

Molecular imaging of carcinoid

To the Editor: Carcinoid tumours, first described in 1888 by Lubarsch [1], represent 2% of all lung tumours and are endobronchial in 90% of the cases [2]. Differentiating them from other causes of bronchial tumours is difficult as they usually present with signs and symptoms of bronchial obstruction like cough, dyspnoea, haemoptysis etc., which are common to all endobronchial tumours. The various diagnostic methods available for pulmonary carcinoids are tumour markers, structural imaging modalities: computerized tomography (CT) scan and magnetic resonance imaging (MRI), functional imaging modalities: somatostatin receptor (SSR) scintigraphy and positron emission tomography (PET) scan, and finally histopathological examinations. However, except tissue diagnosis, none of the other tests diagnose carcinoids with high accuracy. Tumour markers are not very sensitive and cannot localize these tumours [3]. CT scans and MRI reveal a non specific space-occupying lesion [4]. Indium-111 (^{111}In)-SSR scintigraphy does not have a good resolution for very small tumors, which may be of decisive importance for staging and treatment protocols [5]. Fluoro-18-fluorodeoxyglucose (^{18}F -FDG) PET/CT scan has low uptake in carcinoids because of their low metabolic activity [6].

Carcinoids abundantly express somatostatin receptors. Combining SSR analogues with radionuclides and using the spatial resolution of the latest type of fusion PET/CT scan, offer a better sensitivity and specificity for detecting these tumors. Gallium-68 1, 4, 7, 10 tetraazacyclododecane NI-N1111, -tetra acetic acid phe1-thy3-octreotide (^{68}Ga -Dotatoc), has been used as a SSR analogue, in two of our cases that both were clinically and radiologically suggestive of lung cancer [5]. A 53 years old man presented with cough and hemoptysis for the last 2 years. A chest CT scan revealed an irregular, enhancing, mass with focal calcification in the right middle lobe, measuring 80mmX70mmX60mm diagnosed as lung carcinoma. A ^{18}F -FDG PET/CT scan performed for staging, revealed

mild ^{18}F -FDG uptake in the mass with physiological uptake at the rest of the body (Fig. 1, upper panel). A bronchoscopic biopsy at this stage revealed cells with focal positivity for chromogranin and synaptophysin suggesting bronchial carcinoid. To confirm the diagnosis, ^{68}Ga -Dotatoc PET-CT scan was performed, which showed intense radiotracer uptake (Fig. 1, lower panel). At surgery, the tumor occupied the right middle lobe of the lung, extending across the fissures to involve the upper and lower lobes as also lung vessels, hence a right pneumonectomy was performed. The histopathological examination revealed features compatible with a typical carcinoid (Fig. 2). The patient had an uneventful recovery and was well after 9 months. A ^{68}Ga -Dotatoc PET/CT scan performed 8 months after surgery was normal (Fig. 3). Another case of a 35 years old female was similar to the first with breathlessness since 2 years. The CT scan revealed a 38x37x33mm mass occluding the right main bronchus and collapse of the right lung. Bronchoscopic biopsy revealed features consistent with adenocarcinoma. For staging purpose, she was subjected to ^{18}F -FDG PET/CT scan, which showed no significant ^{18}F -FDG uptake in the bronchial mass casting a doubt on the diagnosis of adenocarcinoma (Fig. 4, upper panel). A ^{68}Ga -Dotatoc PET/CT scan revealed intense uptake suggesting the likelihood of a carcinoid (Fig. 4, lower panel). At surgery, the tumor was seen in the right main bronchus. A frozen section taken at the time of surgery was suggestive of a neuroendocrine tumor. The patient underwent sleeve resection of the tumor. Histopathological examination showed a typical bronchial carcinoid. These cases indicate that ^{68}Ga -Dotatoc PET/CT can play an important role in the diagnosis of pulmonary carcinoids. It also helps to assess the adequacy of treatment by looking for residual disease and to monitor the follow-up of these patients by early detection of recurrent disease.

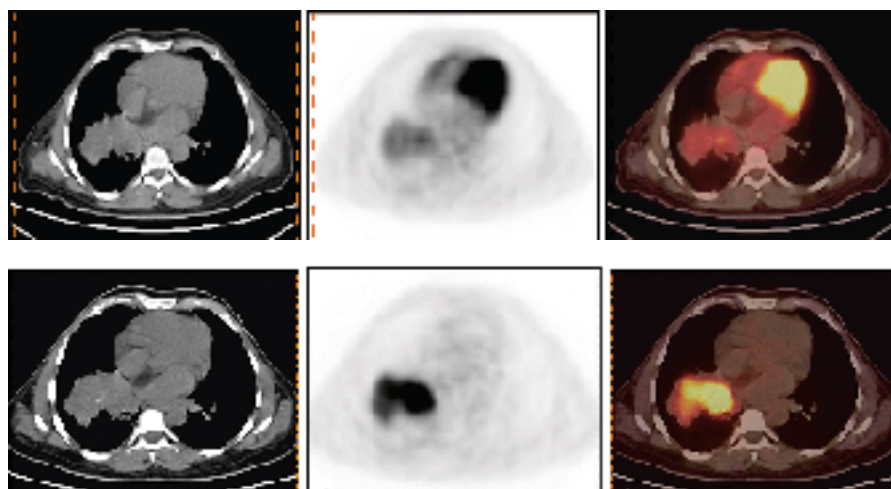


Figure 1. First case, upper panel: Axial section of CT, PET and PET/CT images of ^{18}F -FDG scan. The PET images show an ill-defined soft tissue mass at the right lobe. Lower panel: Axial section of CT, PET and PET/CT images with ^{68}Ga -Dotatoc scan. The PET images show an intense uptake in the above described mass.

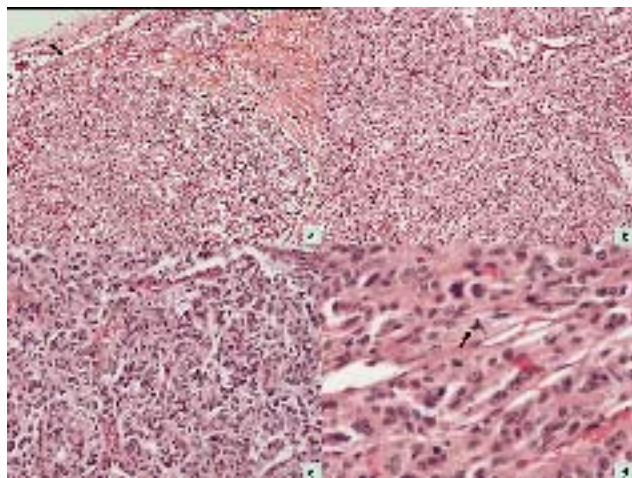


Figure 2. First case: **a:** Photomicrograph shows bronchial epithelium (arrow) with a sub-epithelial tumour arranged in nests (H&E x 40). **b:** Higher-power view shows a nesting pattern of predominantly monomorphic tumour cells with a rich vascular network between (H&E x 100). **c:** Occasionally, bizarre tumour cells are seen in the tumour nests (H&E x 200). **d:** An atypical tripolar mitotic figure is noted on high-power examination (H&E x 400- arrow).

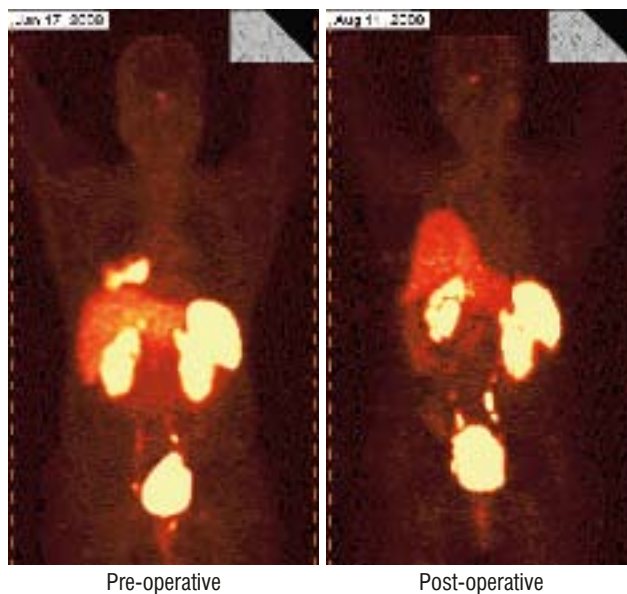


Figure 3. First case. Whole body pre-operative ^{68}Ga -Dotatoc PET/CT scan showing an intense uptake in the right lung mass. Follow-up ^{68}Ga -Dotatoc PET/CT scan performed 8 months post surgery was normal.

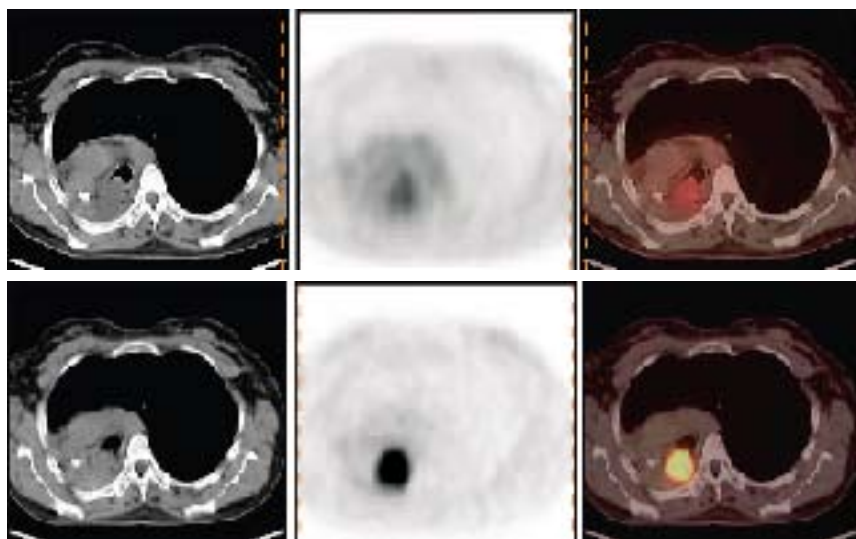


Figure 4. Second case, upper panel: Axial section of CT, PET and PET/CT images with ^{18}F -FDG. The PET scan shows a right bronchial soft tissue mass with lung collapse and very little ^{18}F -FDG uptake. Lower panel: Axial section of CT, PET and PET/CT images with ^{68}Ga -Dotatoc scan. The PET scan shows an intense uptake in the above described mass.

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Hell J Nucl Med 2009; 12(2): 168-169

Published on line: 28 May 2009