

Thyroid Cancer Presenting as an Incidentaloma Detected on F-18 FDG PET/CT Imaging: A Case Report

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ABSTRACT

The authors report a woman with a history of malignant B-cell lymphoma (MALT lymphoma) at the lower lobe of the left lung status post left lower lobe lobectomy who underwent F-18 FDG PET/CT whole-body imaging for evaluation of any suspicious new pulmonary lesion. The study incidentally found abnormal focal hypermetabolic activity, called incidentaloma, at the right thyroid lobe, which was pathologically proven to be papillary thyroid carcinoma. She was further treated with radioiodine therapy after a total thyroidectomy had been done.

Keywords: PET/CT, incidentaloma, thyroid cancer

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Combined positron emission tomography (PET) and computerized tomography (CT) technologies in a single device is now a state-of-the-art imaging mainly applied for oncologic patients. The PET data provides metabolic function of the tumors while the CT images are used for anatomical localization. F-18 Fluorodeoxyglucose (F-18 FDG), which is a glucose analogue is the most commonly used radiopharmaceutical for this purpose. Since F-18 FDG PET/CT imaging is routinely performed as a whole-body scan, it has been widely used as a sensitive imaging tool for several indications in various malignancies.^{1,2}

Apart from the evaluation of previously known cancers, this imaging modality sometimes incidentally picks up abnormal hypermetabolic lesions that appear unrelated to the underlying malignant neoplasms, so called incidentalomas.

The authors report a woman whose F-18 FDG PET/CT images found a thyroid incidentaloma, which was later proven to be papillary thyroid carcinoma.

CASE REPORT

A 55-year-old Thai woman with a history of malignant lymphoma, extranodal marginal zone B-cell lymphoma (MALT lymphoma) at the lower lobe of the left lung status post left lower lobe lobectomy. Five months later her chest radiograph revealed an equivocal new pulmonary lesion at the left lung. Thus, a whole-body F-18 FDG PET/CT imaging was obtained from skull base to mid-thigh level and showed only evidence of lung volume loss without pulmonary nodule or pulmonary infiltration. Furthermore, there is no abnormal F-18 FDG accumulation in the left lung either. Nevertheless, focal intense F-18 FDG uptake at the upper part of the right thyroid lobe with maximum standardized uptake value (SUVmax) of 12.8 was incidentally demonstrated with an associated 1.2 x 0.9 cm. hypodense thyroid nodule on CT images (Fig 1).

Her color Doppler ultrasonogram of the thyroid revealed multiple hypervascularized nodules in the right lobe with a maximum diameter of 2.0 cm. (Fig 2) and cytological findings from fine needle aspiration (FNA) revealed features of papillary thyroid carcinoma. She subsequently underwent total thyroidectomy and the pathological findings revealed a well circumscribed, brown gray mass, with a granular appearance on a cut surface, and measuring approximately 2.2x1x0.5 cm. in the right lobe. Microscopic examination found a cellular tumor, comprising slender papillary structures, with delicate fibrovascular cores,

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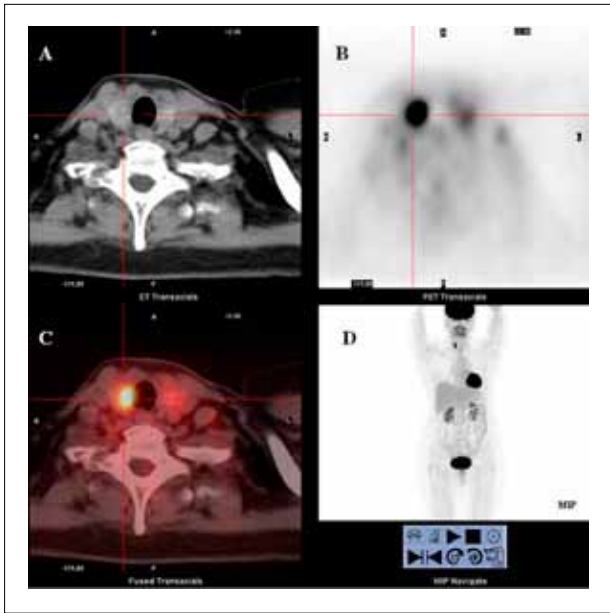


Fig 1. F-18 FDG PET/CT axial images showed focal intense hypermetabolic right thyroid nodule (A, B, C, and D represent CT, PET, fused PET/CT and maximum intensity projection images respectively).

covered with columnar cells. The tumor cells showed eosinophilic cytoplasm and oval nuclei with overlapping on the adjacent cells. A nuclear groove parallel to the long axis of the nucleus and intranuclear pseudoinclusion with ground glass appearance were observed (Fig 3). These findings are compatible with papillary thyroid carcinoma.

Six weeks after surgery, she was treated with 150 millicurie (mCi) of radioactive I-131 treatment for thyroid ablation. Her serum thyroglobulin (Tg) and thyroglobulin antibody (TgAb) during thyroid hormone withdrawal were 4.94 ng/ml and 61.4 IU/ml respectively. Her posttherapeutic I-131 total-body scan (TBS) showed only uptake at the thyroid remnant without evidence of distant functioning metastasis. Diagnostic I-131 TBS at one-year follow-up revealed a little thyroid remnant with serum Tg and TgAb levels of 0.3 ng/ml and 24.9 IU/ml respectively. Therefore, the second 150 mCi I-131 treatment was administered. Follow-up diagnostic I-131 TBS and PET/CT scan revealed



Fig 2. Color Doppler ultrasonogram revealed multiple hypervascularized nodules in the right lobe of the thyroid gland with the maximum diameter of 2.0 cm.

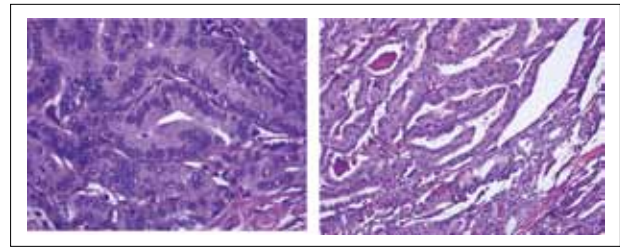


Fig 3. Microscopic examination. (A) x4 Typical papillary carcinoma with delicate central fibrovascular stalk covered by neoplastic epithelial cells. (B) x40 Crowded overlapping of round to oval tumor nuclei with presence of longitudinal nuclear groove, ground glass and nuclear pseudoinclusion.

no evidence of tumor recurrence and she has been doing well since then.

DISCUSSION

Whole-body PET/CT imaging may reveal areas of the unexpected uptake that appear unrelated to the known malignancies. Most observed incidental findings are benign such as adrenal adenoma, uterine fibroid, and fracture but some may represent second primary malignancies.³

Normal thyroid glands usually demonstrate absent or low-grade F-18 FDG uptake.⁴ Elevated uptake within the thyroid is often identified as an incidental finding on the whole-body F-18 FDG PET/CT imaging. Diffuse thyroid uptake is generally related to benign processes, and the risk of malignancy is very low, similar to that of the normal population.⁵⁻⁶ Although mild F-18 FDG uptake in the thyroid gland is likely a normal variant, moderate-to-intense uptake in both thyroid lobes is usually secondary to hypothyroidism associated with elevated thyroid stimulating hormone, thyroiditis, or hyperthyroidism and Graves' disease.⁵⁻⁷

Focal uptake within the thyroid on F-18 FDG PET images in patients without a history of thyroid disease is classically described as an incidental finding, so-called "incidentaloma". Thyroid incidentalomas visualized on F-18 FDG PET imaging are more frequently clinically significant than those discovered by anatomical imaging modalities, such as ultrasound or CT, as the result of a greater frequency of malignancy.⁸

According to the systemic review by Shie et al., the prevalence of thyroid incidentalomas on F-18 FDG PET was 1%, with a risk of malignancy as high as 33%, or one-third of the total population being studied. This risk is higher than that identified by high-resolution ultrasonography, which ranges from 1.5% to 10%.⁹ Papillary thyroid carcinoma, as in this case, is the most common cancer identified in this group of patients.⁹

Although some authors reported that the intensity of F-18 FDG uptake was not useful in differentiating benign and malignant lesions,¹⁰⁻¹¹ Shie et al. summarized from several publications and reported that the mean SUVmax for malignant lesions was statistically higher than that for benign lesions ie. 6.8 ± 4.6 vs 4.6 ± 2.1 ($P < 0.001$).⁹ Although there is some overlap between SUVmax among the benign and malignant groups, such a high SUVmax in this patient also raised the likelihood of malignancy in nature.

When concerned about the CT attenuation pattern of the thyroid lesion, Choi et al. reported that very low attenuation or nonlocalization on CT images is likely

benign and thus, image interpretation that includes F-18 FDG uptake and the CT attenuation pattern, along with the SUVmax, significantly improves the accuracy of PET/CT imaging for differentiating benign from malignant focal thyroid lesions.¹²

CONCLUSION

Thyroid incidentalomas detected as focal hypermetabolic lesions on PET/CT imaging in the patients with nonthyroidal malignancies have a high prevalence of malignancy. Thus, cytological confirmation is recommended for differentiation between benign and malignant lesions, especially in conjunction with other suspicious physical, ultrasound or CT findings.

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