ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

Original Research Article

"ROLE OF COMPUTED TOMOGRAPHY IN EVALUATING MEDIASTINAL MASSES"

Dr. Ashish S Rudrawadi[1], *Dr. Mandava Sai Raghav Chowdary[2], Dr. Muthaiah Adaikkappan[3]

1. Associate Professor, Department of Radio diagnosis, Al Ameen Medical College & Hospital, Vijayapura, Karnataka.

2. 3. Junior Resident, Department of Radio diagnosis, Al Ameen Medical College & Hospital, Vijayapura, Karnataka.

***Corresponding Author: Dr. Mandava Sai Raghav Chowdary, Junior Resident, Department of Radio diagnosis, Al Ameen Medical College & Hospital, Vijayapura, Karnataka.**

ABSTRACT:

Background: The diaphragm is located inferiorly, the thoracic inlet is located superiorly, and the pleural cavities are located laterally to define the mediastinum. According to various anatomists [4] it is further split into anterior, middle, and posterior compartments. Including thymoma, teratoma, thyroid illness, and lymphoma, anterior mediastinal tumours make up 50% of all mediastinal masses.[5] While tumours that develop in the posterior mediastinum are frequently neurogenic tumours, middle mediastinum masses are typically congenital cysts.

OBJECTIVES:

1. To study the computed tomographic characteristics of Mediastinal lesion/masses in Plain and Contrast enhanced scans.
2. To locate, differentiate and diagnose mediastinal masses.

MATERIAL & METHODS: Study Design: A prospective hospital based observational study. **Study area:** Department of Radio diagnosis, Al Ameen Medical College & Hospital, Vijayapura, Karnataka. **Study Period:** April 2021 – March 2022. **Study population**: All cases referred to the department of Radio-Diagnosis for clinically suspected Mediastinal masses. **Sample size:** study consisted of 40 subjects. **Sampling method:** Purposive sampling technique. **Study tools and Data collection procedure:** All the cases were studied on a SIEMENS ACQUISITION computed tomography machine. Patients were kept nil orally 4 hrs prior to the CT scan to avoid complications while administrating contrast medium. Risks of contrast administration were explained to the patient and consent was obtained prior to the contrast study.

Results: CT and Histopathology Diagnosis was Malignant in 90.0%, Benign in 100.0%. CT was Benign and Histopathology Diagnosis was Malignant in 10%. There was a significant difference in CT and HPE classification of mediastinal masses and comparison.

CONCLUSION: we conclude that computed tomography definitely has a major role to play in the evaluation of a mediastinal mass regarding the compartmental distribution, mass effect upon adjacent structure and provisional diagnosis with Sensitivity of 90 % and Diagnostic Accuracy of 97.5%.

Keywords: mediastinal mass, multidetector computed tomography, thymoma, teratoma,

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

INTRODUCTION:

The diagnosis of mediastinal masses, which include a variety of tumours seen in the chest, continues to be a difficult task that affects patients of all ages. [1] Malignant mediastinal tumour incidence has reportedly increased significantly during the previous few decades. Due to its complex anatomical placement, mediastinal anomalies frequently present a barrier in the radiographic diagnosis. Tumors, cysts, vascular anomalies, lymph node masses, and mediastinal fibrosis are a few of the different disorders that can impact the mediastinum. [2]

The examination of choice for mediastinal lesions is computed tomography (CT) imaging, which provides precise anatomical information that aids in the localization of lesions and the delineation of surrounding tissues.

A mediastinal mass' stretch can be investigated, specified, and visualised using multidetector computed tomography (MDCT). Following intravenous contrast medium administration, MDCT with multi-planar reforms (MPR) offers a commendable evaluation of the mediastinal structures, including vasculature, and has essentially eliminated the need for further examination. [3]

The diaphragm is located inferiorly, the thoracic inlet is located superiorly, and the pleural cavities are located laterally to define the mediastinum. According to various anatomists [4] it is further split into anterior, middle, and posterior compartments. Including thymoma, teratoma, thyroid illness, and lymphoma, anterior mediastinal tumours make up 50% of all mediastinal masses.[5] While tumours that develop in the posterior mediastinum are frequently neurogenic tumours, middle mediastinum masses are typically congenital cysts.[6]

Cough, chest pain, fever/chills, and dyspnea are common symptoms at presentation. The release of too many hormones, antibodies, or cytokines is often what causes systemic symptoms, which are related to the invasion of the tumour and include respiratory compromise, paralysis of the limbs, diaphragm, and vocal cords, Horner syndrome, and superior vena cava syndrome.

Computed Tomography has revolutionized in the diagnosis of mediastinal lesions. It is one of the finest non-invasive imaging modalities available for imaging of the thorax. Computed Tomography has good spatial resolution and shorter imaging time, besides being less expensive and being more widely available. It is capable of defining the precise anatomical details and characterizing the nature, site and extent of the disease. Co-existing lung abnormalities and calcification within the lesions are better appreciated on CT.

CT gives much more detail of extent and involvement of disease. This also underlines the importance of close cooperation with the histo-pathologist and the clinicians in diagnosis and management.

Hence the present study was undertaken to determine the accuracy of the diagnosis of mediastinal masses by Computed Tomography and to correlate its findings with histopathology.

OBJECTIVES:

1. To study the computed tomographic characteristics of Mediastinal lesion/masses in Plain and Contrast enhanced scans.
2. To locate, differentiate and diagnose mediastinal masses.
3. To study the involvement of neighbouring structures by mediastinal masses.
4. To compare the CT findings with pathological diagnosis wherever possible.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

5. To know the distribution pattern of mediastinal masses among males and females.

MATERIAL & METHODS:

Study Design: A prospective hospital based observational study.

Study area: Department of Radio diagnosis, Al Ameen Medical College & Hospital, Vijayapura, Karnataka.

Study Period: April 2021 – March 2022.

Study population: All cases referred to the department of Radio-Diagnosis for clinically suspected Mediastinal masses.

Sample size: study consisted of 40 subjects.

Sampling method: Purposive sampling technique.

Inclusion criteria:

- Patients with symptoms of clinically suspected Mediastinal Masses investigated by CT scan and subsequently proved by histopathology.
- Follow up cases.

Exclusion criteria:

i. Patients with prior treatment elsewhere on presentation.

ii. Recurrent mediastinal masses after treatment.

iii. Patient with abnormal renal function test and contrast sensitivity.

IV. Patients not willing for study.

Ethical consideration: Institutional Ethical committee permission was taken prior to the commencement of the study.

Study tools and Data collection procedure:

All the cases were studied on a SIEMENS ACQUISITION computed tomography machine.

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

Routine anteroposterior topogram of the thorax was initially taken in all patients in the supine position. An axial section of 5mm thickness was taken from the level of thoracic inlet to the level of suprarenal. In all cases pre-contrast study was followed by post-contrast study, image acquisition was done with intermittent suspended inspiration. For post-contrast study, 80-100ml of dynamic intravenous injection of Diatrizoate-meglumine (Trazograf 76%; Urograffin 76%, 60%) at a dose of 300mg of Iodine / Kg body weight (in children) was given and axial section were taken from thoracic inlet to the level of suprarenals.

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, Lung window and Bone window 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.

STANDARD IMAGING PROTOCOL

Routine chest scanning protocol:

Scout image: Anteroposterior Landmark: Sternal notch

Slice plane: Axial or spiral Intravenous contrast: 80-120ml

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

Rate 1.5-2ml/sec for 15 sec Followed by 1 ml/sec,
Oral Contrast: Yes
Breath hold: Suspended Respiration
Slice thickness: 5mm sections from apices to base of lung Slice interval: Continuous
Start location: Strenal notch
Because lung cancer may metastasize to the adrenal glands, scanning is often continued through to the adrenals in patients with a history of cancer.
End location: Through lung bases

Statistical analysis:

Data will be analysed using SPSS 21.0 software. Descriptive parameters will be represented as mean with SD or median. Continuous variables will be compared using unpaired t test /Mann Whitney u test. Chi-square or t test will be used to determine significant outcome difference. Categorical data will be represented as frequency with percentage. For all tests a p value of <0.05 will be considered as statistically significant.

OBSERVATIONS & RESULTS:

		Count	%
Age	< 20 years	6	15.0%
	21 to 30 years	3	7.5%
	31 to 40 years	6	15.0%
	41 to 50 years	10	25.0%
	51 to 60 years	8	20.0%
	> 60 years	7	17.5%
	Total	40	100.0%

In our study, 15% were < 20 years, 7.5% were in 21 to 30 years, 15% were in 31 to 40 years, 25% were in 41 to 50 years, 20% were in 51 to 60 years and 17.5% were > 60 years.

Table 2: Sex distribution of subjects

		Count	%
Sex	Female	15	37.5%
	Male	25	62.5%
	Total	40	100.0%

37.5% were in Female and 62.5% were in Male.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

Table 3: CT Findings Localization distribution

Localization		Yes	
		Count	Row N %
Superior		23	57.5%
Inferior	Anterior	20	50.0%
	Middle	6	15.0%
	Posterior	14	35.0%
Superior and Anterior		14	35.0%
Anterior and Middle		2	5.0%
Middle and Posterior		2	5.0%

Table 4: Plain Study distribution

		Count	**%**
Plain Study	**Iso Dense**	**4**	**10.0%**
	Hypodense	**36**	**90.0%**
	Hyperdense	**0**	**0%**

Table 5: Pattern distribution

		Count	**%**
Pattern	**Homogenous**	**5**	**12.5%**
	Heterogenous	**35**	**87.5%**

Table 6: Other Pattern distribution

		Count	**%**
Other Pattern	**Nil**	**19**	**47.5%**
	Calcification	**5**	**12.5%**
	Calcification, Fluid	**9**	**22.5%**

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

	Calcification, Fluid and Fat	**3**	**7.5%**
	Fluid	**4**	**10.0%**

Table 7: Metastasis distribution

		Count	**%**
Metastasis	**Yes**	**6**	**15.0%**
	No	**34**	**85.0%**

Table 8: Superior Mediastinal lesions or masses on CT scan

		Superior	
		Yes	
		Count	**%**
CT Diagnosis	**Ca Lung MLN**	**2**	**8.7%**
	Ca Thyroid	**2**	**8.7%**
	Lymphoma	**6**	**26.1%**
	Schwannoma	**3**	**13.0%**
	Teratoma	**3**	**13.0%**
	Thymic Ca	**2**	**8.7%**
	Thymoma	**5**	**21.7%**

Table 9: Anterior Mediastinal lesions or masses on CT scan

		Count	**%**
CT Diagnosis	**Ca Lung MLN**	**3**	**15.0%**
	GCT	**1**	**5.0%**
	Lymphoma	**7**	**35.0%**
	Teratoma	**4**	**20.0%**
	Thymic Ca	**1**	**5.0%**

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

	Thymoma	**4**	**20.0%**
a. Anterior = Yes			

Table 10: Middle Mediastinal lesions or masses on CT scan

		Middle Mediastinal Lesions	
		Count	**%**
CT Diagnosis	**Ca Lung MLN**	**1**	**16.7%**
	Ca Oesophagus	**2**	**33.3%**
	LM of Oesophagus	**1**	**16.7%**
	Teratoma	**2**	**33.3%**

Table 11: Posterior Mediastinal lesions or masses on CT scan

		Count	**Column N %**
CT Diagnosis	**Ganglioneuroma**	**1**	**7.1%**
	LM of Oesophagus	**1**	**7.1%**
	NB	**1**	**7.1%**
	Neuroendocrine Tumour	**2**	**14.3%**
	Schwannoma	**7**	**50.0%**
	Teratoma	**1**	**7.1%**
	Thymoma	**1**	**7.1%**

Table 12: CT and HPE classification of mediastinal masses and comparison

	Histopathology Diagnosis					
	Malignant		**Benign**		**Total**	
	Count	**%**	**Count**	**%**	**Count**	**%**

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

CT	**Malignant**	**9**	**90.0%**	**0**	**0.0%**	**9**	**22.5%**
	Benign	**1**	**10.0%**	**30**	**100.0%**	**31**	**77.5%**
	Total	**10**	**100.0%**	**30**	**100.0%**	**40**	**100.0%**

χ 2 =34.83, df =1, p = < 0.001*

CT and Histopathology Diagnosis was Malignant in 90.0%, Benign in 100.0%. CT was Benign and Histopathology Diagnosis was Malignant in 10%. There was a significant difference in CT and HPE classification of mediastinal masses and comparison.

Table 13: FINAL REPORT

		CT Diagnosis		Histopathology Diagnosis		Classification
		Count	%	Count	%	
Diagnosis	Ca Lung MLN	3	7.5%	3	7.5%	Malignant
	Ca Oesophagus	2	5.0%	2	5.0%	Malignant
	Ca Thyroid	2	5.0%	2	5.0%	Malignant
	Ganglioneuroma	1	2.5%	1	2.5%	Benign
	Germ Cell Tumor (GCT)	1	2.5%	1	2.5%	Benign
	LM of Oesophagus	1	2.5%	1	2.5%	Benign
	Lymphoma	7	17.5%	7	17.5%	Benign
	NB	1	2.5%	1	2.5%	Benign
	Neurogenic Tumour	2	5.0%	1	2.5%	Benign
	Schwannoma	7	17.5%	7	17.5%	Benign
	Immature teratoma	0	0%	1	2.5%	Malignant
	Teratoma	5	12.5%	3	7.5.0%	Benign
	Thymic Ca	2	5.0%	2	5.0%	Malignant
	Thymoma	6	15.0%	6	15.0%	Benign
	Granular cell tumour	0	0%	1	2.5%	Benign

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

Table 14: Validity of CT in diagnosis of mediastinal masses in comparison with HPE diagnosis (FINAL REPORT)

Parameter	Estimate	Lower - Upper 95% CIs
Sensitivity	**90%**	**59.58, 98.21**
Specificity	**100%**	**88.65, 100**
Positive Predictive Value	**100%**	**70.08, 100**
Negative Predictive Value	**96.77%**	**83.81, 99.43**
Diagnostic Accuracy	**97.5%**	**87.12, 99.56**
Cohen's kappa (Unweighted)	**0.931**	**0.6219 - 1.24**

DISCUSSION:

For imaging mediastinal masses, CT is a crucial modality. The study's aims were to identify the mediastinal lesions that affected the mediastinum and to correlate the CT results. 50% of instances with mediastinal masses are unusual occurrences in which there are no symptoms.

In our study, 15% were < 20 years, 7.5% were in 21 to 30 years, 15% were in 31 to 40 years, 25% were in 41 to 50 years, 20% were in 51 to 60 years and 17.5% were > 60 years. 37.5% were in Female and 62.5% were in Male group.

20 % of females were under the age of 20, 6.7 % were between the ages of 21 and 30, 13.3 % were between the ages of 31 and 40, 13.3 % were between the ages of 41 and 50, 40 % were between the ages of 51 and 60 and 6.7 % were over 60.

12 % of males were under the age of 20, 8% were between the ages of 21 and 30, 16 % were between the ages of 31 and 40, 32 % were between the ages of 41 and 50 in comparison with Pandey, s et al[16] 2018 shows The most common age group to present with the mediastinal mass was between 41 and 50 years. , 8% were between the ages of 51 and 60 and 24 % were beyond the age of 60.80% had Cough, 52.5% is the main symptom, had Chest pain and 25% had Fever. Dyspnea, 27.5% in comparison with Pandey,s et al 2018[16] shows dyspnea 38.82% shows dyspnea .

In CT Findings Localization distribution was Superior in 57.5%, Inferior Anterior in 50%, Inferior Middle in 15%, Inferior Posterior in 35%, Superior and Anterior in 35%, Anterior and Middle in 5% and Middle and Posterior in 5%.12.5% had Homogenous Pattern and 87.5% had Heterogenous.

In Other Pattern distribution 47.5% had Nil, 12.5% had Calcification, 22.5% had Calcification, Fluid, 7.5% had Calcification, Fluid and Fat and 10% had Fluid. 15.0 % had Metastasis, Site of Metastasis was Lung in 2 , lung and liver in 1, lymp car in 1 and plu nod in 2.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

In Superior Mediastinal lesions or masses, 8.7% had Ca Lung MLN, 8.7% had Ca Thyroid, 26.1% had Lymphoma, 13.0% had Schwannoma, 13.0% had Teratoma, 8.7% had Thymic Ca and 21.7% had Thymoma.
In Middle Mediastinal lesions or masses, 16.7% had Ca Lung MLN, 33.3% had Ca Oeso, 16.7% had Immature Teratoma, 16.7% had LM of Oeso and 16.7% had Teratoma.
In Posterior Mediastinal lesions or masses, 7.1% had LM of Oesophagus , 7.1% had NB, 7.1% had Neuroendocrine Tumor , 7.1% had Granular cell tumour, 50% had Schwannoma, 7.1% had Teratoma and 7.1% had Thymoma.
In Lymphoma lesions or masses study, 12.5% had LM of Esophagus and 87.5% had Lymphoma. In Neural Tumours or Masses, 11.1% had Ganglioneuroma, 11.1% had NB and 77.8% had Schwannoma.
In Thymic Mass Distribution, 25% had Thymic Ca and 75% had Thymoma. In CT Diagnosis, 7.5% had Ca Lung MLN, 5% had Ca Oeso, 5% had Ca Thyroid, 2.5% had Ganglioneuroma, 2.5% had GCT, 2.5% had LM of Oeso, 17.5% had Lymphoma, 2.5% had NB, 5% had Neu Tum, 17.5% had Schwannoma, 12.5% had Teratoma, 5% had Thymic Ca and 15% had Thymoma.
According to study conducted by V. Arumugam et al[12], in 2015**,** most mediastinal masses were in the anterior mediastinum constituting 62%, followed by the middle and posterior mediastinum, which were 44% and 18%, respectively.
In the similar studies conducted by Cohen et al[8] and Davis et al [9] found thymic lesions as common mediastinal lesions. In a study by Chen et al [10] on 34 patients with CT diagnosis of thymic mass, thymoma constituted 91 %, thymic cyst 2.9%. Whereas in our study, of the 5 patients with thymic mass, thymoma constituted 60% and thymic carcinoma constitute 40%. According to Naidich et al [11], Thymoma is most commonly seen between 50-60 years which is comparable to our study in which the 3 patients with thymoma where of age 44, 62 and 63 years respectively.
The study of Totanarungroj et al.[13] concluded that fat density within the anterior mediastinal mass was present in 57.1% of germ cell tumours, significantly greater than other anterior mediastinal tumors. The result of Tian et al.[14] study was that the characteristic findings of primary non-teratomatous germ cell tumors of the mediastinum include large, ill-defined, lobulated masses, heterogeneous attenuation with areas of low-attenuation and calcification on non-enhanced CT images. Contrast administration revealed heterogeneous enhancement of the tumours.
Kim et al.[15] in their study concluded that the primary thyroid lymphoma should be included in the differential diagnosis when an old-aged female with a history of rapidly enlarging thyroid mass and with coexistent Hashimoto's thyroiditis had CT findings of homogeneous thyroidal mass isoattenuating to muscles without invasion of surrounding structures.
We believe that in the majority of cases, CT imaging aids in identifying mediastinal goitre as the mediastinal mass visible on the chest radiograph. The mediastinal thyroid and cervical thyroid tissue were continuous in each of our two cases. Even if this was visible on axial plane scans, challenging situations could have the continuity supported by reconstructed coronal pictures. Therefore, if additional caudad scans suggest that the mediastinal mass may be caused by a retrosternal thyroid, we advise that image capture be increased to a greater level. The element that aids in identifying mediastinal tissue as thyroid is high attenuation

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

value. It is unusual for mediastinal tumours like lymphoma or thymoma to exhibit CT attenuation greater than that of muscle.

CONCLUSION:

we conclude that computed tomography definitely has a major role to play in the evaluation of a mediastinal mass regarding the compartmental distribution, mass effect upon adjacent structure and provisional diagnosis with Sensitivity of 90 % and Diagnostic Accuracy of 97.5%.

REFERENCES:

1. A R Aroor, S R Prakasha, S Seshadri, S T Raghuraj, U, A study of clinical characteristics of mediastinal mass J Clin Diagn Res.`, 8: 77-80, 2014.

2. D Johnson, P Shah, P Collins, C Wingley, Heart and mediastinum, Gray's Anatomy: 976-77, 2008.

3. Sergi Juanpere, Noemí Cañete, Pedro Ortuño, Sandra Martínez, Gloria Sanchez, Lluis Bernado, A diagnostic approach to the mediastinal masses, Insights Imaging., 4: 29-52, 2013.

4. Whiteen CR, et al. A diagnostic approach to mediastinal abnormalities. Radiographics. 2007; 27:657–671.

5. Tomiyama N, et al. Anterior mediastinal tumors: diagnostic accuracy of CT and MRI. Eur J Radiol. 2009; 69:280–288.

6. Duwe BV, et al. Tumors of the mediastinum. Chest. 2005; 128:2893–2909.

7. Strollo DC, Rosado de Christenson ML, Jett JR. Primary mediastinal tumors. Part I. Tumors of the anterior mediastinum. Chest 1997; 112: 511-522.

8. Cohen AJ, Thompson LN, Edwards FH et al. Primary cysts and tumors of the mediastinum. Ann Thorac Surg 1991; 51: 378-386.

9. Davis et al. Primary cysts and neoplasms of the mediastinum: Recent changes in clinical presentations, methods of diagnosis, management and results. Ann Thorac Surg 1987; 44: 229-37.

10. Chen J, Weisbrod GL, Herman SJ. Computed tomography and pathologic correlations of thymic lesion. J Thoracic Imaging 1988; 3: 61-65.

11. Naidich DP,Webb WR, Muller NL, Zerhouni EA, Seigelmann SS. Mediastinum, Chapter 2 In: Naidich DP, Muller NL, Zerhouni EA, Webb WR, Krinsky GA (eds) Computed tomography and Magnetic Resonance of the thorax, 3rd edition, Lippincott Williams and Wilkins, Philadelphia, 1999: 38-160.

12. Venkateshwaran Arumugam, Hajimohammed Nazir, Konduru Varadarajulu Rajasekar, Multidetector Computed Tomography Evaluation of Mediastinal Lesions with Histopathological Diagnosis. Open J Respir Dis., 2015: 05: 55-62.

13. K Totanarungroj, C Watcharaporn, N Muangman, Helpful CT Findings for Giving Specific Diagnosis of Anterior Mediastinal Tumors. J Med Assoc Thai. 2010: 93: 489-496.

14. L Tian, L Z Liu, C Y Cui, W D Zhang, Y L Kuang, CT Findings of Primary Non-Teratomatous Germ Cell Tumors of the Mediastinum-A Report of 15 Cases Eur J Radiol., 2012: 81: 1057-1061.

15. H C Kim, M H Han, K H Kim, H J Jae, S H Lee, S S Kim. Primary Thyroid Lymphoma: CT Findings. Eur J Radiol., 2003: 46: 233-239.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE08, 2022

16. Pandey S, Jaipal U, Mannan N, Yadav R. Diagnostic accuracy of multidetector computed tomography scan in mediastinal masses assuming histopathological findings as gold standard. Polish journal of radiology. 2018;83: e234.