Posterior mediastinal masses - An important challenge of chest imaging

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Learning objectives

1. To summarize and describe the different types of posterior mediastinal masses (PMMs);
2. To illustrate the various radiological features of the PMMs using CT/MRI and/or chest X-ray;
3. To highlight the problems in the differential diagnosis of the PMMs.

Background

The posterior mediastinum continues to represent a debated subject, not only in terms of anatomy and content, but also due to the various associated pathology. The involved structures are usually: the esophagus, aorta, azygous and hemiazygous vessels, neural components, lymph nodes and the paravertebral space. Imaging plays an important role in determining the organ of origin, the relation to the surrounding structures, diagnosis, staging and follow-up of PMMs [1].

This poster aims to present a systematic review of the spectrum of PMMs and their radiological features, with special focus on the differential diagnosis.

 Imaging findings OR Procedure details

PMMs are often incidental findings at conventional chest X-ray, thus representing a challenge for radiologists. Cross sectional imaging techniques - CT and MRI - are the examinations of choice for the evaluation of PMMs, which allow an accurate characterization in many cases, therefore providing important information for treatment and prognosis.

The differential diagnosis relies on the specific characteristics of each mass. While chest X-ray provides gross information regarding the size, anatomic location, form and composition, cross-sectional imaging offers enough details to narrow the differential diagnosis and, in most cases, reach a correct final diagnosis. A comprehensive description should include: precise location, size, contour; the presence of septums or capsule; the composition of the mass: homogeneity, the presence of hemorrhage, necrosis, calcifications, cysts; the relation to the surrounding structures, especially the great vessel involvement; and associated mediastinal lymphadenopathy or pleural effusion [2].
I. Neurogenic tumors:

Neurogenic tumors are the most common cause of posterior mediastinal masses, and they are histologically divided into three groups:

1. Peripheral nerve tumors: schwannomas and neurofibromas;
2. Sympathetic ganglion tumors (SGT): ganglioneuromas (Fig.1), ganglioneuroblastomas, neuroblastomas (Fig.2);
3. Tumors of paraganglia origin: paraganglioma;

Most nerve sheath tumors are benign, asymptomatic and are more common in adults, whereas the ganglion cell tumors- neuroblastomas (the malignant form) and ganglioneuromas (the benign form) are essentially childhood tumors. Some of these tumors may be associated with neurofibromatosis type 2 [2].

• Radiological features:
  - Chest X-ray: sharply circumscribed round or oval mass; rib erosion with sclerotic border (benign sign); calcifications within the mass;
  - CT: tumors with tissular density or they may present low-attenuation values attributed to lipid content, cystic degeneration, or entrapment of peripheral neural tissue;
    1. Schwannomas: cystic, hemorrhage and calcification elements are common; "dumbbell" or "hourglass" configuration;
    2. SGT: well-defined or ill-defined mass, orientated along the anterolateral surface of several vertebrae; "whorled appearance"
    3. Paraganglioma: hypervascular tumours;

- MR imaging:
  1. Schwannomas: homogeneous or heterogeneous high signal intensity on T2-WI;
  2. SGT: heterogeneous high signal intensity on T2-WI [3];
  3. Paraganglioma: "salt and pepper" appearance [4];

II. Masses of vascular origin

A. Congenital abnormalities:

• General considerations:
Around 10 % of mediastinal masses are of vascular origin, mostly represented by the aortic aneurysms, but there are many vascular entities that can simulate a mediastinal mass, such as: aberrant right subclavian artery (Fig.3), right aortic arch (Fig.4) associated with an aberrant left subclavian artery, double aortic arch, aberrant left pulmonary artery,
congenital interruption of the inferior vena cava with azygos or hemiazygos continuation [5].

- **Radiological features:**
  - CT with contrast enhanced scanning: evaluation of these abnormalities, delineation of the abnormal origin, the relationship with the surrounding organs.

**B. Aortic aneurysm:**

- **General considerations:**
  Aneurysms of the descending thoracic aorta (Fig.5) are the most encountered vascular cause of a mediastinal mass in adults, and many of them outcome from: atherosclerosis, hypertension, trauma and infections. They usually possess a saccular or fusiform aspect and are often diagnosed by chance during exams or tests done for other reasons [5].

- **Radiological features:**
  - Enhanced CT evaluation (Fig.6): aortic dilatation, intimal calcifications, displacement of mediastinal structures, erosion of the vertebral bodies, enhancement of the patent lumen, intramural thrombus;
  - Unenhanced CT: high-attenuation fluid in the mediastinum, pericardium or pleural cavity indicating rupture or impending rupture;

**III. Cystic masses:**

A. Neuroenteric cyst:

- **General considerations:**
The neuroenteric cysts are the least common of developmental foregut anomalies known. They are posterior enteric remnants that most likely result from incomplete failure of separation of the notochord from the foregut in the third week of embryogenesis. The mesodermal masses surrounding neural tube are prevented from completely enclosing it, resulting in vertebral anomalies (hemivertebrae, butterfly vertebrae, scoliosis, anterior spina bifida or the split notochord syndrome) [6]. The diagnosis should be considered whenever a mediastinal mass with associated vertebral anomalies is encountered on a chest X-ray.

This condition can be asymptomatic or it may present: nonspecific dyspnoea, stridor and persistent cough, back pain, gait disturbance and sensory or motor deficit.

- **Radiological features:**
  - Chest X-Ray: anteroposterior and lateral views- initial modality of diagnosis; posterior mediastinal mass with associated vertebral anomalies;
  - Ultrasonography: can be used as prenatal diagnosis; establishes the cystic nature of the mass, similar to those of a bronchogenic cyst: a anechoic, unilocular, well-defined round lesion;
CT: confirms the cystic nature of the mass and its extent, evidenciates the presence of vertebral anomalies and it can delineate the 'tunnel' through the vertebral body [7,8];

B. Bronchogenic cyst:

- **General considerations:**
  Bronchogenic cysts result from abnormal ventral budding or branching of the tracheobronchial tree during embryologic development. They are lined with pseudostratified columnar respiratory epithelium, and their walls usually contain cartilage, smooth muscle, and mucous gland tissue. They may be filled with clear, serous fluid or thick, mucoid material [7].

  The majority are asymptomatic; may occasionally cause symptoms secondary to compression of adjacent structures: chest pain, cough, dyspnea, fever, and purulent sputum [9].

- **Radiological features:**
  - Chest X-Ray: a well-defined solitary mass with homogeneous opacity just inferior to the carina and often protruding slightly toward the right hilar shadow.
  - CT (Fig.7): single, smooth, round or elliptic mass with an imperceptible wall and uniform attenuation; the attenuation value is dependent on the contents of the cyst and can vary from water attenuation to soft-tissue attenuation; air within the cyst is uncommon and suggestive of secondary infection and communication with the tracheobronchial tree; calcification occurs occasionally in the wall or within the cyst contents [8];
  - MR imaging: T2-weighted images - high signal intensity regardless of the nature of the cyst content; T1- weighted images: variable patterns of signal intensity because of variable cyst content and the presence of protein, hemorrhage, or mucoid material [10];

C. Duplication cyst:

- **General considerations:**
  Esophageal duplication cysts are developmental in origin, usually adjacent to or within the esophageal wall. These uncommon masses are classified as foregut cysts that are either bronchogenic or neuroenteric. [11]

  The majority are asymptomatic, secondary to compression of adjacent structures dysphagia or pain may be present.

- **Radiological features:**
  - Barium examination: extrinsic or intramural compression due to close contact with the esophagus;
  - CT and MR imaging: identical to that of bronchogenic cysts: single, smooth, round or elliptic mass; the wall of the lesion may be thicker and in more intimate contact with the esophagus [8,10,12];

D. Mediastinal pancreatic pseudocyst:

- **General considerations:**
Extension of pancreatitis into the mediastinum is uncommon. It represents an encapsulated collection of pancreatic secretion, blood, and necrotic material. Almost always occurs in the lower part of the posterior mediastinum via the esophageal or aortic hiatus [7].

**Radiological features:**
- **CT:** thin, cystic, low-attenuation mass in the posterior mediastinum associated with compression or displacement of the esophagus or splaying of the diaphragmatic crura; cyst content can be isoattenuating or hyperattenuating relative to water, depending on the presence of hemorrhage or infection; an abdominal component is common but not invariably present [13];
- **MR imaging:** it demonstrates the cystic nature of the mass;

**E. Lymphangioma**

**General considerations:**
Lymphangiomas are rare benign congenital tumors that consist of well-differentiated lymphatic tissue, discovered usually during the first two years of life. The spectrum of appearances of these tumors can vary from a simple aspect to a cavernous or a cystic one, but generally are well defined tumors (only in some cases they may infiltrate soft tissues or displace adjacent structures). Typical places for these tumors in 95% of cases are the cervical area (posterior to the sternocleidomastoid muscle), or the axillary area. Less common sites include the shoulder joint, chest wall, oesophagus, mediastinum, retrocrural region, mesentery and omentum [14].

Most of these patients are asymptomatic (painless neck mass); in some cases, symptoms due to compression may appear such as: chest pain, cough and dyspnea.

**Radiological features:**
- **Chest X-Ray:** well defined, round, lobular masses (in some cases with pleural effusion);
- **CT:** well-circumscribed lobulated mass, either unilocular or multilocular, filled with homogeneous low attenuation material, similar to water (some are inhomogeneous, due to a combination of fluid, soft-tissue density and fat)[15];
- **MR imaging:** on T1 and T2- weighted images simple fluid signal intensity or heterogeneous signal (presence of methemoglobin, fat or protein in the lymphatic fluid); on T2- weighted images, fibrous septa within the lesion are usually observed, structures that may enhance after contrast injection [16];

**F. Lateral meningocele**

**General considerations:**
The intrathoracic meningocele is an unusual herniation of the leptomeninges through an intervertebral foramen or a defect in the vertebral body. This abnormality rarely occurs in isolation; it is frequently associated with neurofibromatosis type I (the patients also present a thoracic spine scoliosis) [17].

**Radiological features:**
- Chest X-Ray: well-defined, smooth, round or lobulated paravertebral masses;
- CT: well-circumscribed, homogeneous, low-attenuated paravertebral masses; vertebral or rib abnormalities may be associated [17];

IV. Fatty masses:

A. Fat-containing tumors:

• General considerations: 
Mediastinal lipomas, teratomas and liposarcomas are rare tumors, less encountered than herniation of abdominal fat or diffuse lipomatosis. The lipomas and teratomas arise commonly in the anterior mediastinum, whereas liposarcomas in the posterior one [1,2].

• Radiological features:
- Chest X-Ray (Fig.8): smooth mediastinal widening;
- CT: lipomas (Fig.9) are homogeneous masses with attenuation-values between -30 to -100 HU; in contrast, liposarcomas are unhomogeneous and contain large areas of soft tissue density, usually locally invasive at the time of the diagnosis; teratomas may present calcifications [1,2];
- MR imaging: fatty nature- high signal intensity on both T1 and T2- weighted sequences, identical to subcutaneous fat;

B. Mediastinal lipomatosis:

• General considerations: 
Mediastinal lipomatosis is a rare benign condition, in which large amount of unencapsulated fat is deposited in mediastinum, cardiophrenic areas and paraspinal areas and without infiltration of the mediastinal structures.

It is usually associated with general conditions, such as: obesity, Cushing syndrome, exogenous corticosteroid administration and alcohol abuse [1,2]. Usually is an incidental finding.

• Radiological features:
- Chest X-Ray: smooth mediastinal widening;
- CT: well-defined unencapsulated, homogeneous, fatty masses, similar to subcutaneous fat;
- MR imaging: fatty masses with homogenous high-signal intensity on both T1 and T2-weighted images; chemical-shift and fat-suppression techniques may be useful;

C. Bochdalek hernia:

• General considerations:
Bochdalek hernia represents visceral herniation through a posterior diaphragmatic defect. This condition is usually diagnosed in infants who present with clinical symptoms of pulmonary insufficiency. Contain fat and omental tissue in a majority of cases, but other retroperitoneal and intraperitoneal structures can infrequently be involved. Left-sided hernias are more common (70%-90% of cases), presumably owing to the protective effects of the liver [18].

Bochdalek hernia may be asymptomatic, but usually causes nausea, vomiting, abdominal pain, chest pain, cough or respiratory distress.

**Radiological features:**
- Chest X-Ray: it is of limited value on depicting the diaphragmatic defect; may appear either as a soft-tissue opacity at the lung base or as a solitary, smooth, round lesion in the posterior costophrenic recess;
- CT: is the procedure of choice for demonstrating a Bochdalek hernia; the diaphragmatic defect and the herniated contents are accurately depicted; sagittal and coronal reformatted images can demonstrate the defect and identify organ entrapment [2].

V. Hiatal Hernia

**General considerations:**
Hiatal hernia is an often encountered abnormality of the lower posterior mediastinum. The sliding type is much common than the paraesophageal hernias, where a portion of the stomach herniates through the esophageal hiatus into the chest alongside the distal esophagus, while the cardia is in normal position below the diaphragm [19].

If symptoms occur, they may include postprandial indigestion, substernal discomfort, nausea, and retching.

**Radiological features:**
- Chest X-Ray (Fig. 10): retrocardiac opacity with air-fluid level;
- Barium studies: paraesophageal hernias: patient in a prone position- the presence of a lower esophageal mucosal ring (web-like narrowing at the gastroesophageal junction’s membranous ridge) 2 cm or more above the diaphragmatic hiatus; the presence within it of gastric folds;
- CT (Fig.11): may appear as a dilated distal esophagus, with or without air-fluid level in the lumen, displacement by the stomach of the paraesophageal line [7,8];

VI. Esophageal pathology

A. Esophageal Diverticulum

**General considerations:**
The esophageal diverticulum is formed either by pulsion due to increased intraluminal esophageal pressure or by traction due to fibrosis in adjacent tissue. Pulsion esophageal diverticula (round contour and wide neck) consist only of mucosa, without a muscular layer. Traction diverticula, on the other hand, contain all layers of the esophageal wall, including muscle [19].

This masses are classified according to their location: the most common- the pharyngoesophageal junction (e.g. Zenker's diverticulum, pulsion type), the middle esophagus (mostly the traction type), and the distal esophagus (e.g. epiphrenic diverticulum, pulsion type).

**Radiological features:**
- **Barium studies:** pulsion diverticula tend to remain filled with barium after the esophagus has emptied because their walls contain no muscle; when the esophagus collapses, traction diverticula tend to empty [19];

*B. Esophageal and Paraesophageal Varices*

**General considerations:**
Esophageal on periesophageal varices may simulate a retrocardiac mediastinal mass. The most common cause of esophageal and paraesophageal varices is portal hypertension, which leads to increased venous flow within esophageal or paraesophageal collateral vessels [19,20]. Downhill varices are associated with superior vena cava obstruction.

**Radiological features:**
- **CT:** the presence and extent of varices, the appearance of which varies according to the severity and extent of the disease; unenhanced CT, thickening of the esophageal walls may be visible; enhanced CT reveals enhancing structures within the esophageal wall or periesophageal region [20];

*C. Leiomyoma*

**General considerations:**
Is the most common benign esophageal tumor. It consists of intersecting bands of muscle and fibrous tissue in a well-defined capsule. Appears as a discrete submucosal mass, ranging from 2 to 8 cm in diameter [19].

Mostly asymptomatic but dysphagia or hematemesis (due to ulceration), may be encountered.

**Radiological features:**
- **Chest X-Ray:** mediastinal mass;
- **Barium studies:** discrete, submucosal lesion;
- **CT:** homogeneous soft tissue lesions; DDx from fibromas, neurofibromas, or hemangiomas is difficult;
- **MR imaging:** T2-weighted imaging: submucosal mass isointense to the esophageal wall;

*D. Esophageal cancer*
**General considerations:**
Most esophageal cancers are either squamous cell carcinomas (SCCs) or adenocarcinomas. SCCs are evenly distributed between the middle and lower esophagus, whereas three-fourths of all adenocarcinomas are found in the distal esophagus. It may invade local, regional, or distant structures by various pathways, including direct extension, lymphatic spread, and hematogeneous metastasis [21, 22].

Symptoms like: progressive dysphagia, weight loss, gastroesophageal reflux, hoarseness, cough, vocal cord paralysis, or other signs/symptoms of mediastinal invasion, are usually present.

**Radiological features:**
- **Chest X-Ray** (Fig.12): widened azygo-oesophageal recess with convexity toward right lung; thickening of posterior tracheal stripe and right paratracheal stripe >4 mm; widened mediastinum; posterior tracheal, or retrocardiac mediastinal mass;
- **CT** (Fig.13), (Fig.14): is limited in determining the exact depth of tumor infiltration of the esophageal wall; any wall thickness greater than 5 mm is considered abnormal; asymmetric thickening of the esophageal wall- nonspecific [21]; loss of fat planes between the tumor and adjacent structures in the mediastinum, displacement or indentation of other mediastinal structures; tracheobronchial invasion: displacement of the trachea or bronchus, or indentation of the posterior wall of the trachea or bronchus by the tumor; pericardial invasion: thickening, pericardial effusion, or indentation of the heart with loss of the pericardial fat plane [22,23];
- **Endoscopic Ultrasonography:** the most accurate imaging modality currently available for primary tumor staging (T staging); the normal esophageal wall- five alternating layers of differing echogenicity, allowing accurate determination of the depth of tumor invasion [21, 24];

**VII. Extramedullary hematopoiesis (EMH):**

**General considerations:**
Extramedullary hematopoietic tissue (extramarrow soft tissue that produces blood elements) can appear as part of various chronic hematologic affections (hemolytic anemias, myelofibrosis, lymphoma, leukemia) with ineffective hemopoiesis or marrow function [25]. Common sites of EMH include the liver, spleen and lymph nodes (foetal sites of hematopoietic tissue proliferation) but it can also come to light in other locations, like the paravertebral region (thoracic region probably the most common).

In 80% of cases this condition is asymptomatic; manifestations such as dyspnea, pleural effusion, hemothorax, neurologic symptoms are encountered due to EMH location and compression of the adjacent structures [26,27].

**Radiological features:**
- **Chest X-Ray:** well-defined, smooth paravertebral masses;
- **CT imaging**: well-defined masses that involve multiple levels, with bilateral distribution, almost symmetric, isodense to the adjacent muscle; actively hematopoietic masses have a mild homogeneous enhancement after contrast and the older inactive areas have inhomogeneous contrast enhancement due to iron deposition and fat infiltration [26];
- **MR imaging**: on T1 and T2-weighted images, paravertebral isointense masses (signal intensity slightly higher than that of adjacent marrow of the vertebral bodies) with no or minimum contrast enhancement; describing the relationship with the spinal cord [25,27];

**VIII. Lymphadenopathy**

- **General considerations:**
  Nodal tissue is present within the mediastinum mainly situated around the distal trachea, carina, and main bronchi [28]. The average sizes of normal lymph nodes vary depending on their region; a lymph node in the paratracheal, hilar, subcarinal, paraesophageal, paraaortic, or subaortic region is generally considered enlarged if the short-axis diameter is greater than or equal to 10 mm [29].

Conditions than can result in mediastinal lymphadenopathy: metastatic malignancies to the mediastinum, lymphoma, sarcoidosis, infectious etiology, occupational lung disease.

- **Radiological features:**
  - **Chest X-Ray**: widened mediastinum; posterior tracheal, or retrocardiac mediastinal mass;
  - **CT imaging** (Fig.15): the most useful preoperative, noninvasive method of assessing for thoracic lymphadenopathy; it’s role is to allow identification of enlarged lymph nodes and document their exact location; low attenuation areas reflecting necrotic changes within the diseased lymph nodes can be identified; at CT, after treatment, pathological lymph nodes may show irregular or eggshell calcifications [28];

**IX. Fibrosing mediastinitis:**

- **General considerations:**
  FM is a chronic and slowly process mostly caused by tuberculosis, fungal infections (including: histoplasmosis, aspergilosis, cryptococcosis) and autoimmune diseases [30]. There are two different patterns of mediastinal involvement: focal and diffuse. The excessive fibrotic tissue can lead to severe complications due to the obstruction and compression of mediastinal vital structures.

- **Radiological features:**
  - **Chest X-Ray**: non-specific widening of the mediastinum, hilar/mediastinal lymphadenopathy; calcifications within the lymph nodes;
  - **CT**: soft-tissue mass, within the mediastinum, sometimes invading adjacent structures; identification of calcification, mediastinal vessels and airway involvement [30,31];
  - **MR imaging**: T1-weighted images show a heterogeneous mass of intermediate signal intensity; variable appearance on T2-weighted images and post-contrast images,
depending on the inflammatory reaction and the maturation of the fibrotic process; assessment of the extension and vascular involvement [31];

X. Spinal infections:

• General considerations:
Pyogenic spondylitis is the most often encountered form of vertebral osteomyelitis and it usually follows some recent infection or surgical procedure (Staphylococcus aureus - the most frequent pyogenic organism). The subacute or chronic course is especially owned to Mycobacterium tuberculosis, also known as Pott's Disease (the most common form of extrapulmonary TB) [32].

• Radiological features:
- X-Ray: radiolucencies of plate margins, narrowing of the disk space, loss of disk height, vertebral body destruction, erosion of end plates, sclerosis, vertebral geodes, involvement of two contiguous vertebral bodies, paravertebral masses;
- CT (Fig.16): evaluates radiographic findings and the lesion extension; post-contrast shows the multiloculated cystic paraspinal masses, enhancing walls located in both bone and soft tissues [33];
- MR imaging: early diagnosis of spinal cord compression syndrome, early detection of disk and bone destruction, extension in soft tissues and bones, differentiation of TB spondylitis from pyogenic spondylitis (for TB spondylitis patterns like: well-defined paraspinal signal, thin and smooth abscess walls, thoracic spine involvement, are more suggestive, whereas the abnormal facet joint is more suggestive for pyogenic spondylitis) [32,34];

XI. Uncommon mediastinal masses

Chordomas, sarcomas, lymphomas (Fig.17), hamartomas (Fig.18) and metastatic disease sometimes can grow into the adjacent paravertebral areas, resulting in a paravertebral mass. The CT findings of these lesions are: posterior element involvement, prevertebral soft tissue swelling, and osteoblastic or osteolytic osseous modifications.

Images for this section:
Fig. 1: Paraspinal Ganglioneuroma: Non-enhanced Axial CT scan reveals a paraspinal homogeneous low attenuation fusiform mass which after resection proved to be a ganglioneuroma.

Fig. 2: Neuroblastoma: CT scout view of thorax (a) in a 6-month-old girl reveals a widened upper mediastinum (arrowhead) with lateral displacement of the trachea. Non-enhanced
axial CT image (b) shows a large infiltrative heterogenous mass (arrow) which displaces the adjacent mediastinal structures.

**Fig. 3:** Lusoria Artery Aneurysm: Non-enhanced axial (a) and coronal (b) CT images in soft tissue settings depict an aberrant right subclavian artery (lusoria artery) (arrow) with a dilated lumen and calcified atheromatous plaques.
**Fig. 4:** Right Aortic Arch: Non-enhanced Axial CT scan depicts a right aortic arch (arrowhead). Parietal atheromatous calcifications can be seen.

**Fig. 5:** Descending Thoracic Aortic Aneurysm (arrow) on posteroanterior and lateral chest radiographs.
**Fig. 6:** Chronic Thrombosed Toracoabdominal Aortic Aneurysm: Axial (a) and Sagittal (b) contrast-enhanced CT scans show important dilatation of the descending aortic lumen with the presence of a circumferential mural thrombus (arrowhead) and calcified atherosclerotic plaques. (c): Contrast-enhanced Axial CT scan depicting a massive hematoma in the mediastinum and left hemithorax caused by rupture of a dissected aortic aneurysm.

**Fig. 7:** Bronchogenic Cyst: CT scout view of thorax (a) shows a retrocardiac round opacity (arrowhead). Non-enhanced (b) and contrast-enhanced (c) Axial CT images depict a thin-walled non-enhanced water-attenuation cyst (arrow) adjacent to the esophagus and descending thoracic aorta which extends to the left lower lobe.
**Fig. 8:** Periesophageal Fat Pad: Posteroanterior and lateral chest radiographs show a retrocardiac soft-tissue-opacity lesion (arrow), which on CT scan was demonstrated to be a periesophageal fat pad.

**Fig. 9:** Lipoma: CT scout view of thorax (a) shows a right paratracheal soft tissue mass (arrowhead). Non-enhanced Axial CT scan (b) reveals a well-defined lesion with homogeneous fat attenuation which displaces anteriorly and compresses the trachea and posteriorly the esophagus.
**Fig. 10:** Hiatal Hernia and Bochdalek Hernia: Posteroanterior and lateral chest radiographs show two retrocardiac opacities, the larger one (arrow), a hiatal hernia, with air-fluid level. The smaller round opacity (arrowhead), representing a Bochdalek hernia, on the lateral view appears to be in contact with the posterior portion of the left hemidiaphragm.
**Fig. 11:** Hiatal Hernia: Contrast-enhanced CT images (a, b, c) reveal an abnormally widened esophageal hiatus with paraesophageal herniation of the stomach (arrow) and also herniation of a portion of the transvers colon (arrowhead).

**Fig. 12:** Stenosing Esophageal Cancer: Posteroanterior and lateral chest radiographs show a widened azygo-esophageal line with convexity toward right lung (arrow). Associated, an air-fluid level (arrowhead) can be seen posterior to the trachea.

**Fig. 13:** Esophageal Cancer: Contrast-enhanced chest CT scans (a, b) show a posterior mediastinal mass (arrow) with loss of fat planes between the tumor and adjacent structures in the mediastinum. There is also asymmetric thickening of the esophageal wall. Dilated fluid- and debris-filled proximal esophageal lumen (arrowhead) can also be seen.
Fig. 14: Posterior Mediastinal Abscess Secondary to Esophageal Perforation: Axial (a) and coronal (b) contrast-enhanced CT images show a thick-walled low-attenuation mass in the posterior mediastinum(arrow) in a patient with sepsis and perforated esophagus (arrowhead).
Fig. 15: Metastatic Lymphadenopathies: Contrast-enhanced Axial CT image shows multiple lymphadenopathies (arrowhead) which displace anteriorly the aorta and esophagus (arrows) in a patient with metastatic seminoma.

![Fig. 15: Metastatic Lymphadenopathies](image)

Fig. 16: Spondylodiscitis and Paraspinal Abscess: Contrast-enhanced axial (c), coronal (a) and sagittal (b) CT images demonstrate disc space narrowing and irregularity of the vertebral endplates at D7/D8 level (arrow). Associated, there are thick-walled low-attenuation masses (arrowhead) in the paravertebral regions. There is a history of sepsis following a complicated pleural empyema.

![Fig. 16: Spondylodiscitis and Paraspinal Abscess](image)
**Fig. 17:** Lymphoma: Axial contrast-enhanced CT scan shows a hypoattenuating, homogenous soft-tissue mass below the carina associated with left axillary lymphadenopathy.
Fig. 18: Hamartoma: Non-enhanced (a) and contrast-enhanced (b, c, d) chest CT scans reveal a well-defined heterogeneous mass (arrow) with parietal calcifications in the posterior mediastinum adjacent to the right lateral border of the aortic arch.
Conclusion

The broad spectrum of PMMs and the characteristics of each lesion can pose a variety of diagnostic challenges.

References


**Personal Information**