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Case report

FDG-CT/PET false positive case in hip prosthesis: a clue to avoid error ☆

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ABSTRACT

A 62 years old woman 6 months after left total hip prosthesis referred to our institution for persistent pain and warm, stiff, and swollen joint. ^{18}F-FDG CT/PET Images showed an intense focal uptake corresponding to the external margin of inter-trochanteric region of prosthesis and inside the stem inferiorly, but common decision was to reconstruct PET images without attenuation correction and now showed a complete and unexpected disappearance of focal and pathological FDG uptake. This case shows the potential propagation of CT artifacts into PET emission data close to metal implants and should be taken in account together to SUV values.

Introduction

Differential diagnosis between infection and aseptic loosening may be difficult in patients after joint replacement because of the similarities among clinical presentations and laboratory tests, however, differentiating prosthetic joint infection from aseptic loosening is pivotal for appropriate patient management. The diagnostic performance of ^{18}F-FDG CT/PET is considered able to detect periprosthetic joint infection in hip and knee replacements with sufficiently high accuracy for routine clinical application [1,2].

Case history

A 62 years old woman 6 months after left total hip prosthesis referred to our institution for persistent pain and warm, stiff, and swollen joint. A chronic infection was suspected on the basis of PCR (30 mg/dL) and VES (<5). Plain RX was normal as well as no fistula or skin lesion were present. She underwent to PET/CT (Biograph 64 Vue-Point HD, Siemens Erlangen) by using a 3D whole body (3 min/bed) and low dose CT, starting from 60 minutes after 378 MBq ^{18}F-FDG injection. PET images were reconstructed by using OSEM algorithm (3 iterations

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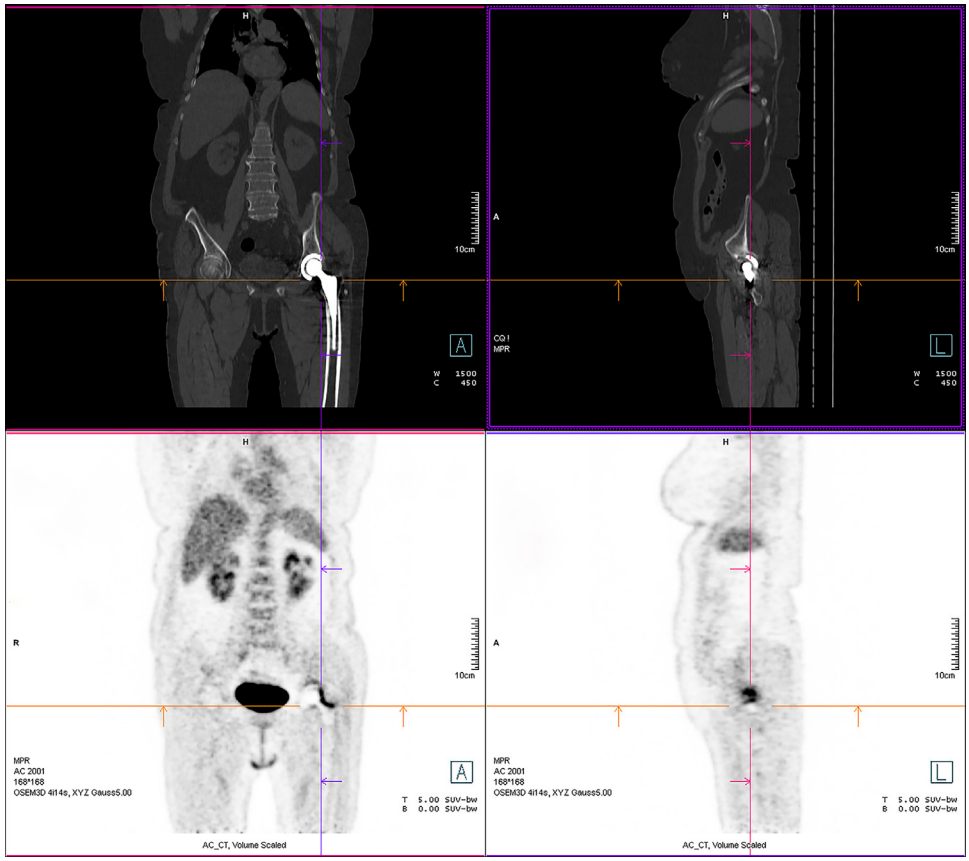

Fig. 1 – Coronal and sagittal planes of whole-body CT with bone window (upper) and FDG PET attenuation corrected (lower). An intense and focal FDG uptake is present in the superior margin of inter-trochanteric region in left hip prosthesis.

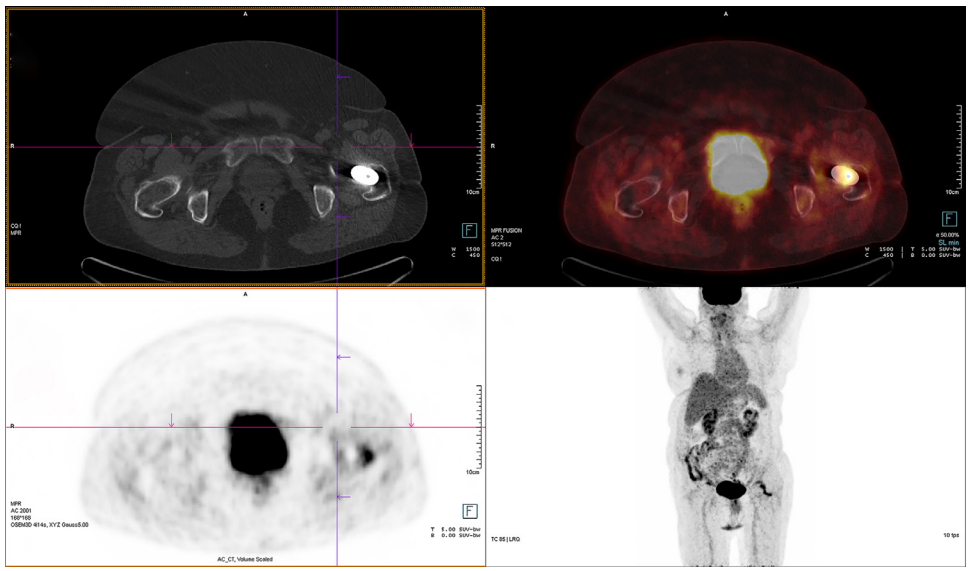

Fig. 2 – Axial CT, Fused images, MIP and FDG PET (in clockwise order) at level of the stem. The focal uptake corresponds to the metal implant.

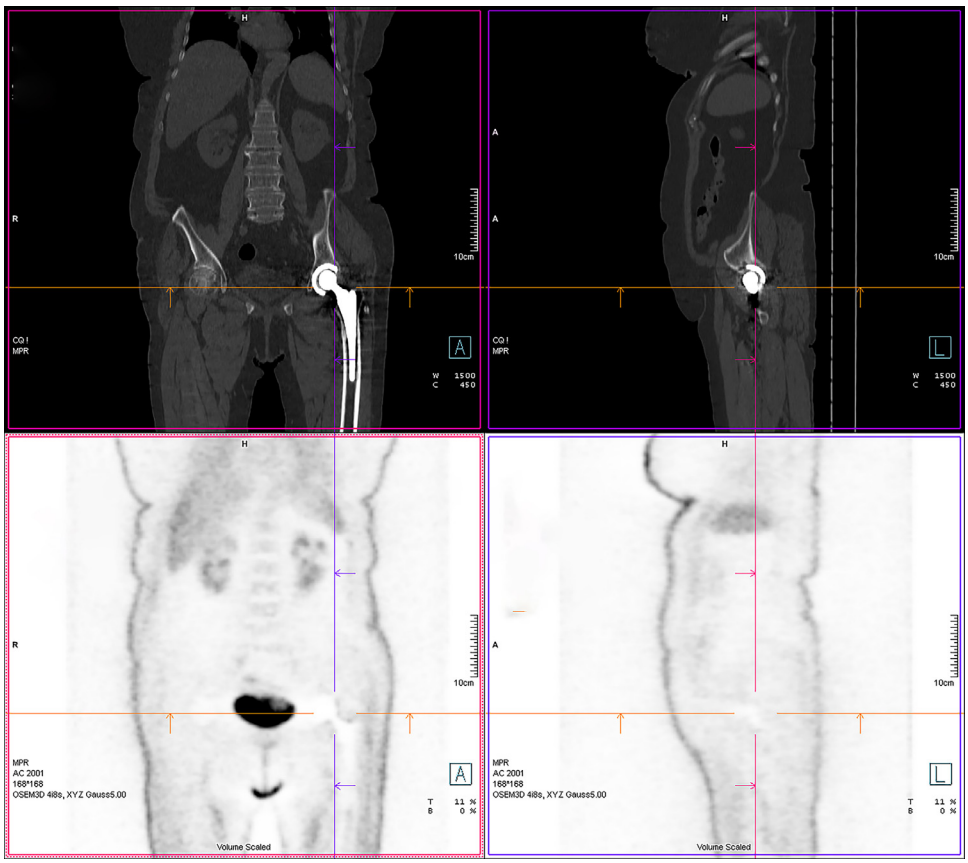

Fig. 3 – Coronal and sagittal planes of whole-body CT with bone window (upper) and FDG PET non-corrected for attenuation (lower). Can be noted here the complete disappearance of FDG uptake detected on images with attenuation correction.

and 27 subsets). Images showed an intense focal uptake corresponding to the external margin of inter-trochanteric region of prosthesis (A) and inside the stem inferiorly (B); all these areas of uptake were intense (SUV max 4.3) supporting the presence of infection. However, the distribution of FDG uptake planted the seed of doubt because of its unusual correspondence to prosthesis more than bone-interface or surrounding tissues (Figs. 1 and 2).

Thus, we decided to reconstruct PET again without attenuation correction (NAC), to estimate contribution of metal implants on PET findings. NAC images demonstrated a complete and unexpected disappearance of focal and pathological area of FDG uptake (C). These final images were re-considered free from infection. Patient on the basis of PET, XR and clinical data and was subsequently submitted to a prosthetic revision (Fig. 3). The absence of infection was confirmed by the surgeon.

Discussion

CT images are used for obtain an attenuation correction map for PET reconstruction, which means that CT may influence PET images in combined CT/PET imaging. PET attenuation correction CT-based is susceptible to errors particularly when close to metal implants; they increase in Hounsfield units resulting in correspondingly high PET attenuation coefficients, which lead to an overestimation of PET signal and false-positive finding. This phenomenon is particularly significant in case of high-density metallic implants such as hip prosthesis [3].

This phenomenon is well known, it has been discussed several times in the literature. Already in 2000, Heiba et Al. described an artefact in knee metallic prostheses. This artefact mimic increased FDG uptake adjacent to the metal and therefore could lead to misinterpretation if PET images as a false positive infection on metal implants. [4] In a much-cited article, Goerres et Al in 2003 examined possible artefacts due to both CT correction and reconstruction software concluding that it seems appropriate to verify an increased FDG uptake near to prosthetic material by also reviewing the non–attenuation corrected emission scan images to avoid false positive results [5]. Martin et Al. in more recent paper have evaluated the impact of different metal artefact reduction algorithms on Hounsfield unit and standardized uptake values [6].

This case shows the needing to consider FDG distribution close to metal implants and not only SUV values because of propagation of CT artifacts into PET emis-

sion data. These artifacts generally, but not always, produce cold and well-located defects on PET easily to detect in clinical practice. For these reason NAC or where available IMAR algorithm should be implemented in case of infection [1–3].

Lesson learned

This case shows how FDG PET-CT images may be misperceived when metal implants are presents. In the suspicion of infection, other authors report similar findings in vascular heart valve with false positive FDG PET. Although FDG pattern of infections are well defined, the influences of metal artefacts on final findings are unrecognizable *a priori*; then algorithm for bone reconstruction and for metal implants correction are now commercially available on new PET-CT scanner. However, NAC PET reconstruction may be a cheap alternative to avoid clinical errors.

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