Surgical Techniques in Breast Conservation

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The surgical treatment of breast cancer has changed dramatically in the last 30 years. The era of the Halsted radical mastectomy has passed, and less deforming surgeries have come into use. Partial mastectomy in association with axillary lymph node dissection has become a viable alternative for stage 1 and 2 carcinomas; more advanced tumors may be treated with breast conservative surgery when neoadjuvant chemotherapy is utilized. Further, the use of mammography in screening for breast cancer has led to an increase in the diagnosis of ductal carcinoma in situ (DCIS), another lesion for which breast conservation is often indicated.

In order to provide optimal care to the patient with breast cancer, we have applied a multidisciplinary approach. This "team approach" allows for consistent and informed administration of all aspects of therapy and includes input from experts in surgical and medical oncology, radiation therapy, plastic surgery, and mental health. Such input allows for the integration of local control into a larger treatment picture, and has caused us to modify our surgical techniques to provide for removal of the breast cancer with minimal deformity. This paper will review surgical techniques we use for breast conservation, emphasizing adequate removal of the malignancy, as well as the maintenance of cosmesis and sensibility of the breast.

ANATOMIC AND AESTHETIC CONSIDERATIONS IN BREAST SURGERY

In order to understand the principles of breast conservative surgery, a thorough understanding of the anatomy of the breast is necessary. The anatomy of the breast is well described elsewhere, and will not be duplicated in detail here. We will focus instead on those anatomic considerations which have had particular impact on our surgical techniques–the skin lines and the ductal system of the breast.

Skin lines within the breast are important in deciding upon optimum placement of skin incisions. Such lines were first demonstrated by Dupuytren

in 1832 and elaborated upon by Langer in 1861, who noted that puncture of the skin resulted in elliptical wounds oriented along lines of skin tension. Langer's lines, however, exist in excised skin and do not correlate well with skin tension in living patients. "Relaxed" or "resting" skin tension lines (RSTL) described by Borges in 1973 are more relevant for the surgeon.[1,2] RSTL describe the orientation of collagen and elastin fibers within the skin, which become oriented perpendicular to the direction of the underlying musculature (Fig. 1). Scars parallel to RSTL are not subject to muscular distraction and are therefore less likely to hypertrophy. Matory has recently emphasized the importance of using RSTL rather than Langer's lines in breast conservation.[1] In the upper breast, RSTL are essentially transverse. Proceeding inferiorly, the RSTL develop a central and inferiorly directed convexity which gradually approximates the inferior mammary crease. Skin incisions should optimally parallel RSTL, though radial incisions are more appropriate in some circumstances as described below. The commonly recommended circumferentially oriented incisions are often perpendicular to RSTL and therefore more likely to result in scarring.

While the pattern of RSTL affects our choice of skin incision, the ductal anatomy of the breast affects our choice of parenchymal excision. The work of Sartorius[3] suggests that the ductal system of the breast consists of five to nine ductal systems which follow a relatively consistent pattern. His work demonstrates the existence of one system posterior to the nipple, and one each medial and lateral to the nipple. One to three ducts may be found in both the superior and inferior breast. In addition to the openings of the major ducts, 5 to 10 blind openings exist in the nipple and are thought to represent sebaceous glands. The branches of these ductal systems are oriented radially; while they do not communicate with one another, they do intertwine and overlap extensively, making the precise delineation of a lobe impossible. This anatomy may explain the fact that many consider DCIS to be "multicentric"; DCIS may often (or always) be contained within a single ductal system and yet still be found in pathologic specimens from seemingly different portions of the breast parenchyma. Invasive cancer too may also spread along breast ducts.[4] As the ductal systems are oriented in a radial fashion, a radial parenchymal resection would seem a more logical option than does a more traditional transverse resection (Fig. 2). Additional considerations favor radial parenchymal resections; as the principle innervation for the nipple enters from the lateral breast, radial resections may be more likely to preserve nipple sensibility than non-radial resections, as they parallel the direction of innervation. With some exceptions (see below), radial resections also provide for gravity-induced reapproximation of tissue, which improves cosmetic outcome.

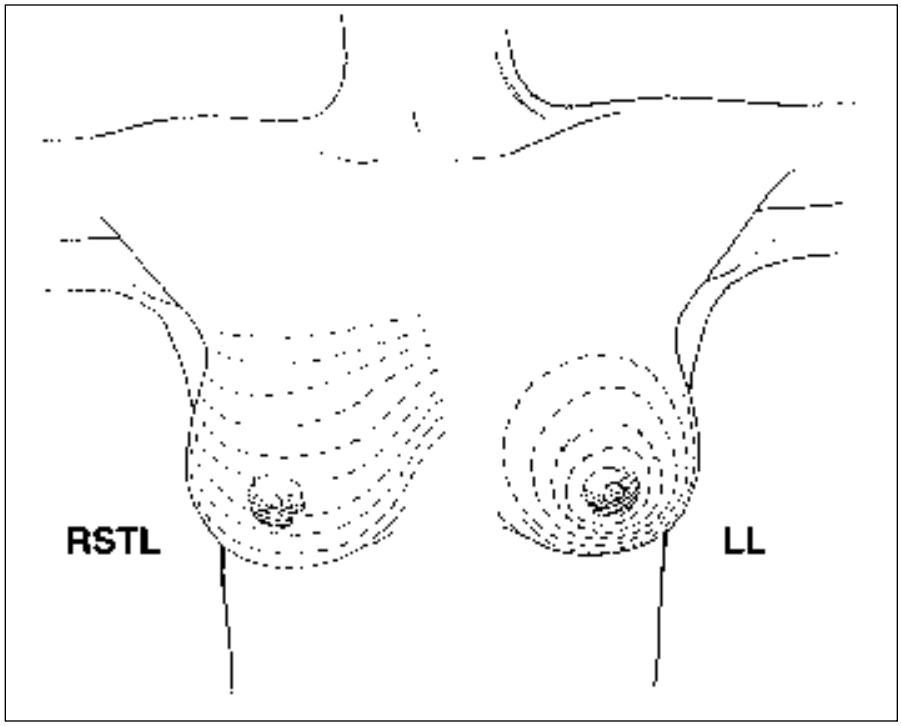

Figure 1. "Resting Skin Tension Lines" (RSTL), depicted on the patient's right, are utilized in selecting skin incisions. Langer's lines are depicted on the patient's left. (Reproduced with permission from Love SM, Matory WE, Silen W. Surgical treatment of breast disease. J.B. Lippincott Co. In press.)

DIAGNOSTIC BIOPSY

In anticipating breast conservation, it is important to consider techniques of tissue diagnosis. The skin and soft tissue deformity induced by diagnostic biopsy affects the outcome and feasibility of breast conservation, and good planning at this stage may facilitate definitive treatment later.

The advent of fine needle aspiration biopsy (FNAB) and, more recently, of mammographically directed stereotactic core biopsy have dramatically changed the manner in which breast cancer is identified. These procedures have the potential nearly to eliminate the need for open biopsy for diagnosis of breast pathology. However, when FNAB or core biopsy is nondiagnostic or unavailable, excisional biopsy is required. Excisional biopsy may also be appropriate in the treatment of small lesions strongly suspected to be benign, such as fibroadenoma.

Many surgeons utilize skin incisions oriented circumferentially about the nipple for excisional biopsy in the belief that this affords optimal cosmesis. Circumareolar incisions can provide a good cosmetic result but may result in a numb nipple by interfering with innervation and can only be used for lesions within 1 to 2 cm of the nipple. For more eccentric lesions, the incision should be made along RSTL directly over the lesion. Tunneling to such lesions through a circumareolar incision is likely to result in hematoma and subsequent scarring, and makes re-excision of those lesions which prove to be malignant extremely difficult. While incisions along RSTL produce the least visible cutaneous scarring, radial incision provides certain benefits when malignancy is strongly suspected. Specifically, when re-excision of malignant lesions is required, re-resection of

a radial scar is less likely to result in nipple displacement. Radial incision also facilitates subsequent radial parenchymal resection.

When a lesion is unlikely to be malignant, only a small rim of normal tissue need be removed with the specimen. For suspicious lesions, a 1-cm rim of normal tissue is desirable. For such lesions, the specimen should be oriented for the pathologist for proper evaluation of surgical margins (e.g., short stitch superior, long stitch lateral). This may prove to be useful information should re-resection be necessary for involved or inadequate margins. Meticulous hemostasis is important in the prevention of hematoma, which may compromise cosmetic outcome and complicate re-excision. Parenchymal reapproximation is not indicated. We prefer to close the cutaneous defect using an interrupted, buried, absorbable dermal suture and a running subcuticular suture for skin.

Wire localization of non-palpable lesions requires separate consideration. This may be performed either as a diagnostic procedure, or as part of a definitive resection. We have preferred the use of Kopans and Sadowski wires, as they have smaller tips and allow for more precise localization, and come with stiffeners which make the wire easier to palpate for the surgeon. The lesion must be localized to within 0.5 cm in order to provide for excision of the pathology with a minimal amount of normal breast tissue. After the surgeon approximates the location of the tip of the wire by viewing radiographs and palpating the wire, incision should be made as close to the lesion as possible. Tunneling along the wire to locate the lesion, or tunneling from a circumareolar incision, is not indicated for the reasons elaborated above. If large areas of calcifications are encountered, it may be useful to localize the lesion with more than one wire in order to define the borders of, or "bracket," the lesion. This assists in ensuring removal of all calcifications. After the specimen is removed, a mammogram of the specimen confirms the presence of the lesion in the excised tissue. If the mammographic abnormality is not present in the specimen, attempts at blind excision should be limited; excessive resection may affect cosmesis and compromise attempts at breast conservation should the lesion prove to be malignant. It is more appropriate to repeat the procedure in several weeks should this occur. After the immediate postoperative period, a follow-up mammogram should be performed, usually after four to six weeks. This will ensure complete excision of the mammographic lesion and will provide a baseline postoperative mammogram for future comparison.

DEFINITIVE RESECTION IN BREAST CONSERVATION

"Breast conservation" implies a limited resection of the breast for the treatment of carcinoma. While a variety of terms have been used to describe such resections, including "lumpectomy," "segmental resection," and "quadrantectomy," we prefer to use the term "partial mastectomy" to encompass all such resections. The goals of breast conservation include not only adequate extirpation of tumor but also a cosmetically acceptable outcome which preserves sensibility.

The margin of normal breast tissue around a malignant lesion which needs to be removed has not been precisely quantified. Quadrantectomy and radiation is equivalent to mastectomy in terms of survival and local recurrence rate,[5-7] but resection of one-fourth of the breast is unnecessary and deforming in many women. In assessing adequate excision of tumor, microscopic examination of margins gives us some information, although it represents only a sampling of the resected margin. It is also important to consider the pathology of the tumor when assessing these margins. Those tumors which are more insidious, such as those associated with EIC (extensive intraductal component) and infiltrating lobular carcinoma, warrant a wider tissue resection.

The cosmetic results of breast conservative surgery are generally well accepted by patients.[8,9] Cosmesis in such resections is influenced by the amount and location of tissue removed, the orientation of the skin and parenchymal resection, and postsurgical and postirradiation scarring. While the dimension and location of the tumor will dictate the extent and location of resection, surgical technique will clearly impact the final cosmetic outcome.

In the course of surgical planning, one should note that resections of more than 25% of the breast tissue in small and medium-sized breasts will generally result in a poor cosmetic outcome, which will be worsened by radiation. Larger breasts, however, may accommodate resections of over 50% with an acceptable outcome, using techniques of surgical breast reduction. Resections of tissue in the supra-areolar, upper-

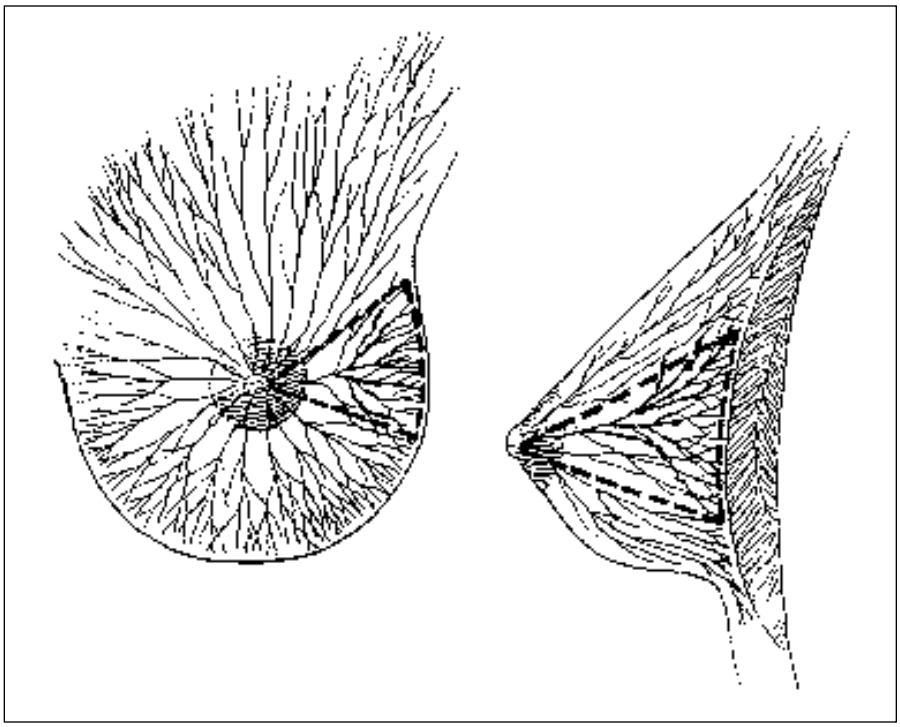

Figure 2. A radial parenchymal excision (depicted by the dotted line) is more likely to excise a lesion which extends along the ductal system than is a transverse excision. (Reproduced with permission from Love SM, Matory WE, Silen W. Surgical treatment of breast disease. J.B. Lippincott Co. In press.)

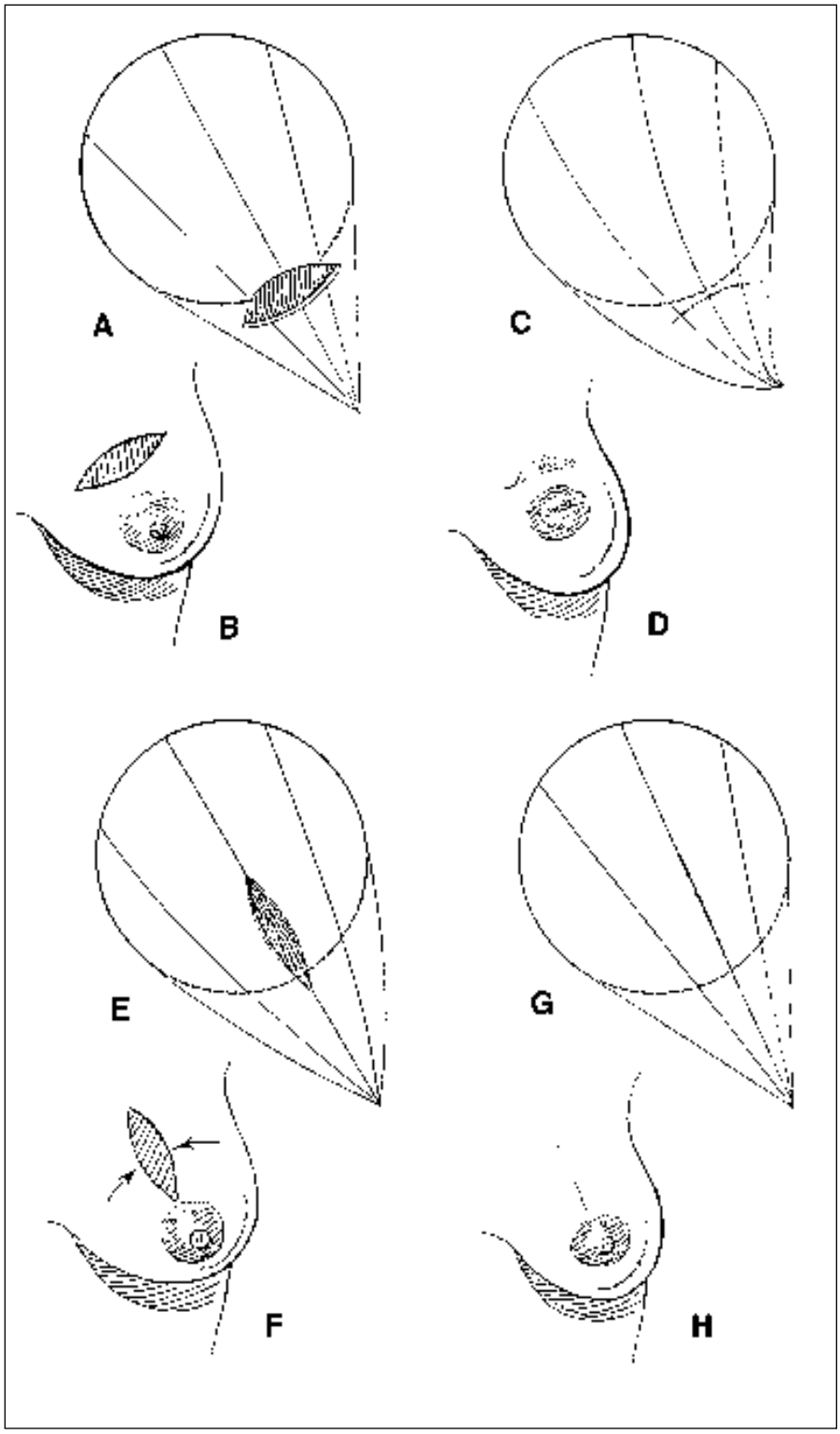

Figure 3. A nonradial parenchymal excision will distort the ultimate position of the nipple, which is drawn superiorly here (A-D). A radial parencymal excision will not alter the position of the nipple (E-H). (Reproduced with permission from Love SM, Matory WE, Silen W. Surgical treatment of breast disease. J.B. Lippincott Co. In press.)

inner and mid-medial portions of the breast are particularly prone to cosmetic deformity including soft tissue depression and/or nipple displacement. For those patients in whom partial mastectomy is likely to create an unacceptable cosmetic defect, total mastectomy with or without reconstruction may be preferable. It is also possible to reconstruct partial defects using a modified latissimus flap[10,11] following the primary resection.

In order to obtain the best cosmetic result, skin incisions should theoretically follow the RSTL, as described above. We have found that radial skin incisions provide specific advantages while maintaining acceptable cosmesis. Should repeated resections become necessary, as for involved margins, the presence of a non-radial cutaneous scar will almost ensure nipple dislocation; radial incisions, however, are well suited to repeated resections without nipple displacement and facilitate subsequent radial parenchymal resection. In the supra-areolar breast, where radial incisions cross RSTL and result in a highly visible scar, transverse incisions within RSTL are preferable. This is combined with a radial parenchymal resection, as described below. In the central breast, circumareolar of transareolar incisions may be used, with extensions along RSTL, if needed for exposure. All skin incisions should anticipate removal of the tumor with a 1-cm margin. If a re-resection is being performed, the previous scar should be excised; if such an excision is likely to produce a suboptimal cosmetic result, a new incision may be chosen, and both scars irradiated.

In resecting breast parenchyma, radial resections are superior, as they are less likely to result in nipple displacement and more likely to preserve the conical shape of the breast than are non-radial resections (Fig. 3). Radial resections of parenchyma have other specific advantages. As mentioned above, radial resection in the lateral breast may be more likely to preserve sensibility, as the resection parallels the direction of innervation. In patients with DCIS, radial resection is better suited to the resection of the entire involved ductal system due to the radial orientation of breast ducts.

Radial parenchymal resections should be made in the form of a wedge. If large excisions are necessary, a pie-shaped excision of parenchyma provides the most suitable reconstruction of the conical shape. For lesions within 1 cm of the of the areola, centric resection including removal of the nipple-areola complex is necessary.

Radial resections will generally result in reapproximation of tissue by gravity. Gravity-induced separation of parenchyma may occur in the supra- and infra-areolar breast, however, and surgical reapproximation is a consideration in

such cases. If reapproximation is considered, the breast should be evaluated with the patient in the sitting position both with and without parenchymal closure. This will allow the surgeon to assess any deformity present in the upright position, which is how the patient will view her own breast. After appropriate skin and parenchymal resection with adequate margins, a two-layer skin closure is usually sufficient.

Re-excision mandates separate consideration. It is optimal to perform a re-excision four to six weeks after the initial surgery, in order to allow inflammation to resolve and seroma to resorb. Even after four to six weeks, seroma may be encountered during re-excision. Should the cavity be entered, care must be taken to remove the entire cavity. In performing re-excision for non-palpable (mammographic) lesions, it is important to repeat mammography prior to surgery in order to allow for relocalization of any calcifications.

AXILLARY LYMPH NODE DISSECTION

While axillary lymph node dissection may ultimately be abandoned, it continues to prove useful at this time in the management of breast cancer through breast conservation. The principal uses of axillary lymph node dissection at this time are in establishing the need for adjuvant therapy for some patients and in the determination of patient prognosis.

It has been established that extensive nodal dissection does not impact on survival.[12] The question then becomes, "What level of dissection is acceptable to provide adequate staging and prevent axillary recurrence?" One trial indicated that a level I dissection including at least four lymph nodes may provide adequate staging.[13] Additional studies have indicated that small lymph node dissections of six or more nodes may provide adequate prophylaxis against axillary recurrence.[12,14,15] Therefore, a level I or level I and II dissection should provide adequate sampling, even if as few as six nodes are retrieved by the pathologist. Level III dissection is unlikely to provide additional information; if the dissection includes level I and II, only 0.5% of patients will have undetected nodal metastases.[16] Extensive nodal dissection should be avoided, as it increases the incidence of postoperative lymphedema.[17,18]

In performing axillary node dissection, a separate incision in the axilla is usually required, unless the primary lesion is located in the tail of the breast and within several centimeters of the axilla. The edges of the pectoralis and latissimus are defined and marked. The incision is made in the transverse RSTL just inferior to the hairline, extending from a point posterior to the lateral border of the pectoralis to a point just over the latissimus; extension of the incision anteriorly will result in a scar which is visible in sleeveless garments. After making the skin incision, the axillary fascia is incised to reveal the axillary contents. Using sharp or blunt dissection, the medial pectoral nerve is identified and preserved. Dissection is continued deep to the pectoralis major to the medial border of the pectoralis minor (level II), including Rotter's interpectoral nodes in the specimen. The axillary vein is identified superiorly, and the axillary fat is swept inferiorly from the vein and laterally from the chest wall. The adventitia of the vein is preserved, as skeletonizing the vein adds nothing to the procedure and may increase the incidence of postoperative edema or encourage thrombosis. Intercostobrachiocutaneous nerves are identified and preserved, if possible, by dissecting the nerve out of the fat pad; this may necessitate removing the fat pad in several pieces. The long thoracic nerve is identified and preserved medially along the chest wall as it courses inferiorly to innervate the serratus anterior. The thoracodorsal nerve and accompanying vessels are identified and preserved laterally. The dissection proceeds inferiorly to the tail of the breast, removing the axillary fat pad lying on the subscapular muscle between the long thoracic and thoracodorsal nerves. The procedure is terminated with skin closure; we choose not to drain routinely, as symptomatic seroma is relatively unusual and, when present, is easily managed with aspiration.

CONCLUSIONS AND FUTURE DIRECTIONS

Despite the excellent therapeutic and cosmetic results of breast conservative surgery, modified radical mastectomy remains the more prevalent procedure in the United States at this time. With improved education and dissemination of knowledge, partial mastectomy will become the preferred procedure. While in the future therapeutic advances may provide us with less invasive methods by which to treat breast cancer, partial mastectomy remains the least deforming procedure currently available. With thoughtful preoperative planning and skill, the results of partial mastectomy provide good cosmesis as well as maintenance of sensibility of the breast. STI

REFERENCES

1. Silen W, Matory WE Jr, Love SM. Atlas of techniques in breast surgery. J.B. Lippincott Co. In press.
2. McCarthy JG, ed. Plastic surgery. Vol. 1. Philadelphia: W.B. Saunders; 1990. p 43-45.
3. Sartorius OW, Morris PL, Benedict DL, et al. Contrast ductography for recognition and localization of benign and malignant breast lesions: an improved technique. In: Logan WW, ed. Breast carcinoma. New York: Wiley and Sons; 1977. p 281-300.
4. Ohtake T, Abe R, Izoh K, et. al. Intraductal extension of primary invasive breast carcinoma treated by breast conservative surgery. Cancer 1995;76(1):32-45.
5. Fisher B, Montague ED, Redmond C, et. al. Findings from the NSABP B-04: comparison of radical mastectomy with alternative treatment of breast cancer. Cancer 1980; 46(1):1-13.
6. Veronesi U, Zucali R, Del Vecchio M. Conservative Treatment of Breast Cancer with QUART Technique. World J Surg 1985;9(5):676-681.
7. Veronesi U, Banfi A, Del Vecchio M, et. al. Comparison of Halsted mastectomy with quadrantectomy, axillary dissection and radiotherapy in early breast cancer: long term results. Eur J Cancer Clin Oncol 1986; 22(9):1085-1089.
8. Matory WE Jr, Wertheimer M, Fitzgerald TJ, et al. Aesthetic results following partial mastectomy and radiation therapy. Plast Recontr Surg 1990;85(5):739-746.
9. Schover LR, Yetman RJ, Tuason LJ, et. al.. Partial mastectomy and breast reconstruction: a comparison. Their effects on psychosocial adjustment, body image and sexuality. Cancer 1995;75(1):54-64.
10. Slavin SA, Love SM, Sadowsky, NL. Reconstruction of the radiated partial mastectomy defect with autogenous tissues. Plast Reconstr Surg 1992;90(5):854-865.
11. McGraw JB, Papp C, Edwards A, et al. The autogenous latissimus breast reconstruction. Clin Plast Surg 1994;21(2):279-288.
12. Fisher B, Redmond C, Fisher ER, et. al. Ten-year results of a randomized clinical trial comparing radical mastectomy and total mastectomy with or without radiation. N Eng J Med 1985;312(11):674-681.
13. Steele RJC, Forrest APM, Bibson T, et al. The efficacy of lower axillary sampling in obtaining lymph node status in breast cancer: a controlled randomized trial. Br J Surg

1985;72(5):368-369.
14. Kjaergaard J, Blichert-Toft M, Anderson, JA, et. al.. Probability of false negative nodal staging in conjunction with partial axillary dissection in breast cancer. Br J Surg 1985;72(5):365-367.
15. Dewar JA, Sarrazin D, Benhamou S, et. al.. Management of the axilla in conservatively treated breast cancer in 592 patients treated at Institut Gustave-Roussy. Int J Radiat Oncol Biol Phys 1987;13(4):475-481.
16. Rosen PP, Lesser ML, Kinne DW, et. al.. Discontinuous or "skip" metastases in breast carcinoma: analysis of 1,228 axillary dissections. Ann Surg 1983;197(3):276-283.
17. Kissen MW, della Rovere QG, Easton D, et al. Risk of lymphedema following the treatment of breast cancer. Br J Surg 1986; 73(7):580-584.
18. Aitken RJ, Gaze MN, Rodger A, et. al. Arm morbidity within a trial of mastectomy and either nodal sample with selective radiotherapy or axillary clearance. Br J Surg 1989;76(6):568-571.