Nipple-Sparing Mastectomy via an Inframammary Fold Incision for Patients With Scarring From Prior Lumpectomy

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Background: Nipple-sparing mastectomy (NSM) through an inframammary fold (IMF) incision can provide superior cosmesis and a high level of patient satisfaction. Because of concerns for nipple-areolar complex (NAC) viability using this incision, selection criteria may be limited. Here, we evaluate the impact of scarring from prior lumpectomy on NAC viability.

Methods: A retrospective chart review was conducted on a prospectively collected database at a single institution between July 2006 and October 2012. A total of 318 NSMs through IMF incisions were performed. We compared the incidence of NAC ischemia in 122 NSM cases with prior lumpectomy with 196 NSM cases without prior lumpectomy. All 318 mastectomies were followed by implant-based reconstruction. Clinicopathologic factors analyzed included indications for surgery, technical details, patient demographics, comorbidities, and adjuvant therapy.

Results: The overall incidence of NAC ischemia was 20.4% (65/318). Nipple-areolar complex ischemia occurred in 24.6% (30/122) of cases with prior lumpectomy and 17.9% (35/196) of cases without prior lumpectomy ($P = 0.1477$). Among the 30 ischemic events in the 122 cases with prior lumpectomy, epidermolysis occurred in 20 (16.4%) and necrosis occurred in 10 (8.2%). Two cases (1.6%) required operative debridement. Seven cases (5.7%) were left with areas of residual NAC depigmentation. All other cases completely resolved with conservative management. There was no significant correlation between the incidence of ischemia and surgical indication, tumor staging, age, body mass index, tissue resection volume, sternal notch to nipple distance, prior radiation, single-stage reconstruction, sentinel or axillary lymph node dissection, acellular dermal matrix use, presence of periareolar lumpectomy scars, diabetes, or smoking history. At a mean follow-up of 505 days (range, 7–1504 days), patient satisfaction was excellent. Local recurrence of breast cancer occurred in 3 cases (2.5%), and distant recurrence occurred in 2 cases (1.6%).

Conclusions: Patients with scarring from prior lumpectomy do not have a higher rate of NAC ischemia and may be considered for NSM via an IMF incision.

Key Words: nipple-sparing mastectomy, implant reconstruction, tissue expander reconstruction, nipple ischemia, nipple necrosis, lumpectomy

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BACKGROUND

Oncologic surgical principles often conflict with the desire for esthetically pleasing results. This controversy has motivated surgeons to develop more specific and less invasive therapies for breast cancer. One recent advance is the nipple-sparing mastectomy (NSM). This technique is cosmetically appealing because it ensures a natural-looking nipple, which provides a more authentic appearance to the breast. Psychological research demonstrates the importance of the nipple-areolar complex (NAC) to women, and its loss may generate more psychological distress than the loss of the entire breast mound itself.[1]

Nipple-sparing mastectomy can be considered for both prophylactic and therapeutic mastectomy. Through increases in breast cancer screening, as well as the discovery of the BRCA mutation, there are many more women who are candidates for mastectomy. For patients with in situ or invasive cancers, the primary goal remains to be oncologic safety. Numerous studies demonstrate that NSM with immediate reconstruction is an oncologically safe procedure.[2,3]

In addition to satisfying oncologic principles, the challenge for reconstructive surgeons with the NSM technique is to identify criteria for patient selection and to develop safe and esthetically superior surgical techniques. Although there are currently insufficient data to identify an optimal incision for NSM,[4] our personal experience suggests that the inframammary fold (IMF) incision provides both adequate exposure for resection and superior cosmetic results. Unlike other approaches, such as the radial and periareolar approaches, the IMF incision hides the scar in a natural crease and does not contribute to scar contracture of the breast envelope. For these reasons, we are not alone in considering the IMF incision to be the cosmetically preferable approach.[5] To date, this study is the largest series of NSMs through an IMF incision.[6–12]

Because of concerns for nipple viability, patients who have undergone prior lumpectomy or breast conservation therapy (BCT) are not always considered candidates for NSM through an IMF approach. Here, we evaluate the impact of prior lumpectomy and underlying clinical factors on nipple viability in patients undergoing NSM via an IMF incision.

METHODS

Study Design

A retrospective chart review was conducted on a prospectively collected, institutional review board–approved database of patients who had undergone NSM via an IMF incision with either single-stage or 2-stage implant-based reconstruction by a single plastic surgeon at a tertiary care academic medical center between July 2006 and October 2012.

Patients who were candidates for a skin-sparing mastectomy were given the option of an NSM if there was no nipple involvement, the tumor was more than 2 cm from the nipple, and they could maintain frequent follow-up for examination of the remaining nipple and/or the areolar complex. A total of 318 NSMs through IMF incisions were identified. One hundred twenty-two cases had undergone a previous lumpectomy, and 196 cases had not. There were no lumpectomy scar locations that were contraindications to an NSM through an IMF approach. Rates of postoperative NAC ischemia (both epidermolysis and full-thickness necrosis) were reported.

Numerous patient factors were analyzed to identify potential risks of NAC ischemia among prior lumpectomy patients. Factors analyzed included indications for surgery, technical details, patient

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TABLE 1. NAC Ischemia Rates

	Sample Size, n	NAC Ischemia Rate	*P*
Prior lumpectomy	122	24.6% (30/122)	0.1477
No prior lumpectomy	196	17.9% (35/196)	
Both prior lumpectomy and radiation	20	30.0% (6/20)	0.2288
Neither prior lumpectomy nor radiation	187*	18.7% (35/187)	

*Nine of the 196 cases without prior lumpectomy had undergone prior mantle radiation.

demographic factors and preoperative comorbidities, and adjuvant therapy. For all continuous variables, an unpaired Student *t* test was used and *P* values were reported. For all binary outcomes, a χ^2 test was used and *P* values were reported.

Surgical Technique

All NSMs were performed using the same subdermal technique. Breast skin flaps were infiltrated with 30 mL of a local anesthetic consisting of 0.25% bupivacaine and 1% lidocaine with 1:100,000 epinephrine in a 1:1 ratio. An incision, approximately 12 cm in length, was made along the IMF. With a traction suture in the nipple, subdermal dissection was carried out with sharp scissors in a plane akin to a face-lift, leaving a flap approximately 3- to 5-mm thick. A marking suture was placed on the breast gland immediately deep to the NAC for the pathologist. The NAC was inverted and sharply cleaned of glandular tissue. An additional tissue specimen was scraped from the deep dermis of the nipple and sent for immediate frozen section. If this specimen was found to have malignant or atypical cells, the procedure was then converted to an areola-sparing or skin-sparing mastectomy. The gland was then resected off of the pectoralis muscle using electrocautery.

For a single-stage reconstruction, a permanent implant was then placed submuscularly. If the coverage was not sufficient, then a strip of acellular dermal matrix (ADM) was placed inferiorly as a sling for implant coverage. Single-stage reconstruction was reserved at the discretion of the senior author for patients with small-volume implants, optimal tissue quality, and minimal clinical or demographic comorbidity.

For a 2-stage reconstruction, a tissue expander was placed in a standard fashion in a submuscular pocket and fully covered by the pectoralis major and serratus muscles. Drains were placed, and the skin was closed in layers. The tissue expanders used in these patients were the McGhan 133 series (Allergan Inc, Santa Barbara, Calif). Base width, rather than desired cup size, dictated the size of the expander. In cases of poor muscle coverage, ADM was placed at the discretion of the senior author. Most of the patients underwent between 2 and 3 expansions before exchange. Permanent implants were available from various manufacturers and were selected by the esthetic desires of the patient and the clinical judgment of the senior author. For each operation, all patients received intravenous antibiotics within 30 minutes of surgical incision and were maintained on 7 days of oral antibiotics postoperatively.

All patients were examined postoperatively at intervals of 2 weeks, 1 month, 2 months, 6 months, and then yearly. The patients were monitored for NAC ischemia and questioned about their satisfaction with the cosmetic result (excellent, good, fair, or poor).

RESULTS

A total of 318 NSMs through IMF incisions were identified. All 318 mastectomies were followed by implant-based reconstruction. One hundred twenty-two breasts had prior lumpectomy incisions, and 196 breasts did not. The overall incidence of NAC ischemia was 20.4% (65/318). The incidence of ischemia for the lumpectomy subset was 24.6% (30/122) and the incidence of ischemia for the nonlumpectomy subset was 17.9% (35/196), which were not significantly different ($P = 0.1477$) (see Table 1). Among the 30 ischemic events of the 122 NSMs with lumpectomy defects, epidermolysis occurred in 20 (16.4%) and necrosis occurred in 10 (8.2%) (see Table 2). Two cases (1.6%) required operative debridement (see Fig. 1). Seven cases (5.7%) were left with areas of residual NAC depigmentation (see Fig. 2); of those patients, 1 had full-thickness necrosis and 6 had epidermolysis. All other incidences of ischemia (epidermolysis and necrosis) resolved with conservative management (see Figs. 3 and 4, respectively).

Of the 122 cases with prior lumpectomy, 14 had prophylactic mastectomies (11.5%), 36 had ductal carcinoma in situ (DCIS) (29.5%), 1 had lobular carcinoma in situ (LCIS) (0.8%), 6 had DCIS/LCIS (4.9%), 51 had infiltrative ductal carcinoma (IFDC) (41.8%), 12 had infiltrative lobular carcinoma (IFLC) (9.8%), and 2 had IFDC/IFLC (1.6%). Of the 30 cases that had NAC ischemia, 7 were prophylactic mastectomies (23.3%), 8 had DCIS (26.7%), 1 had DCIS/LCIS (3.3%), 10 had IFDC (33.3%), and 4 had IFLC (13.3%). There was no statistically significant correlation between clinical pathology and NAC ischemia.

Of the 122 cases with prior lumpectomy, 12 were prophylactic (12/122, 9.8%), 7 of which had NAC ischemia (7/12, 58.3%). Thirty-nine breasts had stage 0 disease (39/122, 32.0%), 7 of which had NAC ischemia (7/39, 17.9%). Forty-four breasts had stage 1 disease (44/122, 36.1%), 9 of which had NAC ischemia (9/44, 20.5%). Eighteen breasts had stage 2 disease (18/122, 14.8%), 6 of which had NAC ischemia (6/18, 33.3%). Finally, 9 breasts had stage 3 disease (9/122, 7.4%), only 1 of which had NAC ischemia (1/9, 11.1%). There was no statistically significant correlation between disease severity and NAC ischemia.

Of the 122 cases with prior lumpectomy, the mean age was 50.1 years (mean age, 51.0 years with NAC ischemia and 49.8 years without NAC ischemia, $P = 0.56$) (see Table 3). The mean body mass index (BMI) was 21.1 (mean BMI, 21.4 with NAC ischemia and 21.0 without NAC ischemia, $P = 0.46$). The mean resection volume was 563.2 cm^3 (mean resection volume, 656.5 cm^3 with NAC ischemia and 532.7 cm^3 without NAC ischemia, $P = 0.21$). The mean sternal notch to nipple distance was 21.5 cm (mean distance, 21.8 cm with NAC ischemia and 21.4 cm without NAC ischemia, $P = 0.40$).

Of the 122 cases with prior lumpectomy, prior ipsilateral radiation occurred in 20 cases (6 cases with NAC ischemia and 14 cases without NAC ischemia, $P = 0.5389$) (see Table 3). Single-stage reconstruction was performed in 21 cases (3 cases with NAC ischemia and 18 cases without NAC ischemia, $P = 0.2281$). Sentinel lymph node biopsy was performed in 65 cases (14 cases with NAC ischemia and 51 cases without NAC ischemia, $P = 0.4032$). Axillary lymph node dissection

TABLE 2. Response of NAC Ischemia to Treatment

	NAC Ischemia, All Types	NAC Epidermolysis	NAC Necrosis
No.	30	20	10
Rate	24.6%	16.4%	8.2%
Required operative debridement and explant	2 (1.6%)	0 (0%)	2 (1.6%)
Resolved with conservative treatment	28 (23.0%)	20 (16.4%)	8 (6.6%)
With NAC depigmentation	7 (5.7%)	6 (4.9%)	1 (0.8%)
Without NAC depigmentation	21 (17.2%)	14 (11.5%)	7 (5.7%)

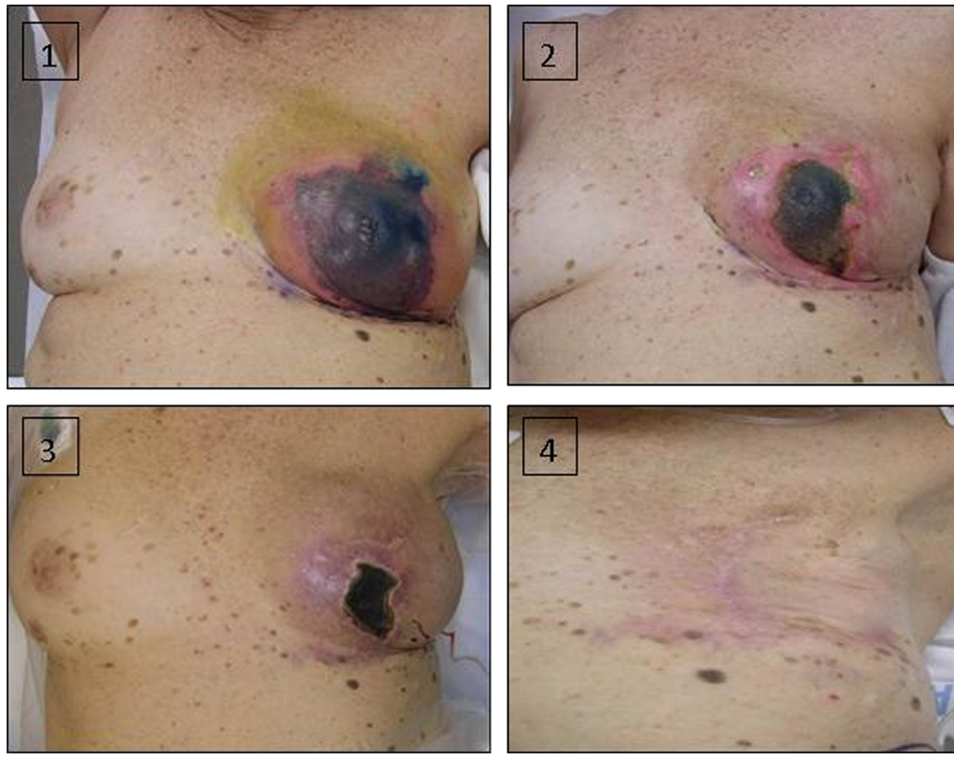

FIGURE 1. Full-thickness ischemia—operative debridement. A 74-year-old woman, with a history of lumpectomy with radiation, after unilateral left NSM for IFLC with tissue expander reconstruction with ADM who had full-thickness ischemia (1–3) requiring operative debridement and explantation of the expander (4).

FIGURE 2. Full-thickness ischemia—persistent depigmentation. A 41-year-old woman, with a history of lumpectomy, after unilateral right NSM for IFDC with tissue expander reconstruction who had full-thickness ischemia (1). Final reconstruction with a 15- to 700-cm^3 silicone implant and a symmetrizing mastopexy (2). Final result after resolution of ischemia with persistent depigmentation (3).

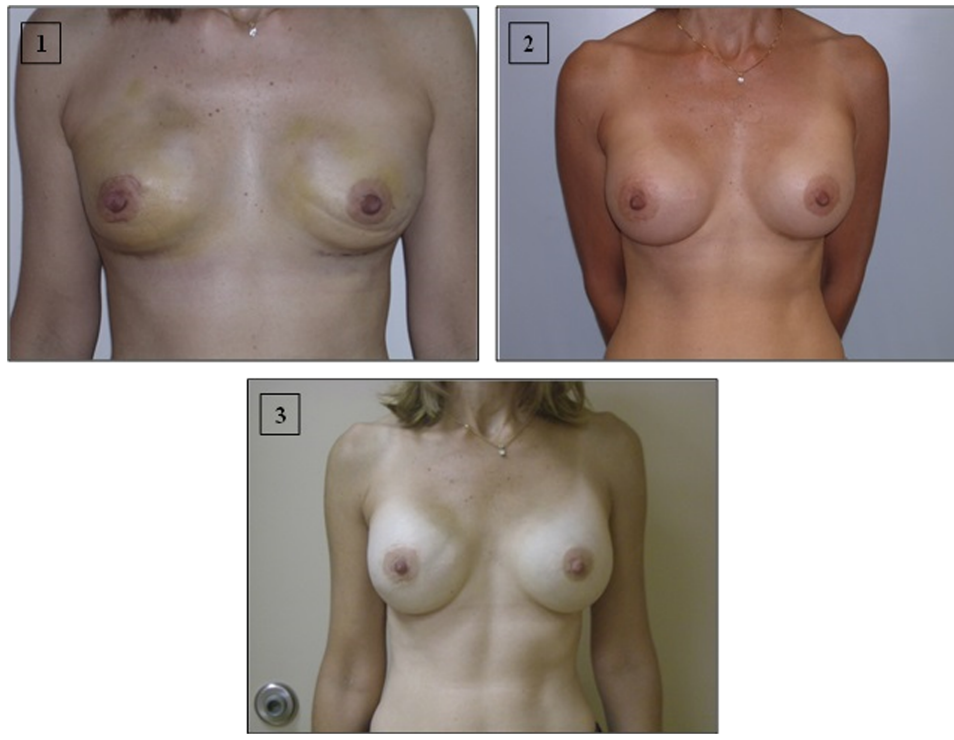

FIGURE 3. Epidermolysis—complete resolution. A 44-year-old woman, with a history of lumpectomy, after bilateral NSM for right-sided DCIS with tissue expander reconstruction who had right-sided epidermolysis (1). Final reconstruction with 20- to 400-cm^3 silicone implants and with complete resolution of epidermolysis (2–3).

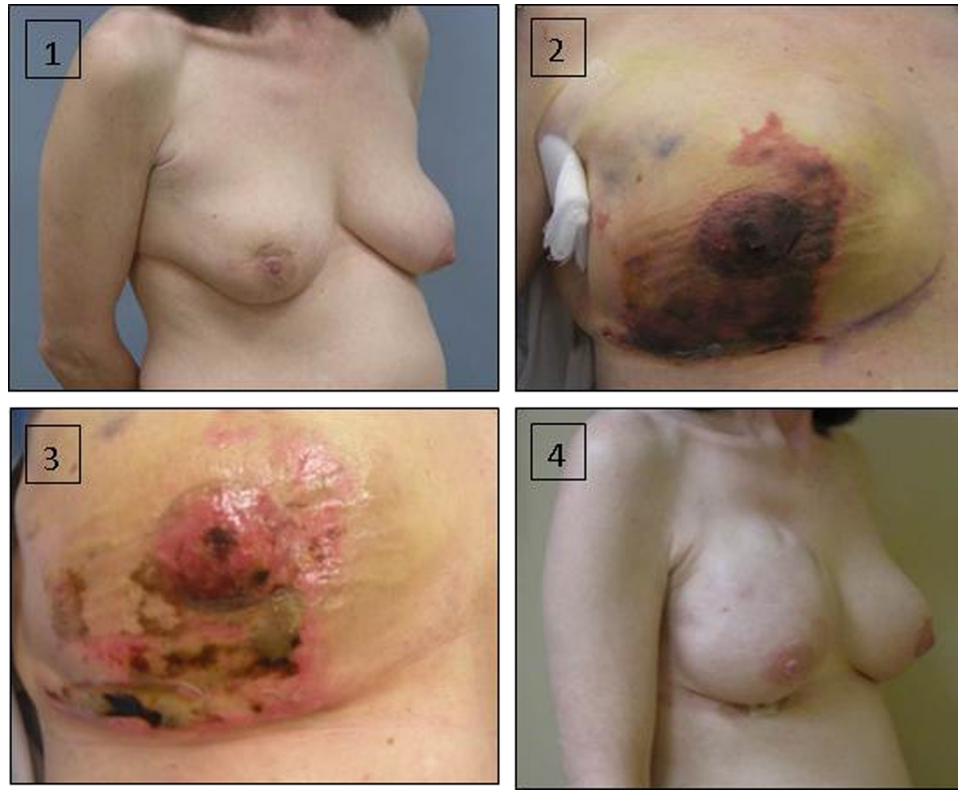

FIGURE 4. Full-thickness ischemia—complete resolution. A 55-year-old woman, with a history of lumpectomy (1), after unilateral right NSM for IFDC with tissue expander reconstruction who had full-thickness ischemia (2–3). Final reconstruction with a 475-cm^3 saline implant and with complete resolution of ischemia (4).

TABLE 3. Patient Factors Not Associated With Higher Rates of NAC Ischemia

	NAC Ischemia (Mean or Rate)	No NAC Ischemia (Mean or Rate)	*P*
Age, y	51.0	49.8	0.56
BMI	21.4	21.0	0.46
Resection volume, cm^3	656.5	532.7	0.21
Sternal notch to nipple distance, cm	21.8	21.4	0.40
Prior radiation	20.0% (6/30)	15.2% (14/92)	0.5389
Single-stage reconstruction	10.0% (3/30)	19.6% (18/92)	0.2281
Sentinel lymph node biopsy	46.7% (14/30)	55.4% (51/92)	0.4032
Axillary lymph node dissection	13.3% (4/30)	18.5% (17/92)	0.5168
ADM use	23.3% (7/30)	27.2% (25/92)	0.6780
Periareolar lumpectomy scar	10.0% (3/30)	5.4% (5/92)	0.3804
Diabetes mellitus	6.7% (2/30)	2.2% (2/92)	0.2301
Smoker, current or former	30.0% (9/30)	37.0% (34/92)	0.4886

was performed in 21 cases (4 cases with NAC ischemia and 17 cases without NAC ischemia, $P = 0.5168$). Acellular dermal matrices were used in 32 cases (7 cases with NAC ischemia and 25 cases without NAC ischemia, $P = 0.6780$). Eight cases had undergone prior periareolar lumpectomies (3 cases with NAC ischemia and 5 cases without NAC ischemia, $P = 0.3804$). Four cases were patients with diabetes (2 cases with NAC ischemia and 2 cases without NAC ischemia, $P = 0.2301$). Forty-three cases were either current or former smokers (9 cases with NAC ischemia and 34 cases without NAC ischemia, $P = 0.4886$).

Of the 122 cases with prior lumpectomy, 102 had not completed BCT at the time of NSM. Reasons for not undergoing postlumpectomy radiation included lumpectomy for benign breast disease; refusing postlumpectomy radiation; or scheduling NSM before receiving radiation in response to new clinical information, such as positive margins. Twenty of 122 cases had undergone both prior lumpectomy and prior ipsilateral radiation therapy (18 cases of failed BCT and 2 cases of previous mantle radiation). A total of 30.0% (6/20) of the previously radiated, prior lumpectomy cases had postoperative NAC ischemia (see Table 1). This subset was compared with the cases in which neither lumpectomy nor prior radiation had occurred, of which 18.7% (35/187) had NAC ischemia (9 of the 196 cases without prior lumpectomy had undergone prior mantle radiation). No significant difference in the rate of postoperative NAC ischemia was found between these 2 groups ($P = 0.2288$).

At a mean follow-up of 505 days (range, 7–1504 days), patient satisfaction was excellent. Local recurrence of breast cancer occurred in 3 cases (2.5%), and distant recurrence occurred in 2 cases (1.6%).

DISCUSSION

Historically, mastectomies have been performed through an elliptical incision encompassing the NAC. When first introduced, NAC preservation was limited to use in prophylactic mastectomy and was not considered suitable for patients with a documented malignancy. In these early NSM cases, mastectomies were performed using a subcutaneous dissection in an effort to preserve the NAC. This dissection left a significant volume of breast tissue on the mastectomy flaps, with residual tumor cells remaining in as many as 7% of cases.[7] Consequently, the incidence of local recurrence with subcutaneous mastectomy was significantly higher than with traditional mastectomy.[8]

The subdermal NSM technique that we use differs from the subcutaneous mastectomy in that there is complete removal of subcutaneous and glandular breast tissue, including beneath the dermis of the nipple. The success of this technique is dependent on meticulous, sharp dissection and preservation of the subdermal plexus of blood vessels to the NAC and the remainder of the skin flap. It preserves the medial intercostal blood supply, which is paramount for the survival of the flap, and allows for dissection to the clavicle and to the medial and lateral borders of the breast.

Prophylactic mastectomy has been shown to reduce the risk for breast cancer in both moderate- and high-risk patients.[9,10] The consensus in most of the current reported literature is that NSM is an oncologically safe technique for prophylaxis. In 2001, McDonnell et al[11] studied the effect of nipple-sparing versus skin-sparing mastectomy on risk reduction in a high-risk population of patients and found that the benefits were equivalent in both groups. In 2006, Sacchini et al[12] reported 55 patients who had undergone prophylactic NSM. There were 2 cases of local disease, but neither occurred at the nipple.

Criteria for the selection of therapeutic NSM candidates, in whom the primary goal remains to be oncologic safety, are more controversial. The risk for local recurrence with this procedure is comparable with conventional mastectomy. Data obtained from observational studies is critical because randomized trials comparing these procedures are not possible for ethical reasons. Oncologic surgeons generally believe that patients who undergo this procedure should have smaller tumors that are distant from the NAC and should be able to participate in close follow-up of the residual NAC.

Nipple-sparing mastectomy seems oncologically safe in appropriately selected patients. The remaining questions relate to appropriate patient selection and the best technique. Although there are currently insufficient data to identify an optimal incision for NSM,[4] it is our personal experience, as well as the experience of others,[5] that the IMF incision provides both adequate exposure for resection and superior cosmetic results. Rather than leaving patients with a visible scar on the anterior surface of the breast mound, the IMF approach results in a scar that is completely hidden within the fold of the reconstructed breast and that heals well with a low incidence of hypertrophic scarring.

Despite previous concerns for NAC viability, we observed that women with prior lumpectomy, with or without prior radiation, do not have a significantly increased risk for postoperative NAC ischemia with the IMF approach. We believe that our incidence of necrosis requiring operative debridement (1.6%) (see Table 2 and Fig. 1) is an acceptable complication profile for optimal esthetic outcomes and comparable with rates reported in the literature.

Of the 122 NSM cases with prior lumpectomy defects, there was no statistically significant correlation between incidence of NAC ischemia and surgical indication, tumor staging, age, BMI, tissue resection volume, sternal notch to nipple distance, prior ipsilateral radiation, single-stage reconstruction, sentinel lymph node biopsy, axillary lymph node dissection, ADM use, presence of a periareolar lumpectomy scar, diabetes, or smoking history. These various demographic and clinical factors do not seem to affect the NAC ischemia rate

in patients with prior lumpectomy defects. This study presents the largest number of NSMs through an IMF incision published to date.[6–12] Our findings suggest that patients with prior lumpectomy, with or without prior radiation, should also be considered for the cosmetically advantageous NSM via an IMF incision.

As our experience grew with NSM through an IMF incision, we made minor modifications to the reconstructive approach. For example, we found that patients with smaller and less ptotic breasts were better candidates for this technique. Larger breasts with more significant degrees of ptosis had an increased risk for nipple malposition. Furthermore, all previous augmentations were offered single-stage reconstruction, whereas others were performed only at the request of the patient. Toward the end of the retrospective review, single-stage reconstruction was performed only if the breast size was a B cup or smaller. With the thin subdermal mastectomy flaps, there is a risk for pressure ischemia when a full implant is placed at the time of mastectomy.

There are certainly limitations to our study. This study is a retrospective chart review of the NSM patients of a single plastic surgeon operating at a tertiary care academic medical center; as such, it may not necessarily be generalizable to all surgeons and all institutions across the country. Secondly, this study compares various clinical factors with esthetic outcomes after NSM in the setting of a previous lumpectomy defect; however, this study was unable to assess the impact of chemotherapy or all lumpectomy locations. In reviewing the database, some of the patients received multiple chemotherapies at innumerable time points during their clinical course; as such, a comparison between NAC ischemia and these chemotherapeutic variables would be low yield. Similarly, there are hundreds of permutations for placement of a lumpectomy scar on the breast, and a comparison of NAC ischemia with each location would provide insufficient conclusions. We did evaluate the effect of periareolar lumpectomy scars in relation to other lumpectomy sites on NAC ischemia and did not discover any statistically significant increase in NAC ischemia in this subset; however, this lack of significance may be due to a small sample size (n = 8). Thirdly, all patients underwent NSM with an IMF incision and immediate implant-based reconstruction, per our inclusion criteria; this study does not seek to compare ischemia rates using different surgical approaches to NSM or using different reconstructive approaches. We would encourage others to further investigate any and all of these areas. Finally, our study does not use a blinded questionnaire to assess the subjective outcomes of the reconstruction, which may weaken the power of the reported excellent cosmetic results. Despite these limitations, our study provides statistically significant data about the risk factors of ischemia in the setting of NSM with an IMF incision with a prior lumpectomy defect.

CONCLUSIONS

Nipple-sparing mastectomy via an IMF incision is an oncologically safe and, in our experience, cosmetically superior approach for the surgical treatment of breast cancer. Importantly, our results indicate that women with prior lumpectomy defects, including those who have undergone prior radiation therapy, do not have a higher rate of NAC ischemia after NSM via an IMF incision with immediate implant-based reconstruction and should, therefore, be considered candidates for this approach.

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