Diffuse Skeletal Uptake on ^{18}F-Fluoro-2-deoxy-d-glucose Positron Emission Tomography/Computed Tomography Scan in a Patient with Acute Lymphoblastic Leukemia: A Typical Superscan Pattern Resembling NaF Positron Emission Tomography Scan

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Abstract

A 65-year-old patient with acute lymphoblastic leukemia presented for an ^{18}fluoro-2-deoxy-d-glucose positron emission tomography computed tomography (^{18}FDG PET) after several courses of chemotherapy for metastatic evaluation. Unexpectedly, on ^{18}FDG PET scan, no discernible uptake was observed in the visceral organs, but instead, the skeleton/bone marrow showed homogenously intense metabolic activity. The distribution of ^{18}FDG observed on the scan was remarkably similar to that on the NaF PET scan, indicating a superscan appearance.

Keywords: *18 fluoro-2-deoxy-d-glucose positron emission tomography computed tomography, acute lymphoblastic leukemia, bone marrow, diffuse uptake, skeleton, superscan*

A 65-year-old man with a history of acute lymphoblastic leukemia (L3 subtype) was referred for an ^{18}F fluoro-2-deoxy-d-glucose positron emission tomography computed tomography (^{18}FDG PET/CT) for possible metastatic assessment. After obtaining an informed consent, an ^{18}FDG PET/CT scan was performed. The diagnosis was established by a bone marrow biopsy following a pancytopenia developed 2 years ago, and then, the chemotherapy was instituted shortly thereafter. After completion of 8 cycles of chemotherapy, the bone marrow biopsy examination revealed no leukemic involvement, but mild erythroid hyperplasia. Subsequently, a CT scan of the thorax was performed, on which, a few small nodules were detected in the lungs. Two months later, the patient underwent an ^{18}FDG PET/CT [Figure 1a], on which, a massive redistribution of the tracer from internal organs to the skeleton/bone marrow was noticed. Except mild physiological uptake in the brain, the visceral organs and soft tissue background activity were barely discernible. The most conspicuous finding on the maximum intensity projection image was the intense, homogeneous uptake in the axial and appendicular skeleton, suggesting diffuse bone marrow involvement. In addition, uptake irregularity of the renal parenchyma suspicious for tumoral involvement was evident. In Figure 1b, on enhancement of the brightness of the image in part "a" of Figure 1, the liver and spleen demonstrated faint uptake, and the background activity is still suppressed. As can be seen in Figure 2, the CT, PET, and fused PET/CT images from thorax (a), upper abdomen (b), and pelvis (c) demonstrate intense hypermetabolic pulmonary nodules in the right lung and substantial uptake in the bones as compared to faint uptake in the parenchyma of the liver and spleen. Two months later, despite the initiation

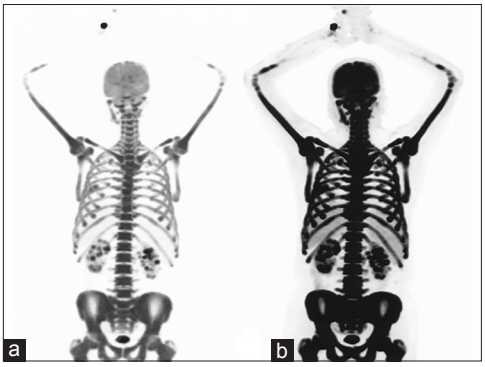

Figure 1: Maximum intensity projections of ^{18}FDG PET scan without (a) and with (b) brightness enhancement

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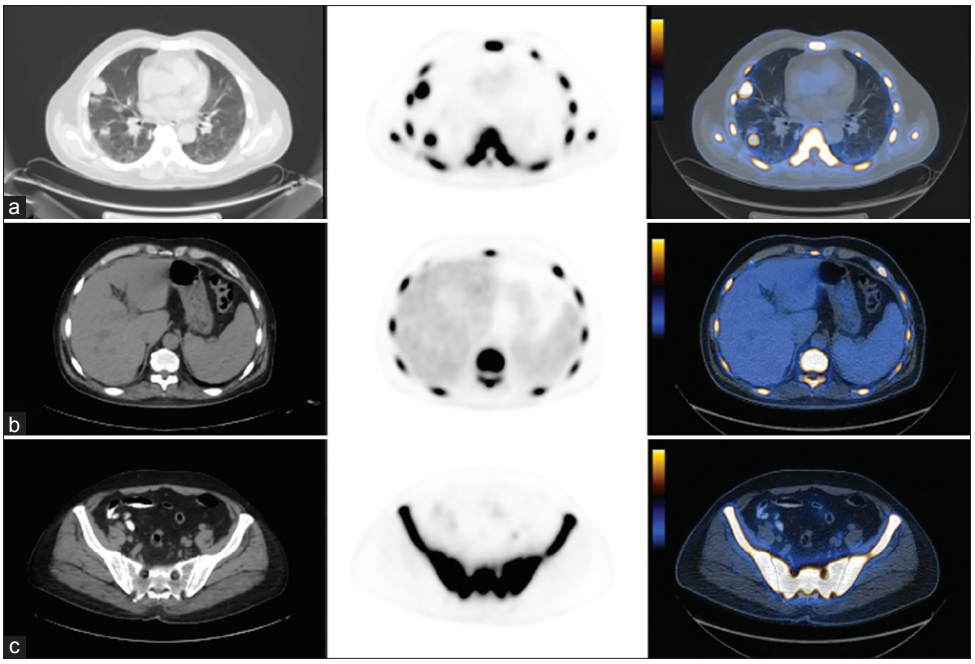

Figure 2: CT (left), PET (middle) and fused PET/CT (right) slices of ^{18}FDG PET scan from thorax (a), upper abdomen (b) and pelvis (c)

of a new regimen of chemotherapy, the patient expired. "Superscan" appearance is an interesting terminology that has long been in use in nuclear medicine.[1,2] Initially, by definition, this terminology applied to a pattern on bone scintigraphy that assumes a condition in which the ^{99}mTc-mthylene-diphosphonate is perfectly taken up in the skeletal system, and no background activity is noticed. Owing to the homogeneous distribution, this appearance resembles a normal scan but with much higher quality and is associated with varieties of metabolic disorders and rarely, widespread metastatic involvement of the skeleton.[1-3] Later, the application of this term is generalized to similar features in other scans or any dominant uptake limited to a specific organ, for example, liver,[4,5] suppressing uptake elsewhere, although some misuses have been occurred. Diffuse ^{18}FDG uptake in the skeleton and bone marrow as superscan pattern on PET scan has been reported in multiple malignant disorders, including lymphoma and leukemia,[6,7] multiple myeloma,[8] and metastasis like prostate cancer[9,10] as well as other hematologic conditions, for example, following administration of granulocyte colony-stimulating factor.[11] This finding is also observed in metabolic disorders such as renal osteodystrophy[12] and parathyroid carcinoma.[13] In this case, although some uptake in the brain and excretion via the urinary system are present, the uptake in the skeleton is sufficiently high and homogeneous that conforms, to a large extent, to the definition of superscan and bears a striking resemblance to an NaF PET scan, an exceptionally rare finding. In such conditions, because of less tracer available to accumulate in other organs, the detection of lesions may be compromised and more importantly, as in our patient, the prognosis is considerably poorer in patients without such finding.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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