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Original Research Article

Computed Tomographic Evaluation of Mediastinal Masses

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Abstract: Mediastinal masses represent wide diversity of disease state which may be completely asymptomatic or present with symptoms and signs suggesting intrathoracic pathology. Chest X ray can be used to detect mediastinal mass but CT is used for further characterization of mediastinal mass. Patients from our hospital who were suspected to have a mediastinal mass either on clinical examination or on the basis of an abnormal chest radiograph were included in the study. The patients were subjected to a thorough history and clinical examination. CT examination of the patient was done using a GE LIGHT SPEED 16 SLICE CT SCANNER. Our study included a total of 50 cases, 31 males and 19 females. Anterior mediastinum is the most commonly involved compartment (n=27, 42.2%), followed by middle (n=23, 35.9%) and posterior mediastinum (n=14, 21.8%). Thymic masses (n=7, 46.6%), Aneurysms (n=6, 54.5%) and Nerve sheath tumours (n=4, 33.3%) are the most common masses to have isolated compartmental involvement of anterior, middle and posterior mediastinum respectively. The majority of the mediastinal masses are well defined (n=36, 72%), with soft tissue (n=34, 68%) attenuation on plain CT, showing heterogeneous enhancement (n=22, 44%) on administration of intravenous contrast. Computed tomography is an important modality in the evaluation of mediastinal masses for their exact localization, analyzing their morphology and arriving at a provisional diagnosis for optimal patient management.
Keywords: Computed Tomography, Mediastinum, Lymphoma, Thymoma, Mass, Compartment

INTRODUCTION

The aims and the objectives of the study are to study the distribution of mediastinal masses, to study the computed tomographic characteristics of mediastinal masses and to study the involvement of neighbouring structures and associated findings in mediastinal masses.

Mediastinal masses have a very wide clinical spectrum. The patient may be asymptomatic or may show severe symptoms due to compression of various organs in the mediastinum. Chest radiography is a very common examination in clinical practice. Computed Tomography (CT) can be used in determining the exact location of a mediastinal mass as well as its relationship to adjacent structures.

Advantages of CT such as better spatial resolutions, shorter imaging time, less expensive and its availability made CT a better imaging technique. Co-existing lung abnormalities and calcifications within the lesions are better appreciated on CT. CT guided biopsies can be performed with CT apart from evaluating the mediastinal mass accurately.

The lateral boundaries of the mediastinum are formed by the pleural cavities whereas; the superior boundary is formed by thoracic inlet and the inferior boundary by diaphragm. The mediastinum is divided into 3 compartments which are anterior, middle and posterior compartments [1]. The mediastinal masses generally present with chest pain, cough, fever, chills and dyspnea.

INDICATIONS FOR THE CT EVALUATION OF THE MEDIASTINUM [2-4]:

1. To define and characterize a mediastinal abnormality suspected or diagnosed on plain radiographs.
2. To evaluate the mediastinum in patients who have normal chest radiographs yet a clinical reason to suspect mediastinal disease.
3. Radiation treatment planning and follow up.
4. Aid biopsy and drainage procedures.

Table 1: Classification Of Mediastinal Abnormalities Based On Ct Attenuation Characteristics [5-7]:

CT Attenuation	Lesion
Fat	Lipoma, lipomatosis, thymolipoma, liposarcoma, teratoma, epicardial fat pad, hernia
Water	Thymic cyst, teratoma, pericardial cyst, bronchogenic cyst, esophageal duplication cyst, meningocele, neurenteric cyst
Soft tissue	Thymoma, thymic carcinoma, germ cell tumor, esophageal neoplasm, neurogenic tumor, lymphoma, lymphadenopathy
High attenuation	Calcified nodes (histoplasmosis, tuberculosis, sarcoidosis, silicosis), calcified neoplasms (thymoma, teratoma, treated lymphoma, neurogenic tumor, metastases), fibrosing mediastinitis, hemorrhage, goiter
Contrast enhancing	Vascular, goiter, Castleman disease, hemangioma, paraganglioma

Table 2: The Anatomical Location of Mediastinal Masses [3]:

Position in mediastinum	Common lesions	Rare lesions
Anterior mediastinum	Tortuous innominate artery Lymph node enlargement Retrosternal goiter Fat deposition Thymic tumor Germ cell tumor Aneurysm of ascending aorta Epicardial fat pad Diaphragmatic hump Pleuropericardial cyst	Aneurysm of innominate artery Parathyroid adenoma Lymphangioma Sternal mass Lipoma Hemangioma Morgagni hernia
Middle mediastinum	Lymph node enlargement Aneurysm of arch of aorta Enlarged pulmonary artery Dilated superior vena cava Bronchogenic cyst	Tracheal lesions Cardiac tumors
Posterior mediastinum	Neurogenic tumors Pharyngo esophageal pouch Hiatus hernia Aneurysm of descending aorta Esophageal dilatation Dilatation of azygous vein Paravertebral mass	Neuroenteric cyst Pseudocyst of pancreas Sequestrated lung segment Bochdalek hernia Ectopic kidney Extramedullary hemopoiesis Cyst of thoracic duct Lateral meningocele

MATERIALS AND METHODS

All the patients referred from the departments of medicine, surgery, pediatrics and chest & TB, to the department of radiodiagnosis with a clinical suspicion of a mediastinal mass or who had an abnormal chest radiograph suggestive of mediastinal mass were taken for the study. Thorough clinical history and clinical examination is done before CT examination. All the cases taken up for the study are evaluated using GE Light Speed 16 Slice CT Scanner.

The type of the study is Prospective type and the sample size is 50.

Inclusion Criteria:

- Clinically suspected cases of mediastinal mass/lesion.
- Patients where the chest radiograph showed the mediastinal mass.

Exclusion Criteria:

- Cardiac cases
- Traumatic cases

Preparation of the patient:

All patients were kept overnight fasting to avoid the complications related to contrast administration. Risk associated with contrast administration was explained to the patients and informed consent was obtained prior to the contrast administration.

Standard Imaging Protocol:

1. Scout image- Anteroposterior
2. Landmark- Lung apices
3. Slice Plane- Axial or spiral
4. Intravenous contrast- 80-130ml
5. Breath hold- Suspended inspiration
6. Slice thickness- 7mm sections with 5mm retro reconstruction from apices to the level of lung bases
7. Slice interval- Continuous
8. Start location- Lung apices
9. End location- Through lung bases

Because lung cancer may metastasize to the adrenal glands, scanning was continued through to the adrenals in patients with a history of cancer.

CT scan images were viewed in lung window (level 700 HU; width 1500 HU), mediastinal window (level 30 HU-50 HU; width 350 HU-500 HU) and bone window (level 2400 HU; width 200 HU).

THYMIC CARCINOMA

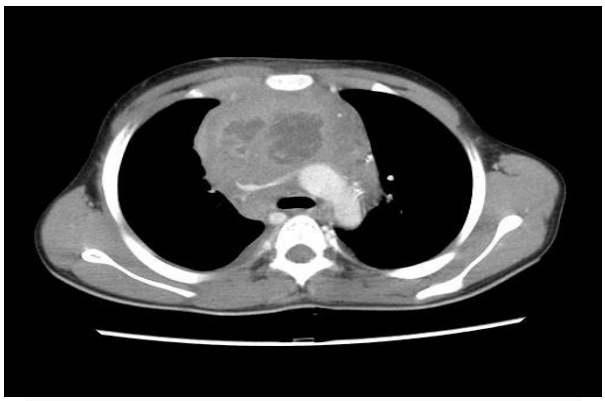

Fig 1: Axial CT of thorax in an 11 years old male showing thymic carcinoma.

METASTATIC LYMPHADENOPATHY

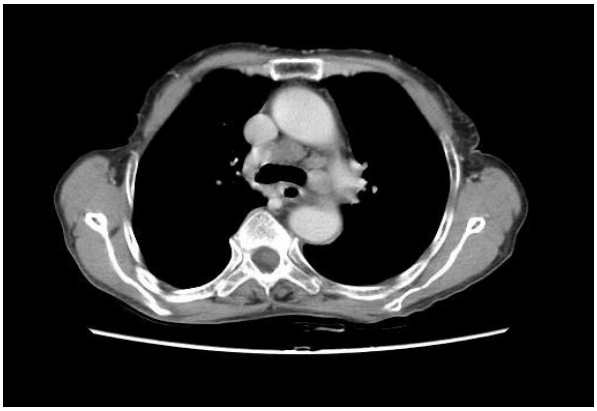

Fig 2: Axial CT of thorax in a 70 years old female showing metastatic lymphadenopathy.

BRONCHOGENIC CYST

Fig 3: Axial CT of thorax in a 12 days old baby showing bronchogenic cyst.

CARCINOMA THYROID WITH DISTAL ESOPHAGEAL CARCINOMA AND METASTATIC MEDIASTINAL LYMPHADENOPATHY

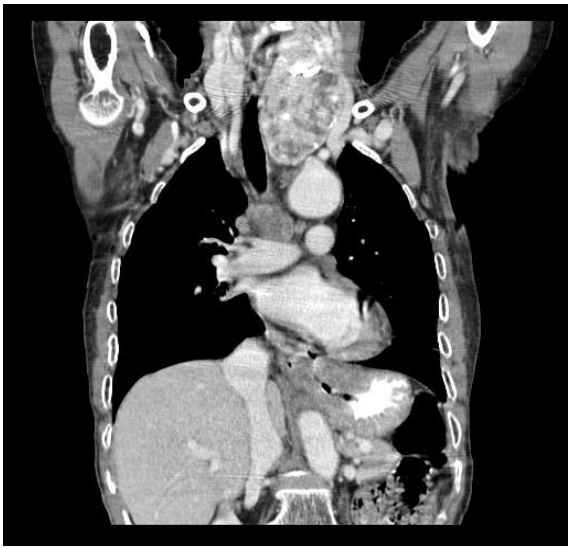

Fig 4: Coronal CT of thorax in a 65 years old female showing thyroid carcinoma, distal esophageal carcinoma and metastatic mediastinal lymphadenopathy

RESULTS

Table 3: Age Distribution of Mediastinal Masses:

Age in Years	No. of Cases	Percentage
<1	1	2.0
1-20	1	2.0
21-40	23	46.0
41-60	22	44.0
>60	3	6.0
Total Cases	50	100.0

In the present study, mediastinal masses were found to be common in 3rd to 6th decade of life (90%).

Table 4: Sex Distribution of Mediastinal Masses:

Age	Male	Female	Total
<1	0 (0%)	1 (5.3%)	1 (2.0%)
1-20	1 (3.2%)	0 (0%)	1 (2.0%)
21-40	9 (29.0%)	14 (73.7%)	23 (46%)
41-60	19 (61.3%)	3 (15.8%)	22 (44.0%)
>60	2 (6.5%)	1 (5.3%)	3 (6.0%)
Total	31 (100.0%)	19 (100.0%)	50 (100.0%)

In the present study, mediastinal masses were more common in men who presented more commonly in the 5th-6th decade of life. Females more commonly presented in the 3rd-4th decade of life.

Table 5: Localisation of Mediastinal Masses:

Mediastinal Compartment	No. of cases	Percentage
Anterior	15	30.0
Middle	11	22.0
Posterior	12	24.0
Anterior+Middle	10	20.0
Anterior+Middle+Posterior	2	4.0
Total	50	100.0

In the present study, isolated compartment involvement is most common in the anterior mediastinum followed by posterior mediastinum and middle mediastinum.

Table 6: Distribution of Anterior Mediastinal Compartment Masses

	No. of cases	Percentage
Thymic masses	7	46.7
Thyroid	5	33.3
Teratomas	2	13.3
Lymphoma	1	6.7
Total	15	100.0

In the present study, the most common mass to involve solely the anterior mediastinum are thymic masses.

Table 7: Distribution of Middle Mediastinal Compartment Masses:

	No. of cases	Percentage
Aneurysms	6	54.6
Metastatic lymph nodes	3	27.2
Tuberculous lymph nodes	1	9.1
Lymphoma	1	9.1
Total	11	100.0

In the present study, the most common mass to involve solely the middle mediastinum are aneurysms.

Table 8: Distribution of Posterior Mediastinal Compartment Masses:

	No. of cases	Percentage
Nerve sheath tumors	4	33.3
Aneurysm	3	25.0
Paravertebral abscess	2	16.7
Mediastinal pseudocyst	2	16.7
Bronchogenic cyst	1	8.3
Total	12	100.0

In the present study, the most common mass to involve solely the posterior mediastinum are nerve sheath tumors.

Table 9: Distribution of Anterior+Middle Mediastinal Compartment Masses:

	No. of cases	Percentage
Lymphoma	6	60.0
Metastatic lymph nodes	2	20.0
Tuberculous lymph nodes	2	20.0
Total	10	100.0

In the present study, the most common mass to involve anterior+middle mediastinum is lymphoma.

Table 10: Distribution of Anterior+Middle+Posterior Mediastinal Compartment Masses:

	No. of cases	Percentage
Aneurysm	1	50.0
Lymphoma	1	50.0
Total	2	100.0

In the present study, a single case of lymphoma and aneurysm each were found to involve all the mediastinal compartments.

Table 11: Plain Study Attenuation of Mediastinal Masses:

Attenuation	No. of cases	Percentage
Soft	34	68.0
Cystic	23	46.0
Calcifications	22	44.0
Fat	2	4.0

In the present study, soft tissue attenuation is seen in 68% cases and cystic attenuation is seen in 46% cases. Calcifications are seen in 44% cases and fat is seen in 4% cases.

Table 12: Contrast Enhancement Pattern of Mediastinal Masses:

Pattern of	No. of cases	Percentage

enhancement		
Homogenous	11	22.0
Heterogenous	22	44.0
Rim	7	14.0
Intense	10	20.0
Total	50	100.0

In the present study, heterogenous enhancement of masses is seen in 44% cases, homogenous enhancement in 22% cases, rim enhancement in 14% cases and intense enhancement in 10% cases.

DISCUSSION

The present studies were undertaken with the objectives of exact localization of mediastinal masses and study their morphological features.

Table 13: Age Group Distribution:

Age group (Years)	**Our study (50 cases)**	**Harmeet Kaur *et al.*;(120cases) [9]**
0-20	4.0%	10.0%
21-40	46.0%	25.0%
41-60	44.0%	33.3%
>61	6.0%	31.6%

In our study, most common age group was 21-40 yr of age which is comparable to study by Harmeet Kaur et al. However, in our study, only 6% cases were seen in >61 yrs of age whereas Harmeet Kaur *et al* found 31.6% cases in >61yrs age group.

Table 14: Compartmental Distribution:

Compartment	**Our study (50 cases)**	**Strollo *et al.*; (35 cases) [10]**	**Kiran *et al.*; (50 cases) [11]**
Anterior mediastinum	42.0%	50.0%	52.0%
Middle mediastinum	36.0%	50.0%	18.0%
Posterior mediastinum	22.0%	-	30.0%

In our study, anterior mediastinum is the most commonly involved compartment, followed by middle and posterior mediastinum.

In our study, vascular masses are the most common mediastinal masses followed by lymphomas and thymic masses.

Table 15: Distribution of Individual Masses:

Masses	**Our study (50 cases)**	**Kiran *et al.*; (50 cases) [11]**	**Dutta *et al.*; (50 cases) [12]**	**Benjamin *et al.*; (214 cases) [13]**	**Cohen *et al.*; (230 cases) [14]**
Thymic masses	14.0%	14.0%	18.0%	20.6%	24.3%
Thyroid masses	10.0%	4.0%	4.0%	11.2%	1.7%
Lymphomas	18.0%	6.0%	8.0%	14.9%	15.7%
Germ cell tumors	4.0%	2.0%	4.0%	12.6%	10.0%
Neurogenic tumors	8.0%	10.0%	8.0%	22.9%	16.9%
Vascular	20.0%	8.0%	10.0%	7.5%	1.7%
Miscellaneous	26.0%	-	22.0%	-	-

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 mediasinum 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. Transcompartmental 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 heterogenous enhancement on contrast study. Thus CT with an overall accuracy of 94% is an important imaging modality in evaluation of a mediastinal mass.

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