



Transient ^{18}F -Fluorodeoxyglucose Activity on PET/CT of Herniation Pit in Thyroid Cancer Patient: A Case Report

갑상선암 환자의 PET/CT에서 일시적인 ^{18}F -Fluorodeoxyglucose 섭취 증가를 보인 Herniation Pit: 증례 보고

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A herniation pit is a benign bone pit characterized by its femoral location and surrounding sclerotic margin. Few reports have been issued on the fluorodeoxyglucose (FDG) positron emission tomography findings of herniation pit. Here, we report the unique case of a thyroid cancer patient, having a herniation pit showing transient FDG uptake, which mimicked bone metastasis.

Index terms

Positron-Emission Tomography

Femur Head

Femur Neck

Fluorodeoxyglucose F18

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INTRODUCTION

A herniation pit is a benign bone pit, typically located in the superolateral aspect of the femoral neck or at the anterolateral base of the femoral head. The prevalence of these pits is about 4–5% in the adult population, and are generally incidental findings. Radiological features include small subcortical defects surrounded by a thin sclerotic border (1-3). To the best of our knowledge, there are few case reports on increased ^{18}F -fluorodeoxyglucose (FDG) uptake in herniation pits (4). In this report, we present a unique case of herniation pit showing transient FDG uptake on serial positron emission tomography/computed tomography (PET/CT) images.

CASE REPORT

A 53-year-old woman with papillary thyroid cancer, who had undergone total thyroidectomy and radioactive iodine ablation treatment 1 year back, visited our hospital for tumor investigation. The patient had no history of trauma, athletic activity, or inflammation. The physical exam was within normal limits. Laboratory data included measurement of thyroglobulin antibody and thyroglobulin levels, following thyroid-stimulating hormone (TSH) stimulation (TSH ≥ 30 $\mu\text{IU/mL}$). All laboratory results were within normal range.

An initial PET/CT showed focal hypermetabolism (maximum standardized uptake values = 4.8) in the anterolateral femoral head (Fig. 1A). There was no abnormal FDG uptake except in the femoral head, and CT images revealed no abnormal density in the same lesion (Fig. 1B). Two to three weeks later, pelvic

bone CT, bone scintigraphy, and magnetic resonance imaging (MRI) were performed to further evaluate the lesion. CT images revealed a small hypodense lesion without a sclerotic rim (Fig. 1C). The bone scan showed focally increased uptake in the lateral femoral head, corresponding with the lesion noted on the pre-

vious PET/CT (Fig. 1D). On MR images, the lesion showed high signal intensity (SI) with thin dark SI rim on T2-weighted images, low SI on T1-weighted images, and mild enhancement on contrast enhanced T1-weighted images. Adjacent marrow edema was also seen on T2-weighted images and contrast enhanced

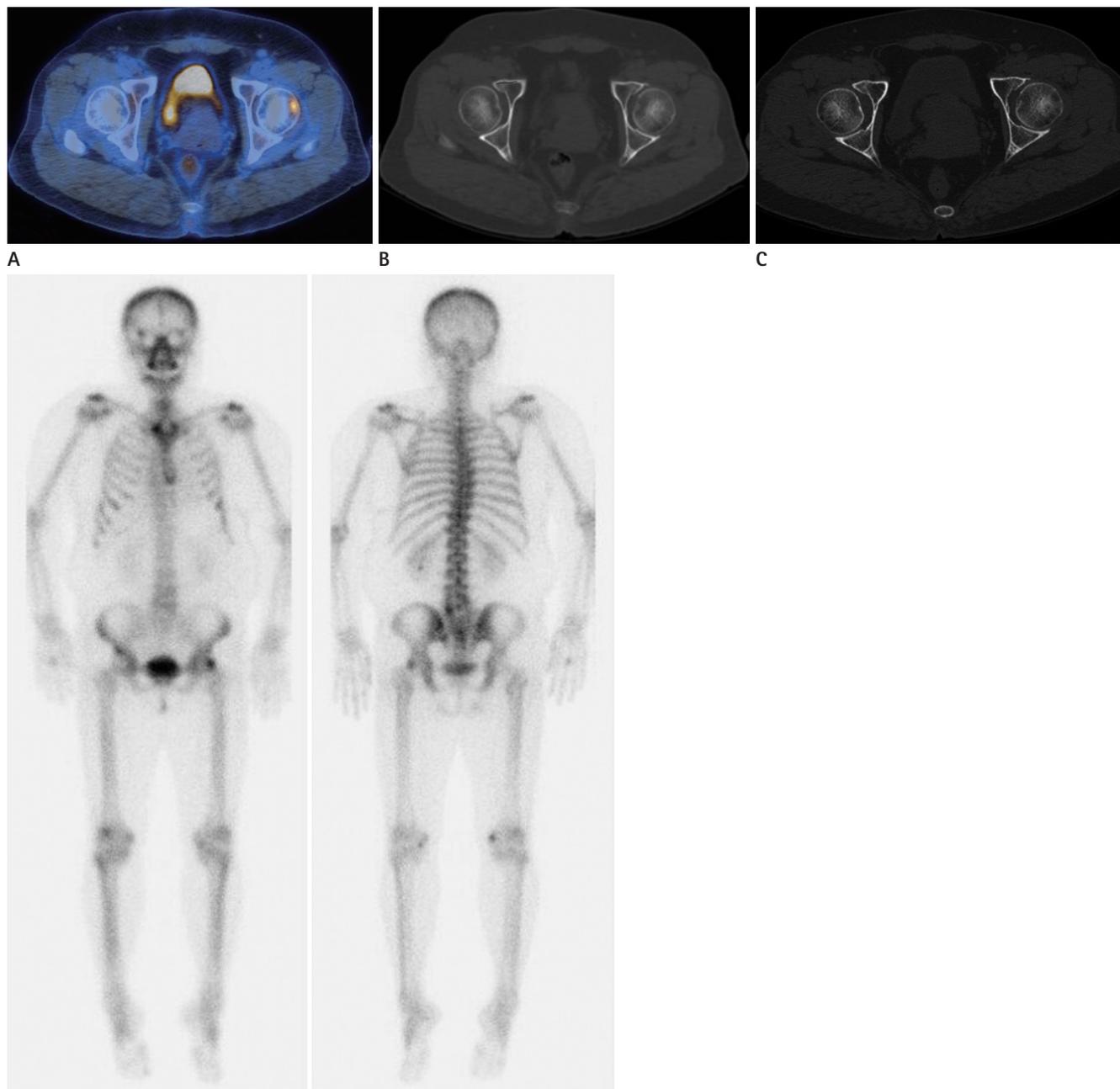


Fig. 1. Transient ¹⁸F-FDG activity of herniation pit, in a 53-year-old woman with thyroid cancer.
A. PET/CT fusion image shows a focal hypermetabolism in the left anterolateral femoral head.
B. CT bone setting finding, which corresponds to the location of the hypermetabolic lesion, shows no definite abnormality.
C. After 3 weeks, axial CT of pelvic bone shows a small hypodense lesion without a sclerotic rim, in the left anterolateral femoral head.
D. Bone scan shows focal increased uptake in the left lateral femoral head.
 CT = computed tomography, FDG = fluorodeoxyglucose, PET = positron emission tomography

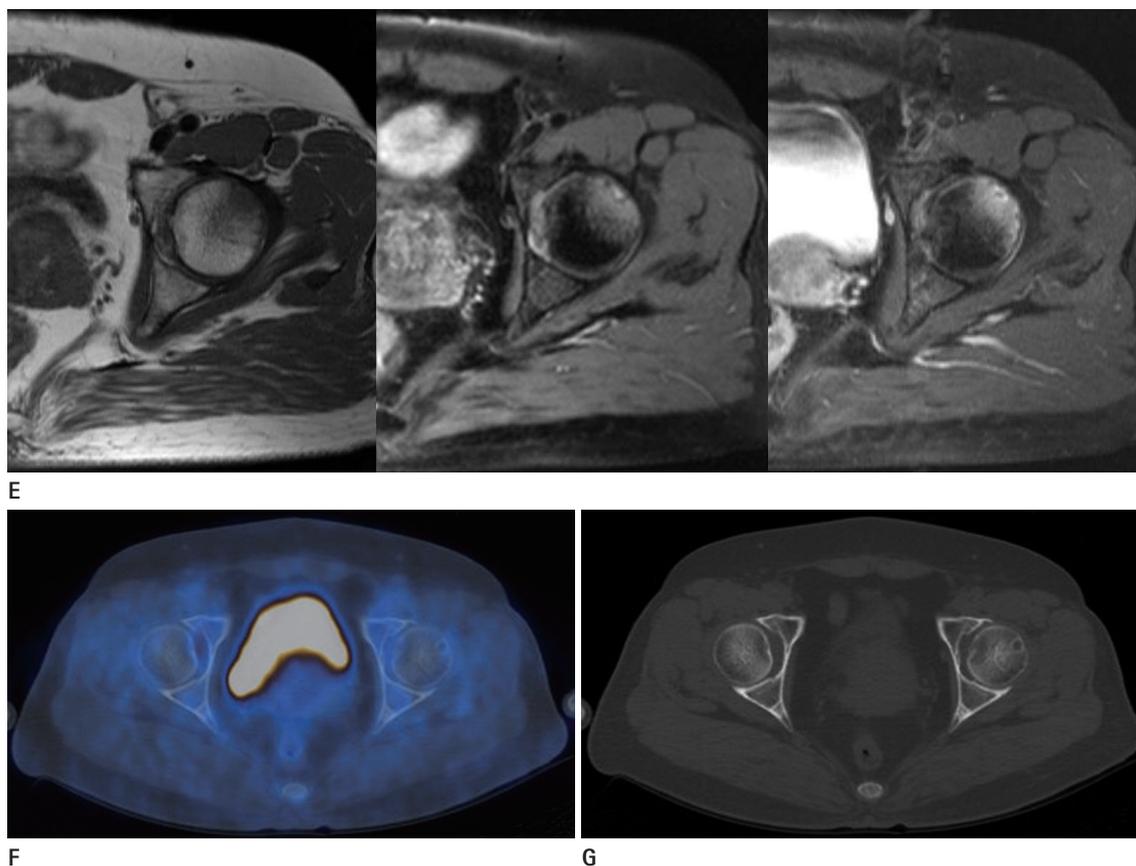


Fig. 1. Transient ^{18}F -FDG activity of herniation pit, in a 53-year-old woman with thyroid cancer.

E. MR T1-weighted (left), T2-weighted (middle), contrast enhanced T1-weight (right) images. T1 weighted image shows ill defined low SI lesion in the anterosuperior femoral head/neck junction. T2-weighted image shows high SI with adjacent marrow edema. Contrast enhanced T1-weighted image shows focal rim enhancing lesion with mild diffuse enhancement of marrow.

F, G. Follow up PET/CT images after 9 months show no FDG uptake (**F**), and a hypodense lesion with a sclerotic border in the left anterolateral femoral head, characteristic of a herniation pit (**G**).

CT = computed tomography, FDG = fluorodeoxyglucose, PET = positron emission tomography, SI = signal intensity

images (Fig. 1E).

Base on clinical and imaging features, we suspected a herniation pit. However, the probability of bone metastasis could not be excluded. Further evaluation was warranted to make an accurate diagnosis, and an out-patient follow up PET/CT was scheduled. Nine months later, the increased FDG uptake was no longer observed, and the low density lesion had a sclerotic rim on serial PET/CT images (Fig. 1F, G). These CT findings were consistent with herniation pit, which was the final diagnosis of the lesion.

DISCUSSION

A herniation pit of the femur is a normal variant, located in the femoral neck or at the base of the femoral head, and were

first described by Pitt et al. (5) in 1982. Herniation pits were suggested to be synovial invaginations through cortical defects at the femoral neck. This benign lesion presents histopathologically as a subcortical cavity filled with hyaline and fibrocartilaginous tissue, surrounded by reactive new bone (1, 2). They are usually asymptomatic, and revelations of most herniation pits are incidental. The diagnosis of these pits relies not only on imaging features, but also on their characteristic location. An imaging study for herniation pit of the femur usually includes radiography and CT. Typically, the CT finding reveals a well-defined round or oval, subcortical/subchondral low density, at the femoral neck or head. The hypodense central area is usually surrounded by a sclerotic border. Identification of the location, completely surrounding sclerosis, clear demarcation, and round-to-oval shape in radiography or CT, are the diagnostic findings

in differentiating herniation pit from other hypodense bone lesions, such as bone metastases as well as cystic appearing lesions at the femoral neck (3, 6). However, the initial phase of development or the small herniation pit may be difficult to appreciate upon radiographic study, similar to the initial observations of our case (2).

On MR images, most herniation pits present as bright high SI lesion on T2-weighted images, with mild adjacent bone marrow edema. However, MRI findings may vary, depending on the stage or histological components of the pit (3, 7). In our case, the lesion was seen as T1 low and T2 high SI lesion with very thin, dark, peripheral rim and adjacent bone marrow edema. The very thin sclerotic rim and marrow edema may suggest an early stage and ongoing activity of this lesion.

The differential diagnosis of herniation pit includes osteoid osteoma, intraosseous ganglia, and bone metastasis. Osteoid osteoma usually occurs in the long tubular bones of the limbs, especially the femur and tibia. They have a characteristic low attenuated nidus (less than 2 cm), accompanied by cortical thickening and reactive sclerosis (3, 8). Intraosseous ganglia are usually subarticular and are in close connection to the synovial joints. Histologically, these ganglia are cystic lesions containing mucoid material and sclerotic changes in the adjacent bone, as a result of active remodeling (3, 6). MRI of bone metastasis usually presents as T2 high and T1 low SI lesion with conspicuous enhancement (3, 7).

In the current case, the patient had no pain, and the serum thyroglobulin level was not elevated. MR finding of very thin sclerotic rim supported the impression of a herniation pit rather than bone metastasis, but further study was warranted to make a definitive diagnosis.

Most pits are negative on bone scans. However, as observed in our case, there have been a few reported cases of herniation pit that displayed increased uptake; this increased uptake is probably associated with the interplay of resorption, stress, and remodeling involved in the lesion (3, 8).

PET is as accurate as bone scan in detecting metastatic bone lesions, and has a better specificity than bone scan. However, it is difficult to differentially diagnose bone metastasis and other benign disease based solely on hypermetabolism (9). To the best of our knowledge, there are few reports on ¹⁸F-FDG PET/CT of herniation pits. Yoo et al. (4) reported a case of herniation pit mim-

icking bone metastasis in a lung cancer patient, which showed increased FDG uptake in the femoral neck on PET/CT. Increased FDG uptake on PET/CT is frequently observed in various benign lesions, such as inflammation. The FDG uptake mechanism in herniation pits is uncertain, but it may be related to the interplay of resorption, stress, and remodeling, involved with the formation and potential growth of the pits (4).

Distant metastases are seen in a minority of differentiated thyroid cancer patients, and the reported rates of occurrence range from 9–15%. The most frequent sites of distant metastases are lungs (50%) and bones (20%) (10). In our case, early herniation pit had increased FDG uptake on PET/CT, and a pure hypodense lesion on pelvic bone CT. Although the incidence of bone metastasis in differentiated thyroid cancer is very low, the PET/CT finding could not exclude bone metastasis to the femoral head. However, the serial PET/CT images 9 months later, showed a definite sclerotic rim surrounding the original lesion, and the disappearance of FDG uptake. These findings were helpful clues, leading to the decisive diagnosis of herniation pit.

In conclusion, we present a unique case of herniation pit showing transient FDG uptake on serial PET/CT imaging. The main differential diagnosis for hypermetabolic lesion of the femoral neck or head is bone metastasis, as seen in the initial PET/CT of our case. However, on serial follow-up PET/CT, changes in the FDG uptake and CT image features are helpful in the decisive diagnosis of herniation pit. We therefore propose that herniation pit should be considered in the differential diagnosis of a hypermetabolic hypodense lesion of the femoral neck or head.

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갑상선암 환자의 PET/CT에서 일시적인 ¹⁸F-Fluorodeoxyglucose 섭취증가를 보인 Herniation Pit: 증례 보고

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Herniation pit은 대퇴부의 위치와 주변부 경화의 특징을 보이는 양성 골병변이다. Herniation pit의 양전자방출단층촬영 소견에 대한 보고는 거의 없다. 저자들은 갑상선암 환자에서 일시적인 fluorodeoxyglucose 섭취를 보이며 골전이와 혼동되었던 herniation pit의 증례를 보고하고자 한다.

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