

A Case of False Positive FDG PET/CT Scan Due To Foreign Body Granuloma Mimicking Malignant Disease: Case Report

Malign Hastalığı Taklit Eden Yabancı Cisim Granülomunun Neden Olduğu Yanlış Pozitif FDG PET/BT Olgusu

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ABSTRACT A 61-year-old patient with a history of laryngeal carcinoma presented to the emergency room with hemoptysis. Thorax computed tomography (CT) scan demonstrated a mass with irregular margins in the right upper lobe. Fiberoptic bronchoscopy and CT-guided transthoracic biopsy revealed no specific pathology for malignancy or infection. Fluorodeoxyglucose positron emission tomography (FDG PET)/CT scan showed an area of increased metabolic activity in the right upper lobe region [Standardized uptake value (SUV): 6.6]. The patient underwent open lung biopsy and the assessment of pathological material revealed foreign body granuloma secondary to food aspiration surrounded with chronic inflammation. Foreign body granuloma with a high standardized uptake value on FDG PET/CT scan imitates primary lung cancer or metastasis of laryngeal carcinoma. Histopathological confirmation is necessary to prevent misdiagnosis in the event of increased FDG uptake on PET imaging that may be due to a source of false positive image.

Key Words: Positron-emission tomography; granuloma, foreign-body; lung neoplasms

ÖZET Altmış bir yaşında larinks karsinomu öyküsü olan bir hasta hemoptizi şikâyeti ile acil servise başvurdu. Toraks bilgisayarlı tomografi (BT) incelemesinde, sağ üst lobda düzensiz sınırlı bir kitle görüldü. Fiberoptik bronkoskopi ve BT eşliğinde transtoraksik biyopsi yapıldı ancak enfeksiyon ya da maligniteye ait spesifik bir patoloji tespit edilemedi. Flurodeoksiglikoz pozitron emisyon tomografisi (FDG PET) BT taramasında, sağ üst lobda artmış bir metabolik aktivite alanı görüldü [Standart tutulum değeri (STD): 6.6]. Hastaya açık akciğer biyopsisi yapıldı ve patolojik materyal, kronik yangı ile çevrelenmiş gıda aspirasyonuna ikincil bir yabancı cisim granülomu olarak değerlendirildi. FDG PET/BT taramasında yüksek bir STD değerine sahip yabancı cisim granülomu primer akciğer karsinomunu ya da larinks karsinomunun metastazını taklit edebilir. PET incelemelerinde yanlış pozitif değerlendirmelere neden olan potansiyel durumların varlığı nedeni ile PET görüntülerinde FDG tutulumunda artış saptanması halinde yanlış tanıları önlemek için histopatolojik inceleme yapılmalıdır.

Anahtar Kelimeler: Pozitron-emisyon tomografisi; granülom, yabancı cisim; akciğer kanseri

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Positron emission tomography (PET) with 18-FDG has a role in the diagnosis and staging of lung cancer, but is also appealing for the detection of recurrence and monitoring of therapeutic efficacy.¹ The high sensitivity of FDG PET allows accurate identification of disease extension and therefore minimizes the need for extra diagnostic procedures.² However, a wide range of diseases including inflammatory and benign disorders, and physiologic variants have been shown to accumulate remarkable amounts of FDG.³ In patients with a proven malignancy, new uptakes of 18-FDG on

PET may lead to false diagnosis and staging. These uptakes may occasionally pose a problem in distinguishing malignant from inflammatory diseases.⁴ We reported a case of foreign body granuloma secondary to food aspiration that presented as a mass with a high standardized uptake value on 18-FDG PET/CT scan mimicking primary lung cancer or metastasis of laryngeal carcinoma.

CASE REPORT

A 61-year-old man presented to the emergency room with hemoptysis and fatigue that had started two weeks ago. The patient's medical history was complex. He was diagnosed with laryngeal carcinoma three years ago. After radical neck dissection and total laryngectomy, he received radiotherapy for five weeks on his neck. Three years later, he was admitted to the hospital with dysphagia. Chest radiography revealed a mass with irregular margins in the right upper zone and chest CT scan demonstrated a 4 x 3 cm right upper lobe density with irregular margins and a 2 x 1 cm paratracheal lymphadenopathy (Figure 1). He was consulted with and transferred to the pulmonary department for primary lung malignancy or metastasis of laryngeal carcinoma. He has smoked for nearly 50 years.

Physical examination and all routine laboratory tests were normal. Fiberoptic bronchoscopy revealed an edematous area on the apico-posterior carina of the right upper lobe. An extensive work-up for infectious diseases including tuberculosis were all negative and cytologic analysis of bronchoscopic biopsies and bronchoalveolar lavage showed no evidence of malignancy. CT-guided transthoracic biopsy of the mass revealed no specific pathology for malignancy or infection. An F-18 FDG combined PET/CT scan was performed to identify primary lung cancer or metastasis. PET/CT scan showed an area of increased metabolic activity in the right upper lobe region with an increased standardized value uptake (SUV:6.6) (Figure 2). After the patient was consulted to chest surgery specialists, he underwent open lung biopsy and frozen section was not consistent with malignancy or infection. The patient was discharged from the Department of Chest Surgery and was asked to refer to



FIGURE 1: Chest CT scan demonstrated a 4 x 3 cm right upper lobe density with irregular margins and a paratracheal 2 x 1 cm lymphadenopathy.

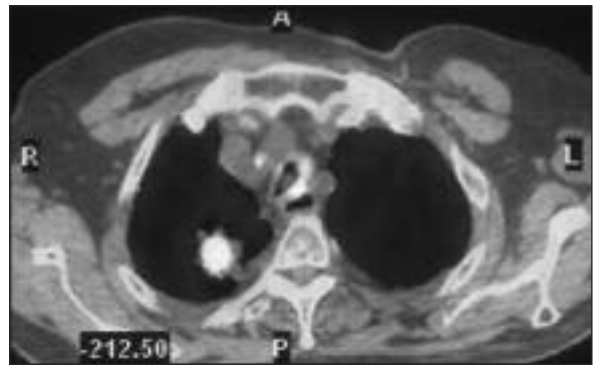


FIGURE 2: PET/CT scan showed an area of increased metabolic activity in the right upper lobe region with an increased standardized value uptake (SUV:6.6).

the Department of Pulmonary Diseases with the pathologic result of the surgical material. However, the patient presented to our clinic three months later with a 2-week history of hemoptysis and fatigue. Physical examination was normal and all routine laboratory tests were normal except for the elevation of white blood cells ($11000/\text{mm}^3$) and sedimentation rate (80 mm/h). Fiberoptic bronchoscopy revealed that the source of hemoptysis was hyperemic and granulomatous areas at the end of the tracheostomy canule. The examination of the bronchoscopic biopsy and bronchoalveolar lavage specimens showed no malignancy or infectious diseases including tuberculosis. The tracheotomy canule was suspected to be the source of hemoptysis and fiberoptic pharyngolaryngoscopy confirmed the bronchoscopic findings. A suggestion was ma-

de for the otolaryngologist to shorten the tracheotomy canule and after the shortening process hemoptysis did not repeat.

The pathology report from the previous open lung biopsy revealed foreign body granuloma surrounded with chronic inflammation with no evidence of malignancy. The pathological specimen was reinvestigated and the diagnosis was confirmed as foreign body granuloma secondary to food aspiration surrounded with chronic inflammation. The patient was subsequently discharged after an uneventful recovery and the symptoms did not recur.

DISCUSSION

Combined PET/CT examination has an established role in malignancies for early diagnosis and to identify the therapeutic strategies. The abnormal activity of the malignant cells is shown by the uptake of 18-FDG by the hypermetabolic cells.⁴ The high sensitivity of PET allows accurate identification of disease extension and therefore minimizes the need for extra diagnostic procedures. However, tissues with increased glucose metabolism occur not only in malignant lesions, but also in conditions such as infectious or inflammatory processes and granulomatous diseases. In our case, the accumulation of FDG resulted from the inflammatory and granulomatous reaction to the foreign body due to food aspiration.

False-positive results occur in various diseases and are associated with infectious or inflammatory processes including sarcoidosis, pneumonia, empyema, aspergillosis, tuberculomas, fungal infections, lipoid pneumonia, Wegener's granulomatosis, talc granuloma, radiation pneumonitis, surgical incisions, biopsy sites and rheumatoid nodules.⁵ Other rare conditions of false positive entities are pancreatic lipoma, lipoid pneumonia, physiological uptake of FDG in the neck and upper chest region, lipomatous hypertrophy of the interatrial septum and occult lung infarction in pulmonary malignancies.⁵⁻⁹ To our knowledge, this is the first report of a false positive PET/CT imaging secondary to food aspiration granuloma that mimicks a primary lung cancer or a metastasis of a laryngeal carcinoma.

The lesions determined on PET/CT scan are analysed semi-quantitatively using the SUV, which

relates to the activity concentration in a fixed volume of tissue to the amount of the injected dose and the patient's body weight.¹⁰ SUV greater than 2.5 has been shown to be very sensitive and specific for malignant lesions.¹ SUV in our case was 6.6, which is greater than the normal range. While inflammatory and infective diseases may show abnormal activity on imaging with 18 FDG PET/CT, significant F-18 FDG uptake has been described in other granulomatous diseases of the lung such as sarcoidosis and tuberculosis. F-18 FDG is not a cancer specific agent and F-18 FDG accumulation by neutrophils, lymphocytes and macrophages has been reported in vitro.¹¹ The use of semiquantitative analysis of the activity with the SUV has been suggested to aid in the differentiation of benign from malignant disease.¹² However, in many cases, there is considerable overlap in the normal ranges of benign and malignant lesions.¹³ In addition, several factors affect the SUV measurements including the patient's total body surface and the ratio of muscle to fat, whether or not the intravenous injection was complete, partial volume averaging within the region of interest measured and serum glucose levels at the time of the PET scan.⁵

Visual interpretation and quantitative analysis with different cutoff values have also been shown to be effective in differentiating benign from malignant lesions.^{11,14} The apical, lobar or segmental pattern was atypical for cancer and suggested benign disease on the F-18 FDG scan alone.¹⁵ FDG PET/CT scan was most accurate in patients without a history of carcinoma for the evaluation of lung malignancy, in whom the sensitivity of PET was 95% and specificity was 82%. However, patients with a treated extrapulmonary primary carcinoma or primary lung carcinoma demonstrated a lower sensitivity (92% and 70%, respectively) and specificity (63% and 67%, respectively) for the diagnosis of metastatic or recurrent disease.¹⁶

The major problem with FDG PET/CT imaging is the false positive results due to inflammation.¹⁷ False positives may be reduced with the use of multitracer studies and labelled amino acids PET scans instead of the FDG scan.¹⁸ In addition, using dual time imaging was beneficial to differentiate malignancy from inflammation and normal tissue

es. Tumor SUV increased by up to 30% over time, while inflammatory and normal tissue uptakes remained relatively unchanged.¹⁹

The mechanism of the uptake of 18-FDG combined PET/CT scan is very important in granulomatous lesions. Granulomas contain epithelioid macrophages surrounded by lymphocytes and plasma cells with chronic inflammation. In vitro studies have shown FDG accumulation in lymphocytes, neutrophils and macrophages and activated inflammatory cells have markedly increased glycolysis, thus providing a mechanism for the increased uptake in macrophage-laden granulomas and inflammatory tissue.²⁰ Therefore, granulomas have the potential to display false-positive PET images. Lim et al and Hewitt et al reported foreign body granulomas secondary to suture and teflon materials leading to false positive PET/CT imaging.^{10,21}

Patients diagnosed with malignancy are frequently referred to the combined PET/CT imaging to examine potential metastases. In patients with prior malignancy history, false positive results may le-

ad to pitfalls in the treatment due to misdiagnoses like receiving unnecessary treatments. Prosch et al reported a case of a false positive finding on PET/CT secondary to gluteal injection site granuloma in a patient with non-small cell lung cancer.²² F-18 FDG uptake in benign conditions, for the most part inflammation or infection, may limit the specificity of whole-body scans.

Moreover, false-negative conditions occur in bronchioalveolar carcinoma, carcinoids, well-differentiated malignancies, neuroendocrine carcinomas, thyroid carcinomas, tumors less than 1 cm in diameter and cavitating or necrotic lesions.^{5,23} Thus, histopathologic confirmation is the cornerstone of the diagnosis and clinical and radiological findings, and medical history should be considered in addition to SUV.

In conclusion, histopathological confirmation is required to prevent misdiagnosis in the event of increased F-18 FDG uptake on PET imaging due to potential sources of false positive PET interpretations.

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