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### **Standard for the Management of Ductal Carcinoma In Situ of the Breast (DCIS)**

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## Standard for the Management of Ductal Carcinoma In Situ of the Breast (DCIS)

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**ABSTRACT** The multidisciplinary guidelines for management of ductal carcinoma in situ of the breast from the American College of Radiology, the American College of Surgeons, the College of American Pathology, and the Society of Surgical Oncology have been updated to take into account continuing advances in the diagnosis and treatment of this disease. The continued growth in mammographic evaluation and technology has resulted in an increase in the diagnosis of ductal carcinoma in situ of the breast (DCIS). The resulting guidelines provide a framework for clinical decision-making for patients with DCIS based on review of relevant literature, and includes information on patient selection and evaluation, technical aspects of surgical treatment, techniques of irradiation, and follow-up care. (*CA Cancer J Clin* 2002; 52:256-276.)

### INTRODUCTION

Standards of care in the diagnosis and management of any disease should be based on the best available scientific information. Such information is derived from prospective, randomized clinical trials through the cooperative group or intergroup mechanism, single or multi-institutional prospective trials, prospective nonrandomized trials, retrospective studies, and personal experiences.

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A collaborative effort in 1991 of the American College of Radiology, the American College of Surgeons, the College of American Pathologists, the Society of Surgical Oncology, and the American Cancer Society culminated in a 1992 publication entitled *Standards for Breast Conservation Treatment*. Both invasive and noninvasive diseases were considered in that document, although the focus was on invasive breast cancer. A task force of the first four of these national organizations decided that there was a sufficient body of knowledge on ductal carcinoma in situ of the breast to publish a standard.

Prior to the widespread use of screening mammography, ductal carcinoma in situ (DCIS) was an infrequently encountered problem that was routinely treated by mastectomy. As a result, there is a limited amount of information on the natural history of DCIS on which to base treatment decisions. In addition, the majority of DCIS seen today is identified mammographically due to the presence of microcalcifications, and it is uncertain whether the biologic potential of this subclinical DCIS is the same as that of clinically evident DCIS. Total mastectomy, excision and irradiation, and excision alone have all been advocated as management strategies for DCIS. The acceptance of breast-conserving therapy for invasive carcinoma has stimulated great interest in its use for the management of DCIS.

The direct extrapolation of data from randomized trials comparing mastectomy with lumpectomy and irradiation in invasive carcinoma to the patient with DCIS is inappropriate. In the patient with invasive carcinoma, the risk of metastatic disease is present at the time of diagnosis, and many distant failures occur without evidence of local recurrence in the breast. In DCIS, the risk of metastases at the time of diagnosis is negligible, so an invasive local recurrence carries with it the possibility of breast cancer mortality. The appropriateness of breast-conserving approaches in DCIS should be guided by the incidence of invasive recurrence in the breast and the results of salvage therapy. The evaluation of the results of

different local therapies in DCIS is complicated by changes in the presentation of DCIS and differences in the extent of mammographic and pathologic evaluation over time, as well as the long natural history of the disease.

Treatment selection for the individual patient with DCIS requires a clinical, mammographic, and pathological evaluation. The term DCIS encompasses a heterogeneous group of lesions, and prior to the determination of a patient's suitability for breast conservation with or without irradiation or the necessity of mastectomy, a thorough evaluation to characterize the extent and character of the patient's disease is necessary.

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#### PATIENT EVALUATION

An adequate history and physical examination will include a complete assessment of the patient's overall health status. Much of the information needed to determine a patient's suitability for breast conservation therapy could be obtained from a directed history and physical examination.

The elements of the breast cancer's specific history and physical examination are listed in Tables 1 and 2, and represent information that may affect the selection of local therapy.

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#### MAMMOGRAPHIC EVALUATION

The most common mammographic presentation of DCIS is microcalcifications. In 54 patients with DCIS undergoing needle localization, 53 of the 54 (98 percent) had calcifications on mammography as reported by Dershaw, et al.<sup>1</sup> Similarly, Stomper, et al. reported that 90 percent of his DCIS cases presented with microcalcifications.<sup>2</sup> Calcifications in DCIS typically are pleomorphic, varying in size, form, and density, and grouped in a cluster, frequently manifesting linear or segmental arrangements reflecting their presence in the duct. In contrast, calcifications associated with benign disease

TABLE 1

Elements of the Breast Cancer-Specific History
<ul style="list-style-type: none"> <li>• Family history: relatives with breast cancer (age at diagnosis, bilaterality), ovarian carcinoma, and other malignancies.</li> <li>• History of prior therapeutic irradiation involving breast region.</li> <li>• History of collagen vascular disease: type, documentation of diagnosis.</li> <li>• Presence of breast implants: submammary or subpectoral.</li> <li>• Date of last menstrual period, possibility of pregnancy, use of hormone replacement therapy, oral contraceptives or fertility and gynecologic surgeries.</li> <li>• Nipple discharge: spontaneous versus induced, color.</li> </ul>

tend to be more rounded, more uniform in density, and scattered or distributed in groups.<sup>3</sup> The shape of the clusters of calcifications may be important also. Lanyi analyzed 153 clusters of microcalcifications and observed that the most common cluster shape was irregular or triangular, suggestive of a segmental or ductal distribution. He found no round or oval cluster shapes in DCIS.<sup>4</sup>

Approximately ten percent of mammographically evident DCIS will be without calcifications. On occasion, DCIS will be diagnosed without mammographic findings. In a retrospective, consecutive series of 190 DCIS cases, calcifications were the most common finding of malignancy (117/190, 62 percent), soft tissue changes other than calcifications were less common (43/190, 22 percent) and even fewer patients had negative mammograms (30/190, 16 percent). Atypical mammographic findings of DCIS included a mass (16/190, 8 percent), nodules or prominent ducts (16/190, 8 percent), or other soft tissue changes (12/190, 6 percent).<sup>5</sup>

Recent mammographic evaluation (usually within three months) prior to biopsy or definitive surgery is needed to establish the appropriateness of breast conservation treatment by defining the extent of a patient's disease. In addition to mediolateral oblique and craniocaudal views, magnification views should be obtained routinely to identify areas of

TABLE 2

Elements of the Breast Physical Exam
<ul style="list-style-type: none"> <li>• Tumor size (measured) and location, if palpable.</li> <li>• Nipple discharge: discharging duct, guaiac positive or negative.</li> <li>• Nipple appearance: eczematoid changes, discoloration.</li> <li>• Ratio of breast size to tumor size.</li> <li>• Axillary node status: size, mobility.</li> <li>• Supraclavicular node size.</li> <li>• Opposite breast and axilla.</li> </ul>

calcified tumor elsewhere in the breast that otherwise might not be apparent. Magnifications or spot-compression magnification views increase imaging resolution for better depiction of shapes of calcifications, their number, and extent.<sup>6-8</sup>

The preoperative diagnosis of DCIS can be suggested by mammography, but a definitive diagnosis depends on pathologic evaluation of the specimen. Imaging techniques are not reliable to determine whether or not the basement membrane has been violated, and peritumoral inflammation and/or fibrosis can cause a mass to be present along with microcalcifications in the absence of invasion. The subtypes of DCIS, nuclear grade, and extent of necrosis can be suggested on the basis of characteristic patterns of calcifications, but these patterns are not diagnostic, and a definitive diagnosis depends on the analysis of tissue by the pathologist.<sup>9,10</sup>

The mammogram may underestimate the extent of DCIS. Underestimation is increasingly likely with increasing lesion size. However, an effort should be made to determine the extent of tumoral calcifications preoperatively in all cases, and the maximal span of the calcifications should be reported. If a mass is present, it should be measured. The size of low- and intermediate-grade DCIS is underestimated by two cm in as many as 50 percent of cases when only two-view mammography is performed.<sup>11,12</sup> Routine use of magnification views, as well as other special

views as required, will significantly reduce the likelihood of this problem. The entire breast should be carefully examined to determine if areas of tumor are present elsewhere in the breast, thereby influencing a decision about breast-conserving treatment.

The contralateral breast should also be evaluated, and bilateral mammography is required. Bilateral DCIS was found in 7 of 36 women (19 percent) with DCIS who underwent contralateral subcutaneous mastectomy.<sup>13</sup>

The role of other imaging modalities, especially MRI, in evaluation of DCIS has yet to be established. Contrast-enhanced MRI is very sensitive for detecting invasive cancers, but DCIS has nonspecific appearances and kinetic enhancement curves that can mimic fibrocystic changes and other benign findings.<sup>14-18</sup>

## SURGICAL CONSIDERATIONS

### Introductory Comments

When breast conservation treatment is appropriate, the goals of any surgical procedure on the breast are total removal of the suspicious or known malignant tissue and minimal cosmetic deformity. These goals apply to both diagnostic open surgical biopsy and definitive local excision. Failure to consider them at all stages may jeopardize conservation of the breast.

DCIS presenting as a palpable mass can occur, but is unusual. The surgical techniques described for the evaluation and excision of palpable invasive disease apply to palpable DCIS. The most common presentation of DCIS microcalcifications, and in these cases, image-directed procedures will be necessary for diagnosis and treatment.

### Image-directed Biopsy

#### *Stereotactic Core Needle Biopsy*

Stereotactic core needle biopsy of the breast

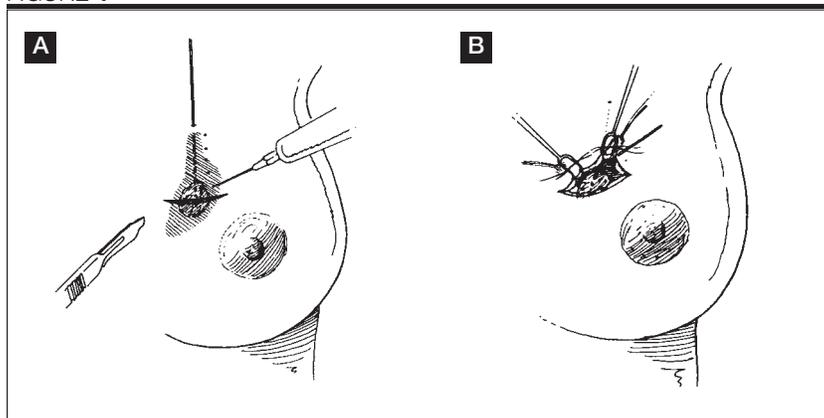
performed by qualified radiologists, surgeons, or other physicians can be utilized as the initial approach for biopsying suspicious nonpalpable mammographic abnormalities.<sup>19</sup> Ultrasound-guided biopsy is useful for nonpalpable masses, but usually cannot be relied upon for biopsy of microcalcifications.

Not all patients with microcalcifications are ideal candidates for stereotactic biopsy. Some patients' breasts may be too small to accommodate the biopsy probe. The thickness of the breast must be adequate to allow the full throw of the device. Abnormalities just under the skin and those in extremely posterior locations may pose technical problems in some cases. Widely separated calcifications may pose difficulties with generating accurate stereotactic coordinates to guide needle biopsy. When microcalcifications are not tightly clustered or when the sensitivity or resolution of the stereotactic imaging system is such that individual microcalcifications are not well-visualized, accurate localization and retrieval of microcalcifications within core biopsy specimens may be difficult. The difficulty of the procedure will be increased with an uncooperative patient. If any one or a combination of these adverse factors exists, image-directed open surgical biopsy is the preferred approach.

For lesions amenable to stereotactic breast biopsy, multiple cores should be taken and specimen radiography performed to confirm an adequate sampling of the microcalcifications. It is desirable to leave some microcalcifications at the site in the event that the diagnosis of DCIS is made in order to accurately localize the site for definitive excision. For small lesions likely to be completely removed with the diagnostic biopsy, a marker should be left at the biopsy site unless another landmark near the biopsy site makes it possible to localize the area.

If a presurgical diagnosis of DCIS is made by percutaneous core needle biopsy, physicians should be aware that areas of invasive carcinoma will be found in about 20 percent of cases at the time of surgical excision.<sup>20,21</sup> Localized calcifications with a high probability of

FIGURE 1



A. Incision placement for needle localization biopsy should be over the lesion, not at the point of entry of the wire into the breast. Reprinted with permission from Silen W, Matory EJ Jr, Love S. Atlas of techniques in breast surgery. Philadelphia, PA: Lippincott-Raven;1996:53-54.

B. The breast tissue is dissected until the wire is identified within the parenchyma, and then the wire is stabilized distally and brought into the field. Traction on the wire should be avoided at all times. Reprinted with permission from Silen W, Matory EJ Jr, Love S. Atlas of techniques in breast surgery. Philadelphia, PA: Lippincott-Raven;1996:53-54.

malignancy (BI-RADS™ 5)\*\* in a patient who is suitable for breast preservation may be approached initially with a core biopsy or needle localization and excision. Studies have shown that a preoperative core biopsy diagnosis of DCIS does not facilitate achieving negative margins compared to a diagnostic needle localization performed by experienced surgeons.<sup>22,23</sup> Indeterminate calcifications (BI-RADS™ 4)\*\* and those that are too diffuse to allow breast-conserving surgery should undergo core biopsy for diagnosis.<sup>19</sup>

#### *Guided-wire Open Biopsy*

Surgical excision of nonpalpable, mammographically evident lesions should be conducted with presurgical localization with a guide such as a hookwire. Any suspicious lesion detected by mammography requires presurgical localization in order to assure accurate removal of the abnormal area and to

avoid excess sacrifice of breast tissue. Methods of localization can be by needle-hookwire, dye injection, or a combination of both. The localization should be precise and may require positioning of more than one wire. Labeled craniocaudal and 90-degree lateral films (or other orthogonal views that show the hook-wire) should be sent to the operating room for the surgeon's orientation. Availability of the current diagnostic films

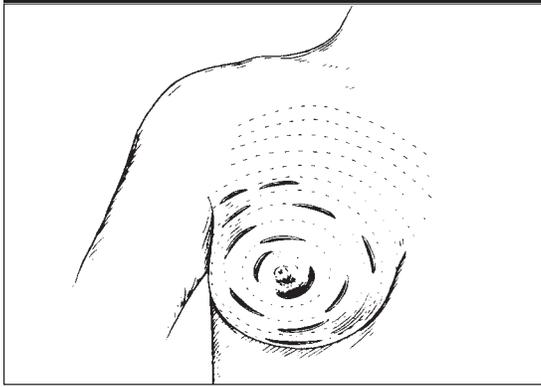
may be of additional value to the surgeon.

The surgeon should assess the exact location by triangulation based on the position, depth of penetration, and angle of the wires, and then place the incision closest to the area of pathology to achieve the best cosmetic result (Figure 1). Placement of a radiopaque skin marker at the point of entry of the wire into the breast prior to obtaining the final radiographs of the wire position will facilitate incision placement. Tunneling should be avoided, and the skin incision should be made as close to the lesion as possible. The length of the incision should be sufficient to permit the removal of the specimen in one piece. Removal of the lesion in multiple fragments should be avoided as this practice precludes margin assessment and size determination.

Curvilinear skin incisions are preferable, but for tumors at three o'clock, nine o'clock, or in the inferior breast, radial incisions may provide the best cosmesis (Figure 2). The surgeon

\*\*BI-RADS™ categories 4 and 5 are described as follows: Category 4 – Suspicious Abnormality – Biopsy should be considered: These are lesions that do not have the characteristic morphologies of breast cancer but have a definite probability of being malignant. The radiologist has sufficient concern to urge a biopsy. If possible, the relevant probabilities should be cited so that the patient and her physician can make the decision on the ultimate course of action. Category 5 – Highly Suggestive of Malignancy – Appropriate Action Should Be Taken: These lesions have a high probability of being cancer. American College of Radiology (ACR). Breast imaging reporting and data system (BI-RADS™). Third Edition. Reston, VA: American College of Radiology;1998:95.

FIGURE 2



Recommended locations of incisions for performing breast biopsy. For larger lesions in the lower breast, a radial incision may result in better cosmesis. Reprinted with permission from Bland KI, Copeland EM. Indications and techniques for biopsy. In: Bland KI, Copeland EM (eds). *The breast: Comprehensive management of benign and malignant diseases*. Philadelphia, PA: WB Saunders;1998:802-816.

should always place the location of the incision so that it can be easily incorporated within the mastectomy specimen if negative margins cannot be achieved with breast conservation surgery. Periareolar incisions are not appropriate for lesions in the periphery of the breast because they do not provide adequate exposure and may make it difficult to obtain negative margins. The procedure can be readily accomplished under local anesthesia with or without intravenous sedation.

Meticulous hemostasis is of critical importance. Hematoma formation produces changes that are difficult to interpret by physical examination. These changes may be long lasting and lead to unnecessary biopsy because of the difficulty in evaluation. A better cosmetic result can be expected by leaving the biopsy cavity to fill with serum. Drains in the breast should be avoided. In addition, clips outlining the excision cavity should be placed to aid in the planning and executing of radiation therapy, and to demarcate the tumor bed for future imaging studies. Skin incisions should be closed with a subcuticular technique.

Intraoperative specimen radiography should be performed to determine that the mammographic lesion has been excised and to direct pathologic analysis to the site in question

in the removed tissue. Magnification and compression of the specimen will increase the resolution of the radiograph, and may be necessary to visualize the lesion. However, these may make measurement of the distance of DCIS from the anterior and posterior margins inaccurate due to the increased compressibility of the fat relative to the tumor rather than due to any alteration of the tumor. The specimen film should be correlated with a preoperative mammogram and interpreted without delay. Absence of the mammographic abnormality on the specimen radiograph usually indicates that it has not been removed. If the diagnosis is DCIS, extensions of calcification (or mass) to the margin of the specimen suggest that a residual tumor might be present in the breast and that further resection along that margin may be indicated.

The specimen radiograph is not adequate to determine the completeness of excision. Histologically negative margins also do not guarantee complete lesion removal since DCIS may grow in a discontinuous fashion. A postoperative mammogram should usually be obtained to document complete removal of calcifications. This can be performed as soon as the patient can tolerate compression. However, a large seroma may obscure small residual calcifications. Magnification views may show calcifications not evident on nonmagnified views. Margin status and the postoperative mammogram are complementary means of assessing the completeness of excision. If re-excision is performed for residual calcifications, specimen radiography and a post-excision mammogram should again be obtained to reassess the tumorectomy site.

#### Re-excision of Biopsy Site

Re-excision of the previous biopsy site must be performed carefully to assure negative margins of resection, avoid excess breast tissue removal, and achieve good cosmesis. If microcalcifications are the indication for re-excision, needle localization should be considered. Proper orientation of the original

biopsy specimen is essential for identification of the individual margin surfaces involved with tumor, so that re-excision can be limited to these areas. When the specimen has not been oriented, removal of a rim of tissue around the previous biopsy is necessary.

#### Management of the Axilla

Axillary nodal metastases occur in fewer than five percent of patients in whom a surgical specimen is interpreted as containing DCIS only, and are due to the presence of unrecognized invasive carcinoma.<sup>24,25</sup> As many as 20 percent of patients diagnosed as having DCIS only with an image-guided breast biopsy will have invasive carcinoma identified when the entire lesion is removed.<sup>20,21</sup> Invasion is more likely in association with extensive high-grade DCIS or when a mass is present on the mammogram. In patients treated with breast-conserving therapy, the need for axillary sampling can be assessed after the lesion has been completely removed and evaluated for the presence of invasive carcinoma. If invasive tumor is found, these patients are candidates for sentinel node biopsy or axillary dissection. The presence of a surgical biopsy cavity has not been found to be a contraindication to lymphatic mapping. In patients with large DCIS lesions requiring mastectomy, sentinel node biopsy should be considered when invasion has not been documented, since the procedure cannot be performed after a mastectomy. The mapping agent can be injected around the DCIS lesion or in the periareolar region since the precise location of any invasive carcinoma is not known.

For surgeons inexperienced in lymphatic mapping, consideration should be given to performance of a Level I axillary dissection at the time of mastectomy (particularly if immediate reconstruction is done) to avoid a second operation. Some authors<sup>26</sup> have suggested that lymphatic mapping and sentinel node biopsy with immunohistochemistry should be carried out in all patients with DCIS. Pendas, et al.<sup>26</sup> reported that 5 of 87 patients (six

percent) with pure DCIS had metastatic disease to the sentinel node, which was detected by immunohistochemistry only in three cases. No additional nodal metastases were found on completion dissection. All involved nodes occurred in patients with large or high-grade DCIS. Since the prognostic significance of immunohistochemically positive cells in the sentinel node remains a matter of debate, and since long-term survival rates of 97 to 99 percent<sup>24-26</sup> for DCIS patients treated by surgery alone are not compatible with a significant incidence of axillary nodal metastases, we would favor a selective approach to the axillary nodes as described.

#### PATHOLOGIC EVALUATION

##### Tissue Handling

The excised tissue should be submitted for pathology examination with appropriate clinical history and anatomic site specifications including laterality (right or left breast) and quadrant. For wide excisions or segmental breast resections, the surgeon should orient the specimen (e.g., superior, medial, lateral) for the pathologist with sutures or other markers. The specimen radiograph should be available to the pathologist for review while examining the specimen.

Gross examination should document the type of surgical specimen when this information is provided to the pathologists (e.g., excisional biopsy, quadrantectomy), the size of the specimen, and the proximity of the tumor (if visible) or biopsy site to the margins of excision. The presence or absence of tumor at the margins of excision is determined by marking them with India ink or another suitable technique. In general, the entire mammographic lesion, and as much of the remaining specimen as practical, should be submitted for histologic examination. Additionally, the margins of the specimen must be thoroughly evaluated, particularly those closest to the lesion.<sup>27,28</sup>

Frozen section examination of image-guided needle biopsies of nonpalpable lesions or mammographically directed biopsies done for microcalcifications is strongly discouraged.<sup>29</sup> Distinguishing between atypical ductal hyperplasia and DCIS may be impossible in frozen section preparations, and small foci of microinvasion may be lost or rendered uninterpretable by freezing artifact. In general, frozen sections should be prepared only when there is sufficient tissue that the final diagnosis will not be compromised (i.e., grossly visible tumors larger than 1.0 cm) and when the information is necessary for immediate therapeutic decisions.

#### Pathologic Features Influencing Treatment Choice

DCIS has traditionally been classified primarily by architectural pattern. In this system, DCIS is divided into comedo, cribriform, micropapillary, papillary, and solid subtypes. However, this classification was developed at a time when all patients with DCIS were treated by mastectomy, and the histologic subclassification of DCIS was largely an academic exercise. With the increasing use of breast-conserving therapy for DCIS, there is a need to identify those lesions more likely to recur or progress to invasive cancer. To address this need, several new classification systems have been proposed based primarily on nuclear grade and/or necrosis.<sup>30-35</sup> Several studies have supported the clinical relevance of this approach showing that high nuclear grade and/or necrosis (particularly extensive comedonecrosis) are associated with a higher risk of early local recurrence following breast conservation therapy.<sup>36,37</sup> Although the architectural pattern of DCIS does not correlate well with the risk of local recurrence,<sup>37</sup> studies have shown that micropapillary subtypes tend to be more extensive.<sup>38,39</sup> No classification system to date, however, has been useful in predicting whether local disease is likely to recur as in situ or invasive carcinoma.

A consensus conference on the classification of DCIS was convened in 1997. Although a

single classification system for DCIS was not endorsed at this meeting, it was recommended that the pathologist should clearly report the nuclear grade of the lesion and the presence or absence of necrosis and cell polarization. Because of the recognition of the importance of nuclear grade, this was defined in detail in the consensus document.<sup>40</sup> If a specific grading system for DCIS is used, this should be stated in the pathology report. The report also should include the architectural patterns present, since this may have clinical relevance (e.g., the micropapillary pattern may be more prone to multiple quadrant involvement, independent of nuclear grade).<sup>38,39</sup>

A few recent studies have addressed the issue of consistency among pathologists in categorizing DCIS using the newer classification systems.<sup>36,41-44</sup> In general, greatest consistency is achieved using classification systems based primarily on nuclear grade.

Knowledge of the extent (size) of DCIS is important in deciding treatment, but in contrast to most invasive cancers, measuring the size of DCIS is difficult because it is usually nonpalpable and cannot be identified grossly. While a precise measurement of size may not be possible, the pathologist may be able to estimate the extent of DCIS, and this information should be included in the pathology report. Several methods for estimating the extent (size) of DCIS have been suggested: (1) directly measuring the size of the lesion when confined to a single slide; (2) determining the size after submitting the entire specimen for microscopic examination in sequence, and in sections of uniform thickness (two to three mm); (3) estimating the percentage of breast tissue involved by DCIS in relation to the total specimen; and (4) reporting the total number of slides examined and the number with DCIS.

The assessment of surgical margins is arguably the most important aspect in the pathologic evaluation of breast tumor excisions in patients with DCIS being considered for breast conservation. Although the definitions of "positive" and "negative" margins vary

among institutions, microscopic extension of DCIS to surgical margins usually results in further surgery. The pathologist should clearly specify in the pathology report whether DCIS is transected at the surgical margin and, if not, how close the lesion is from the nearest margin.

In contrast to DCIS, lobular carcinoma in situ (LCIS, lobular neoplasia) is an incidental histologic finding that is considered a marker of increased risk for subsequent breast cancer rather than a malignant lesion requiring surgical excision. This increase in risk applies to both breasts and is probably lifelong. The relation between LCIS and surgical margins is not important. The management of patients with recently recognized histological variants of LCIS (such as pleomorphic LCIS) has not been defined due to lack of information about the natural history of such lesions.

HER2/neu gene amplification/protein overexpression is not necessary for the routine evaluation of noninvasive breast carcinomas. Recent data from the NSABP B-24 trial indicate that the addition of tamoxifen to local excision and radiation decreases the risk of local recurrence.<sup>45</sup> However, the role of estrogen and progesterone receptor status in selecting DCIS patients for tamoxifen therapy has not been evaluated (see *The Role of Tamoxifen in DCIS* page 268).

#### The Pathology Report

Certain pathologic features should be included in the surgical pathology consultation report because they help determine the most appropriate therapy. These features include:

1. How the specimen was received (e.g., number of pieces, fixative, orientation).
2. The laterality and quadrant of the excised tissue and the type of procedure as specified by the surgeon.
3. Size of the specimen in three dimensions.
4. Whether the entire specimen was submitted for histologic examination.
5. The histologic features of DCIS (e.g., nuclear grade, necrosis, architectural pattern).
6. An estimate of the extent or size of DCIS (if

possible).

7. The location of microcalcifications (e.g., in DCIS, in benign breast tissue, or both).
8. The presence or absence of DCIS at the margins of excision. If possible, the distance of the lesion or biopsy site from the margin should be stated.

The use of a synoptic report summarizing key features such as tumor size, grade, and margin status in a list is highly recommended.<sup>40</sup>

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#### SELECTION OF TREATMENT OPTIONS

##### Introduction

It is the collective responsibility of the surgeon, pathologist, radiation oncologist, and radiologist to integrate all available data in order to clearly articulate treatment options and recommendations to the patient. The treatment team must decide (on the basis of imaging studies, the physical exam, and the pathology report) whether the patient is a candidate for a breast-conserving approach. If so, further discussion regarding the issue of local recurrence must be conducted. Local recurrence with total mastectomy is rare. Local recurrence is observed at a higher rate in patients treated with breast conservation, but the impact of these local recurrences on overall survival is small. Finally, patients need to understand the excellent prognosis for this disease with either surgical approach.

##### Supporting Literature

###### *Mastectomy*

There have been no prospective randomized trials comparing the treatment of DCIS by mastectomy versus breast conservation. Studies from single institutions (including patients with both clinically evident and mammographic DCIS) indicate that one to two percent of patients treated by mastectomy will relapse, either regionally or systemically, presumably due to the presence of unrecognized foci of

invasive tumor in the breast (Table 3).<sup>24,36,46-52</sup> Thus, while mastectomy results in cure rates approaching 100 percent, this may be overtreatment for many patients with DCIS, particularly those with small, mammographically detected lesions.

### *Breast-conserving Surgery and Radiation Therapy*

#### PROSPECTIVE RANDOMIZED CLINICAL TRIAL DATA

In 1985, the National Surgical Adjuvant Breast Project (NSABP) began protocol B-17, a prospective randomized study to evaluate the worth of postoperative radiation therapy (RT) following lumpectomy for patients with DCIS. The initial clinical and pathologic results were published in 1993 and 1995.<sup>53,54</sup>

In 1997, the results were updated.<sup>55</sup> For this analysis, 814 patients were available with a mean time in study of 90 months (range: 67 to 130 months). Eighty percent of patients had tumors detected by mammographic screening. Negative margins, defined as tumor-filled ducts not touching ink, were required. There were a total of 151 ipsilateral breast tumor recurrences (IBTR), 70 (46.4 percent) of which were invasive. Almost all of the ipsilateral breast tumor recurrences were at or near the original lesion.

The rate of IBTR was markedly reduced by breast irradiation. The incidence of invasive recurrence was 3.9 percent in the radiated group compared with 13.4 percent in the nonirradiated group ( $p = 0.000005$ ). The incidence of recurrent DCIS was also significantly reduced, from 13.4 percent in the group with no radiation to 8.2 percent in the radiated group ( $p = 0.007$ ). The overall survival rate did not differ between groups: 94 percent for patients treated by lumpectomy alone, 95 percent for lumpectomy and RT.

The impact of pathologic features on IBTR was reported for a subset of 623 patients in NSABP B-17 with eight-year follow-up.<sup>56</sup> The cumulative frequency of IBTR was 137 (22 percent) for all 623 patients. Ninety-four of 303

TABLE 3

Results of Treatment of DCIS With Mastectomy				
Study	Number of Patients	Follow-up	% Nonpalpable	Number of Recurrences
Ashikari et al. <sup>46</sup>	92	11 years (maximum)	0	0
Sunshine et al. <sup>47</sup>	68	10 years (minimum)	0	0
Farrow <sup>48</sup>	181	5-20 years	0	2
Silverstein et al. <sup>49</sup>	228	7 years (median)	80	2
Von Rueden and Wilson <sup>50</sup>	45	Not stated	7	0
Lagios <sup>36</sup>	42	Not stated	60	0
Kinne et al. <sup>24</sup>	101	11.5 years (median)	59	1
Schuh et al. <sup>51</sup>	51	5.5 years (mean)	33	1
Arnesson et al. <sup>52</sup>	28	77 months	100	0

(31 percent) occurred in the lumpectomy-only group, and 43 of 320 (13 percent) in those receiving RT. This represented a 61 percent relative reduction in IBTR for patients receiving RT (log rank test,  $p < 0.0001$ ).

Nine pathologic features were examined for prognostic significance, and only moderate-to-marked comedonecrosis was an independent predictor for IBTR in nonirradiated patients. RT reduced the eight-year risk of recurrence in the breast from 40 to 14 percent in patients with moderate- or marked-comedonecrosis. Patients with absent or slight comedonecrosis experienced a decrease in local recurrence from 23 to 13 percent with RT. Of note, in irradiated patients comedonecrosis was not a predictor of an increased risk of breast recurrence. Margin status was not found to be a significant predictor of recurrence in this study, but it is likely that the definition of a negative margin that was used (tumor-filled ducts not touching ink) and the lack of post-excision mammograms resulted in some patients with significant residual DCIS being included in the "negative" margin group. For the "most favorable" group in the study, those with negative margins and absent or slight comedonecrosis, the addition of RT to excision resulted in a 7% absolute reduction in local failure at eight years.<sup>56</sup>

Of the 818 patients in the B-17 trial,<sup>57</sup> only 14 had died of breast cancer with a mean follow-up of 90 months. Three deaths occurred after IBTR, six occurred in patients who had regional failure without recurrent breast tumor, and six patients developed distant metastases without locoregional disease. These findings indicate that even the most meticulous local control in the breast will not eliminate all breast cancer mortality in patients diagnosed with DCIS.

A second prospective randomized trial of the role of RT in DCIS was initiated by the European Organization for Research and Treatment of Cancer (EORTC) in 1986 and completed accrual of patients in 1996.<sup>58</sup> Women were eligible for this trial if they had clinically or mammographically detected DCIS measuring five cm or less in size. Mammographic lesions were present in 71 percent of the study population. After complete local excision, 503 women were randomly assigned to observation with no further treatment, and 507 were randomized to postoperative radiotherapy at a dose of 50 Gy in five weeks to the whole breast. The median duration of follow-up at the time of the initial report was 4.25 years.<sup>58,59</sup> The four year local relapse-free rate was 84 percent in the group treated with surgery only compared with 91 percent in women treated by postoperative radiotherapy (log rank  $p = 0.005$ ; hazard ratio 0.62). Comparable reductions were seen for the risk of invasive (40 percent,  $p = 0.004$ ) and noninvasive (35 percent,  $p = 0.06$ ) local recurrence. No differences in regional recurrences, distant metastases, or survival were noted.

#### RETROSPECTIVE SERIES DATA

The results of conservative surgery and radiation for DCIS from retrospective series are presented in Table 4.<sup>60-73</sup> The crude incidence of breast recurrence ranges from four to 18 percent. Deaths due to breast cancer have been reported in up to four percent of patients treated in studies with a median follow-up of ten years or less.

The long-term results of conservative surgery and radiation for DCIS were reported

by Solin, et al.<sup>69,70</sup> This collaborative study of ten institutions in the United States and Europe analyzed outcomes in 259 patients. Seventy-eight percent of the tumors were detected solely by mammography. The ten-year actuarial risk of breast recurrence was 16 percent, and the ten-year actuarial cause-specific survival was 97 percent.<sup>69</sup> The 15-year actuarial breast recurrence was 19 percent, and the 15-year actuarial cause-specific survival was 96 percent. Median follow-up was 10.3 years.<sup>70</sup>

Various clinical, pathologic, and treatment-related factors have been assessed for their ability to identify patients with a substantial risk of recurrence in the treated breast for whom mastectomy may be recommended. One factor for which there appears to be agreement in terms of its association with a high risk of recurrence is the presence of residual malignant-appearing calcifications on a post-biopsy mammogram. Failure to remove these calcifications prior to radiation has resulted in a 100% recurrence rate in the few patients reported.<sup>60,67</sup> DCIS presenting as a bloody nipple discharge was noted in earlier series to be associated with a higher risk of recurrence. However, in the collaborative study, there appeared to be no increased risk in this group of patients.<sup>70</sup>

The significance of young age (less than 40 years) is controversial. Three studies have observed an increased risk of breast recurrence (approximately 25 percent) in young women with DCIS treated with conservative surgery and radiation when compared with older women (approximately 10 percent).<sup>65,74-76</sup> However, three additional studies have found no correlation with young age and breast recurrence rates.<sup>66,67,70</sup> The effect of age on local failure was analyzed in NSABP B-24, a prospective randomized study of 1,804 women with DCIS. All patients received radiotherapy and were randomized to tamoxifen at 20 mg daily for five years or placebo.<sup>45</sup> Negative margins were not required. The rate of ipsilateral breast recurrence in women age 49 or less in the placebo arm was 33.3 per 1,000 per year, compared with 13.03 per 1,000 per year for

those age 50 and older. For those taking tamoxifen, recurrence rates were 20.77 per 1,000 per year for those aged 49 and under, and 10.19 per 1,000 per year for those in the older age group. This randomized trial provides convincing evidence that young age is associated with a higher rate of breast recurrence. The effect of age on the risk of breast recurrence has recently been reviewed in detail.<sup>77</sup>

A similar controversy exists with a positive family history of breast cancer. Two series<sup>60,66</sup> have reported a higher breast recurrence rate (approximately 40 percent) in women with a positive family history when compared with those with no such history (approximately 10 percent). However, a third series found no such association.<sup>75</sup> The impact of a positive family history of breast cancer on treatment options in women with DCIS requires further evaluation.

The contribution of various pathologic factors (histologic subtype, nuclear grade, necrosis) to the risk of breast recurrence in patients treated with conservative surgery and radiation is controversial. It was initially suggested that high-grade or comedo DCIS was associated with a higher breast recurrence rate.<sup>69,78</sup> However, in the collaborative study, the ten-year actuarial breast recurrence rate was 18 percent for tumors with the combination of both comedo pattern and a high nuclear grade versus 15 percent for DCIS in which these factors were absent ( $p = 0.15$ ).<sup>70</sup> The median interval to recurrence for comedo DCIS was 3.1 years versus 6.5 years for the noncomedo DCIS. Therefore, series with shorter follow-up tend to underestimate the number of recurrences in low-grade or noncomedo DCIS, and recurrences in the high grade or comedo DCIS predominate. As previously discussed, NSABP B-17 found that the presence of comedonecrosis was not a predictor of breast recurrence when RT was given.<sup>54</sup>

The majority of breast recurrences in patients undergoing conservative surgery and radiation for DCIS occur in the vicinity of the primary tumor, and approximately 50 percent are invasive cancers.<sup>61,63,66-70,79</sup> Invasive recurrences appear at later intervals than

TABLE 4

Results of Conservative Surgery and Radiation for Clinically and Mammographically Detected DCIS

Study	Number of Patients	% Crude Breast Recurrence	Five-year Cause-Specific Survival	Median Follow-up Years
McCormick et al. <sup>60</sup>	54	18	100	3.0
Haffty et al. <sup>61</sup>	60	7	100	3.6
Kurtz et al. <sup>62</sup>	47	4	100	5.0
Ray et al. <sup>63</sup>	56	9	—	5.0
Solin et al. <sup>64</sup>	51	10	—	5.7
Van Zee et al. <sup>65</sup>	65	10	—	6.2
Hiramatsu et al. <sup>66</sup>	76	9	100	6.2
Sneige et al. <sup>67</sup>	49	10	—	7.2
Fourquet et al. <sup>68</sup>	153	16	—	9.0
Collaborative Group <sup>69,70</sup>	268	17	97	10.3
Amichetti et al. <sup>71</sup>	139	9	100	6.8
Beron et al. <sup>72</sup>	185	16	99	7.5
Mirza et al. <sup>73</sup>	87	13	99	11.0

noninvasive and may occur in a separate quadrant.<sup>45,62,74</sup> Virtually all of the patients who develop a noninvasive recurrence, and approximately 75 percent of those with an invasive recurrence, are long-term survivors after mastectomy.<sup>60,61,63,66-68,79-81</sup>

Over the last ten years, there has been a significant change in the method of detection of DCIS. Approximately 85 to 90 percent of all DCIS is now detected solely as a mammographic finding, which is most often characterized by the presence of microcalcifications. The earlier reports of conservative surgery and radiation for DCIS do not accurately reflect outcome for mammographically detected DCIS since many included clinically evident DCIS (palpable mass or bloody nipple discharge), and detailed mammographic and pathologic correlation was frequently lacking. Unfortunately, the results of these earlier series were used for comparisons with those of conservative surgery alone for mammographically detected DCIS and not infrequently claimed to be equal. The NSABP B-24 trial<sup>45</sup> prospectively documented that the risk of local failure for clinically evident DCIS was approximately twice that of

mammographically detected DCIS.

The results of conservative surgery and radiation for mammographically detected DCIS are presented in Table 5.<sup>56,57,66,67,69,70,75,76,78,79</sup> The ten-year actuarial breast recurrence rate ranges from 6 to 23 percent, with a ten-year cause-specific survival rate of 96 to 100 percent. The variation in the results reported reflects differences in patient selection, the extent of surgical resection, and the degree of mammographic and pathologic correlation. There is increasing evidence that wide surgical excision<sup>67</sup> and negative margins of resection diminish the risk of a breast recurrence in patients with mammographically detected DCIS treated with conservative surgery and radiation.<sup>45,67,73</sup> In the collaborative study with a median follow-up of 9.3 years, the crude breast recurrence rate was 29 percent for patients with a close or positive margin compared with seven percent for negative margins.<sup>73</sup> In NSABP B-24,<sup>45</sup> patients with positive margins had a significantly higher rate of breast recurrence than those with negative margins, regardless of whether tamoxifen was given (RR 1.68, 95, CI 1.20–2.34).

Two series have reported the results of conservative surgery and radiation for mammographically detected DCIS in patients who would meet Lagios' criteria for observation without radiation. These criteria include calcifications as the only manifestation of DCIS, DCIS size < 2.5 cm, negative margins, and negative post-biopsy mammogram.<sup>73,75</sup> In these two studies, there have been no breast recurrences reported to date in the 37 patients (median follow-up 4.9 and 9.3 years). In comparison, Lagios reported a 17% breast recurrence rate in 78 such patients treated by excision alone with a follow-up of 10.3 years.<sup>82</sup>

#### *Breast-conserving Surgery Alone*

A number of studies have examined the outcome of treatment of DCIS by excision alone. In the majority of these studies, patients were highly selected, usually on the basis of small tumor size, low histologic grade, and lack

of clinical presentation. Lagios<sup>83</sup> reported 79 patients with mammographically detected tumors treated by excision alone, with a mean tumor size of 7.8 mm. After a mean follow-up of 124 months, the local recurrence rate was 19 percent. Recurrence occurred in 33 percent of patients with Grade 3 lesions compared with six percent of those with Grade 1 lesions. Recurrence was also less common in patients with margins greater than one mm in size.

A number of other studies of DCIS treated with excision alone are shown in Table 6.<sup>76,83-94</sup> Silverstein, et al.<sup>95</sup> developed the Van Nuys Prognostic Index (VNPI), a retrospectively derived risk classification that assigns a value of one to three to tumor size, margin width, and histologic classification to define three risk groups with scores of three or four (low risk), five to seven (intermediate), and eight or nine (high risk). In retrospective analyses, no benefit for radiation was seen in the low-risk subgroup, where the local failure rate was only two percent regardless of treatment. The VNPI was applied to 367 DCIS patients by de Mascarel, et al.<sup>96</sup> and a local failure rate of nine percent was seen in the low-risk group. More recently, Silverstein, et al.<sup>97</sup> suggested that any DCIS lesion, regardless of size or grade, which could be excised with a margin of one cm in all directions did not require radiotherapy or tamoxifen. Because patients were retrospectively collected over a 20-year interval, and the pathology assessment used was not routine in many hospitals, and the distribution of treatment over time was not random, these results cannot be considered definitive.

#### *The Role of Tamoxifen in DCIS*

The role of tamoxifen was addressed in the NSABP B-24 trial<sup>45</sup> in which 1,804 women with DCIS were treated with excision and radiation and randomized to tamoxifen 20 mg daily or placebo for five years. After a median follow-up of 74 months, tamoxifen reduced the total number of breast cancer events by 37 percent ( $p = 0.0009$ ). This included a 43% reduction in invasive breast cancer events

TABLE 5

Study	Number of Patients	Actuarial Breast Recurrence %			Cause-Specific Survival %			Median Follow-up Years
		5-year	8-year	10-year	5-year	8-year	10-year	
		NSABP B-17 <sup>56,57</sup>	411	10.0	12.1	—	—	
Kuske et al. <sup>78</sup>	44	7.0	—	—	—	—	—	4.0
Fowble et al. <sup>75</sup>	110	1.0	—	15.0	100.0	—	100.0	5.3
Kestin et al. <sup>76</sup>	146	8.0	—	9.2	100.0	—	99.2	7.2
Hiramatsu et al. <sup>66</sup>	54	2.0	—	23.0	—	—	96.0	6.2
Sniese et al. <sup>67</sup>	31	0.0	—	8.0	—	—	—	7.2
Silverstein et al. <sup>79</sup>	133*	7.0	—	19.0	—	—	97.0	7.8
Collaborative Group <sup>69,70</sup>	110	7.0	—	14.0	100.0	—	96.0	9.3

\*Eighty nine of these patients had mammographically-detected cancers.

( $p = 0.004$ ) and a 31% reduction in noninvasive breast cancer events ( $p = 0.08$ ). As anticipated from other studies of tamoxifen, there was both a 30% reduction in ipsilateral and a 52% reduction in contralateral breast cancer events. This translates into an absolute reduction in breast cancer events from 13.4 to 8.2 percent. Tamoxifen reduced the risk of ipsilateral breast tumors in women under age 50 by 38 percent and in those age 50 and older by 22 percent. Negative surgical margins were not required for this study, and tamoxifen was found to reduce the risk of recurrence in patients with both positive and negative margins. However, even with tamoxifen there were fewer local failures (12.5/1,000/year) in the group with negative margins than in the group with positive margins (17.4/1,000/year), emphasizing the importance of complete surgical excision.

The well-documented side effects of tamoxifen were again observed in this study. These included an increase in endometrial carcinoma from 0.45 to 1.53 per 1,000 per year in the tamoxifen group and an increase in deep-vein thrombosis from 0.2 to 1.0 percent. No pulmonary emboli were reported. Hot flashes were noted in 69.6 percent of tamoxifen patients and 59 percent of the placebo group.

Tamoxifen provides a reduction in the risk of both ipsilateral and contralateral breast cancer events in women with DCIS. It is not a

mandatory part of treatment, but the risk/benefit ratio should be considered in each patient. Women undergoing breast-conserving therapy, premenopausal women, and postmenopausal women without a uterus are likely to achieve the greatest benefit from tamoxifen, as are women felt to be at high risk of local failure. The impact of tamoxifen in preventing recurrence following lumpectomy without RT is not yet known.

#### Treatment Options

##### *Indications for Mastectomy*

Although many women with DCIS are candidates for breast-conserving treatment with or without irradiation, there are some patients for whom mastectomy is clearly indicated. These include:

- Women with two or more primary tumors in the breast or with diffuse malignant-appearing microcalcifications.
- Persistent positive margins after reasonable surgical attempts.

In addition, there are some women for whom the risk/benefit ratio of breast conservation must be carefully assessed and consideration given to mastectomy as a treatment alternative.

Neither tumor size nor histologic type of

TABLE 6

Results of Treatment of DCIS by Excision Alone

Study	Number of Patients	Follow-up (months)	% Recurrence	% Invasive
Arnesson and Olsen <sup>84</sup>	169	80†	16/22 (5/10-year actuarial)	36
Baird et al. <sup>85</sup>	30	43*	13	25
Carpenter et al. <sup>86</sup>	28	38*	18	20
Cataliotti et al. <sup>87</sup>	99	79*	8/23 (5/10-year actuarial)	38
Eusebi et al. <sup>88</sup>	80	210	20	69
Lagios <sup>93</sup>	79	124*	19 (15-year actuarial)	56
Salvadori et al. <sup>89</sup>	74	31*	14	60
Scheer <sup>90</sup>	102	56*	24	42
Schwartz et al. <sup>91,92</sup>	194	53†	14/25 (5/10-year actuarial)	18
Sibbering and Blamey <sup>93</sup>	48	58†	6	33
Silverstein <sup>94</sup>	130	45†	21 (8-year actuarial)	33
Kestin et al. <sup>76</sup>	31	71†	7.8/7.8 (5/10-year actuarial)	50

† Mean  
‡ Median

DCIS is an absolute indication for mastectomy. However, a relative indication for mastectomy is the presence of extensive DCIS that can be removed with only a small negative margin. This is particularly true in the patient with a small breast in which an adequate resection would result in a significant cosmetic alteration unacceptable to the patient.

#### *Indications for Breast-conserving Surgery and Radiation Therapy*

1. DCIS detected mammographically or by physical exam that is localized (without evidence of gross multicentricity or diffuse malignant calcifications).
2. The extent of DCIS should be  $\leq 4$  cm as there are little data to support breast conservation's effectiveness in larger lesions. The difficulty in measuring the size of DCIS makes definitive recommendations difficult. For mammographically detected DCIS

presenting as microcalcifications, all malignant calcifications must be removed prior to the initiation of radiation. Negative margins of resection are important to minimize the ipsilateral breast recurrence rate in patients with DCIS.

Certain factors preclude the use of radiation in the treatment of patients with DCIS and are unrelated to the extent of the disease. These include a history of collagen vascular disease (especially scleroderma and lupus erythematosus), prior therapeutic radiation to the breast and/or chest, and pregnancy. The first two factors are related to the potential for significant morbidity, and the last is related to radiation exposure to the fetus.

#### *Indications for Breast-conserving Surgery Alone*

Individual centers have suggested a low local recurrence rate for low-grade tumors of small

volume excised with clear margins, but the maximum size of DCIS for which radiation therapy could be safely omitted is unknown. Two randomized trials have demonstrated risk reduction with radiation for all subgroups of DCIS patients studied, but for some groups the absolute benefit of radiation is very small. The patient's attitude toward risks and benefits should play a major factor in the decision to omit radiation in these cases.

#### Patient Choice Issues

Perhaps the most difficult aspect of patient evaluation is the assessment of the patient's needs and expectations regarding breast preservation. The patient and her physician must discuss the benefits and risks of mastectomy compared with breast conservation treatment in her individual case with thoughtful consideration of each. Each woman must evaluate how her choice of treatment is likely to affect her sense of disease control, self-esteem, sexuality, physical functioning, and overall quality of life. A number of factors should be considered:

1. Long-term survival.
2. The possibility and consequences of local recurrence.
3. Psychological adjustment (including the fear of cancer recurrence and attitudes toward radiation), cosmetic outcome, sexual adaptation, and functional competence.

For most patients, the choice of mastectomy with or without reconstruction or breast conservation treatment does not impact on the likelihood of survival, but it may have a differential effect on the quality of life. Psychological research comparing patient adaptation following mastectomy and breast conservation treatment shows no significant differences in global measures of emotional distress. Research also does not reveal significant changes in sexual behavior and erotic feelings in the treated breast or nipple and areolar complex. However, women whose breasts are preserved have more positive attitudes about their body image and experience fewer changes

in their frequency of breast stimulation and feelings of sexual desirability.

#### RADIATION THERAPY CONSIDERATIONS

Radiation therapy should be delivered only after evaluation of the mammography findings, the pathology findings, and the surgical procedures performed on the patient. The optimal combination of surgery and irradiation to achieve the dual objectives of local tumor control and preservation of cosmetic appearance varies from patient to patient. The optimal combination is determined by the extent, nature, and location of the tumor, the patient's breast size, and the patient's relative concerns about local recurrence and preservation of cosmetic appearance.

#### Elements in the Technique of Irradiation

There is a general consensus regarding some but not all of the elements in the technique of irradiation. As soon as the patient has healed adequately from the surgical procedure and has been able to undergo mammography with magnification views to exclude the presence of residual calcifications when indicated, radiation therapy should begin. Therefore, irradiation usually can begin within two to four weeks of uncomplicated breast-conserving surgery.

The radiation oncologist should use measures to assure reproducibility of patient set-up, treatment simulation, treatment planning, and choice of supervoltage equipment to assure dose homogeneity. The tumor bed, surrounding tissue, and most of the ipsilateral breast are encompassed in paired tangential photon fields. Higher energy photons ( $\geq 10$  MV) may be indicated for very large-breasted women or patients with significant dose inhomogeneity ( $\geq 10$  percent) on treatment planning using lower energy photons.

The radiation oncologist can use sophisticated treatment planning that involves three- rather than two-dimensional dose distributions and accounts for the lower density of lung

tissue in the treatment field. (In standard treatment planning, the lung is considered to have unit density.) However, the impact of this recent development on patient outcomes has not been demonstrated. Currently three-dimensional dose distributions are not considered standard.

Each field should be treated on a daily basis, Monday through Friday. Bolus should not be used. In order to minimize the risk of radiation pneumonitis, not more than 3 to 3.5 cm of lung (as projected on the radiograph at isocenter) should ordinarily be treated, and a minimum of 1 to 1.5 cm of lung is required.<sup>98</sup> For left-sided lesions, efforts should be made to minimize the amount of heart in tangential fields.<sup>99-101</sup> Whole-breast radiation therapy is delivered using opposed tangential fields to a dose of 4,500 to 5,000 cGy at 180 to 200 cGy per fraction.

Controversy exists concerning the need for delivering an additional boost dose to the primary site.<sup>102-104</sup> Several considerations may be involved in the decision to use a boost: histological studies show that residual cancer following resection of the primary usually is in the vicinity of the primary site;<sup>11</sup> recurrences following treatment usually are seen at or near the primary site;<sup>105</sup> and boost treatment can be delivered without significant morbidity.<sup>106</sup> Although boost irradiation often is used, the precise indications for its use are not well defined.

When used, boost irradiation usually is delivered using electron beam or interstitial implantation. The total dose to the primary tumor site is increased to approximately 6,000 to 6,600 cGy.<sup>107</sup>

A boost may not be required for patients who have been treated with more extensive breast resections and have margins of resection that are clearly negative.<sup>108,109</sup> If the breast boost is omitted in these patients, the only available data indicate that the standard whole-breast radiation therapy dose is 5,000 cGy at 200 cGy per fraction.<sup>110-115</sup>

#### Techniques To Be Avoided

There is agreement on the need to avoid certain radiation therapy techniques that either

have no demonstrated benefit or expose the patient to excessive risk.

1. Nodal irradiation is unnecessary for patients with DCIS.
2. Excess dose to the heart or lungs through tangential irradiation of the breast must be avoided.

#### FOLLOW-UP CARE RECOMMENDATIONS

Follow-up assessment of the results of breast conservation treatment should be provided by surgeons and oncologists experienced in that treatment as outlined in this standard, and it should also evaluate the cosmetic outcome as well as the detection of local recurrence. The goals of a regular follow-up examination include the following:

1. Early detection of recurrent or new cancer allowing timely intervention.
2. Identification of any treatment sequelae and appropriate interventions where indicated.
3. Provision of the individual practice with the database necessary to optimize treatment and compare outcomes against national standards.

Regular history and physical examination in conjunction with breast imaging are the cornerstones of effective follow-up care. Unfortunately, many patients perceive history and physical examination to be less important as reliable follow-up measures than sophisticated medical testing. Routine tests such as bone scan, chest x-ray, CT scan, and liver function tests are not indicated for asymptomatic patients treated for DCIS. A public education effort is needed to address this problem.

The following evaluations should be performed by the physician at the cited intervals following the completion of treatment:

#### Examinations and Mammography

##### *History and Physical Examination*

Examination frequency is directed toward the identification of local recurrence and new second primary tumors.

1. Every six months, years one to five. (Some oncologists prefer every six months until after year eight, when the risk of local recurrence with breast conservation treatment begins to approach the risk of contralateral breast cancer.)
2. Annually thereafter.

### *Mammography*

A goal of follow-up imaging of the treated breast is the early recognition of tumor recurrence. To prevent unnecessary biopsy, it is important to know that postoperative and irradiation changes overlap with signs of malignancy on a mammogram. The changes include masses (postoperative fluid collections and scarring), edema, skin thickening, and calcifications.

Postsurgical and radiation edema, skin thickening, and postoperative fluid collections will be most marked in the first six months. For most patients, radiographic changes will slowly resolve after the first six to twelve months and will demonstrate stability within two years.<sup>116-120</sup>

In order to interpret mammograms accurately and assess the direction of change, the current mammogram must be compared in sequence with the preceding studies. The diagnostic radiologist should carefully tailor mammographic studies of the treated breast to the surgical site by using special mammographic views in addition to routine mediolateral oblique and craniocaudal views. Magnification and spot compression can be used with any view to increase detailed visualization of the site of tumor excision and other areas. Magnification radiography is useful for classifying calcifications morphologically and quantitating them. Other special views may be useful in the assessment of the breast after conservation.

As postoperative masses resolve and scars form, a spiculated mass that mimics tumor may be seen on the mammogram. Additional radiographic projections of the site of tumor removal will facilitate more confident radiographic interpretations.

### *Schedule of Imaging of the Treated Breast*

1. A postoperative mammogram is essential to ensure that microcalcifications have been removed in patients having breast conservation treatment with or without irradiation. The site of the excision may be optimally evaluated with magnification radiography for residual microcalcifications if none are seen on routine views.
2. A baseline mammogram during the first six to twelve months following breast conservation treatment.
3. A mammogram at least annually thereafter or at more frequent intervals as warranted by clinical or radiographic findings.

### *Schedule of Imaging of the Contralateral Breast*

A mammogram should be performed annually, according to the guidelines endorsed by both the American College of Radiology and the American Cancer Society. More frequent intervals may be warranted by clinical or radiographic findings. (The risk of cancer is approximately the same for both the treated and untreated breast.)

### **Evaluation of Sequelae**

At the time of the first follow-up examination and serially thereafter, the physician should evaluate the patient for any treatment-related toxicities. This evaluation should include:

1. Assessment of the overall cosmetic result: A four-point scoring system is recommended for assessing the cosmetic result (Appendix A).
2. Patient evaluation of results: The patient's evaluation of treatment outcomes in terms of psychological and cosmetic consequences should be taken into account in the follow-up process. CA

## Appendix A: Four-point Scoring System of Breast Cosmesis

### Excellent

Treated breast almost identical to untreated breast.

### Good

Minimal difference between the treated and untreated breasts.

### Fair

Obvious difference between the treated and untreated breasts.

### Poor

Major functional and esthetic sequelae in the treated breast.

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