Evaluation of $^{99m}$Tc-MIBI scintimammography in the diagnosis of primary breast cancer: a meta-analysis

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CRD summary
This review assessed the diagnostic value of technetium- $^{99m}$methoxyisobutylisonitrile ($^{99m}$Tc-MIBI) scintimammography in detecting breast cancers (all, palpable and non-palpable breast cancers) and axillary lymph nodes in women with primary breast cancer. The authors concluded that $^{99m}$Tc-MIBI has value in detecting palpable breast cancers, but has poor sensitivity for detecting axillary lymph node metastases. The reporting of review methods was limited and the reliability of the results is unclear.

Authors' objectives
To determine the diagnostic value of technetium- $^{99m}$methoxyisobutylisonitrile ($^{99m}$Tc-MIBI) scintimammography in breast cancer and axillary lymph node metastases in women with primary breast carcinoma.

Searching
MEDLINE and CNKI were searched. The authors provided no information on the dates searched or the search terms used.

Study selection
Study designs of evaluations included in the review
Prospective observational studies were eligible for inclusion. Only studies of grade A quality were eligible for inclusion. Such studies were defined as ‘independent blind comparisons of the diagnostic test with a reference standard among an appropriate population of consecutive patients’.

Specific interventions included in the review
Studies of $^{99m}$Tc-MIBI scintimammography for detecting female breast masses, palpable and non-palpable breast cancer, or for evaluating metastatic axillary lymph nodes, were eligible for inclusion. A positive study for malignant breast tumour was defined as the increased uptake of $^{99m}$Tc-MIBI in the focalised lesion, compared with surrounding or contralateral normal breast tissue.

Reference standard test against which the new test was compared
Studies using histological biopsy taken within 3 weeks of scintimammography as the reference standard were eligible for inclusion.

Participants included in the review
Studies of women with primary breast carcinoma were eligible for inclusion. The mean age, where reported, ranged from 48.3 to 61 years of age. Sample sizes ranged between 45 and 300 patients. The number of malignant lesions in each study ranged from 32 to 247.

Outcomes assessed in the review
The included studies of $^{99m}$Tc-MIBI scintimammography were required to provide information on the numbers of true positives, true negatives, false positives and false negatives. Sensitivity, specificity, accuracy, positive and negative likelihood ratios, and positive and negative predictive values were reported for all studies included in the review.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors stated that only grade A studies (defined above) were included in the review, but did not state how the validity assessment was performed.

**Data extraction**
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

**Methods of synthesis**
How were the studies combined?
Group differences between palpable and non-palpable breast cancer were evaluated using Fisher's test (significance of \( p<0.05 \)). Pooled weighted values and 95% confidence intervals (CIs) for sensitivity and specificity were calculated using a linear regression model. A fixed-effect model was used where no evidence of statistical heterogeneity was present; a random-effects model was used where heterogeneity was found. The authors stated that forest plots were constructed, but these were not presented. Summary receiver operating characteristic (SROC) curves were calculated using Meta-test software (Version 9.0), and the area under the curve was calculated.

How were differences between studies investigated?
Between-study heterogeneity was assessed statistically using the Q statistic and the chi-squared test.

**Results of the review**
Sixteen studies with a total of 2,343 participants were included in the review. The diagnostic accuracy of 99mTc-MIBI was evaluated for palpable breast masses in 13 studies, for non-palpable breast masses in 7 studies, and for axillary node metastases in 7 studies.

Significant heterogeneity was found between studies evaluating the diagnostic value of 99mTc-MIBI for breast cancer (\( Q=46.63, p<0.01 \)) and for non-palpable breast cancer (\( Q=25.21, p<0.01 \)).

The pooled estimates of sensitivities for detecting breast cancers (0.86, 95% CI: 0.82, 0.89) and axillary lymph nodes (0.75, 95% CI: 0.66, 0.81) were similar, as were the specificities (0.80, 95% CI: 0.75, 0.80 and 0.86, 95% CI: 0.75, 0.91, respectively).

The pooled weighted sensitivity and specificity of 99mTc-MIBI in detecting palpable cancers was higher than in detecting non-palpable cancer (\( p<0.05 \)), and the area under the SROC curve for sensitivity and specificity in detecting palpable breast cancers was 15% more than for non-palpable breast cancers.

**Authors' conclusions**
99mTc-MIBI is more valuable in detecting palpable breast cancers when an adequate specimen has been obtained. Sensitivity is not dependent on the mammographically determined density of the breast tissue. 99mTc-MIBI had a higher specificity in evaluating axillary lymph node metastases, with a relatively low sensitivity. Its value for non-palpable breast cancers is limited and new methods are warranted.

**CRD commentary**
This review addressed a clear research question with rigorous inclusion criteria. However, the search, selection and data extraction methods used by the authors were not reported clearly and the possibility of reviewer error and/or bias cannot, therefore, be discounted. The reporting of the characteristics of the included studies in the review was adequate. The authors limited their review to studies of high quality (grade A), which was defined in the publication, although the methods for determining quality were not described.

Despite the presence of significant heterogeneity between studies for diagnosing breast cancers and non-palpable breast cancers, the authors pooled measures in these groups in their meta-analysis. This may influence the reliability of the
results. Though mentioned in the authors’ conclusions, the effect of sample quality upon the accuracy of the test was not addressed by the review. Overall, this was a well-defined review but the authors’ conclusions did not clearly match the data and the results did not show improved accuracy for axillary lymph nodes.

**Implications of the review for practice and research**

**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that new methods for detecting non-palpable lesions need to be developed.

**Bibliographic details**


**Indexing Status**

Subject indexing assigned by CRD

**MeSH**

Adult; Breast Neoplasms /radionuclide imaging; Female; Mammography /methods; Predictive Value of Tests; Radiopharmaceuticals /diagnostic use; Technetium Tc 99m Sestamibi /diagnostic use

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.