

**18F-FDG PET/CT THYROID INCIDENTALOMA REVEALING PAPILLARY THYROID  
CARCINOMA: A CASE REPORT AND LITERATURE REVIEW**

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**ABSTRACT**

Thyroid incidentalomas are rarely discovered during 18F-FDG PET/CT exams for extrathyroid conditions. We report a case of papillary thyroid cancer discovered during 18F-FDG PET/CT examination carried out as part of the management of Hodgkin lymphoma. Through this observation, we underline the interest of exploring any hypermetabolic thyroid focus visualized on 18F-FDG PET/CT, by fine needle aspiration biopsy to determine its nature which may be neoplastic.

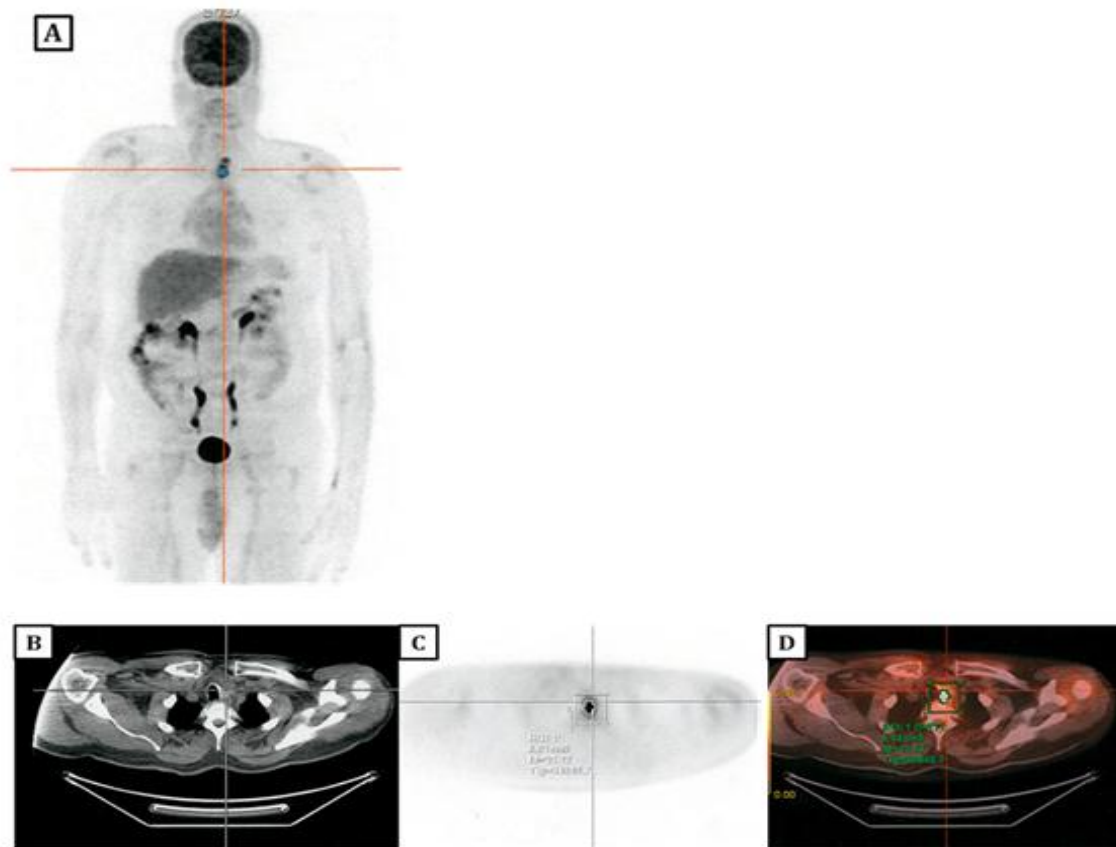
**KEYWORDS:** Thyroid incidentaloma; 18F-FDG; PET/CT; thyroid; cancer; Papillary carcinoma.**INTRODUCTION**

Thyroid incidentalomas (TI) are described as thyroid nodule discovered accidentally during imaging studies performed for unrelated pathologies of the thyroid.<sup>[1,2]</sup> The progress in technology, especially improvements the quality of images in ultrasonography (USG), computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography/computed tomography (PET/CT) with different tracers such as 18 fluoro-2-deoxy-d-glucose (FDG), radiolabeled prostate-specific membrane antigen (PSMA), Fluorine-18 (F18), or Carbon-11 (C11) have significantly increased the rate detection of thyroid incidentalomas.<sup>[3,4]</sup> However, the risk of malignant etiology differs depending on the imaging modality used.<sup>[5,6]</sup>

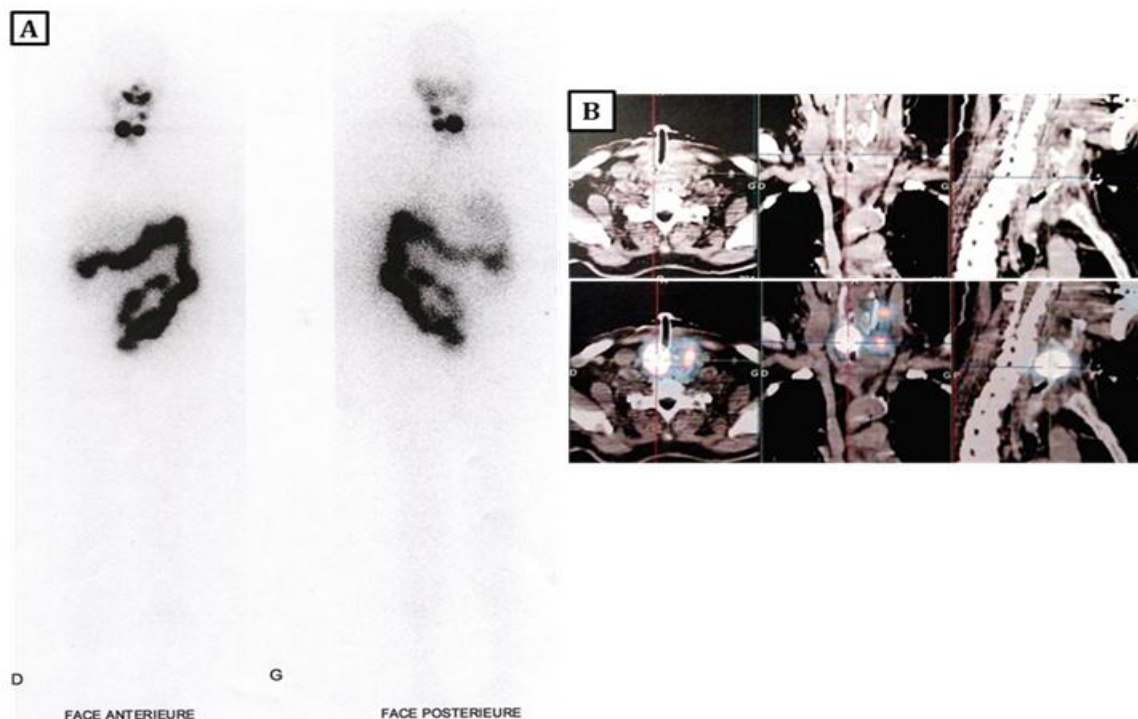
We reported the case of papillary thyroid carcinoma discovered during a 18F-FDG PET/CT performed in the management of non-Hodgkin's lymphoma. Through this observation, we underlined the value of exploring any hypermetabolic thyroid focus visualized on PET/CT to determine its nature that may be neoplastic.

**OBSERVATION**

A 71-year-old patient treated for non-Hodgkin's lymphoma who has undergone ileal resection with anastomosis followed by adjuvant chemotherapy. The 18F-FDG PET/CT examination conducted as part of the therapeutic evaluation, showed a fairly intense hypermetabolic lesion in the left laterotracheal region (SUVmax at 10.12) with a thyroid appearance (Fig 1). Complement by cervical ultrasound was performed showing a left thyroid nodule of 30x20 mm in diameter classified score 5 of the TIRADS classification, with a second nodule of 25 mm in diameter classified as TIRADS 4. A total thyroidectomy was performed; the anatomopathological examination was in favor of a 1.5 cm papillary thyroid carcinoma invading the surrounding thyroid parenchyma massively with thyroid capsule impairment and presence of poorly differentiated foci without the presence of vascular emboli. The patient received six weeks after surgery a therapeutic supplement with iodine 131 dosed at 3.7 GBq (100 mCi). Serum thyroglobulin level after thyroid hormone withdrawal was 176 ng/ml, the anti-thyroglobulin antibodies were negative. Post-therapeutic I-131 whole body scan showed an uptake in thyroid bed compatible with thyroid remnants without foci of pathological iodine uptake at a distance.



**Figure 1:** A: whole body  $^{18}\text{F}$ -FDG positron emission tomography (PET). B: Axial section computed tomography (CT), C: axial section  $^{18}\text{F}$ -FDG PET, D : fusion  $^{18}\text{F}$  -FDG PET/CT showing a focal FDG uptake on the left thyroid lobe of a patient followed-up with FDG PET/CT for non-Hodgkin's lymphoma; the histology report after thyroidectomy revealed papillary thyroid carcinoma incidentally identified in PET/CT.



**Figure 2:** Anterior and posterior view I-131 post-therapy whole body scan (A) and slices SPECT/CT (B) showing an uptake in thyroid bed compatible with thyroid remnants without foci of pathological iodine uptake at a distance.

## DISCUSSION

Thyroid incidentaloma, by definition, is any thyroid lesion discovered incidentally during a medical imaging examination performed for various extra-thyroid pathologies. The incidence of detecting a thyroid nodule on palpation ranges between 2% and 7%.<sup>[7,8]</sup> However, the incidence increases to 14%–46% using USG<sup>[9,10,11]</sup> and 16-56% using CT or MRI.<sup>[9,12,13]</sup>

The incidence of a TI demonstrated by 18F-FDG PET/CT compared to other imaging techniques is rare. Several authors reported a TI incidence to range between 0.2 and 8.9%.<sup>[14,15,16,17]</sup> This can be explained by the absence of the glucose transporter 1 (GLUT-1) in normal thyroid cells which is necessary for the uptake of glucose into the cell across the plasma membranes; and also by the fact that the thyroid gland uses mostly the free fatty acids for its energy metabolism.<sup>[18]</sup>

However, although rare, TI discovered on 18F-FDG PET/CT deserve special attention in exploration since the malignancy rate reported in the literature is about 8 to 64%.<sup>[4,14,17,19-20]</sup>

FDG can be captured by thyroid parenchyma in a diffuse or focused manner. The diffuse nature of hypermetabolism suggests a benign situation such as an inflammatory thyroid,<sup>[21,22]</sup> but does not exclude that a malignant lesion may coexist. However, these circumstances are very rare.<sup>[22,23]</sup>

The interpretation of the FDG uptake is facilitated by the possibility of coupling the PET images to the CT and by calculation of the SUV (Standardized Uptake Value). This latter remains a semi-quantitative parameter that reflects metabolic activity, but does not constitute a specific factor of malignancy. In this regard, some studies reported a statistically significant difference between SUVmax of benign lesions and the value of malignant ones,<sup>[24,25,26,27]</sup> but most do not find a cut-off value of SUVmax for differentiating a malignant from a benign nodule. Although it is known that malignant lesions have SUVmax value higher than benign ones.<sup>[23,28,29]</sup> In a retrospective study, Wang et al. analyzed different SUV thresholds, and considered that a value of 3.3 has a high sensitivity, and, taking into consideration the risk of malignancy, it is better to over-investigate these cases than to under-investigate them.<sup>[30]</sup> Also, Larg et al considered that SUVmax greater than 4 was significantly associated with the risk of malignancy.<sup>[31]</sup> In our patient, the SUVmax value of the hypermetabolic thyroid focus was high, in the order of 10.12. However, other controversial studies have not shown a significant difference between SUVmax from benign and malignant lesions.<sup>[20, 23, 29, 32, 33]</sup>

Another parameter that has been evaluated by some authors is about tumor size. Indeed for some of them, there is a positive correlation between the SUV value max and tumor size, so the diameter of the lesion

influences the FDG uptake.<sup>[31]</sup> Others found no significant correlation between SUVmax values and the size of malignant nodules.<sup>[34]</sup> Measuring the SUV value in a small lesion can be challenging, because of the partial volume effect, which can cause an underestimation of the radiopharmaceutical uptake, so lower values of SUV are found.<sup>[41,42]</sup> This issue is still being debated and no definitive conclusions could be drawn regarding the impact of SUV value on diagnostic driving for these patients.

The current guidelines for thyroid nodules have not established specific management plans for thyroid incidentalomas detected on 18F-FDG PET/CT. Only the American Thyroid Association (ATA) guidelines recommend performing Fine Needle Aspiration Biopsy (FNAB) for all thyroid nodules incidentally discovered on 18F-FDG PET/CT and confirmed through USG, having a dimension of >1 cm and a suspicious USG criteria.<sup>[35]</sup> In this regard, there are studies that stated that the FNAB procedure performed for thyroid nodules with suspicious USG features had benign results in 36–75% of cases, and therefore a large number of thyroid surgeries were avoided.<sup>[26,36]</sup> These results demonstrate the importance of this technique in the evaluation process of thyroid incidentalomas.

The most common primary malignancies where TIs were identified were breast cancer, Hodgkin lymphoma, colon cancer, and malignant melanoma.<sup>[15,17,31,38]</sup> In previous studies, the most common histological type of malignant thyroid incidentalomas most frequently diagnosed is represented by papillary thyroid carcinoma.<sup>[4,17,26,37]</sup> with an excellent prognosis and high survival rate. However, the undifferentiated type, anaplastic and medullary carcinoma or metastases of solid cancers are not exceptional.<sup>[17,31]</sup>

It should be noted that the capture of 18F-FDG is more pronounced in the histological sub types that are not very differentiated or anaplastics. Indeed Grabellus et al.<sup>[39]</sup> concluded that the differentiation of thyroid carcinoma was generally accompanied by an over expression of GLUT-1 responsible for the capture of FDG. However, some thyroid carcinoma, although well differentiated, are greedy for FDG due to the presence of a pejorative histology, such as peri-thyroid extension and lympho vascular invasion that make them greedy at the FDG, as demonstrated by Choi et al.<sup>[40]</sup>

## CONCLUSION

At the end of this work, thyroid incidentalomas discovered on 18F-FDG PET/CT although rare deserve a supplement by Cervical USG to clarify the nodular nature and possible FNAB if needed, regardless of the SUVmax value, given the high risk of malignancy in this imaging modality.

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