The advantage of PET/CT in detecting bone metastases: a case report

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Abstract

Introduction: *When detecting bone metastases bone scintigraphy has been long used as the most sensitive radiological modality, especially in lytic metastases, to assess the spread of disease in skeletal structures. Currently bone scintigraphy and CT remain the gold standard for bone metastasis detection in oncological patients in our nation.*

Method: *We describe the case of a 45-year-old man who was diagnosed with large B-cell lymphoma and was having a whole-body PET/CT scan for staging purposes. The overall report identified the pathological lymph nodes, in more than one region of lymph node stations. These nodes had increased in size compared to the previous study of the patient. Diffuse skeletal pathological uptake of the radiotracer indicated the diffuse bone marrow infiltration, while the CT images alone showed no evidence of typical lytic bone lesions. Other findings included splenomegaly and secondary splenic infiltration.*

Discussion: *One of the primary diagnoses for which PET/CT is particularly effective is lymphoma, when it comes to identifying intra and extraosseous recurrence. This is particularly true when it comes to identifying marrow infiltration. Few centers in Kosovo and Albania have used the combined PET/CT modality in the last two* *years, besides the importance of including it as part of the imaging protocol in the follow-up of the patients with lymphoma, or oncologic patients in general.*

Keywords: *Case report, PET/CT, scintigraphy, metabolically active, bone lesions, lymphoma.*

Introduction

Fusion imaging PET/CT is a new multimodality that enables correlation of results from two simultaneous modalities imaging in an analysis. While 18F-FDG PET shows features of tumor function and allows metabolic studies, CT displays great anatomic detail but does not provide functional information, when correlated with concurrently collected CT data, subtle findings at FDG-PET that would otherwise be ignored or interpreted as physiological variations can result in the identification of a malignant process [(5)].

Case description

We present the case of a 45-year-old male patient, diagnosed with large B-Cell lymphoma, undergoing a whole-body PET/CT for staging purposes after chemotherapy treatment.

The overall report detected the pathological lymph nodes distributed in the cervical region, mediastinal, pelvic and bilateral inguinal regions, specifying their increase in size compared to the previous study, the lymph nodes were categorized as pathological according to the anatomical CT size criteria (more than or equal to 15 mm of short axis), and by their high uptake of radiotracer, for lymph nodes smaller than 15 mm. Secondary splenic infiltration was evident both on CT due to splenomegaly and focal increased uptake of 18-FDG of the spleen.

The curiosity about this case was that PET/CT showed multiple/diffuse metabolically active bony lesions involving the cranial bones, both upper and lower extremities bones, vertebral column, and pelvic bones.

The CT showed no evidence of typical lytic lesions, or it only showed a mild reduction in the density of medullar pattern of bones mostly in the appendicular skeleton, reaffirming the advantageous PET-CT in bone metastases. The patient was classified as Deauville 5, "Progressive Disease".

FIGURE 1. The CT shows mild reduction in bone density in humeral head bilaterally. No typical metastatic lesions detected in the scapular bone nor first thoracal vertebra.

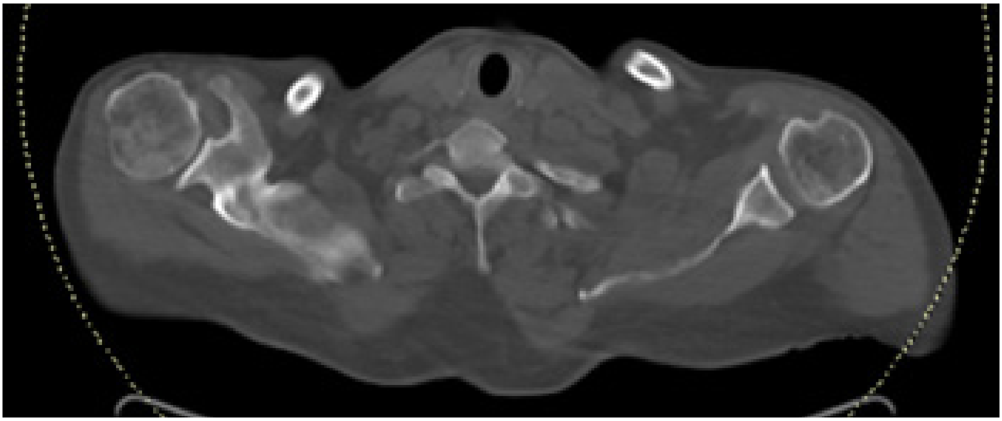


FIGURE 2. Same axial PET/CT image as in fig. 1, indicating increased uptake of 18F-FDG in both humeral heads. Increased uptake is remarked at the upper border of the right scapular bone and the first thoracal vertebra.

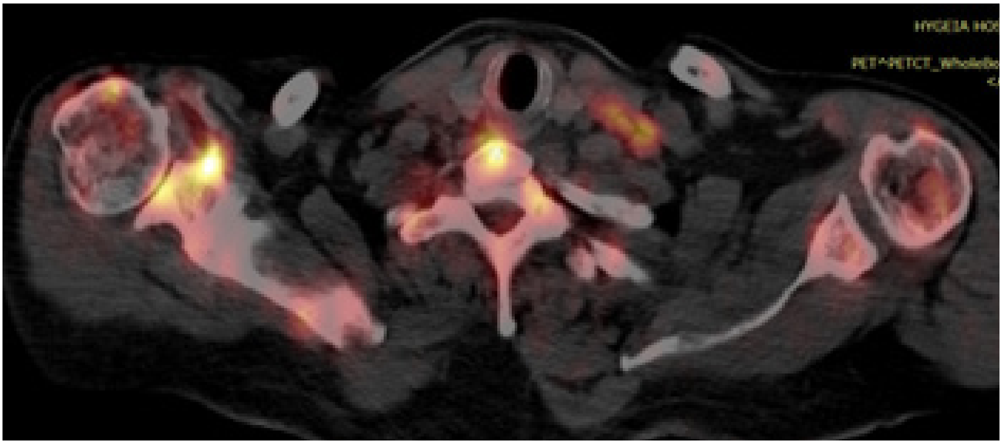


FIGURE 3A. Humeral diaphysis CT, mild reduced bone density. No typical lytic lesion evident.

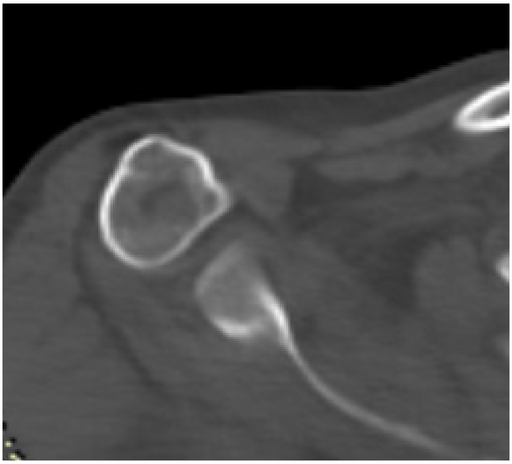
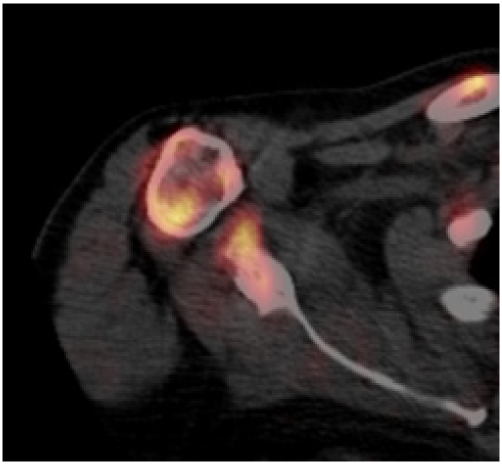


FIGURE 3B. Same axial image as in fig. 3a showing diffuse increased uptake of radiotracer in PET/CT.



Literature review

Fused images Positron Emission Tomography/Computed Tomography (PET/CT), has shown improved sensitivity in detecting bone metastases by quantifying the metabolic activity of malignant cells, thus indicating the presence of tumor metastases in bone. Various studies have been comparing the different modalities.

A prospective study conducted by the Portuguese Institute of Oncology in a period of 6 years in breast cancer patients, concluded that PET/CT is significantly more sensitive than bone scintigraphy in detecting bone metastases (respectively 93.3% vs 81.48%), it is more sensitive in detecting lytic bone metastases compared to bone PET. Bone scintigraphy resulted to be more sensitive than PET/CT only in cranial secondary lesions [(1)].

Another study, compared the three modalities, PET, CT and PET/CT fused images, in 1705 detected bone lesions of 123 patients with lymphoma, concluding that the low sensitivity in detecting bone metastases has been improved by combined modality PET/CT. Fused PET/CT modality ranged in sensitivity and specificity in various malignancies, but it was significantly higher in sensitivity and specificity especially in lymphoma[2].

A retrospective study, published in "Asian Pacific Journal of Cancer Prevention" in China, analyzed 530 patients in whom both 18FDG PET/CT and bone scintigraphy were done within one month, concluding that the sensitivity of 18FDG PET/CT was 97.8% the sensitivity of 18FDG-PET was 89.1% followed by bone scintigraphy and CT with 89.5% and 70.4% sensitivity respectively. More than 50% of the metastases were presented as lytic or sclerotic changes on CT[3].

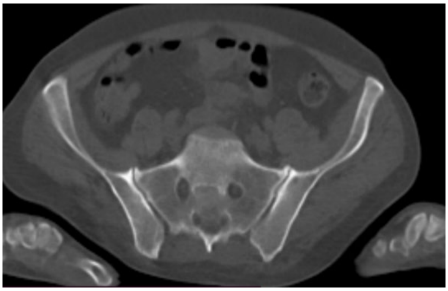
One of the main advantages of fused PET/CT is its ability to detect metabolic changes in the areas involved by malignant cells before the structural changes become visible, as with lymphoma in normal sized infiltrated spleen and lymph nodes. It is advantageous compared with CT in detecting lesions and may also change the stage of up to 8-20% of patients. A high value of uptake also suggests aggressive disease, for value of more than 10 of SUV[4].

Discussion

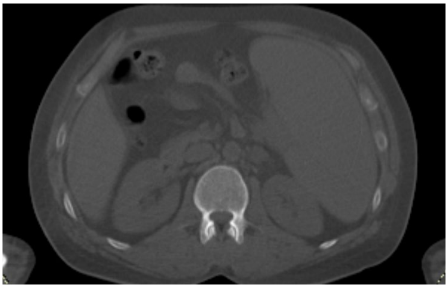
Lymphoma is one of the main diagnoses in which PET/CT is highly efficient, as concluded by many studies, especially in detection of marrow infiltration, resolution of metabolic activity before signs of complete healing on CT, detecting missed sclerotic metastases on bone PET, detection of intra and extra-osseous recurrence[2].

In the past two years, few centers in Albania and Kosovo, have implemented the fused PET/CT modality, by sharing this article we aim to share the experience of our center in the major advantage of bone metastases detected by fused PET/CT images when compared to CT and bone scintigraphy, thus, it is of high value making this modality more accessible for patients for an accurate staging of lymphoma or other oncological pathology.

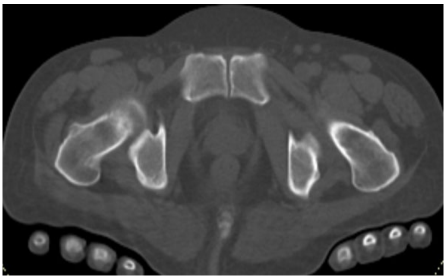
FIGURE 4 - a, b, c, d. No evidence of lytic lesions on the left CT image in the sacro-iliac bones (a), lumbar vertebra (b), ischium-pubic bones (c) and bilateral femoral diaphysis (d).



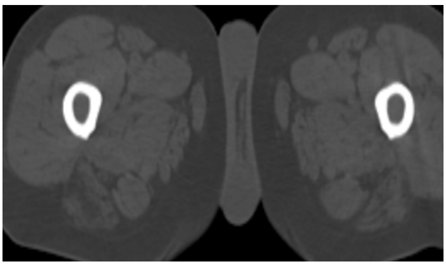
a.



b.

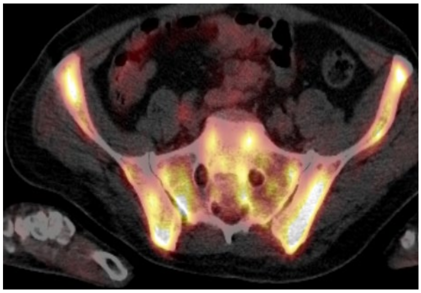


c.

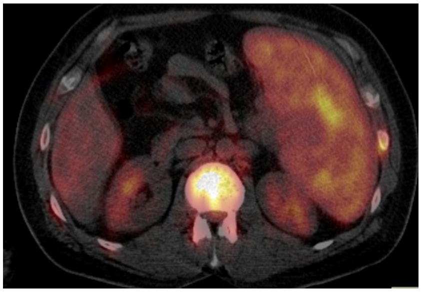


d.

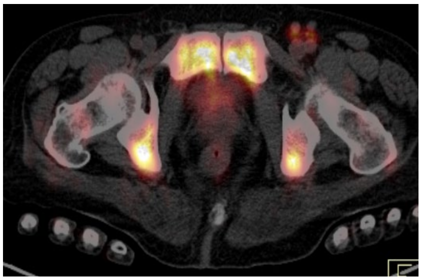
FIGURE 4 - e, f, g, h: Diffuse increased uptake of radiotracer on the e, f, g, h images, corresponding to the same axial planes as in a, b, c, d.



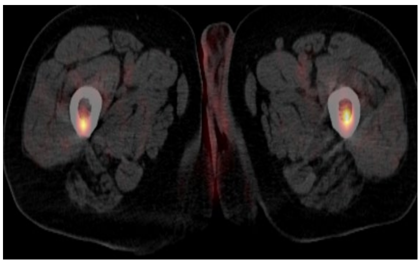
e.



f.



g.



h.

FIGURE 5 – MIP representation of the study. Diffuse pathological uptake of 18F-FDG in axial skeleton, Deauville 5.

References

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