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Case Report

Incidental primary breast cancer detected on surveillance ^{68}Ga -DOTATATE PET/CT in a patient with metastatic neuroendocrine carcinoma

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ABSTRACT

We present a case of a 53-year-old woman with metastatic neuroendocrine tumor, presumed primary in the small intestine with metastases to the liver and mesenteric lymph nodes. The patient was being treated with lanreotide and followed with somatostatin receptor (SSTR)-targeted ^{68}Ga -labeled 1,4,7,10-tetraazacyclododecane- N,N',N'',N''' -tetraacetic acid- d -Phe(1)-Tyr(3)-octreotate (^{68}Ga -DOTATATE) positron emission tomography – computed tomography (PET/CT). On a follow-up exam, the patient's primary and metastatic disease had improved but she had new ^{68}Ga -DOTATATE-avid lesions in the right breast and right axilla. Subsequent breast imaging workup and biopsy demonstrated a primary breast cancer and axillary lymph node metastasis.

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Introduction

Neuroendocrine tumors (NETs) are rare malignancies, although the incidence has been rising over the past 30 years [1]. Because NETs typically express somatostatin receptor (SSTR), somatostatin analogues can be used for molecular imaging [2]. Specifically, gallium-68-labeled radiotracers, based on synthetic somatostatin analogs have become widely available for imaging. Clinical trials have also shown that peptide receptor radionuclide therapy (PRRT) targeting SSTR can be successfully used for treating metastatic NETs [3]. There are lim-

ited data on the detection efficiency of breast cancers with SSTR agonists, although a review article including 24 papers on SSTR-mediated nuclear imaging found reported sensitivities ranging from 36% to 100% and specificities 22% to 100% [4].

Case report

The patient is a 53-year-old woman who was found to have multiple liver masses on a trauma protocol CT of the ab-

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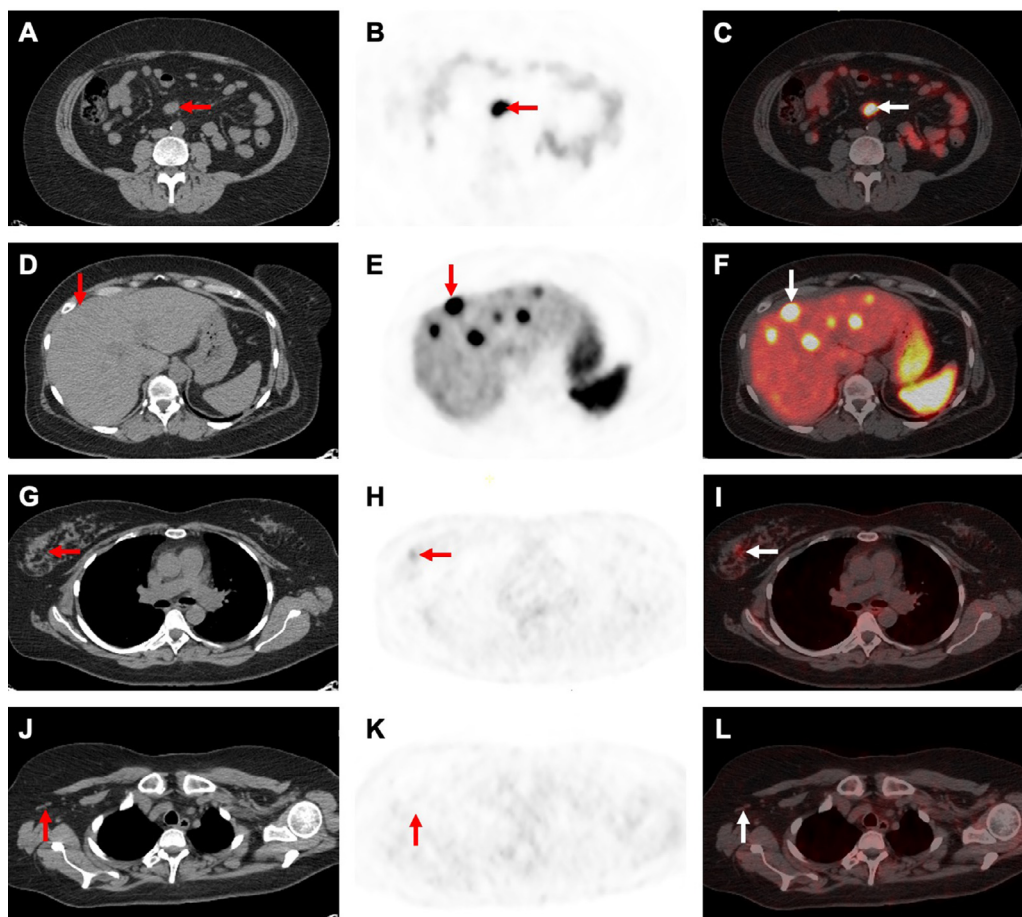


Fig. 1 – Baseline ^{68}Ga -DOTATATE PET/CT. (A) Axial CT, (B) axial PET, and (C) axial PET/CT images through the mid-abdomen demonstrating intense radiotracer uptake in a mesenteric lymph node (red arrows), consistent with metastatic neuroendocrine tumor. (D) Axial CT, (E) axial PET, and (F) axial PET/CT images through the liver show multiple sites of intense radiotracer uptake (red arrows), also consistent with metastatic neuroendocrine tumor. (G) Axial CT, (H) axial PET, and (I) axial PET/CT images through the chest show subtle asymmetric uptake in the right breast (red arrows), which may be an early indication of the patient's developing primary breast cancer. (J) Axial CT, (K) axial PET, and (L) axial PET/CT images from higher in the chest demonstrate no abnormal uptake in normal-sized right axillary lymph nodes (red arrows).

domen and pelvis. Liver biopsy showed well-differentiated NET. Further history revealed intermittent recurrent episodes of diarrhea without known cause. On further workup, patient had elevated serotonin and chromogranin A levels. She then had a ^{68}Ga -DOTATATE PET/CT which showed activity in multiple liver lesions, and a mass in the right middle abdomen small intestinal mesentery (Figs. 1A-F). No abnormal uptake was seen in the breast or axillary regions (Figs. 1G-L). The patient was started on lanreotide as part of a clinical trial and diarrhea symptoms improved. After 9 months of treatment, follow-up ^{68}Ga -DOTATATE PET/CT showed decreasing size and activity of the primary mass and liver lesions (Figs. 2A-F). However, there was a new ^{68}Ga -DOTATATE PET avid mass in the right breast and also a new enlarged ^{68}Ga -DOTATATE PET avid right axillary lymph node (Figs. 2G-L). The standardized uptake value of the primary mass was 8.0, and the standardized uptake value of the breast mass was 3.8. The breast mass was considered an SSTR-RADS-3C lesion [5] and the patient was referred to breast imaging where

a mammogram showed new architectural distortion in the upper outer right breast middle depth (Figs. 3A and B). Targeted ultrasound demonstrated an irregular hypoechoic mass with indistinct margins measuring 2.7 cm (Fig. 3C). An enlarged right axillary lymph node measuring 2.0 cm was also seen (Fig. 2D). These were both recommended for ultrasound-guided biopsy. Biopsy of the breast mass revealed moderately-differentiated infiltrating mammary carcinoma, estrogen receptor (ER) and progesterone receptor (PR) positive, human epidermal growth factor receptor 2 (HER2) negative, Ki67 moderate (10%-20%). The lymph node showed metastatic breast carcinoma.

Discussion

There have only been rare case reports of incidental breast carcinomas found on SSTR-targeted PET/CT [6,7] and addi-

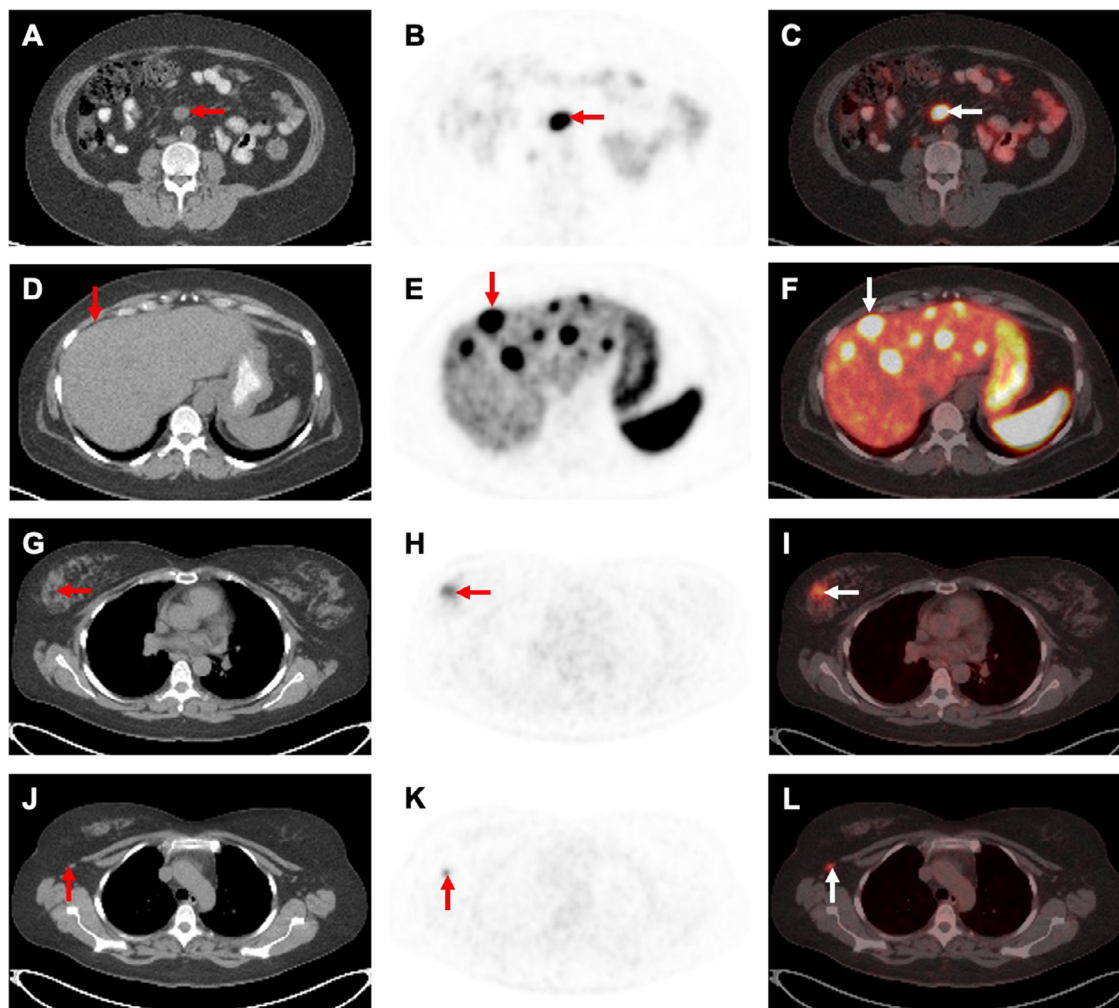


Fig. 2 – Follow-up ^{68}Ga -DOTATATE PET/CT after 9 months of lanreotide treatment. (A) Axial CT, (B) axial PET, and (C) axial PET/CT images through the mid-abdomen demonstrating a similar degree of intense radiotracer uptake in the previously noted mesenteric lymph node (red arrows), consistent with metastatic neuroendocrine tumor. (D) Axial CT, (E) axial PET, and (F) axial PET/CT images through the liver show an increasing number of sites of intense radiotracer uptake (red arrows), consistent with progressive metastatic neuroendocrine tumor. (G) Axial CT, (H) axial PET, and (I) axial PET/CT images through the chest show more-apparent asymmetric uptake in the right breast, consistent with the biopsy-proven primary invasive mammary carcinoma. (J) Axial CT, (K) axial PET, and (L) axial PET/CT images from higher in the chest demonstrate focal uptake in a small right axillary lymph node (red arrows), compatible with biopsy-proven mammary carcinoma involvement.

tional cases included in publications on SSTR imaging [5,8]. Rarely, NETs can metastasize to the breast [9]. For this reason, when an avid mass is incidentally seen in the breast on SSTR-targeted PET, the patient should be referred to breast imaging and tissue sampling should be performed to confirm whether the finding represents a metastatic site vs a second primary. This is particularly critical when the finding is new or increased compared to improving disease elsewhere. Even in patients with widespread metastatic NETs, the prolonged progression-free intervals that can be achieved with PRRT sug-

gest that workup and treatment of an underlying breast cancer may still be necessary.

Finding SSTR-targeted PET-avid breast cancers may have clinical significance. In breast cancers that express SSTR, SSTR-targeted PET/CT could be used for surveillance imaging [4]. This could be particularly helpful in patients who are unable to tolerate magnetic resonance imaging. The radiotracer avidity could also be harnessed in sentinel node identification [4]. Finally, PRRT could play a role in metastatic breast cancer treatment, which has been previously reported [10].

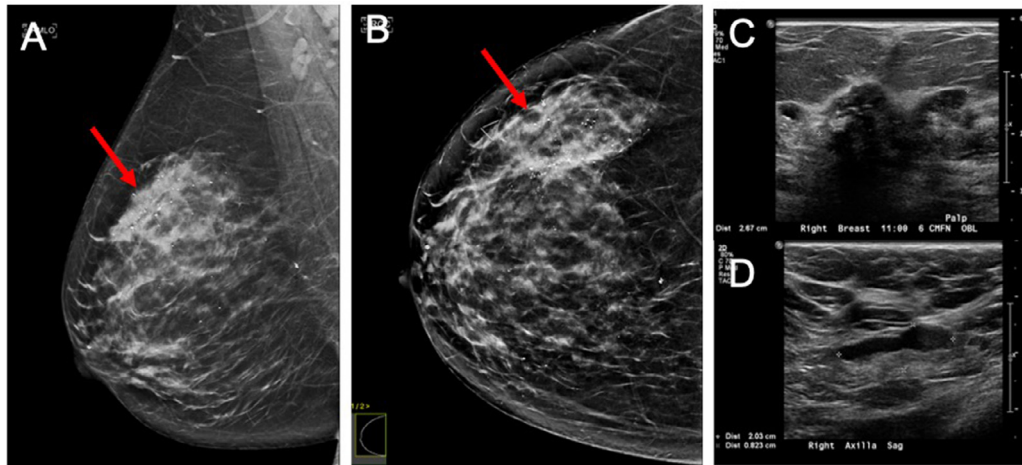


Fig. 3 – Breast Imaging. (A) Right mediolateral oblique and (B) craniocaudal mammograms with the arrows indicating the area of architectural distortion which was new compared to prior exams. There are also associated coarse heterogeneous calcifications. (C) Demonstrates an ultrasound image of the suspicious mass correlating with the mammographic architectural distortion and also correlating with the ^{68}Ga -DOTATATE-PET avidity. (D) Shows the enlarged right axillary lymph node correlating to the ^{68}Ga -DOTATATE PET finding.

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