Imaging of Pediatric Mediastinum

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Abstract

This is a review article on imaging findings in mediastinal pathology. Mediastinum is better studied on imaging methods such as plain radiography, MDCT, MRI and angiography. The characteristic findings of various mediastinal masses are described with a stress on plain radiography. Preoperative diagnosis can be made with imaging.

Key words: Pediatrics, mediastinal masses, plain radiography

Introduction

Mediastinum is a median septum or partition containing mass of tissues and organs between the two pleural sacs. Anteriorly the sternum, posteriorly vertebral column, superiorly thoracic inlet and inferiorly diaphragm constitute its borders. Heart is considered to be in the anterior mediastinum. Aortic arch, descending aorta and pulmonary vessels are in the middle mediastinum. These structures can be identified in posteroanterior and lateral chest radiographs and abnormal masses can be studied. CT and MRI may help to study the matrix as well as the capsule, thus, giving a histological diagnosis. FNAC/ biopsy are conducted to confirm the diagnosis.

The imaging methods are in the following table Table I: Plain radiography of the chest – PA and lateral, MD CT MRI, Angiography, Pet CT

In children, ALARA principle, (as low as reasonably allowable) should be adopted so that minimal radiation is used as the children are very sensitive to radiation exposures.

Mediastinum is divided into various compartments (Figure 1ab). Felson [1] and other authors have divided the mediastinum into various compartments and Felson’s method is followed in this study.2

The following table lists the anterior mediastinal masses in children (Table II)

| Table II: Enlarged thymus, Cystic Hygroma, Lymphoma, Teratodermoid |
| Thymomas are not generally encountered in children |
| In pediatric practice, most common mediastinal mass is the enlarged thymus. This may persist up to 4 years and rarely encountered even at 6-8 years [2]. Spontaneous regression is known and steroid therapy may help when the child is having respiratory problems (Figure 2ab). Radiologically, several signs have been described including the sail like density in the paratracheal area (Figure 3ab). |
| A wavy sign has been described where the costal cartilages produce an impression on the thymus (Figure 4ab-8abc). |
| The common anterior mediastinal masses, generally go by the eponem (4Ts) |
| Thymus |
| Thyroid |
| Teratoma |
| Terrible lymphoma |

The masses in the middle mediastinum are listed in the table III: Lymph nodes, Bronchogenic cyst, Vascular Esophageal, Hernia

The most common middle mediastinal mass is due to enlarged lymph nodes

The etiologies are listed in table IV: Tuberculosis, Sarcoi, Lymphoma, Leukemia, Infectious mononucleosis, Pseudo lymphoma, Castleman’s disease, Angio immuno lymphadenopathy Figure 9

CT imaging is performed to find out various sites of lymphadenopathy

Figure 10ab, Figure 11abc Next entity is sarcoidosis. Although, sarcoidosis is not very common in India and yet several cases have been reported in all ages [3]. Right paratracheal and bilateral hilar lymphadenopathy is characteristic. Unilateral hilar adenopathy may also be encountered [4]. Figure 12

Vascular rings and slings

These are often produce mediastinal widening simulating masses. Of these, right sided aorta with or without associated congenital heart disease is common. Although, plain films are classical as there is no normal aortic shadow on the left and an abnormal shadow is seen on right side of the trachea [5]. Normally, the trachea is deviated to the right by the presence of aortic knob. In right side aorta5, the trachea is deviated to the left (Figure 13a). Esophagogram confirms the nature of the aorta. Angiogram is rarely necessary except when congenital heart disease is suspected (Figure 13bc). Multidetector CT Angiogram is the latest investigation to be performed to study the cardiovascular structures (Figure 14ab)

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Old classification

Felson's Classification

Figure 1ab: a. Mediastinal compartments, b. A-Anterior, M-middle and P-posterior.

Figure 2ab: a. Persistent thymus, b. Post steroid therapy.

Figure 3ab: a. Enlarged thymus, b. Sail like sign.
Figure 4ab: a-Enlarged thymus – wavy sign, b-Compression by costal cartilages anteriorly.

Figure 5ab: Teratodermoid - Note Calcification in the anterior mass.

Figure 6ab: Large anterior mediastinal mass due to lymphoma.
Figure 7ab: a-Lymphoma, b- 2 Months later with effusion.

Figure 8abc: ab- Right anterior mediastinal mass due to lymphoma, c- osteoarthropathy of the lower limbs.

Figure 9: Tuberculous lymphadenopathy.
Figure 10ab: Hodgkin’s lymphadenopathy, b-CT right paratracheal and para-aortic adenopathy.

Figure 11abc: Lymphoma at various stages

Figure 12: 16 yr old - Sarcoidosis with hilar lymphadenopathy.
Figure 13a: Right sided aorta.

Figure 13bc: Esophagogram with right sided aorta.

Figure 14ab: a-Esophagogram, b-CT angiogram - Right sided aorta.
Figure 15ab: Esophageal duplication cyst.

Figure 15c: CT showing fluid in the cyst.

Figure 16a: 6 yr M – Neuroblastoma.
Figure 16bc: CT neuroblastoma showing calcifications.

Figure 17abc: a-AP, b-Lateral, c-Esophagogram – Neuroblastoma with calcifications.

Figure 17d: CT necrotic centre in neuroblastoma.

Figure 17d: CT necrotic centre in neuroblastoma.
Next entity in the middle mediastinum comprises duplication cysts. Duplication cysts are congenital in nature and they may present as solid lesion on radiography (Figure 15ab). If they communicate with the respiratory / esophagus tract. They may contain fluid / air [6]. CT often helps in identifying the nature of contents (Figure. 15c) Observe alarp principle as far as possible to avoid radiation exposure in children [7]. CT of the chest is often avoided and replaced by ultrasonography or magnetic resonance imaging. The indications are mentioned in table V

Table V - Indications for CT Chest

- Identify mediastinal mass
- To differentiate between solid and cystic lesions
- To identify calcification
- To identify fat
- To study cardiovascular system

Most of the posterior Mediastinal masses are neurogenic and include the following:

Table VI - Neurogenic Masses

- Neuroblastoma, Ganglioneuroma, Neurofibroma, Neurenteric cyst, Meningocele (Intrathoracic) Figure 16abc, Figure 17abc Neuroblastoma constitutes 75% of neurogenic tumors. Next in order include ganlionic origin, ganglioneuroma, ganglioneuroblastoma [8]. Neurofibromas and schwannomas are uncommon in children. Figure 17 d The other masses include the following: Lymphoma, Extramedullary hemopoiesis mass, Hernia, Ectopic kidney Figure 18

Summary

Mediastinal Lesions in children are ideally studied by conventional radiographs. Where ever indicated advanced imaging methods are adopted. CT is minimally used to avoid excessive radiation. As far as possible ultrasonography and MRI studies should be replaced in the place of CT. Divisions of mediastinum help in identifying various masses.

References