Role of $^{18}$F-FDG PET Scan in Rheumatoid Lung Nodule: Case Report and Review of the Literature

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Case Report

Role of $^{18}$F-FDG PET Scan in Rheumatoid Lung Nodule: Case Report and Review of the Literature

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Flourine-18 fluoro-2-deoxy-glucose ($^{18}$F-FDG) positron emission tomography combined with computed tomography (PET/CT) is a useful test to evaluate malignancies [1]. However, inflammatory diseases may also show increased uptake of $^{18}$F-FDG and cause false-positive PET scan results, necessitating further investigations to rule out malignant conditions [2]. Positron emission tomography (PET) is an analytical imaging technology developed to use compounds labeled with positron-emitting radioisotopes as molecular probes to image and measure biochemical processes in vivo [3]. Numerous tracers have been used in conjunction with PET scanning to aid in the diagnosis of various disorders. $^{18}$F-FDG has now become the most commonly used radiotracer for PET scanning. Because of the increased metabolic activity of the tumor cells, there is an increased uptake of glucose in tumor cells, thus forming the basis for widespread use of $^{18}$F-FDG PET scan in the diagnosis, staging, and management of malignancies. However, the increased uptake of $^{18}$F-FDG tracer is not limited to malignant states and has been seen in benign as well as inflammatory conditions such as sarcoidosis, large vessel vasculitis, inflammatory bowel disease, and rheumatoid arthritis (RA) [2, 4–8].

We describe a patient with RA who developed pulmonary nodules, showing increased uptake on $^{18}$F-FDG PET/CT scan. We also review the current literature on the use of PET scanning in articular and extra-articular RA.

1. Introduction

Flourine-18 fluoro-2-deoxyglucose ($^{18}$F-FDG) positron emission tomography combined with computed tomography (PET/CT) is a useful test to evaluate malignancies [1]. However, inflammatory diseases may also show increased uptake of $^{18}$F-FDG and cause false-positive PET scan results, necessitating further investigations to rule out malignant conditions [2]. Positron emission tomography (PET) is an analytical imaging technology developed to use compounds labeled with positron-emitting radioisotopes as molecular probes to image and measure biochemical processes in vivo [3]. Numerous tracers have been used in conjunction with PET scanning to aid in the diagnosis of various disorders. $^{18}$F-FDG has now become the most commonly used radiotracer for PET scanning. Because of the increased metabolic activity of the tumor cells, there is an increased uptake of glucose in tumor cells, thus forming the basis for widespread use of $^{18}$F-FDG PET scan in the diagnosis, staging, and management of malignancies. However, the increased uptake of $^{18}$F-FDG tracer is not limited to malignant states and has been seen in benign as well as inflammatory conditions such as sarcoidosis, large vessel vasculitis, inflammatory bowel disease, and rheumatoid arthritis (RA) [2, 4–8].

We describe a patient with RA who developed pulmonary nodules, showing increased uptake on $^{18}$F-FDG PET/CT scan. We also review the current literature on the use of PET scanning in articular and extra-articular RA.

2. Case Report

A 50-year-old Caucasian woman with a history of RA presented with dyspnea on exertion. RA was diagnosed 4 years earlier and has been treated with methotrexate since the time of diagnosis. RA is currently in remission on oral methotrexate 15 mg weekly and folic acid 1 mg daily. Both rheumatoid factor and anticitrullinated peptide antibody are highly positive. Past medical history is significant for coronary artery disease with stent placement, chronic obstructive pulmonary disease (COPD), hypothyroidism, hypertension,
and gastroesophageal reflux disease. She has a 60-pack-year smoking history and continues to smoke. Family history is positive for a mother and sister with lung cancer who were both heavy smokers and 2 sisters with COPD. She has lost 15–20 pounds of weight intentionally over a period of 3 months. There is history of loss of appetite. Physical examination including joint examination is normal except for decreased breath sounds in both upper lobes. Laboratory data revealed normal blood count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and renal and liver functions. A chest X-ray done for evaluation of dyspnea on exertion revealed a new right upper lobe (RUL) lung nodule. Her previous chest X-ray four years earlier showed multiple calcified nodules bilaterally and a small noncalcified RUL nodule less than a centimeter. CT chest revealed a 1.5 cm × 2.5 cm noncalcified pleural-based RUL nodule, a 1.1 cm calcified nodule in the left upper lobe, and an 8 mm noncalcified nodule in the right lower lobe (Figure 1). 18F-FDG PET/CT scan showed moderately increased uptake in all nodules with a maximum standardized uptake value (SUV) of 3.7 in the RUL nodule (Figure 2). Given the patient's high risk based on tobacco use and family history of lung cancer, she underwent a CT-guided biopsy of the RUL nodule that was nondiagnostic. Subsequent video-assisted thoracic surgery (VATS) biopsy of the right upper and lower lobe nodules was performed. Pathology of both nodules revealed chronic inflammation with necrotizing granulomatous formation consistent with rheumatoid nodules and no evidence of malignancy (Figures 3 and 4). Fungal and acid-fast bacilli stains and cultures were negative.

3. Discussion

It has been noted that around 50 percent of solitary pulmonary nodules and a greater percentage of multiple pulmonary nodules turn out to be benign processes [9]. This, in the face of 200,000 cases of lung cancer diagnosed per year with mortality of 150,000 per year, creates a difficult conundrum in the management of pulmonary nodules in diseases known to cause lung nodules such as RA [10]. 18F-FDG PET/CT scan has a sensitivity of 96–97% and a specificity of 83–85% in differentiating malignant pulmonary nodules [11–13]. However, the presence of inflammation and fibrosis significantly hinders PET scan accuracy. This is compromised even more so in the era of RA treatment with biologics that confers increased risk of mycobacterial and fungal infections which can potentially present as PET-positive lesions.

Reports of the use of PET and PET/CT in extra-articular RA are limited to subcutaneous nodules, lymph nodes, and the lung. Rodriguez et al. described two patients with RA in whom pulmonary nodules showed increased SUV on 18F-FDG PET scan [14]. Biopsy of the nodules demonstrated bronchogenic carcinoma developing within preexisting rheumatoid nodules. Based on their experience they concluded that PET scan is a diagnostic test of high accuracy and can be used before surgical biopsy in patients with RA and pulmonary nodules who are suspected to have bronchogenic carcinoma. However, not all cases of increased uptake on PET scan are related to malignancy as is evidenced by the
the use of invasive diagnostic methods such as needle biopsy or VATS, is prudent in the management of lung nodules in rheumatoid arthritis.

Disclosure

The paper has not been presented in any form in any meeting or forum. The contents of this paper have not been published in any other journal. All authors have read the paper and agreed on the content.

Conflict of Interests

The authors declare that they have no conflict of interests.

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