Case report
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Intense uptake evidenced by 18F-FDG PET/CT without a corresponding CT finding — dream or reality?

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Abstract

Although 18F-fluoro-deoxy-glucose (FDG) positron emission tomography (PET) has been widely validated and extensively used in the latest years in clinical practice, interpretation of PET/CT images can be affected by several pitfalls. We here present a case of intense lung uptake in a patient without a corresponding finding on CT images, probably due to a microembolism produced during the injection process and located in small vascular structures of the lung parenchyma.

KEY words: PET/CT; focal lung FDG uptake; microembolism, artefact

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Introduction

18F-fluoro-deoxy-glucose (FDG) positron emission tomography (PET) has been widely validated and extensively used in the latest years in clinical practice for a large variety of purposes. In particular, the indications for PET/computed tomography (CT) examinations make it one of the most promising imaging techniques in oncology for staging and restaging purposes and for treatment response evaluation [1].

Anyway, often interpretation of PET/CT images can be affected by several pitfalls or variants, which can have dramatic impact on PET accuracy [2].

We here present a case of intense lung uptake in a patient without a corresponding finding on CT images.

Case report

A 34 year-old man came to our observation for staging purposes after being diagnosed with a subcutaneous lesion in right lumbar region, pathologically confirmed as sarcoma.

The patient underwent a PET/CT scan using a hybrid Biograph mCT TOF PET/CT scanner (Siemens Medical Solution AG) and was scanned approximately 1 hour after the intravenous administration of 224 MBq 18F-FDG from the base of the skull through the pelvis with a 90-s time of acquisition per bed position.

There was the evidence of an intense uptake involving the subcutaneous lesion in right lumbar region (Figure 1); moreover, another intense uptake (SUVmax > 100) involving the lower lobe of the left lung was detected, without any corresponding lesion on CT images used for attenuation correction (Figure 2, arrows).

The unusually increased FDG uptake in the left lung in the absence of any focal lesion in the parenchyma suggested the possibility of an artefact.

Since the PET finding in the lung did not have a corresponding lesion on CT images and since this could considerably change the therapeutic approach, the patient repeated PET acquisition one hour later in breath hold and the intense uptake was still present.

We therefore performed a high resolution chest CT without contrast medium, revealing no lesions as well in the left lung.

The patient underwent surgical excision of the subcutaneous mass and is currently on follow-up. A restaging 18F-FDG PET/CT was performed one month later and showed no pathological uptakes in the lungs.

Discussion

Pitfalls and common variants in 18F-FDG uptake must be kept on mind when interpreting PET/CT images, since the accuracy of the technique can be seriously affected by this drawback [2]. Anyway, the possibility of using hybrid PET/CT systems allows to accurately study any suspected pathological lesion in order to determine whether it is pathological or not.

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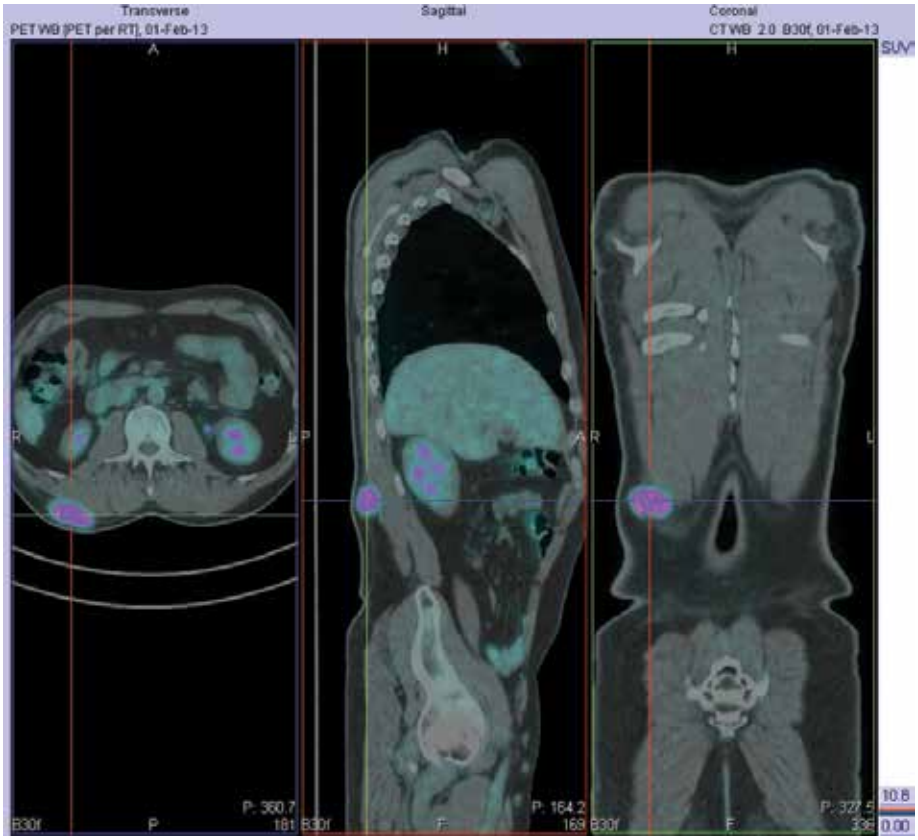

Figure 1. Transaxial, sagittal and coronal PET/CT fused images evidencing an intense subcutaneous uptake in the right lumbar region

Figure 2. Transaxial images on corresponding slices on PET, CT and fused PET/CT images. There is an evidence of intense uptake in the lower lobe of the left lung on PET images, without corresponding lesions on CT (arrows)

In our case, we found high incidental FDG accumulation in the lung parenchyma without any corresponding lesion on CT images, thus suggesting a possible artefact.

Some cases have been reported in literature about this relatively rare pitfall.

Hany et al. [3] described 3 cases of abnormal FDG uptake in the lungs, suggesting a possible microembolism which could explain the high FDG concentration.

Other authors described similar cases [4–7], also suggesting the opportunity not to miss a misregistered pulmonary nodule that appears in a different level on the CT images [5].

This possible drawback was excluded in our case by performing a late acquisition in breath hold, which has been demonstrated to limit possible artefacts due to the respiratory motion which causes an overestimation of tumor volume, degrades the contrast, and interferes with SUV evaluation resulting in reduced PET/CT accuracy [8].

A well accepted explanation of FDG uptake in the lungs is that microembolisms produced during the injection process and located in small vascular structures of the lung parenchyma could be the cause of this artefact.

A suggested physiological mechanism is that after an alteration of the vascular endothelium, as it happens during paravenous injection, high flow of materials, location of the needle tip, or aspiration of blood, tiny blood clots may be produced and enter the small pulmonary vessels thus causing distal microembolism [3, 6].

This microembolism causes platelet activation; once activated, platelets adhere to the subendothelium and subsequently aggregate, releasing the contents of the a-cytoplasmic granules by exocytosis [4].

All the steps of this activation process cause an intense consumption of extracellular glucose, which can be transported into the activated platelet by the glucose transporter GLUT-3, which has been demonstrated to be the major agent responsible for glucose uptake in such conditions [9, 10]. In particular, GLUT-3, when platelets are activated by thrombin, induces an increase in glucose transport for a factor of 3 to 5 [10].

Since GLUT-3 receptors are mainly stored in platelets and translocate to the cell surface after activation by thrombin [4, 9], this could explain the high 18F-FDG uptake observed in the left lung on PET images.

Another possible mechanism is the neutrophil activation as a primary mediator of lung vascular injury after pulmonary microembolism [6], causing a translocation of GLUT-1 from the cell interior to the cell surface and a dose-dependent increase in glucose uptake [9, 11, 12].

Our case report supports what previously observed by other authors and suggest the opportunity of considering the possibility of an artefact when an abnormal FDG uptake is detected. In fact, although technology has greatly improved in latest years regarding hardware and software, artefacts are still present and always will be.

References

1. Cohade C, Wahl RL. Applications of positron emission tomography/computed tomography image fusion in clinical positron emission tomography — clinical use, interpretation methods, diagnostic improvements. Semin Nucl Med 2003; 33: 228–237.
2. Cook GJ, Wegner EA, Fogelman I. Pitfalls and artifacts in 18FDG PET and PET/CT oncologic imaging. Semin Nucl Med 2004; 34: 122–133.
3. Hany TF, Heuberger J, Von Schulthess GK. Iatrogenic FDG foci in the lungs: a pitfall of PET image interpretation. Eur Radiol 2003; 13: 2122–2127.
4. Farsad M, Ambrosini V, Nanni C et al. Focal lung uptake of 18F-fluorodeoxyglucose (18F-FDG) without computed tomography findings. Nucl Med Commun 2005; 26: 827–830.
5. Karantanis D, Subramaniam RM, Mullan BP, Peller PJ, Wiseman GA. Focal F-18 Fluoro-Deoxy-Glucose Accumulation in the Lung Parenchyma in the Absence of CT Abnormality in PET/CT. J Comput Assist Tomogr 2007; 31: 800–805.
6. Ha JM, Jeong SY, Seo YS et al. Incidental focal F-18 FDG accumulation in lung parenchima without abnormal CT findings. Ann Nucl Med 2009; 23: 599–603.
7. Schreiter N, Nogami M, Buchert R, Froeling V, Brenner W, Diekmann F. Pulmonary FDG uptake without a CT counterpart — a pitfall in interpreting PET/CT images. Acta Radiol 2011; 52: 513–515.
8. Caobelli F, Puta E, Ren Kaiser S et al. Deep Inspiration Breath Hold [18F] FDG PET-CT on 4-rings scanners in evaluating lung lesions: Evidences from a phantom and a clinical study. Rev Esp Med Nucl Imagen Mol 2013. DOI http://dx.doi.org/10.1016/j.remn.2013.08.006.
9. Heijnen HF, Oorschot V, Sixma JJ, Slot JW, James DE. Thrombin stimulates glucose transport in human platelets via the translocation of the glucose transporter GLUT-3 from alpha-granules to the cell surface. J Cell Biol 1997; 138: 323–330.
10. Sorbara LR, Davies-Hill TM, Koehler-Stec EM, Vannucci SJ, Horne MK, Simpson IA. Thrombin-induced translocation of GLUT3 glucose transporters in human platelets. Biochem J 1997; 328: 511–516.
11. Malik AB. Pulmonary microembolism and lung vascular injury. Eur Respir J Suppl 1990; 11: 499–506.
12. Schuster DP, Brody SL, Zhou Z et al. Regulation of lipopolysaccharide-induced increases in neutrophil glucose uptake. Am J Physiol Lung Cell Mol Physiol 2007; 292: 845–851.