

## ORIGINAL ARTICLE

# ROLE OF SCINTIMAMMOGRAPHY IN THE DIAGNOSIS OF BREAST CANCER

Birendra Kishore Das, Biswa Mohan Biswal, Murali Bhavaraju

Department of Nuclear Medicine, Radiotherapy and Oncology,  
School of Medical Sciences, Universiti Sains Malaysia, Health Campus  
16150 Kubang Kerian, Kelantan, Malaysia

X-ray mammography has been the backbone of early detection of breast cancer. Several large scale systematic studies have shown that judicious use of X-ray mammography can indeed save life. However, though reasonably sensitive, X-ray mammography lacks in specificity leading to many unnecessary biopsies. Scintimammography is a relatively new imaging method to demonstrate cancer tissue in the breast. A radiopharmaceutical agent (Tc-99m Sestamibi) is administered intravenously and images of the breast are taken under a Gamma Camera. There is no need for any manipulation like compression of the breast as required to be done during mammography. The radiopharmaceutical accumulates in the breast in the presence of cancer tissue which can easily be seen in the images. The affinity of the cancer tissue to this radiopharmaceutical is up to 9 times in comparison to normal breast tissue. Several multi centric studies with blinded image interpretation have established the sensitivity and specificity of scintimammography to be above 85 and 90 % respectively as compared to 89 and 14 % respectively for X-ray mammography. The positive and negative predictive values of scintimammography are 70 and 83 % as against 49 and 57 % respectively for X-ray mammography. With the increasing availability of Nuclear Medicine facilities it is expected that more and more patients will benefit with the use of this new imaging modality.

*Key words : Scintimammography, Breast Cancer Detection, Breast Imaging Sestamibi in Breast Cancer*

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*Figure 1 : Scintimammography of a patient with carcinoma of right breast. Left half showing lateral view and right half showing anterior view. See the intense uptake of Tc-99m Sestamibi at the site of the malignant tumour in the right breast*

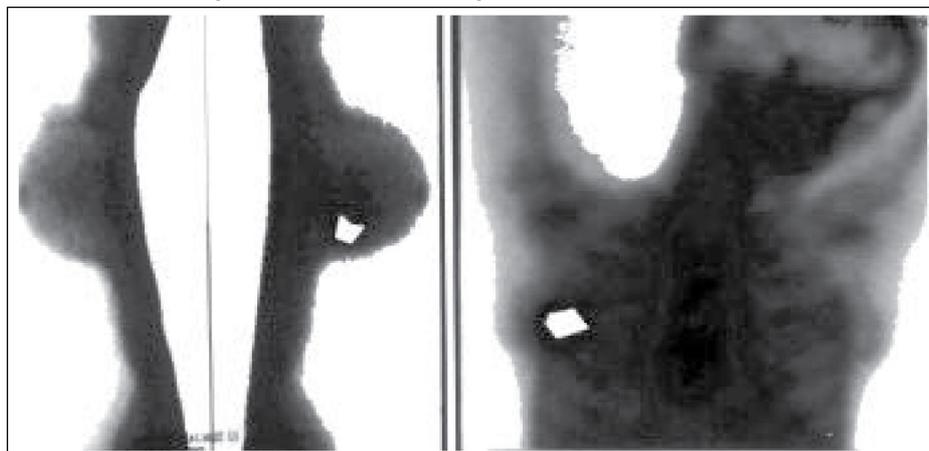


Table 1 : Imaging of the breast (data from multi-centric studies)

	Scitimammography %	X-rays mammography %
Sensitivity	85	89
Specificity	66	14
Positive Predictive value	70	49
Negative Predictive value	83	57

**Introduction**

There has been significant increase in the incidence of breast cancer all over the world. In developed countries breast cancer is the first cause of cancer death among women below the age of fifty. In many developing countries in South-East Asia like India the incidence of breast cancer has shown a steady increase and now it occupies the second place in the list of cancers suffered by women (1).

In spite of significant developments in recent years in the method of treatment of this dreadful disease, the rate of morbidity and mortality has not changed substantially and still remains very high.(2). Early diagnosis appears to be the most cost effective and acceptable method for reducing morbidity and

mortality(3).

Apart from self examination in a systematic way, X-ray mammography is still used as the main diagnostic procedure for early detection of breast cancer. Other modalities like Sonography, MRI, FNAB etc. have been found to be useful, but are less reliable or more cumbersome to replace X-ray mammography. This procedure, used as a screening method, has indeed saved life in western countries. However, though reasonably sensitive, mammography lacks specificity.

Multi centric studies involving large number of patients have established the sensitivity of this procedure, to be about 89 % whereas the specificity is only 14% (8). Both positive and negative predictive values ( 49 % and 57 % respectively ) are

Table 2 : Sensitivity and specificity of Scintimammography

<u>Study Group</u>	<u>No. of cases</u>	<u>Sensitivity</u>	<u>Specificity</u>
Lastoria et al	330	92%	90%
Lastoria et al (MDP vs MIBI)	65	94%	93%
NCI of Naples	186	92%	90%
Piccolo et al	200	92%	Not given

Table 3 : Clinical accuracy of Scintimammography

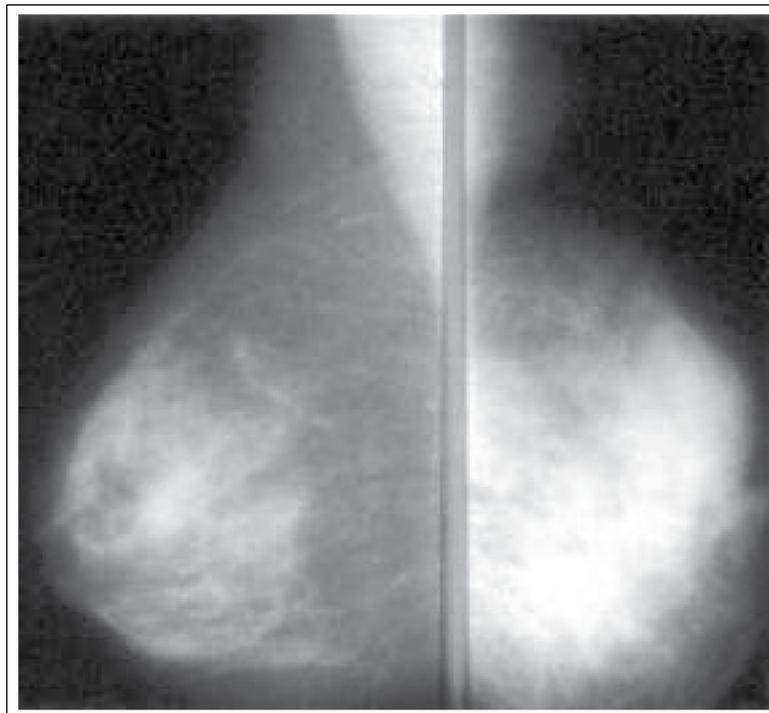
Parameter	Type of Lesion	Blinded image interpretation (%) (median values)
Sensitivity	Palpable lesions	76
	Non-palpable lesions	52
Specificity	Palpable lesions	85
	Non-palpable lesions	94
Positive predictive value	Palpable lesions	83
	Non-palpable lesions	79
Negative predictive value	Palpable lesions	85
	Non-palpable lesions	94

also low ( Table 1). As a result of the low specificity, a large number of patients are subjected to unnecessary FNAC or biopsy, which is associated some times with severe mental tension and also cause inconvenience to patients(4).

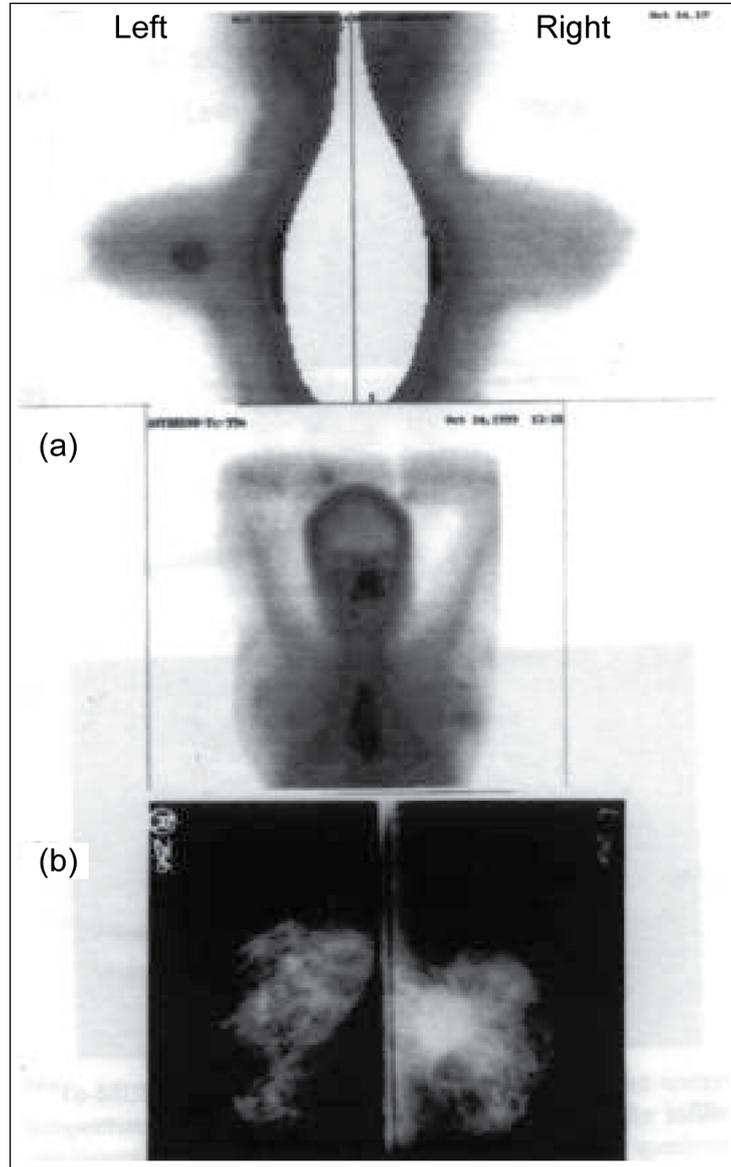
**Technique of breast imaging using radioisotopes:**  
 Although many authors have tried to use

radioisotopes / pharmaceuticals in detecting breast cancer, the real break through came only recently by accidental observation. While doing myocardial perfusion study, accumulation of Tc-99m-sestamibi was observed in malignant tumours of the lung. Subsequently systematic studies were carried out using this radiopharmaceutical for the detection of breast cancer (5). The technique is simple and non-

Figure 2 : X-ray mammography of a patient with dense breast difficult for interpretation. Such patients are usually referred for FNAC / Biopsy to rule out malignancy.



*Figure 3 : Scintimammography of a patient with a small carcinoma in the left breast with involvement of the axilla. ( a ) lateral and anterior views. See discrete concentration of activity in the left axilla in addition to the breast lesion. ( b ) X-ray mammography of the same patient showing dense zones also in the normal right breast difficult to interpret.*



invasive. The radiopharmaceutical is injected intravenously and images of the breast in lateral and anterior projections are taken 10 to 20 minutes p.i. using a Gamma Camera. The patient lies in prone position on a specially designed cushion so that the breasts hang downwards freely and the Gamma Camera detector is positioned laterally for imaging. There is no manipulation or compression of the breast needed which sometimes is very uncomfortable to patients subjected to x-ray mammography (6). The privacy of the patient is

maintained which is important for women in developing countries. Fig 1 shows a typical scintimammographic finding of a small breast cancer of the right breast both in lateral and anterior view.

### **Results & Discussion :**

Uptake of Sestamibi is about 9 times more in cancer cells than in normal cells (5). So focal concentrations of the radiopharmaceutical is seen in the cancer of the breast as well as in the axilla, if

involved. Fig 2 shows scintimammographic finding of a patient with cancer of the left breast and involvement of the axilla (a). In the anterior view one can see discrete concentration of activity in the left axilla in addition to the concentration in the lesion of the left breast. The X-ray mammography of the right and left breast of the same patient is seen in the lower part (b) of the figure.

The sensitivity and specificity of scintimammography have been established by several studies involving large number of patients (7,8). Table 2 summarizes some of the important published data. The sensitivity and specificity of scintimammography is 92 to 94 % and 90 to 93 % respectively. The sensitivity is in the same range as of X-ray mammography. However, the specificity is much higher (90 to 92 %).

In another publication (9) consisting data from two multi-centric studies with 673 patients and blinded image interpretation, the positive predictive value for palpable lesions has been calculated to be 83 % and for non palpable lesions 79 %. The negative predictive values for palpable and non palpable lesions are 85 % and 94 % respectively (Table 3). The relatively low sensitivity reported in this study for non-palpable tumours is due to the small masses (less than 1 cm) in which the intensity of uptake is low and has a high inter observer variability.

A study done by Deswal Salyaret et al on more than 150 cases using Tc-99m MDP instead of sestamibi had revealed a sensitivity of 96.9% and specificity of 96.6% in palpable breast masses (10). The higher sensitivity and specificity in this particular study might have been due to larger size of the tumours at the time of presentation. The X-ray mammography available in 59 patients of this group had revealed correct diagnosis in 30 (50.8%) patients and suspicion of malignancy in 8 (13.6 %).

#### **Concluding remarks :**

Scintimammography cannot replace X-ray mammography in routine screening of breast cancer patients. However, scintimammography can be used as a useful technique in situations like equivocal or non-diagnostic mammogram, dense or lumpy breast, breasts with distorting scars from previous surgery, breasts with implants where mammography is difficult to undertake (compression is too painful), during hormone replacement therapy (HRT), suspected multicentric or multifocal disease, palpable mass which is negative or equivocal at biopsy, dense mass without calcification, where

clinical extent of cancer is at variance with the mammographic findings and in determining sites for biopsy (if ultrasound guided biopsy is not possible). Fig. 3 shows a case of dense breast harboring cancer in which it is very difficult to identify the lesion.

Although any test with less than 100% negative predictive value is unacceptable, the relatively high negative predictive value of above 85 % in scintimammography may be considered worth trying particularly in the absence of any other modality with better negative predictive value. In any case it is better than X-ray mammography where the negative predictive value is less than 60%. The patient may benefit from the non-invasive, simple painless imaging procedure. In addition the specificity and accuracy of the diagnosis with the use of scintimammography will lead to less need for biopsy or FNAC.

#### **Correspondence :**

Prof. Dr. Birendra Kishore Das MD, SAR, ANM (Germany)  
Department of Nuclear Medicine,  
School of Medical Sciences,  
Universiti Sains Malaysia, Health Campus,  
16150 Kubang Kerian, Kelantan, Malaysia  
Tel: 09-7663160 Fax: 09-7653370  
e-mail: [bkishoredas@yahoo.com](mailto:bkishoredas@yahoo.com)

#### **References**

1. Althuis MD, Dozier JM, Anderson WF et al : Global trends in breast cancer incidence and mortality 1973 – 1997 *Int J Epidemiol* 2005 Apr; **34(2)**: 405 – 12.
2. Wilson CM, Tobin S, Young RC : The exploding worldwide cancer burden : the impact of cancer on women. *Int J Gynecol Cancer* 2004 Jan-Feb; **14(1)**: 1 – 11
3. Furnival CM : Breast cancer : current issues in diagnosis and treatment, *Aus N Z Surg.* 1997 Jan; **67(1)**: 47 – 58
4. Zorbas HM : Breast cancer screening *Med J Aust.* 2003 Jun 16; **178(12)**: 651 – 2.
5. Khalkhali I, Iraniha S, Cutrone JA et al : Scintimammography with Tc-99m sestamibi. *Acta Med Austriaca.* 1997; **24(2)**: 46 – 9.
6. Bombardieri E, Crippa F, Baio SM et al : Nuclear Medicine advances in breast cancer imaging *Tumori* 2001 Sept.-Oct.; **87(5)**: 277 – 87.
7. Buscomb JR, Holloway B, Roche N et al : Position of Nuclear Medicine modalities in the diagnostic work up of breast cancer *Q J Nucl Med Mol Imaging.* 2004 Jun; **48(2)** : 150 – 63

8. Buscomb JR, Scintigraphic imaging of breast cancer : a review *Nucl Med Commun.* 1997 Aug; **18(8)**: 698 – 709
9. Palmedo H, Grunwald F, Bender H et al : Scintimammography with technetium-99m methoxyisobutylisonitrile: comparison with mamography and magnetic resonance imaging *Eur J Nuc Med* 1996; **23(8)**: 940 – 946..
10. Deswal Satya : Scintimammography using Tc-99m MDP *Inaugural dissertation for M.D. (Nuclear Medicine) Degree* Submitted to SG Postgraduate Institute of Medical Sciences (deemed university) Lucknow, India 2001.