Preoperative Scintigrams to Identify the Sentinel Lymph Node in Breast Cancer: a Waste of Time?

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Abstract Sentinel lymph node biopsy (SLNB) remains the gold standard for assessing axillary node status in breast cancer. Preoperative scintigrams have been used to identify the sentinel lymph node (SLN); however, their use is controversial. Studies suggest they add little to successful SLN detection in theatre, immediately prior to node excision. They have been associated with high false negatives, time expense, patient dissatisfaction, and unnecessary costs. The aim of the present study was to evaluate the diagnostic accuracy of scintigrams in comparison to intraoperative SLN identification techniques. This study included all patients undergoing a SLNB for breast cancer from April 2010 to 2011. Scintigram reports, operation notes, and histology results were analyzed. Mann–Whitney U and chi-squared tests were used for statistical analysis of data. Two hundred nineteen female patients with a median age of 59.6 years (24.0–89.9 years) were included in this study. Scintigram was performed in 185 and not in 34 patients due to time constraints. Combined γ -probe and Isosulfan blue dye for SLN detection (intraoperative methods) have an identification rate of 98.2 % ($p=0.005$), compared to 92.4 % ($p=0.088$) from scintigrams alone. Scintigrams confer no additional advantage to the operating surgeon for successful SLN detection and excision in theatre. Intraoperative SLN identification is more accurate and reliable. Routine scintigram use is unjustified and should be withdrawn from current practice.

Keywords Scintigram · Sentinel lymph node biopsy · Breast cancer

Introduction

Sentinel lymph node biopsy (SLNB) is the gold standard for axillary staging and prognostication in breast cancer surgery [1–3]. While locating the sentinel lymph node (SLN) is essential, its excision can be performed by a minimally invasive surgical approach. Intraoperatively, the node is identified with the use of a surgical γ -probe along with direct visualization of injected Isosulfan blue dye [4, 5]. Conventionally, preoperative SLN detection with a scintigram is performed. The value of this to the operating surgeon, however, is controversial. The aim of our study is to compare the diagnostic accuracy of scintigram SLN detection versus intraoperative methods (surgical γ -probe and blue dye).

Materials and Methods

This retrospective study was conducted at Sandwell and West Birmingham Hospital NHS Trusts. All patients undergoing SLNB of breast tissue between April 2010 and April 2011 were identified. Their scintigram reports, theatre notes, and histology results were analyzed. A statistician was employed to perform data analysis using Mann–Whitney U and chi-squared tests.

Results

Two hundred nineteen patients underwent a SLNB for breast cancer. Preoperative localization with a scintigram demonstrated the SLN in 171 patients (92.4 %), but failed to do so in 14 patients (7.6 %) within the 60 min provided. Thirty-four patients

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did not have a scintigram due to time constraints and unavailability of isotope.

Intraoperatively, the SLN was detected in 210 patients (97.2 %) with the surgical γ -probe. Three patients had incomplete documentation to confirm if the excised node was “hot,” and in six patients (2.7 %), a “hot” node was not demonstrated.

Isosulfan blue-dye identified the SLN in 182 patients (93.8 %) but failed to identify any in 12 patients (6.2 %). Twenty-one patients were excluded from this group due to inaccurate documentation, in addition to three patients who did not receive blue-dye because of allergy. Combined surgical γ -probe and blue dye achieved a detection rate of 98.2 %.

Of the 14 patients who did not have a SLN identified on the preoperative scintigram, the SLN was demonstrated intraoperatively in 13 patients (93 %). In one patient, a SLN was not shown on scintigram, blue dye, or use of the surgical γ -probe; an axillary node clearance was performed which was negative for metastatic spread.

In 34 patients who did not have a scintigram, blue dye identified the SLN in 29 (85.3 %) and the surgical γ -probe in 33 patients (97.1 %); combination of blue dye and γ -probe identified all the SLN in theatre (100 %).

Fourteen patients had an axillary node clearance, 7 due to the inability to identify the SLN, and 7 as a result of suspicious lymph nodes at the time of SLN dissection. From this group, only one patient was shown to have metastatic lymph nodes on histology. One scintigram identified two internal mammary nodes but none in the axilla. Fifty-eight patients (34 %) had a scintigram, which identified more than one SLN. Of the 171 patients whose scintigram identified a SLN, 1 patient failed to have the SLN identified by intraoperative techniques, which resulted in an axillary node clearance that was negative for metastatic spread.

Two hundred twelve patients had their SLN successfully identified (combination of scintigram, blue dye, and surgical γ -probe), of which 42 patients (20 %) had nodes with metastatic spread on histology.

Discussion

The conventional approach for identification and excision of SLN in malignant breast disease includes use of a preoperative scintigram, in theatre with Isosulfan blue dye visualization and γ detection of isotope with a hand held surgical γ -probe.

Our study demonstrates that intraoperative methods have greater accuracy in detecting the SLN than scintigrams alone. Furthermore, intraoperative methods have a 93 % accuracy of identifying SLN not demonstrated by scintigram.

Preoperative scintigrams have been employed as a useful adjunct to intraoperative localization and serves as a focused

approach for the operating surgeon [6]. Their use has greater efficacy in malignant melanoma because their lymph drainage is usually far from the primary tumour site. Lymph drainage in breast tissue is often confined to the axilla, and so the value scintigrams provide in this field is controversial [7]. Our study suggests we could abandon the use of scintigrams without detriment to patient safety or the surgeon’s ability to identify the SLN in theatre.

Our results confirm the findings of previous studies, with no significant difference in SLN identification rate whether preoperative scintigrams were performed or not [3, 8]. In addition, failure of a scintigram to detect a SLN did not predict failure of intraoperative localization [7].

Despite this, there are studies supporting the use of scintigrams. Namwongprom et al. showed scintigrams are reliable and an accurate method for SLN detection [9], with success rates between 75 and 98 % [6]. Kraft O et al. stated scintigrams are more accurate than the combined method [10]. Pandey et al. demonstrated the simultaneous use of scintigram, blue dye, and γ -counting forms the basis of a triple assessment, which increases SLN pick up rate and offered the most beneficial result [3]. In addition, when using a modified oblique view of the axilla, there may be a greater SLN pick up rate when compared to using standard anterior views [6]. Abdollahi et al. showed failure to identify a SLN on a preoperative scintigram was predictive of failure to pick up the SLN in theatre with blue dye and the surgical γ -probe [11].

Previous breast surgery may disrupt lymphatics resulting in higher failed procedures, and is certainly true for extensive breast surgery [12]. Filippakis et al. states that the sensitivity and visualization rates for scintigrams are unaffected by previous excisional breast surgery [13]. They can, thus, provide a “useful map” of lymphatic drainage in cases where there is likely to have been disruption to the former. Luini et al. looked at patients who have had previous breast surgery and found a scintigram that had a SLN detection rate of 99 % [14]. Birdwell et al. found no difference between SLN identification in women who underwent prior excisional biopsy of breast tissue.

Nevertheless, intraoperative methods have been deemed superior to scintigram use [8]. Giuliano et al. showed Isosulfan blue dye to be an effective means of accurately mapping the SLN within the lymphatic tree [15], and when combined with the use of a surgical γ -probe in theatre, their identification rates are cumulative, having increased diagnostic accuracy [16].

Failure of some studies to demonstrate high accuracy of the combined method may be accounted for by the operating surgeon’s level of experience. There is a well-known fact that accurate SLN detection with the combined method requires the surgeon to go through the learning curve [17].

One scintigram identified two internal mammary nodes. The significance of which is controversial. Reports show that 6–10 % of patients with negative axillary SLN have internal

mammary metastases [18]. Thus scintigrams may be important in identifying atypical drainage patterns as their diagnoses may lead to modification of intended treatment [19]. Koo et al. on the other hand states that internal mammary SLNB (IMSLNB) can be omitted in early breast cancer. In a study concerning 525 patients', he demonstrated no significant difference in survival outcomes of those who did and those who did not have IMSLNB [20]. According to Birdwell et al., scintigrams are not mandatory especially if internal mammary node status is not acted upon [18].

Fourteen scintigrams performed in our study failed to identify a SLN despite localization in theatre in 93 % of this group. Nonvisualization of SLN on preoperative scintigrams have been documented and been attributed to technical errors involving improper or inadequate injection of radioactive colloid, inappropriate timing of scintigram, or true lymphatic blocking from cancer cells [17].

Scintigram use is also associated with several limitations. Anatomical changes in breast with fatty tissue deposition, reduced tissue turgor in elderly patients, and those with high BMI are contributing factors to scintigram failure rates [17, 18]. Obesity can make scintigram use more difficult; increased adipose tissue may act as a barrier to successful intradermal injection of isotope, causes scattered radiation and soft tissue attenuation, leading to poor signal-to-noise ratio [21].

We also looked at the effect of tumor size on the scintigram success rate (Table 1). In 171 positive scintigrams, the average tumor size was 22 mm (16–35 mm); in 14 negative scintigrams, average tumor size was 19 mm (13.75–26.25 mm). In our current study, we did not find any statistical correlation, $p=0.165$.

Average time for scintigram procedure in our institution is 30 min (injection of isotope and scintigram imaging). This, however, can be prolonged because of reduced lymphatic flow within breast tissue [7].

Scintigrams performed in our institution require close synchronization between nuclear and surgical teams, often achieved with difficulty. Due to time constraints, the planned scintigram may not be performed leading to a waste of hospital resource and patient dissatisfaction.

Cost of a scintigram performed within our department is £70. If we no longer performed these, we could have potentially saved £12,950 in our department over 1 year; £64,750 over 5 years. This leads us to the question, are we spending money unnecessarily during a time of economical recession and scarce resources within our current NHS?

Conclusion

Accurate SLN detection is paramount for successful node biopsy and subsequent axillary staging. This forms the cornerstone for breast cancer management. Our results have supported and reinforced similar studies on this subject; preoperative scintigram confers no additional advantage in successfully identifying the SLN in theatre. Combined method is accurate and reliable. Scintigrams may be of used in selected cases, but routine use is unjustified. We advocate they be withdrawn from current practice.

Conflict of Interest There is no conflict of interest or any financial relationship.

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Table 1 The effect of tumor size on the scintigram success rate

Tumour size (mm)	Scintigram success rate
0–10	83.30 %
11–20	91.70 %
21–30	93 %
31–40	91.30 %
41–50	100 %
51–60	93.80 %
61–70	100 %
71–80	100 %

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