Incidental PET/CT Detection of Breast Cancer in a Patient with Negative Mammogram and Breast Sonogram

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We present the case of a 57-year-old woman with known Hodgkins lymphoma who presented with PET/CT findings of a breast mass and diseased axillary lymph node despite negative results from a recent routine mammogram and ultrasound. Needle biopsy of the mass and lymph node confirmed a diagnosis of infiltrating ductal carcinoma of the breast with nodal metastases.

Introduction

   Most breast cancers are clinically detected during a screening exam. To confirm, mammography and ultrasound are the main diagnostic imaging modalities used. However, these conventional methods have diagnostic limitations. The imaging modality PET/CT is used in various fields of medicine its role in the diagnosis of breast cancer is getting more attention. In this case report, we present a 57-year-old woman with known Hodgkins lymphoma who presented with PET/CT findings of a breast

Abbreviations: CT, computed tomography

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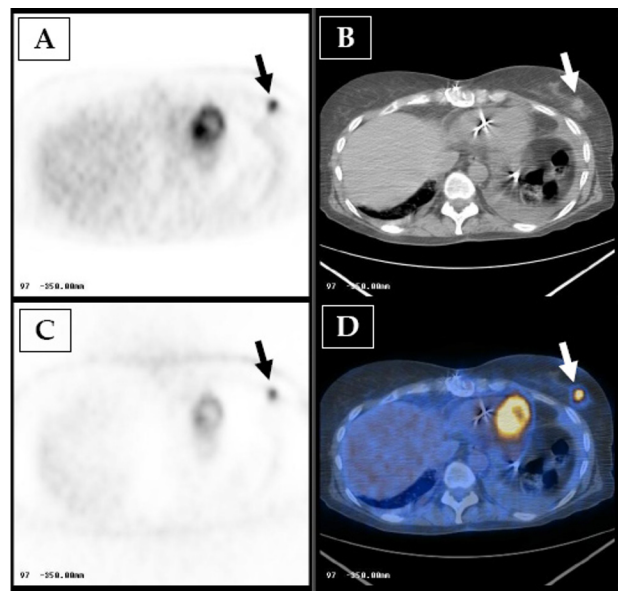
Figure 1. 57-year-old woman with incidentally discovered metastatic breast cancer. Axial 18F-FDG PET/CT scans showing an intensely hypermetabolic focus (arrows, SUVmax of 7.7) in the lower lateral quadrant of the breast, corresponding to the primary tumor: A, uncorrected PET image; B, CT image; C, corrected PET image; and D, fused PET/CT image.

mass and diseased axillary lymph node despite negative results from a recent routine mammogram and ultrasound. Needle biopsy of the mass and lymph node confirmed a diagnosis of infiltrating ductal carcinoma of the breast with nodal metastases.

Case Report

A 57-year-old woman with a history of Hodgkins lymphoma, treated with whole body radiation and splenectomy 33 years ago, presented with recurrent left pleural effusions for the past two years. The patient was referred to Nuclear Medicine at our institution for re-staging of her Hodgkins lymphoma.

A full-body PET/CT scan with intravenous injection of 13.3 mCi of 18F-fluorodeoxyglucose (FDG) was performed at a rate of 5 minutes/bed. An intensely hypermetabolic focus (SUVmax of 7.7) was incidentally found in the lower lateral quadrant of the breast (Fig 1A, 1C and 1D), which corresponded to a 17 mm soft-tissue lesion found on CT scan (Fig 1B). An additional intensely hypermetabolic focus (SUVmax of 3.8) was noted in the left pectoral muscle region (Fig 2A, 2C and 2D), which corresponded to a 6 mm left interpectoral lymph node on CT scan (Fig 2B). Otherwise, PET and CT were normal.

The patient stated that no palpable mass was detected during a routine clinical examination, and mammogram and ultrasound four months before at an outside hospital was interpreted as negative for any breast mass.

A fine needle aspiration of the breast mass was performed. Histological analysis of the breast mass showed at least intermediate-grade infiltrating ductal carcinoma. Immunohistochemistry showed the mass to be estrogen and progesterone receptor negative, Her2neu gene negative but KI-67 positive. A core needle biopsy of the interpectoral lymph node showed adenocarcinoma with breast origin, cytologically similar to the breast mass biopsy.

Due to an unstable cardiac condition, the patient was unable to undergo immediate treatment for her metastatic breast cancer. Four months later, a repeat PET/CT scan performed in our clinic showed essentially no change in mass/lymph node size or metabolic activities from the previous scan.

Discussion

Breast cancer is the most common female cancer and the second leading cancer death in women, with a yearly mortality of approximately 43,000 [1]. Because of high
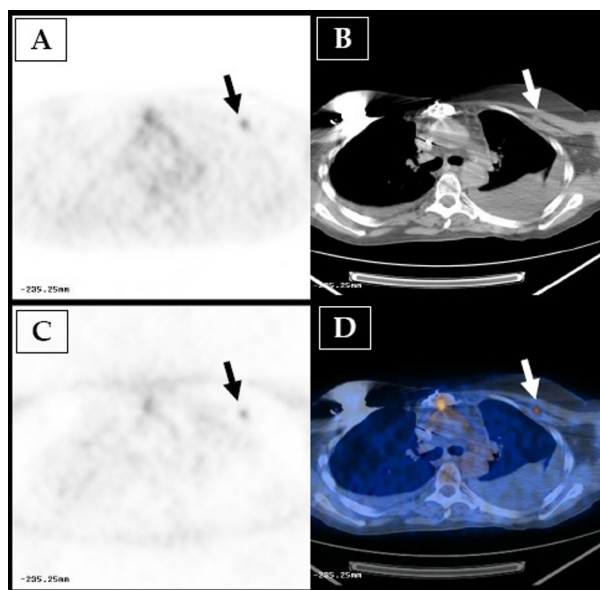

Figure 2. Axial 18F-FDG PET/CT scans showing an intensely hypermetabolic focus (arrows, SUVmax of 3.8) in the left pectoral muscle, corresponding to a nodal metastasis: A, uncorrected PET image; B, CT image; C, corrected PET image; and D, fused PET/CT image.

patient compliance, relatively low cost, and low radiation exposure, mammography is widely used as first-line diagnostic imaging for breast cancer along with clinical examination. Ultrasound is indicated when determining if the breast mass is malignant or benign.

However, these conventional methods have diagnostic limitations. 20% of palpable breast cancers are not detectable with mammography [2] and it has been shown to have a low positive predictive value (ranges from 5 to 40%) [3], especially in patients with implants or who have undergone prior treatment for breast cancer [4] To help overcome these deficiencies, imaging techniques such as MRI, PET, magnetic resonance mammography [5] and scintimammography [6] are receiving attention.

PET/CT is a metabolic imaging modality that provides accurate correlation of metabolic changes with anatomical localization, making it useful in tumor diagnosis, staging, and monitoring of treatment. This modality is highly utilized in oncology and neurology, but it is considered unsuitable as a primary diagnostic method for breast cancer because of high expense, limited availability, low spatial resolution and whole-body radiation exposure. The advantages of PET/CT, however, include sensitivities and

specificities of up to 96% and 100% respectively [7-9], whole-body scanning, and both diagnosis and tumor staging in one examination. The last feature is significant because when staging tumors, imaging techniques such as x-ray, bone scan, CT or MRI are often required to supplement lymph node detection. In the end, the patient undergoes multiple imaging modalities to accurately diagnose and stage the breast cancer. PET/CT, however, offers both diagnostic and staging capabilities in one approach, offering a simpler and possibly more cost-effective option.

In our case, PET/CT was not intended to be a primary diagnostic method for breast cancer, but was used to restage the patient's known lymphoma. In so doing, a hypermetabolic lesion in the left breast and in a local lymph node was detected, later histologically confirmed to be ductal carcinoma and metastatic lymphadenopathy. Four months earlier, the patient had undergone a routine breast examination with negative findings on clinical exam, screening mammogram and screening ultrasound.

It is highly unlikely that the tumor occurred after the routine examination in the intervening four months (from November to March) for two reasons: 1) the tumor had already metastasized to a lymph node, an unlikely occurrence in such a short time, and 2) the size and metabolic activity of the tumor and metastasis were unchanged at the follow-up PET/CT four months after initial detection (in July). This suggests that the tumor was stable and had been established for a period of time longer than four months. Thus, PET/CT detected a primary breast mass and metastatic lymphadenopathy that mammography and ultrasonography failed to detect a finding not previously reported, to our knowledge.

In conclusion, this case shows that PET/CT can be utilized as an alternative method of diagnosing breast cancer in cases where conventional imaging modalities fail. Further studies are warranted to compare PET/CT to mammography and ultrasonography, especially in high risk patients or when dealing with complicated presentations.

References

1. Jemal A, Siegel R, Ward E, et al. Cancer statistics. CA Cancer J Clin 2007; 57:43. [PubMed]

2. Kopans DB. Detecting breast cancer not visible by mammography. J Natl Cancer Inst 1992; 84:745. [PubMed]

3. Burrell HC, Pinder SE, Wilson AR, et al. The positive predictive value of mammographic signs: a review of 425 non-palpable breast lesions. Clin Radiol 1996; 51:277-281. [PubMed]

4. Wahl RL, Helvie MA, Chang AE, Andersson I. Detection of breast cancer in women after augmentation mammoplasty using fluorine-18-fluorodeoxyglucose-PET. J Nucl Med 1994; 35:872-875. [PubMed]

5. Fischer DR, Baltzer P, Malich A, et al. Is the "blooming sign" a promising additional tool to determine malignancy in MR mammography? Eur Radiol 2004; 14:394-401. [PubMed]

6. Romero L, Khalkhali I, Vargas HI. The role of nuclear medicine in breast cancer detection: a focus on technetium-99 sestamibi scintimammography. Curr Oncol Rep 2003; 5:58-62. [PubMed]

7. Schirrmeister H, Kuhn T, Guhlmann A, et al. Fluorine-18 2-deoxy-2-fluoro-D-glucose PET in the preoperative staging of breast cancer: comparison with the standard staging procedures. Eur J Nucl Med 2001; 28:351-358. [PubMed]

8. Scheidhauer K, Scharl A, Pietrzyk U, et al. Qualitative [18F]FDG positron emission tomography in primary breast cancer: clinical relevance and practicability. Eur J Nucl Med 1996; 23:618-623. [PubMed]

9. Avril N, Bense S, Ziegler SI, et al. Breast imaging with fluorine-18-FDG PET: quantitative image analysis. J Nucl Med 1997; 38:1186-1191. [PubMed]