

## **$^{18}\text{F}$ -FDG PET/CT vs. $^{68}\text{Ga}$ -PSMA-11 PET/CT in evaluation of distant metastatic disease in recurrent Renal Cell Carcinoma**

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### **Abstract:**

The prostate-specific membrane antigen (PSMA) expression has been observed in neo-vasculature of various malignancies. We present a case of metastatic renal cell carcinoma (RCC), with comparative FDG-PET/CT and  $^{68}\text{Ga}$ -PSMA-11 imaging, in which FDG-PET/CT failed to detect metastatic thyroid disease and showed less FDG concentrating lesions in other sites, while  $^{68}\text{Ga}$ -PSMA-11 PET/CT scan identified metastatic thyroid disease and demonstrated intensely PSMA expressing distant metastatic lesions.  $^{68}\text{Ga}$ -PSMA-11 PET/CT may be contemplated a potentially useful imaging technique in RCC to detect metastasis and also to guide choice of specific treatments like PSMA-based radionuclide therapy in patients with recurrent metastatic RCC.

### **Introduction:**

PSMA is a type II transmembrane glycoprotein, highly expressed in prostate cancer, where  $^{68}\text{Ga}$ -PSMA-11 PET/CT constitutes an important molecular imaging modality in management of patients. The over-expression of PSMA is not limited to prostate cancer only and has been also observed in neo-vasculature of several non-prostatic tumors such as RCC, where the role of radiolabeled PSMA is being explored for theranostic purposes (1,2).

### **Case report:**

A 60-year-old male underwent left nephrectomy for clear cell variant of RCC 8 years previously. He received Sunitinib for metastatic lung disease 3 years back and recently complained of left sided chest pain and swelling of 2 months' duration. FDG-PET/CT (Fig 1) showed mild-to-moderate grade FDG avid soft tissue mass (SUVmax:6.40, measured

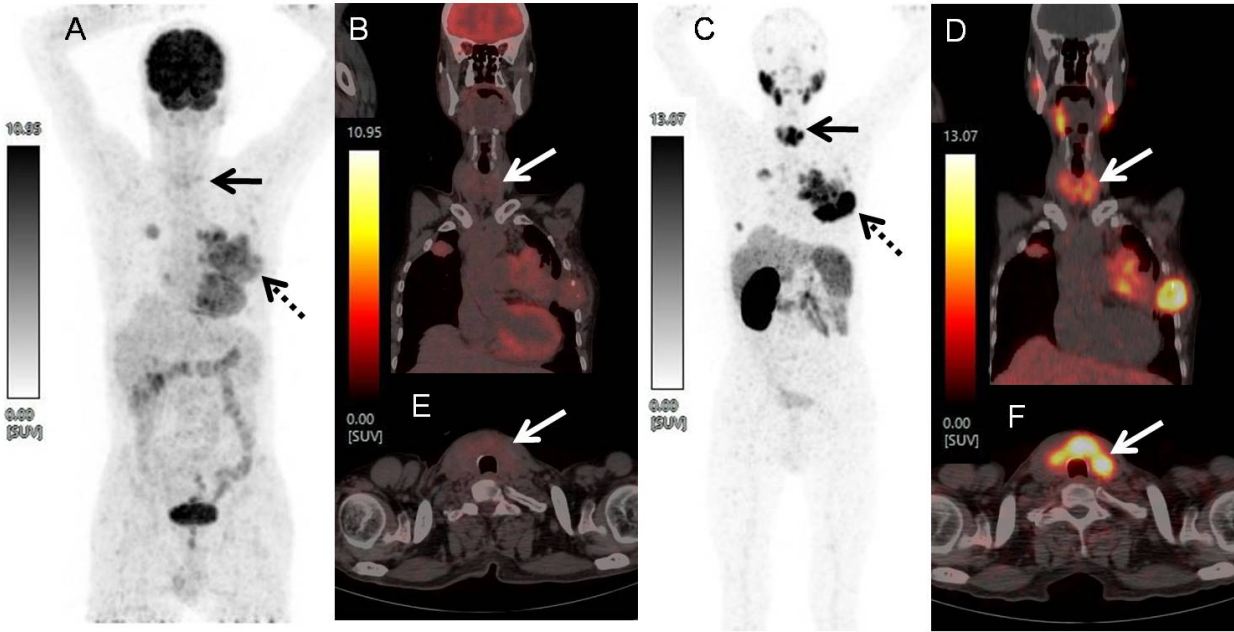
10.1x6.3x9.5cm) in left chest wall, soft tissue lesions in mediastinal and nodules in bilateral lungs. <sup>68</sup>Ga-PSMA-11 PET/CT, undertaken 5 days after FDG-PET with 111 MBq (3 mCi) of <sup>68</sup>Ga-PSMA-11 at 60 minutes acquisition, showed intensely PSMA expressing left chest wall mass (SUVmax:22.49, dotted arrow in 1C), mediastinal lesions and bilateral lung nodules. In addition, intensely PSMA avid hypodense thyroid lesions (white arrow in 1D and 1F) were demonstrated in fused coronal(1D) and trans-axial(1F) images. Subsequently, FNAC from thyroid lesions demonstrated them to be metastasis from RCC.

### **Discussion:**

RCC is a highly aggressive lethal cancer with tendency of distant metastatic spread. The notable features of RCC are late recurrence and distant metastases after initial diagnosis. Metastatic spread of RCC to head and neck region is less frequent. Of this uncommon metastatic spread to head-neck region, thyroid is the most commonly involved organ (2,3). The clinical utility of FDG-PET/CT for evaluation of recurrent RCC, is doubtful because of variable glucose metabolism and biological characteristics of RCC. PSMA is over-expressed in neo-vasculature of RCC particularly in clear cell subtypes, leading to clinical use of <sup>68</sup>Ga-PSMA-11 PET/CT for detection of distant metastases (4). In a recent report, concordant FDG and PSMA uptake in metastatic lesions was seen in majority cases of RCC, but limited number of cases showed discordant uptake, favoring PSMA uptake in metastatic lesions. However, to support this, concrete evidence with prospective studies is lacking. <sup>68</sup>Ga-PSMA-11 PET/CT imaging has shown number of advantages for evaluation of RCC patients (5-7), such as (i) higher PSMA uptake in lesions as compared to FDG uptake leading to high lesion detection rate, (ii) future possible role in therapeutic response assessment for various therapies e.g. antiangiogenic agents, immune checkpoint inhibitors and stereotactic radiation and (iii) future potential in theranostics [PSMA-PET/CT imaging and treatment with PSMA labeled with  $\beta$ -emitting (<sup>177</sup>Lu or <sup>90</sup>Y) or  $\alpha$ -emitting (<sup>225</sup>Ac) radionuclides] in PSMA positive lesions. In the present case, PSMA uptake was higher as compared to FDG uptake in all metastatic lesions and discordant positive uptake for metastatic thyroid lesion. Knowledge of this may be helpful for management and future treatment planning in RCC.

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**Figure 1:** The maximum intensity projection (MIP) image of  $^{18}\text{F}$ -FDG PET/CT (A) showed mildly FDG avid soft tissue mass (SUVmax:6.40, measured 10.1x6.3x9.5cm) in left chest wall, soft tissue lesions in mediastinal and nodules in bilateral lung regions. No abnormally increased FDG uptake was noted in fused coronal (B) and trans-axial (E) images of neck region. The  $^{68}\text{Ga}$ -PSMA-PET/CT showed intensely PSMA expressing left chest wall mass (SUVmax:22.49), mediastinal lesions and bilateral lung nodules (C). Additionally, intensely PSMA avid hypodense thyroid lesions were seen in fused coronal (D) and trans-axial (F) images.