Nucl Med Mol Imaging (2011) 45:152–155
DOI 10.1007/s13139-011-0080-1

CASE REPORT

^{18}F-FDG PET/CT Findings in a Breast Cancer Patient with Concomitant Tuberculous Axillary Lymphadenitis

Jeong Won Lee · Sang Mi Lee · Jae Hyuck Choi

Received: 25 January 2011 / Revised: 17 March 2011 / Accepted: 22 March 2011 / Published online: 12 April 2011

Abstract Although ^{18}F-fluorodeoxyglucose (^{18}F-FDG) positron emission tomography (PET) is a sensitive modality for detecting a malignant lesion, increased ^{18}F-FDG uptake is also seen in infected or inflammatory processes. Here, we report the case of a breast cancer patient with concomitant tuberculous axillary lymphadenitis that showed increased ^{18}F-FDG uptake. A 39-year-old woman underwent preoperative ^{18}F-FDG PET/computed tomography (CT) as a part of the work-up for right breast cancer. ^{18}F-FDG PET/CT images showed a malignant lesion in the right breast with moderate ^{18}F-FDG uptake, and multiple enlarged right axillary lymph nodes with intense ^{18}F-FDG uptake. Subsequently, the patient underwent right mastectomy and right axillary lymph node dissection. Histopathological examination confirmed breast cancer and tuberculous lymphadenitis, and the patient was treated concomitantly with anti-tuberculous therapy.

Keywords Breast cancer · Tuberculosis · F-18 fluorodeoxyglucose · Positron emission tomography

J. W. Lee (✉)
Department of Nuclear Medicine,
Jeju National University Hospital,
66 Jeju-Daehakno,
Jeju-si, Jeju, Korea 690–767
e-mail: jwonleemd@gmail.com

S. M. Lee
Department of Nuclear Medicine,
Soonchunhyang University Cheonan Hospital,
Cheonan, Korea

J. H. Choi
Department of Surgery,
Jeju National University School of Medicine,
Jeju, Korea

Introduction

^{18}F-fluorodeoxyglucose (^{18}F-FDG) positron emission tomography (PET) is a useful modality for staging breast cancer and it can be used for determining prognosis and evaluating biological characteristics of breast cancer [1, 2]. Furthermore, ^{18}F-FDG PET showed a high specificity for detecting axillary lymph node metastasis, which is the most significant and independent factor for predicting survival of breast cancer patients [3, 4]. However, ^{18}F-FDG uptake is not tumor-specific, and inflammatory or infectious conditions such as tuberculosis, sarcoidosis, and pneumoconiosis have been reported to show increased ^{18}F-FDG uptake, thus, making it difficult to differentiate these lesions from malignant lesions [5, 6]. Here, we report a case of breast cancer with concomitant tuberculous axillary lymphadenitis that showed increased^{18}F-FDG uptake.

Case Report

A 39-year-old woman presented to our medical center with a palpable mass in her right axilla. She had no previous history of tuberculosis. Ultrasound of the right breast and axilla revealed a 2.0-cm hypoechoic irregular lesion in the breast along with multiple enlarged lymph nodes in the axilla, raising the suspicion of breast cancer with multiple axillary lymph node metastases. Routine blood examinations, including white blood cell count, carcinoembryonic antigen (CEA) level, and carbohydrate antigen (CA15-3) level, were within the normal limit (white blood cell count: 5,900 cells/μl; CEA: 1.6 ng/ml; CA15-3: 18.9 U/ml). Examination of the biopsy of the right breast lesion revealed an invasive ductal carcinoma; however, examination of the biopsy of the right axillary lymph nodes showed

granulomatous inflammation with no involvement of malignancy and negative results for special stains for acid-fast bacilli.

As a part of the preoperative work-up for the right breast and axillary lesions, ^{18}F-FDG PET/computed tomography (CT) scan was performed after 8 h of fasting (Fig. 1). ^{18}F-FDG PET/CT scan was performed using a dedicated PET/CT scanner (Biograph 40, Siemens Healthcare, Erlangen, Germany) 60 min after the intravenous administration of 6.29 MBq/kg of ^{18}F-FDG. ^{18}F-FDG PET/CT images showed a moderate focal ^{18}F-FDG uptake with a maximum standardized uptake value (maxSUV) of 2.4 in the inner aspect of the right breast, which corresponded to the right breast cancer lesion seen on ultrasonography (Fig. 2a–c). Furthermore, multiple enlarged lymph nodes with intense ^{18}F-FDG uptake (maxSUV of 8.8) were noted in the right axilla and a small lymph node with intense ^{18}F-FDG uptake (maxSUV of 5.0) was found in the right lower paratracheal area of the mediastinum (Fig. 3a–c). There was no evidence of inflammatory pulmonary lesion including pulmonary tuberculosis on CT images.

Subsequently, she underwent right mastectomy with right axillary lymph node dissection. Histopathological examination of the right breast lesion showed invasive ductal breast carcinoma with no lymphatic or vascular invasion. All 36 dissected lymph nodes showed granulomatous lymphadenitis with caseation necrosis and no involvement of malignancy. Special stains for acid-fast bacilli were negative for the axillary lymph nodes; however, polymerase chain reaction (PCR) assays for *Mycobacterium tuberculosis* DNA were positive, indicating tuberculous lymphadenitis. The mediastinal lymph node

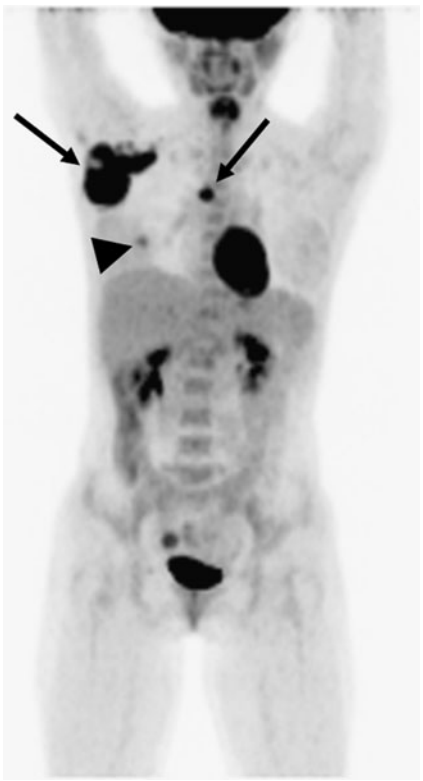

Fig. 1 Maximum intensity projection image of ^{18}F-FDG PET/CT scan. A moderate focal ^{18}F-FDG uptake is seen in the right breast (*arrowhead*) with multiple intense ^{18}F-FDG uptake in the right axilla and mediastinum (*arrow*)

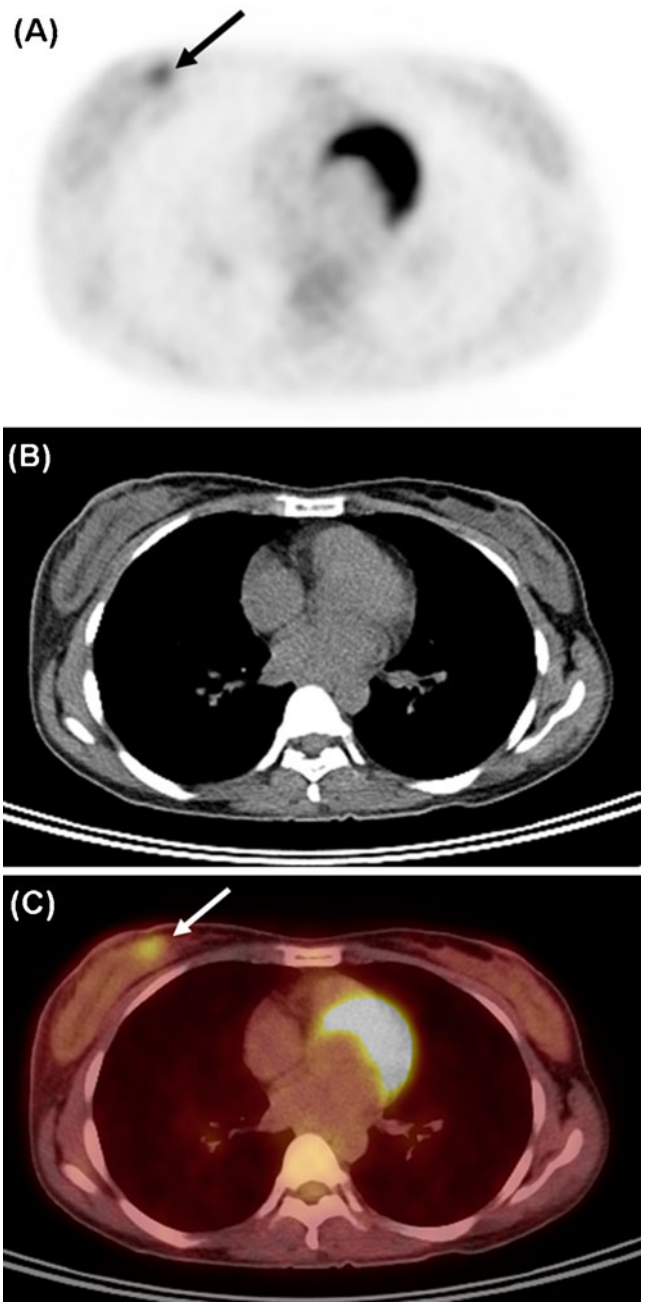

Fig. 2 Transaxial ^{18}F-FDG PET (**a**), CT (**b**) and fused ^{18}F-FDG PET/CT (**c**) images of the right breast lesion. A moderate focal ^{18}F-FDG uptake with maximum SUV of 2.4 is seen in the right breast (*arrow* in **a** and **c**) which was diagnosed with invasive ductal breast carcinoma

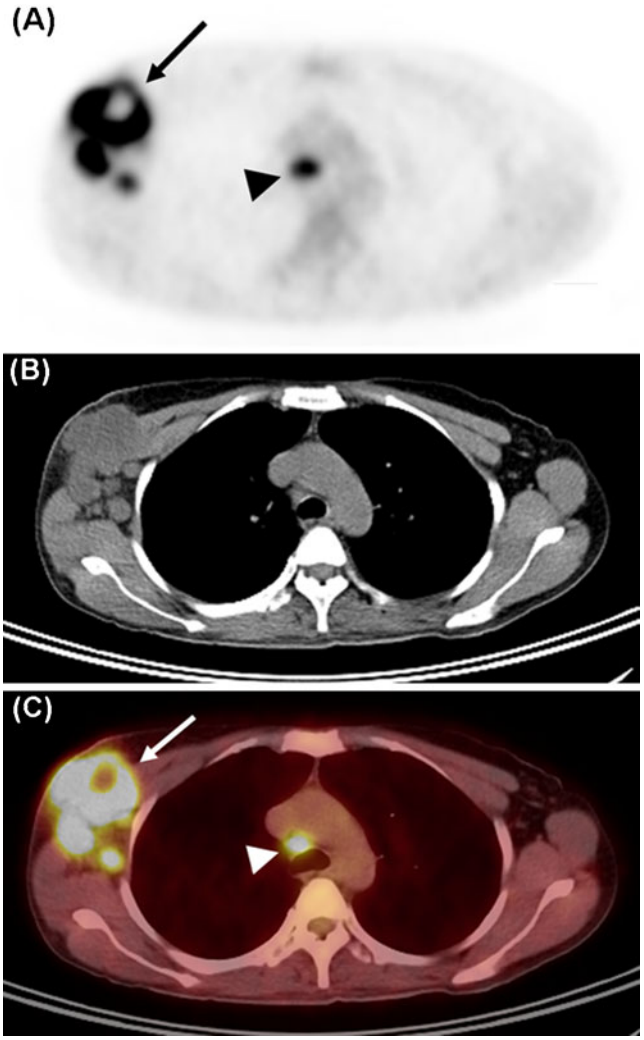

Fig. 3 Transaxial ^{18}F-FDG PET (**a**), CT (**b**) and fused ^{18}F-FDG PET/CT (**c**) images of the right axillary nodal lesions. Multiple lymph nodes with intense ^{18}F-FDG uptake (maximum SUV of 8.8) are seen in the right axilla (*arrow* in **a** and **c**), which were diagnosed with tuberculous lymphadenitis. Moreover, a lymph node with intense ^{18}F-FDG uptake (maximum SUV of 5.0) is seen in the right lower paratracheal area of the mediastinum (*arrowhead* in **a** and **c**)

with intense ^{18}F-FDG uptake was clinically diagnosed as inflammatory lymphadenopathy, possibly tuberculous lymphadenitis, because of the absence of signs of lymph node metastasis. The patient was treated with adjuvant radiotherapy for the breast lesion and concomitant anti-tuberculous medication.

Discussion

Tuberculous lymphadenitis is the most common form of extrapulmonary tuberculosis [7]. When there is no primary source of tuberculous infection, as seen in our case, the only possible explanation of tuberculous infection limited to the axillary lymph nodes could be either a retrograde spread from the mediastinal lymph nodes or hematogenous spread from a subclinical focus [7]. The prevalence of tuberculosis in Korea is still high, especially in the elderly. The latest nationwide tuberculosis survey in Korea, performed in 1995, showed that the prevalence of active pulmonary tuberculosis was 1.0%, while that of smear-positive and/or culture-positive cases was 219 per 100,000 of the population [8]. Although the most frequent granuloma-associated conditions in patients with malignancy are tumor-related, non-specific granulomatous reactions [9], tuberculous lymphadenitis should always be considered in cancer patients with granulomatous lymph node lesions in tuberculosis-endemic countries such as Korea.

Pulmonary tuberculosis and mediastinal tuberculous lymphadenitis are already known to cause false-positive findings on ^{18}F-FDG PET [10, 11]. Several recent studies have used specific methods or interpretation criteria to reduce false-positive findings, caused by granulomatous disease including tuberculous lymphadenitis on ^{18}F-FDG PET in patients with lung cancer [11–13]. Furthermore, Ataergin et al. [14] reported a case of breast cancer along with tuberculous lymphadenenitis that was found as a false-positive finding on ^{18}F-FDG PET 6 years after complete remission of breast cancer. These false-positive findings on ^{18}F-FDG PET result from increased ^{18}F-FDG uptake by active granulomatous tissue, mainly by fibroblasts, endothelial cells of vessels and phagocytes of neutrophils and macrophages [15]. Although primary axillary tuberculous lymphadenitis in adults without clinical evidence of any other organ or systemic involvement is rare [7], benign inflammatory lymphadenitis should be considered in a breast cancer patient who shows increased ^{18}F-FDG uptake at axillary lymph nodes.

Although invasive ductal breast carcinoma shows significantly higher ^{18}F-FDG uptake than invasive lobular carcinoma or carcinoma in situ [16, 17], Avril et al. [16] revealed that some patients with invasive ductal carcinoma showed moderate ^{18}F-FDG uptake in primary tumors, as shown in our case. However, unlike the primary breast tumor lesion, the axillary lymph nodes in our case showed intense ^{18}F-FDG uptake, which implies that pathological process of the axillary nodes could be different from the primary breast tumor. Nguyen et al. [18] reported that high correlations were found between primary tumors and metastatic lymph nodes with regard to ^{18}F-FDG uptake in lung cancer patients, and suggested that this correlation could be a valuable tool for ^{18}F-FDG PET-based lymph nodal discrimination.

Because the CT scan of the ^{18}F-FDG PET/CT scan in this case was a non-contrast-enhanced CT scan, the morphological characteristics of the axillary nodes on our CT scan was not helpful for the differential diagnosis.

However, a contrast-enhanced CT scan can be helpful to differentiate tuberculous lymphadenitis. Previous studies showed that lymphadenopathy showing peripheral irregular thick wall enhancement or peripheral rim enhancement with no enhancement on a central area can suggest tuberculous lymphadenitis [19, 20].

In conclusion, we reported the case of breast cancer with concomitant tuberculous axillary lymphadenitis that produced a false-positive finding on preoperative ^{18}F-FDG PET/CT without any evidence of pulmonary tuberculosis. Hence, even if the axillary lymph nodes show intense ^{18}F-FDG uptake in a breast cancer patient, careful assessment should be performed to avoid false-positive diagnosis.

References

1. Almubarak M, Osman S, Marano G, Abraham J. Role of positron-emission tomography scan in the diagnosis and management of breast cancer. Oncology. 2009;23:255–61.
2. Ueda S, Tsuda H, Asakawa H, Shigekawa T, Fukatsu K, Kondo N, et al. Clinicopathological and prognostic relevance of uptake level using ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography fusion imaging (^{18}F-FDG PET/CT) in primary breast cancer. Jpn J Clin Oncol. 2008;38:250–8.
3. Peare R, Staff RT, Heys SD. The use of FDG-PET in assessing axillary lymph node status in breast cancer: a systematic review and meta-analysis of the literature. Breast Cancer Res Treat.123:281–90.
4. Shek LL, Godolphin W. Model for breast cancer survival: relative prognostic roles of axillary nodal status, TNM stage, estrogen receptor concentration, and tumor necrosis. Cancer Res. 1988;48:5565–9.
5. Rosenbaum SJ, Lind T, Antoch G, Bockisch A. False-positive FDG PET uptake—the role of PET/CT. Eur Radiol. 2006;16:1054–65.
6. Chang JM, Lee HJ, Goo JM, Lee HY, Lee JJ, Chung JK, et al. False positive and false negative FDG-PET scans in various thoracic diseases. Korean J Radiol. 2006;7:57–69.
7. Avninder SP, Saxena S. Infiltrating ductal carcinoma of the breast, metastatic to axillary lymph nodes harboring primary tuberculous lymphadenitis. Pathol Oncol Res. 2006;12:188–9.
8. Hong YP, Kim SJ, Lew WJ, Lee EK, Han YC. The seventh nationwide tuberculosis prevalence survey in Korea, 1995. Int J Tuberc Lung Dis. 1998;2:27–36.
9. Khurram M, Tariq M, Shahid P. Breast cancer with associated granulomatous axillary lymphadenitis: a diagnostic and clinical dilemma in regions with high prevalence of tuberculosis. Pathol Res Pract. 2007;203:699–704.
10. Goo JM, Im JG, Do KH, Yeo JS, Seo JB, Kim HY, et al. Pulmonary tuberculoma evaluated by means of FDG PET: findings in 10 cases. Radiology. 2000;216:117–21.
11. Lee JW, Kim BS, Lee DS, Chung JK, Lee MC, Kim S, et al. ^{18}F-FDG PET/CT in mediastinal lymph node staging of non-small-cell lung cancer in a tuberculosis-endemic country: consideration of lymph node calcification and distribution pattern to improve specificity. Eur J Nucl Med Mol Imaging. 2009;36:1794–802.
12. Yen RF, Chen KC, Lee JM, Chang YC, Wang J, Cheng MF, et al. ^{18}F-FDG PET for the lymph node staging of non-small cell lung cancer in a tuberculosis-endemic country: is dual time point imaging worth the effort? Eur J Nucl Med Mol Imaging. 2008;35:1305–15.
13. Kim YK, Lee KS, Kim BT, Choi JY, Kim H, Kwon OJ, et al. Mediastinal nodal staging of nonsmall cell lung cancer using integrated ^{18}F-FDG PET/CT in a tuberculosis-endemic country: diagnostic efficacy in 674 patients. Cancer. 2007;109:1068–77.
14. Ataergin S, Arslan N, Ozet A, Ozguven MA. Abnormal FDG uptake on ^{18}F-fluorodeoxyglucose positron emission tomography in patients with cancer diagnosis: case reports of tuberculous lymphadenitis. Intern Med. 2009;48:115–9.
15. Yamada S, Kubota K, Kubota R, Ido T, Tamahashi N. High accumulation of fluorine-18-fluorodeoxyglucose in turpentine-induced inflammatory tissue. J Nucl Med. 1995;36:1301–6.
16. Avril N, Menzel M, Dose J, Schelling M, Weber W, Janicke F, et al. Glucose metabolism of breast cancer assessed by ^{18}F-FDG PET: histologic and immunohistochemical tissue analysis. J Nucl Med. 2001;42:9–16.
17. Gil-Rendo A, Martinez-Regueira F, Zornoza G, Garcia-Velloso MJ, Beorlegui C, Rodriguez-Spiteri N. Association between [^{18}F] fluorodeoxyglucose uptake and prognostic parameters in breast cancer. Br J Surg. 2009;96:166–70.
18. Nguyen XC, So Y, Chung JH, Lee WW, Park SY, Kim SE. High correlations between primary tumours and loco-regional metastatic lymph nodes in non-small-cell lung cancer with respect to glucose transporter type 1-mediated 2-deoxy-2-F18-fluoro-D-glucose uptake. Eur J Cancer. 2008;44:692–8.
19. Luo MY, Liu L, Lai LS, Dong YX, Liang WW, Qin J. Deepgoing study on intrathoracic tuberculous lymphadenitis in adults using multidetector CT. Chin Med J. 2010;123:1283–8.
20. Pombo F, Rodriguez E, Mato J, Perez-Fontan J, Rivera E, Valvuena L. Patterns of contrast enhancement of tuberculous lymph nodes demonstrated by computed tomography. Clin Radiol. 1992;46:13–7.