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Incidental Detection of Meningioma by ^{18}F -FMAU PET/CT in a Patient with Suspected Prostate Cancer

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Abstract

We report on an incidental detection of a meningioma on [^{18}F]-2'-fluoro-5-methyl-1-beta-D-arabinofuranosyluracil (^{18}F -FMAU) PET/CT scan that was performed during a prospective investigation of ^{18}F -FMAU PET/CT for targeted biopsy of potential sites of tumor in men with suspected prostate cancer based on elevated prostate specific antigen level. Neither prostate multiparametric MRI nor ^{18}F -FMAU PET/CT localized small volume Gleason 3+3 tumor deposits. However, an incidental focal high accumulation of ^{18}F -FMAU was observed in high right parietal lobe that displayed characteristics of a meningioma on a subsequent brain MRI.

Keywords

Prostate; Cancer; FMAU; PET; CT; meningioma

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Figure 1.

A 69-year-old man with elevated serum prostate-specific antigen (PSA) level of 6.9 ng/mL and suspected prostate cancer underwent a clinical 3T multi-parametric magnetic resonance imaging (MRI) of the prostate gland and an Internal Review Board approved whole body research protocol PET/CT with ^{18}F -FMAU. The maximum intensity projection PET/CT showed normal biodistribution of ^{18}F -FMAU except for a focal intense activity in the right head region (A). Axial ^{18}F -FMAU PET (B), axial CT at brain window level (C) and axial fused PET and CT at brain window level (D) localized the focal tracer accumulation to high right parietal lobe (SUVmax 6.2, mediastinal blood pool SUVmean 0.4) without definite localizing sign on CT alone. A follow-up 3T brain MRI (post-contrast T1-weighted

sequence is shown; T1 pre-contrast, T2/FLAIR, GRE, and DTI sequences are not shown) demonstrated homogeneously enhancing, round, $1.5 \times 1.4 \times 0.9$ cm extra-axial mass compatible with a meningioma (E). Meningiomas are the most common nonglial primary brain tumors (1). The mainstay imaging study for diagnosis of meningioma is contrast-enhanced MRI that demonstrates isointense to slightly hypointense signal on T1-weighted, hyperintense signal on T2-weighted and homogeneous post-contrast T1 sequence enhancement relative to normal brain cortex (2). PET/CT is not routinely used in the imaging evaluation of meningiomas. However, meningioma can accumulate a variety of PET radiotracers (e.g. ^{18}F -fluorodeoxyglucose, ^{11}C - or ^{18}F -labeled amino acids ^{11}C - or ^{18}F -labeled choline, ^{11}C -acetate, ^{13}N - NH_3 , ^{68}Ga -DOTA-peptides, and radiolabeled prostate-specific membrane antigen agents) (3). ^{18}F -FMAU is a thymidine analog that tracks the thymidine salvage pathway of DNA synthesis and after phosphorylation by thymidine kinase (TK, mitochondrial TK2 > cytoplasmic TK1) is incorporated into the DNA and has been investigated for tumor imaging (4–7). The high accumulation of ^{18}F -FMAU in meningioma may be related to the enhanced TK enzymatic activity in meningiomas (8). With regards to the prostate gland in this case, multi-parametric MRI showed diffusely heterogeneous gland and PET demonstrated diffuse mild tracer localization (not shown). A subsequent prostate biopsy demonstrated low volume tumor deposits in 3 of 15 biopsy specimens (0.5–1.5 mm length, 5–10% tumor, Gleason 3+3). Neither multi-parametric MRI nor ^{18}F -FMAU PET/CT localized these small tumor deposits.