^{68}Ga-PSMA PET/CT versus ^{18}F-FDG PET/CT for detecting lesions in a case of fumarate hydratase-deficient renal cell carcinoma

Abstract

Gallium-68 (^{68}Ga)-prostate-specific membrane antigen (PSMA) positron emission tomography/computed tomography (PET/CT) and fluorine-18-fluorodeoxyglucose (^{18}F-FDG) PET/CT were performed for staging in a 51-year-old man with renal cell carcinoma. Compared with ^{18}F-FDG PET/CT, no obvious tracer uptake in right renal mass and less metastatic lesions were found on ^{68}Ga-PSMA PET/CT. Postoperative pathology demonstrated the diagnosis of fumarate hydratase-deficient renal cell carcinoma (FHRCC).

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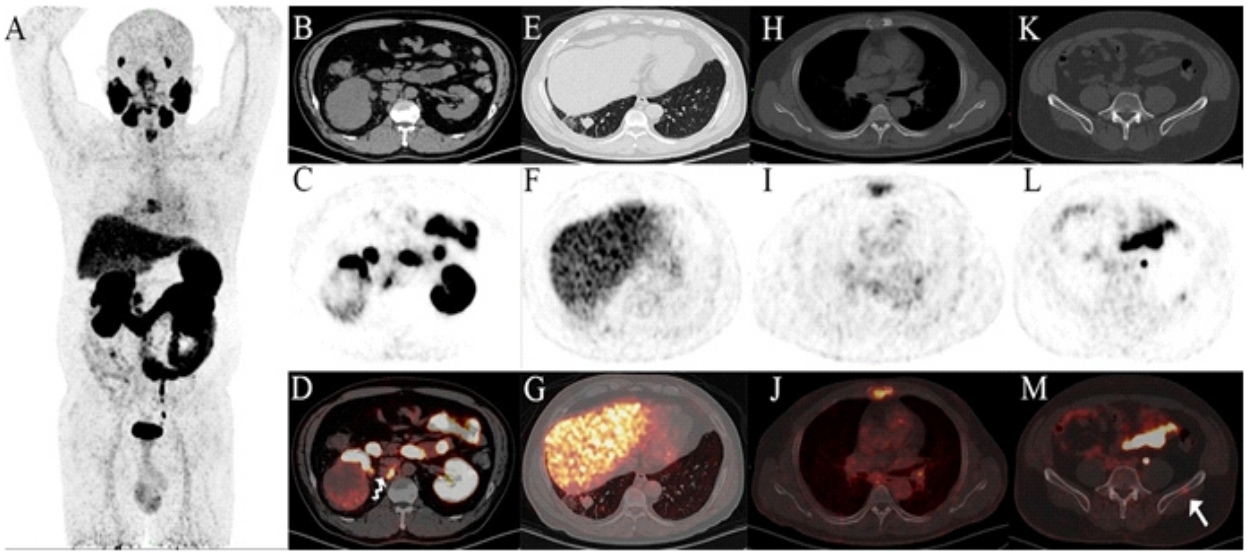

Figure 1. A 53-year-old man was referred to our hospital due to right renal mass. The cytopathology of fine needle aspirationin other hospital indicatedrenal cell carcinoma. The ^{68}Ga-PSMA PET/CT and ^{18}F-FDG PET/CT were performed for staging. Maximum-intensity projection (MIP) image (A) revealed several foci on ^{68}Ga-PSMA PET/CT. No obvious PSMA avidity was detected in right renal mass (B-D) and pulmonary nodules (E-G); mild PSMA accumulation was found in local swollen lymph nodes (bent arrow, B-D), sternum (H-J) and left ilium (arrow, K-M), with maximum standardized uptake value (SUVmax) 8.56, 7.08 and 3.14 respectively.

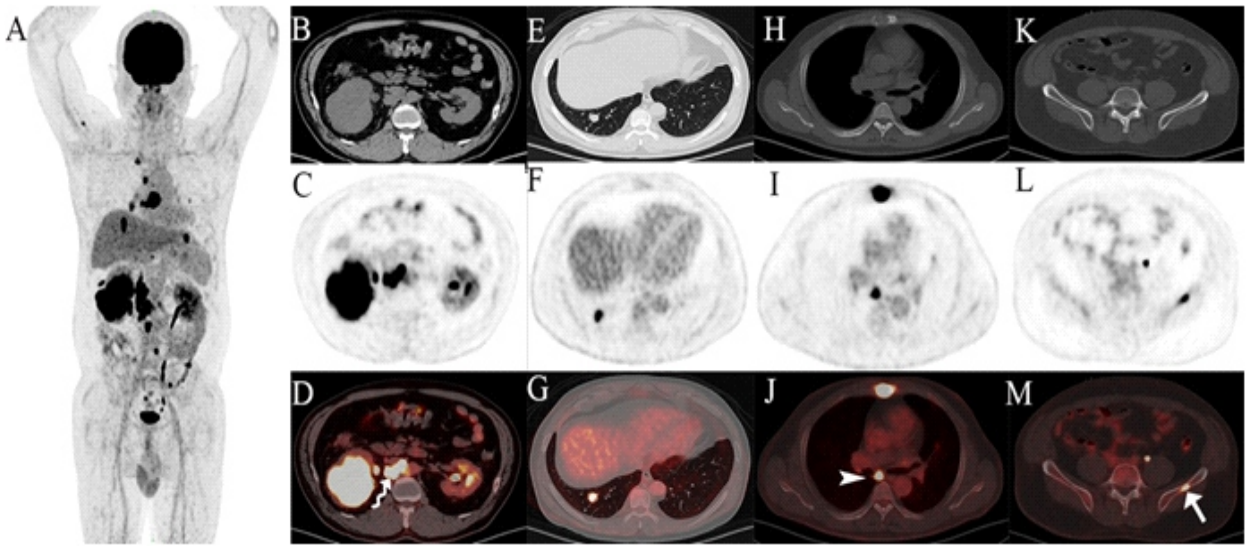

Figure 2. Fluorine-18-FDG PET/CT was further performed next day. Maximum-intensity projection revealed multiple foci on ^{18}F-FDG PET/CT (A). Axial CT, PET and fused images found intense ^{18}F-FDG uptake in right renal mass with SUVmax 25.59 (B-D)and local lymph nodes with SUVmax 38.37 (bent arrow, B-D). Besides, pulmonary nodules (E-G), sternum, mediastinal lymph nodes(arrow head, H-J) and left ilium (arrow, K-M) also presented intense ^{18}F-FDG uptake, with SUVmax 19.18, 22.46, 16.78 and 10.66, respectively.

Combined the imaging results of two tracers, we draw the conclusion that renal cancer with metastases of local lymph nodes, lung, bone, and mediastinal lymph nodes. Subsequent radical right nephrectomy was performed [1], and postoperative pathology revealed the diagnosis of FHRCC. Prostate-specific membrane antigenis a type II integral membrane glycoprotein which is highly expressed in prostate cancer cells and tumor-associated neovasculature of other solid tumors [2]. Baccala et al. (2007) [3] demonstrated PSMA is also expressed in tumor-associated neovasculature of RCC, especially in clear cell renal cell carcinoma (ccRCC). Besides, Spatz et al. (2018) [3, 4] found higher expression of PSMA had worse survival. The first application of PSMA PET/CT on ccRCC was reported in 2014 and promising results were found [5, 6]. Afterwards, PSMA PET/CT was increasingly used in RCC for diagnosis and staging. The SUVmax of primary renal tumors on ^{68}Ga-PSMA PET/CT can predict aggressive pathological features and the expression of vascular endothelial growth factor receptors and platelet-derived growth factor in RCC patients [7, 8]. With evidence increasing, ^{68}Ga-PSMA PET/CT was found with high false negative in some non-ccRCCs, including papillary RCC, chromophobe RCC, unclassified RCC and Xp11 translocation RCC [9-13]. Fumarate hydratase-deficient renal cell carcinoma is a rare non-ccRCC characterized by the deficiency of fumarate hydratase (FH), which is induced by the germline / somatic gene of FH gene [14-16]. The deficiency of FH would disrupt tricarboxylic acid cycle and activate hypoxia-inducible factor-1, which can increase glucose uptake [17]. To our knowledge, there were no cases reported the imaging of ^{68}Ga-PSMA PET/CT in FHRCC and compared the ability of ^{68}Ga-PSMA PET/CT and ^{18}F-FDG PET/CT in detecting lesions in FHRCC. Based on above imaging results, we thought ^{18}F-FDG PET/CT may be more suitable than ^{68}Ga-PSMA PET/CT in FHRCC patients for detecting primary and metastatic lesions.

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