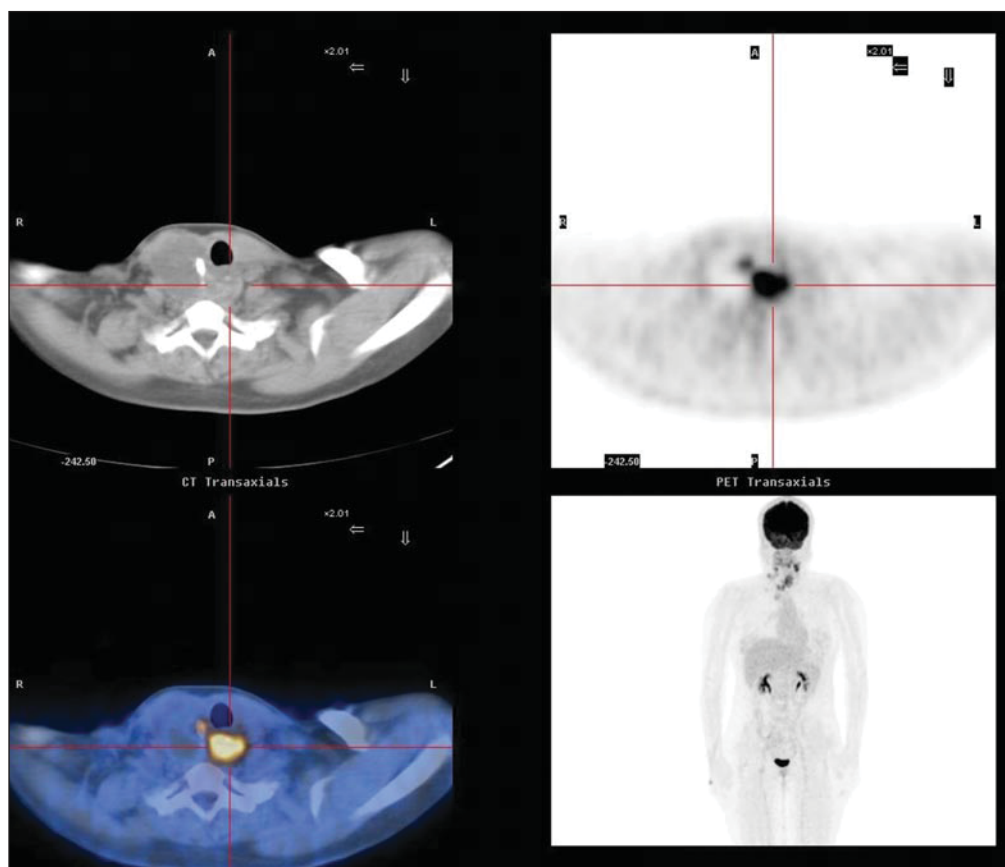


FDG-PET in thyroid papillary carcinoma: a case report



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Introduction

The most common form of thyroid cancer is papillary thyroid cancer, accounting for 70-90% of well differentiated thyroid malignancies.¹ The incidence of malignant thyroid tumours is approximately 4/100,000 in women and 1.5/100,000 in men.² In recent years, there has been an increase in the incidence of papillary carcinoma; whether this is due to dietary changes over time remains unclear.³ Although papillary tumours tend to metastasise via lymphatics, they have a good prognosis, with a 90% 10-year survival rate.⁴

Positron emission tomography (PET) with the glucose analogue fluorodeoxyglucose (FDG-PET)

has a special place in the investigation of papillary thyroid malignancies. These tumours are generally poorly differentiated and have impaired Na^+/I^- pumps, resulting in poor iodine uptake.⁵ However, these tumour cells have an increased expression of GLUT-1 and GLUT-3 glucose transporters.⁶ FDG is a glucose analogue that does not enter glycolysis, and so papillary tumour cells accumulate FDG, leading to positive findings on PET. Therefore, FDG-PET is especially important in cases where an iodine 131 (^{131}I) scan is negative but serum thyroglobulin levels remain high. In this scenario, FDG-PET sensitivity has been shown to be greater than 90%.⁷

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The case

Mrs H is a 35-year-old female who presented with a goitre and underwent a bilateral subtotal thyroidectomy. She was found to have papillary carcinoma of the thyroid gland in November 1999. Since this surgery, she has undergone ¹³¹I ablation therapy and has been receiving thyroxine (T4) treatment. The patient attended regular follow-up at the general surgery outpatient clinic and good recovery was noted. Her thyroid function was placed on close monitoring through radio-immuno assays during these routine visits. However, in June 2006, Mrs H's thyroglobulin level was extremely high at 1,698ng/ml. Chest x-ray and CT scans revealed no abnormalities. ¹³¹I total body cancer imaging revealed radiotracer accumulation in the left upper quadrant and lower midline pelvic regions, which was likely to be due to physiological excretion of radiotracer through the intestinal or urinary tracts. No abnormal tracer uptake was demonstrable in the thyroid bed or elsewhere. However, after considering the patient's clinical history of elevated thyroglobulin, and negative ¹³¹I cancer scan, FDG-PET scan was recommended and performed.

PET whole body imaging was performed 45 minutes after intravenous injection of 10mCi of [F-18] FDG. Focal areas of increased FDG uptake were seen in the lower neck (retrocricoid, retrotracheal and right paratracheal regions), bilateral jugular

(level II), right jugular (level III), and paratracheal (level VI) lymph nodes. These findings pointed to a probable recurrence of papillary thyroid carcinoma with bilateral neck lymph node metastases. Surgery was performed and intraoperative frozen section revealed areas of inflammation, haemorrhage, and fibrotic change. However, no neoplasm was observed. A subsequent radio-immuno assay indicated an elevated thyroglobulin level of 163ng/ml. The patient was brought back to theatre and left-sided lymphatic tissue was excised. The submitted specimen consisted of several pieces of tissue measuring 1.2cm in greatest dimension. The pathological finding was of metastatic thyroid papillary carcinoma, demonstrating characteristic cytologic features and papillary growths. Following surgery, the patient's thyroglobulin level dropped to within the normal range. She recovered quickly and was discharged home.

Discussion

The ¹³¹I whole body scan is a commonly performed investigation for thyroid carcinomas; however, roughly 20% of patients with high serum thyroglobulin have negative ¹³¹I whole body scans.⁸ False-negative scans may be due to the tumour being too small to detect, loss of differentiation of cancer cells leading to low iodine uptake, or poor TSH stimulation (for

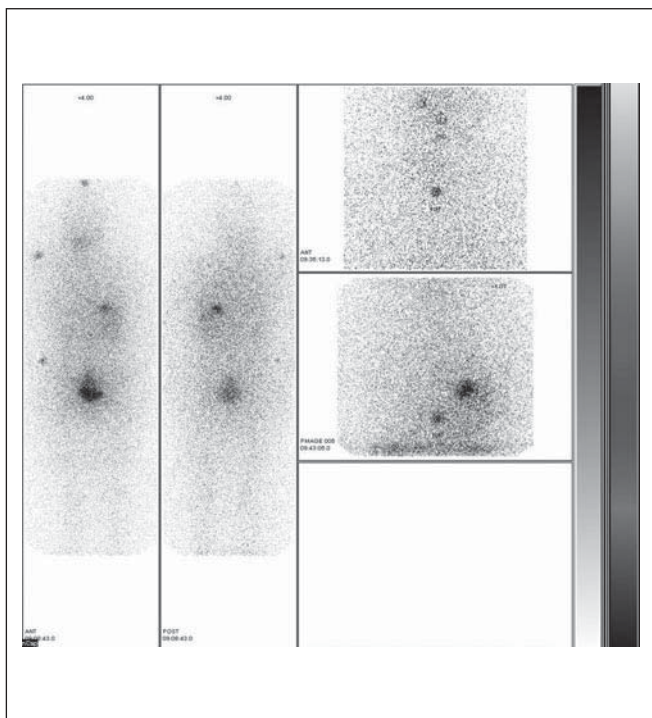


FIGURE 1: Negative scan result of ¹³¹I whole body scan. The image shows radiotracer uptake in the thyroid bed. The two small round focal uptakes marked by circles are radiotracer injections used for positioning.

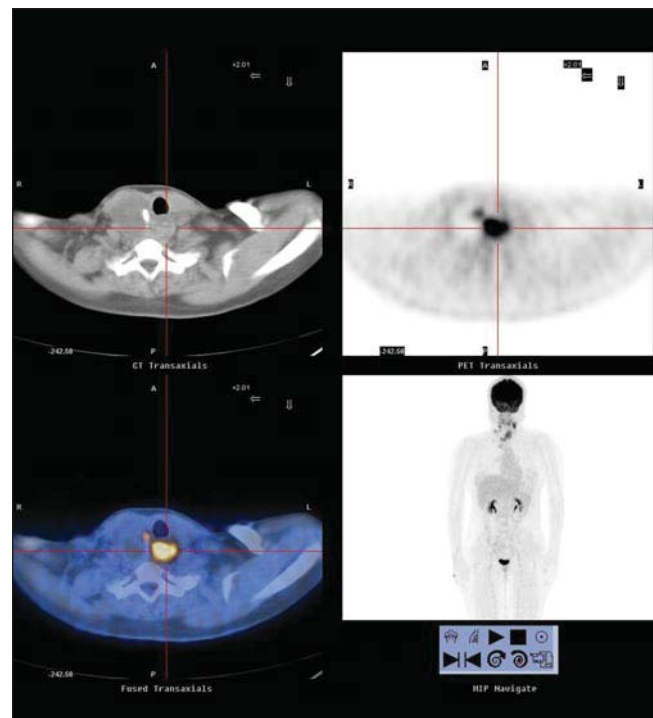


FIGURE 2: FDG-PET scan revealing a mass indicated by red lines.

example, poor compliance of thyroid hormone withdrawal). In general, FDG-PET is recommended when there is a negative radioiodine scan with suspicion of metastatic spread, which can present clinically as elevated thyroglobulin levels. In our patient, an FDG-PET scan revealed increased radiotracer uptake in the area where surgical exploration confirmed recurrence of papillary thyroid carcinoma. The FDG-PET was not ordered until the ¹³¹I thyroid scan revealed no abnormal areas of radiotracer uptake. CT, chest x-ray and thyroglobulin measurement were performed prior to the PET scan. Our patient also underwent a subtotal thyroidectomy prior to her FDG-PET. According to Grünwald and Diehl, the sensitivity and specificity of FDG-PET increases if the scan is performed postoperatively when no large amounts of thyroid tissue remain.⁹

In evaluating a lesion preoperatively, it must be noted that there are no indications in the literature for using FDG-PET as a first-line tool for diagnostic imaging. According to Feine *et al*, even benign tumours can have markedly high uptake of FDG.¹⁰ Also, some papillary growth may not show any radiotracer uptake at all. Therefore, sonography, scintigraphy, fine needle biopsy and morphological imaging, such as CT in conjunction with laboratory analysis, are generally recommended for investigation initially.

FDG is a glucose analogue and does not normally demonstrate

significant uptake in the neck region. However, in areas such as the brain, FDG uptake will be very high under normal conditions, reflecting the organ's high glycolytic activity. To improve the specificity of the PET scan, it is important for patients to refrain from excessive talking and swallowing that may lead to increased muscular uptake of FDG in the neck and larynx.¹¹

Our patient underwent three neck surgeries, initially for hyperthyroid goitre and subsequently for papillary thyroid carcinoma. The second surgery resulted in the excision of tissue of no pathological significance. The PET-transaxial scan had poor spatial resolution (5mm). However, in this case new technology enabled radiographers to combine PET-transaxials with CT-transaxials. The fused transaxial images provided adequate information for accurate preoperative evaluation.

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