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Brett W. Carter

Numerous systems have been created to divide the mediastinum into specific compartments for the purposes of generating a focused differential diagnosis for masses and other abnormalities identified on imaging, planning for biopsies and surgical interventions, and facilitating communication between health care professionals in a multidisciplinary setting. Most have focused on imaging and are based on arbitrary landmarks delineated on the lateral chest radiograph. The International Thymic Malignancy Interest Group has developed a classification system based on cross-sectional imaging, defining specific prevascular, visceral, and paravertebral compartments, that has been accepted as a new standard and is the topic of this review.

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Sherief H. Garrana and Melissa L. Rosado-de-Christenson

Prevascular mediastinal masses include a wide range of benign and malignant entities. Localization of mediastinal masses to specific compartments together with characteristic imaging findings and demographic and clinical information allows formulation of a focused differential diagnosis. Radiologists may use these methods to distinguish between surgical and nonsurgical cases and thus inform patient management and have an impact on outcomes. Treatment of choice varies based on the pathology, ranging from no intervention or serial imaging follow-up to surgical excision, chemotherapy, and/or radiation.

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John P. Lichtenberger III, Brett W. Carter, Dane A. Fisher, Regina F. Parker, and P. Gabriel Peterson

Thymic epithelial neoplasms, as classified by the World Health Organization, include thymoma, thymic carcinoma, and thymic carcinoid. They are a rare group of tumors and are often diagnosed incidentally in the work-up of parathymic syndrome, such as myasthenia gravis, or when mass effect or local invasion causes other symptoms. In each of these scenarios, understanding the radiologic-pathologic relationship of these tumors allows clinical imagers to contribute meaningfully to management decisions and overall patient care. Integrating important imaging features, such as local invasion, and pathologic features, such as necrosis and immunohistochemistry, ensures a meaningful contribution by clinical imagers to the care team.

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Marcelo F.K. Benveniste, Sonia L. Betancourt Cuellar, Brett W. Carter, Chad D. Strange, and Edith M. Marom

Thymic epithelial neoplasms are a group of malignant tumors that includes thymoma, thymic carcinoma, and thymic neuroendocrine tumors. Although several

staging systems have been developed over the years for use with these cancers, they have been interpreted and implemented in a nonuniform manner. Recently, the International Association for the study of Lung Cancer and the International Thymic Malignancy Interest Group developed a tumor-node-metastasis staging system that has been universally accepted and correlates with patient survival and outcomes. Although pathologic staging is determined by histologic examination of the resected tumor, imaging plays an important role in clinical staging and is important for informing therapeutic decisions.

## **Imaging of the Middle and Visceral Mediastinum**

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Patrick P. Bourgoquin and Rachna Madan

The visceral mediastinum contains important vascular and non-vascular structures including the heart, great vessels, lymph nodes, and portions of the esophagus and trachea. Multiple imaging modalities, including chest radiography, computed tomography, MR imaging, and nuclear medicine studies, can be used to detect, diagnose, and characterize masses in this compartment. Lymphadenopathy is the most common process involving the visceral mediastinum and can be seen with a wide variety of diseases. Less commonly seen entities include foregut duplication cysts, neoplasms and other lesions arising from the trachea and esophagus, paragangliomas as well as other mesenchymal tumors.

## **Esophageal Neoplasms: Radiologic-Pathologic Correlation**

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John P. Lichtenberger III, Merissa N. Zeman, Adam R. Dulberger, Sadiq Alqutub, Brett W. Carter, and Maria A. Manning

The epidemiology and clinical management of esophageal carcinomas are changing, and clinical imagers are required to understand both the imaging appearances of common cancers and the pathologic diagnoses that drive management. Rare esophageal malignancies and benign esophageal neoplasms have distinct imaging features that may suggest a diagnosis and guide the next steps clinically. Furthermore, these imaging features have a basis in pathology, and this article focuses on the relationship between pathologic features and imaging manifestations that will help an informed imager maintain clinical relevance.

## **Esophageal Cancer: Tumor-Node-Metastasis Staging**

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Sonia L. Betancourt-Cuellar, Marcelo F.K. Benveniste, Diana P. Palacio, and Wayne L. Hofstetter

Esophageal cancer is an uncommon malignancy that ranks sixth in terms of mortality worldwide. Squamous cell carcinoma is the predominant histologic subtype worldwide whereas adenocarcinoma represents the majority of cases in North America, Australia, and Europe. Esophageal cancer is staged using the American Joint Committee on Cancer and the International Union for Cancer Control TNM system and has separate classifications for the clinical, pathologic, and postneoadjuvant pathologic stage groups. The determination of clinical TNM is based on complementary imaging modalities, including esophagogastroduodenoscopy/endoscopic ultrasound; endoscopic ultrasound–fine-needle aspiration; computed tomography of the chest, abdomen, and pelvis; and fluorodeoxyglucose PET/computed tomography.

**Cardiac Neoplasms: Radiologic-Pathologic Correlation** 231

John P. Lichtenberger III, Brett W. Carter, Michael A. Pavio, and David M. Biko

Cardiac neoplasms are a diagnostic challenge on many levels. They are rare, their clinical presentation may mimic other much more common cardiac diseases, and they are at an uncommon intersection of oncologic and cardiac imaging. The pathology of primary cardiac neoplasms explains their varied imaging features, for example, calcification in primary cardiac osteosarcomas and T2 hyperintensity in myxomas. Integrating the imaging and pathologic features of cardiac tumors furthers our understanding of the spectrum of appearances of these neoplasms and improves the clinical imager's ability to confidently make a diagnosis.


**Imaging of the Posterior/Paravertebral Mediastinum** 243

Brett W. Carter and John P. Lichtenberger III

A wide variety of abnormalities may be encountered in the paravertebral mediastinum, ranging from congenital lesions to malignant neoplasms. A combination of localizing mediastinal masses to the paravertebral compartment, characterizing them with cross-sectional imaging techniques, and correlating the imaging findings with demographics and other clinical history typically enables the development of a focused differential diagnosis. Radiologists must be familiar with these concepts in order to help guide subsequent imaging and/or intervention and, when appropriate, treatment planning for neoplasms and other abnormalities.

**Added Value of Magnetic Resonance Imaging for the Evaluation of Mediastinal Lesions** 251

Allen P. Heeger and Jeanne B. Ackman

 Video content accompanies this article at <http://www.radiologic.theclinics.com>.

The high soft tissue contrast and tissue characterization properties of magnetic resonance imaging allow further characterization of indeterminate mediastinal lesions on chest radiography and computed tomography, increasing diagnostic specificity, preventing unnecessary intervention, and guiding intervention or surgery when needed. The combination of its higher soft tissue contrast and ability to image dynamically during free breathing, without ionizing radiation exposure, allows more thorough and readily appreciable assessment of a lesion's invasiveness and assessment of phrenic nerve involvement, with significant implications for prognostic clinical staging and surgical management.

**Potential Pitfalls in Imaging of the Mediastinum** 279

Orly Goitein, Mylene T. Truong, Elena Bekker, and Edith M. Marom

Chest computed tomography (CT) is the modality of choice for mediastinal imaging. The high-resolution images provided by multi-detector CT result in routine visualization of normal anatomic structures, which can be confused with pathology. In addition, many mediastinal abnormalities are discovered incidentally, with a routine chest CT protocol which may be insufficient for definite diagnosis. Awareness of the spectrum of potential pitfalls of mediastinal imaging, artifacts related to flow, motion, and solutions to mitigate these problematic issues is important in accurate interpretation. The purpose of this review is to highlight and discuss potential pitfalls in the imaging of the mediastinum.

**Image-Guided Biopsies and Interventions of Mediastinal Lesions****291**

Soheil Kooraki and Fereidoun Abtin

Optimal assessment of the mediastinal masses is performed by a combination of clinical, radiological and often histological assessments. Image-guided transthoracic biopsy of mediastinal lesions is a minimally invasive and reliable procedure to obtain tissue samples, establish a diagnosis and provide a treatment plan. Biopsy can be performed under Computed Tomography, MRI, or ultrasound guidance, using a fine needle aspiration or a core-needle. In this paper, we review the image-guided strategies and techniques for histologic sampling of mediastinal lesions, along with the related clinical scenarios and possible procedural complications. In addition, image-guided mediastinal drainage and mediastinal ablations will be briefly discussed.