

---

# Detection of Occult Breast Carcinoma during Evaluation of a Skeletal Tumor by Tc-99m MIBI Scintigraphy

Nir Hod MD, Lilia Mindlin MD and Tifha Horne MD

Department of Nuclear Medicine, Assaf Harofeh Medical Center, Zerifin, Israel  
Affiliated to Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel

**Key words:** breast carcinoma, musculoskeletal tumors, Tc-99m MIBI scintigraphy

*IMAJ 2003;5:296–297*

---

For the last several years the role of Nuclear Medicine in Oncology has been growing exponentially. One of the advantages of these techniques is that they survey the entire body and detect metastases at multiple sites simultaneously. New nuclear medicine techniques may also provide a functional evaluation of a tumor. This article demonstrates clinical applications using Tc-99m MIBI in a woman with bone metastases from unknown breast cancer.

## Patient Description

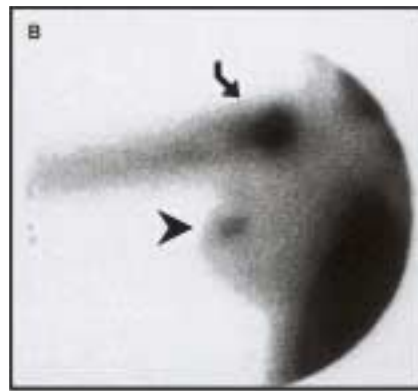
A 56 year old woman presented with a 2 month history of right shoulder pain. X-ray examination revealed a bone lesion in the

proximal right humerus that was evaluated by magnetic resonance imaging and found undetermined for a malignant tumor. For further evaluation of the nature of the lesion the patient was referred for Tc-99m sestamibi (MIBI) scan. Whole body Tc-99m MIBI scan revealed markedly increased tracer uptake at the tumor site in the right shoulder [Figure A, curved arrow] compatible with the aggressiveness of a malignant tumor. A spot view to that region clearly demonstrated the lesion in the head of the right humerus but also revealed unexpected markedly increased focal tracer uptake localized in the right breast [Figure B, arrowhead]. Cytologic examination from both lesions confirmed the diagnosis of a

malignant breast carcinoma with skeletal metastasis. Sequential bone scans revealed progression of the disease with enlargement of the humeral metastasis and appearance of widespread metastatic skeletal disease.

## Comment

Over the last decade, there has been a significant improvement in the ability of nuclear medicine physicians to preoperatively characterize the nature of lesions that are found undetermined for malignancy by conventional imaging modalities such as X-ray, computed tomography or MRI, by using more specific tumor-detecting agents. Tc-99m MIBI is a clinically



**[A]** Anterior whole body Tc-99m MIBI scintigraphy showing a large focal area of increased uptake in the proximal right humerus. **[B]** A spot view demonstrating the focus in the humerus, as well as an area of increased uptake in the right breast.

effective tumor-seeking agent indicated for detection of musculoskeletal tumors [1–4] and for the detection of primary malignant breast carcinoma in patients with dense breast, or where significant architectural distortion has occurred from prior biopsies or surgery, making mammography inaccurate [5]. The tracer is concentrated within the mitochondria of metabolically active cells with a strikingly higher uptake in malignant pathologies. It is also a useful adjunct tool to distinguish between residual or recurrent active tumor from necrotic non-malignant tissue and post-therapeutic changes. MIBI localization in tumors reflects not only blood flow and tumor viability but also the presence or absence of p-glycoprotein activity, which is responsible for pumping chemotherapeutic drugs out of the tumor cells, thereby thought to be responsible for multidrug

resistance and for cases of inefficient chemotherapy. Based on the fact that MIBI itself is treated as a substrate of p-glycoprotein, similar to chemotherapeutic agents, MIBI scintigraphy allows imaging assessment of multidrug resistance, thus predicting chemotherapy efficacy. For detection of musculoskeletal tumors, sensitivity and specificity have been reported to be 85% and 87% respectively, with over 95% sensitivity for detecting metastases in peripheral skeleton [2,3]. However, there have been case reports describing MIBI localization at sites of non-pathologic fractures, as well as a report on the rather limited usefulness of MIBI in the evaluation of Ewing's sarcoma due to unpredictable uptake in the primary tumors. For detection of breast carcinoma, an overall sensitivity of 85% with a specificity of 81% has been reported [5]. In non-palpable tumors and in tumors smaller than 1 cm, lower sensitivity was reported.

The prime utility in this patient was to aid in differentiating a benign from a malignant skeletal lesion, as many primary malignant skeletal tumors and bone metastases have been shown in recent literature to avidly concentrate Tc-99m MIBI [1–4]. On the contrary, if Tc-99m MIBI imaging

shows little or no uptake, a benign tumor is more likely, with a reported negative predictive value of 88%, though this cannot replace histologic confirmation as a definitive diagnosis [2]. Recent studies have shown that the new nuclear medicine imaging modality of PET (positron emission tomography) using  $F^{18}$ -FDG (fluoro-deoxyglucose) is even more sensitive and specific for detection of various malignant tumors, however it is more expensive and not currently available for all oncologic patients [4]. In the present case, we demonstrate the potential of Tc-99m MIBI scan, both for imaging of skeletal metastases and detecting their origin from breast carcinoma. This is achieved by selectively adding spot views to include the breast, following whole-body scanning during evaluation of skeletal lesions in women. In this way it is possible to detect occult breast carcinoma, the most common primary malignancy metastasizing to bone in women.

## References

1. Caner B, Kitapci M, Unlu M, et al. Technetium-99m-MIBI uptake in benign and malignant bone lesions: a comparative study with technetium-99m-MDP. *J Nucl Med* 1992;33: 319–24.
2. Pinkas L, Robinson D, Halperin N, et al.  $^{99m}Tc$ -MIBI scintigraphy in musculoskeletal tumors. *J Nucl Med* 2001;42:33–7.
3. Wakasugi S, Noguti A, Katuda T, Hashizume T, Hasegawa Y. Potential of  $^{99m}Tc$ -MIBI for detecting bone marrow metastases. *J Nucl Med* 2002;43:596–602.
4. Garcia R, Kim EE, Wong FC, et al. Comparison of fluorine-18-FDG PET and technetium-99m-MIBI SPECT in evaluation of musculoskeletal sarcomas. *J Nucl Med* 1996; 37:1476–9.
5. Waxman AD. The role of  $^{99m}Tc$  methoxyisobutylisonitrile in imaging breast cancer. *Semin Nucl Med* 1997;27:40–54.

**Correspondence:** Dr. T. Horne, Dept. of Nuclear Medicine, Assaf Harofeh Medical Center, Zerifin 70300, Israel.  
Phone: (972-8) 977-9752  
Fax: (972-8) 977-9750  
email: thorn@asaf.health.gov.il

*Travel is glamorous only in retrospect*

*Paul Theroux (1941-), American novelist and travel writer*