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FDG positron emission tomography imaging of drug-induced pneumonitis

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Abstract

Several studies have reported the findings of FDG-PET in benign lung disease with diffuse pulmonary injury, but the characteristics and effectiveness of FDG-PET imaging for interstitial pneumonitis have not been substantiated. We report two cases of drug-induced pneumonitis in two patients treated for breast cancer who were diagnosed by FDG-PET examination.

Both of these cases showed diffuse interstitial infiltration in the bilateral lungs on CT, but the degree of FDG accumulation was different. It is probable that the degree of FDG accumulation reflected the activity of the drug-induced pneumonitis. The present cases show very interesting FDG-PET imaging findings of diffuse lung disease.

Key Words; FDG-PET, drug-induced pneumonitis, interstitial pneumonitis

Introduction

Fluorine-18-labeled fuluoro-2-deoxy-D-glucose positron emission tomography (FDG-PET) is increasingly used for diagnosing lung cancer[1][2], but FDG accumulation is not specific to malignancy. There are numerous causes of FDG uptake in benign processes,[3][4] such as inflammatory lung disease. However, ^{67}Ga scintigraphy has been widely used for the evaluation of interstitial pneumonitis. Until now, the utilization or features of imaging of FDG-PET in interstitial pneumonitis have not been known. Recently, comparisons of FDG-PET and ^{67}Ga scintigraphy in malignant and benign disease, such as sarcoidosis, have been reported.[5][6] The application of FDG-PET in the management of interstitial pneumonitis is expected in the future.

We report two cases of drug-induced pneumonitis that show FDG uptake in interstitial pneumonitis and also discuss the features of FDG-PET imaging in diffuse lung disease.

Case Report

Case 1: A 47-year-old woman with recurrent breast cancer after mastectomy was treated weekly with paclitaxel. She had never received radiotherapy to any part of her body. Positron emission tomography/computed tomography (PET/CT) was performed for cancer follow-up using a whole-body scanner with a Discovery LS (GE Medical Systems, Milwaukee, WI, USA). After 4 hours of fasting, scanning was performed 60 minutes later after the patient received an intravenous

injection of 185MBq ^{18}F-FDG. PET/CT imaging showed moderately diffuse increased FDG uptake in the bilateral lungs (Fig. 1) that was not apparent in the PET/CT examination performed 3 months earlier (Fig. 2). Chest radiography and CT examinations were performed because PET/CT showed abnormal uptake, and the patient's symptoms, such as fever and dry cough, immediately developed after the PET/CT scan following the 10th paclitaxel treatment. The chest CT scan revealed diffuse interstitial infiltration in the bilateral lungs (Fig. 3). However, laboratory examinations, including KL-6, SP-A, and SP-D, which are biomarkers for interstitial pneumonitis, showed no remarkable findings, and the serum antigen and bacterial culture examinations were negative. Bronchoalveolar lavage (BAL) and transbronchial lung biopsy (TBB) were not performed because they would not have been tolerated by this patient, who was in a fragile condition due to her illness and the side effects of chemotherapy. Drug-induced pneumonitis caused by paclitaxel was diagnosed according to the clinical course. Both the patient's symptoms and the interstitial infiltration on imaging improved with high-dose corticosteroid treatment.

Case 2: A 70-year-old woman with brain metastasis from breast cancer was treated with oral quetiapine fumarate, which is an antipsychotic drug prescribed for symptoms of anxiety. She had never received radiotherapy to any part of her body. PET/CT breast cancer follow-up revealed markedly diffuse FDG uptake in the bilateral lungs. (Fig. 4) Immediately after the PET/CT examination, the patient had no respiratory symptoms, but on physical examination fine crackles

were audible in the chest; subsequent laboratory examinations showed increases of SP-A, SP-D and CRP as follows: serum SP-A, 135.0 ng/ml (<43.8 ng/ml); serum SP-D, 247.0 ng/ml (<110 ng/ml); CRP, 25.6 mg/dl (<0.32 mg/dl), and chest CT showed a diffuse thickening of the bronchovascular bundle and interlobular septum, and panlobular interstitial infiltration in the bilateral lungs (Fig. 5). BAL and TBB were not performed for the same reasons as in Case 1. The patient was treated with high-dose corticosteroids following a diagnosis of interstitial pneumonitis, including drug-induced pneumonitis. The physical findings and interstitial infiltration improved initially, but recurrence of an abnormal shadow was seen when quetiapine was re-introduced following the development of psychological symptoms. Because drug-induced pneumonitis was diagnosed according to this clinical course, the quetiapine therapy was discontinued and the patient has had no evidence of recurrent interstitial pneumonitis since. PET/CT performed 7 months after improvement of the pneumonitis did not show diffuse FDG uptake in the bilateral lung fields other than uptake in mediastinal lymph nodes and right shoulder bone due to metastases of breast cancer. (Fig. 6).

Discussion

Several studies have reported the findings of FDG-PET in benign lung disease with diffuse pulmonary injury,[7]–[9] but the characteristics of FDG-PET in interstitial pneumonitis remain unknown. To the best of our knowledge, few reports have described the FDG-PET features of

interstitial pneumonitis including drug-induced pneumonitis;[9] the present report is the first to show a strong FDG uptake in interstitial pneumonitis, as observed in Case 2. The present report compares the FDG-PET features of two cases with different inflammatory activity.

Drug-induced pneumonitis is characterized by acute to subacute presentation. Chest radiographs typically show air-space disease, which may be focal, lobar, or diffuse in distribution; a peripheral predominance of infiltrates may be present. Pathologically, acute inflammation with neutrophils and eosinophils, as well as a prominent mononuclear cell infiltration, are seen.[10] It is known that drug-induced pneumonitis presents clinical features of various patterns, including acute or chronic interstitial pneumonitis, acute or chronic eosinophilic pneumonia, bronchiolitis obliterans organizing pneumonia, and hypersensitive pneumonitis.[11] Both of the cases in the present study demonstrated diffuse interstitial infiltration in the bilateral lungs on CT examination, but with different degrees of SP-D and FDG accumulation.

In reports of methotrexate-induced pneumonitis, serum SP-D concentration was found to increase with the severity of pneumonitis; this suggests that serum concentrations of SP-D may be implicated in pulmonary fibrosis and in the activation of macrophages.[12] It is reported that the higher the activation of macrophages, neutrocytes, or lymphocytes, the higher the accumulation of FDG.[9],[13]–[15] Both of the cases in the present study showed bilateral diffuse accumulation on PET/CT, but the degree of SP-D and FDG accumulation was higher in Case 2 than in Case 1.

Therefore, it is possible that the degree of FDG accumulation reflects the activity of the drug-induced pneumonitis. If FDG-PET examination reflects activity in diffuse pulmonary injury, these findings would be useful in the assessment of disease activity.

These two cases are considered to be drug-induced pneumonitis that was diagnosed early, by chance, using PET/CT during follow-up of breast cancer; the diagnosis might have been overlooked if PET/CT had not been performed. The frequency of lung disturbances induced by existing anticancer drugs is estimated to be approximately 10%.[16] It has been reported that the frequency of anticancer-drug-induced pneumonitis is increasing because a combination of drugs, including anticancer drugs and also radiotherapy, is used in many cases. [16],[17] The possibility of drug-induced pneumonitis, which requires immediate treatment, should be considered when FDG-PET examination reveals the sudden appearance of diffuse pulmonary accumulation in a cancer patient following treatment.

FDG-PET is known to be useful in detecting lung cancer; however, FDG-PET may also show high accumulation in cases of drug-induced pneumonitis. Case 2, in particular, showed a very high FDG-accumulation, and a careful differential diagnosis was needed. Knowledge of the FDG-PET imaging features of drug-induced pneumonitis will enable differential diagnosis in cases that exhibit diffuse FDG uptake. It will be necessary to collect more cases in future studies.

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Figure legends

Figure 1: FDG-PET image in Case 1. Moderately increased diffuse FDG uptake is demonstrated in the bilateral lungs.

Figure 2: FDG-PET image 3 months before the onset of pneumonitis in Case 1. No FDG uptake is apparent in the bilateral lungs. The markedly increased FDG uptake demonstrated in the liver metastases was not observed in Fig. 1A (after cancer treatment).

Figure 3: Chest CT in Case 1. Infiltration is apparent in the bilateral lungs.

Figure 4: FDG-PET image in Case 2. Markedly diffuse FDG uptake is demonstrated in the bilateral lungs.

Figure 5: Chest CT in Case 2. There is diffuse thickening of the bronchovascular bundle and interlobular septum; panlobular interstitial infiltration is demonstrated in the bilateral lungs.

Figure 6: FDG-PET image 7 months after improvement of the pneumonitis in Case 2. FDG uptake is demonstrated in mediastinal lymph node metastases and shoulder bone metastasis, but not in the bilateral lung fields.

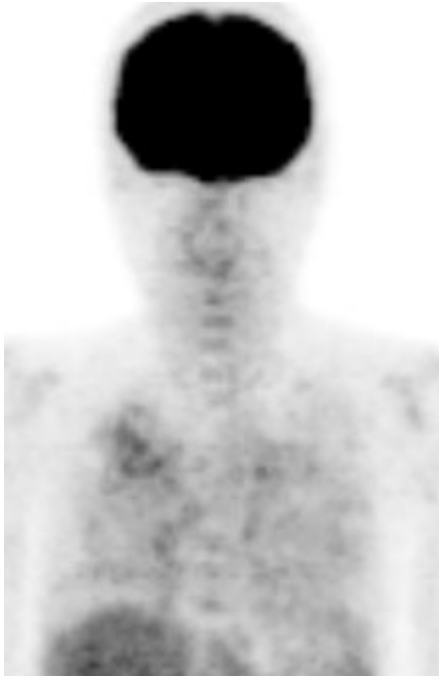


Figure1

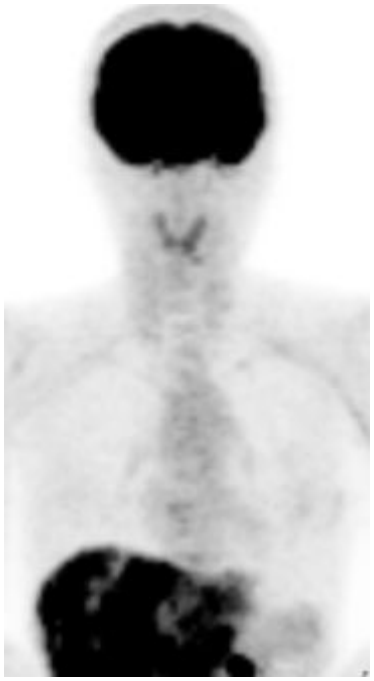
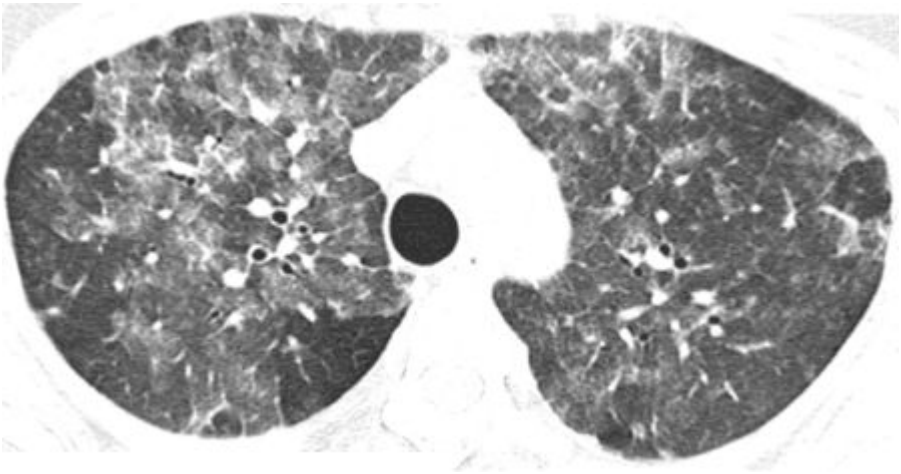


Figure2



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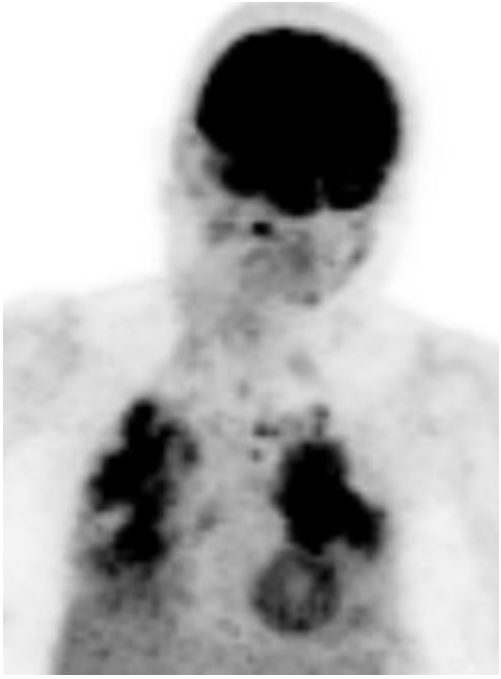

Figure4

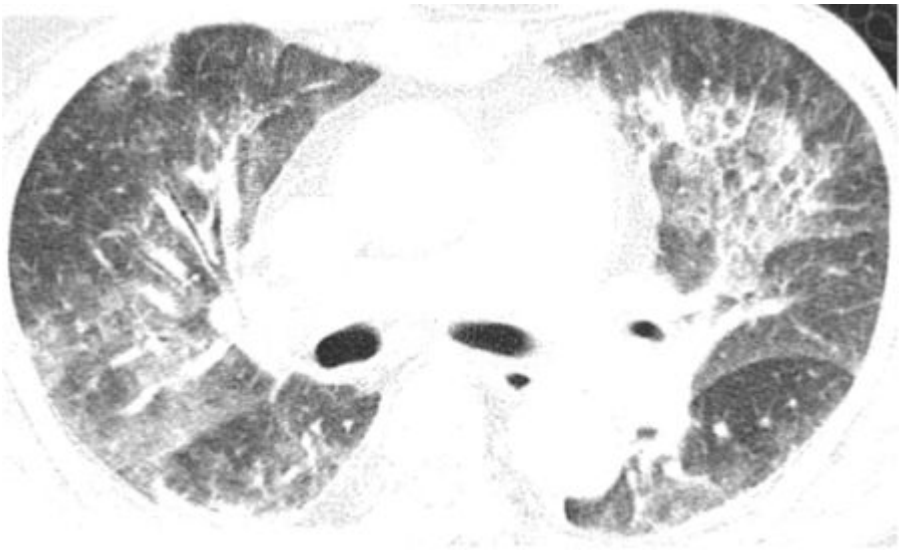

Figure5

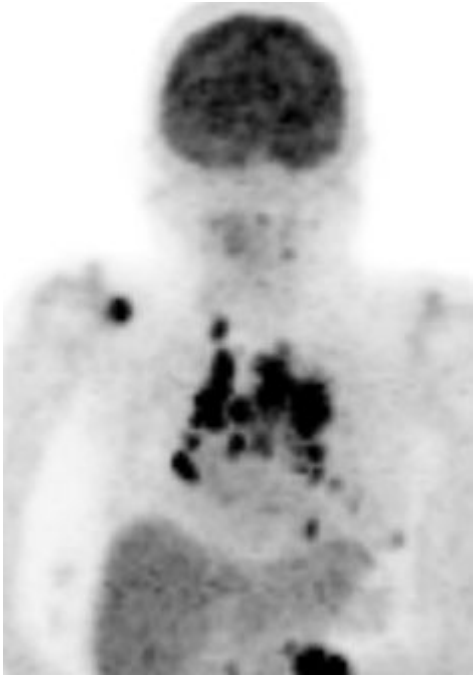

Figure6