

Angiogenesis Imaging of Adrenocortical Carcinoma with Ga-68-NODAGA-RGD Positron Emission Tomography: Opening New Horizons in Multimodality Imaging from Theranostic Perspective

Abstract

A 53-year-old female, with a known case of adrenocortical carcinoma (ACC), underwent F-18 fluorodeoxyglucose (FDG) positron emission tomography/computed tomography (PET/CT) for initial staging, which revealed FDG avid large left suprarenal mass contiguous with hypermetabolic tumor thrombus in the inferior vena cava (IVC) through the left renal vein. Thereafter, she underwent angiogenesis imaging using Ga-68-NODAGA-RGD PET/CT, which showed similar avid tracer uptake in both primary and IVC thrombus. Demonstration of RGD avidity in ACC in this case opens a new horizon for targeted radionuclide therapy (e.g., Lu-177 RGD) in selected patients, who may have limited therapeutic options.

Keywords: Adrenocortical carcinoma, F-18 fluorodeoxyglucose positron emission tomography/computed tomography, Ga-68-NODAGA-RGD positron emission tomography/computed tomography, Lu-177 RGD

A 53-year-old female, a diagnosed case of adrenocortical carcinoma (ACC) was referred for F-18 fluorodeoxyglucose positron emission tomography/computed tomography (F-18 FDG PET/CT) for initial staging [Figure 1a whole-body maximum intensity projection (MIP) image, b and c axial coregistered PET/CT images] which revealed a large well-defined heterogeneous left suprarenal mass with central hypodense necrotic areas (thick arrow in MIP image). The lesion measured 7.8 cm × 6.6 cm × 8.2 cm (AP × TR × CC) with an intense peripheral FDG uptake (SUVmax: 10.2) and a contiguous hypermetabolic thrombus (SUVmax: 7.9) that was infiltrating into the inferior vena cava (IVC) through the left renal vein up to the level of D-11 vertebra. Ga-68-NODAGA-RGD PET/CT in this patient showed avid uptake in the tumor with SUVmax of 18.55 (thin arrow in MIP) [Figure 1d whole-body MIP image, e and f axial coregistered PET/CT images]. Ga-68-NODAGA-RGD uptake was greater than the physiological uptake in the liver (7.79) and spleen (5.54). Additionally increased tracer uptake in the tumor thrombus was observed in IVC through the renal vein (SUVmax: 5.57). Figure 1g and h show contrast-enhanced CT images elucidating the left suprarenal mass with left renal and IVC invasion.

ACC is a rare malignant neoplasm with a poor survival.^[1,2] The majority of ACC is in the advanced stage at the time of presentation leading to poor prognosis.^[3] Radical surgery of the primary tumor irrespective of the disease stage improves survival^[4] even though patients operated at an earlier stage have better outcomes.^[5] Therefore, early diagnosis and localization of metastases are critical in the management of ACC. F-18 FDG PET is useful in the detection of primary ACC and metastatic lesions.^[6-9]

Oncologic imaging of angiogenesis with theranostic implications has been used for the evaluation of solid tumors including glioblastoma multiforme, squamous cell carcinoma of the head and neck, nonsmall cell lung cancer, breast cancer, melanoma, sarcoma, renal cancer, rectal cancer, and radioiodine refractory thyroid cancers with proven therapeutic benefit in the latter.^[10-13]

Pereira *et al.* have shown that blood vessel density is increased in ACC, implying that angiogenesis could play an important role in the biologic behavior of these tumors.^[14] As a corollary of the above, imaging using various radiolabeled derivatives of Arg-Gly-Asp (RGD) peptides, for example,

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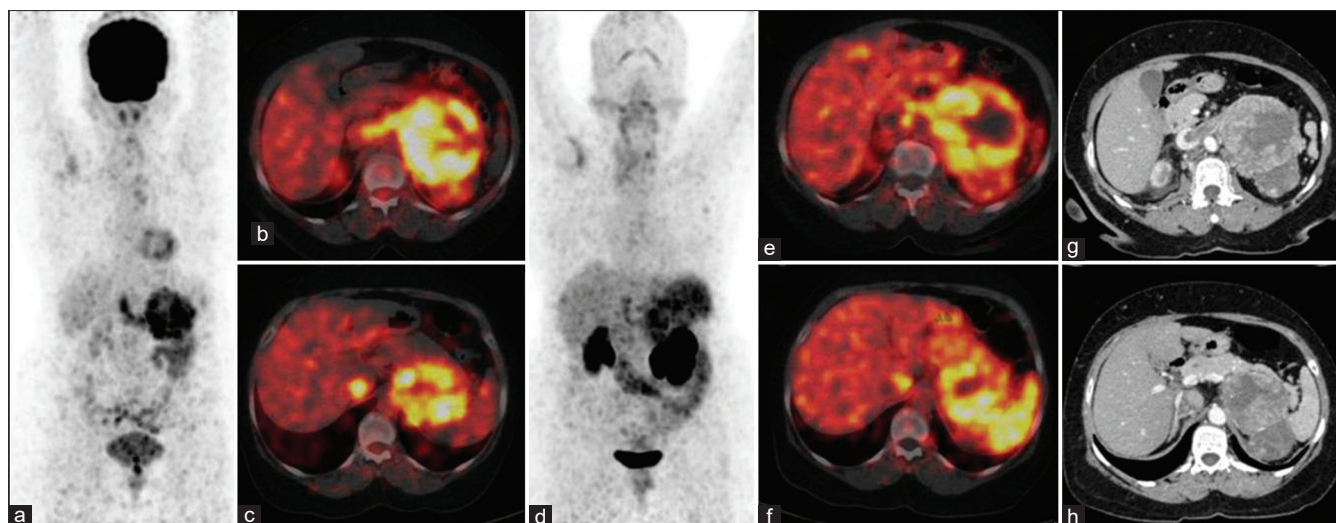


Figure 1: 18F-FDG PET/CT for initial staging (a whole body MIP image, b and c axial PET/CT images) revealed a large heterogeneous left supra renal mass with central hypodense necrotic areas and a contiguous hypermetabolic thrombus infiltrating into the inferior vena cava through left renal vein up to the level of D-11 vertebra. 68Ga-NODAGA-RGD PET/CT showed avid uptake in the tumor with (d whole body maximum intensity projection image, e and f axial co registered PET/CT images). 68Ga-NODAGA-RGD uptake was greater than the physiological uptake in the liver and spleen. Additionally increased tracer uptake in the tumor thrombus was observed in IVC through renal vein. CT images (g and h) show left suprarenal mass with left renal and IVC invasion

Ga-68-NODAGA-RGD may be useful in functional imaging of angiogenesis in ACC as has been shown in the present case. Avid tracer uptake in both primary ACC and contiguous IVC tumor thrombus opens a new horizon for targeted alpha or beta emitters labeled RGD (e.g., Lu-177 RGD) therapy, which might be useful in selected patients (especially in those with inoperable and metastatic disease) in reducing the tumor burden and improving the quality of life. However, prospective studies with larger number of patients are required to validate our preliminary findings.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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