Incidental detection of prostate-specific antigen-negative metastatic prostate cancer initially presented with solitary pulmonary nodule on fluorodeoxyglucose positron emission tomography/computed tomography

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ABSTRACT

A 71-year-old male patient with solitary pulmonary nodule underwent fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) showing slightly increased FDG uptake in this nodule. In addition, PET/CT detected hypermetabolic sclerotic bone lesions in the right second rib and 7th thoracic vertebrae, which were interpreted as possible metastases, and mildly increased FDG uptake in the prostate gland highly suspicious of malignancy. The patient’s prostate-specific antigen (PSA) level was within normal range (3.8 ng/dL). The histopathological examination of the lung nodule and right second rib lesion proved metastases from prostate cancer, then the prostate biopsy-confirmed prostate adenocarcinoma. The unique feature of this case is to emphasize the importance of performing PET/CT for solitary pulmonary nodule in detecting PSA-negative metastatic prostate cancer. This case indicated that it should be kept in mind that, even if the PSA is negative, a lung metastasis of prostate cancer may be an underlying cause in patients evaluated for solitary pulmonary nodule by FDG PET/CT.

Keywords: Fluorodeoxyglucose positron emission tomography/computed tomography, prostate cancer, solitary pulmonary nodule
CASE REPORT

Fluorodeoxyglucose PET/CT was performed for metabolic characterization on a 71-year-old male patient who had been detected to have lung nodule in the upper lobe of his right lung in thoracic CT that he underwent because of chest pain. The patient fasted for at least 4 h before the injection of FDG. In order to provide a better assessment of the gastrointestinal tract, oral iodinated contrast was used. His plasma glucose level was 130 mg/dL. PET/CT scan was obtained after intravenous injection of 370 MBq (10 mCi) 18F-FDG, and standard whole-body scan was obtained (vertex to the upper thigh) on a Biograph 16 PET/CT scanner (Siemens Medical Solutions, Knoxville, TN, USA). A well-circumscribed nodule with 0.8 cm in diameter in the anterior segment of the upper lobe of the right lung, showing a slightly increased FDG uptake standardized uptake value (SUVmax 2.1) was seen [Figure 1]. PET/CT also showed hypermetabolic sclerotic lesion with a moderately increased FDG uptake (SUVmax 5.0) at the lateral portion of the right second rib, and another hypermetabolic sclerotic lesion at the left side of the vertebral body of T7 with a mildly increased FDG uptake (SUVmax 3.8), and a focus of minimally increased FDG uptake at the right 4th rib without any accompanying CT lesion [Figure 2]. Besides, two incidental foci of mildly increased FDG uptake in the anterior and left posterolateral of the prostate gland (SUVmax 3.9 and 3.5, respectively) were observed [Figure 2]. In addition, minimally increased FDG uptake (SUVmax 2.4) in the right anterolateral side was noticed. PSA value immediately after PET/CT scan was measured as 3.83 ng/ml (normal range: 0–4 ng/dL). In this case, all the hypermetabolic foci were located peripherally in the prostate gland. In the differentiation of malignancy from benign lesions of the prostate gland, the average PSA values in benign and malignant groups were found as 3.2 and 49.7 ng/ml, respectively. Among the patients who had increased FDG uptake in the prostate gland, the average PSA values in benign and malignant quadrants in which more intense FDG uptake were seen [Figure 3]. Adenocarcinoma infiltration was detected in both tissues. In the immunohistochemical examination, prostate cancer markers such as prostate-specific acid phosphates, PSA and the polyclonal carcinoembryonic antigen staining were positive and the other organ markers such as thyroid transcription factor-1, cytokeratin 7 and 20 were negative in the both foci of cancer. In our case, Gleason score was 7 (3 + 4). Adenocarcinoma was detected in the 4th and 12th quadrants in which there was minimally increased FDG uptake. Then, multiple osteoblastic lesions consistent with metastases were detected by bone scan with 99m-Tc-methylene diphosphonate [Figure 3].

DISCUSSION

Prostate cancer is the most common type of cancer in men. In the routine examination of prostate cancer, generally TRUS, CT and magnetic resonance imaging are used. Although FDG PET/CT is widely applied in oncology, its success is limited in prostate cancer because of variable FDG uptake and tumor differentiation. Incidental FDG uptake in prostate gland is rarely seen with a rate of 1.2–1.5% among all routine PET/CT scans for various indications; and approximately 5–12% of these increased FDG uptake is reported to be associated with cancer. In the literature, the mean SUVmax value in the incidental prostate cancer was 5.7 ± 5.1, which is similar to the value in our case (3.9). Among the patients who had increased FDG uptake in the prostate gland, the average PSA values in benign and malignant groups were found as 3.2 and 49.7 ng/ml, respectively. This finding was not compatible with our case whose PSA was in a normal range. Serum PSA level increases with the increment of the production of PSA in the malignant prostate epithelial cells, or with any damage to disrupt the structure of these cells. In addition, PSA levels may be low in some cases of prostate cancer. For this reason, serum PSA levels are not always reliable in the differentiation of malignancy from benign lesions of the prostate gland.

It has been reported that the probability of prostate cancer is more likely in patients who had focal FDG uptake localized peripherally than that of centrally on PET/CT images. In our case, all the hypermetabolic foci were located peripherally in the prostate gland.

There are some studies indicating that poorly differentiated prostate cancer had higher FDG uptake than low-grade prostate cancer.

Figure 1: A slightly hypermetabolic nodule in the right lung (arrows) on positron emission tomography/computed tomography (PET/CT) with axial PET (a), CT (b) and fusion (c), and coronal PET (d) slices.
In summary, we reported a patient who underwent FDG PET/CT to evaluate solitary pulmonary nodule. PET/CT demonstrated slightly increased FDG uptake in the lung nodule, and also hypermetabolic sclerotic bone lesions and hypermetabolic foci in the prostate gland suggesting a metastatic prostate cancer, which was then proven histopathologically in our PSA-negative patient. Therefore, it should be kept in mind that metastatic prostate cancer may initially present with solitary pulmonary nodule. Also, this case emphasizes the necessity of careful examination of FDG uptake in the prostate gland to exclude malignancy, even if PSA is within normal ranges.

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