Anterior mediastinal masses: more than the 4 T's

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Learning objectives

In adults mediastinal masses settle more frequently in the anterior portion of the mediastinum, where 75% of lesions are germ cell tumors (teratoma), thymoma, lymphoma and thyroid tissue.

However there are several types of tumoral pathology of the anterior mediastinal, the ones should be kept in mind to characterize and to carry out a differential diagnosis with imaging techniques.

Our objective is to review some rare lesions of the anterior portion of the mediastinum with CT (computed tomography) cases.
Background

ANATOMY REVIEW

Limits of anterior mediastinum (figure 1):
- Lateral: parietal mediastinal pleura
- Anterior: sternum
- Posterior: ventral cardiac surface, trachia and brachiocephalic vessels
- Inferior: diafragm
- Superior: thoracic operculum

Frequently lesions get spreaded to other compartments and there is a very small chance to know where they come from.

Contains:
- Fat, Thymus, lymph nodes and arterial, venous and lymphatic vessels.

PATHOLOGY

Common lesions (the 4 T's)

- Thyroid goiter and ectopic thyroid tissue:

Usually goiter presents continuity with the thyroid cervical gland across the thoracic operculum and determines tracheal displacement. A quarter of cases it spreads to meddle and posterior mediastinum. Goiter presents heterogenius attenuation at CT (hyperdense parenchyma and cyst formation), which increases once intravenous contrast administration has started. Calcifications are prevalent. Signs that suggest malignancy include adenopathies and fat and adjacent organ infiltrations.

- Cell germ tumors (teratoma).

The most common one is the mature teratoma, which is a benign tumor and derives from more than one germ layer. The CT shows a well defined mass with a solid, cystic and
fatty component in different proportions. Fatty tissue stands by a 60 % of teratomas and there is a very characterized existence of fat-fluid level. Calcification and ossification are very frequent.

Seminoma is the most common malignant cell germ tumor of the mediastinum. It is usually a lobulated mass with a homogeneous attenuation at CT associating necrotic and cystic areas. Chest wall involvement and calcifications are very bizarre.

Other malignant cell germ tumors are immature teratomas, choriocarcinomas and embryona carcinomas. They manifest as heterogeneous masses due to necrosis. Invasion and growth into adjacent organs and mediastinal fat is frequent. Calcifications are unusual.

-Terrible lymphoma (figure 2).
Adenopathies in the anterior mediastinum can be due to a lot of diseases: metastasis, lymphoma, sarcoidosis, infection or cardiac failure. We will refer to the characteristics of the lymphomas.

Hodgkin’s and non Hodgkin’s lymphomas usually are well-marginated or lobulated homogenous masses with smooth enhancement after intravascular contrast administration. Necrosis is not unusual and calcifications may appear after treatment.

- Non Hogkin: it is commonly seen in children and young adults. 90 % of patients develop extrathoracic involment. Solitary adenopathies and in costophrenic angle are often seen. Sometimes it show strong enhancement after intravenous contrast.

- Hodgkin: nodular sclerosis is the most common Hodgkin subtype, showing extend necrotic areas. It spreads through ganglionar levels, including internal thoracic ganglia. Pleural, parenchymal and thymic infiltration may occur.

-Thymus

Thymoma (figure 2):
In adults thymoma is the most common neoplasm of the anterior mediastinum. Myasthenia Gravis or other autoimmune deseases are associated to 50% of cases. Non invasive thymomas: CT shows well-marginated masses, with smooth or lobulated contours, that frequently arises from one lobe of the thymus. Enhancement is usually homogeneous and calcification may occur being punctate or linear along the capsule. Necrosis is unusual.

Invasive thymoma: produces pleural dissemination. CT shows pleural nodules without metastasis to distant.
Thymic carcinoma:
Presents heterogeneous enhancement, due to necrosis and calcifications. Usually infiltrate adjacent organs or metastasize to distant.

Thymic follicular hyperplasia (figures 3 and 4):
Associated with autoimmune diseases such as myasthenia gravis, thyrotoxicosis or lupus. It is due to B and T lymphocitic proliferation in the germinal center.
It may usually appear, at CT, as normal parenchyma, enlarged thymic lobes or diffuse thymic remnats along the anterior mediastinum

-Other thymic lessions
Cyst
Thymic lymphoma, associated wiht Hodgkin disease.
Thymolipoma
Thymic carcinoid.
True secundary thymic hyperplasia.

Uncommon lesions

-Parathyroid adenoma (figure 5):
Frequently ectopic parathyroid adenomas are settled in the anterior mediastinum, next to or inside the thymus. At CT parathyroid adenomas are seen as little adenopathies. 99mTechnetium-sestamibi parathyroid gammagraphy helps to identify parathyroid tissue.

-Pericardial cyst:
Are usually congenital but may also be acquired after cardiothoracic surgery. Cysts frequently occur in the cardiophrenic angle. CT shows an homogeneous thin-walled cystic lesion without enhancement.

-Mesenchymal tumors:
Leiomyosarcoma:
They arise from vascular structures in the anterior mediastinum. Usually occur in the fifth or sixth decade. Clinical manifestations are due to local mass effect: superior vena cava syndrome, dyspnea or pain. CT shows large heterogeneous neoplasms secondary to necrosis or hemorrhage.
**Rhabdomyosarcoma (figures 6 and 7):**

Typically presents in childhood or between the fifth and the seventh decades. They arise from the chest wall, the diaphragm or a sarcomatous degeneration of a teratoma.

At CT rhabdomyosarcomas manifest as large masses with variable attenuation due to necrosis and cystic components within the masses.

**Hemangioma:**

CT shows well-marginated masses with calcifications consequence of previous thrombosis and strong enhancement after the administration of intravascular contrast media.

**Angiosarcoma:**

Usually are heterogeneous masses with areas of hemorrhage, cyst degeneration and necrosis. They present strong contrast enhancement.

Thoracic angiosarcomas usually arise in the heart, however primary angiosarcomas can also grow in the anterior mediastinum without an obvious vascular origin.

**Lymphangioma:**

Proliferation of lymphatic tissue that tends to reach the anterior mediastinum by growing from cervical or axillary lesions. A small percentage comes from the mediastinum.

They are well-marginated multicystic masses, which mild enhancement after contrast administration. It also exist mixed-shape lymphangioma and angioma.

**Epithelioid hemangioendothelioma (figures 8 and 9):**

Often seen in females patients, usually origineted in medium and large venous vessels, these lesions are halfway between hemangioma and angiosarcoma. They are slow growers and metastasis can rarely occur. In case of appearing the prognosis will worsen as it will do in case of adjacent organs invasion.

At CT they are similar to carcinomas and lymphomas metastasis. It is usually reflected as a poorly-marginated mass with moderate enhancement after the administration of intravascular contrast media. Calcification may occur.

**Lipoma and Liposarcoma:**
They can not differentiate at CT images, both present mixed soft tissue and fat attenuation. Usually high-grade liposarcomas present a predominant soft tissue attenuation and infiltrate diffusely the mediastinum.
**Fig. 1:** Limits of anterior mediastinum. Saggital section of contrast CT.

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Fig. 2: A: Thymoma in sagittal section of thoracic CT. B: Lymphoma in axial section of thoracic CT. Both masses are very similar at CT: well-marginated, mild enhancement after intravenous contrast and areas of cystic-necrotic degeneration.

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**Fig. 3:** Thoracic CT without IV contrast. Thymic follicular hyperplasia CT shows nodules with soft tissues attenuation along the anterior mediastinum in a patient with rheumatoid arthritis.

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**Fig. 4:** Thymic follicular hiperplasia. The biopsy shows thymic parenchyma with multinodular architecture separated by lobule of fat tissue. A: Hematoxiline-eosine tinction showing lymphofollicular hiperplasia with persistence of Hassall's corpuscles (degenerated epithelial reticular cells). B, C an D: Lymphoid follicle with B: CD 20 marker. C: Giemsa tinction. D: MIB1 marker.

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Fig. 5: Paratiroid adenoma. A: 99Tc- sestamibi gammagraphy shows radionuclide deposit in the mediastinum. B: Coronal CT section showing an hyperdense nodule in the anterosuperior mediastinum.

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Fig. 6: Rhabdomyosarcoma in sagital and axial contrast CT sections. Findings: -Anterior right mediastinal heterogeneous mass with strong enhancement. -Pleural effusion. -Nodular pleural thickening.

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Fig. 7: Hystopathology of rhabdomyosarcoma showed a poorly differentiated mesenchymal tumor, which contains a pattern of fusiform cell and round cell. In immunochemistry markers of vimentin and actine of striated muscles are positive. Smooth muscle markers were negative. A: Hematoxylin-eosin tinction. B: Positive vimentin. C: Positive actine. D: Detail of vimentin.

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Fig. 8: Contrast CT of the chest in coronal and sagittal sections shows a mass in the upper anterior and middle mediastinum, which infiltrates the superior vena cava, producing a prominent collateral circulation. A pleural thickening can also be seen.

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Fig. 9: Mesenchymal tumor with dense fibrous connective tissue, with laxus basophilic areas, which acquire mixoid morphology. The stroma contains fusiform cells. It also appear random agrupations of giant epithelioid cells. These cells present moderately atypical nuclei. Immunochemistry was positive for CD31 and CD10 (vascular differentiation). A: hematoxylin eosin staining. B: positive for CD31 marker.

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Imaging findings OR Procedure details

A 64 or 128 slice CT are used to perform exams.
Conclusion

Anterior mediastinum tumors are a diagnosis challenge for radiologists because of the similarity that they do present in the CT studies.

In addition to the four most frequent masses we have to count on other lesions which also can be found at this level.

There are epidemiological data and radiological characteristics that let an approach to the final diagnosis that provides the histopathology.
References


