CT EVALUATION OF MEDIASTINAL MASSES: A STUDY OF 80 CASES

Ishtiaq Ahmed, Ahsen Farooq, Tahir Naeem, Tariq Jaffar and Atiq-ur-Rehman

Eighty patients with mediastinal masses were imaged with computed tomography (CT). Results were analyzed with regard to the ability of CT to demonstrate the masses, their location, their morphology, and their encroachment upon or displacement of adjacent mediastinal structures. CT images were compared with plain chest radiographs which were available in all cases. CT depicted all lesions successfully with good anatomic detail. Among the 80patients the largest number of cases (n =51) were found to be having lymphadenopathy with Hodgkin's lymphoma in 57% and non-Hodgkin's lymphoma in J5% of cases. CT is regarded as the best single radiological investigation for evaluating a mediastinal abnormality demonstrated on a high-kV chest radiograph or for detecting occult mediastinal disease.

KEYWORDS: Mediastinal Mass, CT Imaging

INTRODUCTION

The mediastinum, an area of great interest to clinicians. radiologists and pathologists, is the site of origin of numerous disease processes. Plain chest radiography remains the basic imaging examination to define location and morphology of mediastinal masses *'[2]. However, pathologic processes cannot be detected unless they produce a contour abnormality of the lung mediastinal interface. Confusing radiographic appearances due to superimposition of different structures are readily resolved by subsequent cross-sectional imaging. In general, computed tomography is the primary cross-sectional imaging procedure in the evaluation of most mediastinal masses [1,2,3]. CT not only allows visualization of traditional radiological "blind spots" of thoracocervical junction, crura, and the intrapericardial vessels, but it also helps define the location, size, contour, extent and character of mediastinal masses as well as involvement of adjacent structures [2,3,4] Detection, diagnosis staging and follow-up of mediastinal masses are important and this study highlights the value of CT in this respect.

from Army Medical College, Rawalpindi.

COL. ISHTIAQ AHMED, MBBS, MCPS, FTPS, Professor. Army Medical College.

DR AHSEN FAROOQ, MBBS, Graded Radiologist, Trainee FCPS(II).

DR TAHIR NAEEM, MBBS, Graded Radiologist, Trainee FCPS(II).

DR TARIQ JAFFAR, MBBS, Graded Radiologist, Trainee FCPS(II).

DR ATIQ-UR-REHMAN, MBBS, Trainee FCPS(II).

MATERIALS AND METHODS

Patient Selection

The 80 patients included in this study were referred between January 1992 to December 1994 for CT scanning to evaluate mediastinal masses, mostly detected on plain chest radiographs but in a few cases on the basis of clinical suspicion. Patients with pulmonary' parenchymal lesion in addition to the mediastinal mass were included when the parenchymal findings on the chest radiographs appeared to be secondary to the mediastinal lesion. The patients ranged in age from 4 to 80 years; 64 were males, and 16 were females. All patients had a frontal and a lateral chest radiograph within one week of the CT examination. In *15* of 80 patients a histopathological diagnosis by biopsy or surgery was available.

Imaging Method

CT examination was performed with a fourth generation CT scanner (Technicare). Axial, plain and contrast enhanced contiguous images were acquired with a slice thickness of 10 mm without interval. For enhanced images, first a 40 ml bolus injection of 76% (Urograffm) was given followed by 5 ml of contrast medium for every two slices. The region included was from the thoracic inlet above to the adrenals below.

RESULTS

The final diagnoses for the 80 patients are tabulated as follows (Table-1): -

TABLE – I FINAL DIAGNOSIS OF PATIENT
(TOTAL NO – 8O)

S. No.	Diagnoses / Lesions	No. of Patients	% age
1.	Lymph Node Masses	51	63.75
2.	Thymic Tumours	10	12.50
3.	Retrosternal Goitre	6	7.50
4.	Aortic Aneurysms	5	6.25
5.	Neurogenic Tumours	4	5.00
6.	Terato-dermoids	2	2.50
7.	Hydatid Disease	1	1.25
8.	Bronchogenic Cyst	1	1.25

Histopathological diagnoses were obtained in 75 patients. In the remaining, the diagnosis was based on other clinical information.

CT revealed each of the mediastinal masses and their location in the various mediastinal compartments with good anatomical detail. In general, masses were well discriminated from normal mediastinal contents. The excellent bone-to-soft tissue contrast on plain scans and vessels-to-solt tissue contrast on enhanced scans always permitted distinction of masses from adjacent mediastinal structures. Sagittal and coronal reconstructed images were useful for defining the extension of masses into the neck and cervicolhoracic junction.

Among the SO patients, 51(63.75%) cases were found to be of lymph node enlargement. (Fig 1). 57% (n=29) Hodgkin and 33% (n=17) non-Hodgkin lymphoma, 6% (n=3) tuberculosis. 2% (n=l) metastatic bronchogenic carcinoma and 2% (n=l) sarcoidosis.

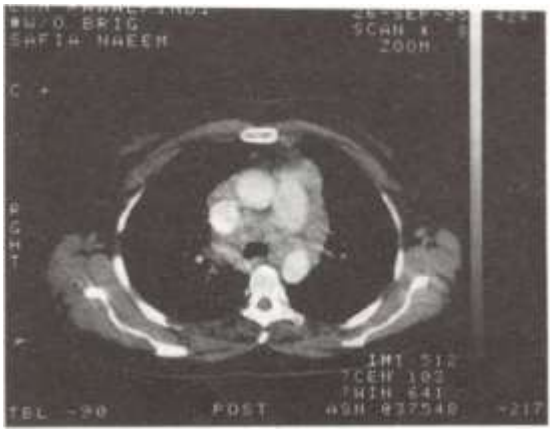


Fig. 1: CT scan chest of a female showing mediastinal lymphadenopathy

Thymic masses (thymomas) were found in 10 (12.5%) patient and in 40% (n=4) cases a benign thymoma (Fig 2 & 3) was present along with myasthenia gravis and the remaining 60% (n=6) were diagnosed on histopathology as malignant thvmoma.

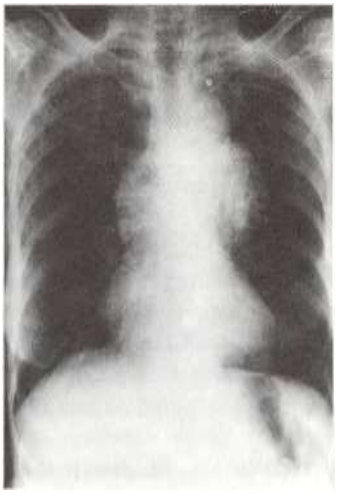


Fig. 2 (a) Chest P view showing a well-defined soft tissue mass in the left hilar regions with hilar vessels visible through it

Fig. 2 (b) Lateral view shows it is in the retrosternal area.

Fig. 2 (c) t I scan chest showing it as a well-defined hypodense area on the left side of anterior mediastinum.

Fig. 2: Thymnlipoma in an adult female.

Fig. 3 (a) Chest PA view showing a smooth oval opacity in the left hilar region.

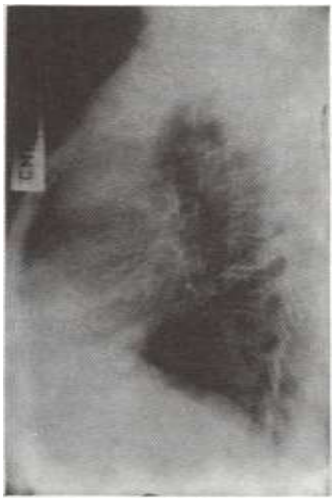
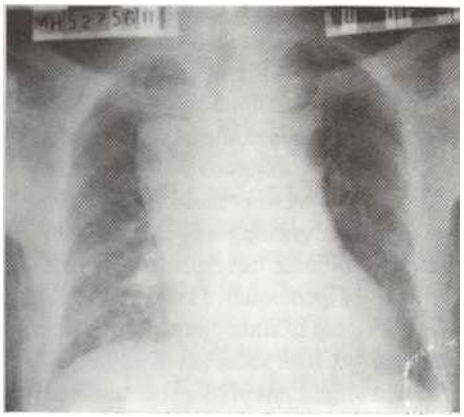


Fig. 3 Chest Lateral view, the oval fat density is seen in the anterior mediastinum, Fig. 3: An adult female with Thymolipoma.

Intrathoracic extension of thyroid (Fig 4) was found in 0 (6.5%) patients. 66.5% (n=4) were in the anterior compartment and 33.5% (n=2) were in the posterior mediastinum.



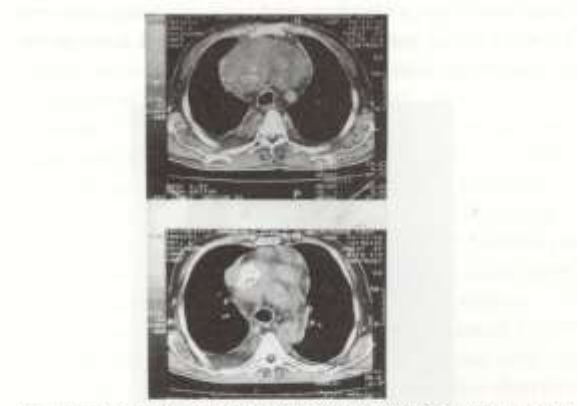
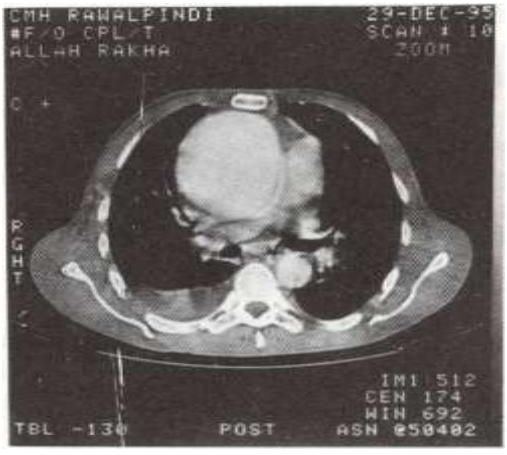


Fig. 4 (b) CT scan chest (Abrar CT) suggested it to be a retro-sternal goitre showing calcification and enhancement in CT slice.

Fig. 4: A case of superior mediastinal mass.

The vascular lesion detected were aortic aneurysms (Fig 5) found in 5 (6.25%) cases

Fig.5 (a) Chest radiograph showing cardiomegaly and superior mediastinal widening.



Four (5%) cases of neurogenic tumours were detected, two in children and two in adults, one was located in the middle mediastinum and 3 were in the posterior mediastinum (Fig 6).

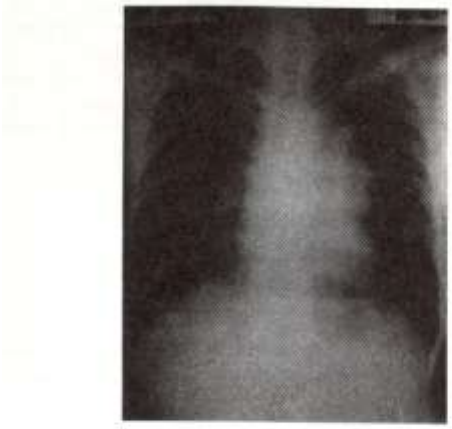


Fig. 6 (a) Chest PA view showing a large, well defined soft tissue mass on the right side of mediastinum.

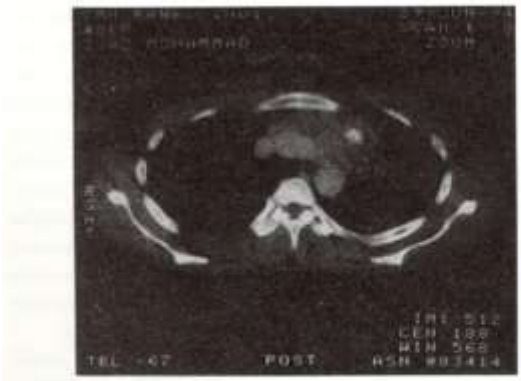
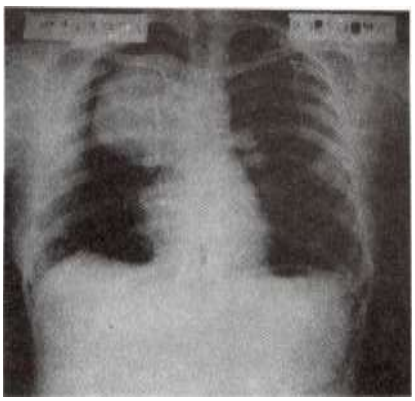


Fig. 6 (b) CT scan chest showing the mass to be in the right paravertebral region.

Fig. 6: A large neurofibroma in an adult female.

Two (2.5%) cases of cystic teratodermoid were found in the anterior mediastinum (Fig 7).



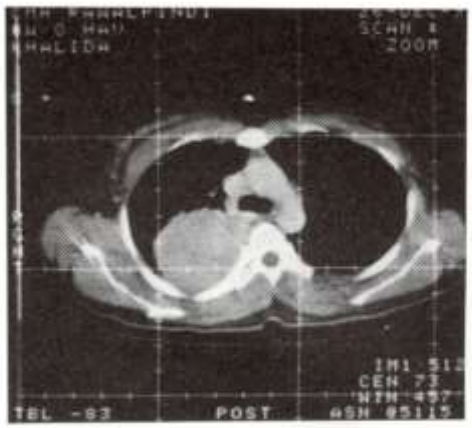


Fig. 7 (b) On CT scan bone density is seen in the mediastinal mass.

Fig. 7: Teratoma in an adult male.

One case of hydatid cyst and one case of broncho-genic cyst were also detected.

DISCUSSION

There are several ways of defining the anatomic division of the mediastinum but the most widely used scheme is a simple one that divides the mediastinum into four compartments: superior, anterior, middle, and posterior[5]. Division of the mediastinum into various compartments facilitates interpretation of radiological findings and aids in suggesting differential diagnosis as certain pathologic lesions are found most frequently in certain compartments.

Causes of anterior mediastinal masses include reterostemal thyroid, adenopathy, abnormalities of thymus, blood vessels, sternum, pericardium and diaphragm, and germinal cell tumours [6,7]. Causes of posterior mediastinal masses include neurogenic tumours, oesophageal lesions, paravertebral masses vertebral lesions, vascular abnormalities, adenopathy, congenital or pseudocyst, and intrathoracic goiters [3,6] The middle mediastinum strictly should include only the pericardium and its contents. For convenience, however, most anatomy books describe the hila of the lungs and broncho-pulmonary lymph nodes in this compartment The middle mediastinal masses arise from adenopathy, carcinoma of the bronchus, abnormalities of great vessels and bronchogenic cyst [6] Causes of cardiac enlargement are excluded.

The mediastinum can be examined radiologically with a variety of techniques. Plain chest radiography is the basic imaging examination to define location and morphology Cross sectional imaging subsequently clarities the origin, morphology, extent and nature of the lesion and also helps in staging and follow up of malignant masses [2,3,7,9]. While CT and MRI are equally effective in demonstrating

mediastinal masses, CT remains the primary cross sectional imaging procedure
of choice [1].

CT of the mediastinum is the dominant imaging modality, in use, today. To some extent use of the technique depends on the suspected lesion and information desired. However, many hospitals develop a routine procedure that is followed in most instances [1,10]

In most cases, attenuation coefficients (Hounsfield units HI I) are precise enough to allow the differentiation of fatty, cystic and solid masses, and if, contrast has been given, abnormal vessels can also be easily identified [4,10,11.] On CT fat is easily detected by its low' density (-20 to -120 HI I)[10, 12.] Most fluid filled mediastinal masses have a density of zero to 20 HU, less than that of soft tissue [13] However, presence of a proteinaceous fluid or calcium can increase the density measurements as high as 90 HU [14]

Also, degeneration in a solid tumour can lead to formation of a thick walled cystic mass [15] A solid looking mass is considered to be soft tissue if its density is greater than that of water, in the range of 15 to 50 HIJ[16]

In addition to characterizing mediastinal masses CT scan aid in differential diagnosis of a mass lesion defining its precise location or organ of origin and can greatly assist in the percutaneous biopsy of accessible lesions [11,12,17] CT also helps detect the invasion of adjacent mediastinal structures [4] This information can have great bearing on subsequent management.

Both normal and abnormal (enlarged) lymph nodes are visible on mediastinal CT. In general mediastinal nodes under one cm in greater diameter are considered to be normal [1S] Mediastinal nodes between one and 1.5 cm are considered suspicious [19] Mediastinal lymph nodes greater than 1.5 cm are very frequently involved by tumour but may be hyperplastic [19] But the likelihood that a mediastinal lymph node is pathologically enlarged is a function not only of its sized by also of its location [10] However, whether such enlargement is caused by metastatic neoplasm, lymphoma or inflammation usually cannot be ascertained by CT [,10]. In one international study of 800 patients, lymphadenopathy was the cause in 65% cases [1]. We found (Table) adenopathy as a cause of mediastinal mass in 51 out of 80 (63.75%) cases.

Mediastinal lymphadenopathy (big 1) is the most common intrathoracic manifestation of lymphomas [10] Approximately 65% of patients with Hodgkin lymphoma have intrathoracic disease, 90% of these have mediastinal disease and in 40% it is the sole site of involvement [10] In patients with non-Hodgkin lymphoma, about 40% initially have intrathoracic disease, but in less than 10% it is purely mediastinal [ln]. In our study Hodgkin lymphoma was diagnosed in 33% and non-Hodgkin lymphoma in 57% of total 51 cases with mediastinal adenopathy. The overwhelming majority of mediastinal lymph nodal metastases originate from primary neoplasms within the thorax with bronchogenic carcinoma the most common and esophageal carcinoma a much less frequent cause [10] Mediastinal lymph node metastases may also occur secondary to extrathoracic malignant neoplasms such as from tumours of the head and neck, breast, kidney and malignant melanoma. We found one case of metastatic bronchogenic carcinoma out of 51 cases. Mediastinal lymph nodes may be involved in the primary phase of tuberculosis or histoplasmosis [,0]. Out of 51 adenopathies in our study 6 were confirmed to be of tuberculous etiology and one was caused by sarcoidosis.

Thymic masses (Fig 2 & Fig 3) constituted 12.5% (10 out of 80 cases) in our study as compared with one international study of 1000 cases where this distribution was 20% [1]. Thymomas are present in 10 to 15% patients with myasthenia gravis (4 cases in our study) and approximately 10 to 15% of thymomas are classified as malignant (6 out of 10 in our study) [10]. CT is helpful to detect and differentiate Thymic hyperplasia, Thymoma or other Thymic tumours[20].

Mediastinal thyroid (Fig 4) comprise 5 to II percent of mediastinal masses suspected at thoracotomy [1,23] They generally represent intrathoracic extension of a cervical thyroid (Fig 4). With CT, most of these masses have a suggestive appearance. We found six (7.5%) cases of intrathoracic extension of the thyroid.

CT allows a confident diagnosis of several vascular anomalies, and in most cases the need for angiography is obviated [10]. We found vascular abnormalities in four (5.6%) cases as compared with 10% in another study V These all were aortic aneurysms (Fig 5) (5.6%) cases as compared with 10% in another study V These all were aortic aneurysms (Fig 5).

Neurogenic tumours (Fig 6) account for about 80% of posterior mediastinal tumours and can originate from the nerve roots (sehwanomas, neurilemmomas or neurofibromas) or from the sympathetic ganglia (neuroblastomas, ganglioneuromas or ganglioneuroblastomas) [10] One study describes the incidence of neurogenic mediastinal masses to be 20% (5% in our study)[1].

Most mediastinal cysts are of congenital origin and include acrodigestive tract duplication (bronchogenic, foregut, neuroenteric, lymphogenous and pericardial cysts) [1]. We found one case of hydatid cyst and one case of bronchogenic cyst.

The commonest of the germ cell tumours in the mediastinum are the dermoid and the benign and malignant teratoma[1]. We found two benign cystic teratodennoid tumours (Fig 7).

the current and previous studies indicate that mediastinal masses are easily detected, clearly defined and significantly distinguished from normal mediastinal structures by CT imaging [1,10] CT appears particularly suitable for the evaluation of mediastinal masses because of superior spatial resolution afforded by it especially when small structures with relatively good CT contrast have to be visualized, such as the small bronchi or slightly enlarged lymph nodes and small thymic masses. Fat and calcification are easily detected and above all both soft tissue and bone can be studied together.

REFERENCES

1. 1 Sutton D.(Ed). A textbook of Radiology and Imaging. Churchill Livingstone (fifth edition), 1993; pp 337-64.
2. Merten DF. Diagnostic imaging of mediastinal masses in children. AJR; 1992 Apr; 158: 825-32.
3. Kewaskum A, Fishman EX, Kuhlman JE, & Nixon MS. CT of posterior mediastinal masses. Abstract radiographic; 1991 Nov; 11(6): 1045- 67.
4. Heitzman ER. Computed tomography of the thorax. Current perspectives. AJR, 1981; 136: 2.
5. Williams PE. Warwick R, Dyson M & Bannister HL (eds) Grays Anatomy. Churchill Livingstone. 1989; 1271-72.
6. Chapman S & Nakieley R. Aids to radiological differential diagnosis. Bailliere Tindall. 2nd Edition, 1990; 138-46.
7. Brown ER & Anghenbaugh GE. Masses of the anterior mediastinum CT and MR1 imaging; AJR, 1991 DRC; 157(6): 1 171-80.
8. Slonecker CE & Basmajian JV (eds) Grants Method of Anatomy, A clinical problem solving approach. William's Wilkins. 1989, p. 106.
9. Murray JG & Breatnache. Imaging of the mediastinum and hila (Abstract) Curr. Opin. Radiol. 1992 Oct: 4: 44-52.
10. Lee JKT. Sagel SS & Stanely R.J (Ed). Computed body tomography with MRI correlation. Raven Press. New York, Second edition, 1989: pp 245- 94
11. Barohj RE, Levitt RG & Sagel SS et al. Computed tomography in the evaluation of mediastinal widening: Radiology; 1981,13: 107-11.
12. Mendez G, Isikoff MB & Isikoff SK, et al. Fatty' tumours of the thorax demonstrated by CT: AJR. 1979; 133: 207-12.
13. Pugatch RD, Braver JH & Robbins Al 1, et al. CT diagnosis pericardial cysts. AJR, 1987, 131; 515- 76.
14. Marvasti MA, Mitchell GE & Burke WA, et al. Misleading density of mediastinal cysts on computed topography. Ami Thorax Surg; 1981; 31: 167-70.
15. Federal MP & Callen PW. Cystic Hodgkins lymphoma of the thymus: computed tomographic appearance. J Comput Assist Tomogr, 1979; 542- 44.
16. Goldwin RL, Heitzman ER & Fproto AV. Computed tomography of the mediastinum. Radiology, 1977; 124: 204-214.
17. Fink I, Gamsu G & Harter EP. CT guided aspiration biopsy' of the thorax. J comput Assist Tomogr. 1982,6: 958-62.
18. Schnyder PA & Gamsu G. CT of the pretracheal retrocaval space. AJR, 1981, 136: 303-308.
19. Baran RL., Levitt RG & Sagel SS, et al. Computed tomography in the preoperative evaluation of bronchogenic carcinoma. Radiology, 1982, 145: 727-32.
20. Baron RE, Loe JKT & Sagel SS et al. Computed tomography of the normal thymus. Radiology, 1982, 142: 121-125.
21. Wyehulis AR, Payne WS & Clagett OT. et al. Surgical treatment of mediastinal tumours. J. Cardiovasc. Surg., 1971, 69, 379,-91