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# Sonographic Findings of Breast Hamartoma: Emphasis on Compressibility

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The characteristic features of hamartoma in terms of discrepancies in mammographic and sonographic shapes of the mass were evaluated. We reviewed 16 pathologically proven breast hamartomas, which had undergone preoperative mammography and ultrasonography. All masses were analyzed according to ACR-BIRADS on mammography. On sonography, each mass was analyzed for size, shape, margin, internal echogenicity, and posterior acoustic enhancement. We also analyzed the echogenicity of halo, and compared the characteristic changes in the shape of hamartomas attributable to compression in mammograms and sonograms. The most common sites were at 12 o'clock in the right breast and 2 o'clock in the left. The most common mammographic findings of the hamartomas were a round shape (11/16), a circumscribed margin (13/16), internal fat densities (D4)(16/16) and radiolucent halos (14/16). The most common sonographic findings of the hamartomas were an oval shape (16/16), circumscribed margins (10/16), heterogeneous internal echogenicity (14/16), echogenic (7/16) or echolucent halos (5/16), and posterior enhancements (12/16). The characteristic feature of hamartomas was a change of the mammographic round shape mass into an elongated oval shape mass by sonography (11/11), suggesting the compressibility of hamartomas. Three of the hamartomas contained a pathologically proven internal calcification. The presence of a hamartoma was suggested by a change in a mammographic round mass with a radiolucent halo into an oval heterogeneous mass surrounded by an echogenic or echolucent halo on the sonogram. This characteristic difference between the mammographic and sonographic findings was attributed to the hamartoma compressibility, and was associated with the over-proliferation of fat containing mature normal breast tissue.

**Key Words:** Breast sonography, breast neoplasm-benign, breast neoplasm-diagnosis

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## INTRODUCTION

Breast hamartoma, a benign breast tumor composed of an admixture of glandular fat and fibrous tissue,[1-3] is often discovered incidentally during screening mammography. With the increased availability of screening mammography, radiologists are more frequently encountering this benign lesion.[1-3] While the mammographic characteristics of these lesions are well described, few cases of hamartoma detected by ultrasound have been described in the radiological literature.[4,5] Furthermore, previous sonographic reports have shown that ultrasound can play only a minimal role in the diagnosis of breast hamartoma due to the wide variability in its sonographic appearance.[4,5]

Although a clinically palpable small hamartoma does not need surgical excision, it is interesting to note that after its removal, the breast tissue expands and once again becomes clinically and radiologically symmetrical with a normal appearance.[6]

In their reports on breast hamartoma with malignancy, Coyne, et al.[7] reported a lobular carcinoma in a mammary hamartoma, while Anani, et al.[8] reported two cases of breast hamartomas with invasive ductal carcinomas. They emphasized surgical excision of the breast hamartoma if the diagnosis was uncertain or the patient complained of discomfort.

Compressibility on sonography might be important feature of the differentiation of hamartoma and other solid tumors of the breast. We report 16 pathologically proven cases of breast hamartomas in which the compressibility attributed difference between the mammographic and sonographic findings, was an important factor in the differentiation of breast hamartomas from other benign or malignant tumors of the breast.

## MATERIALS AND METHODS

From June 1997 to June 2001, 16 breast hamartomas were pathologically diagnosed in 15 patients at our institute. The women's ages ranged from 20 to 74 years, with a mean of 38 years. Ages when the masses were first detected ranged from 20 to 54 years, with a mean of 35.6 years. All patients underwent a physical examination and preoperative mammography and sonography. Surgical excision with pathological confirmation was obtained because of patient's preferences or cancer phobia.

All examinations were reviewed retrospectively. Two experienced radiologists (K.K. Oh and E.K. Kim) independently evaluated the mammograms on a Senographe DMR (GE, Milwaukee, Wisconsin, USA). Each mass was analyzed according to the ACR (American College of Radiology) BI-RADS (Breast Imaging Reporting and Data System) criteria for mass shape (round, oval, lobular, irregular, architectural distortion), margin (circumscribed, microlobulated, obscured, indistinct, spiculated), location, distortion of the architecture of the adjacent breast parenchyma, and for the presence of fat density, internal calcification and halo around the mass.

All sonograms were performed by one experienced breast radiologist (K.K. Oh). A 5-10 MHz linear-array probe, either of a HDI 3000 (Advanced Technology Laboratories, Bothell, Washington, USA) or Acuson 128 XP/10 (Acuson, Mountain view, California, USA) was used. All examinations were performed with the patient in the posterior oblique, supine position with the ipsilateral arm raised. Scanning was performed in the radial and antiradial directions, by following the ductal system for mass shape evaluation. Mass diameters were measured in two vertical directions. Two experienced radiologists (K.K. Oh, E.K. Kim) separately reviewed all sonograms. Each mass was analyzed for size, shape, margin, internal echogenicity, posterior acoustic enhancement and echogenicity of halo, according to the US BIRADS, as suggested by Mendelson.[9] The patterns of blood flow on Doppler study, and the presence of compressibility were also analyzed.

The sonographic appearance of the hamartomas was also analyzed with respect to compressibility. First, a mass was defined as compressible when it appeared more elongated in appearance on the sonogram than on the mammogram and any other dimension will be shorter than that in mammography. We measured the longest diameter of the mass parallel to the surface of the transducer as transeverse diameter (T), and the shortest vertical diameter crossing the transeverse diameter of the mass as length diameter (L). for ultrasonography. Second, on ultrasonography, we compared the length/transverse diameter ratio (L/T ratio) obtained when the sonographic transducer was just touching the skin versus fully pressing pressed. Each dimension was determined using a caliper during sonographic scanning and the mean was calculated.

## RESULTS

### Clinical features

Sixteen hamartomas were found in 15 patients between June 1997 and June 2001. Patient ages at first detection ranged from 20 to 54 years with a mean of 35.6 years. Eleven of the 16 masses were found on physical examination, 10 of these by self-examination and one by a physician. The other 5 hamartomas in 4 patients, were not initially palpable; all were detected by mammographic screening as probable benign masses.

### Mammographic findings

Mammographic features are listed in Table 1. All 16 masses were evident by mammography. Eight of the 16 masses involved the right breast, most frequently at 12 o'clock (3 of 8, 37.5%) or 11 o'clock (2 of 8, 25.0%). The other 8 masses involved the left breast, most frequently at 2 o'clock (4 of 8, 50.0%). Eleven masses were round (68.4%)

**Table 1.** Mammographic Features of Hamartomas

| No. | Age (yr) | Location | Shape | Margin | Fat Density (D4) | Calcification | Halo | | Displacement |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Radiolucent | Radioopaque | |
| 1 | 23 | Rt. 6 | round | C | + | - | + | | + |
| 2 | 50 | Lt. 3 | round | C | + | - | + | - | + |
| 3 | 29 | Lt.2 | oval | C | + | - | + | - | + |
| 4 | 33 | Rt. 12 | round | C | + | - | + | - | + |
| 5 | 41 | Lt.2 | oval | C | + | - | + | - | + |
| 6 | 35 | Rt. 1 | round | C | + | - | + | - | + |
| 7 | 44 | Rt. 11 | round | C | + | - | + | + | + |
| 8 | 33 | Lt. 2 | round | C | + | - | + | - | + |
| 9 | 20 | Lt. 2 | oval | C | + | - | + | - | + |
| 10 | 31 | Lt. 2 | round | C | + | - | + | - | + |
| 11 | 37 | Rt. 12 | oval | I | + | - | - | + | + |
| 12 | 37 | Lt. 6 | round | I | + | - | - | + | + |
| 13 | 74 | Rt. 3 | round | C | + | + | + | - | + |
| 14 | 45 | Lt. 9 | oval | O | + | - | + | - | + |
| 15 | 52 | Rt. 12 | round | C | + | + | + | - | + |
| 16 | 29 | Rt. 11 | round | C | + | + | + | - | + |

C, circumscribed margin; I, indistinct margin; O, obscured margin; +, presence; -, absence.

and 5 were oval (31.0%). Thirteen featured circumscribed margins (81.2%). Although mass contained variable amount of fat, all masses showed fat density (D4), and all had discrete halos. Thirteen masses showed only a radiolucent halo (81.3%)(Fig. 1), two a radio-opaque halo (12.5%) and one a mixed halo pattern (6.3%). Three exhibited internal calcifications (18.8%), of which 2 were typically benign, showing either macrocalcification (Fig. 1) or dystrophic calcification (Fig. 2). The other was regarded as having a higher probability of malignancy due to evidence of pleomorphic calcification (Fig. 3). All masses displaced adjacent normal breast parenchyma, and showed no retraction or distortion.

## Sonographic findings

Sonographic features are listed in Table 2. All hamartomas were well visualized sonographically. The masses were 1.5 to 10 cm in their greatest dimension, as measured by sonography (mean, 4.94 cm), and all masses were elongated or flattened and oval in shape (100.0%). All 16 of round masses on the mammogram revealed elongated oval masses on the sonogram (100.0%) (Figs. 1-4). Ten of the 16 masses showed circumscribed margins (62.5%) by sonography. Fourteen showed heterogeneous internal echogenicity (87.5%), but the type of heterogeneous echogenicity differed markedly in intraductal or infiltrating carcinomas. The heterogenicity of hamartomas was due to from focally grouped fat and glandular tissue. Within the masses, fat and glandular tissues were well arranged and easily differentiated (Fig. 2 and 4). Internal calcifications were found in four of the masses (25.0%), three were demonstrated by mammography (Fig. 3) and one was newly found by sonography. Twelve of the masses showed a halo between the main mass and the surrounding breast parenchyma (75.0%), Seven of these were echogenic halos (58.3%) and 5 echolucent halos (41.7%). Thirteen showed at least some kind of posterior echogenicity (75.0%); ten with only posterior acoustic enhancement (76.9%), one posterior shadowing (7.7%), and two


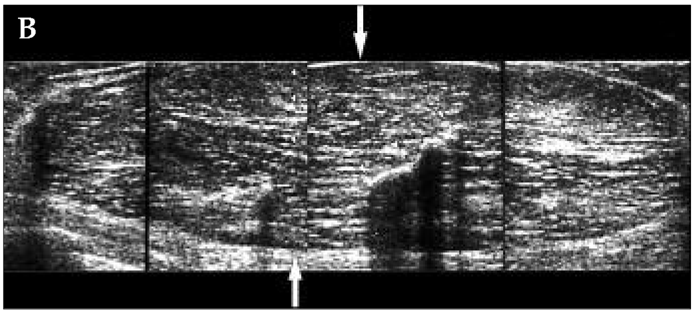


**Fig. 1.** A 74-year-old woman with a hamartoma. A. MLO film mammogram showing a round circumscribed encapsulated mass (white arrows) containing fat density, branching dystrophic calcifications (classified as typically benign) and a radiolucent halo defining the margin of the mass at 3 o'clock in the right breast. B. Sonogram with compression showing an elongated oval mass (white arrows). Heterogeneous lower echoic nodules with posterior shadowing (white arrowheads) suggesting dense calcification.


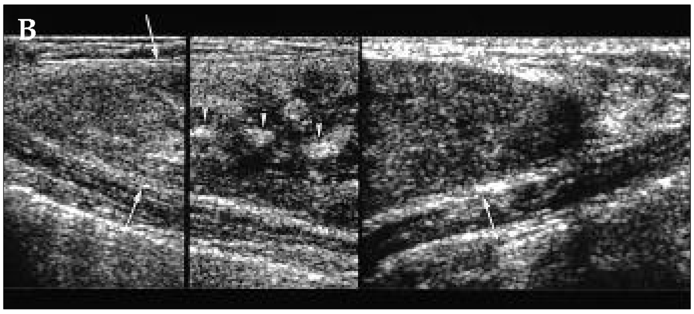


**Fig. 2.** A. 31-year-old woman with a hamartoma. A. MLO view mammogram of left breast showing a round and partially obscured fat containing mass with a slight radiolucent halo at 5 o'clock (white arrows). Dystrophic punctate calcifications are shown in the center of the mass (arrowheads). B. Sonogram with compression showing an elongated oval hypoechoic mass with hyperechoic central scattered echogenicity without posterior shadow (white arrowheads) and decreased L/T ratio. Regular and thick high echoic capsule showing compressed parenchyma without bilateral shadowing (white arrows).

as a mixture of both (15.4%). Ten masses revealed no blood flow on Doppler study (62.5%), 3 showed marginal blood flow, and the other mass exhibited a penetrating blood flow which was found to have a malignancy associated with hamartoma.

Table 3 presents the compressibility of the masses. All of the 16 masses showed a longer transeverse diameter by ultrasonography than by mammography. On sonography, all masses had a more transversely elongated shape in the pressed image than on the non-pressed scan. This data corresponds with the compressibility of hamartomas.

**Table 2.** Sonographic Features of Breast Hamartomas

| No. | Size (cm) | Shape | Margin | Internal echogenicity | Compressibility | Halo | | Posterior echogenicity | | Doppler |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Echolucent | Echogenic | PE | PS | |
| 1 | 10 | oval | C | homogeneous | + | - | + | + | - | +* |
| 2 | 2.3 | oval | C | homogeneous | + | - | + | + | + | +* |
| 3 | 3.7 | oval | C | heterogeneous | + | + | - | + | - | +* |
| 4 | 3 | oval | C | heterogeneous | + | - | + | + | - | - |
| 5 | 4 | oval | C | heterogeneous | + | - | + | + | - | - |
| 6 | 3 | oval | ML | heterogeneous | + | - | + | - | - | - |
| 7 | 2 | oval | I | heterogeneous | + | - | - | - | - | - |
| 8 | 3 | oval | I | heterogeneous | + | + | - | + | - | - |
| 9 | 7 | oval | I | heterogeneous | + | - | - | + | - | - |
| 10 | 2 | oval | C | heterogeneous | + | - | - | + | - | - |
| 11 | 7 | oval | I | heterogeneous | + | + | - | - | - | - |
| 12 | 4 | oval | ML | heterogeneous | + | - | + | + | - | - |
| 13 | 1.5 | oval | C | heterogeneous | + | + | - | + | - | - |
| 14 | 9 | oval | C | heterogeneous | + | - | - | - | + | - |
| 15 | 1.5 | oval | C | heterogeneous | + | - | + | + | + | - |

PE, posterior enhancement; PS, posterior shadowing.
+,presence; -, absence; C, circumscribed; ML, Macrolobulated; *, marginal blood flow; †, penetrating vessel associated DCIS.

**Table 3.** Compressibility of Hamartomas

| No. | Longest diameter on XM (cm) | Longest transverse diameter on US (cm) | A/W on XM CC | L/T of non-compressed US | L/T of compressed US |
|---|---|---|---|---|---|
| 1 | 7 | 10 | 0.9 | 0.8 | 0.3 |
| 2 | 1.5 | 2.3 | 0.74 | 0.67 | 0.46 |
| 3 | 2.5 | 3.7 | 0.65 | 0.62 | 0.29 |
| 4 | 1.5 | 3 | 0.9 | 0.86 | 0.34 |
| 5 | 3 | 4 | 0.63 | 0.5 | 0.4 |
| 6 | 2 | 3 | 0.92 | 0.83 | 0.5 |
| 7 | 0.8 | 2 | 1.3 | 1 | 0.6 |
| 8 | 1.5 | 3 | 1.1 | 1 | 0.34 |
| 9 | 5.2 | 7 | 1.55 | 1.52 | 0.2 |
| 10 | 0.8 | 2 | 1.35 | 1.29 | 0.43 |
| 11 | 5.6 | 7 | 1.23 | 1.22 | 0.29 |
| 12 | 2.3 | 4 | 1.2 | 0.93 | 0.43 |
| 13 | 1.1 | 1.5 | 1 | 1 | 0.3 |
| 14 | 7.2 | 9 | 1.8 | 1.2 | 0.42 |
| 15 | 0.5 | 1.5 | 1.4 | 1 | 0.31 |
| 16 | 7 | 10 | 1.2 | 1.01 | 0.3 |

XM, Mammography; US, Ultrasonography; A/W ratio on CC view, Anterior-posterior diameter/Width on craniocaudal view; L/T ratio on US, Length/Transverse diameter ratio on ultrasonogram.

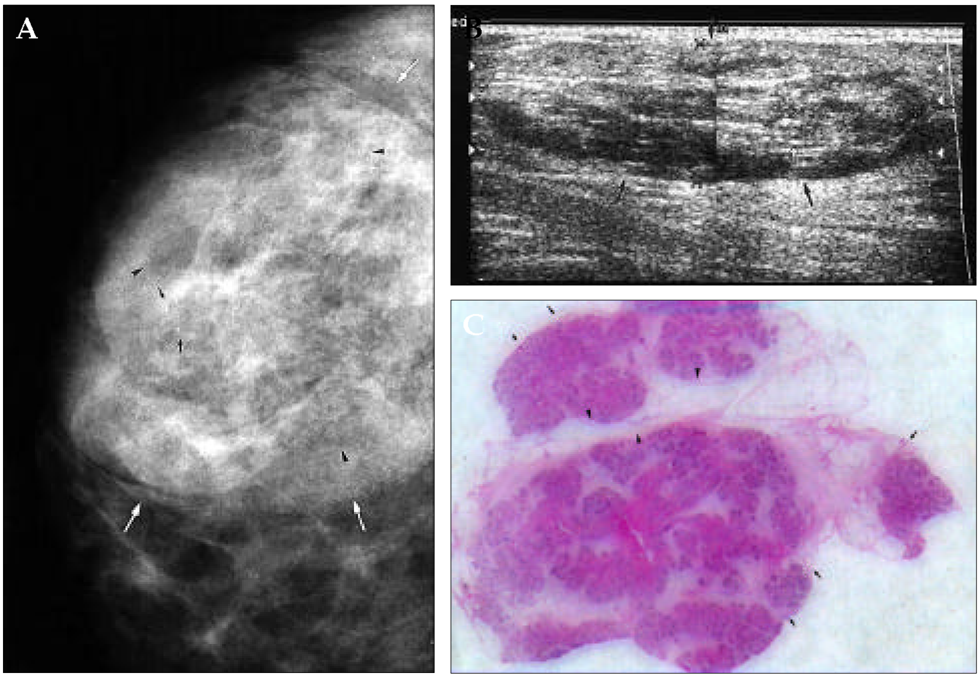


**Fig. 3.** A 29-year-old woman with a hamartoma. A. Coned compression view of the right breast showing a large round well circumscribed mass (white arrows) surrounded by a radiolucent halo containing fat density (D4)(arrowheads). A few punctate dense calcifications (short arrows) are shown at center of the mass. B. Compressed sonogram of right at 11 o'clock showing an elongated oval mass (arrows) with intermingled fat, normal breast tissue and clustered high echoic dots within the mass (open arrow), suggestive of microcalcifications. C. Photomicrograph of partly submitted mass (H&E stain × 10) showed mature breast tissue (arrows) and interleaved fat component (arrowheads).

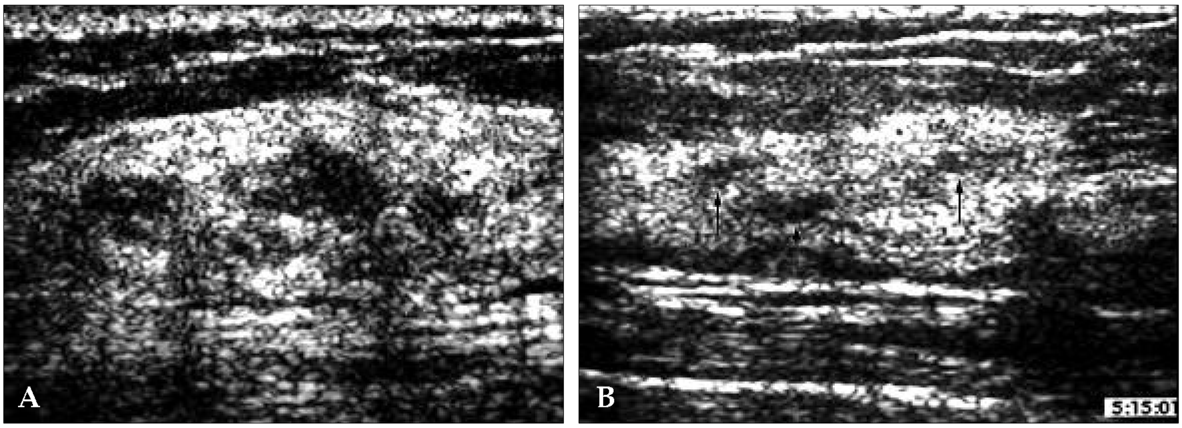


**Fig. 4.** A 29-year-old woman with hamartoma of the left breast. A. Non-compressed sonogram showing an oval heterogeneous echoic mass in the left 2 o'clock , the L/T ratio of the mass is 0.62. B. Compressed sonogram showed a more elongated mass, and the L/T ratio of the mass is 0.29. The low echoic intratumoral fat is compressed (arrows).

## DISCUSSION

The pathology of hamartoma of the breast, a term first proposed in 1971 by Arrigoni, et al.,[1] is non-specific, and represents a relatively rare benign breast mass. In the present study, we investigated 16 breast hamartomas. Mean age at first detection was 35.6 years, which correlates with that of a previous report.[2]

Generally, a hamartoma is round to lens-shaped, and is frequently surrounded by a narrow zone of radiolucency, which is suggestive of a pseudocapsule.[10] This pseudocapsule is actually a result of the hamartoma pushing normal parenchyma aside rather than replacing it.[11] This pathological entity consists of a well-circumscribed benign tumor composed of variable amounts of glandular tissue, fat and fibrous connective tissue,[2] which may be normal or may contain various benign changes. The microscopic variability of these tumors has been emphasized by Arrigoni, et al.[1] Pathologist' reports for all 16 masses were "consistent with a hamartoma", indicating their inability to differentiate masses from normal breast tissue. Five of the masses showed associated other pathological entities within the hamartomas; four hamartoma involved fibrocystic change and one hamartoma associated with DCIS

Film-screen mammographic findings usually describe mammary hamartoma as a circumscribed, non-homogeneous tumor, consisting of fatty tissue interspersed with an area of density similar to that of normal glandular tissue. The degree of mammographic opacity is variable, and depends on the fat/parenchyma ratio.[11] Helvie, et al.[12] suggested that the previously described classic mammographic appearance of breast hamartomas was less evident in small hamartomas. We found that the majority of our masses exhibited typical mammographic findings, such as a round or oval shape, well circumscribed margins, fat densities in the mass, radiolucent halos around the mass, and displacement of the adjacent normal parenchyma with no adhesion, retraction or distortion. In addition to the internal fat densities, we observed that hamartomas did not have central radiopacity or relative peripheral radiolucency as fibroadenoma or other solid mass. However, even the smallest masses (3.2 cm in diameter) presented the previously described typical mammographic findings. Therefore, hamartomas were easily diagnosed preoperatively on mammograms except the patient under 30 years old who had hamartoma in dense breast.

Oh, et al.[13] reported a case showing clustered microcalcification in breast hamartoma at mammography and ultrasonography. This microcalcification was represented as focal posterior shadowing on the ultrasonogram. Daya, et al.[14] reported focal calcification in breast hamartoma in 25% of their cases, based on microscopic findings. We found 4 cases showing calcifications in hamartoma which were benign dystrophic or pleomorphic calcifications. In one of the 4 hamartomas, the ultrasonographic heterogenicities in the mass were found to be due to microcalcifications suggesting a suspicious lesion, which was later confirmed as hamartoma with DCIS.

Adler, et al.[4] and Black, et al.[5] reported that ultrasound has a minimal role in the diagnosis of breast hamartomas, due to their wide sonographic variability. In their reports, the most frequent sonographic appearances were of a moderate to well-circumscribed, solid, hypoechoic mass with posterior acoustic shadowing.[4] However, others have reported that the sonographic appearance was helpful in diagnosing breast hamartomas. Oh, et al.[13] stated that typically based on sonographic findings hamartomas are oval in shape, with a well circumscribed margin and internal heterogeneous echogenicity. Oh, et al.[13] and McSweeny, et al.[15] reported that the sonographic appearance of a hamartoma depends on the relative amount and distribution of fat, and of epithelial elements, which explains the heterogeneous internal echogenicity of the mass. Our typical sonographic findings correlated with their descriptions.

On the basis of our study, we propose adding 'internal heterogeneous echogenicity', to the previously described finding of the internal echogenicity, which is as typical sonographic finding of hamartomas. We found that the histological components of hamartomas were focally grouped fat and glandular tissues rather than diffusely mixed. So the sonographic heterogenicity in hamartomas was grouped and well arranged than in other tumors as medullary carcinoma or calcified involuting fibroadenoma, which shows irregularly dispersed heterogenicity.

The compressibility of the mass was found to be helpful for the detection and diagnosis of breast hamartomas. When we examined breasts with pressing transducer, easily compressed masses were noted. All 11 of the mammographic round masses showed elongated oval shaped masses on sonography. These mammographic oval masses also showed a decrease the L/T ratio by sonography, reflecting their compressibility. This compressibility may be a result of well arranged fat tissue in hamartomas.

Another helpful diagnostic finding was the halo around the mass on the sonogram. Pseudocapsule formation was demonstrated in twelve of 16 masses by mammography, sonography and pathology. Seven of these 12 showed echogenic halos surrounding the wall, and the other 5 showed echolucent halos. Fibroadenomas show an echogenic capsule on a sonogram, which is a true capsule, but hamartomas does not have true capsule. Therefore, we consider the halo observed around hamartomas to be the result of the interface between the mass and the normal parenchyma. These echolucent halo findings seemed to be caused by fat tissue between the mass and the adjacent normal parenchyma on one side, and the echogenic halo from the glandular component on the other.

In conclusion, when a mammographic round mass with a radiolucent halo becomes an oval heterogeneous mass on a sonogram, and that is surrounded by an echogenic or echolucent halo, hamartoma can be diagnosed. This characteristic difference between the mammographic and sonographic findings is due to the compressibility of hamartomas, and is associated with the over-proliferation of matured fat containing normal breast tissues.

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