

Clinical Science

Lumpectomy specimen margins are not reliable in predicting residual disease in breast conserving surgery



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Abstract

BACKGROUND: In breast conserving surgery, the concordance between lumpectomy margin (LM) status and the status of the corresponding lumpectomy cavity remains uncertain.

METHODS: We analyzed pathology reports of lumpectomies from 2004 to 2006. We included those which contained both ink-directed LM and complete (≥ 4) separate corresponding shaved cavity margins (SCMs). SCM pathology was used as a surrogate for lumpectomy cavity status, to determine the predictive value of LM for residual disease.

RESULTS: Pathology from 1,201 pairs of LM and SCM from 242 patients was compared. LM status predicted corresponding lumpectomy cavity status with 50.9% sensitivity, 69.5% specificity, 35% positive predictive value, and 81.4% negative predictive value, giving an overall accuracy of 64.9%.

CONCLUSIONS: Oriented LMs are not reliable for predicting lumpectomy cavity status, and therefore not reliable for directing re-excision. Taking complete, oriented SCMs at the time of lumpectomy may improve accuracy compared with traditional LM assessment.

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Breast conservation therapy (BCT) is equivalent to mastectomy in terms of overall and disease-free survival.¹⁻³ The main disadvantage of BCT is the increased

risk of local recurrence, which is 8% to 14% at 20 years of follow-up.^{2,3}

Previous studies have reported that the strongest predictor of local recurrence is positive surgical margins.^{4,5} The site of local recurrence is often close to the original tumor site with histological characteristics similar to the primary tumor, suggesting that local recurrences arise from residual tumor left at the time of lumpectomy.⁶⁻⁸

Although the optimum width of tumor-free lumpectomy margins (LMs) has recently been revisited,⁹ the ability to

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identify and accurately re-excite positive LMs remains critical for safe breast conservation. Re-excision of inadequate margins achieves local control rates similar to those of initial lumpectomies with adequate margins.^{10,11} To ensure adequate tumor clearance, several methods have been developed for margin assessment and detection of residual disease within the lumpectomy cavity, including pathologic evaluation of LMs, taking additional shaved cavity margins (SCMs), and intraoperative ultrasound or radiographic examination of the lumpectomy specimen or cavity.¹²⁻¹⁵

Among these, spatial orientation of lumpectomy specimens with multicolor inking and ink-directed re-excision of involved LMs is widely practiced. This technique can provide exact tumor-to-margin distance to determine if re-excision is required, and allows for targeted re-excision. Targeted re-excision versus whole cavity re-excision decreases the amount of tissue excised and improves cosmesis.¹⁶

One shortcoming of multicolor inking and ink-directed re-excision is that no residual tumor is found at the time of re-excision in 35% to 49.5% of patients¹⁷⁻²⁰ and therefore some patients undergo unnecessary re-excisions. In addition, negative margins do not always guarantee complete excision. The reported rate of residual carcinoma in re-excision or mastectomy specimens following initial negative LM greater than 0.1 cm^{8,21} or greater than 0.2 cm^{19,22} in width is as high as 43%.

An alternative approach, the SCM technique, consists of taking thin strips of tissue from all aspects of the lumpectomy cavity at the time of lumpectomy in a tangential manner.^{23,24} SCM represents the tissue just outside the standard lumpectomy perimeter—thus, it is reasonable to use SCM status as a surrogate for lumpectomy cavity status. Based on this assumption, our study evaluated the predictive value of oriented and inked LM for residual disease in the corresponding lumpectomy cavity. We wished to determine (1) how often additional tumor will be found in the lumpectomy cavity adjacent to an inked LM deemed negative by conventional pathology assessment; (2) how often there will be “no” additional tumor found in the lumpectomy cavity adjacent to an inked LM deemed positive by conventional pathology assessment; and (3) to identify causes and possible solutions for these false negative and false positive margin assessments.

Methods

An Institutional Review Board-approved retrospective analysis was performed to identify all consecutive patients undergoing BCT for primary invasive breast cancer or ductal carcinoma in situ (DCIS) between January 1, 2004 and December 31, 2006 at the Massachusetts General Hospital, Boston, MA. This time frame was selected because it represented a period of transition from lumpectomy alone to lumpectomy plus excision of SCM at our institution.

All surgical procedures were performed by 4 dedicated breast surgeons (B.L.S., K.S.H., M.A.G., and M.C.S.). The decision to resect one or more SCMs and the thickness of the shaves were at the discretion of the surgeon. In general, most surgeons aimed for SCM thickness between 0.2 and 1.0 cm.

This study included only patients who had the following: oriented lumpectomy specimens, all 6 LMs (superior, inferior, medial, lateral, anterior, and posterior) inked and evaluated separately, and complete (≥ 4) SCM taken during the same procedure. Patients with unoriented lumpectomies, fewer than 4 SCMs, or complete but not separate SCMs (eg, shaves taken as hemispheres) were excluded from this study.

Lumpectomy specimens were sent to pathology with sutures that allowed for spatial orientation of the specimen (eg, long suture for lateral, short suture for superior). Specimens were inked with multiple colors by the pathologist and sectioned. Representative tissue, including the closest margins, was submitted for histologic evaluation. Most SCMs were entirely submitted for histologic evaluation. The presence and extent of tumor was recorded for each SCM.

LM's predictive value was analyzed at the individual margin level, considering each LM separately. Pathologic data of the LM and corresponding SCM were recorded in a paired pattern based on the presence or absence of tumor and tumor type. LMs were considered clinically positive/involved if cancer cells were within 0.2 cm of the inked margin's surface because this generally triggered re-excision at our institution during the study period. The lumpectomy cavity was considered positive for residual disease when the SCM contained tumor, regardless of the distance of cancer cells to the SCM surface.

LM-to-tumor distance, degree of margin involvement (none, one focus, several foci, broad front), and tumor histopathology of the primary tumor, including histology, size, grade, presence of extensive DCIS, lymphovascular invasion, multifocality, margin involvement, estrogen receptor status, human epidermal growth factor receptor 2 status, and lymph node status, were determined.

Pearson's chi-square test was used to test for categorical variables (risk factors for positive LMs). Statistical analyses were performed using STATA 12.0, and *P* values less than or equal to .05 were considered statistically significant.

Results

Two hundred forty-two patients with 1,452 LMs and 1,201 SCMs were identified. Mean patient age was 53.3 years (range 31 to 86 years). All patients were female. One hundred twenty-three (50.8%) patients had invasive ductal carcinoma (IDC) and DCIS, 66 (27.3%) had DCIS alone, 26 (10.7%) had IDC alone, 19 (7.9%) had invasive lobular cancer (ILC) alone, 7 (2.9%) had ILC and IDC with or without DCIS, and 1 (.4%) had tubular carcinoma. The

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