Vacuum-Assisted Stereotactic Breast Biopsy

Histologic Underestimation of Malignant Lesions

William E. Burak, Jr, MD; Kerry E. Owens, MD; Mary Beth Tighe, PhD; Lisa Kemp, RN, LNP; Susan A. Dinges, MD; Charles L. Hitchcock, MD, PhD; John Olsen, MD

Hypothesis: The histopathologic correlation between stereotactic core needle biopsy and subsequent surgical excision of mammographically detected nonpalpable breast abnormalities is improved with a larger-core (11-gauge) device.

Design: Retrospective medical record and histopathologic review.

Setting: University-based academic practice setting.

Patients: Two hundred one patients who underwent surgical excision of mammographic abnormalities that had undergone biopsy with an 11-gauge vacuum-assisted stereotactic core biopsy device.

Main Outcome Measure: Correlation between stereotactic biopsy histologic results and the histologic results of subsequent surgical specimens.

Results: Results of stereotactic biopsy performed on 851 patients revealed atypical hyperplasia in 46 lesions, ductal carcinoma in situ (DCIS) in 89 lesions, and invasive cancer in 73 mammographic abnormalities. Subsequent surgical excision of the 46 atypical lesions revealed 2 cases of DCIS (4.3%) and 4 cases of invasive carcinoma (8.7%). Lesions diagnosed as DCIS on stereotactic biopsy proved to be invasive carcinoma in 10 (11.2%) of 89 patients on subsequent excision. Stereotactic biopsy completely removed 21 (23.6%) of 89 DCIS lesions and 20 (27.4%) of 73 invasive carcinomas.

Conclusions: In summary, 11-gauge vacuum-assisted core breast biopsy accurately predicts the degree of disease in the majority of malignant lesions; however, understaging still occurs in 11% to 13% of lesions showing atypical hyperplasia or DCIS.

Arch Surg. 2000;135:700-703

Image-guided core biopsy is becoming the standard of care in the diagnosis of nonpalpable breast abnormalities. Both ultrasound-guided and stereotactic core biopsy have been shown to rival the accuracy of open (surgical) wire localization biopsy, while minimizing patient morbidity and cost.1-4 Although these minimally invasive techniques possess significant advantages compared with open biopsy, certain drawbacks exist. Because stereotactic core biopsy yields fragmented samples of the mammographic abnormality, the entire breast lesion is often not available for histologic interpretation; thus the tissue diagnosis may change (underdiagnosis) following subsequent excision and evaluation of the remaining lesion. Underdiagnosis occurs when core biopsy specimens are diagnosed as atypical ductal hyperplasia (ADH) but contain carcinoma on follow-up excision, or when core biopsy specimens show ductal carcinoma in situ (DCIS) but invasive cancer is present on reexcision. These inaccuracies may lead to the need for additional surgical procedures, with associated increased patient morbidity, cost, and anxiety. This is particularly an issue when invasive carcinoma is initially understaged as DCIS and a subsequent additional axillary lymph node staging procedure is required after a lumpectomy is performed. Another potential drawback of image-guided biopsy occurs when harvesting multiple large cores of tissue results in the removal of the entire tumor, rendering it difficult to accurately determine the exact pathologic tumor size. This information is important in determining the benefit of adjuvant chemotherapy in axillary node-negative patients and has been shown to be the most accurate predictor of lymph node status and recurrence.5 Fortunately, the majority of mammographic abnormalities are benign; this is where the benefits of image-guided core biopsy are best observed. Nevertheless, understaging and
PATIENTS AND METHODS

Records of patients undergoing stereotactic breast biopsy at The Ohio State University between October 1996 and December 1998 were reviewed. During that time, 11-gauge vacuum-assisted stereotactic biopsies were performed routinely on patients with mammographic abnormalities requiring tissue diagnosis. Indications for biopsy included clustered microcalcifications, densities/masses, or a combination of microcalcifications and densities/masses. Open surgical biopsy was performed on patients with lesions near the chest wall or on patients exceeding the weight limits (112.5 kg) of the prone imaging table. Ultrasound-guided core biopsies were performed occasionally during this time period and these patients were not included in the present analysis.

Patients were placed on a prone imaging table (Fischer Imaging, Denver, Colo) and the mammographic abnormality was visualized using a digital scout image (midline) and images +15° and −15° from the midline. Following application of a local anesthetic, the 11-gauge device (Mammotome; Biopsys Inc, Cincinnati, Ohio) was introduced into the breast parenchyma to the appropriate depth, which was calculated following manual targeting. Multiple core biopsy specimens were harvested (10-15 routinely), using vacuum assistance, in a circumferential pattern. Specimen radiography was used to verify that microcalcifications were removed and a titanium clip (Biopsys Inc) was placed in the biopsy cavity when it was felt that the mammographic abnormality was completely removed. Postbiopsy images were then obtained for comparison with those obtained prior to biopsy.

Routine histologic analysis using hematoxylin–eosin staining was performed on all core samples. In borderline cases, breast tissue was stained with the antimyoepithelial antibody HHF-35 to assess the integrity of the myoepithelium. Atypical hyperplasia was described as ADH, atypical epithelial hyperplasia, or as atypical lobular hyperplasia. Atypical ductal and epithelial hyperplasia were both classified as ADH for analysis. Patients with biopsy specimens indicative of atypical hyperplasia, DCIS, or invasive carcinoma underwent excision, either with open biopsy, lumpectomy, or mastectomy. Preoperatively, wire localization was performed on all patients under ultrasonographic or mammographic guidance. A wire bracketing technique was used in some patients when the residual microcalcifications encompassed a large area. The entire specimen, including the stereotactic biopsy cavity and residual tumor, was evaluated and routine histologic studies were performed. The histologic results of the excision were then compared with the stereotactic biopsy findings.

accurate measurement of tumor size remain problematic in the patients with atypical hyperplasia, DCIS, and small invasive tumors.

Although vacuum-assisted stereotactic biopsy has improved the accuracy of staging over traditional core biopsy methods, patients with a diagnosis of atypical hyperplasia and DCIS are still being underdiagnosed more than 18% of the time. To improve accuracy, larger-gauge tissue harvesting devices have been developed under the premise that bigger samples will allow enhanced histologic evaluation of these tissue fragments. Few data are currently available to support this hypothesis. This retrospective review was undertaken to assess the accuracy of 11-gauge vacuum-assisted stereotactic breast biopsy in the diagnosis of nonpalpable, malignant mammographic abnormalities, with a particular focus on the issue of histologic underdiagnosis.

RESULTS

INDICATIONS FOR STEREOTACTIC BIOPSY

Stereotactic breast biopsies were performed in 851 patients. Open surgical excision was subsequently undertaken in 201 patients (23.6%) because of 208 lesions exhibiting atypical hyperplasia, DCIS, or invasive carcinoma. Table 1 presents the mammographic indications for biopsy in this group of patients.

Table 1. Results of Stereotactic Biopsies Based on Mammographic Abnormality*

<table>
<thead>
<tr>
<th>Mammographic Lesion</th>
<th>Atypical Hyperplasia (n = 46)</th>
<th>DCIS (n = 89)</th>
<th>Invasive Carcinoma (n = 73)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass/density</td>
<td>17 (37)</td>
<td>5 (5.6)</td>
<td>41 (56.2)</td>
</tr>
<tr>
<td>Microcalcifications</td>
<td>29 (63)</td>
<td>84 (94.4)</td>
<td>23 (31.5)</td>
</tr>
<tr>
<td>Mass/density with microcalcifications</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>9 (12.3)</td>
</tr>
</tbody>
</table>

*Data are presented as number (percentage) of patients. DCIS indicates ductal carcinoma in situ.

CORRELATION OF STEREOTACTIC RESULTS WITH SUBSEQUENT EXCISION

Open excisions (biopsy, lumpectomy, or mastectomy) were subsequently performed on 208 lesions owing to 46 cases of atypical hyperplasia (22.1%), 89 cases of DCIS (42.8%), and 73 cases of invasive carcinoma (35.1%) (Table 2). There were 4 additional patients with atypical hyperplasia who did not have an excisional biopsy; these patients were excluded from the analysis.

Table 2. Results of Subsequent Excision of Biopsied Lesions*

<table>
<thead>
<tr>
<th>Surgical Excision Histologic Results</th>
<th>Benign</th>
<th>DCIS</th>
<th>Invasive Carcinoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atypical hyperplasia (n = 46)</td>
<td>40 (87.0)</td>
<td>2 (4.3)</td>
<td>4 (8.7)</td>
</tr>
<tr>
<td>DCIS (n = 89)</td>
<td>21 (23.6)</td>
<td>58 (65.2)</td>
<td>10 (11.2)</td>
</tr>
<tr>
<td>Invasive carcinoma (n = 73)</td>
<td>10 (13.7)</td>
<td>10 (13.7)</td>
<td>53 (72.6)</td>
</tr>
</tbody>
</table>

*Data are presented as number (percentage) of patients. DCIS indicates ductal carcinoma in situ.
Atypical Hyperplasia

Atypical hyperplasia was found in 46 lesions (5.4%) by stereotactic biopsy. Of the 46 atypical lesions, 40 (87.0%) were ADH (or atypical epithelial hyperplasia), while the remaining 6 (13.0%) were atypical lobular lesions (Table 3). When the lesions demonstrating atypical hyperplasia were excised, 40 (87.0%) of 46 were found to be benign, 2 revealed DCIS, and 4 showed invasive carcinoma. The mammographic findings in the 2 DCIS lesions revealed BIRADS [Breast Imaging Reporting and Data System] category 4 (1 lesion) and BIRADS category 5 (1 lesion); the 4 invasive carcinomas were BIRADS category 4 (2 lesions) and BIRADS category 5 (2 lesions). The stereotactic biopsy histologic examination revealed atypical lobular hyperplasia in 1 of the 2 lesions later found to be DCIS; all 4 invasive lesions had a diagnosis of ADH or epithelial hyperplasia before excision. Two of the invasive carcinomas were lobular (0.1 cm and 1.1 cm), while the other 2 were ductal (0.7 cm and 2.0 cm). The resulting diagnostic error was 13.0%.

Ductal Carcinoma In Situ

Excision of the 89 DCIS lesions diagnosed with stereotactic biopsy disclosed that invasive carcinoma was present in 10 lesions (Table 2). The average size of the invasive component of these neoplasms was 0.59 cm (size range, 0.2-1.4 cm). The mammographic findings in these 10 invasive cancers were reported to be BIRADS category 4 in 9 lesions and BIRADS category 5 in 1 lesion. In reference to the management of these 10 lesions, 3 patients had no further evaluation of their axillary nodes and 7 had either an axillary node dissection or sentinel node biopsy performed either at the same time as their initial excision (5 patients) or as a separate procedure (2 patients). Lymph nodes were histologically negative in all 7 patients.

Complete removal of DCIS was achieved by stereotactic biopsy in 21 (23.6%) of 89 lesions as evidenced by benign histologic results on subsequent surgical excision. Mastectomy was performed on 25 (28%) of 89 patients because of extensive DCIS or patient preference. Lumpectomy was performed on the remaining 64 lesions (72%) and negative tumor margins (invasive or DCIS) were obtained in 56 (87.5%) of 64 cases. Patients with involved margins underwent a second lumpectomy or mastectomy.

Invasive Carcinoma

It was discovered that the invasive component of malignant lesions was completely removed during the stereotactic biopsy procedure in 20 of 73 mammographic lesions (Table 2). No residual carcinoma was found on excision in 10 lesions (13.7%) and residual DCIS was identified in 10 lesions (13.7%). Mastectomy was performed on 15 (20.5%) of the 73 lesions, while breast conservation was attempted in the remaining patients. Negative surgical margins were obtained in 50 (86.2%) of 58 lesions with the initial lumpectomy.

Stereotactic breast biopsy has evolved as a less-invasive alternative to open biopsy in the evaluation of nonpalpable mammographic abnormalities. Automated large-core devices have low miss rates (2%-4%) in studies that compared the stereotactic technique with subsequent surgical excision. As first described, core needle biopsy using multiple passes resulted in undiagnosed malignant neoplasms in 3% to 7% of cancerous lesions when followed by needle localization surgical excision.2,3,8,9 Most of the “underdiagnosed” stereotactic cores revealed ADH and were thus termed “high-risk lesions.” Reported rates of underdiagnosis of ADH lesions ranges from 31% to 88% with traditional multiple-pass core biopsy techniques.10-15 Because of the difficulty in distinguishing ADH from DCIS, particularly low-grade DCIS, more tissue is often required to make a firm diagnosis. Open surgical excision of these lesions has been recommended because of this observation.15

With the development of vacuum-assisted large-core needle biopsy, it is possible to harvest multiple cores with 1 pass of the needle. A greater number of harvested core specimens have been reported with vacuum-assisted devices compared with the number obtained with the multiple-pass technique.6 Several authors have reported lower rates of ADH converting to carcinoma on excision when using vacuum-assisted large core biopsy devices. A recent multicenter study compared ADH conversion rates with 14-gauge multiple-pass large-core biopsy with rates seen with 14-gauge vacuum-assisted devices.6 This study revealed that 48% of lesions undergoing biopsy with automated large-core devices contained carcinoma, compared with 18% of lesions diagnosed with the vacuum-assisted device.

When 11-gauge is compared with 14-gauge vacuum-assisted stereotactic biopsy, it has been shown that more tissue is removed with no resultant increase in procedure time or number of complications.16 The results of the present study reveal that understaging only occurred in 13% of these atypical lesions. There are several possible explanations for these findings. Clearly, more tissue is being provided for histologic evaluation with 11-gauge biopsy devices, which should lead to less uncertainty about borderline lesions and permit a more accu-

Table 3. Results of Lesions Demonstrating Atypical Hyperplasia on Stereotactic Breast Biopsy (SBB)*

<table>
<thead>
<tr>
<th>Surgical Excision</th>
<th>Histologic Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign</td>
<td>DCIS</td>
</tr>
<tr>
<td>Atypical ductal hyperplasia on SBB (n = 40)</td>
<td>35 (87.5)</td>
</tr>
<tr>
<td>Atypical lobular hyperplasia on SBB (n = 6)</td>
<td>5 (83.3)</td>
</tr>
<tr>
<td>Total (N = 46)</td>
<td>40 (87)</td>
</tr>
</tbody>
</table>

*Data are presented as number (percentage) of patients. DCIS indicates ductal carcinoma in situ.
rate diagnosis. Although atypical epithelial conversion rates are low with the 11-gauge device, surgical excision remains necessary.

It is critical to obtain accurate information as to the presence or absence of invasive carcinoma on image-guided biopsies. Equipped with this knowledge, decisions regarding management of the axilla can be made when lymphatic pathways are largely intact, which is an issue when performing a sentinel lymph node biopsy for staging purposes. It has been demonstrated that patients with a prior excisional biopsy of the primary tumor may have lower sentinel node biopsy localization rates when compared with patients with “intact” tumors. Therefore, performing a sentinel node biopsy after a wide excision for DCIS (diagnosed on stereotactic biopsy), in which invasive cancer is found on excision, is undesirable. It would seem reasonable to perform a sentinel node biopsy (a low-morbidity procedure) during the wide excision of a stereotactic biopsy–diagnosed DCIS lesion that is suspicious for invasive cancer by mammographic appearance or has a questionable area(s) of microinvasion on histologic examination. The results of the present study suggest that this should occur in only 11% of DCIS lesions, many of which were suspicious for invasion on mammography.

It has been argued that obviously malignant mammographic abnormalities should be managed with primary surgical excision, which would serve to be both diagnostic and therapeutic, therefore sparing the patient an unnecessary stereotactic biopsy. In this series, most of the malignant lesions (86%) were managed with 1 surgical procedure. Preoperative knowledge of histologic results should allow a more “complete” surgical procedure, including wide excision with bracketed wires and sentinel node biopsy, if necessary.

Complete excision of malignant lesions occurred in 25.3% of patients. This included 23.6% of patients with DCIS and 27.4% of patients with invasive cancer. Tumor measurement for staging may be difficult in T1 lesions and adequate staging is important. It would seem reasonable to perform biopsy on lesions that are highly suspicious for invasive cancer (ie, spiculated densities) with fewer cores, in an effort to not completely excise the tumor.

In summary, 11-gauge vacuum-assisted core breast biopsy accurately predicts the degree of disease in the majority of malignant lesions; however, underdiagnosis still occurs in 11% to 13% of lesions showing atypical hyperplasia or DCIS.

Reprints: William E. Burak, Jr, MD, N914 Doan Hall, 410 W 10th Ave, Columbus, OH 43210 (e-mail: burak.1@osu.edu).

REFERENCES