

Prostate cancer nodal oligometastasis accurately assessed using prostate-specific membrane antigen positron emission tomography-computed tomography and confirmed histologically following robotic-assisted lymph node dissection

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Abstract

We herein present a case of a 76-year-old gentleman, where prostate-specific membrane antigen positron emission tomography-computed tomography (PSMA PET-CT) was used to accurately detect prostate cancer (PCa), pelvic lymph node (LN) metastasis in the setting of biochemical recurrence following definitive treatment for PCa. The positive PSMA PET-CT result was confirmed with histological examination of the involved pelvic LNs following pelvic LN dissection.

Key Words: Imaging, prostate cancer, prostate-specific membrane antigen positron emission tomography

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INTRODUCTION

Prostate cancer (PCa) imaging has undergone a revolution in the past 5 years, with the rise of multiparametric magnetic resonance imaging (MRI) for cancer detection and the evolution of positron emission tomography-computed tomography (PET-CT) for staging. Choline PET-CT was considered the new standard for detecting metastasis in biochemical recurrence (BCR) after primary treatment, but a newer agent based on prostate-specific membrane antigen (PSMA) has emerged. Few reports correlating PSMA PET-CT with PCa histology have been documented.

CASE REPORT

A 76-year-old gentleman underwent high-dose-rate brachytherapy and external beam boost radiotherapy for high-grade (Gleason pattern 4 + 5), high-volume (5 out of 6 sites), and organ-confined PCa in 2011. Pretreatment prostate-specific antigen (PSA) was 13.9 ng/ml. Adjuvant androgen deprivation therapy (ADT) was commenced given the high-risk nature of this cancer. The patient was subsequently followed up with regular PSA tests, which remained stable for

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3 years. ADT was discontinued after 3 years, and the patient experienced a small PSA rise. This increase was slow initially, and then a large incremental increase from 1.6 to 12.1 ng/ml over 6 months period prompted reevaluation with a PSMA PET-CT. PSMA PET-CT displayed high tracer uptake in the common iliac lymph nodes (LNs) bilaterally, with greater uptake on the right side [Figure 1]. After a lengthy discussion with the patient, a robotic-assisted pelvic LN dissection (PLND) was performed. Histological examination of the LN specimens displayed metastatic PCa (Gleason pattern 4 + 4) in 2 of 11 LNs (1 right common iliac LN and 1 left common iliac LN) [Figure 2]. The largest LN was on the right side measuring 20 mm. The histological findings correlate closely with the findings on PSMA PET-CT, confirming its perceived positive predictive value. The patient recovered well and was discharged at 48 h with no documented complications.

DISCUSSION

PCa is one of the most commonly diagnosed cancers in men and a leading cause of cancer-related mortality.^[1] Despite continual evolution of practice, radiological imaging has retained a primary position in the initial diagnosis and staging of PCa.^[2] Conventional imaging techniques such as CT, MRI, and bone scintigraphy are commonly used in these settings. Established imaging modalities are, however, limited when used in isolation, and in more recent years, the combination of PET with CT and MRI has shown particular promise.^[3]

The last decade has seen major improvements in progression-free and overall survival outcomes for patients with localized PCa due to improvements in diagnostic and therapeutic techniques. Despite this, there are a number of patients who experience BCR following definitive treatment for localized PCa.^[4] The

use of PSA in this context has revolutionized the treatment of PCa; however, its use in guiding salvage treatment following BCR is limited as it does not allow for localization of metastatic disease. To guide treatment options following BCR, it is crucial to differentiate between locoregional and systemic metastasis.^[5] The use of CT and MRI alone has shown low sensitivity in the context of reevaluation following BCR. Using threshold measurements of 10 mm for involved LNs lead to the sensitivities of <40% with these modalities.^[6] Seventy percent of LNs involved in metastatic PCa spread are <8 mm, making detection a major challenge when depending on CT or MRI.^[7]

PSMA is a prostate epithelial cell surface protein that is overexpressed in the most PCas.^[8] The expression of PSMA increases progressively with higher grade PCas, PCa metastasis, and castrate-resistant PCa.^[9] PSMA PET using Gallium 68 (⁶⁸Ga) ligands have shown improved sensitivity in PCa metastasis over choline PET. Due to its better signal to background ratio than choline derivatives, ⁶⁸Ga PSMA PET-CT detects local recurrence and metastasis with higher contrast, particularly with lower PSA levels.^[10]

Although there has been very promising initial sensitivity and specificity with PSMA PET-CT in the context of BCR, there have been few reports of histologically confirmed true-positives with this imaging modality.

PSMA PET-CT is an imaging modality with potential to improve accuracy of diagnosis, staging, and treatment planning in PCa. This imaging modality may help to accurately plan and focus salvage treatment in selected patients. Our case highlights a further instance where PSMA PET-CT has been used to accurately detect locoregional PCa metastasis after BCR and

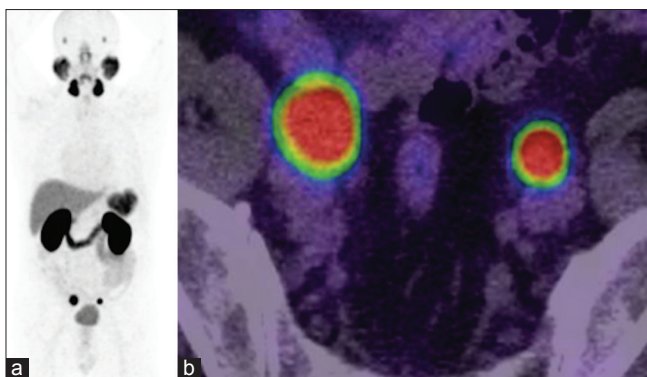


Figure 1: (a) Whole body Gallium 68 prostate-specific membrane antigen positron emission tomography image displaying avid tracer uptake within right and left pelvic lymph nodes, and normal physiological uptake elsewhere. (b) Gallium 68 prostate-specific membrane antigen positron emission tomography-computed tomography clearly showing tracer uptake within right and left common iliac lymph nodes, with a larger volume on the right side, which correlated with histological findings

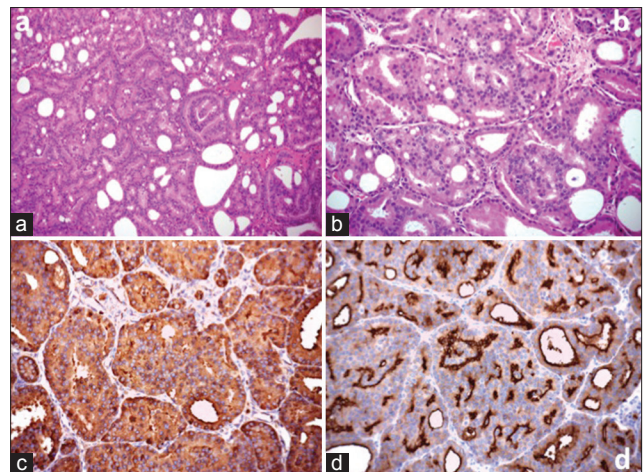


Figure 2: Histological sections of lymph node specimens confirming prostate acinar adenocarcinoma, Gleason pattern 4 + 4 = 8. Sections were stained separately for H and E (a and b) magnification $\times 100$ and $\times 200$, respectively, prostate specific antigen (c) magnification $\times 200$, and prostate specific membrane antigen (d) magnification $\times 200$

one of a small number of cases in the literature where PSMA PET-CT positivity has been confirmed histologically following PLND.

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Conflicts of interest

There are no conflicts of interest.

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