

Feasibility of Sentinel Lymph Node Biopsy Through an Inframammary Incision for a Nipple-Sparing Mastectomy

John V. Kiluk, MD,^{1,2} Alfredo A. Santillan, MD, MPH,^{1,2} Paramjeet Kaur, MD,^{1,2}
Christine Laronga, MD, FACS,^{1,2} Tammi Meade, BS,^{1,2} Dan Ramos, BS,^{1,2}
and Charles E. Cox, MD, FACS^{1,2}

¹MCC—Breast Program, H. Lee Moffitt Cancer Center & Research Institute (MCC), Tampa, FL 33612, USA
²Department of Surgery, University of South Florida College of Medicine, Tampa, FL, USA

Background: Nipple-sparing mastectomy (NSM) via an inframammary (IM) incision has been described for selected patients with breast cancer. However, the application of sentinel lymph node (SLN) mapping via an IM incision for NSM has yet to be reported. The objective of this study is to determine the technical feasibility of performing SLN through an IM incision without making an axillary counterincision.

Methods: We retrospectively reviewed our single-institutional experience with SLN biopsy and NSM through IM incisions between January 2006 and March 2008. Clinicopathologic factors were analyzed regarding indications, technical details, postoperative morbidity, and follow-up.

Results: Fifty-two patients underwent 87 NSM through an IM incision (17 unilateral, 35 bilateral) with immediate reconstruction and SLN biopsy. Indications for surgery included invasive breast cancer ($n = 21$), ductal carcinoma in situ (DCIS) ($n = 18$), and prophylactic ($n = 48$). Mean tumor size of invasive carcinoma was 2.1 cm. The mean mastectomy specimen weight was 437 g. Subareolar injection consisted of blue dye ($n = 43$), technetium sulfur colloid ($n = 2$), or combination injection ($n = 42$). SLN biopsy through an IM incision was successfully performed in 84 of 87 cases (96.6%). A mean of 2.8 SLN were removed with a positive sentinel node encountered in 8 of 21 patients (38%) with invasive cancer. No complications were observed regarding the SLN portion of the operation. With a median follow-up of 6.5 months (range, 0.4–23 months), there have been no axillary local recurrences.

Conclusion: SLN biopsy can be performed through an IM incision during a NSM, avoiding a secondary axillary incision.

Abbreviations: IM, inframammary incision; NAC, nipple areolar complex; NSM, nipple-sparing mastectomy; SLN, sentinel lymph node.

The traditional approach for a mastectomy involves an elliptical incision on the breast mound that excises the entire nipple areolar complex (NAC) en bloc with the mastectomy specimen. The basis of this incision stems from studies more than 20 years

ago showing occult cancer in the NAC in 8–50% of mastectomy specimens.^{1–9} Because the majority of breast cancers originate from the ductal system and 8–12 major ducts transverse the nipple proper, the nipple was excised to completely remove all potentially malignant cells and to minimize subsequent risk for developing breast cancer. Attempts at preserving the NAC were initially performed using the “subcutaneous” mastectomy technique. This technique preserved the NAC by performing a mastectomy through an inframammary (IM) incision and was

Published online September 27, 2008.
Address correspondence and reprint requests to: John V. Kiluk, MD; E-mail: john.kiluk@moffitt.org
Published by Springer Science+Business Media, LLC © 2008 The Society of Surgical Oncology, Inc.

largely used in the prophylactic setting.¹⁰ Unfortunately, results using this technique for patients with cancer were not as favorable as initially hoped in that there were a higher number of local recurrences than the traditional mastectomy.¹¹

Recently, there has been resurgence in developing new surgical techniques that preserve the NAC. The potential benefits of preservation of the NAC include improved cosmesis and possible preservation of nipple sensation.¹²⁻¹⁴ Nipple-sparing mastectomy (NSM) has been described using various techniques and incisions (IM, periareolar, transareolar).^{15,16} The technique for NSM differs from a subcutaneous mastectomy in that much thinner skin flaps are performed and the breast tissue is shaved from the undersurface of the nipple. Intraoperative frozen sections from the base of the nipple are performed to rule out an occult cancer or atypia at the base of the remaining NAC. Obviously, if the frozen section returns positive for cancer or atypia, the nipple is sacrificed.

The rebirth of NSM comes during a time of SLN biopsy for the axillary staging of breast cancer. However, by using an IM incision, SLN biopsy provides a technical challenge since the distance between the IM incision and axilla is greater than the standard mastectomy incision. Although a counter-incision could be made in the axilla to obtain a SLN, this would add another scar to a procedure that was developed to minimize scars and hide the incision in the IM crease.

The objective of this paper is to review our experience with SLN biopsy through an IM incision in patients undergoing a NSM mastectomy.

METHODS

An institutional review board (IRB)-approved Health Insurance Portability and Accountability Act (HIPPA)-compliant breast cancer database and electronic health record (IRB No. 102554) was searched under separate IRB approval (IRB No. 106198) for patients undergoing a NSM using an IM incision between January 2006 and March 2008 at the Moffitt Cancer Center.

Candidates for NSM at our institution are generally patients with small breast (A or B cup) pursuing prophylactic mastectomy or patients with small, peripheral tumors who desire reconstruction. Age is generally not considered in patient selection as long as they are suitable choices for reconstruction. Preferably, candidates should be node negative as positive

nodes may increase the likelihood of receiving postmastectomy radiation as well as having nipple involvement of atypical or malignant cells.¹ One surgeon (C.C.) at our institution preferentially uses an IM incision for his NSM, and his technique is described here. The IM incision starts 6–8 cm from the midline of the chest and extends 7–12 cm laterally in the IM fold depending on the size of the breast. The breast is first elevated entirely off the underlying pectoralis muscle with electrocautery taking the pectoralis fascia with the specimen. By lifting the breast tissue off the pectoralis first in a relatively avascular plane, visualization of the sentinel node in the axilla is enhanced as more bleeding is encountered with the creation of skin flaps. Skin flaps of 3 mm are created with facelift scissors as the breast can then be removed. Marking of the specimen is critical in that the base of the nipple is marked with a suture for pathologic evaluation. The mastectomy flap must be inverted at this time and a separate biopsy from the base of the nipple is taken and sent for frozen section evaluation. If the frozen section returns positive for malignancy or atypia, the nipple is sacrificed at time of operation. Immediate reconstruction with either a tissue expander or immediate implant was used in every case of this study.

All of these patients undergo immediate reconstruction generally with the use of tissue expanders and application of a collagen matrix sling using Alloderm or Cosmatrix to provide support for the prosthesis and to fix the lower border of the pectoralis major muscle. At this point in the operation, the nipple effectively has been stripped of its blood supply by meticulous removal of all the breast tissue from the base of the nipple. The positioning and fixation pectoralis muscle directly behind the nipple theoretically provides or improves vascular blood supply from the pectoralis muscle to the under surface of the nipple. Fixation of the muscle prevents “window shading” of the muscle as it contracts by suturing it to an immovable layer of collagen (Cosmatrix/Alloderm) The creation of a sling also minimizes muscle stretching and thinning by the expansion process, theoretically enhancing blood supply from the muscle to the nipple. Photos taken 1 week after surgery (Fig. 1) and several months after surgery (Fig. 2) are shown.

As far as technique of SLN biopsy, a combination of 3 cc of isosulfan blue dye and approximately 450 μ Ci of technetium sulfur colloid are generally used for biopsy proven noninvasive or invasive cancer. In SLN biopsy performed in a prophylactic setting, a single agent of blue dye is generally used. Common



FIG. 1. Postoperative photo (1 week) of nipple-sparing mastectomy.



FIG. 2. Postoperative photo (several months) of nipple-sparing mastectomy.

exceptions to this rule include patients with a prior sensitivity to blue dye. Although locating the SLN through an IM incision is more technically challenging, we have found that the use of a lighted retractor aids significantly in identification and retrieval of the SLN. Furthermore, visualization of the axilla is improved if the sentinel node is identified after the breast is lifted off the pectoralis muscle but before the skin flaps are created by facelift scissors. Raising the breast off of the muscle in a relatively avascular plane allows for improved visualization of the sentinel node. Attempts to identify the sentinel node after detaching the breast from the skin flaps are precluded

by the bleeding from the flap, making it very difficult for the surgeon to identify blue channels.

Patient's demographic, clinical, and treatment variables were recorded. Clinicopathologic factors were analyzed regarding indications, technical details, postoperative morbidity, and disease-free survival.

RESULTS

Fifty-two patients (mean age, 48 years) underwent 87 NSM through an IM incision (17 unilateral, 35 bilateral) with immediate reconstruction and SLN biopsy. These 87 NSM represent 7.5% of all mastectomies (87/1165) performed at our institution over this period of time. Indications for surgery included invasive breast cancer ($n = 21$), ductal carcinoma in situ (DCIS) ($n = 18$), and prophylactic ($n = 48$). Mean tumor size of invasive carcinoma and breast size were 2.1 cm (range, 0.1–10 cm) and 437 g (range, 74–880 g), respectively. Special note should be made of the one patient with a 10-cm invasive cancer, as NSM should not be offered in this patient population. On breast magnetic resonance imaging, the cancer appeared to be less than 4 cm, and there were no dominant masses by physical examination. On final pathology, the mastectomy specimen included a diffuse carcinoma without discrete mass measuring at the greatest dimension 10 cm with negative margins and subsequently received postmastectomy radiation.

Subareolar injection consisted of isosulfan blue dye ($n = 43$), technetium sulfur colloid ($n = 2$), or a combination of blue dye and technetium sulfur colloid ($n = 42$). SLN biopsy through an IM incision was successfully performed in 84 of 87 cases (96.6%). The three mapping failures were in patients with prior axillary surgery. All three failed mapping cases were in prophylactic mastectomies in which a single agent was used (blue dye only was used in two cases, and technetium sulfur colloid only was used in the third case as this patient had a prior allergic reaction to blue dye). Two of the three patients had prior axillary nodal dissections, and the third patient had a negative sentinel node biopsy performed 2 years prior to deciding upon performing bilateral mastectomies. For the 84 successful cases, a mean of 2.8 SLN were removed per patient with positive sentinel nodes encountered in 8 of 21 patients (38%) with invasive disease. Intraoperative touch preparation cytology analysis identified positive nodes in 5 of 8 cases, while the other 3 positive cases were identified on final pathologic evaluation. The SLN was negative in cases performed for prophylaxis (45 patients) and ductal

TABLE 1. Characteristics of patients who had sentinel lymph node (SLN) biopsies through an inframammary incision during nipple sparing mastectomy (NSM)

Total number of patients	52	
Unilateral NSM	17	33%
Bilateral NSM	35	67%
Indications for operation		
Invasive cancer	21	24%
DCIS	18	21%
Prophylactic	48	55%
Patient characteristics		
Mean size of invasive cancer	2.1 cm	
Mean size of breast	437 g	
Successful identification of SLN	84/87	96.6%
Mean number of SLN removed	2.8	
Number of patients with positive SLN	8	
Technique for SLN mapping		
Blue dye	43	49%
Technetium sulfur colloid	2	2%
Combined	42	48%

carcinoma in situ (18 patients). Table 1 summarizes the patients who underwent sentinel node biopsies through an inframammary incision at time of their nipple-sparing mastectomy.

Axillary dissections were completed at the time of the initial operation in four patients by extending the IM incision along the lateral breast fold toward the axilla 4–5 cm. An additional axillary incision was made in one patient for an axillary dissection at the time of the initial operation. The choice of incision for the axillary dissection was based on surgeon preference and comfort level with exposure. All secondary axillary dissections were performed at a second operation through a separate axillary incision. A secondary axillary dissection through the IM incision would be, at best, difficult and would pose a danger to the patient's reconstruction and risk of technical inability to perform an adequate axillary dissection. No intraoperative complications were observed regarding SLN biopsy portion of the NSM such as nerve injury, vascular injury, or uncontrolled bleeding. We did experience complications pertaining to the mastectomy portion of the operation including: full-thickness nipple necrosis requiring excision of the nipple (6.9%), hematoma (1.1%), and cellulitis (1.1%). With a median follow up of 6.5 months, there have been no local recurrences in either the breast or axilla.

DISCUSSION

Initial reports using NSM have been promising.^{7,17,18} First, tumor involvement of the NAC can be minimized by patient selection. Patients with

small, peripheral invasive tumors have been shown to have minimal risk of NAC involvement of the tumor.^{1,9,19} With regard to subsequent risk of breast cancer, short-term studies have shown minimal risk for recurrence within the NAC. Of 192 NSM with a median follow up of 2 years, Sacchini and colleagues reported only two local recurrences in the mastectomy flap and no recurrences within the NAC.⁷ At our institution, most of our experience with NSM has been through an IM incision technique. This approach is cosmetically appealing in that the incision is hidden below the breast. Generally, patients chosen for NSM have smaller, less ptotic breasts with favorable preoperative tumor characteristics (small, peripheral tumors).

However, oncologic safety must not be sacrificed at the expense of cosmesis. SLN mapping for breast cancer has become the primary means for accurately assessing nodal metastasis, which remains the most important prognostic indicator for patients with breast cancer.²⁰ Under ideal circumstances, the SLN should be accurately and safely taken through an IM incision sparing a separate axillary incision. Obviously, this may pose a technical challenge in that the axilla is not easily reached and requires a lighted retractor and elongated instruments for success to be achieved.

Our initial experience of SLN biopsies through IM incisions has produced excellent results similar to traditional incisions. Identification rates of sentinel nodes do not appear to be sacrificed through an IM incision as success rates for SLN through a standard, axillary incision are generally greater than 96%.²¹ The combined use of technetium sulfur colloid and blue dye aids significantly in the ease of locating the sentinel node. At our institution, blue dye only is traditionally used in cases of prophylactic mastectomy as SLN in a prophylactic setting is considered controversial.^{22–24}

Although we have experienced complications such as nipple necrosis, infections, and hematomas in patients undergoing NSM, there have been no complications related to the SLN biopsy portion of the operation such as axillary bleeding or nerve injury. Although our follow-up period is short and the number cases are relatively low, there have been no cases of axillary recurrences. Overall, our results demonstrate that a SLN biopsy can be performed via an IM incision during a NSM without making a separate axillary incision. However, the ultimate decision on either sentinel node or axillary dissection through an IM incision should lie with the surgeon and their comfort level of exposure. Future studies

will need to be performed with longer follow-up to ensure similar accuracy and local recurrence rates to standard SLN biopsy procedures.

ACKNOWLEDGMENTS

Photos are courtesy of Paul D. Smith, MD, University of South Florida Plastic Surgery Department. Jeff King assisted in data retrieval from the Breast Cancer Database.

REFERENCES

- Laronga C, Kemp B, Johnston D, et al. The incidence of occult nipple-areola complex involvement in breast cancer patients receiving a skin-sparing mastectomy. *Ann Surg Oncol* 1999; 6:609-13.
- Lagios MD, Gates EA, Westdahl PR, et al. A guide to the frequency of nipple involvement in breast cancer. A study of 149 consecutive mastectomies using a serial subgross and correlated radiographic technique. *Am J Surg* 1979; 138:135-42.
- Fisher ER, Gregorio RM, Fisher B, et al. The pathology of invasive breast cancer. A syllabus derived from findings of the National Surgical Adjuvant Breast Project (protocol no. 4). *Cancer* 1975; 36:1-85.
- Wertheim U, Ozzello L. Neoplastic involvement of nipple and skin flap in carcinoma of the breast. *Am J Surg Pathol* 1980; 4:543-9.
- Smith J, Payne WS, Carney JA. Involvement of the nipple and areola in carcinoma of the breast. *Surg Gynecol Obstet* 1976; 143:546-8.
- Parry RG, Cochran TC Jr, Wolford FG. When is there nipple involvement in carcinoma of the breast? *Plast Reconstr Surg* 1977; 59:535-7.
- Santini D, Taffurelli M, Gelli MC, et al. Neoplastic involvement of nipple-areola complex in invasive breast cancer. *Am J Surg* 1989; 158:399-403.
- Suehiro S, Inai K, Tokuoka S, et al. Involvement of the nipple in early carcinoma of the breast. *Surg Gynecol Obstet* 1989; 168:244-8.
- Morimoto T, Komaki K, Inui K, et al. Involvement of nipple and areola in early breast cancer. *Cancer* 1985; 55:2459-63.
- Hartmann LC, Schaid DJ, Woods JE, et al. Efficacy of bilateral prophylactic mastectomy in women with a family history of breast cancer. *N Engl J Med* 1999; 340:77-84.
- Horiguchi J, Iino JHY, Takei H, et al. A comparative study of subcutaneous mastectomy with radical mastectomy. *Anticancer Res* 2001; 21:2963-7.
- Nahabedian MY, Tsangaris TN. Breast reconstruction following subcutaneous mastectomy for cancer: a critical appraisal of the nipple-areola complex. *Plast Reconstr Surg* 2006; 117:1083-90.
- Benediktsson KP, Perbeck L, Geigant E, et al. Touch sensitivity in the breast after subcutaneous mastectomy and immediate reconstruction with a prosthesis. *Br J Plast Surg* 1997; 50:443-9.
- Laronga C. Quality of life with skin-sparing mastectomy: sensation in the nipple-areola complex. *J Support Oncol* 2006; 4:234-5.
- Garcia-Etienne CA, Borgen PI. Update on the indications for nipple-sparing mastectomy. *J Support Oncol* 2006; 4:225-30.
- Sacchini V, Pinotti JA, Barros ACS, et al. Nipple-sparing mastectomy for breast cancer and risk reduction: oncologic or technical problem? *J Am Coll Surg* 2006; 203:704-14.
- Gerber B, Krause A, Reimer T, et al. Skin-sparing mastectomy with conservation of the nipple-areola complex and autologous reconstruction is an oncologically safe procedure. *Ann Surg* 2003; 238:120-7.
- Crowe JP Jr, Kim JA, Yetman R, et al. Nipple-sparing mastectomy: technique and results of 54 procedures. *Arch Surg* 2004; 139:148-50.
- Lambert PA, Kolm P, Perry RR. Parameters that predict nipple involvement in breast cancer. *J Am Coll Surg* 2000; 191:354-9.
- Fisher B, Slack NH. Number of lymph nodes examined and the prognosis of breast carcinoma. *Surg Gynecol Obstet* 1970; 131:79-88.
- Krag DN, Anderson SJ, Julian TB, et al. National Surgical Adjuvant Breast and Bowel Project. Technical outcomes of sentinel-lymph-node resection and conventional axillary-lymph-node dissection in patients with clinically node-negative breast cancer: results from the NSABP B-32 randomised phase III trial. *Lancet Oncol* 2007; 8:881-8.
- Dupont EL, Kuhn MA, McCann C, et al. The role of sentinel lymph node biopsy in women undergoing prophylactic mastectomy. *Am J Surg* 2000; 180:274-7.
- Soran A, Falk J, Bonaventura M, et al. Is routine sentinel lymph node biopsy indicated in women undergoing contralateral prophylactic mastectomy? Magee-Womens Hospital experience. *Ann Surg Oncol* 2007; 14:646-51.
- Boughey JC, Khakpour N, Meric-Bernstam F, et al. Selective use of sentinel lymph node surgery during prophylactic mastectomy. *Cancer* 2006; 107:1440-7.