Sarcomatoid carcinoma of the lung mimics aspergilloma on ^{18}F-FDG PET/CT

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Abstract
Primary PSC in the lung is a rare malignant cancer that represents a particularly aggressive subtype of non-small cell lung carcinomas (NSCLC) containing sarcoma or sarcoma-like components with spindle or giant cell features. The medical literature referring to imaging characteristics by fluorine-18- fluorodeoxyglucose (^{18}F-FDG) positron emission tomography/computed tomography (PET/CT) of these tumors is very limited. We present a case of PSC with air crescent and halo signs that resemble aspergilloma on the, ^{18}F-FDG PET/CT, scan.

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Introduction

Lung carcinoma is the second most common cancer in the UK. Pulmonary sarcomatoid carcinoma (PSC) accounts for 0.1% to 0.4% of all lung malignancies and represents an aggressive histologic subtype of non-small cell lung cancer (NSCLC) [1-3]. The 2004 WHO classification identified PSC as a group of poorly differentiated NSCLC that contains components with sarcoma or sarcoma-like (spindle and/or giant cell) features. There are five subgroups of PSC: pleomorphic carcinoma, spindle cell carcinoma, giant cell carcinoma, carcinosarcoma, and pulmonary blastoma [2-5]. Currently, although PSC are difficult to differentiate from other groups of NSCLC, using imaging modalities and biopsies we may have a definitive answer. Positron emission tomography/computed tomography fluorine-18 fluorodeoxyglucose (^{18}F-FDG PET/CT) may provide imaging characteristics of local and distant metastases [3]. Management options include both surgical and conservative approaches depending upon imaging modalities, the clinical stage and the progression of the disease. Air crescent and halo signs are most often associated with benign diseases, like aspergilloma but may be seldom detected in PSC. The current case highlights the importance of differentiating pulmonary aspergilloma from PSC, which can show similar imaging signs.

Case Report

A 67 years old male, who was a government staff, and a heavy smoker presented with nonproductive cough since 12 months. A chest computed tomography (CT) scan with contrast medium showed air crescent and halo signs, in the right upper lung (RUL) which is a high likelihood of aspergilloma. The air crescent sign could also be due to tumor tissue necrosis and the halo to hemorrhage (Figure 1).

After 1 month of anti-aspergillus therapy with voriconazole and amphotericin B-liposome, the morphology of the lesion did not change significantly. Subsequently, CT-guided, fine needle aspiration biopsy (FNAB) of the RUL mass was performed. Histopathology findings revealed spindle cell carcinoma. The patient was referred for ^{18}F-FDG PET/CT (Discovery ST, GE Healthcare, Canada) (Figure 2) to determine the stage of the disease prior to surgery. The scan showed a mass in RUL, measuring 4.5×5.5cm with a maximum standardized uptake value (SUVmax) of 35.5. There were no other suspicious ^{18}F-FDG avid abnormalities apparent on the scan.

The patient underwent video-assisted thoracoscopic surgery, RUL wedge resection and

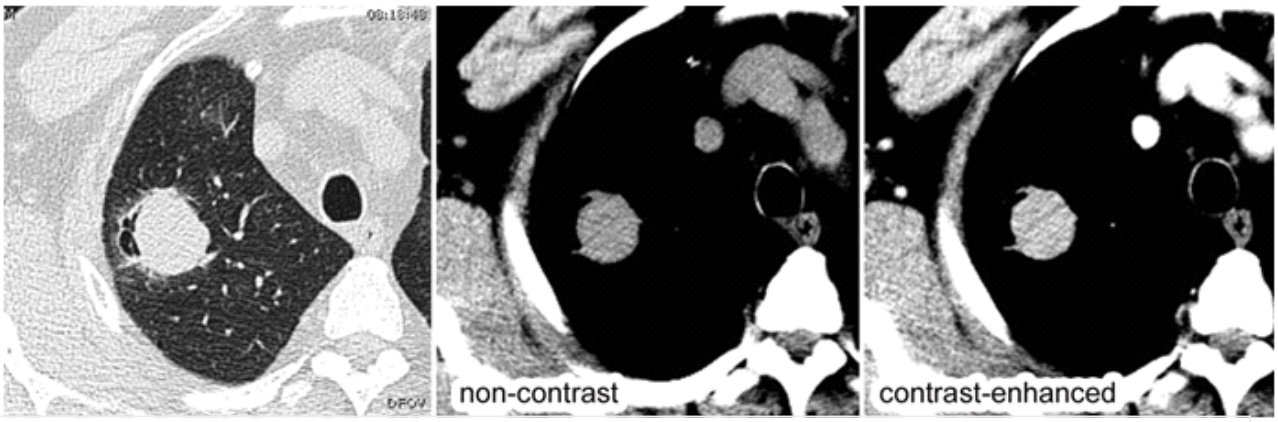

Figure 1. Images of CT scan showed a right upper lung mass, measuring 4.5×5.5cm with air crescent and halo signs, significantly contrast enhanced. Findings are highly suspicious of aspergilloma.

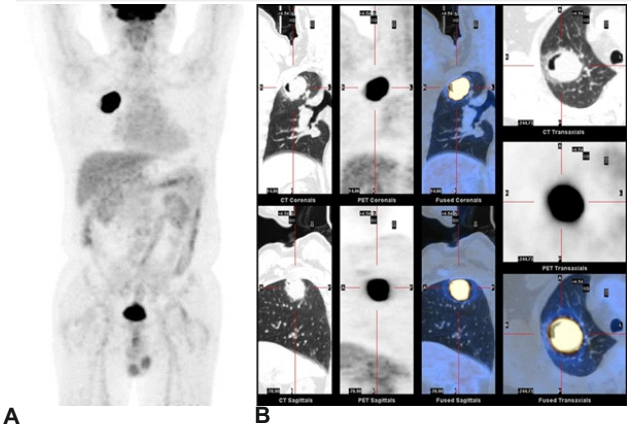

Figure 2. A maximum intensity projection ^{18}F-FDG PET image showed a mass in the right upper lung (RUL), with a maximum standardized uptake value of 35.5 **(A)**. There were no other suspicious ^{18}F-FDG avid abnormalities apparent on the scan. Coronal, sagittal, and transaxial views of the mass in the RUL were observed on an overlay of the CT, PET, and PET/CT images **(B)**.

mediastinal lymph node dissection, the next day. Gross analysis revealed that the tumor was ovoid in shape, poorly circumscribed, grayish-white in color, hard, and necrotic. Microscopically, the tumor was composed of a large number of highly atypical spindle cells and a small number of giant cells. The tumor cells were positive for CK7 and vimentin, and had a high Ki67 index of >40% (Figure 3). The tumor was negative for thyroid transcription factor-1 (TTF-1), napsinA (a functional aspartic proteinase that may be an alternative marker for primary lung adenocarcinoma), P63 (tumor protein p63 is a protein that in humans is encoded by the TP63 gene), SYN (synaptophysin), CD68 (cluster of differentiation 68, a glycoprotein which binds to low density lipoprotein), PAS (periodic acid-Schiff stain is used for the demonstration of glycogen), and GMS (Gomori or Grocott methenamine silver stain is used for the demonstration of fungi). No regional metastatic lymph nodes metastases were observed. The pulmonary PSC was classified as stage IB (T2, N0, M0).

The patient underwent 3 cycles of a chemotherapy consisted of etoposide (VP-16, 100mg/m^2/day) on days 1-3 and cisplatin (DDP, 75mg/m2/day) on day 1. Two months after surgery, multiple bone metastases were detected. The patient died 8 months later.

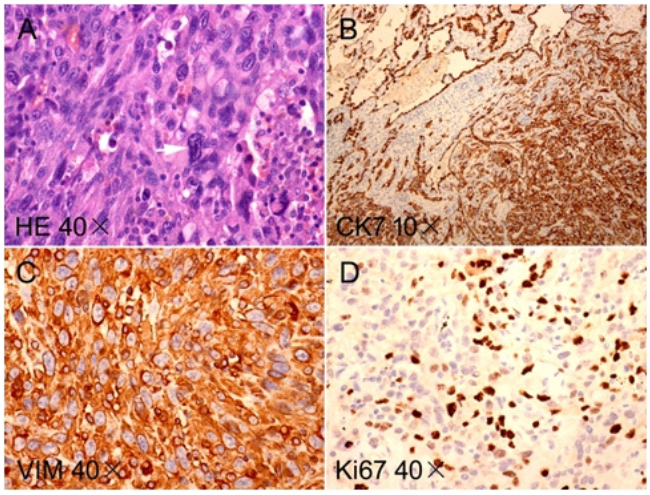

Figure 3. Histopathology examination showed that the tumor consisted of a large number of highly atypical spindle cells **(A)** and a small number of giant cells (white arrow). The tumor cells were positive for CK7 (**B**, lower right portion of the image) and for vimentin**(C)**. The Ki67 index, >40% was high **(D)**.

Discussion

Pulmonary sarcomatoid carcinoma is a rare and aggressive histology subtype of NSCLC [1-4, 6] prevalent in males and in smokers, with an average age at presentation of 60 years [7]. These tumors present as either central or peripheral lesions, often in the upper lung lobes, with a mean size of 5 to 8cm (range, 1-28cm) [2]. These tumors grow by invading the bronchial tree, the pulmonary parenchyma, and adjacent anatomical structures (mediastinum and chest wall) in the form of large, widely necrotic and hemorrhagic, round to bosselated masses that can be soft, variably firm or hard [4]. Symptoms include thoracic pain, cough, and hemoptysis [2]. Diagnosis is made via histopathological evidence [4].

The standard treatment for PSC is similar to that of other NSCLC. Early surgery is the preferred treatment for PSC, during which postoperative adjuvant chemotherapy can be

performed [8, 9]. Life expectancy in patients with PSC is generally considered to be worse than for patients with conventional NSCLC, with an overall 5 years survival of 25% compared with 46% for other types of NSCLC [7].

The PSC tumors are occasionally misdiagnosed by medical imaging examinations, before surgery. They resemble malignant pleural mesothelioma [3] and pulmonary aspergillosis (figure 4) [10, 11].

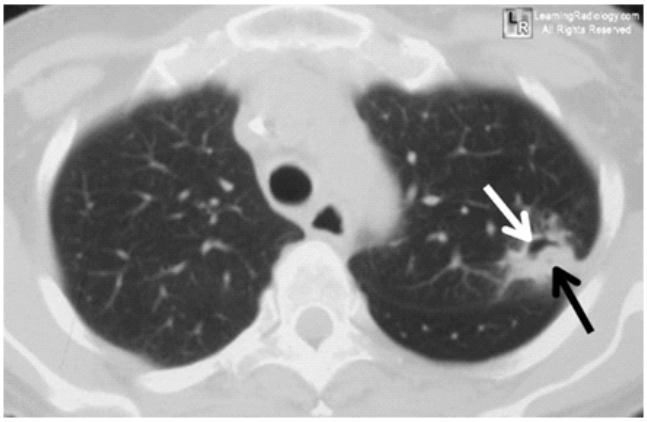

Figure 4. Aspergilloma: The axial CT scan of the chest showed a nodule (black arrow) within an air-filled cavity with a crescent of air at the superior surface of the cavity (white arrow). Aspergilloma usually occurs in a pre-existing cavity due to TB or sarcoid. The ground glass densities in the area around the nodular density are called the "halo sign" and are indicative of hemorrhage.

The medical literature on ^{18}F-PET/CT imaging characteristics of these tumors is very limited [3, 12]. Chuang TL et al (2012) described PSC as a solitary, lobulated pulmonary nodule with increased ^{18}F-FDG uptake. Ciarallo A et al, reported that PSC, diagnosed by biopsy, mimicked malignant pleural mesothelioma on ^{18}F-FDG PET/CT. In our case, the PSC mimicked pulmonary aspergilloma [3].

In conclusion, our case had an image of air crescent and halo signs which are most often associated with benign diseases, like aspergilloma, lung abscess with pus and blood clots, with tuberculous cavitation and with Rasmussen's aneurysm formation [13].

The authors declare that they have no conflicts of interest.

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