J of Nuclear Medicine Technology, first published online June 14, 2023 as doi:10.2967/jnmt.123.265442

Investigating a Technologist-Driven Injection Technique in Lymphoscintigraphy at a Single Rural Center: A Retrospective Audit

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Our aim was to investigate the effectiveness of the technologist-driven injection technique of lymphoscintigraphy used at a rural hospital in Australia to identify the correct lymph node for sentinel lymph node biopsy (SLNB) in early-stage breast cancer patients. **Methods:** A retrospective audit was conducted using imaging and medical record data from 145 eligible patients who underwent preoperative lymphoscintigraphy for SLNB at a single center throughout 2013 and 2014. The lymphoscintigraphy technique included a single periareolar injection with subsequent dynamic and static images as required. Descriptive statistics, sentinel node identification rates, and imaging–surgery concordance rates were generated from the data. Additionally, χ^2 analysis was used to examine the relationships between age, previous surgical intervention, and injection site and time until a sentinel node is visualized. The technique and statistical results were directly compared against multiple similar studies in the literature. **Results:** The sentinel node identification rate was 99.3%, and the imaging–surgery concordance rate was 97.2%. The identification rate was significantly higher than those of similar studies in the literature, and concordance rates were similar across studies. The findings demonstrated that age ($P = 0.508$) and previous surgical intervention ($P = 0.966$) did not influence the time it takes to visualize a sentinel node. Injection site did appear to have a statistically significant effect ($P = 0.001$), with injections in the upper outer quadrant correlating with increased times between injection and visualization. **Conclusion:** The reported lymphoscintigraphy technique for identifying sentinel lymph nodes for SLNB in early-stage breast cancer patients can be justified as an accurate and effective method that is time-sensitive and has outcomes comparable to those of successful studies in the literature.

Key Words: nuclear medicine; lymphoscintigraphy; breast cancer; audit

J Nucl Med Technol 2023; 00:1–7
DOI: 10.2967/jnmt.123.265442

Breast cancer is the second most common type of cancer in Australia, with an estimated 20,000 new cases diagnosed annually (*1*). Nevertheless, it has a better prognosis than other forms of cancer, having mortality rates of as low as 2%–3% per annum, due to high early detection rates and the extensive treatment options available. Generally, the first sign of breast cancer is a palpable lump in the breast, sometimes accompanied by swelling, pain, redness, nipple inversion, or discharge. However, early-stage breast cancer (ESBC) can be asymptomatic. In Australia, more than 70% of newly diagnosed cases of breast cancer are in the early stage (0, I, or II), and ESBC has 5-y survival rates of 99% for stage I and 93% for stage II, highlighting the significance of early diagnosis and treatment (*2*). The typical diagnostic pathway after mammographic or physical identification of a suspected lesion involves ultrasonography of the breast and axillary lymph nodes, as well as biopsy of the lesion for histopathologic staging. This pathway may then progress to intervention with the addition of sentinel lymph node biopsy (SLNB).

Despite overwhelming positivity in the overall outlook on breast cancer in Australia, disparities still exist in the diagnostic and treatment experience of rural compared with urban patients. The disease burden is greater for those in rural and remote areas because of limited access to certain health services and time spent traveling to receive diagnosis and treatment (*3*). Many diagnostic tests and treatments for breast cancer require rural and remote Australians to travel to urban centers, incurring travel and accommodation costs in addition to the loss of time and separation from family. The burden of restricted access discourages and prevents many from receiving early, appropriate care. As a result, the risk of dying from breast cancer is over 10% higher for Australians who live outside urban locations (*3*).

ROLE OF LYMPHOSCINTIGRAPHY IN BREAST CANCER MANAGEMENT

Lymphoscintigraphy is a nuclear medicine imaging technique that enables visualization of lymphatic drainage pathways. It involves the injection of a colloidal radiotracer at a point of interest and subsequent imaging using a γ-camera to visualize lymphatic vessel drainage and localize regional lymph nodes (*4*). Lymphoscintigraphy of the breast first appeared in the literature in the early 1980s, resulting in early descriptions of a "primary draining node" (*5*). This formed the basis for the development of sentinel node lymphoscintigraphy (SNLS): the

Received Jan. 10, 2023; revision accepted Mar. 7, 2023.
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Published online Jun. 14, 2023.

concept of identifying the first lymph node in the drainage channel (the sentinel node) from an area of malignancy. The use of preoperative SNLS for lymph node mapping was first introduced in 1993 to aid in SLNB in melanoma patients to assess stage III metastatic spread (*6*). Immediately after SNLS, the process involves the use of a handheld radiation detection device during surgery to locate the sentinel node for removal, often in conjunction with patent blue dye (*7*). This blue dye is injected during surgery to visually highlight lymphatic drainage channels and nodes for more precise removal. This process has since been adopted into the early management of breast cancer, allowing the identification and excision of axillary sentinel nodes. Excised nodes are then histologically examined for cancerous cells, and this information is used to guide the subsequent surgical management of breast cancer patients and assist in the staging and treatment process.

Before the introduction of SLNB, many ESBC patients underwent full axillary lymph node clearance to prevent metastatic spread. Although effective, the complete resection of the axillary nodes has the consequence of lymphoedema in the ipsilateral arm, which can cause subsequent discomfort, pain, and difficulty with venepuncture for the patient (*8*). By limiting the number of surgically removed nodes for histologic assessment, SLNB can provide effective management of ESBC patients with clinically negative nodes while reducing the risk of significant lymphoedema (*9*). This benefit is especially important in rural communities where specialized lymphoedema services may be less accessible for patients.

CONTROVERSIES IN LYMPHOSCINTIGRAPHY

Over the past 3 decades, guidelines for performing lymphoscintigraphy have changed with the evolution of nuclear medicine technology and available radiopharmaceuticals. However, uncertainty around best practices in lymphoscintigraphy remains. The most recent guidelines for breast lymphoscintigraphy are those of the European Association of Nuclear Medicine (EANM) published in conjunction with the Society of Nuclear Medicine and Molecular Imaging (SNMMI) in 2013 (*10*). In addition to the age of the document, some sections provide merely a range of suggestions that leave ambiguity, which is unhelpful in the development of departmental protocols. A standardized SNLS procedure must, first and foremost, accurately identify the sentinel node for SLNB. An ideal protocol would meet this requirement while also providing fast visualization of nodes with minimal discomfort to the patient.

The ideal radiotracer for breast lymphoscintigraphy should have fast transit to the axillary nodes and prolonged nodal retention for imaging (*10*). Colloid particles labeled with ^{99m}Tc-technetium are recommended in the EANM guidelines, including a mix of small and large particles for quick initial transit followed by extended nodal retention. The choice of radiopharmaceutical varies depending on local availability and legal regulations. At the time of data collection, ^{99m}Tc-antimony trisulfide colloid was typically used in Australia because of its mean particle size of 3–30 nm (*10*). Activity and volume can vary, with 5–30 MBq suggested for same-day and 150 MBq for 2-d procedures (*10*). For superficial injections, no more than a 0.5-mL volume is advised, with a 1-mL maximum for peritumoral injections.

Possibly the most significant controversy in breast lymphoscintigraphy surrounds the method of administration of the radiopharmaceutical. The EANM and SNMMI guidelines list multiple possible injection techniques and suggest that 2 injections—both superficial and deep—could be complementary. However, the combined-injection technique is not always possible, as deep injections are difficult to perform and often require ultrasound guidance to avoid vascular damage and localized hemorrhage and to locate the lesion itself when it is not palpable. Superficial injections are less invasive and easier to perform, especially in the absence of a palpable mass (*10*). This consideration is particularly important for a rural center where there is limited access to an on-site physician and injections are piloted by nuclear medicine technologists.

There are a range of SNLS imaging techniques reported in the literature (*10*). The EANM and SNMMI provide imaging times, though protocols vary in the literature. Although delayed imaging may be useful in cases with slow transit or nonvisualization of nodes, delayed imaging does not generally contribute to the success of sentinel node identification. Rather, it leads to longer wait times, inconvenience, and increased costs (*11*). Additionally, SPECT/CT imaging can improve detection rates, better localize nodes, and clarify areas where there is ambiguity around drainage pathways (*12*).

STUDY AIMS

There is a need for individual departments to develop protocols that confidently and accurately identify the sentinel node while considering time sensitivity and minimal invasiveness. In a rural nuclear medicine practice, where there is limited access to an on-site specialist nuclear medicine physician, generating confidence in the ability of a technologist-driven injection technique and standardized protocol is essential in the appropriate management of ESBC patients. Primarily, the aim of this study was to investigate the effectiveness of the technologist-driven injection technique and lymphoscintigraphy protocol that is used at Tamworth Rural Referral Hospital (TRRH) in New South Wales, Australia, in identifying the correct lymph node for SLNB in ESBC patients. Using retrospective analysis of patient data and imaging records, an audit was conducted measuring outcomes based on the identification of a sentinel node and concordance of imaging findings with SLNB after surgical excision among a cohort of ESBC patients who underwent SNLS at TRRH throughout 2013 and 2014. The secondary aims were to compare the findings with those for imaging protocols and techniques reported in the peer-reviewed literature and to assess the impact of specific variables on the time efficiency and success of this technique.

MATERIALS AND METHODS

Ethics

Ethical approval for this retrospective audit was considered by the Hunter New England Governance and Research Office but was waived because of the low and negligible risk, under the provision that patient data had been deidentified by a third party who was not directly associated with the research (authorization AU202104-04). The institutional review board (or equivalent) approved this retrospective study, and the requirement to obtain informed consent was waived.

Setting and Study Population

With 282 beds, TRRH is the largest rural hospital in New South Wales outside the Newcastle–Sydney–Wollongong catchment (*13*). The study population included 204 ESBC patients who underwent lymphoscintigraphy for SLNB at TRRH from January 1, 2013, to December 31, 2014. These dates were chosen to allow for the simultaneous collection of 5 y of follow-up data on the same patients for a future study on their disease outcomes. Fifty-seven patients were excluded because of lack of access to surgical reports or limited reporting on concordance between marked nodes and excised nodes. The final sample size was 145 patients, whose demographic data can be reviewed in Table 1.

Imaging Protocol and Technique

There is no set reference standard for comparison; however, the findings for the index test were compared with those of various methods reported in the literature. For the index test, lymphoscintigraphy was performed using a single intradermal periareolar injection of 40 MBq of ^{99m}Tc-antimony trisulfide colloid in a 0.5-mL volume. Imaging was completed with Symbia T16 and E-Cam γ-cameras, both of which are manufactured by Siemens Medical Solutions in the United States. Dynamic imaging was acquired anteriorly immediately after injection at 2 s/frame for 150 frames (5 min) using a 128 × 128 matrix, followed by static imaging encompassing anterior and lateral views for 5 min each using a 256 × 256 matrix (Fig. 1). All patients underwent imaging using both views at 10–15 min and 30–35 min after injection. The patients were positioned supine, with the ipsilateral arm abducted. When drainage patterns were unclear, static imaging continued until the sentinel node was identified or ruled nonvascularized at a maximum imaging time of 180–210 min. Between each set of static images, patients with delayed drainage were instructed to sit up, walk around, or massage the breast to encourage tracer movement. SPECT/CT with both arms above the head was incorporated when node visualization was ambiguous. SPECT imaging was conducted at 15 s/view for 32 views with a 128 × 128 matrix. The CT parameters were set at 130 kVp, 60 reference mAs (Care Dose4D; Siemens), 3-cm slices, and a 1.5 pitch. Sentinel node identification was communicated to the surgeon by placing anterior and lateral marks on the skin, in addition to providing the images and distributing the report before surgery.

Data Collection and Analysis

Data were collected retrospectively from the imaging results and reports, histopathology reports, surgical reports, and medical/imaging histories via electronic records. Key variables were collected around tumor characteristics, imaging technique, previous

TABLE 1

Descriptive, Technique-Related, and Surgical Follow-up Variables for Breast Cancer Cases in This Study

Variable	Result
Age (y)	64 (±11.9)
Female	140 (97.2%)
Left-sided lesion	77 (52.4%)
Lesion size (mm)	18.6 (±12.7)
Lesion type	
IDC	109 (75.2%)
ILC	14 (9.7%)
DCIS	8 (5.5%)
Other	14 (9.7%)
Histologic grade	
1	61 (42.1%)
2	51 (35.2%)
3	31 (21.4%)
Histologic type	
HR+	113 (77.9%)
HER2-enriched	14 (9.7%)
Triple-negative	9 (6.2%)
Unknown	9 (6.2%)
Multicentric disease	17 (13.1%)
Previous intervention	
Biopsy	126 (86.9%)
WLE	8 (5.5%)
Mastectomy	1 (0.7%)
None	3 (2.1%)
Unknown	7 (4.8%)
Injection site by quadrant	
Upper outer	64 (44.1%)
Upper inner	37 (25.5%)
Lower outer	29 (20%)
Lower inner	14 (9.66%)
Retroareolar	1 (0.7%)
Transit on flow	100 (69%)
Time to first node, ≤30 min	136 (93.8%)
Time of last image, ≤60 min	134 (92.4%)
SPECT/CT	18 (12.6%)
IMN visualized	1 (0.7%)
Echelon nodes visualized	76 (52.4%)
SN marked	144 (99.3%)
Postlymphoscintigraphy intervention	
SN hot and blue	127 (87.6%)
Concordance at surgery	140 (96.6%)
Nodes excised	2.8 (±2)
Sentinel node–positive	34 (23.5%)
Intervention after SLNB	
WLE	85 (58.6%)
Mastectomy	55 (37.9%)
SLNB only	5 (3.5%)
Hookwire	54 (62.8%)

IDC = invasive ductal carcinoma; ILC = invasive lobular carcinoma; DCIS = ductal carcinoma in situ; HR+ = hormone receptor–positive; HER2 = human epidermal growth factor receptor 2; WLE = wide local excision; IMN = internal mammary node; SN = sentinel node.

Qualitative data are number and percentage; continuous data are mean ± SD.

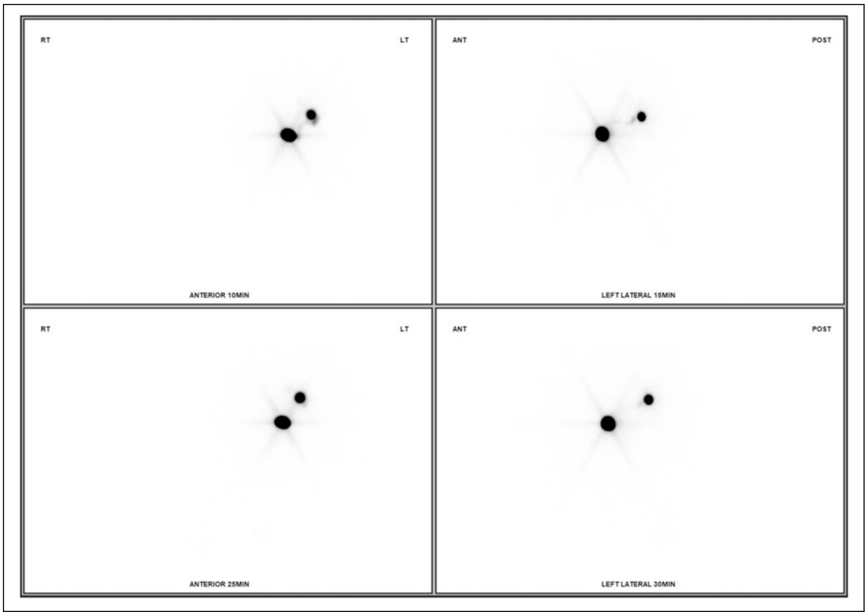

FIGURE 1. Anterior and left lateral images displaying prompt radiotracer egress from injection site to axillary lymph node.

interventions, surgical notes, and concordance between nodes marked and those excised in SLNB. Success rates were determined through relationships between the variables investigated using χ^2 analysis. The statistical results were then compared against those of similar large-scale studies in the literature to determine their significance.

RESULTS

Descriptive Findings

Patient Characteristics. The cohort consisted of 141 women and 4 men from 37 to 87 y old. The patients were categorized into 10-y age brackets for statistical analysis and comparability to other studies that used similar brackets (*14*). Full demographic details can be found in Table 1.

Disease Characteristics. Seven patients had bilateral disease and were counted as separate cases for each breast for the purpose of this study. Invasive ductal carcinoma was the most common tumor type, encompassing 109 patients. Lesion dimeter ranged from 3 to75 mm and was grouped into 3 categories—less than 20 mm (90 patients), 20–50 mm (49 patients), and more than 50 mm (3 patients)—based on breast cancer staging standards (*15*). Seventeen patients had multicentric disease, classed by a distance of more than 55 mm between the primary and secondary lesions. The number of secondary lesions per patient ranged from 1 to 3, with an average diameter of 10.9 mm.

Tumors were assigned a histopathologic grade from 1 to 3, increasing in severity (*15*). Sixty-one patients were classed as grade 1, 51 as grade 2, and 31 as grade 3. Histologic type was also recorded; 113 patients presented with hormone receptor–positive disease, 14 were human epidermal growth factor receptor 2–enriched, and 9 were triple-negative. Histopathology results were inaccessible for the remaining 9. After SLNB, 34 patients were found to have nodal spread. Further information on disease characteristics can be found in Table 1.

Surgical and Technique-Related Characteristics. Of the 145 patients, 126 had previously received a biopsy for disease confirmation and 8 had a wide local excision for historical ESBC on the same breast. One patient had a previous mastectomy, though not all breast tissue had been removed. Multiple previous interventions had occurred in some cases, typically a combination of previous wide local excision and recent biopsy. Fifty-four patients did not have a palpable mass and had a hookwire inserted under mammographic guidance after lymphoscintigraphy and before surgery. Generally, SLNB is not a standalone procedure, with only 5 patients proceeding to SLNB as a sole intervention; 85 patients underwent concurrent mastectomy (wide local excision), and the remaining 55 had a full mastectomy. The number of nodes removed ranged from 1 to 10.

Intradermal periareolar injections were performed toward the tumor site, and these sites were categorized into quadrants. The upper outer quadrant was the most common for the tumor site. Lymphatic transit of the radiotracer was clear on initial dynamic imaging in 100 patients, with a clear sentinel node visible at 10 min after injection in 106. The sentinel node was visible in 30 min or less in 136 patients. In 1 patient, no nodes were visualized. The time between injection and final imaging ranged from 15 to 210 min, with SPECT/CT utilized in 18 patients.

Echelon nodes, which are those farther along in a single lymphatic chain than the sentinel node, were observed in 76 patients. These nodes are not routinely marked for surgery but are still removed in some cases. Internal mammary nodes were visualized in 1 patient, though not marked or removed in surgery. Further technique and surgical information is recorded in Table 1.

Statistical Analysis

At least 1 node was identified and marked for surgery in all but 1 patient, with 2 nodes marked in 13 patients. The success of a study was based on concordance between the node marked and the node removed in surgery. Imaging and surgery were concordant in 140 patients. Four patients had nodes removed other than the marked node, and 1 patient had no visualized nodes to be marked. Excised nodes presented both high counts and absorption of patent blue dye during surgery in 127 patients.

With reference to previous studies, the effects of variables that could reasonably be perceived to affect lymphatic flow and, hence, have an impact on lymphoscintigraphy were examined. Previous intervention, age, and injection

TABLE 2
Associations Between Age, Injection Site, or Previous Interventions or Surgery and Time to Visualization of First Node

Variable	Time to first node (min)										Total	Statistics
	10	15	20	25	30	35	40	45	60	180		
Age (y)												$\chi^2_{36} = 35.2$, $P = 0.508$
35–44	5	0	0	1	0	0	0	0	0	0	6	
45–54	24	5	0	0	2	0	0	0	0	0	31	
55–64	28	2	2	1	0	1	1	0	0	0	35	
65–74	29	10	0	1	1	0	0	1	0	1	43	
75+	20	4	1	0	0	1	1	0	1	1	29	
Total	106	21	3	3	3	2	2	1	1	2	144	
Injection site												$\chi^2_{36} = 67.6$, $P = 0.001$
Lower inner	10	3	1	0	0	0	0	0	0	0	14	
Lower outer	22	3	0	1	1	0	1	0	0	0	28	
Upper inner	28	3	1	0	1	1	1	0	0	2	37	
Upper outer	46	12	1	2	0	1	0	1	1	0	64	
Retroareolar	0	0	0	0	1	0	0	0	0	0	1	
Total	106	21	3	3	3	2	2	1	1	2	144	
Previous intervention or surgery												$\chi^2_{27} = 35.2$, $P = 0.966$
Biopsy	94	16	2	3	3	1	2	1	1	2	125	
Mastectomy	1	0	0	0	0	0	0	0	0	0	1	
None	1	2	0	0	0	0	0	0	0	0	3	
WLE	4	3	1	0	0	0	0	0	0	0	8	
Total	100	21	3	3	3	1	2	1	1	2	137	

WLE = wide local excision.

site were assessed against time to first node. χ^2 analysis was used to examine these variables, with accepted statistical significance set at a P value of less than 0.05 (Table 2).

Previous intervention did not show a significant effect on lymphatic flow ($P = 0.966$). Similarly, age did not have an effect ($P = 0.508$); however, the injection site did appear to have a statistically significant relationship with lymphatic flow rate ($P = 0.001$) (Table 2).

DISCUSSION

Our primary aim was to investigate the effectiveness of this lymphoscintigraphy technique in identifying the correct axillary lymph node for SLNB in ESBC patients by concordance between imaging and surgical notes and histopathology findings. A successful node identification rate of 99.3% is high when compared with the results of similar studies. Because of the vast differences in techniques between centers, it is difficult to directly compare results between studies relating to lymphoscintigraphy. Table 3 compares the EANM guidelines and the techniques of the index study and 2 main comparator studies. A study by Goyal et al. (*16*) reported an identification rate of only 72%, whereas a more recent, large-scale trial by Kuemmel et al. (*14*) identified nodes in 90.2% of cases. Goyal et al. used the technique most comparable to this study, though a peritumoral injection technique was utilized with a 2-mL volume and the acquisition of delayed images at 3 h after injection. Because of the large-scale, multicenter nature of the study by Kuemmel et al., techniques slightly differed between sites, with varying injection techniques and a minimum activity of 150 MBq. The increased effectiveness of the current study's technique in comparison to those studies might be attributable to differences in injection technique. Povoski et al. (*17*) assessed the difference in sentinel node identification rates between superficial and deep injections, finding superficial injection to produce a rate of 94.7% whereas deep injection localized only 62%. The single patient for whom nodes were not visualized was imaged up to 3 h without success. That patient had a small tumor (15 mm) and required hookwire insertion before surgery, in which a single node was identified using patent blue dye and removed.

The node marked during lymphoscintigraphy was excised in surgery in 140 of 145 patients (96.6%). The 5 nonconcordant cases included the nonvisualized case. All 5 patients had small lesions (<20 mm) that required hookwire insertion before surgery. Three of these patients were injected in the upper outer quadrant, and only 1 had radiotracer transit on initial dynamic imaging. One patient displayed both echelon nodes and internal mammary nodes, highlighting the potential for the incorrect node to have been marked with unclear lymphatic flow direction. There were no stand-out commonalities among the 5 patients other than small lesion size. The study by Goyal et al. (*16*) reported a 96% concordance rate when a

TABLE 3
Comparison of Techniques Between Present Study, EANM Guidelines, and Studies in Literature

Variable	This study	EANM guidelines (*10*)	Goyal et al. (*16*)	Kuemmel et al. (*14*)
Radiotracer (^{99m}Tc-labeled)	ATC	Various radiopharmaceuticals	Colloidal albumin (^{99m}Tc-nanocolloid)	Unspecified radiocolloid
Dose (MBq)	40	3.7–370	Same-day, 20; 2-d, 40	Maximum, 150
Injection volume (mL)	0.5	Superficial, 0.05–0.5; deep, 0.5–1	2	Variable across sites
Injection technique	Periareolar	Superficial or deep	Peritumoral	Periareolar, 1,045; peritumoral, 113
No. of injections	1	Not specified	4	Variable across sites
Dynamic imaging?	Yes	Suggested but deemed uncommon	No	Variable across sites
Delayed imaging?	No	Suggested at 1 h and 2–4 h	Yes at 3 h	No

ATC = ^{99m}Tc-antimony trisulfide colloid.

[AQ8] [AQ9]

node was marked preoperatively, though this decreases to 66.8% when nonvisualized cases are included. Kuemmel et al. (*14*) had a concordance rate of 96.8%, putting this study's results at equal strength to those reported in the literature.

The secondary aims were to compare the findings with those for imaging protocols and techniques reported in the peer-reviewed literature and to assess the impact of specific variables on the time efficiency and successfulness of the technique. The effect of previous intervention, age, and injection site on lymphatic flow was assessed. A slower lymphatic flow can extend the overall time of the study and increase false-negative rates. Higher degrees of previous surgical intervention were predicted to negatively affect axillary lymphatic flow rate. However, χ^2 analysis revealed no statistically significant relationship between previous intervention and time to first node ($P = 0.966$) (Table 2). Because most patients had undergone only a previous biopsy (126/145), this result is not indicative of the effects of more invasive interventions such as wide local excision and mastectomy. An earlier report showed that lymphoscintigraphy in patients with previous breast and axillary surgery is still viable, with only a slightly reduced success rate (*18*).

The effect of increasing age on lymphatic function and flow rate has been thoroughly examined in the existing literature. Using lymphoscintigraphy, it has been determined that older age correlates negatively with lymphatic flow rate (*19*). On this basis, we predicted that it would take longer to observe the first node after injection in older patients. However, χ^2 analysis revealed no statistically significant relationship between age and lymphatic flow ($P = 0.508$) (Table 2). It is possible that the results of this study contradict the existing literature because of the small sample size, which included a limited number of younger patients; 17 of 145 patients were under the age of 50 y.

Breast lesions are located most commonly in the upper outer quadrant and least commonly in the lower inner quadrant (*20*). This localization was reflected in this study, with 44.1% in the upper outer quadrant and 9.7% in the lower inner quadrant. χ^2 analysis found a statistically significant correlation between injection site and time to first node ($P = 0.001$), revealing that injections in the upper outer quadrant were related to extended time taken to identify a sentinel node (Table 2). This finding reflects the findings of the existing literature on the influence of injection site on sentinel node visualization (*16*). A potential explanation is superimposition of shine-through due to the proximity of the axillary nodes to the injection site (*16*). Three of 5 patients who were nonconcordant in surgery had lesions in the upper outer quadrant. There is the potential that counts recorded by the intraoperative γ-detection device from the sentinel node may be obscured by the injection site. SPECT/CT could be a viable solution for nonvisualization in patients with lesions in the upper outer quadrant, allowing visualization from all angles and eliminating the issue of shine-through.

The main strength of this study was the determination that the technologist-driven injection technique and protocol in lymphoscintigraphy are an easy-to-perform, time-efficient, and accurate way to identify sentinel nodes for SLNB, thus providing rural ESBC patients with an effective and accessible service that is comparable to the services received in an urban environment. However, the study was limited by difficulty in comparing this technique with those in the literature because of the vast differences between individual protocols. The retrospective nature of the study was also a limitation, as a lack of access to—or unrecorded—surgical information essential to the study meant that the final sample size was much smaller than anticipated. Additionally, we did not have follow-up information to determine long-term patient outcomes.

CONCLUSION

Our lymphoscintigraphy technique is an accurate and effective way to identify sentinel lymph nodes for SLNB in ESBC patients. The ability to identify the correct sentinel node is more accurate than in comparison studies, and the method is more time-efficient and standardized. Additionally, the intradermal periareolar injection technique makes the procedure easy to perform and therefore adoptable across rural departments with limited access to an on-site physician.

Patients who attend TRRH for SNLS are receiving quality care that is comparable to that of urban nuclear medicine departments.

DISCLOSURE

No potential conflict of interest relevant to this article was reported.

KEY POINTS

QUESTION: Is the technologist-driven injection technique and lymphoscintigraphy protocol used in a rural setting effective at identifying the correct lymph node for sentinel node biopsy in breast cancer patients?

PERTINENT FINDINGS: The reported lymphoscintigraphy technique can be justified as an accurate and effective method of identifying sentinel lymph nodes for SLNB in ESBC patients. The technique is time-efficient and has outcomes comparable to those of successful studies in the literature.

IMPLICATIONS FOR PATIENT CARE: The technique provides effective and accurate identification of lymph nodes for biopsy in breast cancer patients and can easily be implemented in a wide variety of institutions. It is suitable for use in rural settings where a physician may not be available on site.

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