Usefulness of Hybrid Single-Photon Emission Computed Tomography/Computed Tomography in a Case of Ectopic Thyroid Tissue in the Thyroglossal Duct Remnant

Abstract

Here, we report a case of a 54-year-old woman affected by thyrotoxicosis, with scintigraphic evidence of a diffuse hyperfunctioning goiter and a large ectopic thyroid tissue in the thyroglossal duct remnant. The latter was apparently more active than the two lobes at 99mTc-pertechnetate scintigraphy, mimicking a condition of preexisting increased sensitivity to thyroid-stimulating hormone stimulation. On the other hand, single-photon emission computed tomography/computed tomography has proven to be a very useful tool in demonstrating this activity to be similar to the thyroid lobes and in defining extension and anatomical relationships of the mass.

Keywords: Ectopic tissue, Graves’ disease, single-photon computed tomography/computed tomography, thyroglossal duct remnant, thyroid scintigraphy

A 54-year-old woman was referred to our Nuclear Medicine Unit for the evaluation of hyperthyroidism encountered during a recent hospitalization. On physical examination, she had a diffuse elastic soft goiter and a right paramedian mass overlying the thyrohyoid membrane, mobile with the soft tissues, not painful. Laboratory tests showed a suppressed thyroid-stimulating hormone (TSH) level of <0.001 mIU/L and an elevated free thyroxine concentration of 3.03 ng/dL (range: 0.93–1.90 ng/dL). The level of serum antibodies to TSH receptor was 9.0 U/L (range: 0–1.75 U/L). 99mTc-pertechnetate (99mTcO4−) scintigraphy demonstrated a diffuse homogeneous increase of tracer uptake in an enlarged thyroid gland, confirming the diagnosis of Graves’ disease. Moreover, an ellipsoid area of highly increased tracer uptake located just right of the midline was observed, slightly overlapping the two lobes [Figure 1]. The overall tracer uptake was 3.4% (range: 0.3–3.0%). Single-photon emission computed tomography/computed tomography (SPECT/CT) was performed through a dual-head gamma-camera with an integrated X-ray tube for a combined transmission and emission tomography (GE Discovery 670 Pro), equipped with low-energy high-resolution collimators set in H-mode. The study protocol consisted of the acquisition of 60 projections in a 128 × 128 matrix, at 15 s for view, a zoom factor of 1.0, automated body contour detection. Images have been processed on GE Xeleris Workstation (version 3.1) General Electric, Wisconsin, USA, reconstructed by iterative protocol (ordered subset expectation maximization, 2 iterations, 10 subsets, resolution recovery correction). Low-dose CT attenuation correction has been applied as well.

At SPECT/CT examination, the area of increased 99mTcO4− uptake, detected by planar images, corresponded to a solid tissue of 30.5 mm in length, 23 mm in width, and 10 mm in depth, developing caudally from the hyoid region and clearly separated from the thyroid lobes [Figure 2]. Subsequently, ultrasound confirmed the presence in the same area of an inhomogeneous hypoechoic solid tissue, without evidence of cysts inside. In light of the foregoing, the final diagnosis was ectopic thyroid tissue in the thyroglossal duct.

Ectopic thyroid tissue is a rare condition, in about 90% of cases located in the lingual area.[1] The descent of the thyroid primordium from the foramen cecum of the cartilage

How to cite this article: Calandri E, Filippi L, Alessandro F, Aretano I, Pultrone M. Usefulness of hybrid single-photon emission computed tomography/computed tomography in a case of ectopic thyroid tissue in the thyroglossal duct remnant. Indian J Nucl Med 2021;36:97-9.

Address for correspondence:
Dr. Enrico Calandri,
Department of Medicine and Urgency, Nuclear Medicine Unit, “Degli Infermi” Hospital,
Department of Medicine and Urgency, Unit of Cardiology, “Degli Infermi” Hospital,
Department of Surgery, Unit of Transfusion Medicine and Immunohematology,
“Degli Infermi” Hospital, Ponderan (BI), Department of Nuclear Medicine, “Santa Maria Goretti” Hospital, Latina, Italy

Received: 03-03-2020
Revised: 14-03-2020
Accepted: 17-03-2020
Published: 04-03-2021
tongue along the thyroglossal duct may explain the most frequent presence of ectopic tissue along the midline, from the base of the tongue to the mediastinum.\cite{1} Graves’ disease is the most common cause of thyrotoxicosis, with an annual incidence of 20–50 cases/100,000 persons. Its autoimmune basis results from complex interactions between genetic and environmental factors. Activating autoantibodies of the IgG1 subclass directed against the thyrotropin receptor play a central role, stimulating hormone production, as well as hypertrophy and hyperplasia of the thyroid epithelial cells.\cite{2} In our case, planar images showed a prominent activation of the ectopic tissue with respect to the two thyroid lobes. This finding appeared analogous to unilateral Graves’ disease, an extremely rare condition in which an “a priori” clonal heterogeneity is believed to explain the greater sensitivity to TSH stimulation by one of the two lobes.\cite{3} In our patient, the difference of uptake between normal thyroid gland and thyroglossal duct remnant was only related to the anatomy of the neck and, consequently, to the different distance of the radiation sources from the plane of the detect.

Hybrid SPECT/CT is widely used in clinical practice for improving the diagnostic accuracy of scintigraphic images. It has been demonstrated, in fact, that this technological approach, by combining anatomical and functional data, can be a useful tool for disease location and extent definition, in particular as far as it concerns infection and tumors.\cite{4} As specifically regards the applications of hybrid SPECT/CT device for the imaging of benign thyroid disease, scientific data are still limited. In a cohort of 73 patients with thyroid nodularity or retrosternal goiter, hybrid SPECT/CT with \( {\text{123}}\text{I} \) was reported to be clinically effective for the accurate characterization of morphological patterns of nodules or of the autonomously functioning benign tissue, thus aiding the selection of the most suspicious nodules to be submitted to biopsy.\cite{5}

The case we describe further supports the utility of hybrid SPECT/CT for the correct functional characterization of thyroid ectopic tissue [Figures 3 and 4]. Moreover, it was a useful imaging tool for defining the mass extension and its contiguity with the underlying anatomical structures. In this regard, it is worth mentioning the study published by Gandhi et al. reporting the usefulness of hybrid SPECT/CT with \( {\text{123}}\text{I} \) or \( {\text{99m}}\text{TcO}_4^- \) in 3 patients with obstructive lingual thyroid tissue, successfully treated with an ablative dose of \( {\text{131}}\text{I} \).\cite{6} In such cases, hybrid technology resulted of utmost importance not only for the precise location of the ectopic thyroid tissue but even more for measuring the target volume of therapy through the CT component of the SPECT/CT system and the calculation of the prescribed activity of \( {\text{131}}\text{I} \) to be administered. In agreement with the aforementioned study, our case strengthens the potential usefulness of hybrid SPECT/CT with \( {{\text{123}}\text{I}} \) or \( {\text{99m}}\text{TcO}_4^- \) for a personalized approach to well-selected patients with benign thyroid pathologies, in the perspective of a combined use of diagnostics and therapeutics, namely “theranostics” or “theragnostics.”\cite{7}

Further studies with larger series are needed to better define the role of hybrid imaging in the field of thyroid benign
pathology, especially as concerns the clinical indications and the balancing between dosimetric issues and clinical benefits.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Moon A, Kim HS, Chang K, Do SI. Multifocal ectopic thyroid tissues including breast: A case report. Mol Clin Oncol 2020;12:117-9.
2. Yamauchi M, Inoue D, Sato H, Ashida C, Hiraumi H, Shan L, et al. A case of ectopic thyroid in lateral neck associated with Graves’ disease. Endocr J 1999;46:731-4.
3. Smith TJ, Hegedüs L. Graves’ disease. N Engl J Med 2016;375:1552-65.
4. Manthri RG, Ajit N, Vaikakkara S, Devi BV, Kalawat T. Unilateral Graves’ disease: The lesser known. Indian J Nucl Med 2019;34:96-8.
5. Filippi L, Schillaci O. SPECT/CT with a hybrid camera: A new imaging modality for the functional anatomical mapping of infections. Expert Rev Med Devices 2006;3:699-703.
6. Sergieva S, Dimcheva M, Robev B. SPECT-CT in diagnosis of thyroid nodularity and retrosternal goiter. J Nucl Med 2014;55:1940.
7. Gandhi A, Wong KK, Gross MD, Avram AM. Lingual thyroid ectopia: Diagnostic SPECT/CT imaging and radioactive iodine treatment. Thyroid 2016;26:573-9.
8. Ahmadzadehfar H, Essler M. It is time to move forward into the era of Theranostics. EJNMMI Res 2018;8:9.

Figure 4: A coronal single-photon emission computed tomography/computed tomography view showing both fused (c and d) and corresponding computed tomography (a and b) slices was considered useful for demonstrating the different anatomical location of the thyroglossal duct remnant and the thyroid gland, in spite of their equal grade of tracer uptake.