Analysis of the use of specimen mammography in breast conservation therapy

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Abstract

Background: Obtaining tumor-negative margins when performing breast-conserving surgery is the standard of care to prevent local recurrence. We believe two-view specimen mammography is a useful method for intraoperative determination of adequacy of excision.

Methods: A retrospective review was performed on patients who underwent wire-localized partial mastectomy for invasive cancer in our Breast Center from 2000 to 2001. Two-view specimen mammography reports were compared to the pathologic evaluation.

Results: Eighty-eight of 93 patients (95%) had complete primary excision. Sixteen patients had additional margins excised at the time of the initial operation based on specimen mammogram. Six patients would have had positive margins had additional excision at the primary surgery not been performed.

Conclusions: Specimen mammography can help reduce reoperation rate by identifying patients who need additional margin excision at the time of initial surgery for breast conservation therapy. Using two-view specimen mammography, our reoperation rate was reduced from 12% to 5%. © 2004 Excerpta Medica, Inc. All rights reserved.

Keywords: Breast cancer; Mammography; Specimen mammography; breast-conserving surgery; Margin assessment; Reoperation

For many patients, breast-conserving surgery is the preferred method of treatment for early-stage breast cancer. This may involve surgical resection of the primary tumor followed by adjuvant radiation to the same breast. Obtaining tumor-negative margins is the standard of care to prevent local recurrence. In addition to adhering to oncologic principles [1], patients who have satisfactory margins at initial excision have a higher rate of successful breast conservation [2] and a better cosmetic result [3]. Achieving this goal can be elusive when lesions are not palpable and require radiographic localization. Wire-localized specimens have tumor within 1 mm of the margin in up to 59% of patients [4]. It has been reported that approximately 5% to 60% of patients undergoing partial mastectomy will require reoperation. Intraoperative ultrasound, imprint cytology, scrape cytology, and specimen mammography have all been employed with varying degrees of success for intraoperative margin assessment [3,5–7].

We use two-view specimen mammography to grossly assess tumor margins intraoperatively. We believe our protocol is a useful method to determine the adequacy of excision and that it can minimize reoperation rates.

Methods

A retrospective review was performed on 97 consecutive patients who underwent wire-localized partial mastectomy for malignant conditions through our Breast Center from 2000 to 2001. This review was approved by our Institutional Review Board. Only patients with invasive carcinoma, with or without carcinoma-in-situ, were considered. Ninety-three patients had two-view specimen mammography with magnification for the assessment of the margins. As agreed upon by the surgeon and a radiologist, the margin was considered...
positive if the mammographic abnormality extended close to the border of the specimen. Consensus was uniformly accomplished and documented in the operative report. Patients had tumor re-excision during the same procedure if margins were deemed positive. For the purpose of this study, the report of the mammographer was considered final. These reports were compared to the pathologic evaluation of margins, which was used as the definitive indicator of margins. Pathology of the specimen before re-excision and of any additional margin specimens was noted to facilitate the determination of sensitivity and specificity of the specimen mammogram. Re-excision of margin(s) were based on intraoperative specimen mammography results and documented. Complete primary therapeutic excision was considered successful if margins after all excisions performed during the same operation were negative for tumor per established National Surgical Adjuvant Breast and Bowel Project (NSABP) guidelines. Fisher’s exact test was used to perform a critical analysis of obtained data.

**Specimen mammography protocol**

The partial mastectomy specimen is orientated in the operating room by the surgeon. Metallic clips are placed on margins: three clips are placed on the lateral margins, two clips on the superior margin, and one clip on the superficial margin. The specimen is then placed in a clear biohazard bag and hand carried by the surgeon to the Breast Imaging Department.

In the Breast Imaging Department, the surgeon orientates the bagged specimen so the single clip is in the center of the specimen, thus maintaining anatomical position. Using the GE Senographe DMR machine, a 1.9× magnification view with compression is performed. A second image is obtained after the specimen is rotated 90 degrees to place the single clip at the edge of the specimen. Using these two magnified images, all 6 margins can be grossly assessed. Figures 1A and B represent a negative and Figures 2A and B a positive specimen mammogram. Intraoperative specimen radiograph and evaluation time is approximately 15 minutes.

**Results**

Four specimens could not be evaluated mammographically due to characteristics of the lesion. Of these, 2 specimens had no intraoperative evaluation, 1 specimen had frozen sectioning, and 1 was evaluated by specimen sonography. These were excluded from further analysis. Eighty-eight of the remaining 93 patients (95%) had complete primary therapeutic excision of their breast cancer. There were 5 false negative specimen mammograms. Of these, 2 were infiltrating ductal carcinoma while 2 had ductal carcinoma-in-situ at the margin and 1 was infiltrating lobular carcinoma. Sixteen patients (18%) had additional excision performed at the time of the initial operation based on specimen mammogram. In all of these patients, final margins were negative. Table 1 shows the comparison between the specimen mammogram interpretation of the margin and the actual pathologic status of the margin prior to re-excision. Ten patients had negative margins on the initial pathologic specimen submitted before re-excision representing false positive specimen mammograms. Scientific assessment of specimen mammogram is shown in Table 2.

**Comments**

It has been reported that approximately 6% to 50% of patients undergoing partial mastectomy will require reoperation. In effort to minimize this problem, intraoperative assessment of margins has become increasingly popular. Intraoperative ultrasound, imprint cytology, scrape cytology, and specimen mammography have all been employed.
All of these modalities are available at our institution; however, in this study we used specimen mammography exclusively. No attempt at comparison is made in this report, although such a study would yield valuable information.

Graham et al stated that, in their hands, specimen radiography yields a positive predictive value of 98% but a negative predictive of only 32%, providing little assurance of complete therapeutic excision [8]. Dixon et al reported complete excision rates of 86%. The authors credited this success to accurate specimen orientation for the specimen mammogram, which can then be used as a guide for additional excision at areas with close margins [9]. Others have corroborated the importance and have described the nuances of specimen handling [2,10–12]. We have described our technique and have found it to be effective in reducing the need for reoperation. Meticulous attention to specimen handling and a collegial relationship between surgeon and mammographer are paramount to the success of intraoperative specimen mammography.

We noted a 5% reoperation rate. As a result of specimen mammography, 6 patients who would have otherwise had positive margins underwent additional excision at the primary surgery eliminating the need for reoperation. Without this advantage our reoperation rate would have been 12%. A recent study has demonstrated a similar advantage using specimen mammography in patients with ductal carcinoma-in-situ [13].

There were 5 false negative specimen mammograms. Two were infiltrating ductal carcinoma and were attributed to examiner error. Two had ductal carcinoma-in-situ at the margin without radiographic calcifications present. This can be a notoriously difficult disease for which to achieve negative margins [13]. Another was infiltrating lobular carcinoma, a tumor with characteristics that make it difficult to assess mammographically. Ten false positive specimen mammograms resulted in unnecessary margin re-excision in these patients. The impact of this re-excision on the cosmetic result was not assessed as part of this review.

We practice in a center where large volumes of breast-conserving surgeries are performed. We have dedicated mammographers who are therefore familiar and experienced with this technique. Whether our experience can be extrapolated to a particular setting may be contingent on available expertise and resources.

### Table 1
Comparison of specimen mammography to pathologic evaluation of margins

<table>
<thead>
<tr>
<th>Specimen mammogram</th>
<th>Pathologic margin status</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>6 (true positive)</td>
</tr>
<tr>
<td></td>
<td>Negative</td>
<td>5 (false negative)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

* Margin refers to margin of the original specimen before re-excision.

### Table 2
Analysis of specimen mammography

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>95% Confidence interval</th>
</tr>
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<tbody>
<tr>
<td>Sensitivity</td>
<td>0.5455</td>
<td>0.2338–0.8325</td>
</tr>
<tr>
<td>Specificity</td>
<td>0.8780</td>
<td>0.7872–0.9400</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>0.3750</td>
<td>0.1520–0.6459</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>0.9351</td>
<td>0.8550–0.9786</td>
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* P = 0.0029 by Fisher’s Exact test.
In conclusion, specimen mammography can help reduce the reoperation rate by identifying patients who need additional margin excision at the time of initial surgery for breast conservation therapy. Using two-view specimen mammography, we were able to reduce a potential reoperation rate of 12% to only 5%. This method is performed in a timely manner and is beneficial to our patients.

References