Clinics in Oncology

Clinical Image
Published: 12 Oct, 2020

Utilization of Technium-99m PSMA in the Evaluation of Bone Metastases in Prostate Cancer, Interesting Medical Image

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Clinical Image

A 51 years old male presented with right sided hip pain and limping for one year with weight and appetite lose for few months. He denied any symptoms related to urinary tract or prostate enlargement. Past medical history is not significant.

Contrast Enhanced Computed Tomography (CECT) and later Magnetic Resonance Imaging (MRI) of the pelvis revealed multiple bone lesions as well as heterogeneously enhancing lesion involving the left half of prostate seen crossing the midline measuring approximately 41 mm × 45 mm involving the Peripheral Zone (PZ), Central Zone (CZ) and Transitional Zone (TZ) of the LT half of the prostate.

He looked well and examination was unremarkable except for limping while walking. Direct rectal examination revealed hard fixed prostate.

Investigations revealed Prostate Specific Antigen level (PSA) >100 ng/ml.

Trans-Rectal Ultrasound Biopsy (TRUSB) revealed acinar adenocarcinoma with peri-neural and adipose tissue invasion but no vascular invasion. The total percentage of cancer in all cores: 60%.

The patient was booked for bone scan (Tc-99m MDP) to further evaluate the extent of bone involvement, Figure 1. It showed numerous widespread foci of increased radiotracer uptake involving the axial and appendicular skeleton in keeping with bone metastases.

Technium-99m PSMA scan was performed and revealed extensive skeletal metastatic lesions similar to the bone scan distribution, Figure 2. Areas with pathological fractures (in this case was in the proximal part of left clavicle) were more prominent in the Tc-99m MDP bone scan compared to the Tc-99m PSMA scan, which is due to high affinity of MDP to areas with new bone formation at sites of fracture, osteoarthritis, or degenerative changes of the vertebral bodies (Figure 3). This

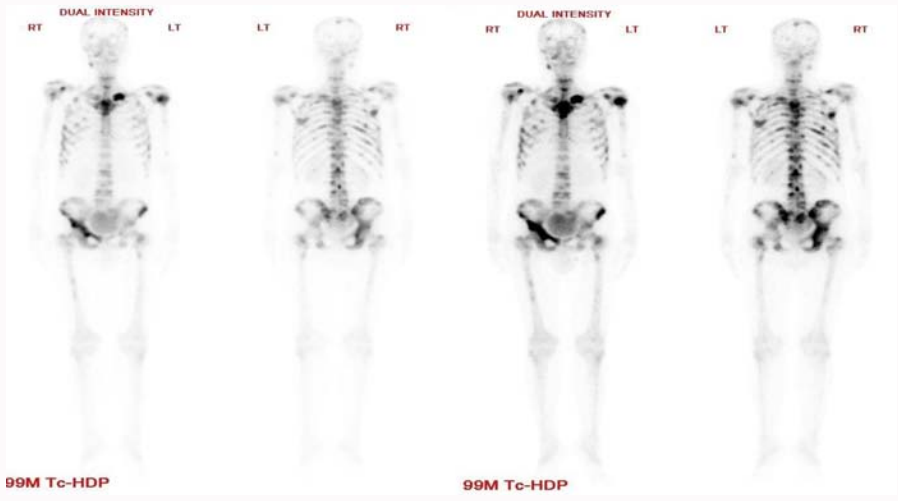

Figure 1: Whole body planar, dual intensity images of Tc99m-HDP showing the widespread foci of abnormal radiotracer uptake in keeping with metastases.

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Received Date: *22 Sep 2020*
Accepted Date: *08 Oct 2020*
Published Date: *12 Oct 2020*

Citation:
Al Saqri B, Al Bulushi N. Utilization of Technium-99m PSMA in the Evaluation of Bone Metastases in Prostate Cancer, Interesting Medical Image. Clin Oncol. 2020; 5: 1744.

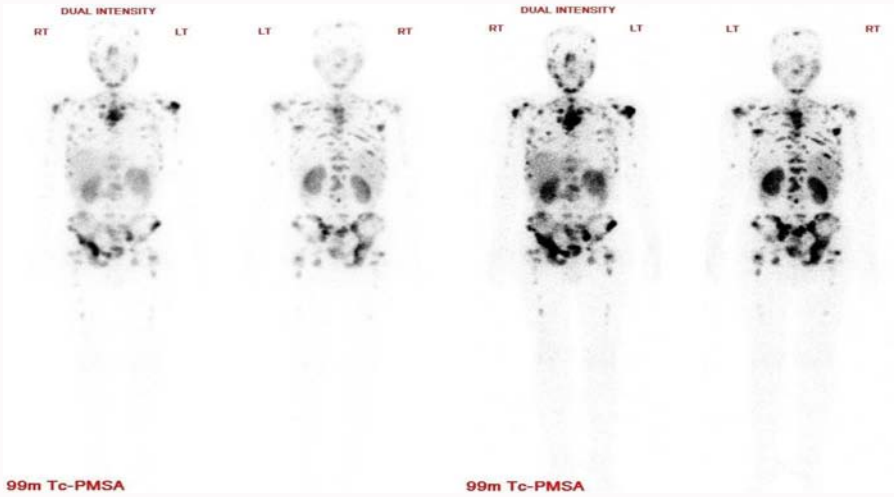

Figure 2: Whole body planar, dual intensity images of Tc-99m PSMA showing similar distribution of abnormal uptake corresponding to the metastatic lesions seen in the bone scan.

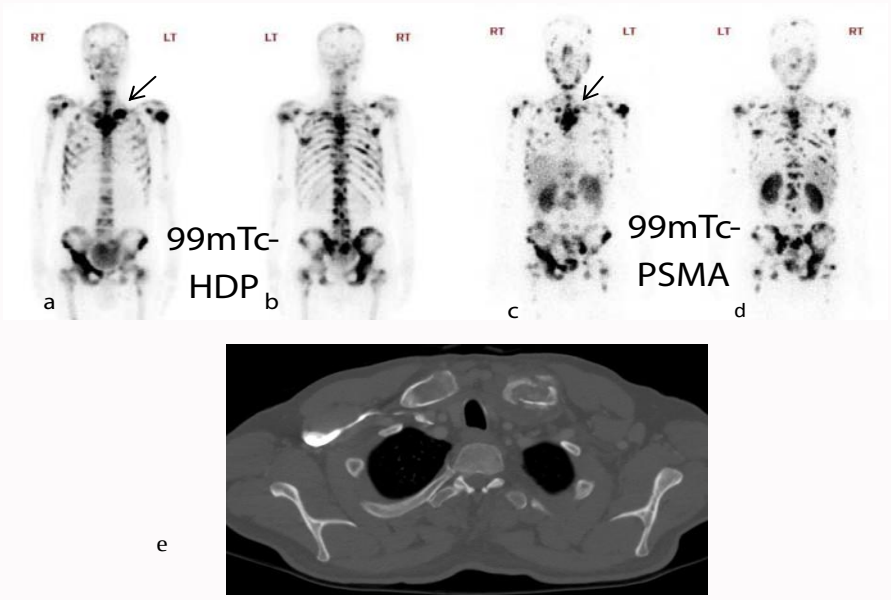

Figure 3: Side to side comparison between Tc-99m HDP and Tc-99m PSMA whole body images revealing similar distribution of the bone metastases. Arrow: Left clavicular lesion showing more prominent uptake in the bone scan due to associated pathological fracture that is seen clearly in the CT (e). a & b: Tc99m-HDP (bone scan), c & d: Tc99m-PSMA, e: axial image from contrast enhanced CT scan of the chest.

clearly reflects the high specificity of PSMA compared to that of MDP in imaging bone metastasis in prostate cancer.

Comment: Prostate-Specific Membrane Antigen (PSMA) is an attractive target for the diagnosis and therapy of metastasized prostate cancer [1,2].

PSMA shows high affinity to prostate primary tumor and metastatic lesions and low affinity to the non-prostate related tissue. Hence, it is the most valuable molecular marker in prostate cancer both in staging and therapy [3].

Initially the PSMA was labeled with 111-Indium. However, as 111-In is not readily available which enforced limitations to the PSMA usage and necessities looking for alternatives. The next and up to date best radiotracer to label PSMA is Gallium-68, which is a positron emitter and patients are imaged using PET/CT.

Ga-68-PSMA PET/CT is also the modality of choice to identify patients who could be candidates to radionuclide therapy using Luteium-177-PSMA (used for metastatic Castration Resistant Prostate Cancer, mCRPC) [4]. However, Ga-68 PSMA is not widely available.The ready kit Tc-99m PSMA shows high affinity to prostate cancer and increased target to background ratio up to 21 h post-tracer injection. It is labeled with Tc-99m that is readily available in all nuclear medicine departments and can be used as a SPECT imaging agent. Tc-99m labeled PSMA appears to be straightforward reliable option and provides a cost-effective alternative in the non-availability of Ga-68 radiotracer [5].

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