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Focal FDG Activity in the Region of Right Atrium: Coregistered CT Identifies Three Benign Etiologies

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We present the whole body FDG PET-CT images on 3 different patients with benign focal activity in the region of the right atrium. Co-registered CT correctly identified the cause of focal FDG activity as: right atrial appendage, lipomatous hypertrophy of the interatrial septum, and catheter-related activity. Although all these have been reported separately in the literature, we are presenting them together to emphasize the importance of recognizing the benign causes of FDG uptake in the region of right atrium and the role of co-registered CT in improving the accuracy and specificity of the FDG PET.

Introduction

We present the whole body FDG PET-CT images on three different patients with benign focal activity in the region of the right atrium. Although all these have been reported separately in the literature, we are presenting them together to emphasize the importance of recognizing the benign causes of FDG uptake in the region of right atrium and the role of co-registered CT in improving the accuracy and specificity of the FDG PET.

Case Report 1

A 66-year-old woman with history of breast cancer was evaluated for metastatic disease with PET-CT. Focal 18F-flurodeoxyglucose (FDG) activity with standardized uptake value (SUV) measuring 2.4 was noted on the transaxial images at the interatrial septum, which correlated with a linear area of low attenuation measuring fat density (white arrow) (-57 Hounsfield units) on CT scan (Fig. 1). The mean cross-sectional thickness of this low attenuation region was 10 mm. Based on the CT appearance, a presumptive diagnosis of lipomatous hypertrophy of the interatrial septum was made. Lipomatous hypertrophy of the interatrial septum is a benign process in which the adipose tissue, a normal component of the interatrial septum, increases and infiltrates between the myocardial fibers (1). FDG uptake in lipomatous hypertrophy of the interatrial septum can be explained by the presence of a variable amount of brown fat in the interatrial septum (2). CT scan is a sensitive imaging modality to diagnose fat attenuation in the interatrial septum (3, 4).

Case Report 2

A 54-year-old woman with history of lung cancer, status post right upper lobectomy, was evaluated for metastatic disease with FDG PET-CT. On the fused PET-CT images (Fig. 2), focal FDG uptake is seen in the right atrial

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Abbreviations: CT, computed tomography; FDG, fluorodeoxyglucose; PET, positron emission tomography; SUV, standardized uptake value

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appendage (white arrow). No anatomic evidence of mass or neoplasm is seen in corresponding CT images. The increased FDG activity in the wall of right atrium may be associated with atrial fibrillation or could be a normal variant (2, 5). The patient has no history of cardiac disease or atrial fibrillation. FDG activity could be due to normal physiologic uptake in the right auricle or atrial appendage, a thick muscular pouch of the superior extremity of the right atrium (6).

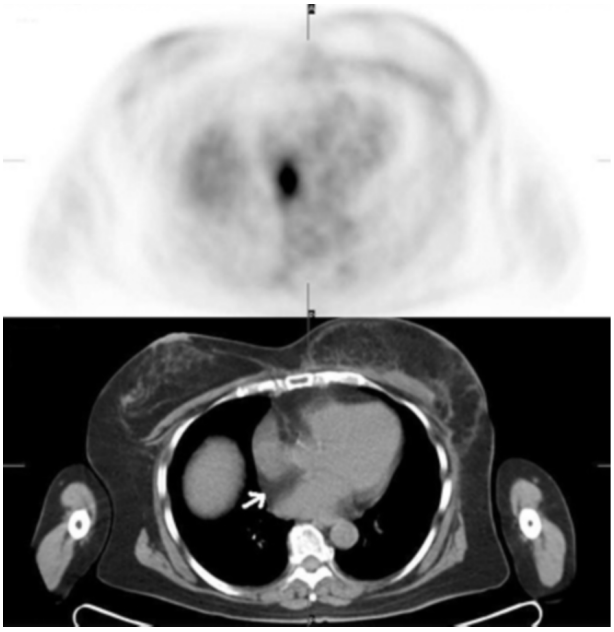

Figure 1. 66-year-old woman with breast cancer evaluated for metastatic disease with PET-CT. Focal FDG activity in the interatrial septum on PET corresponded with low attenuation on CT, consistent with lipomatous hypertrophy of the interatrial septum.

Case Report 3

A 68-year-old man with history of colon cancer, was evaluated for possible metastatic disease. FDG PET-CT showed focal FDG uptake is seen in the right upper medistinum corresponding to the distal end of a central venous catheter (white arrow) with an SUV measuring 5.0 (Fig. 3). Corresponding CT images demonstrated the distal part of the catheter at or near the junction of right brachiocephalic vein and superior vena cava. Catheter related injury can lead to thrombosis (7) and subsequent inflammatory response with resultant FDG uptake (8). Both site of insertion and distal end of catheters can show increased FDG uptake with inflammation (9, 10). Co-registration of the CT scan acquired with PET-CT increases the diagnostic accuracy by reducing the number of equivocal lesions seen with PET alone (11). It is important to recognize

Figure 2. 54-year-old woman with lung cancer, status post right upper lobectomy, being evaluated for metastatic disease. Fused PET-CT images show focal FDG uptake in the right atrial appendage (white arrow), with no anatomic abnormality seen on corresponding CT images.

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these benign causes of focal FDG activity when reporting the PET scan for evaluation of malignancies.

Discussion

PET is a powerful diagnostic tool for staging and therapy monitoring of several malignancies. As altered glucose metabolism is characteristic of malignant cells in almost all cancers, FDG uptake is very sensitive for tumor localization. However, increased FDG uptake can also be associated with normal healthy tissue, infected or inflammatory cells, and post-traumatic reparatory processes including post surgical granulation tissue. This benign uptake can be mistaken for the presence of a malignancy. A co-registered CT scan better delineates the anatomy of the equivocal lesions which in turn increases the diagnostic accuracy and specificity when compared to PET alone (11). This case report illustrates the powerful diagnostic ability of the combined PET-CT in differentiating the benign variants from malignancy.

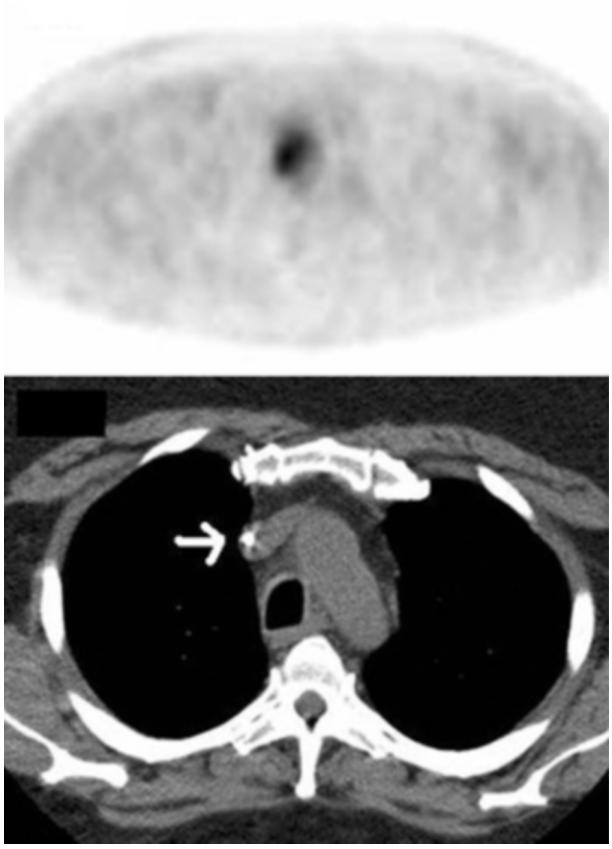

Figure 3A. 68-year-old man with colon cancer evaluated for metastatic disease. PET-CT images focal FDG uptake is seen in the right upper medistinum, corresponding to the distal end of a central venous catheter (white arrow).

It is a well-documented that left ventricular myocardial uptake of F-18 FDG can be variable. The assumption is that the myocardium preferentially uses fatty acids during the fasting state and the FDG tracer should not be taken up by the myocardium because it is glucose analog. However, in the fasting state FDG uptake in the ventricular myocardium is not uncommon since glucose can still account for 30-40% of energy derived from oxidative metabolism (12). On the other hand, there is no significant uptake in a normal atrium, as its energy expenditure is minimal when compared to the ventricles (13). There is no clear documentation in the literature regarding the FDG uptake in the region of right atrium. We believe that it is very important to point out the different non-malignant causes of the FDG uptake in the region of right atrium, since it can be potentially mistaken for an underlying cardiac or extra-cardiac malignancy. In this case report, we present three patients with known malignancies who underwent PET scan as a part of their evaluation. The PET images demonstrated FDG uptake in the superior mediastinum and middle mediastinum in the region of the right atrium, while the corresponding CT images revealed catheter related injury, lipomatous hypertrophy of interatrial septum, and a normal right atrial appendage. The other likely benign causes for an increased uptake in the right atrium are atrial fibrillation, congestive heart failure with valvular disease, and atrial septal defect (5). However, none of the patients described in this case report had documented history of cardiac disease. Alternatively, as discussed, the increased mediastinal uptake in the region of right atrium can also be caused by primary and secondary malignancies involving the heart, lung and the mediastinum. Therefore, in the evaluation of chest by PET scan, we suggest that the interpreting physicians consider all the benign causes for FDG uptake in the region of right atrium, and additionally obtain a corresponding CT image to better characterize the lesion. This helps to minimize the rate of false positive diagnoses and resultant unwarranted treatments.

We conclude that a co-registered CT image of the chest, along with familiarity of the benign causes for atrial FDG uptake, increases the diagnostic specificity and accuracy of F-18 FDG PET.

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