Skin-sparing mastectomy (SSM) is being used increasingly often in breast surgery. The technique offers improved cosmesis with preservation of the breast envelope and complete removal of breast tissue to achieve an oncologically safe approach for the treatment of patients with early-stage breast cancer.

The first description of SSM in the medical literature was by Toth and Lappert in 1991. They described the preoperative planning of modified radical mastectomy incisions to maximize skin preservation and yield a good cosmetic result with cooperative planning from a plastic surgeon. The procedure removes the breast parenchyma through a periareolar incision that includes previous biopsy site(s) and the skin overlying superficial tumors while sparing uninvolved breast skin. Preservation of the breast skin envelope leaves a small defect that can often be closed primarily while autologous skin is used only for the nipple-areolar reconstruction. This yields a more favorable cosmetic result than the conventional mastectomy.

With the advent of sentinel node techniques, which decrease complications of axillary lymph node dissection, and advances in breast surgery such as SSM, the approach of the oncologic surgeon is to minimize tissue loss while obtaining maximally safe oncologic results. In this article, we describe the technique of SSM with sentinel node biopsy and possible complete axillary dissection, its advantages and limitations, and current local recurrence and flap necrosis rates of SSM found in the surgical literature.

After appropriate discussion of the surgical options for breast cancer treatment with the patient, the oncologic and plastic surgeons coordinate in marking the mastectomy incision, inframammary fold, and the donor sites of either the latissimus dorsi, transverse rectus abdominus myocutaneous flap, or free flap. The patient is placed supine under general anesthesia with the use of short-acting paralytics, if necessary. A folded towel is placed under the lateral aspect of the trunk and arm. The affected breast, from above the sternal notch to below the inframammary fold, medially past the sternum and the ipsilateral part of the arm are prepared into the operative field. The hand and forearm are covered with a stockinette. If a transverse rectus abdominus myocutaneous or free flap is performed, both breasts are included in the operative field with exposure from above the sternal notch to the symphysis pubis. The planned skin incisions are outlined with sterile glove paper wrapping and the amount of tissue “defect” is used by the plastic surgeon when contemplating primary repair or the use...
of autologous tissue transfer. For a latissimus dorsi myocutaneous flap, the patient is repositioned in the lateral decubitus position during harvesting of that flap. The patient is then returned to a supine position after the flap has been tunneled to the mastectomy site and the donor site is closed.

When using the sentinel node technique, we prefer to make a separate incision in the axilla for localization of the sentinel node before starting the SSM component of the surgery (Figure 1). This technique allows for optimal identification of the sentinel node with excellent exposure. Lymphoscintigraphy is used to map the sentinel drainage preoperatively and isosulfan blue dye is injected just before skin incision. To enhance exposure of a deep axillary node, the ipsilateral arm is bent up in a 90° fashion from the elbow and brought up over the patient’s head.

While the sentinel node is being analyzed by frozen section, the SSM segment of the surgery begins (Figures 2, 3, 4, 5, and 6). For surgeons still validating their sentinel node techniques, and for patients found to have a positive sentinel lymph node, a complete axillary node dissection can be performed after the dissection of the breast tissue. This can be performed via either the periareolar incision or the counter axillary incision that was made before the mastectomy (Figure 7 and Figure 8). Exposure of the thoracodorsal vessels for free flap microvascular anastomosis can also be accomplished through either the extended periareolar incision or the counter axillary incision.

Incision planning will vary depending on breast size, location of previous biopsy site, and sentinel node considerations. The mastectomy incision should include the nipple-areolar complex and previous biopsy site(s). If the previous biopsy site is close to the areola, it may be incorporated into one skin island (Figure 2). If the biopsy site is distant to the areola, a separate incision should be performed as long as the intervening skin can maintain viability (Figure 3). Excising needle tract sites of core biopsies is considered, especially when 11- and 14-gauge devices are used. There is anecdotal evidence in the breast literature and stronger evidence in the prostate literature that tumor seeding of the tract may occur when a large-gauge needle is used compared with fine needle aspiration.2
Primary closure of the biopsy or skin excision site is performed once the breast tissue has been removed. A lateral extension of the areolar incision may need to be performed to provide adequate exposure for patients who have a proportionately small areola with a large breast (Figure 4). Patients with large or ptotic breasts may require a wise pattern incision, especially in cases in which reduction mammoplasty is planned for the opposite breast. The wise pattern incision includes a semicircumferential periareolar incision superiorly that includes a strip of skin the diameter of the areola extending to the inframammary fold, with a curvilinear inframammary incision. This type of incision is typically used for reduction mammoplasty procedures.

After the periareolar incision, Friedman scissors are used to perform sharp dissection of the tissue plane between the breast tissue and the subcutaneous fat (Figure 5). The technique involves opening the scissors midway and sliding along the flap toward the designated landmarks. The subcutaneous fat usually allows a smooth gliding action of the Friedman scissors. Intermittent cautery is used as needed for bleeding vessels after isolation of the vessel with DeBakey pickups, especially on the flaps. Particular attention must be given to the maintenance of the vascular supply of the native skin flaps. Some surgeons prefer the use of clysis, subcutaneous injection of saline to facilitate separation of the flap. While the breast tissue is dissected toward each landmark, a circular sequence allows for increasing exposure during each round of dissection to yield a wider cavity under the native flap. Although skin flap thickness can vary with body habitus of the patient, every effort is made to remove all breast tissue. The difficulty lies in the ability to dissect through a small opening. As the breast tissue is dissected off the skin, there is a substantial increase in mobility of the flap, allowing improved exposure of the cavity, and adherence to traditional landmarks for a standard mastectomy. A headlight can improve visualization and control of bleeding deep into the cavity.

Skin flaps must be handled carefully with the use of double-pronged skin hooks for retraction. The use of large abdominal retractors is discouraged, as the flaps are sensitive to pressure, resulting in an increased incidence of ischemia. Appreciation of the anatomic boundaries defined by Hicken allows the use of traditional resection techniques through a small periareolar skin incision. Superiorly, as the clavicle is approached, the breast tissue is dissected away to expose the pectoralis major muscle (Figure 6).

Figure 4. A lateral extension may be necessary to provide adequate exposure to the underlying breast tissue and, if necessary, the axilla.

Figure 5. Friedman scissors are used to perform the sharp dissection between the tissue and the subcutaneous fat layer.
the inframammary fold, citing a study by Carlson et al\textsuperscript{5} indicating the oncologic safety of this method. At this time, we prefer to adhere to the classically defined boundaries ensuring complete removal of all of the breast parenchyma until additional studies show oncologic effectiveness. As the breast tissue is dissected off the pectoralis muscle, the cavity becomes very mobile, and this allows the use of the Richardson retractor to elevate the lateral aspect of the pectoralis muscle to assist in the axillary dissection (Figure 7).

When indicated, the axillary dissection is performed in continuity with the breast tail, and the specimen is removed en bloc either through the central incision or through the counter incision previously made for the sentinel node dissection (Figure 7, Figure 8, and Figure 9). Ideally, SSM removes the same amount of breast tissue as a modified radical mastectomy while preserving the breast envelope. The abundant skin envelope greatly facilitates reconstruction, and the plastic surgeon needs only to fill the void created by the removal of breast tissue. In conventional mastectomy, the plastic surgeon, in essence, has to recreate the entire breast with overlying skin.

Once appropriate hemostasis of the mastectomy site has been achieved, the plastic surgery team assumes care. The plastic surgeon has already examined the patient preoperatively and discussed the appropriate type of reconstruction, considering the patient’s desires, body habitus, the diagnosis, and whether chemotherapy and/or radiation therapy will be involved in the treatment. Included in the decision making is the use of autologous tissues alone, implants, tissue expanders, or a combination of these options.

In surgery, the plastic surgeon reevaluates the defect created by the mastectomy, as well as the specimen removed (Figure 9), to further calculate the amount of tissue needed to be transferred and/or added with the use of an implant. Volumetric and weight analysis is carried out accordingly. Once the flap is mobilized and the tissue is transposed into the mastectomy site, the donor site is closed with suction drains. Final adjustments in shape and volume are made, comparing both sides while the patient is placed in the semisitting position on the operating room table. Nipple reconstruction is deferred until the flap has healed, tissues have settled down, and adjuvant therapy is completed.

**COMMENT**

The use of SSM allows the patient to retain the native skin envelope, leading to an improved aesthetic result. It also gives an ideal color and texture match of the reconstructed breast and aids the plastic surgeon in creating a natural breast shape. The use of SSM with immediate reconstruction has emerged because of the recognition that traditional mastectomy boundaries need not be compromised and only a minimal amount of skin excision is necessary for patients with early or noninvasive cancer. The addition of the sentinel node technique allows the patient the option of using advanced breast cancer surgery technology with the skin-saving procedure.
When considering the safety of SSM, it is important to analyze the local recurrence rate. The incidence of local recurrence after SSM has been reviewed in several retrospective studies (Table) [6-13]. Singletary published a 4-year retrospective study with 545 patients who had early-stage breast cancer treated with SSM and immediate reconstruction. The regional recurrence rate was 2.6%, increasing to 4.2% when patients were followed up for more than 4 years. Carlson et al reported their results comparing 327 SSM procedures with 188 non-SSM (NSSM) procedures in 435 patients, with a mean follow-up of 41.3 months. Local recurrences occurred in 4.8% of patients undergoing SSM vs 9.5% of those having NSSM. The higher recurrence rate in the NSSM group was explained by longer follow-up and a higher percentage of patients with more advanced disease. Similarly, Kroll et al reported comparative results with the longest mean follow-up of 67 months (from 1991-1996). The local recurrence in 104 patients with SSM was 6.7%, and in 27 patients with NSSM, 7.4%. Simmons et al showed in their retrospective review of 77 SSM and 154 NSSM cases that there were no significant differences in recurrence rate between SSM and NSSM when broken down into distal (3.9% in SSM, 3.9% in NSSM) and local (3.9% in SSM, 3.25% in NSSM) recurrence groups. When time to recurrence was evaluated, there were no significant differences in SSM and NSSM groups (0.7 vs 1.5 years for local recurrence and 1.9 vs 3.3 years for distal recurrence, respectively).

The issue of increased local recurrence when breast skin is preserved has not been confirmed by multiple retrospective studies. Rather, local recurrence relates most closely to the pathologic characteristics of the breast cancer and stage of disease, not an inadequate surgical excision.12,13,14,15 One major limitation of retrospective studies is a possible selection bias of the patient populations treated with SSM. Ideally, a randomized prospective trial comparing SSM with NSSM would clarify groups of patients who are excellent candidates for this technique. Until such a trial is performed, the availability of retrospective data for patients with early breast cancer suggests a role for SSM.

Tissue flap necrosis in SSM is another potential complication. Singletary reported fat necrosis or partial flap loss in 7% of the 545 patients, and it appeared to be related to the smoking history of the patients (9% of 99 smokers compared with 3% of 112 nonsmokers). Slavin et al indicated a 21.6% partial- or full-thickness necrosis rate after latissimus dorsi myocutaneous flap, but no flaps were lost. Carlson et al reported a 10.7% rate of native skin flap necrosis in SSM vs 11.2% in NSSM. Factors identified for increased risk for flap necrosis included smoking history and a Wise pattern incision. Hidalgo et al reported no instances of flap loss in a small retrospective study.

Other limitations of this procedure include the technical difficulty, the need for immediate recon-
struction because of maintenance of a skin envelope, and the management of a positive mastectomy margin. An inherent risk is the failure to remove all of the breast parenchyma through a small incision because of the surgeon’s inexperience with the technique or a superficial location of the cancer. If standard margins of dissection and thickness of the flap are maintained, then SSM and conventional mastectomy differ only in the skin envelope left behind. Barton et al17 compared residual breast tissue on the anterior chest wall by performing chest wall biopsies on 27 patients who had SSM and 28 patients after conventional mastectomy. Both groups had equivalent results with respect to the amount of residual breast tissue. In patients with superficial tumors, there is a risk of microscopically positive margins if skin is left over the tumor site. This risk exists whether SSM or NSSM techniques are used.

All efforts are made at the time of surgery to ensure a negative margin. These include (1) considering removing the tumor through a separate, more remote incision including overlying skin (essentially performing a lumpectomy before the mastectomy); (2) careful orientation and marking of the specimen; (3) gross pathological consultation during the operative procedure; and (4) margin evaluation by touch preparation cytologic examination20,21 and/or frozen section analysis.19 Cox et al19 also compared frozen section with imprint cytologic examination of 114 cases. Frozen section analysis tends to underpredict margin involvement (false-negative rate higher) compared with touch preparation cytologic examination. Imprint cytologic examination carries a slightly higher false-positive rate that may be related to specimen handling. The advantage of imprint cytologic examination is that it can be performed intraoperatively in about 15 minutes, with a diagnostic accuracy of 97.3%.19 After use of these maneuvers (gross pathological examination and touch preparation cytologic examination with or without frozen section analysis), if a positive margin is still found on conventional final histologic examination, the surgeon has a choice of either attempting a reexcision or treating the patient with radiation.20,22

Follow-up after SSM for detection of local recurrence consists of clinical examination. More than 90%22 of the recurrences are superficial and on the skin, easily detectable by manual examination. Routine mammography is not necessary. A careful protocol of postoperative follow-up consists of a clinical breast examination by an experienced health care provider every 6 months for 2 years, followed by annual breast examinations thereafter. It is important to emphasize routine self-breast examinations, including the mastectomy and reconstructed site, and to educate patients about the importance of this practice for early detection of new or recurrent breast cancers.

Complete SSM and immediate breast reconstruction with sentinel node removal offers patients ideal aesthetic results without incurring additional oncologic or flap necrosis risks. Technical expertise and careful individualized planning are essential to the success of the procedure.

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Antihypertensive Drug Therapies and the Risk of Ischemic Stroke

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Background: The relative effectiveness of various antihypertensive drugs with regard to the reduction of stroke incidence remains uncertain.

Objective: To assess the association between first ischemic stroke and use of antihypertensive drugs.

Methods: A population-based case-control study was performed among enrollees of the Group Health Cooperative of Puget Sound. Case patients included pharmacologically treated hypertensive patients who sustained a first ischemic stroke (fatal or nonfatal; n=380) between July 1, 1989, and December 31, 1996. Control subjects were a random sample of treated hypertensive enrollees without a history of a stroke (n=2790). Medical record review and a telephone interview of consenting survivors were used to collect information on risk factors for stroke. Computerized pharmacy records were used to assess antihypertensive drug use.

Results: Among 1237 single-drug users with no history of cardiovascular disease, the adjusted risk of ischemic stroke was higher among users of a β-blocker (risk ratio [RR], 2.03; 95% confidence interval [CI], 1.05-3.94), calcium channel blocker (RR, 2.30; 95% CI, 1.16-4.56), or angiotensin-converting enzyme inhibitor (RR, 2.79; 95% CI, 1.47-5.27) than among users of a thiazide diuretic alone. Among 673 single-drug users with a history of cardiovascular disease, the RRs were 1.22 (95% CI, 0.63-2.35), 1.18 (93% CI, 0.59-2.33), and 1.45 (95% CI, 0.70-3.02) among users of a β-blocker, calcium channel blocker, and angiotensin-converting enzyme inhibitor, respectively, compared with users of a thiazide diuretic alone.

Conclusions: In this study of pharmacologically treated hypertensive patients, antihypertensive drug regimens that did not include a thiazide diuretic were associated with an increased risk of ischemic stroke compared with regimens that did include a thiazide. These results support the use of thiazide diuretics as first-line antihypertensive agents.

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