Nipple-Sparing Mastectomy in Patients with a History of Reduction Mammaplasty or Mastopexy: How Safe Is It?

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Background: Nipple-sparing mastectomy has gained popularity, but the question remains of whether it can be offered safely to women with a history of reduction mammaplasty or mastopexy. The authors present their experience with nipple-sparing mastectomy in this patient population.
Methods: Patients at the authors' institution who had reduction mammaplasty or mastopexy before nipple-sparing mastectomy were identified. Outcomes measured include nipple-areola complex viability, mastectomy flap necrosis, infection, presence of cancer in the nipple-areola complex, and breast cancer recurrence.
Results: The records of the nipple-sparing mastectomy patients at the authors' institution from 2006 through 2012 were reviewed. The authors identified 13 breasts in eight patients that had nipple-sparing mastectomy following reduction mammaplasty or mastopexy. Within this subset of patients, the mean age was 46.6 years and the mean body mass index was 25.1. Nine of 13 breasts had therapeutic resections, whereas the remaining four were for prophylactic indications. Average time elapsed between reduction mammaplasty or mastopexy and nipple-sparing mastectomy was 51.8 months (range, 33 days to 11 years). In all cases, prior reduction mammaplasty/mastopexy incisions were used for nipple-sparing mastectomy. Ten breasts underwent reconstruction immediately with tissue expanders, one with a latissimus dorsi flap with immediate implant and two with immediate abdominally based free flaps. Complications included one hematoma requiring evacuation and one displaced implant requiring revision. There were no positive subareolar biopsy results, and the nipple viability was 100 percent. Mean follow-up time was 10.5 months.
Conclusions: The authors' experience demonstrates that nipple-sparing mastectomy can be offered to patients with a history of reduction mammaplasty or mastopexy with reconstructive outcomes comparable to those of nipple-sparing mastectomy alone. (*Plast. Reconstr. Surg.* 131: 962, 2013.)
CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

Breast cancer management has evolved dramatically in recent decades. With each transition, surgeons have strived for decreased morbidity and an improved aesthetic result without sacrificing oncologic integrity. One of the first milestones was breast conservation therapy as a safe alternative to mastectomy.[1]

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Received for publication September 8, 2012; accepted November 12, 2012.

DOI: 10.1097/PRS.0b013e3182865ad2

Another major milestone has been the reintroduction and popularization of nipple-sparing mastectomy. Traditionally, patients who required total mastectomy underwent excision of an ellipse of skin tissue containing the nipple-areola complex. Nipple-sparing mastectomy excises only breast tissue, preserving the entire skin envelope and nipple-areola complex.

The first reports of nipple-sparing mastectomy date back to the 1960s.[2–4] Interest has been

Disclosure: *The authors have no financial interest to declare in relation to the content of this article. No external funding was received.*

renewed since a 1999 report by Hartmann et al.[5] Nipple-sparing mastectomy is now performed routinely in well-selected patients who require mastectomy.

The major aesthetic benefit of nipple-sparing mastectomy over total mastectomy is preservation of the nipple-areola complex. Women who undergo nipple-areola complex preservation have improved body image and psychological adjustment.[6] Numerous reports exist documenting the safety and efficacy of nipple-sparing mastectomy.[7–9] However, there is a paucity of studies examining whether nipple-sparing mastectomy can be safely offered to patients with a history of reduction mammaplasty or mastopexy.

In 2011, the American Society of Plastic Surgeons estimated that there were 63,109 reconstructive breast reductions performed.[10] The growing acceptance of nipple-sparing mastectomy ensures that plastic surgeons will encounter more patients with prior breast reductions requesting nipple-sparing mastectomy in the future. In addition, the extirpative and reconstructive surgeons are often different from those who performed reduction mammaplasty or mastopexy. In these cases, the surgeons may be unfamiliar with the details of prior breast surgery.

In this report, the authors review their experience with nipple-sparing mastectomy and its reconstruction in patients who have previously undergone reduction mammaplasty or mastopexy. The outcomes and techniques critical to their success are presented.

PATIENTS AND METHODS

All patients treated with nipple-sparing mastectomy at New York University Langone Medical Center were identified. The study period extended from 2006 through 2012. A multidisciplinary team evaluated all patients.

Women with a history of reduction mammaplasty or mastopexy were selected for further study. With institutional review board approval, the charts and records of all these patients were reviewed. Patient demographics, breast cancer history, intraoperative details, complications, and revision operations were all examined. Collected data included timing of reduction mammaplasty or mastopexy, medical comorbidities, body mass index, smoking history, type of nipple-sparing mastectomy incision, choice of reconstruction, stage and characteristics of cancer, nipple viability, mastectomy flap necrosis, infection, hematoma, and other postoperative complications.

Nipple-sparing mastectomy was presented to eligible women with breast cancer or as a prophylactic option for risk reduction. The indications, benefits, risks, and alternatives to nipple-sparing mastectomy were discussed. Indications for nipple-sparing mastectomy included smaller tumors; lesions greater than 2 cm from the nipple-areola complex; negative axilla on clinical examination; and normal, everted nipples without discharge on clinical examination.

After incisions were marked jointly by the breast and plastic surgeons, breasts were infiltrated with a 0.5% lidocaine and 1:200,000 epinephrine mixture. Infiltration was focused along the marked incision and dissection planes. Emphasis was placed on symmetric tumescence for even hemostasis and vasoconstriction.

The subcutaneous nipple-sparing mastectomy flap was dissected sharply with minimal use of electrocautery. Subareolar tissue with a core of posterior nipple tissue was dissected sharply and sent for pathologic evaluation. Most subareolar biopsy specimens were reviewed as intraoperative frozen sections, and all were further studied with permanent pathologic evaluation. Patients were counseled preoperatively that suspicious intraoperative frozen sections would result in resection of the nipple-areola complex.

Given the higher risk of mastectomy flap and nipple-areola complex necrosis in nipple-sparing mastectomy, we selectively assessed the vascular perfusion of the mastectomy flaps intraoperatively using indocyanine green, a marker for perfusion. Indocyanine green was diluted and injected intravenously by the anesthesiologist. Images were captured and analyzed in real-time using the SPY Elite System (LifeCell Corp., Branchburg, N.J.). A combination of clinical judgment and the results of indocyanine green were used to guide surgical decision-making.

All patients were offered the full range of implant-based and autologous reconstruction. Final reconstruction was based on discussion between the patient and her plastic surgeon.

RESULTS

Demographics and Breast Cancer History

The records of nipple-sparing mastectomy patients at our institution from 2006 through 2012 were reviewed. Eight patients ($n = 13$ breasts) were identified as having a history of reduction mammaplasty or mastopexy before nipple-sparing mastectomy. Eleven breasts had prior reductions and two had mastopexies. Mean time from reduction

Table 1. Characteristics of the 13 Breasts in Eight Patients with a History of Reduction Mammaplasty/ Mastopexy followed by Nipple-Sparing Mastectomy

Patient Characteristics	Mean (Range)
Time between reduction mammaplasty and NSM, mo	
Mean	51.8
Range	1.1–140.4
No. of therapeutic NSMs (no. of breasts)	9/13
Stage 0	5/9
Stage I	1/9
Stage IIA	2/9
Stage IIIA	1/9
No. of prophylactic NSMs (no. of breasts)	4/13
Age, yr	
Mean	46.6
Range	39–53
BMI	
Mean	25.1
Range	20.1–31.9
Diabetes	0/8
Smoking	1/8

NSM, nipple-sparing mastectomy; BMI, body mass index.

mammaplasty or mastopexy to nipple-sparing mastectomy was 51.8 months, with a range from 33 days to 11 years. Patient characteristics are listed in Table 1.

Of 13 breast procedures, nine were for therapeutic and four were for prophylactic indications. Of the therapeutic nipple-sparing mastectomies, five were stage 0, one was stage I, two were stage IIA, and one was stage IIIA. The mean age of the patients was 46.6 years and the mean body mass index was 25.1. No patients had diabetes, but one patient was an active smoker.

Outcomes

Mean follow-up time was 10.5 months. Reconstruction included 10 tissue expanders, one latissimus dorsi flap with implant placement, and two abdominally based microvascular free flaps, all immediately following mastectomy. The average tissue expander fill rates at the time of surgery and at the conclusion of expansion were 142 and 372 cc, respectively. Acellular dermal matrix was used in four breast reconstructions. The remaining tissue expanders used serratus anterior and pectoralis major muscle alone. These results are summarized in Table 2. All nipple-sparing mastectomies and reconstructions were carried out through the prior reduction mammaplasty/ mastopexy scars. Reconstructive and oncologic outcomes are summarized in Table 3. Figure 1 demonstrates representative preoperative and postoperative results following nipple-sparing mastectomy in a patient with a history of reduction mammaplasty.

Table 2. Detailed Tissue Expander Data Outlining Intraoperative Fill Rate, Fill Rate at the Conclusion of Expansion, and Use of Acellular Dermal Matrix for 13 Breasts in Eight Patients with a History of Reduction Mammaplasty/Mastopexy followed by Nipple-Sparing Mastectomy

Breast	Type of Reconstruction	If TE, Fill in OR (cc)	If TE, Final Fill (cc)	ADM Used?
1	TRAM MVFF	N/A	N/A	No
2	TRAM MVFF	N/A	N/A	No
3	Latissimus flap with permanent implant	N/A	N/A	No
4	TE	200	380	Yes
5	TE	100	460	No
6	TE	100	460	No
7	TE	150	420	No
8	TE	120	420	No
9	TE	150	390	No
10	TE	150	390	No
11	TE	200	345	Yes
12	TE	200	290	Yes
13	TE	50	160	No then yes*

TRAM, transverse rectus abdominis myocutaneous; MVFF, microvascular free flap; TE, tissue expander; ADM, acellular dermal matrix; N/A, not applicable.
*Acellular dermal matrix was not used at the time of initial surgery in breast 13. On postoperative day 0, the patient developed a hematoma after a fall requiring a return to the operating room. During the reoperation, hematoma was evacuated and acellular dermal matrix was placed.

One patient with tissue expander reconstruction required a return to the operating room for hematoma evacuation. Another patient who underwent latissimus dorsi flap with implant reconstruction also required a reoperation for replacement of a displaced implant. There were no cases of nipple necrosis, partial or complete. All patients had drains postoperatively until outputs were less than 30 cc over 24 hours with no postoperative seromas. Oncologically, there were no positive subareolar biopsy results, and there have been no cancer recurrences to date.

Indocyanine green was selectively used intraoperatively to assess the vascular perfusion of the mastectomy flap and nipple-areola complex. Figure 2 demonstrates the intraoperative gross image and the relative intensity of indocyanine green captured using the SPY Elite System.

DISCUSSION

Nipple-sparing mastectomy represents the latest in extirpative breast cancer surgery and has applications in prophylactic risk reduction. Multiple centers, including our own, have described their experience with nipple-sparing mastectomy and subsequent reconstruction. However, there

Table 3. Reconstructive and Oncologic Outcomes of the 13 Breasts in Eight Patients with a History of Reduction Mammaplasty/Mastopexy followed by Nipple-Sparing Mastectomy

Patient Outcomes	Mean (Range)
Follow-up, mo	
Mean	10.5
Range	3–24
Reconstruction type	
Immediate tissue expander	10/13
Immediate abdominally based microvascular free flap	2/13
Immediate latissimus dorsi flap with implant	1/13
Incision type	13/13 used previous incision
Reconstructive complications	
Hematoma evacuation	1/13
Implant replacement for displacement	1/13
Nipple necrosis (partial or complete)	0/13
Mastectomy flap necrosis	0/13
Infection	0/13
Seroma	0/13
Oncologic complications	
Positive subareolar biopsies	0/13
Cancer recurrences	0/13

is a paucity of studies to evaluate nipple-sparing mastectomy in women with a history of reduction mammaplasty or mastopexy. The authors present a single-institution experience with nipple-sparing mastectomy in patients with a history of reduction mammaplasty or mastopexy.

Preservation of the nipple and areola is both the greatest benefit and potential risk to nipple-sparing mastectomy. Reduction mammaplasty or mastopexy in conjunction with nipple-sparing mastectomy theoretically increases the risk to the nipple-areola complex. Only one of the patients in our series had reduction mammaplasty or mastopexy performed by our plastic surgeons, further limiting our insight preoperatively. In addition, prior breast surgery may result in scar tissue that makes the nipple-sparing mastectomy more difficult. In this series, there was not a single case of nipple-areola complex epidermolysis, partial necrosis, or complete necrosis. In addition, there were no cases of mastectomy skin flap necrosis. The 100 percent nipple viability rate and absence of mastectomy flap necrosis are attributable to preoperative preparation of the surgical site, careful intraoperative dissection, and use of clinical judgment and new technologies to critically evaluate the mastectomy flap and nipple-areola complex.

First, preoperatively, a mixture of 0.5% lidocaine and 1:200,000 epinephrine is infiltrated along the planned incision lines and dissection planes. Infiltration achieves both hemostasis and hydrodissection, thereby enabling the mastectomy to be performed almost exclusively using a scalpel and scissors. Through hydrodissection, the plane between the breast parenchyma and subcutaneous tissue is more easily identifiable.

Second, another factor we believe indispensable to optimal results is maintaining consistent flap thickness during intraoperative dissection. At our institution, 96 percent of all nipple-sparing mastectomies were performed by three breast surgeons who have each individually performed 100 to 200 cases. We agree that for optimal results the skin flap thickness must be consistent to avoid compromising the superficial blood supply.[11] The thickness of our mastectomy flaps is uniform throughout the breast and subareolar area. Moreover, the thickness in this subset of patients does not differ significantly from

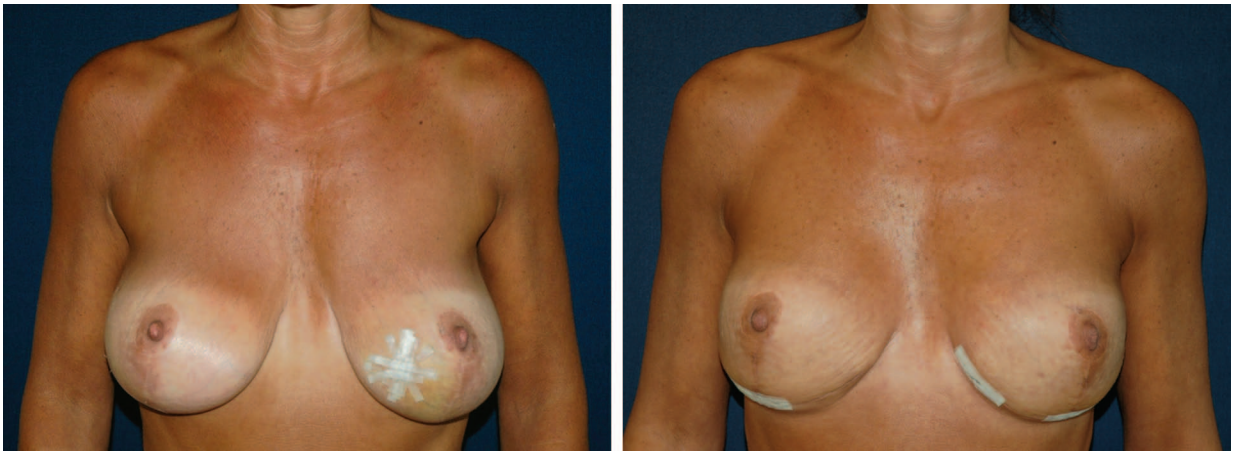

Fig. 1. Preoperative (*left*) and postoperative (*right*) photographs of a 45-year-old patient who underwent reduction mammaplasty at an outside hospital followed by nipple-sparing mastectomy 11 years later.

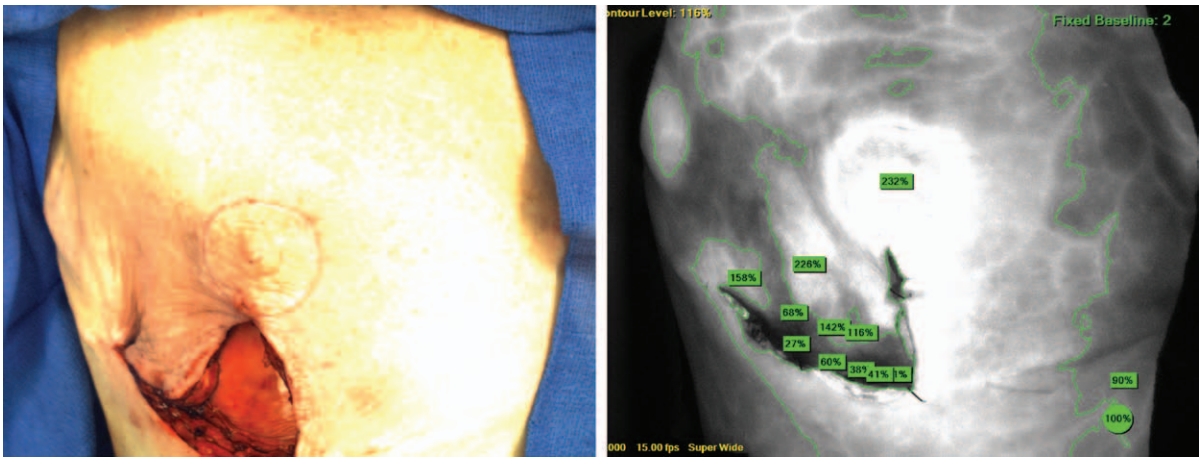

Fig. 2. Indocyanine green was used selectively to assess real-time intraoperative vascular perfusion of the mastectomy flap and nipple-areola complex. (*Left*) Gross image of the breast at the time of mastectomy. (*Right*) Relative intensity of indocyanine green penetration using the SPY Elite System. Given the relative intensity at the nipple-areola complex in combination with the surgeon's judgment, it was preserved during the reconstruction.

the thickness in the rest of our nipple-sparing mastectomy cases.

Finally, at the conclusion of the mastectomy, the plastic surgeon critically examined the mastectomy flap and nipple-areola complex. When the viability of a portion of the flap was questionable, indocyanine green was used to assess vascular perfusion.[12] Indocyanine green binds plasma proteins after intravenous injection, remains intravascularly, and can be used as a marker for vascular perfusion. It provided a quantitative measure of nipple-areola complex viability to complement qualitative judgment. The SPY Elite System was used at the plastic surgeon's discretion between the mastectomy and reconstruction to guide reconstructive decision-making.

The SPY Elite System affected intraoperative management in one patient who had reduction mammaplasty 33 days before nipple-sparing mastectomy. Intraoperative images demonstrated ischemia along the lateral mastectomy skin edge. Based on these results, the lateral mastectomy flap was trimmed. Furthermore, to limit pressure on the mastectomy flaps, a tissue expander filled to 200 cc was used instead of a 400-cc implant.

Previously, Woods described subcutaneous mastectomy with formal mastopexy.[13] He reserved the technique for women with ptotic or large, pendulous breasts. However, "subcutaneous mastectomy" created thicker flaps and left up to 10 percent of residual breast tissue compared with the thin flaps that are standard to nipple-sparing mastectomy today.[5] The vascularity of the nipple-areola complex is more threatened using today's technique.

Spear et al. described their experience with staged nipple-sparing mastectomy following mastopexy or breast reduction in 19 breasts and unplanned nipple-sparing mastectomy following breast reduction in five breasts.[11] They reported a complication rate of 17 percent for return to the operating room for débridement of nipple-areola complex and skin flap necrosis, with ultimate explantation of one implant and autologous salvage.[11] In their study, the average time from mastopexy or breast reduction to nipple-sparing mastectomy in the staged group was 3.4 months, compared with 51.8 months in this series. The longer interval from initial surgery to nipple-sparing mastectomy may have contributed to our lower nipple-areola complex and mastectomy flap necrosis rates.

Based on the series presented, the authors believe that reduction mammaplasty followed by nipple-sparing mastectomy has potential as a reconstructive tool in women with large or ptotic breasts unsuitable for primary nipple-sparing mastectomy. A modified nipple-sparing mastectomy with a periareolar pexy using a "tobacco pouch suture" along the circumference of the deepithelialized areolar area has been described for medium breasted women.[14] However, this solution does not address nipple-areola complex preservation in large breasted women.

Using the medial pedicle/vertical breast reduction favored at our institution, two-stage nipple-sparing mastectomy can be offered to women with large or ptotic breasts, with a scar burden identical to that of the primary nipple-sparing mastectomy patients.[15]

Compared with Spear et al., our experience of 13 breasts exclusively focuses on women who presented with a history of reduction mammaplasty or mastopexy and were otherwise eligible for nipple-sparing mastectomy. Our results demonstrate that despite the history of previous breast surgery, often performed by other plastic surgeons, nipple-sparing mastectomy can be offered safely to this population of women.

When 1 year or more has passed since reduction mammaplasty or mastopexy, nipple-sparing mastectomy can be offered safely using our described techniques. In shorter time periods, we recommend selectively using indocyanine green to evaluate perfusion of the mastectomy flap and nipple-areolar complex intraoperatively.

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