A False Positive Uptake of ^{18}F-Fluorodeoxyglucose in the Liver in PET/CT Scan: Case Report

PET/BT İncelemede Karaciğerde Yanlış Pozitif ^{18}F-Florodeoksiglukoz Tutulumu

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ABSTRACT We reported a case that shows two simultaneous pitfalls of positron emission tomography/computed tomography (PET/CT), including mislocalization and iatrogenic ^{18}F-Fluorodeoxyglucose (^{18}F-FDG) microembolism in the lung. A follow up 1^{8}F-FDG scan of the patient operated due to a cutaneous leiomyosarcoma indicated a focus of intense radiotracer accumulation in the right liver lobe and in the right inferior paratracheal lymph node. Focal accumulation of 18F-FDG in the lung can be observed following paravenous injection. The difference in respiratory cycles between PET and CT images may potentially result in mislocalization if the radiotracer activity is close to either side of the diaphragm.

Key Words: Fluorodeoxyglucose F18; positron-emission tomography; artifacts; pulmonary embolism

ÖZET Pozitron emisyon tomografi/bilgisayarlı tomografi (PET/BT) görüntülemede saptanan lezyonun yanlış lokalize edilmesi ve akciğerde iyatrojenik ^{18}F-florodeoksiglukoz (^{18}F-FDG) mikroembolizmi olmak üzere iki eş zamanlı gerçekleşen olayı gösteren bir olgu bildirilmektedir. Kutanöz leiomiyosarkom nedeniyle opere olan hastanın takip ^{18}F-FDG taramasında, sağ karaciğer lobu ve sağ alt paratrakeal lenf nodunda kuvvetli radyofarmasötik tutulumu gösteren odaklar mevcuttu. Akciğerde ^{18}F-FDG'nin odaksal birikimi, radyofarmasötiğin paravenöz enjeksiyonunu takiben gözlenebilir. Diyaframın her iki tarafına yakın yerleşimli patolojilerde, PET ve BT görüntülemede, solunum döngüsündeki farklılık nedeniyle potansiyel olarak lezyonun yanlış lokalize edilme olasılığı vardır.

Anahtar Kelimeler: Fluorodeoksiglukoz F18; pozitron emisyon tomografi; artefaktlar (insan eliyle yapılmış); pulmoner emboli

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The ^{18}F-FDG positron emission tomography/computed tomography (PET/CT) has become an important staging modality for many tumors in oncology. A correlation of molecular and morphological information in PET/CT system helps to specify ^{18}F-FDG PET findings.[1] ^{18}F-FDG not only accumulates in tumors, but also in inflammatory tissue and a variety of physiological and artificial settings.[2] We reported a unique case that showed two simultaneous pitfalls of PET/CT, including mislocalization (mis-registration) and iatrogenic ^{18}F-FDG microembolism in the lung.

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CASE REPORT

A 48-year-old patient with a cutaneous leiomyosarcoma had a follow up ^{18}F-FDG PET/CT after surgical resection of a local relapse in the left anterior abdominal wall. The images were performed on an integrated PET/CT scanner (Biograph 6, Siemens Medical Solution) consisting of a 6-row multislice CT detector system with a full-ring lutetium oxyorthosilicate PET system. The patient fasted for at least 6 hours prior to the scanning in supine and arms-up position, which started approximately 60 min after the injection of a 385 MBq of ^{18}F-FDG through an i.v. 22F cannula. Oral CT contrast agent (50 ml iohexol in 1,5L water) was initiated the evening before the scan and the last 150 mL was given to the patient 15 min before the injection. Initially, the CT scan was run starting from skull base to midthigh using the following parameters: 88 mAs, 130 kV, 3sn per tube rotation, slice thickness 5 mm. CT scan was acquired during free tidal breathing without any manipulation. Immediately following the CT scan, a PET emission scan was acquired for 8 bed positions with an acquisition time of 3 min per bed with one slice overlap. The CT data was used for attenuation correction of the PET emission data (AC-PET). PET, CT and fused images were displayed in the transaxial, coronal and sagittal planes by using "True D" software (Siemens Medical Solution).

The maximum intensity projection image of PET showed a focus of intense radiotracer accumulation in the right liver lobe and in the right mediastinum. ^{18}F-FDG PET images revealed a focus in the right liver lobe at segment 7 (SUVmax= 8.39) and a focus in the inferior para-tracheal lymph node with a diameter of 11 mm (SUVmax=10.92) (Figure1). The ^{18}F-FDG focus in the liver was not visible in the transmission unenhanced CT images at corresponding anatomic localization (Figure 2 A-D). Neither the liver ultrasonography (US) nor Gadolinium (Gd) contrast magnetic resonance imaging (MRI) (T1 and T2 images) showed any liver pathology (Figure 3). To overcome the respiration artifact, non-attenuation correction images (NAC-PET) were also reviewed. NAC-PET sagittal images showed that the hot spot (arrow) was indeed in the most caudal part of the posterior-basal segment of the right lung (Figure 4). The unenhanced CT im-

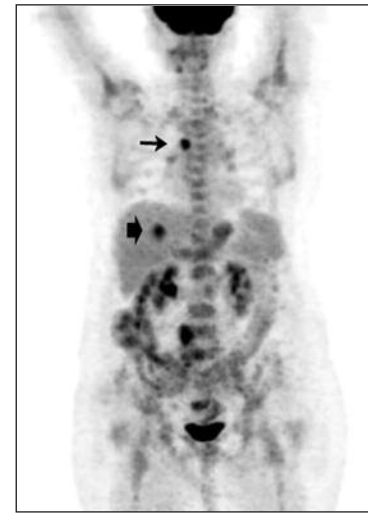

FIGURE 1: TThe maximum intensity projection image showed a focus of intense radiopharmaceutical accumulation on the right liver lobe (thick arrow) and in the mediastinum (thin arrow).

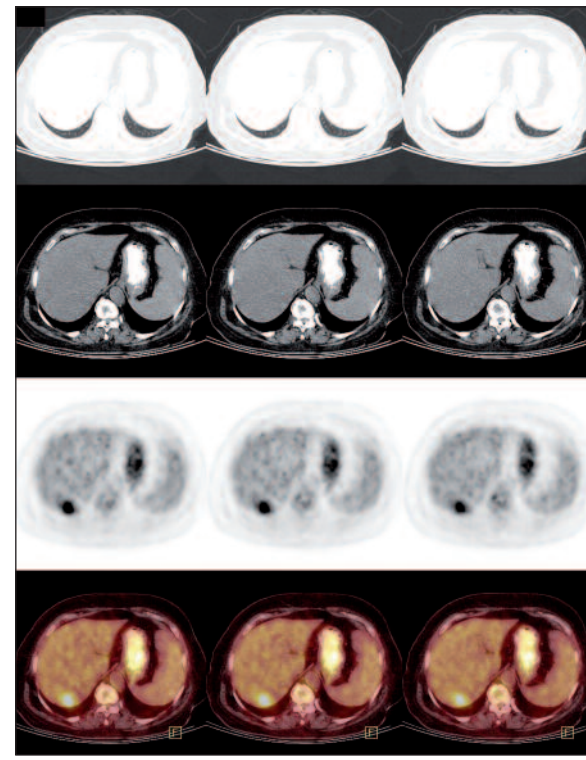

FIGURE 2: The transaxial unenhanced computed tomography (CT) images of thorax and liver revealed no pathology **(A, B)**. CT attenuation corrected-positron emission tomography (PET) and fused PET/CT images of the corresponding transverse slice showed an intense 18F-fluorodeoxyglucose focus in the right liver lobe at segment seven **(C, D).**
(See for colored form http://tipbilimleri.turkiyeklinikleri.com/)

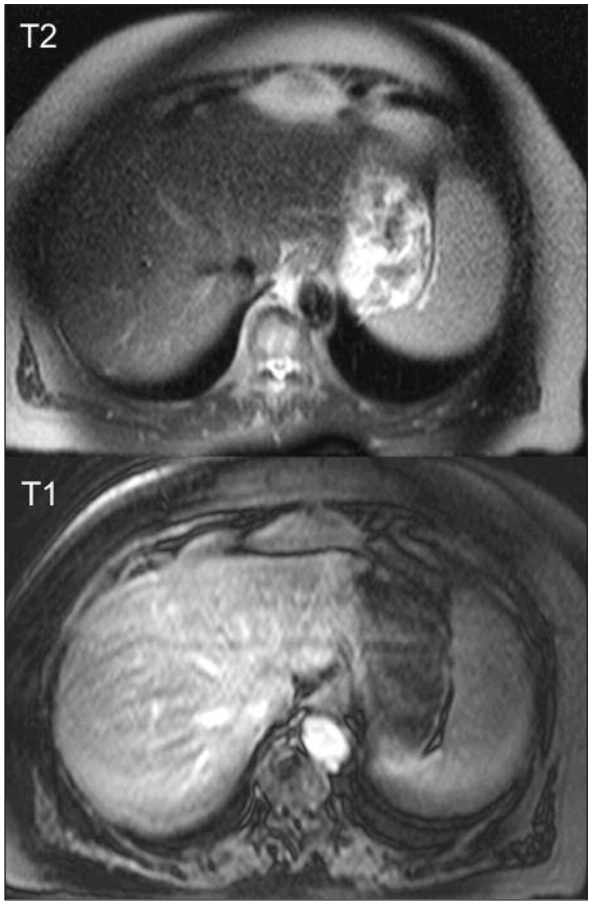

FIGURE 3: The gadolinium contrast magnetic resonance images of T1 and T2 showed no pathology in the liver.

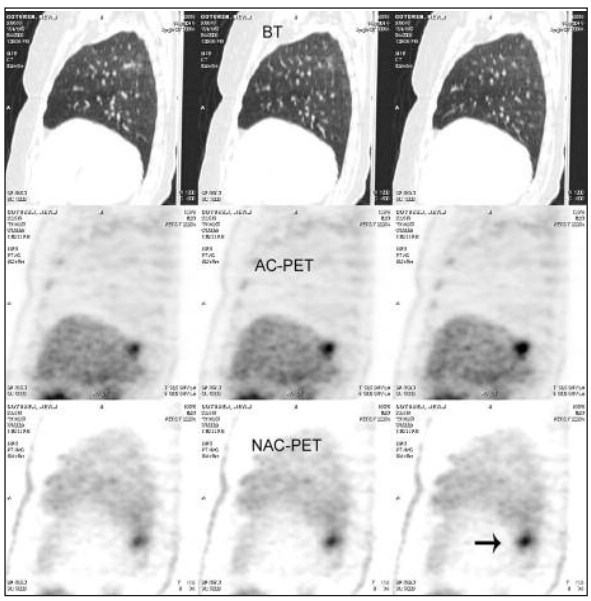

FIGURE 4: The non-attenuation corrected-positron emission tomography (NAC-PET) sagittal images showed (arrow) the fluorodeoxyglucose hot spot was in the most caudal part of the posterior-basal segment of the right lung.

ages of right lower lung were also normal. The injection site could not be evaluated because of its location in the left antecubital vein that could not be imaged due to arms-up positioning. The control enhanced thorax CT examination was acquired 3 months later especially to follow FDG avid mediastinal lymph node. The lymph node in the right paratracheal area was still 11 mm in dimension. No lesion was detected in the liver. The thorax CT angiographic images did not show any pulmonary arterial filling defect. The patient is currently on chemotherapy.

DISCUSSION

The differential diagnosis of focal accumulation of ^{18}F-FDG in the liver could be any primary/metastatic tumor or infectious/inflammatory disease. Since there was no morphological abnormality in liver imaging, including US, Gd-MRI, unenhanced CT and enhanced CT examination acquired 3 months apart, the artifactual ^{18}F-FDG uptake had to be considered.

Due to respiratory motion, the accuracy of image registration between PET and CT might be lower in the lungs compared to other areas of the body. The difference in respiratory cycles between PET and CT images may potentially result in misregistration if lesions are close to either side of the diaphragm.[3,4] To overcome the respiration artifact, it is suggested to review the NAC-PET or germanium attenuation corrected PET images.[5] Although the AC-PET images showed the FDG hot spot was localized in the dome of the liver, the NAC-PET images showed the hot spot was in the most caudal part of the posterior-basal segment of the right lung.

Focal accumulation of ^{18}F-FDG in the lungs can be observed following venous damage during injection of the radiopharmaceutical, preceding the PET scan.[6,7] The damage to the vein endothelium during paravenous injection may have contributed to the formation of blood clots at the site of the injury, that may in turn, be responsible for distal lung microembolism. The activation of platelets by thrombin induces a three- to five-fold increase in glucose transport via glucose transporter type-3

protein.[8] Activated platelets and fibrin are the major constituents of blood clots and this may account for the high ^{18}F-FDG uptake of the focal lung lesions observed on PET images.[9]

The hot spot in the right liver lobe was indeed at the base of the right lung misplaced due to the respiratory motion. ^{18}F-FDG microembolus activity at the base of the right lung can be monitored in the dome of the liver as a result of respiratory motion in this PET/CT fusion imaging.

^{18}F-FDG microembolism could not be shown in our patient due to the peripheral localization of emboli in the lung and because the pulmonary CT angiographic examination was not run at that time. The pulmonary CT angiographic images obtained 3 months later did not show any filling defect at the corresponding FDG focus; this might explain recanalization of iatrogenic microembolism.

In conclusion, extra care with ^{18}F-FDG i.v. injection should be taken and a differential diagnosis of ^{18}F-FDG microembolus in the lungs mimicking a liver lesion has to be considered, if no corroborating anatomic evidence of the lesion is found.

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