Breast Cancer: Advances in Surgical Management

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Learning Objectives: After studying this article, the participant should be able to: 1. List the diagnostic techniques available for breast cancer. 2. Describe the evolution of mastectomy operations. 3. Discuss the technique of imprint cytology and its role in breast cancer surgery. 4. Explain the advantages of the sentinel node approach to the axillary lymph nodes in breast cancer.

The surgical management of breast cancer has changed dramatically from a deforming ablative procedure to an approach that for the majority of breast cancer patients can preserve the breast and axillary anatomy. The current approach to the diagnosis of breast cancer and the evolution of the more limited approach to surgical resection are discussed. The technique of sentinel lymph node biopsy, originally developed for melanoma patients, has now been adopted for use in the treatment of breast cancer. The methodology and advantages of this approach to the axillary lymph nodes in both tumor recognition and reduced risk to the patient are detailed. (Plast. Reconstr. Surg. 107: 541, 2001.)

More than 185,000 women in the United States will be diagnosed this year with breast cancer, with approximately 10 million women reaching the age of 50. The age incidence for breast cancer indicates that within the next 10 years, 286,000 women will be diagnosed annually with breast cancer. In another 10 years, 420,000 women in the United States will develop breast cancer each year. With this significant increase in breast cancer cases, there has been an equally dramatic evolution of the surgical approach to a kinder, gentler technique.

Diagnosis

For most patients today, the biopsy procedure is performed as a separate step before the definitive surgical management of the breast cancer. There is no oncologic disadvantage to this approach, and there are real psychological advantages for the patient in knowing precisely what will occur in the operating room with each phase of treatment.

Diagnosis of a breast cancer can be made by fine-needle aspiration, core biopsy, or excisional biopsy. Diagnosis should be made using the least invasive technique possible. Fine-needle aspiration can be performed on palpable lesions or under ultrasound guidance for nonpalpable lesions. A skilled cytopathologist is required for this technique, which depends on the analysis of a cellular aspirate. A positive result using fine-needle aspiration is diagnostic; however, an inadequate cellular aspirate or benign diagnosis should be confirmed by a tissue sample technique if the mammographic or palpable abnormality is suspicious. The sensitivity of fine-needle aspiration is reported from 68 percent to 93 percent and the specificity from 88 percent to 100 percent. The false negative rate for this method ranges from 0 to 32 percent.

The core-needle biopsy will provide a tissue segment and can be obtained on nonpalpable lesions by stereotactic or ultrasound guidance. Because an actual tissue segment is obtained using a core-needle biopsy procedure, all that is required is standard pathologic evaluation. A larger tissue core can be obtained by the advanced breast biopsy instrument technique, in which a core 1 to 2 cm in diameter is excised by stereotactic guidance. This approach, currently under evaluation, could prove useful for the

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definitive surgical management of small tumors.

The findings of atypical ductal or atypical lobular hyperplasia in an otherwise benign needle-core biopsy mandate that additional tissue be obtained, usually by needle localization technique. A significant percentage of patients with atypical ductal hyperplasia on core biopsy might have ductal carcinoma in situ or invasive ductal carcinoma in the adjacent tissue indicated by the mammographic abnormality.

The stereotactic needle technique is not amenable to mammographic abnormalities in certain locations of the breast because of equipment limitations. Lesions that are superficial, close to the chest wall, or high in the upper outer quadrant might be impossible to reach using this procedure. For these areas, needle localization biopsy is necessary. This involves the placement of a wire marker into the mammographic abnormality under either x-ray or ultrasound guidance. An incision is then made in the breast, and the wire-marked tissue segment is excised.

The open incisional or excisional biopsy with or without needle localization can provide the largest tissue segment for diagnosis; however, this approach is the most invasive. The location and orientation of the biopsy incision are extremely important. Textbook diagrams often illustrate biopsy incisions oriented along Langer’s lines. It is suggested that this orientation will provide the best healed appearance. We believe that the biopsy incision should be planned to be within the area of a skin-sparing mastectomy incision should this be necessary. Incisions oriented within Langer’s lines are most often perpendicular to the orientation of the skin-sparing mastectomy ellipse and would often necessitate the removal of more skin than necessary to excise the biopsy scar should a mastectomy be required. The needle localization technique often results in the wire marker exiting the skin some distance from the underlying lesion. If the incision is made at the exit point of the wire marker, it might be necessary to track the wire marker through a long distance of normal breast tissue.

A new technique has been developed at the H. Lee Moffitt Cancer Center for the radiographic localization of nonpalpable lesions. Under x-ray guidance, a radioactive seed containing 0.05 to 0.1 mCi of I-125 is placed into the lesion preoperatively using a radiology needle technique. The radioactive seed marker is then located in the operating room using a gamma probe instrument. With this approach, an incision can be made directly over the lesion, oriented appropriately, thereby disturbing less of the surrounding normal breast tissue and minimizing the necessary biopsy tissue volume. This approach also avoids the potential problems of wire needle localization biopsy, which include displacement of the wire during patient transfer, wire transection at operation, and patient discomfort associated with the wire exiting the breast for a period of time before surgery.

SURGICAL TREATMENT

The Halsted radical mastectomy approach was begun at the Johns Hopkins Hospital in Baltimore in 1882. The operation involved an extensive resection of the skin and breast tissue, underlying pectoralis major and minor muscles with level I to III axillary lymph nodes. This aggressive surgical approach reduced the local recurrence rate to 6 percent from reported rates of 51 to 82 percent at the time. The operation, which required split-thickness skin graft coverage of the anterior chest wall, left a grotesque deformity and resulted in frequent problems of lymphedema and sensory abnormalities of the arm and chest. We have found reconstruction of the radical mastectomy deformity to be a challenging undertaking.

By 1912, surgeons led by J. B. Murphy had discontinued removal of the pectoralis muscles on the basis of evidence there was little risk of tumor recurrence within the muscle tissue. The approach of modified radical mastectomy with preservation of the pectoralis musculature in patients without direct tumor involvement of the muscle gained additional support from the report of Patey in 1948. The American College of Surgeons in 1976 conducted a survey that indicated that radical mastectomy was still employed in 20 percent of the 6793 patients reviewed. Just 5 years later a similar survey revealed that the radical mastectomy approach was being used in only 3.4 percent of breast cancer patients.

The report of McWhirter in 1948 began the transition to less-than-complete surgical ablation of the breast and axillary area for the treatment of breast cancer. His approach was that of a simple mastectomy followed by radiation therapy to the breast area. Two long-term clinical trials subsequently proved the effectiveness of less-than-complete removal of breast
tissue and axillary lymph nodes. In 1971, the National Surgical Adjuvant Breast and Bowel Project’s B-04 trial was begun, which eventually contained 1500 women followed for more than 14 years. This study revealed no significant differences in overall treatment failure, distant metastases, or survival among three treatment groups; these groups included radical mastectomy, simple mastectomy with radiation, or simple mastectomy with delayed removal of lymph nodes that became clinically positive. The results of this study indicated that patients who were treated by total mastectomy without axillary node dissection or removal of the pectoralis muscles were at no higher risk for distant disease or death than those patients treated by radical mastectomy.

A new trial was begun in 1976, which involved a lumpectomy arm. Patients were randomly assigned to one of three treatment groups: mastectomy, lumpectomy, or lumpectomy with radiation. All patients underwent complete axillary dissection, and chemotherapy was given to patients with axillary nodal metastases. There was no significant difference in disease-free survival, distant disease-free survival, or overall survival between patients in the three groups after 8 years of follow-up. The publication of these data in 1989 established the move toward less radical surgery and provided the rationale that many patients could be treated surgically with preservation of an essentially normal breast.

Although overall survival was no different in patients treated by lumpectomy with radiation versus mastectomy, local recurrence of the tumor in some series was higher following lumpectomy and radiation than that following modified radical mastectomy. Series published between 1986 and 1994 yielded local recurrence rates of 16 percent following a lumpectomy and radiation. Local recurrence following modified radical mastectomy is usually reported in the 3 to 5 percent range. Local recurrence following lumpectomy is in most cases simply persistence of unresected original tumor. Margin assessment of the lumpectomy specimen, therefore, is the critical step.

There has not been a standard approach for the pathologic assessment of lumpectomy margins. The original protocols of the National Surgical Adjuvant Breast and Bowel Project required evidence of tumor extension to the surgical margin based on permanent section analysis of the tissue for a positive margin determination. Frozen section analysis of tumor margins at the time of surgery has been used; however, the abundance of fat within the breast tissue makes frozen section determination difficult. There are also widely variable approaches to permanent section preparation from a lumpectomy specimen. Virtually all permanent section techniques involve only limited examinations of the total margin.

**Imprint Cytology**

Imprint cytology is a rapid diagnostic technique based on the analysis of surface cytology of a surgical specimen. The technique can obviate some of the problems associated with frozen section analysis of a surgical specimen, which include potential tissue loss, sampling errors, and frozen section artifacts. At the H. Lee Moffitt Cancer Center, we initially examined the use of this technique for diagnosis of needle localized breast lesions. In a series of 88 lesions, imprint cytology was accurate in 87 when compared with the results of permanent section analysis. We then developed an intraoperative touch preparation cytology protocol to evaluate the entire surface of all lumpectomy specimens. Resection margins are evaluated grossly, and following this protocol, standard histologic techniques are used. On removal, the specimen is oriented with clips in the superior, inferior, medial, lateral, anterior, and deep planes. Imprint smears are obtained from the surfaces of the specimen using labeled glass slides. The slides are stained by Diff-Quik (Dade Behring, Inc., Newark, Del.) and examined microscopically. The specimen is then painted with orienting surface dyes to prepare for permanent section evaluation. The analysis of the imprint slides is completed in 15 minutes. If a margin is positive or suspicious, reexcision of that area is performed immediately.

We examined the results of this approach over a nine-year period with 701 lumpectomy specimens evaluated by touch preparation cytology with a mean patient follow-up of 3.5 years. Nineteen of 701 patients developed a local recurrence for a rate of 2.7 percent. The mean time of recurrence in this group of patients was 2.53 years. We compared this with a group of 192 patients referred to our institution who had undergone conventional histologic analysis of lumpectomy margins at other hospitals. A local recurrence rate of 14.6 percent was found in this group. We believe the
use of the touch preparation cytology technique to evaluate the adequacy of tumor resection can provide for the lumpectomy patient a local recurrence rate that is equivalent to that reported for modified radical mastectomy. The caveat to this approach is the requirement of an interested and capable cytopathologist. The pathologist must be able willing to process and examine the specimen while the patient waits in the operating room. Our pathologists work in an area immediately adjacent to the operating room, which makes it possible for the surgeon to sit with the pathologist at the microscope for the examination of the margins. We believe this is an essential element in the achievement of optimal margin control.

**RESECTION TECHNIQUE: LUMPECTOMY**

The objective of a lumpectomy approach to the treatment of breast cancer is the adequate surgical removal of the tumor with the preservation of a normal breast contour. We believe there are no absolute criteria for the use of the lumpectomy approach. The location of the tumor, the size of the tumor, and the size of the breast are variables, which must be considered. A 4-cm tumor can be resected from the upper outer quadrant area of a large breast with little or no distortion of the shape of the breast. A large tumor in the central area of a large breast can be resected, perhaps necessitating also the removal of the nipple-areola complex yet yielding the preservation of a very satisfactory breast form. With a subsequent reconstruction of the nipple-areola complex and a minor mastopexy-reduction procedure of the opposite breast, this may provide for the patient with large breasts a much more satisfactory result than what would be achieved with mastectomy and any type of breast reconstruction. Three-quarters of all primary breast cancers currently treated at the H. Lee Moffitt Cancer Center are treated using the lumpectomy technique.

Postoperative radiation treatment to the remaining breast tissue is an essential component of the lumpectomy approach to breast cancer treatment. Preoperative adjuvant chemotherapy has been advocated as a possible method to decrease tumor volume, permitting lumpectomy rather than mastectomy for the definitive surgical treatment. We take a very cautious approach to this technique, even though preoperative chemotherapy might accomplish a significant reduction in the tumor mass. Pathology examination of the resected tissue will often reveal islands of viable tumor remaining in areas of diffuse tumor necrosis and scar at some distance from the central tumor. Therefore, we believe the true tumor margin could be difficult to identify in such patients and one might inadequately resect the tumor-bearing tissue.

Although a variety of techniques have been suggested for reconstruction after lumpectomy, we believe this should rarely be necessary. The decision as to whether the lumpectomy approach is possible and will yield a satisfactory breast form can be made with reasonable assurance preoperatively. The size of the breast, the location of the tumor, the type of tumor, and the mammographic appearance of the tumor provide the information with which the decision can be made regarding lumpectomy versus mastectomy. We prefer to discuss and plan with the patients preoperatively exactly what will occur in the operating room. There are the occasional patients, often those with ductal carcinoma in situ, in whom we will find at operation a more extensive pattern of tumor than we had anticipated. We believe that it is best to confirm the extent of the tumor by permanent section technique and return the patient to the operating room at a later date if a mastectomy is deemed necessary. This is a most conservative approach, relying on permanent section pathology analysis before sacrificing the breast.

**RESECTION TECHNIQUE: MASTECTOMY**

Our mastectomy technique has evolved to that of a skin-sparing approach in many patients. Most surgeons believe that the nipple and the biopsy scar must be removed, whereas the remainder of the skin envelope can be preserved unless there is obvious tumor involvement. A periareolar incision can be used for the mastectomy and for the sentinel node biopsy/axillary node dissection in the moderately sized breast. The periareolar incision can be closed with a purse-string suture, yielding a minimal scar and tissue area, which can be favorable for nipple-areola reconstruction. The location of the inframammary fold should be carefully noted, and the anatomy of the inframammary fold should be preserved in the mastectomy technique. The breast tissue can be completely resected without the destruction of the inferior aspect of the inframammary fold. Preservation of the inframammary fold is as
important as the skin-sparing technique for the quality of the subsequent reconstruction.

Although the techniques of breast reconstruction after mastectomy are beyond the scope of this article, we will briefly address a few points. The reconstruction of a moderately sized breast can be accomplished relatively easily using either autologous tissue or implants. In our own experience and in our consultation role within a tertiary care institution, we have observed that the vast majority of problems develop when we try to exceed reasonable volume limits in our reconstructions. The reconstruction of a large, pendulous breast by any technique subjects the patient to a higher risk of complications. We believe that it is best to reduce or reshape the opposite breast rather than attempt to stretch the limits on volume of the reconstruction. Implants larger than 500 to 600 cc can impose unacceptable and long-term unworkable stresses upon the relatively thin soft-tissue envelope existing after a mastectomy. Similarly, the attempt to transfer a large TRAM flap using the bipedicle technique can increase the potential for abdominal wall complications. The breast cancer patient should be spared unreasonable risks of complications from her elective reconstructive procedures.

Postoperative radiation therapy to the chest wall and draining lymph node regions have been used as adjuvant treatment after mastectomy. The addition of postoperative radiation therapy has long been shown to reduce the risk of local-regional recurrence. Despite the benefits in preventing local recurrence, the effect of postoperative radiation therapy on long-term survival had been equivocal. Two recent studies from Denmark have shown a survival benefit of postoperative radiation therapy. A total of 1708 premenopausal high-risk women were treated with chemotherapy or with chemotherapy plus radiation after mastectomy and followed for a median of 114 months. Disease-free survival after 10 years was 48 percent among the women who received radiation therapy plus chemotherapy and 34 percent among those treated by chemotherapy alone. Overall survival at 10 years was 54 percent in the radiation plus chemotherapy group and 45 percent in the group who received only chemotherapy. Another study addressed the effects of postoperative radiation therapy in postmenopausal patients. A total of 1375 postmenopausal women following mastectomy were treated by tamoxifen alone or tamoxifen plus postoperative radiation therapy and followed for a median of 123 months. Disease-free survival was 36 percent in the radiation therapy plus tamoxifen group and 24 percent in the tamoxifen alone group. The survival at 10 years was 45 percent in the radiation therapy plus tamoxifen group and 36 percent in the tamoxifen alone group.

These recent studies showing a long-term survival benefit of postoperative radiation therapy have increased the use of postoperative radiation treatment in many centers. This is an important consideration in the management of the reconstructive procedures. We believe that if radiation treatment is planned, breast reconstruction should be performed as a delayed procedure after completion of the radiation treatment and chemotherapy. We have observed the development of a very firm capsule around the tissue expander or implant in all patients who received radiation therapy to the chest wall after placement of the implant. Radiation adversely affects autologous tissue reconstructions as well. The Emory group reported its experience with radiation effects on TRAM flap reconstructions. Fifty-two percent demonstrated postradiation changes in the TRAM flap reconstruction, and 31 percent required surgical revision.

We believe that it is desirable to wait at least 6 months after completion of radiation treatment before beginning the reconstructive procedure. Radiation produces a variable acute effect on the skin and muscle. These changes resolve over a period of a few months after treatment. We believe the reconstructive procedure can be best planned and performed after resolution of the early changes. Unfortunately, the radiation effects are long-term and progressive and can continue to alter the reconstruction years later. We do not believe that tissue expander and implants alone provide a satisfactory reconstruction in the radiated patient. Others have reported the same difficulties we have encountered in expansion of the radiated tissue and long-term unsatisfactory results. We would prefer a TRAM flap reconstruction or a latissimus dorsi flap with an implant in radiated patients.

**Sentinel Lymph Node Biopsy**

The status of the regional nodal basin remains the single most important independent variable predicting prognosis for the breast cancer patient. The current standard of care
for the management of invasive breast cancer is the complete removal of the tumor by either mastectomy or lumpectomy, followed by complete axillary lymph node dissection. Propo-
nents of the latter method suggest that the procedure renders regional control of axillary disease and can improve overall survival. However, a wide spectrum of complications including paresthesias, seromas, drain complications, and acute and chronic lymphedema are seen with axillary lymph node dissection. Breast cancer patients fear most the complications associated with axillary lymph node dissection as they face their course of surgical therapy, chemotherapy, and radiation therapy. Approximately 40 percent of patients following axillary lymph node dissection will develop acute lymphedema, and approximately 5 percent will have chronic lymphedema. Unfortunately, there is no satisfactory treatment for chronic lymphedema.

Recently factors such as tumor grade, estrogen and progesterone receptor status, DNA index, S phase fraction, and HER2/neu expression have been studied to determine their prognostic value. These elements can be helpful in determining the type of adjuvant chemotherapy, although none reliably identifies the metastatic potential of individual tumor cells, as does the status of the axillary nodes. Critics of axillary lymph node dissection suggest that overall survival depends on the development of distant metastases and is not influenced by axillary dissection in most patients. The abandonment of this method in early-stage breast cancer has been advocated by some.

The development of lymphatic mapping and sentinel lymph node biopsy have the potential to change the standard of surgical care of the breast cancer patient. The concept of a sentinel node was first described by Cabanas, using blue dye to identify a lymphatic channel and lymph node draining a penile tumor. Lymphatic mapping was initially developed by Morton and colleagues at the John Wayne Cancer Institute for the treatment of melanoma. Single lymph nodes could be identified in regional basins after the injection of technetium-labeled sulfur colloid into the subdermal lymphatic plexus at the tumor site. By using this technique with lymphoscintigraphy, the lymphatic drainage pathway(s) from a melanoma could be identified and the first node in the drainage pattern could be removed and examined. Patent blue dye or lymphazurin blue dye was subsequently added to the technique by Morton. Initially, lymph nodes removed were examined by standard hematoxylin and eosin staining. In an early study, 11 of 243 melanoma patients developed their recurrence within 2 years in the lymph node basin that had been sampled and deemed negative by sentinel lymph node mapping. More refined techniques were developed for examination of sentinel lymph nodes including immunohistochemical staining for S-100 proteins. When the patients were further studied by these more sensitive techniques, micrometastases were found in the sentinel lymph nodes in 10 of the 11 patients with recurrences, indicating the importance of the detection of micrometastases.

Sappey first described the lymphatic drainage of the breast in the 1800s. Two or three large collecting ducts originating in the subareolar plexus and draining to the axillary nodes have been confirmed by lymphography. The extent of the communication between the lymphatics of the breast tissue and the overlying subdermal plexus remains a matter of debate; however, most investigators now agree that there is an orderly drainage of lymph to the axillary nodes.

Several techniques of lymphatic mapping are currently used. One method involves the injection of technetium-labeled sulfur colloid into the breast parenchyma surrounding the tumor or the biopsy cavity. One millicurie of the radiocolloid is injected 1 to 6 hours before surgery. Mapping is performed with a gamma probe device. A second method involves the injection of 5 ml of isosulfan blue dye into the breast tissue around the tumor or the biopsy cavity just before beginning the surgery. After injection, the breast tissue is massaged for 5 minutes to aid in mobilization of the dye within the lymphatic channels. A third technique involves the subdermal injections of 1 mCi of radiolabeled micro-colloidal human serum albumin 8 to 12 hours before surgery. Mapping is performed with a gamma probe device. We have demonstrated improved sensitivity of mapping by combining the use of radioactive sulfur colloid and isosulfan blue dye.

Beginning in 1994, all patients with clinically node-negative breast cancer presenting to the Comprehensive Breast Cancer Program at the H. Lee Moffitt Cancer Center were evaluated for enrollment in an institutional review board–approved breast lymphatic mapping
study. Lymphatic mapping is performed using a combination technique. A total of 450 mCi of filtered, technetium-labeled sulfur colloid (Syncor International, Tampa, Fla.) in 6 cc of saline in 1-cc aliquots is injected into the breast tissue around the tumor or around the biopsy site 1 to 6 hours before surgery. Just before beginning the operation, 3 to 5 cc of isosulfan blue dye (Lymphazurin Blue Dye, U.S. Surgical Corp., Norwalk Conn.) is injected into the same location as the radiocolloid. Intraoperatively, the blue-stained lymphatics are traced to the blue-stained lymph node(s). A gamma probe device (Navigator, U.S. Surgical, or Neoprobe, Neoprobe Corp., Dublin, Ohio) is used to direct the dissection toward the hot node and confirm the sentinel lymph node status. The sentinel lymph node is defined as any blue node and/or hot node with a radioactivity count of sentinel lymph node to non–sentinel lymph node of 10 to 1 and/or in vitro radioactivity count of sentinel lymph node to background of 3 to 1.

Our initial phase I protocol was the training phase of lymphatic mapping in which a complete axillary lymph node dissection was performed following sentinel lymph node identification; 173 of 186 patients (93 percent) were mapped successfully. A total of 53 patients (30.6 percent) had positive sentinel lymph node(s) and 120 patients (69.4 percent) had negative sentinel lymph node(s). After complete lymph node dissection in the 120 patients who had negative sentinel lymph node(s), one patient was found to have a positive node in the non–sentinel axillary nodes, for a false negative rate of 0.83 percent. With this confirmation of the sensitivity of the technique, we advanced to the phase II protocol, in which only patients with a positive sentinel lymph node would undergo complete axillary dissection.

A recent report details our results of lymphatic mapping in 1147 consecutive breast cancer patients.32 A sentinel node was identified in 1098 of 1147 patients (95.7 percent). A complete axillary dissection was performed in the 49 patients in whom mapping failed to identify a sentinel lymph node. A total of 2395 such nodes were identified and 421 were positive for metastases in 315 of 1098 patients (28.7 percent). The risk of lymphatic metastases increased with the size of the tumor. Positive sentinel lymph nodes were found in 18 of 200 ductal carcinoma in situ patients (9 percent). For patients with tumors 0.1 to 1 cm in size, positive nodes were found in 58 of 297 (19.5 percent). Of the 370 patients with tumors 1 to 2 cm in size, 118 (31.9 percent) had positive nodes. The rate of sentinel lymph node metastases in patients with tumors ranging from 2 to 5 cm was 53.5 percent (108 of 202) and for tumors larger than 5 cm was 88 percent (22 of 25).

The sentinel nodes were evaluated intraoperatively by the imprint cytology technique. The nodes were then submitted for permanent section evaluation with hematoxylin and eosin stain. The nodes were also examined using an immunohistochemical stain employing the peroxidase-antiperoxidase technique with monoclonal antibody directed against cytokeratin (CAM 5.2 Becton Dickinson Immunocytochemistry Systems, San Jose, Calif.). The cytokeratin stain was considered positive if clusters of immunoreactive cells were noted within the lymph node or if similar stained cells were noted in the subcapsular sinuses. In an earlier study, we found that 17 out of 180 patients (9.4 percent) who were node negative by hematoxylin and eosin staining were upgraded to lymph node positive through immunohistochemical staining of the sentinel lymph node(s).33

In our series of mapped patients, only 28.7 percent were node positive, and thus complete axillary dissection could be avoided in the remaining 72.3 percent. Identification of the sentinel lymph node(s) allows a very thorough pathologic examination of the node(s)—something that is not economically possible for all of the tissue obtained in a complete axillary dissection. Using immunohistochemical staining to identify micrometastases, we have upstaged approximately 9 percent of our patients to lymph node–positive from a lymph node–negative status. There is a reported 15 to 20 percent failure rate at 5 years for lymph node–negative patients determined by routine pathology.34 It is probable that by a detailed focused examination of the sentinel lymph node(s) we are identifying the previously unrecognized node-positive breast cancer patients. This corresponds to the finding of micrometastases by histochemical techniques in the lymph node–negative melanoma patients who recurred in the mapped node basin and has important implications for decisions regarding adjuvant chemotherapy treatment. In a large European trial, the presence of lymph node micrometastases in the breast cancer pa-
tient has been shown to adversely affect survival. It is also interesting that we have found axillary metastases in 9 percent of our ductal carcinoma in situ patients. This may indicate unrecognized areas of invasive carcinoma in patients thought to have only ductal carcinoma in situ, which should have no metastatic potential. This finding argues against the exclusion of patients with ductal carcinoma in situ from consideration of axillary dissection and supports the sentinel node approach for all breast cancer patients.

The sentinel node approach to the axilla substantially eliminates the risks of axillary dissection for node-negative patients. No patient who has had only a sentinel node biopsy has developed lymphedema, nor have we seen in our sentinel node biopsy—only patients the development of postmastectomy pain syndrome. This syndrome occurs in approximately 5 percent of patients undergoing mastectomy and axillary dissection. The clinical picture is one of lancinating, burning pain in the anterior chest, proximal arm, and axillary areas. The cause is believed to be trauma to the intercostobrachial nerves during the axillary dissection.

The technique of sentinel node biopsy in the breast cancer patient represents a substantial change in the surgical approach to the axilla. The meticulous bloodless dissection required to visualize the fine, lymphazurin-dyed lymphatics in the search for the sentinel node is quite different from the standard approach to an axillary dissection. As with any new surgical technique, there is a definite learning curve. We have studied the learning curves of the surgeons performing this procedure at the H. Lee Moffitt Cancer Center. For the five surgeons performing the operation, 23 operations were required on average to achieve a 90 ± 4.5 percent success rate, and 53 operations were required to achieve a 95 ± 3 percent success rate in identification of the sentinel node. Surgeons beginning to perform this operation should first take a training course then confirm their ability to successfully identify the sentinel node by performing a series of cases in which the sentinel node was identified followed by a complete axillary dissection. We believe that each surgeon should first perform 30 procedures involving identification of the sentinel node followed by complete axillary dissection before limiting dissection to only the sentinel node(s).

REFERENCES

13. Early Breast Cancer Trialist’s Collaborative Group. Effects of radiotherapy and surgery in early breast can-


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1. WHICH BREAST BIOPSY TECHNIQUE REQUIRES A FORMAL OPEN APPROACH TO THE BREAST?
   A) Stereotactic core biopsy
   B) Fine needle aspiration
   C) Needle localization biopsy
   D) Advanced breast biopsy instrument technique

2. THE SENTINEL NODE IS
   A) The first node in the lymphatic drainage pattern within the regional node basin
   B) The first node with metastatic tumor within the regional node basin
   C) The largest volume node in the regional node basin
   D) The “highest” or most proximal node in the regional node basin

3. THE SENTINEL NODE BIOPSY TECHNIQUE WILL IDENTIFY ALL NODES WITH METASTATIC TUMOR.
   A) True
   B) False

4. IN CURRENT NEW BREAST CANCER PATIENTS AXILLARY NODE METASTASES CAN BE ANTICIPATED IN
   A) 10 percent of patients
   B) 25 percent of patients
   C) 50 percent of patients
   D) 66 percent of patients

5. THE OBJECTIVES OF THE LUMPECTOMY APPROACH TO THE TREATMENT OF BREAST CANCER INCLUDE ALL BUT
   A) Preservation of normal breast form
   B) Preservation of normal breast sensibility
   C) Optimal surgical management of the tumor
   D) Elimination of adjuvant radiation therapy

6. WHICH TECHNIQUE PROVIDES THE MOST COMPLETE TISSUE MARGIN ASSESSMENT FOR LUMPECTOMY PATIENTS?
   A) Permanent section analysis
   B) Frozen section analysis
   C) Polymerase chain reaction analysis
   D) Touch preparation imprint cytology

To complete the examination for CME credit, turn to page 631 for instructions and the response form.