

CT EVALUATION OF MEDIASTINAL MASSES

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ABSTRACT

BACKGROUND

The mediastinum is demarcated by the pleural cavities laterally, the thoracic inlet superiorly and the diaphragm inferiorly. It is further divided into anterior, middle and posterior compartments by many anatomists.¹ CT imaging allows early diagnosis and more specific characterization of anterior mediastinal masses than is possible with plain film radiographs. This study describes state-of-the-art CT imaging of the mediastinum.¹ Detection, diagnosis, staging, and follow-up of anterior mediastinal masses is important and has been significantly improved with CT imaging.

MATERIALS AND METHODS

The study was conducted on 50 patients on SIEMENS 16 Slice CT SCAN Machine in our department of Radio-diagnosis at C. U. Shah Medical College and Hospital from May 2014 to Oct 2015. The patients were chosen on the basis of clinical findings and suspected mediastinal lesion on X-rays. The study is completely an observational type of study.

RESULTS

On the basis of our study, it was found out that maximum number of patients were of more than 61 years of age with common symptoms of cough with chest pain and breathlessness. Common sites of mediastinal pathology is in middle compartment with maximum number of lesions were of malignant nature either extending from perihilar region or in mediastinal proper some of them showing metastasis. Most of the lesions were solid in nature showing heterogeneous contrast enhancement showing vascular and adjacent structure involvement. The common benign lesions were goiter, hernia and infective collection.

CONCLUSION

The mediastinum represents a wide variety of pathologies ranging from congenital lesions to malignant tumours. Conventional radiographs have limited spectrum in diagnosing mediastinal pathologies, thus CT plays an important role in proper delineation of the lesion and defining the anatomical details of the surrounding structures involved by the lesion. With the help of CT and its excellent high resolution images it is now possible to locate even smaller lesions without any obscurity.

KEYWORDS

Mediastinal masses, Contrast Enhanced Computed Tomography, Diagnosis, Mediastinum.

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BACKGROUND

In the era of cross-sectional imaging, mediastinal abnormalities can easily be identified. However, these abnormalities often manifest initially at conventional radiography. Chest radiography is a very common examination, and radiographic identification of an unexpected mediastinal mass is important. Knowledge of the normal mediastinal reflections that can be appreciated at conventional radiography is crucial to identifying a mediastinal mass. These mediastinal reflections can also help identify the location of a mass, thereby aiding in

differential diagnosis and possibly influencing the choice of modality for further assessment.

Aims and Objectives

1. To study the characteristics and nature of mediastinal masses by NECT or CECT or both.
2. To study the involvement of adjacent structures.
3. To determine the fine and precise anatomical details of the involved part.

MATERIALS AND METHODS

The study was conducted on 50 patients on SIEMENS 16 Slice CT SCAN Machine in our department of Radio-diagnosis at C U Shah Medical College and Hospital from May 2014 to Oct 2015.

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Inclusion Criteria

1. Signs and symptoms like prolonged cough and dyspnoea with loss of weight and appetite s/o chronic chest pathologies.
2. Known case of long standing tuberculosis or defaulter or relapse.
3. Known chronic smoker.

Exclusion Criteria

1. Young females of reproductive age
2. Lactating or pregnant mothers
3. Patients with history of contrast allergies.

OBSERVATIONS AND RESULTS

Age Group	Male	%	Female	%
0-15	3		0	
16-30	0		3	
31-45	2		3	
46-60	12		2	
>61	19		6	
Total Cases	36	72%	14	28%

Table 1. Age and Sex Wise Distribution of the Lesions

So above study indicates that there is high male preponderance of mediastinal lesions as compared to females and that too above 61 years of age group. Out of 50 cases, 36 were males and rest 14 were females. Also, there is less incidence of mediastinal pathology in early age group i.e. up to 45 years of age.

Symptoms	Cases
Cough	24
Dyspnea	06
fever	06
chest pain	04
hemoptysis	02
breathlessness	06
others (reduced weight and appetite, dysphagia)	02

Table 2. Symptoms wise Distribution

If we observe the data symptom wise, the maximum number of patients have complaints of cough rather than other symptoms like dyspnoea, breathlessness, chest pain, fever and other complaints like weight and appetite loss. So cough proves to be a prominent symptom whether it be an acute phase or chronic phase.

Compartment	Cases	Percentage
Anterior	16	32%
Middle	20	40%
Posterior	10	20%
Superior	04	8%

Table 3. Compartment Wise Distribution

Incidence wise, maximum number of lesions occur in middle mediastinum (n=20 i.e. 40%) then, anterior mediastinum (n= 16 i.e. 32%), posterior mediastinum (n=10 i.e. 20%), superior mediastinum (n=04 i.e. 8%), thus proving middle mediastinum being most common site of pathologies.

Anterior Mediastinum Cases

Benign	Malignant
Necrotic Node	Left peri hilar UL malignancy extending into anterior mediastinum
Goiter -2	Right hilar malignant mass with extension
Morgagni Hernia	Malignant lesion
Pericardial cyst	Left perihilar UL lesion with extension and encasement of left pulmonary artery
	Left hilar ML lesion with extension in anterior mediastinum and adrenal metastasis
	Malignant lesion
	Malignant lesion
	Malignant lesion
	Malignant lesion
	Right hilar lesion with extension
	Right hilar mass in UL with extension

Table 4. Lesion in Compartment Wise Distribution with Provisional Diagnosis

Graphical representations show the maximum number of cases to be of aggressive and malignant pathology rather than being benign

Middle Mediastinum

Benign	Malignant
Aortic Arch and Descending Aortic aneurysm with thrombosis	Right perihilar lesion in right UL with extension and bronchus cut off
Ascending, Descending and aortic arch aneurysm	Right perihilar lesion in right UL with extension
Koch's collection on right sided diaphragmatic and mediastinal pleura (infective)	Mesothelioma on left mediastinal pleura
Bronchogenic cyst	Left perihilar lesion in left UL and ML with mediastinal extension
Descending aorta aneurysm	Malignant lesion

	Right hilar lesion with mediastinal extension
	Left perihilar lesion in left UL with extension
	Right perihilar lesion with extension
	Right perihilar lesion in UL with extension
	Right perihilar lesion with extension and SVC thrombus
	Malignant lesion with lung metastasis
	Malignant lesion
	Right perihilar lesion with extension
	Right perihilar lesion with extension
	Left hilar lesion with extension

Table 5. Lesion in Compartment Wise Distribution with Provisional Diagnosis

Above study indicates that the number of incidences of malignancy are more as compared to benign lesions.

Benign	Malignant
Neurogenic tumor	Esophageal malignancy in lower 1/3 rd
Koch's etiology (Infective)	Esophageal malignancy in lower 1/3 rd
Bochdalek hernia	Malignant lesion
Hiatus hernia	Malignant lesion
	Malignant lesion
	Esophageal malignancy

Table 6. Posterior Mediastinum

The number of malignant cases are still proves to be more in this compartment also out of which oesophageal malignancy is a common pathology found in posterior compartment (almost 40%).

Benign	Malignant
Goiter	
Cystic hygroma	
Multinodular goiter	
Retrosternal goiter	

Table 7. Superior Mediastinum

In our study there were no malignant cases noted per se, however the maximum number of benign lesions were originated from thyroid gland which is the commonest pathology noted in posterior as well as anterior mediastinum (only if it is extended).

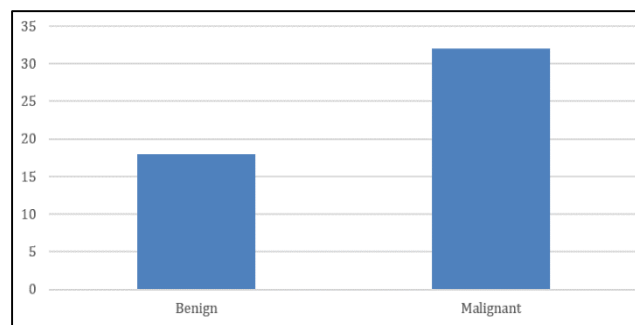


Figure 1. Overall Presenting Nature of the Lesions

When comprising the total cases on the basis of their nature it was found out that out of 50 cases, 32 cases were of malignant nature (64%) and rest 18 were of benign nature (36%), thus concluding that the incidence of malignant lesions to occur in mediastinum is higher than benign lesions.

Representation of Characteristics of Lesions in CT

Characteristics	Cases	Percentage
Solid	29	58
Cystic	03	06
Vascular	03	06
Solid + Cystic	12	24
Solid + Cystic + Fatty	03	06

Table 8. Distribution on the Basis of content Present

Homogenous	Heterogeneous	Peripheral	Non-Enhancing
09	35	03	03

Table 9. Distribution on the Basis of Enhancement Pattern

Above data suggests that maximum number of lesions are made up of solid component showing heterogeneous contrast enhancement are more suggestive of malignant nature whereas rest of the lesions shows homogenous enhancement implying benign nature of lesion (e.g. Infective, vascular, benign thyroid lesion) and rest minimal lesions are of cystic variety showing either peripheral enhancement (cystic lesions- bronchogenic, pericardial and cystic hygroma) or no enhancement (mostly hernias). Some of the lesions which are of solid- cystic variety are mostly benign in nature whereas lesions containing fatty component suggests mostly hernias. Vascular component mostly reflects aneurysm derived pathology.

Provisional Diagnosis	Cases
Bronchogenic Cyst	1
Pericardial Cyst	1
Ascending, Arch and Descending Aorta Aneurysm	1
Descending Aorta Aneurysm	1

Arch and Descending Aorta Aneurysm	1
Hiatus Hernia	1
Morgagni Hernia	1
Bochdalek Hernia	1
Retrosternal Goiter	4
Multinodular Goiter	1
Necrotic Nodes	1
Cystic Hygroma	1
Neurogenic tumor	1
Infective Collection	2
Esophageal Malignancy	3
Malignant lesions (with or without extension)	27
Mesothelioma	2
Table 10. Provisional CT Diagnosis	

Aneurysm-

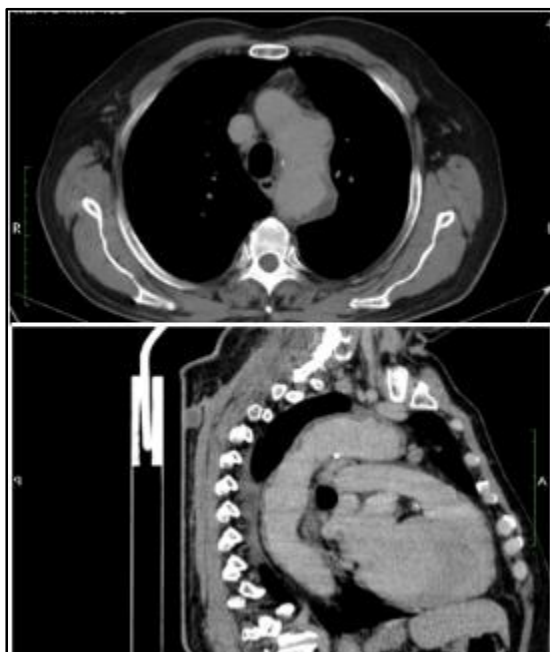


Figure 2. CT images (axial and sagittal) Shows Fusiform Dilated Aortic Arch and Descending Aorta Taking Homogenous Contrast Enhancement with Luminal Thrombus

Pericardial Cyst-



Figure 3. CT Axial View Shows Well Defined Cystic Lesion in Right Cardio Phrenic Angle

Bronchogenic Cyst-



Figure 4. CT Sagittal View Shows Well Defined Cystic Lesion in Right Lung Field Lower Zone Adjacent to Bronchus

Goiter-

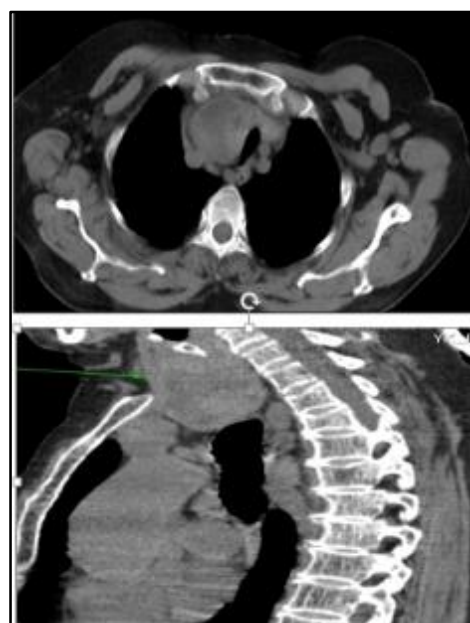


Figure 5. CT Images (Axial and Sagittal) Shows Well Defined Solid Cystic Lesion in Thyroid Extending in Retrosternal Region

Hiatus Hernia-



Figure 6. CT Axial View Shows Presence of Stomach in Posterior Mediastinum

Bochdalek Hernia-



Figure 7. CT Image (Axial and Coronal) Shows Presence of Stomach Through Diaphragmatic Defect in Posterior Region

Neurogenic Tumour-



Figure 10. CT Images (Axial and Sagittal) Shows Well Defined Homogenously Enhancing Lesion in Paravertebral Lesion on Left Side in Posterior Mediastinum

Infective Collection-



Figure 8. CT Images (Axial and Coronal) Shows Well Defined Peripheral Enhancing Collection Along Mediastinal Pleura on Right Side

Necrotic Node-

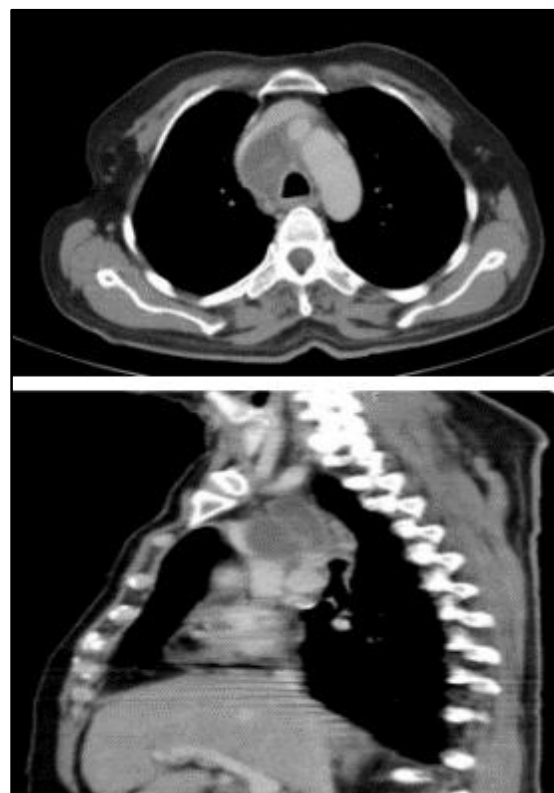


Figure 11. CT Image (Axial and Sagittal) Shows Well Defined Peripheral Enhancing Multiple Lesions in Middle Mediastinum

Cystic Hygroma-

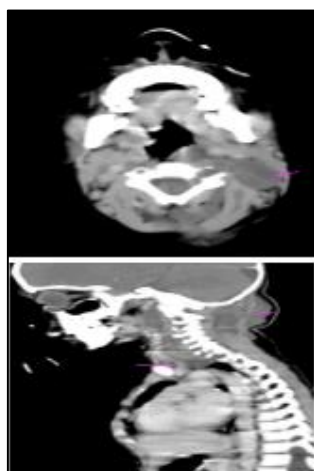


Figure 9. CT Image Shows Well Defined Elongated Dilated Tortuous Lesion in Left Side of Neck Extending in Superior Mediastinum with Peripheral Enhancement

Mesothelioma-

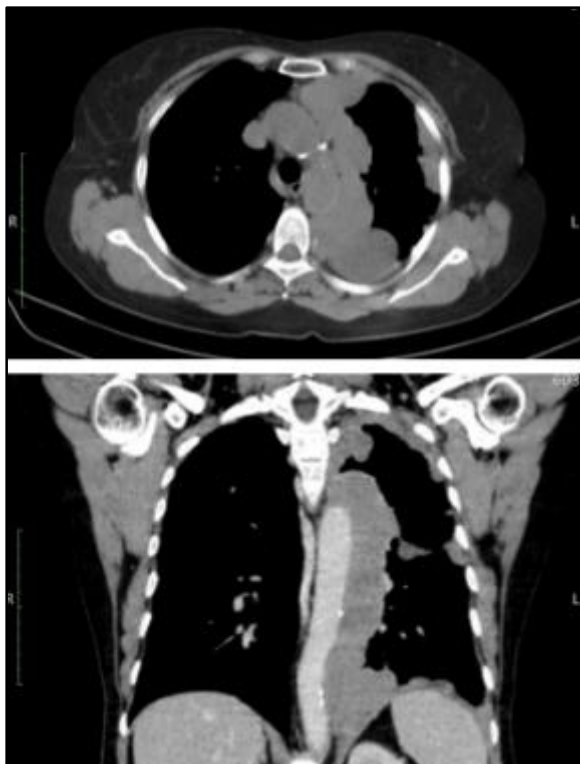


Figure 12. CT Images (Axial and Coronal) Shows Ill-defined Lesion Along Mediastinal Pleura on Left Side with Heterogeneous Enhancement

Oesophageal Malignancy-

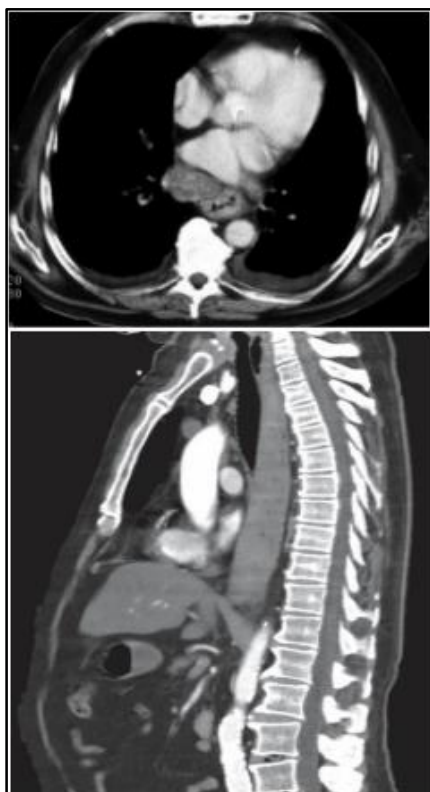


Figure 13. CT Images (Axial and Coronal) Shows Heterogeneously Enhancing Intraluminal Lesion in Lower 1/3rd of Oesophagus

Mediastinal Malignancy-



Figure 14. CT Image Axial View Shows Heterogeneous Enhancing Lesion in Middle Mediastinum with Encasement of Vessels

Mediastinal Malignancy with Metastasis-

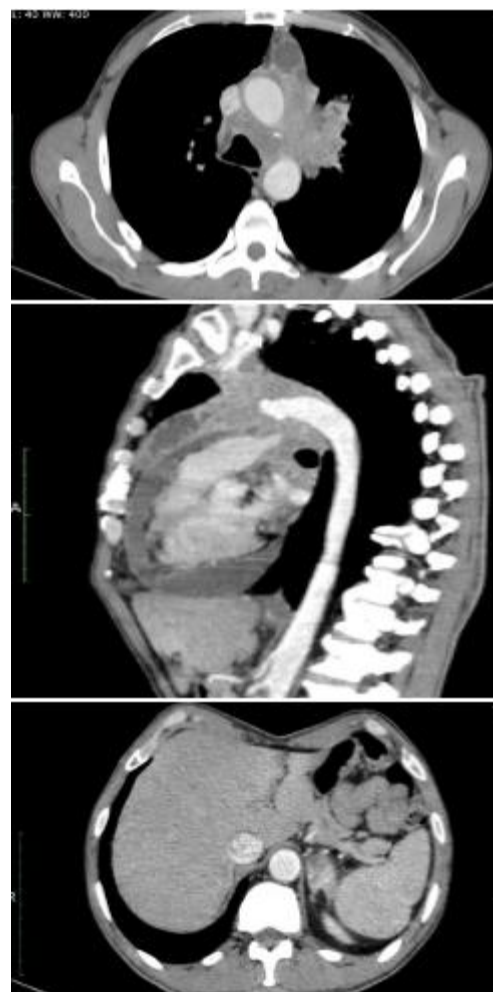


Figure 15. CT Images (Axial, Sagittal) Shows Ill-defined Heterogeneously Enhancing Lesion in Middle Mediastinum Extending Anteriorly with Bronchus Cut Off and Vessel Encasement Along with Heterogeneous Enhancement of Left Sided Adrenal s/o Metastasis

DISCUSSION

The mediastinum represents a wide variety of pathologies ranging from congenital lesions to malignant tumours. Conventional radiographs have limited spectrum in diagnosing mediastinal pathologies, thus CT plays an important role in proper delineation of the lesion and defining the anatomical details of the surrounding structures involved by the lesion.

Thymoma is the most common tumor of the thymus in adults, and the most common primary tumor of the anterior mediastinum in adults. Thymomas are usually low-grade malignant tumours and are extremely unusual below the age of 15 and rare under 20.² All of these features are best demonstrated using CT, which shows homogeneous density mass with uniform enhancement after contrast media injection. Invasion of the mediastinal fat and adjacent pleura may be identified with invasive thymomas which can be detected by CT.³

Thymic carcinoma are typically large, heterogeneous masses, containing areas of necrosis and calcification, often demonstrating evidence of invasion of adjacent structures, in particular the mediastinum, pericardium and pleura. Thymolipomas shows the fatty nature of the mass, with islands of thymus and fibrous septa running through the lesion. Thymic hyperplasia occurs as a consequence of steroid or antineoplastic drug therapy but usually returns to its original size on recovery or cessation of treatment, but may become larger than its original size.

Germ cell tumours include⁴ teratomas present as a well-defined, rounded or lobulated mass, localized to the anterior mediastinum along with fat and calcification. Seminoma appears to be usually well-defined solid masses with small foci of degenerative changes representing haemorrhage and necrosis. Non-seminomatous germ-cell tumours shows a lobular, asymmetric mass with obliteration of adjacent mediastinal fat planes and shows heterogeneous contrast enhancement.

CT Imaging features of mediastinal thyroid goiters are^{5,6}

1. Continuity of the mass with the cervical thyroid gland
2. Foci of heterogeneous attenuation (cystic areas and calcifications);
3. High attenuation on unenhanced CT, reflecting high iodine content of thyroid tissue
4. Intense and prolonged enhancement.

Mediastinal lymphadenopathy can be seen in wide spectrum of conditions ranging from infective to malignant conditions. Extensive lymph node calcification is common following tuberculosis and fungal infection but may also be encountered in other conditions like sarcoidosis, silicosis and amyloidosis. Two common patterns of calcification are coarse, irregularly distributed clumps within the node and homogeneous calcification of the whole node. On CT, areas of low attenuation within enlarged nodes, corresponding to necrosis, may be seen in a variety of conditions, particularly tuberculosis, infections in immune compromised patients,

metastatic neoplasm. Necrotic nodes demonstrate central areas of low attenuation with peripheral enhancement and are indicative of active TB. Castleman's disease show striking contrast media enhancement on both.

Cystic lesions include.^{7,8} Bronchogenic cysts appears to be a thin-walled mass, with cystic contents close to that of water, thereby effectively making the diagnosis of a fluid-filled cyst. Oesophageal duplication cyst appears identical to those of bronchogenic cysts. Neurenteric cysts result from incomplete separation of the foregut from the notochord in early embryonic life and contains both gastrointestinal and neural elements. Radiologically, a neurenteric cyst is a well-defined, round, oval or lobulated mass in the posterior mediastinum between the oesophagus and spine.

Neurogenic tumours.⁹ present as well-defined round or oval posterior mediastinal masses causing pressure deformity causing a smooth, scalloped indentation on the adjacent ribs, vertebral bodies, pedicles or transverse processes. On CT the tumours may be homogeneous or heterogeneous, usually enhancing heterogeneously.

Extramedullary haematopoiesis can result in paravertebral masses caused by compensatory expansion of bone marrow in patients with severe anaemia and appears as lobulated paravertebral masses, well margined, usually multiple and bilateral, in the lower thoracic vertebra.

A thoracic aortic aneurysm.¹⁰ is usually seen as an incidental mediastinal abnormality on a chest radiograph and appears as either widening of the mediastinum or as a well-defined round or oval soft-tissue mass in any part of the mediastinum, often with curvilinear calcification in its wall. The diagnosis is confirmed by CT (or MRI), which shows dilated aorta measuring more than 4 cm in diameter and containing contrast-enhanced blood in its lumen with surrounding mural thrombus of lower attenuation and calcification in its wall.

A hiatus hernia is herniation of abdominal contents into the thoracic cavity via the oesophageal hiatus of diaphragm. Hiatus hernia is often found incidentally on CT scans, as a retro-cardiac mass with or without air-fluid level. Herniation of omental fat through the oesophageal hiatus results in an increase in fat surrounding the lower oesophagus.

Mediastinal haemorrhage.¹¹ shows an increase in the mediastinal diameter, blood may track through the mediastinum. When haemorrhage is severe, blood may rupture into the pleural cavity or dissect into lung along peribronchovascular sheaths, resulting in a radiographic pattern resembling interstitial oedema. On unenhanced CT, acute haemorrhage may appear of relative high attenuation

Mediastinal lipomatosis is a benign accumulation of excessive amount of normal fat in the mediastinum and on CT, it appear homogeneously low in attenuation with fat density, sharply outlining the mediastinal vessels and lymph nodes.

Mediastinal lipomas show uniform fat attenuation. Their boundaries are smooth and sharply demarcated from adjacent mediastinal structures. Mediastinal liposarcomas are rare malignant fat containing tumours which usually contain large areas of soft-tissue density material. CT

findings include heterogeneous attenuation with significant soft tissue within a mass with fat attenuation, poor definition of adjacent mediastinal structures and infiltration or invasion of mediastinal structures. Lipoblastoma,¹² a benign tumour of childhood, contains fat and soft tissue. Angiomyolipoma and myelolipoma are both benign tumours which may show a combination of soft-tissue and fat attenuation on CT and therefore can be indistinguishable from liposarcoma on imaging.

Lymphangioma,¹³ are congenital lymphatic malformations or cystic spaces containing clear or straw coloured fluid and appears to be a lobulated smooth mass envelops the adjacent mediastinal structures rather than displaces them thus differentiating them from other mediastinal cysts

Mediastinal fibrosis,¹⁴ produces widening of the mediastinum which may contain calcified lymph nodes. The diagnosis is confirmed by CT which shows the fibrous tissue as streaky soft-tissue attenuation and calcification within the mediastinal fat.

The most common cause of acute mediastinitis is iatrogenic oesophageal perforation during diagnostic or therapeutic endoscopic procedures. CT shows obliteration of the normal mediastinal fat planes, oesophageal thickening and extra luminal gas bubbles with solitary or multiple fluid collections, which may be contiguous with other fluid collections in the cervical region and diffuse obliteration of normal fat planes.

The radiographic signs of pneumomediastinum includes-

Air around the pulmonary artery (usually the right pulmonary artery) results in the 'ring around the artery Sign'.¹⁵

Elevation of the thymus causes the 'sail sign'.¹⁶

Air anterior to the pericardium is best seen on the lateral radiograph.

The 'continuous diaphragm sign'.¹⁷ is seen because of the air trapped posterior to the pericardium, giving the appearance of a continuous collection of air on the AP projection

Air from the mediastinum can extend laterally between the parietal pleura and the diaphragm to produce the 'extrapleural sign'.¹⁸

With the help of CT and its excellent high resolution images it is now possible to locate even smaller lesions without any obscurance.

Our study involved 50 patients (from May 2014 to Oct 2015) and was conducted in Dept. of Radio diagnosis in our institute.

Majority of symptoms were nonspecific which included cough, fever, breathlessness, chest pain and dyspnoea which were mainly due to compressive effect of the lesion and involvement of other neighbouring structures. It was also found out that maximum number of pathologies were found in middle mediastinum i.e. 40%, anterior mediastinum being second most common i.e. 32% and rest posterior and superior mediastinum showed least of the pathologies i.e. 20% and 8%. Felson in 1978 showed that there is no such compartmental predilection of lesions, however in 550

cases, he reported maximum number of cases in anterior followed by middle and then posterior and then superior.

The most common presenting symptom was cough (48%) followed by dyspnoea, breathlessness and fever (12%). Davis et al¹⁹ showed in a study of 400 patients the most common presenting complain was chest pain followed by cough, dyspnoea and breathlessness.

In our study majority of mediastinal lesions were present in middle compartment followed by anterior and then posterior and superior which is similar to the study conducted by Stroll et al²⁰ in 1997 in which middle mediastinal pathologies were predominant by 46%.

In our study maximum lesions were of malignant nature i.e. 54% followed by infective aetiology and goiter (8%) pathologies. Malignant lesions showed male predominance and common age group being more than 61 years of age. However females also showed prevalence of malignant lesions but less as compared to males. Infective aetiologies were mostly due to Koch's prevalence (as per the clinical correlation). In a study conducted by Wychulis et al²¹ showed that 6% of mediastinal pathologies were of infective origin and that too of Koch's aetiology. Apart from this, intrathoracic goiters were also found to be very prevalent in female patients and accounts for mainly superior and anterior mediastinal pathology i.e. 10%. Prasad A et al²² in 2000 showed the incidence of goiters presenting as mediastinal lesion to be 6%.

CONCLUSION

Computed Tomography plays a significant role in assessment of mediastinal pathologies. Maximum number of cases occurred in age group more than 61 years both in males and females with maximum number of lesions being malignant (mostly originated from hila) with extension into mediastinum mostly having mass effect on adjacent structures with male preponderance.

The common location was middle mediastinum followed by anterior, posterior and superior. The common pathology was malignancy followed by infective aetiology and thyroid pathologies.

Paediatric age group however showed less incidence of lesions (2%) followed by other benign lesions in adults also like aneurysm, hernias and cystic lesions. Calcification was noted in only 2 cases. Majority of cases contained solid content followed by solid along with cystic content followed by pure vascular (aneurysms) and fatty contents (hernias).

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