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Skin-Sparing Mastectomy

Oncologic and Reconstructive Considerations

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Objective
The authors compared skin-sparing mastectomy and traditional mastectomy both followed by immediate reconstruction in the treatment of breast cancer.

Summary Background Data
Skin-sparing mastectomy is used increasingly in the treatment of breast cancer to improve the aesthetic results of immediate reconstruction. The oncologic and reconstructive outcomes of this procedure have never been analyzed closely.

Methods
Institutional experience with 435 consecutive patients who underwent total mastectomy and immediate reconstruction from January 1989 through December 1994 was examined. Mastectomies were stratified into skin-sparing (SSM) and non-skin-sparing (non-SSM) types.

Results
Three hundred twenty-seven SSMs and 188 non-SSMs were performed. The mean follow-up was 41.3 months (SSM,37.5 months, non-SSM,48.2 months). Local recurrences from invasive cancer occurred after 4.8% of SSMs versus 9.5% of non-SSMs. Sixty-five percent of patients who underwent SSMs had nothing performed on the opposite breast versus 45% in the group of patients who underwent non-SSM ($p = 0.0002$). Native skin flap necrosis occurred in 10.7% of patients who underwent SSMs versus 11.2% of patients who underwent non-SSMs.

Conclusions
Skin-sparing mastectomy facilitates immediate breast reconstruction by reducing remedial surgery on the opposite breast. Native skin flap necrosis is not increased over that seen with non-SSM. Skin-sparing mastectomies can be used in the treatment of invasive cancer without compromising local control.

The term skin-sparing mastectomy (SSM) was used first by Toth and Lappert in 1991.[1] They described preoperative planning of mastectomy incisions to maximize skin preservation and to facilitate breast reconstruction. In that same year, Kroll[2] et al. reported their experience with 100 patients with breast cancer undergoing SSM and immediate reconstruction. After an average follow-up of 23.1 months, only one local recurreence was noted.

This operation has been adopted for patients with early breast cancer treated by total mastectomy and immediate reconstruction, but it has received little attention in the general surgery literature. It removes the breast, nipple-areola complex, previous biopsy incisions, and skin overlying superficial tumors.[3] Preservation of the inframammary fold and native skin greatly enhances the esthetic result of breast reconstruction (Fig. 1). The oncologic and reconstructive outcomes of this procedure have never been analyzed closely.

METHODS

A retrospective review was performed of 435 consecutive patients who underwent 515 total mastectomies and immediate reconstruction from January 1989 through December 1994 at Emory University Hospital. Patient records were analyzed for demographic, oncologic, and reconstructive data. The American Joint Committee on Cancer (AJCC) staging system for breast cancer was used. Mastectomy types were classified as either (SSM) or non-SSM. A skin-sparing mastectomy removed the breast, nipple-areola complex, skin overlying superficial tumors, and previous incisions. The native skin envelope and inframammary fold were preserved. Non-skin sparing mastectomy included total mastectomy, modified radical mastectomy, and radical mastectomy. The choice of mastectomy type was made by the surgical oncologist.

Skin-sparing mastectomy was classified further by the type of incision used and the amount of skin removed (Table 1) (Fig. 2). Type I SSM was used commonly for prophylactic purposes and for patients whose cancer was diagnosed by needle biopsy. Lateral extension of the incision may be necessary to improve exposure to the axillary tail. Type II SSM was used when the superficial tumor or previous biopsy was in proximity to the areola. Type III SSM was used when the superficial tumor or previous incision was remote from the areola. Type IV SSM was used in large, ptotic breasts when a reduction was planned on the opposite breast.

Statistical analysis of variance between treatment groups was performed using the chi square test.

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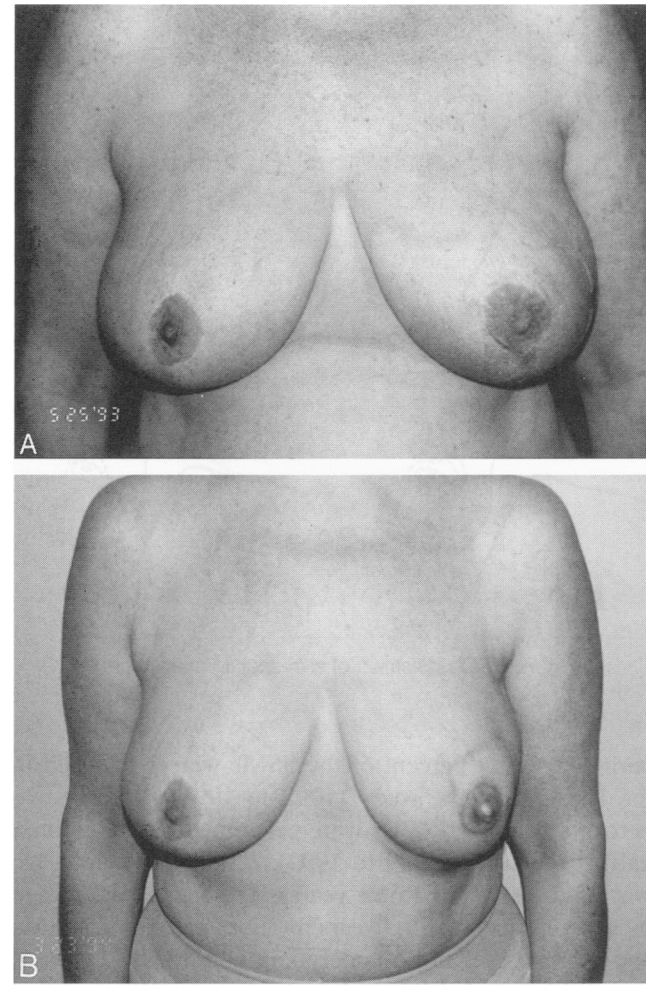

Figure 1. A 48-year-old woman with a history of bilateral reduction mammplasty had a T1N0 infiltrating ductal carcinoma of the left breast. (A) Preoperative appearance. (B) Postoperative appearance after a type II SSM and immediate transverse rectus abdominus muscle (TRAM) flap reconstruction.

RESULTS

Two hundred eighty patients underwent 327 SSMs, and 155 patients underwent 188 non-SSMs during the study

Table 1. CLASSIFICATION OF SKIN SPARING MASTECTOMY

Type	Classification
I	Only nipple-areola removed
II	Nipple–areola, skin overlying superficial tumors, and previous biopsy incision removed in continuity with nipple–areola
III	Nipple–areola removed, skin overying superficial tumors and previous biopsy incision removed without intervening skin
IV	Nipple–areola removed with an inverted or reduction pattern skin incision

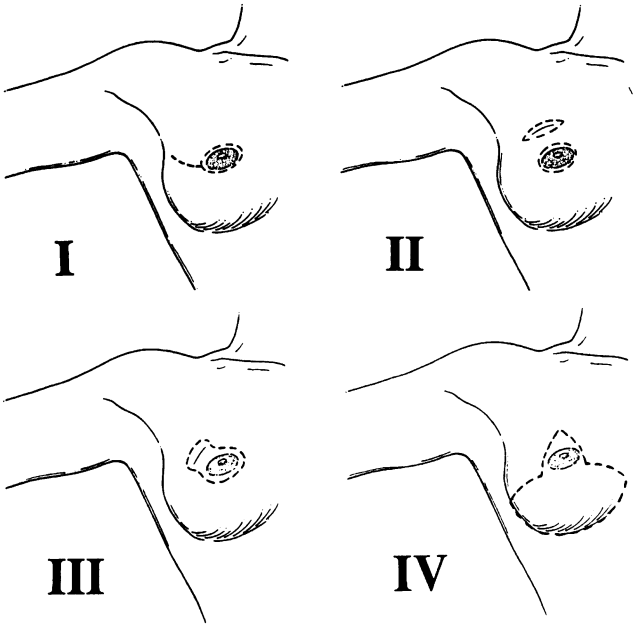

Figure 2. Classification of skin-sparing mastectomy.

period. Seventy percent of the SSMs were performed in the last half of the study (1992 to 1994). Seventy-two percent of the non-SSMs were performed during the first half of the study (1989 to 1991). The mean patient age was 48.2 years (15 to 83 years). The mean patient age by study group was 48.9 years for those undergoing SSMs and 47 years for those undergoing non-SSMs. Types of non-SSM included 80 total mastectomies, 106 modified radical mastectomies, and 2 radical mastectomies. Nine patients were lost to follow-up. The mean follow-up for the entire group of 426 patients was 41.3 months. The mean follow-up was 37.5 months for the 274 patients who underwent SSM and 48.2 months for the 152 patients who underwent non-SSM.

One hundred thirty-nine (42%) of the SSMs were performed prophylactically or for stage 0 disease. One hundred one (54%) of the non-SSMs were performed prophylactically or for stage 0 disease. Recurrences after breast conservation therapy were treated by 2 SSM and 4 non-SSM. In three instances of cystosarcoma phyllodes,one patient underwent SSM and two patients underwent non-SSM. The distribution according to AJCC pathologic staging was as follows: stage I, 77 SSM, 26 non-SSM; stage II, 86 SSM, 39 non-SSM; stage III, 19 SSM, 14 non-SSM; and stage IV, 3 SSM, 1 non-SSM. A comparison of AJCC staging by treatment group is depicted in Figure 3. All patients with stage III disease were treated with preoperative chemotherapy.

Local recurrences of invasive breast cancer occurred in 9 of 187 (4.8%) of patients undergoing SSM versus 8 of 84 (9.5%) of those undergoing non-SSM. Local recurrences by tumor stage were as follows: stage I SSM, 1; stage II SSM, 5; stage 3 SSM, 3; stage I non-SSM, 1; stage II non-SSM, 3; stage 3 non-SSM, 4. In the SSM group of local recurrences, two patients died of disease, five patients are alive with disease, and two patients have no evidence of disease at last follow-up. In the non-SSM group, two patients died of disease, four patients are alive with disease, and two patients have no evidence of disease at last follow-up. The overall recurrence rates were 30 of 187 (16%) for SSM and 25 of 84 (29.8%) for non-SSM. Eleven patients (5.9%) in the SSM group and 10 (11.9%) in the non-SSM group died of disease.

Reconstructive methods used in the SSM group were 8 implants, 43 expanders, 58 latissimus flaps, and 218 TRAM (transverse rectus abdominis muscle) flaps. Reconstructive methods in the non-SSM group were 14 implants, 85 expanders, 37 latissimus flaps, 51 TRAM flaps, and 1 gluteal flap. A comparison of reconstructive methods by mastectomy type is depicted in Figure 4.

In the SSM group, 181 patients underwent no procedures to the opposite breast. Thirty-nine had remedial surgery for augmentation (14), mastopexy (12), and reduction (13). Forty-nine patients underwent a contralateral mastectomy (47 SSM and 2 subcutaneous mastectomy). In 11 patients, delayed reconstruction was performed on the opposite breast by implant (1), expander (2), latissimus flap (1), and TRAM flap (7).

In the non-SSM group, 69 patients underwent no procedure to the opposite breast. Thirty-two underwent remedial surgery (10 augmentations, 14 mastopexies, and 8 reductions). Thirty-three patients underwent a contralateral mastectomy (28 total mastectomies and 5 modified radical mastectomies). Delayed reconstruction was performed on the opposite breast in 21 patients. Methods included 2 implants, 8 expanders, and 11 TRAM flaps. A comparison of procedures performed on the opposite breast by mastectomy type is depicted in Figure 5.

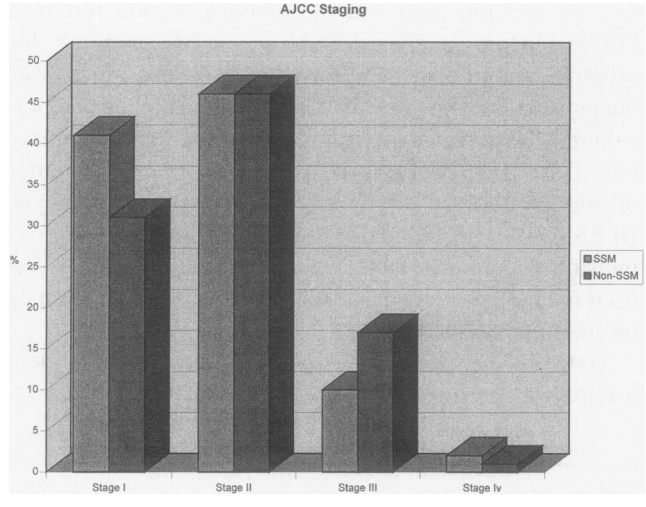

Figure 3. Pathologic staging of invasive breast cancers by treatment group.

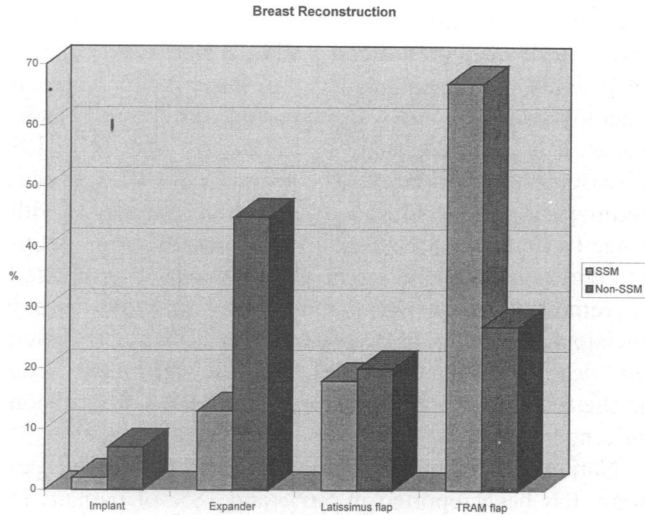

Figure 4. Methods of immediate reconstruction used by treatment group.

Complications of mastectomy and immediate reconstruction are depicted in Table 2. Native skin flap necrosis was defined as epidermolysis or skin loss that required debridement and local wound care. It occurred in 35 patients (10.7%) who underwent SSM and in 21 patients (11.2%) who underwent non-SSM (p=0.87). In the SSM group, one patient with native skin flap necrosis required implant removal, but the remainder of the patients healed by secondary intention. In the non-SSM group, one patient with native skin loss required implant removal, and in two patients, latissimus flaps were performed to salvage expander reconstruction. Eight of the 35 (22.9%) patients who underwent SSM with skin flap necrosis smoked tobacco and 3 of 21 (14.3%) of the patients who underwent non-SSM with ski flap necrosis (p = 0.43) smoked tobacco. Overall, 39 (13.9%) of the patients who underwent SSM and 22 (14.1%) of the patients who underwent non-SSM smoked tobacco (p = 0.85). The incidence of native skin flap necrosis by type of SSM was as follows: type I, 8 of 130 (6.2%); type II, 13 of 138 (9.4%); type III, 2 of 15 (13.3%); and type IV, 12 of 44 (27%)(p = 0.0001).

Flap necrosis was defined as necessitating wound debridement and local wound care. There were no patients with total flap loss in the entire series. Fat necrosis was documented by the clinician and confirmed by fine-needle aspiration cytology.

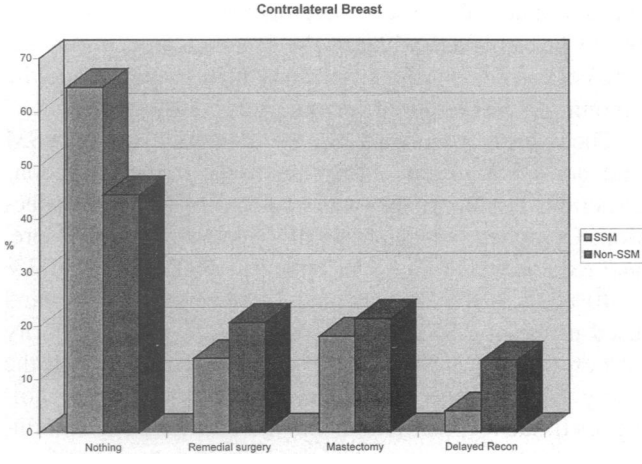

Figure 5. Depiction of the procedures performed on the opposite breast by treatment group. Remedial surgery included augmentation, mastopexy, and reduction. Delayed reconstruction indicated previous mastectomy and delayed reconstruction at the time of ipsilateral immediate reconstruction.

Table 2. RECONSTRUCTIVE METHODS COMPLICATIONS

	SSM		Non-SSM		
	N	%	N	%	
Implant	8	2	14	7	
Seroma	1	12.5	1	7.1	
Skin flap necrosis	1	12.5	2	14.3	
Hematoma	1	12.5	0	0	
Infection	0	0	2	14.3	
Overall	3	37.5	5	35.7	p = 0.93
Expander	43	13	85	45	
Implant failure	1	3.3	0	0	
Skin flap necrosis	1	3.3	10	11.8	
Hematoma	1	3.3	0	0	
Infection	1	3.3	8	9.4	
Implant exposure	0	0	3	3.5	
Seroma	0	0	8	9.4	
Overall	4	9.3	18	32.9	p = 0.09
Latissimus flap	58	18	37	20	
Donor site	19	32.8	10	27	p = 0.55
Seroma	15	25.9	9	24.3	
Infection	2	3.4	1	2.7	
Dehiscence	2	3.4	0	0	
Skin flap necrosis	9	15.5	7	18.9	p = 0.67
Infection	2	3.4	0	0	p = 0.25
Implant failure	2	3.4	1	2.7	p = 0.83
Flap necrosis	2	3.4	4	10.8	p = 0.15
Hematoma	0	0	1	2.7	p = 0.21
Overall	32	55.2	19	51.4	p = 0.72
TRAM flap	218	67	51	27	
Donor site	24	11	10	19.6	p = 0.10
Seroma	9	4.2	5	9.8	
Hernia	5	2.3	2	3.9	
Umbilicus	3	1.4	1	2.0	
Skin necrosis	3	1.4	1	2.0	
Infection	4	1.8	0	0	
Dehiscence	0	0	1	2.0	
Flap necrosis	10	4.6	8	15.7	p = 0.004
Fat necrosis	33	15.1	7	13.7	p = 0.80
Infection	3	1.4	0	0	p = 0.40
Skin flap necrosis	24	11	2	3.9	p = 0.12
Overall	90	41.3	21	41.1	p = 0.99

SSM = skin-sparing mastectomy; TRAM = transverse rectus abdominis muscle.

DISCUSSION

Skin-sparing mastectomy requires meticulous surgical technique and gentle handling of tissues to prevent skin flap ischemia. Careful dissection above the enveloping fascia of the breast allows optimal removal of breast tissue. The use of SSM in the treatment of invasive cancer is based on our growing understanding of the biology of local recurrent tumors. All forms of mastectomy, whether radical, modified radical, or skin-sparing, leave residual breast tissue. The differences are in the microscopic breast tissue left behind in the skin and the inframammary fold. The breast is supported by Cooper's "ligaments," which are peripheral projections of breast tissue in fibrous processes that fuse with the superficial layer of the superficial fascia.[4] Skiles[5] demonstrated that these projections were associated intimately with the skin and concluded that, to excise the whole breast, a large amount of skin must be sacrificed or the dissection must be kept as close to the skin to risk skin slough. Barton et al.[6] compared the residual breast tissue after total glandular mastectomy with that after a modified radical mastectomy by performing a biopsy on various sites at the time of reconstruction. They found residual breast tissue in 22% of the patients who underwent total glandular mastectomy and in 21% of the patients who underwent modified radical mastectomy. Carlson et al.[7] used computer image analysis to examine the inframammary fold tissue retained in SSM. Breast tissue was identified in 13 of 24 specimens but comprised only 0.02% of the total area examined.

Histologic examination of local recurrences rarely shows identifiable breast tissue. Much of the early surgical literature associated locoregional relapse with inadequate surgical technique. Recurrences were thought to result from tumor left behind during surgery. Despite varying surgical approaches, the locoregional recurrence rate after total mastectomy for breast cancer has remained relatively constant over the years. It is clear that other factors are involved as the dominant predictors of local recurrences. The stage of the tumor at the time of excision, including size and nodal involvement, predict locoregional recurrences. More advanced stages have a more rapid local relapse.[8–10] The median time for the appearance of clinically overt local disease is 2 to 4 years, depending on the tumor stage. Most develop in the skin or subcutaneous tissue of the chest wall. Disseminated disease almost invariably follows locoregional recurrence after total mastectomy. Gilliland et al.[10] reviewed 60 patients with isolated local recurrence of breast cancer. All the patients eventually died of metastatic breast cancer. This suggests that local recurrence is rarely an isolated event that can be ascribed to inadequate surgical excision and instead represents a component of widespread relapse.

The type of mastectomy did not affect the local recurrence rate of cancer in this study. The higher recurrence rate seen in the non-SSM group can be explained by a longer follow-up period and a slightly higher percentage of patients with more advanced disease. As the surgical oncologists became more comfortable with the SSM technique, it became the method of choice to treat stage I/II disease when immediate reconstruction was planned. Skin-sparing mastectomy was used in select patients with stage III disease after neo-adjuvant chemotherapy. Preoperative incision planning in the SSM group attempted to remove skin overlying tumors and previous biopsy incisions. The retrospective nature of this study prevented any determination of whether the local recurrences seen in the SSM group had been included in the skin excision of a non-SSM.

Native skin flap necrosis after modified radical mastectomy has been reported in 5.6% and 18% of patients in two recent series.[11,12] Compared to traditional mastectomy, the wide skin undermining seen with SSM did not increase the risk of skin necrosis. Native skin loss healed by secondary intention in 97% (34 of 35) of the patients who underwent SSM and 86% (18 of 21) of patients who underwent non-SSM. A reduction or Wise pattern incision was associated with native skin necrosis in more than one fourth of the patients.

Nicotine in cigarette smoke is a direct cutaneous vasoconstrictor, and it indirectly inhibits capillary blood flow by releasing catecholamines.[13] Vinton et al.[12] showed that cigarette smoking was a significant risk factor for increased wound complications in patients undergoing modified radical mastectomy. Smokers had a significantly higher rate of epidermolysis than nonsmokers, 49% versus 14% ($p < 0.01$). Tobacco smoking increased the risk for skin flap necrosis in the SSM group but not in the non-SSM group.

Skin-sparing mastectomy improves breast reconstruction results in several ways. Preservation of the inframammary fold and native skin envelope allows breast symmetry to be achieved without altering the opposite breast. The periareolar incisions are more inconspicuous, and the amount of flap required for reconstruction is reduced.

The overall complication rates are similar for the SSM and non-SSM groups except in tissue expander reconstruction. Tissue expansion demands careful patient selection. Complications such as infection, implant exposure, and expander deflation can result in a failure rate of 3% to 40%.[14–22] It was the predominant reconstructive method used in the non-SSM group. As mentioned, the majority of non-SSMs were performed during the first half of the study. More careful patient selection, refinement in autologous tissue reconstruction, and the Federal Drug Administration moratorium on breast implants accounted for a decrease in the use of this method and the reduced complication rate seen in the latter half of the study.

Latissimus dorsi flap reconstruction was associated with a high complication rate. Excluding the native skin

flap necrosis, the results were similar to those of previous reports.[17,23,24] Donor site seroma formation occurred in one fourth of the patients and accounted for approximately half of the overall complications. These responded to serial aspiration without surgical intervention. There was a trend toward a higher partial flap necrosis rate in the non-SSM group (10.8% vs. 3.4%). Increased native skin removal necessitating larger flap size could account for this difference.

The overall complication rates for TRAM flap reconstruction were similar for the SSM and non-SSM groups. Excluding the native skin flap necrosis, the results were similar to those of previous reports.[25–28] The types of complications varied between the SSM and non-SSM groups. Preservation of native skin reduced the amount of autologous tissue required for TRAM flap reconstruction in the SSM group. This could account for the decrease in partial flap necrosis compared to the non-SSM group (4.6% vs. 15.7%). Preservation of native skin could also account for the increase in native skin flap necrosis (SSM 11% vs. non-SSM 3.9%) seen in the SSM group.

This study demonstrated that SSM facilitated immediate breast reconstruction by reducing remedial surgery on the opposite breast. Native skin flap necrosis was similar to that seen with non-SSM. It was associated with cigarette smoking and reduction pattern skin incisions. Skin-sparing mastectomy can be used in the treatment of invasive cancer without compromising local control.

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Discussion

DR. EDWARD M. COPELAND, III (Gainesville, Florida): Thank you, Dr. Griffen. We, like the Emory group, have been using skin-sparing mastectomy for a ductal carcinoma *in situ*, stage I, and highly selected stage II patients, and have had comparable success. We have not extended the technique to patients with stage III disease for fear of compromising treatment with postoperative radiation therapy.

We agree that the nipple areola complex and previous biopsy sites should be excised. Usually the incision to accomplish these excisions allows a large enough surgical field to do a level I and a level II axillary lymph node dissection without the additional