Incidentally Detected Thyroid Follicular Neoplasm on Somatostatin Receptor Imaging and Post-therapy Scan

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Abstract

Peptide receptor radionuclide therapy (PRRT) either using Lu-177 or Y-90 peptide radiopharmaceuticals has emerged as promising treatment modality in patients with inoperable metastatic neuroendocrine tumour (NET) including medullary thyroid cancer, because of overexpression of somatostatin receptor 2 (sstr-2) on these cells. The several investigators have used PRRT in non-iodine avid differentiated thyroid cancer patients with limited success, where other treatment modalities have failed, probably due to faint sstr-2 expression in these lesions. However Hurthle cell neoplasms being predominantly non-iodine avid lesions have shown sstr-2 over-expression. The present case of inoperable NET patient imaged and treated with radiolabelled somatostatin analogue showed incidentally detected thyroid lesion highlighting the its importance in imaging and treatment in these type of thyroid malignancies.

Keywords: *F-18-fludeoxyglucose positron emission tomography/computed tomography, Ga-68 DOTANOC positron emission tomography/computed tomography, Hurthle cell neoplasm, Lu-177 DOTATATE, peptide receptor radionuclide therapy*

Introduction

Neuroendocrine tumors (NETs) including medullary thyroid carcinoma overexpress the different somatostatin receptor (SSTR 1–5) subtypes. These receptors have been utilized for the detection and treatment of the NETs.[1-3] The differentiated thyroid carcinoma (DTC) is also seen to express SSTR, but the different studies indicate that the expression of the different subtypes of SSTR is more variable than in NETs where it is predominantly SSTR2 expression. The noniodine avid differentiated thyroid cancer with limited treatment options has shown variable therapeutic efficacy of peptide receptor radionuclide therapy (PRRT) in progressive metastatic/recurrent disease.[4-6] Here is a case of patient with inoperable gastropancreatic NET with lymph node/hepatic metastatic and tracer avid right thyroid lobe lesion detected on whole-body Ga-68 DOTATATE positron emission tomography/computed tomography (PET/CT) scan. The thyroid lesion shown to be follicular neoplasm on histopathology. The subsequent post-Lu-177 DOTATATE therapy scan showed the tracer uptake in thyroid lesion in addition to lesions at primary and metastatic sites. This case report emphasizes the importance of evaluation of thyroid lesions detected on SSTR imaging along with the potential use of Lu-177 DOTATATE as an adjunctive therapeutic option in relatively radioiodine resistant neoplasm.

Case Report

A 46-year-old male presented with severe abdomen pain and jaundice of 1-month duration, preceded by mild abdominal pain and vomiting on and off for the past 3 years. The ultrasound and contrast-enhanced computed tomography of the abdomen revealed a mass in the mesentery in front of D3 and D4 part of the duodenum, abdominal lymphadenopathy, and multiple hypodense liver lesions. The histopathology of the mesenteric mass revealed to be metastatic NET. The patient underwent whole-body Ga-68 DOTANOC PET/CT to assess the extent of the disease as well avidity for SSTR in the lesions. The imaging revealed SSTR expressing circumferential mural thickening (~1.3 cm) at the duodenopyloric region (maximum standardized uptake value [SUV] 44.1) with retroperitoneal and mesenteric lymphadenopathy (~3.0 cm × 2.5 cm; maximum SUV 33.5) and multiple hypodense lesions in the

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How to cite this article: Sood A, Singh H, Sood A, Basher RK, Mittal BR. Incidentally detected thyroid follicular neoplasm on somatostatin receptor imaging and post-therapy scan. Indian J Nucl Med 2017;32:224-6.

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Access this article online

Website: www.ijnm.in

DOI: 10.4103/ijnm.IJNM_37_17

Quick Response Code:

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liver (maximum SUV ~18.0) along with SSTR expressing nodular hypodense lesion (~1.3 cm × 1.2 cm; maximum SUV 10.1) in the right lobe of the thyroid gland. The whole-body F-18-fludeoxyglucose (FDG) PET/CT scan done as a part of protocol for PRRT also showed intense tracer avid lesion in the right thyroid lobe in addition to mildly FDG avid lesions in primary and metastatic sites of NET origin [Figure 1a-h]. Ultrasonography (USG) neck revealed a hypoechoic nodule (~1.2 cm × 1.0 cm) with no microcalcification, in the right lobe of thyroid. The USG-guided fine-needle aspiration (FNA) done from the thyroid lesion revealed cytology consistent with Hurthle cell neoplasm. The patient was given an option of thyroid surgery, but he refused for the same, due to existing inoperable NET.

The patient received 200 mCi of Lu-177 DOTATATE infusion with amino acid infusion for renal protection over 4 h due to inoperable disease. The patient was also treated with low-dose oral capecitabine for 14 days as radiosensitizer agent along with Lu-177 therapy. The post-Lu-177 therapy scan showed tracer uptake in the primary lesion, abdominal/hepatic lesions as well as in the right thyroid lobe nodule [Figure 2a-d]. Since patient had refused for thyroid surgery, he is on regular follow-up with USG thyroid and further lutetium therapy at present. The patient is symptomatically better on his follow-up after two cycles of Lu-177 therapy and capecitabine without much change in thyroid lesion on ultrasound.

Discussion

PRRT has shown great promise for treatment of advanced well-differentiated NETs in the past two decades. Majority of these tumors overexpress SSTRs with predominance of SSTR2 to which radiolabeled somatostatin analog therapy in form of either beta-emitting Y-90 or beta- and gamma-emitting Lu-177 radiopeptides is used for their treatment.[3] Although the radiolabeled somatostatin analogs have also shown different and variable efficacy in treatment of noniodine avid differentiated thyroid cancer, because of predominant SSTR3 and 5 expressions with faint SSTR2 expression in papillary and follicular thyroid cancer in SSTR subtype profile. However, medullary thyroid cancer and Hurthle cell neoplasm have demonstrated overexpression of SSTR2.[6-8]

Hurthle cell neoplasm of thyroid gland is predominantly (>75%) composed of oncocytic follicular cells. These neoplasms are classified as benign, intermediate, or malignant depending on capsular and vascular invasion, pattern of growth, nuclear atypia, and necrosis. FNA cytology cannot differentiate between Hürthle cell adenoma and carcinoma and can only be distinguished by the presence of capsular and/or vascular invasion on histopathologic examination, hence called as Hurthle cell neoplasm.[9] Malignant Hurthle cell tumors are 2%–3% of all patients with thyroid malignancy.[10] Hurthle cell cancers are different clinical entities because of different metabolic and biologic behaviors.[10] They have shown minimal avidity for radioactive iodine, and the overall outcome in these patients is poorer in comparison to other DTCs. Hurthle cell carcinoma is rarely seen to respond to radioiodine therapy, even at the initial stage. The surgery is the definite management of all thyroid cancers including Hurthle cell cancer. However, the therapeutic alternatives for metastatic Hurthle cell cancer are limited and have relatively poor prognosis. The chemotherapy and radiotherapy are known to be ineffective. SSTR expression on malignant Hurthle cells suggests that imaging and treatment with somatostatin analogs may be of value in inhibiting the tumor growth.[5,6] A study done in 5 noniodine avid

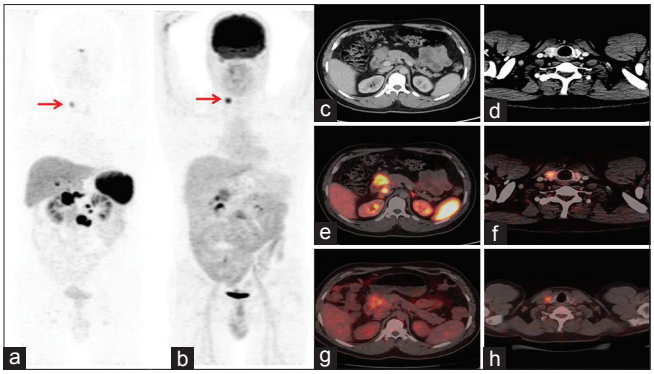

Figure 1: (a-h) Whole-body Ga-68 DOTANOC positron emission tomography/computed tomography and F-18 fludeoxyglucose positron emission tomography/computed tomography scintigraphy: Maximum intensity projection images, computed tomography, and fused cross-sectional images of the abdomen and thyroid region showed intense somatostatin avid tracer uptake in the primary site lesion, mesenteric lymph nodal mass, multiple hypodense liver lesions, and focal lesion in the right thyroid region (arrow). Mild fludeoxyglucose uptake is noted in the primary site lesion, mesenteric lymph nodal mass, and multiple hypodense liver lesions; however, right thyroid lobe nodule showed intense fludeoxyglucose uptake (arrow)

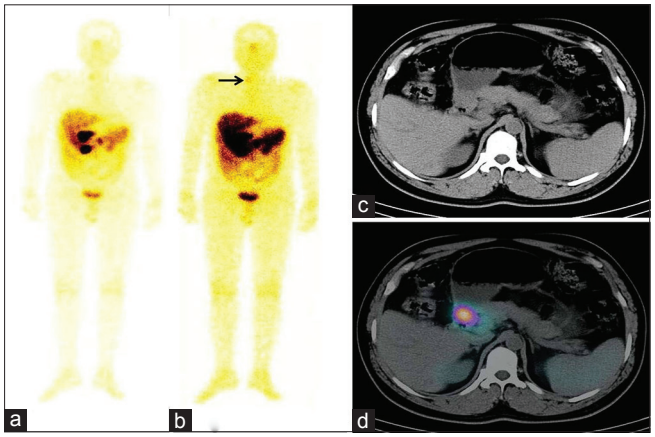

Figure 2: (a-d) Anterior whole-body posttherapy Lu-177 DOTATATE scans (dual intensity) at 24 h showed tracer uptake in the primary site, mesenteric lymph nodal mass liver lesions as well as in the right thyroid region (arrow). Regional transaxial computed tomography and fused single-photon emission computed tomography/computed tomography images showed tracer avid primary lesion

thyroid cancer patients (including three patients of Hurthle cell thyroid cancer) treated with Lu-177-based PRRT showed the best result with noniodine avid metastatic disease of Hurthle cell thyroid cancer.[11] The reason for a better outcome in Hurthle cell carcinoma was probably due to SSTR2 expression.[8] The SSTR expression in incidentally detected Hurtle cell neoplasm in the present case highlights that radiolabeled somatostatin analogs can be utilized not only for the characterization of the thyroid lesion but also for the PRRT of the nonradioiodine avid Hurthle cell neoplasm, where existing treatment options have been exhausted.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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