Comparison of ^{99m}Tc-PSMA-T4 imaging with conventional ^{99m}Tc-Methylene Diphosphonate(MDP) in patients with prostate cancer

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Introduction

Prostate cancer is one of the most common malignancy in men, with increasing incidence in recent years.

Prostate cancer treatment is influenced by presence or absence of metastasis. Conventional imaging includes CT ,MRI, ^{99m}Tc-MDP (methylene diphosphonate) bone imaging .

Although PSMA (Prostate specific membrane antigen) labelled PET/CT and ^{18}F-NaF PET imaging has been found superior to conventional ^{99m}TC-MDP bone imaging but PET/CT is still not widely available. Recently ^{99m}Tc-PSMA tracers have been developed for SPECT/CT imaging and they have shown promising results .

Aims & Objectives

The purpose of this study was to compare ^{99m}Tc PSMA-T4 imaging with conventional ^{99m}Tc-MDP bone scan.

Materials and Methods

Twenty-two male patients with histologically confirmed prostate cancer were included. All patients underwent both conventional ^{99m}Tc-MDP bone scan and ^{99m}Tc-PSMA T-4 scintigraphy within a time period of 2 weeks. All the procedures were performed in accordance with the ethical standards of the institution. The ^{99m}Tc-MDP was given as an intravenous bolus injection of 740 MBq and whole-body images were acquired 2 to 3 h after injection. For ^{99m}TC-PSMA-T4 imaging, whole-body with SPECT-CT studies were done 2-3 hrs post intravenous administration of ^{99m}Tc-PSMA-T4 (555 MBq).

Planar images in both studies were acquired with GE Discovery NM 670 pro with matrix size 256 x 1024 for both detectors, and the zoom was set 1.0. SPECT/CT imaging was done in selected regions of interest determined by the tracer uptake on the planar whole-body images. Dual-head SPECT : 64 projections, 25 s/projection, matrix 256 × 256. A low dose CT scan was performed in the helical mode.

Results

Table 1:General Characteristics of Patients (n=22)

Patient Characteristics	Frequency(n)	%
Age at diagnosis		
50-59 y	7	33.3
60-69 y	10	47.6
70-79 y	3	14.3
80-89 y	1	4.8
Stage at Diagnosis		4.5
1	1	18.2
2	4	31.7
3	7	45.5
4	10	
PSA level		
0-9.9 ng/ml	6	27.3
10-20 ng/ml	1	4.5
> 20ng/ml	15	68.2
Gleason score		
6 (low risk)	3	13.6
7 (intermediate risk)	7	31.8
8–10 (high risk)	11	50

Table 2. Mean Number of Bony Lesions and Number of Patients with Bone Lesions Observed on MDP and PSMA scan.

Test	No. of Bone Lesions	No. of patients (n=22)	
	Mean	With Bone lesions	Equivocal
^{99m}Tc-MDP	6.95	15 (68.2 %)	2
^{99m}Tc PSMA-T4	7.22	17 (77.3%)	0

Figure 1: Location of Tumor Tissue In PSMA-T4 Positive Scans

Bones (77.3%), Prostate bed (59.1%), Lymph nodes (50%), liver (9.09%), Lung (4.5%)

Figure 2: 72yr/male, pT3bpN0M0, AdenoCA prostate, GS = 7 (4 + 3) suspected biochemical. PSA = 10.5 ng/mL . (A) ^{99m}Tc-MDP showed no definite skeletal metastasis . (B,C,D) ^{99m}Tc PSMA-T4 SPECT-CT imaging showing left supraclavicular node metastases with intense tracer uptake.
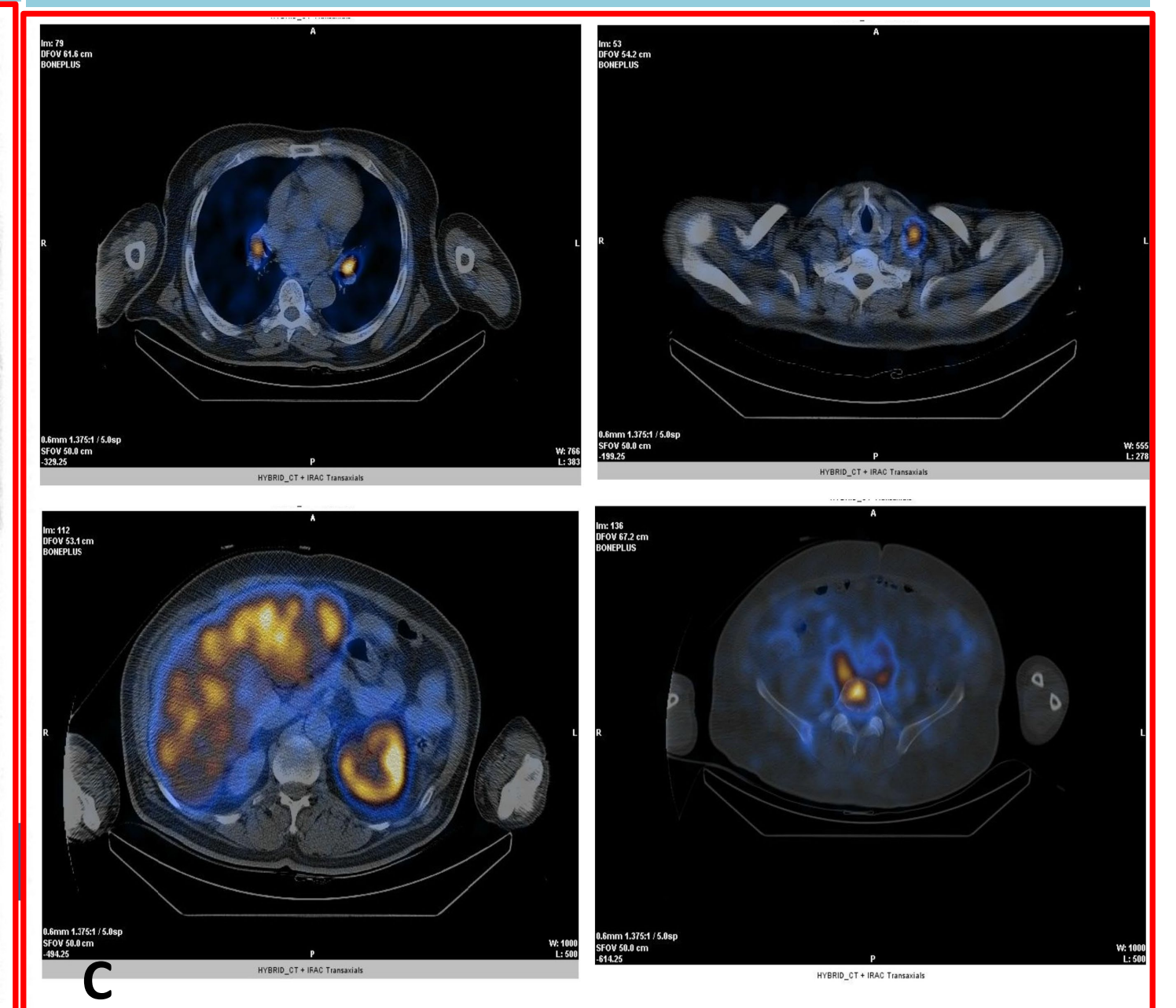
Figure 3: 65yr/M with AdenoCA prostate, GS = 8 (4 + 4). (A) Whole-body scan showed suspicious lesion in L-5 vertebrae, right ilium and adjoining SI joint region.(B,C) ^{99m}Tc-PSMA-T4 SPECT-CT imaging showed bone (skull, right iliac blade, lumbar vertebrae and sacrum, right femur), and soft tissue mets(in liver, left cervical LN, B/L hilar, periaortic lymph nodes)

Conclusion And Future Perspectives

➢ ^{99m}Tc-PSMA-T4 imaging has an advantage over conventional bone scanning by reducing the number of equivocal findings as well as depicting extraosseous metastasis.

➢ ^{99m}Tc-PSMA-T4 SPECT-CT imaging can be applied in patients with biochemical progression for the diagnosis of recurrent disease and in patients with recurrent disease in deciding personalized treatment (Radioligand Therapy with Lu-177).

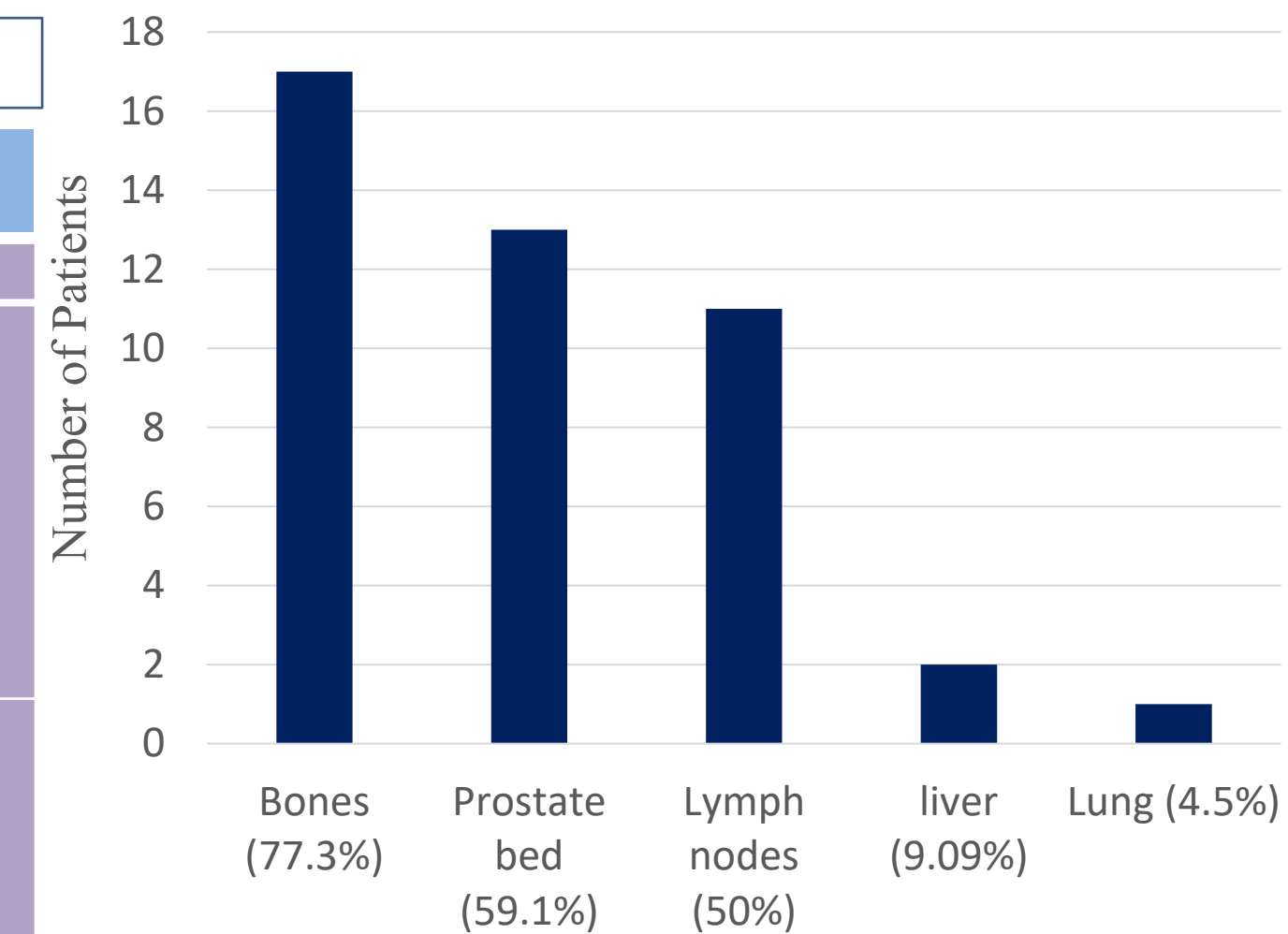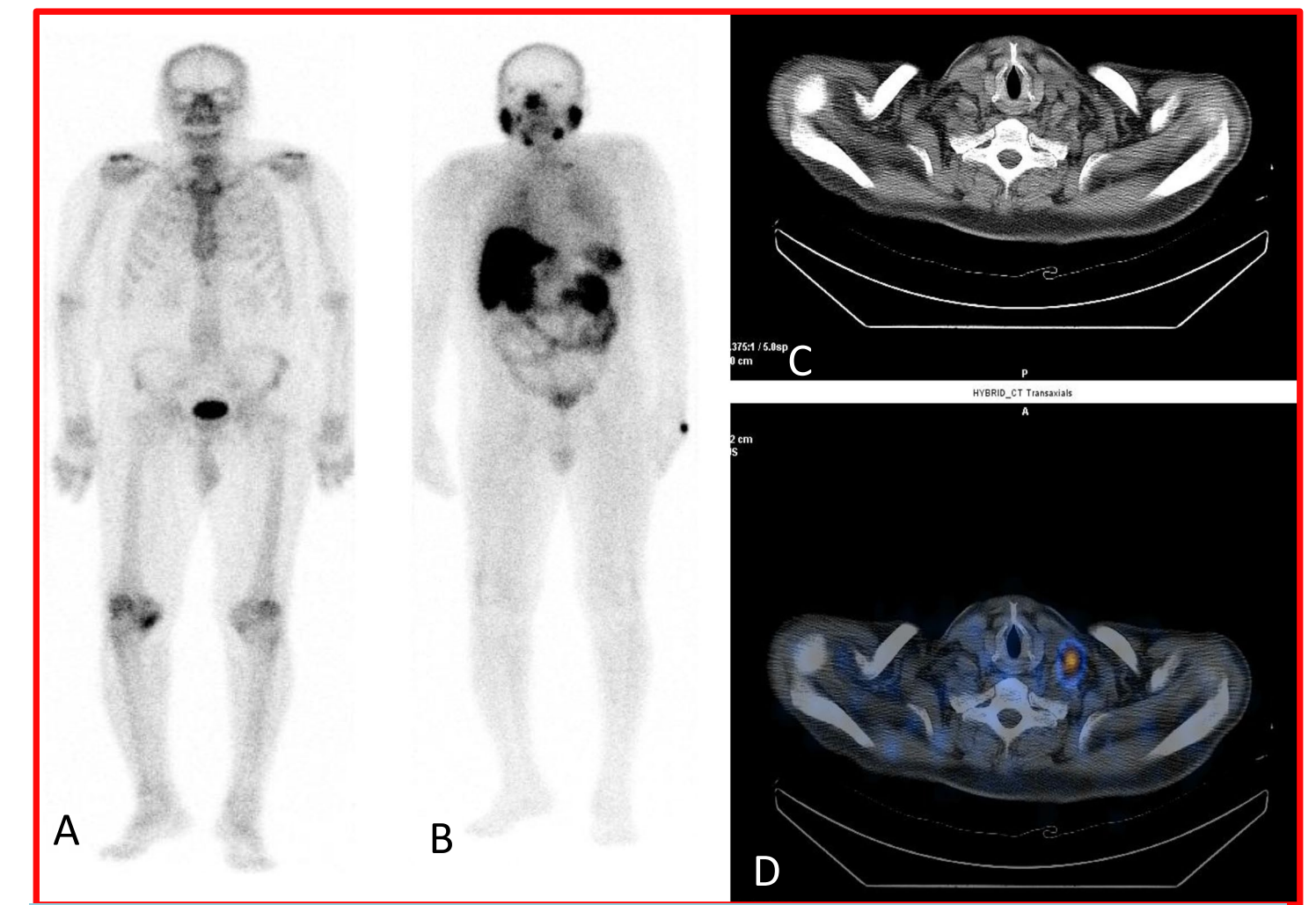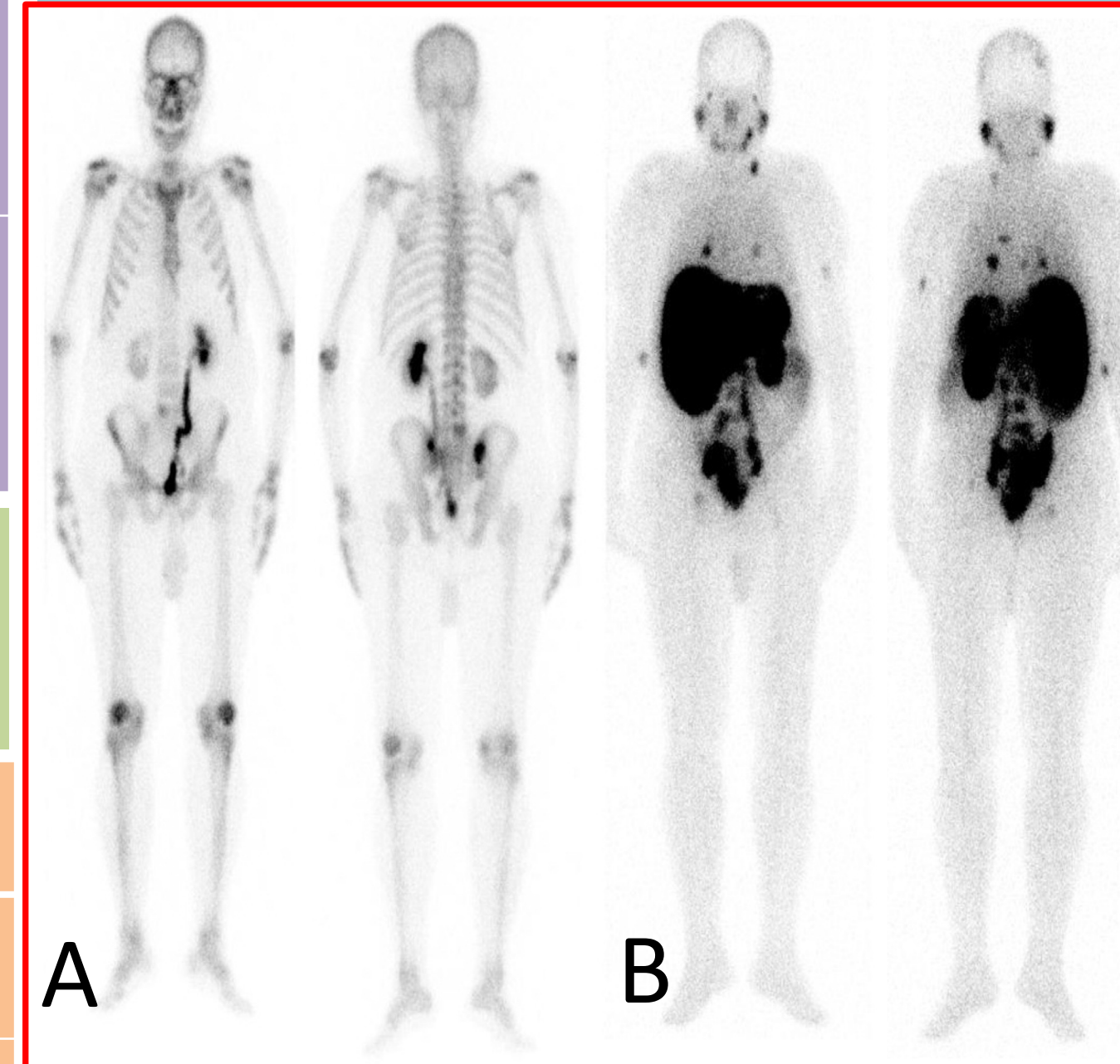➢ ^{99m}Tc-PSMA-T4 SPECT-CT imaging may be cost-effective in resource limited countries.