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Detection of Mediastinal Masses in Adult Patients Using Spiral Computerised Tomography

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Research Article

Introduction:

Since, its advent, Computerised Tomography (CT) has emerged as the main technique to evaluate mediastinum. CT has become the imaging method of choice in the evaluation of mediastinal widening or suspected mediastinal abnormalities. CT has the ability to distinguish density differences as well as provide a 3 dimensional cross sectional view of anatomic relations. A variety of imaging modalities are available for investigating the mediastinum, but CT and Magnetic Resonance Imaging (MRI) are undoubtedly the most versatile radiological investigation for evaluating an abnormality demonstrated on high kv chest radiograph. The indications for their use include –

1. The investigation of an obvious mediastinal mass.
2. The investigation of the wide mediastinum.
3. The investigation of abnormal hilum.
4. The staging of malignant disease.
5. The investigation of suspected vascular abnormality.
6. The detection of occult mediastinal disease.

If we discuss the role of CT and MRI in detection of mediastinal masses, then certainly CT has many obvious advantages over that of MRI. There are certain points that can be considered before pointing out usefulness of CT over that of MRI.

The advantages of CT include:

1. Calcification is well demonstrated by CT.
2. CT can distinguish between lymphadenopathy, fat deposition and hemorrhage when there is mediastinal widening on chest radiograph.
3. CT can distinguish solid mass and a pulmonary vessel when there is abnormal hilum.
4. CT is used in the staging of malignant disease to demonstrate mediastinal lymph node enlargement, pulmonary and bone metastasis in the chest and hepatic and adrenal metastasis in the abdomen.
5. CT is also used to detect occult disease in the mediastinum, such as thymoma or enlarged lymph node when the chest radiograph appears normal.
6. Fine needle biopsy of mediastinal mass lesions is being increasingly used to produce a pathological diagnosis instead of mediastinoscopy or surgical exploration, aspiration of mediastinal cysts can also be performed.

To summarise, mediastinal masses can be evaluated by spiral CT technique with a high degree of accuracy for predicting nature, size, location and involvement of other organs by the mass. The use of other tests before resection generally yields little additional information.

Materials and Methods:

OBJECTIVES:

1. Detection of mediastinal masses using contrast enhanced spiral computerized tomography.
2. Detection of site and differentiation of mediastinal lesions.

MACHINE- Philips Tomoscan AV Expander.

TECHNIQUE-

Serial axial CT sections of the thorax will be obtained at 7 mm intervals before and after i.v. contrast administration using spiral CT technique.

Thin sections will be obtained whenever essential.

PROTOCOL-

A. standard thorax (axial scans)

Patient`s position: body first supine
Gantry angulation: zero degree
Start position: thoracic inlet
End position: up to adrenal glands.

SCAN PARAMETERS-

TH	SEC	MA	KV	FOV	F	MIX	INDEX
7	1	250	120	350	8	512	7

PROFORMA-

Serial axial CT sections of the thorax will be obtained at 7 mm intervals before and after i.v. contrast administration using spiral CT technique.

High resolution CT images are obtained whenever essential.

SCANNOGRAM-

- Lung fields
- Costophrenic angles
- Heart, aorta
- Bony thorax.

MEDIASTINAL WINDOW IMAGES-

- trachea
- oesophagus
- mediastinal fat planes

- mediastinal lymphnodes
- mediastinal great vessels
- visualized vertebrae, ribs and sternum

LUNG WINDOW IMAGES-

- high resolution CT images

FEATURES OF LESIONS-

-site, distribution
-single/multiple
-focal/diffuse
-enhancement
-cavitations/consolidation
-calcification

Results and Discussion:

In our study of 25 patients the youngest patient was 10 years old while the oldest was 65 years old. 15 patients were male and 10 were female. All patients were studied using non enhanced CT (NECT) and contrast enhanced CT (CECT) using spiral CT technique. In our study 7 patients were diagnosed having aortic aneurysm. All the seven patients of aortic aneurysm showed peripheral thrombosis. The pattern of calcification that was found was peripherally in 5 patients, central in 1 case while one aneurysm was not associated with calcification. Two cases were associated with leak and pericardial effusion while one showed suspected leakage. Out of the seven cases, three of the aneurysms were associated with destruction of vertebral bodies. One of the aneurysm showed signs of aortic ulcer.

Our study was similar to that done by Crooke JP et al [1]. In our study the commonest portion to be involved was of descending aorta (6 cases). One aneurysm was noted involving descending aorta and extending into intra abdominal portion of aorta while in one case it involved arch as well as descending aorta.

Two cases were found out to be involving arch of aorta. In our study, aneurysm involving ascending portion of aorta was not found. One aneurysm showed saccular dilatation while rest showed fusiform dilatation. Our study was similar to that conducted by Hortell GG, et al [2]. In our study the youngest patient detected to have aortic aneurysm was 16 years old while the oldest was of 52 years. In one case a female aged 16 years, aneurysm of descending thoracic aorta distal to origin of left subclavian artery with suspicion of leak was detected. In this case incidentally detected aneurysm of left subclavian artery was found. This patient was found to have aorto-arteritis. In our study four aneurysms were of size larger than 6 cm, the largest measured 8x 8.4 cms. In one study of ruptured descending thoracic aortic aneurysm approximately 86% were more than 6cm in size assuming no major contra indication to surgery; operation is advocated by some surgeons with aneurysm more than 5cm. Surgery is recommended for false aneurysm regardless of their size. None of the aneurysm were found to be associated with Ehler Danlos or Marfan`s syndrome. In our study of thoracic vascular anomalies especially thoracic aortic aneurysms spiral CT techniques proved to be very beneficial and accurate in assessing the characteristics of aneurysms. More detailed multiplanar and three dimensional reformatted images were obtained. The size and extent of aneurysm and its relationship to other anatomic structures were accurately assessed. Spiral CT technique proved helpful in detecting dilatation of aortic segment to characterize whether it is saccular or fusiform dilatation and other characteristics like calcification in aortic wall, intraluminal thrombus and displacement of adjacent mediastinal structures were also studied. CT also proved helpful in the evaluation of impending or suspected aortic aneurysm rupture. In our study one case was diagnosed as benign teratoma. It was a large rounded predominantly fluid density mass lesion of size 12x10 cm, which was showing rim enhancement was noted in anterior mediastinum. This mass lesion showed few fat components CT value -80 HU, calcified foci, CT value 90 HU and few soft tissue density foci CT VALUE 35 HU within it. Fat planes between this mass lesion and mediastinal great vessels and trachea were maintained. This large benign teratoma was compressing the right lung sparing the apical segment of right upper lobe, posterior basal segment of right lower lobe. Teratoma accounts for most mediastinal germ cell tumours. Teratoma is further subdivided into (1) Mature solid (2) Cystic [dermoid cyst] (3) Immature (4) Malignant [teratocarcinoma] and (5) Mixed on CT. Most types of Teratoma contain a prominent cystic component, small dense localized areas of calcification or ossification and in up to half, either fat or mixed low density material with an attenuation value nearer to that of fat than that of water. Fat fluid levels have also been reported. Few types of Teratoma are totally solid, although nearly all contain a solid component. In our study 9 cases were found to be of mediastinal lymphadenopathy. On CT, individual mediastinal lymph nodes are easily identified as discrete, round or oval soft tissue attenuation structure within the mediastinal fat. Out of the 9 cases one of the enlarged lymph nodes contained spotty calcification. It was found to be of high attenuation on plain CT .Calcification within lymph node is the most common cause of high attenuation mediastinal mass. In most cases it represents a healed infectious process, especially granulomatous diseases [eg. Histoplasmosis and tuberculosis], calcified mediastinal lymph node may also occur in disseminated pnuemocystis carinii infection in patients with AIDS. These calcifications are believed to be caused by necrotizing granulomatous infection, pnuemocystis organisms are frequently identified within calcified granulomas. Inhalational diseases such as coal workers pneumoconiosis and silicosis may cause lymphadenopathy that contains calcification. Although classically described in Silicosis, an egg shell pattern of calcification can be

seen rarely in sarcoidosis, treated lymphoma, or healed infectious granulomatous disease. Our study was similar to that done by Harvey S Glazer et al. [3] In our study in all the three cases studied there was significant enlargement of the lymph nodes .The enlarged lymph nodes in all the cases were above two centimetres in size. The upper limit for a node to be labelled as enlarged differs , as to which group of lymph node is affected .If the node measures more than 6mm in supradiaphragmatic, retrocrural , and in the region of left brachiocephalic vein then the lymph node is considered as enlarged. Similarly if in right tracheobronchial region, in the aortopulmonary and in the subcarinal space normal nodes measures 11 mm. In the hilar region lymph nodes greater than 5 mm are considered as abnormal. Out of the nine cases studied, five cases showed areas of low attenuation. The low attenuation is usually secondary to necrosis or cystic degeneration. In our study the mediastinal group of lymph node to be most affected was pretracheal and paratracheal group of lymph nodes although other groups were involved as well. In our study one patient presented to us on chest radiograph PA view with a sharply defined oval paravertebral mass. It was associated with destruction of the ribs. On contrast enhanced CT, it was seen as a homogenously enhancing extra pleural soft tissue density mass lesion of CT value 51-82HU was noted at T5-T6 level in right costovertebral gutter. It was extending into spinal canal and causing displacement of thecal sac with widening of neural foramena, showing dumb-bell shape appearance. On histopathology this tumour was diagnosed as neurofibroma. In our study one case was found to be associated with complete collapse of right lung with severe narrowing of right main bronchus with multiple enlarged lymph nodes. Thrombosis of right internal jugular vein, bilateral subclavian veins, bilateral brachiocephalic veins and superior vena cava was noted possibility of primary lung malignancy with mediastinal adenopathy was considered. Our findings were similar to that of Robert G Levitt [4]. In our study four cases were found to be that of Lymphoma. In one case, a large mass of size 16x9 cm which showed minimal enhancement on post contrast study was noted involving the middle mediastinum. It was also involving the pretracheal, paratracheal and subcarinal region. In another case a mass of size 5x4 cm was noted involving the posterior mediastinum. In this case, deposits in the lower pole of right kidney and left adrenal gland were noted. Nodular deposits in the lungs were also noted. In another case, a female aged 11 years presented to us with a large anterior mediastinal mass on plain chest radiograph. On NECT and CECT, it was found to be a large anterior mediastinal mass with enlarged neck and axillary lymph nodes. This mass was encasing the mediastinal great vessels and causing mediastinal shift to right side. Tracheal and carinal compression was also noted. The left pleura were thickened. All these features suggested the possibility of Lymphoma. In a similar case, a female aged 16 years presented to us with a mediastinal widening on chest radiograph. On NECT and CECT, this large mass was found to be involving anterior mediastinum with encasement of great vessels with compression of trachea and carina with involvement of liver and left kidney with bilateral pleural effusion. [5, 6]. In all the four cases studied, the nodal involvement that was detected ranged from enlarged discrete lymph nodes to large conglomerate mass. All the masses were of soft tissue attenuation. In two cases, slight to moderate enhancement on post contrast study was observed. Marked contrast enhancement is unusual with Lymphomas. None of the cases showed calcifications. Lung involvement (seen in < 10% of cases) at presentation was seen in one of the four cases studied. CT is frequently used in patients with Lymphoma because it helps-

a. to determine the extent of disease.

b. assist in treatment and planning.

c. assess response to treatment and evaluate for possible relapse.

In our study, one case was found to be that of bronchogenic cyst. Bronchogenic cysts are the most common type of foregut cysts. They arise from abnormal branching of bronchopulmonary foregut and are therefore closely situated to Tracheo-bronchial tree. The CT findings of bronchogenic cyst include-

a. smooth, oval or tubular mass with well defined margins and thin imperceptible wall.

b. homogenous attenuation – often near water density (but variable)

c. no enhancement after iv contrast administration.

d. characteristic paratracheal or subcarinal location.

In the case studied by us, all these classical features were found to be present.

Conclusion:

Computerised Tomography using spiral CT technique demonstrated good sensitivity and specificity in demonstrating the radiologic pattern of involvement.

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