Cost Analysis of a Surgical Consensus Guideline in Breast-Conserving Surgery

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BACKGROUND: The Society of Surgical Oncology and American Society of Radiation Oncology consensus statement was the first professional guideline in breast oncology to declare "no ink on tumor" as a negative margin in patients with stages I/II breast cancer undergoing breast-conservation therapy. We sought to analyze the financial impact of this guideline at our institution using a historic cohort.

STUDY DESIGN: We identified women undergoing re-excision after breast-conserving surgery for invasive breast cancer from 2010 through 2013 using a prospectively maintained institutional database. Clinical and billing data were extracted from the medical record and from administrative resources using CPT codes. Descriptive statistics were used in data analysis.

RESULTS: Of 254 women in the study population, 238 (93.7%) had stage I/II disease and 182 (71.7%) had invasive disease with ductal carcinoma in situ. A subcohort of 83 patients (32.7%) who underwent breast-conservation therapy for stage I/II disease without neoadjuvant chemotherapy had negative margins after the index procedure, per the Society of Surgical Oncology and American Society of Radiation Oncology guideline. The majority had invasive ductal carcinoma (n = 70 [84.3%]) and had invasive disease (n = 45 [54.2%]), and/or ductal carcinoma in situ (n = 49 [59.0%]) within 1 mm of the specimen margin. Seventy-nine patients underwent 1 re-excision and 4 patients underwent 2 re-excisions, accounting for 81 hours of operative time. Considering facility fees and primary surgeon billing alone, the overall estimated cost reduction would have been $195,919, or $2,360 per affected patient, under the guideline recommendations.

CONCLUSIONS: Implementation of the Society of Surgical Oncology and American Society of Radiation Oncology consensus guideline holds great potential to optimize resource use. Application of the guideline to a retrospective cohort at our institution would have decreased the overall re-excision rate by 5.6% and reduced costs by nearly $200,000. Additional analysis of patient outcomes and margin assessment methods is needed to define the long-term impact on surgical practice. (J Am Coll Surg 2017;225:294–301. © 2017 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

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As one of the standard of care options in early-stage breast cancer, breast-conservation therapy (BCT) has proven to be comparable with mastectomy for rates of disease-free and overall survival.[1] Despite this equivalence in outcomes, positive surgical margins after BCT have been associated with a considerably increased risk of local recurrence.[2-6] Margin status has become a critical factor in the management of patients undergoing BCT, and the controversy surrounding the importance of negative margins and the absence of definitive guidelines has led to wide variability in surgeon practice of the threshold for re-excision. In 2002, the landmark National Surgical Adjuvant Breast and Bowel Project B-06 trial prompted the widespread acceptance of BCT and considered no tumor cells at the inked specimen margin to be a negative

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Abbreviations and Acronyms

ASTRO = American Society of Radiation Oncology
BCS = breast-conserving surgery
BCT = breast-conservation therapy
DCIS = ductal carcinoma in situ
SSO = Society of Surgical Oncology

margin, but this definition failed to translate universally into practice until recently.[1]

Numerous studies have debated the significance of close margins and the most appropriate threshold for re-excision based on patient and tumor characteristics. Before early 2014, up to 60% of patients underwent re-excision for management of margins, and adequacy of pathologic margin status remained surgeon-specific and highly ambiguous, ranging from no tumor at the inked margin to margin widths >5 mm.[6-11] In May 2014, the Society of Surgical Oncology (SSO) and American Society of Radiation Oncology (ASTRO) published a consensus statement recommending that the definition set forth in National Surgical Adjuvant Breast and Bowel Project B-06 become the global standard for an adequate margin in breast-conserving surgery (BCS) in women with stage I/II disease undergoing adjuvant whole breast radiation therapy.[12] Drawing on a meta-analysis of 33 studies, a multidisciplinary consensus panel determined that no significant differences in local recurrence were present, regardless of factors such as patient age, tumor biology, or presence of an extensive intraductal component in the setting of "no ink on tumor."[12]

The consensus guideline aims to standardize the surgical component of BCT in women with early-stage breast cancer and to positively influence a diverse array of patient outcomes and system processes. We sought to analyze the potential impact of the consensus guideline on surgical practice at our institution and to extrapolate its financial impact and potential cost-savings using a historic cohort.

METHODS

Study population

Approval from the IRB at Washington University in St Louis was obtained before the commencement of this study, and written informed consent of patients was not required. From a prospectively maintained institutional database, all patients undergoing breast re-excision procedures after index BCS between January 2010 and December 2013 were identified. All female patients age 18 years or older with invasive breast carcinoma with or without ductal carcinoma in situ (DCIS) diagnosed by preoperative image-guided needle core biopsy or by excisional biopsy were selected for inclusion in the analysis. Patients with pure DCIS and those undergoing the primary surgical procedure for their breast cancer diagnosis at another hospital or surgical center were excluded. A retrospective cohort study was conducted and clinical, demographic, and pathologic data were recorded on review of the electronic medical record. During the time period of the study, 5 breast oncologic surgeons were practicing at our institution.

Data analysis

Patient characteristics including age, race, ethnicity, weight, and medical therapies were extracted from the clinical record. The original operative notes and pathology reports were used to obtain information on the index and re-excision surgical procedures, tumor histology, and surgical margins. Tissue specimen margins were intraoperatively marked in 2 dimensions with a short stitch placed superiorly and a long stitch placed laterally. A dedicated team of breast pathologists was the sole resource for specimen processing, and tumor dimensions were assessed on both gross and microscopic evaluation. Tissue specimens were inked on all margins, serially sectioned at 3- to 5-mm intervals, and stained by hematoxylin and eosin per standard protocol. The pathologic examination included documentation of the tumor-margin distance, and margin positivity was defined as the presence of invasive disease or DCIS at the inked margin. Close margins were divided into categories defined by distance between the tumor and any inked margin (anterior, posterior, medial, lateral, superior, and inferior).

Cost data from our institution were retrieved from facility and administrative databases based on CPT codes and work relative value units. Information for individual patient encounters was collected for facility costs and primary surgeon billing alone. Facility data included any equipment, staff, medication, and operating room costs, as well as any costs associated with inpatient admission, if applicable. Primary surgeon costs were calculated based on institutional billing data, using CPT codes and the associated mean clinical cost per physician work relative value units.

Study data were managed using REDCap electronic data capture tools hosted at Washington University in St Louis.[13] Descriptive statistics were used to assess frequency distributions, and analyses were performed using a statistical package, SAS, version 9.4 (SAS Institute).