All that glitters is not prostate cancer: incidental finding of PSMA-avid meningioma

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Abstract
We present a case of a 79 year old patient with a medical history of unilateral nerve-sparing radical prostatectomy due to a pT3aN0 (Gleason score 7) prostate carcinoma. Because of slightly elevated prostate specific antigen (PSA) level (0.35ng/dL), a fluorine-18-prostate specific membrane antigen ([18]F-PSMA)-1007 positron emission tomography/computed tomography (PET/CT) scan was performed, showing no signs of malignant recurrence. However, a moderately PSMA-avid nodular lesion was observed in the left occipital region with homogeneous contrast enhancement, suggestive for a meningioma, which was confirmed on magnetic resonance imaging (MRI). One year later, the lesion was resected due to a small but significant growth. Histology confirmed the diagnosis of a transitional type meningioma (WHO grade 1).

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Introduction

We present a case of a 79 year old patient with a medical history of unilateral nerve-sparing radical prostatectomy due to a pT3aN0 (Gleason score 7) prostate carcinoma (PCa). Biochemical recurrence was detected eight months after surgery, external irradiation of the prostate lodge was performed with complete biochemical remission. Almost one year later, prostate specific antigen (PSA) levels rose again to 0.19ng/mL. A carbon-11 ([11]C)-choline positron emission tomography/computed tomography (PET/CT) was performed showing no underlying malignancy. Due to a doubling time of less than 12 months, treatment with a nonsteroidal anti-androgen bicalutamide was started leading to a complete biochemical response after seven months. After five years of stable, undetectable PSA levels (<0.01ng/mL), bicalutamide was ceased with 6-monthly biochemical follow-up. Eighteen months later, because of slightly elevated PSA levels (0.35ng/mL, doubling time 65 days), a fluorine-18-prostate specific membrane antigen ([18]F-PSMA)-1007 PET/CT scan with CT-contrast enhancement was performed to detect a focus of recurrent PCa. Prostate specific membrane antigen is a type II transmembrane glycoprotein consisting of an intracellular, transmembrane, and an extensive extracellular domain, which is overexpressed in PCa and has been positively associated with tumour aggressiveness markers such as the Gleason score [1]. This overexpression makes the PSMA-receptor a valuable target for molecular imaging, although some pitfalls do exist and must be accounted for. On the one hand, PSMA expression in non-prostatic malignancies occurs and is mainly related to the tumour neo-vasculature in contrast to the predominantly epithelial expression in PCa [2, 3]. On the other hand, high physiologic uptake is seen in the lacrimal, parotid and submandibular glands and more subtle activity can be seen in sites of benign bone lesions [4-6]. Another well-known pitfall is the physiological uptake in sympathetic ganglia [7, 8]. In our patient, the [18]F-PSMA-1007 PET/CT scan showed no signs of malignant recurrence. However, a moderately PSMA-avid nodular lesion was observed in the left occipital region with homogeneous contrast enhancement, suggestive for a meningioma. Figure 1 (A-C) show PET, CT and fused images. The maximum intensity projection of the PET illustrates the relatively low PSMA-avidity of the meningioma (Figure 1C). Additional MR imaging showed that this lesion in the left occipital lobe expressed homogeneous contrast enhancement on T1-weighted images (Figure 1D-E) confirming the diagnosis of an occipital meningioma. Figure 1 (F-G) show PET co-registered with MR. One year later, the lesion was resected due to a small but

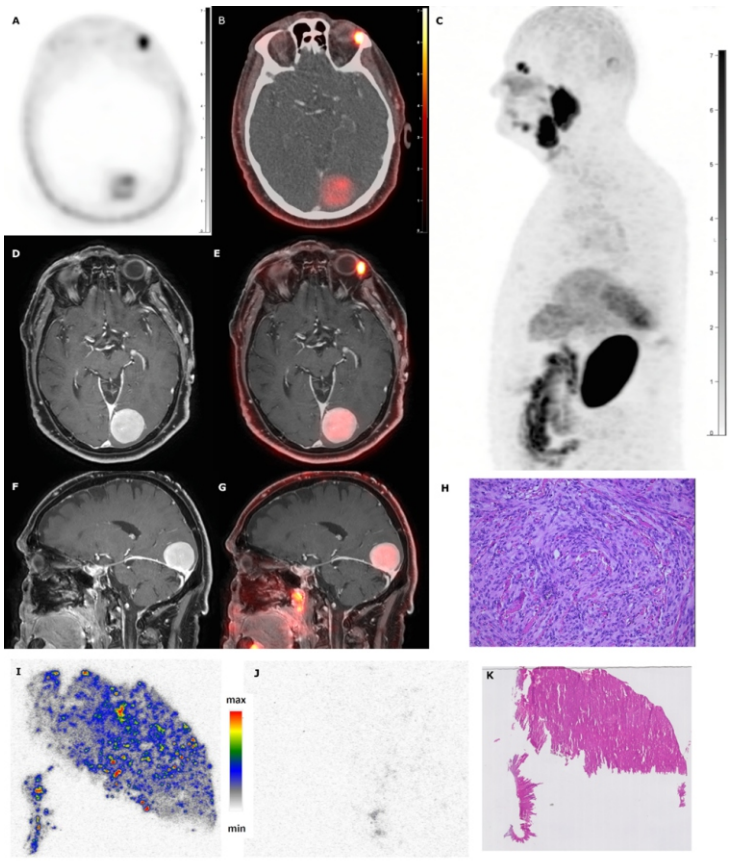

Figure 1. Fluorine-18-PSMA-1007 PET, CT and MRI image showing a PSMA positive menigeoma, hematoxylin and eosin (HE) staining and autoradiography image of the menigeoma. (A) axial PET, (B) fused PET/CT, (C) maximum intensitity projection of PET, (D) axial gadolinium enhanced T1 weighted (CET1W) MRI, (E) fused axial PET MRI, (F) sagital CET1W MRI showing connection tot he dura of the tentorium, (G) fused sagital CET1W MRI. (H) High manification HE staining of the menigeoma, (I) autoradiography with ^{18}F-PSMA-1007, (J) blocking with PMPA, (K) HE stained reference sample for autoradiolography.

significant growth on follow-up MRI. Histology showed a typical syncytial growth pattern an open nuclei, characteristic for a grade 1 transitional type meningioma (Figure 1H). Autoradiography on tissue sample using 74KBq/mL ^{18}F-PSMA-1007 shows specific PSMA binding (Figure 1I), which can be nearly complete blocked (87%) using 100μM of the non-structural related inhibitor 2-(phosphonomethyl) pentanedioic-acid (2-PMPA) (Figure 1J). Figure 1(K) shows HE-staining of an adjacent slice. It is most likely that endothelial cells are the cells expressing PSMA, since endothelial binding has been shown before [9] and meningiomas are highly vascularised tumours. To the best of our knowledge, this is the first case report presenting an incidental finding of PSMA-avidity in meningioma with histological confirmation [10-12]. Since not all meningiomas present with such a clear meningeal mass, one should realise that isolated elevated meningeal uptake on PSMA-PET could represent a meningioma.

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