Interesting Image

Mol Imaging Radionucl Ther 2025;34:146-148 *DOI:10.4274/mirt.galenos.2024.75547*

Combined ^{68}Ga-PSMA PET/CT and mpMRI Findings Improve Tumor Localization and Biopsy Guidance in the Initial Diagnosis of Prostate Cancer

Kombine ^{68}Ga-PSMA PET/BT ve mpMRI Bulgularının Prostat Kanserinin ilk Tanısında Tümör Lokalizasyonunu ve Biyopsi Rehberliğini Desteklemesi

Yavor Gramatikov[1], Petia Nikolova[1], Mihaela Ilcheva[1], Valentin Yotovski[2], Nikolay Halachev[3], Valeria Hadzhiyska[1]

[1]*University Hospital Alexandrovska, Clinic of Nuclear Medicine, Sofia, Bulgaria*
[2]*University Hospital Alexandrovska, Clinic of Urology, Sofia, Bulgaria*
[3]*Medical Institute of the Ministry of Interior, Clinic of Urology, Sofia, Bulgaria*

Abstract

Gallium-68 (^{68}Ga)-prostate-specific membrane antigen (PSMA) positron emission tomography/computed tomography (PET/CT) is a relatively new imaging modality that has already proved its role in the initial staging of prostate cancer and in biochemical recurrence following definitive primary therapy. Furthermore, emerging data several ongoing studies demonstrate its potential role in the primary diagnosis of this malignancy. We present a 67-year-old male patient with increasing clinical suspicion of prostate cancer despite a previous negative prostate gland biopsy. He was referred to our nuclear medicine department for a ^{68}Ga-PSMA PET/CT with the aim of improving tumor localization and assisting in the guidance of repeat prostate biopsy. One month before presentation of elevated prostate-specific antigen levels, he underwent multiparametric magnetic resonance imaging (mpMRI), which revealed a prostate imaging reporting and data system 4 lesion in the right lobe of the prostate gland. The MRI lesion completely matched a PRIMARY score 5 lesion registered by PET/CT. Furthermore, we detected another suspicious finding in the left lobe (PRIMARY score 4). The patient underwent PSMA PET/CT-guided MRI/ultrasonography fusion transperineal biopsy of both lesions. The latter were histologically confirmed as prostate carcinoma with a Gleason score of 3+4 =7.

Keywords: ^{68}Ga-PSMA PET/CT, mpMRI, initial diagnosis of prostate cancer

Öz

^{68}Ga-prostat-spesifik membran antijeni (PSMA) pozitron emisyon tomografisi/bilgisayarlı tomografi (PET/BT), prostat kanserinin ilk evrelemesinde ve birincil tedaviyi takiben biyokimyasal nükste rolünü kanıtlamış nispeten yeni bir görüntüleme yöntemidir. Ayrıca, devam eden birkaç çalışmadan elde edilen yeni veriler, bu malignitenin birincil tanısında potansiyel rolünü göstermektedir. Daha önce negatif prostat bezi biyopsisine rağmen artan prostat kanseri klinik şüphesi olan 67 yaşında erkek hastayı sunuyoruz. Hasta tümör lokalizasyonunu iyileştirmek ve tekrar prostat biyopsisinin rehberliğine yardımcı olmak amacıyla ^{68}Ga-PSMA PET/BT için nükleer tıp bölümümüze sevk edildi. Bir ay önce yüksek prostat spesifik antijen seviyeleri nedeniyle multiparametrik manyetik rezonans görüntüleme (mpMRG) uygulanan hastada prostat bezinin sağ lobunda prostat görüntüleme raporlama ve veri sistemi 4 lezyon saptandı. MRG lezyonu PET/BT ile kaydedilen PRİMARY skor 5 lezyonla tamamen uyuşuyordu. Ayrıca sol lobda PRİMARY skor 4 olan bir şüpheli lezyon daha tespit ettik. Hastanın her iki lezyonundan PSMA PET/BT kılavuzluğunda MRI/ultrasonografi füzyon transperineal biyopsi alındı ve histolojik olarak Gleason skoru 3+4=7 olan prostat karsinomu doğrulandı.

Anahtar kelimeler: ^{68}Ga-PSMA PET/BT, mpMRG, prostat kanserinin ilk tanısı

Address for Correspondence: Yavor Gramatikov, MD, University Hospital Alexandrovska, Clinic of Nuclear Medicine, Sofia, Bulgaria
E-mail: yavorgramatikov@abv.bg **ORCID ID:** orcid.org/0009-0001-2901-2940
Received: 16.07.2024 **Accepted:** 08.09.2024 **Publication Date:** 03.05.2025

Cite this article as: Gramatikov Y, Nikolova P, Ilcheva M, Yotovski V, Halachev N, Hadzhiyska V. Combined ^{68}Ga-PSMA PET/CT and mpMRI findings improve tumor localization and biopsy guidance in the initial diagnosis of prostate cancer. Mol Imaging Radionucl Ther. 2025;34:146-148.

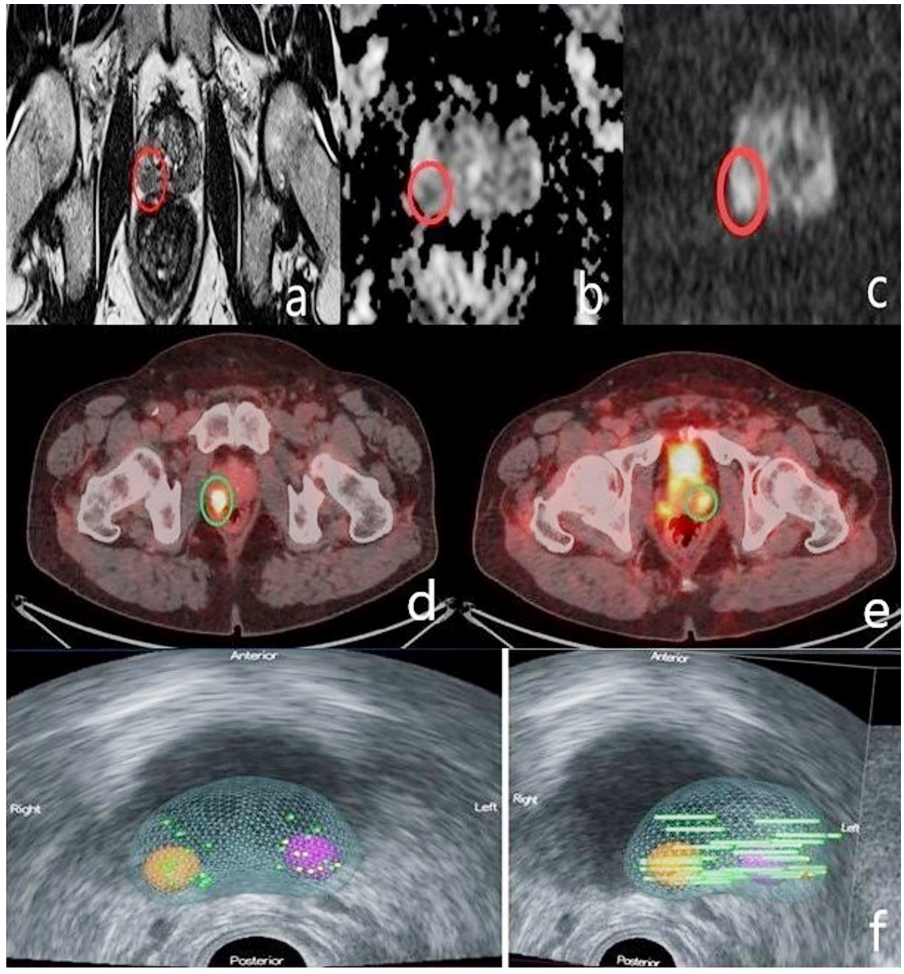

Figure 1. A 67-year-old male patient with increasing clinical suspicion of prostate cancer (PCa) based on a consistent increase in prostate-specific antigen (PSA) levels despite a previous negative 12-core systematic prostate gland biopsy. He was referred to our nuclear medicine department for a ^{68}Ga-PS membrane antigen (PSMA) positron emission tomography/computed tomography (PET/CT) with the aim of improving tumor localization and assisting in the guidance of repeat prostate biopsy. One month before presentation of elevated PSA levels (4.1 ng/mL) and intermediate-to-high PSA density risk (0.16 ng/mL^2) he underwent multiparametric magnetic resonance imaging (mpMRI). Axial T2-weighted (Figure 1a) and diffusion-weighted (Figure 1b and Figure 1c) images show a hypointense nodule with restricted diffusion (red circles) in the right peripheral prostate zone, corresponding to a prostate imaging reporting and data system (PI-RADS) 4 lesion. The MRI lesion completely matched a primary score 5 lesion registered by ^{68}Ga-PSMA PET/CT with a maximum standardized uptake value (SUV_{max}) 13.4 (Figure 1d-green circle). Furthermore, this relatively new hybrid imaging technique revealed one more suspicious finding, located in the left peripheral zone of the prostate base, classified as primary score 4 (Figure 1e-green circle). The patient underwent PSMA PET/CT-guided MRI/ultrasonography fusion transperineal biopsy of both lesions. A patient-specific 3D prostate map (Figure 1f) shows 7 cores taken from the lesion in the right lobe (PI-RADS 4/primary score 5 - orange sphere), 11 cores from the lesion in the left lobe (primary score 4 - purple sphere) and 9 cores from the systematic biopsy of both lobes. Both of the targeted lesions, including the additional lesion in the left lobe detected only on the ^{68}Ga-PSMA PET/CT, were histologically confirmed as clinically significant PCa with a Gleason score of 3+4=7. ^{68}Ga-PSMA PET/CT has already proven its role in the initial staging of PCa and in biochemical recurrence following definitive primary therapy. Furthermore, emerging data several ongoing studies demonstrate its potential role in the primary diagnosis of this malignancy. In March 2022, Emmett L. et al. (1) published the largest prospective multicenter study to date in 291 biopsy-naive men with suspected PCa and studied the additive role of ^{68}Ga-PSMA PET/CT combined with mpMRI in the diagnosis of clinically significant PCa. The results indicated that the combination of the two imaging methods had higher negative predictive value and sensitivity for clinically significant PCa than mpMRI alone. Moreover, the authors proposed a 5-point scale (primary score) to evaluate the PSMA uptake pattern in the prostate gland to standardize and objectify the reported results. The use of PSMA-ligand PET for the guidance of prostate biopsy is a new indication added in the latest joint European Association of Nuclear Medicine procedure guidelines/Society of Nuclear Medicine and Molecular Imaging procedure standard for PCa imaging 2.0, but it should be combined with mpMRI (2). Currently, this procedure is considered as a possible option after one previous negative biopsy and existing or rising clinical suspicion for PCa, based on imaging findings and laboratory results. Recently, PSA density has gained considerable clinical application and has been correlated with the PI-RADS score

derived from mpMRI in the decision to perform a prostate biopsy. According to the risk data table in the recent European Association of Urology Guideline 2023 on PCa (3), biopsy is strongly recommended in patients with a PSA density >0.2 ng/mL² and PI-RADS score >4. Still, there is a gray area with PSA density between 0.1 and 0.2 ng/mL² and intermediate PI-RADS 3 score, where the decision for biopsy remains controversial and subjective. Based on our recent clinical experience with a larger patient cohort, we believe that in this clinical scenario PSMA PET could be a useful tool not only for diagnostic management but also for the detection of additional lesions missed by mpMRI to improve the detection rate, as demonstrated in the case presented.

Ethics

Informed Consent: The patient consent was obtained.

Footnote

Authorship Contributions

Surgical and Medical Practices: Y.G., V.Y., N.H., Concept: Y.G., P.N., Design: Y.G., M.I., V.Y., Data Collection or Processing: Y.G., V.Y., Analysis or Interpretation: Y.G., P.N., Literature Search: Y.G., V.H., Writing: Y.G., M.I., V.H.

Conflict of Interest: No conflicts of interest were declared by the authors.

Financial Disclosure: The authors declare that this study has received no financial support.

References

1. Emmett L, Papa N, Buteau J, Ho B, Liu V, Roberts M, Thompson J, Moon D, Sheehan-Dare G, Alghazo O, Agrawal S, Murphy D, Stricker P, Hope TA, Hofman MS. The PRIMARY Score: Using Intraprostatic 68Ga-PSMA PET/CT Patterns to Optimize Prostate Cancer Diagnosis. J Nucl Med. 2022;63:1644-1650.
2. Fendler WP, Eiber M, Beheshti M, Bomanji J, Calais J, Ceci F, Cho SY, Fanti S, Giesel FL, Goffin K, Haberkorn U, Jacene H, Koo PJ, Kopka K, Krause BJ, Lindenberg L, Marcus C, Mottaghy FM, Oprea-Lager DE, Osborne JR, Piert M, Rowe SP, Schöder H, Wan S, Wester HJ, Hope TA, Herrmann K. PSMA PET/CT: joint EANM procedure guideline/SNMMI procedure standard for prostate cancer imaging 2.0. Eur J Nucl Med Mol Imaging. 2023;50:1466-1486.
3. EAU Guidelines. Edn. presented at the EAU Annual Congress Milan 2023. ISBN 978-94-92671-19-6.