

Spinal Tuberculosis Mimicking as Prostate Cancer Metastases in Ga-68 Prostate-specific Membrane Antigen Positron-emission Tomography/Computed Tomography

Abstract

Prostate-specific membrane antigen (PSMA) is a type II transmembrane glycoprotein which is overexpressed in prostate cancer. However, the widespread use of PSMA positron-emission tomography (PET) scan revealed various nonprostatic PSMA-avid diseases. Here we present a report of a known case of carcinoma prostate, post orchidectomy, radiotherapy, on hormonal therapy with complain of back pain, referred for Ga68 PSMA PET/CT scan. The scan revealed PSMA-avid lesion of contiguous D6 and D7 vertebrae with associated soft-tissue component. The biopsy of the lesion was suggestive of tuberculosis.

Keywords: Carcinoma prostate gland, Ga-68 prostate-specific membrane antigen positron-emission tomography/computed tomography scan, spine tuberculosis

A 66-year-old male patient who was a known case of adenocarcinoma prostate gland with Gleason's score $4 + 4 = 8$, postradiotherapy, postbilateral orchidectomy, and on hormonal therapy was referred for Ga-68 prostate-specific membrane antigen (PSMA) whole-body positron-emission tomography/computed tomography (PET/CT) scan for disease status evaluation and restaging. The patient was being evaluated for moderate-to-severe dull aching back pain associated with loss of weight and appetite for 4–5 months and rising serum prostate-specific antigen (PSA) levels. Recent PSA level was 36.017 ng/ml, raised from 10.33 ng/ml. Multiple image projection [Figure 1a] image was suggestive of multiple PSMA-avid lesions. The corresponding PET, CT, and fused axial [Figure 1b-d] and sagittal [Figure 1e-g] images revealed PSMA-avid destructive lesion of contiguous D6 and D7 vertebrae with associated PSMA-avid pre- and paravertebral soft-tissue component with maximum standardized uptake value (SUVmax) corrected to the patient's body weight of 9.6. The fused axial PET-CT images [Figure 1h-j] showed PSMA-avid left infraclavicular lymph node (SUVmax – 12.0), multiple intensely PSMA-avid discrete and coalescent

abdominal lymph nodes (SUVmax – 42.4), and inhomogeneous mild PSMA uptake in the primary site that is prostate gland. Subsequently, suspicion of Pott's spine was raised, apart from differential diagnosis of metastatic disease of skeletal lesion since the disease pattern was classical of spine tuberculosis. Magnetic resonance imaging images [Figure 2a-c] were suggestive of altered hypointense signal on T1W and altered low signal intensity on T2W images of D6 and D7 vertebrae, suggestive of sclerotic metastases. However, biopsy [Figure 3a-c] from D6 to D7 vertebral body tissue revealed necrosis with ill-formed granuloma suggestive of tuberculosis. After confirmation, the patient was started on antituberculosis medications and kept on follow up.

PSMA PET/CT scan has revolutionized the molecular imaging of prostate cancer. Its extensive use in recent times have shown PSMA uptake in physiologic tissues and in various benign and malignant diseases, quite contrary to its name. It is a Type II transmembrane protein physiologically expressed by prostatic tissues and significantly overexpressed by prostate cancer cells^[1] and its expression increases with tumor aggressiveness.^[2] The PSMA ligands are internalized into cell upon

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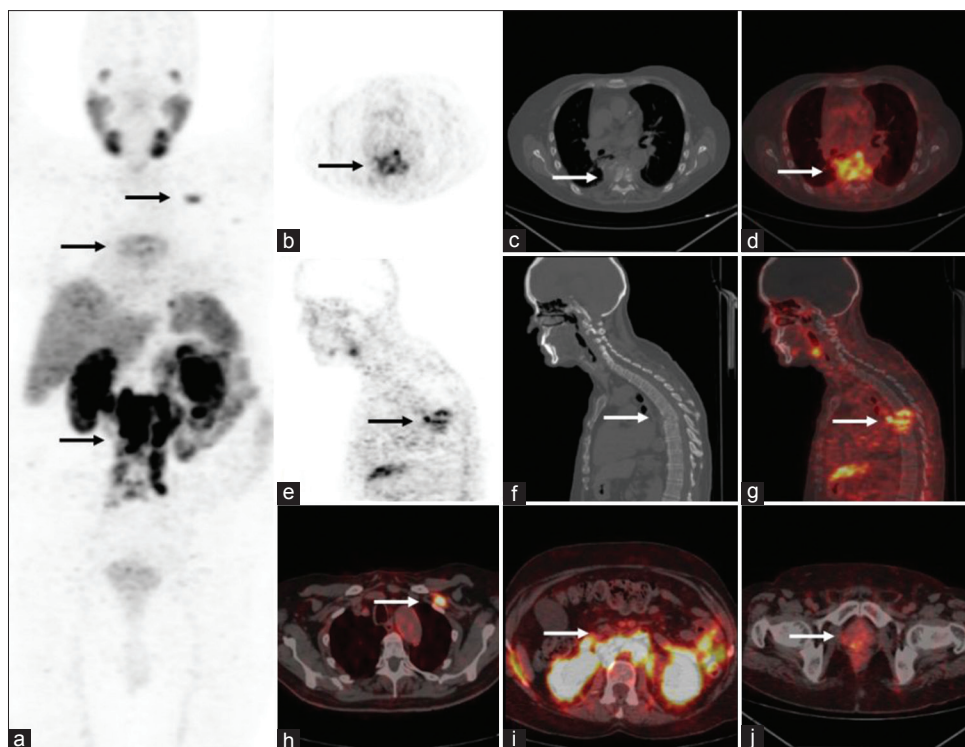


Figure 1: Multiple image projection (a) of whole-body Ga-68 prostate-specific membrane antigen positron-emission tomography/computed tomography scan showing multiple prostate-specific membrane antigen-avid metastatic lesions. Axial and sagittal positron-emission tomography, computed tomography, and fused positron-emission tomography/computed tomography (b-g) showing prostate-specific membrane antigen-avid destructive lesion of contiguous D6 and D7 vertebrae with associated prostate-specific membrane antigen-avid pre- and para-vertebral soft-tissue component. Fused positron-emission tomography-computed tomography images (h-j) revealing prostate-specific membrane antigen-avid left infraclavicular lymph node, abdominal lymph node, and mild inhomogeneous prostate-specific membrane antigen uptake in the primary site (prostate gland)

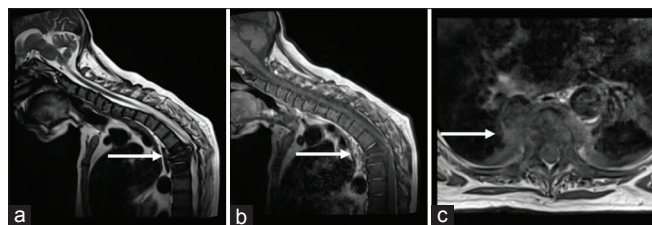


Figure 2: (a-c) Magnetic resonance imaging images showing altered signals of D6 and D7 vertebrae

binding and are thus used in the management of prostate cancer. The hypothesis to explain the mechanism of PSMA uptake in benign pathological conditions includes neovascularization and uptake driven by hyperemia, leading to increased radiotracer delivery. The uptake in nonprostatic neoplastic conditions is due to the expression of PSMA either on their cell membrane or in the endothelial cells of capillary beds of tumor neovasculation.^[3]

Of 10 million cases diagnosed with tuberculosis in 2018 worldwide, India tops the list with 27% of all cases. Spinal tuberculosis is the most common form of extrapulmonary tuberculosis and accounts for 1%–2% of all cases with tuberculosis.^[4] The most common imaging appearance of spinal tuberculosis is vertebral body destruction (predominantly anterior), loss of disk height, erosion of end plates, bone sequestration, sclerosis,

paravertebral masses, and calcification in paraspinal masses.^[5] However, there can also be atypical findings such as anterior subperiosteal lesion, anterior vertebral scalloping with sparing of the disk, noncontiguous vertebral involvement, isolated involvement of the neural arch, and reactive sclerosis.^[6] These atypical findings make it difficult to differentiate spinal tuberculosis from metastatic lesions.

As seen in our case, these skeletal lesions can mimic prostate cancer metastases and their characterization becomes important in deciding further management. If skeletal lesion is metastatic, then this changes prognosis of the patient, and therapeutic agents such as bisphosphonates (zoledronic acid) and denosumab are beneficial. Otherwise, if tubercular, then antituberculous treatment remains the cornerstone of treatment in spinal tuberculosis. Surgery may be required in selected cases, for example, large abscess formation, severe kyphosis, an evolving neurological deficit, or lack of response to medical treatment. With early diagnosis and early treatment, prognosis is generally good.

Various reports have been published previously, describing the nonspecific PSMA uptake in diseases other than prostate malignancy,^[7] tubercular lesions,^[8,9] and conditions like hypothyroidism^[10] and in few nonprostate cancer malignant neoplasms such as thyroid neoplasm,^[11] medullary thyroid

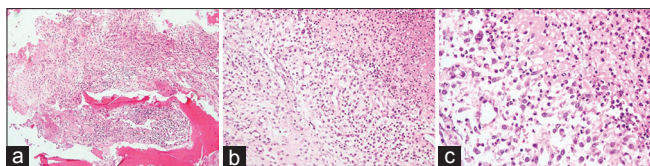


Figure 3: (a-c) Sections from D6 to D7 vertebral tissue showing expanded bony trabeculae with infiltration by mixed inflammatory cell infiltrate and large areas of necrosis surrounded by palisading histiocytes suggestive of necrosis with ill-formed granuloma, tuberculosis

cancer,^[12] Ewing's sarcoma,^[13] hepatocellular carcinoma,^[14] and renal cell carcinoma.^[15] Thus, this case highlights the importance of PSMA uptake in nonprostatic diseases and need of correlating the PSMA uptake with CT findings. As seen in our case, the PSMA-avid lesion in the spine with CT characteristics of Pott's spine was another case of nonspecific PSMA uptake.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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