

Detection of Residual Breast Carcinoma after Excisional Biopsy

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Purpose: To investigate the role of high-resolution US in revealing the presence and extent of residual tumor within the breast after excisional biopsy and before further surgical intervention.

Materials and Methods: One hundred thirty patients (age range, 26-74 years; median age, 45 years) with breast cancer underwent prospect US examination of the breast using a 10 or 12 MHz transducer for evaluation of residual disease soon after excisional biopsy before further surgery. Time interval between lumpectomy and US ranged 7-64 days (mean, 12 days). Postbiopsy mammograms were obtained in 37 of the 44 patients with calcium-containing lesions. US criteria for residual tumor was indeterminate solid mass and biopsy was performed.

Results: Forty-four patients were treated with breast-conserving surgery and 86 with mastectomy. US depicted 39 (95%) of 41 invasive tumor foci and 24 (50%) of 48 foci of ductal carcinoma in situ (DCIS). Twenty-six false negative cases (20%) were due to 0.5-1.2 cm invasive carcinomas in two patients and DCIS with or without microcalcifications in 24 patients. Five false positive cases (4%) were due to fat necrosis and granulation tissues in two, and fibrocystic changes in three. Postbiopsy mammograms depicted 12 foci of DCIS missed at US. The sensitivity, specificity, and positive and negative predictive values of US for predicting residual tumor was 71% (63/89), 90% (46/51), 93% (63/68) and 64% (46/72). In 17 patients, management was altered from breast conserving surgery to mastectomy based on the basis of US findings.

Conclusion: High-resolution US has a high PPV for predicting residual tumor particularly invasive cancers and within one month after excisional biopsy. False negative findings due to focal residual DCIS remain limitations.

Index words: Breast cancer, Ultrasound; Excisional biopsy

INTRODUCTION

For women with breast cancer who are potential can-

didates for breast-conserving therapy, determining the adequacy of excision of the tumor is important in making treatment decisions (1). If residual tumor is present in the breast after initial excision, the woman might benefit from reexcision before irradiation. If no residual tumor is present, further surgery might be avoided. It is traditional that the two main methods of predicting the presence of residual disease after excisional biopsy are evaluating the margins of the excisional biopsy specimen for the presence of tumor and using postbiopsy

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mammography to identify residual calcification (2). However, evaluating postoperative breasts for residual tumor with physical examination and mammography is difficult because of breast edema, focal thickening and retraction, and increased mammographic density at the surgical site (3–5). Some studies suggest a potential role for MR imaging in the detection and staging of residual tumor after excisional biopsy with positive (PPV) and negative (NPV) predictive values of 82% and 61% (6). The MRI diagnosis of residual disease seems to be much less accurate if the patient is examined early than one month after surgery.

Ultrasound (US) is a valuable adjunctive to mammography in the diagnosis and management of breast disease and there has been a broadening of the indication for breast US in the last 2 decades. Advances in instrumentation, higher-resolution probes, and improvement in scanning techniques of US have promoted characterization of solid masses and detection of mammographically and clinically occult carcinoma (7). According to several investigators, high resolution US can detect breast mass associated with malignant microcalcifications in the majority of the cases (8). Whole breast US is a valuable adjunctive to mammography in preoperative assessment of patients with known or suspected breast cancer who are contemplating breast conservation. US detected hidden multifocal or multicentric cancer in these patients (9, 10). To our knowledge, the role of high-resolution US in the examination of women after excisional biopsy for breast carcinoma has not been described in the literature.

The purpose of this study was to evaluate the value of high-resolution US in the examination of women after excisional biopsy for breast carcinoma before further surgical intervention.

MATERIALS AND METHODS

Between May 2002 and March 2004, 130 consecutive patients (age range, 26–74 years; median age, 45 years) underwent prospect US examination of the breast soon after excisional biopsy for breast cancer. All patients had positive ($n = 71$) or close ($n = 59$) surgical margins and were undergoing evaluation for possible breast-conserving therapy. The initial excisional biopsy was per-

formed at an outside institution in 117 patients and at our institution in 13 patients. Time from excision to US was 6–36 days (mean, 12 days) and the time from US to reexcision or mastectomy was 1–7 days (mean, 2 days).

The majority (96 of 130; 73.8%) of patients initially presented with a palpable mass. Mammograms obtained before excisional biopsy were available in 109 patients. Abnormal mammographic findings were seen in 96 of these 109 patients. The lesions were seen as mass in 43 cases, mass with microcalcifications in 28 cases, microcalcifications in 16 cases, asymmetric density in six cases, and architectural distortion in three cases. The size of mammographic lesion was 4–9 mm in 18 cases, 10–19 mm in 32 cases, 20–29 mm in 31 cases, and over 3 cm in 15 cases. US obtained before excisional biopsy were available in 51 patients. According to American College of Radiology Breast Imaging Reporting and Data System (BI-RADS)(11), the final assessment category of these 109 patients was category 3, probably benign lesions, in 12 cases; category 4, suspicious lesions, in 59 cases; and category 5, highly suspicious lesions, in 38 cases.

All US examinations were performed by one breast radiologist who had 4 years experience in breast US. A 10–5 MHz linear array probe (HDI 3000; Advanced Technology Laboratories, Bothell, Wash) was used in 109 patients and a 12–5 MHz linear array probe (HDI 5000; Advanced Technology Laboratories, Bothell, Wash or LogiQ; GE, Milwaukee, Wis) was used in 21 patients. US was targeted first to the biopsy bed and then to the surrounding breast tissue in the same quadrant. The remainder of the ipsilateral breast was then scanned in clockwise radial and antiradial orientations as well as longitudinal and transverse planes. Five to nine (mean; seven) representative hard-copy images were obtained in all cases. The examination took approximately 15 minutes (range 10–30 minute).

At our institution, postbiopsy mammography is recommended in patients with mammographically detected carcinomas that contain microcalcifications. Postbiopsy mammograms were obtained in 37 (84%) of the 44 patients with calcium-containing lesions. Seven patients refused postbiopsy mammograms. These mammograms were read by one of two radiologists. In 30 patients, magnification images were obtained when re-

quested by the interpreting radiologists. Radiograph of the specimen was performed in 23 of the 44 patients with calcium-containing lesions.

The US images were assessed in consensus by the two radiologists, who had knowledge of the mamographic findings, before reexcisional biopsy. The radiologists did not know whether the margins of the initial excisional biopsy specimen had been positive or close and did not know which margins were positive. US findings of seroma cavity and solid mass at or near the resection site were described according to the shape as oval, round, lobular, or irregular; according to the orientation as wider than tall or taller than wide; according to the echogenicity as hyperechoic, isoechoic, mildly hypoechoic, or markedly hypoechoic; according to the echotexture as homogeneous or heterogeneous; according to the margin as well-defined, microlobulated, ill-defined, or spiculated; according to the acoustic transmission as shadowing, enhancement, or normal; and according to the presence of a pseudocapsule. A lesion was considered multicentric if it was in a different quadrant than the biopsy cavity. Suspected carcinoma was classified as diffuse if the mass was extensive and distinct separate foci of enhancement were not visible.

The reviewers provided a final assessment category modeled on the BI-RADS to indicate the probability of malignancy. Each mass was further categorized as benign (benign or probably benign) or malignant (suspicious or highly suggestive of malignancy). US criterion for residual tumor was any solid mass without typically benign features at or near the resection site. In 21 patients, hookwire-guided localizations were used for lesion characterization of multifocal or multicentric lesions in the breast.

In the pathology department, the reexcision specimen was measured and inked. The specimen was oriented by the surgeon and different colors of inks and different shapes of surgical clips were used to correspond to six margins (superior, inferior, medial, lateral, superficial, and deep). The specimen was then sectioned every 5-10 mm. The size of the biopsy cavity or any lesions identified grossly were measured. In those cases in which mastectomy was performed after excision of the primary tumor, the specimen was inked and sectioned and the biopsy cavity and any residual tumor were

identified. If no tumor was grossly visible adjacent to or within the biopsy cavity, representative sections from the biopsy cavity were submitted for microscopic examination. A perpendicular section and parallel section of the nipple and one of two random sections of the breast tissue from the four quadrants were submitted. Any additional suspicious areas, with notation of the quadrant and the relationship to the primary tumor or the biopsy cavity, were submitted for histologic analysis.

US and postbiopsy mammographic findings were correlated with histopathologic results at a multidisciplinary conference. A diagnostic accuracy including sensitivity, specificity, and PPV and NPV was calculated at US.

RESULTS

Forty-four patients underwent re-excision only, 21 patients underwent re-excision followed by mastectomy and 65 underwent mastectomy only. Finally, 89 residual tumors (41 invasive and 48 DCIS) in 69 patients (53%) including 20 multifocal or multicentric cancers were found at pathology and 77% (69 of 89) of residual tumors were found near or at the surgical cavity.

All lumpectomy sites were identified at US. US depicted 39 (95%) of 41 invasive tumor foci and 24 (50%) of 48 foci of DCIS (Table 1). Twenty-six false negative cases (20%) were due to 0.5-1.2 cm invasive carcinomas in two patients and DCIS with ($n = 12$) or without ($n = 12$) microcalcifications in 24 patients. Five false positive cases (4%) were due to fat necrosis and granulation tissues in two, and fibrocystic changes in three. Postbiopsy mammograms depicted 12 calcified DCIS missed at US. In 17 patients (13%) with multifocal or multicentric lesions seen at US alone, therapy was correctly changed from breast conserving surgery to mastectomy.

The sensitivity, specificity, and positive and negative

Table 1. Identification of 89 Malignant Foci

Methods	Invasive Cancer ($n = 41$)	DCIS ($n = 48$)
Mammography alone	1	12
US alone	16	10
Mammography and US	23	14
Pathology alone	1	12

predictive values of US for predicting residual tumor was 71% (63/89), 90% (46/51), 93% (63/68) and 64% (46/72).

DISCUSSION

Breast-conserving surgery has become a widely accepted treatment option for early stage breast carcinoma. However, difficulties in the preoperative assessment of tumor extent result in positive pathologic margins in 5–70% of patients undergoing breast-conserving surgery (1). Although the appropriate treatment for positive pathologic margins is controversial, re-excision at the initial biopsy site is commonly performed when the initial margins of resection are positive or unknown. In cases in which the margins of the initially resected specimen are positive or unknown, reported rates of finding residual tumor are 23–69%, with the higher rates in those cases with positive margins (12, 13). Detecting the residual disease and determining its extent are important for further treatment planning. This application will determine whether patients could be effectively treated by reexcision or whether more extensive disease is present that requires mastectomy. However, the location and extent of surgery required at reexcision is difficult to establish by physical examination and mammography.

The results of our investigation suggest that US could play a role complementary to the traditional methods of margin evaluation and mammographic imaging in assessing the adequacy of tumor removal. A potentially more clinically important role of US would be to identify a subgroup of patients with clinically and mammographically unsuspected extensive or multifocal residual tumor who would be better served by undergoing mastectomy rather than reexcision. US proved to be particularly useful in identifying additional foci of infiltrating carcinoma. In our study, management was altered from breast conserving surgery to mastectomy on the basis of US findings in 17 patients (13%).

While the PPV of US was high (93%), the NPV was lower (64%). However, the false-negative rate for US in this study is comparable to the reported false-negative rate for negative margins of resection or MRI, which was 26–33% and 25% respectively (6). Nevertheless,

owing to the high false-negative rate for US after excisional biopsy, negative US imaging findings, like negative postbiopsy mammographic findings, cannot be used to reliably predict the removal of all tumor. One major advantage of US over MR imaging is the ease of guiding core needle biopsy or needle localization.

In our study, US at biopsy site within one month showed variable amount of fluid in the cystic space or abrupt tissue plane that can be easily differentiated with true mass. Five false positive cases at US were due to fat necrosis and granulation tissues in two, and fibrocystic changes in three. If there is no fluid collection at surgical bed, it is sometimes difficult to differentiate postoperative change from residual tumor. The patients in our study underwent initial excisional biopsy rather than core biopsy and the problem of false-positive US could potentially be overcome with the US-guided core biopsy.

In conclusion, high-resolution US has a high PPV for predicting residual invasive tumor after excisional biopsy. False negative findings due to focal DCIS remain limitations. Postbiopsy mammograms are needed for the evaluation of calcium-containing lesions.

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