest which is fairly large in childhood but essentially disappears in adults), lymphomas, germ cell tumors (such as teratomas), and retrosternal (behind the sternum or breastbone) thyroid masses.
- **Middle Mediastinum:** Enlarged lymph nodes are a common cause of a mass in the middle mediastinum. These lymph nodes could, in turn, be related to underlying cancer. Bronchogenic cysts may also be seen in this area, as well as cardiac abnormalities such as an enlarged aorta.
- **Posterior mediastinum:** Esophageal cancers and other esophageal abnormalities may appear in the posterior mediastinum, and enlarged lymph nodes may also be noted here. Other possibilities include sarcomas,

neurogenic tumors, spinal tumors, Para spinal abscesses, and ectopic thyroid tissue (thyroid tissue growing in an area outside of the thyroid gland. A mass in this region could also be extra medullary hematopoiesis. This is a condition in which blood cells are formed in areas outside of the bone marrow, and while often normal in young babies, is usually abnormal in adults.

Anatomically mediastinum is limited by the pleural cavity, thoracic inlet and diaphragm. [1]. Mediastinal masses are relatively rare (approx.3%) of tumor seen in the chest.The mediastinal mass is found (or suspected) on chest CT and the lesion further diagnostic work up and characterization. 54% masses occurred in the anterior mediastinal, 20% in the middle mediastinal and 26% in the posterior mediastinal.[a]The most common mass in the anterior mediastinum are thymoma, teratoma, lymphoma and thyroid lesions. Congenital cysts and neurogenic masses form the most common in the middle and posterior mediastinum respectively [2].Almost 40% of people who have mediastinal tumors experience no symptoms. Most of the growths are often discovered on a chest x-ray that is performed for another reason. When symptoms are present they are often a result of the compression of surrounding structures, such as the spinal cord, heart or the pericardium (the heart's lining), and may include:

Shortness of breath
Chest pain

- cough
- Fever
- Chills
- Night sweats
- Coughing up blood
- Hoarseness
- Unexplained weight loss
- Lymphadenopathy (swollen or tender lymph nodes)
- Wheezing
- Stridor (a high-pitched, noisy respiration, which can be a sign of respiratory obstruction, especially in the trachea or larynx) [3]

Dyspnea is the most common symptom followed by cough, fever, chest pain, hemoptysis and dysphagia [3]. Localising symptoms are secondary to tumour invasion (respiratory compromise; paralysis of the limbs, diaphragm and vocal cords; Horner syndrome; superior vena cava syndrome), while systemic symptoms are typically due to the release of excess hormones, antibodies or cytokines.
The mediastinum is thymomas, neurogenic tumors and benign cysts, altogether representing 60% of patients with mediastinal masses. Neurogenic tumors, germ cell neoplasms and foregut cysts represent 80% of childhood lesions, whereas primary thymic neoplasms, thyroid masses and lymphomas are the most common in adults [4].
Mediastinum might be affected by tumors, cysts, vascular anomalies and lymph node masses. These lesions are challenging problems [3] frequently faced by the radiologist and often a plain chest radiograph is inadequate for answering the queries posed by the physicians.

1. Previously people have been using invasive procedures like aortography.
2. or surgery

Computed tomography (CT) scanning is the imaging modality of choice in the evaluation of mediastinal lesions. CT scanning is an excellent modality for determining the exact location of the mediastinal tumor, as well as its relationship to adjacent structures. It also is useful in differentiating masses that originate in the mediastinum from those that encroach upon the mediastinum from the lung or other structures. CT scans may help in differentiating various tissue attenuations, and they are highly accurate in differentiating fluid, fat, calcification, and cysts from solid tumors. CT may be used to assess the degree of vascularity of mediastinal tumors. [5,6,7,8]
The CT scan discloses the hidden mediastinal pathology when there is no obvious contour abnormality of mediastinum on plain chest radiography. CT demonstrates the exact size, shape, site, extent and contour of mediastinal masses. [9] Although conventional radiographs detect the mediastinal abnormality, it is limited in delineating the extent, origin and characterization of mediastinal mass [10].
Thymic lesions, bronchogenic cysts and neurogenic masses forms the most common mediastinal masses in the anterior, middle and posterior mediastinum respectively [11].
The CT features of various mediastinal masses have been the subject of numerous reports, and CT is firmly established as an important modality for imaging such masses. CT provides excellent delineation of mediastinal masses, and CT demonstration of fat, calcium, or water attenuation in a mediastinal mass often suggests a specific diagnosis.
However, the ability of CT to differentiate soft tissue mediastinal masses on the basis of morphologic appearance and distribution of disease has not been fully explored. [12]

Aims and Objective

- To determine the sensitivity and specificity of computed tomography in evaluation of mediastinal masses
- To determine the localization of mediastinal masses.
- To determine the common age group exposed to mediastinal masses.

Material and Methods
Study Design

- A retrospective cross-sectional design will be used.

Source of Data

- A secondary source of data was used for the study. It was obtained from the radiology record book of the CT unit, radiology department at NIMS Hospital.

Study population

- All records with requests for CT Chest scan with an indication of mediastinal masses.

Sample Size

- A population study was conducted.

Inclusion Criteria

- The inclusion criteria were: case-control or cohort studies involving participants 18 years or older
- Clinically suspected cases of mediastinal mass/lesion.
- Patients where the chest radiograph showed the mediastinal mass

Exclusion Criteria
- Cardiac cases
- Traumatic cases

Instrument of data collection
- ***128*** CT slice philips genuity machine of the radiology Department.

Method of data collection
- Study of existing records.

Data Analysis
- Subjects were classified according to age group sex and month of examination.
- Data was presented in charts tables.
- Data was analyzed using descriptive statistical tools; frequencies, mean and percentages.

Ethical Considerations
- Ethical clearance will be obtained from the ethical clearance committee of the hospital. The Helsinki declaration as regards confidentiality will be adhered to.

Standard imaging protocol
- Scout image- Antero-posterior.
- Landmark- Lung apices
- Slice Plane- Axial or spiral
- Intravenous contrast- 80-130ml
- Breath hold- Suspended inspiration
- Slice thickness- 7mm sections with 5mm retro-reconstruction from apices to the level of lung bases
- Slice interval- Continuous
- Start location- Lung apices
- End location- Through lung bases

Data analysis and presentation

Results

A total of Fourty (40) patients of the age range of 20-69 were referred for CT scan of the chest to the department of radio diagnosis with a clinical suspicion of a mediastinal mass or who had an abnormal chest radiograph suggestive of mediastinal mass during the study period. Twenty six (26) of the patients were males while fourteen (14) were females.

Out of the total, seventeen (17) patients had anterior mediastinal mass, eight (08) patients had middle mediastinal mass and fifteen (15) patients had posterior mediastinal mass (figure 11).

A total of 2 (5.0%) patients fall within the age group of 20 - 29 years, 7 (17.5%) patients were within the age group of 30 - 39 years. The highest number 16 (40.0%) of patients were patients were within the age group of 40 - 49 years, 18 (32.5%) patients were the age group of 50 - 59 years, A total of 3 (5.0%) patients were within the age group of 60 - 69 years. (Table 2)

Majority of the patients that fall within the age group with the highest patients i.e. 40 -49 years were males.

Table 1: Localization of Mediastinal masses

Mediastinal compartment	Number of cases	Percentage
Anterior	17	42.5%
Middle	08	20.0%
Posterior	15	37.5%
Total	40	100%

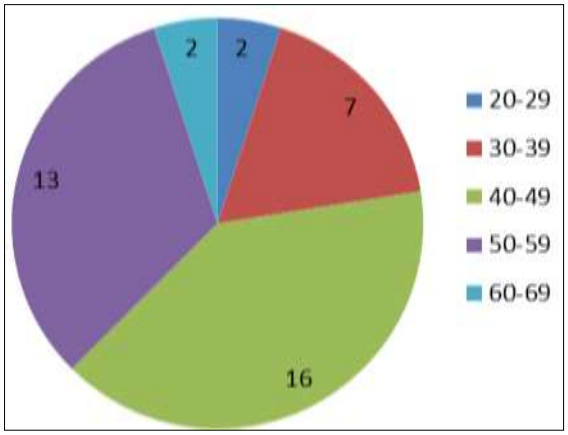

Fig 1: shows age distribution of mediastinum masses

Table 2: Gender distribution of mediastinal masses

Age Group	Number of cases	Male	Female
20-29	2	1	1
30-39	7	4	3
40-49	16	10	6
50-59	13	10	3
60-69	2	1	1
TOTAL	40	26	14

Discussion

CT is an important modality for imaging mediastinal masses. The study was undertaken with the objectives of determining the mediastinal lesions affecting the mediastinum and to correlate the CT findings Mediastinal masses are the rare cases, where 50% of cases does not show any symptoms.Before the discovery of CT scan physician were mainly dependent on history, physical examination etc. But accurate diagnosis was not 100%.Study have proved that CT scan is helpless in differentiating the exact location of mediastinal masses like the anterior mediastinal masses, middle mediastinal masses and the posterior mediastinal masses.

In our study of 40 cases, the majority of the mediastinal masses were in the anterior mediastinum constituting 42.5% followed by middle and posterior mediastinum, which were 20.0% and 37.5% respectively. It is similar to the study conducted by Strollo *et al*. in 1997 wherein anterior mediastinum constituted50% of the masses [13].

In Japan, Takeda *et al*. retrospectively reviewed 806 patients with mediastinal masses a single institute between 1951 and 2000, in which anterior compartment was common location in adults and posterior mediastinum in children [14].It is keeping with findings with the present study.

In our study it was seen between 37 to 69 years. In our study, among the 6 thymoma cases including invasive thymoma, one case had myasthenia gravis (16.6%).

Approximately 30% - 40% of thymoma patients have myasthenia gravis and 10% - 15% of patient with myasthenia gravis have thymomas [15]

In our study of 40 cases of mediastinal lesions, we had 4 cases of paravertebral abscess presenting as posterior mediastinal mass. All the 4 cases were predicted correctly on CT (100% sensitivity, 100% specificity). Among the 4 cases all were cystic (100%) with spine involvement (100%) and showed peripheral enhancement (100%) on post contrast images. Among the 4 cases, 50% were pyogenic and 50% were tuberculosis. Anterior vertebral end plate erosions were noted in all the 4 cases.

In the study, out of 40 cases, 26 cases (65%) were males and 14 cases (35%) were females. The most common age group to present with the mediastinal mass was between 40 and 60 years [16].

In our study of 40 cases of mediastinal lesions, we had 3 cases of sarcoidosis presenting as lymph node masses in middle mediastinum. All the three cases were predicted correctly on CT (100% sensitivity, 100% specificity). All the 3 cases had bilateral hilar and Para tracheal lymph nodes with homogenous post contrast enhancement. None of the cases had lung parenchymal involvement. We had one case of bronchogenic cyst presenting as non-enhancing middle mediastinal cyst in sub carinal location. It was predicted correctly on CT due to its typical CT characteristics and location. In our study we had an unusual case of granulocytic sarcoma presenting as anterior and middle mediastinal mass which was diagnosed histopathologically. We had made a CT diagnosis of lymphoma as it appeared as a heterogeneously enhancing solid lesion with cystic areas on CT. Takasugi et al. in their study concluded that mediastinum was common location among intra-thoracic granulocytic sarcoma [17]

Conclusions

Although Chest X ray is the initial modality in suspected cases of mediastinal mass, their further evaluation needs computed tomography for their accurate localization, analyzing their morphology, involvement of adjacent structures and associated findings in lungs, pleura and chest wall.

In the present study, overall, anterior mediastinum is the most common compartment involved followed by middle and posterior compartment.

Lymphomas and thymomas are the most common masses to involve the anterior mediastinum, aneurysms and lymph node masses to involve the middle mediastinum and nerve sheath tumors to involve the posterior mediastinum. Tran's compartmental involvement is seen in lymph node masses and aneurysms. Most of the mediastinal masses are well defined, with soft tissue attenuation on plain study, showing heterogeneous enhancement on contrast study. Thus CT with an overall accuracy of 94% is an important imaging modality in evaluation of a mediastinal mass.

Recommendation

There is always a scope of improvement and change in time to come ahead. Thus every study leaves back scopes for other researcher to do something more advanced and varied in order to touch the height of perfection. This study is not an exception as it only examined 40 subjects.

- The study can expand the study by including more number of subjects so as to make generalization of the results and practice.
- A study with a larger sample size and in multiple centers can also be carried out.

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