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Role of Contrast Enhanced Computed Tomography in Evaluation of Mediastinal Lesions

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Abstract: ***50 cases with clinical or radiological suspicion of mediastinal lesions were underwent CECT chest for characterization ofmediastinalmasslesionandsubsequentlyimagingfindingswereverifiedwithpathologicaldiagnosis. The most common compartment to be involved was antero-superior mediastinum (48%) followed by middle (28%) and posterior mediastinum (24%). Predominant lesions were benign. The commonest lesion was tubercular lymphadenopathy (16%). Thymic masses and metastatic lymphadenopathy (41% total) were the most common mediastinal lesions in the anterior mediastinal compartment. Neural tumors (28.59%) and metastatic lymphadenopathy (33.33%)were the common lesions in middle and posterior mediastinal compartments respectively. Ascending aortic dissection was the predominant vascular lesion (8.3%).***

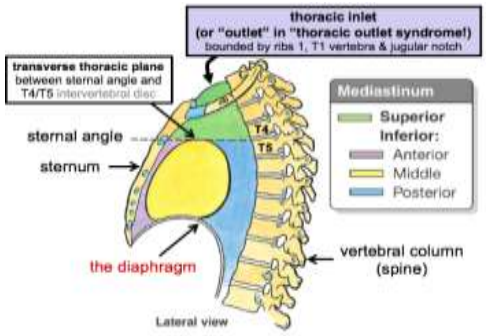
Keywords: CECT, Mediastinum, histopathology, benign, malignant

1. Introduction

The mediastinum is an extra pleural space within the thorax between two lungs. Anatomy of media stinumis complex, because of the presence of vital structures, like heart and great vessels. It extends from the sternum anteriorly to the vertebral column posteriorly. The upper limit is formed by the thoracic inlet and the lower limit by the diaphragm. An imaginary plane extends from the sternal angle to the lower border of the fourth dorsal vertebra dividing the mediastinum into superior and inferior divisions. The inferior mediastinum is subdivided by the heart into anterior, middle and posterior mediastinum. [1] Localization of mediastinal masses to one of these divisions can facilitate their differential diagnosis on conventional radiographs. The multitude of diseases affecting the mediastinum varies considerably, comprising of tumors (benign to extremely malignant), cysts, vascular anomalies, lymph node masses, mediastinitis, mediastinal fibrosis and pneumo-mediastinum. CT clearly demonstrates the malleable nature of the cysts, which change their shape with respect to change in position from prone to decubitus. [2]

Mediastinal lesions are difficult to detect on X-ray because these lesions are of soft tissue densities and are surrounded by softtissuestructures. Although conventional radiographs can show recognizable abnormalities in many patients with mediastinal abnormalities, radiographs are limited in their sensitivity and ability to delineate the extent of mediastinal abnormalities and the relationship of masses to specific mediastinal structure.[3]

With the CECT these problems are overcome because of its excellent density resolution and tomographic format helping the clinicians and radiologists in identifying the precise location, extent, discrimination of vascular and a vascular causes of mediastinal widening, ,characterization((fat, fluid, calcification etc.) of thesemasses, vascular variants or benign pathologies of mediastinum such as lipomatosis, from true pathological conditions.[4][5]



Cross-sectional imaging of the mediastinum by CT demonstrates precise anatomic details and is the imaging modality of choice for most the mediastinal lesions. [6,7,8]Coexisting lung abnormalities and calcification within the lesions are better appreciated on CT. On CT, it is more appropriate to base the differential diagnosis of a mediastinal mass on direct observation of the tissue or structure from which the mass is arising (*e.g*., lymph nodes, veins, arteries, thymus and thyroid) rather than its location. CECT can help to narrow the differential diagnosis or even reach the diagnosis without the need of further invasive procedures.

CT gives clear delineation of lesions and distinguishes them better from normal structures. CT clearly demonstrates mediastinal invasion based on the following criteria: (1) confluence of tumor with mediastinum; (2) angle more than 90 degrees between the mass and mediastinal vessels or pericardium; (3) indentation of border between the mass and vessel with absence of mediastinal fat plane; (4) thickened wall of proximal end of main stem bronchus [9]. In correlation with clinical data, it is more accurate in suggesting whether lesions are benign or malignant [10].

The differential diagnosis of a mediastinal mass on CECT is usually based on several findings, including its location, identification of the structure from which it is arising, whether it is single, multifocal or diffuse, its size and shape, its attenuation, the presence of calcification and its character and amounts, and its opacification following contrast administration.[11,12]In this study, all the cases were subjected to CECT evaluation for better characterization, extent, probable tissue of origin, and effect on adjoining structures.

The additional role of CT in performing CT guided biopsies of lesions cannot be over emphasized. Since the advent of CT, a decline in the use of other diagnostic chest procedures like chest fluoroscopy, mediastinoscopy, arteriography and thoracotomy has occurred.

2. Aims and Objectives

- To characterize different mediastinal lesions on plain X-ray and contrast enhanced Computed Tomography,
- To estimate proportion of benign and malignant mediastinal mass lesions based on CT findings
- To compare findings with histo- pathological diagnosis wherever possible.

3. Materials and Methods

All patients referred to Department of Radio-Diagnosis, SMIMERbetween May2017and August 2018 with clinical suspicion of mediastinal space occupying lesions or who had a chest radiograph with a suspicious of mediastinal abnormality were included in the study. The prospective study was carried out on 50 cases. Informed consent was taken from all patients.All relevant clinical information and details of laboratory investigations like routine hemogram, sputum examination and any other relevant investigation were recorded. Standard chest radiographs (Postero-Anterior and lateral views) and barium swallow investigation was done in cases where required.

Inclusioncriteria:

- Patientsofbothsexesofany age group clinically suspected to have mediastinal mass lesion
- Suggestion of mediastinalwidening/mass on chest radiograph
- Availability of histopathological examinationreport.

Exclusioncriteria:

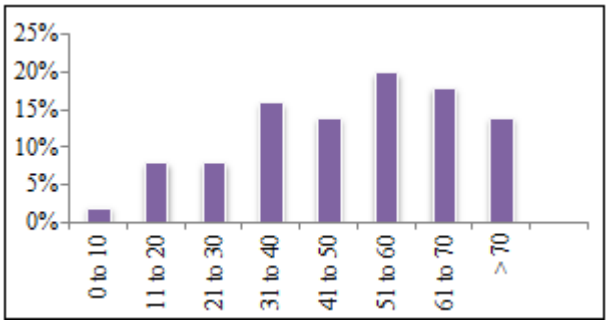
- Historyof hypersensitivity to intravenous contrast agents
- Renal failure
- Post-surgical patients; pregnant women
- Post traumatic patient
- Cardiacmasses.

Computed tomography was done on PHILIPS 16 SLICE CT scanner in all cases in supine position with breath hold at the end of inspiration. Contrast Enhanced Computed Tomography (CECT) was done using 60 to 120 ml of 300 mg/ml of nonionic iodinated contrast (*i.e.* Omnipaque). CT scans of thorax were being viewed with slice acquisition thickness of 8mm and reconstruction interval of 8mm from the level of 2cm superior to lung a pices upto the diaphragm and routinely included the adrenals. Additional thin sections were being taken for multiplanar reconstructions and 3D image analysis. CT scan images were being viewed in lung window (level 700 HU; width 1,500 HU), mediastinal window (level 30 HU-50 HU; width 350 HU-500 HU) and bone window (level 2,400 HU; width 200 HU). CT scan analysis was done for any mediastinal mass, enhancement pattern, calcification, mass effect, bone destruction or associated findings (pulmonary/ extrapulmonary/ cardiac). Pathological diagnosis was done by Fine Needle Aspiration Cytology (FNAC)/ biopsy/ surgery wherever it was required.

4. Observation & Discussion

Table 1 Distribution of patients according to age & sex

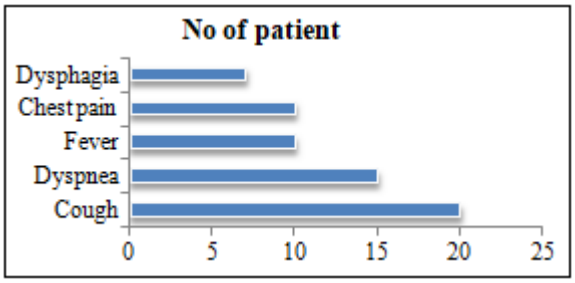
Age group	*Male*	*Female*	*Total*	*Percentage (%)*
0 to 10	1	0	1	2%
11 to 20	1	3	4	8%
21 to 30	2	2	4	8%
31 to 40	5	3	8	16%
41 to 50	4	3	7	14%
51 to 60	6	4	10	20%
61 to 70	5	4	9	18%
> 70	4	3	7	14%
Total Cases	28	22	50	100%



As shown in Table 1 maximum number of cases (20%) were seen in the age group of 51-60 years. There were 28 male (56%) and 22 female (44%), that give the ratio of 1.2:1.

Table 2: Distribution of patients according to clinical symptoms

Symptom	*No. of patients*
Cough	20
Dyspnea	15
Fever	10
Chest pain	10
Dysphagia	7

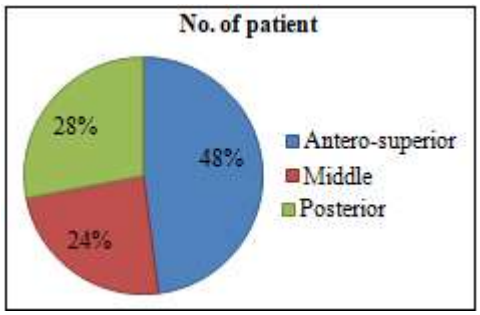


In present study of 50cases, Cough was the most common clinical symptom constituting 40% followed by dyspnea in

30%, fever in 20% , chest pain in 20% and dysphagia in 14% patient.

Table 3: Compartmental distributions of mediastinal masses

Compartment	*No. of patient*
Antero-superior	24
Middle	12
Posterior	14



In the study, total 24 patients (48%) formed the antero-superior mediastinal masses. Among this 24 patients, thymic masses formed the majority constituting 25% (*n*=6),followedby lymphoma in 20.83%%(*n*=5). Middle mediastinal masses comprised of 24% (*n* = 7) of the total mediastinal masses. Among them the metastatic LN involvement formed the majority, i.e., 33.33% (*n* = 4) followed by tuberculosis (TB) LN enlargement constituting 25.01% (*n* = 3). Posterior mediastinalmasses comprised 28% (*n* = 14) of the total mediastinal masses, the majority were contributed to neural tumors constituting 28.59% (*n*=4) followed by para vertebral abscess constituting 21.42% (*n* = 3) and esophageal mass constituting 21.42% (n—3).

Table 4: Distribution of the lesions based on their Computed tomography enhancement pattern

Pattern of enhancement	No. of patient	Percentage (%)
Heterogeneous enhancement	28	56%
Homogenous enhancement	9	18%
Non enhancing lesions	2	4%
Rim enhancement	3	6%
Intense enhancement	5	10%
Luminal enhancement	3	6%
Total cases	50	100%

In the study, majority of the masses, showed heterogeneous enhancement, i.e., 56% (*n*=28) followed by homogenous enhancement; 18% (*n* = 9) and non enhancing masses constituted 4% (*n* = 2).

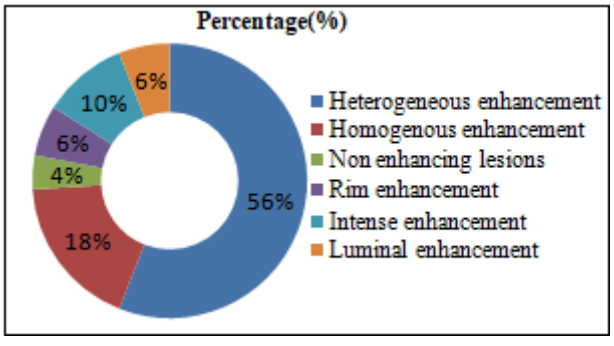


Table 5: Distribution of the lesions based on their nature on CT

Type of lesion	*No. of Patients*
Solid lesions	24
Solid + Cystic lesions	13
Cystic	5
Vascular lesions	2
Fatty + cystic + solid	4
Fatty	2
Total cases	50

As seen in Table 5, majority of the mediastinal lesions/masses were solid constituting 48% (n = 24) of the total masses followedbysolid+cysticlesionsconstituting26%(n=13) ofthemasses.

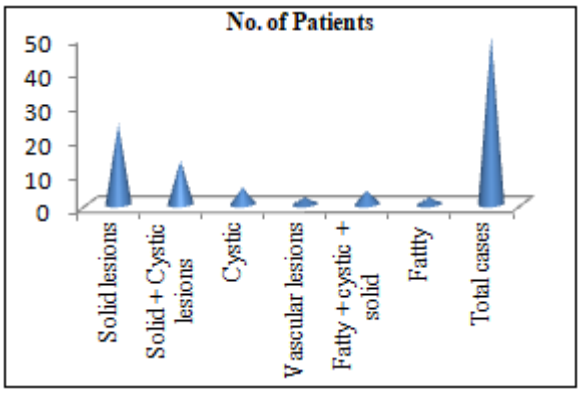


Table 6: Antero-superior mediastinal lesions distribution

Mediastinal lesions	*Number of cases*	*Percentage*
Thymic masses	6	25%
Metastatic LN	4	16.60%
TB LN	4	16.60%
Sarcoidosis	1	4.16%
Lymphoma	5	20.83%
Thyroid mass	3	12.50%
Genu cell tumor	1	4.16%
Total	24	100%

Table 7: Middle mediastinal lesions distribution

Mediastinal lesions	*Number of cases*	*Percentage*
Metastatic LN	4	33.33%
TB LN	3	25.01%
Neuroenteric cyst	1	8.33%
Esophageal duplication cyst	1	8.33%
Bronchogenic cyst	2	16.67%
Vascular	1	8.33%
Total	12	100%

Table 8: Posterior mediastinal lesions distribution

Mediastinal lesions	*Number of cases*	*Percentage*
Neural	4	28.59%
Paravertebral abscess	3	21.42%
Tb LN	1	7.14%
Esophageal mass	3	21.43%
Extramedullaryhemopoiesis	1	7.14%
Lymphangioma	1	7.14%
Vascular	1	7.14%
Total	14	100.00%

5. Images & Discussion

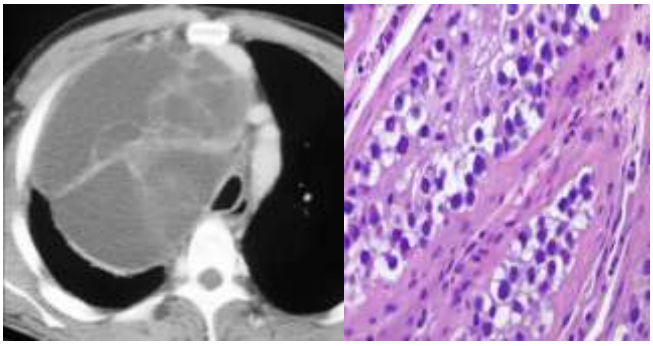


Figure 1: Axial images of CECT chest shows cystic anterior mediastinalmass with solid enhancing septa. (Germ cell tumor)

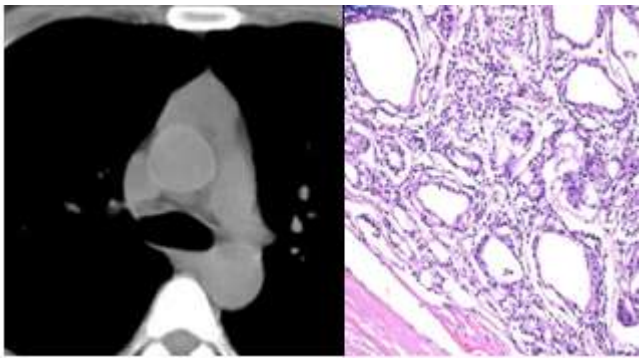


Figure 2: Axial images of CECT chest shows anteriormediastinal mass with water density attenuation. – (Thymic cyst)

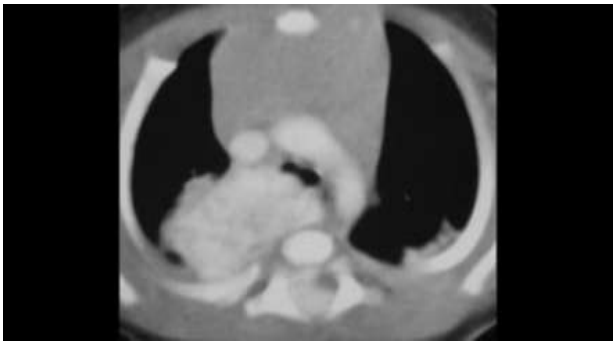
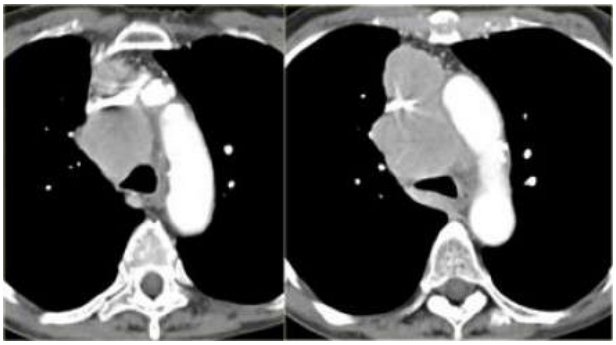


Figure 3: Axial images of CECT chest shows a large thymus in this young child and also an enhancing mass in the posterior mediastinum extending into the vertebral canal.(hemangioma)



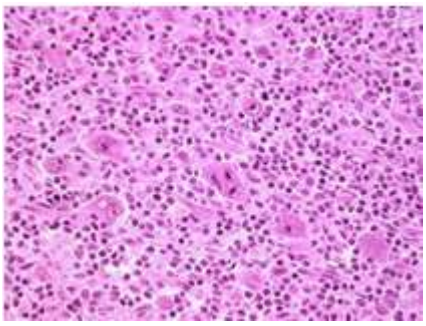


Figure 4: Axial images of CECT chest shows Lymphoma in both the anterior and the middle mediastinum

6. Discussion

In present study of 50 cases, Cough was the most common clinical symptom constituting 40% followed by dyspnea in 30%, fever in 20%, chest pain in 20% and dysphagia in 14% patient whereas in the study of Davis *et al.* (1987) comprising of 400 consecutive patients with mediastinal masses, chest pain constituted the most common symptom *i.e.* in 30% followed by fever in 20%[13]

In this study, total 24 patients (48%) formed the antero-superior mediastinal masses, Middle mediastinal masses comprised of 24% (n = 7) of the total mediastinal masses, Posterior mediastinal masses comprised 28% (n = 14) of the total mediastinal masses, which is similar to the study conducted by Davis *et al.*[8] on adults which depicted that anterior mediastinum constituted 54% of the masses followed by posterior and then middle which constituted 26% and 20% respectively. The findings of our study are also consistent with the study of Dubashi *et al.* [14] which concluded that majority of tumors were seen in the anterior mediastinum followed by posterior mediastinum.

In present study, granulomatous lesions constituted 16%, which is greater in comparison to Wychulis *et al.*[15] study (i.e., 6.3%) probably due to the higher prevalence of TB in our population as compared to the western population. According to Im *et al.* series, right paratracheal LN enlargement was seen in 87% of cases whereas Present study showed 60% involvement. Similarly in Im *et al.* [16] study, 52% of the TB LN enlargement showed central areas of low attenuation with rim enhancement on contrast study. The present study showed 40% involvement. The present study had 3 cases of paravertebral abscess (5.0%) which was associated with vertebral body destruction.

In present study, the thymic tumors formed the majority with 12%, which is similar to studies conducted by Cohen *et al.*[17] In a study by Chen *et al.* [18] on 34 patients with CT diagnosis of thymic mass, thymoma constituted 42% and thymic cyst 2.9%. Whereas in present study, out of 6 patients with thymic mass, thymoma constituted 50%, thymichyperplasia, thymolipoma and thymic cyst constituted 16.6%.

In the study of 4 cases of neurogenic tumors, neurofibroma constituted 50% (n=2), schwannoma 25% (n = 1) and paraganglioma 25% (n =1). Intrathoracicgoiters are also common cause of mediastinal enlargement. Thyroid masses account for 11-15% of mediastinal masses.[19] In

the present study, they represented only 6% of the cases.

7. Conclusion

CT plays a significant role in the assessment of various mediastinal pathology with a higher accuracy. It is a promising 3D imaging tool which allows substantial anatomical volumes to beroutinely covered with isotopic sub-millimeter spatialresolution highly useful for the investigation of mediastinal masses. CECT definitely has a major role to play in the evaluation of a mediastinal mass lesions regarding theircharacterization and differentiating between benign andmalignant lesions.

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