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CASE REPORT

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Ipsilateral Hyperhidrosis: Atypical Symptom of Small Lung Adenocarcinoma Evaluated by ^{18}F-FDG PET-CT

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Abstract

A 45-year-old male visited our clinic due to right palmar anhidrosis and contralateral hyperhidrosis. Chest computed tomography (CT) showed a solitary pulmonary nodule with mediastinal lymph node enlargement, but a cause for atypical palmar anhidrosis was not identified. Subsequent fluorine-18-fluorodeoxyglucose (^{18}F-FDG) positron emission tomography/computed (PET/CT) revealed a localized pleural metastasis at the right apex with direct invasion of the paravertebral sympathetic chain. The pleural metastasis, which was not seen on chest CT, evoked ipsilateral anhidrosis independent of a mass effect or direct invasion by the primary lung tumor. ^{18}F-FDG PET/CT can be helpful in identifying the cause of atypical symptoms in patient with small sized lung cancer.

Keywords Lung adenocarcinoma · Hyperhidrosis · ^{18}F-FDG PET/CT · Pleural metastasis

Introduction

Despite modern advanced diagnostic tools and medications, lung cancer remains a fatal disease that is usually diagnosed at an advanced stage [1]. The typical symptoms of lung cancer are cough, chest pain, and dyspnea. The late detection of lung cancer is primarily because symptoms present only when the disease reaches an advanced stage. However, atypical symptoms are sometimes the only manifestations of the disease [2, 3]. Such atypical symptoms including shoulder pain and ipsilateral anhidrosis can develop in patients with a Pancoast tumor or massive upper lobe lung malignancy [2, 4–6]. These specific tumors are identified easily on chest X-ray or chest computed tomography (CT), and the related pathophysiology is easily attributable to mass effect or direct invasion. However, in some cases, it can be difficult to establish a clear relationship between symptoms and malignancy [7].

Fluorine-18-fluorodeoxyglucose (^{18}F-FDG) positron emission tomography/computed (PET/CT) is the recommended initial staging tool in patients with lung cancer [8, 9]. Ozmen et al. reported that ^{18}F-FDG PET/CT is useful to assess Pancoast tumors that can cause Pancoast syndrome by showing the extension and border of the tumor [10]. However, there have been no reports regarding the role of ^{18}F-FDG PET/CT in patients with small-sized lung cancer presenting with atypical symptoms.

Here, we report a case of ipsilateral anhidrosis as the initial symptom of a lung malignancy that was neither a Pancoast tumor nor massive upper lobe mass. The associated pathophysiology of the identified cancer was successfully evaluated using ^{18}F-FDG PET/CT.

Case Report

A 45-year-old male patient visited our thoracic surgery clinic due to right palmar anhidrosis and contralateral hyperhidrosis. The patient also presented with mild ptosis of his right eye without prominent miosis. The patient had a 25 pack-year history and was a current smoker. He also reported intermittent right shoulder and scapular discomfort, but an orthopedic examination was benign. There were no signs or symptoms

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suggestive of lung cancer including cough, dyspnea, weight loss, or chest pain. Chest CT revealed a 25-mm solitary pulmonary nodule in the posterior segment of the right upper lobe (RUL) and mediastinal lymph node enlargement (Fig. 1a). However, a cause for right palmar anhidrosis and contralateral hyperhidrosis was not explained by chest CT.

Subsequent ^{18}F-FDG PET/CT showed increased uptake of ^{18}F-FDG by an RUL mass (maximum standardized uptake value 5.3), multiple enlarged mediastinal lymph nodes, liver mass, and multiple destructive bone lesions (Fig. 1b, c). ^{18}F-FDG PET/CT also revealed localized hypermetabolic pleural lesions invading the right T1 nerve root that were not evident on contrast-enhanced chest CT (Fig. 2a–c). Coronal images showed hypermetabolic pleural lesions infiltrating the T1-T2 level paravertebral sympathetic chain (Fig. 2d–f).

CT-guided lung biopsy identified the RUL mass as primary pulmonary adenocarcinoma, and the clinical stage was cT1cN3M1c. Epidermal growth factor receptor and anaplastic lymphoma kinase tests were negative, but the expression of programmed death ligand-1 was 50%. The patient was treated with an immune check point inhibitor under study ID GO40290. Although the patient's ipsilateral anhidrosis and mild ptosis persisted, he experienced improvement in scapular pain.

Discussion

This report presents a rare case of apical pleural metastasis from primary pulmonary adenocarcinoma causing Pancoast syndrome and ipsilateral anhidrosis detected by ^{18}F-FDG PET/CT. The lesions were not evident on chest CT, and the cause of anhidrosis was not fully understood during the initial evaluation. Subsequent ^{18}F-FDG PET/CT provided a clear view of an invasive pleural metastasis that explained the patient's atypical symptoms.

Pancoast syndrome refers to a set of symptoms that include radiating pain along the C8-T2 nerve trunk distributions. Pancoast syndrome can arise from a diverse array of tumors, inflammation, and infections but is most commonly caused by extension of superior pulmonary sulcus tumors or Pancoast tumors at the thoracic inlet [11]. Approximately 14–50% of patients with Pancoast syndrome suffer from Horner's syndrome, which consists of triad of symptoms (ipsilateral ptosis, miosis, and hemifacial anhidrosis) [12]. Horner's syndrome is caused by direct invasion of the thoracic paravertebral sympathetic chain and the inferior cervical ganglion. Contralateral facial flushing and hyperhidrosis in Horner's syndrome are not common, but can arise as a result of an excessive reaction by the contralateral undamaged sympathetic pathway [13, 14].

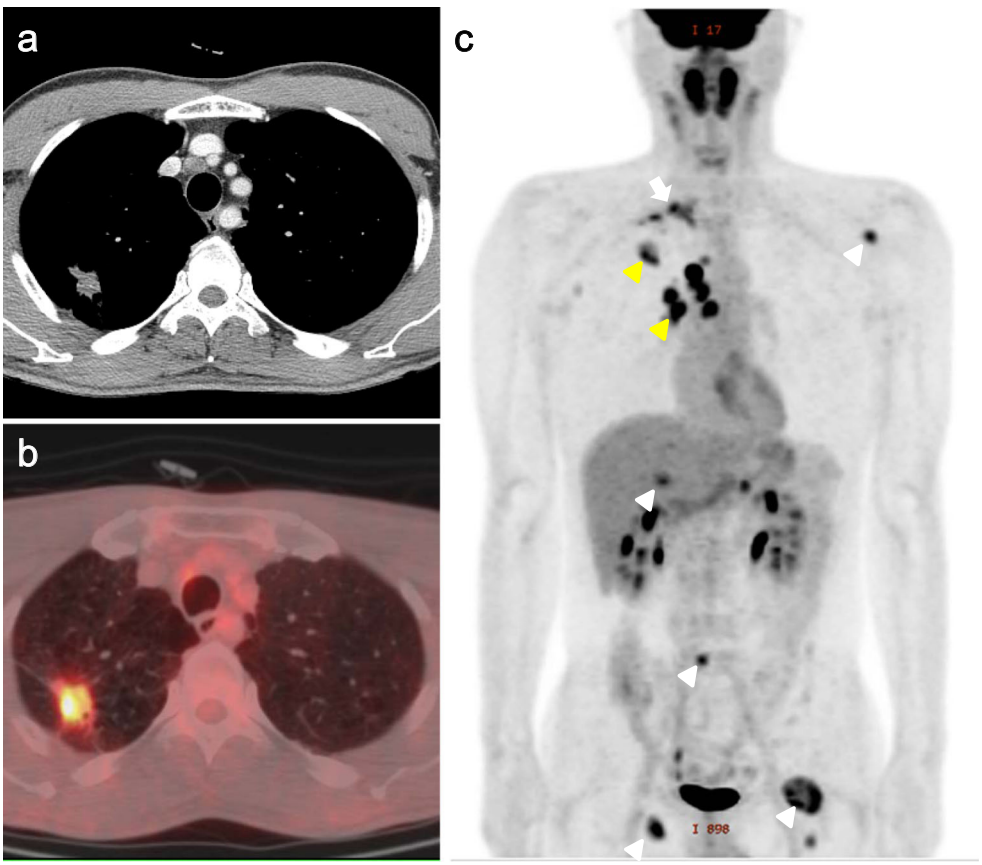

Fig. 1 Contrast-enhanced chest CT (**a**) and ^{18}F-FDG PET/CT (**b**) showing an irregularly shaped enhanced nodule in the posterior segment of the right upper lobe (RUL) with hypermetabolism. The maximum intensity projection image of the PET (**c**) showed RUL lung cancer with metastatic mediastinal LNs (yellow arrow head), localized pleural seeding of the right apex (white arrow), and multi-organ metastasis (white arrow heads)

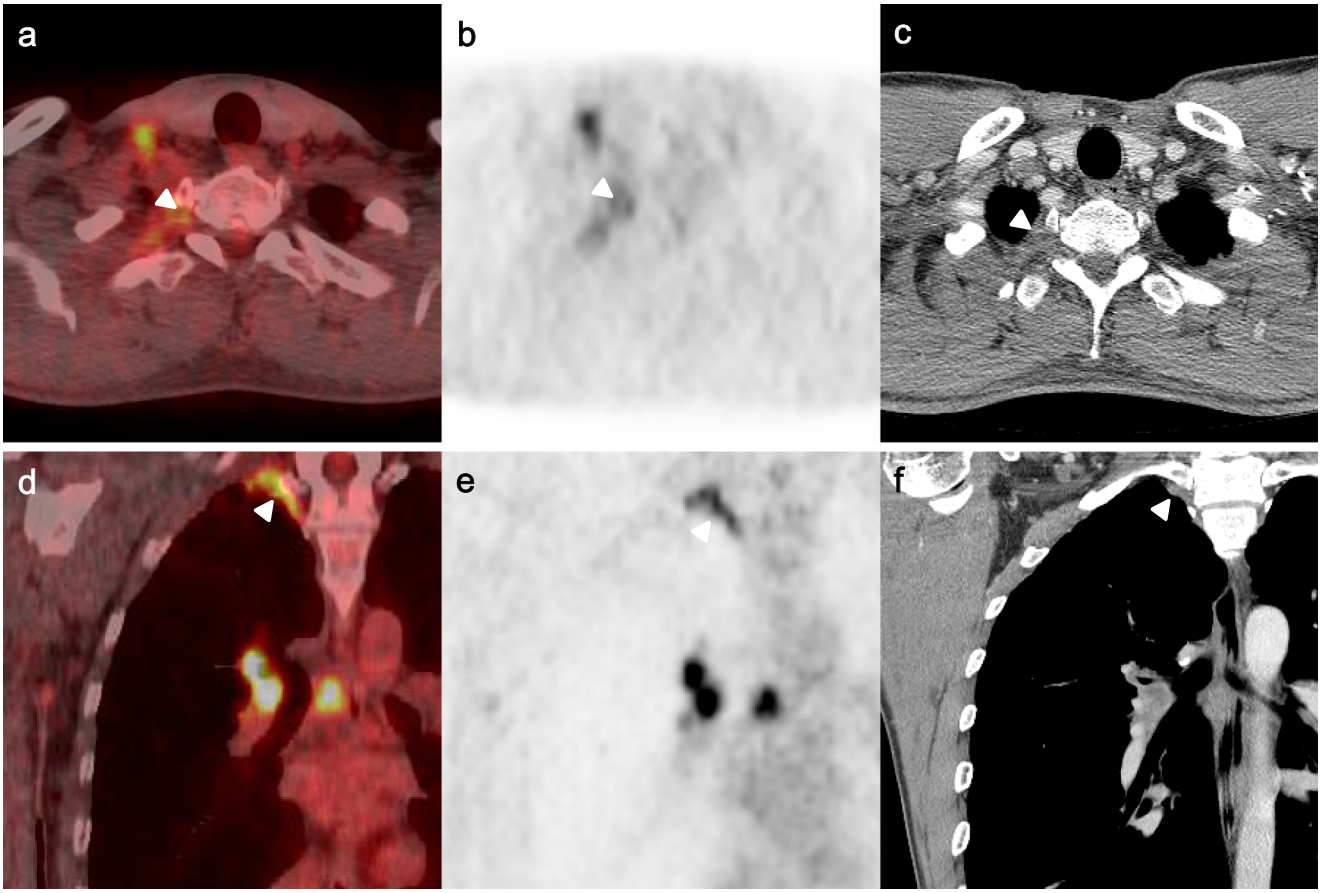

Fig. 2 Axial image of fusion ^{18}F-FDG PET/CT (**a**) and PET (**b**) showed localized pleural lesions invading the right T1 nerve root. Contrast-enhanced CT (**c**) showed a mildly enhanced pleural lesion in the right paravertebral area (white arrowhead). Coronal images of fusion ^{18}F-FDG PET/CT (**d**) and PET (**e**) showed a hypermetabolic pleural lesion invading the apex and T1-T2 level paravertebral sympathetic chain, which were observed as small, slightly enhancing nodules on chest CT (**f**)

Our patient presented with right scapular pain, ipsilateral palmar anhidrosis, and mild ptosis consistent with Pancoast syndrome and Horner's syndrome. However, the patient showed no radiological signs (chest CT and upright chest radiograph) of a Pancoast tumor, although a relatively small sized tumor at the posterior segment of the RUL was identified. In addition, the patient did not have a pleural effusion or diffuse pleural thickening in the dependent part of the thorax to suspect pleural metastasis [15].

Previous studies have shown that ^{18}F-FDG PET/CT improves diagnostic accuracy in lung cancer patients, especially in patients with pleural seeding, involvement of the supraclavicular fossa lymph nodes, mediastinal invasion, or chest wall invasion [16, 17]. In our patient, ^{18}F-FDG PET/CT revealed localized pleural seeding at the apex of the thoracic cavity that had invaded the paravertebral sympathetic chain. Ipsilateral ptosis and miosis were not prominent in our patient, and the symptoms corresponded to T1-T2 level sympathetic chain denervation without cervical ganglion involvement [18]. Following detection of the previously unrecognized pleural and multi-organ metastasis by ^{18}F-FDG PET/CT, the patient was upstaged to cT1cN3M1c. There is one report in the literature of sympathetic denervation inducing relative hypometabolism of brown adipose tissue in a patient with Horner's syndrome; however, in that case, a pattern of ipsilateral hypometabolism in brown adipose tissue was not observed [19].

In conclusion, in patients with small-sized lung cancer presenting with atypical symptoms consistent with Pancoast syndrome or Horner's syndrome, ^{18}F-FDG PET/CT is an important diagnostic tool to identify the cause of symptoms and expedite early and appropriate treatment.

Compliance with Ethical Standards

Conflict of Interest Min Young Yoo, Sung-Soo Koong, Si-Wook Kim, and Dohun Kim declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent The institutional review board of our institute approved this retrospective study, and the requirement to obtain informed consent was waived.

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