Procedure Guideline for Breast Scintigraphy

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Key Words: breast scintigraphy; procedure guideline

J Nucl Med 1999; 40:1233–1235

PART I: PURPOSE

The purpose of this guideline is to assist nuclear medicine practitioners in recommending, performing, interpreting and reporting the results of ^{99m}Tc-sestamibi breast scintigraphy (mammoscintigraphy, scintimammography).

PART II: BACKGROUND INFORMATION AND DEFINITIONS

Breast scintigraphy is performed after intravenous administration of ^{99m}Tc-sestamibi and includes planar and/or SPECT.

PART III: COMMON INDICATIONS AND APPLICATIONS

A. Evaluate breast cancer in patients in whom mammography is not diagnostic or is difficult to interpret (e.g., the presence of scar tissue or mammographically dense breast tissue).
B. Assist in identifying multicentric carcinomas in patients with tissue diagnosis of breast cancer.
C. May be useful in the evaluation of the effectiveness of neoadjuvant chemotherapy for breast carcinoma.

PART IV: PROCEDURE

A. Patient Preparation
   1. No special preparation for the test is needed; however, a thorough explanation of the test should be provided by the technologist or physician.
   2. The patient should remove all clothing and jewelry above the waist and should wear a hospital gown open in front.
B. Information Pertinent to Performing the Procedure
   1. Recent (not older than 3 mo) or prior mammograms should be available, as well as sonograms, if obtained.
   2. A breast physical examination must be performed by either the nuclear medicine physician or the referring physician.
   3. The time of last menses and pregnancy and lactating status of the patient should be determined.
   4. Breast scintigraphy should be delayed at least 2 wk after cyst or fine-needle aspiration, and 4–6 wk after core or excisional biopsy.
   5. The nuclear medicine physician should be aware of physical signs and symptoms and prior surgical procedures or therapy.
C. Precautions
   None
D. Radiopharmaceutical
   1. Intravenous injection of 740–1110 MBq (20–30 mCi) ^{99m}Tc-sestamibi should be administered in an arm vein contralateral to the breast with the suspected abnormality. If the disease is bilateral, the injection is ideally administered in a foot vein.
   2. The radiopharmaceutical should be administered using an indwelling catheter or butterfly needle. The radiopharmaceutical should be followed by 10 mL saline to flush the vein.
   3. Normal distribution of the radiopharmaceutical includes the salivary and thyroid glands, myocardium, liver, gallbladder, small and large intestine, kidneys, bladder and skeletal muscles.
   4. Radiation dosimetry (Table 1).
E. Image Acquisition
   1. Instrumentation
      a. A standard scintillation camera is equipped with a low-energy, high-resolution collimator.
      b. A symmetric 10% energy window (±5%) should be centered over the 140-keV photopeak of ^{99m}Tc.
   2. Patient Position
      a. The patient lies prone with a single breast dependent from the imaging table. The contralateral breast should be compressed against the table to prevent cross-talk of activity. A breast positioning device (table adaptor, foam pad, etc.) should be used to minimize patient motion. The arms should be raised to expose the axillae.

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Note: All 29 SNM-approved procedure guidelines are available on the Society's home page. We encourage you to download these documents via the internet at www.snm.org. If you would like information on the development of this guideline or to order a compendium of all 29 procedure guidelines for $35, contact Marie Davis, Society of Nuclear Medicine, at (703) 708-9000, ext. 250 or at the addresses given above.

TABLE 1
Radiation Dosimetry for Adults

Radiopharmaceutical	Administered activity MBq (mCi)	Organ receiving largest radiation dose* MGy/MBq (rad)	Effective dose* MSv/MBq (rem/mCi)
^{99m}Tc-sestamibi		Gallbladder	
	740–1110 (20–30)	0.039 (0.14)	0.0085 (0.031)

Per MBq (mCi)
*Data from reference 4, page 23.

b. The detector should touch the patient's side for improved resolution.
c. The anterior image may be acquired with the patient supine or upright.

3. Images
   a. Imaging begins 5–10 min after administration of the radiopharmaceutical.
   b. Planar images are acquired for 10 min each, using a 128 × 128 × 16 or larger matrix to allow for pixel overload that may come from the liver, heart, etc.
   c. The following planar images should be acquired:
      i. Prone lateral image of the breast with the suspected abnormality. The field of view should include the breast, axilla and anterior chest wall, excluding any internal organ activity. Electronic magnification should be used as needed to optimize pixel size.
      ii. If needed, prone posterior oblique image of the ipsilateral breast. The detector is moved 30° posterior of lateral.
      iii. Prone lateral and, if needed, posterior oblique images of the contralateral breast.
      iv. Anterior supine or upright chest image. The anterior upright or supine image should include both breasts and both axillae in the field of view. Do not use zoom in anterior position if the camera system does not allow breasts and both axillae in the image.
   d. The use of radioactive markers over palpable abnormalities is optional. If markers are placed, they must be placed *after* the patient is positioned in the prone position. The location of the breast lesion in relation to the marker may change significantly if the markers are placed in supine or upright position and then the breast is positioned in prone lateral.
   e. No consensus has been reached regarding the utility of SPECT imaging; therefore no parameters for SPECT imaging or processing are included here.

F. Interventions
   None
G. Processing
   1. Masking high-activity chest and abdominal organs such as the myocardium and liver from the final images will improve visualization of breast tissue. This masking may be performed using regions of interest generated on the computer or by count subtraction. Both the masked and original images should be included in the final display.
   2. Interpretation of the images should be done on a computer monitor whenever possible, because the interpreting physician may need to adjust the image contrast.
   3. A logarithmic scale to enhance low-count areas instead of a linear scale is preferable for image display.
   4. Gray scale is preferable to color for interpretation.
H. Interpretation Criteria
   1. Focal increased uptake of the radiopharmaceutical in the breast or axilla (in the absence of radiopharmaceutical infiltration) is suggestive of malignancy.
   2. Mild homogeneous uptake of the radiopharmaceutical in the breast or axilla is consistent with a normal study.
   3. Patchy or diffuse radiopharmaceutical uptake in the breasts is probably not consistent with malignancy.
   4. Intensity of focal uptake can vary greatly. The following image features are suggestive of breast malignancy: focal increased uptake, unilateral, relatively well-delineated contours, with mild to intense radiotracer uptake; focal increased uptake (one or more foci) in the ipsilateral axilla in the presence of a primary lesion in the breast is strongly suggestive of axillary lymph node metastatic involvement. Note that linear and superficial axillary uptake on the lateral thoracic views usually corresponds to uptake in skin folds. The following image features are suggestive of benign disease of the breast: diffuse or patchy radiotracer uptake of mild to moderate intensity, often bilateral, edges are not visually well defined.
I. Reporting
   The report to the referring physician should recommend correlation with clinical findings, as well as the results of other imaging studies.
J. Quality Control
   1. Routine scintillation camera quality control should be performed as described in the *Society of Nuclear Medicine Procedure Guideline for General Imaging*.
   2. Quality control measures and radiation safety precautions should be followed as described in the

Society of Nuclear Medicine Procedure Guideline for Use of Radiopharmaceuticals.

K. Sources of Error
   1. Infiltration of the radiopharmaceutical administered in an arm vein may cause false positive uptake in the axillary lymph nodes.
   2. Patient positioning that does not allow the breast to be fully dependent will decrease the accuracy of the test.
   3. Patient motion will decrease the accuracy of the test.
   4. If both breasts are dependent, cross-talk of activity may result in a false positive result in the contralateral breast.
   5. The sensitivity, specificity and accuracy of this test depend upon several factors including the size of the breast tumor being imaged. The sensitivity of this test for tumors under 1 cm in diameter is very low with current nuclear medicine cameras in use.

PART V: DISCLAIMER

The Society of Nuclear Medicine has written and approved guidelines to promote the cost-effective use of high-quality nuclear medicine procedures. These generic recommendations cannot be applied to all patients in all practice settings. The guidelines should not be deemed inclusive of all proper procedures or exclusive of other procedures reasonably directed to obtaining the same results. The spectrum of patients seen in a specialized practice setting may be quite different than the spectrum of patients seen in a more general practice setting. The appropriateness of a procedure will depend in part on the prevalence of disease in the patient population. In addition, the resources available to care for patients may vary greatly from one medical facility to another. For these reasons, guidelines cannot be rigidly applied.

Advances in medicine occur at a rapid rate. The date of a guideline should always be considered in determining its current applicability.

PART VI: ISSUES REQUIRING FURTHER CLARIFICATION

A. Further study is needed to determine the characteristics of the population most likely to benefit from breast scintigraphy.
B. No consensus has been reached as to the efficacy of routine SPECT imaging.
C. The usefulness of other radiopharmaceuticals for breast scintigraphy has not been established.
D. The usefulness of breast scintigraphy for all indications included above requires further study.

PART VII: CONCISE BIBLIOGRAPHY

1. Cutrone JA, Shane Yospur L, Khalkhali I, et al. Immunohistologic assessment of Tc-99m-MIBI uptake in benign and malignant breast lesions. *J Nucl Med.* 1998;39:449–453.
2. Del Vecchio S, Ciarmiello A, Pace L, et al. Fractional retention of technetium-99m-sestamibi as an index of p-glycoprotein expression in untreated breast cancer patients. *J Nucl Med.* 1997;38:1348–1351.
3. Diggles L, Mena I, Khalkhali I. Technical aspects of prone dependent-breast scintimammography. *J Nucl Med Tech.* 1994;22:165–170.
4. International Commission on Radiological Protection. *Radiological Protection in Biomedical Research.* ICRP publication 62. Stockholm, Sweden: ICRP; 1992.
5. Khalkhali I, Mena I, Jouanne E, et al. Prone scintimammography in patients with suspicion of breast cancer. *J Am Coll Surg.* 1994;178:491–497.
6. Palmedo H, Schomburg A, Grunwald F, et al. Scintimammography with Tc-99m MIBI in patients with suspicion of primary breast cancer. *Nucl Med Biol.* 1996;23:681–684.
7. Peller PJ, Khedkar NY, Martinez CJ. Breast tumor scintigraphy. *J Nucl Med Tech.* 1996;24:198–203.
8. Taillefer R, Robidoux A, Lambert R, Turpin S, Laperrigre. Technetium-99m-sestamibi prone scintimammography to detect primary breast cancer and axillary lymph node involvement. *J Nucl Med.* 1995;36: 1758–1765.
9. Tiling R, Sommer H, Pechmann M, et al. Comparison of technetium-99m-sestamibi scintimammography with contrast-enhanced MRI for diagnosis of breast lesions. *J Nucl Med.* 1997;38:58–62.
10. Villanueva-Meyer J, Leonard MH Jr, Briscoe E, et al. Mammoscintigraphy with technetium-99m-sestamibi in suspected breast cancer. *J Nucl Med.* 1996;37:926–930.

PART VIII: LAST HOUSE OF DELEGATES APPROVAL DATE

February 7, 1999

PART IX: NEXT ANTICIPATED APPROVAL DATE

2001