



Unexpected false-positive uptake of ^{131}I on the right eye in a patient with differentiated thyroid cancer: a case description

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Introduction

Differentiated thyroid cancer (DTC), including papillary and follicular thyroid cancer, comprises over 90% of all thyroid cancer cases (1). Iodine-131 (^{131}I) is the most specific radionuclide for DTC imaging, and it plays an important role in depicting metastatic disease after ^{131}I treatment. The accumulation of ^{131}I outside the thyroid bed and areas of physiological uptake is strongly suggestive of a distant functioning metastasis. Therefore, it is essential to distinguish physiologic radioiodine activity from metastatic disease. This report describes a case of false-positive uptake of ^{131}I on the right eye of a patient with DTC. We aimed to contribute to the information available about the false-positive uptake of ^{131}I and improve nuclear medicine physicians' understanding of this to avoid diagnostic errors which may lead to unnecessary administration of ^{131}I therapeutic doses or surgical procedures.

Case presentation

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

A 58-year-old female patient underwent a total thyroidectomy and neck lymph node dissection due to thyroid nodules in her bilateral thyroid lobes. The

histological examination showed a bilobular thyroid with papillary cancer that was 10 mm (right lobe) and 2 mm (left lobe) in diameter. The tumor in the right thyroid lobe was a hobnail cell subtype with infiltration of the thyroid capsule, but the tumor in the left thyroid lobe did not infiltrate the thyroid capsule. The central compartment lymph nodes were not involved (0/13). The BRAF-^{V600E} was wild type.

The patient was admitted to the Department of Nuclear Medicine, the Affiliated Hospital of Qingdao University for radioiodine therapy without thyroid hormone for 4 weeks after thyroid surgery. Her serum thyroglobulin (Tg) level was 3.28 ng/mL (reference range, 1.4–78 ng/mL), her serum antithyroglobulin antibody (TgAb) level was 10.15 IU/mL (reference range, 0–115 IU/mL), and her thyroid-stimulating hormone (TSH) level was >100 mIU/L. Her risk stratification when predicting persistent or recurrent disease before ^{131}I treatment was intermediate. Six days after oral administration of 3.7 GBq (100 mCi) of ^{131}I , the post-therapeutic ^{131}I whole-body scan (WBS) showed two foci of ^{131}I (Figure 1A,1B). Single-photon emission computed tomography/computed tomography (SPECT/CT) revealed one lesion in the thyroid bed, which was residual thyroid tissue (Figure 1C-1E). Another lesion was noted in the right eye (Figure 1F-1N).

Further inquiries into the patient's medical history were unremarkable, and there was no discomfort in her right eye. She refused to undergo an ophthalmic examination. She was followed up on an outpatient basis with determinations of serum Tg and TgAb and neck ultrasonography during TSH-suppressive treatment. At the 5-year follow-up, her

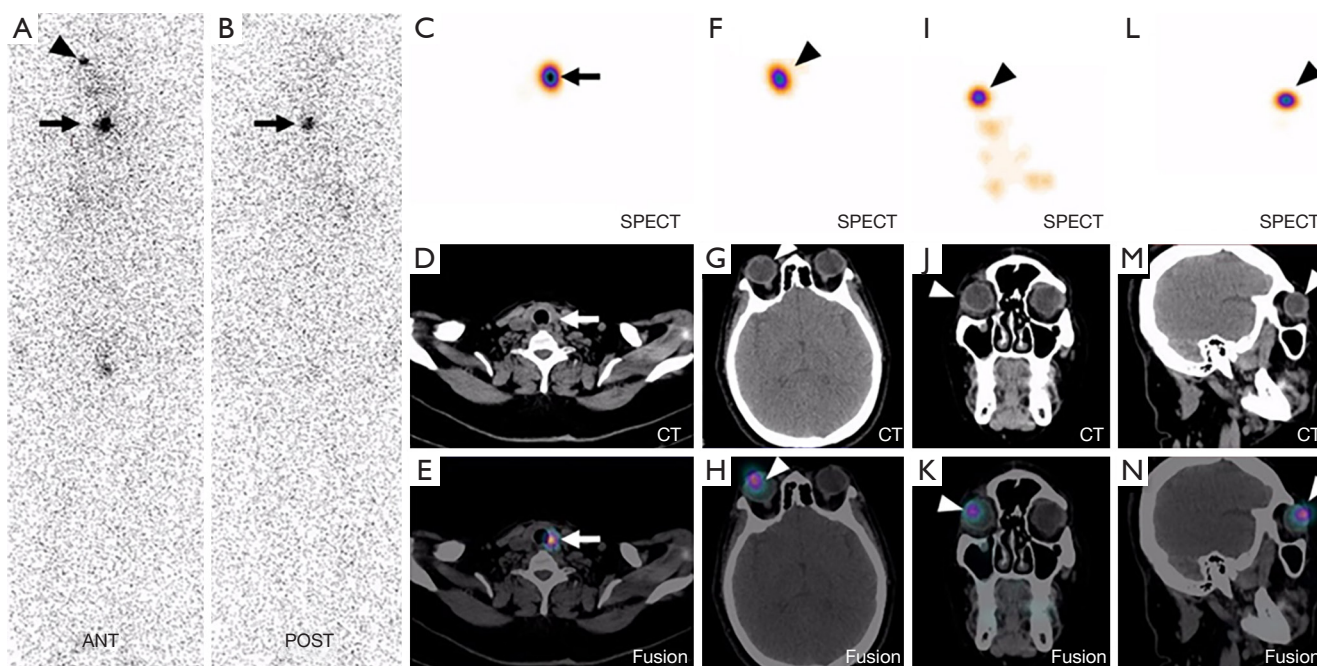


Figure 1 The post-therapeutic ^{131}I WBS and SPECT/CT findings. ^{131}I WBS showed two foci of ^{131}I (A, anterior view, arrow and arrowhead; B, arrow and posterior view). SPECT/CT was performed and revealed that one lesion was in the thyroid bed (arrows) and represented residual thyroid tissue (C-E), and the other was in the right eye (arrowheads) (F-H, axial; I-K, coronal; and L-N, sagittal). WBS, whole-body scan; SPECT, single-photon emission computed tomography; CT, computed tomography.

inhibitory Tg was less than 0.04 ng/mL, her serum TgAb level was less than 10 IU/mL, and her TSH level was less than 2.0 mIU/L. Follow-up examinations showed no signs of metastatic disease. The outcome showed that she had experienced an excellent response to thyroidectomy and radioiodine therapy.

Discussion

The accumulation of ^{131}I outside the thyroid bed and areas of physiological uptake is strongly suggestive of a distant functioning metastasis. The false-positive uptake of ^{131}I may lead to unnecessary ^{131}I therapy or surgery. The mechanism of false-positive uptake of ^{131}I can be summarized as follows (2): (I) the uptake of ^{131}I is related to the expression of the sodium iodide symporter (NIS) in ectopic thyroid tissue, which can be localized, for example, at the root of the tongue, the thyroglossal duct, or in the subdiaphragmatic organs. (II) The nonthyroidal tissues which can express NIS, such as the salivary gland and the lacrimal gland, can also uptake ^{131}I (3). (III) Retention of ^{131}I in physiological secretions accumulates in dilated ducts or cavities. (IV) Since inflammatory diseases can increase vascularity and

capillary permeability, they can also lead to false-positive ^{131}I uptake.

To date, there have been many case reports of false-positive ^{131}I whole-body scans (4-8), but very few reports have detailed the false-positive uptake of ^{131}I in the eyes. As far as we know, eye metastasis from thyroid cancer is rare (9). Bakheet *et al.* (10) reported the case of a 33-year-old man with an artificial eye who showed ^{131}I uptake, but the uptake completely disappeared after washing of the artificial eye. The mechanism underlying the abnormal collection of radioiodine was also not clear. The authors speculated that it could have been secondary to the accumulation of nasal or lacrimal secretions in the frontal sinuses or lacrimal drainage system or to the nonspecific concentration of iodine in inflamed tissues. Bakheet *et al.* (10) also reported that some inflammatory conditions, such as dacryocystitis or uveitis, may appear as ^{131}I uptake on scintigraphy. In our case, we were able to rule out this possibility as the patient did not experience any optical symptoms suggestive of inflammation. The CT images did not show swelling or thickening of the lacrimal sac. Since NIS expression is one of the primary mechanisms for false-positive findings on radioiodine scintigrams, reports have indicated that the

eye's ciliary body can have functional NIS expression (11). The patient in our case did not accept any surgery or treatment for her right eye. We speculated that the "hot spot" of ^{131}I on her right eye may have been a false-positive uptake caused by functional NIS expression on her right ciliary body.

In conclusion, our interesting case highlights the potential for false-positive uptake of ^{131}I to be shown on a scan of a normal right eye in a DTC patient. Recognizing false-positive cases is essential to avoid diagnostic errors. The case also illustrated that SPECT/CT could improve imaging specificity for patients after undergoing ^{131}I ablation.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <https://qims.amegroups.com/article/view/10.21037/qims-22-247/coif>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was provided by the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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