

## Case Report

# Incidental Follicular Thyroid Carcinoma Detected on F-18 FDG PET CT Imaging for Breast Cancer Staging: A Case Report

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## Abstract

The detection rate of thyroid incidentalomas is increasing; in fact, as many as 2.3% of patients undergoing FDG PET-CT for other indications have been found to have thyroid incidentalomas. The risk of malignancy in these thyroid incidentalomas can be as high as 47%. The increased uptake and the focal uptake pattern of F-18 fluorodeoxyglucose (FDG) in the thyroid during positron emission tomography (PET)-computed tomography (CT), and the calcification of the thyroid incidentaloma, are associated with even higher risk of malignancy. We report a case of a lady undergoing FDG PET-CT for breast cancer staging but noted to have a calcified thyroid incidentaloma, which was proven to be follicular thyroid carcinoma.

**Keywords:** thyroid carcinoma, PET-CT, FDG, incidentaloma, thyroid nodules

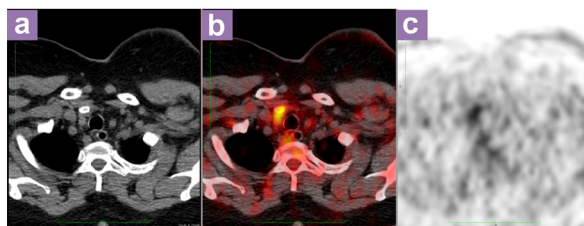
## Introduction

The advent and tremendous improvements of imaging modalities have greatly increased the detection rate of incidentalomas (eg. thyroid, adrenal). Similarly, the increasing prevalence of differentiated thyroid carcinoma worldwide is postulated to be due to earlier detection of thyroid incidentalomas. Studies have shown that thyroid incidentalomas, especially those showing focal fluorodeoxyglucose (FDG)-avidity, should be further investigated. A retrospective study by Cohen et al. showed that thyroid FDG-PET incidentaloma was found in 2.3% of a group of patients who underwent FDG-PET for metastatic evaluation of non-thyroid cancer. Interestingly, the incidentalomas in 47% of those patients were subsequently found to be malignant (1). Similarly, Kim et al. demonstrated that thyroid incidentaloma was found in 2.1% of their patients (of 22,674 patients) but only 24.3% (68/280) were subsequently confirmed to malignant (2).

The normal thyroid gland generally shows mild homogeneous uptake on F-18 FDG-PET, and the presence of focal or diffuse F-18 FDG uptake in the thyroid is an incidental finding. Studies have shown that thyroid incidentalomas with focal F-18 FDG uptake and high standard uptake values (SUV) are at increased risk of malignancy (1). This finding, in association with calcification, indicates an even higher risk of malignancy.

## Case Report

We report a case of a 41-year-old lady who was diagnosed with left breast infiltrating ductal carcinoma (ER+, PgR+, ERBB2-) in November 2012. She participated in an unrelated breast cancer clinical research study using F-18 FDG-PET-CT in January 2013, after undergoing left mastectomy with axillary clearance and local radiotherapy. Her scan was negative for metastatic breast cancer (Stage IIB, T<sub>2</sub>N<sub>1</sub>Mo), but she was noted to have a focal FDG-avid thyroid incidentaloma and non-metabolically active bilateral cervical level III nodes (the largest measuring 1.2 cm × 0.8 cm). The thyroid incidentaloma with microcalcification measured 2.3 cm × 2.6 cm and was metabolically active (SUVmax 3.4) (Figure 1).



**Figure 1:** (a) Computed tomography, (b) fused and (c) positron emission tomography images of the thyroid incidentaloma.

The initial fine-needle aspiration histology of the thyroid lesion was equivocal, but right hemithyroidectomy subsequently revealed the lesion to be a follicular thyroid carcinoma. The patient underwent a complete thyroidectomy in October 2013 (T<sub>2</sub>N<sub>0</sub>M<sub>0</sub>). The histopathological examination of the right thyroid gland revealed a follicular thyroid carcinoma measuring 35 mm x 20 mm x 15 mm, with extracapsular involvement and lymphovascular permeation. The left thyroid gland, however, showed no malignant changes. No regional lymph nodes removed during the surgeries; therefore, the possibility of metastatic lymph node involvement could not be ascertained. Her thyroglobulin (Tg) level measured just prior to therapy was noted to be 3.7 mcg/L with negative anti-Tg level. In view of the histopathological findings and possibility of nodal metastases, it was decided that the radioactive iodine remnant ablation dose of 4.4 GBq. The therapy was performed in November 2013.

Her post-ablative whole body scan done 3 days after the therapy is shown in Figure 2. The scan revealed an iodine-avid lesion (with a star

artefact) in the cervical region, with physiological uptake seen elsewhere in the body.

## Discussion

The preference for free fatty acids for energy metabolism and TSH-dependent thyrocyte glucose utilisation has been suggested to be the reason behind the poor F-18 FDG uptake in the normal thyroid gland (3,4). Under physiological conditions, the thyroid glands show mild homogenous FDG uptake.

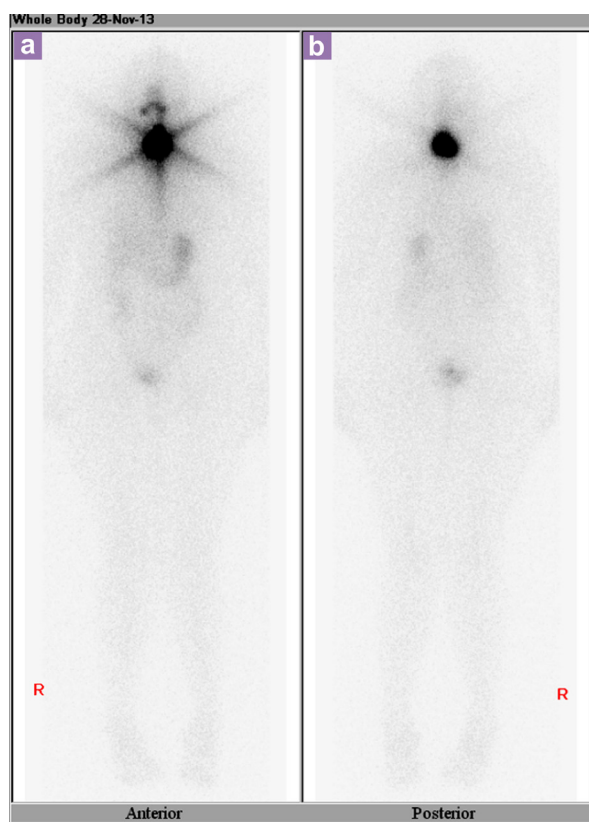
Any thyroid lesion with increased FDG-uptake should be given due attention. Diffuse thyroid uptake may be due to chronic thyroiditis or Graves' disease, whereas focal uptake may be due to thyroid carcinomas, functional thyroid nodule or adenomatous goiter. Malignant tumours tend to exhibit increased rates of glycolysis and glucose consumption, with accelerated glucose transport. Hence, increased thyroid FDG-uptake on PET, notably in focal lesions, are closely associated with increased risk of malignancy (5).

The use of the SUV to differentiate benign and malignant thyroid nodules is still debateable. Bloom et al. and Cohen et al. suggested that F-18 FDG uptake may help discriminate benign and malignant thyroid nodules (1,6). On the other hand, Bogsrud et al. (2007) concluded that there were no significant differences in the SUV<sub>max</sub> between benign and malignant nodules (7). Nevertheless, the studies share in common the need for further evaluation if focally increased uptake of FDG is evident in the thyroid nodule, regardless of the SUV value.

Studies have also shown that solitary thyroid nodules with calcification and increased SUV are associated with increased risk of malignancy (8–10). The cancer risk of focal thyroid lesions detected on F-18 FDG PET-CT has been quoted as high as 47%, whereas the cancer risk for calcification in thyroid gland is as high as 54% (8, 11). In this case, the patient's thyroid nodule was calcified in addition to being metabolically active. Hence, her risk of thyroid malignancy was higher and this was subsequently proven to be true.

## Conclusion

Thyroid incidentaloma with focally increased uptake of FDG must be investigated. The presence of calcification in these metabolically active thyroid nodules conveys a more sinister outcome and steps need to be taken to ensure early administration of the appropriate treatment.



**Figure 2:** Whole body radioactive Iodine images post-ablation.

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## Conflict of Interest

None.

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## Authors' Contributions

Conception and design and drafting of the article: AKCH

Analysis and interpretation of the data: AKCH, FH

Critical revision of the article for the important intellectual content: AKCH, FH, MAA

Final approval of the article: MAA

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