Technical Considerations in Nipple-Sparing Mastectomy: 82 Consecutive Cases without Necrosis

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Technical Considerations in Nipple-Sparing Mastectomy: 82 Consecutive Cases without Necrosis

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Background: Even without comparative trials, nipple-sparing mastectomy (NSM) is gaining traction in the treatment of established breast cancer and in the prophylactic setting. As yet, there are no established techniques that are universally applied to NSM. Herein we describe our surgical approach.

Methods: All mastectomies performed by a single surgeon (AJS). Reconstructions performed included synthetic implants, deep inferior epigastric (DIEP) and gluteal artery perforator flaps (GAP). A lateral incision (12.1%) and a 6:00 radial incision (87.9%) were used in all patients. The areola was elevated just beneath the deep dermis and ductal tissue within the nipple papilla was "cored".

Results: Fifty-eight patients underwent 82 NSMs for both cancer and prophylaxis. No patient developed necrosis of the nipple-areola complex (NAC). Minor skin-edge necrosis not involving the NAC occurred in 2 patients. Four patients developed a hematoma, 2 requiring re-operation. One patient required re-operation to correct a vein problem. There were no flap losses.

Conclusions: NSM can be performed with a minimal incidence of skin-flap related complications. In our hands, radial incisions perform well in this regard. Indications for NSM and the optimal technique are yet to be determined.

Key Words: Mastectomy—Nipple-sparing mastectomy—DIEP flap—GAP flap.

Nipple-sparing mastectomy (NSM) is clearly gaining traction as both a surgical approach to the treatment of breast cancer and in the prophylactic setting.[1–8] NSM is now a term that is applied to a skin-sparing mastectomy (SSM) in which the nipple-areola complex (NAC) is preserved. The exact origin of the name nipple-sparing mastectomy is unknown but seems to imply a more radical approach to breast tissue removal compared to subcutaneous mastectomy which began to fall out of favor several decades ago.[9,10] For instance, in 1983, Woods described in detail the technique used for subcutaneous mastectomy in a series of more than 1400 patients at the Mayo Clinic. A "1 cm thick button of tissue" was left beneath the areola in order to preserve its blood supply.[11] The surgical approach to NSM differs from surgeon to surgeon and is dependent on factors such as the type of planned breast reconstruction as well as the size and shape of the breast. Herein we describe our surgical approach to NSM and our initial surgical results.

METHODS AND SURGICAL TECHNIQUE

Between March 1, 2006 and August 1, 2007 162 women underwent mastectomy by a single surgeon, for both cancer and prophylaxis. In 58 of the 162 patients (35.8%), NSM was performed. Twenty-four of the 58 patients underwent bilateral NSM for a

total of 82 procedures. It is these 58 patients which make up the study population.

Description of the Surgical Practices

All mastectomies were performed by a single surgeon (AJS), fellowship trained in surgical oncology with practice limited to breast since 1993. The reconstructive team (SKS and FJD) are board-certified plastic surgeons with specialty training in microsurgical techniques. Aside from community-based practice, approximately 70% of all patients referred specifically for mastectomy are referred from out of state.

Informed Consent

All patients were counseled prior to surgery regarding the lack of prospective data for this procedure and the potential for an increase in risk of local recurrence or development of a new cancer. Furthermore, patients were counseled regarding the possibility of nipple removal should cancer cells be detected in histological samples of tissue in or beneath the nipple.

Contraindications for Nipple-Sparing Mastectomy

In those patients with recently diagnosed breast cancer, contraindications for NSM included lesions within 2 cm of the NAC, multicentric disease, lesions > 3 cm and prominent lymphovascular invasion. Morbid obesity and active smokers were also not considered good candidates for microsurgical flap reconstruction and none were included in this study. Well-controlled diabetes was not a contraindication, but again none were included in this study. Patients with inadequate fat to fill the breast envelope or patients who desired breast reduction were initially not considered good candidates for NSM. Because the underlying breast tissue has been removed there is no vascular pedicle to support the elevation of the NAC to a new location. Recently however our approach to this group of patients has changed. NSM and reconstruction is performed. At least 3 months following reconstruction, a second stage mastopexy with or without reduction is performed.

Breast Reconstruction

All patients underwent immediate reconstruction with either a deep inferior epigastric perforator flap (DIEP), a gluteal artery perforator flap (GAP) or
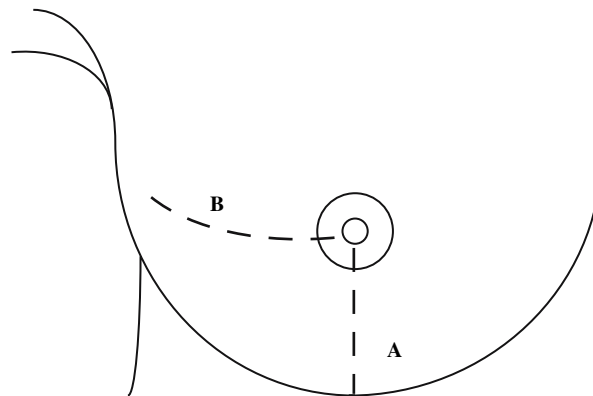

FIG. 1. Incisions used in the current study: (A) 6:00 radial (B) Lateral.

synthetic implant. Two of the authors (SKS, FJD) performed all but one of the reconstructions.

Incisions and Lighting

A variety of incisions were utilized during this time period (Fig. 1) including the following: (A) A 6:00 radial incision (Fig. 2), extending from just below the nipple to just above the inframammary fold. (B) A lateral incision (Fig. 3) which is a slightly curved incision beginning from just outside the nipple or areola and extending laterally for a variable distance depending on breast size and other exposure variables. The default incision is 6:00 radial. In our hands this incision allows good exposure to all areas of the breast including the axillary tail while also allowing access to the internal mammary vessels which are used exclusively for the microsurgical anastamosis. The lateral incision is used in two situations. In patients who require skin excisions for lumpectomy scars or superficial tumors, the excision can in many instances be included in the single lateral incision. Where skin excisions are required elsewhere on the breast, the skin is excised as an ellipse, allowed to remain on the specimen and the mastectomy is completed by a 6:00 radial or lateral incision (Fig. 4).

Lighted retractors are commonly used (Lightmax Surgical Illuminator, Strongsville, MA) as is a headlight (Sunoptics SolarPlus Headlight, Jacksonville, FL). Our recent experience favors this headlight, which has an adjustable field size, over lighted retractors. Sentinel node biopsy when needed was performed through a separate transverse incision just beneath the hair-bearing region of the axilla. In cases where a lateral incision was used, sentinel node biopsy was performed through the mastectomy incision. Because the internal mammary vessels serve as the recipient vessels
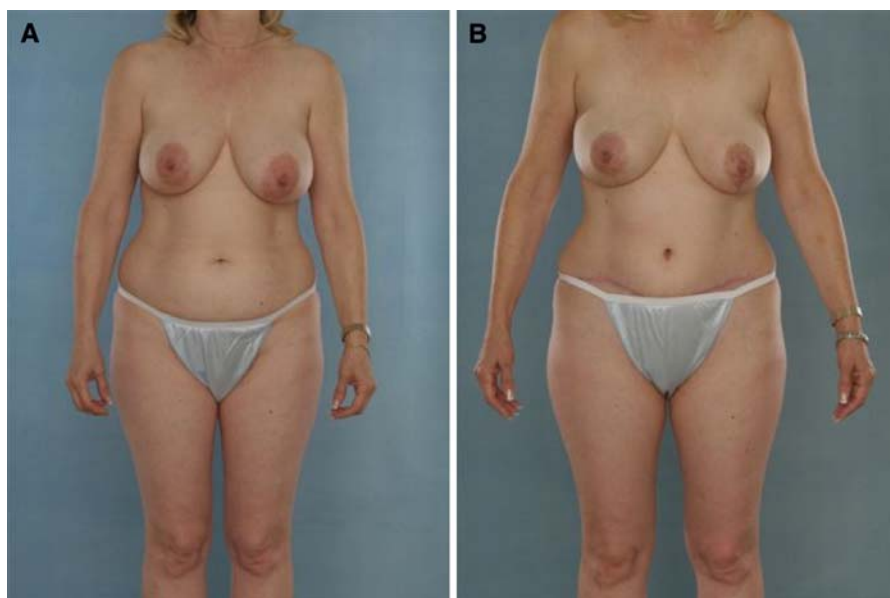
FIG. 2. (**A**) Preoperative photograph. (**B**) Postoperative bilateral nipple-sparing mastectomy using 6:00 radial incisions and deep inferior epigastric perforator flap reconstruction.
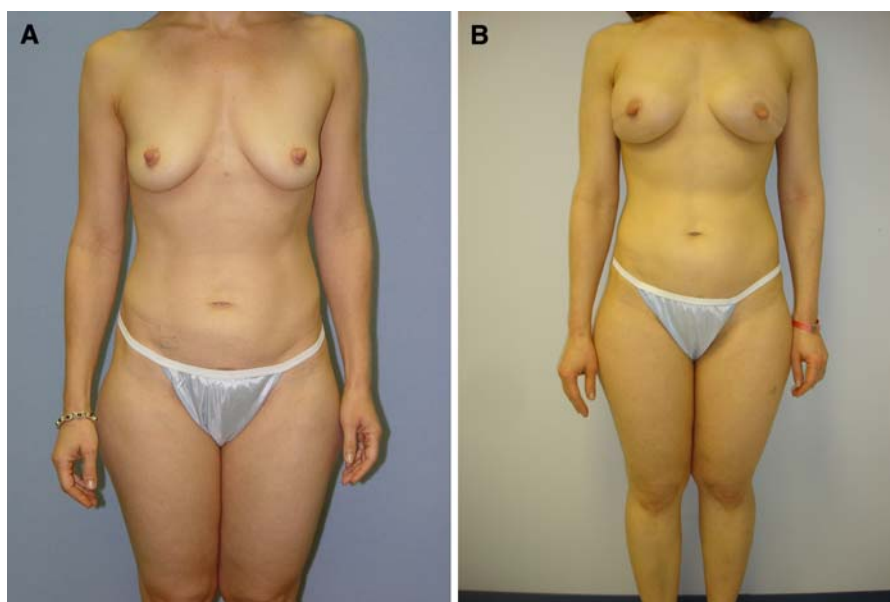

FIG. 3. (**A**) Preoperative photograph. (**B**) Postoperative photograph, bilateral prophylactic mastectomies using lateral incisions and gluteal artery perforator flap for reconstruction.

in all cases, delayed axillary node dissections can be carried out without fear of disrupting the vascular supply to the reconstructed breast.

Skin Flaps and Elevation of the Nipple-Areola Complex

The areola was elevated off of the underlying breast parenchyma utilizing the plane just beneath the deep dermis. In most instances the breast adhered tightly to the underside of the areola and separation was generally carried out using scissors dissection with only point cauterization. The larger lactiferous ducts are identified entering the base of the nipple and are usually transected at the base of the nipple papilla. Standard-thickness skin flaps are then raised between the plane of the breast and the subcutaneous
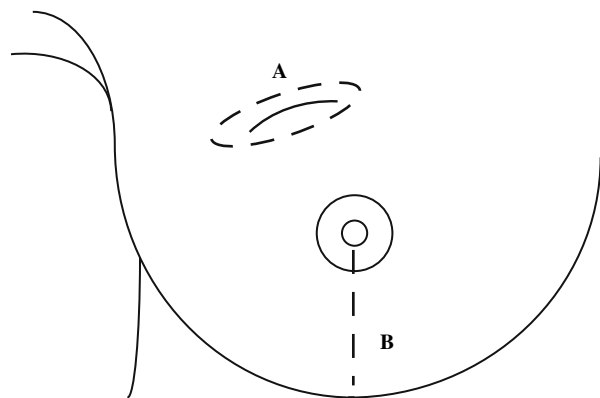
FIG. 4. Surgical approach in patients with prior lumpectomy. (**A**) Lumpectomy site excised. (**B**) 6:00 radial incision for nipple-sparing mastectomy.

TABLE 1. *Patient and tumor characteristics*

Characteristic	No. (%)
Total number of patients	58
Total number of procedures	82
Mean age	48.6 years
Recent diagnosis of breast cancer	25 (43.1)
Invasive ductal or lobular carcinoma	16
Ductal carcinoma in situ	9
Axillary nodes sampled	19 (32.7)
Level I, II dissection	4
Sentinel node biopsy	15
BRCA mutation	13 (22.4)
Tested	31
BRCA1	5
BRCA2	8

TABLE 2. *Indications for surgery based on BRCA status*

BRCA status	No. of patients	No. of mastectomies
BRCA positive		
Invasive CA in past	3	5
Invasive CA	1	2
Prophylactic	9	18
BRCA negative		
Invasive CA	16	21
DCIS	9	14
LCIS	1	2
Prophylactic: prior unilateral mastectomy	18	18
Prophylactic	1	2
Total	58	82

fat. A defined preset skin flap thickness was not utilized. In an attempt to reduce heat damage to the skin flap, blended-current cautery is used to elevate skin flaps. Recently, we have also begun to frequently utilize bipolar scissors (PowerStar bipolar scissors Ethicon, Inc.) for this purpose and find them extremely useful in maintaining an accurate tissue plane. Care was also taken not to elevate the skin flaps past the anterior edge of the latissimus dorsi muscle or over the sternum in order to preserve as many feeding vessels as possible. Following breast removal, the nipple was then inverted and using sharp scalpel dissection the ductal tissue within the nipple papilla was dissected out while attempting to leave approximately 2 mm of tissue at the tip. When completed the stubs of the remaining ducts entering the tip of the nipple can easily been visualized. In cases where the nipple was shallow and there was little visible ductal tissue remaining, no further attempt was made to remove more tissue.

RESULTS

Patient characteristics are seen in Table 1. Fifty-eight patients underwent 82 NSMs. The mean age of patients was 47.7 years. Twenty-four patients (41.3%) underwent bilateral NSM whereas 34 (58.7%) had a unilateral procedure. Twenty-five patients (43.1%) underwent NSM on the side of a recently diagnosed cancer. Sixteen had invasive cancer (ductal or lobular), nine had DCIS. One patient had been recently diagnosed with lobular carcinoma in situ (LCIS). Nineteen patients had sentinel node biopsy. Frozen sections were carried out routinely. Four patients were found to have positive nodes on

frozen section and all underwent completion axillary node dissection at the time of mastectomy. No additional positive node cases were found on permanent section and immunohistochemistry. Thirty-one patients underwent genetic testing for the *BRCA1/2* genes prior to surgery. Thirteen patients tested positive (22.4%) for a *BRCA* mutation. Five were *BRCA1* positive and eight tested positive for deleterious mutation in *BRCA2*.

Table 2 examines indications for surgery by *BRCA* status. In general, patients undergoing prophylactic mastectomy and who were *BRCA* negative had either a recently diagnosed cancer or had undergone breast cancer treatment in the past (75.5%). Only one patient, with a strong family history of breast cancer, underwent bilateral prophylactic NSM who did not have a prior cancer diagnosis and who had tested negative for *BRCA1/2*. However in *BRCA*-positive patients, only a third (30%) of the patients had a recent or distant cancer diagnosis. No occult cancers were found in *BRCA*-positive patients undergoing prophylactic NSM.

Surgical approach and complications can be seen in Table 3. A 6:00 radial incision was used in 51 pa-

TABLE 3. *Surgical approach and complications*

Characteristic	No. (%)
Incision	
6:00 radial	51(87.9)
Lateral	7 (12.1)
Breast reconstruction	58
DIEP[1]	31 (53.4)
GAP[2]	20 (34.5)
Saline implant	7 (12.1)
Surgical complications	10 (17.2)
Flap loss	0
Necrosis NAC	0
Skin-edge necrosis (not NAC)	2
Hematoma, no surgery	2
Hematoma, surgery	4
Venous anastamosis	1
Pulmonary	2

[1] Deep inferior epigastric perforator flap.
[2] Gluteal artery perforator flap.

tients while a lateral incision was used in seven. Breast reconstruction was performed in all patients using the following techniques. The DIEP was used in 31 patients (53.4%), GAP in 20 (34.5%), and saline-filled implants in 5 patients (12.1%). One of the GAP reconstructions was based on the inferior gluteal artery (I-GAP) with the remaining based on the superior gluteal artery (S-GAP). One DIEP was "stacked" utilizing both sides of the abdomen for a unilateral reconstruction.

No patient developed either superficial or full-thickness skin loss affecting the NAC. Eight patients (13.7%) developed postoperative complications related directly to technical aspects of the surgery. Two patients developed skin-edge necrosis involving the lower aspect of the 6:00 radial incision. No patient with a lateral incision developed skin-edge necrosis. Six patients developed a hematoma, four of whom required a return to the operating room. Five of these patients had 6:00 radial incisions and one patient had a lateral incision. One patient developed problems with the venous anastamosis requiring a return to surgery for repair. There were no flap losses. There were two pulmonary complications that resolved with appropriate therapy.

DISCUSSION

Though no prospective trials exist, SSM has gained wide acceptance in the treatment of both established cancer and prophylaxis, and while outcomes with a reconstructed nipple can be quite satisfactory, results are clearly not consistently reproducible. Unfortunately, only scattered series of NSM have been reported, and prospective data in unlikely, at least in the near future. Interpretation of these reports is not straight forward, as there is significant difficulty determining exactly what tissue is removed and what is meant by certain terminology. For instance, the phrase "nipple coring" has been used to indicate that breast tissue is removed from the nipple papilla.[2] What is unclear is how aggressively this is pursued. It is our opinion, based on observation, that removal of all ductal tissue is very unlikely as doing so would certainly lead to an unacceptable incidence of nipple necrosis. In the prophylactic mastectomy series by Hartmann et al.,[12] excellent outcomes were obtained. Yet in a description of the procedure published years before this study, 1 cm of breast tissue was purposefully retained behind the NAC.[13]

Incision planning for NSM is extremely important and many decisions have been described.[2,7,13] In patients with established cancer appropriate areas of skin may in some instances require excision including prior lumpectomy incisions. Our approach to this issue is seen in Fig. 4. It is also important for the surgeon to know what type of reconstruction is planned. Communication of the surgeon performing the mastectomy with the reconstruction team is critical. If synthetic implants are planned, there is a great deal of freedom in determining incision placement. Access to the subpectoral space is easily available from virtually all mastectomy incisions, but even in this situation, preoperative consultation will be valuable. For instance in women with a very small breast or with large areola, mastectomy may be performed through a very small periareola incision, yet some small incisions may allow placement of an expander but not a fully formed implant and extensions may be required. Prior to this consecutive series, NSM was performed only occasionally and always patient driven. During these years a variety of incisions were used (Fig. 5). The envelope mastectomy has been previously described[8] and does allow access to the entire breast. Because there are no incisions on the breast proper, the cosmetic results can be excellent. This approach is best suited to implant reconstruction, pedicle transverse rectus abdominus myocutaneous (TRAM) or free-flap reconstruction utilizing the subscapular artery and vein as recipient vessels. In our hands, using the internal mammary vessels, the flap had to be folded upon itself to access the vessels and resulted in approximately 1 cm of skin-edge necrosis. The inframammary incision also results in an excellent cosmetic outcome (Fig. 3). Sacchini et al. noted that in their hands this incision is reserved for the small non-ptotic breast with a maximum distance of 18 cm between the incision and the
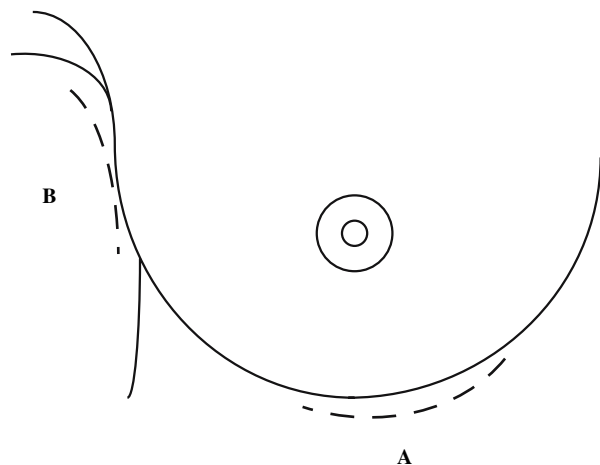
FIG. 5. Previously used incisions for nipple-sparing mastectomy: (**A**) inframammary fold and (**B**) envelope incision.

upper inner quadrant.[2] Margulies et al. reported excellent results using the inframammary fold incision in 31 patients.[12] They describe dissecting the breast off of the pectoralis major muscle prior to elevating the upper skin flaps, which we have also found to be helpful at times. In our hands however, based on a much earlier experience the inframammary fold incision was problematic. Access to the vessels was difficult, making the procedure more suited to implant reconstruction. We also felt that accurate dissection around the NAC, which is likely to be critically important for good long-term outcomes, was considerably more difficult. We also found that in our hands, the dissection in the upper reaches of the breast to be less than satisfactory particularly when considering the importance of removing all visible tissue in gene-positive patients.

Partial and full-thickness NAC necrosis has been reported with NSM.[2,5] We believe that our lack of nipple necrosis, at least in our early experience, is likely due to several factors. Both the 6:00 radial and lateral incisions utilized in this series seemed to allow adequate blood supply even to a thin NAC. We also suggest minimal use of the electrocautery when elevating the NAC, mostly for pinpoint hemostasis. Great care must be taken after elevating the NAC to follow the plane of the breast as it moves away from the skin. This cannot be overemphasized. Using a spread-and-cut technique, we have found the use of the bipolar scissors to be very helpful in this regard. To continue in the same superficial plane as used to elevate the NAC would likely increase the risk of necrosis. A final consideration is careful attention paid to the limits of the dissection. Dissecting far beneath the inframammary fold, lateral to the la-

tissimus dorsi muscle, and over the sternum may unnecessarily damage the peripheral blood supply to the breast envelope.

Despite the lack of comparative data, SSM has gained wide acceptance in the surgical community. Technically, SSM required only a change in surgical incisions and time to deal with more limited exposure. The same is not true of NSM. The optimal surgical technique for maximum breast tissue removal, retaining a viable NAC and maximizing cosmetic outcome is not yet clear. What are the best incisions? What plane should be used in dissecting the NAC? Should an attempt be made to remove tissue within the nipple papilla? Can a rim of breast tissue be retained behind the NAC? Most importantly, will NSM result in risk increase in local recurrence and in the development of new cancers, which are not justified by the improved cosmetic outcome? This study represents a group of consecutive, yet highly selected and motivated patients with minimal follow-up. It cannot provide definitive answers to these questions.

Moreover, the answers will not be the same for each surgeon or for each patient. Surgeons with limited available reconstruction options may select different choices than those with a wide variety of breast reconstruction alternatives. Surgeons with large breast practices may utilize different incisions than those without vast mastectomy experience. What is the importance of NSM to our patients? Some patients with breast cancer may accept small differences in outcome to substantial improvements in body image, whereas others may scrap for every percentage point of reduced risk. In women testing positive for the *BRCA1/2* gene, is it satisfactory to return their risk of developing breast cancer to that of unaffected women, or is a near-zero risk the only acceptable pathway? As we attempt to answer these questions in the coming years, it is imperative that surgeons performing NSM take great care to report minute technical details and most importantly, long term follow-up.

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