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Extent of Lumpectomy for Breast Cancer After Diagnosis by Stereotactic Core Versus Wire Localization Biopsy

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Background: Stereotactic core biopsy of mammographically defined breast abnormalities is an alternative to wire localization biopsy. The purpose of this study was to evaluate the extent of lumpectomy in patients diagnosed by stereotactic core versus wire localization biopsy.

Methods: A total of 67 consecutive patients diagnosed with invasive cancers or ductal carcinoma in situ (DCIS) were retrospectively reviewed. Thirty-four were diagnosed by core biopsy and the remaining 33 by wire localization biopsy.

Results: Approximately 65% of patients subsequently had breast-conserving surgical therapy. Seventy-nine percent of patients undergoing wire localization biopsies had positive surgical margins. Achievement of negative surgical margins for lumpectomies performed after wire localization or stereotactic core biopsies was 100% and 89%, respectively, which was not significantly different. However, the total volume of breast tissue removed for breast conservation in patients undergoing lumpectomy after wire localization versus core biopsies was 183 cm^3 and 104 cm^3, respectively, which was significantly different ($P = .003$).

Conclusions: Diagnosis by stereotactic core biopsies resulted in less tissue removal to achieve margin-negative lumpectomies for breast conservation. Stereotactic core biopsy is the method of choice for biopsying nonpalpable, suspicious breast lesions.

Key Words: Breast cancer—Mammography—Biopsy—Breast conservation.

The use of annual screening mammography has increased the detection of nonpalpable breast lesions requiring biopsy. It is estimated that approximately 500,000 of these lesions are detected annually in the United States.[1] Most of these mammographic abnormalities prove to be benign, but approximately 15% are found to be malignant.[2] There are different biopsy techniques available for studying these nonpalpable lesions.[3]

Stereotactic larger core biopsy, an alternative method to diagnose mammographic abnormalities, was first described in 1990 by Parker and coworkers.[4] This biopsy technique has been adopted by many practitioners. It costs less than a surgical biopsy[5–7] and has been reported to have a high sensitivity and specificity rate in diagnosis.[8,9] However, there are some difficulties in differentiating between atypical ductal hyperplasia and breast carcinoma.

Wire localization biopsy of nonpalpable breast lesions detected mammographically has been the "gold standard" method for the last three decades. It remains the only technique available in centers where stereotactic core facilities are not available. It is more invasive than stereotactic core biopsy, because it requires an operative approach and leaves a scar.

In this report, we compared the utility of these biopsy procedures in patients subsequently diagnosed with breast cancer. Specifically, we examined the surgical outcomes of patients who went on to receive lumpectomies for breast conservation.

MATERIALS AND METHODS

Subjects

A total of 337 patients identified as having moderately to highly suspicious mammographic lesions underwent biopsies during the period from April 1996 to April 1998

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at the University of Michigan Medical Center. Of those patients, 147 and 190 patients had either stereotactic core or wire localization biopsies, respectively. A total of 67 of these patients (20%) who were found to have invasive or noninvasive cancers made up the group analyzed in this study. Patients diagnosed with lobular carcinoma in situ only were excluded from the study. Four surgical oncologists within the Division of Surgical Oncology performed the wire localization biopsies and definitive surgical procedures. The decision whether to perform a wire localization biopsy versus a stereotactic core biopsy was made jointly by the surgeons in consultation with the mammographers. If a mammographic lesion could be biopsied by either technique, the surgeon presented the options to the individual patient to allow the patient to make an informed choice. In our early experience with the stereotactic core biopsy apparatus, fewer attempts were made by the mammographers to biopsy microcalcifications in contrast to mass lesions. This was not the case in the latter part of the study period after more experience with the technique had been acquired. The decision of what definitive surgical procedure should be performed (breast conservation versus mastectomy) was made by the patient after consultation with the multidisciplinary team of healthcare providers at the Breast Care Center of the University of Michigan Cancer Center. Medical records were reviewed for patient demographics, mammographic findings, pathological characteristics, and the definitive surgical procedures.

Wire Localization

The skin surface closest to the lesion was chosen, The breast was compressed with the patient in a sitting position, and an alphanumeric fenestrated paddle was placed over the suspicious abnormality. Coordinates were transferred onto the skin, and a 21-gauge hook-wire apparatus (Kopans Spring Hook Localizer Needle, Wire Loc Cook, Bloomington, IN) was inserted into the breast following local anesthesia with 1% lidocaine. After needle placement, orthogonal views were obtained to determine the correct depth. A hook-wire was then deployed through the needle, which was subsequently withdrawn. The hook-wire usually was placed with the reinforced portion within the lesion and the tip of the wire extending beyond it. Craniocaudal and lateral mammographic views were obtained with the hook-wire in place. These views were labeled and submitted with the patient to the surgeon for subsequent operative procedure. The excisional biopsy was performed in an operating room suite using a combination of a local anesthetic and intravenous sedation. Specimen radiography was performed to confirm lesion excision.

Stereotactic Core Biopsy

The breast was suspended through the aperture of a dedicated prone digital breast biopsy table. Following compression and identification of the suspicious abnormality, stereotactic pairs of images were obtained at 15° off center. The suspicious lesion was identified on both stereotactic images on a video terminal, and its location was determined using the software package employing geometric formulas that assess the relative movement of the index lesion on the stereotactic pairs. A 14- or 11-gauge vacuum-assisted needle (Core Needles Biopsys Mammotome TM needle, Biopsys Medical, Irvine, CA) was then inserted into the compressed breast at the correct coordinates following local anesthesia with lidocaine. A “prefire” stereotactic pair was obtained to document correct needle location. This was followed by “postfire” stereotactic pairs after the needle had been advanced mechanically through the lesion. Following confirmation of needle location, vacuum-assisted core biopsy samples of the lesion were obtained. Generally, at least 12 samples were taken. If calcifications were present, a specimen radiograph was obtained to confirm retrieval. Mammographic/pathologic concordance was determined when the pathology results were available. Discordant results led to recommendation for wire-localized surgical biopsy.

Local Breast Excision Techniques

Wire localization biopsies were performed for diagnostic purposes. A radius of at least 1 cm to 2 cm of breast tissue from the wire was excised. A specimen radiograph was performed to confirm that an adequate sample of tissue had been obtained.

In the setting of a confirmed diagnosis of malignancy (i.e., after stereotactic core or wire localization biopsy) a margin-negative lumpectomy was attempted in patients deemed to be candidates for breast conservation. This entailed a wire localization lumpectomy for patients previously diagnosed by stereotactic core biopsy. The technique is similar to that described above in which breast tissue was excised in an effort to achieve negative surgical margins. For patients who had had a prior wire localization biopsy in whom the malignant lesion involved the surgical margin, a re-excision lumpectomy was performed. This procedure involved excising the previous biopsy skin incision in continuity with the underlying breast tissue surrounding the biopsy site, with an effort made not to enter the biopsy cavity.

All breast excision specimens were inked for evaluation of the margin status. Tumor cells present at the margin or less than 3 mm away from the margin were considered positive.

TABLE 1. *Mammographic and histologic characteristics*

Characteristic	Core biopsy (n = 34)	Wire localization (n = 33)
	No. (%)	No. (%)
Mammographic findings		
Mass	23 (68)	14 (42)
Microcalcifications	7 (21)	14 (42)
Mass with microcalcifications	4 (11)	4 (12)
Architectural distortion	—	1 (4)
Histologic findings		
IDC	21 (62)	15 (45)
IDC + DCIS	5 (15)	5 (15)
DCIS	6 (18)	13 (39)
DCIS with microinvasion	2 (5)	—

DCIS, ductal carcinoma in situ; IDC, infiltrating ductal carcinoma

Statistical Analysis

Comparisons were analyzed by the Student's *t*-test. These analyses were performed with the aide of the StatView statistical software (Abacus Concepts, Inc., Berkeley, CA).

RESULTS

Mammographic Findings, Biopsy Results, and Surgical Therapy

A total of 67 patients were evaluated in this study; 34 underwent stereotactic core biopsy and 33 had wire localization biopsy. The median ages of the patients diagnosed by stereotactic core and wire localization biopsy were 59 years (range, 43–70 years) and 58 years (range, 31–85 years), respectively, and were not statistically different. Table 1 summarizes the mammographic findings of both groups. In the stereotactic core biopsy group there were 27 (79%) patients with masses with or without microcalcifications and 7 (21%) with microcalcifications only. By contrast, in the wire localization group, 18 (54%) patients presented with masses with or without microcalcifications, 14 (42%) with microcalcifications only, and 1 (4%) with architectural distortion.

In the stereotactic core biopsy group, there were 26 (77%) patients who had invasive carcinoma, 5 of whom had an intraductal component (Table 1). Eight patients were diagnosed as having DCIS, with two of these patients having evidence of microinvasion. In the wire localization group, 20 (60%) patients had invasive carcinoma, of whom 5 had an intraductal component; and 13 (39%) patients had DCIS without evidence of microinvasion.

The correlation between the mammographic findings and the subsequent biopsy results is summarized in Table 2. Among the 45 patients who presented with a mass with or without evidence of microcalcifications, 40 (89%) were found to have infiltrating ductal carcinoma with or without an intraductal component. By contrast, among the 21 patients who presented with microcalcifications, 16 (76%) were diagnosed with DCIS.

The operative procedures performed after biopsy are summarized in Table 3. Among the 34 patients diagnosed by stereotactic core biopsy, 33 patients had their definitive surgical procedure performed at the University of Michigan. Nineteen (57%) of these patients underwent breast conservation; the remaining 14 (43%) had mastectomies. Among the 33 patients diagnosed by wire localization biopsy, six patients had no further surgery at the University of Michigan. Among these six patients, four had DCIS with negative surgical margins and went on to receive radiotherapy; one patient had DCIS with a focally positive surgical margin and had radiotherapy without re-excision; and one patient had positive margins and went on to have surgical therapy at another institution. The remaining 27 patients of the 33 diagnosed by wire localization biopsy had a subsequent surgical procedure performed (see Table 3). Of the 32 patients diagnosed by wire localization biopsy and treated at the University of Michigan, 23 (72%) underwent breast conservation and the remaining nine had mastectomies. There was no significant difference between the two biopsy techniques in the proportion of patients undergoing breast conservation (χ^2, $P = .17$). Combining all 65 patients diagnosed and treated at our institution, 42 (65%) of patients underwent breast conservation.

Surgical Margins in Patients Undergoing Breast Conservation

The status of the surgical margins among the 33 patients undergoing wire localization biopsy was evaluated.

TABLE 2. *Correlation of mammographic findings with histologic diagnosis*

Histology	Mass (n = 37)	Microcalcifications (n = 21)	Mass with microcalcifications (n = 8)	Architectural distortion (n = 1)
IDC	27	1	7	1
IDC + DCIS	6	4	0	0
DCIS	3	16	0	0
DCIS with microinvasion	1	0	1	0

IDC, infiltrating ductal carcinoma; DCIS, ductal carcinoma in situ.

TABLE 3. *Operative procedures performed after biopsy*

Procedure	Core biopsy (n = 34)	Wire localization (n = 33)
	No. (%)	No. (%)
Lumpectomy	4 (12)	10 (37)
Lumpectomy + ALND	15 (45)	6 (22)
ALND		2 (7)
Simple mastectomy	6 (18)	4 (15)
Modified radical mastectomy	8 (24)	5 (19)
Total	33 (100)	27 (100)

ALND, axillary lymph node dissection.

Twenty-six (79%) of these patients had positive surgical margins with the wire localization biopsy specimen. Among these 26 patients, 16 proceeded to have a subsequent re-excision lumpectomy for breast-conserving therapy. Re-excision lumpectomy resulted in negative surgical margins in all 16 (100%) of these latter patients (Table 4). Nineteen patients who had stereotactic core biopsies proceeded to a lumpectomy for breast-conserving surgery. Seventeen (89%) of these 19 patients had negative surgical margins (see Table 4). Among the two patients with positive margins, one underwent a re-excision lumpectomy with negative margins and the other patient had a mastectomy. The mastectomy was performed because a second primary cancer (chondrosarcoma) in addition to an invasive ductal carcinoma was found within the lumpectomy specimen.

Extent of Lumpectomy

We estimated the extent of lumpectomy by calculating the volume of tissue that was excised in cubic centimeters (cm^3). These volumes were determined from the pathology reports, where the sizes of the tissues removed were recorded in three dimensions. For re-excision lumpectomies, the dimensions of the entire specimen, which excluded the biopsy cavity, were used to calculate the volume. The volumes of tissue excised for patients undergoing breast conservation are summarized in Table 4. The mean volume of tissue removed with the wire localization biopsy was 38 cm^3. For those patients undergoing subsequent lumpectomy, the mean volume was 143 cm^3. We combined the amount of tissue removed in each patient by adding the volume removed at wire localization biopsy plus the subsequent lumpectomy volume to derive a mean total volume of breast tissue removed, which was 183 cm^3. For purposes of comparison, the mean volume of tissue removed by lumpectomy after core biopsy was 104 cm^3. When this latter volume of tissue is compared with the total amount of tissue removed for patients undergoing wire localization biopsy followed by lumpectomy, it is clear that the patients who initially had a core biopsy had significantly less breast tissue removed ($P = .003$).

TABLE 4. *Volume of breast tissue excised in patients undergoing breast conservation*

Procedure	No. patients	No. negative margins (%)	Mean tissue volume (SD)[a]
Wire localization biopsy	24	6 (25)	38 (29)
Lumpectomy after wire localization biopsy	16	16 (100)	143 (80)
Combination of Groups 1 and 2[b]	16		183 (83)
Lumpectomy after core biopsy	19	17 (89)	104 (59)[c]

[a] Volumes expressed in cm^3 ± standard deviation (SD).
[b] Total volume of tissue removed = wire localization biopsy volume + subsequent lumpectomy volume
[c] $P < .0001$ compared to Group 1; not significantly different compared to Group 2; $P = .003$ compared to Group 3.

Total Number of Surgical Procedures per Patient

The number of surgical procedures performed in the operating room suite per patient was calculated for the groups biopsied by stereotactic core versus wire localization biopsy. For the stereotactic core group, there were 38 surgical procedures performed resulting in a mean ± SD of 1.1 ± 0.3. For the wire localization biopsy group, there were 61 surgical procedures performed, which resulted in a mean ± SD of 1.8 ± 0.4; and was significantly increased ($P < .001$) compared to core biopsy. For the subset of patients undergoing breast conservation after stereotactic core biopsy, there were 23 surgical procedures performed, resulting in a mean of 1.2 ± 0.4 procedures per patient. For the subset of patients diagnosed by wire localization biopsy who subsequently underwent breast conservation, there were 37 procedures performed, which calculated to a mean of 2.1 ± 0.2 procedures per patient. This was significantly greater ($P < .0001$) than patients having stereotactic core biopsies.

DISCUSSION

The wide use of screening mammography has resulted in the detection of increasing numbers of nonpalpable breast lesions. The recent recommendations by the National Cancer Institute and American Cancer Society that all women over 40 years of age consider annual screening mammograms will add to these numbers. The management of these lesions varies according to the level of suspicion of malignancy identified by the mammographer.

The College of Radiology Breast Imaging Reporting and Data System (BI-RADS) has devised a useful classification scheme for characterizing mammographic findings that has been widely adopted by mammographers.[10] A mammogram that does not demonstrate an abnormality is classified as BI-RADS 1. A mammogram that identifies a benign finding (i.e., calcified fibroadenoma) is classified as BI-RADS 2. Mammographic lesions that are probably benign (BI-RADS 3) and have a less than 2% probability of being malignant should undergo short-term follow-up mammography rather than biopsy. Suspicious lesions (BI-RADS 4) do not have all the characteristic features of breast cancer but are sufficiently suspicious to recommend biopsy. These lesions generally are considered for stereotactic core biopsy because a definitive benign diagnosis would eliminate the need for a surgical biopsy. Lesions highly suggestive of malignancy (BI-RADS 5) have characteristic features of cancer, and have a high probability of being cancer. Several reports have documented these lesions to be cancers in approximately 80% of cases.[9] The role of stereotactic core biopsy has been controversial in this category of patients. Because of the high index of suspicion of these lesions, some clinicians recommend an open biopsy to obtain a definitive diagnosis, because a nondiagnostic reading of a stereotactic core biopsy would not avoid the need for a subsequent open biopsy.[11–13] Our study, as well as reports by others, suggests that there are several reasons why stereotactic core biopsy may be advantageous for even the highly suspicious lesions.[9–14]

From the cost standpoint, Yim et al.[1] and Whittin et al.[15] have reported that stereotactic core biopsy reduced the number of surgical procedures performed per patient. We observed the same phenomenon when analyzing the entire group of patients who had core biopsies compared to wire localization biopsies. This has translated to a cost reduction ranging from $1000 to $2000 per patient for individuals undergoing stereotactic core biopsy.[1,15,16] One area in which this cost reduction is realized is the high incidence of positive surgical margins associated with wire localization biopsies. In our series, we observed a 79% incidence of positive margins in wire localization biopsy specimens. This is consistent with other reported series, in which the finding of positive surgical margins after wire localization biopsy has ranged from 55% to 83%.[1,15,17] No attempt at achieving negative margins, such as the use of "touch preps," was made because these were diagnostic procedures. By contrast, the incidence of positive surgical margins for breast lumpectomy after a diagnosis was established by stereotactic core biopsy was significantly lower. In this setting, we observed an 11% incidence of positive margins. Whittin et al. reported a 29% incidence of positive margins in similar patients.[15] In the series reported by Yim et al., where patients with DCIS only were excluded, the incidence of positive margins after stereotactic core biopsy was 6%.[1] These observations indicate that a definitive lumpectomy can be performed as a single procedure in the majority of cases when the diagnosis has been established by core biopsy. The use of touch preparation cytology at the time of lumpectomy may be useful in increasing the rate of negative-margin specimens.[18]

In patients who are potential candidates for breast-sparing surgery, resection of the primary tumor with the least amount of tissue removal and achievement of negative surgical margins obviously is desirable. We have been able to document that a reduced volume of tissue is removed at the definitive surgical procedure in patients diagnosed by stereotactic core biopsy compared to the total volume of tissue removed in patients diagnosed by wire localization biopsy. The volume of tissue removed for lumpectomy after core biopsy was significantly greater than the volume of the initial wire localization biopsy. Similar results were observed by Whittin et al.[15] Moreover, the volume of tissue removed for patients undergoing re-excision after wire localization biopsy was equivalent to that removed for lumpectomy after core biopsy. This translated to a significantly greater total volume of tissue removed in the wire localization biopsy group than in the core biopsy group.

Some clinicians advocate performing definitive lumpectomies or segmental mastectomies on highly suspicious mammographic lesions (BI-RADS 5), which would result in obtaining a diagnosis of malignancy as well as achieving a negative surgical margin in the majority of patients with just one procedure.[17,18] However, 10% to 20% of patients in this group will be found to have no malignancy and thus would have undergone an unnecessarily more aggressive procedure to achieve a diagnosis. The patients determined to have invasive cancers still will require a staging procedure such as an axillary lymph node dissection or lymphatic mapping. Hence, the number of surgical procedures per patient will not be reduced in that subset of patients. Moreover, lymphatic mapping may be compromised by the large volume of breast parenchyma removed at the initial lumpectomy procedure. These issues argue in favor of obtaining a tissue diagnosis up front with the least invasive procedure, such as an image-guided needle or core biopsy. One concern with this approach is the possible implantation of tumor cells along the needle or core track. Longer follow-up will be needed to determine if there is a higher incidence of in-breast recurrences in

patients undergoing breast conservation surgery initially diagnosed by image-guided needle or core biopsy. When we perform a definitive lumpectomy, we excise the skin puncture site and track at the same time whenever possible. This requires close interaction with the mammographer so that core biopsy sites are placed appropriately at locations that will traverse the least amount of tissue to the lesion. Subsequent lumpectomy by the wire localization technique then requires placement of a wire along the previous core or needle biopsy track.

Cooperation among surgeons, radiologists, and primary physicians is very important in the management of patients with mammographically detected lesions. Accordingly, the best method for following or biopsying these lesions should be determined by this team. The advantages and disadvantages should be explained to the patient. We favor stereotactic core biopsy for suspicious (BI-RADS 4) and highly suspicious (BI-RADS 5) suspicious mammographic lesions. This approach would result in a reduction of the amount of breast tissue removed at the time of definitive lumpectomy for patients desiring breast conservation, with the advantage of a potentially improved cosmetic result. In addition, stereotactic core biopsy is a more cost-effective method of making a diagnosis of a mammographically detected lesion.

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