CASE REPORT

SPECT/CT imaging of primary mediastinal goitre: case report and literature review

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Abstract

Primary mediastinal goitre (PMG) is an ectopic thyroid in a rare location, even more so when associated with an anomaly of the native thyroid gland. It should be considered in the differential diagnosis of all mediastinal masses.

We report the case of a 74-year-old woman presenting primary anterior mediastinal goitre with a toxic multinodular goitrous thyroid gland located in the thyroid bed in the anterior neck. ^{99m}Tc pertechnetate scintigraphy (planar and SPECT/CT) confirmed the uptake of the radiotracer in the mediastinal mass, showing the mass to be separate from the cervical thyroid gland, thus confirming an ectopic PMG. A surgical resection of the cervical multinodular goitre and the intrathoracic mass was performed. Histopathology showed a

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Dr Imad GHFIR Department of Nuclear Medicine Ibn Sina hospital, Mohammed V University Rabat, Morocco Email : imadghfir@yahoo.fr Tél: 00212610327734 multinodular adenomatous goitre without signs of malignancy. The patient has had an unremarkable postoperative recovery.

^{99m}Tc scintigraphy with SPECT-CT imaging seems to be the most important diagnostic tool for the detection of ectopic thyroid tissue and shows the absence or presence of thyroid in its normal location. The technique is not only important for establishing the diagnosis, but crucial in deciding upon the correct therapeutic strategy, including the surgical approach.

Key words: Primary mediastinal goitre, ^{99m}Tc scintigraphy, SPECT/CT imaging

Introduction

Primary mediastinal goitre (PMG) or true ectopic mediastinal goitre in presence of a multinodular native thyroid is an exceedingly rare entity representing less than 1% of all endothoracic tumours with only a few cases reported in the literature [1]. The diagnosis may be difficult and is based on the imaging data. We present a case of a female with a toxic multinodular goitre located in the anterior neck with a separate large anterior mediastinal ectopic goitre, imaged by hybrid SPECT-CT imaging and subsequently treated successfully with surgical removal. bone scan.

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Case report

A 74-year-old woman was admitted with complaint of dyspnoea and slight dysphagia. She had a history of hyperthyroidism treated by antithyroid drugs. Physical examination revealed a thyroid goitre. Ultrasonography of neck was performed which showed a multinodular goitre without any evidence of retrosternal extension. A chest x-ray (Figure 1) revealed marked mediastinal widening and predominant right with a tracheal deviation. Cervical and thoracic CT scan (Figure 2) showed a multinodular cervical goitre, with a large retrosternal mass (12,8 x 6, 6 x 5, 3 cm) with well defined borders, in the upper and middle mediastinum containing microcalcifications and showing an enhancement after iodinated contrast



Figure 1 Chest x-ray showing tracheal deviation (red arrow) and marked mediastinal widening with a prominent right atruim (white arrow)

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Figure 2 CT scan showing: (a) a multinodular orthotopic goitre (white arrow) and; (b) a large mixed density mass lesion in the anterior mediastinum containing microcalcifications showing enhancement after iodine contrast administration without vascular invasion (yellow arrow)

administration, without signs of infiltration. The appearances were compatible with a diagnosis of thymoma, teratoma or an intrathoracic goitre. Laboratory tests showed normal thyroid function with the patient on anti-thyroid medications. Anti-thyroperoxidase and anti-thyroglobulin antibodies were absent, with normal serum calcitonin concentration and normal β HCG and α FP levels.

Thyroid scintigraphy was carried out 20 minutes after an intravenous injection of 185 MBg of ^{99m}Tc pertechnetate. Imaging was performed using a dual-headed hybrid (SPECT/CT)gamma camera fitted with parallel-hole, high-resolution low-energy collimators, with 20% energy windows centered at 140 keV. SPECT/CT images were according to predetermined obtained parameters including 64 steps (20)sec/step), 360° orbit and reconstruction in a 128 × 128 matrix with a threedimensional ordered-subset expectation maximization (OSEM) algorithm. Low-dose CT parameters included 120 kV and 100 mAs, and images were reconstructed with a section thickness of 5 mm in a 256 × 256 matrix. A CT-based attenuation correction algorithm was applied. The acquisition in planar mode highlighted an intense uptake in the cervical multinodular thyroid gland (Figure 3), with less intense and heterogeneous uptake at the upper and middle mediastinal regions but without any continuity between the mass and the cervical thyroid gland. SPECT-CT complement confirmed the uptake of the mediastinal radiotracer in mass, diagnosis attesting the of primary intrathoracic goitre (Figure 4). CT scan guided mediastinal biopsy confirmed the mass to be a benign colloid goitre. The multinodular orthotopic goitre and the intrathoracic mass were completely resected through a cervicotomy and a total median sternotomy. There were no tissue or vascular connections between the mass and the cervical thyroid gland. Histopathology showed a multinodular adenomatous goitre without signs of malignancy. Antithyroid drugs were replaced by thyroid hormone replacement therapy and the patient had a remarkable postoperative recovery.



Figure 3 ^{99m}Tc pertechnetate planar thyroid scan showing intense uptake in the orthotopic multinodular thyroid gland with less intense and heterogeneous uptake in the upper and middle mediastinum (white arrow) without continuity with the orthotopic thyroid

Discussion

Primary mediastinal goitre (PMG) or true ectopic mediastinal goitre is a rare developmental abnormality involvina aberrant embryogenesis of the thyroid gland during its passage from the floor of the primitive foregut to its final pretracheal position [2, 3]. It corresponds to a rare location of ectopic thyroid where thyroid the intra-thoracic tissue is independent of the native cervical thyroid gland. It represents about 0,2 - 1% of intra-thoracic tumours with a female preponderance (female/male ratio: 3). It is localized primarily in the anterior mediastinum (85% of cases). The middle and posterior mediastinum are less frequent locations in 15% of cases [4].

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Figure 4 SPECT-CT complement with three orthogonal reconstructed images, confirming the uptake of radiotracer in the anterior mediastinal mass, without any continuity with the orthotopic thyroid (white arrows

Most ectopic goitres are asymptomatic at the time of diagnosis but when they occur, clinical manifestations such as dysphagia, dyspnea, superior vena cava syndrome, are mostly related to the compression of adjacent organs 5. Chest pain may be present in case of nerve compression [6]. Also, some cases of hyperthyroidism have been reported in the literature including certain forms of lymphocytic thyroiditis or toxic nodular goitres as in the present case [7].

A chest x-ray is the initial investigation showing mediastinal widening and perhaps compression signs like tracheal deviation [8]. Ultrasound permits excellent characterization of cervical thyroid tissue, but it is not very effective in the evaluation of the PMG [9].

Computed tomography (CT) of the thorax, in addition to suggesting the thyroid origin of the mediastinal mass, often in the form of multicystic appearance with calcifications in its interior, may show a lack of continuity between PMG and the cervical thyroid gland [10].

Magnetic resonance imaging may be useful in more precisely defining the relationship of the tumour to the adjacent structures. However, the definitive diagnosis is made only by means of histopathological analysis, often achieved only after removing the tumour. In some cases, biopsies can be obtained successfully using CT-guided puncture, as in our patient [11].

Further diagnostic tools are needed for deciding upon the appropriate management. Scintigraphy can be useful for the differential diagnosis of thymoma and teratoma 12 . Indeed. radionuclide scintigraphy usina 99mTc, 1311, or 1231, is the most important diagnostic tool for detecting ectopic thyroid tissue and shows the absence or presence of thyroid in its normal location. It provides an excellent estimate of the functional status of a mediastinal goitre, its nature and extent. Also, it is very useful for confirming a discontinuity between the mediastinal mass and the cervical thyroid gland in the PMG and for delineating additional sites of thyroid tissue. It is considered the best preoperative investigation as it can be performed quickly, reliably, and with very low radiation exposure [13-16].

Although compared with other radioisotopes ¹³¹I is the preferred radionuclide for thyroid scintigraphy for imaging an intrathoracic goitre due to its low background activity, we currently prefer ^{99m}Tc to ¹³¹I/¹²³I for several reasons including its low expense, ready availability, and the short time between injection and imaging. Radioiodine thyroid imaging, however, is preferred to ^{99m}Tc for the management and the follow-up of patients with well differentiated thyroid carcinoma.

Hybrid SPECT/CT combined with planar diagnostic 99mTc scintigraphy allows precise localization and accurate characterization of foci of radioactivity in the head, neck and thorax. Equivocal findings on planar imaging may be clarified on SPECT/CT, with subsequent changes made to treatment plans [17, 18] as in the present case. The ability to fuse functional data provided by SPECT slices and morphological images provided by CT, combines physiologic information of one method with the superior anatomic resolution of the other. In many cases, this allows more definitive diagnosis than can be obtained by simple visual comparison of nuclear medicine images and conventional cross-sectional imaging [19].

Surgical resection is advocated for relieving compressive symptoms, and for ruling out the diagnosis of malignancy [20, 21]. The specific surgical modality depends on the goitre location, size and its relationship to adjacent structures. Secondary intra-thoracic goitres are usually resected through an inferior cervical collar incision; nevertheless, extended mediastinal tumours beyond the aortic arch may require additional extra-cervical incisions including sternotomy, clavicular resection, anterior and posterolateral thoracotomy or video-assisted thoracoscopic surgery [22].

Conclusion

PMG is a rare condition, even more so in the presence of a native multinodular toxic goitre. This case demonstrates the importance of considering an ectopic thyroid in the differential diagnosis of mediastinal masses. 99mTc scintigraphy with SPECT-CT imaging is not only helpful in determining the aetiology of the mediastinal mass but also helps in the therapeutic strategy including the surgical approach. Surgical resection is advocated for relieving compressive symptoms, and for ruling out the presence of malignancy.

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