Original Study

Preoperative Sentinel Node Mapping in Sentinel Node Biopsy in Early Breast Cancers — Is It Cost-Effective?

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Abstract

Many centers internationally still routinely perform preoperative sentinel lymph node (SLN) mapping. A recent review in 2015 also concluded that SLN mapping is playing an important role in SLN biopsy. However, in some financially less-privileged regions or localities where healthcare system is largely subsidized by the government, the extra cost incurred from the use of SLN mapping has significant implications on public health economics. This study aims to evaluate the efficacy as well as the cost-effectiveness of preoperative SLN mapping for early breast cancers.

Introduction: Sentinel lymph node (SLN) biopsy is currently the gold standard of treatment in early breast cancers. Identification of SLNs by preoperative scintigraphy has been carried out to improve the detection of SLNs intraoperatively, but the evidence of its cost-effectiveness is lacking. Here, we analyze the cost-effectiveness of the utilization of scintigraphy in detection of SLNs. **Patients and Methods:** Clinical and operative details were retrieved from a prospectively maintained database. The resources and cost data from each patient who had undergone SLN biopsy with preoperative scintigraphy were retrieved. **Results:** From January 2008 to December 2012, 400 patients underwent SLN biopsy for breast cancer. A total of 329 had preoperative SLN mapping with scintigraphy, Baseline patient demographic data for both arms were comparable. The relapse and recurrence rate of both arms were not statistically different. The detection rate of SLNs of both arms was the same (100%), and there were no grade 2 or above lymphedema in both groups of patients. However, the cost of each patient undergoing SLN mapping was USD $345.8. **Conclusion:** Preoperative SLN mapping does not improve the SLN detection rate. In addition, it does not affect the surgical outcomes in terms of complication, local relapse, and recurrence. The use of preoperative SLN mapping is no longer cost-effective.

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Introduction

Sentinel lymph node (SLN) biopsy is currently the gold standard in treating early node-negative breast cancers. This technique has spared patients from unnecessary axillary dissection, which can result in substantial morbidities like lymphedema and nerve injuries. Sixty-nine observational studies and 5 randomized trials have all concluded that SLN biopsy is feasible and oncologically safe when compared with the conventional axillary dissection (AD).[1-6]

Identification of SLN was made possible with either injection of blue dye or radionucleotide or both. The success rate of 66% in identifying SLN using blue dye technique in the initial 1994 report from Giuliano may simply reflect the learning curve of the technique.[7] A 93% identification rate was subsequently achieved by the same group in 1997.[8]

Lymphoscintigraphy (ie, SLN mapping), is well-established in the context of management of skin melanoma. It enables the better identification of anomalous patterns of lymphatic drainage that can directly alter the surgical approach. However, in breast cancer, where the primary focus of lymphatic surgery is in the axilla, and there is less data to support the excision of other lymph nodes in the region, the use of preoperative SLN mapping may not be as useful. In fact, there is no consensus regarding the use of preoperative SLN

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mapping, although one recent review concluded that it is still playing an important role in SLN biopsy.[9] Some centers still routinely perform preoperative SLN mapping for every SLN procedure, but evidence to support such practice is lacking. In areas where financial resources for healthcare are limited or when the healthcare system is heavily subsidized by the government, the use of SLN mapping should be justified.

Here, we study the cost-effectiveness of preoperative SLN mapping in a tertiary breast center.

Material and Methods

We carried out a retrospective review on patients who had undergone SLN biopsy in our center from a prospectively maintained database from January 2008 to December 2012. A total of 400 patients were included in the study. We included all patients with node-negative breast cancers (ductal carcinoma-in-situ or invasive ductal carcinoma only) of different nationalities and ethnic origins. We excluded patients who had undergone neoadjuvant chemotherapy or radiotherapy because there is still an open discussion on the influence of neoadjuvant chemotherapy on sentinel node identification.[9] Patients with previous lumpectomy for malignant breast lesions on the studied site are also excluded owing to the possibility of disrupted lymphatic channels after breast surgery, which might lower the SLN identification rate.

In the current series, 329 patients received preoperative SLN mapping, whereas 71 did not because of logistic reasons. All patients underwent SLN biopsy with dual SLN identification technique (radioisotope and blue dye).

Preoperative SLN mapping was carried out by the Department of Nuclear Medicine under a standardized protocol. These patients received injection of Tc99m-labeled colloids (antimony sulfide colloid, nano-colloid, or sulfur colloid) at the tumor sites. The injection site was then massaged for 2 minutes, followed by the SLN mapping. Thirty-minute post-injection static images were then captured at anterior, lateral oblique, and lateral positions, and additional 2-hour delayed scans were taken only if SLNs were not detected in the 30-minute scan (See Figure 1 for SLN mapping protocol).

In the operating theater, 2.5 mL patent blue dye was injected at the periareolar region. A portable GM probe (RMD Navigator 2.0 14-mm angled probe) was also used to locate and excise the SLN. All patients received SLN biopsy by the same group of breast surgeon specialists, and all operations were performed in the 2 university-affiliated hospitals.

Patient demographic data, SLN identification rate, disease relapse rate, and costs were analyzed and compared between the 2 groups using the χ^2 test, the Student t test, or the Fisher exact test. A P-value of less than .05 was considered statistically significant.

Results

The median age of our patients was 47 years (range, 24-85 years). A total of 371 patients were Chinese; other nationalities included 26 Filipinos and 3 British. Baseline patient demographic data were comparable on both groups and are summarized in Table 1. A total of 240 (72.9%) patients had T0/T1 tumors in the SLN mapping group, whereas 50 (70.4%) patients had T0/T1 tumors in the nonmapping group. Similarly, most patients were node-negative in both arms (233 patients and 52 patients, in the mapping and nonmapping groups, respectively) (Table 2). Most patients received mastectomy in both groups (231 [70.2%] in the SLN mapping

Figure 1 Sentinel Lymph Node Mapping Protocol

(II) LYMPHOSCINTIGRAPHY (BREAST SENTINEL NODE)

Indications: (1) Detection and localization of sentinel lymph node in breast cancer.

Preparations: (1) For breast sentinel node scan, apply EMLA cream 5% by referring ward on injection sites 1 hour before injection.
(2) An old Cobalt 57 transmission source is mounted onto detector two to delineate body contour.

Exam-Time: 30 minutes post injection static images about 30 minutes. Delay 2 hours imaging may be required if sentinel node could not be detected in the 30 minutes scan.

Collimator: LEHR

Dose: Sub-areolar injection of 2mCi Tc99m non-filtered Sulfur Colloid (in 1ml) if OT is to be done on next day.
0.5mCi Tc99m filtered Sulfur Colloid (in 1ml) if OT is to be done on same day.

Positioning: (1) Patient in supine position with arm of affected side abducted 90° for anterior and oblique view. Both arms are raised over head for lateral view.
(2) Detector at anterior and Co57 flood source at posterior.
(3) Projections: Anterior, Anterior Oblique 30° and Lateral of the involved breast.

Acquisition protocol

- 256 x 256 matrix for 300 seconds.
- Zoom 1 and photopeak at 140keV in 10% window.