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False-Positive Iodine Uptake in a Patient with Differentiated Thyroid Cancer: A Rare Case of Uptaking Bronchoceles

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Abstract

Introduction: Radioiodine is used for diagnosis and treatment of differentiated thyroid cancer. Thyroid cells most effectively express the Sodium-Iodide Symporter (NIS), which enables iodine uptake; however, NIS is also expressed in inflamed tissues.

Methods: This is a report on a 58 year old woman with a papillary thyroid cancer and false-positive pulmonary radioiodine (^{131}I) uptakes at the Whole Body Scan (WBS).

Case Report: Two radioiodine treatments during withdrawal of levothyroxine were performed, with evidence of pulmonary ^{131}I uptake. A chest Computed Tomography (CT) revealed the presence of multiple acinar opacities associated with thickening of the peripheral bronchi in both lungs, showing an uptake (SUV 8.17) at the subsequent 18F-fluorodeoxyglucose positron emission tomography with CT (FDG-PET/CT). Broncho-alveolar lavage and cytological examination were compatible with inflammation, confirming the suspicion of bronchocele.

Conclusion: Several cases of unexpected ^{131}I uptakes have been reported so far. Therefore, WBS uptake should be correlated with clinical, biochemical data and radiological imaging in order to reduce the false-positive incidence and to avoid unnecessary treatments.

Keywords: Thyroid cancer; Bronchocele; False positive; Whole body scan; Radioiodine

Introduction

Differentiated Thyroid Cancer (DTC) is usually treated with surgery, Radioiodine Ablation Therapy (RAI) and Levotiroxine Therapy (L-T4). In particular, radioiodine has been used for more than five decades for the diagnosis and treatment of patients with DTC. The efficacy of the RAI is due to the ability of the thyroid cells to concentrate iodine, owing to the expression of the Sodium-Iodide Symporter (NIS) on the thyroid cell membrane, which mediates trapping, organification, and storage of radioiodine (^{131}I) especially in functioning thyroid tissues [1,2].

The mechanisms of NIS regulation are multiple and not fully understood. However, it has been recently observed that some of the intracellular pathways involved in its regulation are over-activated in thyroid cancer [3-5].

A considerable number of cases of false-positive radioiodine uptakes have been reported in the Literature so far [6-8].

We herein reported on a case of false-positive ^{131}I uptake in correspondence of a bronchocele, a segment of bronchus, usually dilatated, filled with mucus and completely enclosed [9]. In addition, a summarized review of the Literature on this topic is also reported.

Case Presentation

A 58 year old woman with a multinodular goiter underwent total thyroidectomy with incidental histological detection of multifocal follicular variant of Papillary Thyroid Cancer (PTC) in the left thyroid lobe (maximum size 0.7 cm), without infiltration of the perithyroidal soft tissues. TNM classification [10] was pT1a (m), Nx, Mx.

Upon subsequent RAI with 2.59 GBq of ^{131}I uptake was detected in correspondence of the thyroid remnant, the thyroglossal duct and in the left hemithorax (Figure 1), in the absence of detectable serum Thyroglobulin (Tg) but positive anti-Tg Antibodies (TgAb). In order to investigate the pulmonary uptake of uncertain origin, a chest Computed Tomography (CT) was performed, which revealed multiple acinar opacities associated with thickening of the peripheral bronchi in both lungs (Figure 2), as well as in correspondence of the previously observed areas of WBS uptake.

During a second RAI, undetectable Tg and positive but decreasing TgAb were confirmed, but the WBS again revealed the same uptake in the left hemithorax.

A new CT study confirmed unchanged lung lesions supposed to be bronchoceles, which showed an uptake (SUV 8.17) at the following 18F-fluorodeoxyglucose positron emission tomography with CT (FDG-PET/CT) (Figure 3).

The patient thus underwent a Broncho-Alveolar Lavage (BAL), which revealed the presence of inflammation/infection, compatible with the suspicion of bronchocele and explaining the FDG-PET/CT

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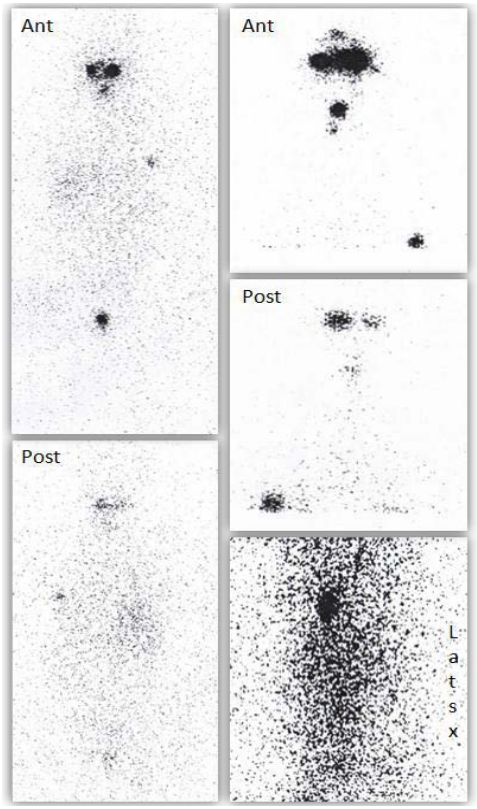

Figure 1: Therapeutic WBS during withdrawal of LT4 therapy, 4 days after the first radioiodine treatment. WBS images revealed a round-shaped masslike lesion uptake in the left hemitorax.

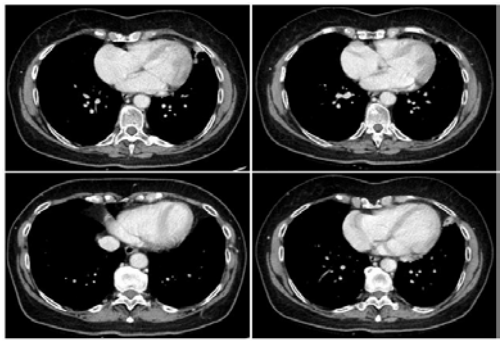

Figure 2: Chest CT with contrast medium performed in February 2014. Enhanced CT demonstrated multiple acinar opacities associated with thickening of the peripheral bronchi in both lungs subsequently interpreted as bronchoceles.

result.

The patient was then strictly followed up, with persistence of TgAb positivity during suppressive L-T4 therapy and after stimulation, without any sonographic evidence of locoregional recurrence.

Discussion

The ability to trap iodine is a unique feature of thyroid tissue. However, a variety of pathologic lesions have been reported to cause false-positive ^{131}I uptake at WBS and, opposed to contrary to physiological uptake, they can create diagnostic misinterpretation.

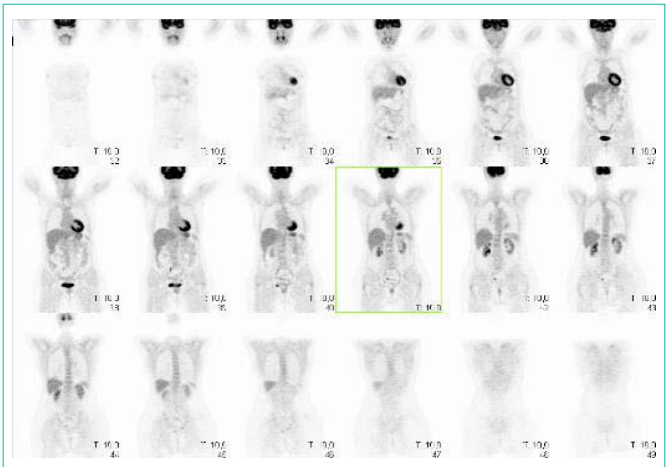

Figure 3: FDG-PET/CT performed in October 2015 during rhTSH stimulation test. The FDG accumulative bronchoceles was shown on the PET fused with low-dose nonenhanced CT images.

Several cases of unexpected radioiodine uptake have been reported in Literature [6-8], in particular cystic (ovarian, breast and pleuro-pericardial), inflammatory and non-thyroidal neoplastic diseases. Interestingly, only one other case of bronchial mucocele with a scintigraphic uptake was described so far [11].

Although the mechanisms of these false-positive uptakes is not fully understood, in a recent review by Oh and Anh [6] this phenomenon was categorized as follows: 1) functional NIS expression in normal tissues or in different benign and malignant tumors, 2) metabolism of radioiodinated thyroid hormone, 3) retention of radioiodinated body fluids associated with or without structural change, 4) retention and uptake of radioiodine in inflamed tissues, 5) contamination by physiologic secretions, and 6) unknown.

In particular, points 3 and 4 of this classification could explain the case described in this paper. In fact, physiological dilatation of ducts such as a bronchus, regardless of the presence of obstruction, causes retention of body fluid containing radioiodine [6,12,13]. Moreover, considering that tracheobronchial secretions contain radioiodine, the presence of a bronchial obstruction, such as bronchocele, can result in positive radioiodine uptake which mimics metastatic involvement of DTC [8].

With regards to the point 4, in inflamed the occurrence tissues of hyperaemia, vasodilation, local edema and increased capillary permeability can result in a stasis of radioiodinated blood and in retention of radioiodine in leukocytes, which induce iodide organification as part of their bactericidal effect [6,14-18].

Finally, secretion of mucin containing iodide salts has also been suggested as another possible mechanism of iodine accumulation associated with chronic inflammatory conditions in mucocele [12,19,20].

Therefore, there are pitfalls in ^{131}I WBSs interpretation, and, regrettably, there is a tendency to consider any localized ^{131}I accumulation as metastatic localization of thyroid cancer, especially when located outside the neck. Some false positive can be ruled out easily. Contamination of skin, hair and garments by physiological secretions should be avoided by removing clothes and carefully

washing skin and hair. Accumulation of iodine in the esophagus or gastrointestinal tract can be avoided by drinking water. The major diagnostic problems are constituted by false positive accumulations projecting in areas where thyroid cancer may metastasize, such as lungs and bones [21]. Clinicians should especially consider a possible false positive uptake in case of discordant serum Tg or clinical history (low-risk thyroid cancer, complete surgical removal, previous negative imaging). To recognize the exact localization of radioiodine uptake and to reduce the incidence of false-positives in planar WBS, additional views (obliques), CT or MRI scan, and/or Single Photon Emission Computed Tomography/CT (SPECT/CT) [22-24] are recommended, so as to avoid unwarranted treatment. Although these are not common findings, false positive radioiodine uptakes should be suspected in presence of biochemical data and imaging finding negative for recurrence of disease. In these cases, the measurement of Tg and other imaging studies are useful to avoid unnecessary therapy [24].

Therefore, the correlation of the scintigraphic finding with the anatomical imaging, the available biochemical data, the clinical history, and the physical examination are mandatory [6], and could decrease the possibility of misinterpretation of the WBS images, thus avoiding further improper staging, unnecessary administration of radioactive iodine, improper management, emotional stress and superfluous financial burden [22].

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