Case Report

Pulmonary Typical Carcinoid Tumor and Liver Metastasis with Hypermetabolism on 18-Fluorodeoxyglucose PET: A Case Report

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Pulmonary carcinoid tumors are generally hypometabolic on 18-fluorodeoxyglucose (FDG)–positron emission tomography (PET). We experienced a case of pulmonary typical carcinoid that showed rapid growth and high FDG uptake at the primary site and liver metastasis. A 56-year-old man with hemosputum had a medical examination by his family physician. A roentgenogram and computed tomography of the chest showed a solitary solid mass on the right lower lung field. However, he had not been shown an abnormal shadow on a roentgenogram taken 8 months earlier. He had undergone fiber-optic bronchoscopy, but the cytological diagnosis showed no evidence of malignancy. After that, FDG-PET was examined and revealed hot spots in the pulmonary tumor and liver mass. A standard uptake value of this pulmonary tumor was 32.9 mg/mL, and that of the liver mass was almost the same value of pulmonary lesion. He had undergone a right lower lobectomy diagnosed as a typical carcinoid. Thereafter he underwent partial resection of he liver mass, and the histology was metastasis from pulmonary carcinoid. We first reported a typical pulmonary carcinoid that showed high FDG uptake at the primary site and liver metastasis. (Ann Thorac Cardiovasc Surg 2008; 14: 109–111)

Key words: positron emission tomography, 18-fluorodeoxyglucose, hypermetabolism, pulmonary carcinoid

Introduction

Pulmonary carcinoid tumors are low-grade malignancies. They are one of the neuroendocrine neoplasms that account for 1%–2% of all lung malignancies[1)] and 20% of neuroendocrine neoplasms.[2)] Twenty percent of pulmonary carcinoid tumors occur in the peripheral to segmental bronchi and manifest as solitary nodules or masses on chest roentgenograms, usually in asymptomatic patients. Pulmonary nodules are a common radiographic finding and often require further evaluation because of the concern for lung cancer. Recently, positron emission tomography (PET) with 18-fluorodeoxyglucose (FDG) has been used to evaluate pulmonary nodules and has proven to be an effective technique in differentiating benign from malignant lung diseases. Most studies have shown that PET has a high sensitivity for malignant tumors and that most lung cancers have increased FDG uptake. However, FDG uptake is not specific for carcinoid tumors because of low-grade malignancy and hypometabolism on FDG-PET.[3)] We herein report the high FDG uptake in a pulmonary carcinoid tumor and liver metastasis.

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Case Report

A 56-year-old man experienced a hemosputum episode, and a chest roentgenogram was taken by his family physician; however, an abnormal shadow was not recognized. Again, he experienced hemosputum 8 months after the first episode, so he received another chest roentgenogram and was then made aware of the mass shadow in the right lower lung field. A chest computed tomography (CT) scan a showed solid tumor 4 cm in diameter originating from the right dorsal basal segment, and there were no local lesions in other areas of this CT scan. He underwent a fiber-optic bronchoscopy; however, the cytological diagnosis had no evidence of malignancy, showing benign columnar cells, epitheloid cells, and lymphoid cells. Thereafter he received a whole-body PET study, and it showed an isolated focus in the right lower lobe, increased FDG activity (the range of maximum standardized uptake value [SUVmax]; 32.9 mg/mL) corresponding to the location of the pulmonary nodule visualized on the chest CT scan; a hot-spot nodule invisible on CT was detected in the liver (Fig. 1). He also underwent brain magnetic resonance imaging, and there was no evidence of brain metastasis. A lung cancer with local single metastasis in the liver was strongly suspected, based on his hemosputum history and the results of the imaging studies. The patient was scheduled for a right lower lobectomy and systematic lymph node dissection in the same operative setting if the intraoperative histological examination confirmed a diagnosis of nonsmall cell lung cancer. A surgical excision of the pulmonary mass was undertaken. The intraoperative aspiration cytology was completed, and the diagnosis was a carcinoid tumor; so the patient underwent a lobectomy and lymph nodes resection. The solid mass in the lower lobes measured 32 mm in diameter. In conventional hematoxylin and eosin (HE) staining, the relatively uniform tumor cells with oval nuclei and a moderate amount of cytoplasms are proliferating in acinar-like or trabecular pattern (Fig. 2, A-1). Besides HE staining, a typical pulmonary carcinoid was confirmed by an immunohistochemical procedure using an epithelial marker (CAM 5.2) and two neuroendocrine markers, chromogranin A and synaptophysin. Tumor cells strongly react with antibodies to CAM 5.2, chromogranin A (Fig. 2, B-1), and synaptophysin. Thereafter the patient underwent a sequentially partial resection of liver to diagnose either liver metastasis from pulmonary carcinoid or primary liver tumor, or liver metastatic carcinoid from intestinal carcinoid. Consequently, the diagnosis of liver mass was also

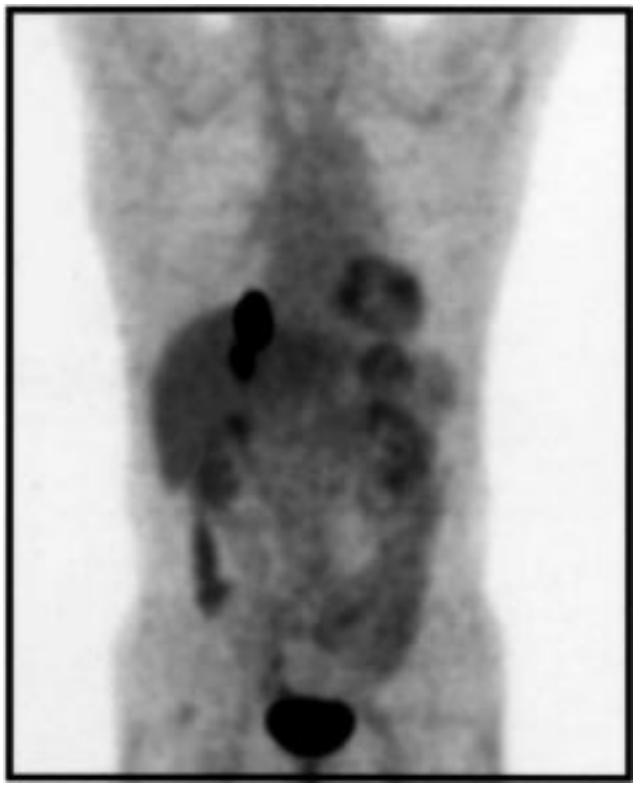

Fig. 1. A coronal integrated 18-fluorodeoxyglucose (FDG)–positron emission tomography (PET) scan image showed the right lower lobe nodule and a liver nodule to be intensely hypermetabolic.

typical carcinoid and decided pathologically metastasis from pulmonary carcinoid, as shown in Fig. 2, A-2 and B-2. The same as with primary tumors, the relatively uniform tumor cells with oval nuclei and a moderate amount of cytoplasms are proliferating in an acinar-like or trabecular pattern. Moreover, immunohistochemical studies were performed with glucose transporter 1 (Gult-1),which was a biological activity marker.[4] Tumor cells show a membranous expression of Glut-1 (Fig. 2, C-1 and C-2). Although there was weak membranous expression in lung carcinoid tumor, a strong membranous expression was detected in the metastatic lesion.

Discussion

PET has emerged as a powerful diagnostic tool in the evaluation of patients with indeterminate pulmonary lesions detected on conventional imaging studies. Furthermore, a correlation of SUVmax with staging showed a significant positive correlation.[5] Generally, carcinoid tumors are considered one of the hypometabolic tumors for FDG, so the sensitivity of FDG-PET is low remark or

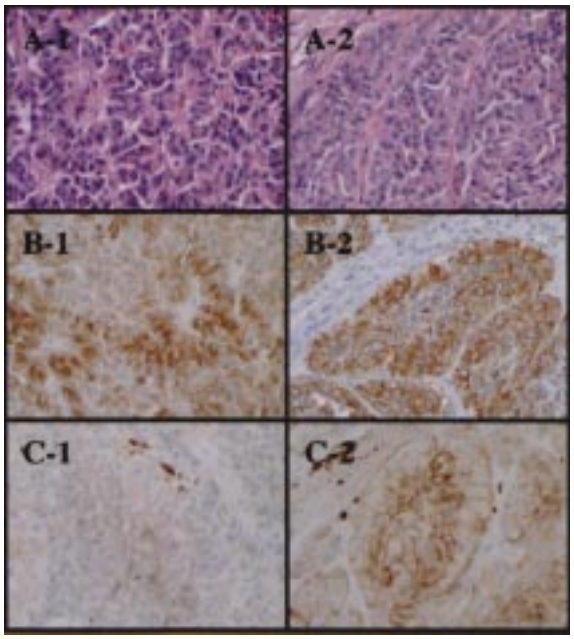

Fig. 2. Microscopic finding.
A: A slide of tumor was routinely stained with hematoxylin and eosin. Sections of both the primary lesion and the metastatic lesion showed a lower mitotic rate (<2/10 high-power field) with nonnecrosis: A-1, primary lung carcinoma; A-2, metastasis of liver.
B: The immunohistological microscopic findings of the tumor were positive for chromogranin A, which was one of the markers for the neuroendocrine marker: B-1, primary lesion; B-2, metastasis of liver.
C: Immunohistological microscopic finding of the tumor was slightly to highly positive for Gult-1, which was one of the markers for biological activity: C-1, primary lesion was slightly positive; C-2, metastasis of the liver was highly positive.

false negative findings for these tumors. However, several investigators[6,7] have reported typical carcinoid tumors that were hypermetabolic on FDG-PET: SUVmax was 4.87 to 10.6. These cases were Stage IA according to the TNM criteria for cancer staging of the Union International Contre Cancer.[8] In our case, the patient had liver metastasis, and the pathological stage was IV. We experienced Stage IV typical carcinoid tumor with hypermetabolism for FDG above 30 mg/mL. Although there was no literature on typical carcinoid tumors with such a hypermetabolism for FDG, we considered that the high value of SUVmax related not only to staging, but also to the potential for metastasis.

In our case, tumor growth was rapid: it was detected in the roentgenogram after an 8-month interval. We considered that this tumor had the possibility to have a higher biological activity than other tumors with a low value of SUVmax. Recently, Gult-1 was reported to be one of the biological activity marker, and the expression of this marker by immunohistochemical analysis has a correlation of FDG uptake. The malignancy of the lung had reported that FDG uptake correlates well with Glut-1 expression.[4] This time we tried to examine the expression of Gult-1 in this patient's tumor. The positive status of Gult-1 is considered to be one of the reasons for the high uptake of FDG in this typical carcinoid tumor.

In conclusion, our case suggests that a typical carcinoid tumor with hypermetabolism for FDG might be capable of distant metastasis and of predicting malignancy. This is the first report of a rare case of pulmonary typical carcinoid tumor with distant metastasis showing hypermetabolism of FDG.

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