Upper thymic prolongation simulating mediastinal lymphadenomegaly
Prolongamento tímico superior simulando linfonodomegalia mediastinal

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ABSTRACT
The thymus is located in the anterior portion of the upper mediastinum, immediately behind the sternal manubrium, and extends to the anterior mediastinum, anteriorly to the pericardium. Two patients were evaluated due to nodulations at the transition from the cervical region to the anterior mediastinum, which simulated lymphadenomegaly. The first patient, a seven-year-old male, presented with a rhabdomyosarcoma of the masticatory space; during progressive follow-up, a nodule was noted with FDG uptake on the positron emission tomography coupled with the computed tomography (PET-CT). The second patient, a 51-year-old female, presented with a nodule characterized on the magnetic resonance image for follow-up of a papilliferous carcinoma of the thyroid. In both cases, the nodulation displayed an upper prolongation of the thymus. These nodulations showed the same density on the computed tomography and the same signal intensity on the magnetic resonance image as the adjacent thymic tissue, and there was no adipose tissue layer between the nodulations and the thymus. Knowledge of the upper prolongation of the thymus as an anatomical variation is vital for differentiating it from mediastinal lymphadenomegaly, thus avoiding unnecessary biopsies or procedures.

Keywords: Thymus gland; Mediastinum; lymphadenopathy; Positron-emission tomography; Case reports

INTRODUCTION
The thymus is a bilobulated organ with a vital role in the immune system, as it is responsible for the maturation of T lymphocytes¹.

The thymus (or its remaining tissue) is located on the anterior portion of the upper mediastinum, immediately behind the sternal manubrium, and extends to the anterior mediastinum, anteriorly to the pericardium,
but it may reach inferiorly to the xiphoid process. In some newborn children, the thymus may also extend superiorly through the upper thoracic opening to the neck. The thymus grows constantly during childhood and reaches its largest size during puberty. From then on, it begins a process of involution, and most of it is substituted by fibrous and adipose tissue (2).

The variable presentation of the thymus in childhood causes difficulties in imaging tests of the thorax. The thymus may extend to the posterior mediastinum, to the topography of the great vessels in the thorax, or even to the region of the neck, causing confusion with pathological masses (3).

The objective of this report is to demonstrate an anatomical variation of the thymus that may simulate mediastinal masses, primarily lymphadenomegalies in oncology patients submitted to staging.

**CASE REPORTS**

**Case 1**

A male seven-year-old patient with a computed tomography (CT) showing an expansive solid lesion in the left masticatory space, with an anatomopathological diagnosis of embryonic rhabdomyosarcoma.

He was submitted to chemoradiation treatment and on the positron emission tomography coupled with the computed tomography (PET-CT) for control of evolution (Figures 1A and 1B), a nodular image was observed in the left anterosuperior mediastinum, with attenuation of soft tissues and FDG uptake, simulating metastatic upper left paratracheal lymphadenomegaly.

This same image, however, had already been previously characterized on the chest CT before treatment (Figures 1D, 1E, and 1F) as an ovate image with attenuation of soft tissues, located in the upper left mediastinum, showing continuity with and the same attenuation as the thymus, likely representing a superior prolongation of the thymus. On the post-therapy CT, the nodulation showed slightly larger dimensions due to the effect of thymic rebound.

With the intention of confirming the possibility of being merely thymus tissue, and in order to not irradiate the patient unnecessarily, follow-up ultrasound tests of the region were chosen (Figure 1C), which demonstrated a thymic prolongation interposed between the brachiocephalic trunk and the left common carotid artery. There was clear characterization of the tissue bridge that connected this prolongation to the rest of the thymic parenchyma, and there were no changes in the serial tests, excluding the possibility of lymphadenomegaly.

**Case 2**

A female 51-year-old patient, submitted to total thyroidectomy due to papilliferous carcinoma, albeit with cervical persistence of the neoplasm, was treated with radioiodine ablation.

On the magnetic resonance imaging (MRI) of the neck (Figures 2A and 2B) performed after the radioiodine ablation, there were still various cervical lymph nodes increased in size that corresponded to metastases. An ovate image in the anterior mediastinum was characterized as a probable thymic prolongation.

Cervical lymph node dissection was chosen, and during the procedure this nodulation was biopsied. The histological result (Figure 2C) confirmed that it was thymus tissue.

**Figure 1.** PET-CT sagittal (a) and axial (b) sections demonstrated FDG uptake in a nodular image in the left anterosuperior mediastinum. Ultrasonography (c) showed thymic prolongation interposed between the brachiocephalic trunk and the left common carotid artery. Chest CT in axial (d) and sagittal (e) sections and three-dimensional reconstruction (f) after injection of intravenous contrast demonstrated the thymus at normal localization with upper prolongation, insinuating among the great mediastinal vessels

**Figure 2.** Weighed T2 (a) and T1 (b) MRI axial sections with fat suppression demonstrated upper thymic prolongation, insinuating among the great mediastinal vessels and presenting cleavage plan with them. Biopsy (c) of nodulation tissue in the anterosuperior mediastinum showed thymic histology with small thymocytes and Hassal corpuscle (arrow)
**DISCUSSION**

Differentiation between a normal and abnormal thymus is a difficult situation for the radiologist, since the thymus undergoes changes according to the individual’s age. The presence of an anatomical variation can hinder this assessment even more. The primordial thymus (Figure 3) originates from the ventral sac of the third pharyngeal pouch (thymopharyngeal ductus). It is believed that a small rudimentary portion develops from the fourth pharyngeal pouch. At the end of the sixth week, the primordial thymic connection with the third pharyngeal pouch is no longer observed, which is when it migrates medially and caudally; at this time, obliteration of the epithelial lumen also occurs. In the middle of the seventh week, this obliteration is complete and two solid masses, one on each side of the median line, under the thyroid gland, form the primitive thymus. At the beginning of the eighth week, the two masses join together and start to descend to the upper mediastinum. At the ninth week of gestation, the thymus is in its final position, and its remnant atrophies and disappears during this trajectory.

A wide spectrum of abnormalities may be attributed to embryologic migration of the primordial thymus in the mediastinum. Anomalies may result from three pathological mechanisms: incomplete migration of the thymus, sequestration of the thymus tissue along the descending trajectory, or failure in the involution of the thymopharyngeal ductus. These abnormalities may manifest as solid or cystic masses at any point of the descending path (Figure 4), from the mandibular angle to the superior mediastinum, as thymic cysts or ectopic thymus.

An isolated portion of thymic tissue, the ectopic, may persist in the neck, generally near the lower parathyroid gland. This tissue detaches from the thymus during its caudal migration.

The above-mentioned cases also demonstrate an anomaly in thymus migration, likely due to sequestration of a portion of thymus tissue, immediately above its normal implantation site in the upper mediastinum, generating confusion with other causes of masses at this topography.

The thickness of the thymus measured perpendicularly to the length of the lobe has been used as a criterion of an abnormal increase of the gland, with 1.8 cm as the upper limit of “normal” in patients under 20 years of age, and 1.3 cm as the upper limit in patients over 20 years of age.
finding that corresponds to the bilobulated configuration of the thymus. The increased thymic uptake of FDG may represent physiological capitation, but it may also represent the presence of hyperplasia, lymphomatous infiltration, or primary or metastatic thymic neoplasm. Capitation ceases during puberty, when the thymus is substituted with adipose tissue and undergoes involution. Nevertheless, with thymic hyperplasia after chemotherapy (thymic rebound), both in children and in adults, there may be physiological uptake of FDG(8).

Even though the image of the thymus has received considerable attention in radiological literature, its extension above the left brachiocephalic vein is not adequately emphasized. Cory, Cohen e Smith(3) published six cases in which the thymus simulated lymphadenomegaly in the upper mediastinum, and all the patients were under 15 years of age and were in oncology follow-up, one of them bearing a rhabdomyosarcoma(5). Alibazoglu et al. reported the case of a 54-year-old patient with increased uptake after radioiodine ablation of follicular carcinoma of the thyroid(9).

CONCLUSION
Knowledge of the upper prolongation of the thymus as an anatomical variation is vital in differentiating it from mediastinal lymphadenomegaly, thus avoiding unnecessary biopsies or procedures.

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REFERENCES