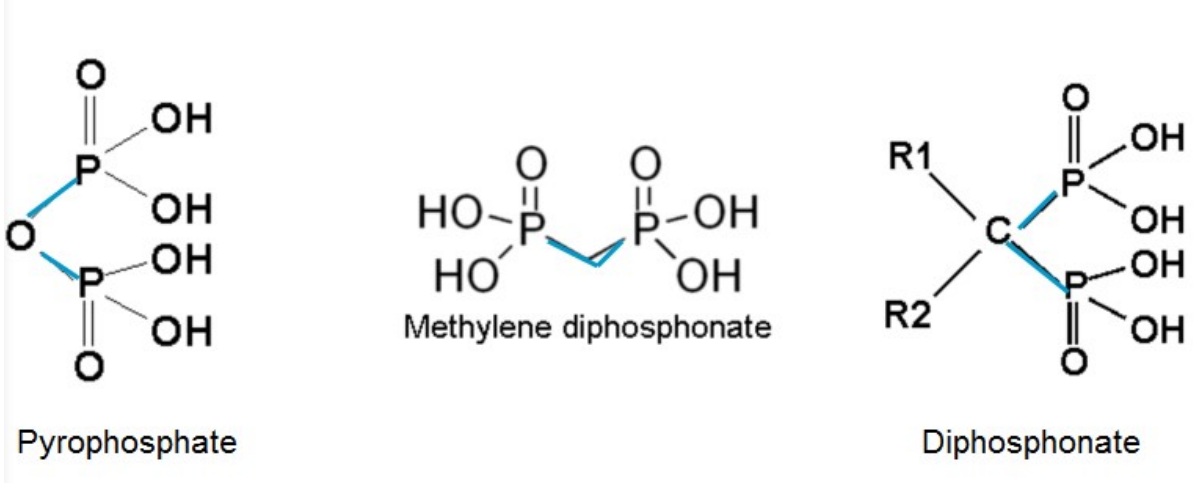
Bone scan

Radiopharmaceuticals

- Bone-seeking radiopharmaceuticals are analogs of calcium, hydroxyl groups, or phosphates.
- ^{99m}Tc-labeled diphosphonates: ^{99m}TC-MDP



^{99m}TC-MDP

- Tc: $T^{1/2}$: 6.03 hours.
- γ-ray 140 (88%) keV.

- Rapid renal excretion.
- high target-to-nontarget ratio : 2 to 3 hours after injection, 50% to 60% of the activity in bone
- the remainder being cleared by the kidneys

- impair renal function→increased soft-tissue activity→ reduces the quality of the bone scan.
- With most diphosphonates, maximal skeletal uptake occurs at about 5 hours.
- The biologic half-life is about 24 hours.

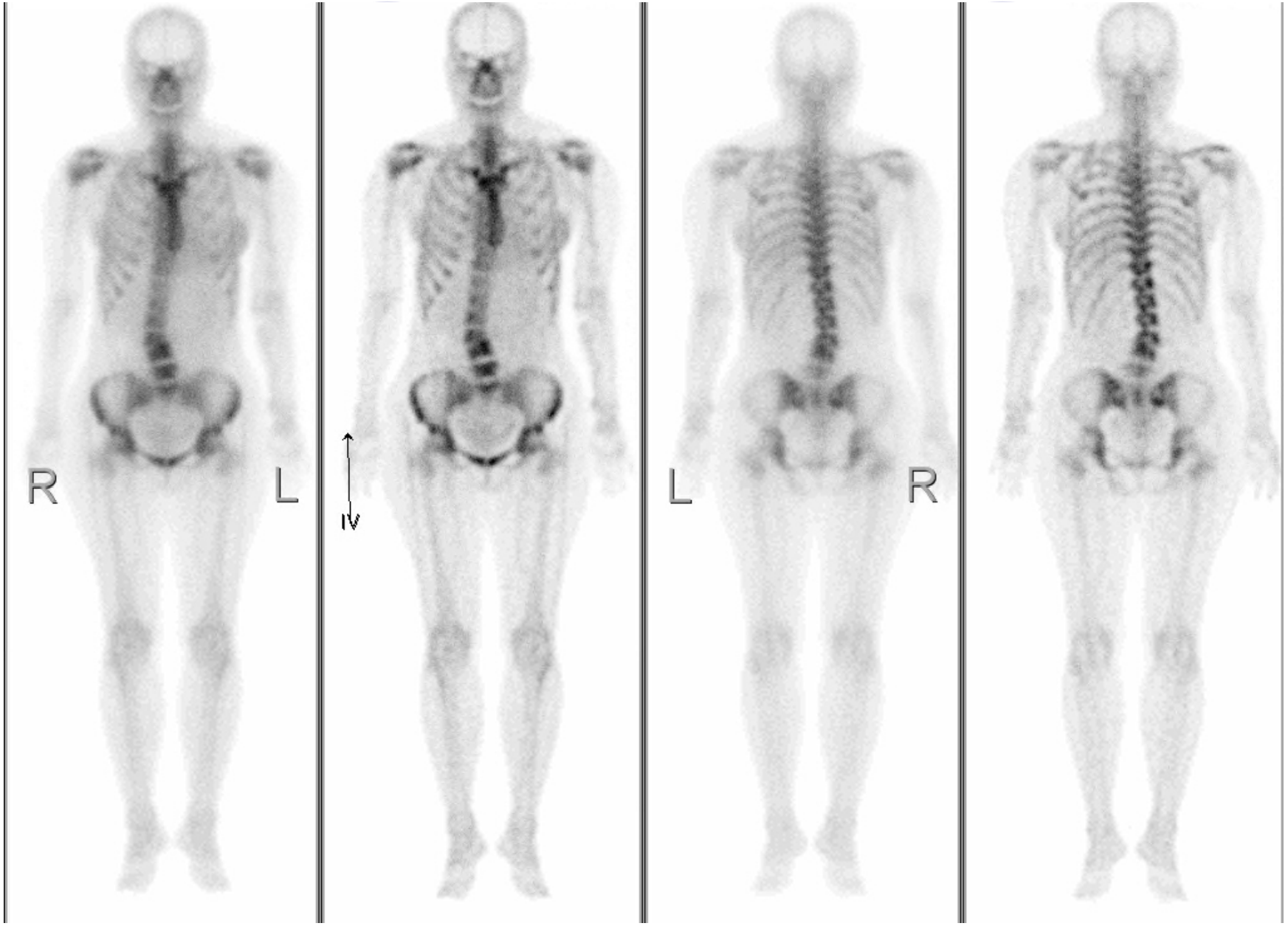

R
L
L
R

TABLE 9–1. Possible Mechanisms of Increased Activity on Bone Scans

Increased osteoid formation

Increased blood flow

Increased mineralization of osteoid

Interrupted sympathetic nerve supply

- The initial accumulation of technetium-labeled radiopharmaceuticals in bone is primarily related to blood supply.

TABLE 9–2. Causes of Increased Activity on Bone Scan

LOCALIZED

Primary bone tumor
Metastatic disease
Osteomyelitis
Trauma
- Stress or frank fractures
- Battering
- Postsurgical osseous changes
- Loose prosthesis

Degenerative changes
Osteoid osteoma
Paget's disease, melorrheostosis, fibrous dysplasia
Arthritis
Locally increased blood flow
- Hyperemia
- Decreased sympathetic control

Decreased overlying soft tissue (e.g., postmastectomy)
Soft-tissue activity (see Table 9—5)

GENERALIZED (SUPERSCAN)

Primary hyperparathyroidism

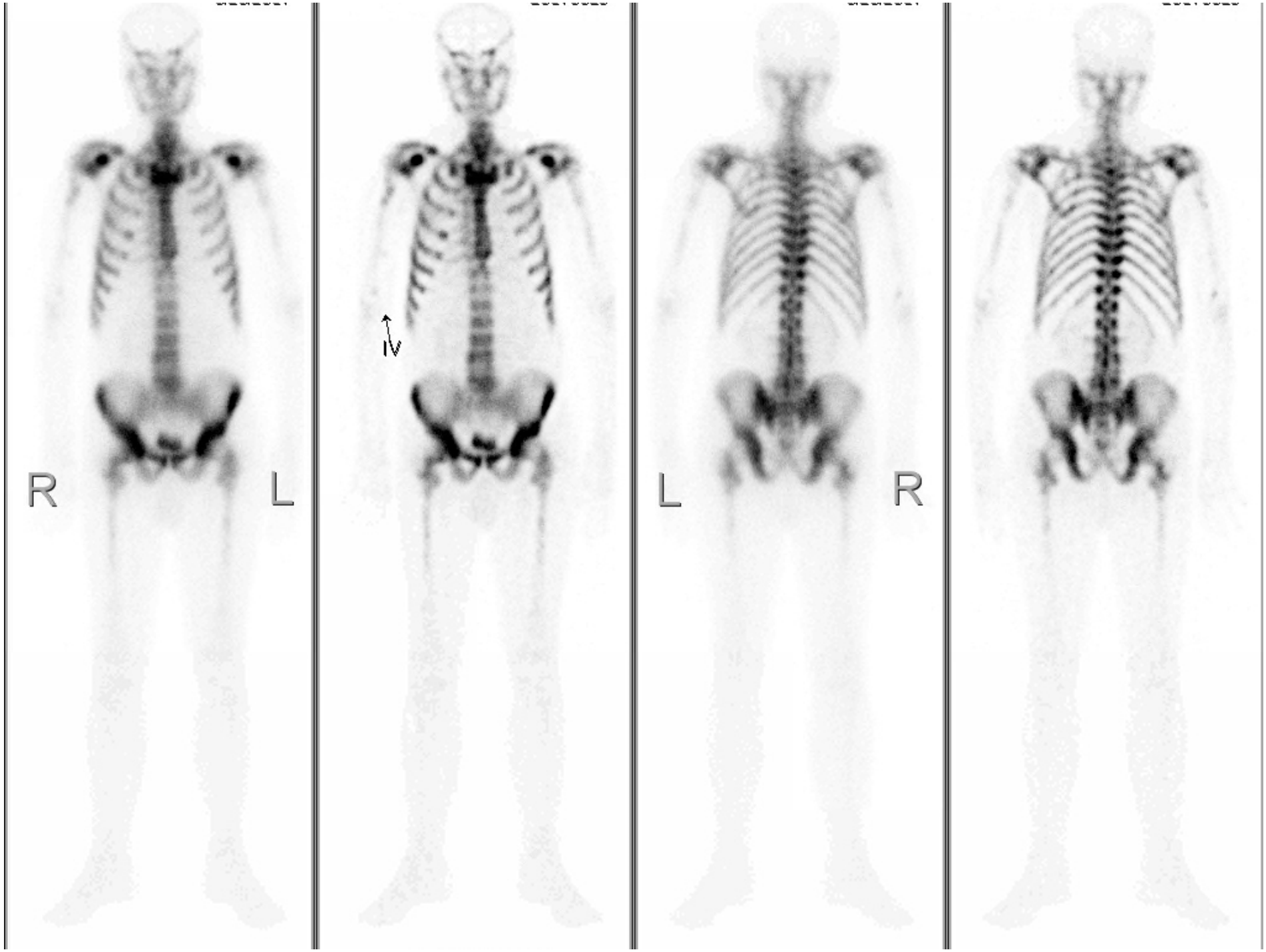
Secondary hyperparathyroidism

Renal osteodystrophy

Diffuse metastases

- Prostate
- Lung
- Breast

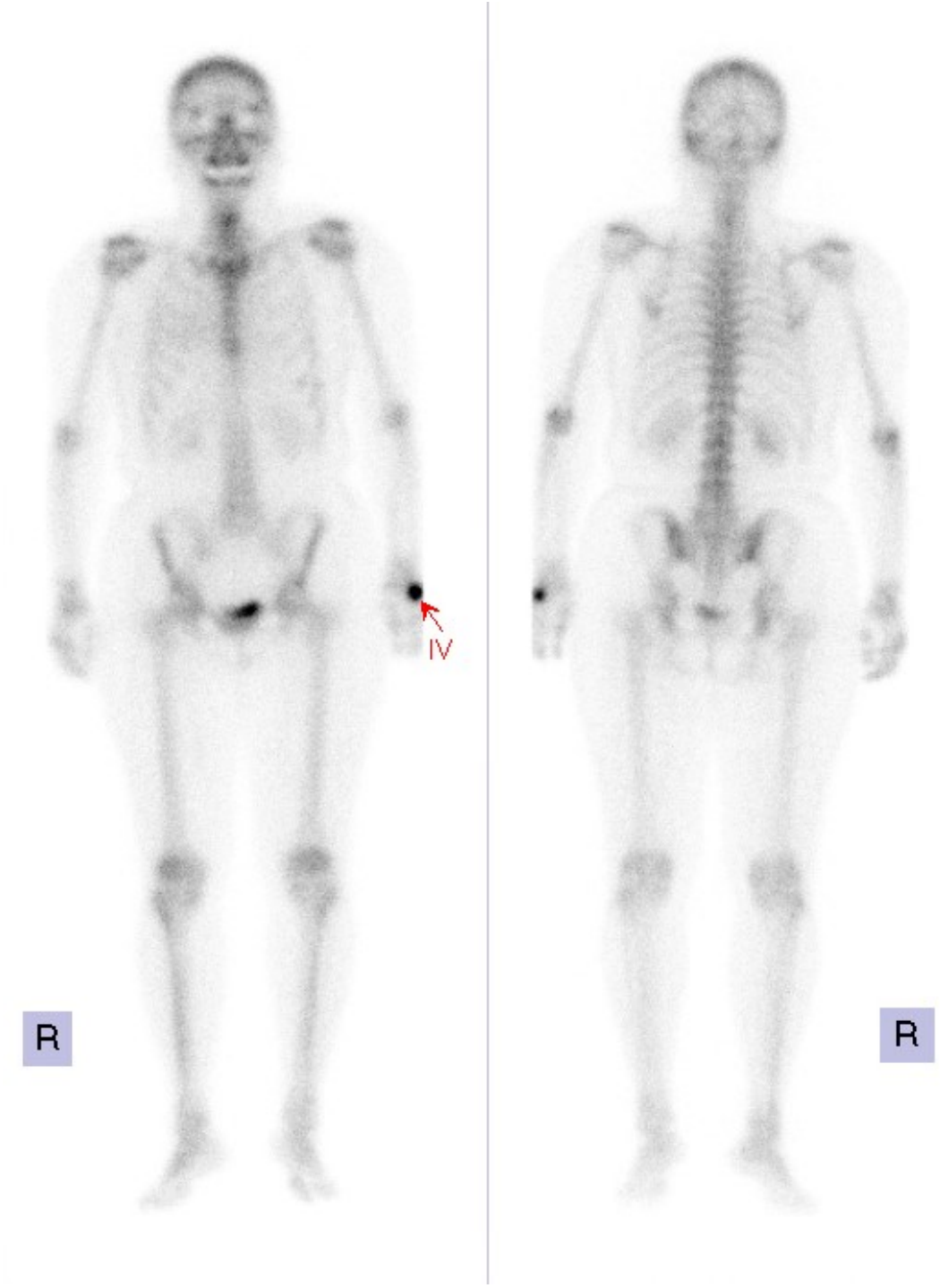
Hematologic disorders


R
L
L
R

Clinical indications

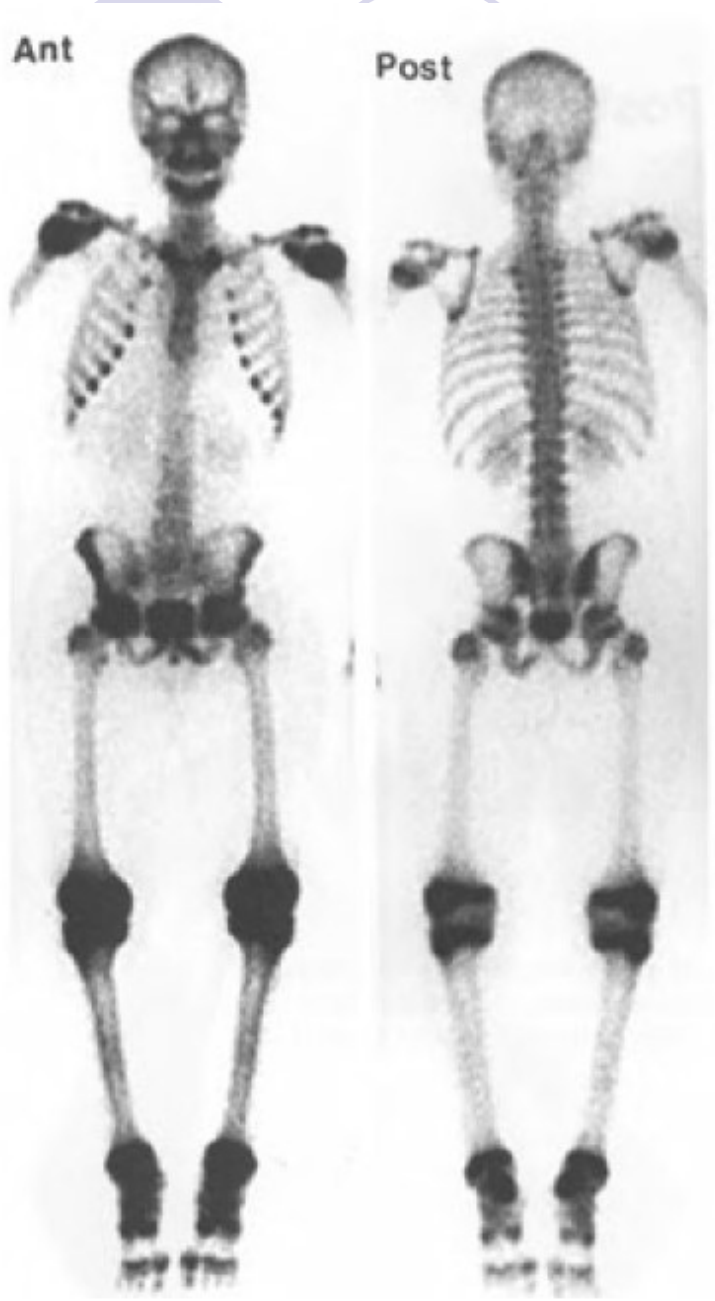
- Detection and follow-up of **metastatic disease**
- Differentiation between **osteomyelitis and cellulitis**
- Determination of bone viability
- Evaluation of fractures difficult to assess on radiographs
- Evaluation of prosthetic joints for infection or loosening
- Determination of biopsy site
- Evaluation of bone pain in patients with normal or equivocal radiographs
- Evaluation of the significance of an incidental skeletal finding on radiographs

Benign bone scan image



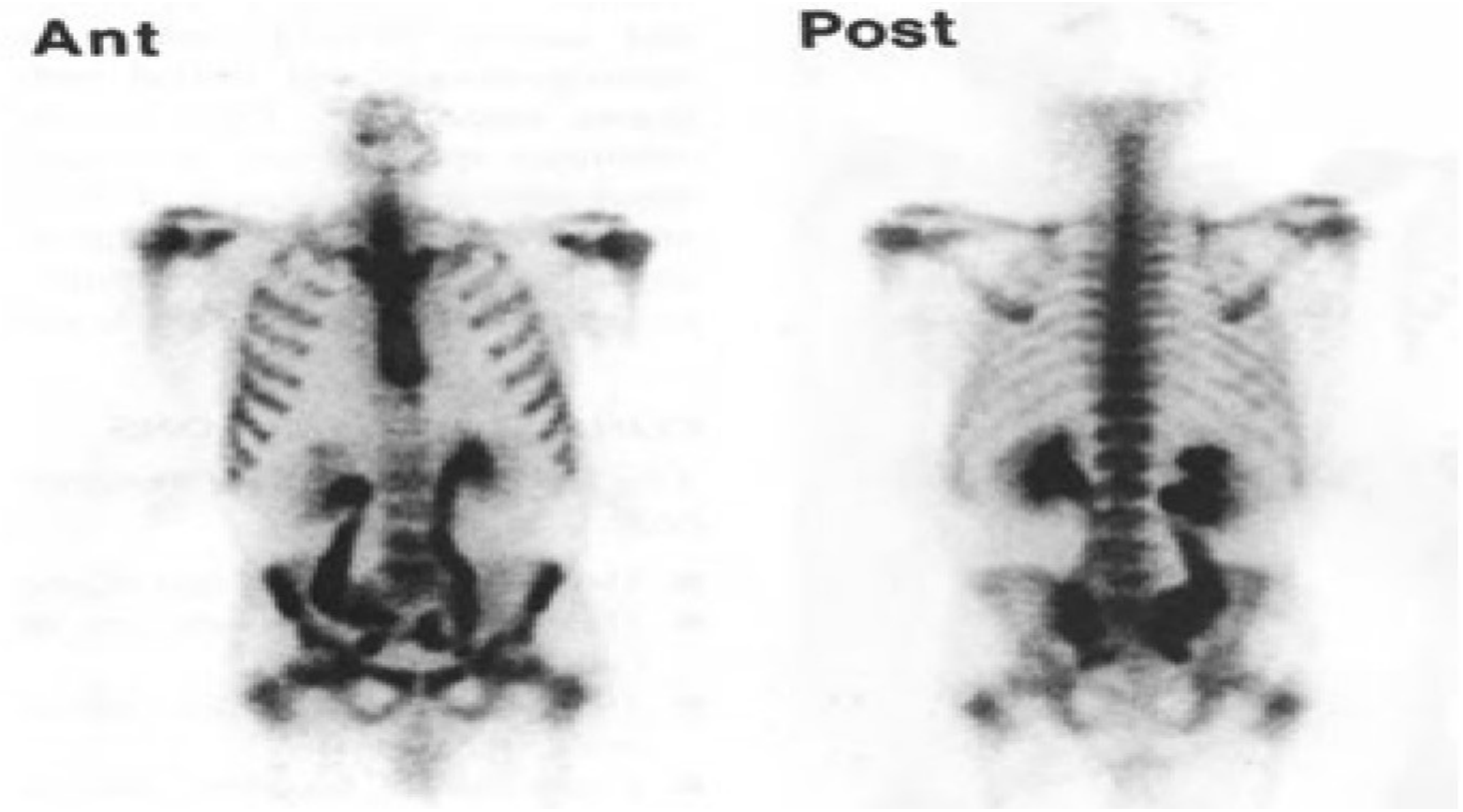
- Skull
- Nasopharynx (high proportional blood flow)
- lower cervical spine (degenerative changes; thyroid cartilage)
- sternum, shoulders (SC/ AC joints)
- iliac crests, hips.
- spine often demonstrates increased activity.
- Kidney / urinary bladder.

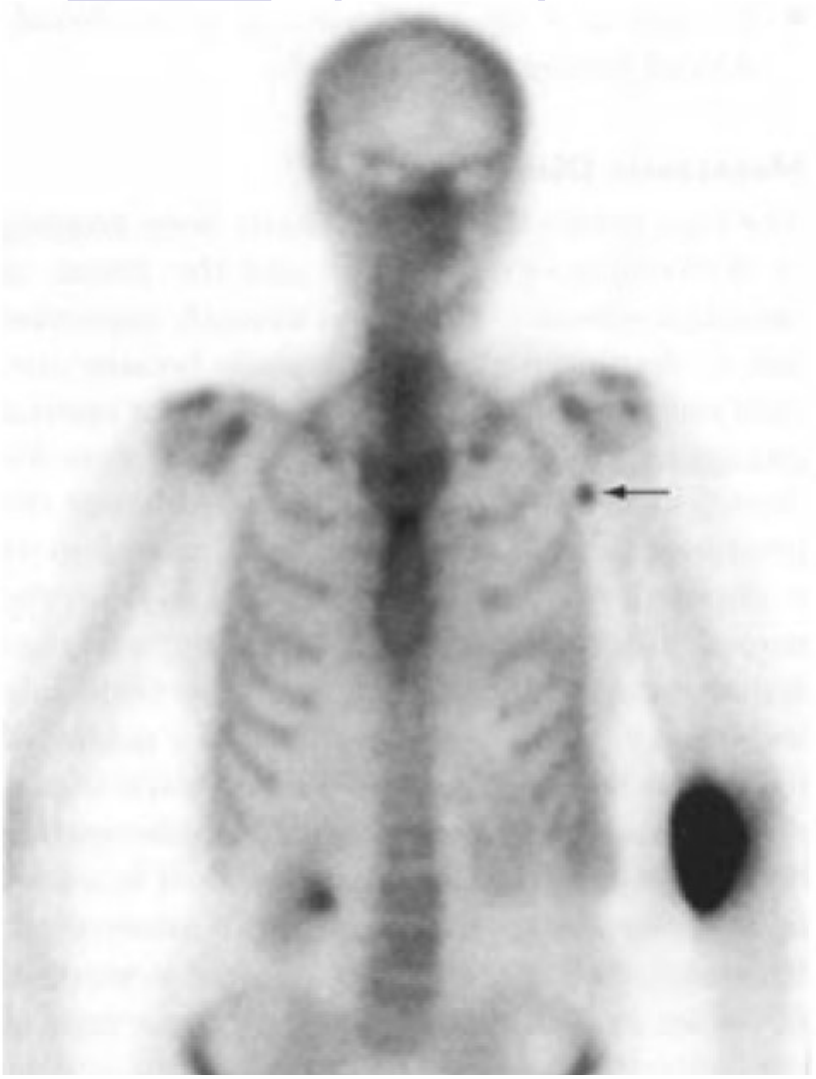
- Because the human skeleton is symmetric, any asymmetric osseous activity should be viewed with suspicion.



- 15 y/o boy
- markedly increased activity around the epiphyseal plates.
- knees, ankles, shoulders, and wrists

Hydronephrosis

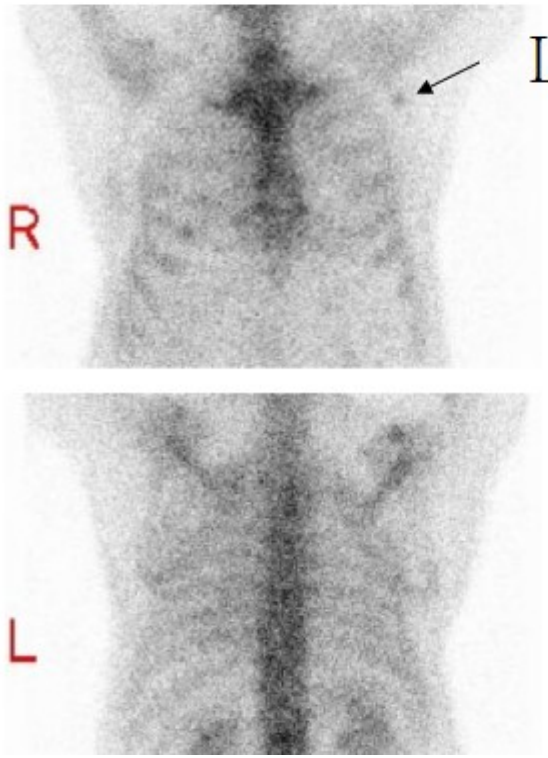


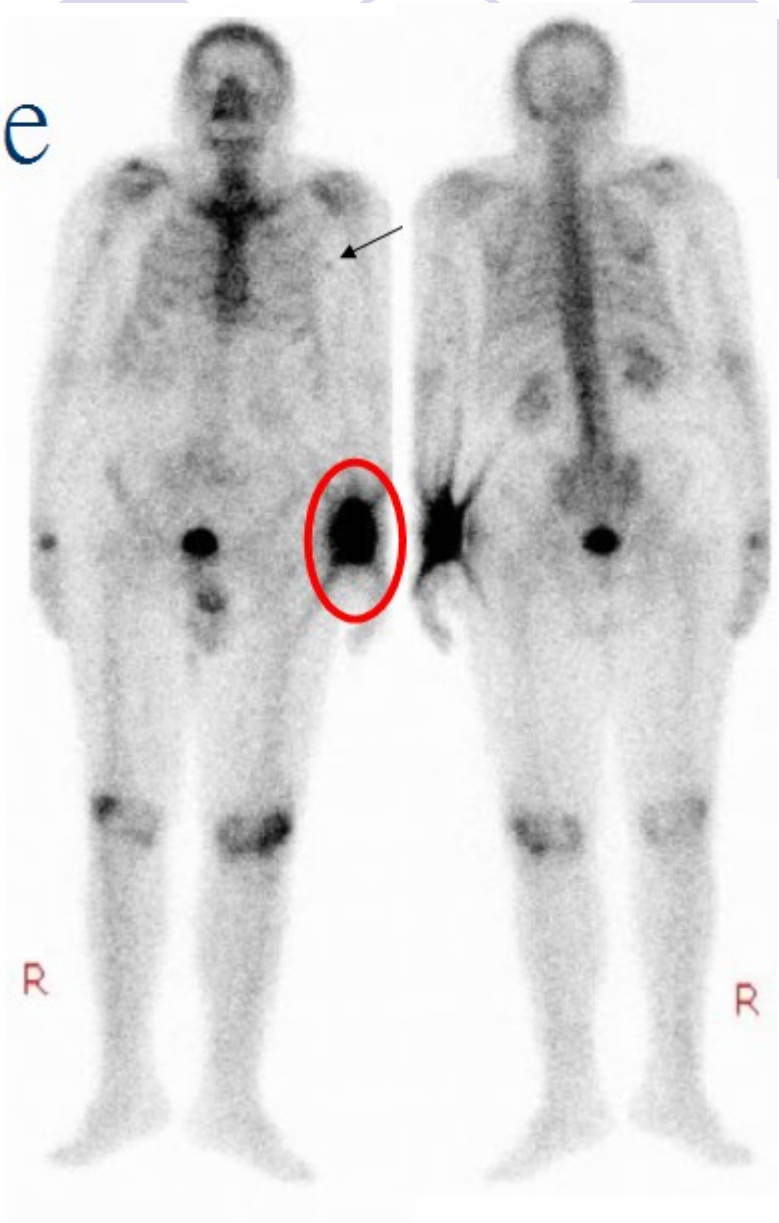


- lymphatic drainage.
- Activity in axillary lymph node after extravasation of injection into left antecubital fossa.

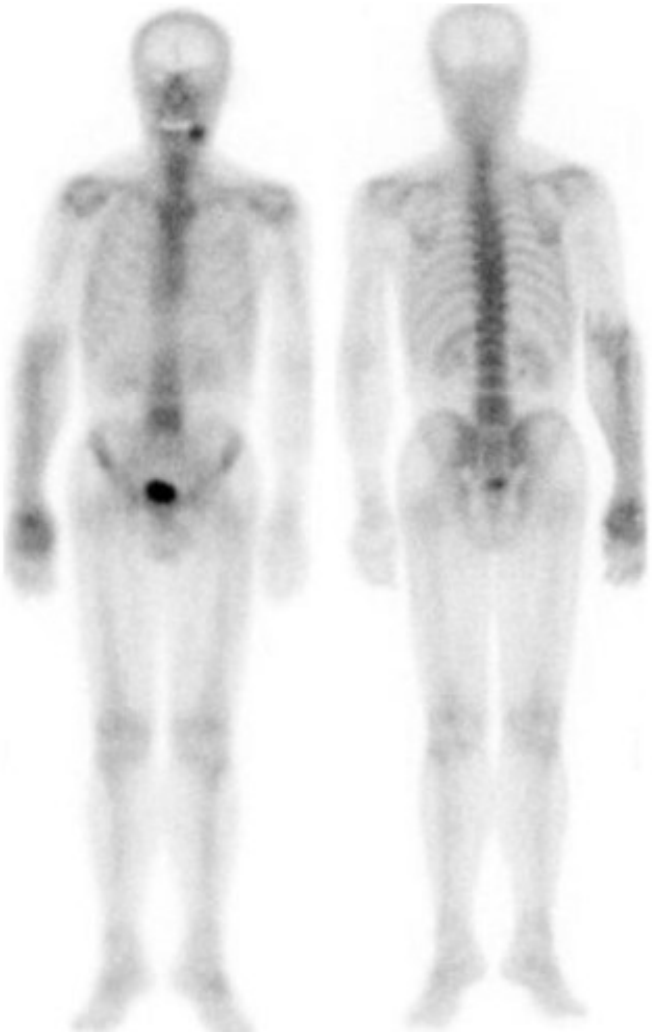
Radiotracer leakage

73 y/o male,
lung cancer and prostate cancer

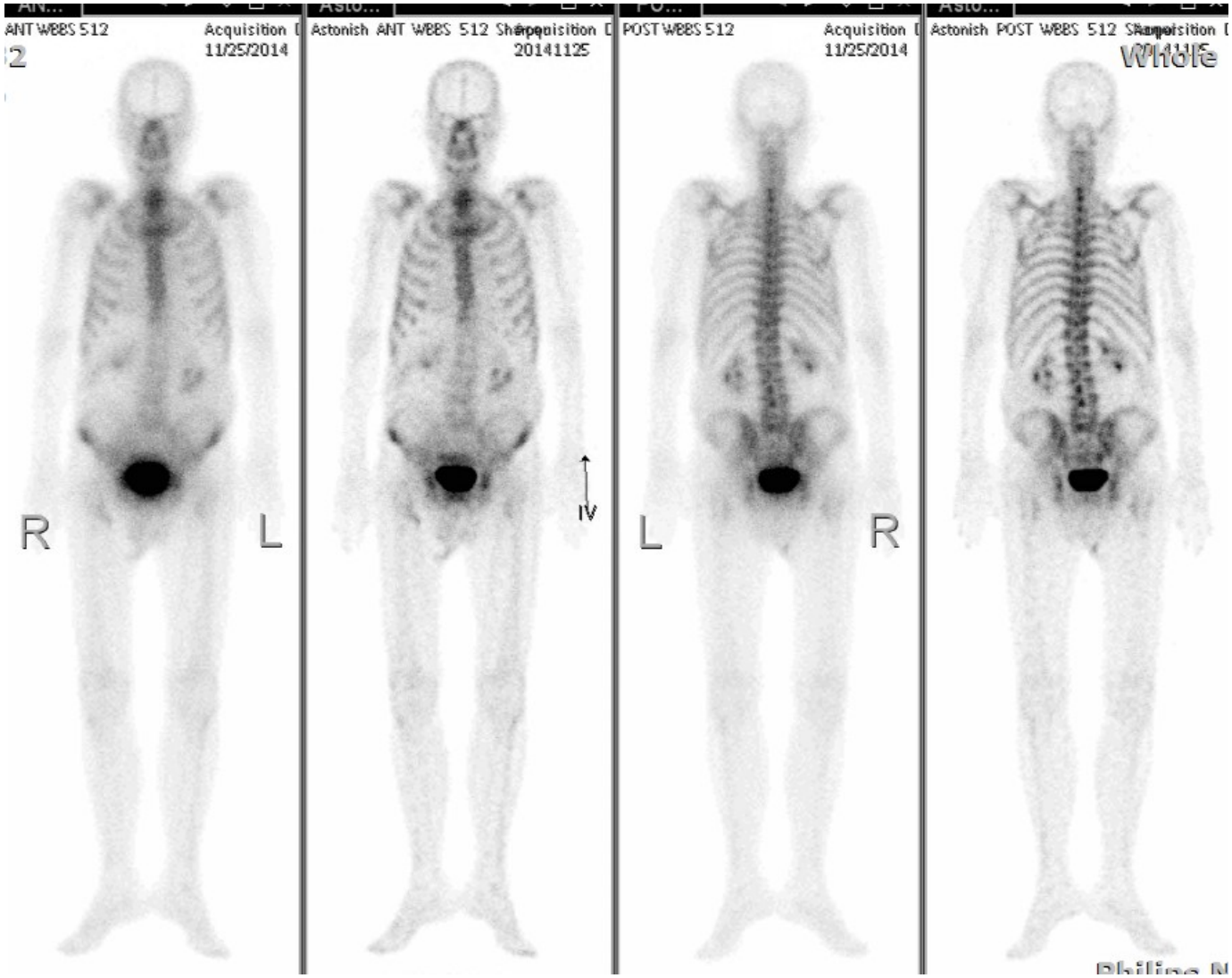




Glove Phenomenon (arterial injection)



scoliosis of L spine with uneven spinal uptake
-favored Spinal DJD

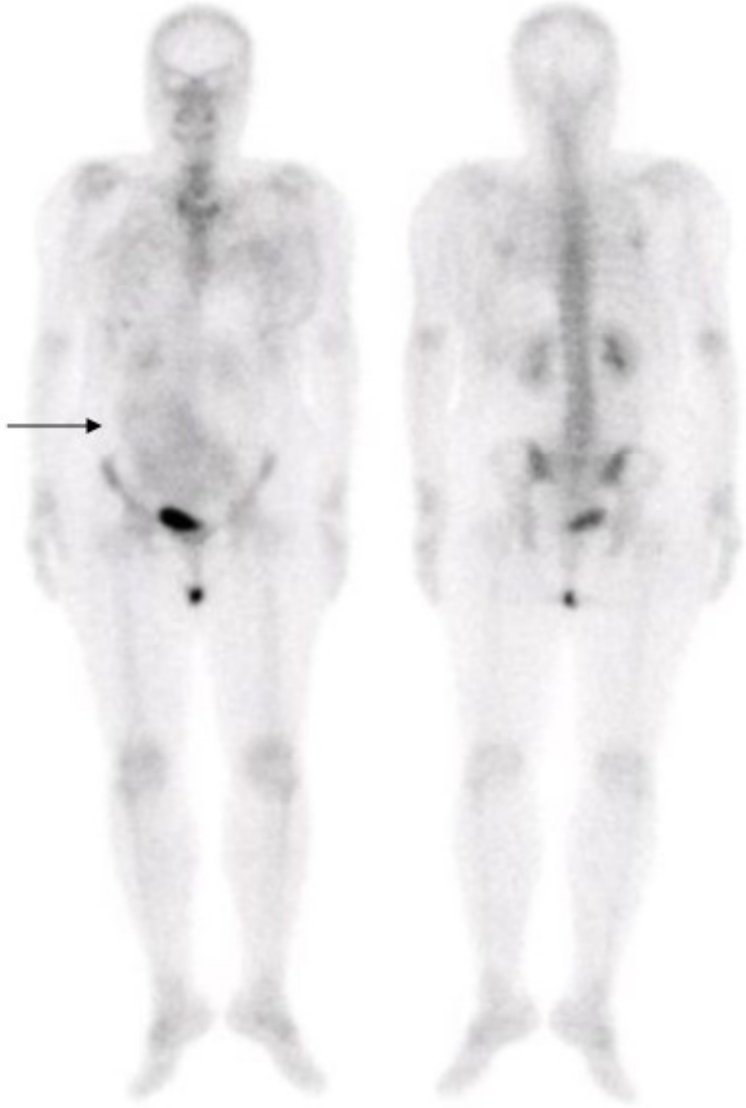


Abdominal soft tissue uptake

Abdominal soft tissue uptake (1)

Left breast cancer S/P OP

uterine myoma, 7cm



Abdominal soft tissue uptake (2)

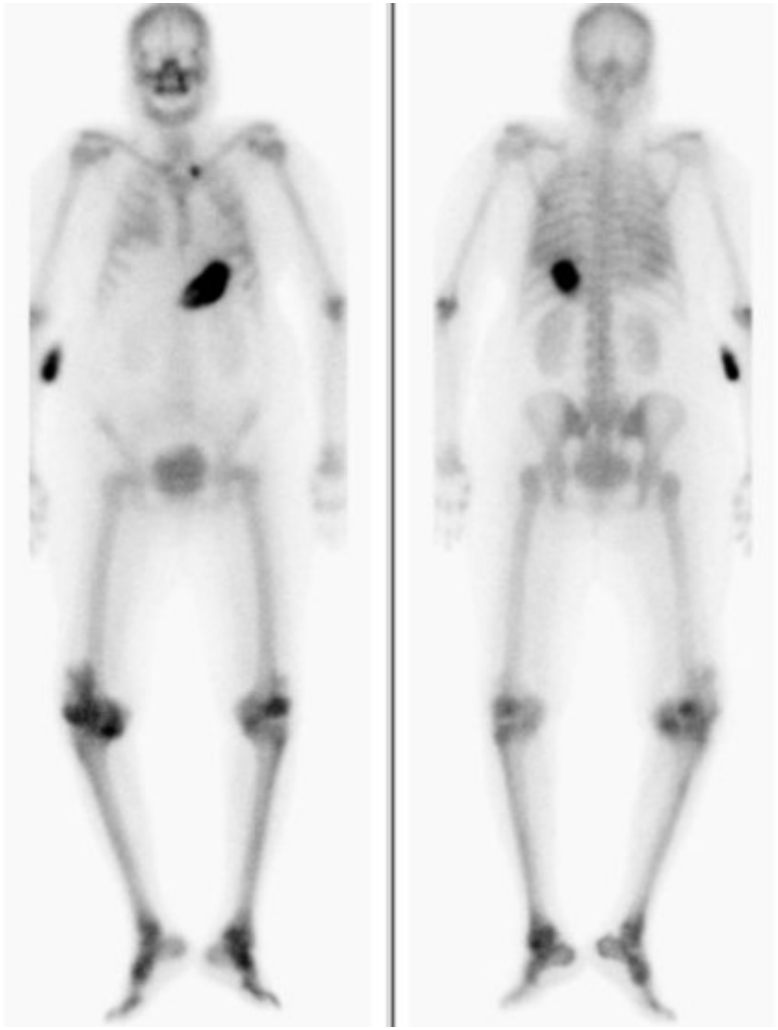
Left thigh sarcoma S/P OP

with lung and liver metastasis

Abdominal soft tissue uptake (3)

Hypercalcemia

1. Diffuse mild uptake in both lungs
2. Hot uptake in stomach
3. Ca: 12.7 (8.4 -10.6)
4. BUN=59, Cr=4.6

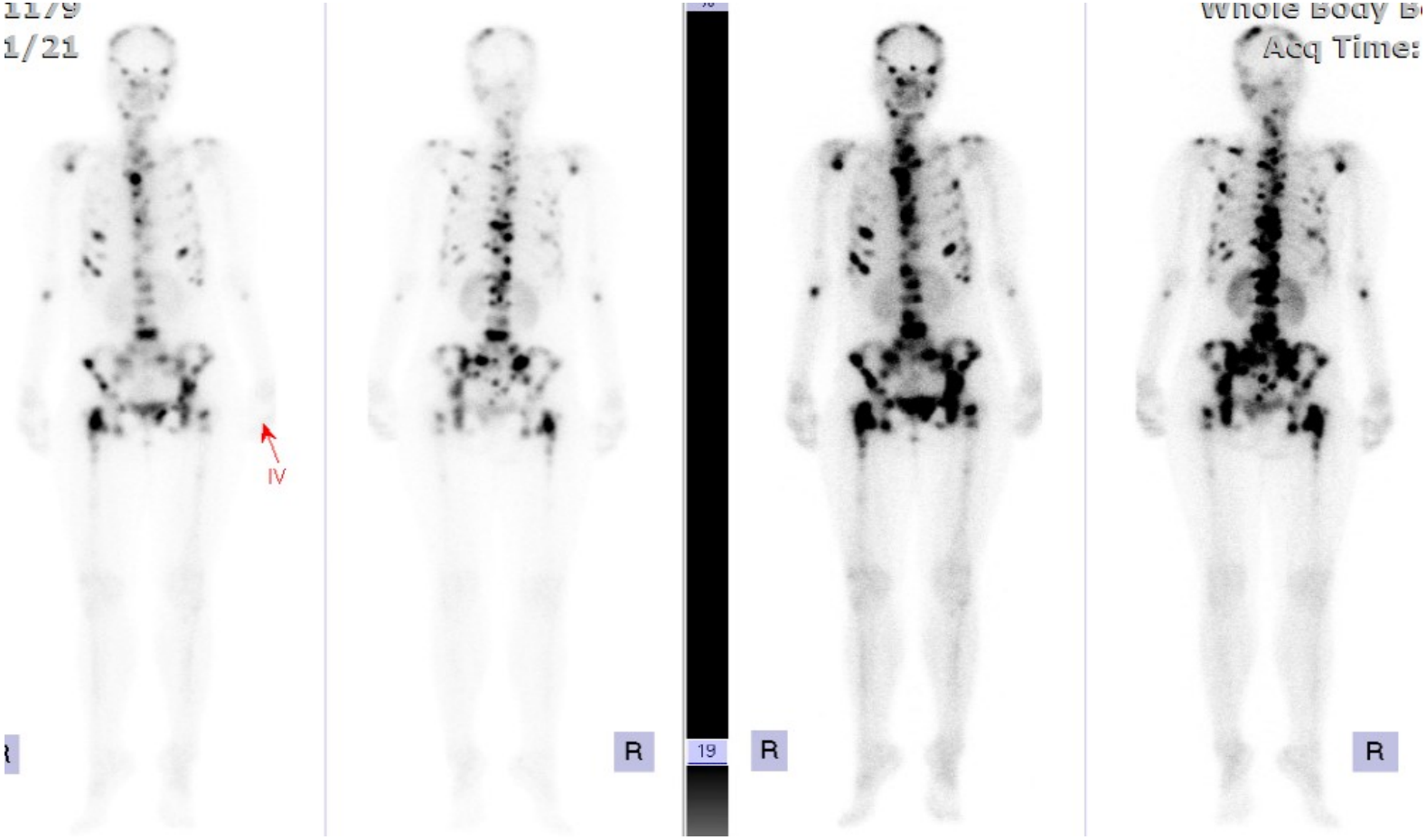


Metastatic calcification:

lung, stomach, renal parenchyma, thyroid

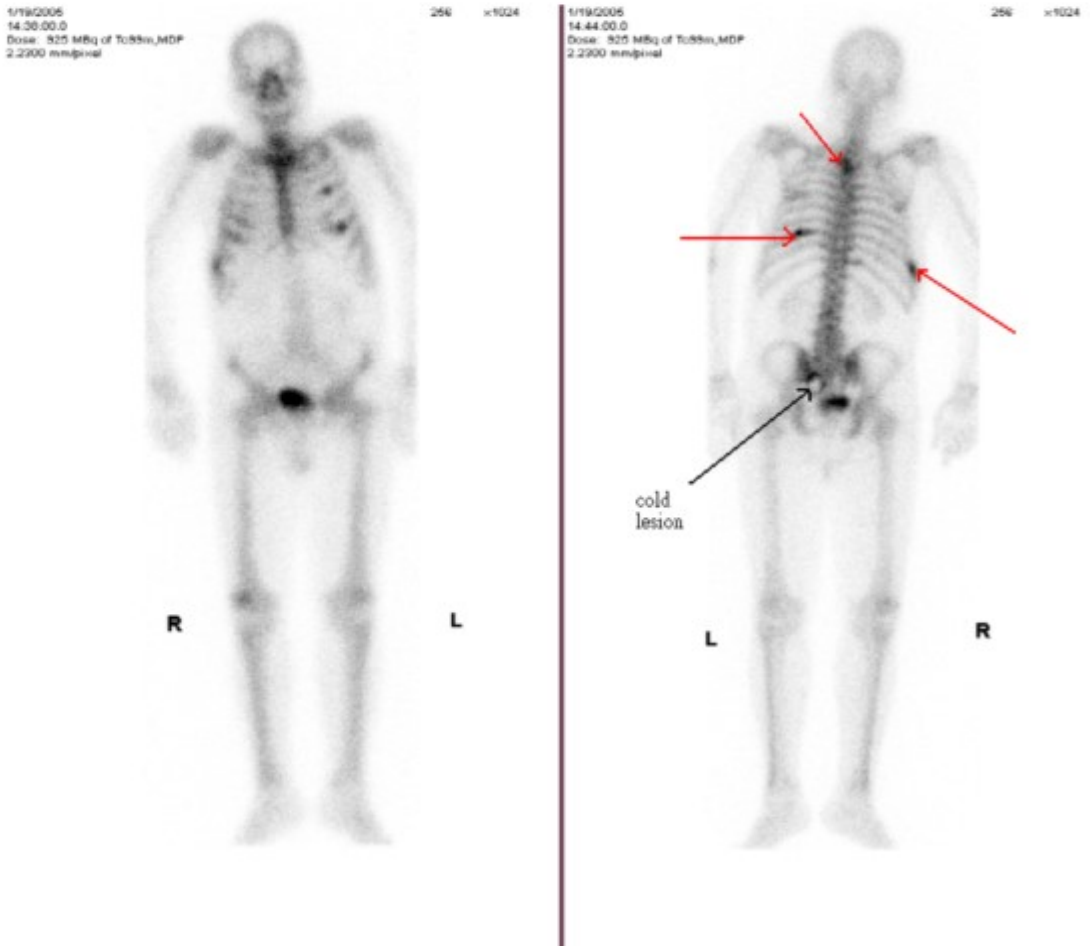
Metastatic

Multiple bony metastases



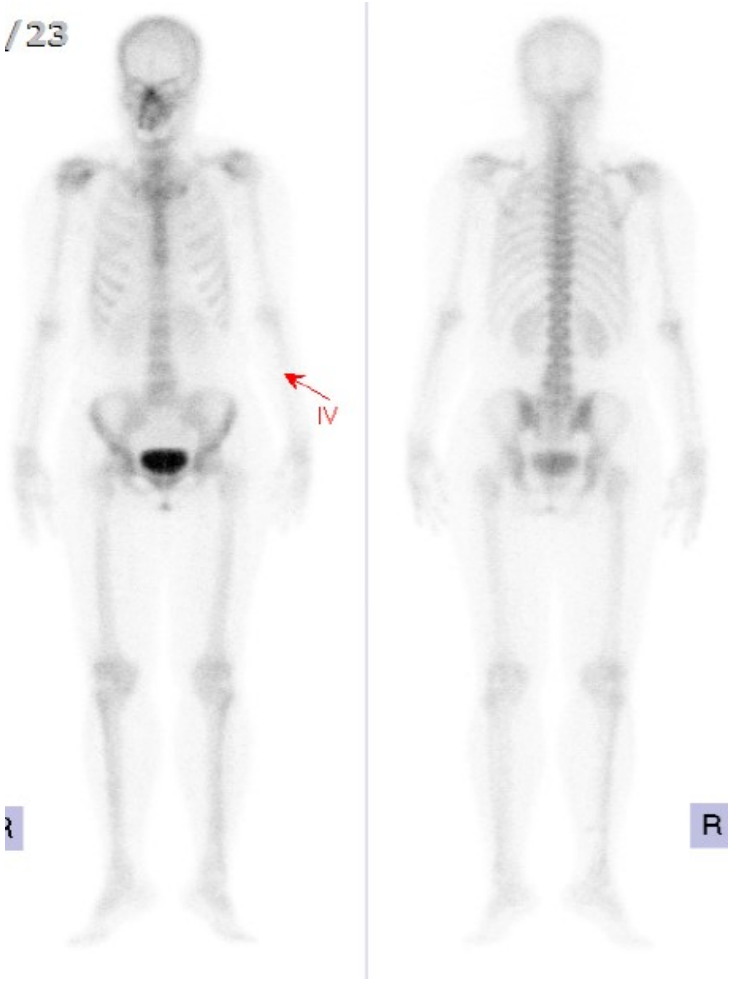
Bony metastases
(Red arrows)

Cold lesion
(Black arrow)



SPECT/CT

NPC



- NPC
- r/o skull base invasion→ arrange SPECT/CT of skull

❑ T1
❑ T2
❑ T3
❑ T4

Nasopharynx

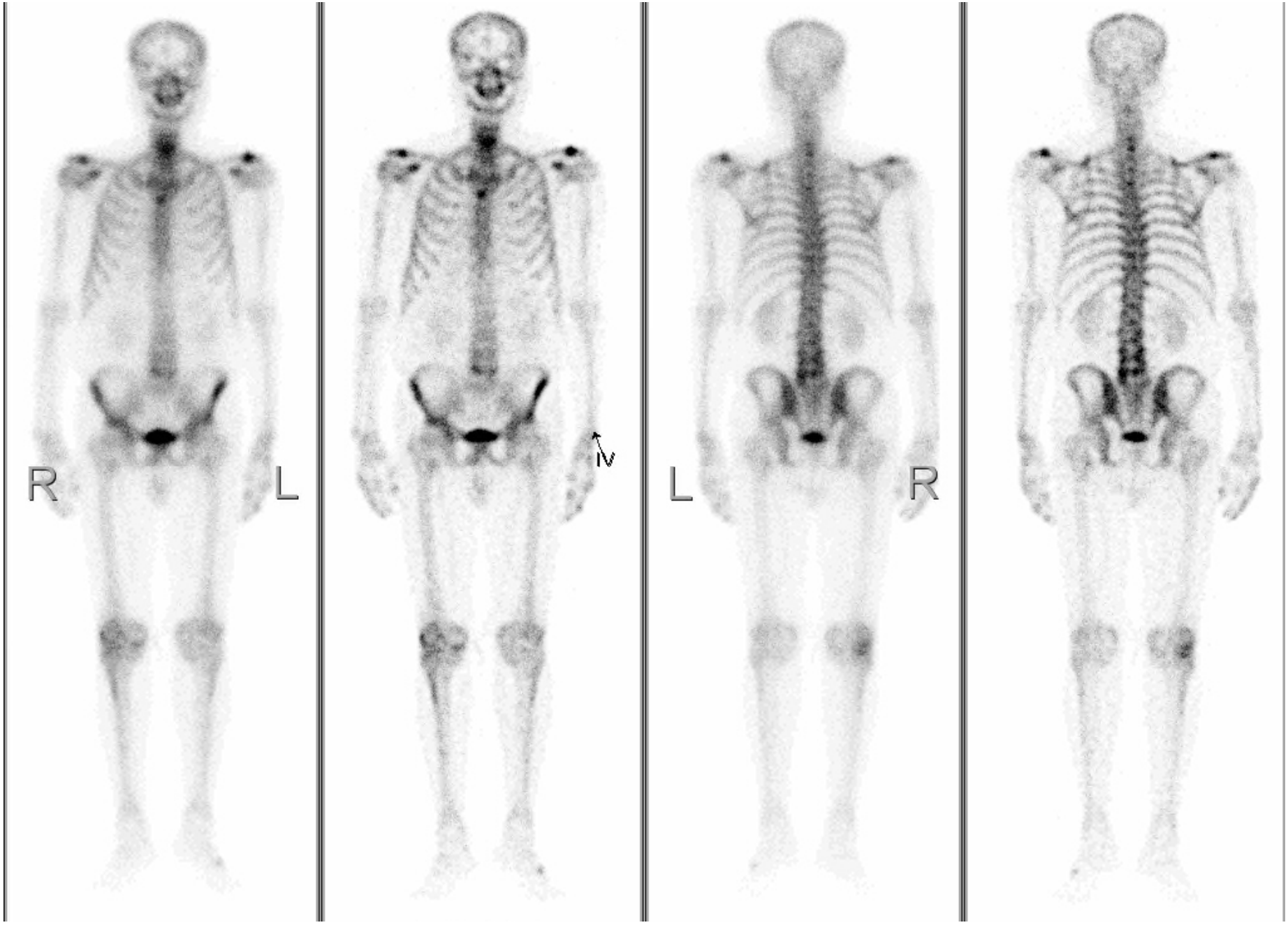
Tumor confined to the nasopharynx, or extends to oropharynx and/or nasal cavity without parapharyngeal extension*

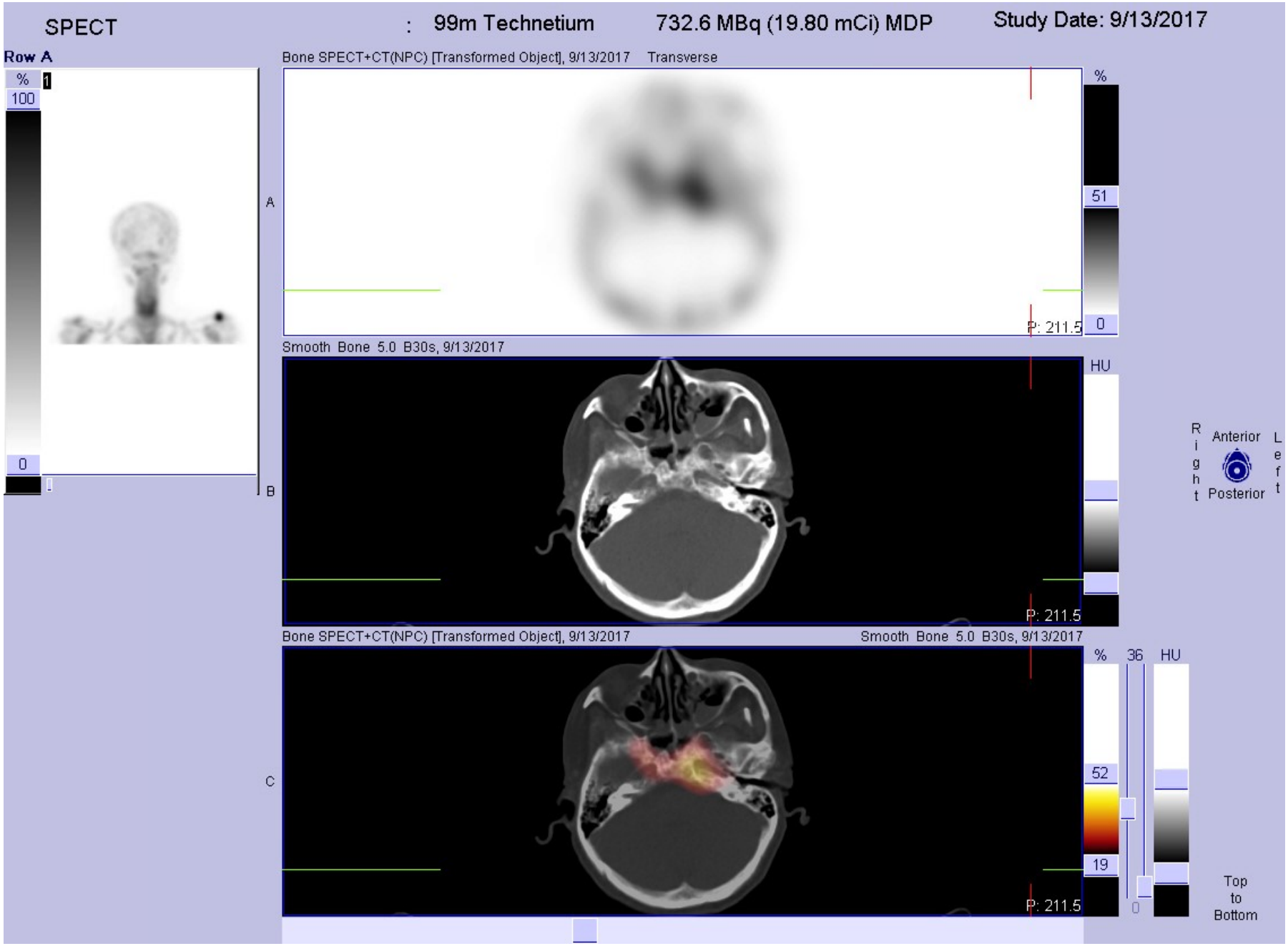
Tumor with parapharyngeal extension*

Tumor involves bony structures of skull base and/or paranasal sinuses

Tumor with intracranial extension and/or involvement of involvement of cranial nerves, hypopharynx, orbit, or with extension to the infratemporal fossa/ masticator space

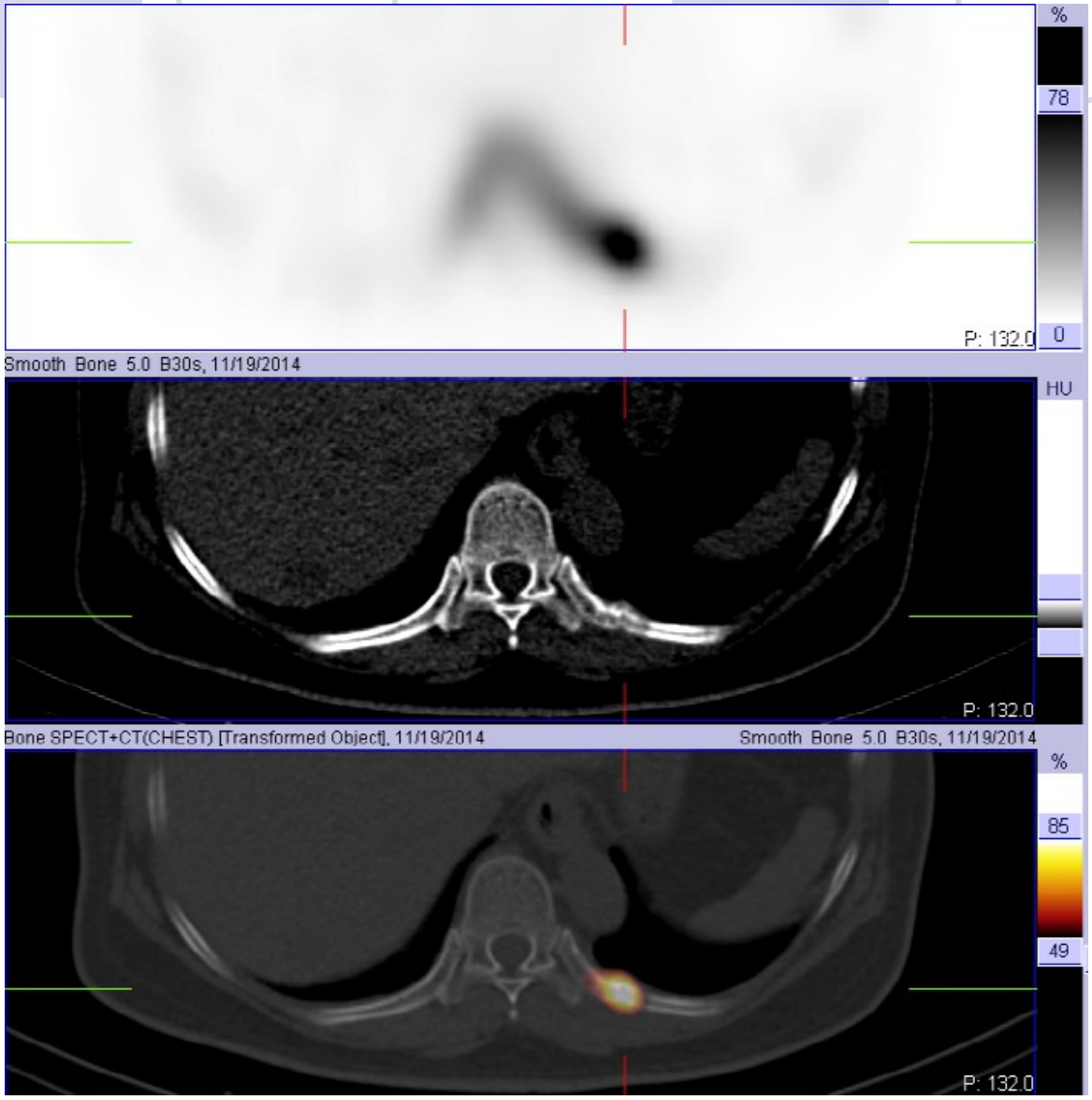
* Parapharyngeal extension denotes posterolateral infiltration of tumor.

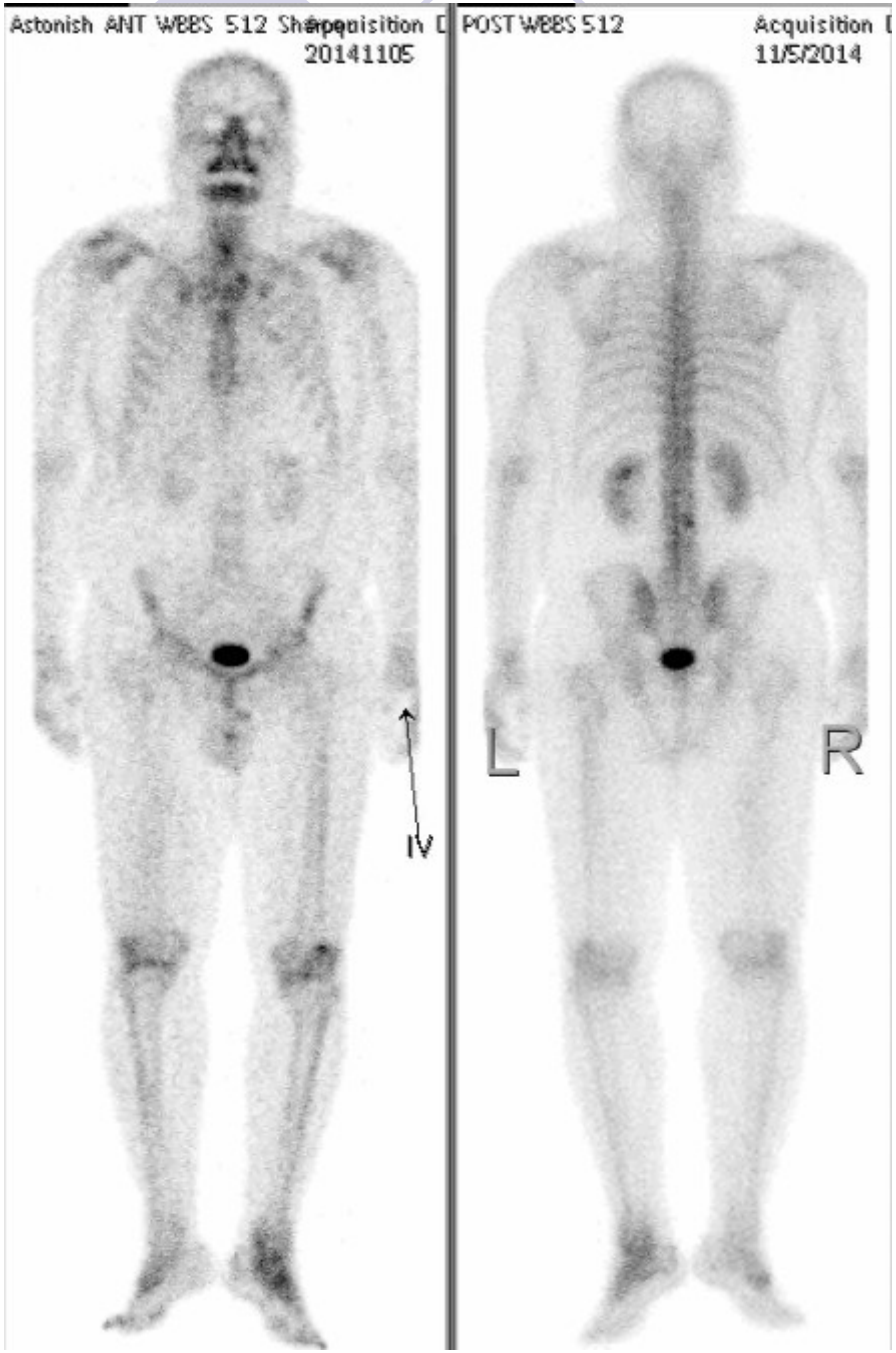

R
L
N
L
R

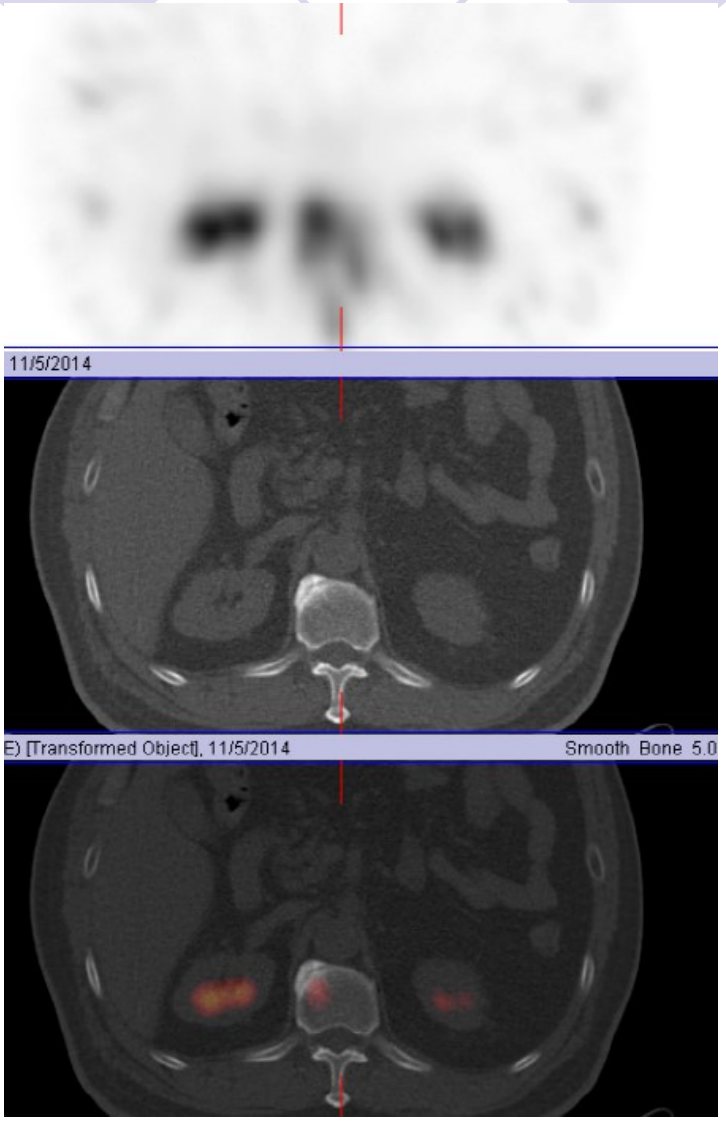

SPECT
: 99m Technetium 732.6 MBq (19.80 mCi) MDP
Study Date: 9/13/2017
Row A
% 1
100
0
Bone SPECT+CT(NPC) [Transformed Object], 9/13/2017 Transverse
A
%
51
0
P: 211.5
Smooth Bone 5.0 B30s, 9/13/2017
B
HU
P: 211.5
Right
Anterior
Posterior
Left
Bone SPECT+CT(NPC) [Transformed Object], 9/13/2017
Smooth Bone 5.0 B30s, 9/13/2017
C
%
36
HU
52
19
0
P: 211.5
Top
to
Bottom

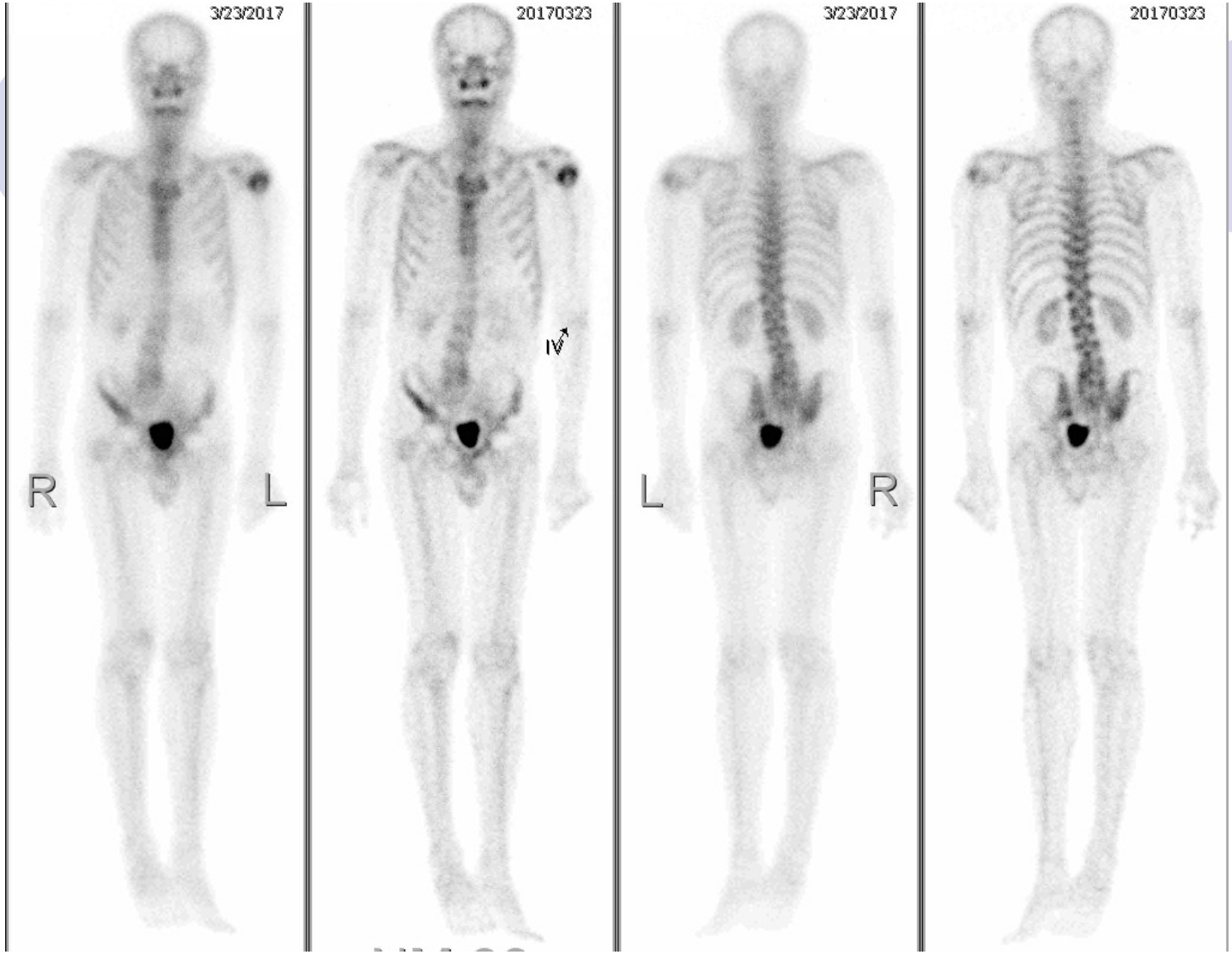
- In some patients, SPECT imaging is helpful to better characterize the presence, location and extent of disease.


Whole Body B
Acq Time:
R
R

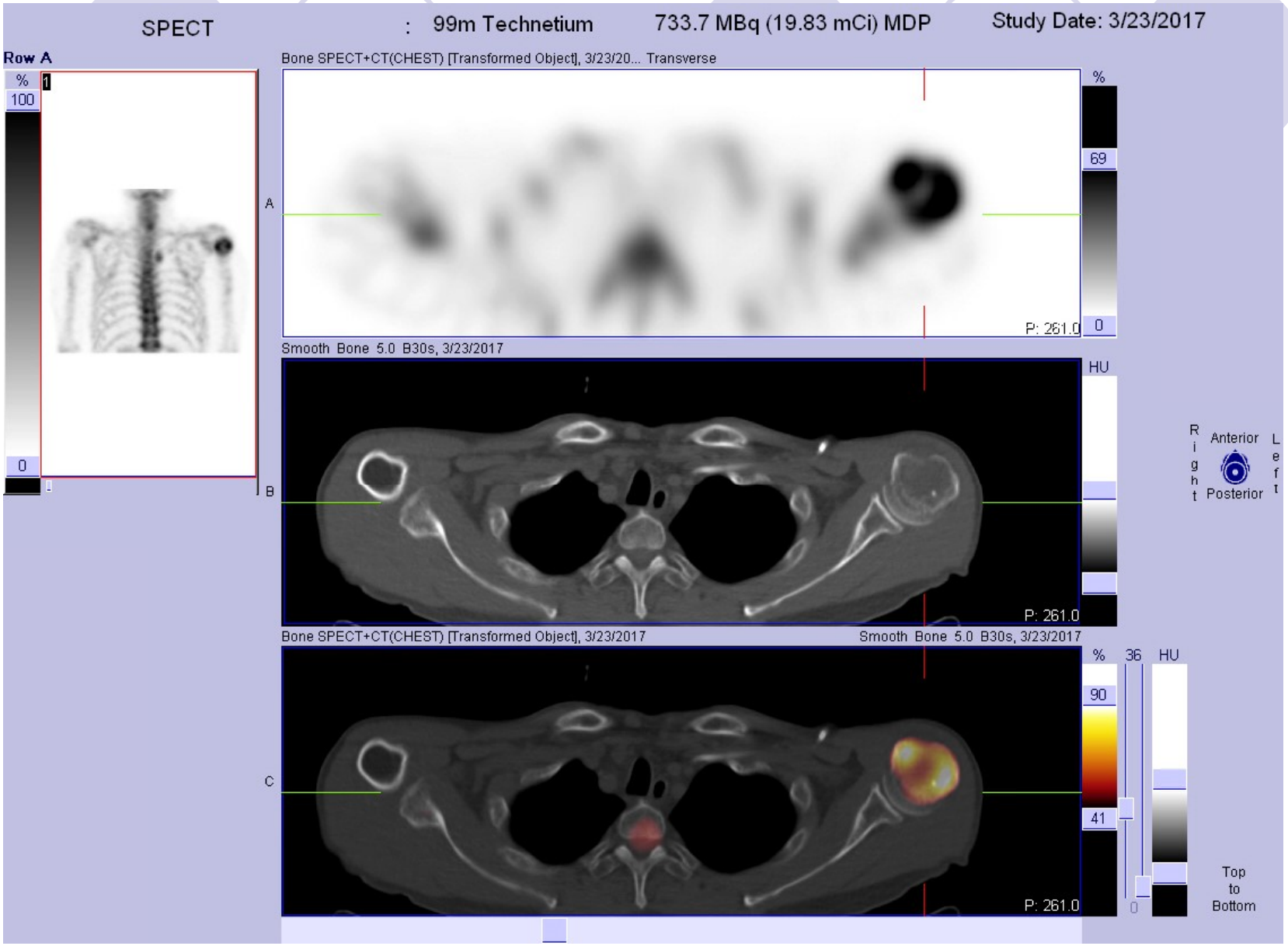

%
78
P: 132.0
0
Smooth Bone 5.0 B30s, 11/19/2014
HU
P: 132.0
Bone SPECT+CT(CHEST) [Transformed Object], 11/19/2014
Smooth Bone 5.0 B30s, 11/19/2014
%
85
49
P: 132.0

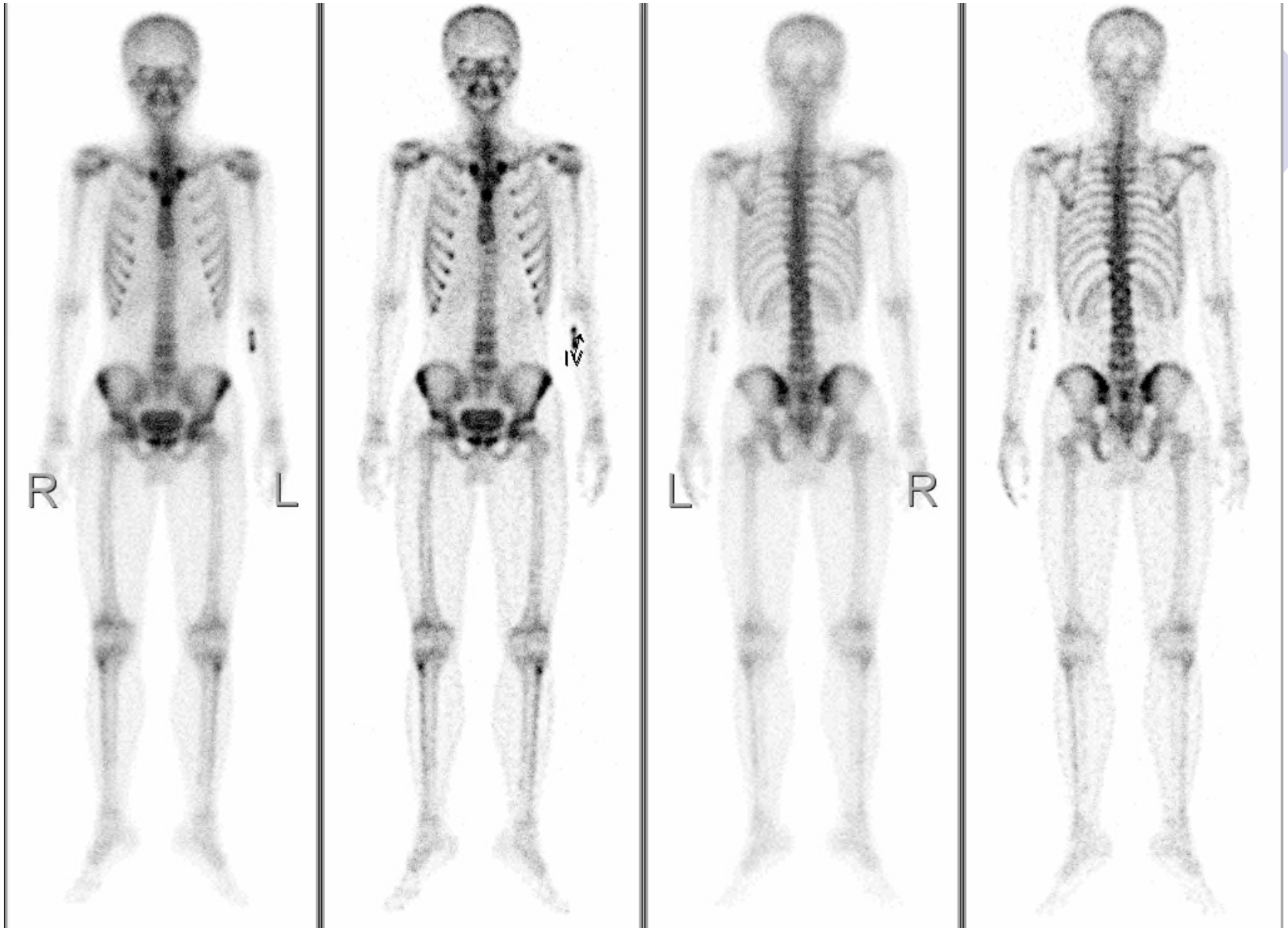

Astonish ANT WBBS 512
20141105
POST WBBS 512
11/5/2014
L
R
IV


11/5/2014
E) [Transformed Object], 11/5/2014
Smooth Bone 5.0

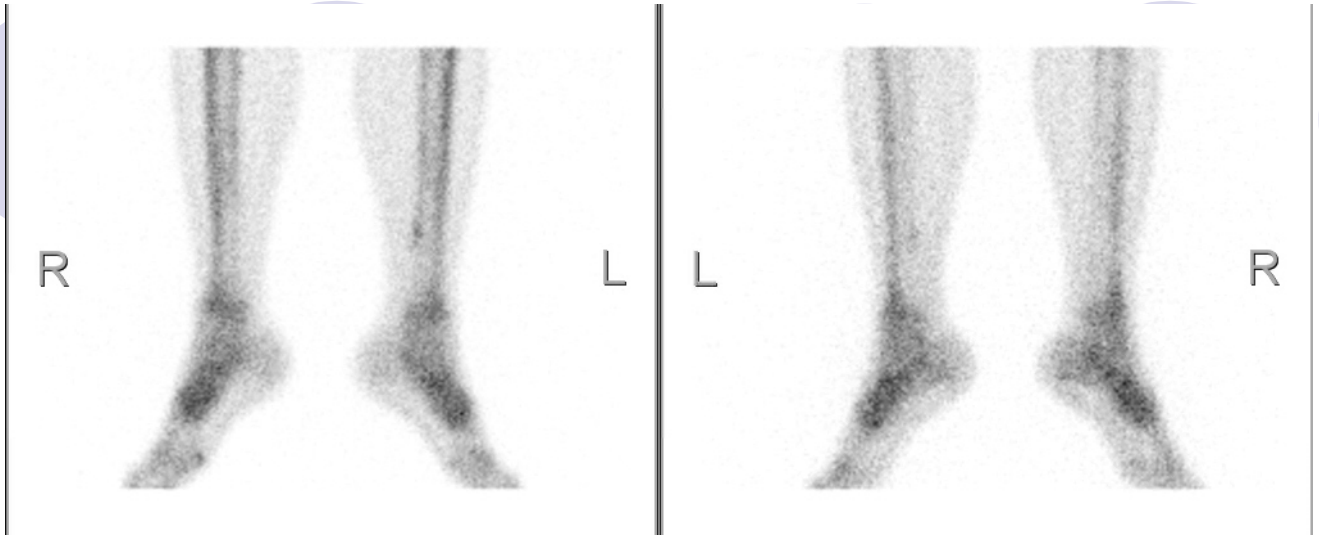


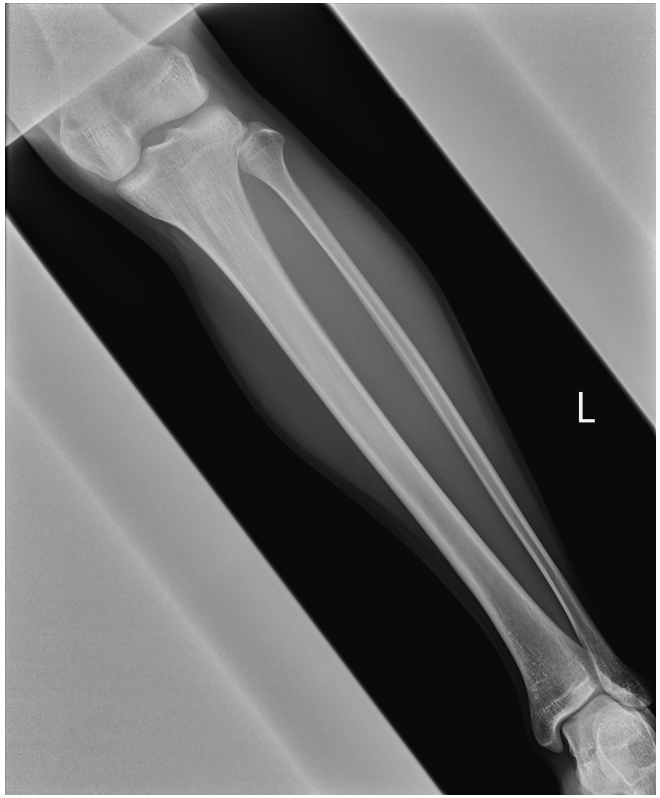
61 y/o man has SqCC of tongue base, cT4aN2cM0 stage IVA, s/p CCRT (2016-06-20~2016-08-08).


SPECT : 99m Technetium 733.7 MBq (19.83 mCi) MDP Study Date: 3/23/2017
Row A
%
100
0
1
Bone SPECT+CT(CHEST) [Transformed Object], 3/23/20... Transverse
A
%
69
0
P: 261.0
Smooth Bone 5.0 B30s, 3/23/2017
B
HU
P: 261.0
Right
Anterior
Posterior
Left
Bone SPECT+CT(CHEST) [Transformed Object], 3/23/2017
Smooth Bone 5.0 B30s, 3/23/2017
C
%
90
41
36
0
HU
P: 261.0
Top
to
Bottom

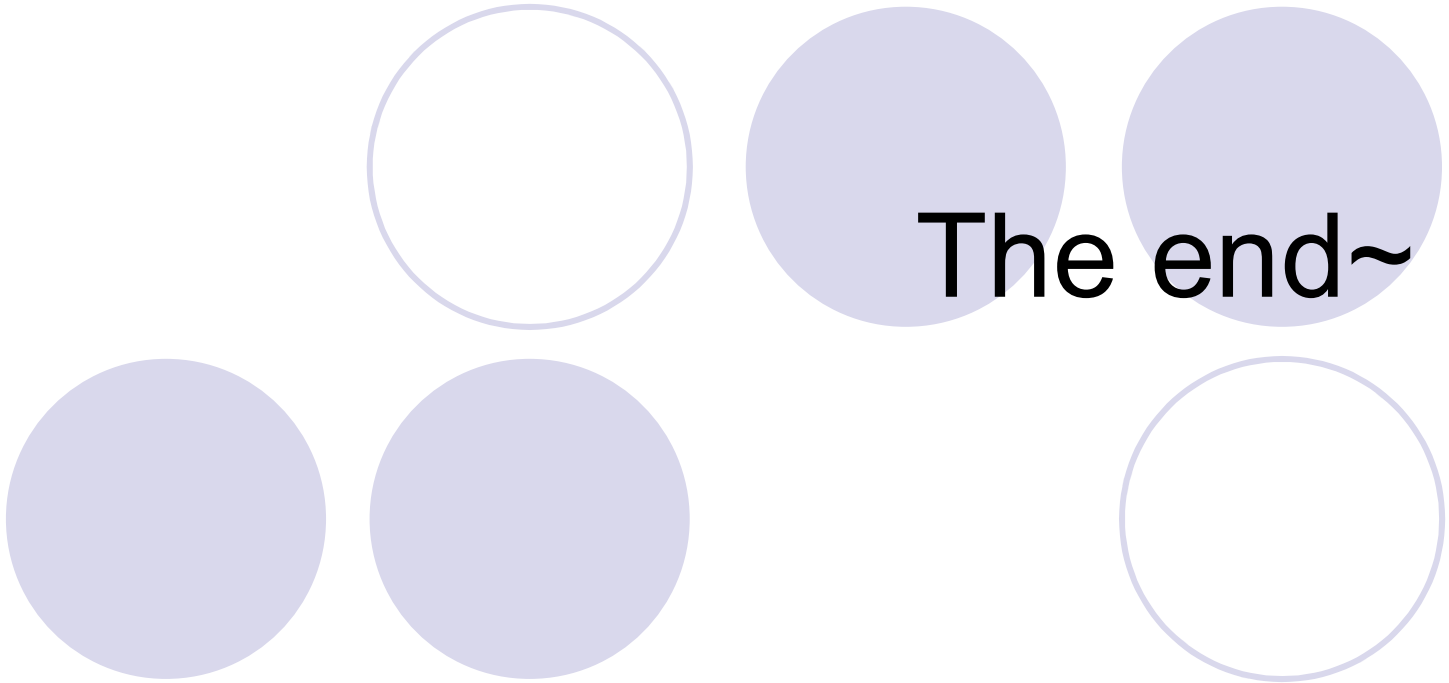


16 y/o boy has painful sensation and tenderness over left lower leg for months after playing basketball


R
L
L
R


L


L


The end~