

## Case report

# Serendipitous Detection of Extraosseous Metastases on Bone Scintigraphy: Utility of Cross-sectional and Correlative Imaging

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## Abstract

Whole body bone scintigraphy is most commonly used imaging modality to detect and assess the extent of osteoblastic osseous metastases in malignant conditions, though visceral metastases need additional imaging. The authors describe a case of 50-year-old postoperative breast cancer female where bone scintigraphy showed soft tissue uptake in thorax and hepatic region in addition to multiple skeletal metastases, indicating the involvement of three different organs by metastatic disease. The present case highlights that extraosseous tracer uptake in addition to abnormal osseous tracer uptake may raise the suspicion of widespread and visceral metastatic disease and warrant further evaluation in the form of cross-sectional and correlative imaging.

**Keywords:** Bone scintigraphy, extraosseous metastases, single photon emission computed tomography/computed tomography,  $^{99m}\text{Tc}$ -methylene diphosphonate

## Introduction

The standard whole body skeletal imaging using  $^{99m}\text{Tc}$ -methylene diphosphonate (MDP) is most commonly used nuclear medicine procedure for metastatic osseous evaluation in cancer patients. The abnormal osseous tracer uptake in the skeletal system due to malignant etiopathology depicts the bony reaction to malignant condition.<sup>[1]</sup> However, nonosseous tracer uptake in the soft tissue may be related to primary malignant or metastatic disease apart from numerous other reasons. The detection of extraosseous uptakes alerts the physician regarding the presence of unsuspected disease processes.<sup>[2]</sup> Planar imaging of extraosseous uptake is limited by its exact localization and characterization. Single photon emission

computed tomography (SPECT) and SPECT/computed tomography (SPECT/CT) provide cross-sectional and correlative imaging and help in the localizing and anatomical correlation of the lesions seen on whole body planar bone scintigraphy.<sup>[3]</sup> We present a case of breast cancer female patient, where bone scintigraphy showed widespread osseous metastatic disease and probable extraosseous involvement. The extraosseous hepatic and pulmonary uptake were confirmed by SPECT/CT and  $^{18}\text{F}$ -fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT.

## Case Report

A 50-year-old female with left breast cancer (T2N1M0) underwent left total mastectomy with axillary clearance 2 years back with histopathology report of infiltrating ductal carcinoma Grade II and estrogen

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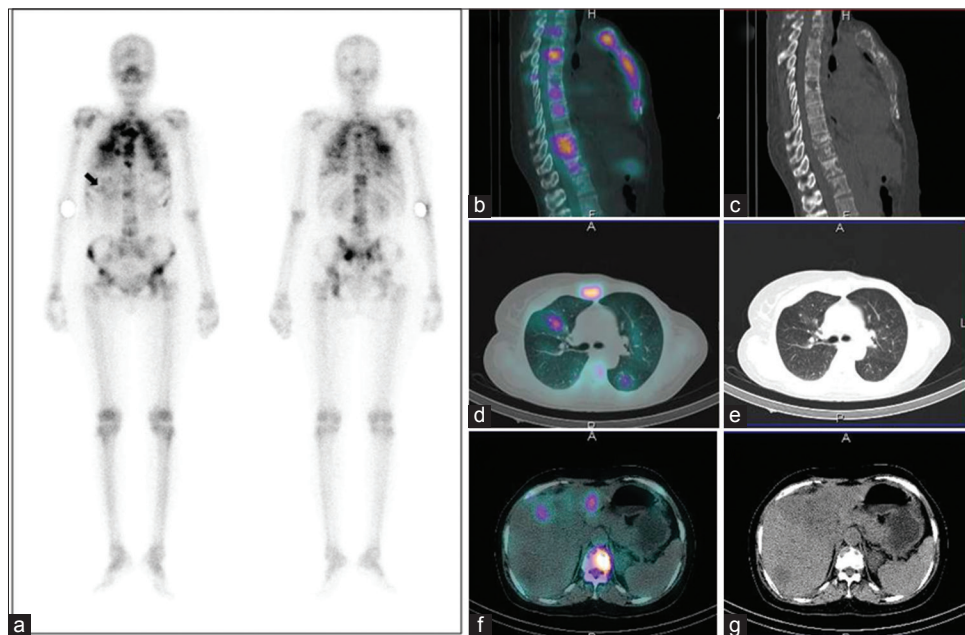
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receptor-2+ (70%); progesterone receptor-2+ (60%); human epidermal growth factor receptor 2/neu-negative and Ki-67 index of 10%. The baseline  $^{99m}\text{Tc}$ -MDP bone scintigraphy did not show any abnormal osteoblastic activity suggestive of metastasis. She received the first course of adjuvant chemotherapy and failed to turn-up for subsequent chemotherapy and radiotherapy. After a gap of almost 2 years, she again presented herself with complaints of generalized body aches for 2 months; constipation and vomiting for 10 days. The ultrasound abdomen revealed multiple ill-defined heterogeneous lesions in the liver suggestive of hepatic metastasis.  $^{99m}\text{Tc}$ -MDP whole body bone scintigraphy (anterior and posterior views) done for generalized body aches as a part of metastatic workup, showed multiple focal areas of abnormal radiotracer uptake in multiple bones suggestive of multiple skeletal metastases. In addition, multiple foci of increased abnormal tracer uptake were seen in thorax and hepatic region (arrow) [Figure 1a]. SPECT/CT of the thorax and upper abdomen region performed in view of extraskeletal tracer uptake, revealed skeletal metastases, tracer avid multiple ground glass opacities/nodules in bilateral lung fields and tracer avid multiple hypodense lesions in liver on CT axial and fused (SPECT/CT) images [Figure 1 b-g]. A whole body, FDG-PET/CT scan, was done within a week, revealed widespread multiple skeletal lesions, tracer avid hypodense hepatic lesions, and tracer avid few ground glass opacities/nodules in the lungs on maximal intensity projection image [Figure 2]. She succumbed to her disease just before the planned image-guided biopsy.

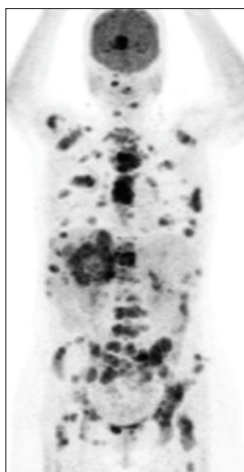
## Discussion

The bone scintigraphy delineates whole of the skeleton due to high bone to background ratio. Abnormal soft tissue/visceral uptake in the bone scintigraphy if any, may be detected due to the minimal background and it is well recognized that it can be due to benign and neoplastic conditions including metastases.<sup>[4]</sup> Recognition of these serendipitous findings of pathological uptake provide diagnostic information and improve the interpretation leading to better patient's management. Nonosseous hepatic and pulmonary metastatic lesions have shown MDP uptake due to various factors, i.e., increased regional blood flow and permeability, altered regional extracellular fluid and its dynamic, elevated tissue calcium concentration, and tumor necrosis.<sup>[5-8]</sup>

Careful inspection and additional imaging in the form SPECT/CT of the thorax and hepatic regions in the present case was helpful in delineating the pulmonary and liver metastases and correct interpretation. The whole body  $^{18}\text{F}$  FDG PET/CT done subsequently to further elucidate the nonosseous tracer uptake was suggestive of widespread skeletal and visceral metastatic disease. Although MDP uptake in the soft tissues other than bones has been reported extensively in the literature, however, a single scan showing MDP uptake as an evidence of metastases in three separate organs, namely, the bone, liver, and the lungs, in this case, was a very unusual finding, necessitated further investigations.



**Figure 1:**  $^{99m}\text{Tc}$ -methylene diphosphonate whole body bone scan (anterior and posterior views) showing multiple foci of abnormal tracer uptake in multiple bones suggestive of multiple skeletal metastases. Multiple foci of increased abnormal tracer uptake were also seen in thorax and hepatic region (arrow) (a). Computed tomography (sagittal and transaxial) and fused (single photon emission computed tomography/computed tomography) images of the thorax and upper abdomen region showing skeletal metastases in sternum and vertebral column (b and c) and tracer avid multiple ground glass opacities/nodules in bilateral lung fields and tracer avid multiple hypodense lesions in liver (d-g)



**Figure 2:**  $^{18}\text{F}$ -fluorodeoxyglucose whole body positron emission tomography/computed tomography maximal intensity projection image showing widespread multiple skeletal lesions, tracer avid hypodense hepatic lesions and tracer avid few ground glass opacities/nodules in the lungs

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### Conflicts of interest

The authors declare no conflicts of interest.

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