

Original research article

Study of radiologic characteristics of various mediastinal lesions using CT thorax

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Abstract

Background: The mediastinum is an extra pleural space within the thorax between the two pleural spaces. CT remains the most available reliable tool among different imaging methods. Present study was aimed to study radiologic characteristics of various mediastinal lesions using CT Thorax.

Material and Methods: Present study was single-center, descriptive, Retrospective and Prospective study, conducted in patients of all ages suspected to have mediastinal related complaints and referred to the Department of Radiodiagnosis for CT scan.

Results: In our study most common age group to present with mediastinal lesion was between 31-45yrs (30%) & male patients (65%). Majority of the mediastinum lesions were in the anterior mediastinum constituting 58% followed by posterior (22%) and middle (20%) mediastinal compartment, Among the anterior mediastinal lesions, TB lymph node lesions formed the majority of all of them (34.4%), followed by metastatic lymph nodes (20.6%), thymic lesions (10.3%) & thyroid lesion (12%). Among Middle mediastinal lesions, TB lymph node involvement (45%) was common. In posterior mediastinal lesions, majority were neural tumors and TB lymph nodes (22.72% each). In this study majority showed heterogeneous enhancement (51%), followed by rim enhancement (18%). 88 cases were histologically verified out of which 80 cases showed finding consistent with CT findings, 8 cases showed different findings compared to CT findings. Sensitivity of CT is 90.9% for diagnosing of mediastinal lesions which are confirmed by histologically.

Conclusion: CT is very useful in imaging the mediastinum because of its excellent contrast resolution; CT is able to identify normal mediastinal structures, vessels CT is highly sensitive imaging modality for diagnosing mediastinal lesions.

Keywords: CT scan, mediastinal pathology, contrast resolution, sensitive imaging modality, diagnosing mediastinal lesions.

Introduction

The mediastinum is an extra pleural space within the thorax between the two pleural spaces. It is divided into superior and inferior mediastinum. Inferior mediastinum is further divided into anterior, middle, posterior mediastinum. Complex anatomy of mediastinum sometimes makes difficulties in radiological diagnosis of these tumors^[1].

Mediastinal disease is usually initially demonstrated on a chest radiograph and appears as mediastinal soft tissue mass, widening of mediastinum, or a pneumomediastinum. However, many a times chest radiograph appears normal in presence of mediastinal disease^[2].

CT remains the most available reliable tool among different imaging methods. Due to its permanent technical improvements, it can be used as one step answer to all the requirements of the pretherapeutic evaluation of mediastinal lesions^[3]. Computed Tomography has hence revolutionized the diagnosis of mediastinal lesions. It is one of finest non-invasive imaging modalities available for imaging of the thorax^[4].

While both CT and MR provides cross sectional depiction, CT has better spatial resolution and shorter imaging time, besides being less expensive and being more widely available. Coexisting lung

abnormalities and calcification within the lesions are better appreciated on CT^[9] Present study was aimed to study radiologic characteristics of various mediastinal lesions using CT Thorax.

Material and Methods

Present study was single-center, descriptive, Retrospective and Prospective study, conducted in department of Radiodiagnosis in collaboration with department of medicine, surgery, pediatrics and TB & chest disease at Department of Radiology, Dr. Shankarrao Chavan Government Medical College, Vishnupuri, Nanded, India. Study duration was of 2 years (July 2016 to October 2018). Study was approved by institutional ethical committee.

Inclusion criteria

- All patients of all ages presenting in the outpatient and/or inpatient Departments of our institute suspected to have mediastinal related complaints and referred to the Department of Radiodiagnosis for CT scan.

Exclusion criteria

- Patient not consenting for study.
- Contraindication to contrast enhanced ct.
- Pregnancy
- Allergy to intravenous iodinated contrast media
- Renal failure
- Hemodynamic instability

After Requisition form requesting for CT Thorax (P+C) received, detailed clinical history along with clinical examination findings was recorded. The procedure was explained to the patient in detail and informed, written and valid consent as per the proforma was taken. Patient will be evaluated with the help of Philips Brilliance 64-Slice Ct Scanner and various radiologic characteristics of mediastinal lesion such as origin (thymic, neural, lymph nodal or vascular), CT enhancement pattern (homogenous/heterogeneous enhancement, peripheral enhancement or non-enhancing), density (solid, cystic, fatty), margin (well defined/ ill-defined), calcification, necrosis, invasion of surrounding structures were noted.

Adequate hydration was maintained. Patients were asked not to consume any solid food six hours before the study. Risks of contrast administration were explained to the patient and consent was obtained prior to the contrast study. An initial supine AP scout film with 30mA was obtained to confirm the tomographic plane. Precontrast scan done in supine position using 4mm collimation (70 mA, 130Kv) from the thoracic inlet up to the supra renal glands followed by contrast scan. Images were obtained in intermittent suspended inspiration. For contrast enhancement initially 60 - 80 ml of dynamic injection of 370mg/ml iodinated nonionic contrast iopamidol. OR in a dose of 300mg of Iodine/Bodyweight (in children) was given and section will be taken from thoracic inlet to the level of suprarenal's. Sagittal and coronal reconstructions were done. The scan was reviewed on a direct display console at multiple window settings which includes. (1)soft tissue(mediastinal>window at 320/40 (2) Lung window of 1400/-600(3) Bone window of 2400/200 to examine the variation of tissue density.

The pre and post contrast attenuation values, the size, location of the lesion, presence of calcification, lesion effect on adjoining structures and others associated findings were studied. Sutton's method of mediastinal division was used to locate the tumor in mediastinum. Diagnostic efficacy of CT diagnosis of mediastinal as compared to Histopathology will be assessed by calculating Sensitivity.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

Results

In our study most common age group to present with mediastinal lesion is between 31-45yrs (30%) followed by 16-30 yrs age group (24%). Present study included a greater number of male patients (65%) as compared to female patients (35%).

Table 1: Age & gender Distribution

Age in Years	No. of cases	Percentage
0-15	16	16%
16-30	24	24%
31-45	30	30%
46-60	14	14%

>61	16	16%
Gender		
Male	65	65%
Female	35	35%

In the study out of 100 patients, 90% patients were symptomatic.

Table 2: Symptomatic and asymptomatic patient distribution

	No of patients	Percentage
Symptomatic	92	90%
Asymptomatic	8	10%

In our study of 100 cases, Cough was the most common symptom (50%) followed by dyspnea and chest pain 15%.

Table 3: Clinical Symptom Distribution

Clinical symptoms	No of patients	Percentage
Cough	50	50%
Dyspnea	15	15%
Fever	12	12%
Chest pain	15	15%
Other	8	08%

In our study, the majority of the mediastinum lesions were in the anterior mediastinum constituting 58% followed by posterior (22%) and middle (20%) mediastinal compartment, In our study among the anterior mediastinal lesions, TB lymph node lesions formed the majority of all of them (34.4%), followed by metastatic lymph nodes (20.6%), thymic lesions (10.3%) & thyroid lesion (12%). Middle mediastinal lesions comprised of 20% of the total mediastinal lesions. Among them TB lymph node involvement formed the majority i.e. 45%. In our study posterior mediastinal lesions comprised 22% of the total mediastinal lesions. Majority of the posterior mediastinal lesions were neural tumors and TB lymph nodes which are 22.72% each.

Table 4: Compartmental distribution of mediastinal lesions

Compartment	No of cases	Percentage
Anterior mediastinum	58	58
TB lymph nodes	20	34.4%
Metastatic lymph nodes	12	20.6%
Thymic lesions	6	10.3%
Thyroid lesion	7	12
Lymphoma	5	8.6
Aortic	8	13.7%
Middle mediastinum	20	20%
TB lymph nodes	9	45%
Metastatic lymph nodes	5	25%
Esophageal duplication cyst	3	15
Bronchogenic cyst	2	8
Pericardial cyst	1	05%
Posterior mediastinum	22	22%
Neural tumours	5	22.7%
Neuroenteric cyst	1	04%
TB lymph nodes	5	22.72
Paravertebral abscess	4	18.1%
Esophageal lesion	3	13.6%
Hiatus hernia	4	18.1%

In this study majority showed heterogeneous enhancement which comprised 51% followed by rim enhancement which comprised 18%; none enhancing lesions constituted 12% (n=7); homogeneous enhancement was seen in 9% of patients. 6 cases showed intense vascular enhancement of these 4 were Aortic aneurysm and 2 were dissection. Enhancement pattern was not applicable to 4 cases of hiatus hernia in which diagnosis was made if there contrast within the hernia. In our study majority were solid lesions which comprised 52%. Of the total cases. In my study 15% of the cases revealed calcification in the mediastinal lesions.

Table 5: CT features of mediastinal lesions

CT features	No of cases	Percentage
Enhancement pattern		
Intense enhancement	6	6%
Rim enhancement	18	18%
Non-enhancing	12	12%
Heterogeneous	51	51%
Homogeneous	9	9%
Not applicable	4	4%
Nature		
Solid	52	52%
Solid +cystic	34	34%
Vascular	8	8%
Cystic	6	6%
Calcification		
Present	15	15%

In our study 88 cases were histologically verified out of which 80 cases showed finding consistent with CT findings, 8 cases showed different findings compared to CT findings. Out of these 8 cases one case was diagnosed as thymoma on CT, and showed features of invasive thymic carcinoma on histopathology. 4 cases which was diagnosed as tubercular lymphadenopathy appeared to be sarcoidosis on histopathology and two cases with CT diagnosis of tubercular lymph node was shown to be metastatic lymph nodes on histopathological examination. From above table, sensitivity of CT is 90.9% for diagnosing of mediastinal lesions which are confirmed by histologically.

Table 6: Statistical analysis

	Total (Mediastinallesions)	Gold standard investigation	
		Consistent with CT finding	Not consistent with CT finding
Anterior mediastinum	58	52	6
Middle mediastinum	20	20	0
Posterior mediastinum	22	20	2
Total	100	92	8

Discussion

Mediastinum is the extrapleural space within the thorax between the two pleural spaces. 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. Radiographic evaluation of the mediastinum has been widely used for investigating the location and the extent of the mediastinal lesions within the thorax^[5].

Characteristics such as presence of calcification, fat, fluid or soft tissue within the lesion, invasion of the mediastinal fat (indicating malignant rather than benign disease) and contrast enhancement on CT are important in narrowing the differential diagnosis. Other CT characteristics of mediastinal lesions are considered in improving specificity of the differential diagnosis such as shape, edge, sharpness, contour, relation to normal structures, effect on adjacent structures (especially displacement) and the presence of other abnormalities including those visible in the lung and abdomen as well as those remote from the lesion in the mediastinum^[6].

In our study 92% patients were symptomatic and 8% patients were asymptomatic This is similar to study done by Dubashi B *et al.*,^[7] in which 97% patients were symptomatic and 3% were asymptomatic.

In our study of 100 cases, cough was the most common clinical symptom (50%) followed by Dyspnea and fever 20%, chest pain 15% and other 20%. According to the Davis *et al.*,^[8] study in 400 consecutive patients with mediastinal masses, chest pain constituted the most common symptom i.e. 30%, followed by fever 20%.

In our study males (65%) were more commonly affected than females (35%). This is comparable to study done by Singh G *et al.*,^[9] which showed affection of males (61.1%) more compare to females (38.9%) In our study, the majority of the mediastinum lesions were in the anterior mediastinum constituting 58% followed by posterior (22%) and middle (20%) mediastinal compartment, which is similar to the study conducted by Devis *et al.*,^[8] wherein anterior, middle and posterior mediastinum constituted 54%, 20% and 26% respectively.

In our study on CT total 3 cases (50%) were diagnosed to be thymoma, 33.6% were thymic cyst, 16.6% were thymic hyperplasia. In a study done by Cohen *et al.*,^[10] on 230 patients with CT diagnosis of thymic mass, thymoma constituted 55.4%, thymic cyst 19.6% and thymic hyperplasia 10.7%.

In our study neurogenic tumors comprised overall 5% of mediastinal lesions. On histological confirmation neurofibromas & Schwannomas, constituted 60% & 40% respectively. In the study conducted by Srivastava *et al.*,^[11] schwannoma constituted 43.8% and neurofibromas constituted 31.3%

of all neurogenic tumors.

In our study, tuberculous, metastatic and lymphoma were the pathologies of nodal enlargement and they comprised 67.7%, 30% and 8% respectively of total cases of nodal lesions. In the study by Kumar A *et al.*,^[12] tubercular lymph nodes constituted 34.3% of total mediastinal nodes, which is similar to our study (35%).

In our study 20 cases showed mediastinal lymph nodal enlargement, 18 had diagnosis consistent with CT findings. However in 2 cases CT and histological diagnosis did not match. 1 case diagnosed on CT as tubercular lymph nodes were found to be Hodgkin's lymphoma. And one case of lymphoma diagnosed on CT was found to be tubercular lymph nodes on histopathology.

Calcification is usually seen following therapy and can have varying Morphology including irregular, diffuse or even egg shell calcification Lymphomas have areas of necrosis but they usually do not have cystic areas, thymic cysts can occur after irradiation of mediastinal lymphomas or chemotherapy.

CT helps to localize the lesion and can assess the extent of the lesion. It is able to characterize the characteristics of lesion based their site, nature, enhancement. The additional role of CT in performing CT guided biopsies of lesions cannot be over emphasized. CT Scan helps to differentiate mediastinal lesions based on their characteristic appearance like solid, cystic, fat density, calcification and enhancement pattern. Involvement of adjacent structures can be well demonstrated. Pulmonary, bony, hepatic, adrenal metastasis can be seen on CT thorax.

Conclusion

CT is indicated when the clinician suspected mediastinal pathology or diagnosed on plain chest radiographs and in patients who have normal chest radiographs yet there is clinical suspicion of mediastinal disease. CT is very useful in imaging the mediastinum because of its excellent contrast resolution; CT is able to identify normal mediastinal structures, vessels CT is highly sensitive imaging modality for diagnosing mediastinal lesions.

Conflict of Interest: None to declare.

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References

1. Whitten CR, Khan S, Munneke GJ, Grubnic S. A diagnostic approach to mediastinal abnormalities. *Radiographics*. 2007;27(3):657-71.
2. Gregson RHS, Whitehouse RW, Wright AR, Jenkins JPR. The mediastinum. In: *Textbook of Radiology and Imaging*, Chapter 2, 7th edn., Sutton P (Ed.). London, UK: Churchill Livingstone. 2003;1:57-86.
3. Stones PJ, Torres WE, Colvin RS, Meier WL, Sprawls P, Rogers JV Jr. Effectiveness of CT in evaluating intrathoracic masses. *AJR Am J Roentgenol*. 1982;139(3):469-75.
4. Naidich DP, Webb WR, Muller NL, Zerhouni EA, Seigelmann SS. *Computedtomography and Magnetic Resonance of the thorax*. 3rd ed. Philadelphia: Lippincott Williams and Wilkins. 1999;38-160.
5. Baron RL, Lee JK, Sagel SS, Levitt RG. Computed Tomography of the abnormal thymus. *Radiology*. 1982 Jan;142(1):127-34.
6. Torres WE, Colvin RS, Meier WL, Sprawls P, Rogers JV. Effectiveness of CT in evaluating intrathoracic masses. *AJR Am J Roentgenol*. 1982 Sep;139:469-75.
7. Dubashi B, Cyriac S, Tenali SG. Clinicopathological analysis and outcome of primary mediastinal malignancies-A report of 91 cases from a single institute. *Ann Thorac Med*. 2009 Jul-Sep;4(3):140-2.
8. Davis RD, Oldham HN, Sabiston DC. Primary cysts and neoplasms of the mediastinum: Recent changes in clinical presentations, methods of diagnosis, management and results. *Ann Thorac Surg*. 1987 Sept;44(3):229-37.
9. Singh G, Amin Z, Wuryantoro I, Wulani V. Characteristic of Mediastinal mass patient and factors associated with mortality during hospitalization. *Chest*. 2011 Oct;140(4):307A.
10. Cohen AJ, Thompson LN, Edwards FH, Bellamy RF. Primary cysts and tumors of the mediastinum. *Ann ThoracSurg*. 1991;51:378-86.
11. Shrivastava CP, Devgarha S, Ahlawat V. Mediastinal tumors: a clinicopathological analysis. *Asian Cardiovasc Thorac Ann*. 2006;14:102-4.
12. Kumar A, Dutta R, Kanan U, Kumar R, Khilani G, Gupta S. Evaluation of mediastinal lymph nodes using 18F-FDG PET scan and its histopathologic correlation. *Ann Thorac Med*. 2011;6(1):11-6.