Case Report

Is 68Ga-DOTATATE the answer in lung carcinoid? : Case report and review of literature

Amit Bhoil, Bhagwant R. Mittal, Shankaramurthy Gayana, Raghava Kashyap, Anish Bhattacharya, Navneet Singh[1]

Departments of Nuclear Medicine and PET, [1]Pulmonary Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh, India

ABSTRACT

Carcinoid tumors are rich in somatostatin receptors and show high uptake of radiotracer on octreotide scintigraphy. 68Ga-DOTATATE could be of great help at initial staging and during follow-up of these patients. We describe a patient with avid 68Ga-DOTATATE and poor F18-FDG uptake.

KEY WORDS: FDG, 68Ga-DOTATATE, Lung carcinoid, PET/CT

Address for correspondence: Dr. Bhagwant R. Mittal, Department of Nuclear Medicine and PET, PGIMER, Chandigarh, India. E-mail: brmittal@yahoo.com

INTRODUCTION

Carcinoid tumors are part of the spectrum of neuroendocrine tumors, with pulmonary carcinoids being the third most frequent of all tracheo-bronchial tumors. Conventional imaging modalities like computerized tomography (CT) scans and magnetic resonance imaging (MRI) provide structural details of these masses but may not be helpful in differentiating benign from malignant pulmonary tumors. Tissue sampling of these masses with the help of bronchoscopy is considered the gold standard for the diagnosis. Somatostatin receptor imaging may be useful to determine the disease burden in such patients.

CASE REPORT

A 33-year-old male patient presented with a history of cough, occasional breathlessness and haemoptysis for past 4 years. CT scan of the chest showed a well defined lobulated mass lesion measuring 4.18 cm × 3.55 cm in relation to the right hilum and tracheo-bronchial region bulging into the lateral wall of the right main bronchus. No definite area of calcification or necrosis was noted within the lesion. Bronchoscopic biopsy of the lesion revealed the mass to be a carcinoid tumor. No treatment was taken by the patient. Follow up CT scan after a year showed no change in the size of the mass. However, a significant intraluminal component was seen compromising the right main bronchus lumen, with no associated collapse or consolidation of any lung segment. The patient was still not willing to undergo surgery and instead took alternative medication. She subsequently presented with recurrent episodes of pneumonia on follow up after 1½ years. There was no change in the size of the mass but collapse of the right lung with minimal right sided pleural effusion, mediastinal shift and compensatory hyperinflation of the left lung were noted. The patient was subsequently subjected to whole body F18-Fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) imaging scan as well as 68Ga-DOTATATE scan [Figure 1] as a part of the initial staging. Faint FDG uptake (SUV max 2.7) was detected in an enhancing endobronchial soft tissue nodule causing complete obstruction of the right main bronchus with post-obstructive collapse of the right lung, mediastinal shift to the right side and faintly FDG avid pericardial effusion. Mild FDG uptake was also noted in a large enhancing soft tissue mass in the right hemithorax in the right para-vertebral region overlying the right 2nd to 8th ribs abutting the superior vena cava right branch of the pulmonary artery. 68Ga-DOTATATE PET/CT showed intense tracer uptake (SUV max 42.4) with morphological feature similar to those seen in the FDG PET/CT images. Moderate tracer uptake (SUV 11.3) was also noted in multiple enhancing soft tissue nodules in the apex of the right hemithorax and the right para-tracheal

Access this article online

Quick Response Code:

Website: www.lungindia.com

DOI: 10.4103/0970-2113.102839

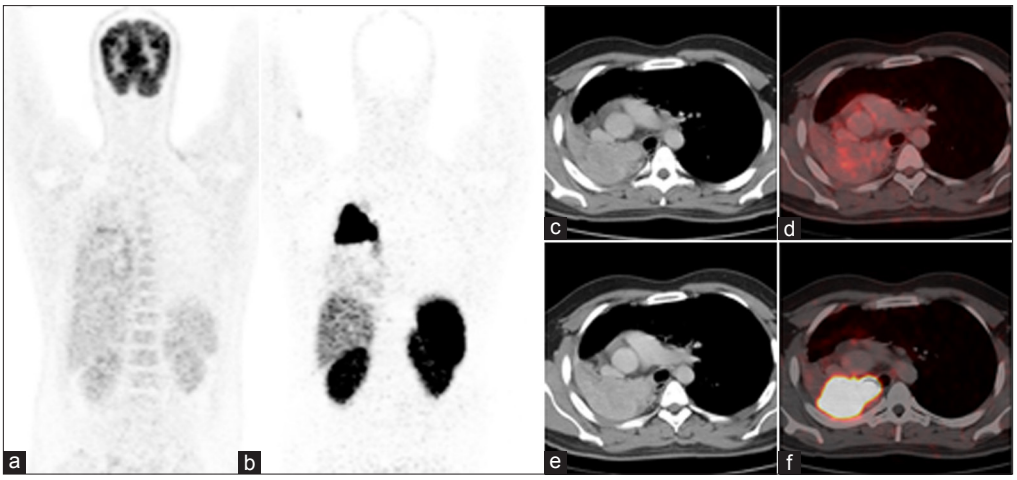

Figure 1: (a) FDG PET/CT maximum intensity projection (MIP) image (b) 68Ga-DOTATATE PET/CT images, MIP (c) transaxial CT image (d) fused PET/CT image showing faint FDG uptake in an enhancing soft tissue mass in the right main bronchus,(e) transaxial CT and (f) fused PET/CT showing intense tracer uptake (SUV max 42.4) in an enhancing soft tissue nodule in the right main bronchus. Minimal DOTATATE uptake is also noticed in the collapsed lung

region with faint tracer uptake in the pericardial effusion. Subsequently, the patient underwent right lung lobectomy in a different hospital. The histopathology revealed a greyish white tumor measuring 6 cm × 5 cm × 4 cm in the upper lobe arising from the bronchus with tumor features compatible with a typical carcinoid. The tumor cells were immunopositive CK, synaptophysin, chromogranin, CD-56 and negative for TTF-1. MIB 1 labelling index was <2%. The regional lymph nodes showed reactive changes and were free from tumor. The histopathological findings corroborated with the 68Ga-DOTATATE uptake seen.

DISCUSSION

Carcinoid tumors were first described by Lubarsch in 1888.[1] Pulmonary carcinoids are the third most frequent pulmonary tumors following non-small cell lung cancer and small cell lung cancer with an incidence of about 1% of all tracheobronchial tumors.[2] Conventional imaging modalities like CT and MRI provide structural details of these masses without any specific signs to differentiate these tumors from one another.[3] Radiological findings also do not help to differentiate benign from malignant pulmonary tumors.[2] Bronchoscopic tissue sampling of these tumor masses is the gold standard for the diagnosis, but is invasive, carries its share of complications and may not always provide a diagnosis.[4]

According to the WHO classification, carcinoid tumors are assigned to the neuroendocrine group of tumors.[5] As these tumors are rich in somatostatin receptors (SSRs), they typically show high tracer uptake on Ga68-DOTA-NOC PET scan.[2,6] The most commonly used somatostatin analogue is Indium111-diethylenetriaminepentaacetic acid (DTPA)-octreotide (In111 -octreotide). Newer analogues such as DOTA-Tyr3 octreotide (DOTATOC) show better uptake than In111-octreotide. Fluorodeoxyglucose (FDG), a D-glucose analogue preferentially accumulates in malignant tumors because of increased glucose metabolism and is useful in differentiating benign from metabolically active malignant lesions.[7] Typical pulmonary carcinoids are slowly growing tumors. Their FDG uptake is intermediate between benign and malignant lesions and may be comparable with benign lesions, which can lead to false-negative results on PET imaging.[2] F18-FDG is therefore thought to be of limited value in the evaluation of these patients.[8]

Atypical carcinoids are more metabolically active than typical carcinoids.[4] They are more often localized peripherally and half of them show lymph node involvement or distant metastases at the time of diagnosis. The main criterion to distinguish typical from atypical carcinoids is the number of mitoses.[2] Most pulmonary carcinoids are of the indolent type with metastases seen in only 15% and with a 5-year survival of over 90%.[8] The primary therapeutic goal is complete surgical resection of the carcinoid, including systematic mediastinal lymph node dissection.[2] Chong *et al*. have reported higher FDG uptake in large cell and small cell neuroendocrine carcinomas.[9] 68Ga-DOTATATE has been shown to be superior to F18-FDG in typical (histologically well differentiated) bronchial carcinoids and to correctly delineate endobronchial tumor from adjacent atelectasis.[8] The avidity of 68Ga-DOTATATE may be useful to identify sites of possible dedifferentiation at initial staging as well as during follow-up period.[8] Hofmann *et al*. compared the diagnostic values of In111-octreotide scintigraphy and Ga68-DOTATOC PET to morphologic imaging. While Ga68-DOTATOC PET identified all the lesions, In111-octreotide scintigraphy identified only 85% of the lesions.[10] 68Ga-DOTATATE uptake in higher grade or metastatic bronchial carcinoids is likely to be less intense and less extensive.[8] Imaging with this tracer may be of significant clinical value because of the potential for targeted radionuclide therapy with Lu177-DOTATATE.[11] The Ki67 index is one of the most useful discriminators of tumor grade and is a prognostic

marker in neuroendocrine tumors.[12] A relationship has been shown between F18-FDG and 68Ga-DOTATATE uptake and tumor proliferation assessed with the Ki67 index in gastroenteropancreatic neuroendocrine tumors.[13] Haug *et al*[14] have also reported the useful contribution of 68Ga-DOTATATE PET/CT in predicting the time to progress (TTP) and treatment outcome in patients with well-differentiated neuroendocrine tumors undergoing peptide receptor radiotherapy.

REFERENCES

1. Lubarsch O. Ueber den primaren krebs des ileum, nebst bemerkungen uber das gleichzeitige vorkommen von krebs und tuberkolose. Virchows Arch 1888;111:280-317.
2. Kruger S, Buck AK, Blumstein NM, Pauls S, Schelzig H, Kropf C, *et al*. Use of integrated FDG PET/CT imaging in pulmonary carcinoid tumours. J Intern Med 2006;260:545-50.
3. Ko JM, Jung JI, Park SH, Lee KY, Chung MH, Ahn MI, *et al*. Benign tumors of the tracheobronchial tree: CT-pathologic correlation. AJR Am J Roentgenol 2006;186:1304-13.
4. Kumar A, Jindal T, Dutta R, Kumar R. Functional imaging in differentiating bronchial masses: An initial experience with a combination of (18) F-FDG PET-CT scan and (68)Ga DOTA-TOC PET-CT scan. Ann Nucl Med 2009;23:745-51.
5. Kulke MH, Mayer RJ. Carcinoid tumors. N Engl J Med 1999;340:858-68.
6. Al-Nahhas A, Win Z, Szyszko T, Singh A, Khan S, Rubello D. What can gallium-68 PET add to receptor and molecular imaging? Eur J Nucl Med Mol Imaging 2007;34:1897-901.
7. Morandi U, Casali C, Rossi G. Bronchial typical carcinoid tumors. Semin Thorac Cardiovasc Surg 2006;18:191-8.
8. Kayani I, Conry BG, Groves AM, Win T, Dickson J, Caplin M, *et al*. A comparison of 68Ga-DOTATATE and 18F-FDG PET/CT in pulmonary neuroendocrine tumors. J Nucl Med 2009;50:1927-32.
9. Chong S, Lee KS, Kim BT, Choi JY, Yi CA, Chung MJ, *et al*. Integrated PET/CT of pulmonary neuroendocrine tumors: Diagnostic and prognostic implications. Am J Roentgenol 2007;188:1223-31.
10. Hofmann M, Maecke H, Börner R, Weckesser E, Schöffski P, Oei L, *et al*. Biokinetics and imaging with the somatostatin receptor PET radioligand (68)Ga-DOTATOC: Preliminary data. Eur J Nucl Med 2001;28:1751-7.
11. Gabriel M, Decristoforo C, Kendler D, Dobrozemsky G, Heute D, Uprimny C, *et al*. 68Ga-DOTATyr3-octreotide PET in neuroendocrine tumors: Comparison with somatostatin receptor scintigraphy and CT. J Nucl Med 2007;48:508-18.
12. Laitinen KL, Soini Y, Mattila J, Paakko P. Atypical bronchopulmonary carcinoids show a tendency toward increased apoptotic and proliferative activity. Cancer 2000;88:1590-8.
13. Kayani I, Bomanji JB, Groves A, Groves A, Conway G, Gacinovic S, *et al*. Functional imaging of neuroendocrine tumors with combined PET/CT using 68Ga-DOTATATE (DOTA-Phe(1),Tyr(3)- octreotate) and 18F-FDG. Cancer 2008;112:2447-55.
14. Haug AR, Auernhammer CJ, Wängler B, Schmidt GP, Uebleis C, Göke B, *et al*. 68Ga-DOTATATE PET/CT for the early prediction of response to somatostatin receptor-mediated radionuclide therapy in patients with well-differentiated neuroendocrine tumors. J Nucl Med 2010;51:1349-56.

How to cite this article: Bhoil A, Mittal BR, Gayana S, Kashyap R, Bhattacharya A, Singh N. Is 68Ga-DOTATATE the answer in lung carcinoid? : Case report and review of literature. Lung India 2012;29:378-80.

Source of Support: Nil, **Conflict of Interest:** None declared.