Reconstructive Approach for Patients With Augmentation Mammaplasty Undergoing Nipple-Sparing Mastectomy

Michael Alperovich, MD; Mihye Choi, MD; Jordan D. Frey, MD; and Nolan S. Karp, MD

Abstract
Background: Nipple-sparing mastectomy (NSM) is a recent advance in the therapeutic and prophylactic management of breast cancer; however, the procedure is associated with increased reconstructive complications. Data on NSM after previous breast augmentation are limited.

Objectives: The authors compared reconstructive complications after NSM between patients with previously augmented breasts and a larger cohort that had not undergone prior augmentation. An approach to NSM that involves 2-stage reconstruction in augmented patients is also described.

Methods: Medical records of NSMs performed at New York University Langone Medical Center from 2006 to 2013 were reviewed. Data points evaluated included patient characteristics, comorbidities, breast implant plane, and reconstructive complications. Fisher’s exact and t tests were used for the comparisons.

Results: During the study period, NSMs were performed in 17 augmented breasts at this institution. After NSM, 15 of these breasts underwent implant-based reconstruction and 2 breasts underwent microvascular free flaps. Reconstructive complications included 1 hematoma managed nonoperatively (5.9%) and 1 partial necrosis of the nipple-areola complex (NAC) (5.9%). Compared with the larger nonaugmented cohort (n = 332), patients with previously augmented breasts had fewer complications, and there were no statistically significant differences in the rates of mastectomy flap necrosis, partial NAC necrosis, complete NAC necrosis, hematoma, capsular contracture, explantation, implant displacement, seroma, or breast cellulitis.

Conclusions: The results indicate that NSM reconstruction is associated with minimal complications in patients with previous augmentation mammoplasty.

Level of Evidence: 4

Keywords
nipple-sparing mastectomy, breast augmentation, breast reconstruction, mastectomy

Accepted for publication January 21, 2014.
diagnosis after breast augmentation.\textsuperscript{5} However, 13\% of all women will be diagnosed with breast cancer during their lifetime.\textsuperscript{5}

Patients with augmented breasts who subsequently develop breast cancer often require mastectomy, even if they are initially treated with breast conservation therapy.\textsuperscript{6} Although the management of breast cancer in these patients remains controversial, previous augmentation in both subglandular and subpectoral planes expands the breast skin, theoretically induces increased vessel ingrowth and tissue vascularity,\textsuperscript{7,8} and potentially facilitates reconstruction.

Given the prevalence of augmentation mammoplasty and the growing popularity of NSM, we present a reconstructive algorithm for NSM in patients with previous breast augmentation and determine the reconstruction-related complications and tissue expander (TE) fill patterns in this subpopulation. Theoretically, expansion from previous augmentation should allow for greater TE fill volume after NSM.

**METHODS**

Medical records of all patients who underwent NSM at New York University Langone Medical Center from February 2006 through September 2013 were reviewed retrospectively. Approval for the study was granted by the Institutional Review Board at New York University Langone Medical Center. Patients who had undergone breast augmentation were also identified. Collected data included demographics, comorbidities, breast implant plane, breast implant size, mastectomy specimen weight, TE size, intraoperative and postoperative TE fill patterns, final implant size, and reconstructive complications. Tissue expander fill was determined as both absolute volume (in cubic centimeters) and as a percentage of TE size. The TE fill percentage was calculated as the volume injected intraoperatively divided by the volume listed on the TE, multiplied by 100.

All patients had been offered the full range of options for implant-based and autologous reconstruction. Nipple-sparing mastectomy was presented to eligible women as an option for breast cancer treatment or as prophylactic management for risk reduction. The final choice of reconstruction method was based on discussions between the patient and her plastic surgeon.

Incision sites were determined and marked jointly by the breast surgeon and plastic surgeon. Prior to surgery, the breasts were infiltrated with 0.5\% lidocaine with 1:200 000 epinephrine, along the marked incision and dissection planes.

Mastectomies were performed sharply with minimal use of electrocautery. In most cases, subareolar tissue was dissected sharply and sent for pathologic examination. Patients were counseled preoperatively that abnormal pathologic results would require resection of the NAC.

**Comparisons and Statistical Analysis**

Patients who underwent NSM plus augmentation were compared with the remaining NSM population. Characteristics of the study groups were compared by $t$ test analysis, and complication rates were compared with the Fisher’s exact test. Statistical significance was defined as $P < .05$.

**RESULTS**

**Demographics**

Between February 2006 and September 2013, 501 NSMs ($N = 293$ patients) were performed at our institution. Of these, 17 were in patients ($n = 10$) with a history of augmentation mammoplasty. The remainder were in patients who had not undergone augmentation. The latter patients served as the control group.

Indications for NSM in the 17 augmented breasts were therapy for breast cancer (58.8\%), contralateral prophylactic management (23.5\%), or high-risk prophylactic management (ie, BRCA mutation) (17.6\%). None of the patients in this study group were smokers or had diabetes. Their mean age was 49.8 years, mean body mass index (BMI) was 20.4 kg/m$^2$, and mean follow-up time was 15.8 months. Results are summarized in Table 1.

Partition type was subglandular in 8 (47.1\%) of the 17 breasts, submuscular in another 8 (47.1\%), and not known in 1 case. Reconstruction was implant based in 15 (88.2\%) of the 17 breasts. The other 2 breasts (11.8\%) received microvascular free flaps.

Incision type was discussed and determined preoperatively by the breast surgeons and plastic surgeons. The previous incision site was used whenever possible. For therapeutic mastectomies, incision sites were based on the location of the primary cancer.

The average intraoperative fill volume in TE cases was 200 cc, with a standard deviation (SD) of 73.6 cc; the average fill percentage ([intraoperative fill volume/total TE volume] × 100) was 52.8\%, with an SD of 12.5\%.

All TEs were Natrelle 133 MV style (Allergan, Inc, Irvine, California), and size selection was based on the width of the breast mound. Sizes ranged from 250 to 500 cc. Expansion of the TE began shortly after surgery, and the mean time from mastectomy to full expansion was 2.6 months. Acellular dermal matrix was placed in 8 breasts and a SERI Surgical Scaffold (Allergan, Inc) in 1 breast.

After mastectomy, drains were placed for all reconstructions, regardless of method. The most common drain type was Hemovac (Zimmer, Warsaw, Indiana). Before extubation, a mixture containing bupivacaine was injected.
through the drain for perioperative analgesia. The drains were removed during posttreatment follow-up once output was consistently below 30 mL/d. Drains were not used when the TE was exchanged for a permanent implant.

Table 2 lists the patient’s preoperative breast cup size (if known), size of implants for augmentation, size of TE and reconstructive implants, type of mastectomy incision, weight of mastectomy specimen (if known), utilization of acellular dermal matrix, TE fill pattern, and time to full TE expansion. Natrelle Style 410 silicone implants (Allergan, Inc) were placed in 2 breasts, and Natrelle Style 20 silicone implants (Allergan, Inc) were placed in 15 breasts. The average number of TE expansions was 4.2.

Reconstructive Outcomes

Reconstructive complications included a hematoma managed nonoperatively in 1 of 17 breasts (5.9%) and partial necrosis of the NAC in 1 breast (5.9%). Two NACs were resected because of positive subareola biopsy results. The resected NACs were not included in the final statistical analyses of partial and complete NAC necroses. There were no instances of mastectomy flap necrosis, complete NAC necrosis, cellulitis requiring oral or intravenous antibiotics, explantation, capsular contracture, or seroma (Table 3).

Patient characteristics and reconstructive complications were compared between the 10 previously augmented patients (17 breasts) and the rest of our NSM cohort (control group of 199 patients [332 breasts] without prior augmentation). According to t test analysis, mean BMI was significantly lower for the augmentation group (20.4 vs 24.1 kg/m² for controls; \(P = .02\)), but mean age was similar (49.8 vs 47.3 years, respectively; \(P = .27\)).

Thirteen breasts in 8 patients had TEs. Among the control group, 247 of the 332 breasts underwent TE placement. The average intraoperative TE fill volume was higher in the augmentation group (8 of whom had TE placement) than the control group (200 vs 184.4 cc, respectively; \(P = .53\)), as was the TE fill percentage (53% vs 47.0%, respectively; \(P = .21\)) (Figure 1).

Complications between groups were compared with the Fisher’s exact test. Although the augmented group had fewer complications, there were no statistically significant differences in the incidence of mastectomy flap necrosis, partial NAC necrosis, complete NAC necrosis, breast cellulitis treated with oral or intravenous antibiotics, hematoma, capsular contracture, explantation, implant displacement, or seroma (Table 3).

Figure 2 includes pre- and postoperative photographs of a patient with augmentation mammoplasty who subsequently underwent bilateral NSM with TE reconstruction.

DISCUSSION

To our knowledge, this is the largest study of reconstruction-related complications after NSM in patients who previously underwent augmentation mammoplasty. Tissue expanders were the preferred reconstructive method for these patients, given their limited donor site availability for autologous fat. Moreover, the 2-stage reconstruction placed less initial tension on the mastectomy flaps and provided an opportunity for minor revisions during the second stage. The subset of previously augmented patients experienced fewer complications overall than our larger NSM cohort; however, the difference was not significant.

The reconstructive benefit of preoperative breast augmentation has been described for prophylactic skin-sparing mastectomies.9 The breast implant expands the breast-skin envelope, which increases vascularity of the overlying skin and soft tissue.7,8 Greater intraoperative TE fill volume (both absolute volume and relative to TE size) was demonstrated for the previously augmented breasts.

In general, women who seek breast augmentation have low BMI.10 This was true for our study, in which 15 of the 17 reconstructions were implant based due to limited availability of autologous tissue.
Our approach to breast reconstruction after NSM in previously augmented patients consists of explantation, immediate TE placement followed by a rapid expansion period, and subsequent exchange of the TE for a permanent implant. With submuscular breast augmentation, every effort is made to leave the implant capsule intact and replace the implant with a TE. If a portion of the capsule is resected during mastectomy, acellular dermal matrix is typically placed. With subglandular breast augmentation, a capsulectomy is performed and a submuscular plane is created for the implant-based reconstruction. Of the 8 breasts with previous subglandular augmentation in our study, 4 were reconstructed with acellular dermal matrix.

Unlike other mastectomy procedures, NSM preserves the entire skin envelope and has been associated with increased complications during the healing process. However, placing TEs rather than immediate implants limits tension on the mastectomy flaps postoperatively and has the benefit of symmetric expansion. Although NSM flap viability has been evaluated with indocyanine green angiography in the past, none of the breasts in our series were examined with this technology.

Two-stage TE reconstruction remains our preferred technique after NSM because it allows for minor revisions to the mastectomy envelope or implant pocket during the second stage. To return patients to their preoperative breast size, final implant volume is approximated as the sum of the resected breast tissue and the volume of the augmentation implant. In the setting of autologous reconstruction, every effort is made to return patients to their preoperative breast size. The main limitation is availability of sufficient donor tissue.

With our protocol, the nipple is not anchored to the underlying tissue at the time of mastectomy because we have found that this creates a dimple in the NAC, distorting the nipple. At the second stage of reconstruction, minor revisions can be made to centralize the NAC or correct any vertical discrepancies.

<table>
<thead>
<tr>
<th>Breast No.</th>
<th>Preoperative Breast Size (Cup)</th>
<th>Prior Implant Size, cc</th>
<th>Mastectomy Incision Type</th>
<th>Mastectomy Specimen Weight, g</th>
<th>ADM Use</th>
<th>TE Size,a cc</th>
<th>Initial TE Fill,a cc</th>
<th>No. of Expansions</th>
<th>Time From Mastectomy to Full Expansion, mo</th>
<th>Type and Size of Permanent Implantb</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not known</td>
<td>270</td>
<td>Lateral ellipse</td>
<td>260</td>
<td>No</td>
<td>400</td>
<td>200</td>
<td>Not known</td>
<td>3.3</td>
<td>Style 20, 450 cc</td>
</tr>
<tr>
<td>2</td>
<td>Not known</td>
<td>270</td>
<td>Lateral</td>
<td>264</td>
<td>Yes</td>
<td>400</td>
<td>200</td>
<td>Not known</td>
<td>3.3</td>
<td>Style 20, 450 cc</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>450</td>
<td>IMF</td>
<td>382</td>
<td>Yes</td>
<td>500</td>
<td>250</td>
<td>5</td>
<td>3.1</td>
<td>Style 20, 600 cc</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>450</td>
<td>IMF</td>
<td>375</td>
<td>Yes</td>
<td>500</td>
<td>300</td>
<td>5</td>
<td>3.1</td>
<td>Style 20, 600 cc</td>
</tr>
<tr>
<td>5</td>
<td>D</td>
<td>275</td>
<td>Lateral</td>
<td>370</td>
<td>Yes</td>
<td>400</td>
<td>300</td>
<td>3</td>
<td>2.2</td>
<td>Style 20, 450 cc</td>
</tr>
<tr>
<td>6</td>
<td>D</td>
<td>255</td>
<td>Lateral</td>
<td>404</td>
<td>Yes</td>
<td>400</td>
<td>300</td>
<td>3</td>
<td>2.2</td>
<td>Style 20, 450 cc</td>
</tr>
<tr>
<td>7</td>
<td>B</td>
<td>230</td>
<td>UlQ ellipse</td>
<td>160</td>
<td>No</td>
<td>250</td>
<td>100</td>
<td>4</td>
<td>1.4</td>
<td>Style 410, 425 cc</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
<td>230</td>
<td>IMF</td>
<td>122</td>
<td>No</td>
<td>250</td>
<td>100</td>
<td>4</td>
<td>1.4</td>
<td>Style 410, 425 cc</td>
</tr>
<tr>
<td>9</td>
<td>B</td>
<td>325</td>
<td>IMF</td>
<td>102</td>
<td>No</td>
<td>300</td>
<td>150</td>
<td>4</td>
<td>1.9</td>
<td>Style 20, 450 cc</td>
</tr>
<tr>
<td>10</td>
<td>B</td>
<td>350</td>
<td>IMF</td>
<td>68</td>
<td>No</td>
<td>300</td>
<td>150</td>
<td>4</td>
<td>1.9</td>
<td>Style 20, 450 cc</td>
</tr>
<tr>
<td>11</td>
<td>Not known</td>
<td>286</td>
<td>Lateral IMF</td>
<td>314</td>
<td>No</td>
<td>400</td>
<td>250</td>
<td>3</td>
<td>1.9</td>
<td>Style 20, 425 cc</td>
</tr>
<tr>
<td>12</td>
<td>C</td>
<td>325</td>
<td>Lateral ellipse</td>
<td>Not known</td>
<td>Yes</td>
<td>450</td>
<td>150</td>
<td>6</td>
<td>6</td>
<td>Style 20, 450 cc</td>
</tr>
<tr>
<td>13</td>
<td>Not known</td>
<td>225</td>
<td>Lateral IMF</td>
<td>Not known</td>
<td>Yes</td>
<td>300</td>
<td>150</td>
<td>5</td>
<td>2.4</td>
<td>Style 20, 375 cc</td>
</tr>
<tr>
<td>14</td>
<td>C</td>
<td>200</td>
<td>Lateral</td>
<td>294</td>
<td>Yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Style 20, 425 cc</td>
</tr>
<tr>
<td>15</td>
<td>C</td>
<td>200</td>
<td>Periareolar</td>
<td>154</td>
<td>Yes</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Style 20, 425 cc</td>
</tr>
<tr>
<td>16</td>
<td>Not known</td>
<td>272</td>
<td>Lateral</td>
<td>184</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>17</td>
<td>Not known</td>
<td>222</td>
<td>Vertical</td>
<td>253</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

ADM, acellular dermal matrix; IMF, inframammary fold; NA, not applicable; TE, tissue expander; UlQ, upper inner quadrant.

aAll tissue expanders were Natrelle 133 MV style (Allergan, Inc, Irvine, California).
bNatrelle styles.
cSERI Surgical Scaffold (Allergan, Inc).
A single-stage, direct-to-implant reconstruction is offered to patients for whom this is a priority. However, patients who undergo NSM are advised of a possible decrease in final breast size.

Other studies of breast reconstruction in previously augmented patients have focused on oncologic risk, method of cancer detection, feasibility of breast conservation therapy, efficacy of lymphatic mapping, method of reconstruction, and indications for previous implant retention or removal. We found only 2 published studies of NSM breast reconstruction in augmented patients. One study included 12 previously augmented patients who received a direct implant after NSM or skin-sparing mastectomy. No increase in reconstructive complications was observed when these patients were compared with the control group. In the other study, 9 NSM reconstructions were performed in 35 previously augmented patients. However, reconstructive complications were not specifically addressed in the results.

In our study of NSM after breast augmentation, the 2-stage implant-based reconstruction was common. Previous augmentation provided a preexpansion effect that allowed greater intraoperative TE fill and fewer reconstructive complications, with a trend toward significance. Although incorporation of TEs necessitated an additional procedure, the need for an average of 4.2 expansions over 2.6 months was acceptable for the potential benefit.

A single-stage, direct-to-implant reconstruction is offered to patients for whom this is a priority. However, patients who undergo NSM are advised of a possible decrease in final breast size.

The fact that the augmented patients in our series were not matched to the remaining NSM population with respect to BMI is a limitation of our study. However, lower BMI is characteristic of breast augmentation patients in general. In addition, our sample size is relatively small, an inherent constraint given the limited number of augmented patients who undergo NSM. Moreover, the duration of follow-up was moderate in our study, and thus some instances of capsular contracture might not have been captured.

### CONCLUSIONS
As a recent advance in the therapeutic and prophylactic management of breast cancer, NSM is associated with reconstructive complications. Data on NSM after previous breast augmentation are limited. To our knowledge, this is the largest study of NSM in patients with previous breast augmentation. With our reconstructive approach, only minimal complications occurred in these patients.

<table>
<thead>
<tr>
<th>Complication</th>
<th>No. (%) of Breasts</th>
<th>P Value (Difference Between Study Groups*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematoma</td>
<td>1 (5.9)</td>
<td>.10</td>
</tr>
<tr>
<td>Partial necrosis of nipple-areola complex</td>
<td>1 (5.9)</td>
<td>.60</td>
</tr>
<tr>
<td>Complete necrosis of nipple-areola complex</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Mastectomy flap necrosis</td>
<td>0</td>
<td>.38</td>
</tr>
<tr>
<td>Breast cellulitis treated with oral antibiotics</td>
<td>0</td>
<td>.15</td>
</tr>
<tr>
<td>Breast cellulitis treated with intravenous antibiotics</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Capsular contracture</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Expantation</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Implant displacement</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Seroma</td>
<td>0</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*The comparison group comprised 199 patients and 332 nipple-sparing mastectomies.

---

**Figure 1.** Comparison of intraoperative tissue expander (TE) fill volumes during nipple-sparing mastectomy for therapeutic or prophylactic management of breast cancer in previously augmented patients (n = 10; 17 breasts) and nonaugmented patients (n = 199; 332 breasts). Fill volume was expressed in cubic centimeters and as a percentage of TE volume.
Disclosures
The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Funding
The authors received no financial support for the research, authorship, and publication of this article.

REFERENCES

Figure 2. (A, C, E) This 54-year-old woman with newly diagnosed invasive carcinoma in the left breast had undergone breast augmentation 16 years earlier. (B, D, F) Subsequently, she underwent bilateral nipple-sparing mastectomy followed by 2-stage reconstruction consisting of tissue expanders and permanent implants. These photographs were obtained 18 months after the second stage of reconstruction.


