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Buffering the Suffering of Breast Lymphoscintigraphy[a]

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Abstract

Rationale: Breast lymphoscintigraphy with ^{99m}Tc-sulfur colloid is frequently performed before breast-conserving surgery to delineate drainage to a sentinel node. Tracer injection for lymphoscintigraphy can be painful. Our aims were to determine whether administering a solution of buffered lidocaine immediately prior to lymphoscintigraphy injection could both reduce the patients' pain and increase nuclear medicine technologists' satisfaction with performing the procedure.

Methods: A pain scale survey was obtained from patients undergoing breast lymphoscintigraphy with or without buffered lidocaine. Our nuclear medicine technologists were also surveyed for their satisfaction with the procedure, both with and without the addition of buffered lidocaine.

Results: The patients' reported pain decreased by 86% with the addition of buffered lidocaine. Technologist satisfaction with performing the procedure increased by 36%.

Conclusions: Lidocaine buffered with sodium bicarbonate injected prior to lymphoscintigraphy significantly reduces pain experienced by the patient, and also improved nuclear medicine technologist satisfaction in performing the procedure.

Keywords: breast cancer; sentinel lymph node; lidocaine; anesthesia; lymphoscintigraphy

Introduction

For tumors of appropriate size and stage, breast-conserving surgery offers survival rates equal to modified radical mastectomy (*1*). Breast lymphoscintigraphy with ^{99m}Tc-sulfur colloid is increasingly being performed before breast-conserving surgery to delineate the drainage path to a sentinel node (*2*).

Tracer injection for lymphoscintigraphy can be painful (*3,4*); the ^{99m}Tc-sulfur colloid solution is acidic, with a pH generally between 3.5 and 6.0 (*5*). The pain experienced during lymphoscintigraphy is multifactorial. Aside from the pain felt from the stretching of skin layers during the injection, part of the pain experienced during the procedure has been ascribed to the acidity of the radiotracer solution (*6*). While injection of lidocaine buffered by sodium bicarbonate just before the sulfur colloid administration has demonstrated efficacy in reducing the pain associated with lymphoscintigraphy (*4*), its use is not uniform in clinical practice. In this study, our goal was to improve the care of our patients with breast cancer by reducing pain during breast lymphoscintigraphy injection. Our primary aim was to determine whether adopting the practice of injecting a solution of buffered lidocaine immediately prior to the radiotracer injection could significantly reduce the pain experienced during lymphoscintigraphy. Because performing a painful procedure can be a stressor for health care personnel (*7*), our secondary aim was to determine whether reducing pain with the addition of the buffered lidocaine injection would also increase procedural satisfaction for the administering technologists.

Materials and Methods

Lymphoscintigraphy Technique

At our institution, the route of radiotracer administration for breast lymphoscintigraphy is intradermal, with 1 injection performed lateral and 1 performed inferior to the areola after the breast has been prepped with povidone-iodine swabs. The dose of sulfur colloid depends on whether the subsequent surgery will be performed the same day or the next. For same day surgery, 2 injections of filtered sulfur colloid are given, 3.7 MBq each diluted in normal saline to measure 0.1 mL, for a total of 7.4 MBq. For next day surgery, the injection doses are increased to 11.1 MBq each, similarly diluted in a solution of 0.1 mL, for a total of 22.2 MBq. When buffered lidocaine is used, 4.5 mL of 1% lidocaine and 0.5 mL sodium bicarbonate are drawn into a syringe and mixed, and 0.1 mL of the buffered lidocaine solution is injected into the skin of the breast at the site of each subsequent lymphoscintigraphy injection. After 10 to 15 seconds, the lymphoscintigraphy injection as described above is performed. The breast is then massaged for about 30 seconds, followed by image acquisition.

Patient Selection and Data Analysis

Our study was approved by the institutional review board at our institution and was Health Insurance Portability and Accountability Act compliant. Pre- and postintervention sets of patient data were reviewed. For the preintervention data, 10 patients routinely scheduled for breast lymphoscintigraphy were selected between January 1, 2016, and March 31, 2016, to complete a pain survey. For the pain survey, a pain score was obtained for lymphoscintigraphy using a verbal descriptor scale ranging from 0 to 10 (0 being “no pain at all” and 10 being “the worst possible pain imaginable”). We then implemented our intervention of anesthetizing the

skin with 1% buffered lidocaine before radiotracer injection. For the postintervention data, 28 patients undergoing lymphoscintigraphy between April 1, 2017, and October 31, 2017 were also asked to complete the same pain survey.

After the intervention, we similarly surveyed 10 nuclear medicine technologists who administered the sulfur colloid for their satisfaction with the procedure. For this survey, the technologists were asked for their satisfaction of procedural workflow both before and after the intervention using a similar verbal scale ranging from 0 to 10 (0 being "extremely dissatisfied" and 10 indicating "extremely satisfied").

Differences between the groups in the surveys were assessed with the Student t-test. A p value < 0.05 was considered significant.

To assess for any impact the addition of buffered lidocaine would have on the diagnostic quality of the lymphoscintigraphy images, 10 examinations performed with and 10 examinations performed without the use of buffered lidocaine were reviewed by 2 board-certified nuclear radiologists (J.M.A. and M.K.J.) who were blinded as to whether or not buffered lidocaine had been administered. Both radiologists determined whether or not the studies were of diagnostic quality and if sentinel lymph nodes could be detected.

Results

All of the patients were female. The mean age of the preintervention group was 62.3 with a median of 64.5 and range of 48-78. The mean age of postintervention group was 63.0 with a median of 60.5 and range of 39-94.

Pain scale score data from our study are summarized in Table 1. Despite the small number of patients surveyed, the decrease in reported pain with the addition of buffered lidocaine was still statistically significant, with a decrease in mean pain scale of 86% ($p < 0.05$).

Technologist satisfaction data are summarized in Table 2. Despite adding steps to the procedure, including an additional needle stick for the administration of the buffered lidocaine solution, technologist satisfaction significantly increased by 36% ($p < 0.05$).

Upon blind review of examinations performed with or without the addition of buffered lidocaine, both nuclear radiologists deemed all studies from both groups to be of diagnostic quality, and all studies had 100% intraoperative sentinel detection rate.

Discussion

The use of buffered lidocaine for local anesthesia in invasive radiologic procedures, including breast lymphoscintigraphy, is not new (*4,8,9*); however, the practice of using local anesthetic immediately prior to breast lymphoscintigraphy remains highly variable among institutions.

Traditionally, breast lymphoscintigraphy has been performed without local anesthesia for multiple reasons.

First, there has been a concern that a buffered lidocaine injection prior to lymphoscintigraphy might diminish visualization of lymph nodes by potentially decreasing lymph node uptake (*10*). However, similar to reports in other studies (*4,11,12*), examinations from both groups in our study were deemed to be of diagnostic quality, and all examinations demonstrated 100% intraoperative sentinel detection rate.

Second, it had been assumed that any benefit gained from local anesthesia may be offset by the increase in pain from additional needle sticks, or pain from the lidocaine itself (*4*). However, as our pain survey covered the entire lymphoscintigraphy procedure, including the buffered lidocaine injection, our results indicated that the benefits of buffered lidocaine far outweighed either of these putative drawbacks. This was further underscored by the satisfaction survey of our nuclear medicine technologists. Their satisfaction with the procedure substantially increased with the administration of buffered lidocaine, despite adding an additional injection step and more time (approximately 2-5 minutes) to the procedure.

Other approaches to reduce the pain of breast lymphoscintigraphy have been proposed previously (*3,13-18*). A topical anesthetic, such as lidocaine and prilocaine cream, has proven effective in some cases, but a logistic shortcoming is the required 30 to 60 minute wait time between cream application and tracer injection to obtain optimum analgesic effect (*3*). In a study evaluating routine use of topical anesthetic, O'Connor et al (*15*) found no statistically significant reduction in pain scores in patients receiving treatment prior to lymphoscintigraphy. ^{99m}Tc-tilmanocept, an alternative agent (Lymphoseek sold exclusively through Cardinal Health), is a receptor-targeted lymphatic mapping agent that carries multiple units of mannose, which bind to CD206 receptors in lymph nodes (*13,16-18*). Lymphoseek pH ranges between 6.8 and 7.2, which is much higher than the 3.5 to 6.0 pH of ^{99m}Tc-sulfur colloid. However, Lymphoseek is substantially more expensive than sulfur colloid, roughly double the cost of sulfur colloid at our institution (*14*).

Limitations of this study include small sample size. However, the decrease in reported pain with the addition of buffered lidocaine was still statistically significant. While the study was concluded with a small number of patients, we switched our practice to buffered lidocaine use

since then and have anecdotally observed that patient and technologist satisfaction have been maintained. Each of the groups was comprised of different subjects; therefore, there is a possibility that the pre- and postintervention groups had different pain thresholds. Also, during our postintervention data set collection, there was a nation-wide shortage of sodium bicarbonate, which delayed our completion of the study.

Conclusion

We were able to demonstrate that lidocaine buffered with sodium bicarbonate injected prior to lymphoscintigraphy significantly reduces pain experienced during the procedure, and can be administered immediately prior to lymphoscintigraphy, with little added cost, no significant increase in procedure time, and no detrimental impact on examination quality. Furthermore, it makes the procedure less stressful for the technologist, thereby helping maintain or improve the overall examination experience. Accordingly, use of buffered lidocaine before radionuclide injection has become our practice standard, with increased patient and technologist satisfaction.

Key Points

QUESTION: Could buffered lidocaine immediately prior to lymphoscintigraphy injection could both reduce the patients' pain and increase nuclear medicine technologists' satisfaction with performing the procedure.

PERTINENT FINDINGS: The patients' reported pain decreased by 86% with the addition of buffered lidocaine with no detrimental impact on examination quality. Technologist satisfaction with performing the procedure increased by 36%.

IMPLICATIONS FOR PATIENT CARE: Buffered lidocaine can be administered immediately prior to lymphoscintigraphy, with little added cost, no significant increase in procedure time, and no detrimental impact on examination quality. Furthermore, it makes the procedure less stressful for the technologist, thereby helping maintain or improve the overall examination experience.

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Table 1. Pain Scores for Patients Undergoing Lymphoscintigraphy

Pain Score	No Lidocaine or Sodium Bicarbonate (n=10)	Lidocaine and Sodium Bicarbonate (n=28)
Mean (SD)	3.45 (1.88)	0.50 (1.32)[a]
Median (range)	3.25 (1-6)	0.00 (0-5)

[a] $P = 0.001$

Table 2. Technologist Satisfaction Scores for Lymphoscintigraphy Procedure

Satisfaction Scale Score	No Lidocaine or Sodium Bicarbonate (n=10)	Lidocaine and Sodium Bicarbonate (n=10)
Mean (SD)	7.3 (1.6)	9.9 (0.3)[a]
Median (range)	8 (5-9)	10 (9-10)

[a] $P = 0.001$