

A Strategic Approach to Nipple-sparing Mastectomy Reconstruction with a Wide-based Inframammary Fold Flap

Anamaria Parus, BS*
Mark L. Venturi, MD, FACS†

Summary: The single biggest advancement in the aesthetic outcome of breast reconstruction following mastectomy has been the contribution of nipple-sparing mastectomy. By preserving the nipple–areolar complex, patients do not experience the same sense of loss that is observed in the setting of skin-sparing mastectomy. Despite this significant contribution, the challenge remains as to how surgeons can extend this option to larger-breasted patients or patients with significant breast ptosis. Several strategies have been described, including reduction mammoplasty before mastectomy, bipediced simultaneous mastopexy with mastectomy, and free nipple grafting. The authors have developed a novel approach to nipple-sparing mastectomy that preserves the nipple–areolar complex on a wide-based inframammary fold (IMF) flap and uses indocyanine green perfusion imaging to successfully and reliably perform nipple-sparing mastectomy with immediate reconstruction in larger-breasted ptotic patients. Six patients underwent bilateral nipple-sparing mastectomies and immediate breast reconstruction with a wide-based IMF flap. All patients underwent immediate reconstruction with prepectoral placement of tissue expanders to treat either breast cancer or ductal carcinoma in situ (DCIS), and all patients successfully completed exchange of expander to implant. There were no complications with infection, seroma, mastectomy flap, or nipple necrosis. Aesthetic results were in line with other nipple-sparing techniques. The wide-based IMF flap with nipple preservation is a viable option for larger-breasted ptotic patients who might not otherwise be candidates for nipple-sparing mastectomy. The approach described is a combination of surgical technique and indocyanine green perfusion technology to deliver reproducible results, with an emphasis on surgical safety and avoidance of complications. (*Plast Reconstr Surg Glob Open* 2020;8:e3053; doi: [10.1097/GOX.0000000000003053](https://doi.org/10.1097/GOX.0000000000003053); Published online 25 August 2020.)

INTRODUCTION

The popularity of nipple-sparing mastectomy has increased as the criteria for eligible patients expand in concordance with data, suggesting its oncologic safety.^{1–5} This rising trend can be attributed to the superior aesthetic outcome provided by the retention of the nipple–areolar complex, improved psychological outcomes and patient satisfaction, and increased surgeon comfort with the procedure.^{3,6–9} Despite these benefits, the challenge remains as to how surgeons can extend this option to patients with macromastia or grade III/IV ptosis. Several techniques

have been described, including reduction mammoplasty followed by mastectomy, bipediced simultaneous mastopexy with mastectomy, and free nipple grafting.^{10–15} However, there is currently no level I evidence in the literature to render any of these strategies superior. The authors have developed a novel approach to nipple-sparing mastectomy that preserves the nipple–areolar complex on a wide-based inframammary fold (IMF) flap and uses indocyanine green (ICG) perfusion imaging to successfully and reliably perform nipple-sparing mastectomy with immediate reconstruction in large-breasted ptotic patients.

PATIENTS AND METHODS

Six consecutive patients underwent bilateral nipple-sparing mastectomies and immediate breast reconstruction

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From the *University of Central Florida College of Medicine, Orlando, Fla.; and †National Center for Plastic Surgery, McLean, Va.

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with a wide-based IMF flap. Selection criteria included patients with a grade III/IV ptosis and patients being amendable to having a smaller breast size. None of the patients were active tobacco users. All patients underwent immediate reconstruction with prepectoral placement of tissue expanders to treat either breast cancer or ductal carcinoma in situ (DCIS).

The patients were marked out for Wise pattern mastectomies with IMF flaps that spanned the entire width of the IMF and narrowed to include the nipple–areolar complex (Fig. 1). A 42-mm cookie cutter was used to resize the nipple–areolar complex initially. After the incision was made around the areola, the flaps were elevated at the level of a standard mastectomy in the plane between the subcutaneous fat and breast tissue. Directly behind the nipple–areolar complex, a very thin layer of subareolar tissue was left behind to remain in continuity with the subcutaneous plane surrounding it, to preserve vascularity (Fig. 2). A frozen section biopsy of this subareolar breast tissue was sent to pathologic examination to rule out malignancy. The wide-based IMF flap was folded inferiorly and wrapped in a warm moist laparotomy sponge during the completion of the mastectomy. The IMF flap was then de-epithelialized using face-lift scissors, with extreme care to stay in the dermal layer.

Following the completion of the mastectomy, prepectoral breast reconstruction with a tissue expander and acellular dermal matrix (ADM) was performed. (See Video [online], which displays a patient on the operating table who has undergone a wise pattern mastectomy. A tissue expander has been placed in the prepectoral space and is covered anteriorly with 2 pieces of ADM sutured together. The IMF flap is placed on top of the tissue expander reconstruction before closure.) Two pieces of ADM were placed: one superiorly and the other inferiorly. The ADM was sutured superiorly to the pectoralis major and inferiorly to the chest wall, with interrupted 3-0 PDS. Two pieces of ADM were used, as it was the surgeon's preferred technique for handling all tissue expander cases. A tissue expander was placed deep into the 2 pieces of ADM, with its suture taps secured with 3-0 Mersilene. Minimal expansion was performed to the tissue expander to limit the internal pressure on the IMF flap. The overlying mastectomy flaps were then tailor tacked together with staples. ICG perfusion imaging was performed using the SPY Elite system (Stryker Corp., Kalamazoo, Mich.) (Fig. 3).

Following visualization of adequate perfusion in the nipple and areola, the complex was delivered through a circular pattern in the overlying mastectomy flaps. The nipple–areolar complex was then inset loosely with interrupted 3-0 Monocryl in the deep dermal layer and 4-0 nylon superficially. Drains were placed, and closure was performed. Postoperative bras were avoided so as to not compress the IMF fold flap blood supply. Expansion resumed 2 weeks postoperatively.

RESULTS

All patients underwent nipple-sparing mastectomy, but 5 of the 6 patients successfully had their first stage of their reconstruction. One patient had a positive intraoperative

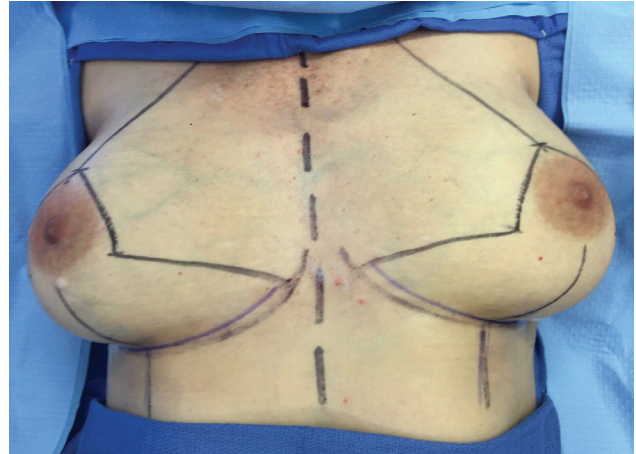


Fig. 1. Intraoperative markings for bilateral nipple-sparing mastectomies with Wise pattern and IMF flaps.

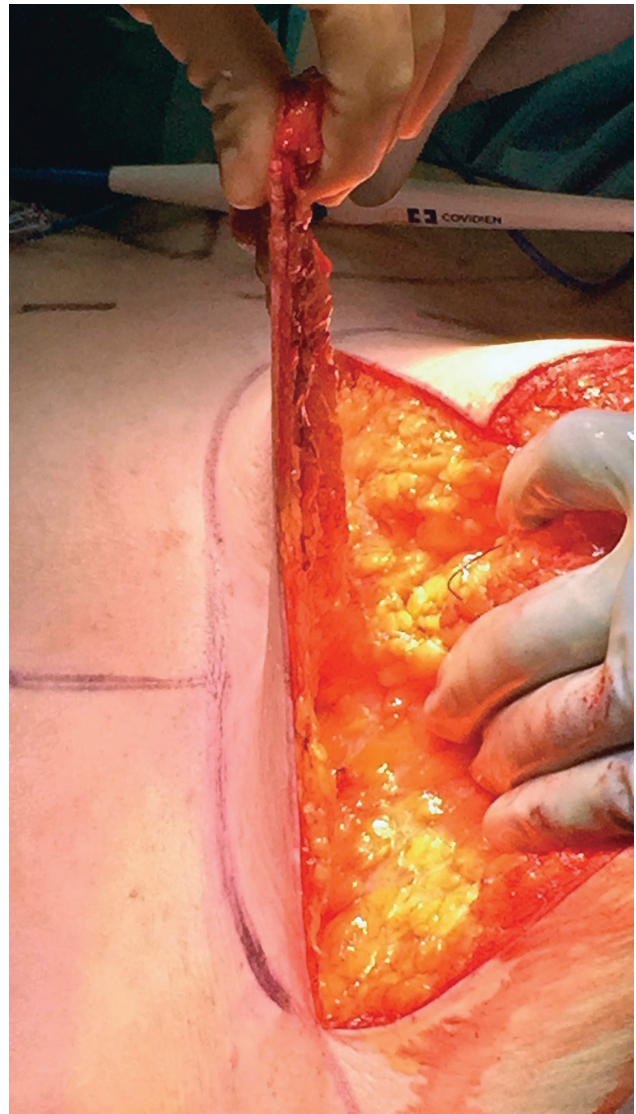


Fig. 2. Wide-based IMF flap elevated, with nipple preservation.

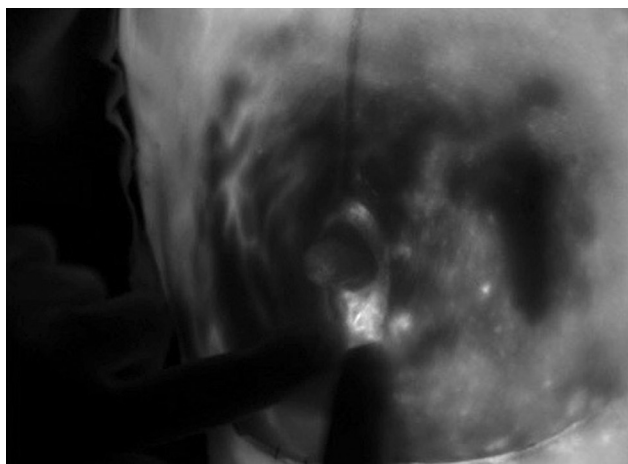


Fig. 3. ICG image showing perfusion of wide-based IMF flap and nipple areolar complex while Wise pattern mastectomy flaps are tailor tacked together with staples.

subareolar margin on the undersurface of her right nipple, determined by frozen section, which necessitated an intraoperative removal. Although the right nipple-areolar complex was viable on the SPY imaging, it needed to be removed for pathologic examination. Nipple-sparing mastectomy and reconstruction were successfully performed on the contralateral breast. All 6 patients went on to successfully underwent exchange of expander to implant (Fig. 4). There were no complications with infection, seroma, and mastectomy flap or nipple necrosis.

DISCUSSION

The wide-based IMF flap has previously been described by Bostwick^{16,17} for its use in breast reconstruction. Surgeons have used this de-epithelialized flap to protect wise pattern mastectomy flaps, cover implants, or replace ADM in breast reconstruction.¹⁶ The technique described in this article is similar to that of the Bostwick flap but includes the nipple-areolar complex and incorporates ICG perfusion imaging to verify its viability. The technique has also been recently described by Mosharafa et al,¹⁸ although their approach excludes the use of ICG perfusion imaging. The authors report a 91% success rate on a study sample of 65 patients, with 9% having experienced

nipple-areolar complex necrosis.¹⁸ Although multiple factors could have contributed to this necrosis, we feel that the use of intraoperative vascular imaging technology could have potentially prevented this postoperative complication by allowing the nipple-areolar complex to be removed intraoperatively if shown to be poorly perfused.

The main advantage of this wide-based IMF flap technique is that it can be offered to large-breasted ptotic patients who otherwise would not be candidates for nipple-sparing mastectomy. The novelty here is that ICG perfusion imaging is combined with the high-risk nipple-sparing technique. The technique allows for the nipple-areolar complex to be placed in a multitude of locations with minimal tension, an advantage over other bipediced techniques.

There are a few caveats to this technique that should be mentioned to facilitate its use. First, the areola must be resized before raising the flap. It is extremely difficult to generate the appropriate tension required to resize the areola after the flap has been raised. Second, whenever possible, the flap should be raised by the plastic surgeon before the mastectomy. This allows for the flap to be safely secured inferiorly during the completion of the mastectomy. Next, care must be taken to leave an even amount of tissue underneath the nipple-areolar complex. If the undersurface of the nipple-areolar complex is excessively thinned, the chances of necrosis are high. The inset of the nipple-areolar complex is best made loosely with interrupted 3-0 absorbable sutures in the dermal layer and interrupted 4-0 nylon sutures superficially. Finally, postoperative bras should be avoided because they may compress the tenuous blood supply of the wide-based IMF flap.

Despite the merits of this technique, it is still a high-risk procedure with regard to potential nipple necrosis. The ICG imaging system was extremely important to the decision-making process in the series because it provided reassurance that the nipple-areolar complexes were adequately perfused. However, it is important to appropriately set patients' expectations in the event that ICG perfusion imaging indicates that the nipple-areolar complex must be removed to avoid a likely necrotic complication and potential infection, jeopardizing the entire reconstruction. ICG perfusion imaging has been shown to be highly reliable in predicting viability of nipple-sparing mastectomy.^{19,20}

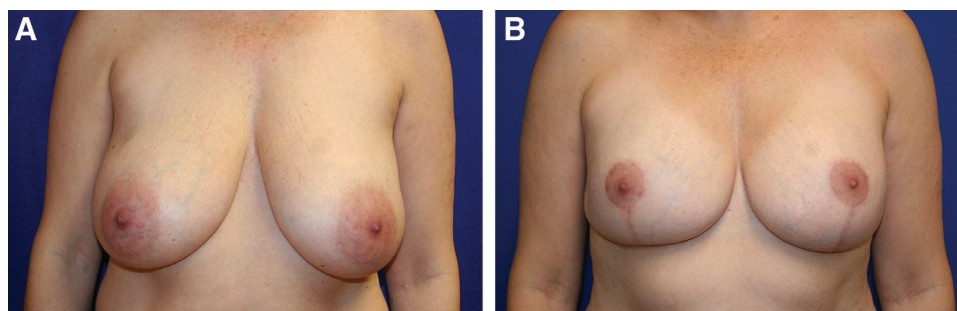


Fig. 4. Before and after photographs. A, A preoperative photograph of a 44-year-old woman diagnosed with right breast infiltrating ductal carcinoma in the setting of extensive DCIS. B, A postoperative photograph of the patient 3 months after exchange of tissue expander to implant.

CONCLUSIONS

The wide-based IMF flap with nipple preservation is a viable option for larger-breasted ptotic patients who might not otherwise be candidates for nipple-sparing mastectomy. The approach described is a combination of surgical technique and ICG perfusion technology to deliver reproducible results, with an emphasis on surgical safety and avoidance of complications. The initial results are encouraging, but this remains a high-risk procedure with regard to nipple necrosis and should only be used in specific instances.

Mark L. Venturi, MD, FACS
National Center for Plastic Surgery
7601 Lewinsville Road
Suite 400
McLean, VA 22102
E-mail: drventuri@gmail.com

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