

Original Research Article

Computed Tomography Evaluation of Mediastinal Masses

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Abstract

Aims: To study the computed tomographic characteristics of Mediastinal masses in plain and Contrast enhanced scans. **Materials and methods:** This study of evaluating the efficacy of computed tomography in the diagnosis of mediastinal lesions was performed on 51 cases. Thorough clinical history and clinical examination was done before CT examination. All the cases taken up for the CT were evaluated for the distribution, CT features of the mediastinal mass and also the involvement of adjoining structures. **Results:** The maximum number of cases occurred in 3rd to 5th decade. Mediastinal lesions occurred more commonly in males. In this study of 51 cases of mediastinal masses, the anterior mediastinum was the most common compartment to be involved with 55% involvement followed by posterior mediastinum (31%) and then middle mediastinum (14%). Neurogenic tumors, metastatic lymphadenopathy, combined lymphoma and tuberculous lymphadenopathy were the most common lesions in posterior, middle and anterior mediastinum respectively. Dyspnea was the most common presenting symptom (76.4% of cases). Solid lesions were commoner than other types of lesions (70%). 44 cases had histopathological confirmation of CT diagnosis and all cases had the same final diagnosis as CT diagnosis. With a sensitivity of 86.2%. **Conclusion:** Computed tomography definitely had a major role to play in the evaluation of a mediastinal mass regarding the distribution pattern, CT diagnosis and mass effect upon adjacent structures.

Keywords: Mediastinal masses, Computed tomography, Contrast enhanced scans

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Introduction

Computed tomography is a recent method of forming images from x-rays. It had a tremendous impact in the field of diagnostic radiology. Mediastinal masses span a wide histopathological and radiological spectrum; the most frequent lesions encountered in the mediastinum are thymoma, neurogenic tumors and benign cysts, altogether representing 60% of patients with mediastinal masses. Hence, every possible effort has to be made to arrive at a specific diagnosis.

Computed tomography (CT) is the most important tool in the evaluation of a mediastinal mass. Characterization on CT is based on specific attenuation of air, fat, water and calcium. High-resolution multiplanar reformation images display the detailed anatomical relationship of the tumor with the adjacent structures. 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[1,2].

The additional role of CT in performing CT guided biopsies of lesions cannot be overemphasized.

Since the advent of CT, a decline in the use of other diagnostic 7 chest procedures like chest fluoroscopy, tomography, mediastinoscopy, arteriography and thoracotomy has occurred. The skepticism and controversy that greeted the introduction of this expensive modality has gradually faded away. This study was conducted to evaluate the data obtained from thoracic computed tomography of mediastinal lesions.

Materials and Methods

This study of evaluating the efficacy of computed tomography in the diagnosis of mediastinal lesions was performed on 51 cases. All patients referred to Department of Radio-Diagnosis with clinically suspected mediastinal space occupying lesions or who had a chest radiogram with a suspicious mediastinal abnormality are taken up for study. The study was conducted in the Department of Radio diagnosis, between November 2013 to October 2015.

Thorough clinical history and clinical examination was done before CT examination. All the cases taken up for the CT were evaluated for the distribution, CT features of the mediastinal mass and also the involvement of adjoining structures.

Inclusion criteria

Computed tomography study of the mediastinum was conducted in Clinically suspected cases of mediastinal mass and Patients where the chest radiographs showed the evidence of mediastinal.

All the cases were studied on a SIEMENS SOMATOM DUAL slice computed tomography system, which is a modified third generation machine. Factors of 120 Kv and 30 mA were a constant feature for all cases

Preparation of the patient

Patients were kept nil orally 4 hrs prior to the CT scan to avoid complications while administering contrast medium. Risks of contrast administration were explained to the patient and consent was obtained prior to the contrast study.

Technique

Routine anteroposterior topogram of the thorax was initially taken in all patients in the supine position with the breath held. An axial section of 5 mm thickness was taken from the level of thoracic inlet to the level of adrenals. In all cases plain scan was followed by contrast scan, images were obtained in intermittent suspended inspiration. For contrast enhancement initially 80-120 ml of dynamic injection of iopamidol or 300 mg of iodine was given and axial

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sections were taken from thoracic inlet to the level of adrenals. Sagittal and coronal reconstructions were made wherever necessary. The magnification mode was commonly employed, and the scans were reviewed on a direct display console at multiple window settings (i.e. soft tissue (mediastinal) window at 320/40; lung window 1400/600; bone window of 2400/200 to examine the wide variation of tissue density and also to look for osseous involvement. The pre and post contrast attenuation values, the size, location of the mass, presence of calcification, mass effect on adjoining structures and others associated findings were studied by a panel of radiologists.

Results

In the study all the cases with mediastinal abnormality on radiographs or with secondary involvement of the mediastinum were subjected to CT evaluation for better characterization, extent, probable tissue of origin and effect on adjoining structures. Plain and

contrast studies were performed. The study comprised of 51 patients. In the present study of 51 cases of mediastinal lesions, 31 cases were male and 20 cases were females.

In the present study of 51 cases, 28 (55%) cases occurred in anterior mediastinum, 7(14%) cases occurred in middle mediastinum and 16(31%) of cases occurred in posterior mediastinum. Therefore majority of the lesions occurred in the anterior mediastinum. There are a total of 18 cases in the age group 31 to 50 years constituting 35.29% of total cases. The average age of presentation of mediastinal lesions is 40.33 years in the present study. The mediastinal masses presented with symptoms of fever, cough, dyspnoea and other symptoms like weight loss, chest pain etc which were grouped into single category of other symptoms. Dyspnoea was the most common presentation in this study with 39 cases (76.4%) presenting as dyspnoea. Cough was the second most common presentation.

Table 1: Distribution of Cases according to Sex

Location	Male		females	
	Number of cases	Percentage of cases	Number of cases	Percentage of cases
Anterior mediastinum	14	45	14	70
Middle mediastinum	5	16.12	2	10
Posterior mediastinum	12	38.7	4	20
Total	31	100	20	100

Anterior mediastinal lesions occurred with same frequency(14cases), in both males and females. In males there were 5 middle mediastinal cases but only 2 cases in females. There were 12 posterior mediastinal cases in males whereas in females only 4 cases occurred in posterior mediastinum. Anterior mediastinum is the most common compartment to be involved in both males and females accounting

for 54.9% of the total number of cases. In females 70% of cases occurred in anterior mediastinum, 10% in middle mediastinum and 20% of cases occurred in posterior mediastinum. In males of the total of 31 cases, 45% occurred in anterior mediastinum, 16.12% in middle mediastinum and 38.7% in posterior mediastinum.

Table 2: Final diagnosis of mediastinal lesions

Anterior mediastinum Lesion	Total cases	Percentage of cases
Lyphoma	7	13.72
Tuberculous lymphadenopathy	7	13.72
Metastatic lymphadenopathy	5	9.8
Thymic lesions	4	7.84
Teratomas	2	3.92
Retrosternal goiters	2	3.92
Lipoma	1	1.96
Total	28	54.9
Middle mediastinum lesions		
Metastatic lymphadenopathy	3	5.88
Bronchogenic cyst	2	3.92
Pericardial cyst	1	1.96
Hodgkins lymphoma	1	1.96
Total	7	13.73
Posterior mediastinal lesions		
Neurogenic tumors	8	15.68
TB lymphadenopathy	3	5.88
Paravertebral abscess	3	5.88
Hydatid cyst	1	1.96
Oesophageal duplication cyst	1	1.96
Total	16	31.37

In this study of 51 cases, 28 cases occurred in anterior mediastinum. There were 5 cases (9.8% of total cases) of metastatic lymphadenopathy in anterior mediastinum, of them 4 cases(7.84% of total cases) were carcinoma lung with adenopathy and 1 case(1.96% of total cases) was carcinoma breast with adenopathy. 7 cases (13.72% of total cases) were lymphomas. 4 cases(7.84% of total cases) of thymic lesions occurred in anterior mediastinum of them one was thymic cyst. Two cases were teratomas, of which one was confirmed on histopathological diagnosis as mature teratoma. 7 cases (13.73% of

total cases) of tuberculous lymphadenopathy occurred in anterior mediastinum. One case of lipoma, and two cases of retrosternal goiter constituted the rest of the anterior mediastinal lesions. In the present study of 51 cases, 7 cases occurred in middle mediastinum, 3 cases (5.88% of total cases) were due to metastatic lymphadenopathy, which were the most common lesions in middle mediastinum. 2 cases of bronchogenic cysts, one pericardial cyst and one case of Hodgkins lymphoma constituted the rest of the middle mediastinum lesions. In the present study, 16 cases (31.37% of total cases)

occurred in the posterior mediastinum. Neurogenic tumors were the most common lesions in posterior mediastinum in this study. 8 cases (15.68% of total cases) were neurogenic tumors in posterior mediastinum. 3 cases (5.88% each of total number of cases) each of

tuberculous lymphadenopathy and paravertebral abscess occurred in posterior mediastinum in this study. One case each of hydatid cyst and oesophageal duplication cyst constituted the remaining posterior mediastinal lesions in this study.

Table 3: Neural tumors and Lymph nodal masses distribution

Neural tumors distribution	Number of cases	Percentage of cases
Neurogenic tumors	5	62.5
Schwannoma	1	12.5
Neurofibromas	2	25
Total	8	100
Lymph nodal masses distribution		
Tuberculous lymphadenopathy	10	38.5
Metastatic lymphadenopathy	8	30.8
Lymphomas	8	30.8
Total	26	100

In this study there were 8 cases of neural tumors which occurred in posterior mediastinum. 6 cases had histopathological confirmation of neural tumors. One was diagnosed as neurofibromatosis and two were diagnosed as schwannomas. Table showing the distribution of neurogenic tumors Lymph nodal masses distribution

In this study 26 cases(51% of total number of cases) were lymph nodal masses in all compartments of mediastinum. 10 cases (38.5% of lymph nodal masses) were due to due to tuberculous lymphadenopathy. 8 cases each (30.8% of lymph nodal masses) of metastatic lymphadenopathy and lymphomas formed the rest of lymph nodal masses.

Table 4: CT characteristics distribution in mediastinal lesions

Calcification	Cases	Percentage of total
Present	31	61
Absent	20	39
Mass effect in mediastinal lesions		
Present	36	71
Absent	15	29
Enhancement		
Heterogenous	37	72.5
Homogenous	8	15.7
No enhancement	4	7.8
Peripheral enhancement	2	3.9
Total	51	100
Nature of lesion		
Solid	36	70
Solid/cystic	08	16
Cystic	06	12
Fatty	01	02
Total	51	100

In this study 31 cases (61 % of total cases) showed calcification. In this study 36 cases (71% of total cases) had mass effect on CT at the time of presentation. In this study majority of lesions showed heterogenous enhancement. Out of a total of 51 cases, 37 Cases (72.5% of total lesions) had heterogenous enhancement, 8 cases (15.69%) had homogenous enhancement, 4 cases had no enhancement and 2 cases had only peripheral enhancement.

In the present study the lesions were classified as solid, cystic, fatty and mixed solid cystic lesions. Majority of lesions were solid. There were total of 36 cases of solid lesions(70% of total). 8 cases (16% of total lesions) of mixed solid and cystic lesions were the second most common type followed by 6 cases of cystic (12% of total) lesions. Fatty lesions were the least common mediastinal lesions which constituted only 2% of total lesions.

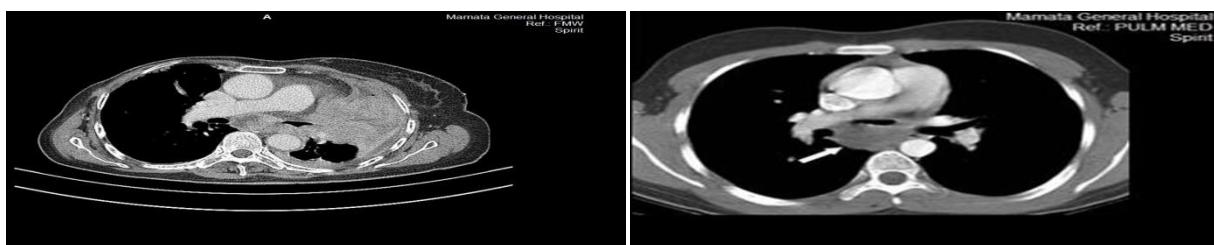


Fig 1: Axial Image Showing Bronchogenic CYST in the Middle Mediastinum
White arrow pointing to bronchogenic cyst of middle mediastinum confirmed on histopathology.
Histopathology slide showing bronchogenic cyst wall with respiratory epithelium.

Discussion

The mediastinum is the site for a vast range of diseases varying considerably, ranging from tumors-both benign and malignant, cysts, vascular lesions, lymph node masses and mediastinitis. Although conventional radiographs can show recognizable abnormalities in many patients with mediastinal abnormalities in many patients with mediastinal pathology, radiographs are limited in their sensitivity and ability to delineate the extent of mediastinal abnormalities and the relationship of masses to specific mediastinal structures. With the computed tomography these problems are overcome because of its excellent density resolution and tomographic format and therefore CT plays an important role in the evaluation of the mediastinum. With the advent of CT, it has helped the clinicians and radiologist in identifying the precise location, extent and characterization of the masses. The following study was undertaken with the objectives of determining the disease pattern affecting the mediastinum and to correlate the CT findings with the histopathology reports whenever possible.

This study comprised a total of 51 cases, the study was conducted for a period of 2 years from November 2013 to October 2015 in the department of radio diagnosis. Majority of the symptoms were of non-specific nature like dyspnoea, cough, chest pain, fever, dysphagia etc. These symptoms were mainly due the mass effect from the mediastinal lesions and was dependent on the location of the mass. Dyspnoea was the most common presentation in this study. Anterior mediastinal masses mostly presented with cough and dyspnoea probably due to tracheal compression. Middle mediastinal lesion due to their location presented with dysphagia, due to either involvement of the esophagus or its compression.

In this study dyspnea was the most common presentation followed by cough where as in the study conducted by Davis et al[3] the most common presentation was chest pain (30 % of cases) followed by fever (20% of cases). This difference might have occurred due to the fact that majority of the patients that presented to this hospital were having anterior mediastinal lesions and presented with dyspnea due to the tracheal compression.

In this study majority of the lesions occurred in anterior mediastinum (28 cases), this is comparable to the study conducted by Akshata Rao Aroor et al[4] in which, 15 cases occurred in anterior mediastinum of 35 cases in total.

In this study of 51 cases, 18 cases occurred in age group 31 to 50 years constituting 35.29% of total cases. The average age of presentation of mediastinal cases is 40.33 years in this study. Three-fifths (31 cases) of the cases were males; this is comparable to the findings in other studies[5-7].

Malignant mediastinal tumors were more common than benign accounting for 62% of cases which is similar to study by Vaziri et al., (60%)[5]. In various series of study on mediastinal masses, incidence of malignant lesions ranged from 25- 49% [48,49]. However, benign lesions were more common in study conducted by Adegbeye et al., (57%) and Davis et al., (58%). This would reflect the increasing incidence of malignancy over the years[3,6]. Other explanation for higher proportion of malignant cases would be the inclusion of secondary tumors in this study.

In this study, Granuloma constituted 19.6% (10 cases), which is greater in comparison to Wychulis et al[7] study (i.e. 6.3%) probably due to higher prevalence of Tuberculosis in comparison to the western population. This study had three cases of paravertebral abscess (5.8%) which was associated with vertebral body destruction. According to Im et al [11] series, right paratracheal lymph node enlargement was seen in 87% of cases whereas this study showed 60 % involvement. Similarly, in Im et al[8] study 52% of the T8 lymph node enlargement showed central areas of low attenuation with rim enhancement on contrast study. This study showed 40 % involvement. According to Choyke PL et al[9] in their study on adult

onset pulmonary tuberculosis, reported 40% of adults showed presence of pleural effusion, whereas this study showed 50 % cases of Tuberculosis associated with pleural effusion.

In the present study, 88% of the subjects were symptomatic at presentation, which is in comparison with study done by Singh et al., (94.7%)[10]. Several other studies reported the range of symptomatic presentation as 61-88% [46,47]. Higher incidences of asymptomatic cases were found in study by Vaziri et al., (12%) [46], Adegbeye et al., (22.9%) and Davis et al., (38%)[5,6,3]. This observation may be because many of our patients visit the hospital for their symptoms rather than for routine evaluation. Malignant tumors are more symptomatic than benign tumors[6].

Majority of lesions were solid in this study. There were total of 36 solid lesions (70% of total), 8 cases (16% of total lesions) of mixed solid and cystic lesions were the second most common type followed by 6 cystic (12% of total) lesions. Fatty lesions were the least common mediastinal lesions, which constituted only 2% of total lesions (one case). These results were comparable to studies conducted by Davis et al[3].

In this study of 51 cases, there was histopathological confirmation for 44 cases and all the cases had same histopathological diagnosis, which was kept as a final diagnosis on computed tomography. Therefore, the sensitivity of CT in this study was 86.2%, which is comparable to other studies. Rest of the cases did not have histopathological confirmation of diagnosis. If histopathology been performed in the rest of the cases, the sensitivity would have further improved in this study.

Intrathoracic goiters are a common cause of mediastinal enlargement. Thyroid masses account for 11-15 % of mediastinal masses (A. Prasad et al, 2000.)[11] In this study they represented only 3.92% of the cases.

In this study, the thymic tumors constituted 7.8% of total mediastinal lesions, which is similar to the studies conducted by Cohen et al¹² and Davis et al[3]. In a study conducted by Chen et al¹³ on 34 patients with CT diagnosis of thymic mass, thymoma constituted 91%, which is 75% in this study and thymic cyst, constituted 2.9%, which is 25% in this study. This difference in the results might be due to few cases of thymic lesions in this study.

In the study conducted by Akshata Rao Aroor[4] tumors in the order of frequency of occurrence were lymphoma, bronchogenic carcinoma, thymoma, mediastinal tuberculosis, metastatic carcinoma and germ cell tumours. Lymphoma was the commonest mediastinal tumour (12; 34.28%), which is in comparison with the studies done by Vaziri et al., and Adegbeye et al.. However, thymoma was the most common lesion in study done by Singh et al[10]. In this study, tuberculous and metastatic lymph nodal masses constituted the majority of lesions followed by lymphoma. This difference might be due to increased prevalence of tuberculosis in this area.

Conclusion

Computed Tomography plays a significant role in the assessment of various mediastinal pathologies, which were initially detected on the chest radiographs. The maximum number of cases occurred in 3rd to 5th decade. Mediastinal lesions occurred more commonly in males.

In this study of 51 cases of mediastinal masses, the anterior mediastinum was the most common compartment to be involved with 55% involvement followed by posterior mediastinum (31%) and then middle mediastinum (14%).

Neurogenic tumors,metastatic lymphadenopathy,combined lymphoma and tuberculous lymphadenopathy were the most common lesions in posterior,middle and anterior mediastinum respectively. Dyspnea was the most common presenting symptom (76.4% of cases). Solid lesions were commoner than other types of lesions (70%). 44 cases had histopathological confirmation of CT diagnosis and all cases had the same final diagnosis as CT diagnosis. With a sensitivity of 86.2%, CT is a highly useful modality for the investigation of mediastinal masses.

Therefore, computed tomography definitely had a major role to play in the evaluation of a mediastinal mass regarding the distribution pattern, CT diagnosis and mass effect upon adjacent structures.

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