Skeletal Scintigraphy – Reporting Document

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Chapter 1: Introduction

Skeletal scintigraphy commonly referred to as bone scan, can diagnose a wide spectrum of bone pathologies from benign conditions such as fractures and infection to primary and secondary malignant tumors. Despite the emergence of new anatomical imaging modalities, including magnetic resonance imaging. (MRI) and computed tomography (CT), bone scintigraphy continues to play an important role in the diagnosis of bone pathology. Bone scintigraphy is commonly used as a screening test for suspected bone metastases because of its high sensitivity, availability, relatively low cost, and ability to scan the entire skeleton.

Common Bone scanning protocols include:

1-Whole-body bone scintigraphy: this produces planar images of the skeleton, including anterior and posterior views of the axial and appendicular skeleton.

2- Limited bone scintigraphy: this records images of only a portion of the skeleton (Spot views).

3-Bone single-photon emission computed tomography (SPECT): this produces a tomographic image of a portion of the skeleton.

4-Multiphase bone scintigraphy: this usually includes blood flow, blood pool and delayed images.

For many years, ^{99m}Tc-labelled diphosphonates, particularly 99mTc-methylene diphosphonate (MDP), have been the most widely used radiopharmaceuticals for skeletal scinitgraphy.

A ^{99m}Tc-MDP bone scan shows exquisite sensitivity for skeletal pathology. In many clinical situations, recognizable patterns of scan abnormality are seen, which can suggest a specific diagnosis before these become evident on radiology.

The mechanism of tracer uptake in bone is called chemisorption, which occurs by the adsorption of diphosphonate onto the surface of the bone, with particular affinity for sites of new bone formation

and areas of high blood flow. Thus, bone scan images provide a functional display of skeletal activity. As functional change in bone occurs earlier than structural change in most pathologies, the bone scan will often detect abnormalities before they are seen on an X-ray.

The route of excretion of diphosphonate, is via the urinary tract, and in a normal study the kidneys are clearly visualized on the bone scan.

Improvements in gamma camera design, including the increased availability of tomographic scintigraphy i.e. SPECT, have also helped bone imaging by increasing sensitivity and specificity achieved by increasing the contrast resolution.

Chapter 2: Indications

Common indications of bone scan are summarized in Table 1.

Table 1. Common indications of bone scan

Oncology:

1. Primary bone tumor
2. Skeletal metastasis (staging)
3. Treatment response evaluation

Orthopedics:

1. Trauma
2. Fracture
3. Prosthesis evaluation
4. Infectious bone disease
5. Bone viability

Others:

1. Metabolic bone disease
2. Paget's disease
3. Asymmetrical mandible growth
4. Unexplained bone pain
5. Complex regional pain syndrome

Chapter 3: Procedure:

20-25mci (740-925MBq) of Tc-99m MDP is injected intravenously and imaging performed after a delay of 2-6 hours, depending on institutional protocol. Whole-body anterior and posterior images are acquired first with spot static views of symptomatic areas or areas that have abnormal uptake or are of clinical interest. A LEAP collimator is usually used but a pinhole collimator for high resolution imaging might be occasionally used too.

The patient is encouraged to drink water during the waiting time between injection and imaging and should empty the bladder immediately before scanning commences. SPECT and SPECT-CT can be used in selected situations. A 3-phase bone scan can be used to assess flow and blood pool activity in cases where an infective malignant lesion is suspected and needs to be differentiated. In this, the injection is given while the patient is positioned under the gamma camera with the camera head positioned over the areas of interest. The injection bolus is visualized as it enters the area of interest and images are saved on a computer or film for 1 minute. This is followed by static images after 3 minutes (blood pool images) without moving the patient followed by routine static images after the prescribed lapse of time (2-6 hours).

Chapter 4: Scan Interpretation

Understanding the normal bone scan is essential to diagnose pathology. The most important point to understand is that the radionuclide distribution on a bone scan varies, quite dramatically, with the age of the patient. The most prominent difference between paediatric and adult scan is the presence of bone growth plate activity in children.

Bone scan normalcy is underscored by symmetry; symmetric uptake tends to be normal (except in metabolic bone disease). In general, the soft tissue uptake varies but is usually faint with the most prominent uptake in the kidneys and urinary bladder, which is usually more in the bladder compared to kidneys (thus the need of an empty bladder).

Skeletal tracer uptake tends to decline with age but there are areas of persistently increased uptake that might represent normal structures, these include the coracoid and acromial processes, the sternal angle, and the sacroiliac joints. These are usually symmetrical and should not be misinterpreted as pathological. A symmetric area of increased calvarial uptake involving frontal bones occurs in hyperostosis frontalis. In the neck, calcified thyroid cartilage and the apophyseal joints in the cervical vertebrae can show increased uptake representing degenerative changes.

Intense focal asymmetric uptake might be seen in region of alveolar processes of mandible/maxilla, in cases of dental caries, that might confound the diagnosis when searching for metastatic disease. A history focused on dental health would, in most cases, clear the doubts.

Chapter 5: Three-Phase Bone Scan

Three phase bone scan includes flow, blood pool followed by the delayed static bone scan (planar or SPECT).

1.1 Quality Assurance

- Pockets should be emptied.
- Belts, bras etc with metal clasps should be removed.
- Patient should be well hydrated but should have emptied his/her bladder immediately before the test
- Gamma camera collimator should be placed over the area of interest.
- If the area of interest is a limb, try to have both the abnormal as well as the contralateral limb in the field of view.
- Injection should be made while the patient is positioned under the collimator. If an upper limb is the area of interest, inject in the lower limb, and vice versa, so that the injection site does not interfere with interpretation.

1.2 Image Acquisition

- The radiopharmaceutical should be rapidly injected as a bolus and flow images acquired at 1-3sec/frame if on computer or 3-5 second/frame on film for a total of 30-45 frames.
- Without moving the patient or collimator, blood-pool static images should be acquired immediately after the flow images. 3-5-minute images or 150,000 - 300,000 counts are adequate.

1.3 Reporting Essentials

- If a limb is being assessed, identify affected side (radioactive marker can be used for this purpose) and compare it with normal side,
- Assess whether the flow is increased or decreased in comparison with the normal limb,
- If the flow is increased or decreased:
    - Increased in a large area (represents Infection)
    - Decreased in a large area (represents ischemia)

  - Increased in a small area (can be due to fracture, noninfective arthritis, tumour, charcot's joint, etc.)
  - decrease in small area (can be due to attenuation, hematoma etc)
- A static bone scan must be done after the flow and blood pool studies, together the flow, blood pool and static bone scans are called the Three Phase Bone Scan.
- Correlation of the three phases help in arriving at diagnosis of many common pathologies (summarized in Table 2)

Table 2: Radiotracer uptake pattern in skeletal scintography in few conditions:

Pathology	Flow	Pool	Static
Osteomyelitis	↑	↑	↑
Fracture	↑	↑	↑
Cellulitis	↑	↑	not increased
Non inflammatory	Not increased	Not increased	↑

Chapter 6: Static Bone Scan

All bone scan reports must contain the following information, though not necessarily as bulleted headings as in this example.

All reports must follow local guidelines about style but the contents should have all of below or as much as possible of the topics below.

- Clinical Details:
- Indications for study:
- Any prior study for comparison:
- Any relevant imaging for correlation:
- Is it a stand-alone test or part of three phase bone scan?
- Procedure
- Radiopharmaceutical: Tc-99m MDP/ other
- Dose: _____ MBq/____ mCi
- Site of Injection:
- Time to image acquisition: _____ hours
- Findings
- Interpretation, impression and further action

2.1 Reporting Essentials

Quality of the image:

It must first be determined that the scan is of good quality, the following should be assessed before concentrating on the report itself:

- Scan must be centered, if the patient is tilted, the bones nearer to the collimator will appear "hotter"
- There should be no evidence of free technetium (stomach or thyroid activity), there should be no evidence of poor labeling (high background)
- Ribs should be clearly seen anteriorly as well as posteriorly
- Vertebral bodies should be identifiable, intervertebral discs should be seen as photopenic areas between the vertebral bodies
- Growth plates are visible in children but not in adults
- Injection site should be away from the site of pathology. Injection site should be noted, and if there is

any perivenous leak or injection, this too should be noted.

- There should be minimal background, kidneys should be faintly visualized and cardiac blood pool should not be seen (High background can be caused by drug interference, recent radionuclide administration, failure of labeling, renal failure, dehydration or scanning soon after injecting the radiotracer. Very low background can be caused by excessively long time between injection and imaging and "super scan pattern"
- Pockets should be emptied of any attenuating objects like coins, watch etc. If there is an implant (cardiac pacemaker, bone plate, etc.) it should be noted. All these can lead to photopenic/cold artifacts.
- Remember incidental areas of uptake on bone scan including calcified thyroid cartilage, sternoclavicular joints, coracoacrominal joint, junction of the body and manubrium sterni (angle of Luois), sacral ala, etc.
- Bladder activity and skin contamination by urine extravasation may occur and should be recognized

Symmetry of distribution:

- Describe symmetry of radionuclide distribution. If asymmetric areas are noted, Question whether these correspond to expected areas of asymmetric uptake, areas where history might suggest abnormal uptake (tooth problems, arthritic pain, fractures, etc.) or might these represent an answer to the clinical question, e.g. looking for metastatic disease, etc.

Bone findings:

- Focal hot areas – Describe number (count if discrete), pattern, location, shape e.g., rounded and discrete, flame shaped, board shaped, irregular etc.
- Focal Cold areas – Describe number, site, shape, and whether it can be attributed to implant, coin, prior surgery, lytic lesion, etc.
- Diffusely hot bones 'super scan pattern'.

Soft tissue findings:

- Soft tissue uptake- Describe location, pattern - diffuse or focal
- Soft tissue cold areas

Kidneys:

- Note and mention whether both kidneys are seen, normally located, ectopic kidney(s), fusion anomalies, single kidney, cold area in the lumbar area. Any evidence of Hydroureteronephrosis seen as prominent renal pelvis and ureter.

Bladder activity

- Any evidence of urine contamination, extravasation/ catheterization with radioactive urine

Any other Observation

References:

- Van den Wyngaert, T., et al. (2016). "The EANM practice guidelines for bone scintigraphy." Eur J Nucl Med Mol Imaging 43(9): 1723-1738.
- Weiner, G. M. J., L.; Mueller, V.; Bohuslavizki, K.H. (2001). "Artifacts and non-osseous uptake in bone scintigraphy. Imaging reports of 20 cases. Radiol Oncol 35(3): 185-91(3): 6.

Chapter 7: Skeletal Scintigraphy Reporting – Examples

7.1 Normal Bone Scan (Example 1)

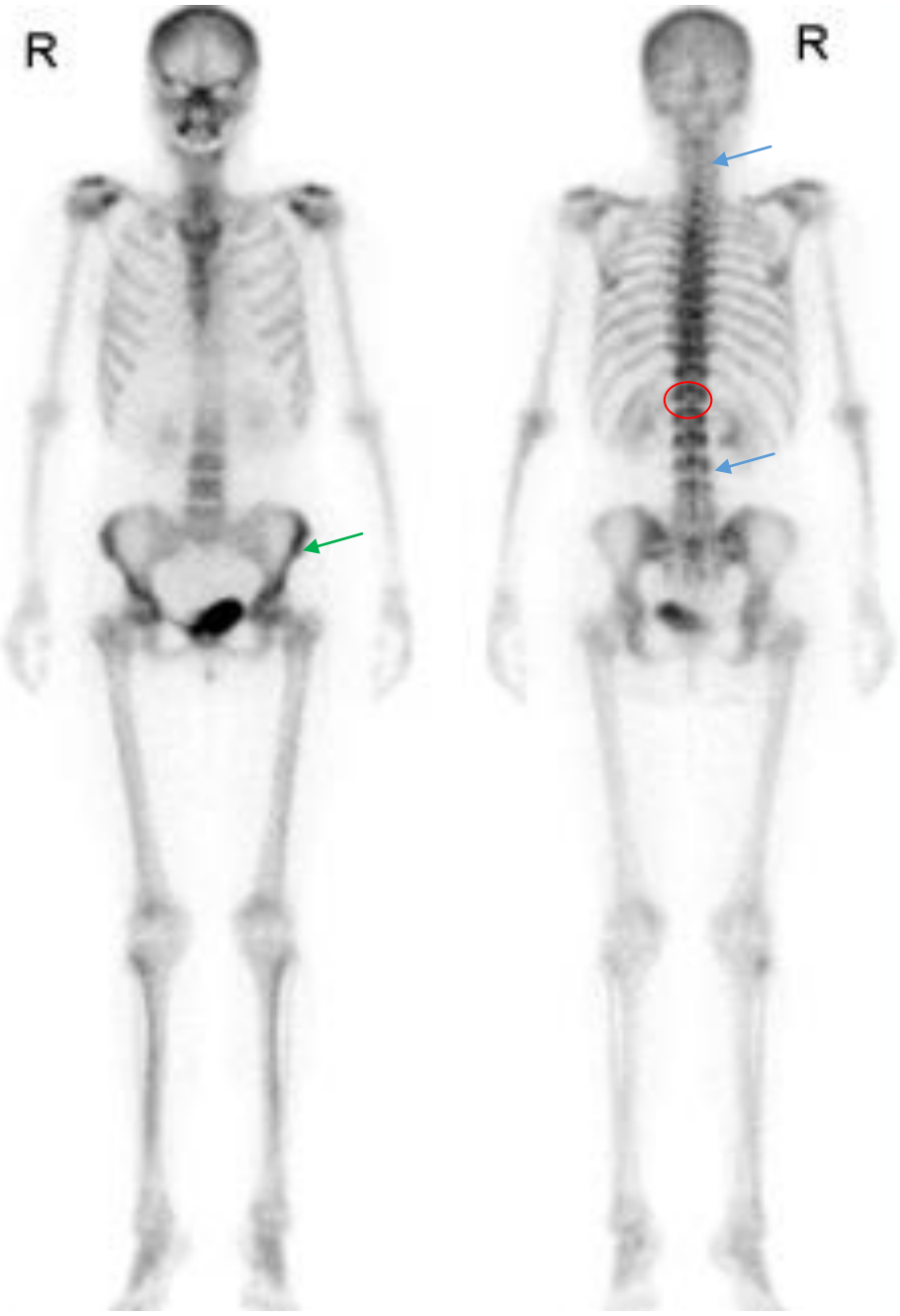
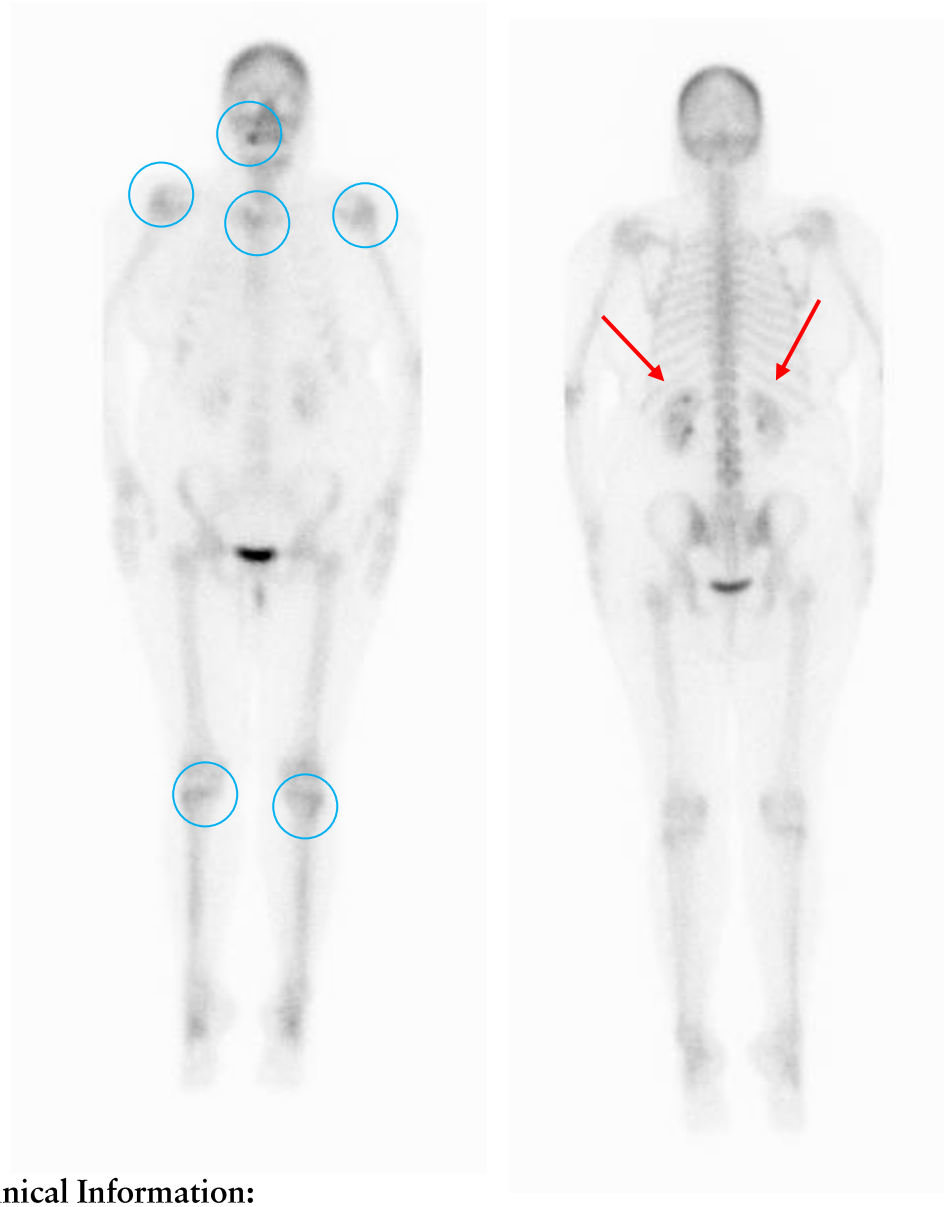


Figure 1: There is clear delineation of vertebral bodies and visualization of spinous process and transverse processes. The intervertebral discs appear as photopenic lines on the posterior view (red circle). There is relatively reduced radiotracer uptake within the cervical and lumbar spines due to the normal lordosis causing these to be positioned away from the detector on posterior acquisitions (blue arrows). For the same reason, iliac bones

show increased uptake in the anterior views (due to proximity to the anterior detector rather than posterior one); (green arrow). No area of abnormally increased or decreased tracer uptake noted.

7.2 Normal Bone Scan (Example 2)



Clinical Information:

A 50 year old female patient diagnosed with right breast cancer with metastases to the lungs.

Indication:

To rule out bone metastases

Tc99m-HDP Bone Scan (Whole Body):

Procedure:

Anterior & posterior whole body bone scans is obtained ? hours post IV injection of ? mCi TC99-HDP.

Findings:

- There is irregular increased radiotracer uptake within the right sterno-clavicular joint, both shoulder joints, and both knee joints, mostly due to degenerative changes.
- There is small focal of radiotracer uptake within the right mandible, mostly due to dental problem , for clinical correlation.
- Radiotracer distribution in the remainder of the skeleton is within normal limits.
- Both kidneys are normally located with normal limit of radiotracer handling.

Impression:

- No evidence of any osteoblastic bone metastasis in this study.
- Ancillary findings as described above.

7.3 Normal Scan in Paediatrics Patient

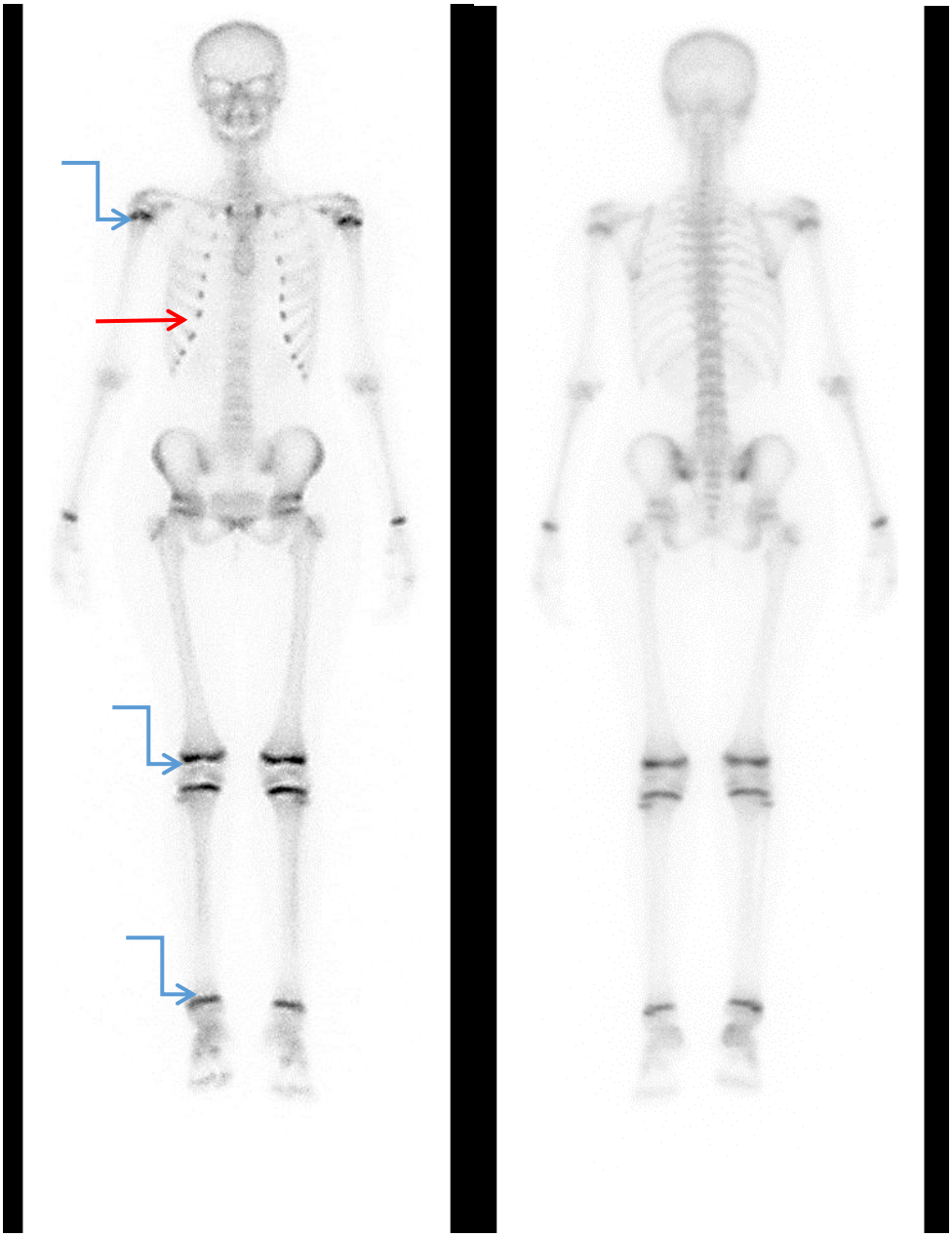


Figure 2: (Right & left) Anterior and posterior whole body bone scan in 13-year-old patient shows the normal symmetrical appearance of growth centers (↳) involving Epiphysis of long bones: proximal humerus, proximal femur, distal femur, proximal tibia and distal tibia. There is also symmetrical uptake at the costochondral junctions (red arrow).

7.4 Different patterns of non-uniform sternal uptake (age-related normal variants)

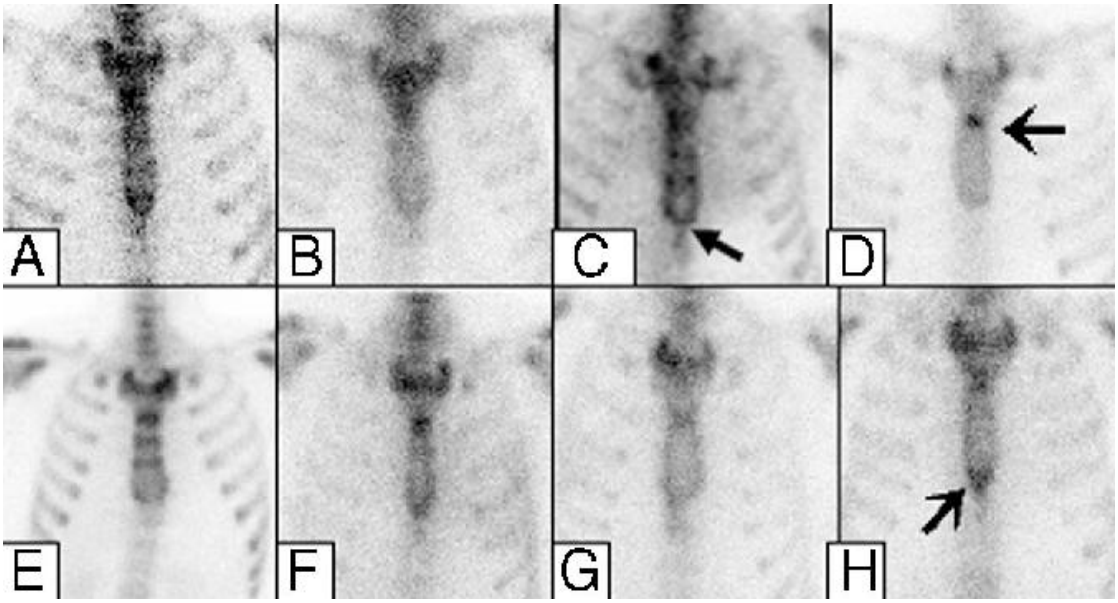


Figure 3: Various patterns of non-uniform sternal uptake

(A): Heterogeneous uptake in the body;

(B): increased uptake in the manubrium;

(C): Photon-deficient area in the lower sternum just above the xiphoid process;

(D): Angle of Louis hot spot;

(E): Hot spots in the body (linear);

(F & G): increased activity in the body borders;

(H): Xiphoid hot spot.

7.5 Pterion

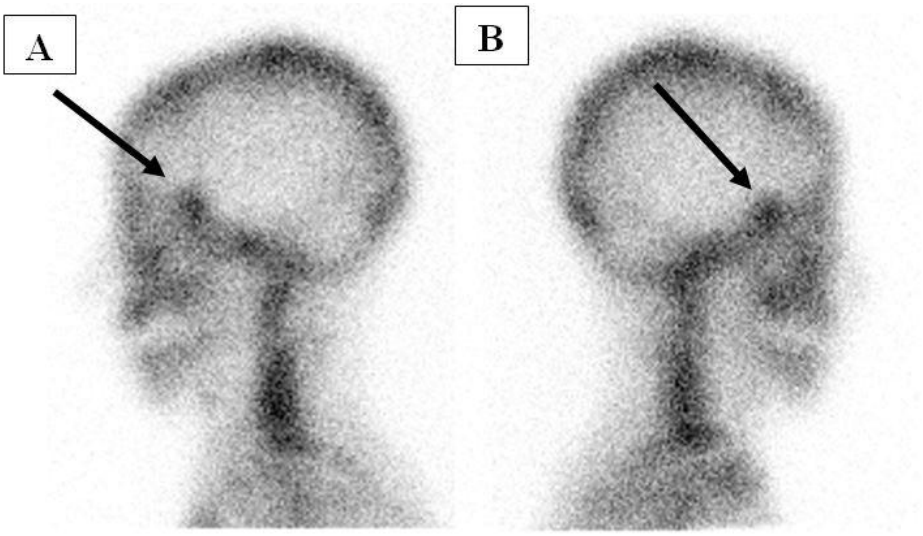


Figure 4: ^{99m}Tc-MDP bone scan (A, B) left and right spot skull shows a focus of increased uptake (Arrows) that corresponds to the pterion, the site of confluence of the frontal, parietal, temporal, and sphenoid bones.

7.6 Hyperostosis frontalis

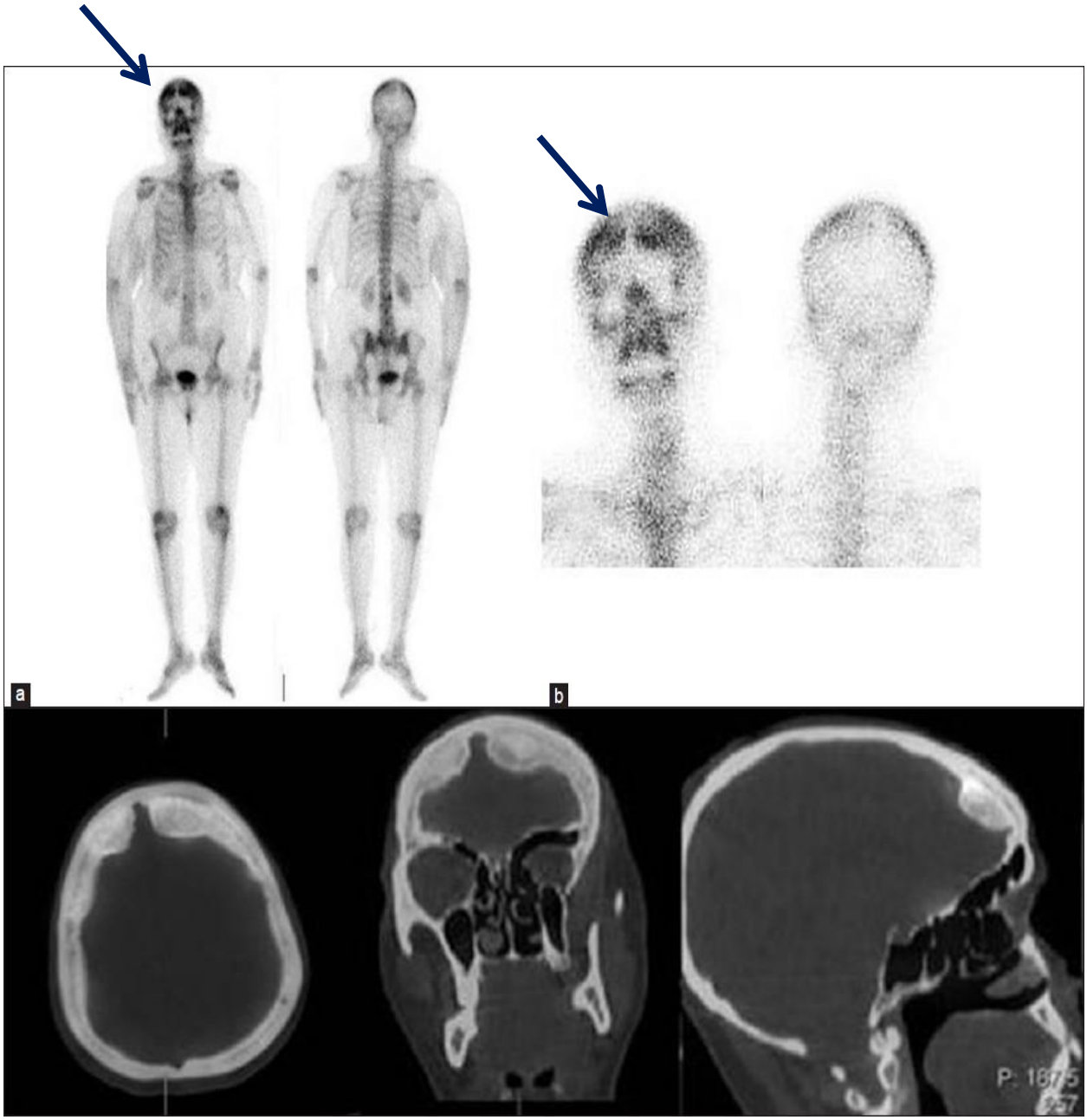


Figure 5: (Upper) Anterior and posterior whole body and spot view bone scan in a 60-year-old female with breast tumor, revealed heterogeneously increased tracer uptake (Arrows) involving bilateral frontal and parietal bones. The remaining skeleton showed normal tracer distribution. (Lower) CT of the cranium. Transaxial, Coronal and Sagittal images showed irregular thickening and nodularity of the inner table of bilateral frontal and parietal bones.

7.7 Normal 3-Phase Bone Scan

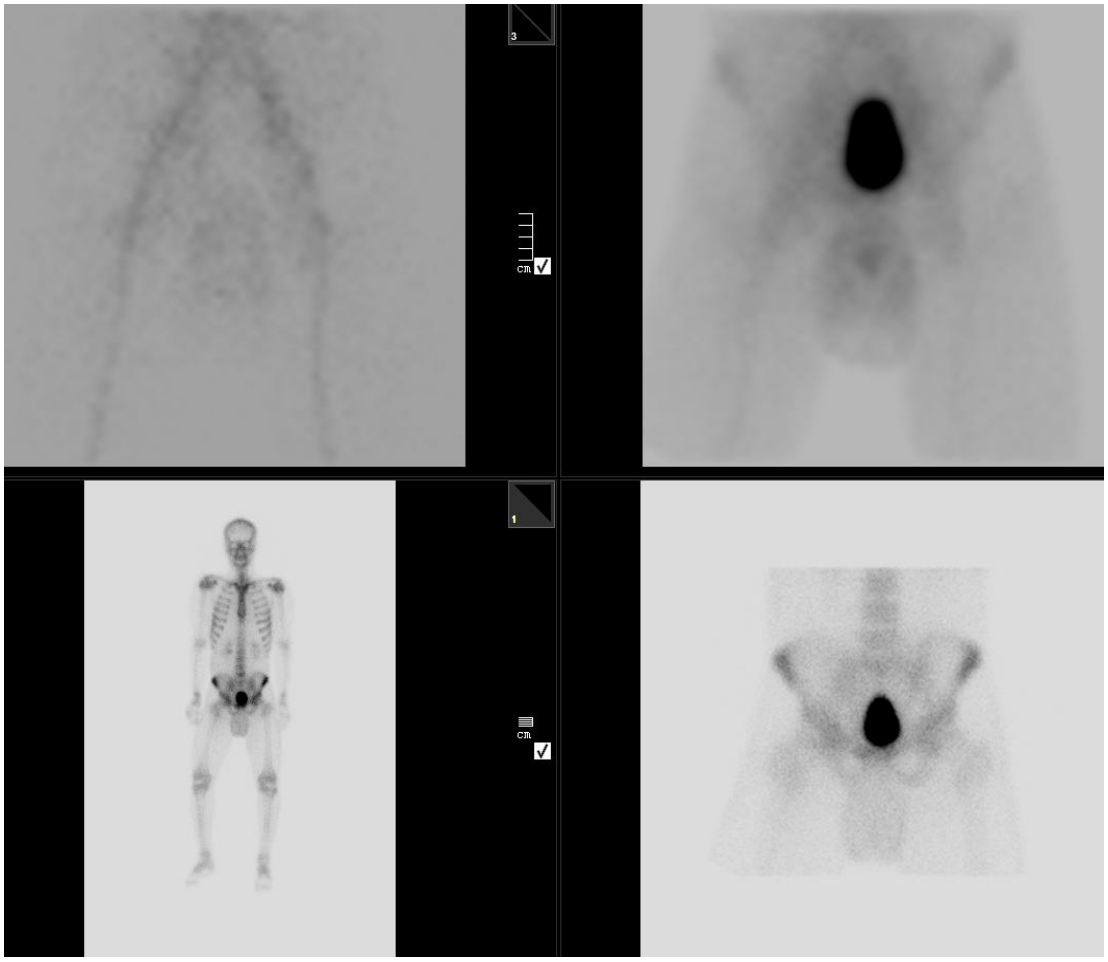


Figure 6: A 3-phase bone scan in a 36-year-old male patient with right hip joint pain (A) shows normal arterial flow phase within the pelvis (B) blood pool of pelvis area, appears normal (C), (D) whole body scan anterior view and delayed spot image shows normal radiotracer uptake in the whole body including pelvic area

Chapter 8: Artefacts/ Pitfalls in Bone Scan

8.1 Soft tissue uptake - I

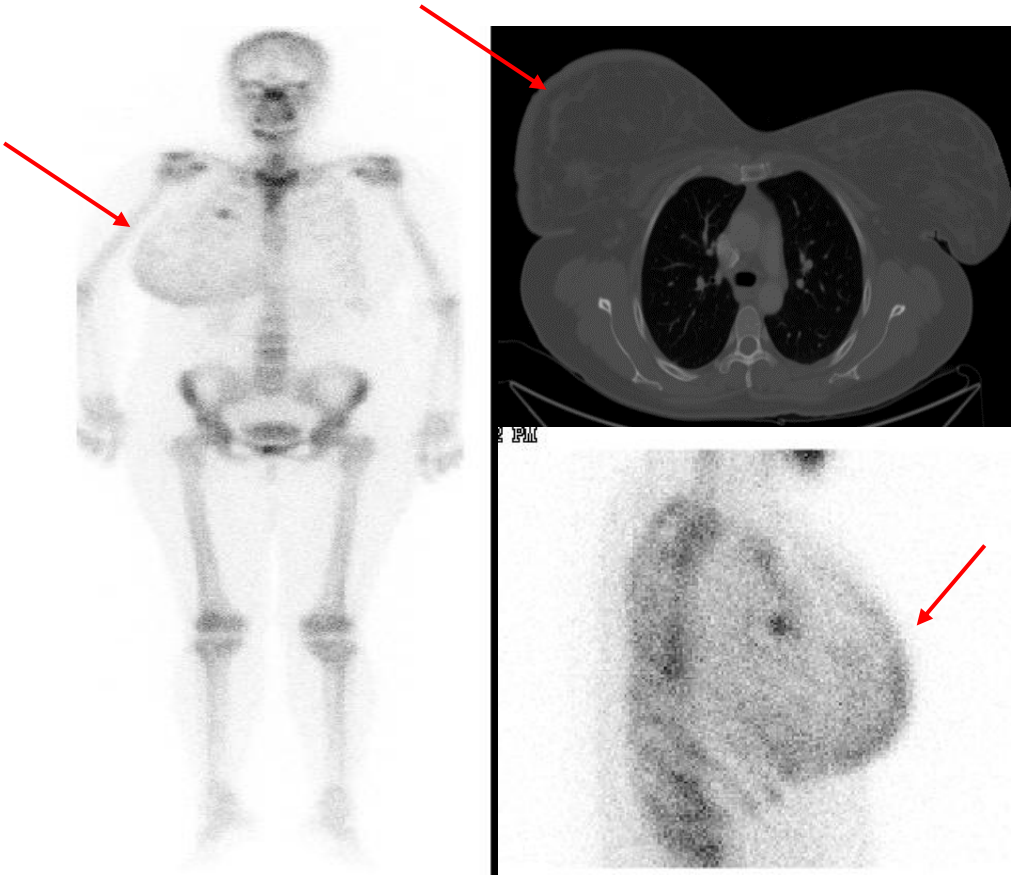


Figure 7: (Left) whole body bone scan in 36-year-old female with right breast cancer shows abnormal increased radiotracer uptake within the soft tissue of enlarged thickened skin as well as an area of uptake corresponding with the breast cancer site. Right breast as appear on CT scan (right upper) with lateral view bone scan (right lower) shows the prominent uptake within the thickened skin of right breast

8.2 Soft tissue uptake - II

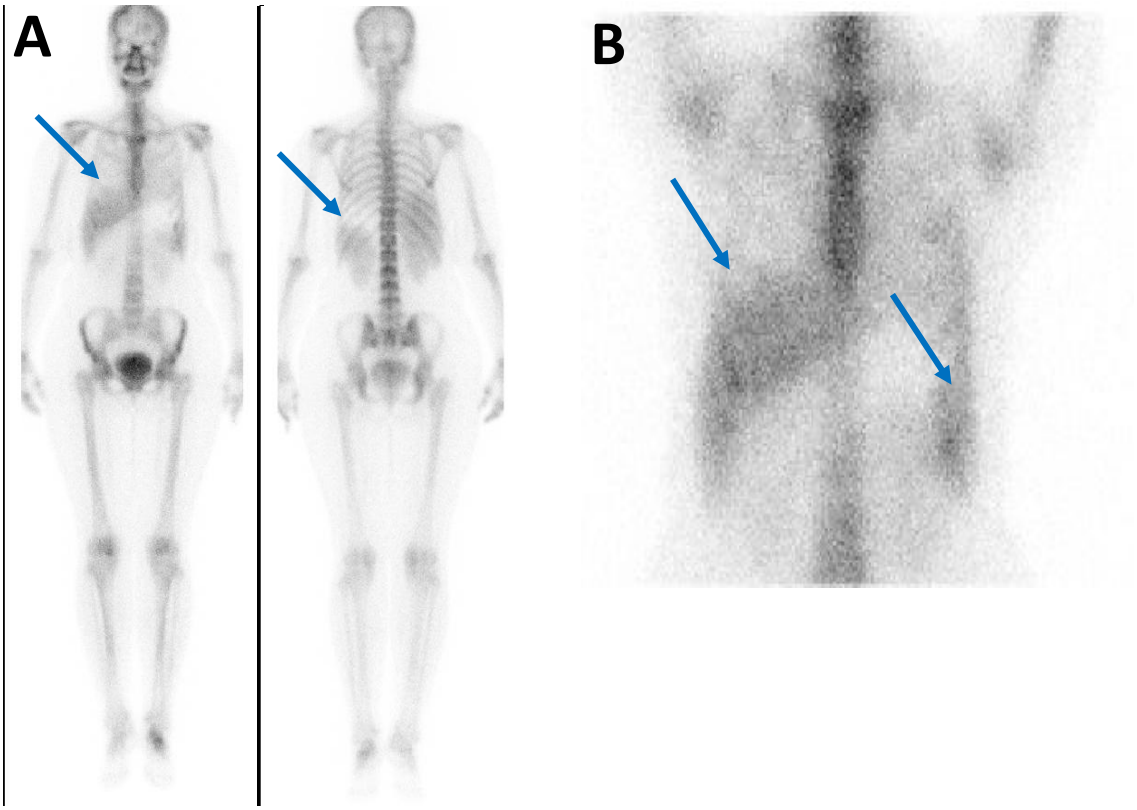
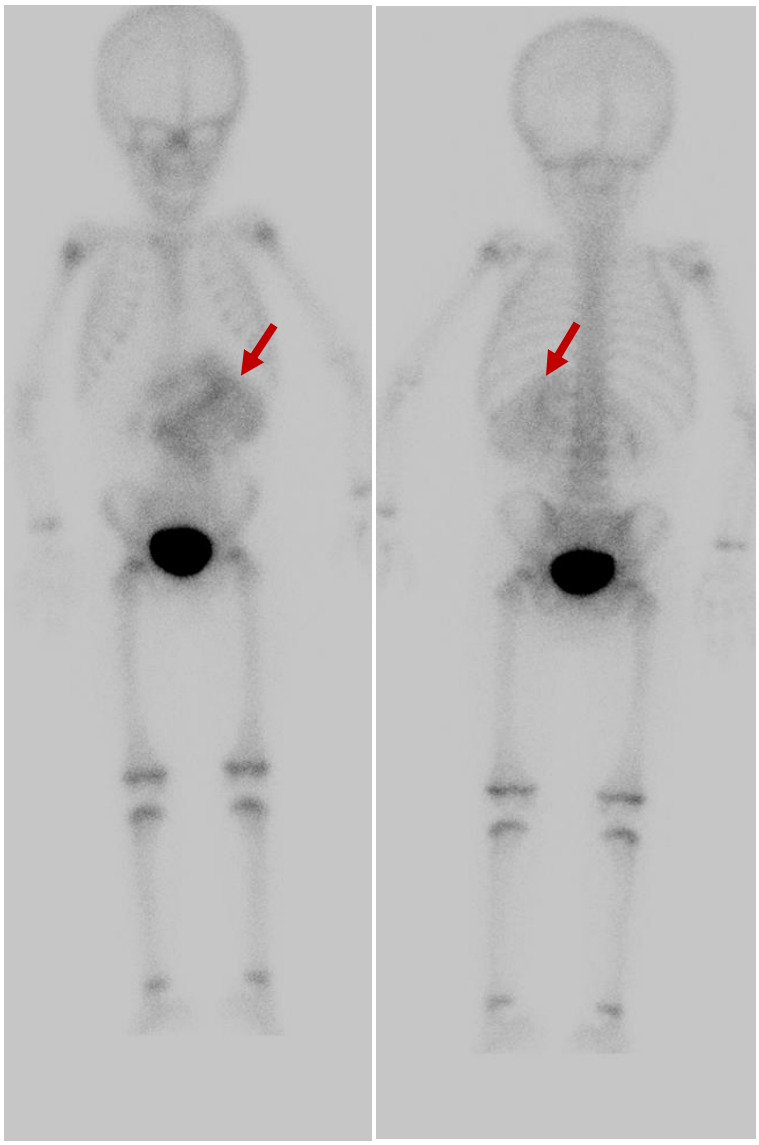


Figure 8: A. Anterior and posterior Whole body bone scan in a 50-year-old female patient with breast cancer shows diffuse abnormal increased radiotracer uptake within the right upper abdomen and left upper abdomen, corresponding in site to the liver and spleen, respectively.

B. Spot view with more prominent appearance of soft tissue uptake within liver and spleen.

Note: The differential diagnosis depends on the pattern of uptake. Metastatic breast and colon cancer are frequent causes of focal faint uptake. Diffuse uptake is rare, but can be seen with hepatitis, amyloid, and IV gadolinium administration. In addition, aluminum breakthrough from the molybdenum generator can cause colloid formation and subsequent diffuse hepatic uptake. We present a case of diffuse uptake in a patient with acute hepatic failure. (Chen P, Clinical Nuclear Medicine. 2014;39(7):658-9.)

8.3 Primary Neuroblastoma avidity



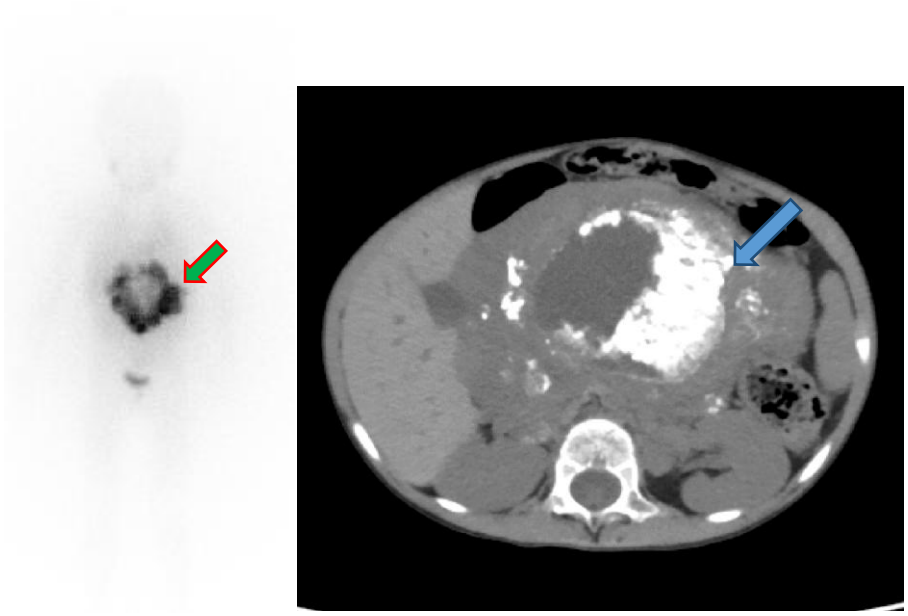


Figure 9: (Upper) Anterior and posterior whole body bone scan of 3 year old male patient with Neuroblastoma shows a large irregular increased radiotracer uptake (red arrows) within the left side of the abdominal cavity (soft tissue).

(Lower) Right, axial view of CT scan to the same patient shows large soft tissue mass representing the primary neuroblastoma with coarse dense calcification (Blue arrow), mainly within its left side.

Left I-131 MIBG scan of the same patient shows irregular uptake by the primary tumor (green arrow).

Other findings on bone scan: Left kidney is inferomedially deviated by the primary tumor while the right kidney is normally located, both kidneys show normal radiotracer handling.

8.4 Ureteric activity

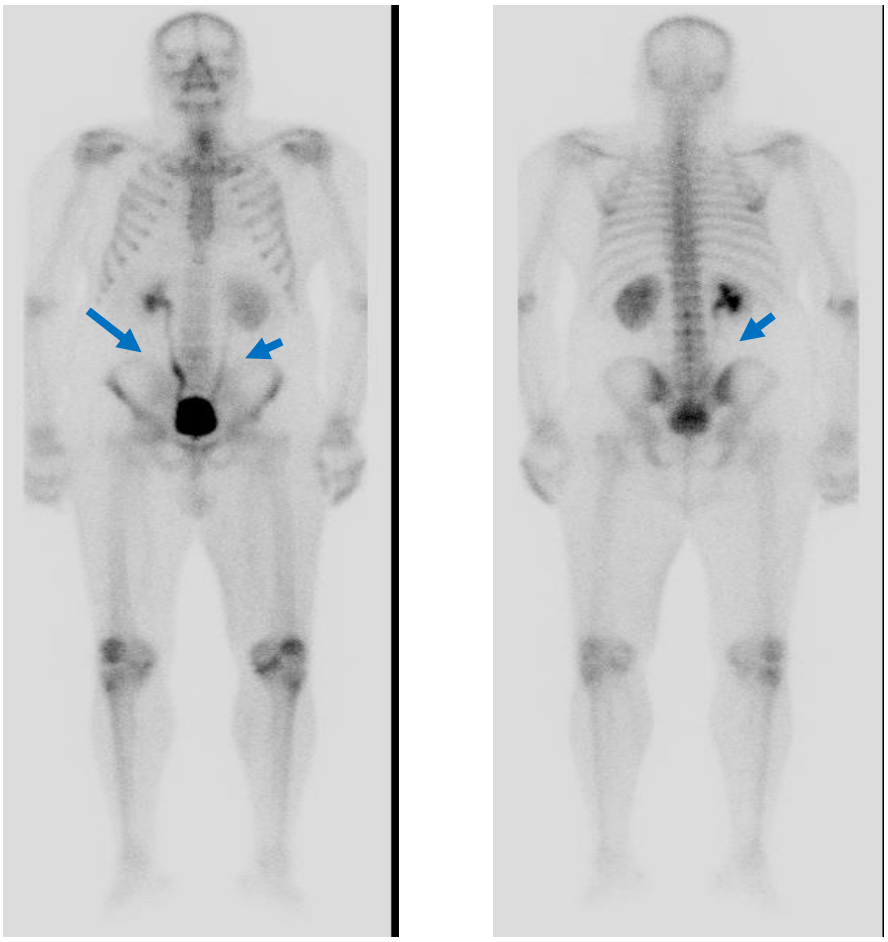


Figure 10: Anterior and Posterior whole body bone scan in a 63-year-old male patient with prostatic enlargement shows prominent radiotracer stasis within both ureters (right ureter appears more dilated and tortuous in its lower half). Also note the periarticular increased tracer uptake in region of bilateral knee joints, likely degenerative. No abnormal focal tracer avid lesion noted in skeleton to suggest metastasis

Note: Radiotracer retention within both pelvicalyceal systems, mainly the right side.

8.5 Stress-Related Changes/ Uptake

Figure 11: Amputation of the right leg (mid tibia and fibula): There is focal uptake (red circle) in the left mid-foot region, likely due to biomechanical stress (dependency)

8.6 Urinary Diversion/ Urinary bag

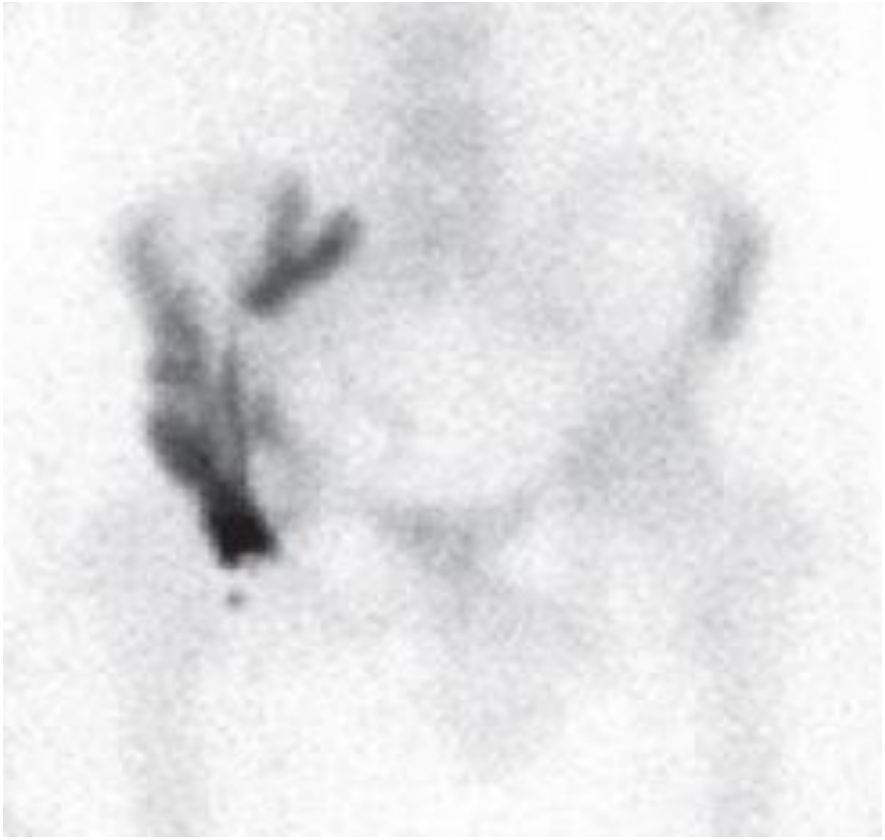


Figure 12: Limited spot view of the pelvis in patient with urinary bladder cancer shows an irregular radiotracer uptake within the right side of pelvis due to a urinary diversion (the activity noted is within the urinary bag)

Chapter 9: Abnormal Bone Scans

9.1 Uptake in lucent bone metastasis

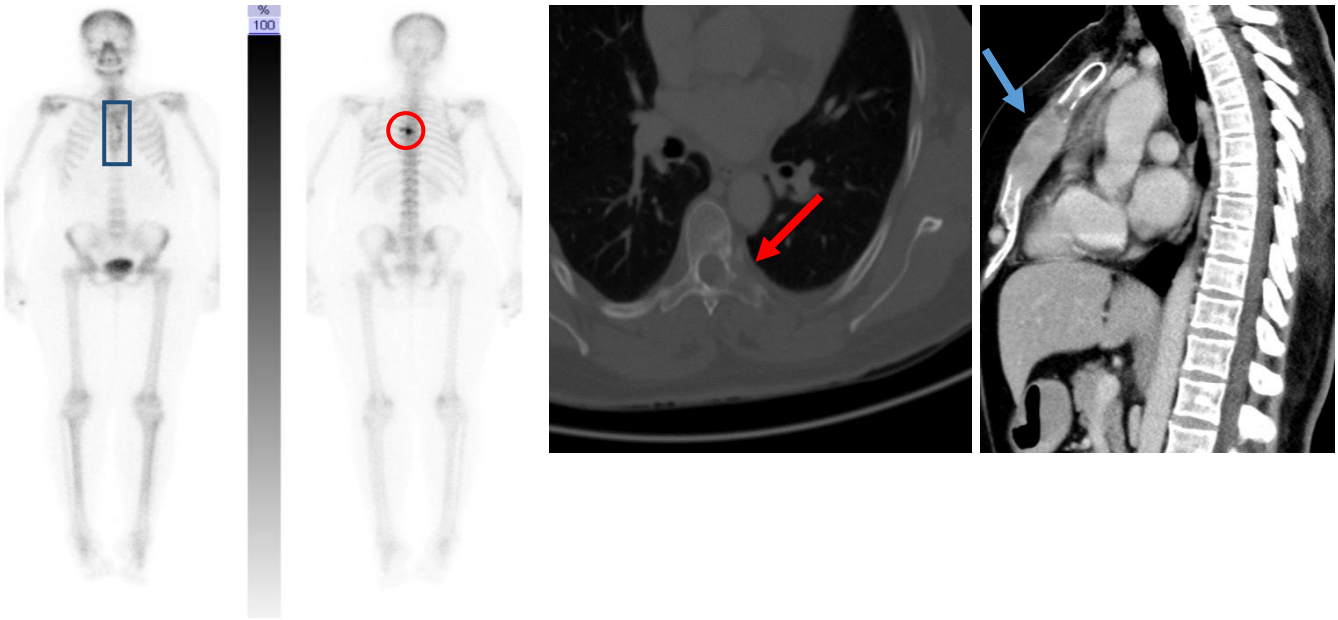


Figure 13: (Left) Anterior and posterior whole body bone scan of 36-year-old female patient known case of left breast cancer shows irregular photopenic area (blue box) within the body of the sternum. Posteriorly there is focal area within abnormal irregular increased Tc99m HDP uptake (red circle) within the left seventh costovertebral junction extending to the left side of 7th thoracic vertebra.
(Middle) Axial CT view shows lucent bony lesion within the left seventh costovertebral junction extending to the left side of 7th thoracic vertebra (red arrow).
(Right) sagittal view CT scan shows destructive lucent bone lesions within the sternum with large soft tissue component (blue arrow).

9.2 Primary Bone Tumor

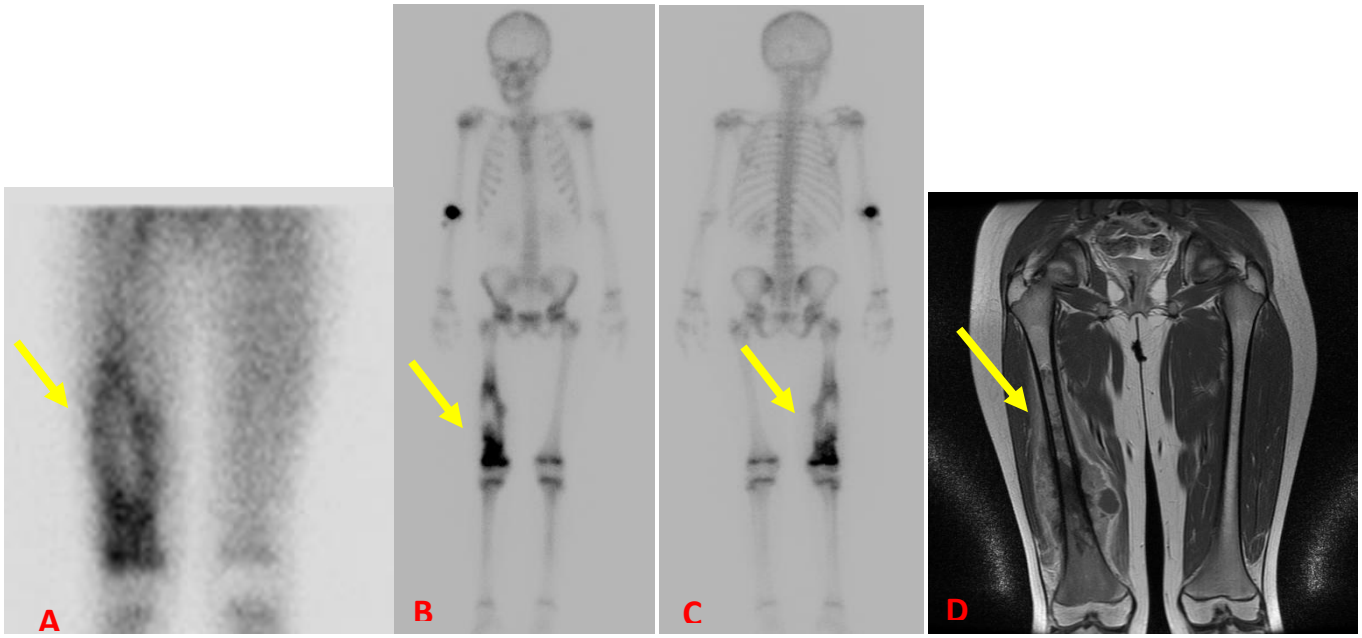


Figure 14: (A): Blood pool of both thighs in 13-year-old patient complaining of severe right lower limb pain and limping shows an abnormal increased blood pool activity within the lower two third of right thigh with a central area of reduced activity
(B) And (C): Anterior and Posterior whole-body scan of the same patient shows an irregular area with heterogenous radiotracer uptake within the distal two third of right femur involving the epiphysis with center area of reduced radiotracer uptake
(D): MRI of this young lady shows illustrate clearly the above-mentioned lesion. Note: the uptake in the right elbow is the injection site. No metastatic bone disease is noted on this scan.

9.3 Widespread Bone Metastases

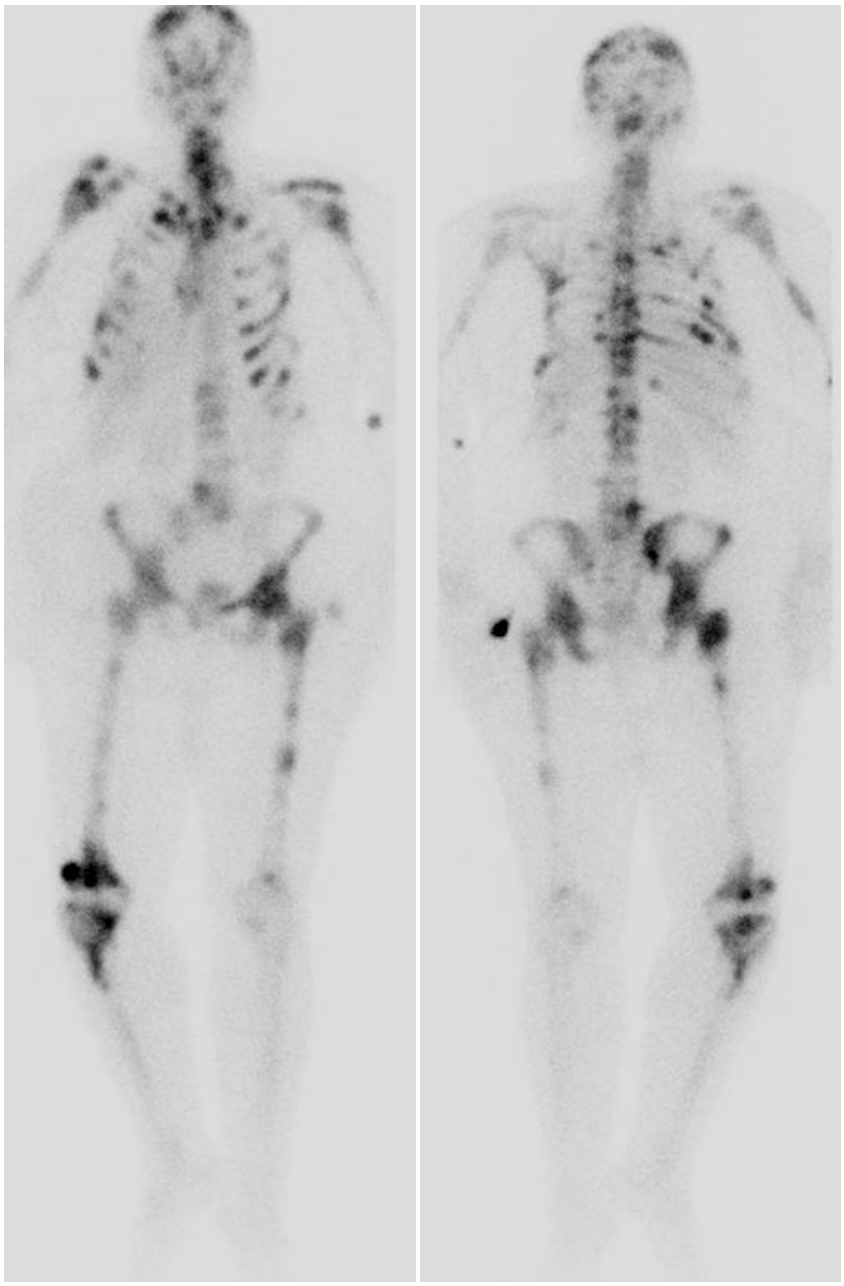
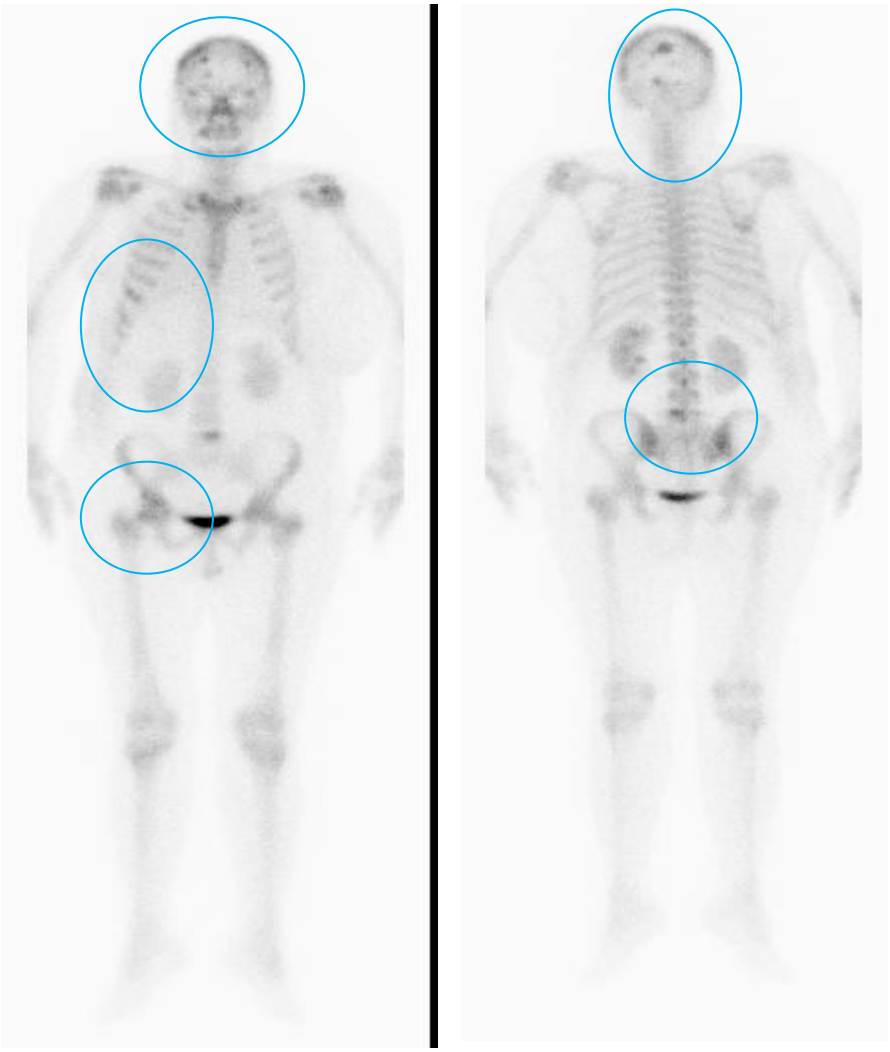


Figure 15: Anterior and Posterior whole body bone scan in a 55-year-old female a known case of breast cancer shows widespread areas of increased uptake in ribs, spine, skull, pelvis and the limbs, suggestive of extensive bone metastases. Bilateral kidneys are faintly visualized.

9.4 Staging Bone Scan – Example 1



Clinical Details:

A 51 year old female patient diagnosed with right breast cancer with metastases to the lungs treated with Neoajuvant Chemotherapy and radiotherapy with hormonal therapy.

Indication:

Restaging bone scan.

Tc-99m HDP Bone Scan (Whole Body):

PROCEDURE:- Anterior & posterior whole body bone scan is obtained ? hours post IV injection of ? mCi TC99-HDP.

Comparison: with previous bone scan performed. (the previously mentioned above).

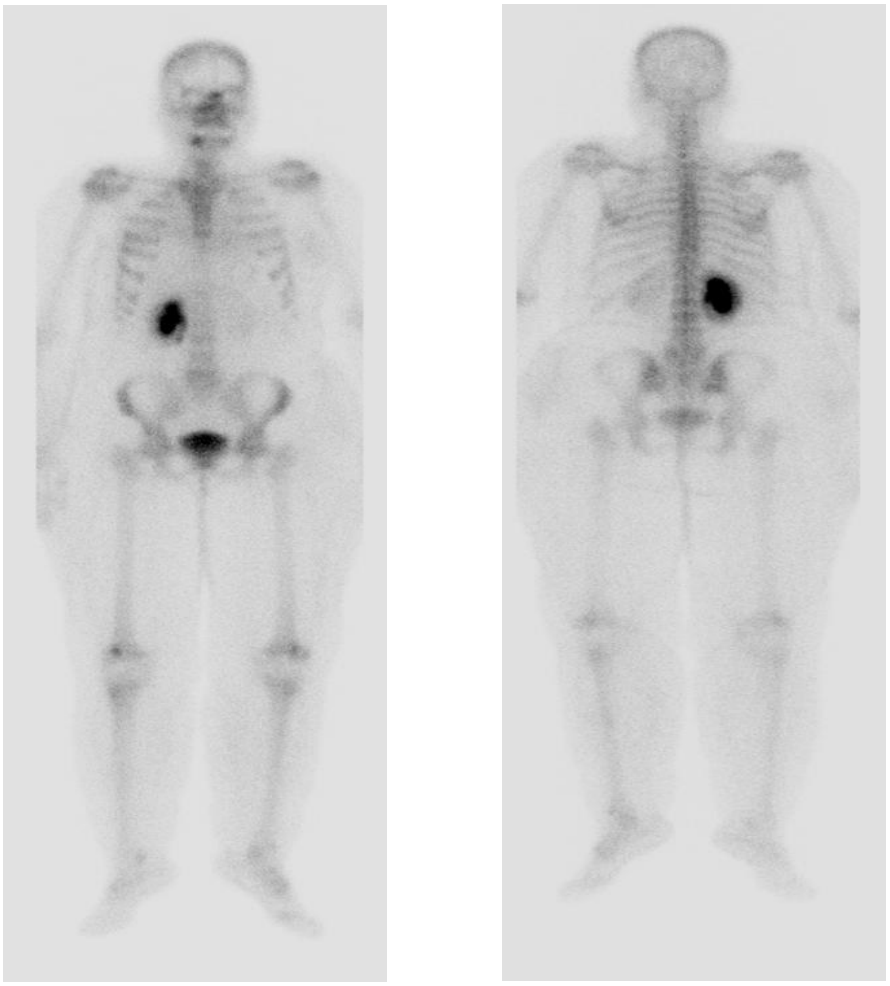
Findings:

- There are new multiple foci of abnormal increased radiotracer uptake within the skull (frontal, parietal and occipital bones), left side of 5th lumbar vertebra, right 7th rib anterolaterally and right acetabular roof.
- Almost stable irregular increased radiotracer uptake within the right sterno-clavicular joint, both shoulder joints, and both knee joints, mostly due to degenerative changes.
- Radiotracer distribution in the remainder of the skeleton is within normal limits.
- Both kidneys are normally located with normal limit of radiotracer handling.

Impression:

- Newly seen multiple active bony lesions as mentioned above, highly suspicious for bone metastases.
- Overall picture indicate disease progression.

9.5 Staging Bone Scan – Example 2



Clinical Details:

A 50 year old female patient a case of right breast cancer for staging

Indication:

Rule out bone metastasis

NM Scan Whole Body Bone

Tc99m-HDP Bone Scan (Whole Body):

Procedure:- Anterior & posterior whole body bone scan is obtained ? hours post IV injection of ? mCi TC99-HDP.

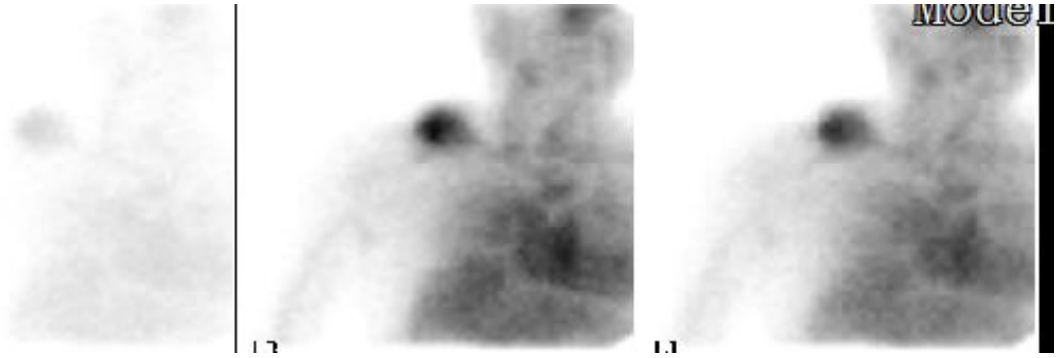
Findings:

- There is irregular increased radiotracer uptake within the thoraco-lumbar spine, both shoulder joints, and both knee joints, mostly due to degenerative changes.
- There is focal area with increased radiotracer uptake within the right mandible, most likely represent dental problem, for clinical correlation.
- Radiotracer distribution in the remainder of the skeleton is within normal limits.
- Right kidney is normally located with prominent retention of radiotracer, left kidney is normally located with normal limit of radiotracer handling.

Impression:

- No convincing evidence of osteoblastic metastases in this study.
- Prominent radiotracer retention within the right kidney. Tc99m MAG3 can be of value to rule out obstruction.

9.6 Staging Bone Scan – Example 3



Clinical Details:

42 year old, male patient, new case of right clavicle mass (he complained of right clavicle pain since 5 months ago, then he started to have swelling and the pain increased in intensity and unrelated to activity)

Indication:

For assessment.

Correlation : with MRI findings.

Bone Scan.

Tc-99m MDP 3-Phase Bone Scan (3-Phase + Whole Body):-

Procedure: - Early images were obtained for the chest (blood flow and blood pool) at the time of injection followed with anterior & posterior whole body bone scan.

Findings:

- Early images (flow and blood pool) show abnormal increased activity around the right shoulder joint medially.
- Delayed images show an area with abnormal increased radiotracer uptake with central photogenic area within the body of right clavicle, corresponding to expansile destructive bone lesion seen on MRI.
- Radiotracer distribution in the remainder of the skeleton is within normal limits.
- Both kidneys are normally located with normal limit of radiotracer handling.

Impression:

- Hypervascular active bony lesion within the body of right clavicle, appearance of which is highly suspicious for malignant primary tumor. Still metastatic process cannot be excluded if the patient proven to have primary tumor.
- No evidence of any other active suspicious bony lesions in this study.

9.7 Osteoporotic fracture – I

Figure 16: Tc-99m MDP bone scan Posterior view bone scan in a 68 year old patient with back pain. The linear horizontal increased uptake of tracer in the lumbar spine is typical of benign vertebral collapse, but the presence of coexistent pathology cannot be excluded.

9.8 Osteoporotic fracture – II

Figure 17: A 56-year-old female known case of breast cancer: Anterior & Posterior Tc-99m MDP bone scan revealed multiple focal areas with abnormal increased radiotracer uptake involving multiple ribs anteriorly and posteriorly (blue arrow) and right sacroiliac joint (red circle). The patient had severe osteoporosis (DEXA scan, with T score - 4.6). These findings likely represent osteoporotic insufficiency fractures. Ancillary findings of photopenic defects in bilateral knee region (post knee implant) with irregular radiotracer uptake around the left knee implant that would need to be followed up and correlated clinically to assess significance.

9.9 Osteoid Osteoma

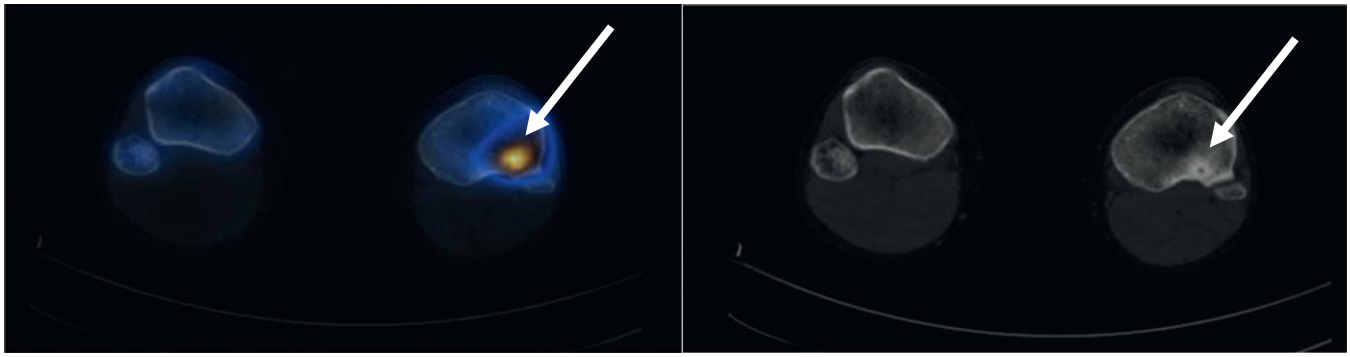
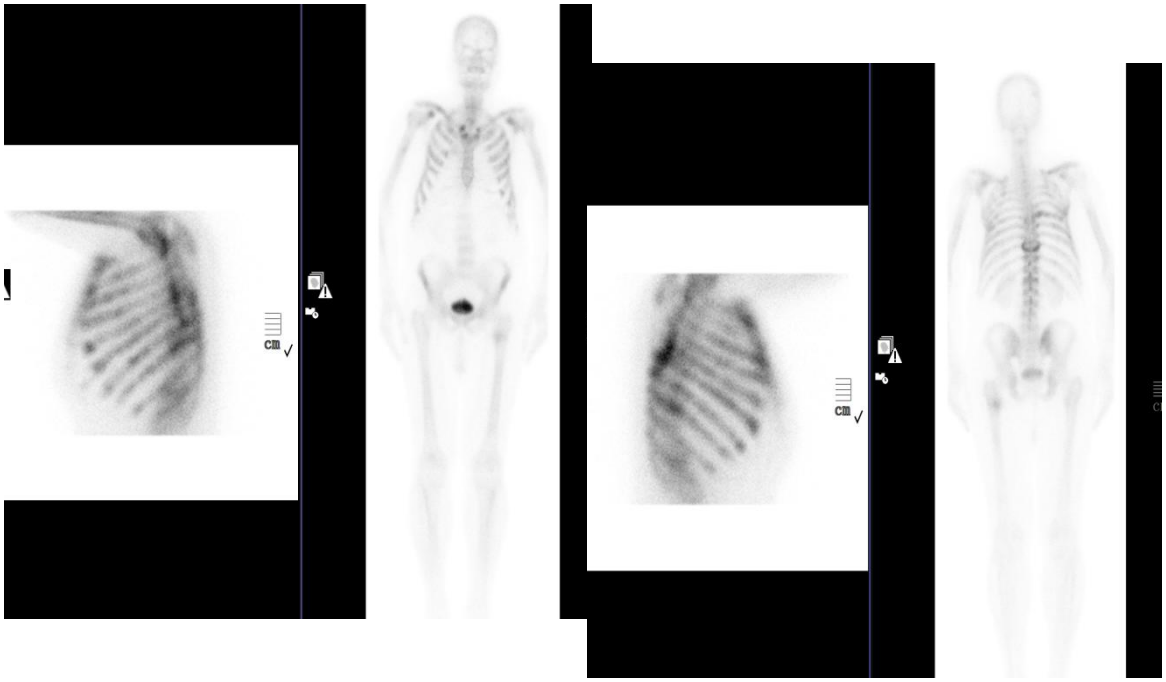


Figure 18: Tc-99m MDP bone SPECT/CT. Patient with left knee pain. (Left) Axial SPECT/CT show focal intense increased tracer uptake in the posterolateral aspect of the left distal femur, which corresponds to a sclerotic lesion on CT (Right) with central lucency due to an osteoid osteoma.

9.10 Monostotic Paget's disease

Figure 19: Tc-99m MDP anterior whole body bone scan in a 67-year-old male patient with right leg pain shows an elongated area of abnormal increased radiotracer uptake involving the right tibia and fibula reaching the ankle joint distally.

9.11 Diffuse Skeletal Metastasis

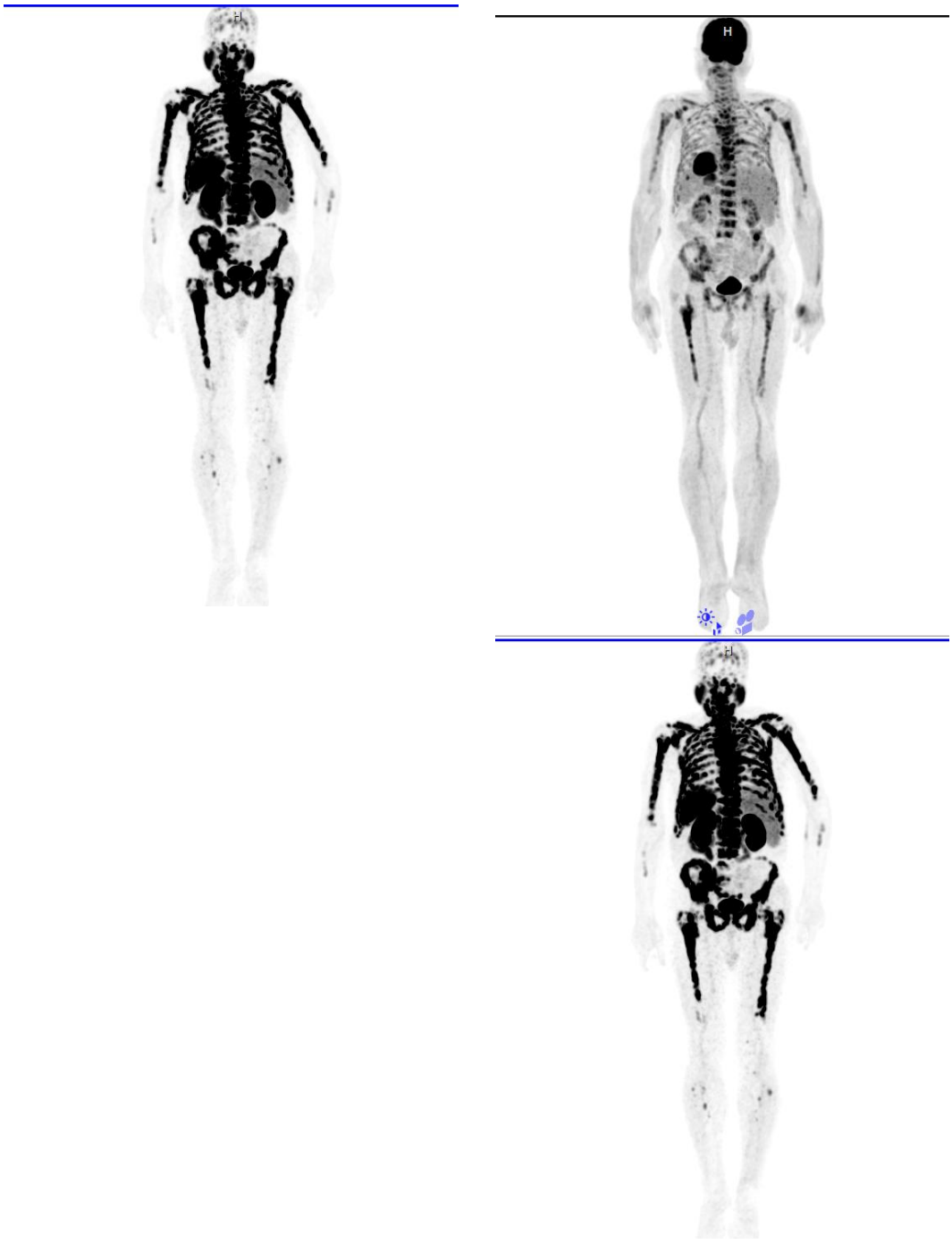


A B

Figure 20: An old man patient with history of prostate cancer: A & B anterior and posterior bone scan with spots chest views revealed heterogeneous increased radiotracer uptake involving both axial and proximal appendicular skeleton indicating extensive skeletal metastasis.

Note the faint visualization of both kidneys posteriorly, indicating Super bone scan

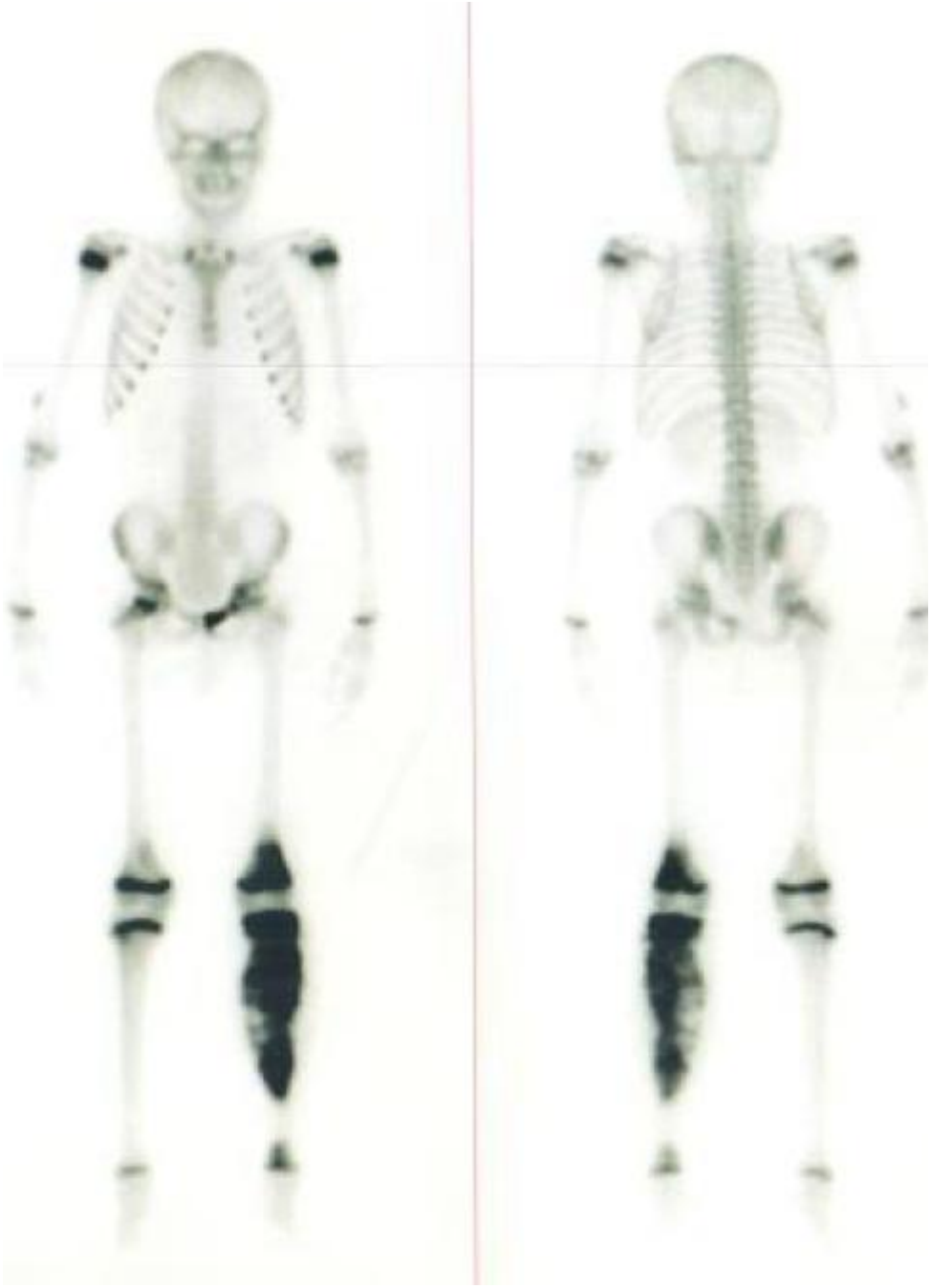
This was confirmed by Ga-68 PSMA scan (shown below in Figure 21)



9.12 Heterotopic Calcification Uptake

Figure 22: Bone scans will also pick areas of heterotopic calcification as in this case of calcified hepatic metastases from Ca. Prostate. (Case courtesy of Dr Chris O'Donnell, https://radiopaedia.org/articles/bone-scan)

9.13 Osteosarcoma



Clinical Details:

13 year old male case of Metastatic osteosarcoma within the left leg.

At first he was treated with chemotherapy

Indication:

To rule out other lesions (skip or distant mets).

Tc99m-HDP Bone Scan (Whole Body):

Procedure: Anterior & posterior whole body bone scan is obtained ? hours post IV injection of ? mCi TC99-HDP.
Comparison: no previous bone scan

Findings:

- There is large expensile area of intense heterogeneous radiotracer uptake compatible with the known extensive destructive primary tumor within the left tibia.
- There are two focal areas of abnormal increased radiotracer uptake within distal left tibia (metaphyseal area) and distal left femur.
- There is focal area of abnormal increased radiotracer uptake involving the left pubic bone.
- Radiotracer distribution in the remainder of the skeleton is within normal limits.
- Both kidneys are normally located with normal limit of radiotracer handling.

Impression:

- No previous bone scan for comparison.
- Large expansile aggressive bony lesion within the left tibial shaft, which is compatible with the known primary destructive bone tumor (osteosarcoma).
- Two other active lesions involving the distal left femur and distal left tibia, suspicious for skip lesions. Still correlation with MRI can be of value.
- Focal metastatic bony lesion within the left pubic bone.
- Remainder of the exam is unremarkable.