A Diagnostic Approach to Mediastinal Abnormalities[1]

TEACHING POINTS
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Camilla R. Whitten, MRCS, FRCR • Sameer Khan, MRCP, FRCR
Graham J. Munneke, MRCP, FRCR • Sisa Grubnic, MRCP, FRCR

A number of mediastinal reflections are visible at conventional radiography that represent points of contact between the mediastinum and adjacent lung. The presence or distortion of these reflections is the key to the detection and interpretation of mediastinal abnormalities. Anterior mediastinal masses can be identified when the hilum overlay sign is present and the posterior mediastinal lines are preserved. Widening of the right paratracheal stripe and convexity relative to the aortopulmonary window reflection indicate a middle mediastinal abnormality. Disruption of the azygoesophageal recess can result from disease in either the middle or posterior mediastinum. Paravertebral masses disrupt the paraspinal lines, and the location of masses above the level of the clavicles can be inferred by their lateral margins, which are sharp in posterior masses but not in anterior masses. The divisions of the mediastinum are not absolute; however, referring to the local anatomy of the mediastinal reflections in an attempt to more accurately localize an abnormality may help narrow the differential diagnosis. Identification of the involved mediastinal compartment helps determine which imaging modality might be appropriate for further study.

Abbreviations: AP = aortopulmonary, IVC = inferior vena cava, SVC = superior vena cava

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[1]From the Department of Radiology, St George's Hospital, Blackshaw Rd, Tooting, London SW17 0QT, England. Presented as an education exhibit at the 2005 RSNA Annual Meeting. Received July 13, 2006; revision requested August 17 and received October 11; accepted October 18. All authors have no financial relationships to disclose. **Address correspondence to** C.R.W. (e-mail: *camillawhitten@hotmail.com*).

Introduction

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.

In this article, we review the methods of mediastinal division, demonstrate the normal anatomy for each compartment, and discuss and illustrate both normal mediastinal reflections and how the presence or distortion of these reflections can reveal mediastinal disease.

Dividing the Mediastinum

The mediastinum is often divided into convenient compartments in an attempt to develop a differential diagnosis. However, there are no physical boundaries between compartments that limit disease.

Anatomists divide the mediastinum into four parts. The mediastinum is divided into superior and inferior compartments by an imaginary line traversing the manubriosternal joint and the lower surface of the fourth thoracic vertebra. The inferior compartment is further subdivided into three parts: the middle mediastinum, which contains the pericardium and its contents as well as the major vessels and airways; the anterior mediastinum, which lies anterior to the middle mediastinum and posterior to the sternum; and the posterior mediastinum, which lies posterior to the middle mediastinum and anterior to the thoracic vertebral column (1). A popular modification of this method divides the entire mediastinum into anterior, middle, and posterior compartments but does not recognize a separate superior compartment (2).

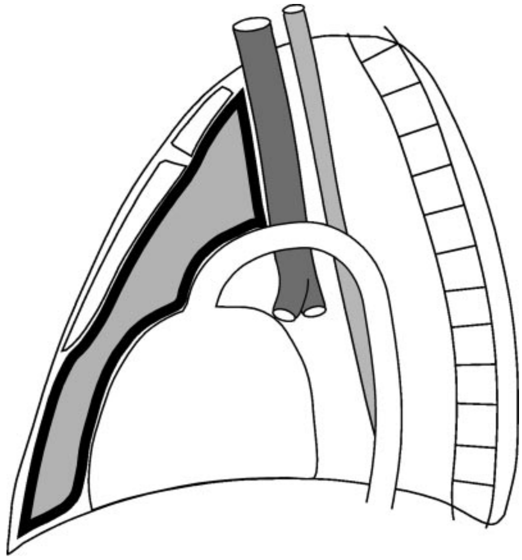
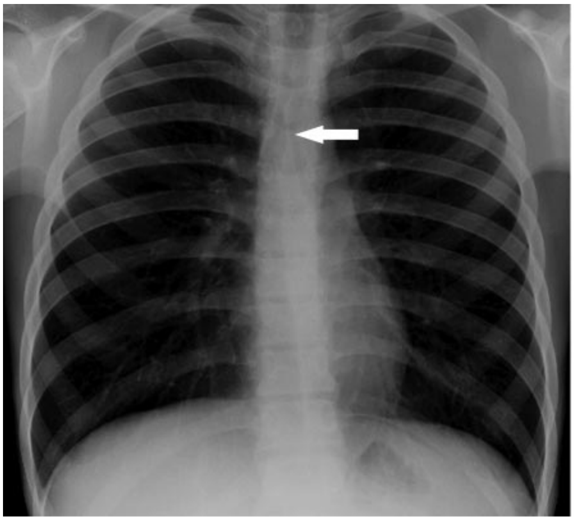


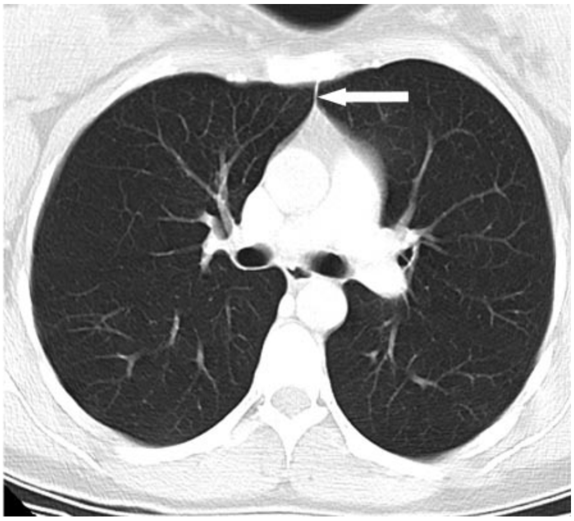
Figure 1. Drawing illustrates the anterior mediastinum (outlined in black).

The Felson method of division is based on findings at lateral chest radiography. A line extending from the diaphragm to the thoracic inlet along the back of the heart and anterior to the trachea separates the anterior and middle mediastinal compartments, whereas a line that connects points 1 cm behind the anterior margins of the vertebral bodies separates the middle and posterior mediastinal compartments (3).

Heitzman (4) divided the mediastinum into the following anatomic regions: the thoracic inlet, the anterior mediastinum, the supraaortic area (above the aortic arch), the infraaortic area (below the aortic arch), the supraazygos area (above the azygos arch), and the infraazygos area (below the azygos arch).

In any method used to divide the mediastinum, the divisions are theoretic rather than physical. Therefore, disease can spread from one compartment to another, and some diseases do not occur exclusively in any one compartment. It is often more instructive to determine precisely where an abnormality lies. However, for ease of classification and for practicality, we have adopted the modified anatomic method of dividing the mediastinum (ie, anterior, middle, and posterior compartments with no separate superior compartment).





a. b.

Figure 2. Anterior junction line. **(a)** Posteroanterior chest radiograph demonstrates the anterior junction line (arrow). **(b)** Computed tomographic (CT) scan shows the four layers of pleura that constitute the anterior junction line (arrow). The interface between aerated lung and pleura allows the line to be appreciated at conventional radiography (cf **a**).

Table 1
Anterior Mediastinal Masses

Prevascular masses
Lymphadenopathy
Retrosternal goiter
Thymic lesions (thymoma, carcinoma, hyperplasia, cysts, thymolipoma)
Germ cell tumor
Precardiac masses in contact with the diaphragm
Epicardial fat pad
Diaphragmatic hump
Morgagni hernia
Pleuropericardial cysts*
Lymph node enlargement
Rare lesions
Lymphatic malformations
Hemangiomas

*Some classification schemes place pleuropericardial cysts in the middle mediastinum.

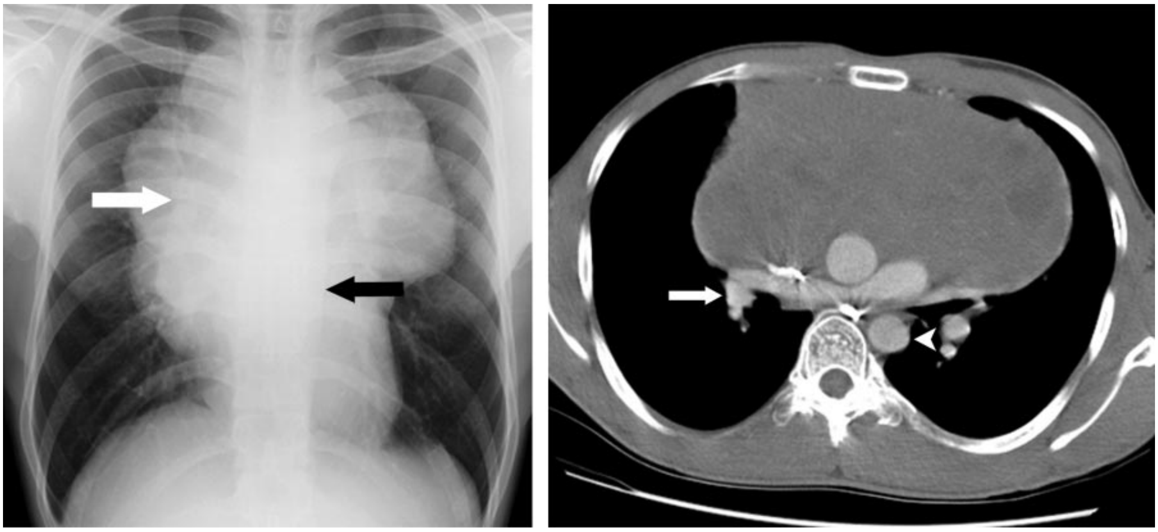
Anterior Mediastinum

Anatomy

The anterior mediastinum is bounded anteriorly by the sternum; posteriorly by the pericardium, aorta, and brachiocephalic vessels; superiorly by the thoracic inlet; and inferiorly by the diaphragm (Fig 1). Its contents include the thymus, lymph nodes, adipose tissue, and internal mammary vessels (1,5,6). The thyroid gland (if it extends into the mediastinum) is traditionally considered an anterior mediastinal compartment structure. Disease of any of the contents of the anterior mediastinum may result in a mass; thus, knowledge of the normal contents of the anterior mediastinum aids in developing a differential diagnosis once a mass has been identified. Masses may be subdivided into *(a)* prevascular masses and *(b)* precardiac masses that are in contact with the diaphragm (Table 1).

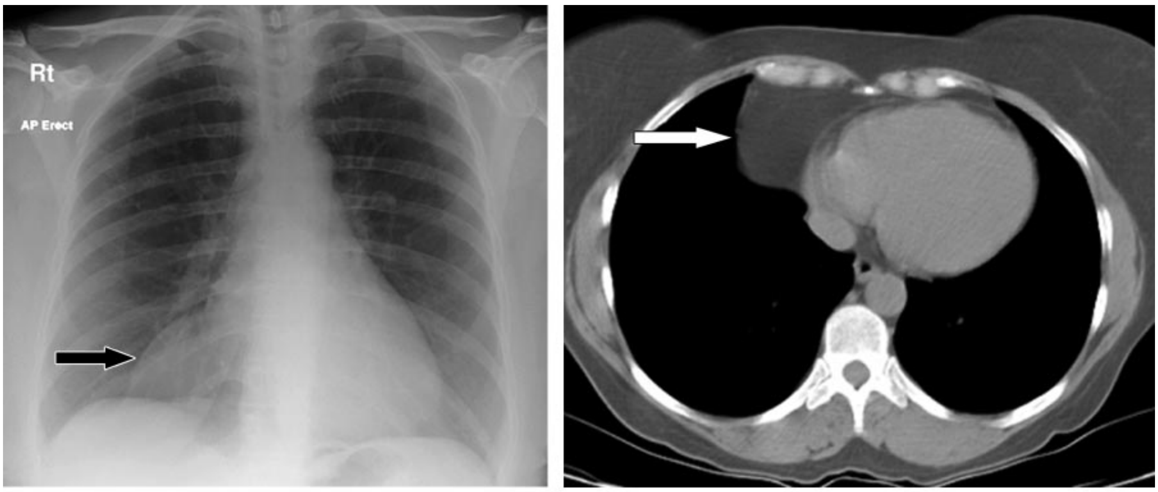
Anterior Junction Line

The anterior junction line is seen at posteroanterior chest radiography. The line is formed by the anterior apposition of the lungs and consists of the four layers of pleura separating the lungs behind the upper two-thirds of the sternum (Fig 2). There is a variable amount of fat between these layers that can affect the thickness of the anterior junction line (5), which can be seen in approximately 25% of examinations. The line runs obliquely from upper right to lower left and does not extend above the manubriosternal junction. These properties help differentiate the anterior junction line from the posterior junction line (discussed later) (7).



a. b.

Figure 3. Hilum overlay sign in a patient with lymphoma. **(a)** Posteroanterior chest radiograph clearly depicts the hila (white arrow), which indicates that the mass is either anterior or posterior to the hila. In addition, the descending aorta is clearly seen (black arrow), indicating that the mass is not within the posterior mediastinum. **(b)** Chest CT scan demonstrates an anterior mediastinal mass. The anterior junction line is obliterated, whereas the lung interfaces with the hilar vessels (arrow) and aorta (arrowhead) are preserved.



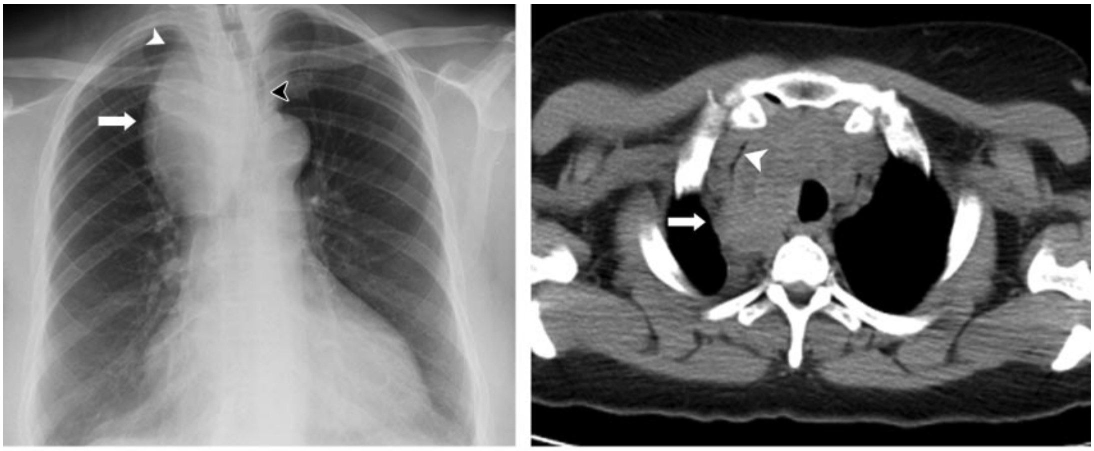
a. b.

Figure 4. Epicardial fat pad. **(a)** Posteroanterior chest radiograph shows loss of the cardiac silhouette at the border of the right side of the heart and an epicardial fat pad with relatively low density (arrow). **(b)** CT scan shows the fat pad (arrow) as an area of homogeneous fat attenuation adjacent to the right border of the heart.

Anterior mediastinal masses in the prevascular region can obliterate the anterior junction line, although it is usually the preservation of more posterior lines at radiography that helps identify the location of an anterior mediastinal mass. The hilum overlay sign (3) is present when the normal hilar structures project through a mass, such that the mass can be understood as being either anterior or posterior to the hilum (Fig 3). Preservation or disruption of posterior mediastinal lines can help further clarify the location of the mass.

Teaching Point

The craniocaudal location and tissue density of a mass may also help in developing a differential diagnosis. Anterior mediastinal masses that are in contact with the diaphragm include an epicardial fat pad, pleuropericardial cyst, and Morgagni hernia (Table 1). Epicardial fat pads obliterate the cardiac silhouette and are of relatively low density (Fig 4). The presence of bowel gas within an anterior mediastinal mass that is in contact with the diaphragm is diagnostic for a Morgagni hernia.



a. b.

Figure 5. Right-sided retrosternal goiter. **(a)** Posteroanterior chest radiograph demonstrates a thyroid goiter (arrow) extending into the middle mediastinum, obliterating the right paratracheal stripe, and causing deviation of the trachea to the left (black arrowhead). Above the level of the clavicles, the margins of the mass are not sharp (white arrowhead), indicating that the mass has an anterior mediastinal component. **(b)** CT scan shows the mass (arrow) between the trachea and right lung, a location that explains the obliteration of the right paratracheal stripe seen in **a**. There is no contact between the anterior component of the mass and the lung (arrowhead) at the level of the clavicular heads, a relationship that continues above the level of the clavicles. This finding explains why the lateral border of the anterior mediastinal component above the level of the clavicles is not sharp in **a**.

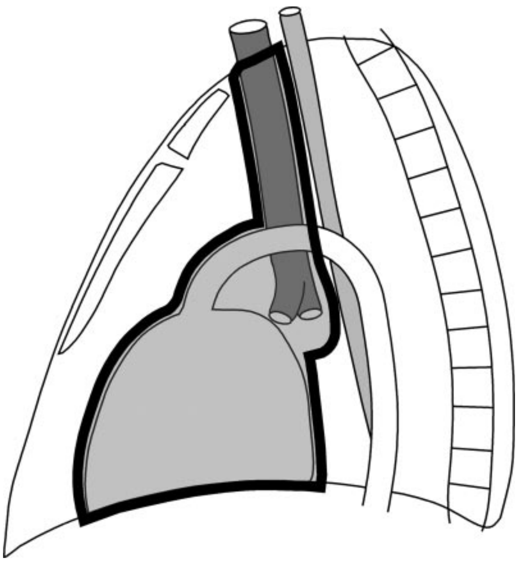


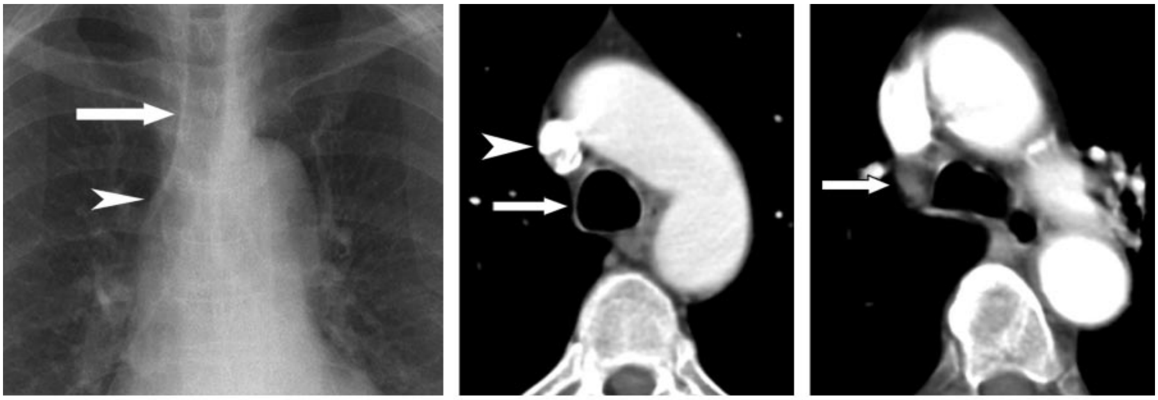
Figure 6. Drawing illustrates the middle mediastinum (outlined in black).

The difficulty of limiting the differential diagnosis to one specific compartment is typified by thyroid disease. The thyroid gland is conventionally included in the anterior mediastinum. This gland is intimately related to the trachea, and a retrosternal goiter may not be limited to the anterior mediastinum, since it can travel along the course of the trachea into the middle and posterior mediastinum. Therefore, this enlargement may disrupt the middle and posterior mediastinal lines (discussed later) (Fig 5). Although involvement of other compartments may be seen when a goiter extends into the mediastinum, above the level of the clavicles it may be possible to appreciate the anterior location of the goiter by assessing its lateral margin. Posterior masses above the level of the clavicles have an interface with lung and therefore typically have sharp, well-defined margins; in contrast, anterior masses above the level of the clavicles do not have an interface with lung, so that their margins are not usually sharp.

Middle Mediastinum

Anatomy

The middle mediastinum is bounded anteriorly by the pericardium, posteriorly by the pericardium and posterior tracheal wall, superiorly by the thoracic inlet, and inferiorly by the diaphragm (Fig 6). Its contents include the heart and pericardium; the ascending and transverse aorta; the superior vena cava (SVC) and inferior vena cava (IVC); the brachiocephalic vessels; the pulmonary vessels; the trachea and main bronchi; lymph nodes; and the phrenic, vagus, and left recurrent laryngeal nerves (1,5,6). Knowledge of the contents of this compartment facilitates the development of a differential diagnosis for middle mediastinal masses



a. b. c.

Figure 7. Right paratracheal stripe. **(a)** Posteroanterior chest radiograph shows the right paratracheal stripe (arrow). The azygos vein is seen at the inferior margin of the stripe at the tracheobronchial angle (arrowhead). **(b)** CT scan shows the right wall of the trachea with medial and lateral air–soft tissue interfaces caused by air within the tracheal lumen and right lung (arrow). These interfaces create the right paratracheal stripe (cf **a**). Note the position of the SVC (arrowhead), which explains why the paratracheal stripe is seen projecting through the SVC at radiography. **(c)** CT scan obtained at the level of the azygos arch shows that the azygos vein (arrow) disrupts the lung–tracheal wall interface at the tracheobronchial angle.

(Table 2). However, as will be demonstrated later, the theoretic boundaries of mediastinal compartments are not clear-cut, and knowledge of the local anatomy of an interrupted mediastinal line is much more helpful in identifying a possible alternative diagnosis.

The aortopulmonary (AP) window is a middle mediastinal space bounded superiorly by the inferior margin of the aortic arch; inferiorly by the superior margin of the left pulmonary artery; anteriorly by the posterior wall of the ascending aorta; posteriorly by the anterior wall of the descending aorta; medially by the trachea, left main bronchus, and esophagus; and laterally by the left lung (7). The AP window contains lymph nodes, the left recurrent laryngeal nerve arising from the vagus nerve, the left bronchial arteries, the ligamentum arteriosum, and fat.

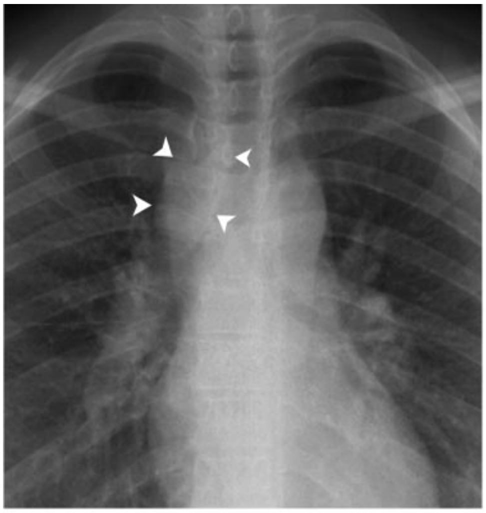
Table 2
Middle Mediastinal Masses

Lymphadenopathy
Aortic arch aneurysm
Enlarged pulmonary artery
Foregut duplication cysts (bronchogenic, esophageal, neurenteric)
Pericardial cyst
Tracheal lesions

Right Paratracheal Stripe

The right paratracheal stripe is seen projecting through the SVC (Fig 7a). It is formed by the trachea, mediastinal connective tissue, and paratracheal pleura and is visible due to the air–soft tissue interfaces on either side (Fig 7b). The right paratracheal stripe should be uniform in width. In one study, this stripe was visible in 94% of patients, with a normal width ranging from 1 to 4 mm; a right paratracheal stripe 5 mm or more in width is considered widened (8). The azygos vein lies at the inferior margin of the right paratracheal stripe at the tracheobronchial angle (Fig 7a, 7c). There have been reports of a normal size range for the azygos vein, including upper limits of 6 mm (9) and 7 mm (10), but most authors consider a transverse diameter of 10 mm or less to be within normal limits (5). In pregnancy, the azygos vein can dilate to a normal maximum width of 15 mm (10). Possible causes of pathologic dilatation of the azygos vein include congestive heart failure,

Teaching Point



a.

b.

Figure 8. Lymphadenopathy. **(a)** On a collimated posteroanterior chest radiograph, the right paratracheal stripe is not seen, having been obliterated by a right paratracheal mass (arrowheads). **(b)** CT scan demonstrates right paratracheal lymphadenopathy (arrow), which obliterates the air–soft tissue interface between the right lung and the tracheal wall. This finding explains the obliteration of the right paratracheal stripe in **a**.

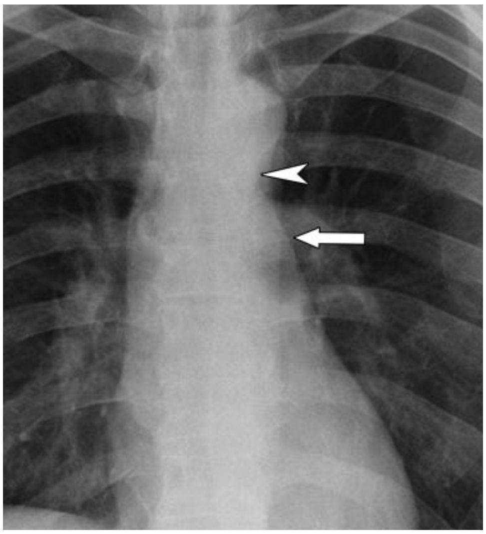


Figure 9. AP window reflection. On a posteroanterior chest radiograph, the AP window reflection (arrowhead) extends from the aortic knob to the left pulmonary artery and has a normal concave appearance. The aortic-pulmonary reflection (arrow) is a more anterior line and extends from the aortic arch to the level of the left main bronchus.

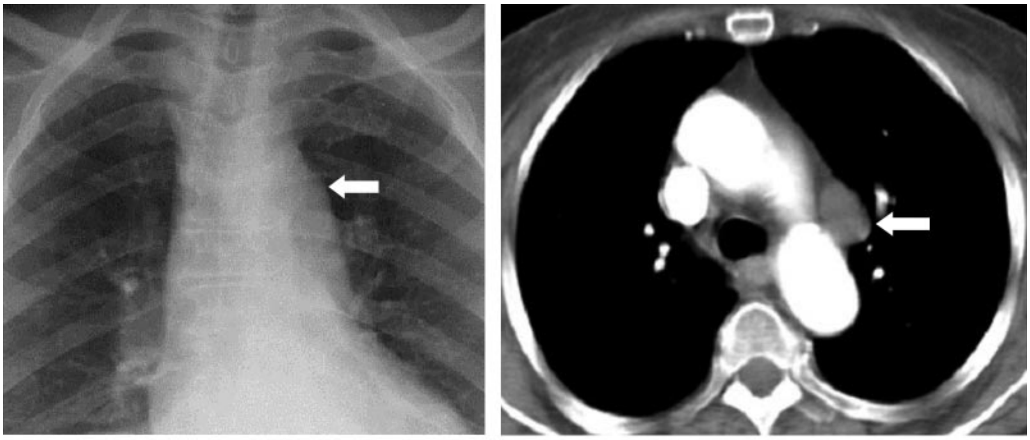
right ventricular strain, tricuspid insufficiency, and constrictive pericarditis (10).

The right paratracheal stripe can be widened due to abnormality of any of its components, from the tracheal mucosa to the pleural space. Paratracheal masses, most commonly lymphadenopathy, can obliterate the right paratracheal stripe by interrupting the air–soft tissue interface between the trachea and lung (Fig 8).

Mediastinal Reflections at the AP Window

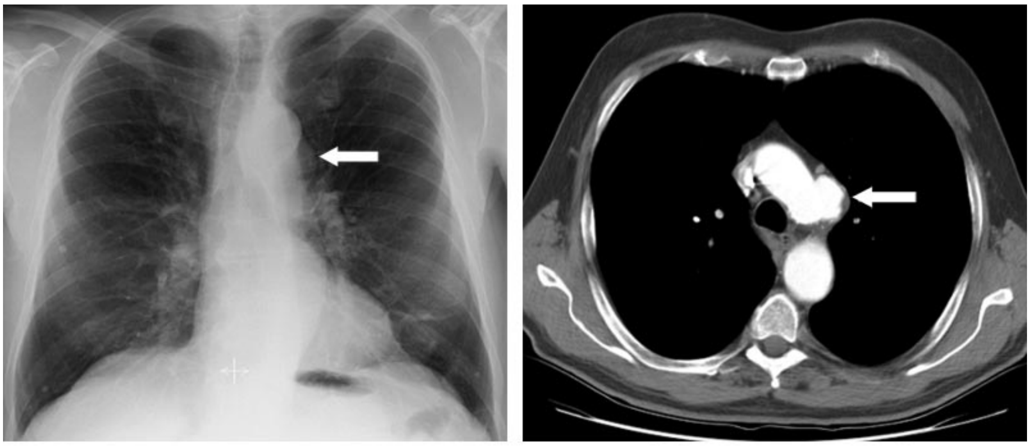
The AP window is bounded by the aortic arch superiorly and the pulmonary artery inferiorly, with its lateral aspect seen as the aortic-pulmonary window reflection due to the interface between the left lung and the mediastinum (Fig 9). At radiography, the "edge" of the window extends from the aortic knob to the left pulmonary artery. This edge should have a concave or straight border with the adjacent lung, with a straight border being considered normal unless previous studies have demonstrated a concave border (7). A convex border between the AP window and the lung is considered abnormal. There are two other lines that have been described as being in proximity to this region, but these lines are separate and distinct from the AP window mediastinal reflection. Anterior to the AP window reflection, the aortic-pulmonary reflection extends from the aortic arch to the level of the left main bronchus, where it usually continues as the border of the left side of the heart (7,11). This

Teaching Point



a. b.

Figure 10. AP window lymphadenopathy. **(a)** Chest radiograph shows the AP window with an abnormal convex border (arrow). **(b)** CT scan demonstrates lymphadenopathy (arrow), which accounts for the distortion of the AP window in **a**.



a. b.

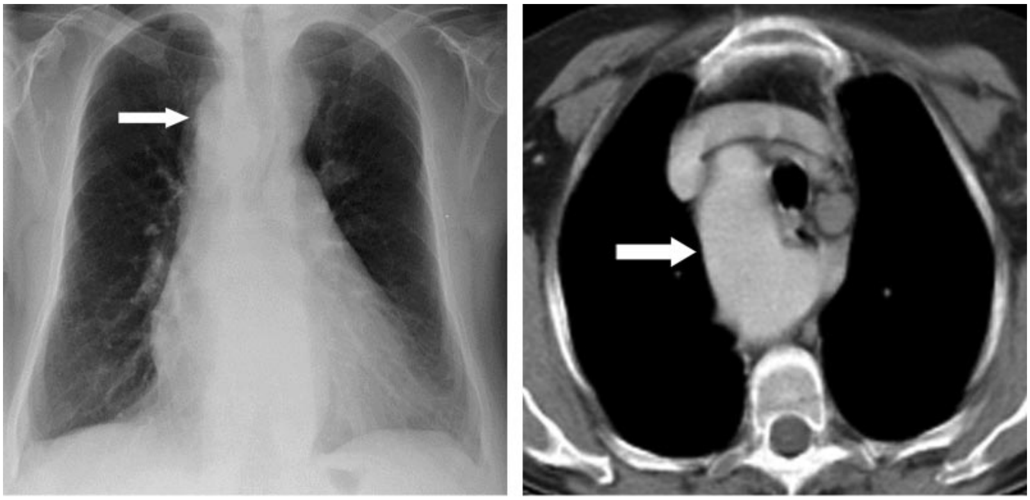
Figure 11. Aneurysm of the aortic arch. **(a)** Posteroanterior chest radiograph demonstrates the AP window with a convex border (arrow). **(b)** CT scan reveals an aneurysm (arrow) arising laterally from the aortic arch, a finding that accounts for the abnormality seen in **a**.

edge represents the interface between the lung and the mediastinum along the main pulmonary artery and toward the aortic arch. A number of configurations of the aortic-pulmonary reflection have been described (11); however, this reflection is not always seen. A preaortic recess may be seen at the posterior aspect of the AP window (7). This mediastinal reflection is created by an interface between the left lung and the mediastinum anterior to the descending aorta and is usually straight or concave relative to the lung in its upper extent. It is considered to be the equivalent of the azygoesophageal recess (discussed later) on the left.

An abnormal convex contour of the AP window suggests a mediastinal abnormality, most commonly lymphadenopathy (Fig 10), although such a contour may occasionally represent a normal variant caused by the accumulation of fat. Similarly, excess fat within the mediastinum can cause apparent mediastinal widening at chest radiography (5,12). Vascular abnormalities such as an aortic arch aneurysm can also distort the AP window (Fig 11).

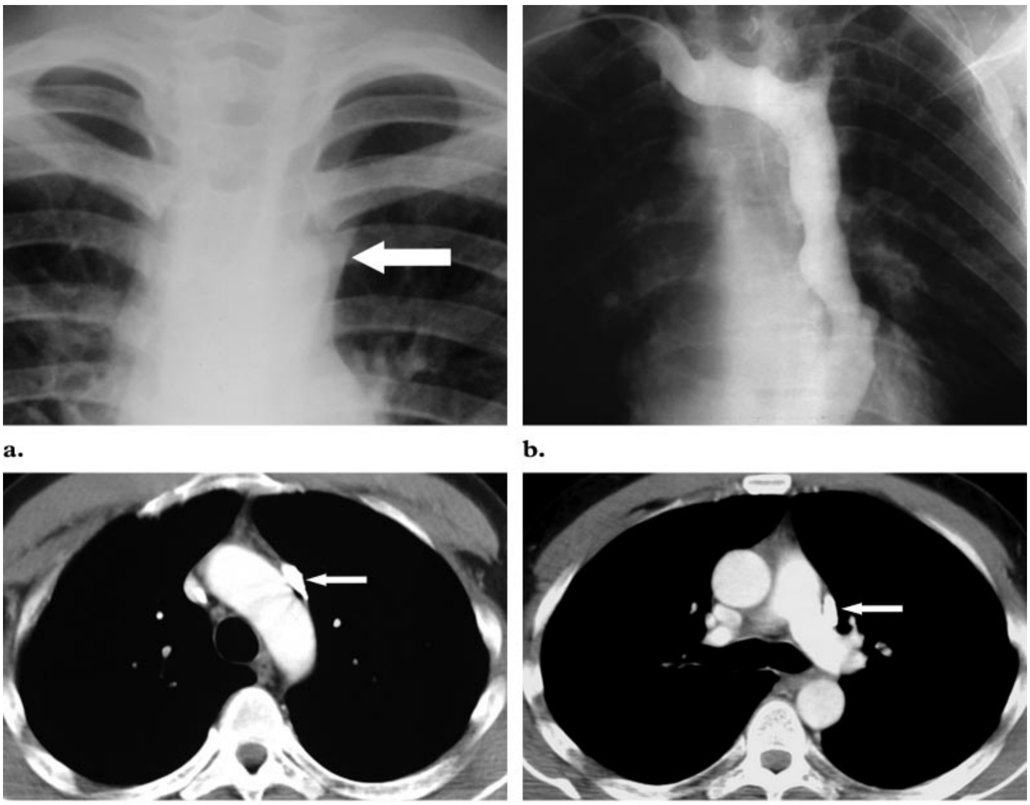
Pitfalls in Assessing the Middle Mediastinum

A variety of normal vascular variants may be mistaken for middle mediastinal disease at chest radiography. A right-sided aortic arch, seen in 0.5% of the general population (13), may mimic paratracheal lymphadenopathy because it obliterates the right paratracheal stripe; however, the absence of the aortic knuckle on the left should help correctly identify this variant (Fig 12). A left-sided SVC may create an additional mediastinal line lateral to the aortic arch at radiography (Fig



a. b.

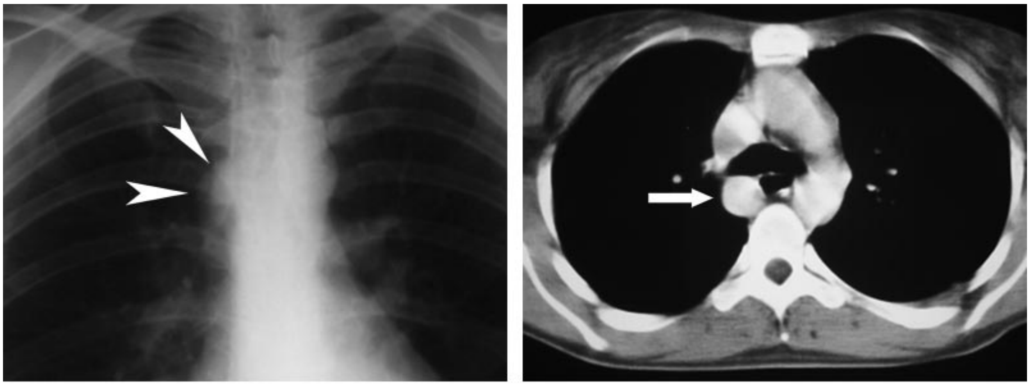
Figure 12. Right-sided aortic arch. **(a)** Posteroanterior chest radiograph demonstrates an abnormality in the right paratracheal region (arrow) with loss of the paratracheal stripe. Note, however, the absence of the aortic knuckle on the left. **(b)** CT scan shows a right-sided aortic arch (arrow), which explains the findings in **a**.



a. b. c. d.

Figure 13. Left-sided SVC. **(a)** Collimated posteroanterior chest radiograph shows an additional line (arrow) lateral to the aortic arch. **(b)** Venogram demonstrates a left-sided SVC, which explains the finding in **a**. **(c, d)** CT scans obtained at the levels of the aortic arch **(c)** and pulmonary trunk **(d)** show the left-sided SVC (arrow), which drains into the coronary sinus.

13). This variant courses anterior to the left hilum and drains into the coronary sinus. A left-sided SVC is present in 0.3% of the general population and in 4.3% of patients with congenital heart disease (14), although some series have reported a prevalence of 11% in the latter group (15). Another normal variant is azygos continuation of the IVC, in which the usual development of the IVC



a. b.

Figure 14. Azygos continuation of the IVC. **(a)** Collimated posteroanterior chest radiograph shows enlargement of the azygos vein at the inferior margin of the right paratracheal stripe (arrowheads), a finding that mimics lymphadenopathy. **(b)** CT scan also shows enlargement of the azygos vein (arrow). This finding is the result of azygos continuation of the IVC.

Table 3
Posterior Mediastinal Masses

Esophageal lesions, hiatal hernia
Foregut duplication cyst
Descending aortic aneurysm
Neurogenic tumor
Paraspinal abscess
Lateral meningocele
Extramedullary hematopoiesis

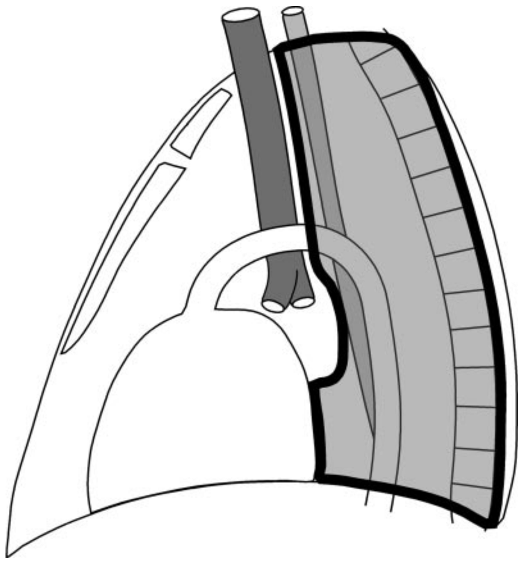


Figure 15. Drawing illustrates the posterior mediastinum (outlined in black).

does not occur and the azygos vein provides an alternate route for systemic venous return to the heart. This anatomic variant results in an enlarged azygos vein, which may be mistaken for lymphadenopathy (Fig 14).

Posterior Mediastinum

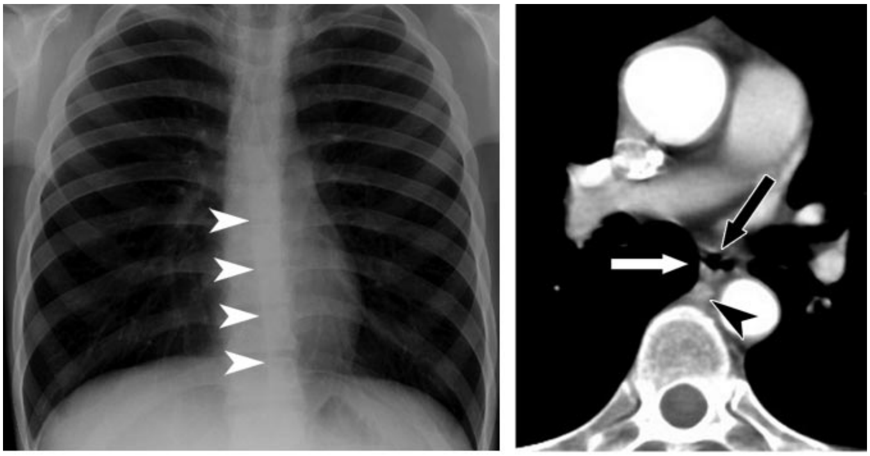
Anatomy

The posterior mediastinum is bounded anteriorly by the posterior trachea and pericardium, anteroinferiorly by the diaphragm, posteriorly by the vertebral column, and superiorly by the thoracic inlet (Fig 15). As discussed previously, the true anatomic posterior boundary is the vertebral column; however, with respect to mediastinal disease, masses in the paraspinal regions are usually included in the posterior mediastinum. The contents of the posterior mediastinum include the esophagus, descending aorta, azygos and hemiazygos veins, thoracic duct, vagus and splanchnic nerves, lymph nodes, and fat (1,5,6).

As with the anterior mediastinum, disease involving any of the contents of the posterior mediastinum may result in a mass, and knowledge of the normal anatomy aids in developing a differential diagnosis (Table 3).

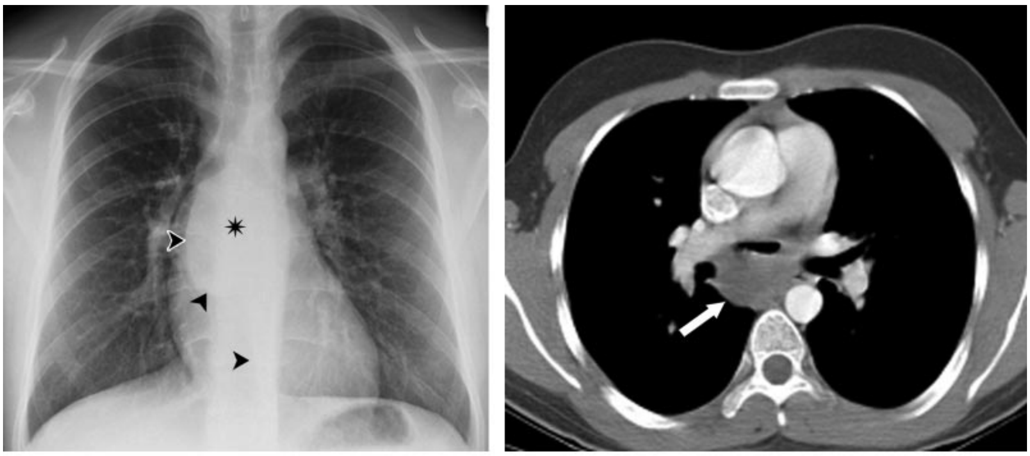
Azygoesophageal Recess

The azygoesophageal recess is the interface between the right lung and the mediastinal reflection inferior to the arch of the azygos vein, with the esophagus lying anteriorly and the azygos vein posteriorly within the mediastinum. At radiography, this interface is seen as a line, or, more accurately, an edge (Fig 16). In its upper third, as it deviates to the right at the level of the carina to accommodate the azygos vein arching forward, the line is usually straight or concave relative to the right lung. In children and young adults, a convexity to the right may be seen (16). In its



a. b.

Figure 16. Azygoesophageal recess reflection. **(a)** Posteroanterior chest radiograph shows the azygoesophageal line (arrowheads). **(b)** CT scan shows the azygoesophageal recess (white arrow) formed by the esophagus anteriorly (black arrow) and the azygos vein posteriorly (arrowhead). The azygoesophageal line in **a** represents the interface between this recess and the lung.



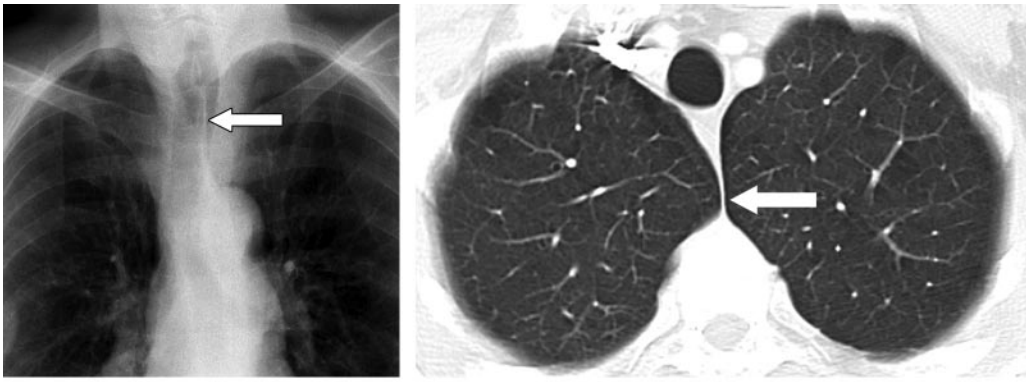
a. b.

Figure 17. Bronchogenic cyst. **(a)** Posteroanterior chest radiograph demonstrates a subcarinal abnormality with increased opacity (*), splaying of the carina, and abnormal convexity of the upper and middle thirds of the azygoesophageal line (arrowheads). **(b)** Corresponding CT scan helps confirm a subcarinal mass (arrow), which proved to be a bronchogenic cyst.

middle third, the line has a variable appearance: It is usually straight, but in the region of the right pulmonary veins a minimal convexity to the right may be seen in adults. In its lower third, the line is usually straight (7,16). If there is air within the esophagus, the right esophageal wall (and any adjacent paraesophageal tissue) may be seen as a stripe. If the left lung forms an interface with the esophagus, the left esophageal wall may have a similar appearance.

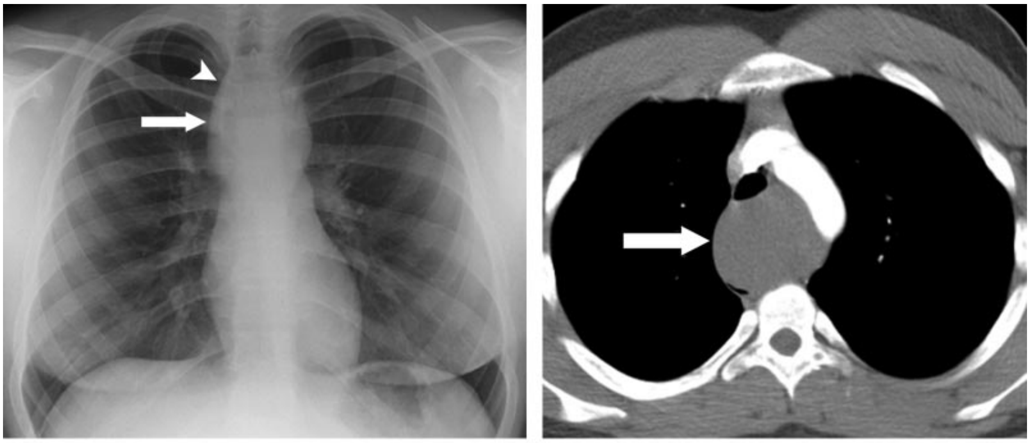
Teaching Point

The azygoesophageal recess reflection is a prevertebral structure and is, therefore, disrupted by prevertebral disease. It has an interface with the middle mediastinum; thus, the resulting line seen at radiography can be interrupted by abnormalities in both the middle and posterior compartments. Again, the divisions of the mediastinum are theoretic rather than physical and do not limit disease occurrence. Identifying the close anatomic relations of a mass is often more instructive. In the subcarinal region, left atrial enlargement, subcarinal lymphadenopathy, esophageal disease, and bronchogenic cysts (Fig 17) may cause deviation of the azygoesophageal line. More inferior to the subcarinal region, the azygoesophageal recess may be disrupted by esophageal disease and hiatal hernia.



a. b.

Figure 18. **(a)** Collimated posteroanterior chest radiograph shows the posterior junction line (arrow) projecting through the tracheal air column. **(b)** CT scan shows the posterior junction line (arrow), which is formed by the interface between the lungs posterior to the mediastinum and consists of four pleural layers.



a. b.

Figure 19. Bronchogenic cyst. **(a)** Posteroanterior chest radiograph shows a mass (arrow) obliterating the posterior junction line. Note that the mass extends above the level of the clavicle and has a well-demarcated outline due to the interface with adjacent lung (arrowhead). **(b)** CT scan helps confirm the posterior location of the mass (arrow), which proved to be a bronchogenic cyst.

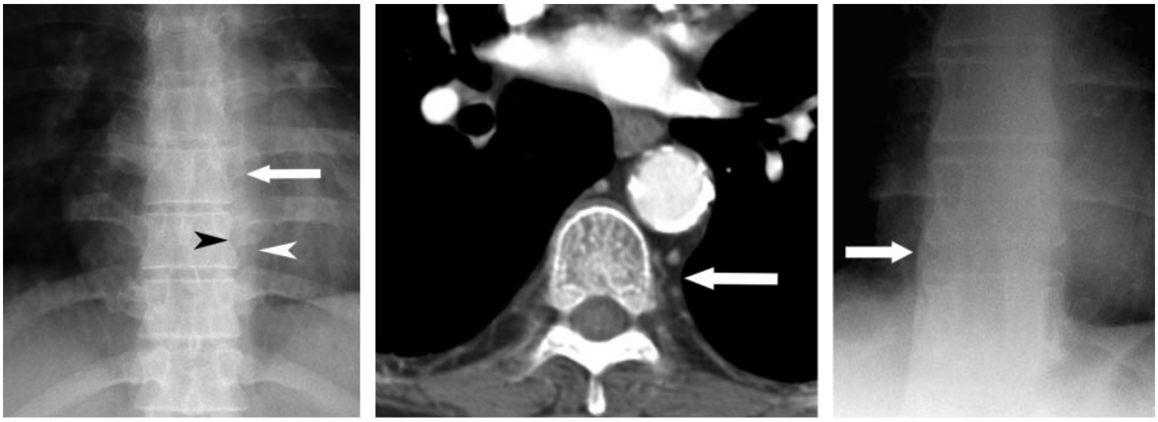
Posterior Junction Line

The posterior junction line is a posterior mediastinal line that is seen above the level of the azygos vein and aorta and that is formed by the apposition of the lungs posterior to the esophagus and anterior to the vertebral bodies, usually the third to fifth thoracic vertebrae (Fig 18). It can occasionally be seen more inferiorly if the lungs come in contact posterior to the esophagus in the lower thorax. Like the anterior junction line, it consists of four layers of pleura. Unlike its counterpart, however, the posterior junction line can be seen above the suprasternal notch and lies almost vertical, whereas the anterior junction line deviates to the left (7).

Prevertebral disease superior to the level of the aortic arch may obliterate the posterior junction line (Fig 19). Further clues to the location of a mass in this region can be inferred from the lateral margins of the line above the level of the clavicles (see "Anterior Junction Line").

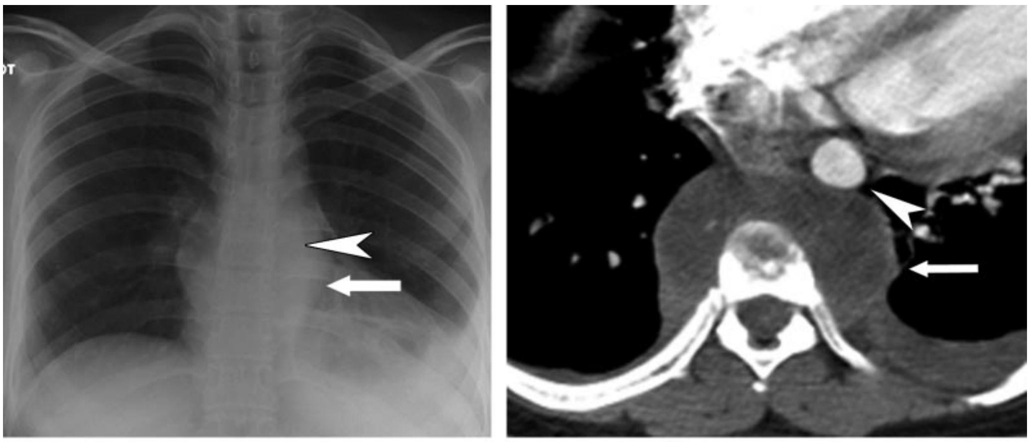
Paraspinal Lines

The paraspinal lines are created by the interface between lung and the pleural reflections over the vertebral bodies. The left paraspinal line is much more commonly seen than the right. The descending aorta holds the pleural reflection off the vertebral body, allowing the lung–soft tissue interface to be more tangential to the x-ray beam and,



a. b. c.

Figure 20. **(a)** On a collimated posteroanterior chest radiograph, the left paraspinal line (arrow) is seen separate and distinct from the vertebral body (black arrowhead) and the descending thoracic aorta (white arrowhead). **(b)** CT scan shows the left paraspinal line. The descending aorta holds the pleural reflection (arrow) away from the vertebral body, which allows the lung–soft tissue interface to be more tangential to the x-ray beam and therefore visualized as a line. **(c)** Collimated posteroanterior radiograph shows the right paraspinal line (arrow).



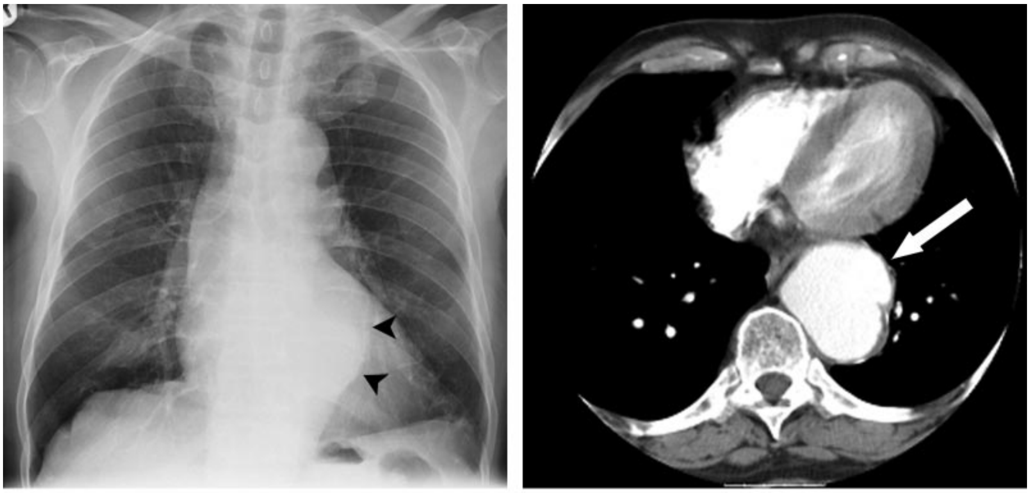
a. b.

Figure 21. Paraspinal abscess. **(a)** Posteroanterior chest radiograph shows a mass (arrow) effacing the left paraspinal line. The lateral wall of the descending aorta is seen as a separate entity (arrowhead). **(b)** CT scan shows a paraspinal abscess (arrow) effacing the paraspinal lines. The air–soft tissue interface between the lung and aorta remains intact (arrowhead), thereby preserving the normal radiographic appearance of the lateral aortic wall (cf **a**).

therefore, to be visualized as a line (Fig 20a, 20b). On the right, the pleural reflection is more often oblique to the x-ray beam and therefore less commonly seen (Fig 20c). The amount of mediastinal fat also affects these lines. Superior to the aortic arch, there is a relatively symmetric distribution of fat lateral to the vertebral bodies. Inferior to the aortic arch, there is usually more fat on the left side than on the right, with the aorta in a left paraspinal or prevertebral location. The left paraspinal line runs parallel to the lateral margin of the vertebral bodies and can lie anywhere medial to the lateral wall of the descending aorta (seen due to the interface between the lateral aortic margin and the lung). The right paraspinal line (when seen) lies within a few millimeters of the vertebrae (5,7).

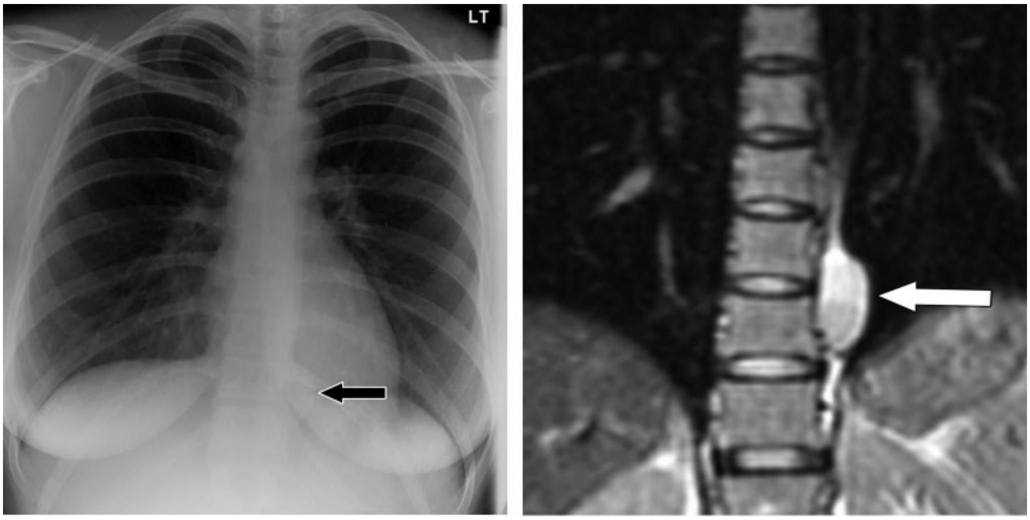
The paraspinal lines are disrupted by paravertebral disease—which commonly includes diseases originating in the intervertebral disks and vertebrae—and by neurogenic tumors. The left paraspinal line and the lateral margin of the descending aorta should be clearly distinguished from one another. This differentiation is demonstrated in Figure 21, which shows a paraspinal abscess effacing the left paraspinal line while the

Teaching Point



a. b.

Figure 22. Descending aortic aneurysm. **(a)** Posteroanterior chest radiograph shows lateral displacement of the lateral margin of the descending thoracic aorta due to an aortic aneurysm (arrowheads). **(b)** CT scan also demonstrates the aneurysm (arrow).



a. b.

Figure 23. Neurogenic tumor. **(a)** Posteroanterior chest radiograph shows a small mass (arrow) disrupting the left paraspinal line inferiorly. **(b)** Coronal T2-weighted magnetic resonance (MR) image helps confirm a left paraspinal mass (arrow).

aorta maintains an air–soft tissue interface with lung and is, therefore, still visible. In contrast, Figure 22 shows a descending aortic aneurysm with deviation of the lateral margin of the aorta. It should be remembered that the paraspinal lines also project below the level of the diaphragm at radiography, and disruption of the lines in this location can also be identified (Fig 23).

Further Assessment

Once a mediastinal mass has been identified, it can be assessed with cross-sectional imaging, which can help confirm its location and further characterize the disease. CT is most often used in the assessment of mediastinal masses, with MR imaging usually being used as an adjunct to CT. MR imaging has high contrast resolution and multiplanar capability, thereby providing additional information as to the location and extent of the abnormality, and is the preferred modality in evaluating neurogenic tumors because it provides information regarding the nature and extent of intraspinal involvement. In addition, MR imaging can further characterize tissue, is useful in showing the cystic nature of mediastinal lesions that appear solid at CT, and can help assess the mediastinum in patients who have contraindications to iodinated contrast material (17). If a posterior mediastinal mass is suspected, MR imaging may be the imaging modality of choice. However, this modality does not demonstrate calcification as well as CT and has poorer spatial resolution.

Summary

Many mediastinal reflections can be appreciated at conventional radiography, and their presence or distortion is the key to the interpretation of mediastinal abnormalities. Anterior mediastinal masses can be identified when both the hilum overlay sign and preservation of the posterior mediastinal lines are present. Widening of the right paratracheal stripe and convexity relative to the AP window reflection both indicate abnormality in the middle mediastinum. Disruption of the azygoesophageal recess can be caused by disease in either the middle or posterior mediastinum. Paravertebral masses disrupt the paraspinal lines, and the location of masses above the level of the clavicles can be inferred by their lateral margins: Posterior masses have sharp margins due to their interface with lung, whereas anterior masses do not.

Although the divisions of the mediastinum are not absolute, attempting to more accurately localize an abnormality with reference to the local anatomy of the mediastinal reflections may help narrow the differential diagnosis. Identification of the involved compartment helps determine appropriate further imaging.

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A Diagnostic Approach to Mediastinal Abnormalities

Camilla R. Whitten, MRCS, FRCR, et al

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Page 660
The hilum overlay sign (3) is present when the normal hilar structures project through a mass, such that the mass can be understood as being either anterior or posterior to the hilum (Fig 3).

Page 662
A right paratracheal stripe 5 mm or more in width is considered widened (8).

Page 663
A convex border between the AP window and the lung is considered abnormal.

Page 667
The azygoesophageal recess reflection is a prevertebral structure and is, therefore, disrupted by prevertebral disease. It has an interface with the middle mediastinum; thus, the resulting line seen at radiography can be interrupted by abnormalities in both the middle and posterior compartments.

Page 669
The paraspinal lines are disrupted by paravertebral disease—which commonly includes diseases originating in the intervertebral disks and vertebrae—and by neurogenic tumors.