PSMA scintigraphy in metastases of prostate cancer within the genital tract

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ABSTRACT
We present a rare case of vas deferens involvement in high-grade prostate adenocarcinoma, detected by both [^{68}Ga]Ga-PSMA PET/CT and [^{99m}Tc]Tc-PSMA SPECT/CT imaging. A 68-year-old male with elevated PSA (Gleason score 4+5) showed locoregional disease involving the prostate, left seminal vesicle, and distal vas deferens on both PET/CT and SPECT/CT scans, with no regional or distant metastasis. This case highlights the value of PSMA imaging in detecting unusual metastatic patterns as well as the clinical utility of [^{99m}Tc]Tc-PSMA SPECT/CT as an accessible alternative to PET/CT. The supplementary file reviews additional reports of PSMA-avid metastases in male genital structures.

Keywords: [^{99m}Tc]Tc-PSMA; Prostate cancer; SPECT/CT; PET/CT

INTRODUCTION
Prostate-specific membrane antigen (PSMA)–targeted imaging has significantly improved the detection of prostate cancer metastases, including rare and atypical sites. Vas deferens involvement (VDI) in prostate cancer is uncommon and underreported, with most published reports limited to isolated case studies. VDI is usually identified during restaging for biochemical recurrence, although rare instances have been reported at initial staging [1-4]. Emerging data suggest that VDI may hold independent prognostic value, akin to seminal vesicle invasion, potentially indicating a more aggressive disease phenotype [5]. We present a rare case of VDI detected using both [^{68}Ga]Ga-PSMA PET/CT and [^{99m}Tc]Tc-PSMA SPECT/CT, highlighting the utility of PSMA-targeted imaging.

CASE PRESENTAION

A 68-year-old man presented with lower urinary tract symptoms (LUTS) and was diagnosed with prostate adenocarcinoma (Gleason score 4+5), with a PSA level of 97.5 ng/mL. He underwent staging with [^{68}Ga]Ga-PSMA PET/CT performed 60 minutes after intravenous administration of 119.88 MBq (3.24 mCi) of [^{68}Ga]Ga-PSMA, with acquisition from the skull to mid-thigh. After initial androgen deprivation therapy, the patient discontinued treatment and was lost to follow-up. Due to persistent symptoms and a PSA of 88 ng/mL after one year, he underwent restaging with ^{99m}Tc-PSMA scintigraphy, including whole-body planar imaging and SPECT/CT three hours after intravenous injection of 740 MBq (20 mCi) of [^{99m}Tc]Tc-PSMA. The initial [^{68}Ga]Ga-PSMA PET/CT demonstrated moderate uptake in the primary prostate tumor, the left seminal vesicle base, and a rounded nodule medial to the seminal vesicle, corresponding to the ampulla of the vas deferens, consistent with locoregional invasion (Figure 1). Restaging with [^{99m}Tc]Tc-PSMA SPECT/CT one year later revealed similar findings, confirming persistent disease confined to the prostate, left seminal vesicle, and vas deferens, with no evidence of nodal, skeletal, or visceral metastases (Figure 2). Subsequent treatment planning for the patient involved radiotherapy.

DISCUSSION

Assessing VDI is challenging due to overlapping activity from adjacent structures. However, in this case, the focal lesion is likely true infiltration, given its consistent appearance on both imaging modalities performed in separate sessions. Additionally, the lesion's shape and anatomical location closely correspond to previously reported imaging features of vas deferens involvement, supporting its interpretation as true infiltration rather than an artifact [6-8]. Current evidence, although limited, indicates that vas deferens involvement (VDI) is associated with poorer prognosis, warranting thorough pathological evaluation, and may lead to decisions regarding adjuvant therapy in selected patients [9, 10]. While there is no definitive evidence that VDI alters initial surgical planning, its presence can influence radiotherapy and systemic therapy strategies. Specifically, VDI may justify expansion of target volumes or focused treatment of vas-deferens–based recurrences and help identify patients who may benefit from closer surveillance or early initiation of systemic therapy when detected as a positive margin on pathology or on post-treatment imaging [11-13]. Case reports have demonstrated that both surgical excision and targeted radiotherapy for vas deferens recurrence can achieve durable local control, emphasizing the clinical relevance of recognizing and appropriately managing VDI [14, 15]. The concordance between PET/CT and SPECT/CT highlights the reliability of these modalities, while the ability of ^{99m}Tc-PSMA SPECT/CT to replicate PET/CT findings underscores its role as a cost-effective and accessible alternative, particularly in regions with limited PET/CT availability. Comparative studies indicate that ^{99m}Tc-PSMA SPECT/CT demonstrates robust diagnostic performance for many clinically relevant lesions, though sensitivity may be reduced at very low PSA levels. In resource-limited settings, ^{99m}Tc-PSMA SPECT/CT offers a practical and scalable imaging strategy to guide diagnosis and treatment, with PET/CT remaining the preferred modality where available [16-19].

Our literature review showed that PSMA-avid metastases involving male genital structures—including the vas deferens, testes, epididymis, penis, scrotal sac, vesicourethral junction, and perineum—are predominantly reported in patients between 45 and 88 years of age (Supplementary file). Most cases occurred during biochemical recurrence, in individuals with high Gleason scores and moderate-to-intense PSMA expression (scores 2&3). These findings emphasize that atypical genitourinary spread often coincides with advanced or biologically aggressive prostate cancer.

CONCLUSION

Identification of vas deferens involvement (VDI) in prostate cancer has significant implications for prognosis, treatment planning, and surveillance. Advanced PSMA-based imaging, combined with thorough pathological assessment, enables more accurate risk stratification and personalized management, especially in high-risk patients.

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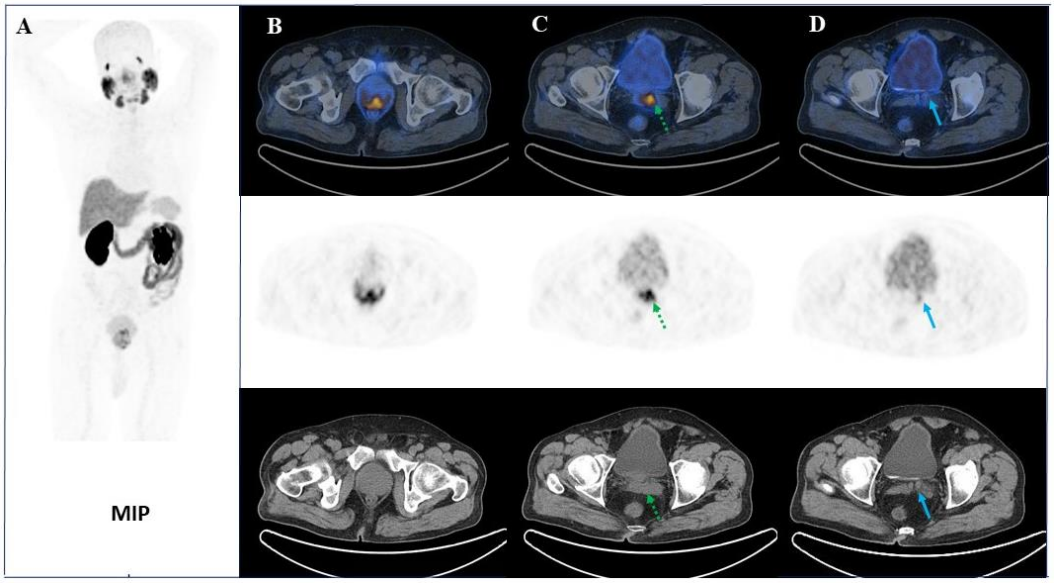

Figure 1. [^{68}Ga]Ga-PSMA PET/CT images showing uptake in the primary prostate tumor (B), left seminal vesicle base (C, dotted arrows), and ampulla of the vas deferens (D, arrows)

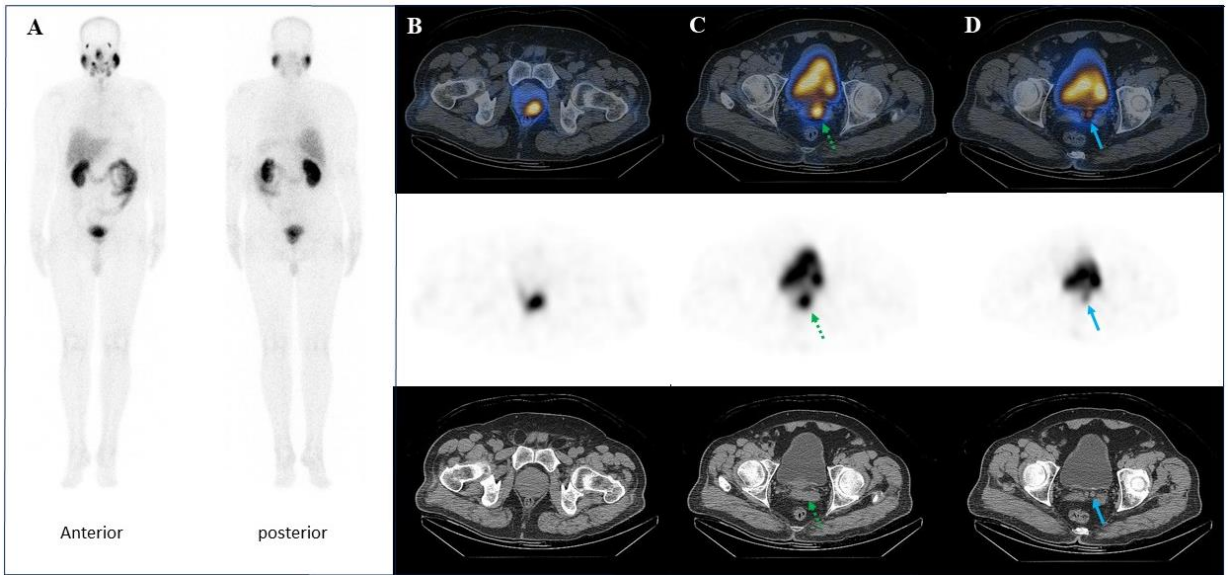

Figure 2. [^{99m}Tc]Tc-PSMA SPECT/CT images demonstrating findings consistent with PET/CT, including uptake in the primary prostate tumor (B), left seminal vesicle base (C, dotted arrows), and vas deferens ampulla (D, arrows)