

IMAGING GAMUT

Unsuspected chronic multifocal osteomyelitis diagnosed on a whole-body ^{18}F-FDG PET/CT scan

Qaisar Hussain Siraj*, Amir Javaid, Khattab Khaled, Anwar Al-Banna

Department of Nuclear Medicine, Farwania Hospital Kuwait

Key words: *Osteomyelitis, PET/CT, ^{18}F-flourodeoxyglucose*

Background A 24-year-old male with prune belly syndrome suffering from end-stage renal disease for which he was undergoing routine haemodialysis reported with a 2-week history of swelling of the left knee associated with fever. Blood culture revealed gram +ve cocci (*s. aureus*). The patient was referred to the nuclear medicine department to investigate the possibility of septic arthritis of the left knee and to rule out any osteomyelitis.

Procedure ^{18}F-flourodeoxyglucose (245 MBq) was injected intravenously and PET/CT imaging performed after 60 minutes. PET, CT and fused images were reconstructed in the transaxial, coronal and sagittal axes.

Findings The whole-body PET/CT scan images (Figure 1) showed mild increased soft-tissue uptake (SUV_{max} 2.4) above and at

***Correspondence**

Qaisar Hussain Siraj
Nuclear Medicine Department
Farwania Hospital
PO Box 18373
Kuwait 81004
Email: sirajqaisar@gmail.com

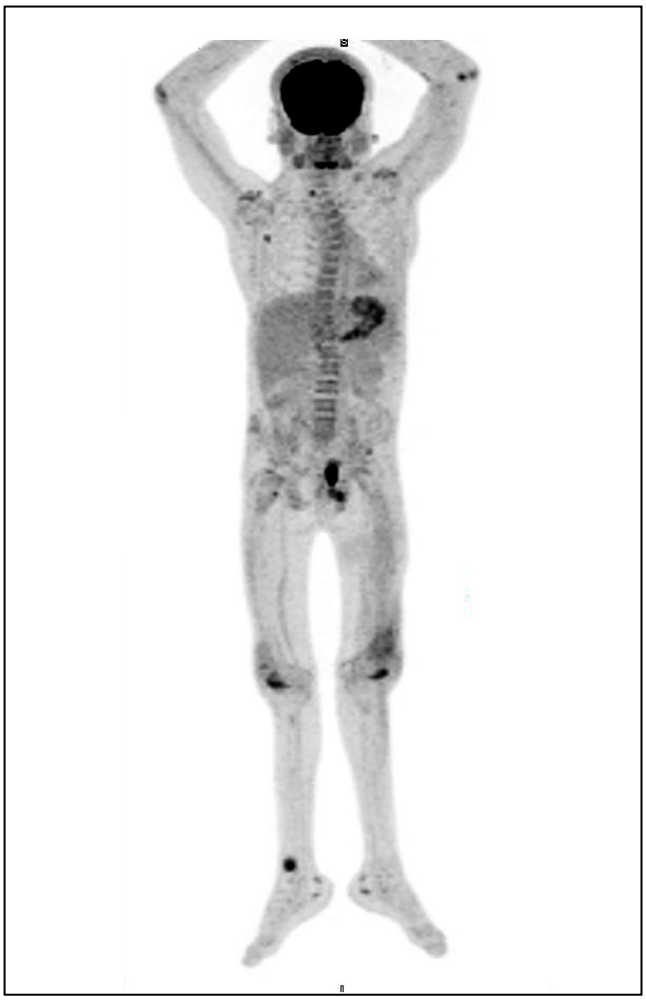

Figure 1 *PET whole-body MIP scan image*

 2221-0288(201601/01)6:1<75:UCMODA>2.0.TX;2-M

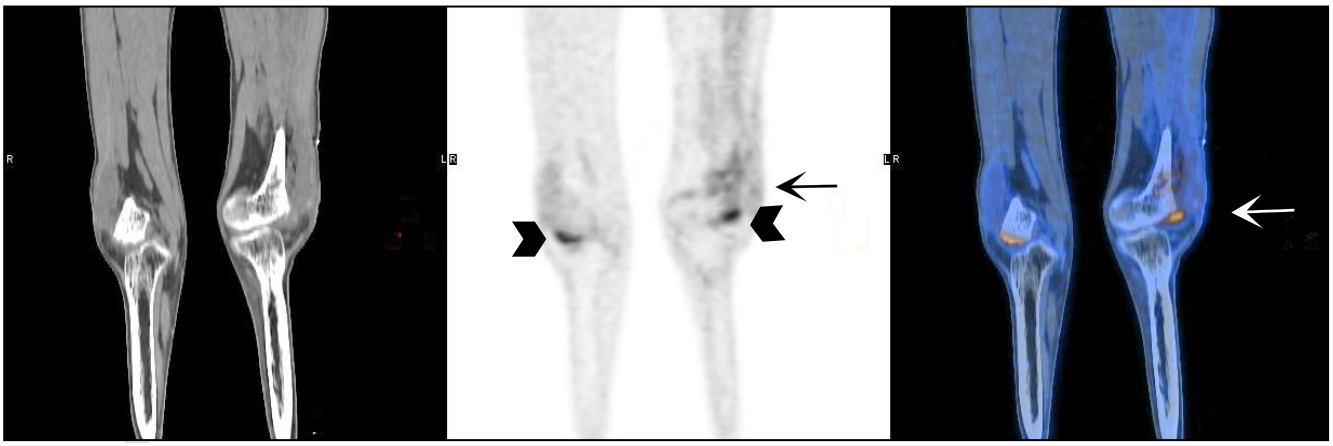

Figure 2 *PET/CT scan with the CT (left), PET (middle) and the fused CT & PET (right) images showing heterogenously increased soft-tissue uptake (SUV_{max} 2.4) in the symptomatic left knee (arrows) without bone involvement consistent with soft-tissue infection/inflammation with bilateral arthritic changes seen in the knee joints (chevrons)*

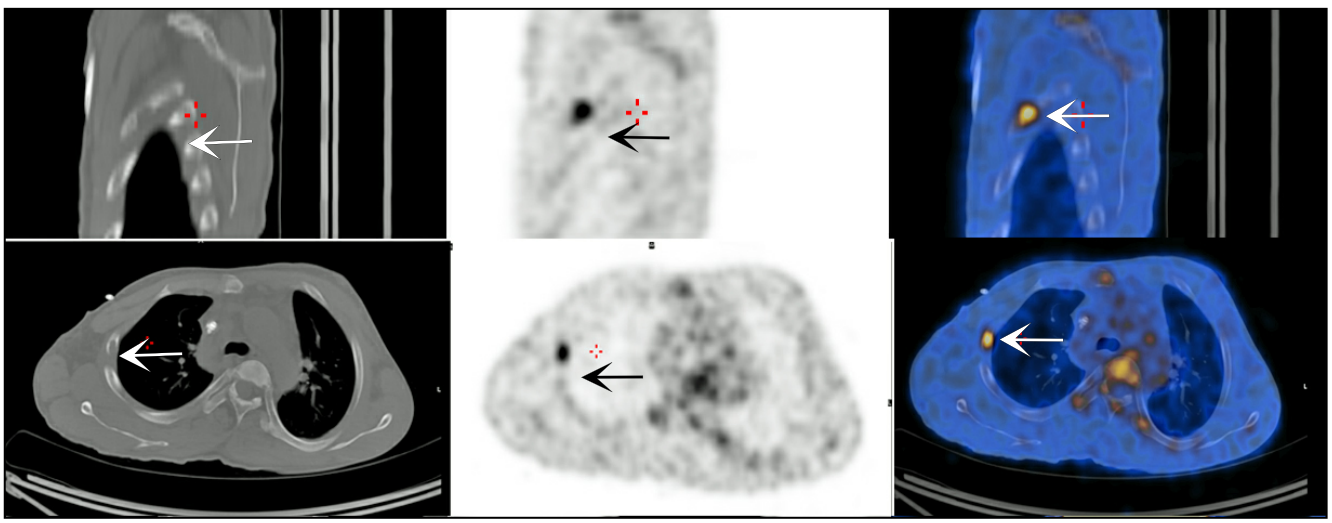

Figure 3 *PET/CT scan with the CT (left), PET (middle) and the fused CT & PET (right) images showing focal increased uptake (SUV_{max} 3.8) in the right 3rd rib laterally with the CT component showing fusiform local expansion of the rib and cortical disruption (arrows)*

the lateral aspect of the left knee without evidence of any increased bone uptake seen to suggest local osteomyelitis (Figure 2).

The whole-body PET/CT scan images additionally showed focal increased uptake (SUV_{max} 3.8) in the right 3rd rib anterolaterally with the CT component showing fusiform local expansion of the rib and cortical disruption (Figure 3).

There was intense focal FDG uptake (SUV_{max} 8.2) in the left pelvis corresponding to the left pubic body, the inferior pubic ramus and the adjacent ischium, with the CT component showing medullary expansion and cortical destruction (Figure 4).

A focus of intense uptake (SUV_{max} 6.0) was seen in the right distal fibula with the CT component showing medullary expansion, bone destruction and fracture at this site (Figure 5).

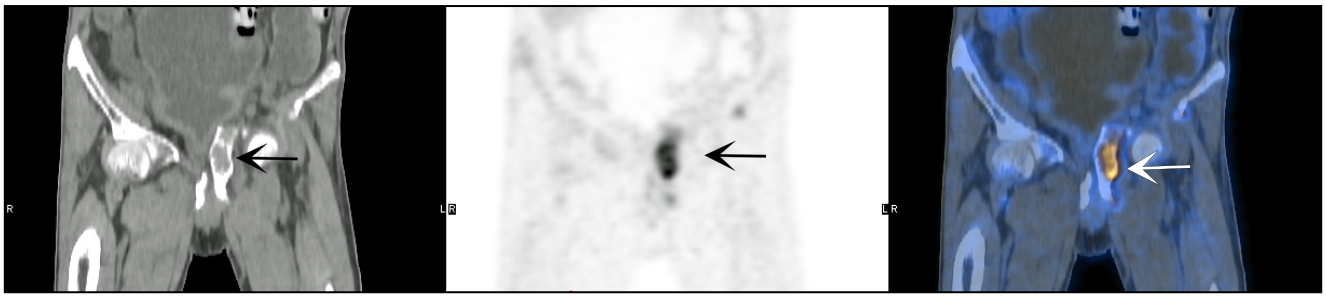

Figure 4 *PET/CT scan with the CT (left), PET (middle) and the fused CT & PET (right) images showing intense focal FDG uptake (SUV_{max} 8.2) in the left pelvis corresponding to the left pubic body, the inferior pubic ramus and the adjacent ischium, with the CT component showing medullary expansion and cortical destruction*

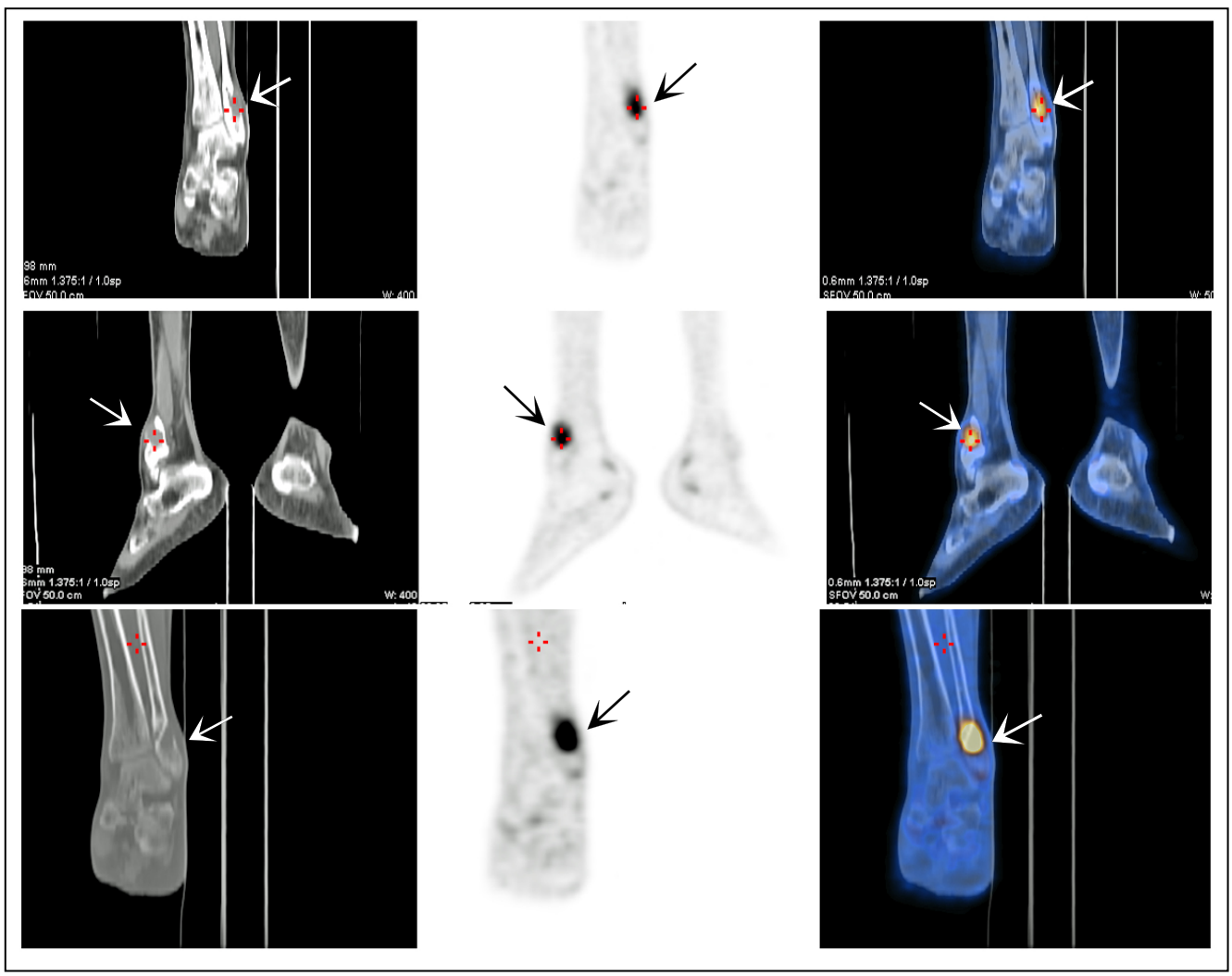

Figure 5 *PET/CT scan with the CT (left), PET (middle) and the fused CT & PET (right) images showing intense focal FDG uptake (SUV_{max} 6) intense focal increased uptake in the distal right distal fibula with the CT component showing medullary expansion, bone destruction and fracture at this site*

Conclusion The PET/CT findings were consistent with soft-tissue infection/ inflammation in the symptomatic left knee region. However, the other multiple hypermetabolic osseous bone lesions documented on the PET/CT scan seen involving the right 3rd rib, in the left pelvis and the right fibula, were consistent with chronic polyostotic osteomyelitis.

Comments Positron emission tomography /computed tomography (PET/CT) with the glucose analogue, ^{18}F-fluoro-2-deoxyglucose (^{18}F-FDG), has an established role in oncological imaging but is being increasingly used for the diagnosis of musculoskeletal infection. The accumulation of FDG at sites of infection/inflammation is due to its uptake by the activated granulocytes, which use glucose as an energy source. Inside the cells, the FDG is phosphorylated by hexokinase to ^{18}F-fluoro-2-deoxyglucose-6-phosphate, which is not further metabolized. Increased cellular metabolism in the activated inflammatory cells results in an increased expression of glucose transporter (GLUT) proteins by these cells, which coupled with an increase in the affinity for glucose by the glucose transporters secondary to the effects of cytokines and growth factors results in high FDG uptake at sites of infection/inflammation [1]. FDG-PET imaging is particularly useful for diagnosing chronic and low-grade infection because of the high uptake of FDG in activated macrophages, the predominant cell type present in chronic infection [1].

The sensitivity and specificity of FDG-PET for diagnosing chronic osteomyelitis is reported at 100% and 92%, respectively by Guhlmann *et al.* [2], with de Winter *et al.* [3] reporting a sensitivity, specificity, and accuracy of 100%, 88%, and 93% respectively. Zhuang *et al.* [4] reported similar results.

The superior imaging characteristics and the shorter imaging time span of positron imaging coupled with its higher spatial resolution compared to conventional nuclear medicine infection imaging techniques such as labelled white cells or the gallium scanning, is a distinct advantage. Also, the combination of functional and morphological imaging provided by the hybrid techniques is evidently superior to either the structural imaging modalities such as the CT or MRI or the conventional nuclear medicine imaging of infection alone. The PET/CT technique not only proved highly sensitive in confirming the soft-tissue infection/inflammation in the region of the left knee and excluding the presence of local osteomyelitis, but also additionally identified previously unsuspected multifocal osteomyelitis. The presence of concomitant structural changes also proved very specific in establishing the chronic nature of the osteomyelitis.

References

1. A. Signore, Glaudemans AWJM. The molecular imaging approach to image infections and inflammation by nuclear medicine techniques. Annals of Nuclear Medicine, 2011;25(10):681–700.

2. Guhlmann A, Brecht-Krauss D, Suger G, *et al.* Chronic osteomyelitis: detection with FDG/PET and correlation with histopathologic findings. Radiology, 1998;206:749-754.

3. de Winter F, van de Wiele C, Vogelaers D, *et al.* Fluorine-18 fluorodeoxyglucose positron emission tomography: a highly accurate imaging modality for the diagnosis of chronic musculoskeletal infections. J Bone Joint Surg Am, 2001; 83-A:651-660.

4. Zhuang H, Duarte PS, Pourdehand M, *et al.* Excusion of chronic osteomyelitis with F-18 fluorodeoxyglucose positron emission tomographic imaging. Clin Nucl Med, 2000; 25:281-284.