
Breast Specific Gamma Imaging (BSGI) is scintimammography performed with breast optimized detectors and has been found to be a cost-effective, highly sensitive and specific breast imaging procedure. Therefore, several authors have proposed various applications for this modality as an adjunctive procedure to mammography and other applications (1,2). The purpose of this summary is to propose the indications for this technique in diagnosis and therapy planning.

In several studies, BSGI or scintimammography has demonstrated comparable sensitivity to that of MRI with an equivalent or significantly higher specificity (3,4). This higher specificity can greatly reduce the number of false positives and result in fewer benign biopsies when compared to MRI (5,67). Additionally, BSGI can be conducted at a fraction of the cost of MRI thereby making it useful in indications where MRI would prove too expensive.

BSGI should also be considered in patients who meet the currently approved indications for MRI but are unable to undergo the prescribed study for the following reasons:

- implanted pacemakers or pumps
- ferromagnetic orthopedic surgical implants
- obesity rendering them unable to be placed inside of the MRI bore
- patients with breasts too large to be evaluated with in the breast coil
- patients with acute claustrophobia
- ferromagnetic vascular stents or clips
- Other factors limiting compliance with a prescribed MRI study.

**SCREENING INDICATIONS**

1) Detection of cancer in dense breast tissue of patients with normal or high risk-factors:
   BSGI can be much more effective than mammography in patients with regionally or generally dense breast tissue. In such cases, the sensitivity of mammography is greatly reduced, about 44% (8). In contrast, BSGI is not impaired by breast density and has been found to be useful in this population. (9, 10).

2) Detection of cancer in dense breast tissue of patients with normal or high risk-factors who can not undergo MRI evaluation.
   In these patients, BSGI can prove to be extremely valuable as an alternative when MRI is indicated, but excluded by circumstance. It has been found to be equal to, if not better for several indications (2 – 7).

3) Evaluation of a palpable mass not demonstrated in Mammogram and/or ultrasound.
   In some cases, a palpable mass is occult in mammography and ultrasound. Although sensitivity of mammography and US combined is good, about 97.4%, it is reduced in cases with dense breasts (8). In such cases, BSGI can be effective in detection as it is not affected by breast tissue density.

4) Evaluation of a palpable mass not demonstrated in Mammogram and/or ultrasound in patients who can not comply with an MRI.
   BSGI can be used to replace MRI in patients with contraindications for MRI, see the list in the MRI section.

5) Monitor for recurrent disease in patients who have post-treatment tissue changes compromising the sensitivity of mammography.
Post-treatment cases can be challenging to monitor, particularly if there are significant fibrous dense changes associated with scarring. These patients are both at high risk for breast cancer and suffer from factors making mammography less sensitive. BSGI can provide a high-sensitivity modality with very good specificity.

6) Monitor for recurrent disease in patients who have post-treatment tissue changes compromising mammography and who can not undergo MRI.
BSGI can be used to replace MRI in patients with contraindications for MRI, see the list in the MRI section.

7) Detection of breast cancer in patients with axillary nodal adenocarcinoma and a suspected primary breast cancer occult in mammography and clinical examination.
Although no study has explicitly examined this subpopulation, there have been reported cases of this use in the current user base and the accuracy may be inferred by the overall sensitivity and specificity of this technique in other populations.

8) Evaluation of densities of low to intermediate concern with disconcordance between mammography and ultrasound.
There is a high degree of clinical confusion and frustration with masses present in screening mammography but not confirmed in additional studies such as spot compression magnification views or ultrasound. Since BSGI can provide a measure of physiological activity not available with these other techniques, it can increase diagnostic confidence in these cases. In combined studies containing 164 patients, BSGI has demonstrated a NPV of 99% and in an additional study, it proved to be an effective addition to the triple assessment protocol (11,12).

**DIAGNOSTIC INDICATIONS**

1) Detection of the extent of disease as well as multicentric and/or multifocal disease in patients with a biopsy confirmed carcinoma.
BSGI can visualize sub-centimeter and occult lesions with a high sensitivity and specificity providing an additional layer of diagnostic confidence and multi-lesion detection (2, 9, 10,13). This is true for both the primary and contralateral breast. In many cases, BSGI has also correctly identified larger extent of the primary lesion than indicated in mammography or ultrasound. This is important as some studies have found an increased occurrence of metastatic disease when positive margins are found in the primary lumpectomy specimen (14).

2) Detection of the extent of disease as well as multicentric and/or multifocal disease in patients with a biopsy confirmed carcinoma that can not undergo MRI evaluation.
In these patients, BSGI can prove to be extremely valuable as an alternative when MRI is indicated, but excluded by circumstance.

3) Patients with multiple masses, clusters of microcalcifications or other areas of low to intermediate suspicion identified in mammography.
In such cases, depending on the location of these masses, it is often impractical, expensive or dangerous to obtain a biopsy from all areas. Since BSGI can provide images of physiologic activity, it can be useful in this patient group to aid in the determination of the optimal biopsy site.

4) Patient with breast implants who present clinically with a mass, calcifications or other suspicious area of low to intermediate concern near the implant.
The risk of rupturing the implant may be unacceptable in situations of lesser concern for malignancy. MRI is an alternative examination, but with a significantly high false positive
rate. Since BSGI has equivalent sensitivity and in some studies, considerably better specificity, it provides a lower cost examination with equivalent or greater accuracy.

5) **Assessment of axillary nodes to aid in pre-operative treatment planning and patient consultation after a primary breast diagnosis is made via tissue biopsy.**

Localized surgery and therapy is preferred and appropriate in many patients with limited breast carcinoma without indications of metastatic disease. Axillary node status is the primary indicator of metastatic risk and prognosis. Sentinel node biopsy is an effective tool for the localization and excision of the primary drainage pathway, but is often performed in conjunction with lesion lumpectomy. This practice has resulted in an underutilization of neoadjuvant therapies in patients who could benefit from them. Earlier detection of these metastases could make neoadjuvant therapy possible, increase the confidence in therapy planning and improve the quality of patient consultation. In studies, scintimammography has provided a preoperative means of nodal evaluation with a high sensitivity and PPV (15,16). It should not be used to obviate sentinel node biopsy, but can establish the increased risk of metastatic disease thereby altering treatment planning.

6) **Determination of chemotherapeutic resistance prior to neoadjuvant or adjuvant therapy.**

Studies have been conducted demonstrating that the washout of sestamibi is closely associated with the p-glycoprotein receptor and therefore may give an indication of resistance to certain chemotherapeutic protocols prior to patient enrollment (17,18, 19 and 20). Avoiding ineffective regimen and altering patient planning to more effective treatments is of profound benefit.

7) **Monitor chemotherapeutic response in patients undergoing neoadjuvant or adjuvant therapy.**

BSGI may also be used to monitor tumor response to chemotherapy (21, 22 and 23). The ability to monitor response can allow the therapy to be modified dynamically in order to maximize effectiveness. In addition early chemotherapeutic response has been correlated with better prognosis, it is an important parameter in patient work up and monitoring response with mammography and ultrasound has proven to be ineffective.

8) **Monitor chemotherapeutic response in patients undergoing neoadjuvant or adjuvant therapy in patients who can not comply with MRI.**

BSGI can be used to replace MRI in patients with contraindications for MRI, see the list in the MRI section.

**References:**


