Interesting Image
Mol Imaging Radionucl Ther 2022;31:223-226 DOI:10.4274/mirt.galenos.2021.41033

Unexpected Metastatic Localizations of Prostate Cancer Determined by ^{68}Ga PSMA PET/CT: Series of Four Cases

^{68}Ga PSMA PET/BT'de Saptanan Prostat Kanserinin Nadir Metastaz Lokalizasyonları: Dört Olgu

Gözde Mütevelizade, Ceren Sezgin, Gül Gümüşer, Elvan Sayit

Manisa Celal Bayar University Faculty of Medicine, Department of Nuclear Medicine, Manisa, Turkey

Abstract

Prostate-specific membrane antigen (PSMA) is a transmembrane protein with overexpression in most prostate cancer cells. Gallium-68-(^{68}Ga) PSMA positron emission tomography/computed tomography (PET/CT) imaging is a game-changer in the management of prostate cancer. ^{68}Ga PSMA PET/CT scan is advanced and a promising radioligand has high sensitivity in determining lesions of prostate cancer with a high tumor to background ratio. The most common areas of metastasis are the bone and pelvic lymph nodes. The prognosis of prostate cancer is mainly determined by the status of metastases. The presence and the localization of metastases affects treatment planning. In our cases, we presented some examples of uncommon sites of metastases such as the brain, adrenal glands, penis and orbit. Improvements in imaging techniques, such as ^{68}Ga PSMA PET/CT have led to the possibility to make more determination of rare metastase sites in prostate cancer patients.

Keywords: Prostate cancer, unexpected, metastases, ^{68}Ga PSMA PET/CT

Öz

Prostat-spesifik membran antijen (PSMA) çoğu prostat kanseri hücresinde bulunan bir transmembran proteinidir. PSMA son yıllarda prostat kanserinin görüntüleme ve tedavisinde hedef molekül olarak ilgi çekmektedir. Galyum-68-(^{68}Ga) PSMA pozitron emisyon tomografi/bilgisayarlı tomografi (PET/BT) günümüzde prostat kanseri görüntülemesinde sıklıkla kullanılmaktadır. Prostat kanserinin en sık metastaz lokalizasyonları iskelet sistemi ve pelvik lenf nodlarıdır. Prognoz ve tedavi yönetimi metastaz varlığına ve lokalizasyonuna bağlı değişmektedir. Yayınımızda beyin, adrenal bez, penis ve orbita gibi prostat kanserine ait nadir metastaz lokalizasyonlarından örnek olgular göstermeyi amaçladık. Görüntüleme tekniklerinde ve moleküler ajanlarda gelişmeler devam ettikçe, beklenmedik metastatik lokalizasyonların saptanmasının giderek artacağını düşünmekteyiz.

Anahtar kelimeler: Prostat kanseri, nadir, metastaz, ^{68}Ga PSMA PET/BT

Address for Correspondence: Gözde Mütevelizade MD, Manisa Celal Bayar University Faculty of Medicine, Department of Nuclear Medicine, Manisa, Turkey
Phone: +90 532 471 32 62 **E-mail:** gozdemutevelizadee@gmail.com ORCID ID: orcid.org/0000-0001-5986-8777
Received: 02.04.2021 **Accepted:** 16.06.2021

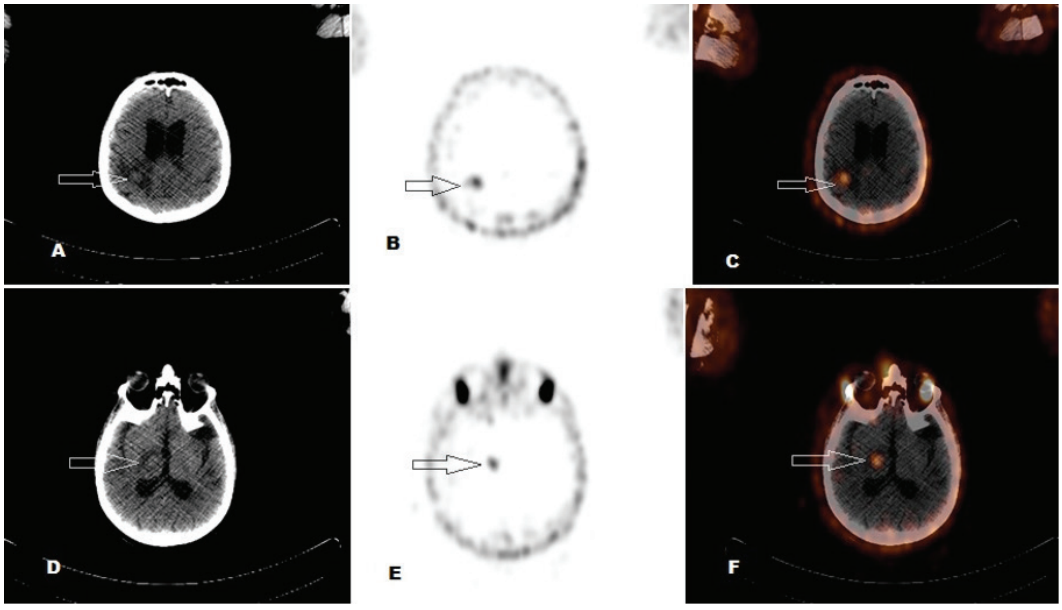

Figure 1. In prostate cancer, correct evaluation of extraprostatic spread is of great importance for estimated prognosis and in treatment planning. The most common areas of metastasis are pelvic lymph nodes and bone (1). Hatzoglou et al. (2) identified the incidence of brain metastasis from prostate carcinoma as 0.16%. They also stated that non-adenocarcinoma pathology are more likely to develop brain metastasis (2). Gallium-68-(^{68}Ga) prostate-specific membrane antigen (PSMA) positron emission tomography/computed tomography (PET/CT) (Philips, True Flight Select, USA) scan was performed on a 62-year-old patient with prostate adenocarcinoma (Gleason's score 4+3, PSA 12.2 ng/mL). ^{68}Ga PSMA avid lesions in the right parietal (A, B, C) and thalamic (D, E, F) regions with perilesional edema were detected [maximum standardized uptake value (SUV_{max}): 1.3-2.6] (arrow). Magnetic resonance imaging (MRI) was performed for further evaluation. MRI report was consistent with our findings, demonstrating a 2 cm diameter mass in the right frontal lobe-precentral gyrus localization with peripheral diffusion restriction and a similar lesion in the right thalamus with a diameter of 1.3 cm. Radiotherapy was planned for cranial metastases.

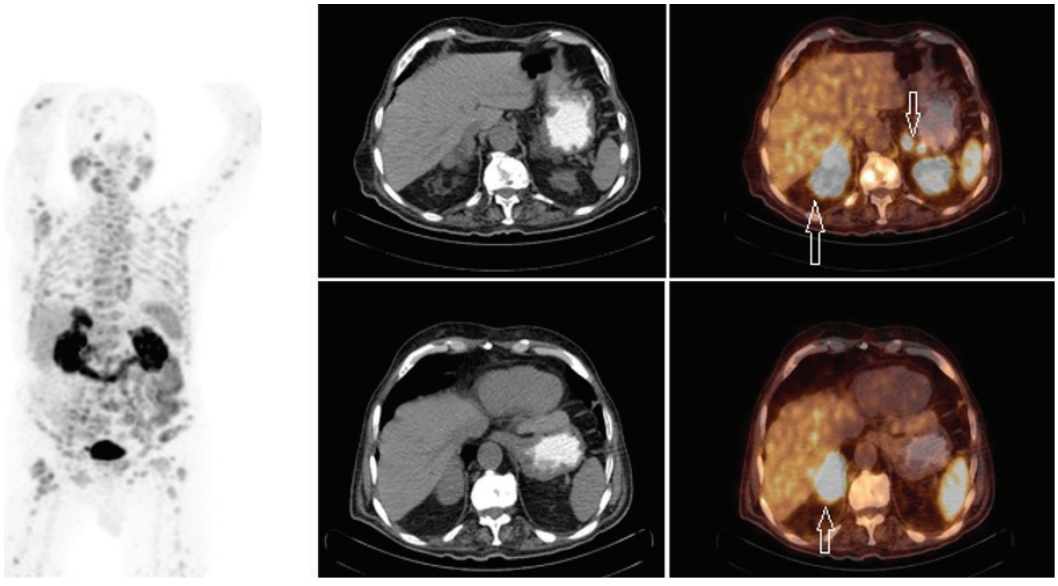

Figure 2. Metastases are the most common malignant lesions of adrenal gland. Adrenal metastasis can originate mostly from the lung (39%) and breast (35%) cancers (3). Even if the frequency of adrenal metastases was shown as 13% in an autopsy series, there are few publications in the literature with adrenal metastases of prostate cancer (4). ^{68}Ga PSMA PET/CT was performed in an 83-year-old patient who had prostate adenocarcinoma (Gleason's score of 4+5, PSA 809 ng/mL). Invasive prostate lesions to seminal vesicles, bilateral adrenal masses with the largest diameter of 61x33 mm (SUV_{max}: 26.2) (arrow), abdominopelvic lymph nodes, and widespread sclerotic skeletal metastases with intense PSMA expression were detected. Androgen deprivation therapy and chemotherapy were started and he has been for follow-up.

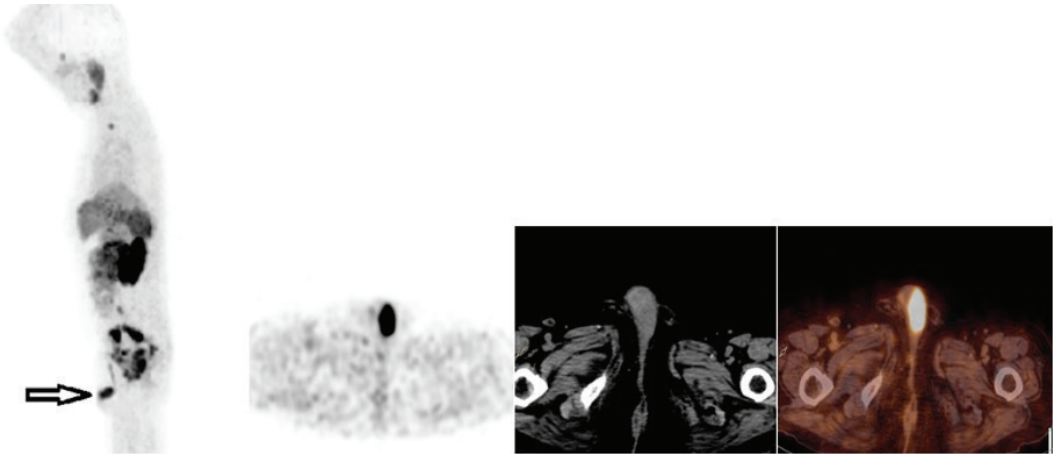

Figure 3. Secondary malignancy of the penis is a rare condition despite its rich vascularization. Tatkovic et al. (5) observed the incidence of penile metastasis of prostate cancer was 0.1% at 4860 ^{68}Ga PSMA PET/CT examinations. Seventy two year-old patient with prostate adenocarcinoma (Gleason's score of 4+5) had significant PSA progression (22.6 ng/mL and 47.9 ng/Ml, respectively) despite eight cycles of chemotherapy and enzalutamide treatment. ^{68}Ga PSMA PET/CT revealed a large prostate mass with rectal and vesical invasion, PSMA avid inferior cervical, abdominal, and pelvic lymph nodes. Additionally, there was an intense ^{68}Ga PSMA expression noted in the penile shaft with a diameter of approximately 40x20 mm (SUV_{max}: 14.9) (arrow). Colour-coded duplex ultrasonography was used to evaluate the penile metastasis, radiotherapy was started for pencil metastasis and Lutetium-177 (^{177}Lu) PSMA was planned.

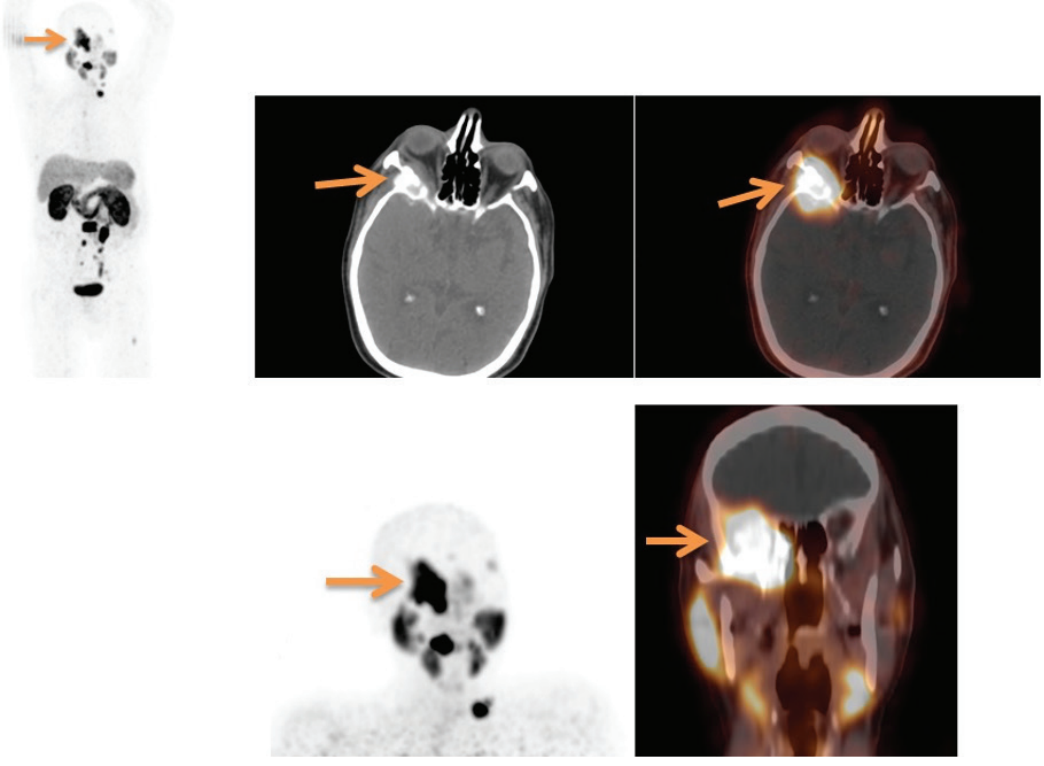

Figure 4. More than 90% of distant metastases in prostate cancer patients are found in the bones. The axial skeleton is the most commonly affected (1). Although the osseous metastases are common in prostate cancer, orbital metastases are very rare. Adenocarcinoma of the prostate is implicated in 3.6% to 4% of all orbital metastases (6). Cranial and orbital MRI was performed on 84-year-old patient with castrate-resistant prostate cancer (PSA 17 ng/mL) who developed diplopia and proptosis in the right eye. ^{68}Ga PSMA PET/CT was performed upon seeing a periorbital mass in the MRI. Pathological PSMA involvement (SUV_{max}: 19.4) was observed in the lesion, approximately 3.5x2.5 cm in size, located in the sphenoid bone in the right and invading the temporal lobe, maxillary sinus and orbit (arrow). ^{68}Ga PSMA PET/CT also demonstrated multiple cervical, abdominal and pelvic nodal involvement and sclerotic skeletal metastases. 7400 MBq ^{177}Lu PSMA radionuclide therapy was administered to the patient. He did not have any side effects during treatment or in the following weeks. The patient died from posttraumatic intracranial bleeding during follow-up.

Ethics

Informed Consent: Written informed consent was obtained from the patients who participated in this study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: G.M., C.S., Concept: G.M., E.S., Design: G.M., G.G., Data Collection or Processing: G.M., C.S., Analysis or Interpretation: G.M., G.G., Literature Search: G.M., E.S., Writing: G.M.

Conflict of Interest: No conflict of interest was declared by the authors.

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

References

1. Morigi JJ, Stricker PD, van Leeuwen PJ, Tang R, Ho B, Nguyen Q, Hruby G, Fogarty G, Jagavkar R, Kneebone A, Hickey A, Fanti S, Tarlinton L, Emmett L. Prospective comparison of 18F-fluoromethylcholine versus 68Ga-PSMA PET/CT in prostate cancer patients who have rising PSA after curative treatment and are being considered for targeted therapy. J Nucl Med 2015;56:1185-1190.
2. Hatzoglou V, Patel GV, Morris MJ, Curtis K, Zhang Z, Shi W, Huse J, Rosenblum M, Holodny AI, Young RJ. Brain metastases from prostate cancer: an 11-year analysis in the MRI era with emphasis on imaging characteristics, incidence, and prognosis. J Neuroimaging 2014;24:161-166.
3. Dhamija E, Panda A, Das CJ, Gupta AK. Adrenal imaging (part 2): medullary and secondary adrenal lesions. Indian J Endocrinol Metab 2015;19:16-24.
4. Bubendorf L, Schöpfer A, Wagner U, Sauter G, Moch H, Willi N, Gasser TC, Mihatsch MJ. Metastatic patterns of prostate cancer: an autopsy study of 1,589 patients. Hum Pathol 2000;31:578-583.
5. Tatkovic A, McBean R, Schoeman J, Wong D. Prostate penile metastasis: incidence and imaging pattern on 68Ga-PSMA PET/CT. J Med Imaging Radiat Oncol 2020;64:499-504.
6. Saadi A, Kerkeni W, Bouzouita A, Ayed H, Gaja A, Cherif M, Slama RB, Mnif N, Derouiche A, Chebil M. Bilateral orbital metastasis of prostatic adenocarcinoma. Urology 2016;94:e3-4.