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 complaint 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

Interesting Image

Nitin Gupta, Ram Kumar Elumalai, Ritu Verma, Ethel Shangne Belho, Shashi Dhawan
Department of Nuclear Medicine, Mahajan Imaging Centre, Sir Ganga Ram Hospital, 1Department of Pathology, Sir Ganga Ram Hospital, New Delhi, India

Address for correspondence:
Dr. Nitin Gupta,
Department of Nuclear Medicine, Mahajan Imaging Centre, Sir Ganga Ram Hospital, New Delhi, India.
E-mail: drnitingpt@gmail.com

Received: 26-03-2020
Revised: 31-03-2020
Accepted: 03-04-2020
Published: 01-07-2020

How to cite this article: Gupta N, Elumalai RK, Verma R, Belho ES, Dhawan S. Spinal tuberculosis mimicking as prostate cancer metastases in Ga-68 prostate-specific membrane antigen positron-emission tomography/computed tomography. Indian J Nucl Med 2020;35:271-3.

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Access this article online
Website: www.ijnm.in
DOI: 10.4103/ijnm.IJNM_56_20

© 2020 Indian Journal of Nuclear Medicine | Published by Wolters Kluwer - Medknow
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 deliver. 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 neovascularity. 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. 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. 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. 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, tubercular lesions, and conditions like hypothyroidism and in few nonprostate cancer malignant neoplasms such as thyroid neoplasm, medullary thyroid.

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.
cancer,\textsuperscript{[12]} Ewing’s sarcoma,\textsuperscript{[13]} hepatocellular carcinoma,\textsuperscript{[14]} and renal cell carcinoma.\textsuperscript{[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.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Silver DA, Pellicer I, Fair WR, Heston WD, Cordon-Cardo C. Prostate-specific membrane antigen expression in normal and malignant human tissues. Clin Cancer Res 1997;3:81-5.
2. Bostwick DG, Pacelli A, Blute M, Roche P, Murphy GP. Prostate specific membrane antigen expression in prostatic intraepithelial neoplasia and adenocarcinoma: A study of 184 cases. Cancer 1998;82:2256-61.
3. Kirchner J, Schaarschmidt BM, Sawicki LM, Heusch P, Hautzel H, Ermert J, \textit{et al.} Evaluation of practical interpretation hurdles in 68Ga-PSMA PET/CT in 55 patients: Physiological tracer distribution and incidental tracer uptake. Clin Nucl Med 2017;42:e322-7.
4. Dunn RN, Ben Husien M. Spinal tuberculosis: Review of current management. Bone Joint J 2018;100-B: 425-31.
5. Jevtic V. Vertebral infection. Eur Radiol 2004;14 Suppl 3:E43-52.
6. Moore SL, Rafii M. Imaging of musculoskeletal and spinal tuberculosis. Radiol Clin North Am 2001;39:329-42.
7. Malik D, Sood A, Mittal BR, Singh H, Basher RK, Shukla J, \textit{et al.} Nonspecific Uptake of 68Ga-prostate specific membrane antigen in diseases other than prostate malignancy on positron emission tomography/computed tomography imaging: A pictorial assay and review of literature. Indian J Nucl Med 2018;33:317-25.
8. Wong VC, Shen L, Nasser E, Adams DN, Mansberg R. 68Ga-prostate specific membrane antigen uptake in cerebral tuberculosis. Clin Nucl Med 2020;45:238-40.
9. Ahuja A, Taneya S, Thorat K, Jena A. 68Ga-prostate specific membrane antigen-avid tubercular lesions mimicking prostate cancer metastasis on simultaneous prostate-specific membrane antigen PET/MRI. Clin Nucl Med 2017;42:e509-10.
10. Sood A, Vadi SK, Kumar R, Singh H, Mittal BR. Incidental detection of hypothyroidism on 68Ga-PSMA-HBED-CC PET/CT imaging. Clin Nucl Med 2020;45:e217-18.
11. Jena A, Zaidi S, Kashyap V, Iha A, Taneya S. PSMA expression in multinodular thyroid neoplasm on simultaneous Ga-68-PSMA PET/MRI. Indian J Nucl Med 2017;32:159-61.
12. Arora S, Prabhu M, Damle NA, Bal C, Kumar P, Nalla H, \textit{et al.} Prostate-specific membrane antigen imaging in recurrent medullary thyroid cancer: A new theranostic tracer in the offing? Indian J Nucl Med 2018;33:261-3.
13. Parihar AS, Sood A, Mittal BR, Kumar R, Singh H, Dhatt SS. 68Ga-PSMA-HBED-CC PET/CT and 18F-FDG PET/CT in Ewing sarcoma. Clin Nucl Med 2020;45:e57-8.
14. Taneya S, Taneya R, Kashyap V, Jha A, Jena A. 68Ga-PSMA uptake in hepatocellular carcinoma. Clin Nucl Med 2017;42:e69-e70.
15. Chang SS, Reuter VE, Heston WD, Gaudin PB. Metastatic renal cell carcinoma neovascularature expresses prostate-specific membrane antigen. Urol 2001;57:801-5.