Scientific Forum

Mammography and Reduction Mammaplasty

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Background: Anecdotal descriptions of the discovery of occult breast cancers in reduction mammaplasty patients during the perioperative period have appeared in the literature. Subsequently, recommendations for routine preoperative and postoperative mammographic screening for reduction mammaplasty patients have been published. Other authors have recommended that only patients at risk according to the American Cancer Society's guidelines should have mammographic screening.

Objective: The purpose of this study was to resolve some of the conflicting conclusions presented in the literature.

Methods: Twenty reduction mammaplasty patients underwent preoperative and postoperative mammography. The mammograms were randomly mixed and evaluated in a blind study by 2 radiologists, who were asked to identify and describe any mammographic abnormalities, indicate which films were preoperative and which were postoperative, and make recommendations for the patient represented in each film.

Results: None of the mammograms identified as preoperative by the radiologists demonstrated any confirmed breast malignancies. Both radiologists reported some abnormalities among the preoperative views and identified a number of characteristic postoperative radiologic changes. Recommendations for patients represented in the films included additional views, repeat interval films, and biopsy. One radiologist accurately identified preoperative and postoperative mammograms in 72\% of the films and the other radiologist in 54\% of the films, with an overall agreement between the radiologists of only 50\%.

Conclusions: The radiologists' evaluations led the authors to recommend against routine preoperative mammography in all breast reduction patients; those breast reduction patients falling within American Cancer Society guidelines for mammographic screening because of high risk characteristics should undergo preoperative mammograms. Based on this study, the authors' recommendations include the option of performing postoperative baseline and interval mammography on all breast reduction patients and the alternative approach of carrying out postoperative baseline mammography only on high-risk patients—ie, those for whom routine screening would be recommended anyway or those whose excised breast tissue has demonstrated risk-indicating histologic features.

Unexpected breast cancers discovered during or immediately after breast reduction by histologic examination or intraoperative palpation have been anecdotally reported in the literature, leading to published recommendations for routine pre-
operative mammographic screening. Other authors, however, have recommended that selective preoperative mammography should be performed according to the American Cancer Society guidelines for mammographic screening.

Some authors have advised that routine baseline mammographic screening should be performed following breast reduction surgery because of the high incidence of postsurgical mammographic changes, some of which may mimic cancer. Postreduction mammographic changes, which are generally readily differentiated from malignancies, have been well described. Baseline mammography after breast biopsy is not recommended, because the number of patients who demonstrate mammographic scarring that is likely to be confused with malignancy is insufficient to warrant subjecting all breast biopsy patients to postoperative baseline mammography. Likewise, for reduction mammoplasty patients, some authors recommend postoperative baseline mammography only for those at high risk, as defined by the American Cancer Society, because of age and personal or family history of breast carcinoma. To our knowledge, few false-negative evaluations (where mammographic changes have masked detection of a cancer) have been reported after breast reduction; there is a greater risk that certain postoperative changes may mimic malignancy.

In an attempt to resolve some of these conflicting conclusions in the literature, we conducted a study in which 20 breast reduction patients underwent preoperative and postoperative mammography. Two board-certified radiologists performed blinded assessment of the mammograms. The results of this study, combined with an analysis of the available published literature, formed the guidelines for our recommendations concerning the use of preoperative and postoperative mammography in breast reduction patients.

### Methods

Preoperative screening mammography was performed on 26 patients who had undergone breast reduction surgery by one of 2 plastic surgeons between 1994 and 1997. Although the patients ranged in age from 24 to 67 years (mean age, 45 years), only 5 were younger than 45 years of age. Despite extensive follow-up, only 20 of the original 26 patients underwent postoperative mammography, which was performed between 5 and 36 months postoperatively. Although exhaustive efforts were made to perform all postoperative mammography within 6 months of surgery, only 10 patients underwent mammography during this period; 7 other patients underwent mammography within 12 months postoperatively.

Three patients in the group each had a first-degree relative who had developed breast cancer. One patient was a...
A former breast cancer patient who had undergone unilateral breast reduction to achieve symmetry after prior contralateral mastectomy and reconstruction. Two other patients had previously undergone breast biopsies for what proved to be benign masses. The amount of tissue removed during the breast reduction procedures ranged from 118 to 1013 g. None of the patients had clinically palpable breast masses preoperatively.

Two board-certified radiologists were asked to independently evaluate and comment on the mammograms of the 20 patients. Preoperative and postoperative mammograms, paired in craniocaudal and mediolateral oblique views, were randomly mixed. The radiologists registered their comments on data sheets (Table 1). Each radiologist randomly evaluated 80 pairs of mammograms for a total of 40 breasts (40 preoperative pairs and 40 postoperative pairs). Patient names and previous radiology reports were concealed. The radiologists were asked not only to identify and describe any mammographic abnormalities but also to indicate which radiographs were preoperative and which were postoperative. They were asked to make recommendations, such as additional mammographic views and biopsies for suspected malignancies. The statistical correlation between the findings of the radiologists was determined. The mammograms were then unblinded and sorted by patient name into preoperative and postoperative categories. The radiologists' reports remained with each set of mammograms.

Results

Preoperative Mammograms

Neither of the radiologists felt that any of the preoperative mammograms demonstrated confirmed breast malignancies. Although calcifications and architectural distortions were reported, none were considered significant for malignancy, because no features suggestive of malignancy, such as clustered microcalcifications or spiculated masses, were encountered on the preoperative mammograms. Other mammographic abnormalities noted in the study group's preoperative mammograms included skin thickening inferiorly from nipple to inframammary fold, surgical clips, intramammary adenopathy, and benign-appearing masses. Radiologist 1 reported 18 (45%) abnormal preoperative mammograms with a total of 29 reported abnormalities (ie, each of 11 films demonstrated 2 abnormalities). Radiologist 2 reported 12 (30%) abnormal preoperative mammograms.

An example of a study patient who demonstrated a mammographic abnormality was a 29-year-old woman who had a benign-appearing nodular mass (Figure 1); Radiologist 1 recommended interval evaluation with repeat mammography at 6 months. In total, Radiologist 1 recommended additional views (magnification/com-
pression) or 6-month repeat interval mammography for 4 patients, whereas Radiologist 2 made such recommendations for a total of 7 patients. The mammographic abnormalities identified by the 2 radiologists in the unblinded preoperative studies are summarized in Table 2. The differences in results given by the 2 radiologists stemmed from more stringent reporting by Radiologist 1. The 6 calcifications noted in patients by Radiologist 2 were included in the 15 reported by Radiologist 1, and the single case of architectural distortion observed by Radiologist 2 was included in the 5 observations of architectural distortion by Radiologist 1.

Postoperative Mammograms
The unblinded postoperative studies were matched with the 2 radiologists’ reports. Radiologist 1 reported far more abnormalities than Radiologist 2 because of his broader definition of abnormality, which included skin thickening inferiorly, nipple elevation, high-to-low parenchymal transposition, duct discontinuity, and retroareolar fibrotic band, which are all characteristic postsurgical radiographic features easily differentiated from malignant changes (Table 3; Figures 2-4).

Discounting these characteristic postsurgical changes, Radiologist 1 reported 23 (58%) abnormal postoperative mammograms and Radiologist 2 reported 20 (50%) abnormal postoperative mammograms. Radiologist 1 reported that 15 of these abnormal mammograms displayed 3 abnormalities each and 8 of them displayed 2

![Figure 2. Retroareolar cord.](image1)

![Figure 3. High-to-low transposition of breast parenchyma.](image2)
abnormalities each. Radiologist 2 reported 1 mammogram with multiple abnormalities.

Based on the postoperative studies, Radiologist 1 requested additional mammographic views or interval follow-up mammography for 6 patients; Radiologist 2 requested interval follow-up mammography for 7 patients. Radiologist 1 recommended biopsy for 2 patients, one 60 and the other 61 years of age, on the basis of the postoperative studies; Radiologist 2 did not recommend biopsy for any of the study patients on the basis of these mammograms.

Adequacy of Studies
Radiologist 1 indicated that 8 (10%) of the studies presented were inadequate and that he would have requested additional mammographic evaluations. The deficiencies that Radiologist 1 reported resulted from generally insufficient views (1 preoperative study), insufficient views of breast parenchyma (2 preoperative and 4 postoperative studies), and radiologic artifacts (1 preoperative study).

Postreduction Mammographic Changes
The radiologists were relatively successful in differentiating between preoperative and postoperative studies. Radiologist 1 correctly identified 91% of the preoperative films and 53% of the postoperative films (72% correct overall). Radiologist 2 correctly identified 74% of the preoperative films and 35% of the postoperative films (54% correct overall). Radiologist 1 identified each mammogram presented as either preoperative or postoperative, whereas Radiologist 2 was unable to make this determination in 22% of the studies. The radiologists were in agreement in the correct identification of 68% of the preoperative views and 32% of the postoperative views, for an overall agreement of 50%. Both radiologists were less accurate in identifying postoperative views than they were in identifying preoperative views on the basis of the McNemar test (Radiologist 1: $\chi^2 = 7.58$, $P < .01$; Radiologist 2: $\chi^2 = 4.65$, $P < .05$).

Discussion
Rees and Coburn described a single case of breast cancer in a patient who developed a palpable breast mass.
soon after reduction mammaplasty, although clinically documented preoperative mammography had not shown a positive result for cancer. In another report, 4 breast reduction patients were found to have carcinoma that had been unsuspected before surgery, and 3 other women who underwent unilateral reduction to match postmastectomy reconstructions were found to have carcinoma. All of these patients had undergone preoperative physical examinations, but not preoperative mammography. All of the patients, except for one 39-year-old woman, were over 45 years of age. Because of concern about the potential for discovery of an occult carcinoma perioperatively, several authors, on the basis of anecdotal reports such as these, have advocated routine preoperative mammographic screening. The American Cancer Society and American College of Radiology have recommended baseline mammographic screening for all women 35 to 40 years of age; this recommended age for baseline mammography was amended by the National Cancer Institute to 40 years.

Malignancies found before, during, or after routine plastic surgical breast procedures have been statistically evaluated in a series of 9172 operations for breast reduction, augmentation, and gynecomastia. Malignancies were reported in 30 (0.3%) patients. Of the 5008 breast reduction patients, 0.4% had diagnosed perioperative malignancies.

Although our preoperative mammographic evaluations did not disclose any breast malignancies, several abnormalities were identified; few of these required any further specific action. Discovery of a perioperative breast cancer seems to be a rare occurrence. Therefore, we do not recommend routine preoperative mammographic screening in all breast reduction patients under 40 years of age, although such a decision rests finally with the patient and her plastic surgeon. However, we agree with recommendations by the American Cancer Society and the National Cancer Institute that clinical breast examinations and mammography should be performed preoperatively in breast reduction patients 40 years of age or older. For a patient contemplating breast surgery, the radiologist should obtain any additional views deemed appropriate for even apparently insignificant mammographic irregularities.

Making a decision concerning recommendations for routine postreduction mammographic baseline screening is more difficult. Anecdotal reports indicate that benign fat necrosis, foreign body reaction to suture material, intra-mammary scar tissue, and other characteristic postoperative changes may mimic carcinoma after both breast biopsy and reduction mammaplasty. Some authors have surmised that the reported low incidence of breast cancer among patients seeking plastic surgery of the breasts may be a result of the relative youth of that population (our study group, with a mean age of 45 years, may have been atypical). However, that patient population will age and may be expected to develop breast cancers in the face of postsurgical mammographic abnormalities. There appear to be few reports of false-negative mammograms in which mammographic changes have masked malignancy.

Postreduction mammographic changes are generally not difficult to distinguish from indicators of malignancy. Clinically recognized postreduction mammographic changes include high-to-low parenchymal distribution, swirled architectural distortion, high nipple, nipple tilt, skin thickening around the areola and in the lower breast, lower-breast retraction, discontinuous subareolar ducts (after free-nipple graft), retroareolar banding, masses, and calcifications. Fat necrosis is relatively common after breast reduction, often beginning with vague, patchy areas of mottled architectural distortion; oil cysts may then form and calcify, and fibrosis manifested by stippling may occur. Oil cysts may cause concern if they are clinically palpable, but they can be differentiated from carcinoma in most cases by mammography and ultrasound. Calcifications are also suspect when they appear initially in mammograms, but readily identifiable, coarse, benign plaques often develop later.

The timing of postoperative mammography, if recommended, is important. The breasts should be nontender and compressible—conditions unlikely to be present for at least 3 months after surgery. Mammographic changes often occur in the early postoperative course and then decrease in frequency, stabilizing approximately 6 months after surgery. Calcifications usually do not develop for at least 6 months after surgery. Initial postoperative mammography should be performed within 6 months after surgery, since after that time mammographic abnormalities must be viewed as possible interval malignancies rather than benign postsurgical changes. We therefore conclude that the ideal time for initial postoperative mammography is from 3 to 6 months after surgery is performed.

The 2 radiologists who participated in this study correctly identified changes attributable to characteristic postsurgical abnormalities in 53% and 35% of the
mammograms they evaluated. One approach to postoperative mammography is to recommend that all breast reduction patients undergo baseline and interval mammography. However, if only a small percentage of operated breasts later develop mammographic features sufficiently suspect to require biopsy, most patients can be considered to derive no benefit from postoperative baseline mammography. Another approach is to recommend baseline mammography only for patients at increased risk either because of age (≥40 years) or family/personal history of cancer—the same group for which preoperative mammographic evaluation is recommended. Among the other patients who should be included in this group are those whose excised breast tissue demonstrates suspect histologic features, such as epithelial hyperplasia. Of course, any recommendation must be combined with compliance of the patient population. Despite persistent efforts to follow up on the subjects of this study, 6 (23%) of the original 26 subjects did not have postoperative mammography, and only 10 subjects had mammography within 6 months of surgery.

On the basis of the results of this study as well as a review of the available published medical literature, we do not recommend preoperative screening mammography for all breast reduction patients; instead, we recommend it only for patients who fall within the increased-risk guidelines of the American Cancer Society and the National Cancer Institute. These patients should also undergo postoperative mammography 3 to 6 months after breast reduction, as has been recommended by other authors. Although routine preoperative and postoperative mammography is not recommended for all breast reduction patients, the individual preferences and circumstances of each patient must be considered.

References