

Clinical Science

Value analysis of postoperative staging imaging for asymptomatic, early-stage breast cancer: implications of clinical variation on utility and cost



Andrew C. Pellet, M.D., Mujde Z. Erten, Ph.D.,
Ted A. James, M.D., M.S., F.A.C.S.*

Department of Surgery, University of Vermont, 89 Beaumont Avenue, Given Building, Burlington, VT, 05405, USA

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Abstract

BACKGROUND: Routine staging imaging for early-stage breast cancer is not recommended. Despite this, there is clinical practice variation with imaging studies obtained for asymptomatic patients with a positive sentinel node (SN+). We characterize the utility, cost, and clinical implications of imaging studies obtained in asymptomatic SN+ patients.

METHODS: A retrospective review was performed of asymptomatic, clinically node-negative patients who were found to have a positive sentinel node after surgery. The type of imaging, subsequent tests/interventions, frequency of additional malignancy detected, and costs were recorded.

RESULTS: From April 2009 to April 2013, a total of 50 of 113 (44%) asymptomatic patients underwent staging imaging for a positive sentinel node; 11 (22%) patients had at least 1 subsequent imaging study or diagnostic intervention. No instance of metastatic breast cancer was identified, with a total cost of imaging calculated at \$116,905.

CONCLUSIONS: Staging imaging for asymptomatic SN+ breast cancer demonstrates clinical variation. These tests were associated with low utility, increased costs, and frequent false positives leading to subsequent testing/intervention. Evidence-based standardization may help increase quality by decreasing unnecessary variation and cost.

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Patients with invasive breast cancer experience various levels of risk for developing distant metastasis. National clinical guidelines recommend obtaining staging imaging in early-stage breast cancer only if there is the suspicion for distant metastasis based on the patient's history and/or

physical examination (eg, symptomatic patients).¹⁻³ Evidence supports the lack of clinical benefit in obtaining staging imaging in patients with positive lymph nodes (LN+) unless there are associated clinical symptoms or suspicious examination findings. Despite this evidence, there exists practitioner variability when performing postoperative staging imaging in asymptomatic patients.⁴⁻⁷ A recent study polled over 100 breast surgeons regarding their postoperative staging approach in 2 patients having the exact same age, tumor type, size, and location but differing in the total number of positive axillary lymph nodes (3 of 19 LN+ vs

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* Corresponding author. Tel.: +1-802-656-5880; fax: +1-802-656-5870.

E-mail address: ted.james@uvm.edu

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17 of 19 LN+); 51% (3 LN+) and 98% (17 LN+) of surgeons polled responded they would proceed with a computed tomographic scan in these patients to evaluate for distant metastasis, demonstrating variation in the use of metastatic evaluation with staging imaging in early-stage breast cancer despite available guidelines.⁸

Variability in practice patterns with respect to staging evaluation creates additional health care costs that may not provide any additional benefit to the patient. By focusing on a particular subset of patients (asymptomatic, clinically node-negative early-stage breast cancer patients, found to be LN+ during surgery), we seek to further characterize this practice variation and ascertain specific clinical outcomes related to nonguideline concordant postoperative staging imaging. In particular, we seek to determine the clinical implications of performing a metastatic evaluation with staging imaging that is not driven by established clinical guidelines. Furthermore, using institutional cost data, we seek to calculate the total cost of staging imaging obtained under these circumstances.

Methods

A retrospective chart review was conducted evaluating women who underwent definitive breast cancer surgery from April 2009 to April 2013 at a single-institution academic medical center. Patients were identified using the institutional cancer tumor registry. Inclusion was restricted to patients with clinically node-negative invasive breast cancer, who were subsequently found to have pathologically LN+ after surgery. For purposes of the study, patients with macro-metastasis, micro-metastasis, and isolated tumor cells were considered in the node-positive group. Exclusion criteria consisted of clinically node-positive patients identified preoperatively by physical examination or imaging and patients with evidence of locally advanced disease detected before surgery. Patients undergoing staging imaging for documented clinical symptoms that developed during the perioperative period were excluded from comparison analysis. All surgeries were performed at a single tertiary care, multidisciplinary cancer center. Variables collected from the Tumor Registry included date and type of operation, patient age, preoperative clinical stage, and pathologic tumor stage. The Mann-Whitney test for nonparametric variables was used to compare preclinical stage distribution between patients undergoing staging imaging evaluations with those who did not undergo staging imaging evaluations. The study received approval from the Institutional Review Board.

The Electronic Medical Record was used to identify the specific type and extent of postoperative staging imaging performed. The indications for staging imaging tests were determined from clinic notes and/or documented clinical signs included on orders or imaging reports. Studies were deemed “nonindicated” if they were obtained after surgery in patients without documented symptoms or clinical

findings or if documentation stated that a positive node drove the decision to obtain staging imaging. Imaging studies were included in the tally if they were initiated postoperatively, performed within 30 days of surgery, and were not driven by symptomatology but rather on the basis of operative findings. The number and types of subsequent follow-up imaging and/or interventional procedures driven by findings of the initial metastatic evaluations were collected. All cases of documented stage IV disease or other inadvertently identified malignancy diagnosed as a result of staging imaging were noted.

Cost analysis

The total cost of postoperative staging imaging was calculated using charge-level costs for actual cases based on volume and expenses through hospital and professional billing systems. The total cost of a service is the sum of direct and indirect costs including the cost for the physician’s time. The direct costs represent the resources used in providing a service, such as labor, supplies, etc. In the case of a computed tomography (CT) scan, for example, the direct costs would be the costs of the staff in the CT department, including CT technicians, nursing staff, and administrative support staff; the costs of contrast and other supplies used for the scan; the costs of maintaining the CT scanning devices and other equipment; and the costs of nonclinical supplies and miscellaneous purchases. The indirect costs represent a share of the organizational overhead. These are allocated using set rules to spread among all procedures that are billed out of that cost center. The costs for the physician’s time include other costs specific to the cost center from which the physician’s time is billed, including the costs of other staff, supplies, and administrative support. The costs for all the services were updated to the most current year using fiscal year 2013 (from October 1, 2012, to February 28, 2013).

Results

There were 113 clinically node-negative patients who were found to have pathologically positive lymph nodes after surgery. The mean age of the group was 60.2 years (± 11.5 SD). The preoperative clinical stages of this group have been stratified in [Tables 1](#) and [2](#). There was no statistically significant difference in preclinical stage distribution between patients receiving staging imaging evaluations and those not receiving staging imaging evaluations ($P = .83$).

Details regarding postoperative metastatic evaluations with staging imaging that were not driven by symptomatology can be found in [Tables 3](#) and [4](#). Within the studied population, 50 patients (44%) underwent at least 1 imaging study to evaluate for distant metastatic disease for a total of 96 imaging studies; 13 of these patients (26%) had further testing performed as a result of concerning findings identified on initial imaging. This resulted in a total of 14

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