

# Comparison of pre-operative lymphoscintigraphy with inter-operative gamma probe and dye technique regarding the number of detected sentinel lymph nodes

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## Abstract

Sentinel lymph node (SLN) identification by lymphoscintigraphy (LS) and biopsy are the standard method for axillary lymph node staging in low stage breast cancer patients. Many previous studies did not compare the number of SLN on LS with SLN detected during surgery. *We aimed* to study the accuracy of pre-operative LS for the prediction of the number of SLN detected by surgical gamma probe and the dye technique during surgery. *Sixty patients were included* in our study. SLN biopsy was performed using the combined radioactive and blue dye methods. Patients without previous excisional biopsy of the tumor (45 patients) received periareolar intra-dermal injections of 17.5MBq/0.2mL technetium-99m-antimony sulfide colloid (<sup>99m</sup>Tc ASC). The remainder of the patients, with the history of excisional biopsy of the tumor (15 patients); received two intra-dermal injections of 17.5MBq/0.2mL <sup>99m</sup>Tc-ASC in both ends of the surgical incision. All injections were done 2-4 h before surgery and gentle massage was applied to the injection site. *Results* showed that the number of SLN was correctly detected by LS in 58 patients. Eighty SLN were totally detected during surgery. All these SLN were radioactive and could be identified by surgical gamma probe. No SLN was detected only by the blue dye. Of the 80 detected SLN, 60 (75%) were both radioactive and colored. Pre-operative LS correctly predicted the number of harvested SLN during surgery in 77.5% of the patients. Only 78.7% (63/80) of the total harvested SLN were detected by pre-operative LS. *We conclude* that pre-operative LS identifies 78.7% and the blue dye technique can identify 75% of the SLN found by the gamma probe during surgery. The pre-operative LS technique can correctly identify the number of SLN in 77.5% of the patients.

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## Introduction

Sentinel lymph node (SLN) by lymphoscintigraphy (LS), gamma probe detection of the SLN during surgery, the related dye technique and biopsy are at present useful techniques for axillary node staging in breast cancer patients [1-5]. These techniques applied separately or in combination have significant results in detecting SLN [6-9]. The radionuclide techniques are often applied in breast carcinoma [10-12] and in melanoma patients [13-14].

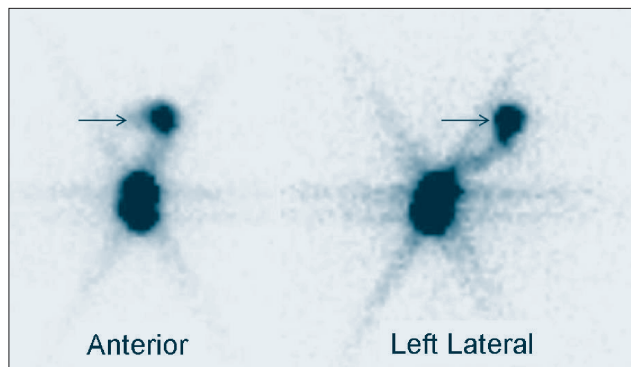
A rather limited number of studies have compared the number of SLN on LS with SLN detected by gamma probe during surgery and with the dye technique and biopsy as we have done in the present study. Technetium-99m antimony sulfide colloid (<sup>99m</sup>Tc-ASC) was the radiopharmaceutical we used [15].

## Subjects and methods

SLN biopsy was performed in 60 female patients with the clinical diagnosis of stage I or II breast cancer using both the blue dye and radionuclide techniques. Patients without previous excision biopsy of the tumor (45 patients) received periareolar intra-dermal injections of 17.5MBq/0.2mL of <sup>99m</sup>Tc-ASC. The remainder of the patients, with the history of excision biopsy of the tumor (15 patients); received two intra-dermal injections of 17.5 MBq/0.2mL <sup>99m</sup>Tc-ASC in both ends of the surgical incision. All injections were done 2-4h before surgery and gentle massage was applied to the injection site.

Anterior, anterior oblique and lateral views were acquired 2min after the injection. Three min images were acquired in a 64x64 matrix using a dual head gamma camera (E.CAM Siemens, Germany), equipped with a parallel hole, low energy, high resolution, collimator. An

energy window of 15% was centered over the 140keV photopeak of <sup>99m</sup>Tc. If the SLN were not visualized delayed images were taken up to 180min. As SLN was defined any node which was directly connected to the injection site by a lymphatic channel (Fig. 1) or the first lymph node that appeared on the scintiscan.



**Figure 1.** Anterior and left lateral lymphoscintigraphy images of a patient. Note the sentinel lymph node (arrow) in the left axilla which is directly attached to the injection site by a lymphatic channel.

In all patients, 2mL of patent blue (Gurbet laboratories, Belgium, Brossel) was injected in the same locations as the radiotracer injections 2min after general anesthesia. All operations were performed by the same surgeon. A surgical gamma probe (RMD Navigator Gamma Positioning System, Radiation Monitor Devices instruments, LLC, USA) was used for the detection of SLN during surgery. Any blue node or any node with an ex vivo radionuclide count of twofold or greater than the axillary background was defined as SLN. The harvested SLN were sent to the pathologist, and the surgical plan of the patients was determined by the result of the frozen section examination of these SLN.

### Results

The SLN detection rate was 96.6% (58 out of the 60 patients examined). In 2 patients SLN could not be detected by LS or by the gamma probe. Eighty SLN were radioactive and were detected by the gamma probe during surgery. No SLN was detected only by the blue dye technique. Sixty out of the eighty SLN, detected during surgery (75%), were both radioactive and blue. The SLN detected by LS and by the gamma probe are compared in Table 1. LS predicted the number of harvested SLN correctly in 45 out of the 58 patients (77.5%). Of the 10 patients with 2 SLN and the 6 patients with 3 SLN detected during surgery, LS detected only 2 and 1 respectively.

One and 2 SLN were additionally detected by gamma probe during surgery in 9 and 1 patients respectively that were not detected by the LS images.

The total number of detected SLN by pre-operative LS was 63. Although at least one SLN was detected by pre-operative LS in 96.6% of the patients, only 78.7% (63/80) of the total harvested SLN were detected by pre-operative LS.

**Table 1.** Differences in the number of SLN detected by LS and by gamma probe during surgery (In bold letters are the numbers of SLN detected by both techniques).

	Number of SLN detected during surgery			Total	
	One	Two	Three		
Number of SLN detected by LS	One	<b>42</b>	8	4	54
	Two	-	<b>2</b>	1	3
	Three	-	-	<b>1</b>	1
Total		42	10	6	58

### Discussion

Most authors and related guidelines recommend performing pre-operative LS imaging for SLN biopsy, especially in breast carcinoma and in malignant melanoma [10-14, 16]. Although the reproducibility of LS is reported to be high [12], some studies have found that LS can not increase the axillary SLN detection rate [13, 17-18]. Some have suggested that pre-operative LS may detect drainage to internal mammary nodes which is useful information for the surgeon [19-20].

Most of the studies mentioned above, did not compare the number of SLN on LS with SLN detected during surgery. Others compared these figures and found that LS accurately predicted the number of SLN identified intra-operatively in only 47% of the patients [21]. This figure was much higher (77.5%) in our study. The above mentioned study had a group of patients (8 cases) with more SLN detected by LS than by gamma probe during surgery. We didn't have such a group of patients in our study. Also in the above mentioned study the authors did not use the same technique in all their patients [21].

After dye injection, visual positive detection of LN during surgery was zero. Dye injection didn't contribute much to SLN harvesting in our study, although combination of radiotracer and blue dye is often used by others [3, 22, 23].

Gamma probe during surgery identified all single SLN detected pre-operatively by LS. In our study, when SLN was not detected by LS, it was not also detected during surgery (2 patients). In these cases LS was a predictor of SLN biopsy failure. In other words, pre-operative LS was a good predictor of SLN detection during surgery. These findings are in concordance with other studies in this field [24, 25]. However pre-operative LS may underestimate the number of SLN which can be harvested during surgery using gamma probe. The surgeons should be aware of this fact and meticulously search axilla for any "hot" node.

*In conclusion*, our findings showed that pre-operative LS identifies 78.7% and the blue dye technique can identify 75% of the SLN found by the gamma probe during surgery. The pre-operative LS technique can correctly identify the number of SLN in 77.5% of the patients.

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