Nucl Med Mol Imaging
Vol. 40, No. 5, Oct 2006

Case Report

전립선암에서 골전이 진단에 대한 F-18 FDG PET/CT와 골스캔의 불일치

인하대학교 의과대학 핵의학교실[1], 내과학교실[2], 방사선과학교실[3]
최승진[1]· 김철수[2]· 변성수[3]· 현인영[1]

Discrepancy of Bone Metastases between F-18 FDG PET/CT and Bone Scan in a Patient with Prostate Cancer

Seung Jin Choi, M.D.[1], Chul Soo Kim, M.D.[2], Sung Su Byun, M.D.[3] and In Young Hyun, M.D.[1]
Department of [1]Nuclear Medicine, [2]Internal Medicine, and [3]Radiology, Inha University College of Medicine, Incheon, Korea

We report the case of a 73-year-old man who had prostate cancer with bone metastases. Tc-99m HDP Whole body bone scan revealed multiple areas of increased bony uptake consistent with widespread bone metastases. F-18 fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) demonstrated mild F-18 FDG uptake in the lymph nodes of neck, abdomen, and pelvis. However, abnormal F-18 FDG uptake was not seen in the skeletal system. Biopsy and immunohistochemical stains of left supraclavicular mass showed metastatic prostate adenocarcinoma. Currently, there are a few reported cases of F-18 FDG PET/CT evaluation of bone metastases in prostate cancer. We discuss the discrepancy between F-18 FDG PET/CT and bone scan in the detection of osseous metastases of prostate cancer. (Nucl Med Mol Imaging 2006;40(5):275-278)

Key Words: osseous metastases, bone scan, F-18 FDG PET/CT, prostate cancer

Introduction

The skeletal system is the third most common localization after the lungs and liver of distant metastases of malignant tumors.[1)] F-18 fluorodeoxyglucose (FDG) positron emission tomograhy (PET) has been increasingly used to diagnose skeletal metastases. The efficacy of PET in the detection of bone metastases is dependent on the type of primary malignancy. F-18 FDG PET has proven to be effective for the detection of bone metastases in lung, breast, colorectal and esophageal carcinoma.[2)] However, the efficacy of F-18 FDG PET has been disappointing in prostate and renal carcinoma.

We describe the case of prostate cancer in whom we observed normal tracer distribution in all bones in F-18 FDG PET/CT. However, bone scan showed widespread bone metastases.

• **Received**: 2006. 6. 21. • **Accepted**: 2006. 9. 7.
• Address for reprints: In Young Hyun, M.D., Department of Nuclear Medicine Inha University Hospital 7-206, Shinheung-dong, Jung-gu, Inchon 400-103, Korea.
Tel: 82-32-890-3160, Fax: 82-32-890-3164
E-mail: iyhyun@inha.ac.kr

Case Report

A 73-year-old man was admitted with back pain for 3 months. He also reported pain in the neck and abdomen. Physical examination revealed a mass in the left supraclavicular area. Abdominal CT demonstrated conglomerated lymph nodes in the aortocaval and left paraaortic area (Fig. 1). F-18 FDG PET/CT was ordered on the suspicion of lymphoma. This was performed on a Siemens/Biograph Duo PET/CT scanner 60 minutes after intravenous injection of 555 MBq (15 mCi) of F-18 FDG and demonstrated mild F-18 FDG uptake in the lesions on CT (Fig. 2). And, there was mild F-18 FDG uptake in the cervical lymph nodes. No abnormal F-18 FDG uptake was seen in the skeletal system (Fig. 3). Whole body Tc-99m oxidronate (HDP) bone scan was performed and revealed

Fig. 1. Enhanced axial image of abdominal CT showed mildly enhanced conglomerated left paraaortic (arrow) and aortocaval (arrowhead) lymphadenopathy.

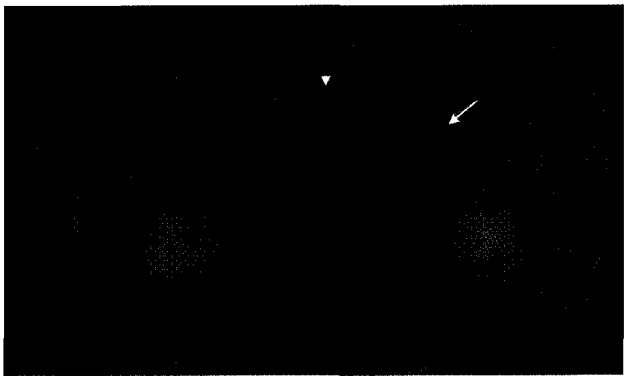

Fig. 2. Transaxial F-18 FDG PET/CT images of the abdomen showed mild F-18 FDG uptake in left paraaortic (maxSUV 1.67) (arrow) and aortocaval (maxSUV 1.6) (arrowhead) lymph nodes.

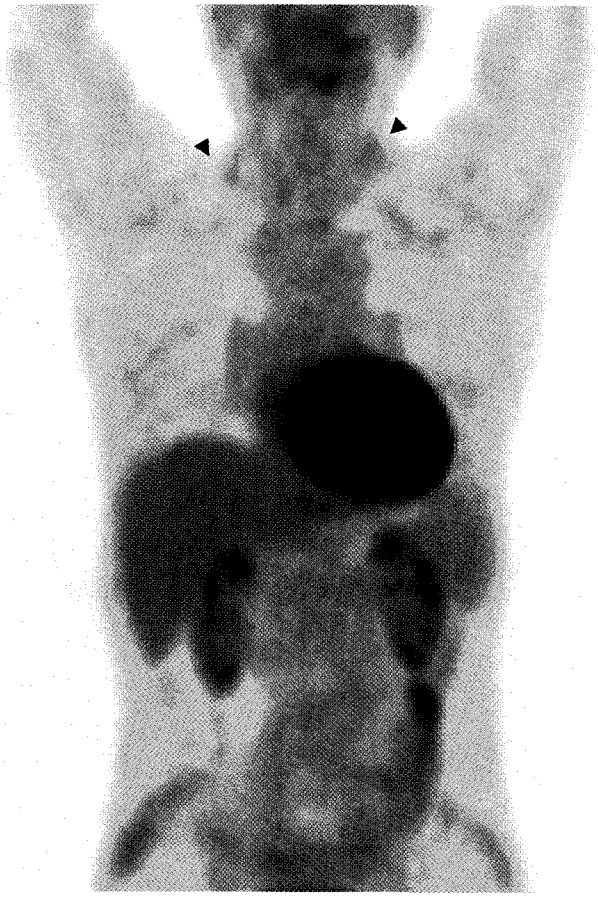

Fig. 3. The projection image of F-18 FDG PET/CT showed no abnormal F-18 FDG uptake in the bones. Mild F-18 FDG uptake was seen in the both cervical lymph nodes (arrowhead).

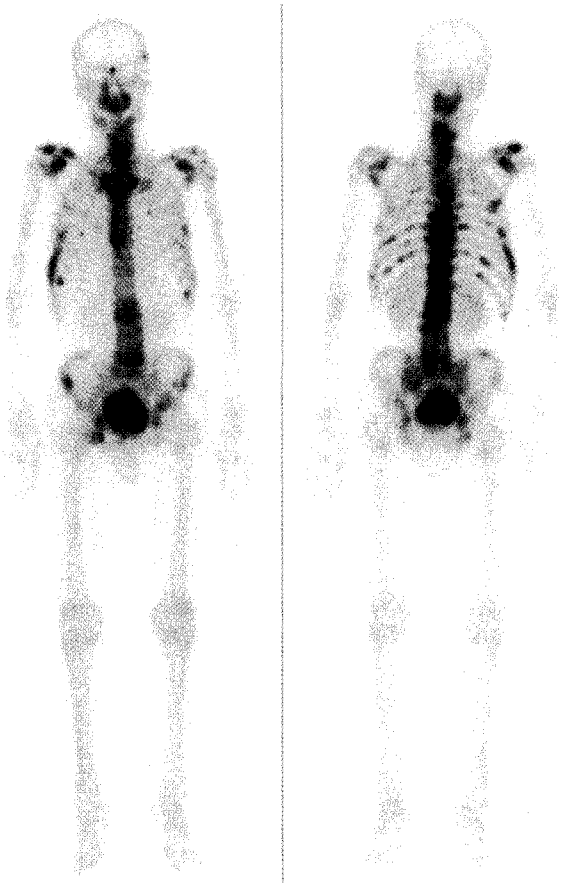

Fig. 4. Anterior and posterior Tc-99m HDP bone scan showed multiple increased bony uptake in the skull, vertebra, shoulders, thorax, and pelvis.

multiple areas of increased bony uptake consistent with widespread bone metastases (Fig. 4).

Consequently, excison of left supraclavicular mass was performed. Histopathology showed metastatic adenocarcinoma. The Immunohistochemical stains of tumor cells showed positive for prostate specific antigen (PSA) and prostatic acid phosphatase (PAP). His serum PSA levels were 1,100 ng/ml (normal: < 5.36 ng/ml).

Fig. 5. Lateral lumbar radiograph demonstrated sclerotic changes in most of the lumbar spines.

Hormone deprivation therapy was started. Three months later, the patient's back pain was not improved. Follow-up radiograph of the lumbar spines showed sclerotic change consistent with osteoblastic metastases (Fig. 5) compared with degenerative change on initial admission (not shown).

Discussion

F-18 FDG PET and bone scan exploit different mechanisms to detect tumor involvement. Bone scan relies on an osteoblastic bone response to tumor, whereas F-18 FDG PET measures glucose uptake into the tumor itself. Therefore, F-18 FDG PET is more likely to detect metastases at an early stage, perhaps when they are confined to the bone marrow.[3] However, the sensitivity of F-18 FDG PET imaging for detecting osteoblastic bony metastases, observed especially in prostate cancer, is generally less than bone scan in the F-18 FDG PET reports.[4-6]

In prostate cancer, bone metastases are osteoblastic nature.[7] In our case with prostate cancer, F-18 FDG PET/CT revealed no lesion in the skeletal system. However, bone scan showed intense uptake throughout most of the skeleton. Our observation of false negative F-18 FDG PET/CT assessments suggests that a small nidus of tumor sufficient to stimulate increased osseous uptake of bone tracer may well be below the requisite tumor mass needed for direct detection of FDG accumulation with the resolution capability of PET camera in this case.[4] Thus, bone scintigraphy is more sensitve in the detection of osseous metastases of prostate cancer than F-18 FDG PET. Plain radiography on initial workup for back pain demonstrated degenerative change of lumbar spines. However, after 3 months, follow-up images showed sclerotic changes. Bone scan can detect osteoblastic metastases at early stage before bone remodeling can be detected on conventional radiography.

Hormone deprivation therapy diminishes FDG uptake in prostate cancer metastatic deposits.[4] This patient underwent hormone therapy after F-18 FDG PET/CT imaging. Therfore, hormonal deprivation therapy had no influence on false negative F-18 FDG PET/CT assessments in our case.

The degree of FDG uptake is not an entirely reliable indicator of malignancy or growth rate, relatively slow-growing neoplasm such as low-grade connective tissue tumors have a reduced level of FDG accumulation, while rapidly growing tumor such as bronchogenic carcinoma, melanoma and lymphoma demonstrate high levels of FDG uptake - a phenomenon that may in part reflect cell density.[4] mild FDG uptake of multiple nodal metastases in our case is consistent with general character of prostate adenocarcinoma as a slow-growing neoplasm.

The presented case demonstrates F-18 FDG PET/CT is insensitive to the detection of osseous metastases of prostate cancer. Thus, bone scan is superior to F-18 FDG PET in detecting osteoblastic matestases in patients with prostate cancer.

References

1. Ghanem N, Uhl M, Brink I, Schafer O, Kelly T, Moser E, et al. Diagnostic value of MRI in comparison to scintigraphy, PET, MS-CT and PET/CT for the detection of metastases of bone. ***Eur J Radiol*** 2005;55:41-55.
2. Peterson JJ, Kransdorf MJ, O'Connor MI. Diagnosis of occult bone metastases: positron emission tomography. ***Clin Orthop Relat Res*** 2003;415s:s120-8.
3. Yang SN, Liang JA, Lin FJ, Kao CH, Lin CC, Lee CC. Comparing whole body (18)F-2-deoxyglucose positron emission tomography and technetium-99m methylene diphosphonate bone scan to detect bone metastases in patients with breast cancer. ***J Cancer Res Clin Oncol*** 2002;128:325-8.
4. Shreve PD, Grossman HB, Gross MD, Warl RL. Metastatic prostate cancer: initial finding of PET with 2-deoxy-2-[F-18]fluoro-D-glucose. ***Radiology*** 1996;199:751-6.
5. Nakamoto Y, Osman M, Wahl RL. Prevalence and patterns of bone metastases detected with positron emission tomography using F-18 FDG. ***Clin Nucl Med*** 2003;28:302-7.
6. Cook GJ, Houston S, Rubens R, Maisey MN, Fogelman I. Detection of bone metastases in breast cancer by 18FDG PET: differing metabolic activity in osteoblastic and osteolytic lesions. ***J Clin Oncol*** 1998;16:3375-9.
7. O'Sullivan JM, Cook GJR. A review of the efficacy of bone scanning in prostate and breast cancer. ***Q J Nucl Med*** 2002; 46:152-9.