

## Case Report

# Fluorodeoxyglucose PET-CT Findings Following Bone Marrow Harvesting

Robert Matthews, Michael Schuster<sup>1</sup>, Elham Safaie, Nand Relan, Dinko Franceschi

Departments of Radiology, and <sup>1</sup>Hematology and Oncology, Stony Brook University Medical Center, Stony Brook, New York, USA

## Abstract

Two patients demonstrated an unusual pattern of intense bone and surrounding soft tissue hypermetabolic uptake in the posterior pelvis on fluorodeoxyglucose positron emission tomography with computed tomography PET-CT scans. After further investigation, we found that both patients underwent uncomplicated autologous bone marrow harvesting several weeks before imaging. These two cases illustrate a distinctive PET-CT appearance following bone marrow harvesting that the radiologist needs to recognize to not confuse the findings with metastatic disease.

**Keywords:** Bone marrow harvesting, FDG PET-CT, lymphoma

## Introduction

Autologous bone marrow transplantation has become an important procedure in the management of lymphoma, leukemia, and other malignancies to protect against the myeloablative effects of therapy. Before chemotherapy and radiation therapy, hematopoietic stem cells are directly harvested from bone marrow, stored, and subsequently reintroduced after therapy has finished. In this report, we present two patients with non-Hodgkin's lymphoma that underwent fluorodeoxyglucose (FDG) positron emission tomography with computed tomography (PET-CT) which demonstrated an unusual pattern of intense bone and surrounding soft tissue uptake in the sacrum and bilateral iliac regions that was not characteristic of malignant involvement. After further investigation, we found that both patients underwent uncomplicated autologous bone marrow harvesting several weeks before PET-CT imaging. These two interesting cases illustrate a distinctive PET-CT

appearance following bone marrow harvesting not described in the literature that the nuclear medicine physician needs to recognize in order not to confuse the findings with metastatic disease.

## Case Report

The first patient is a 67-year-old female who presented for a FDG PET-CT scan for relapsed refractory non-Hodgkin's follicular B-cell lymphoma. Transaxial PET images at the level of the pelvis (Figure 1, bottom image) demonstrated moderate hypermetabolic activity in the right posterior iliac bone and right sacrum with mild increased activity in the left posterior iliac bone and left sacrum. The maximum standard uptake value (SUV) was 6.6. PET-CT fusion images at the same level (Figure 1, middle image) showed hypermetabolic activity extending beyond the sacral and iliac bones, predominantly in the gluteal muscles and subcutaneous tissues, but additionally anterior to the right sacrum. CT images (Figure 1, top image) showed parallel linear osseous defects involving both the cortex and medulla tilted medially on both sides through the posterior iliac bones and sacrum causing a "sergeant stripes" appearance on CT. In addition, subcutaneous stranding was noted on CT.

After further investigation, we discovered that the patient underwent bilateral iliac crest bone marrow

### Access this article online

#### Quick Response Code:

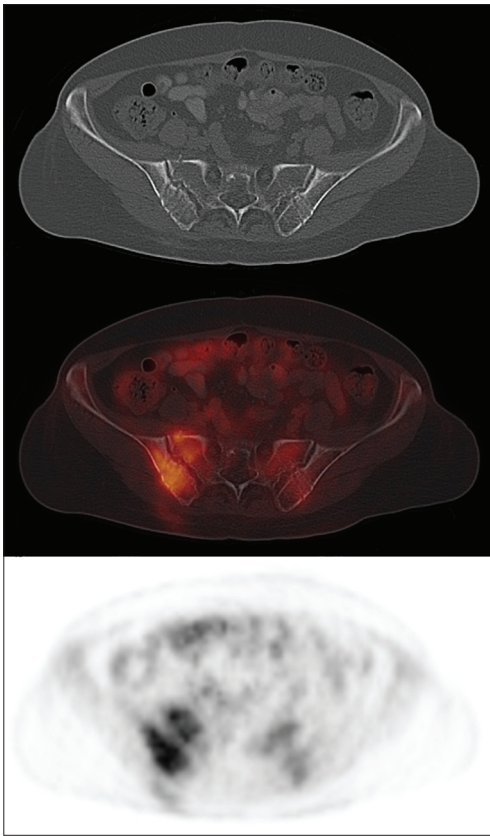


Website:  
www.wjnm.org

DOI:  
10.4103/1450-1147.98740

### Address for correspondence:

Dr. Robert Matthews, Department of Radiology, Stony Brook Medical Center, Health Sciences Center L4, Rm 120, Stony Brook, NY 11794-8460, USA.  
E-mail: robert.matthews@sbumed.org



**Figure 1:** FDG PET-CT transaxial images showing moderate hypermetabolic activity in the posterior pelvis bone and soft tissue with linear needle tracts on CT

aspiration under general anesthesia for autologous bone marrow transplantation, 14 days before PET-CT imaging. At the time of bone marrow harvesting, analysis of bone marrow aspirate showed absence of malignancy and absence of infectious agents. Blood culture showed no bacterial growth.

The second patient is a 73-year-old female with a history of relapsed follicular non-Hodgkin's lymphoma. Twenty-five days before the PET-CT, she also had bone marrow harvesting performed under general anesthesia. Bone marrow aspirate did not reveal evidence of malignancy or infection, and cultures did not grow pathogens. Maximum intensity projections of the PET images [Figure 2] demonstrated prominent increased uptake in the bilateral sacroiliac regions with maximum SUV 10.8. Although FDG PET-CT has good sensitivity and accuracy in the detection of bone marrow involvement with lymphoma and other malignancies, the localized FDG uptake only in the sacroiliac regions with absence of other areas of abnormal uptake was suspicious for nonmalignant pathology.<sup>[1]</sup>

Transaxial PET images at the level of the pelvis [Figure 3, bottom image] showed intense increased FDG



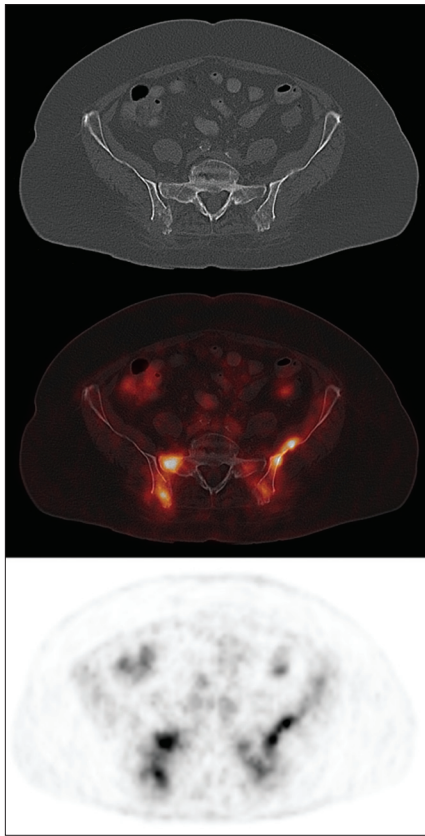
**Figure 2:** Maximum intensity projections of the PET images demonstrating prominent increased FDG uptake in the bilateral sacroiliac regions

uptake in the bilateral iliac bones and sacrum. Fusion images [Figure 3, middle image] showed prominent hypermetabolic activity extending beyond the borders of the bone, in particular, involving the left iliacus muscle where the harvesting needle penetrated the left iliac wing. On CT [Figure 3, top image], needle tracts are again seen angled medially and there was destruction of the right posterior iliac bone from repeated bone marrow aspirations. Prominent inflammatory changes were also seen on both CT and PET images in the posterior musculature and subcutaneous tissues.

## Discussion

Autologous bone marrow transplantation has become a valuable addition to the treatment plan in relapsed Hodgkin's and non-Hodgkin's lymphoma, as well as leukemia and other malignancies. Before the myeloablative effects of chemotherapy and radiation therapy, bone marrow is directly harvested from the iliac bones or other flat bones to be stored until later reintroduction.<sup>[2]</sup> Both FDG PET and PET-CT have developed an increasing role in the monitoring of lymphoma and other malignancies of patients receiving autologous bone marrow transplantation. FDG PET and PET-CT can be used to predict outcome before and after treatment of lymphoma patients with autologous stem cell transplantation.<sup>[3,4]</sup>

Increased FDG uptake within bone marrow on PET scan is described in a variety of benign and malignant pathologies. Patterns of diffuse bone marrow uptake are seen with treatment from colony-stimulating factor, erythropoietin, anemia, inflammation, and other hematopoietic disorders. Focal increased marrow uptake may be seen with malignant involvement including metastases and multiple myeloma, external beam



**Figure 3:** FDG PET-CT transaxial images showing increased FDG uptake in the bilateral iliac bones and sacrum with prominent hypermetabolic activity extending beyond the borders of the bone in the musculature and subcutaneous tissues

radiation therapy, granulomatous inflammation, and infectious sacroiliitis, among other etiologies.<sup>[5-8]</sup> In these illustrated cases, the patients' histories and distinct CT and PET findings allowed the radiologist to arrive at the

correct diagnoses and not be confused with neoplastic recurrence or other pathology.

## References

1. Muslimani AA, Farag HL, Francis S, Spiro TP, Chaudhry AA, Chan VC, *et al.* The utility of 18-F-fluorodeoxyglucose positron emission tomography in evaluation of bone marrow involvement by non-Hodgkin lymphoma. *Am J Clin Oncol* 2008; 31:409-12.
2. Cheson BD, Lacerna L, Leyland-Jones B, Sarosy G, Wittes RE. Autologous bone marrow transplantation. Current status and future directions. *Ann Intern Med* 1989;110:51-65.
3. Johnston PB, Wiseman GA, Micallef IN. Positron emission tomography using F-18 fluorodeoxyglucose pre- and post-autologous stem cell transplant in non-Hodgkin's lymphoma. *Bone Marrow Transplant* 2008;41:919-25.
4. Svoboda J, Andreadis C, Elstrom R, Chong EA, Downs LH, Berkowitz A, *et al.* Prognostic value of FDG-PET scan imaging in lymphoma patients undergoing autologous stem cell transplantation. *Bone Marrow Transplant* 2006;38:211-6.
5. Liu Y, Ghesani NV, Zuckier LS. Physiology and pathophysiology of incidental findings detected on FDG-PET scintigraphy. *Semin Nucl Med* 2010;40:294-315.
6. Blodgett TM, Ames JT, Torok FS, McCook BM, Meltzer CC. Diffuse bone marrow uptake on whole-body F-18 fluorodeoxyglucose positron emission tomography in a patient taking recombinant erythropoietin. *Clin Nucl Med* 2004;29:161-3.
7. Liu Y. Bone marrow granulomatous inflammation: FDG PET findings mimicking hematopoietic malignancy. *Clin Nucl Med* 2008;33:707-8.
8. Ho CL, Wu WC, Chen S, Leung YL, Cheng TK. F-18 FDG PET/CT in an adult case of group B streptococcal sacroiliitis. *Clin Nucl Med* 2010;35:834-5.

**How to cite this article:** Matthews R, Schuster M, Safaie E, Relan N, Franceschi D. Fluorodeoxyglucose PET-CT Findings Following Bone Marrow Harvesting. *World J Nucl Med* 2012;11:19-21.

**Source of Support:** Nil. **Conflict of Interest:** None declared.

### Author Help: Reference checking facility

The manuscript system ([www.journalonweb.com](http://www.journalonweb.com)) allows the authors to check and verify the accuracy and style of references. The tool checks the references with PubMed as per a predefined style. Authors are encouraged to use this facility, before submitting articles to the journal.

- The style as well as bibliographic elements should be 100% accurate, to help get the references verified from the system. Even a single spelling error or addition of issue number/month of publication will lead to an error when verifying the reference.
- Example of a correct style  
Sheahan P, O'leary G, Lee G, Fitzgibbon J. Cystic cervical metastases: Incidence and diagnosis using fine needle aspiration biopsy. *Otolaryngol Head Neck Surg* 2002;127:294-8.
- Only the references from journals indexed in PubMed will be checked.
- Enter each reference in new line, without a serial number.
- Add up to a maximum of 15 references at a time.
- If the reference is correct for its bibliographic elements and punctuations, it will be shown as CORRECT and a link to the correct article in PubMed will be given.
- If any of the bibliographic elements are missing, incorrect or extra (such as issue number), it will be shown as INCORRECT and link to possible articles in PubMed will be given.