Non-necrotizing Granulomatous Pulmonary Vasculitis Mimicking Lung Cancer on PET/CT

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Abstract

Fluorodeoxyglucose positron emission tomography (^{18}FDG-PET) scan has become a valuable resource in the staging of lung cancer. Inflammation is known to cause false positives on ^{18}FDG-PET scan. In the absence of symptoms suggesting a diagnosis of an inflammatory condition, ^{18}FDG-avid lung masses on PET/CT scan is strongly suggestive of a diagnosis of lung cancer, rather than an inflammatory condition. We report the case of a 57-year-old man, with a history of heavy smoking and working in the sandblasting industry, with two suspicious ^{18}FDG-avid nodules in the left lung. Surgical specimens of these nodules revealed findings suspecting giant cell arteritis rather than malignancy.

Keywords

- vasculitis
- lung cancer
- positron emission tomography

Introduction

Accurate preoperative assessment for tumor size (T), lymph node (LN) involvement (N), and metastases (M) is necessary for the formulation of optimal treatment strategies in lung cancer patients. ^{18}Fluorodeoxyglucose-positron emission tomography (^{18}FDG-PET) has emerged as a useful tool in the diagnosis and preoperative staging of lung cancer. Adequate preoperative staging is possible with both computed tomography (CT) and ^{18}FDG-PET, and accuracy may be improved by combining both.[1]

A drawback in the use of ^{18}FDG-PET is that acute inflammatory changes may appear suspicious, and create false positive results. Pulmonary vasculitis, for example, is a broad category of conditions characterized by destruction of pulmonary blood vessels, leading to ischemic damage to the lung parenchyma supplied by these vessels. Granuloma-forming vasculitides involving the pulmonary vasculature is not uncommon, due partly to the extensive vasculature of the lung. These vasculitides can be classified as necrotizing or non-necrotizing. Necrotizing granulomatous syndromes usually affect the small and medium muscular pulmonary arteries.[2] Little has been reported, however, regarding non-necrotizing granulomatous vasculitides involving the lung. We report the case of a patient who underwent an oncologic workup and treatment for abnormal lung nodules found on ^{18}FDG-PET where final pathologic specimens revealed a non-necrotizing granulomatous vasculitis.

Case Report

A 57-year-old man was referred by his primary-care physician after routine chest X-ray demonstrated abnormal lung nodules. He has a history of smoking 1.5 packs/day for 40 years, and worked in the sandblasting industry. Pertinent negatives include no fevers, joint pain, weight loss, or pulmonary symptoms. Pulmonary function testing revealed an forced vital capacity (FVC) of 4.76 L (105% of predicted), and an FEV_1/FVC of 80% (99% of predicted). Diffusion capacity of the lung for carbon monoxide was 19.69 mL/min/mm Hg (68% of predicted). Complete blood counts and serum electrolytes were all within normal limits. Erythrocyte sedimentation rate was 4 mm/h, and C-reactive protein was $<$0.1 mg/dL. p-ANCA and c-ANCA were negative.

Multidetector helical CT scan of the chest demonstrated a spiculated nodule in the left upper lobe (LUL) measuring 2.4 cm $\times$ 1.8 cm $\times$ 1.6 cm (►**Fig. 1**). A second spiculated nodule in the superior segment of the left lower lobe (LLL) measuring 2.3 cm $\times$ 1.7 cm $\times$ 1.6 cm was also discovered. No

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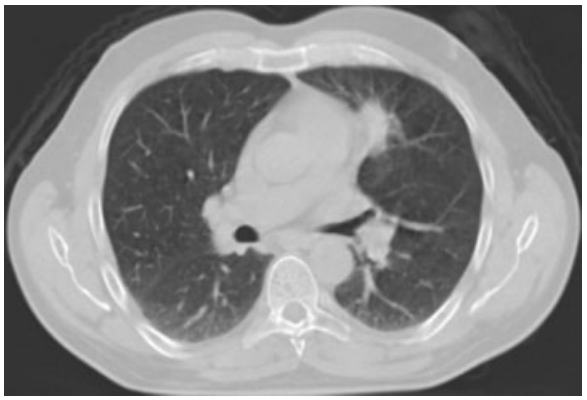

Fig. 1 Chest CT demonstrating spiculated nodule in left upper lobe.

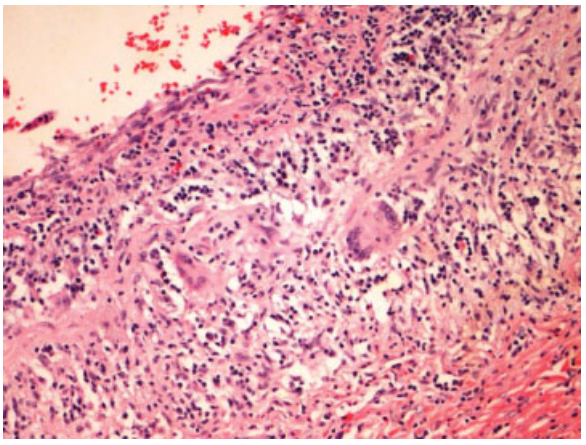

Fig. 3 Hematoxylin and eosin stain of pulmonary artery displaying active vasculitis with giant cells in media; 20× magnification.

pleural effusion was present. LNs were visible in the left hilum, aortopulmonary window, right lower paratracheal, right upper paratracheal, and subcarinal and precarinal regions measuring up to 9 mm.

A ^{18}FDG-PET/CT was performed. The LUL lesion had a maximum standard uptake value (SUV) of 5.82, and volume of ~6.2 mL (►**Fig. 2**). The lesion in the superior segment of the LLL had a maximum SUV of 5.02, and volume of ~2.2 mL. Multiple LNs were visible in the mediastinum and left hilum. The most avid left hilar LN had a maximum SUV of 3.98. An LN in the aortopulmonary window had a maximum SUV of 4.22.

The patient underwent a bronchoscopy and cervical mediastinoscopy. Bronchial brushing and lavage were performed and cytology results were negative. Biopsy of the LLL during bronchoscopy was negative. Biopsies of the subcarinal, right, and left lower paratracheal LN stations revealed hyalinized granulomatous inflammation and benign lymphoid tissue with histiocytes and no evidence of malignant disease. Stains for fungal organisms and acid-fast bacilli (AFB) were negative.

The patient subsequently underwent a left thoracoscopy, superior segmentectomy of the LLL, and wedge resection of the LUL. Aortopulmonary window and paraaortic LNs were also sampled. Pathological specimens revealed a granulomatous vasculitis, organizing pneumonia with giant cell features, and hyalinized granulomas. No malignancy was seen. A second pathologic consultation confirmed a granulomatous, non-necrotizing vasculitis mainly involving the large pulmonary arteries with the presence of chronic inflammatory and granulomatous reaction along with multinucleated giant cells in the intima and media (►**Figs. 3** and **4**), favoring a diagnosis of giant cell arteritis.

Postoperatively, the patient had an uncomplicated hospital course and was discharged home on postoperative day 3.

Discussion

This patient was initially suspected of having lung cancer. ^{18}FDG-PET scan results revealed an area of hypermetabolic tissue, concerning for a malignancy. When staging of the patient's mediastinum was found to be negative, surgical resection was planned for the presumed malignancy. Lung specimens revealed a non-necrotizing granulomatous pulmonary vasculitis described above, which mimicked a pulmonary malignancy on PET scan.

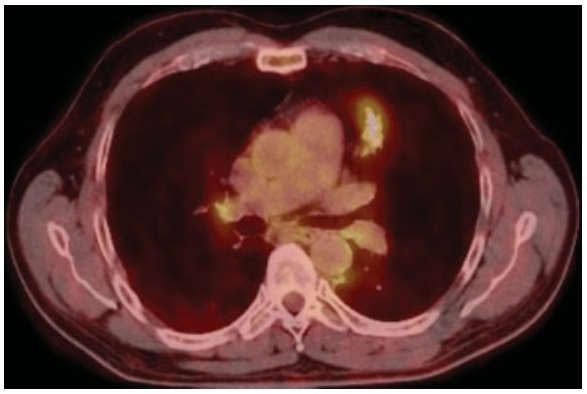

Fig. 2 Corresponding PET/CT image of Fig. 1.

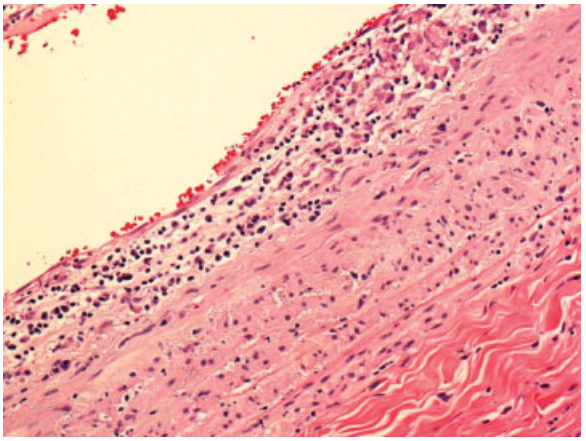

Fig. 4 Hematoxylin and eosin stain of pulmonary artery displaying active vasculitis with intimal inflammation; 20× magnification.

Giant cell arteritis is a condition characterized by involvement of the temporal arteries, cranial arteries, or other carotid system arteries. The vasculitis can be localized, multifocal, or widespread. Extra-cranial artery involvement occurs in as many as 5% of cases, while pulmonary disease is suspected clinically in up to 9% of cases.[3] Isolated pulmonary vessel giant cell arteritis, however, is exceedingly rare.[3] Two prior case reports have described isolated granulomatous vasculitis isolated to the lungs. Masuda et al described an autopsy finding of a 40-year-old woman of a granulomatous vasculitis isolated to the lungs, limited to large- and medium-caliber pulmonary arteries of elastic type, as well as pulmonary veins. Granulomas were distributed mainly in the media and adventitia.[4] Doyle et al described a case in which their patient presented with bronchial obstruction. Bronchoscopy revealed a collapsed right middle lobe bronchus that was oozing blood. Resected specimens of the right lung grossly demonstrated an infarct, and histologically demonstrated intimal fibrosis and mild infiltration of the elastic pulmonary arteries, with focal destruction of the media and internal elastic lamina of many of the muscular arteries throughout the specimen.[5] The giant cell arteritis seen in our patient was not associated with fibrosis and inflammation. This may represent an earlier point in the disease course and these case reports may offer insight into the natural progression of this disease.[4,5]

There has been increasing interest in the utility of metabolic imaging extending beyond that of diagnosing malignancy, and toward the use for assessment of inflammatory diseases such as vasculitides. Slight to high vascular ^{18}FDG uptake observed on PET imaging is likely related to macrophage-rich areas within an area of inflammation. Many inflammatory cells, especially when activated, will take up high amounts of glucose and ^{18}FDG. Macrophages, a culprit in the pathophysiology of vasculitis, may accumulate the glucose tracer as avidly as tumor cells via overexpression of GLUT-1 and GLUT-3 transporters.[6]

In patients where the diagnosis of a large cell vasculitis is clearer, increased ^{18}FDG uptake by the involved vasculature was found to be most prevalent in patients with systemic complaints, such as fever of unknown origin, weight loss, and malaise[6]—all of which were absent in this case.

In summary, we report the case of a 57-year-old man who was believed to have a pulmonary malignancy based on a suspicious appearing mass found on ^{18}FDG-PET scan. Pathological examination of the surgical specimen did not reveal pulmonary malignancy, but instead a granulomatous, non-necrotizing vasculitis that mainly involved the large pulmonary arteries. Inflammation is known to cause false positives on ^{18}FDG-PET scan. This is the first report to describe a non-necrotizing pulmonary vasculitis mimicking lung cancer on ^{18}FDG-PET scan.

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