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Original research article

The role of CT in the evaluation of mediastinal masses

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Abstract

Objectives: The objectives of this study were to investigate the distribution of mediastinal masses, their CT features and spread of these masses in the neighboring structures.

Methodology: This study was conducted in from to. It was a cross-sectional study. A total of 60 patients were included in this study. The plain chest radiographs of these patients showed unusual mediastinal shadow or masses. For further evaluation of these findings CT scan was performed. Both, plain and contrast enhanced studies were performed.

Results: Dyspnea was the most common symptom, present in 34% patients. Most commonly the masses were found in the anterior mediastinum, 46.7% cases, and least commonly in the middle mediastinum, 20% cases. In posterior mediastinum 33.3% masses were found. The most frequent type of mass in anterior mediastinum was thymic mass with 32 percentage, in middle mediastinum lymph node metastasis with 50 percentage and in posterior mediastinum neural tumors with 30 percentage. Thymic cyst was the most typical type of thymic mass with 40 percentage and thymolipoma was least common with 10 percentage. 31% of the masses showed up on the scan as homogeneous. The most frequent nature of mass found was solid, 68%. Calcification of the mass was found in 25% cases and involvement of the neighboring structures was in 41.7% cases.

Conclusion: Our study concluded that CT plays a vital role in the evaluation of mediastinal masses. The most common symptom in our patients was dyspnea. The results showed that most commonly masses were found in the anterior mediastinum and least commonly in the middle mediastinum. The most common type of masses were thymic mass, lymph node metastasis and neural tumors in anterior, middle and posterior mediastinum respectively. Thymic cyst was the most typical type of thymic mass. Most frequently the masses showed up on the scan as homogeneous. The most recurrent nature of mass found was solid. Calcification of the mass and involvement of the neighboring structures was not very common.

Keywords: Mediastinal masses, CT, mediastinum, lesion

Introduction

The mediastinum is the middle part of thoracic cavity, located between the both lungs right above the diaphragm. It is divided into 3 main compartments: anterior, middle and posterior mediastinum. Various type of masses can form here including tumors, lesions and cysts. Mediastinal masses are usually not very clearly demonstrated on plain radiographs of the chest. On chest x ray these masses often appear as ill-defined shadows. So, CT is considered a requisite part of mediastinal investigation. In the past CT was considered a practical choice for the investigation of abdomen and brain. But now studies suggest that CT is also valuable for chest and mediastinal studies.

Before the advent of CT, diagnosing a mediastinal mass was challenging for the doctors. Nevertheless, now CT has made this diagnosis easy. With CT, we can now identify the precise location of the mass, its type and its spread to the neighboring structures. The preoperative CT scan can provide diagnostic information important for the management and prognosis of the disease.

CT has superior contrast and density resolution. Because of this property CT can differentiate between normal and abnormal mediastinal structures. Abnormal structures can be opacified blood vessels, opacified soft tissues, vascular abnormalities, masses, tumors etc. CT can also be used in characterization of mediastinal masses. This is done on the basis of the amount of x rays attenuated by the mass. Similarly, the origin and extent of metastasis can also be reckoned via CT scan.

A CT scan acquires images in the axial plan, which can then be reconstructed into sagittal and coronal

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plane. Therefore, CT can provide images in every plane of the body. This is helpful while imaging the mediastinum with various structures layered over each other i.e. trachea, esophagus, thymus, aorta, pulmonary vessels and superior vena cava. This eliminates the problem of superimposition of structures onto each other, which could completely or partially obscure the details of pathological structures and masses. This is often the leading reason as to why mediastinal masses are not evidently diagnosed on a plain radiograph. Another major benefit of this is that CT can show us the extent of spread of the mass with different planes, allowing us to judge the involvement of neighboring structures.

Mediastinal masses can be of various pathological, as well as in radiological types. Thymoma is one of the most frequently encountered mediastinal lesion. Others include benign cysts and neurogenic tumors. These 3 types of masses represents almost 60 percent of all mediastinal masses. In children, 80 percent of the lesions are neurogenic tumors, foregut cyst and germ cell tumors. On the other hand, in adults primary thymic neoplasms, lymphomas and thyroid masses are most common.

Based on the anatomy of the mediastinum, different types of mass are found in its different compartments. In the anterior mediastinum 50 percent of all tumors are found. It includes teratoma, lymphoma, thymoma and thyroid disease. In middle mediastinum most commonly, congenital cysts are found. Lastly in posterior mediastinum neurogenic tumors are most frequent.

The diagnosis of thymic hypertrophy and thymoma with CT shows that it can differentiate calcium deposits and fat densities. It has also been used in the diagnosis of mediastinal teratoma and mediastinal widening.

Generally, most patients with mediastinal mass presents with dyspnea, chest pain, cough and fever. Invasive tumor can cause respiratory compromise, Horner syndrome, limb paralysis, vocal cord paralysis and superior vena cava syndrome.

This study was conducted to investigate the distribution of mediastinal masses, their CT features and spread of these masses in the neighboring structures.

Method

This study was conducted in from to. It was a cross-sectional study. A total of 60 patients were included in this study. The inclusive criteria was: patients with suspected mediastinal mass and patients with chest radiographs showing mediastinal lesion or distorted shadow. Patients with trauma, cardiac diseases and pulmonary lesion were excluded from this study.

The plain chest radiographs of the patients included in this study showed unusual mediastinal shadow or masses. For further evaluation of these findings CT scan was performed. First plain and then contrast enhanced CT studies were performed.

All the patients were scanned with 16 slice CT scanner in AP and lateral positions. The radiological factors were kept constant for all the cases, 120 kV and 70 mA. Slices of 5mm thickness were acquired from above the sternal notch till the diaphragm. Slice interval was 0.5 cm for all the patients. The procedure was done during arrested inspiration.

Contrast studies were performed to differentiate between the vascular structures and mediastinal tumors. Iodinated contrast media was used. For contrast studies 80 to 130 ml intravenous contrast was administered.

Images were then reconstructed in sagittal and coronal plane for evaluation of the mass. Per and post contrast images were compared and studied.

Results

In this study, 60 patients with x ray finding of mediastinal abnormalities were referred to the CT scan for further evaluation of the x ray results. The purpose of CT scan was to characterize the lesion, investigate the involvement of the neighboring structures and distribution of masses in the mediastinal compartments.

The percentage of male and female patients of different age groups in given in Table 1. Out of 60, 63% patients of the patients aged till 15 years were male and 37% were female. 45% males were aged 16 to 30 years and 55% female. 38% males were aged 31 to 45 years and 62% female. 40% male were aged 46 to 60 years and 60% female. And 70% male were aged above 61 years and 30% female.

Table 1: Age and sex distribution of patients

Age	Percentage of males	Percentage of females
0 to 15 years	63%	37%
16 to 30 years	45%	55%
31 to 45 years	38%	62%
46 to 60 years	40%	60%
Above 61 years	70%	30%

The percentage of different symptoms in the patients is shown in Figure 1. The most common symptom

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was dyspnea, shortness of breath, 34%. The least common symptom was hemoptysis, 0.5%. Other symptoms were cough (21.5%), chest pain (12%), fever (15%), dysphagia (13%) and others (4%).

The distribution of the masses in the different compartments of the mediastinum are shown in Figure 2. The results show that the highest number of the masses were found in the anterior mediastinum, 46.7 percent. The least number of masses were present in the middle mediastinum, 20%. And in the posterior mediastinum 33.3% of the masses were found.

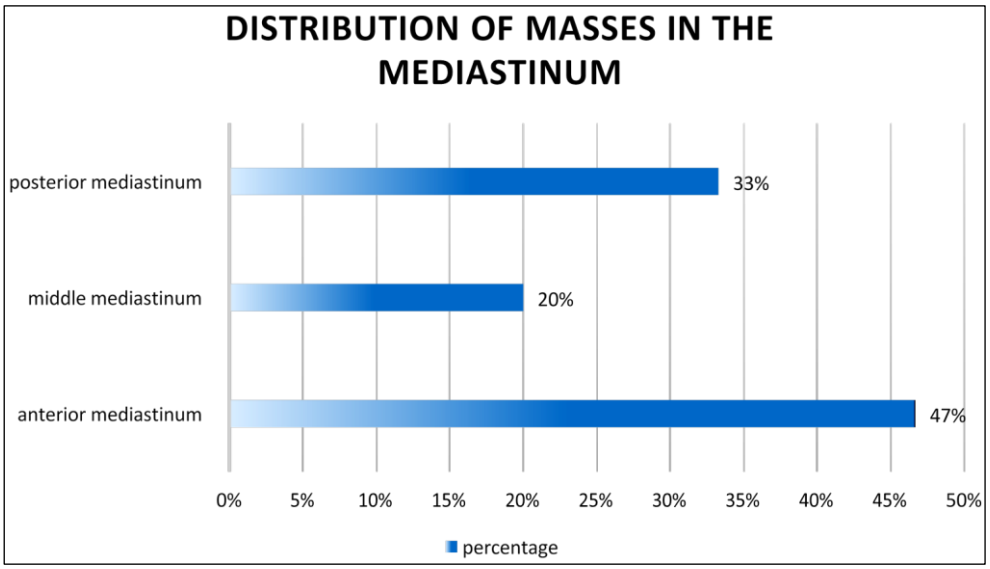

Fig 1: Distribution of masses in the mediastinum

The distribution of masses in the anterior mediastinum is shown in Table 2. 28 patients had anterior mediastinal masses. The most frequently found mass in the anterior mediastinum is thymic mass. In this study, thymic mass was found in 9 patients. Lymphoma was found in 6 patients, tuberculosis lymph node in 5 patients, aortic mass in 2 patients, metastatic lymph node in 2 patients, sternal chondrosarcoma in 1 patient, liposarcoma in 1 patient, thyroid mass in 1 patient, lymphangioma in 1 patient, metastatic giant cell tumor in 1 patient and cervical thymic cyst in 1 patient.

Table 2: Distribution of anterior mediastinal masses

Type	No. of cases	Percentage
Thymic mass	9	32%
Lymphoma	6	21.4%
Tuberculosis lymph node	4	14.3%
Aortic mass	2	7.1%
Metastatic lymph node	1	3.6%
Sternal chondrosarcoma	1	3.6%
Liposarcoma	1	3.6%
Thyroid mass	1	3.6%
Lymphangioma	1	3.6%
Metastatic giant cell tumor	1	3.6%
Cervical thymic cyst	1	3.6%
Total	28	

The distribution of masses in the middle mediastinum is shown in Table 3. 12 patients were diagnosed with mass in the middle compartment of the mediastinum. The most frequently found mass in the middle compartment was lymph node metastasis, with 50% prevalence. The least common one was bronchogenic cyst, 8.3% prevalence. Tuberculosis lymph node was found in 25% cases and other types were 16.7%.

Table 3: Distribution of middle mediastinal masses

Type	No. of cases	Percentage
Lymph node metastasis	6	50%
Tuberculosis lymph node	3	25%

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Bronchogenic cysts	1	8.3%
Others	2	16.7%
Total	12	

The distribution of masses in the posterior mediastinum is shown in Table 4. 20 patients were diagnosed with a posterior mediastinal mass. The most common one was neural tumor, 6 patients. Others were paravertebral abscess 3 patient, tuberculosis lymph node 2 patients, esophageal mass 2 patients, hydatid cyst 1 patient, neuroenteric cyst 1 patient, paravertebral hematoma 1 patient, primary choriocarcinoma 1 patient, lymphangioma 1 patient, mesothelioma 1 patient and descending aortic aneurysm 1 patient.

Table 4: Distribution of posterior mediastinal masses

Type	No. of cases	Percentage
Neural tumors	6	30%
Paravertebral abscess	3	15%
Tuberculosis lymph node	2	10%
Esophageal mass	2	10%
Hydatid cyst	1	5%
Neuroenteric cyst	1	5%
Paravertebral hematoma	1	5%
Primary choriocarcinoma	1	5%
Lymphangioma	1	5%
Mesothelioma	1	5%
Descending Aortic aneurysm	1	5%
Total	20	

Table 5 shows the distribution of thymic masses. Thymic cyst was most commonly found, it constituted 40% of the cases. It was more common in females than in males.

Table 5: Distribution of thymic masses

Type	No. of cases	Percentage
Thymic cyst	4	40%
Thymic hyperplasia	3	30%
Thymoma	2	20%
Thymolipoma	1	10%

The figure 1 shows a CT image of a thymic cyst [13].

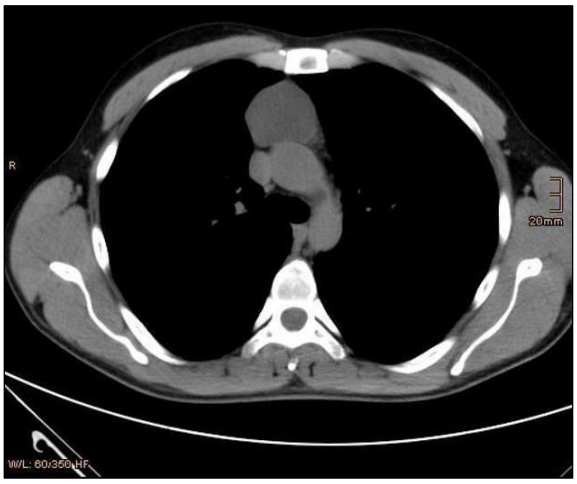

Fig 2: Thymic cyst

The Figure 4 shows enhancement patterns of different types of masses on the CT image. Most lesions showed up as homogenous mass, 31%. 27% showed up as heterogeneous mass, 21% as non-enhanced mass, 15% as rim enhanced mass and 6% as intensely enhanced mass.

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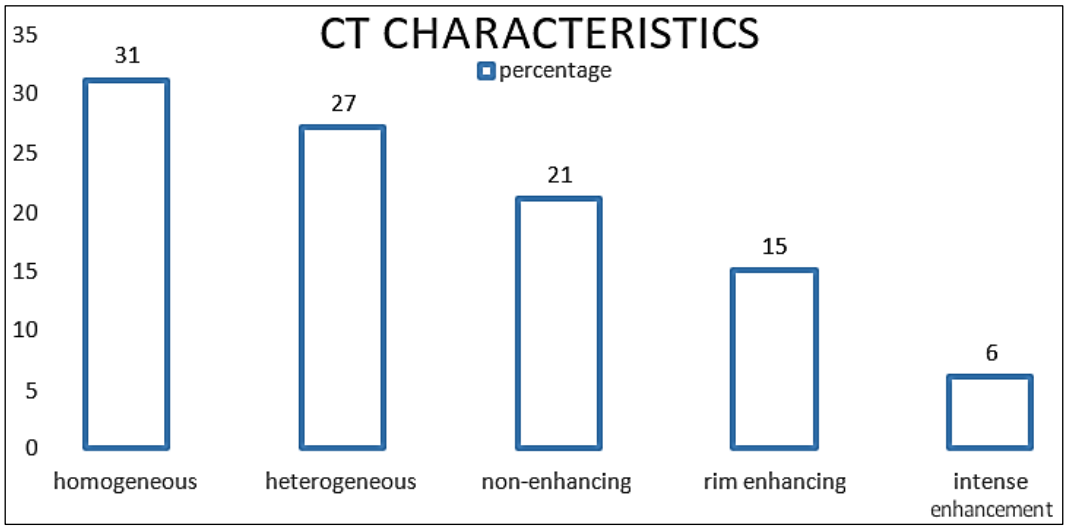

Fig 3: CT characteristics

The Figure 5 shows the nature of masses. Solid masses were the most abundant one with 68% prevalence according to the results of our study.

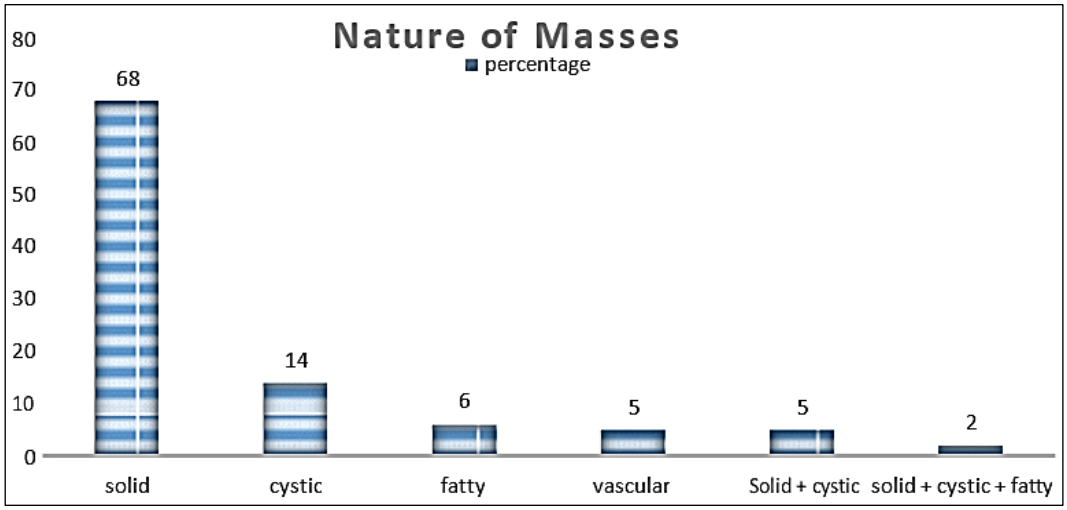

Fig 4: Nature of masses

The table 6 shows the occurrence of calcification. 25% cases had calcification while 75% did not. This shows that majority of the patients did not have any calcification in the mass.

Table 6: Calcification

Calcification	No. of cases	Percentage
Present	15	25%
Absent	45	75%

Table 7 shows the percentage of masses with involvement of neighboring structures. 41.7% of the cases showed involvement of neighboring structures and 58.3% did not. It shows that most patients did not had the involvement of neighboring structures with the mass.

Table 7: Involvement of neighbouring structures

Neighboring structures involvement	No. of cases	Percentage
Present	25	41.7%
Absent	35	58.3%

Discussion

In our study the sample size comprised of 60 patients while in another study the sample size was of 40 patients. The most common type of mass in anterior mediastinum was thymic mass, in middle

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mediastinum lymph node metastasis and in posterior mediastinum neural tumors in our study. While in the study of El-Bargisy *et al*. the most common type of mediastinal mass was lymphoma [14].

In another study, the most common anterior mediastinal mass was lymphoma, 36.5%. Other common masses in this study were invasive thymoma (19%), thymoma (15%), lymph node metastasis (11.5%), TB lymph nodes (8%) [15].

In one of the study with sample size of 60 patients the most common symptom was dyspnea. This result coincides with the result of our study 16. In that study of Pandey S *et al*. dyspnea was present in almost 22% patients, chest pain in 15% and dysphagia in 13% 16. While in our study, dyspnea was 34% prevalent, chest pain 12% and dysphagia in 13%.

In the study of Singh SS at al. cough was present in 44% patients, dyspnea in 38%, chest pain in 20% and fever in 20% 17. Whereas in our study cough was present in 21.5% patients, dyspnea in 34%, chest pain in 12% and fever in 15%. In this study 52% of the masses were in anterior mediastinum, 18% in middle mediastinum and 30% in posterior mediastinum. In our study, however, anterior mediastinum had 46.7% masses, middle 20% and posterior 33.3%. Thymic mass was the most common anterior mediastinum mass, present in almost 27% cases. Similarly, the results of our study also showed thymic mass as the most common anterior mediastinum mass, 32% prevalence. Lymph node metastasis was most common middle mediastinum lesion, 44.5%. This results also corresponds with our results. In posterior mediastinum neural tumors were most common, 33.3%, similar to our results. However, in this study the most common CT enhancement pattern was heterogeneous while in our study it was homogeneous.

Conclusion

Our study concluded that CT plays a vital role in the evaluation of mediastinal masses. The most common symptom in our patients was dyspnea. The results showed that most commonly masses were found in the anterior mediastinum and least commonly in the middle mediastinum. The most common type of masses were thymic mass, lymph node metastasis and neural tumors in anterior, middle and posterior mediastinum respectively. Thymic cyst was the most typical type of thymic mass. Most frequently the masses showed up on the scan as homogeneous. The most recurrent nature of mass found was solid. Calcification of the mass and involvement of the neighboring structures was not very common.

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