Atypical Sonographic Patterns of Fibroadenoma of the Breast: Pathologic Correlation

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Purpose: To correlate the atypical sonographic patterns of fibroadenoma of the breast with the pathologic findings.

Materials and Methods: Among 203 surgically proven 43 which were sonographically atypical fibroadenomas, were retrospectively reviewed. The diagnostic criteria for atypical variety, as seen on sonography, were an ill-defined margin, microlobulated or irregular shape, heterogeneous internal echo-pattern, posterior shadowing, microcalcification, and clefts. The atypical sonographic patterns of these 43 fibroadenomas were analysed and compared with the pathologic findings.

Results: Among 43 lesions, ill-defined margins or irregular shapes were seen in 15 cases, heterogeneous internal echo-patterns in 27, posterior attenuation in nine, and clefts in seven. Thirty-seven (86%) of the 43 were predominantly ductal or had a mixed ductal and stromal component. Eleven (73.3%) of fifteen ill-defined margin or irregular shaped lesions were caused by interdigitation of surrounding normal breast parenchyma and mass. Twenty two (81.5%) of 27 heterogeneous internal echo-patterns were related to dilated ducts, phyllodes features, collagen bundles, adenosis, microcalcification, or fat vacuoles. Eight (88.9%) of nine posterior attenuations were caused by collagen bundles, microcalcification, ductal proliferation or dilatation. All seven cases showing clefts revealed phyllodes features and dilated ducts.

Conclusions: Most atypical fibroadenomas had a predominantly ductal or mixed component. Ill-defined margin or irregular shape was mainly due to interdigitation of normal surrounding parenchyma. Variable histologic features were related to the heterogeneous internal echo-pattern, posterior shadowing, and the clefts revealed by atypical sonographic findings.

Index words: Breast neoplasms, US
cumscribed, round or oval shaped mass, together with the 'classic' sonographic findings of a smooth contour and homogeneous internal echoes (3, 7). Some fibroadenomas, however, have shown 'atypical' sonographic findings such as an ill-defined margin, irregular appearance, heterogeneous internal echo-pattern or posterior shadowing (2, 8). It is quite common for fibroadenomas to demonstrate atypical sonographic findings suggestive of malignancy (3, 4, 9). The most common surgically removed benign solid lesion is a fibroadenoma (10, 11), accounting for 35.3% of all biopsies performed to remove an occult mass (12).

Knowledge of the pathologic features helps provide an understanding of the spectrum of the atypical sonographic findings of fibroadenomas. The purpose of this study is to correlate the atypical sonographic patterns of fibroadenoma with the pathologic findings.

Materials and Methods

The sonographic findings of 203 histologically proven fibroadenomas occurring in 185 patients over a four-year period (July 1993-June 1997) were retrospectively reviewed. To evaluate breast lesions, two high-resolution real-time ultrasonography units (Acuson 128 XP, Mountain View, California and General Electrics Logiq 700, Milwaukee) were used, together with a 7-10 MHz linear-array transducer, and - for extremely superficial lesions - a stand-off pad. The sonographic findings of 203 fibroadenomas were classified as either typical or atypical. The diagnostic criteria set by this study for atypical fibroadenomas, as seen on sonography, were an ill-defined margin, microlobulated or irregular shape, heterogeneous internal echo-pattern, posterior shadowing, microcalcification, and clefts. Any fibroadenoma with more than one atypical sonographic feature was included in the 'atypical' group. Among the 203 cases, 149 fibroadenomas were typical, and 50 cases of atypical; four cases were not detected on sonography. The age of atypical fibroadenomas patients ranged from 12 to 52 (mean, 32) years. Seven of the 50 cases were excluded during pathologic review. This was because of cancer in two cases, a changed diagnosis of phyllodes tumor in two, exclusion of the margin of the mass in one, and the unavailability of pathologic slides in two. Thus, 43 atypical cases were compared with the pathologic findings.

The margin, main component, stromal pattern and associated characteristic findings of the mass were pathologically reviewed and the main components of the fibroadenoma classified as one of three types: ductal predominant (more than 75% ductal component.), mixed component (intermediate between ductal or stromal predominant groups) and stromal predominant (more than 75% of stromal component). The stromal pattern was seen to be fibrocellular, myxoid, hyalinized, sclerotic or mixed, according to the dominant features. Individual atypical sonographic findings were correlated with characteristic histopathologic findings.

Results

Among 43 atypical fibroadenomas, ill-defined margins

![Fig. 1. Palpable mass in upper outer quadrant of the right breast in a 32-year-old woman. Sonography shows irregular, somewhat microlobulated hypoechoic mass (A), and pathology shows interdigitation of the normal breast parenchyma at the capsular portion of fibroadenoma (B, arrows) (H&E stain, × 100).]
or irregular shapes were noted in 15 cases, heterogeneous internal echo-patterns in 27, posterior attenuation in nine, and clefts in seven. Of the 43 cases, 22 were the ductal predominant type, while 15 were mixed and six were stromal predominant. The stromal patterns of 43 lesions were fibrocellular in 23 cases, myxoid in six, hyalinized in four, sclerotic in one, and mixed fibrocellular in nine.

Eleven (73.3%) of 15 ill-defined margins or irregular-shaped masses showed pathologic findings, as seen on sonography, of interdigitation of surrounding normal breast parenchyma and mass. In one of the eleven, infiltrative change was also associated with the finding of interdigitation at the margin (Fig. 1). Even though the mass was shown by sonography to be ill-defined or irregular, the pathologic findings showed that four cases were well-defined, and there was no evidence to support the sonographic finding. All 15 ill-defined or irregular shaped lesions were ductal predominant (9/15) or mixed (6/15) component type, and showed various stromal patterns (Table 1).

Among 27 masses of heterogeneous internal echo-pattern, 22 lesions (81.5%) were of the ductal predominant or mixed component type, while 20 (74%) revealed fibrocellular and sclerotic stromal patterns. There were various associated findings, 21 of 27 lesions (77.8%) were associated - in order of frequency - with dilated ducts (25.9%), phyllodes features (25.9%), collagen bundles (22.2%), adenosis (14.8%), microcalcifications

Table 1. Pathologic Correlation with Atypical Sonographic Findings of Fibroadenoma. (n = 43)

<table>
<thead>
<tr>
<th>Atypical Sonographic Findings</th>
<th>Pathologic Findings</th>
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<tbody>
<tr>
<td></td>
<td>Ill-defined</td>
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<td></td>
<td>(n=15)</td>
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<tr>
<td>Main Component</td>
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<tr>
<td>Ductal &gt;&gt;</td>
<td>9</td>
</tr>
<tr>
<td>Ductal=stromal</td>
<td>6</td>
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<tr>
<td>&lt;&lt; stromal</td>
<td>5</td>
</tr>
<tr>
<td>Stroma</td>
<td></td>
</tr>
<tr>
<td>Fibrocellular</td>
<td>7</td>
</tr>
<tr>
<td>Myxoid</td>
<td>2</td>
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<tr>
<td>Hyalinized</td>
<td>2</td>
</tr>
<tr>
<td>Mixed</td>
<td>4</td>
</tr>
<tr>
<td>Sclerotic</td>
<td>8</td>
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<tr>
<td>Associated features</td>
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<tr>
<td>Duct dilatation</td>
<td>2</td>
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<tr>
<td>Phyllodes feature</td>
<td>1</td>
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<tr>
<td>Collagen bundles</td>
<td>2</td>
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<tr>
<td>Adenosis</td>
<td>3</td>
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<td>Microcalcification</td>
<td>3</td>
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<td>Fat vacuoles</td>
<td>3</td>
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<tr>
<td>Ossification</td>
<td>1</td>
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<tr>
<td>Stromal edema</td>
<td>1</td>
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<tr>
<td>Cleft</td>
<td>1</td>
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<tr>
<td>ADH*</td>
<td>1</td>
</tr>
<tr>
<td>Ductal proliferation</td>
<td>3</td>
</tr>
<tr>
<td>Myxoid proliferation</td>
<td>1</td>
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<tr>
<td>N.S.F.#</td>
<td>6</td>
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</tbody>
</table>

ADH* Atypical ductal hyperplasia, N.S.F. #No specific features.
(11.1%), and fat vacuoles (11.1%) (Table 1).

In nine cases with posterior attenuation, the findings were similar to those described above, especially with regard to component and stromal pattern. In eight of nine cases showing posterior attenuation (88.9%) there was a ductal predominant or mixed component, together with findings - in order of frequency - of collagen bundles (44.4%), microcalcification (33.3%), and ductal proliferation (22.2%) or dilatation (22.2%) (Table 1, Fig. 2).

Clefts were seen in seven masses, all were ductal predominant or mixed component type and six of the seven lesions showed a fibrocellular stromal pattern, with phyllodes features (57.1%), dilated ducts (42.9%), and clefts (14.3%) (Table 1, Fig. 3).

**Discussion**

Fibroadenomas are the most common benign tumors of the breast that arise from the epithelium and stroma of the terminal ductal-lobular unit, and consist of proliferative fibrous stroma and secondarily increased epithelial ductal structures (13). Fibroadenomas demonstrate marked histologic variability, including variations in the degree of sclerosis and cellularity of their stroma. Moreover, they change histologically with time. Cellular tumors are usually more frequent in younger than in older subjects, and often exhibit myxoid change (8,14).

The epithelial component of fibroadenomas is prone to various alterations. These include foci of squamous metaplasia, cyst formation, and fibrocystic change, including apocrine metaplasia and sclerosing adenosis (8,13). In addition, unusual stromal differentiations described within fibroadenomas include adipose tissue, osseous metaplasia, and smooth muscle metaplasia (13-16).

The gross pathology of fibroadenomas usually demonstrates round, oval, or lobulated shapes, sharply defined by a pseudocapsule of compressed parenchyma, and are often easily excised by blunt dissection (14). As seen on sonography, the appearance of fibroadenomas varies, but their margins are mostly sharp and smooth. In our series, 43/203 sonographic patterns (21.2%) did not fulfill all of the "classic" sonographic criteria for fibroadenoma, but other researchers have reported rates of between 43 and 84% (1,2,4). There are two probable explanations for this discrepancy: (1) the updated high resolution US used in this study visualizes the fine detail of wall structure, shape and internal echo texture that may not be evident when older equipment is used, and (2) these variations reflect some discrepancy in various authors' criteria of contour irregularity or smoothness and homogeneity of echo-texture.

Contour irregularity of fibroadenomas has been reported to vary between 5 and 58% (1,4). Jackson et al. (2) noted that among 36 fibroadenomas seen on sonography to have irregular contours, biopsy showed that only 8% were irregular and 25% were lobulated. It has been suggested that among lesions with relatively strong internal echoes, fuzzy contours may be due to low contrast with surrounding tissues (14). In addition, when a fibroadenoma was surrounded by fat or mixed tissue, the borders were more difficult to see, and this may account for some of the apparent tumor irregularity (2). In this study, the ill-defined margin or irregular shape of

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**Fig. 3.** Palpable mass in upper portion of the left breast in 29-year-old woman. Sonography shows a well-defined mass with posterior enhancement. The lesion shows somewhat irregular curvilinear clefts within the mass (A), suggesting phyllodes feature on histology (B) (H&E stain, ×100).

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masses was, in 11 of 15 cases (73.3%) related to the interdigitation of the normal parenchyma with masses.

Sonographic inhomogeneity of a mass often reflects the true internal structure of fibroadenomas, according to the histologic variability, and a heterogeneous internal echo-pattern has been reported in 28%-52% of fibroadenomas(1,2). Because of an inhomogeneous internal sonographic appearance, there were pathologic findings such as prominent clefts, tubules or areas of necrosis, and calcification(2,17). In this study, 77.8% of cases (21/27) revealed such findings and demonstrated dilated ducts, phyllodes features, and collagen bundles. If calcification occurs, the lesion becomes heterogeneous, and on sonograms shows posterior shadowing. Linear microcalcification was rare, occurring in our study in only 3/203 cases (1.5%).

From time to time, fibroadenomas demonstrate variable posterior acoustic patterns including enhancement, lack of change, or shadowing(14,17). Because of their rich cellularity and paucity of fibrous tissue, fibroadenomas in young patients tend to show marked enhancement(14). Without radiologically visible calcification, posterior shadowing of a mass as seen on ultrasound, may suggest malignancy; this may, however occur in benign breast disorders. Similarly, posterior enhancement is also seen in both benign and malignant tumors(3,17,18). Posterior shadowing of fibroadenomas has been reported in lesions with calcifications, hyalinization(1,4), widespread stromal sclerosis(18), or where fibrous tissue has been produced(19). On the basis of our results, we suggest that an additional cause of posterior shadowing should be added, namely ductal proliferation and dilatation. Although the pathologic findings may indicate clefts in a fibroadenoma, these are rarely detected by ultrasound. Infrequently, these elongated spaces are pronounced, and are thus readily evident (13,14). Clefts were observed in 3.4% of cases in our study(7/203) and were related to phyllodes features (57.1%) and dilated ducts (42.9%).

Though sonographic images were compared to representative histopathologic findings, an exact one-to-one correspondence could not be established, and this is a limitation of our study.

In summary, we conclude that most atypical fibroadenomas seen on sonograms showed a ductal predominant or mixed component, and a fibrocellular stromal pattern. An ill-defined margin or irregular shape was related to interdigitation of normal surrounding parenchyma with mass. Various associated features such as dilated ducts, phyllodes features, collagen bundles, adenosin, and microcalcification were related to atypical sonographic findings such as a heterogeneous internal echo pattern, posterior attenuation, and cleft.

References


