Radiography, Bone Scan, and F-18 FDG PET/CT Imaging Findings in a Patient with Paget's Disease

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Abstract

Background A 52-year-old female patient sought evaluation at our hospital for an incidental abnormal finding on an abdominal radiograph.

Methods The initial radiograph showed irregular sclerotic changes involving the right pelvic bone. At the same time, bone scintigraphy showed intense hot uptake in the right iliac and pubic bones. CT images showed characteristic thickening of the pelvic brim, suggesting the mixed phase of Paget's disease.

Results The level of alkaline phosphatase (ALP) was 266 IU/l. ^{18}F -FDG PET/CT images also showed diffusely increased ^{18}F -FDG uptake in the right pelvic bone. However, the findings of ^{18}F -FDG PET/CT were less notable than those of bone scintigraphy.

Conclusion We report the imaging findings of a patient with Paget's disease evaluated by radiography, bone scintigraphy, and ^{18}F -FDG PET/CT.

Keywords Paget's disease · ^{18}F -FDG PET/CT · Bone scintigraphy

Introduction

Paget's disease is a chronic skeletal disease characterized by excessive bone resorption in a focal area, followed by abundant bone formation [1, 2]. Cook et al. [3] reported variable ^{18}F -FDG uptake in patients with Paget's disease. While the majority of patients with Paget's disease showed no abnormal ^{18}F -FDG uptake, a few patients had marked ^{18}F -FDG uptake, mimicking malignant lesions. Indeed, only a few case reports have addressed ^{18}F -FDG PET/CT imaging in Paget's disease [4, 5].

We report herein the imaging findings for a patient with Paget's disease evaluated by radiographs, bone scintigraphy, and ^{18}F -FDG PET/CT. In our case, ^{18}F -FDG PET/CT played an important role in excluding bony metastases or sarcomatous changes of Paget's disease.

Case Report

A 52-year-old female sought evaluation at our hospital for an incidental abnormal finding on an abdominal radiograph during an evaluation of indigestion. The initial radiograph showed irregular sclerotic changes of the right pelvic bone, especially involving the sacroiliac joint (Fig. 1a). She had no pain or limitation of movement. At the same time, bone scintigraphy showed an intense hot uptake in the right iliac and pubic bones (Fig. 1b). Based on the radiographic and bone scintigraphic findings, Paget's disease was the tentative diagnosis; however, metastasis or malignant lesions were not excluded. The physician recommended additional imaging studies, such as a pelvic MRI or ^{18}F -FDG PET/CT. Two weeks later, she had an ^{18}F -FDG PET/CT for the evaluation of the right pelvic bone and other organs. Thickening of the pelvic brim, which is suggestive

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Fig. 1 **a** A 52-year-old woman presented with an incidental abnormal finding on an abdominal radiograph. Specifically, the radiograph of the lumbar and sacral regions showed irregular sclerotic changes of the right pelvic bone, especially involving the sacroiliac joint, suggesting Paget's disease. **b** Bone scintigraphy showed intense hot uptake in the right iliac and pubic bones

of the mixed phase of Paget's disease, was demonstrated on CT images [2]. Increased density, coarse trabeculations, and cortical thickening of the right pelvic bone are characteristic

of Paget's disease (Fig. 2a) [2]. The level of alkaline phosphatase (ALP) was 266 IU/l. ^{18}F -FDG PET/CT images showed diffuse, but mildly increased ^{18}F -FDG uptake in the right pelvic bone (Figs. 2b and c). The ^{18}F -FDG uptake on ^{18}F -FDG PET/CT was less intense than the uptake on bone scintigraphy. The maximum SUV of this lesion was 2.5. After treatment with biphosphonate, the serum ALP level normalized to 74 IU/l.

Discussion

The etiology of Paget's disease is unknown, but viral and genetic factors are suspected to be affecting etiologies [6]. The age at diagnosis of Paget's disease is usually >50 years [2]. Conventional radiography is the best tool to diagnose Paget's disease of the bone. The classic radiographic finding of the early stage of Paget's disease is osteolysis, which is related to the activity of osteoclasts [2]. The osteoclast is the primary cell affected by Paget's disease [2]. Subsequently, bone formation is also markedly increased with the increased number of osteoblasts [2]. In the late phase of Paget's disease, uniform sclerotic changes in the bone may appear. Other imaging modalities, such as computed tomography (CT), magnetic resonance (MR) imaging, and bone scintigraphy, have been useful for the evaluation of Paget's disease [1].

We have presented a case of Paget's disease involving the right pelvic bone. In evaluating this case, three modalities, including radiography, bone scintigraphy, and ^{18}F -FDG PET/CT, were performed. The radiographic and bone scintigraphic findings and the elevation of the ALP level were compatible with Paget's disease [2]. ^{18}F -FDG PET/CT images of the right pelvic bone showed diffuse, but mild increased uptake in the right pelvic bone, different from the imaging findings of bone metastasis. CT images showed the characteristic thickening of the pelvic brim, suggesting the mixed phase of Paget's disease. The mixed phase of Paget's disease involves both osteoclastic and osteoblastic activities, creating a mosaic appearance of typical Paget's disease [1].

There is a previous report regarding the relationship between ^{18}F -FDG uptake of bony lesions and disease activity in Paget's disease [3]. It revealed no statistical correlation between ^{18}F -FDG uptake and the serum ALP level, indicating disease activity of Paget's disease [3]. In their study, the majority of patients with Paget's disease showed no abnormal ^{18}F -FDG uptake, suggesting no relationship between increased osteoblastic or osteoclastic activity and increased use of glucose [3]. However, the available modality in their study was ^{18}F -FDG PET alone. Although the risk of radiation exposure is greater, ^{18}F -FDG PET/CT is widely used for the evaluation of cancer screening or metastases because of its superior accuracy [7–11].

Fig. 2 **a** CT image showed thickening of the pelvic brim characteristic of Paget's disease, including increased density, coarse trabeculation, and cortical thickening. **b** and **c** ^{18}F -FDG PET/CT images also showed diffuse, but mildly increased ^{18}F -FDG uptake (maximum SUV = 2.5) in right pelvic bone (arrows). However, the findings of ^{18}F -FDG PET/CT were less intense than those of bone scintigraphy

Recently, Mahmood et al. [4] reported a patient with Paget's disease who presented with intense ^{18}F -FDG uptake in the left proximal humerus on ^{18}F -FDG PET/CT, mimicking metastasis of malignant mesothelioma. In our case, we have reported a patient with Paget's disease who presented with mild ^{18}F -FDG uptake in the right iliac and pubic bones that differed from bony metastasis. The finding of ^{18}F -FDG PET/CT was crucial for the differential diagnosis of Paget's disease in our case.

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