

MULTIDETECTOR COMPUTED TOMOGRAPHY (MDCT) IN THE DIAGNOSIS OF THE THYMOMA

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ABSTRACT

Thymoma is the most common cancer of the anterior mediastinal compartment. It represents the 20% of all mediastinal tumors in adult and about 50% of anterior mediastinal cancer. Thymoma typically occurs in people with age of 40-60 years. Recognition of thymoma is very important, because a complete resection of the tumor gives an excellent prognosis. Diagnostic imaging plays a key role in the study of mediastinal diseases and thymoma. Multidetector computed tomography (MDCT) might allow a characterization of the lesion and proper treatment planning. We report the case of a man with cholelithiasis that during preoperative examinations reported a large asymptomatic thymoma.

Key words: *Thymoma, front mediastinal, Computerized tomography, large mass, x-ray, MDCT.*

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Introduction

Thymoma originates from the epithelial cell population in the thymus with different histological subtypes⁽¹⁾.

Type A, if the epithelial cells have an oval or fusiform shape (less lymphocyte count);

Type B if they have an epithelioid shape (B1 (lymphocyte-rich), B2 (cortical) and B3 (epithelial)⁽²⁾

Type AB if the tumor contains a combination of both cell types.

Between histologic subtypes type AB thymoma is definitely the most frequent.

Thymoma is the most common primary tumor of the anterior mediastinum; the average age is between 40-60 years⁽³⁾, with no significant difference between males and females.

The incidence of thymoma in the United States is 0,13 per 100000 person-years⁽⁴⁾.

This tumor is uncommon in children and young adults, increases in middle age, and peaks in the seventh decade of life. The incidence in US is higher in blacks and Asian Pacific people than in white or Hispanics ones. The highest incidence was referred to Asian Pacific people; in black people thymoma is more frequent at a younger age than white ones (median age at diagnosis 48 instead of 58 years).

Studies do not suggest a role as risk factors for tobacco and alcohol use. There are no data about the role of occupation environmental exposures or diet and nutrition. The absence of confirmations about the familiarity of thymoma rule out genetic risk factors: it was difficult to evaluate family clustering for the rarity of thymoma and its onset at older ages^(5,6).

Whenever possible thymic tumors require surgical removal.

About one third of thymomas are asymptomatic.

matic and they are discovered incidentally (on chest radiography, for example)^(7,8). When present, symptoms are mostly due to “intra-mediastinal mass effect”: chest pain, cough, dyspnea, dysphonia; immunological disorders as myasthenia gravis may be associated conditions. Superior vena cava syndrome and neurologic deficits more commonly occur with malignancies⁽⁹⁾.

More frequently thymoma is located in the anterior superior mediastinum, in front of the aorta. The non-invasive Thymoma appears as a rounded, well-circumscribed oval mass that shows soft tissue density with calcifications.

At multidetector computed tomography (MDCT) examination, the 30-40% of thymomas are classified as invasive growth, resulting in pleural thickening or pericardial effusion, obliteration of fat planes of the mediastinum, bone erosion of the sternum. Remote metastases are observed in <10% of cases, primarily to the liver, bones, central nervous system, kidney, lymph nodes, adrenal and thyroid.

Invasive thymomas are more likely to be greater in size than noninvasive ones, with lobulated or irregular contours, areas of low attenuation, necrotic or cystic component, multifocal foci of calcification and heterogeneous contrast enhancement⁽¹⁰⁾.

The evidence of vascular invasion and deposits on the pleura are further signs of malignancy.

Tumour recurrence and metastasis correlate with greater size, lobulated or irregular contours, complete mediastinal fat obliteration, great vessel invasion and pleural implants⁽¹¹⁾.

The main role of CT is to evaluate the location and extent of a mediastinal mass. The presence of fat and cystic components, calcification together size, shape, and precise location within the mediastinal compartments are the key features for differential diagnoses of mediastinal masses.

X-rays can show the presence of direct and indirect signs of an anterior mediastinal mass and the relationship with the surrounding structures. The most important things to remember are: obliterated retrosternal clear space, hilum overlay sign, displaced anterior junction line⁽¹²⁾.

In the last decade the introduction of multidetector computed tomography (MDCT) has revolutionized diagnostic imaging. The performance of CT scanning has improved substantially and has allowed for the routine use of thin sections, reduced acquisition time and increased scan length.

MDCT allows a long scan range and high spatial resolution, and can also cut examination time. The 16- to 64-row scanners in particular allow for scan times of less than 10 seconds for almost all body applications.

The advantages of MDCT are a consequence of shorter scan duration, longer scan range and thinner collimation compared with conventional CT. The greatest impact of improved acquisition speed, distance and section thickness has been on CT angiography. With faster scan a smaller than usual quantity of contrast medium can be used and better opacification of vascular structures can be achieved. Movement artifacts are much less problematic with MDCT.

Longer scan ranges are the prerequisite for high-resolution CT of the entire chest or thoracic, abdominal and peripheral CT angiography. The main breakthrough of MDCT has been in the area of thinner section, which make it possible to acquire a near isotropic data volume. As a consequence, arbitrary cross-sectional planes (multiplanar reformations: MPR) with high resolution (similar to that of original axial images) can be reconstructed from the data volume and excellent three-dimensional displays become possible.

Case presentation

In February 2014 a 63-year-old man (Body Mass Index-BMI: 26,4, familiar history with father died for myeloma and mother died for oldness, 2 brothers with no significant pathology) comes to our observation with diagnosis of cholelithiasis (Table 1). During preliminary examination, we perform a thoracic radiography, in which was reported a coarse opacity not dissociable from the left profile of the cardiac image (Fig. 1). Therefore an ultrasonography echocardiography was performed (even if a previous cardiac examination with Electrocardiography (ECG) was negative for cardiac diseases); it reported on the anterior and lateral wall of left ventricle the presence of a solid mass without infiltration of the ventricular wall.

Thus we plan a MDCT examination of chest, abdomen and pelvis. The CT scan confirmed the presence of a massive, solid, polylobulated and inhomogeneous mass (Ø116X113X80mm) in the anterior mediastinal compartment, closely linked to the costal and mediastinal pleura and pericardium, with calcifications inside (Fig. 2a).

	At admission	After surgery	1 st d after surgery	2 nd d after surgery	3 rd d after surgery	7 th d after surgery
Haemoglobin	14,3	12,7	11,7	11,1	10,9	11,6
Platelets	222	164	157	128	144	265
White Blood Cells	6,86	11,35	8,58	8,54	7,45	8,26
INR	1,1	1,1	1,3	1,4	/	/
Total bilirubin	2,20	1,24	1,20	1,41	/	1,95
Direct bilirubin	0,25	0,28	7,5	0,29	/	/
Sodium	139	142	141	141	137	138
Potassium	4,10	4,20	3,50	3,40	3,50	3,00
Chlorine	103	108	110	107	103	102
Calcium	8,9	7,4	7,5	7,6	7,8	8,3

Table 1: Blood Tests.

A heterogeneous enhancement of the lesion was observed after the injection of contrast agent (Figure b-c-d). The mass was contiguous to the main pulmonary artery, the left superior pulmonary vein, the left ventricle and the lingular bronchus. The arterial phase scan showed that the arterial supply of the mass came from branches of the internal mammary artery (Fig. 3).

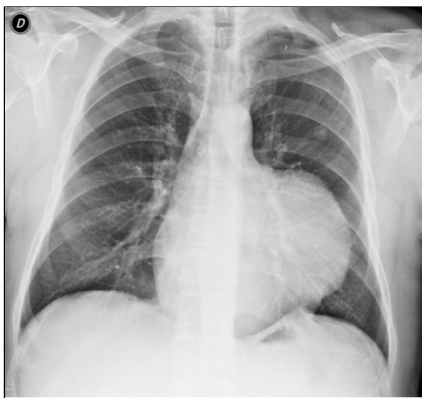


Figure 1: Plain x-ray film in postero-anterior view shows a mass not separable from the left margin of the mediastinum.

On the basis of this finding the diagnosis of thymoma was supposed.

Pre-operative tumoral markers⁽¹³⁾ was as follows⁽¹⁴⁾: CEA 1.1 ng/ml (n.v.0,0 - 3,4), CA 125= 10.4 U/ml (0,0 - 35,0), CA15.3= 15.6 U/ml (0,0 - 25,0), CA19-9= 8,8 U/ml(0,0 - 37,0); the only mild elevated parameter was alpha-fetoprotein: 7.1 IU/ml(0,0 - 5,8)⁽¹⁵⁾.

Therefore, after other preliminary examinations, we planned a surgical intervention. An open left thoracotomy was performed: after opening the

pleura, the solid mass was identified. Following the opening of mediastinal pleura, the mass was isolated from vascular pedicles and then removed. The surgical procedure confirmed the data described at CT examination about the vascularization of the mass and its relationship with the various mediastinal structures. After an accurate check of hemostasis, a double chest drainage was positioned and the surgical breach was sutured. After surgery the patient was transferred to the intensive care unit. On the first post-operative day patient come back to our surgical ward with good vital parameters except for an increase of body temperature (38.5°C) without particular alteration on blood examinations. We prescribe an infusion therapy with antibiotic association (Ciprofloxacin 400mg 2 times/day and

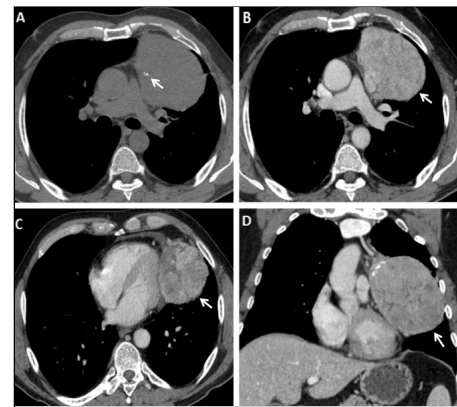


Figure 2: (A-D). (A) Axial nonenhanced CT scan demonstrates large soft tissue mass with speckled multifocal calcification (arrow) in the anterior mediastinum. (B-C) On axial postcontrast CT scan the mass shows mild contrast enhancement (arrows). The mass is contiguous respectively to the main pulmonary artery (B) and to the left ventricle (C). (D) Coronal reformatted image shows the mass (arrow) adjacent to the costal and mediastinal pleura and pericardium, the main pulmonary artery and the left ventricle.

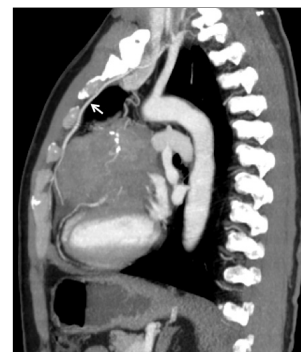


Figure 3: Sagittal Maximum Intensity Projection (MIP) reconstruction clearly shows the vascularity of the mass from internal mammary artery (arrow).

Teicoplanin 200mg), proton pump inhibitors-PPI, analgesics, low molecular weight heparin (LMWE). During the hospitalization we monitored the patient with thoracic radiography examinations to evaluate pulmonary remission and with blood examinations that didn't show significant alterations. After 9 days from surgery intervention, the patient was discharged in good clinical conditions. Histological examination disclosed a type AB thymoma (Fig.4), without capsular invasion (Stage I Masaoka classification; "capsulated thymoma" for Rosai classification (pT1)).

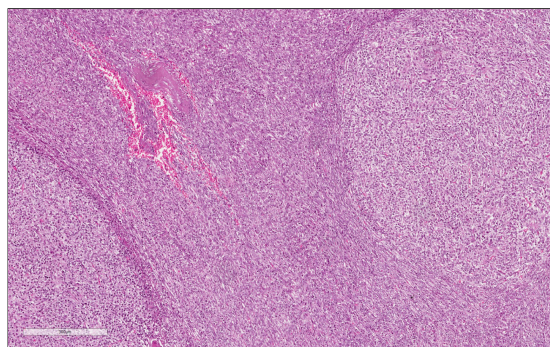


Figure 4: The two components of thymoma type AB: in the central zone fused cells surrounded by poor lymphocytic infiltrate (type A component); on the sides there are two lobules of lymphocytic cells (type B component).

I	Completely encapsulated
IIA	Microscopic invasion through the capsule into surrounding fatty tissue
IIB	Macroscopic invasion into capsule
III	Macroscopic invasion into adjacent organs
IVA	Pleural or pericardial implants
IVB	Lymphogenous or hematogenous metastasis to distant (extrathoracic) sites

Table 2: Masaoka-Koga classification.

The Masaoka-Koga classification⁽¹⁵⁾, is the most widely used staging system (Table 2).

Discussion

Our patient was asymptomatic, even though the presence of a big mediastinal mass. The differential diagnosis includes other common diseases of the anterior mediastinum such as lymphoma, thyroid disease and germ cell tumors^(17,18,19).

Teratomas originate from all three germ layer

derivatives and show a mixture of CT densities ranging from fat and soft tissue to calcium. Malignant teratoma can be differentiated from benign forms by its ill-defined margins, large necrotic areas, and its compression and displacement of mediastinal vascular structures⁽²⁰⁾.

An intrathoracic goiter generally represents a downward extension of orthotopic thyroid tissue. Therefore, finding the continuity between intrathoracic mass with the thyroid gland will suggest the correct diagnosis⁽²¹⁾.

Lymphomas can affect the anterior mediastinum with involvement of unusual lymph node groups. Unlike non-Hodgkin lymphoma, Hodgkin's disease spread from one group of lymph nodes to contiguous nodal groups, specially on the cervical and supraclavicular lymph nodes, and the prevascular and paratracheal lymph nodes of the anterior mediastinum⁽²²⁾.

Non-Hodgkin lymphomas show a noncontiguous mode of spread with involvement of unusual lymph node groups. Involvement of the mammary and paracardiac nodes are suggestive of non-Hodgkin lymphoma. Extranodal disease is more common than in Hodgkin's lymphoma^(23,24,25,26).

However in the presence of a mass of the anterior mediastinum is essential to proceed with the biopsy for a reliable diagnosis of the nature of the lesion⁽²⁷⁾.

Recent advances in CT technology have made MDCT easier and quicker, and reconstructed images have helped us to decide the approach and to avoid intraoperative injury of vessels^(28,29,30).

The MDCT visualization is easy and not invasive. Preoperative MDCT enabled to locate all the thymic veins that it is needed to divide and to define their course through the thymic fat tissue.

CT with 16- to 64-slice units makes true volumetric imaging more feasible. Thus MPR (Multiplanar Reformation), maximum intensity projections (MIP) and three-dimensional volume rendering has become potent tools for visualization of vascular structures. Multislice scanning has transformed CT into a fully three-dimensional imaging technique.

The development of MDCT has expanded the role of CT scanning of the vascular system by allowing the entire thoraco-abdominal aorta and its branches to be visualized with sufficient detail to obviate the need for conventional angiography⁽³¹⁾.

In our patient the arterial phase scan allowed us to demonstrate that the mediastinal mass was fed

by branches from the internal mammary artery (Fig. 3). This aspect has been of great aid in the diagnosis of thymoma; the thymus is normally perfused by branches coming mainly from the internal mammary artery. The study of the vascularization and the relationship of the mass with the great vessels was also essential for a correct surgical planning (Fig. 2-3).

Conclusion

The treatment of choice for thymoma is surgical resection: a complete surgical resection (R0) is an important prognostic factor for overall survival^(32,33,34).

Although the chest radiograph identifies the tumor, the most suitable imaging technique for the study of thymoma is CT that allows an accurate evaluation of the size and extent of the tumor, local invasion and metastases. MDCT, owing to its capability of providing information about vascularization of the lesion is a technique of paramount importance in the surgical planning and may suggest the correct diagnosis.

Surgical resection is considered the treatment of choice for Stage I. It needs postoperative radiotherapy (RT) in stages II-IV and RT in association with chemotherapy in presence of R2 margins⁽³⁵⁾. The neo-adjuvant therapy can be useful in more aggressive forms, but it needs undergoing trials^(36,37,38,39).

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