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Solid Tumors of the Mediastinum in Adults

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A wide spectrum of solid tumors can develop in the mediastinum of adults. Like for any other tumor evaluation, the location and morphology play equally important role for lesion characterization. Compartmentalizing the mediastinal masses greatly narrows the number of possible differential diagnosis. Cross sectional imaging mainly with computed tomography (CT) and magnetic resonance imaging (MRI) are the preferred modalities of choice as they can establish the presence, location and morphology of the lesion allowing to suggest a possible diagnosis.
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Introduction

The mediastinum is the tissue compartment located between the lungs, posterior to the sternum, anterior to the spine, and extending from the thoracic inlet to the diaphragm. A myriad of pathology can present in this region, both neoplastic and nonneoplastic. Mediastinal tumors may present with localizing symptoms secondary to tumors' invasion or compression of surrounding structures (dyspnea, cough, dysphagia, and hoarseness) or systemic symptoms that typically result from release of excess hormones, antibodies, or cytokines such as in hypercalcemia from parathyroid adenoma or myasthenia gravis in thymoma. Regardless, the clinical manifestations are often nonspecific or vague, and imaging examination with either computed tomography (CT) or magnetic resonance (MR) is often required for determining size, location, composition, extension, and possible diagnosis of the mass.[1] Traditionally, the differential diagnosis is derived from the tissue or structure from which the mass is arising (ie, lymph nodes, vascular structures, thymus, thyroid, vertebral column, esophagus, and trachea).

We review the normal mediastinal anatomy and discuss the role of CT and MR imaging (MRI) in the diagnosis and prognosis of the most common solid mediastinal tumors in the adult patient.

Anatomy

Several classification systems have been proposed over the years that divide the mediastinum into multiple compartments, although no physical boundaries between compartments exist that limit disease. Important differences exist in the way anatomist, surgeons, and radiologist divide the mediastinal compartments, which can significantly modify clinical significance and potentially affect patient care.[2] Although most of mediastinal tumors are benign, masses in the anterior compartment are more likely to be malignant.[1] In any method used to divide the mediastinum, the divisions are theoretic and somewhat arbitrary rather than physical. Disease can spread from one compartment to another, and many diseases do not occur exclusively in any one compartment.[3-5]

We do not discuss radiographic signs that suggest a mediastinal lesion in this article, as cross-sectional imaging is the cornerstone of lesion characterization radiologically today. Shields, in 1972 proposed a 3-zone classification (anterior, visceral compartment in the middle, and posterior paravertebral) and is commonly used by surgeons. As was originally noted by Shields,[6] the visceral compartment occupies the thoracic inlet.[4] Of note, the Japanese Association for Research on the Thymus proposed a new method for classifying the mediastinal compartments based on cross-sectional imaging in 2013, (specifically in the transverse plane). In this CT-based classification system, the mediastinum is divided in four anatomic compartments: superior, prevascular (anterior), visceral (middle), and paravertebral (posterior). In an attempt to create a more "user-friendly" system, they cite that classifying the superior portion of the mediastinum has the advantage of making it easy to differentiate an intrathoracic goiter or neurogenic tumor of the thoracic inlet from other mediastinal tumors. They also do not include the cardiovascular system in their classification as actual mediastinal contents, rather boundaries of compartments. Finally, as the esophagus, trachea, and bronchi share an embryologic origin, they argued that these should all be classified into the middle mediastinum, i.e. one shared compartment.[4] As the proposal of this

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Table Compartmental Division of the Mediastinum, Its Contents, and the Most Common Solid Tumors in Each Compartment

Compartment	Anterior	Middle	Posterior
Boundaries	Anterior—posterior surface of sternum Posterior—anterior pericardium Superior—thoracic inlet Inferior—diaphragm	Anterior—anterior pericardium Posterior—vertical line drawn 1 cm behind the anterior margin of vertebral bodies Superior—thoracic inlet Inferior—diaphragm	Anterior—vertical line drawn 1 cm behind the anterior margin of vertebral bodies Posterior—a line connecting the tips of transverse processes of dorsal vertebrae Superior—thoracic inlet Inferior—diaphragm
Contents	Thymus Lymph nodes Intrathoracic thyroid Fat Left brachiocephalic vein	Lymph nodes Trachea Esophagus Heart Aorta Pulmonary artery SVC/IVC Thoracic duct	Paravertebral soft tissues Thoracic spine
Common solid tumors	*Thymic lesions* Thymoma Thymic carcinoma Thymolipoma Thymic lymphoma Thymic Carcinoid *Germ cell tumors* Teratoma Seminoma Nonseminomatous germ cell tumors *Thyroid lesions* Multinodular goiter Thyroid carcinoma *Parathyroid lesions* Adenoma Carcinoma Hyperplasia Lymph node enlargement Lymphoma Lipoma Extra-adrenal paraganglioma	Lymph node enlargement Lymphoma Lipoma Esophageal lesions	*Neurogenic tumors* Schwannoma Neurofibroma Malignant tumor Extra-adrenal paraganglioma Thyroid lesions Spinal lesions Hematopoietic lesions

mediastinal compartment classification method has not yet been validated outside of Japan, for the purposes of this article, we use the method of dividing the mediastinum into anterior, middle, and posterior compartments without a separate superior compartment; anatomical boundaries for these delineations used are outlined in the Table, with the common solid tumors occurring in those compartments. Other issues with the Japanese Association for Research on the Thymus method have been pointed out by the International Thymic Malignancy Interest Group, citing the added complexity of having a fourth anatomical compartment with nonanatomical features and its relative lack of common clinical usage as limitations.

In 2014, they published a CT-based 3-compartment mediastinal classification system (prevascular-anterior, visceral-middle, and paravertebral-posterior compartments).[7]

Contents of the anterior mediastinum include the thymus, lymph nodes, adipose tissue, and internal mammary vessels; the thyroid gland is traditionally considered an anterior mediastinal compartment structure if it extends into this region. Important contents of the middle mediastinum are the esophagus, heart, and pericardium, the ascending aorta and arch, the superior vena cava and inferior vena cava the brachiocephalic vessels, the pulmonary vessels, the trachea and main bronchi, lymph nodes, thoracic duct and the phrenic, vagus, and left recurrent laryngeal nerves.

The aortopulmonary window is an important middle mediastinal space and contains lymph nodes, the left recurrent laryngeal nerve arising from the vagus nerve, the left bronchial arteries, the ligamentum arteriosum, and fat.[5] Although the true anatomical posterior boundary is the vertebral column, with respect to mediastinal disease, masses in the paraspinal regions are usually included in the posterior mediastinum. Important contents of the posterior mediastinal compartment include the descending aorta, azygos and hemiazygos