Radiology Case Reports 17 (2022) 2023–2025

Available online at www.sciencedirect.com

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journal homepage: www.elsevier.com/locate/radcr

Case Report

Incidental prostate-specific membrane antigen-avid glioblastoma detected on ^{68}Ga–prostate-specific membrane antigen PET/CT ☆,☆☆

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ARTICLE INFO

Article history:
Received 19 January 2022
Revised 10 March 2022
Accepted 12 March 2022

Keywords:
PSMA
PET/CT
Glioblastoma
MRI
Prostate

ABSTRACT

A 74-year-old man was referred for a ^{68}Ga–prostate-specific membrane antigen (PSMA) PET/CT scan for newly diagnosed prostate cancer which confirmed the presence of PSMA avid cancer in the right gland with no evidence of PSMA metastasis. Incidentally, there was a markedly PSMA avid (SUVmax 7.0) lobulated periventricular mass in the region of the left basal ganglia which was T2 hyperintense and T1 hypointense with perilesional oedema and vivid Gadolinium enhancement on MRI. The patient underwent stereotactic guided biopsy which confirmed LHD wild-type glioblastoma (WHO grade IV).

Background

Glioblastoma is the most common and most aggressive adult primary tumor of the brain and is unfortunately aggressive, relatively resistant to therapy, and carries a poor prognosis. Conventional gadolinium-enhanced MR imaging is the standard technique for the evaluation of glioblastoma and typically demonstrates a heterogeneous intra-axial mass exhibiting necrosis, hemorrhage, and enhancement surrounded by vasogenic oedema [1].

Prostate-specific membrane antigen (PSMA) is a transmembrane protein highly expressed in prostate carcinoma cells but is also expressed in the kidney, proximal small intestine, lacrimal glands, salivary glands, liver, and spleen [2]. PSMA uptake within various inflammatory, infectious, and neoplastic brain lesions has also been described. For example, uptake can be seen in neurocysticercosis, cerebral

☆ Acknowledgments: There is no funding for this study.
☆☆ Competing interests: None declared.
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https://doi.org/10.1016/j.radcr.2022.03.050

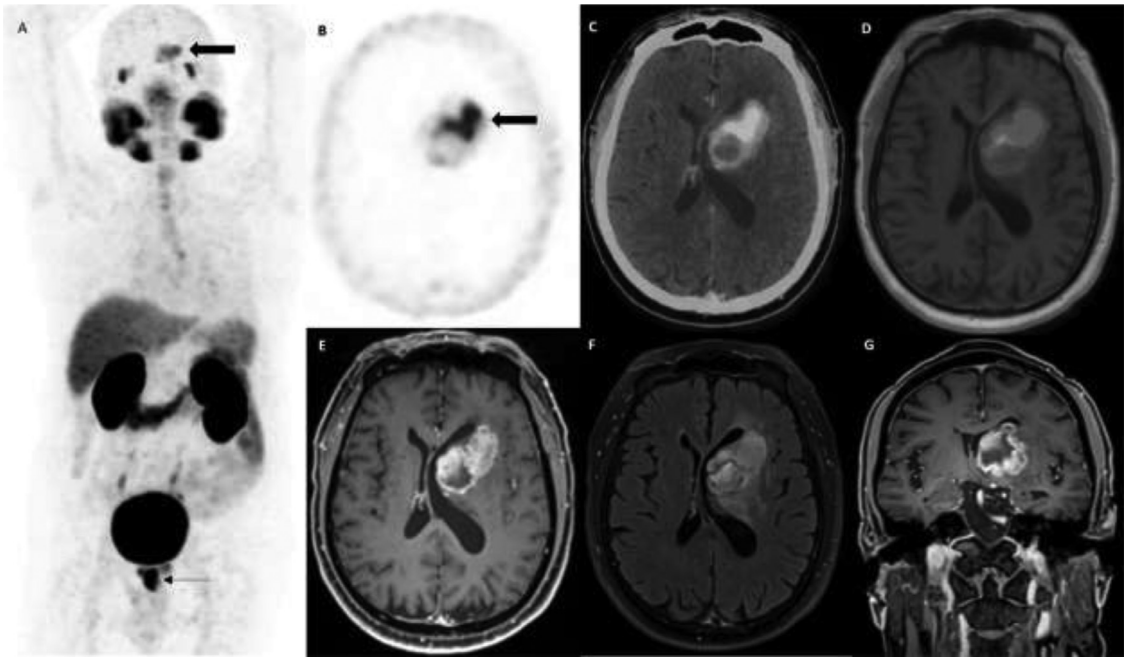

Fig. 1 – A 74-y old man was referred for a ^{68}Ga–prostate-specific membrane antigen (PSMA) PET/CT scan for newly diagnosed prostate cancer (Gleason 4 + 3) which confirmed the presence of PSMA avid prostate cancer in the right gland (Fig. 1A - MIP image, arrow) without evidence of PSMA nodal or distant metastasis. Incidental markedly PSMA avid (SUVmax 7.0) lobulated periventricular mass in the region of the left basal ganglia with a region of photopenia/hypodensity posteromedially was identified (Fig. 1A - MIP image and 1B - Axial PET image, solid arrow, Fig. 1 C Fused PET/CT Axial slice). MRI of the brain showed that the mass was T2 hyperintense and T1 hypointense with perilesional oedema and vivid Gadolinium enhancement. The cavity posteromedially demonstrated non-enhancement and magnetic susceptibility consistent with necrosis and blood products (Fig. 1D - axial fused T1, 1E - axial post-Gadolinium T1, 1F - FLAIR, 1G - coronal post-Gadolinium T1).

tuberculosis, cerebral infarct, breast cancer metastasis, prostate cancer metastases, and primary gliomas [3–6]. We present a case of a 74-year-old man who had an incidental PSMA avid glioblastoma on ^{68}Ga– PSMA PET/CT.

Case presentation

A 74-year-old man was referred for a ^{68}Ga–PSMA PET/CT scan for newly diagnosed prostate cancer (Gleason 4 + 3). His prostate specific antigen level was 9.7. He had a background history of coronary artery disease, type 2 diabetes mellitus, hypertension, hyperlipidemia and right colonic adenocarcinoma that was resected and now in remission. The PSMA PET scan showed PSMA avid prostate cancer in the right gland (Fig. 1A) without any evidence of PSMA avid nodal or distant metastasis. However, there was an incidental markedly PSMA avid (SUVmax 7.0) lobulated periventricular mass in the region of the left basal ganglia with a region of photopenia/hypodensity posteromedially on CT (Figs. 1A-C). The patient denied having any neurologic symptoms, such as headaches, seizures, or motor, sensory, or speech deficits. However, his daughter had noted worsened memory in the past 2-3 weeks. On physical examination, his Glasgow Coma Scale was 15 out of 15, power in the limbs was preserved and gait was unremarkable.

Gadolinium enhanced MRI of the brain showed a mass centered in the left basal ganglia that was hyperintense on T2-weighted images and hypointense on T1-weighted images with perilesional oedema and vivid heterogeneous Gadolinium enhancement. There was moderate mass effect compressing the left lateral ventricle with associated midline shift. Asymmetrical enlargement of the left lateral ventricle was concerning for developing hydrocephalus. The cavity posteromedially demonstrated non-enhancement and magnetic susceptibility consistent with necrosis and blood products (Figs. 1D-G). The patient underwent stereotactic guided biopsy which confirmed LHD wild-type glioblastoma (WHO grade IV).

Discussion

Glioblastoma is the most common and most aggressive primary tumor of the brain. It can occur at any age with peak incidence between 55-60 years of age. Prognosis is extremely poor with a median survival of approximately 14-15 months from diagnosis [7]. Mortality associated with glioblastoma is even worse in older adults above the age of 65 with the median survival being 3.9 months for patients above the age of 65 compared to 7.6 months for those younger than 65 according to 1 study [8]. Gadolinium enhanced MRI is the standard technique

for the evaluation of glioblastoma and they typically appear as heterogeneous masses centered in the white matter with peripheral enhancement and central necrosis with vasogenic oedema [1].

PSMA is a transmembrane protein highly expressed in prostate carcinoma cells. Despite its name, however, PSMA has been found to be widely expressed in the neovasculature of many other malignant tumors such as renal cell carcinoma, lymphoma, thyroid cancer, rectal cancer, lung cancer as well as gastric and colorectal cancers [2,3,9–14]. Moreover, PSMA uptake within various inflammatory, infectious and neoplastic brain lesions have also been described in neurocysticercosis, cerebral tuberculosis, cerebral infarct, breast cancer metastasis and prostate cancer metastases [6,15–18]. PSMA overexpression has also been reported in neovasculatures of many brain tumors including high-grade gliomas including glioblastoma. Histologically glioblastoma has high tumor vasculature and angiogenic activity which likely account for PSMA uptake on PET [19] Saffar et al. demonstrated that high grade gliomas (grade III/IV) exhibited significantly higher expression of PSMA compared to low grade gliomas (grade I/II) signifying the role that PSMA may play in tumor angiogenesis [20]. As normal brain parenchyma expresses low levels of PSMA, the high target-to-background ratio makes the identification of PSMA avid lesions easier, highlighting PSMA as a feasible tracer in the evaluation of brain pathologies such as glioblastoma [21].

Conclusion

We present the case of a 74-year-old man referred for a ^{68}Ga–PSMA PET/CT scan for prostate cancer who was found to have an incidental markedly PSMA avid left basal ganglia glioblastoma. The low background uptake of PSMA in normal brain tissue and high target-to-background ratio make ^{68}Ga-PSMA PET/CT a promising imaging agent for the evaluation of glioblastoma.

Patient consent

Patient consent was obtained.

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