

, , ^{99m}Tc-MIBI (multimodality study) ¹

. . . 2 . 2 . 3 .

: , ^{99m}Tc-MIBI
(multimodality study)
: 1998 1 1999 12 81
^{99m}Tc-MIBI
가 2
grading , ^{99m}Tc-MIBI
4 grading(1=definitely benign, 2=probably benign, 3=probably malignant,
4=definitely malignant) , BIRADS 67 ,
14 , ^{99m}Tc-MIBI grade 3, 4,
BIRADS category 4, 5 , 3

: , , , , , 87.3%, 69.2%,
87.3%, 81.8%, 80.2% , 94.5%, 65.3%, 85.2%, 85.0%, 85.2%
, ^{99m}Tc-MIBI 83.6%, 88.5%, 93.9%, 71.9%, 85.2% .
83.6%, 50.0%, 93.9%, 100.0%, 95.2% , ^{99m}Tc-MIBI
72.7%, 69.2%, 95.2%, 100.0%, 96.7% , ^{99m}Tc-MIBI
80.0%, 61.5%, 95.7%, 94.1%, 95.2% ,
70.9%, 50.0%, 97.5%, 100.0%, 98.1% .

: 가
가 가
가
^{99m}Tc-MIBI 가 ^{99m}Tc-MIBI
MIBI .

가 가 가 가
가 (2).
30-40%
(1).

가
(3, 4).

가
^{99m}Tc-MIBI 가
(5).

1
2
3

: , ^{99m}Tc-MIBI (multimodality study)
 , ^{99m}Tc - MIBI (multimodality study)
 1998 1 1999 12
 81 (46.4 , 9.2).
 81 , ^{99m}Tc - MIBI

(multimodality study)
 (negative) 3
 3
 2 , 3
 (sensitivity), (specificity),
 (positive predictive value), (negative predictive value), (diagnostic accuracy)
 LORAD M - III(LORAD, Danbury, CA, USA) 81 67 14
 (mediolateral oblique view) (fine needle aspiration cytology)
 (craniocaudal view) 55 가 ,
 Acuson 128XP/ 10(Acuson, (invasive ductal carcinoma) 39 ,
 Mountain view, CA, U.S.A.) 5 - 10MHZ (ductal carcinoma in situ) 10 , (medullary carcinoma) 1 , (mucinous carcinoma) 1
^{99m}Tc - MIBI 20 - 30mci ^{99m}Tc - MIBI 가 (ductal carcinoma in situ) 1 , 3
 10 , 5 - (SPECT) 2.79 cm) .
 26 가
 Vertex™(ADAC, Milpitas, CA, U.S.A.) (fibrocystic disease) 11 , (fibroadeno-
^{99m}Tc - MIBI 가

(grading system)
 (1 - , definitely benign, 2 - , probably benign, 3 - , probably malignant, 4 - , definitely malignant). ,
 (uptake)가 grade 1,
 grade 2, 가
 grade 3,
 grade 4 , grade 1, 2 ,
 3, 4 .
 가
 1995 9 American college of Radiology가
 Breast Imaging Reporting And Data System
 (BIRADS™), Second edition. 6
 ; 0- 가 (incomplete study),
 1- (negative), 2- (benign finding), 3- (probably benign finding), 4- (suspicious abnormality), 5- (highly suggestive of malignancy). 1 3
 , 4 5 .
 1995 Stavros가
^{99m}Tc - MIBI
 (grading system) grade 1, 2
 , 3, 4 (6).
 2 2
 (positive),

Table 1. Statistical Results of Mammography, Ultrasonography and ^{99m}Tc-MIBI Scintimammography in the Diagnosis of Breast Lesions

	MM	US	MIBI
TP	48	52	46
FN	4	3	9
FP	7	9	3
TN	18	17	23
Incomplete	4	0	0
Total	81	81	81

TP : True positive, FN : False negative,
 FP : False positive, TN : True negative,
 Incomplete : Category 0 in BIRADS
 MM : Mammography, US : Ultrasonography
 MIBI : ^{99m}Tc-MIBI Scintimammography

Table 2. Sensitivity, Specificity, Positive Predictive value, Negative Predictive Value, Accuracy in Each Study

	MM	US	MIBI
Sensitivity(%)	87.3	94.5	83.6
Specificity(%)	69.2	65.3	88.5
PPV(%)	87.3	85.2	93.9
NPV(%)	81.8	85.0	71.9
Accuracy(%)	80.2	85.2	85.2

PPV : positive predictive value, NPV : negative predictive value
 MM : Mammography, US : Ultrasonography
 MIBI : ^{99m}Tc-MIBI Scintimammography

ma) 3 , (benign phylloides tumor)
 1 , (adenosis) 1 ,
 10 .
 55 , 22
 가 가
 가 4 가 . 7
 가 , 4 가 (Table 1).
 87.3%, 69.2% ,
 87.3%, 81.8% , 80.2%
 (Table 2).
 61 , 20
 . 9 가 , 3
 가 (Table 1).
 94.5%, 65.3% , ,
 85.2%, 85% 85.2% (Table 2).
^{99m}Tc - MIBI 49 , 32
 3 가 , 9
 가 (Table 1). ^{99m}Tc - MIBI
 83.6%, 88.5% , ,
 93.9%, 71.9% , 85.2% (Table 2).
 (Fig. 1) 49 ,
 13 . 3 ,
 (Table 3).
^{99m}Tc - MIBI

83.6%, 50% , ,
 93.9%, 100% , 95.2% (Table 4).
^{99m}Tc - MIBI scan 42
 , 18 ,
 2 (Fig. 2),
 (Table 3).
 1 .
 , 72.7%, 69.2% ,
 , 95.2%, 100% ,
 96.7% (Table 4).
^{99m}Tc - MIBI 46
 (Fig. 3), 16

Table 3. Statistical Results of Multimodality Studies

	MM + US	MM + MIBI	US + MIBI	Triple
TP	46	40	44	39
FN	0	0	1	0
FP	3	2	2	1
TN	13	18	16	13
Disagreement	19	21	18	28
Total	81	81	81	81

MM : Mammography, US : Ultrasonography
 MIBI : ^{99m}Tc-MIBI Scintimammography
 Triple : Mammography + Ultrasonography + ^{99m}Tc-MIBI Scintimammography
 Disagreement : Disagreed with each two studies, and in triple studies, not all coincided cases

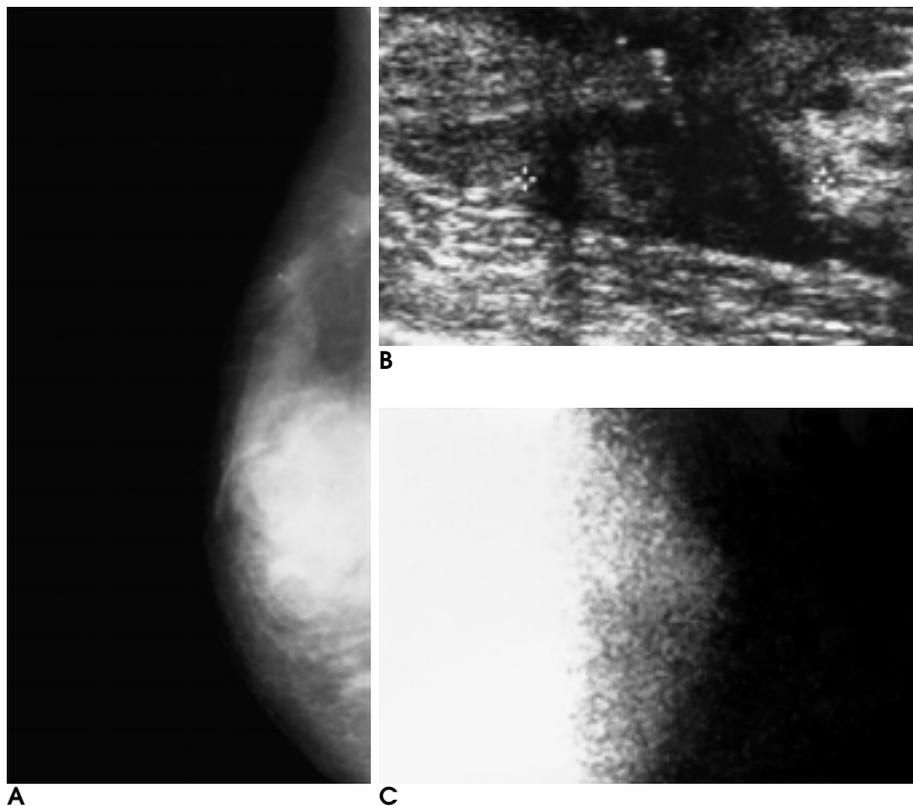


Fig. 1. Invasive ductal carcinoma in 29-year-old woman interpreted as a malignancy on ultrasonography and mammography, but as a benign on ^{99m}Tc-MIBI scintimammography.
A. About 2 cm sized lobulated mass lesion with calcification is present in upper portion of the right breast on mammography(Category 4).
B. Ultrasonogram shows irregular hypoechoic lesion with flow signals on color Doppler image(Grade 3).
C. Diffuse uptake is seen on ^{99m}Tc-MIBI scintimammography(Grade 2).

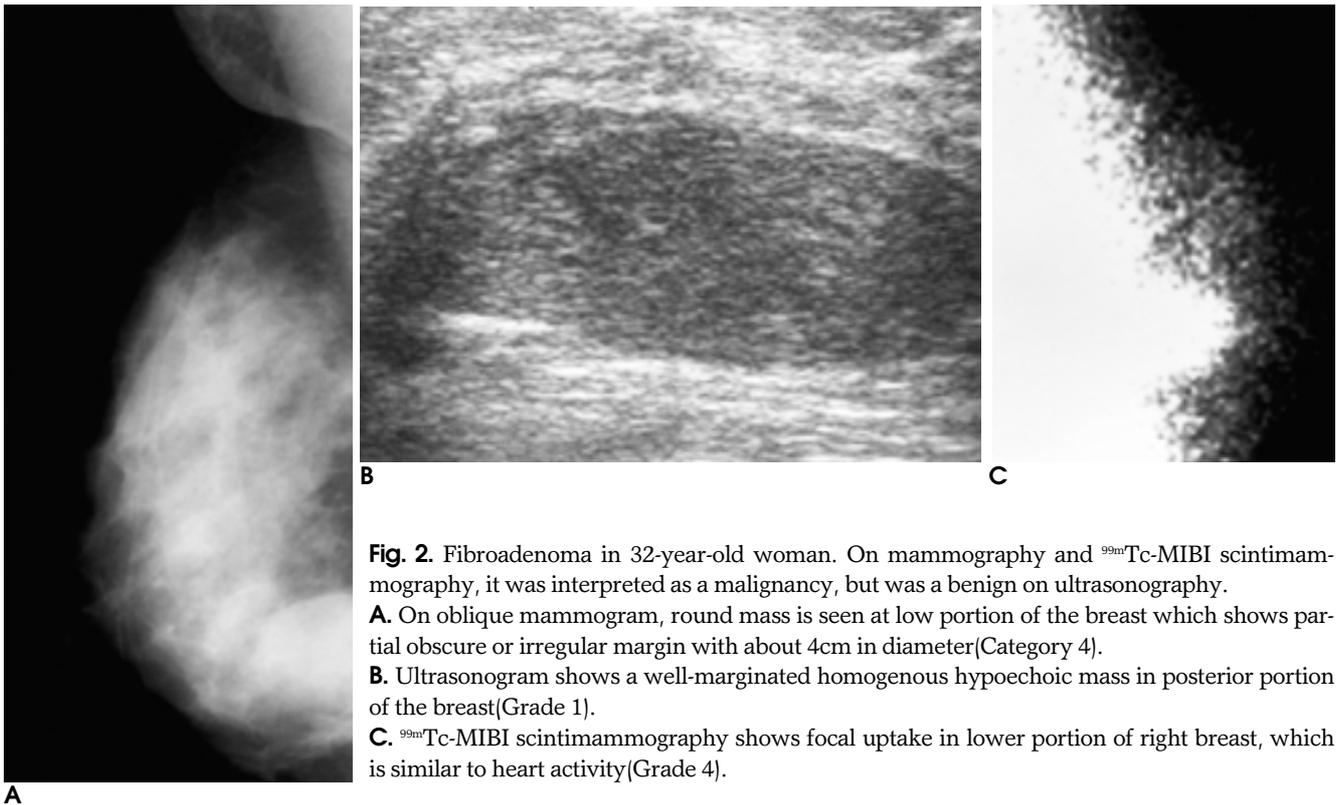


Fig. 2. Fibroadenoma in 32-year-old woman. On mammography and ^{99m}Tc-MIBI scintimammography, it was interpreted as a malignancy, but was a benign on ultrasonography.
A. On oblique mammogram, round mass is seen at low portion of the breast which shows partial obscure or irregular margin with about 4cm in diameter(Category 4).
B. Ultrasonogram shows a well-marginated homogenous hypoechoic mass in posterior portion of the breast(Grade 1).
C. ^{99m}Tc-MIBI scintimammography shows focal uptake in lower portion of right breast, which is similar to heart activity(Grade 4).

A

2, 1 (Table 3).
 80%, 61.5%, 95.7%,
 94.1%, 95.2% (Table 4).
 가 40
 (Fig. 4), 13
 1 (Fig. 5), (Table 3).
 70.9%, 50%, 97.5%, 100%
 , 98.1% (Table 4).
 가 1
 가 ^{99m}Tc-MIBI
 100% . 97%

Table 4. Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, Accuracy in Multimodality Studies

	MM + US	MM + MIBI	US + MIBI	Triple
Sensitivity(%)	83.6	72.7	80.0	70.9
Specificity(%)	50.0	69.2	61.5	50.0
PPV(%)	93.9	95.2	95.7	97.5
NPV(%)	100.0	100.0	94.1	100.0
Accuracy(%)	95.2	96.7	95.2	98.1

PPV : positive predictive value, NPV : negative predictive value
 MM : Mammography, US : Ultrasonography
 MIBI : ^{99m}Tc-MIBI Scintimammography
 Triple : Mammography + Ultrasonography + ^{99m}Tc-MIBI Scintimammography

(9).
 가 (implant)
 가 Sickles 97% 가
 가 15 - 75% 가
 가 (7, 8). 가
 가 가
 가 (10 - 14). Williams (15)
 25%

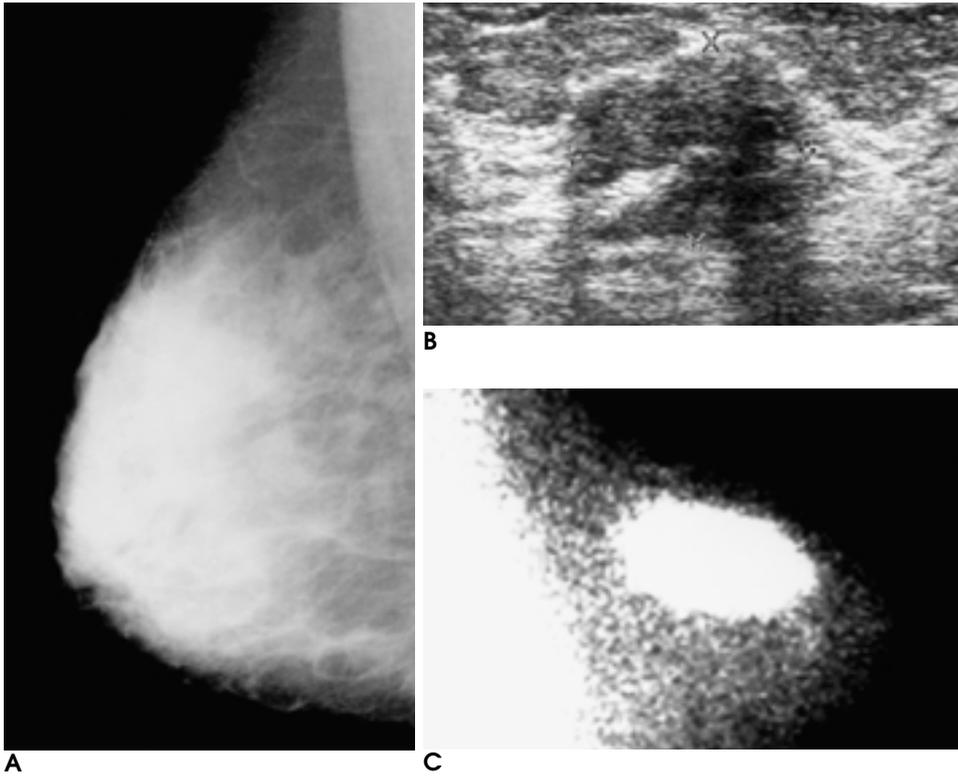


Fig. 3. Invasive ductal carcinoma in 41-year-old woman has difficulty in interpretation of mammogram due to dense parenchyma, but malignant mass is diagnosed on ultrasonography and ^{99m}Tc-MIBI scintimammography.

A. Oblique mammogram shows dense parenchymal pattern which lowers sensitivity of mammogram. It needs a further evaluation (Category 0).

B. Ultrasonogram reveals ill-defined and microlobulated hypoechoic mass with multiple posterior shadowing and irregular peritumoral increased echogenicities (Grade 3).

C. Focal uptake similar to heart activity is present on ^{99m}Tc-MIBI scintimammography (Grade 4).

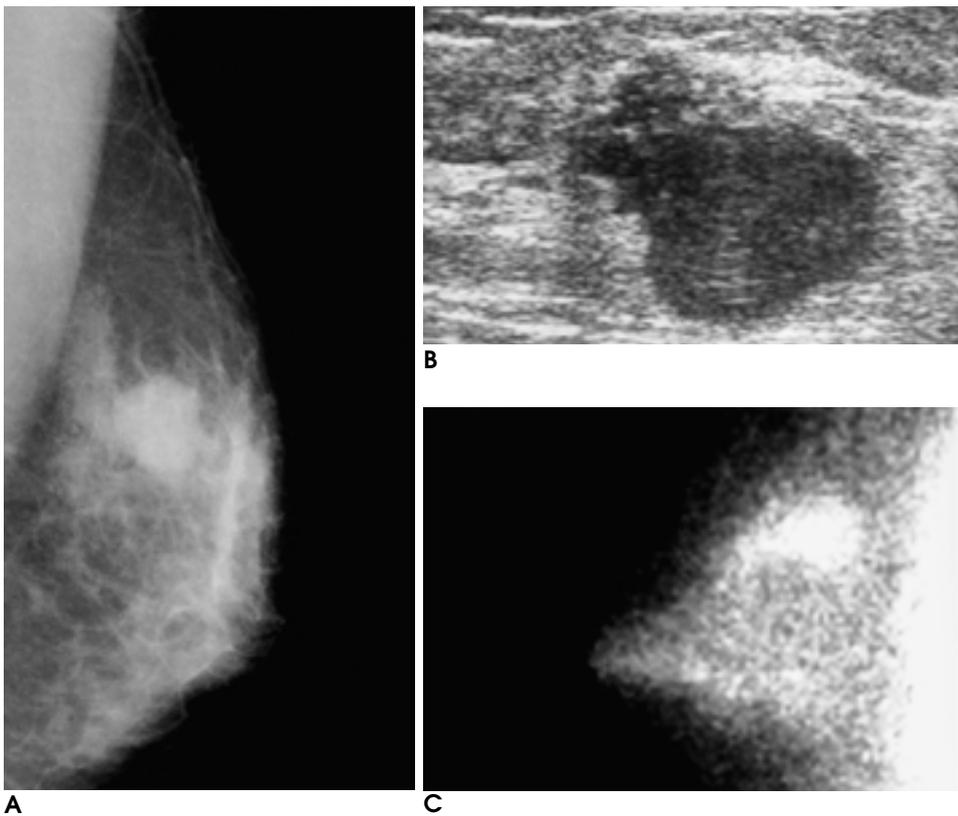


Fig. 4. Medullary carcinoma in a 39-year-old woman.

A. Mammogram reveals about 2.5 cm sized lobulated mass with partial obliteration of the margin at anterior portion in left breast (Category 4).

B. Ultrasonogram shows a globular hypoechoic mass with ill-defined margin at anterior medial portion (Grade 3).

C. Focal uptake is noted and it is lower than heart activity on ^{99m}Tc-MIBI scintimammography (Grade 3).

1 cm ^{99m}Tc - MIBI
 가 (positive)
 (negative)
 1 cm ^{99m}Tc - MIBI
 34%
 19 (Table 3) ^{99m}Tc - MIBI
 , , , (7 , 2
 , 8 , 2), 77.8%, 80.0%, 77.8%,
 80.0%, 78.9% .
 가 70% , 가
 가
 . 가
 . , ^{99m}Tc - MIBI
 , (silicon) 가
 .
 가
 , ,
 가 가
^{99m}Tc - MIBI
 . ^{99m}Tc - MIBI 가
^{99m}Tc - MIBI

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Diagnostic Usefulness of the Multimodality Study with Mammography, Ultrasonography, ^{99m}Tc-MIBI Scan in Breast Cancer¹

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Purpose: To assess the diagnostic usefulness of multimodality study in the diagnosis of breast cancer.

Materials and Methods: Eighty-one patients between January 1998 to December 1999 were involved in this study, and who underwent mammography, breast ultrasonography, and ^{99m}Tc-MIBI scintimammography in all cases the findings were retrospectively reviewed. Each modality was graded by two physicians specializing in nuclear medicine and two radiologists, all unaware of the pathologic results. A four-grade system(1 = definitely benign, 2 = probably benign, 3 = probably malignant, 4 = definitely malignant) was applied to those of breast ultrasonography and ^{99m}Tc-MIBI scintimammography and BIRADS was applied to those of mammography. All breast masses were confirmed by surgery (n = 67) or FNA (n = 14). Findings of grade 3 or 4 the four-grade system, BIRADS category 4 or 5, or positive coincidence in double and triple combination studies were defined as positive results, and on the basis of the data thus obtained, the sensitivity, specificity, positive and negative predictive value and diagnostic accuracy were calculated for each modality and for multimodality studies.

Results: The sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of ^{99m}Tc-MIBI scintimammography were 83.6%, 88.5%, 93.9%, 71.9% and 85.2%, respectively. For ultrasonography, the corresponding figure were 94.5%, 65.3%, 85.2%, 85.0%, and 85.2%, and these for mammography, they were 87.3%, 69.2%, 87.3%, 81.8% and 80.2%. For the ultrasonography and mammography combination, the figures were 83.6%, 50.0%, 93.9%, 100.0% and 95.2%, respectively, and for ^{99m}Tc-MIBI scintimammography and mammography, the corresponding findings were 72.7%, 69.2%, 95.2%, 100.0% and 96.7%. For the ^{99m}Tc-MIBI scintimammography and ultrasonography combination, respective findings of were 80.0%, 61.5%, 95.7%, 94.1% and 95.2%, respectively, and in the triple modality study, respective findings of 70.9%, 50.0%, 97.5%, 100.0% and 98.1% were recorded.

Conclusion: Among multimodality studies, sensitivity was greatest in the ultrasonography and mammography combination, which is thus extremely suitable for the diagnosis of breast cancer. The findings of two series suggest that in equivocal cases, ^{99m}Tc-MIBI scintimammography with its higher specificity and positive predictive value, is a useful adjunctive tool.

Index words : Breast neoplasms
Breast radiography
Ultrasound(US)
Radionuclide imaging

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