The Nipple–Areola Preserving Mastectomy: The Value of Adding a Delay Procedure

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Background: Conservative mastectomy procedures, such as the nipple-sparing mastectomy (NSM), present appealing options for patients with small invasive or noninvasive malignancies and those needing prophylactic mastectomies. Despite outstanding postoperative cosmetic results, nipple–areola complex (NAC) and mastectomy skin flap (MSF) survival remains a concern. We present our two-stage nipple–areola preserving (NAP) mastectomy, which aims to decrease the rate of NAC loss and MSF necrosis after conservative mastectomies.

Material and Methods: Seventy patients who underwent NSM because of malignant and benign conditions were divided into 2 groups: those who underwent our two-stage NAP mastectomy were matched to the group of mastectomy patients without preservation techniques. Demographic data and postoperative results were retrospectively assessed.

Results: The NAP group comprised 45 flaps (24 patients), and the NSM group comprised 75 flaps (46 patients). None were actively smoking. The mean time between the delay of the flap and breast reconstruction was 17.6 days (range, of 10–35 days) in the NAP group. No signs of NAC vascular compromise were observed in the NAP group. Nipple necrosis rates were significantly greater ($P = 0.0136$) in the NSM group: 9 cases in the NSM group versus none within the NAP group. Two patients within the NAP group required nipple excision at the time of their mastectomies after biopsies performed at the time of the NAC delay were positive for malignancy or atypia.

Conclusions: Vascular delay techniques favor the blood supply of a tissue after a surgical wound, effectively improving the survival of the NAC and MSF after nipple-sparing mastectomies. (Plast Reconstr Surg Glob Open 2016;4:e1098; doi: 10.1097/GOX.0000000000001098; Published online 23 November 2016.)

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factors like smoking, incision orientation, degree of ptosis, or increased age are known to influence the survival of the NAC. Preservation of some retroareolar tissue, which is required for adequate perfusion and NAC survival, is of oncologic concern after NSM. As reported by Gerber et al. after mean follow-ups of 101 months, MSF and the NAC are common locations for recurrence after NSM, with rates of 11.7% and 1.7%, respectively.

The nipple–areola preserving (NAP) mastectomy exemplifies current developments in the treatment and reconstructive options for patients scheduled to undergo mastectomy. The NAP mastectomy is a multistaged procedure in which the NAC and central MSFs are surgically delayed to improve its survival in patients undergoing mastectomy and subsequent reconstruction. The surgical delay of the tissue promotes an increase in blood supply and therefore survival of the NAC and mastectomy flaps. In addition, the staged nature of the NAP mastectomy allows sentinel lymph node and subareolar biopsies to be taken in case of malignant disease and analyzed via permanent section pathology to identify NSM candidates for adjuvant chemoradiation protocols before definitive resection and reconstruction.

**PATIENTS AND METHODS**

After approval by the institutional review board, we conducted a retrospective review of 70 consecutive patients who underwent breast reconstruction after nipple-sparing mastectomies (NSM) for benign or malignant disease between October 2010 and June 2015 in our practice. These flaps were retrospectively grouped based on whether a premastectomy procedure was performed or not. Surgical approaches for breast reconstruction included autologous tissue with the deep inferior epigastric perforator (DIEP) flap and prosthetic devices, either implants or tissue expanders. Forty-five flaps from 24 patients, the NAP group, underwent the two-stage NAP procedure. Seventy-five flaps from 46 patients, the NSM group, underwent mastectomies and breast reconstruction without any previous procedures. The resulting cohorts were subjected to comparative analysis.

The first stage of the NAP procedure was performed 2 to 3 weeks before scheduled mastectomies: it consisted in raising the skin flaps and undermining of the NAC, followed by placement of a silicone sheeting in the dissected pocket. Sentinel lymph node and subareolar biopsies were concurrently performed, if pertinent. For this study, sentinel lymph node biopsies were performed in 6 patients. The 2- to 3-week delay was chosen to allow sufficient time for vascular growth within the breast skin flaps, with an increase in NAC subdermal plexus perfusion in the absence of the normal dominant blood supply. In addition, it gave us a window to assess the pathology results.

Demographic data and intraoperative and postoperative outcomes were assessed and collected in an institutional review board–approved database and retrospectively analyzed. Demographic parameters include age, body mass index, American Society of Anesthesiologists score, and history of previous abdominal surgeries. Likewise, we assessed the rates of readmission and reoperation. The delay of the flap and breast reconstructions in every patient were performed by a board-certified plastic surgeon (S.G.B.).

Categorical data are expressed as frequency (%). Continuous parameters are shown as mean ± SD and median or range. Categorical variables were analyzed using chi-square or Fisher’s exact tests, Student’s t test for normally distributed continuous variables, and Wilcoxon rank-sum test for nonnormally distributed continuous variables. A P value of less than 0.05 was considered to be statistically significant.

**Technique**

Under general anesthesia, a transverse incision approximately 1 cm superior to the inframammary fold is made, and the flap carefully elevated in the plane separating the subdermal adipose and breast parenchyma via electrocautery (Fig. 1). Displacement of the incision cephalad from the inframammary fold allows a higher and wider interspace to be reached, permitting microvascular anastomosis without rib resection in future DIEP flap patients; the mastectomy, performed during the second stage, uses the same incision. Dissection then proceeds cephalad toward the NAC. After fully undermining the NAC, the plane of dissection is extended approximately 5 cm medial, 5 cm lateral, and 2 cm superior to the areolar border, resulting in a trapezoidal pocket (Fig. 2). Great care is taken during dissection to divide the breast tissue from the subcutaneous fat without damaging the subdermal plexus vasculature as this is now the skin flap’s and NAC’s single source of perfusion. A 20-cm × 15-cm piece of 0.050-cm thick nonreinforced silicone sheet (Alliedsil, Allied Biomedical, Calif.) is then cut to fit the dissected

![Fig. 1. Superior to the inframammary fold, a transverse incision is made with elevation of the skin flap and separation of the subdermal adipose and breast parenchyma.](image-url)
area and placed between the skin and the breast tissue along with a 15-French Blake drain at the bottom of the pocket (Fig. 3). Before closing, subareolar nipple biopsy is sent for permanent pathology. In addition, sentinel node biopsy can be performed at this stage by the breast surgeon if indicated via axillary lymph node dissection. After 2 to 3 weeks, the second stage of the NAP procedure, including silicone sheet removal and NSM by the breast/general surgeon, is performed followed by immediate reconstruction.

RESULTS

The NAP group comprised 45 flaps (24 patients: 21 bilateral and 3 unilateral), and the NSM group comprised 75 flaps (46 patients: 29 bilateral and 17 unilateral). No significant difference was found between the groups in terms of age, body mass index, or American Society of Anesthesiologists score. It is the standard protocol in our practice to instruct the patients to abstain from smoking 2 weeks before any surgical procedure, and none were actively smoking at the time of their surgeries. The NSM group had a greater statistical significance \( (P = 0.0042) \) when comparing overall rates of adjuvant chemotherapy (both preoperative and postoperative) to the NAP group. No significant difference was found when individually comparing the timing of the chemotherapy (preoperative vs postoperative). Additional preoperative characteristics of the cohorts are shown in Table 1.

We found a significant difference \( (P = 0.0039) \) in terms of indications for mastectomies where malignancy was predominant in the NSM group and benign conditions, including Breast Cancer (BRCA) genes 1/2 mutation, were predominant within the NAP group. Clinical diagnoses and approaches to breast reconstruction are summarized in Table 2.

The mean time between the delay of the flap and breast reconstruction was 17.6 days (range, 10–35 days) in the NAP group. Scheduled mastectomies were delayed for 2 additional weeks in 1 patient because of ischemic skin flaps without evidence of necrosis. Indications for tissue expansion in both groups included desire for larger-than-native breast volumes. No intraoperative complications were observed during any stage in both groups. The length of hospitalization after breast reconstruction was significantly greater \( (P = 0.0064) \) in the NSM group although the difference in terms of type of reconstruction was not statistically relevant between both cohorts \( (P = 0.0842) \); 1 flap from the NSM group developed venous congestion, requiring immediate operative take-back and extending the hospitalization. The mean follow-up for the NAP and NSM groups was 15.1 weeks (range, 8–29) and 9.5 weeks (range, 6–23), respectively.

Table 3 summarizes our postoperative results. One NAP patient developed edge necrosis along the incision lines bilaterally after breast reconstruction, without affecting the NAC, and completely debrided during an office follow-up. Nipple necrosis rates were significantly greater \( (P = 0.0136) \) in the NSM group. These cases were collected from 6 NSM patients.
patients undergoing DIEP flap breast reconstruction: 3 bilateral and 3 unilateral cases; of these, 2 had a remote history of smoking with no previous radiation or relevant medical history. NSM patients who presented with necrotic skin flaps also underwent debridement. To note, 1 patient within the NAP group developed a superficial skin infection to the right breast after DIEP flap breast reconstruction, promptly resolved with oral antibiotics, and no expander/implant loss was recorded in any of the study groups.

Subareolar nipple biopsy was positive for ductal carcinoma in situ in 1 patient within the NAP group and required bilateral nipple resection at the time of mastectomy and reconstruction. In addition, 1 patient underwent left nipple excision after a skin nipple biopsy was positive for metaplasia. Unilateral nipple inversion was seen in 1 NAP patient who underwent implant-based reconstruction, which was corrected with auricular cartilage grafting. Figure 4 presents the steps comprising this technique in a patient who underwent reconstruction with the DIEP flap.

Table 1. Preoperative Characteristics

| Parameters              | NAP (n = 45) | NSM (n = 75) | P   |
|-------------------------|--------------|--------------|-----|
| Age (yr)                | 48.2 ± 10.4  | 46.5 ± 10.3  | 0.3849|
| BMI (kg/m²)             | 25.1 ± 4.7   | 24.5 ± 3.7   | 0.4394|
| Median (range)          | 25.8 (18–35.5)| 23.7 (18–35.1)|   |
| ASA score               | 2            | 2            | 1   |
| Previous abdominal surgeries (%) | 25 (55.5) | 46 (61.3) | 0.67 |
| Radiation               | 5 (11.1)     | 3 (4)        | 0.10 |
| Preoperative            | 2 (4.4)      | 3 (4)        | 1   |
| Postoperative           | 3 (4)        | 0            | 0.0505|
| Chemotherapy            | 8 (17.7)     | 34 (45.3)    | 0.0042*|
| Preoperative            | 6 (13.3)     | 24 (32)      | 0.029*|
| Postoperative           | 2 (4.4)      | 10 (13.3)    | 0.207|

*Statistically significant.

ASA, American Society of Anesthesiologists; BMI, body mass index; N/A, not applicable.

Table 2. Diagnosis and Operations

| Parameters              | NAP (n = 45) | NSM (n = 75) | P   |
|-------------------------|--------------|--------------|-----|
| Clinical diagnosis (%)  |              |              |     |
| Cancer                  | 32 (71.1)    | 69 (92)      | 0.0039*|
| Benign/premalignant     | 13 (28.9)    | 6 (8)        |     |
| Type of reconstruction (%) |            |              |     |
| DIEP flap               | 29 (64.5)    | 60 (80)      | 0.0842|
| Prosthetic based        | 16 (35.5)    | 15 (20)      |     |
| Laterality (%)          |              |              |     |
| Bilateral               | 42 (93.3)    | 58 (77.3)    | 0.0243*|
| Unilateral              | 3 (6.7)      | 17 (22.7)    |     |

*Statistically significant.

Table 3. Postoperative Results

| Parameters              | NAP (n = 45) | NSM (n = 75) | P   |
|-------------------------|--------------|--------------|-----|
| Complications (%)       | 3 (6.6)      | 26 (34.6)    | 0.0004*|
| Skin flap necrosis (%)  | 2 (4.4)      | 10 (13.3)    | 0.207|
| Nipple necrosis (%)     | 0            | 9 (12)       | 0.0150*|
| Infection (%)           | 1 (2.2)      | 2 (2.7)      | 1   |
| Venous congestion (%)   | 0            | 1 (2.7)      | 1   |
| Other (%)               | 0            | 4 (5.3)      | 0.295|

*Statistically significant.

DISCUSSION

The NSM is considered an oncologically safe procedure with a similar rate of local recurrence when compared with skin-sparing mastectomy.11 It is an exceptional technique in the treatment and prophylaxis of breast cancer—a key example of the ever-advancing paradigm in breast surgery, with outstanding aesthetic results. Furthermore, the preservation of the NAC enhances the cosmetic result when combined with autologous tissue or implant-based breast reconstructions, ultimately resulting in better quality of life and psychological well-being in this patient population.

Nahabedian and Tsangaris4 reported that up to 80% of patients undergoing breast reconstruction requested nipple reconstruction, providing valuable insight into the importance of the NAC to a woman’s body image and quality of life. After skin-sparing mastectomies and breast reconstruction, nipple restoration is the standard of care in patients aiming at regaining the native appearance of their breasts. Many reconstructive techniques have been developed to recreate natural anatomy of the nipple; however, loss of sensation and diminished projection over time, along with subsequent tattooing sessions, are factors that often further patient dissatisfaction.12

For patients undergoing NSM, survival of the skin flaps and NAC is paramount. Published rates of nipple necrosis in NSM range from 2% to as high as 29%,13,14 with steady high rates reported in patients who received radiation or those with history of smoking.15–17 Viability of the NAC is dependent on preservation of its blood supply where complications are seen as a reflection of the aggressiveness during dissection and undermining of the subareolar space and surrounding skin.18 Age, smoking, and orientation of the skin incision have also been associated with poor results after NSM.19,20

Our two-stage procedure aims to improve the survival of the NAC and skin flaps after nipple-sparing mastectomies. Improving the blood supply of a tissue by creating a surgical wound, the so-called delay phenomenon or vascular delay, is a familiar technique to plastic surgeons. As previously mentioned, aggressive dissection and undermining of the subareolar space and adjacent skin potentially correlate with the poor vascular state of the postmastectomy NAC. This is a fundamental problem that is discussed with our patients during their
preoperative visit, even when they do not present with other factors typically associated with nipple necrosis, such as tobacco consumption, scars within the NAC, or radiation history.

Jensen et al. first described the usefulness of the surgical delay of the NAC in a thorough description of 31 breasts where its advantages were evaluated with exceptional oncologic and cosmetic results. Although the exact underlying mechanism remains unclear, it is thought that delay-induced ischemia stimulates vascular hypertrophy, augmentation of collateral flow, and opening of choke vessels. Its use has proven particularly beneficial in procedures where the risk of partial or total flap loss and fat necrosis is increased. The rationale for placement of the silicone sheet during the NAP first stage is based on this premise. By interposing it between the NAC-central breast skin and the underlying vascular parenchyma, the silicone sheet serves as a barricade to prevent revascularization from beneath and results in augmentation of the overlying tissue’s blood flow through the subdermal plexus vasculature peripherally. An additional benefit of predissection and placement of the silicone sheet is the facilitation of the subsequent mastectomy by serving both to expedite the procedure and limit further dissection of the delicate skin flaps and NAC. No deep or superficial infections have been observed as a result of sheet placement before definitive mastectomy and reconstruction in any NAP patients.

Our results further substantiate the effectiveness of delaying the NAC before mastectomy when compared with the single-stage NSM in terms of nipple survival and the overall complication rate. We presented an early look at this technique in a previous project, and to our knowledge, this is the largest study assessing the efficacy of delaying the NAC before mastectomies when compared with conventional mastectomy approaches. However, limitations of this study reside in the retrospective design and relatively small number of patients of each group, especially the study group because of the novelty of the procedure. Furthermore, the group’s heterogeneity in terms of types of breast reconstruction might account for confounding factors in the study, even though all the cases of nipple necrosis came from patients undergoing DIEP flap breast reconstruction, and all cases were performed by the senior author (S.G.B.). A proportionally matched comparative study with homogenous arms might mitigate this weakness.

It is important to note that some of our results might be the product of current trends in plastic surgery, such as the statistically significant difference in terms of hospital stay between both groups; we consider that the shorter hospitalization period shown in the NAP group is a consequence of the increased expertise and a general protocol shift from a 4-day to a 2-day length of stay after DIEP flap breast reconstruction. Likewise, the increased occurrence of benign conditions within the NAP group reflects the increasing shift toward prophylactic measures.

Given the ongoing changes and constant financial pressures of modern medicine, the NAP technique is not without its drawbacks. Additional costs and time required for multiple procedures are disadvantages of the two-stage procedure that requires consideration. Conversely, additional procedures required based on final pathology are costly as well, complemented by potential complications associated with known rates of vascular compromise of the NAC. The ability to perform sentinel node and subareolar biopsies before

Fig. 4. A 58-year-old patient presents 13 days after bilateral delay procedures, with both drains already removed; office visits at 2 and 12 months post DIEP flap breast reconstruction.
definitive reconstruction is invaluable and potentially offsets a portion of both the financial and time opportunity costs, in addition to assisting the surgeon and patient in deciding on the optimal reconstructive route. A formal cost–benefit analysis of fresh final pathology versus intraoperative frozen pathology is, however, beyond the scope of this article.

We believe that current multistage protocols for patients thought to require postmastectomy radiotherapy (extensive microcalcifications by mammography, T2 tumors, etc.) may be obviated by the NAP procedure.23 One example of this being the use of a tissue expander as a filler to preserve the shape of the breast skin envelope after mastectomy, followed by pathologic analysis with second-stage delayed definitive breast reconstruction, given pathology is negative and coadjuvant radiotherapy is unnecessary.24 The NAP procedure may preclude such protocols since the pathology results are known before definitive mastectomy and immediate reconstruction, resulting in only 1 major procedure. Additional benefits are multiple, namely, cost savings as expanders are unnecessary with the NAP group, avoidance of complications associated with tissue expansion after mastectomy,25,26 and deceased overall recovery and downtime, given only the first stage of the NAP procedure is performed in the outpatient setting.

In addition, potential cost savings may be afforded with the NAP method by eliminating procedures for debridement of nonviable breast skin, excision of nonviable NACs, and subsequent nipple reconstruction and tattooing. Future investigation may help to further elucidate these tradeoffs.

CONCLUSIONS

We believe that our two-stage approach, with rearrangement of the NAC and breast skin flaps before mastectomy and reconstruction, benefits patients undergoing mastectomy, especially those at high risk, by safely preserving the native breast skin envelope and NAC.

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