Medicine®

CLINICAL CASE REPORT

OPEN

False-positive Uptake on Positron Emission Tomography/ Computed Tomography Immediately After Lung Biopsy

A Case Report

Jung Min Bae, MD, Ho Yun Lee, MD, and Joon Young Choi, MD

Abstract: 18F-fluorodeoxyglucose positron emission tomography (18F-FDG-PET) is an evolving tool in the field of oncology. 18F-fluorodeoxyglucose, however, is not a specific tool for malignant tumor that it may also accumulate in benign processes. To avoid false-positive interpretation of 18F-FDG-PET/computed tomography (CT), having knowledge of the potential pitfalls is important.

The authors present a case of a patient with a lung mass who underwent fluoroscopy-guided transthoracic lung biopsy followed by 18F-FDG-PET/CT scan with a 4-hour interval between biopsy and scanning. Abnormally increased FDG uptake in the mass and pleural effusion was detected. Pathologic examination of the specimen, however, revealed only fibrous tissues with chronic inflammatory cells. On performing CT imaging, 1 month later, the mass and effusion had spontaneously resolved without treatment.

Our findings suggest that PET/CT performed immediately following invasive procedures can result in false-positive results and thus mislead diagnosis. Therefore, the interval and order, in which PET/CT and invasive procedures are performed, should be carefully considered in oncologic work-up.

(*Medicine* 94(44):e1896)

Abbreviations: 18F-FDG-PET = 18F-fluorodeoxyglucose positron emission tomography, CT = computed tomography, GLUT = glucose uptake transporter.

INTRODUCTION

Positron emission tomography (PET) with F-18 fluorodeoxyglucose (FDG) is a clinically convincing tool in the diagnosis, staging, and treatment of non-small cell lung cancer. 18F-fluorodeoxyglucose positron emission tomography/computed tomography (CT) is of high sensitivity (93%–95%) and acceptable specificity (77%–88%) for the differential diagnosis of solitary pulmonary lesions. There, however, are many reports of potential misinterpretation of PET images because FDG accumulates not only in malignancies, but also in many benign lesions and normal physiologic conditions. A typical source of false-positive findings is inflammatory processes, such as granuloma, tuberculosis, aspergilloma, and nocardiosis.[1,2] Here, we present the case of a patient with a suspected lung mass who showed false-positive FDG uptake on PET/CT that was performed 4 hours after transthoracic lung biopsy. There have been several reports about false-positive 18F-FDG-PET/CT days to months after an interventional procedure.[1,3,4] To our knowledge, this is the first reported case of a false-positive 18F-FDG-PET/CT imaging study immediately after an invasive procedure. The case was approved by our institutional review board, and the requirement of patient informed consent was waived for this retrospective investigation.

Case Report

A 53-year-old woman who denied any medical history, presented with a 20-day history of left pleuritic chest pain. Clinical examination at admission was unremarkable, and laboratory investigations showed only mildly elevated C-reactive protein level (4.37 mg/L) with a normal white blood cell count. Tumor markers, such as carcinogenic embryonic antigen and carbohydrate antigen 19-9, were within normal limits. Contrast-enhanced chest CT showed a 5.5 cm-sized, round, pleural-based, well-enhanced mass in the left lower lobe of the lung with accompanying left pleural effusion (Figure 1A). The attenuation value of the mass was 26 Hounsfield units (HU) on precontrast scan and 101 HU on postcontrast scan. Subsegmental atelectasis toward the lesion and converging bronchovascular markings, that is, ''comet-tail'' sign, was noted (Figure 1B).

The differential diagnosis of this patient included neoplasm, including bronchogenic carcinoma, and benign conditions such as round atelectasis. Computed tomography findings of a pleural-based mass with subsegmental atelectasis and comet tail sign are characteristic of round atelectasis, which allowed us to narrow the differential diagnosis. The mass, however was well enhanced after contrast administration and was accompanied by pleural effusion, which made a definitive diagnosis of round atelectasis difficult and the possibility of malignant mass with malignant pleural effusion remained. Consequently, fluoroscopy-guided transthoracic lung biopsy was performed for pathologic confirmation of the lesion. Positron emission tomography/computed tomography was performed 4 hours after the biopsy procedure. On PET/CT, the mass showed abnormally increased FDG uptake with maximum standardized uptake value measuring 2.7 (Figure 1C). The left pleura and pleural effusion showed increased FDG uptake as well. Of note, only a portion of the mass with a tubular shape showed FDG uptake, and the presence of FDG uptake was not

Editor: Michael Masoomi.
Received: August 13, 2015; revised: September 27, 2015; accepted: September 30, 2015.
From the Department of Radiology and Center for Imaging Science (JMB, HYL.); and Department of Nuclear Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, South Korea (JYC).
Correspondence: Ho Yun Lee, MD. Department of Radiology, Samsung Medical Center, Sungkyunkwan University School of Medicine, 50 Ilwon-dong, Gangnam-gu, Seoul 135–710, South Korea (e-mail: hoyunlee96@gmail.com).
The authors report no conflicts of interest.

ISSN: 0025-7974
DOI: 10.1097/MD.0000000000001896

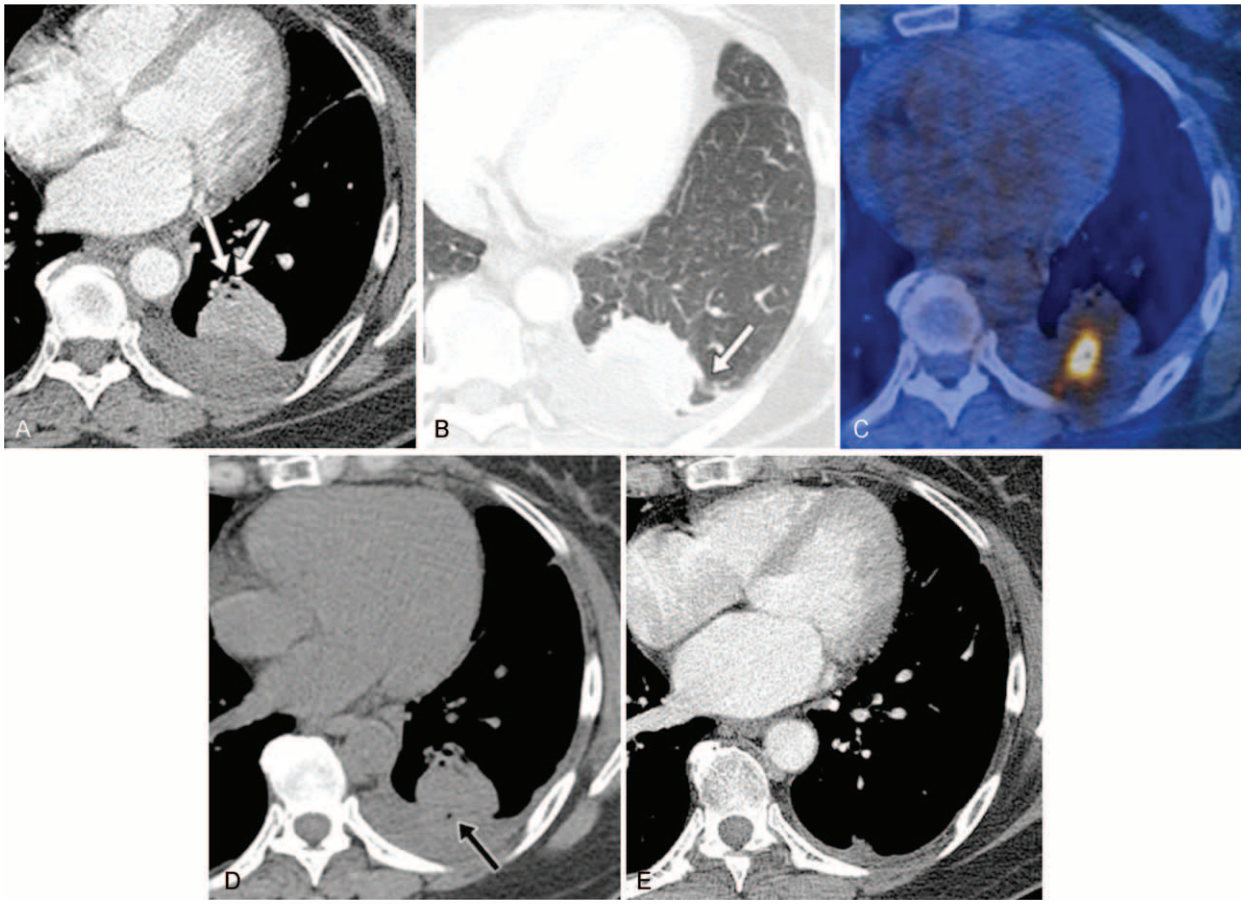

FIGURE 1. A 53-year-old woman with left pleuritic chest pain and a left lower lobe mass. A, Mediastinal window image of contrast-enhanced computed tomography (CT) shows a 5.5 cm-sized well-defined pleural-based mass appearing as a homogenous enhancement in the left lower lobe, with accompanying pleural effusion. Converging bronchovascular markings, referred to as the ''comet-tail'' sign, are noted at the proximal aspect of the mass (arrows). B, On the lung window image of CT, subsegmental atelectasis is noted toward the mass (arrow). C, Positron emission tomography/computed tomography scan reveals abnormally increased fluorodeoxyglucose uptake not only within the mass [standardized uptake value (max) = 9.3], but also in the left pleura and pleural effusion [standardized uptake value (max) = 2.7]. D, Noncontrast CT scan obtained during the Positron emission tomography/computed tomography scan shows air bubbles at the hypermetabolic area (arrow), suggesting fluorodeoxyglucose uptake along the biopsy tract. E, On the mediastinal window image of contrast-enhanced chest CT performed 1 month later, the previously noted mass and pleural effusion had spontaneously resolved without treatment.

only within the mass, but also in the pleural space. Both of these findings suggested false-positive PET/CT results associated with a postprocedural change. Noncontrast CT scan obtained during the PET/CT scan showed some air bubbles along the hypermetabolic area suggesting FDG uptake along the biopsy tract (Figure 1D). There was no abnormally high attenuating lesion suggesting hemorrhage or hematoma on this noncontrast CT scan. Pathology revealed no evidence of malignancy and showed only dense fibrous tissue with chronic inflammatory cells. Based on the image findings and pathologic report, a diagnosis of round atelectasis was made, and the patient was followed without further treatment. After 1 month, a follow-up chest CT was performed (Figure 1E), and the previously noted mass lesion and pleural effusion spontaneously resolved without treatment.

DISCUSSION

Round atelectasis is a benign form of peripheral lung collapse and is a common entity that may be difficult to differentiate from malignancy on cross-sectional imaging. According to Hakomaki et al,[5] the most helpful CT features of round atelectasis are the presence of a rounded peripheral lung mass abutting a pleural surface, a comet tail of bronchovascular bundles blurring the central margin, volume loss in the affected lobe, and associated pleural thickening. Round atelectasis is also known to show homogeneous enhancement of the folded lung because of the presence of converging blood vessels. Thus, contrast enhancement is not able to differentiate round atelectasis from bronchogenic carcinoma completely, because both lesions demonstrate contrast enhancement. On the contrary, round atelectasis has been shown to be metabolically inactive on 18F-FDG-PET/CT scans. Positron emission tomography/computed tomography can therefore help in differential diagnosis of round atelectasis from malignant lesions, especially when CT features are equivocal with few or atypical signs of round atelectasis.[6] In the current case, the CT findings and pathologic results suggested round atelectasis, but PET/CT revealed abnormal FDG uptake of the lesion. This uptake

represented a procedure-induced inflammatory reaction, which caused hypermetabolism and FDG uptake. In response to the stimuli such as infection or irritation, cascade of events such as local hyperemia and infiltration of inflammatory cells occurs. Increased uptake of 18F-FDG in inflammation may be explained by the activation of white blood cells, which have enhanced levels of glucose uptake transporter (*GLUT*) genes, including *GLUT-1*, *GLUT-3*, and *GLUT-9*, and increased affinity to 18F-FDG through various cytokines and growth factors.[7]

With the increasing utilization of integrated PET/CT in oncological imaging, it is important for radiologists and nuclear medicine physicians to be aware that FDG uptake is not specic for malignancy, as many different physiological and non-neoplastic conditions can also lead to increased glucose metabolism. A thorough knowledge of the potential pitfalls is necessary to minimize false-positive 18F-FDG-PET results. In this article, we introduce 1 potential challenge that may be encountered on 18F-FDG-PET/CT studies during the oncological work-up and describe how such ndings can be evaluated accurately, thereby avoiding errors in interpretation and inappropriate management. Moreover, careful consideration of the interval between and order of PET/CT and invasive procedures is needed in oncologic work-up.

REFERENCES

1. Ahmadzadehfar H, Palmedo H, Strunk H, et al. False positive 18F-FDG-PET/CT in a patient after talc pleurodesis. *Lung Cancer.* 2007;58:418–421.
2. Ha JM, Jeong SY, Seo YS, et al. Incidental focal F-18 FDG accumulation in lung parenchyma without abnormal CT findings. *Ann Nucl Med.* 2009;23:599–603.
3. Gorenberg M, Bar-Shalom R, Israel O. Patterns of FDG uptake in post-thoracotomy surgical scars in patients with lung cancer. *Br J Radiol.* 2008;81:821–825.
4. Murray JG, Erasmus JJ, Bahtiarian EA, et al. Talc pleurodesis simulating pleural metastases on 18F-fluorodeoxyglucose positron emission tomography. *Am J Roentgenol.* 1997;168:359–360.
5. Hakomaki J, Keski-Nisula L, Paakkala T. Contrast enhancement of round atelectases. *Acta Radiol.* 2002;43:376–379.
6. Stathopoulos GT, Karamessini MT, Sotiriadi AE, et al. Rounded atelectasis of the lung. *Respir Med.* 2005;99:615–623.
7. Metser U, Even-Sapir E. Increased (18)F-fluorodeoxyglucose uptake in benign, nonphysiologic lesions found on whole-body positron emission tomography/computed tomography (PET/CT): accumulated data from four years of experience with PET/CT. *Semin Nucl Med.* 2007;37:206–222.