Case 12950

Eurorad

Role of recombinant thyroid stimulating hormone in increasing the sensitivity of F18-FDG PET/CT in TENIS syndrome

Published on 13.09.2015

DOI: 10.1594/EURORAD/CASE.12950
ISSN: 1563-4086
Section: Head & neck imaging
Area of Interest: Thyroid / Parathyroids Head and neck Lymph nodes
Procedure: Biopsy
Imaging Technique: Nuclear medicine conventional
Imaging Technique: Ultrasound
Imaging Technique: PET-CT
Special Focus: Metastases Case Type: Clinical Cases
Authors: Osayande Evbuomwan, Khushica Purbhoo, Mboyo Di Tamba Vangu
Patient: 36 years, female

Clinical History:

36-year-old female patient with papillary thyroid carcinoma. Underwent total thyroidectomy with right neck dissection (suspicious neck lymph nodes were seen on pre op sonar) and ablation of residual thyroid tissue with 2960 MBq of I-131. Follow up I-131 whole body scans (WBS) were negative, but thyroglobulin levels remained elevated.
Imaging Findings:

Her diagnostic scan with 74 MBq of I-131 six weeks post-surgery, with a TSH of > 150mIU/l showed focal increased uptake in the neck as shown in figure 1. Six months and one year post therapy scans after ablation with 2960 MBq of I-131 were negative as shown in figures 2 and 3, respectively, however, her Tg levels were elevated (12.9 ug/l). Neck ultrasound (US) done after her one year therapy scan showed a mass on the right side of the thyroid bed, with no calcifications, measuring 15 x 14 mm. FNA of the mass yielded insufficient sample, so an FDG PET/CT scan on TSH suppression was done, which was negative for any metabolically active disease, as shown in figure 5. A repeat FDG PET/CT scan with exogenous TSH stimulation using Thyrogen®, showed avid disease on a right level IIA lymph node. Histology was positive for metastatic papillary thyroid cancer.
Discussion:

Differentiated thyroid cancer (DTC) is the most frequent endocrine cancer, representing 1% of all malignant tumours [1]. After initial surgery and high-dose radioactive iodine 131 (I-131) ablation, follow-up monitoring consists of regular neck ultrasound, WBS with I-131 or I-123, measurements of Tg and Tg antibody. Undetectable levels of Tg are expected after successful treatment. Stimulated Tg [either by thyroxin (T4) withdrawal or recombinant human thyroid stimulating hormone (rhTSH)] is a sensitive marker of both residual and recurrent disease [2]. Although elevated Tg levels may be a normal finding up to 3 years after a normal WBS, it may reflect non iodine-avid recurrence or metastases in a condition referred to as Thyroglobulin-elevated negative Iodine Scintigraphy (TENIS). FDG PET/CT has a role in these patients. A meta-analysis of 17 studies between 1990 and 2008, including a total of 571 patients found an overall sensitivity for PET of 0.835 (95% CI 0.791–0.873) and specificity of 0.843 (95% CI 0.791–0.886)

[3]. FDG PET in combination with TSH stimulation is a more sensitive technique in detecting recurrence or residual disease in patients with negative iodine WBS, as TSH stimulation increases the metabolic activity of tumours. A review by Chao et al [4] looked at 7 prospective controlled clinical trials with 168 patients and found that there was a statistically significant difference between PET scans done on suppression and on TSH stimulation. The detection of non-iodine-avid disease with FDG PET/CT is of importance in the management of DTC as the iodine uptake of a tumour is inversely related to its glucose metabolism, and FDG uptake alone, with concomitant loss of iodine uptake is a functional sign of dedifferentiation[5]. This is likely due to a decrease in sodium-iodide symporter expression and an increase in glucose transporter-1 expression. These patients will not benefit from 'blind' high dose I-131 treatment, but rather benefit from surgery, as was shown in our patient. In conclusion FDG PET/CT scans for patients with TENIS should be done with TSH stimulation. Patients who have contraindication to hormone withdrawal or those who cannot tolerate the side effects of hypothyroidism should opt for rhTSH during the 18F-FDG PET-CT study.

Differential Diagnosis List: Thyroglobulin-elevated negative Iodine Scintigraphy (TENIS), Reactive lymphadenopathy, Lymphoma

Final Diagnosis: Thyroglobulin-elevated negative Iodine Scintigraphy (TENIS)

References:

Özdemir E, Yildirim N, Polat SB, Turkolmez S, Ersoy R, Cakir B (2014) Diagnostic value of 18F-FDG PET/CT in patients with TENIS syndrome: correlation with thyroglobulin levels. Ann Nucl Med 28:241–247 (PMID:24379008)

Mazzaferri EL, Robbins RJ, Spencer CA, et al (2003) A consensus report of the role of serum thyroglobulin as a monitoring method for low-risk patients with papillary thyroid carcinoma. J Clin Endocrinol Metab 88:1433–41 (PMID: 12679418)

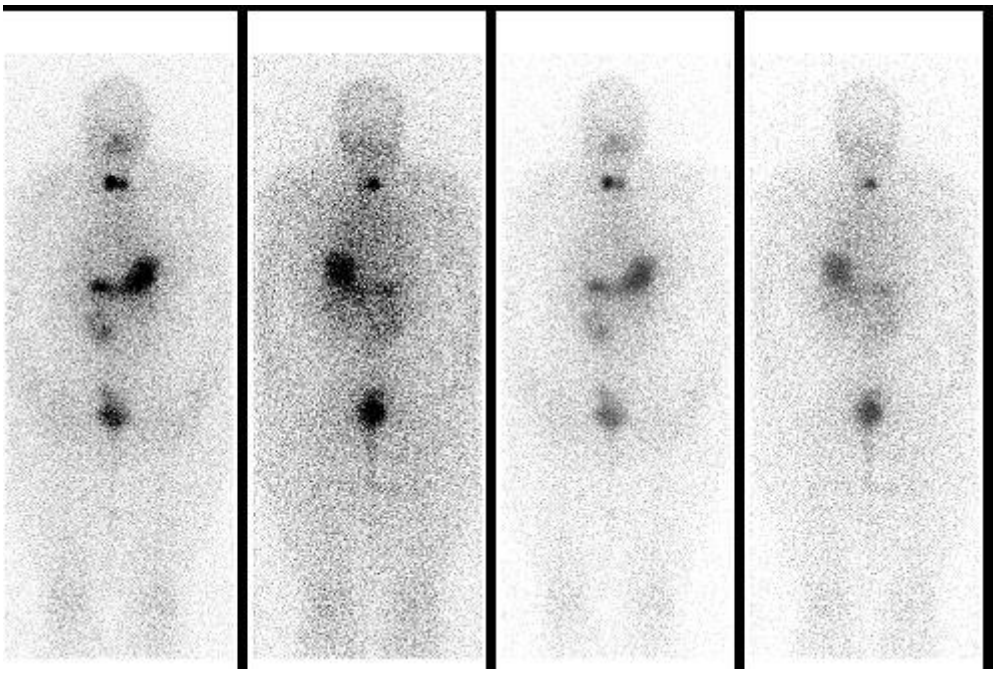
Dong MJ, Liu ZF, Zhao K, et al (2009) Differentiated thyroid carcinoma with radioiodine-negative whole-body scan: a meta-analysis. Nucl Med Commun 30(8):639-50

Chao M, Jiawei X, Yanhui L, Yanyan G, Shuyao Z, Xufu W (2010) The role of TSH for 18F-FDG-PET in the diagnosis of recurrence and metastases of differentiated thyroid carcinoma with elevated thyroglobulin and negative scan: a meta-analysis. Eur J Endocrinol 163:177-183 (PMID: 20484385)

Moog F, Linke R, Manthey N. et al (2000) Influence of thyroid-stimulating hormone levels on uptake of FDG in recurrent and metastatic differentiated thyroid carcinoma. J Nucl Med 41:1989-1995 (PMID:11138683)

Figure 1

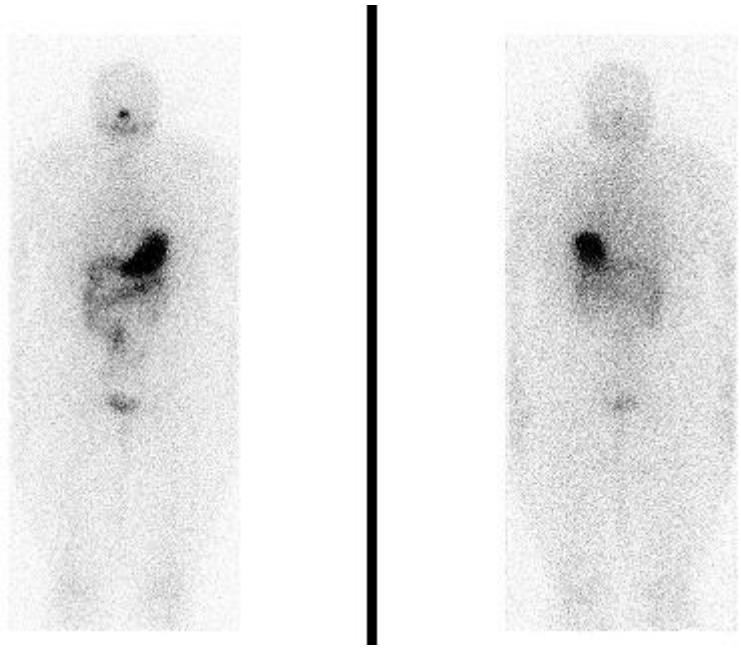
a



Description: Two sets of whole body planar images, with different window levels. For each set, left (anterior) images and right (posterior) images show focal neck uptake post thyroidectomy. **Origin:** Department of Nuclear Medicine and Molecular Imaging, CMJAH, Johannesburg, South Africa.

Figure 2

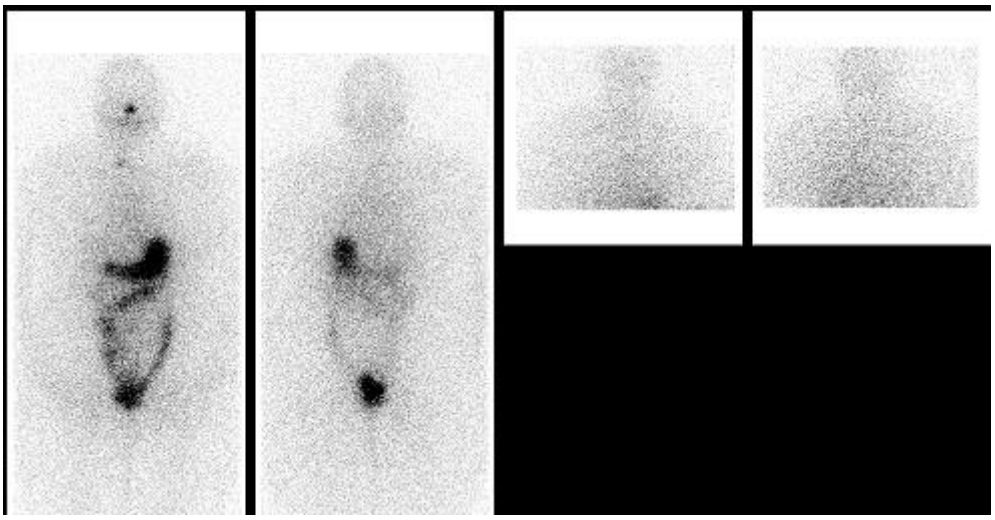
a



Description: Whole body planar images. Left (anterior) and right (posterior) images: negative of iodine avid disease. **Origin:** Department of Nuclear Medicine and Molecular Imaging, CMJAH, Johannesburg, South Africa

Figure 3

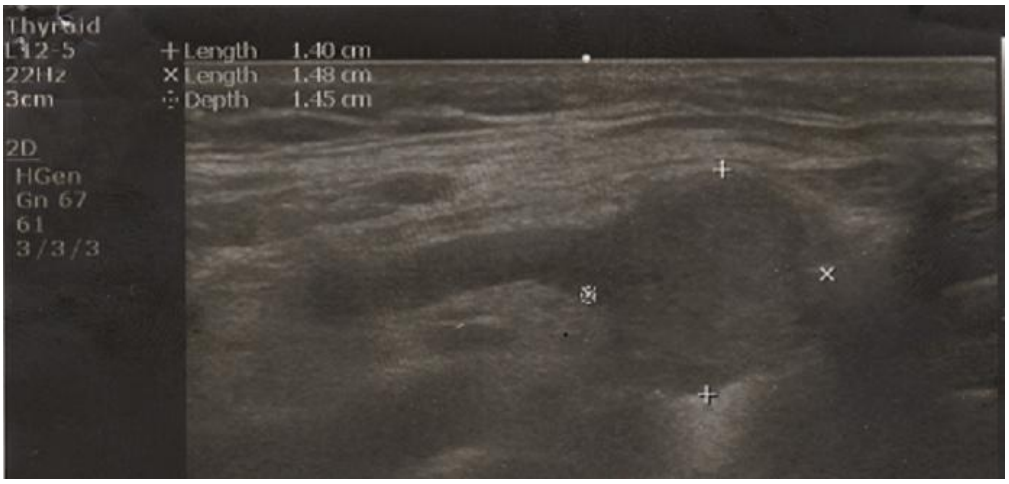
a



Description: Anterior and posterior whole body planar images on the right and left, respectively, negative for iodine avid disease. The static images on the right were done to confirm oesophageal activity clearing post water administration. **Origin:** Department of Nuclear Medicine and Molecular Imaging, CMJAH, Johannesburg, South Africa

Figure 4

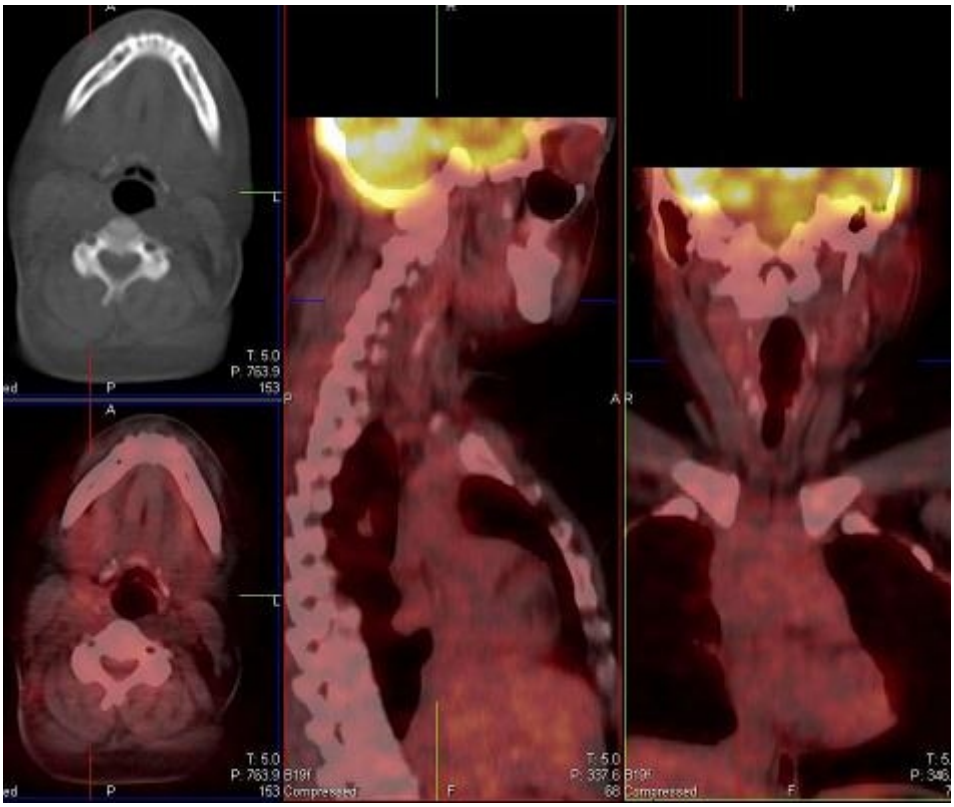
a



Description: Shows a nodal mass in the right jugular digastric region with no calcifications. **Origin:** Department of Nuclear Medicine and Molecular Imaging, CMJAH, Johannesburg, South Africa

Figure 5

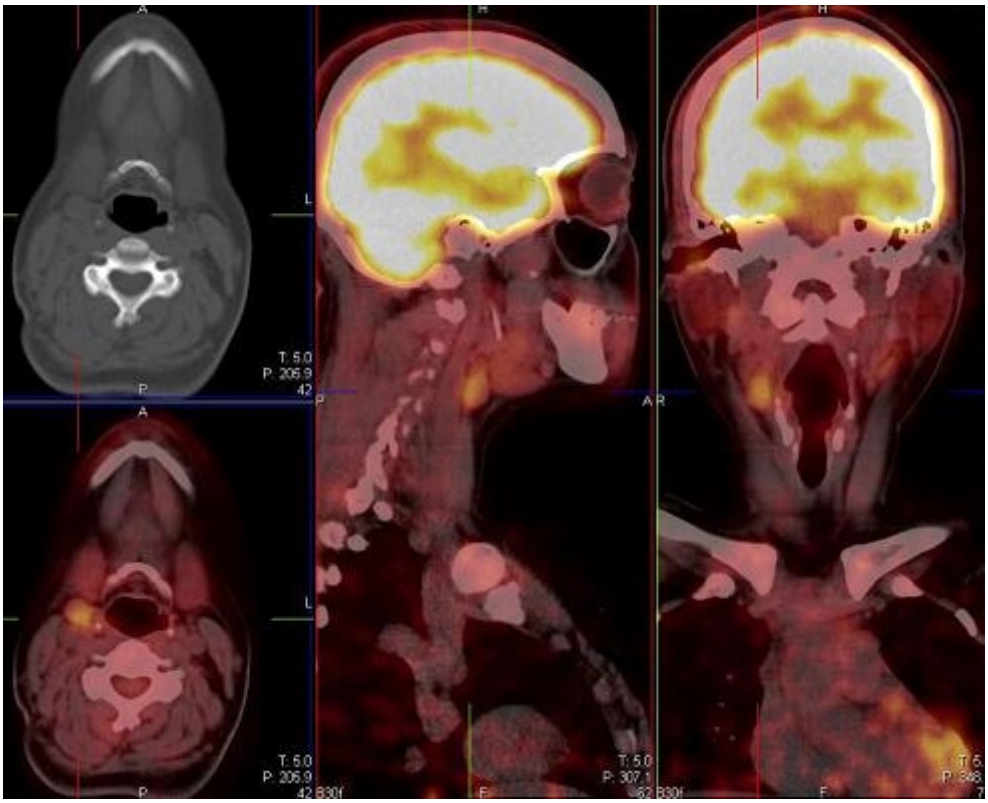
a



Description: Transaxial, sagittal and coronal fused PET/CT images from left to right, respectively, showing no FDG avid disease. **Origin:** Department of Nuclear Medicine and Molecular Imaging, CMJAH, Johannesburg, South Africa

Figure 6

a



Description: Transaxial, sagittal and coronal fused PET/CT images from left to right, respectively, showing active nodal disease in a right level IIA lymph node (SUVmax 8.21). **Origin:** Department of Nuclear Medicine and Molecular Imaging, CMJAH, Johannesburg, South Africa