



Approach to the prevascular mass

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Abstract: A wide variety of lesions can manifest as a localized tumor or mass in the anterior mediastinum. The radiological evaluation of these patients begins with chest radiograph and is followed by CT or MRI. CT and MR imaging allow visualization of the exact location of the lesions. The International Thymic Malignancy Interest Group (ITMIG) has introduced a new definition of mediastinal compartments to be used with cross-sectional imaging and adopted as a new standard. This clinical classification defines a 3-compartment model of prevascular (anterior), a visceral (middle), and a paravertebral (posterior) compartment, with anatomic boundaries defined clearly by computed tomography. The most common masses in the prevascular compartment include thymic abnormalities (cysts, hyperplasia, thymoma, thymic carcinoma, and neuroendocrine tumors), germ cell neoplasms, and lymphoma. Metastatic lymphadenopathy and intrathoracic goiter are sometimes seen.

Keywords: Mediastinal prevascular mass; International Thymic Malignancy Interest Group (ITMIG); new definition of mediastinal compartment; thymoma

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Introduction

On the basis of discussions with experts in the field of mediastinal diseases, the International Thymic Malignancy Interest Group (ITMIG) has introduced a new definition of mediastinal compartments to be used with cross-sectional imaging and adopted as a new standard (1). This clinical classification defines a 3-compartment model of prevascular (anterior), a visceral (middle), and a paravertebral (posterior) compartment, with anatomic boundaries defined clearly by computed tomography.

Thymic cyst

Simple congenital thymic cysts usually appear as well-defined water-attenuation masses with imperceptible walls. Multilocular thymic cysts may appear as well-defined, heterogeneous, multilocular cystic masses with a clearly seen wall (2). However, some thymic cysts may have an increased CT attenuation if hemorrhage or infection occurs as a complication and may be misdiagnosed as solid

masses (*Figure 1A,B*). MRI is useful in this situation. By using water-sat sequence, thymic cysts can be diagnosed with confidence (*Figure 1C,D,E,F*). Of course, any thymic cysts show no enhancement on CT or MRI. Curvilinear calcification of the cyst wall occurs in a minority of cases.

Thymoma

Thymoma, even when invasive, typically manifests as a well-defined, spherical or lobulated soft-tissue mass located in the region of the thymus (3). Thymoma may show thin curvilinear capsular calcification and may be separated by thick fibrous septa (4-6). Tumor heterogeneity with areas of low attenuation representing hemorrhage, necrosis, or cystic formation may be a dominant feature. Mass usually enhances uniformly after intravenous contrast administration, unless necrosis and hemorrhage are present (7). Cross-sectional imaging findings highly suggestive of capsular invasion include irregular structures, calcification, cystic or necrotic portion, encasement of mediastinal structure, or an irregular interface with the

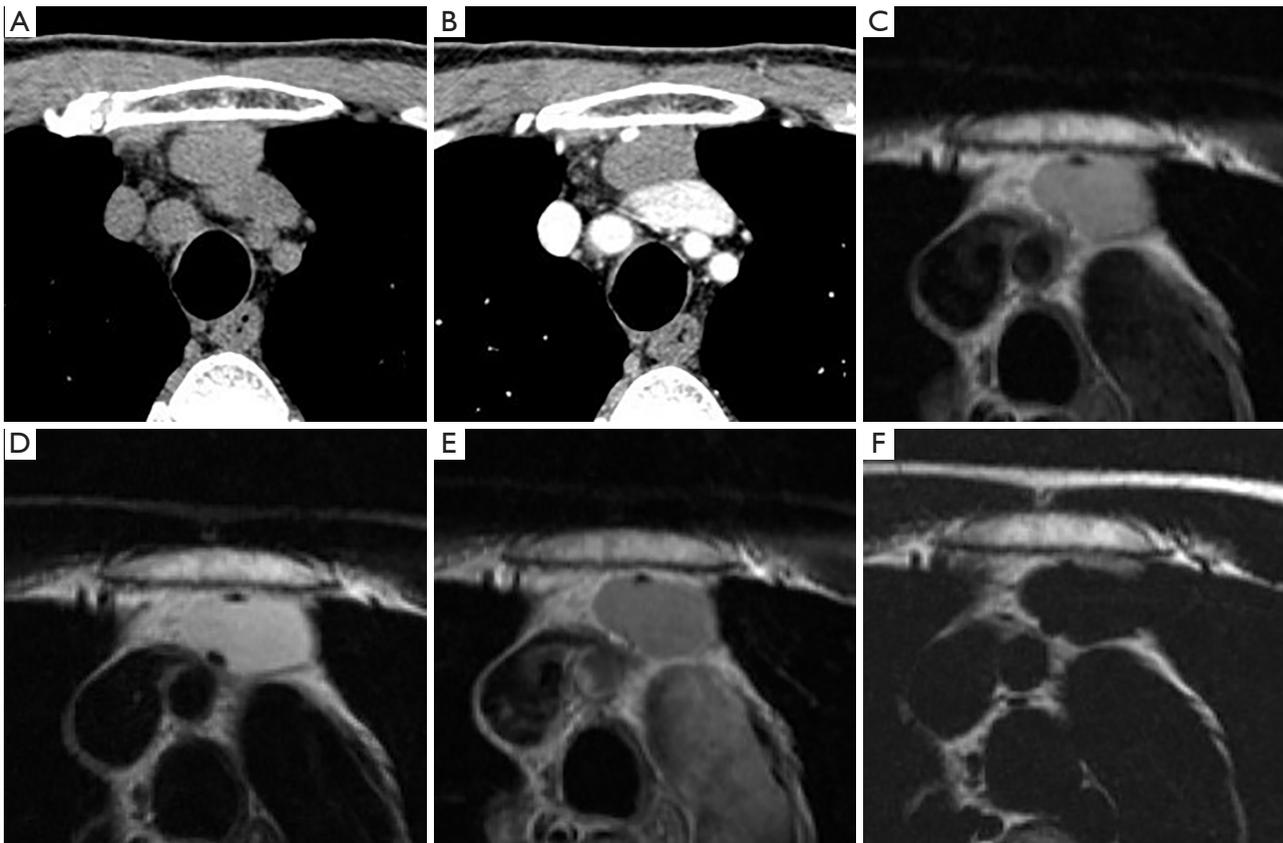


Figure 1 Thymic cyst. (A) Non-contrast CT shows soft tissue density mass in the anterior mediastinum. Average CT value of this mass is 50 HU. (B) Contrast CT shows no enhancement in this mass. (C) T1-weighted image (TR/TE =1,153/21) and (D) T2-weighted image (TR/TE =5,769/91) shows high intensity mass in the anterior mediastinum. (E) Gd-enhanced T1-weighted image (TR/TE =1,153/21) shows no enhancement in this mass. (F) This mass reveals homogeneous decrease in intensity on Water-sat T2-weighted image (TR/TE =5,769/91). TR, repetition time; TE, echo time.

adjacent lung (6,8). However, the absence of a tissue plane between the neoplasm and adjacent structures does not necessarily signify invasion; thus, the surgeon's *in situ* assessment remains the most reliable (7). Drop metastases to the ipsilateral pleural space may manifest as pleural nodules and may progressively coalesce to encase the lung, simulating the radiologic appearance of a diffuse malignant mesothelioma (6). However, in case of extensive pleural involvement by tumor, pleural effusion is rare (9).

Thymic carcinoma

Thymic carcinoma manifests as a large and highly aggressive anterior mediastinal mass in which areas of necrosis, hemorrhage, calcification, or cystic formation may be seen (10). Invasion of the great vessels, lymph node

enlargement, phrenic nerve palsy or extrathymic metastases are suggestive of thymic carcinoma rather than thymoma (11).

Thymic carcinoid

Thymic carcinoid has been described as prevascular mediastinal mass that is generally indistinguishable from thymomas and thymic carcinomas at CT (12). About 25% of patients with thymic carcinoids have a positive history of multiple endocrine neoplasia type 1 (MEN-1) (13) and MEN-1 associated thymic carcinoids occurred almost only in male adults.

Teratoma

Teratoma typically manifests as multilocular cystic mass

with a thin capsule and internal soft-tissue septa, containing soft-tissue, fluid, fat, or calcium attenuation, or any combination of the four. The combination of fluid, soft-tissue, calcium, and fat attenuation in a cystic prevascular mediastinal mass is a highly specific finding that permits the prospective radiologic diagnosis of mature teratoma (14). High lipid content in the cyst fluid may produce fat-fluid level that is a highly specific finding. Inhomogeneity of the internal components and changes in the adjacent lung parenchyma, pleura, or pericardium can be used as signs of tumor rupture (15).

Malignant germ cell tumors

Seminomas appear large and coarsely lobulated and typically have homogeneous soft-tissue attenuation. They may mimic lymphoma with nodal coalescence. The neoplasm may obliterate tissue planes or directly invade adjacent structures (16). Slight homogeneous enhancement may occur after contrast administration. Rarely, necrosis may result in cystic changes with little residual solid tumor, mimicking a multilocular thymic cyst. Calcification is rare. Metastases to regional lymph nodes and bone occasionally occur. Nonseminomatous malignant germ cell tumors are typically large, with heterogeneous attenuation, and may be well-circumscribed or poorly defined. Extension to both sides of the midline and mass effect are common. CT scan shows extensive central areas of heterogeneous low attenuation due to necrosis and hemorrhage. A border of high attenuation along the periphery of the tumor that enhances after administration of intravenous contrast material and calcification have been described (16). Tissue planes are frequently obliterated. The tumor may invade mediastinal structures, lung, and chest wall and may metastasize to regional lymph nodes and distant sites. Pleural and pericardial effusions are common.

Thymic lymphoma

Thymic lymphoma is a heterogeneous group of lymphoproliferative neoplasm. Common subtypes of thymic lymphoma are primary mediastinal large B-cell lymphoma, precursor T-lymphoblastic lymphoma, and Hodgkin lymphoma. Primary mediastinal large B-cell lymphoma (PMLBCL) most probably arises intrathymically (17) and then aggressively invades adjacent structures and tissues, including regional lymph nodes, whereas distant lymph nodes are rarely affected. Characteristic features of

PMLBCL include regular contour and absence of cervical and abdominal lymphadenopathy (18). The presence of vascular involvement is associated with increased likelihood of PMLBCL. Precursor T-lymphoblastic lymphoma (PTLBL) occur most frequently in late childhood, adolescence, and young adulthood, with a male predominance. CT findings including the presence of cervical lymph nodes or inguinal lymph nodes, the presence of pericardial effusion, and the absence of surface lobulation is significantly associated with the likelihood of PTLBL (18). Hodgkin lymphoma (HL) typically spreads to contiguous lymph node regions, rather than showing discontinuous dissemination. Masses typically exhibit homogeneous soft-tissue attenuation, while large tumors may demonstrate heterogeneity with complex low attenuation representing necrosis, hemorrhage, and cystic degeneration. Characteristic features of HL include irregular contour of the anterior mediastinal mass and high prevalence of associated mediastinal lymphadenopathy. CT findings independently associated with increased likelihood of HL were surface lobulation, the absence of vascular involvement, and pleural effusion (18).

Conclusions

A new definition of mediastinal compartments by ITMIG is designed to enable precise identification of mediastinal abnormalities on CT or MRI and helps to make a differential diagnosis. Some mediastinal masses manifest with specific features on CT or MRI which lead to a correct diagnosis with imaging alone.

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