RadioGraphics

Fibrous Lesions of the Breast: Imaging-Pathologic Correlation[1]

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CME FEATURE

See accompanying test at http://www.rsna.org/education/rg_cme.html

LEARNING OBJECTIVES FOR TEST 4

After reading this article and taking the test, the reader will be able to:

- Identify the common fibroepithelial lesions of the breast.
- Recognize other benign fibrous lesions of the breast.
- Describe the imaging findings in fibrous breast lesions.

Fibroepithelial lesions of the breast are commonly seen in clinical practice. The masses are composed of a combination of prominent stroma and varying glandular elements. Fibroadenomas, benign lesions that derive from the terminal duct lobular unit, are the most common and are often identified at clinical examination or mammography as circumscribed masses. Benign mesenchymal tumors include focal fibrosis, pseudoangiomatous stromal hyperplasia, and fibromatosis or desmoid tumor. Phyllodes tumor, which is similar to fibroadenoma but has increased cellularity in the stroma, is typically benign but has malignant potential. Diabetic fibrous mastopathy, a stromal proliferation found in patients with juvenile-onset insulin-dependent diabetes, is a reactive fibrous lesion. Most of these lesions manifest as masses at clinical and/or mammographic examination. Some (eg, fibroadenomas) may be associated with calcifications. Except for fibromatosis and phyllodes tumor, fibroepithelial lesions need not be excised if the diagnosis is confirmed by the results of histologic analysis at percutaneous biopsy. To correctly differentiate between fibrous breast lesions that are benign and those that should be resected, the physician must be familiar with the correlated radiologic-pathologic findings in the various lesion types.

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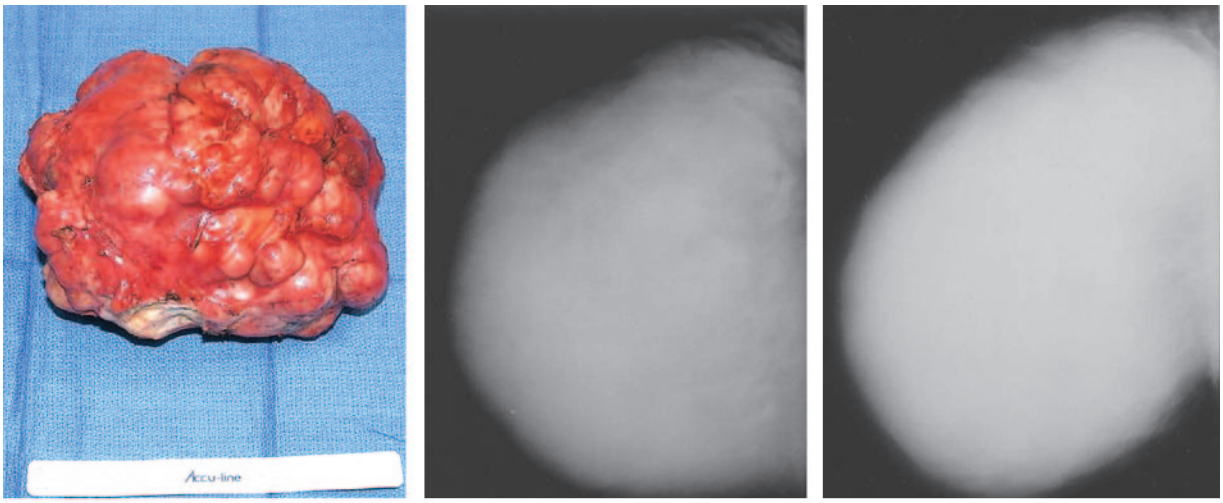

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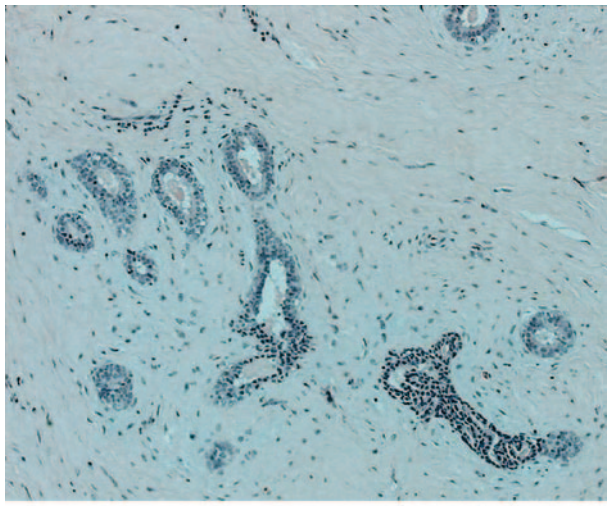


d.

Figure 1. **(a)** Photograph of gross specimen shows a well-circumscribed solid lesion with numerous lobulations. **(b, c)** Left craniocaudal **(b)** and mediolateral oblique **(c)** mammographic views show an extremely dense breast with a normal parenchyma that is nearly eclipsed by a large high-density mass. **(d)** Medium-power photomicrograph (hematoxylin-eosin stain) shows a giant fibroadenoma with an intracanalicular (compressed) glandular growth pattern.

Introduction

Fibrous breast lesions are commonly seen in clinical practice. These lesions are composed of prominent stromal elements and various amounts of glandular epithelium. The most common of these lesions is the fibroadenoma. Fibroadenomas most frequently occur as palpable masses in women of childbearing age, although 44% of fibroadenomas manifest in postmenopausal women (1). A lesion that is similar to fibroadenoma both in its clinical manifestations and its imaging features is sclerosing lobular hyperplasia.

Benign mesenchymal breast tumors include those in focal fibrosis, pseudoangiomatous stromal hyperplasia, and fibromatosis, all of which are composed of dense stromal elements. In fibromatosis, fibroblasts and collagen form an infiltrative mass, known as extraabdominal desmoid tumor, that requires local excision with a wide margin.

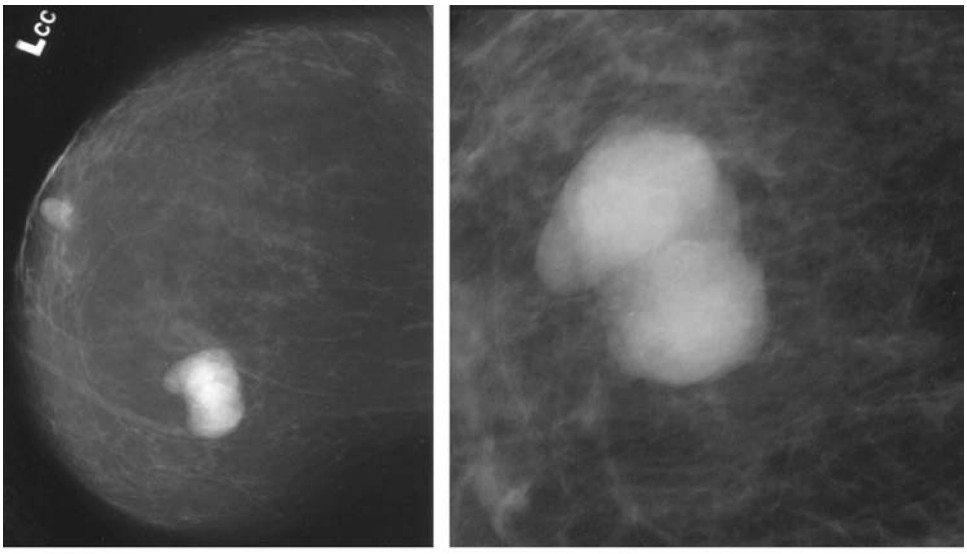
Some fibrous breast lesions, such as phyllodes tumors, have malignant potential. Phyllodes tumors may be characterized according to pathologic findings as benign lesions or as low-grade (borderline) or high-grade malignancies. There are no clinical features that help to differentiate fibrous lesions with malignant potential from fibroadenomas. In addition, no mammographic or ultrasonographic (US) features aid differentiation between benign and malignant fibrous lesions (2). In the presence of a very large and circumscribed breast mass, however, phyllodes tumor should rank high in the differential diagnosis.

Clinical history and physical examination can be very helpful for diagnosing some fibrous breast lesions. For example, in a type 1 diabetic who presents with a firm nontender mass in which a dense acoustic shadow is observed on US images, a diagnosis of diabetic fibrous mastopathy should be considered (2). To better enable differentiation between fibrous breast lesions that are benign and those that should be resected, this article reviews the correlated radiologic and pathologic findings.

Fibroepithelial Lesions

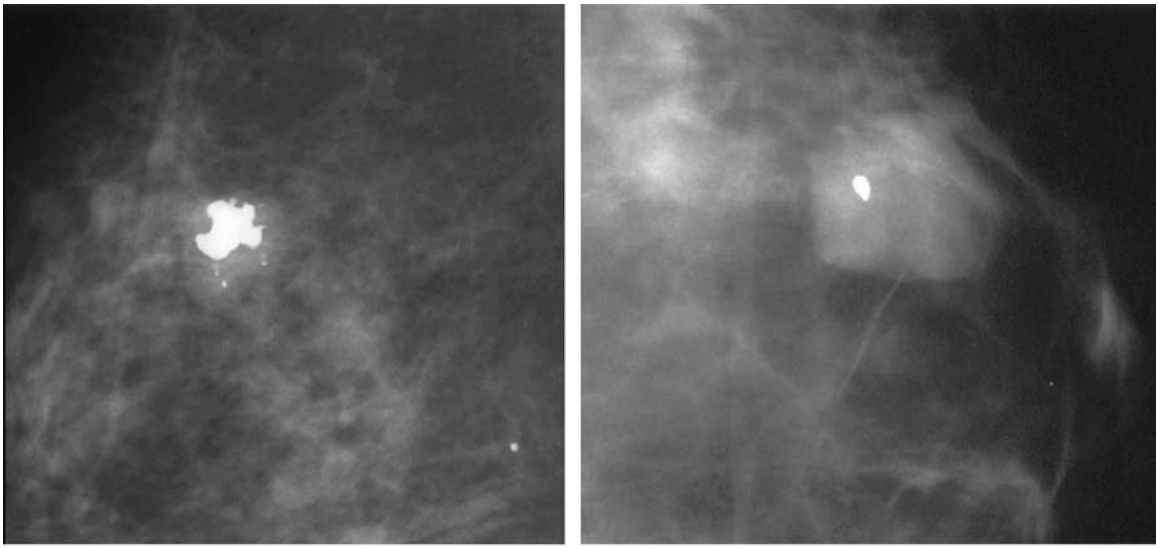
Fibroadenomas

Fibroadenomas are benign fibroepithelial tumors that develop in the lobules at the ends of mammary gland ducts, which are the basic units of analysis at histopathologic assessment. Fibroadenomas are composed of epithelium and stroma,



a. b.

Figure 2. Fibroadenoma in a 35-year-old woman. Left craniocaudal **(a)** and spot magnification **(b)** views show a high-density circumscribed lobular mass with a medial location in the breast. On the basis of the results of pathologic analysis, the mass was diagnosed as fibroadenoma.



3. 4.

Figures 3, 4. **(3)** Left mediolateral oblique magnification view shows a lobular circumscribed mass with coarse popcorn-shaped calcifications characteristic of fibroadenoma. **(4)** Right mediolateral oblique magnification view shows a circumscribed mass in the subareolar area with a single peripheral calcification. This pattern of calcification is typical of early degeneration in fibroadenoma.

and they are the breast tumors most commonly found in adolescent girls and young women at clinical examination and histopathologic analysis. When palpable, fibroadenomas are smooth, mobile and firm or rubbery. In 15% of cases, multiple fibroadenomas are present (1). Fibroadenomas occasionally develop into very large masses, particularly in adolescent girls and young women; such masses are called juvenile giant fibroadenomas (Fig 1).

At mammography, fibroadenomas appear as well-defined round, oval, or lobulated masses (Fig 2). The masses may be calcified, with the most common pattern of calcification being initial small peripheral dots that coalesce over time into coarser popcorn-shaped features (Figs 3, 4). In the presence of a calcified fibroadenoma, which is

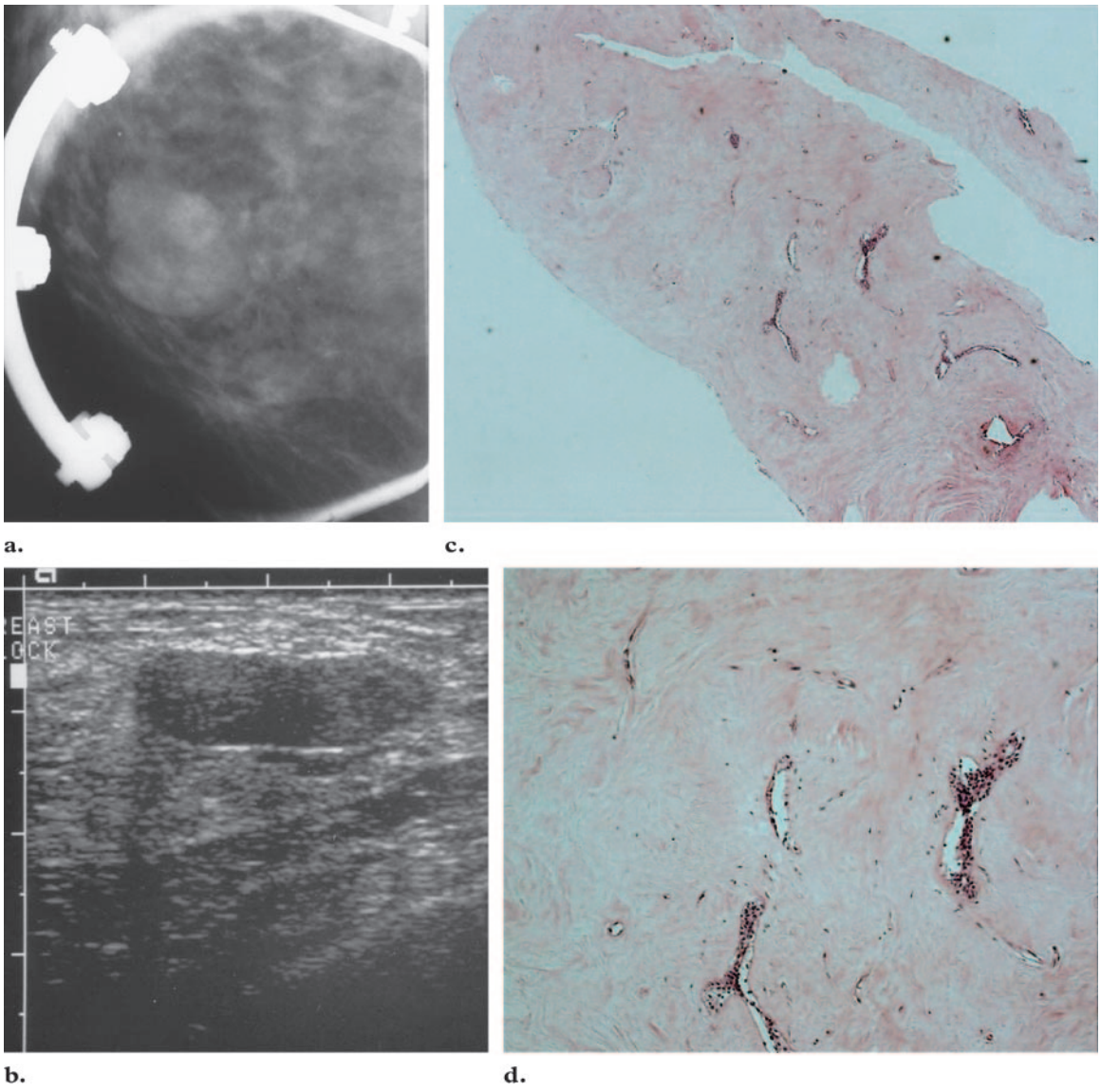
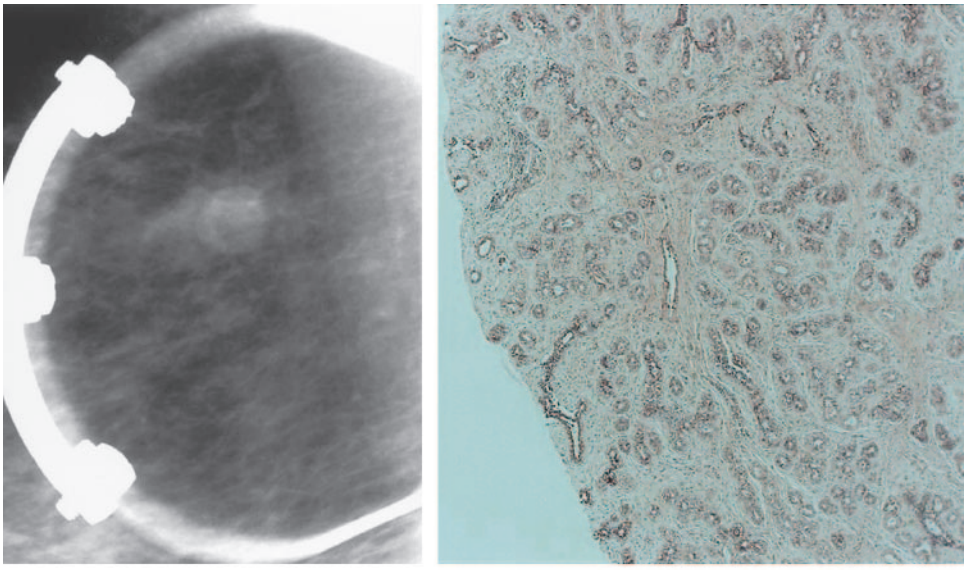


Figure 5. **(a)** Left spot magnification mammographic view shows a nonpalpable mass with features that are highly suggestive of fibroadenoma, including an elliptic shape and a well-defined margin. **(b)** US image shows an elliptic area of uniform hypoechogenicity. **(c)** Low-power photomicrograph (hematoxylin-eosin stain) of a core-needle biopsy specimen shows the abundant hyalinized stroma and intracanalicular pattern characteristic of fibroadenoma. **(d)** Medium-power photomicrograph of the specimen shows compressed canaliculi.

characteristically benign, further work-up, including US imaging or biopsy, is not needed. If a noncalcified isodense circumscribed mass is depicted at mammography, imaging with US is the next step toward characterization of the lesion. On US images, fibroadenoma appears as a well-circumscribed elliptic mass that is either hypoechoic or isoechoic and has uniform echogenicity. The lesion is typically larger in the transverse than in the anteroposterior direction and has very well-demarcated margins. A fibroadenoma may have no effect on ultrasound transmission, or acoustic enhancement or shadow may be observed on US images (Fig 5).

Histopathologic features of fibroadenomas include the concurrent proliferation of stromal and glandular elements. Two histologic categories of fibroadenomas are described: intracanalicular and pericanalicular. In intracanalicular fibroadenomas, the stroma is dense and compresses the duct into a slitlike space. In pericanalicular lesions, there is no compression of the duct (2) (Fig 6). Occasionally, small punctate, dystrophic, or pleomorphic calcifications may form in a fibroadenoma, and the mass may no longer be visible at



a. b.

Figure 6. **(a)** Left mediolateral oblique spot mammographic view, obtained at routine screening in a 45-year-old woman with a history of benign breast biopsy, shows a somewhat obscured round mass with features that are most suggestive of a benign lesion. **(b)** Medium-power photomicrograph (hematoxylin-eosin stain) of a biopsy specimen shows clearly defined borders, loose fibrous stroma, and the open rounded ductules typical of fibroadenoma with a pericanalicular pattern of development.

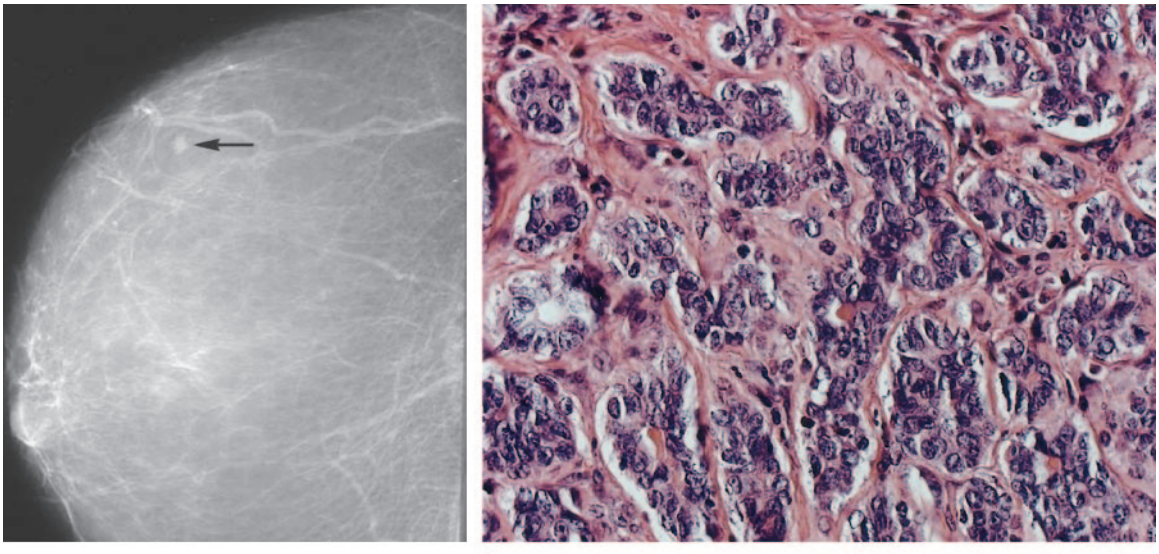


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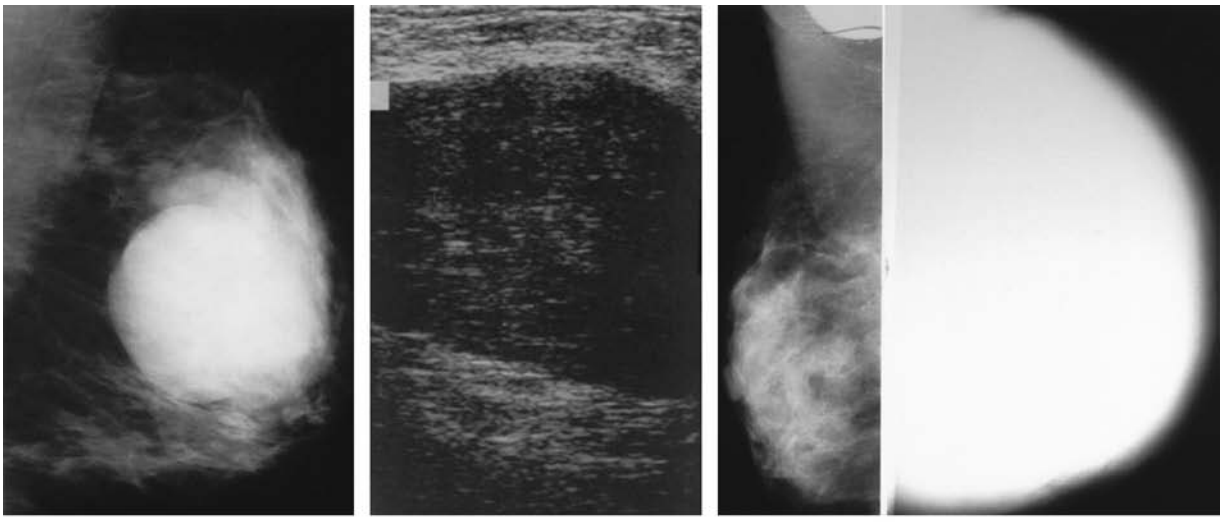
Figure 7. **(a)** Left craniocaudal view obtained at screening mammography in a 45-year-old woman shows a small lobular mass with slightly indistinct margins (arrow). **(b)** High-power photomicrograph (hematoxylin-eosin stain) shows a tubular adenoma, a well-circumscribed aggregate of compact proliferating tubules with very little intervening stroma, surrounded by a delicate and poorly formed capsule. The densely packed tubules in this type of adenoma are lined by epithelial and myoepithelial cell layers.

mammography. In these cases, biopsy may be necessary because of the equivocal mammographic findings.

Special varieties of fibroadenoma include fibroadenoma with lactating adenoma, juvenile fibroadenoma, and tubular adenoma. A lactating adenoma occurs in the epithelium of a fibroadenoma during pregnancy. Tubular adenoma is a variant of pericanalicular fibroadenoma with a florid epithelium like that in adenosis (2) (Fig 7).



9a. 9b. 10.

Figures 9, 10. **(9a)** Right mediolateral oblique view of a palpable breast lesion in a 49-year-old woman shows a lobulated mass with a central area of high density. **(9b)** US image shows a large central solid area and small peripheral cystic spaces, findings suggestive of a phyllodes tumor. Results of pathologic analysis confirmed the presence of a benign phyllodes tumor. **(10)** Bilateral mediolateral oblique views show marked discrepancy in breast size in a 63-year-old woman, with the right breast filled by a very large round high-density mass that is likely, on the basis of its shape and size, to be a phyllodes tumor. Histopathologic findings after excision confirmed a diagnosis of benign phyllodes tumor.

Juvenile fibroadenoma is characterized by prominent stromal cellularity and epithelial hyperplasia (2) (Fig 8).

Phyllodes Tumors

Originally described in 1838 as cystosarcoma phyllodes (3) because of their leaflike pattern of growth, phyllodes tumors may be benign or malignant. The clinical manifestation is most often a firm or hard round tumor. Very large size or rapid growth may suggest a phyllodes tumor rather than a fibroadenoma. In patients who have very large phyllodes tumors, ulceration of the skin or invasion of the chest wall may occur.

On mammograms, a phyllodes tumor is a large well-circumscribed isodense mass that may include plaquelike calcifications. On US images, the tumor appears as a smooth and solid lobular mass, occasionally with cystic components (Figs 9, 10).

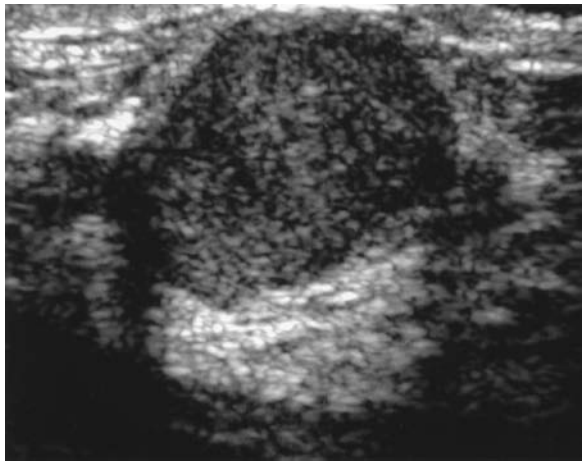
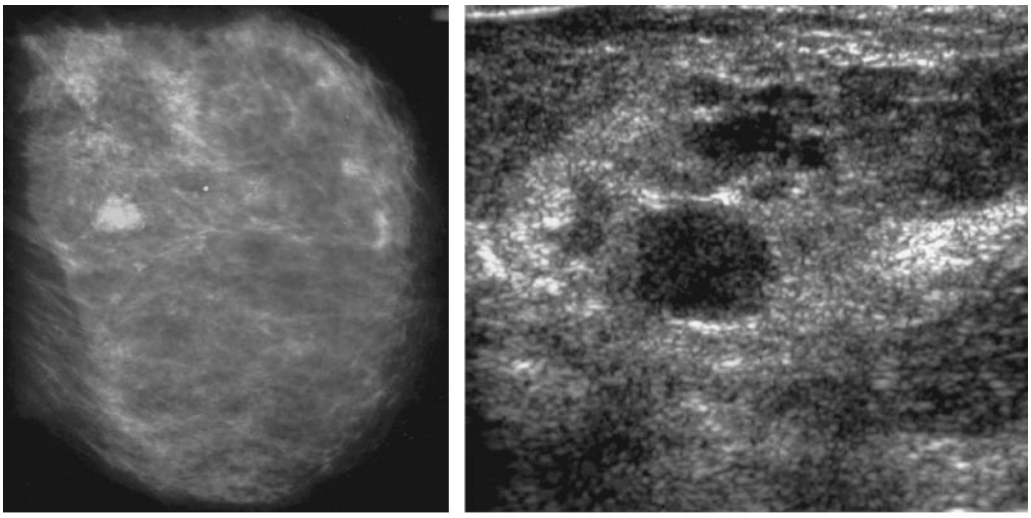


Figure 8. US image of a palpable mass in the right breast of a 17-year-old female patient shows a large lobular circumscribed hypoechoic lesion that, on the basis of the lesion features and the age of the patient, is most likely a juvenile fibroadenoma.

Phyllodes tumors develop from the periductal stroma and contain sparse lobular elements. In comparison with fibroadenomas, phyllodes tu-



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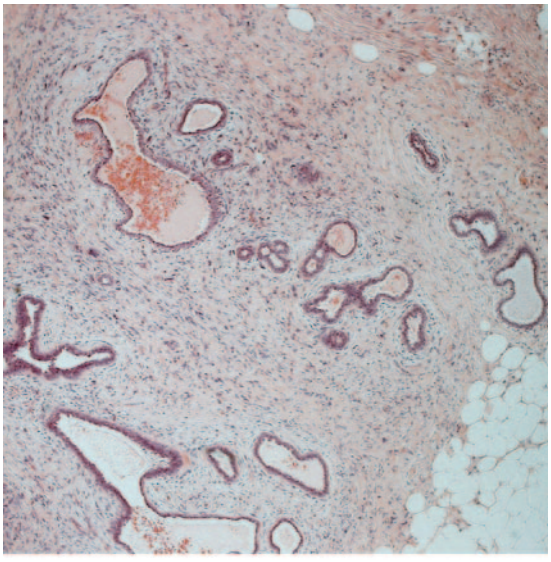

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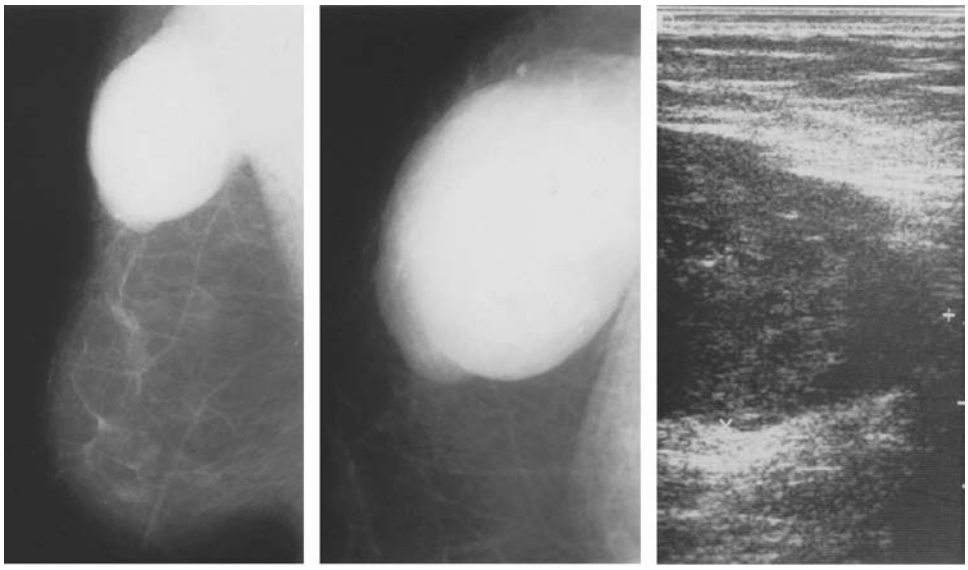
Figure 11. **(a)** Right craniocaudal view obtained at screening mammography in a 38-year-old patient shows a lobular isodense mass (white dot) near the center of the breast, a finding suggestive of a benign lesion. **(b)** US image shows a round lesion that is hypoechoic, a feature inconsistent with a benign lesion. **(c)** Low-power photomicrograph (hematoxylin-eosin stain) of a biopsy specimen shows features of a malignant phyllodes tumor, with classic stromal overgrowth, sparse epithelial components, infiltrative borders, and more than five mitoses per 10 high-power field.

mors are characterized by expansion and increased cellularity of the stroma. In addition, elongated epithelium-lined clefts are present (2).

Benign phyllodes tumors are characterized by few if any mitoses, moderate to marked cellular overgrowth, and slight to moderate cellular pleomorphism (2). The tumors do not metastasize, but there is a 20% likelihood of local recurrence after excision (4). Low-grade malignant or borderline lesions include a zone of microscopic invasion around their borders, an average of two to five mitoses per 10 high-power field, and moderate stromal cellularity that is heterogeneously distributed in hypocellular areas (2). Borderline lesions have a low (less than 5%) likelihood of metastasis and more than a 25% chance of local recurrence (4). Malignant phyllodes tumors show a marked degree of hypercellular stromal overgrowth, with more than five mitoses per 10 high-power field, and have an invasive border (2) (Figs 11, 12). About 25% of phyllodes tumors metastasize (4).



a. b. c.

Figure 12. **(a, b)** Left mediolateral oblique magnification **(a)** and coned-down exaggerated craniocaudal-lateral magnification **(b)** views obtained at mammography in a 28-year-old patient show a very large oval-shaped high-density mass in a posterior location that extends to the pectoralis major muscle. **(c)** US image shows a hypoechoic lesion with heterogeneous echogenicity. **(d)** Medium-power photomicrograph (hematoxylin-eosin stain) of a biopsy specimen shows features of a malignant phyllodes tumor, with hypercellular stromal overgrowth that includes scarce benign epithelial cells and abundant spindle cells, but not the typical leaflike appearance.

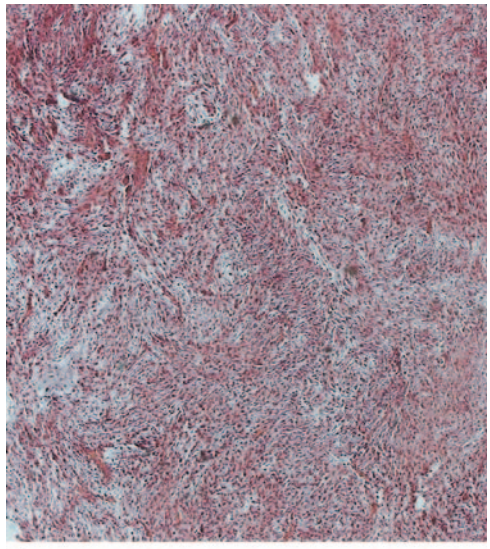


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Figure 13. Right mediolateral oblique mammographic view, obtained in a 53-year-old patient with a palpable mass, depicts an isodense circumscribed lesion (circular area that surrounds the white dot), a finding suggestive of a fibroadenoma. However, the results of pathologic analysis indicated sclerosing lobular hyperplasia.

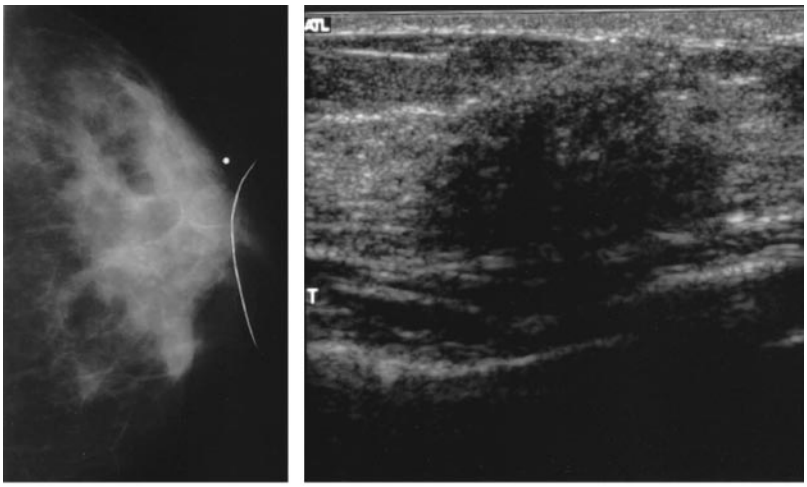

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Figure 14. **(a)** Right craniocaudal mammographic view, obtained in a 35-year-old patient with type 1 diabetes, a palpable mass in the right breast, and a history of prior benign biopsy, shows dense breast parenchyma without a focal mass. **(b)** US image shows a dense acoustic shadow at the site of the palpable mass. Results of pathologic analysis confirmed the presence of diabetic fibrous mastopathy.

Treatment for malignant tumors is complete local excision with a broad surgical margin to lessen the likelihood of tumor recurrence. Mastectomy may be needed for very large lesions. Overall 5-year survival with phyllodes tumors is about 90% (5). However, in patients with high-grade phyllodes tumors, the 5-year survival is only 65% (6).

Other Benign Fibrous Lesions

Sclerosing Lobular Hyperplasia

Sclerosing lobular hyperplasia, which is also known as fibroadenomatoid mastopathy, is a benign proliferative lesion that occurs most often in young black women. The most common clinical manifestation of this lesion is a circumscribed mass, which may be palpable. The mean age of patients at presentation is 32 years. On mammograms, the lesion resembles a noncalcified fibroadenoma (7) (Fig 13). Pathologically, the lesion is characterized by enlarged lobules, an increased number of intralobular ductules (2), and sclerosis of the intralobular septa.

Diabetic Fibrous Mastopathy

First described in 1984 (8), diabetic fibrous mastopathy is a form of stromal proliferation that is found in female patients with juvenile-onset insulin-dependent diabetes. The formation of these fibrous masses is thought to be related to an increased resistance of collagen to normal degradation. The lesions typically occur in young women, about 20 years after the onset of diabetes. Breast lesions of various kinds are found in about one-half of all female patients with type 1 diabetes. Thyroiditis also is found in some women with juvenile-onset diabetes (9).

The most common clinical manifestation of diabetic fibrous mastopathy is a firm to hard nontender breast mass. At mammography, generalized dense tissue is often present. The mass may appear as an asymmetry or an irregular lesion, or it may be obscured by dense tissue. Typically, US images show very dense and obvious acoustic shadows (10). Multiple areas of acoustic shadow may be seen in either breast (Figs 14, 15).

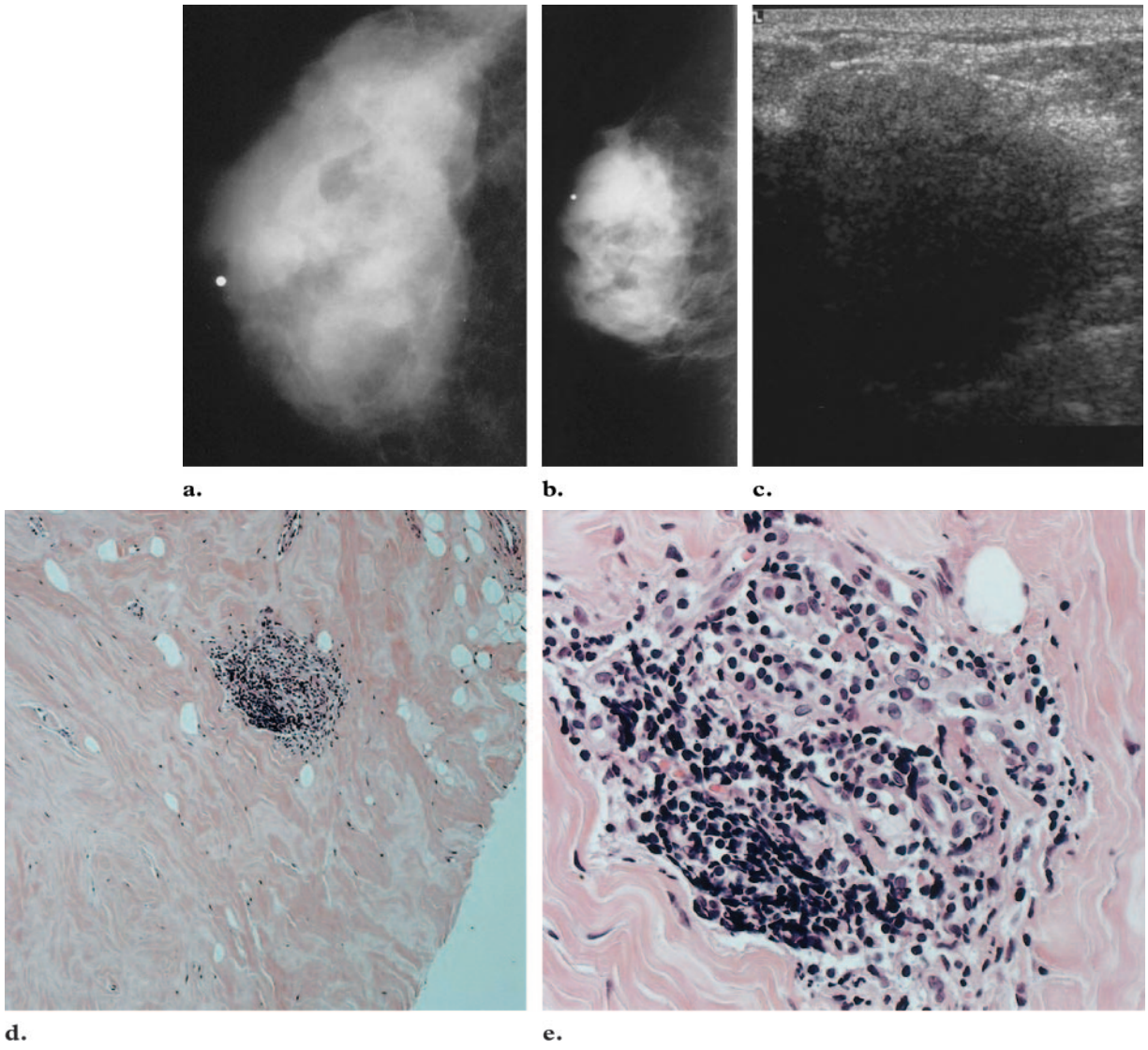
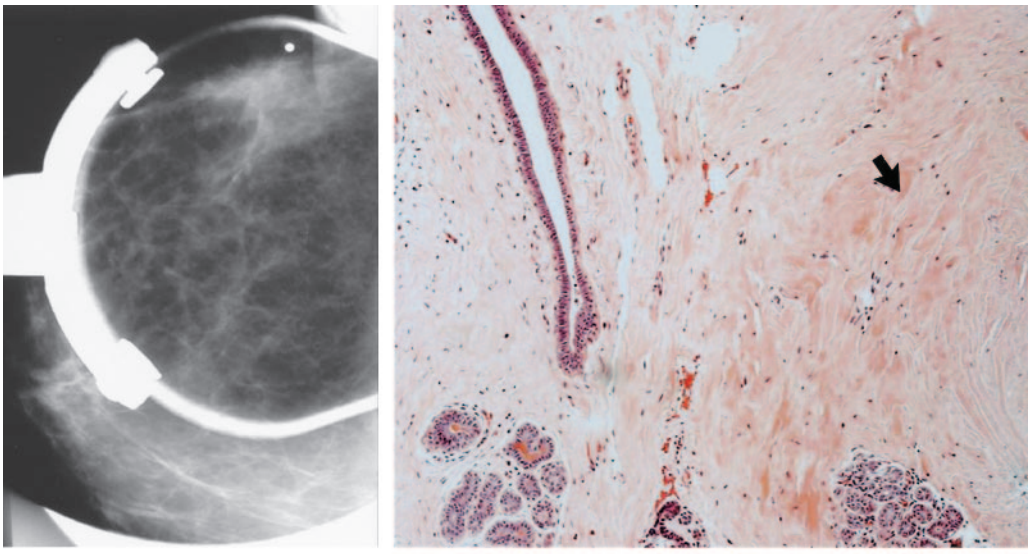


Figure 15. **(a, b)** Left craniocaudal **(a)** and mediolateral **(b)** views, obtained in a 40-year-old patient with type 1 diabetes and a palpable mass in the subareolar area of the left breast, show a very dense breast parenchyma with a focal area of high density at the site of the palpable mass (dot). **(c)** US image shows a dense acoustic shadow in the same area, a finding suggestive of diabetic fibrous mastopathy. **(d, e)** Low-power **(d)** and high-power **(e)** photomicrographs (hematoxylin-eosin stain) show extensive perivascular infiltrate of mature lymphocytes, as well as a markedly dense fibrous stroma, findings characteristic of diabetic fibrous mastopathy.



a. b.

Figure 16. **(a)** Left spot craniocaudal view obtained at screening mammography in a 47-year-old patient shows a focal area (dot) with asymmetric density in the upper outer quadrant. **(b)** Medium-power photomicrograph (hematoxylin-eosin stain) of specimen obtained at stereotactic biopsy shows stromal fibrosis, with thick collagenous bundles (arrow) and dense periductal stroma, as well as fibrous stroma with normal density (left portion of image).

At histopathologic examination, a collagenous stroma composed of an increased number of spindle cells and scattered epithelial cells is observed, with a lymphocytic infiltrate in the perivascular spaces. There is no associated increase in the risk of breast cancer or fibromatosis.

Focal Fibrosis (Fibrous Tumor)

Focal fibrosis, also known as fibrous mastopathy or fibrous disease, is similar to pseudoangiomatous stromal hyperplasia. Fibrous tumors typically occur in premenopausal women and manifest at clinical examination as a firm mass. At mammography, focal fibrosis may appear as a circumscribed or irregular mass (11) or as a focal asymmetric density. The mass is composed of dense collagenous stroma with sparse glandular and vascular elements (2) (Fig 16).

Pseudoangiomatous Stromal Hyperplasia

Pseudoangiomatous stromal hyperplasia is a mesenchymal lesion that may be mistaken for angiosarcoma. The lesion is composed of myofibroblasts and sometimes includes glandular components. The most striking histologic finding is a complex pattern of empty anastomosing slitlike spaces within the stroma. Myofibroblasts may be present at the margins of these spaces (2).

The condition typically occurs in premenopausal women but is frequently found incidentally at biopsy for gynecomastia (12). Patients may manifest a firm but painless breast mass. Occurrence of the lesion during pregnancy may cause massive breast enlargement with skin necrosis.

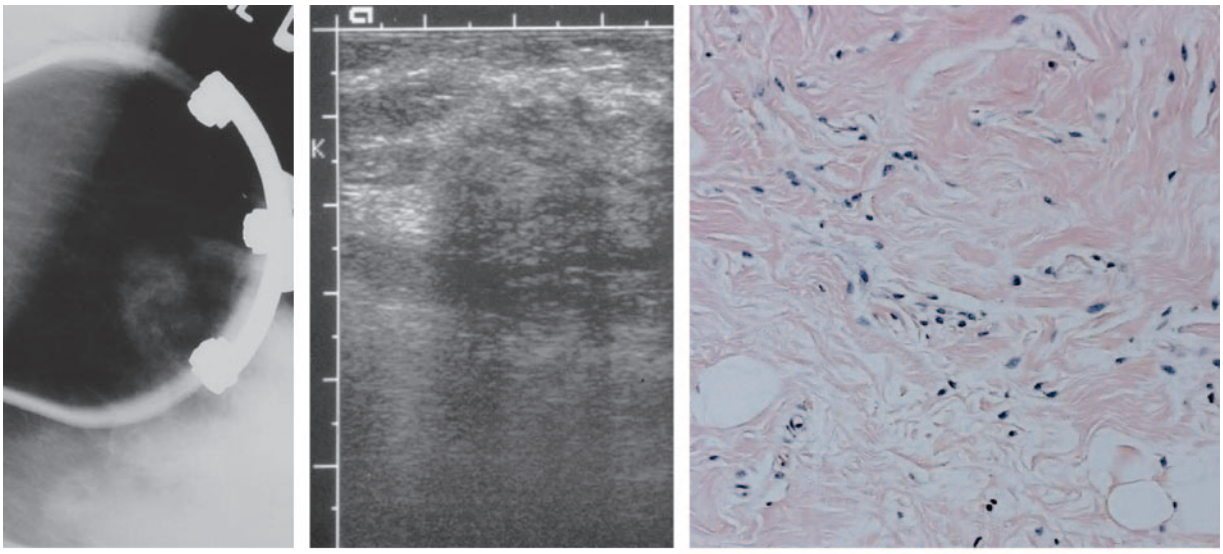


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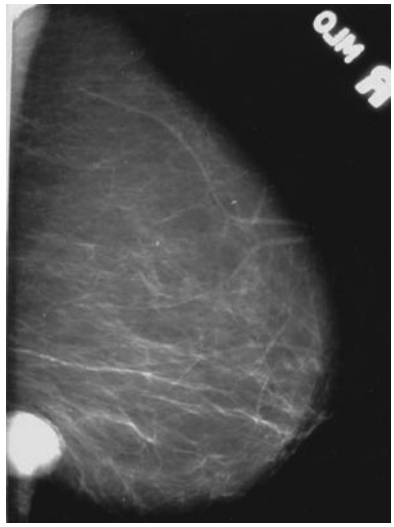
Figure 17. **(a)** Right mediolateral oblique spot magnification view obtained at routine mammography in a 61-year-old woman shows a focal area of asymmetric density not observed at previous screening mammographic examinations. **(b)** US image shows a hypoechoic area with inhomogeneous echogenicity. **(c)** High-power photomicrograph (hematoxylin-eosin stain) of biopsy specimen shows features of pseudoangiomatous stromal hyperplasia, including a diffuse network of spaces in the collagenous stroma and anastomosing slitlike channels outlined by myofibroblasts.

Figure 18. Right mediolateral oblique mammographic view, obtained in a 72-year-old woman with a new fixed palpable mass in the inframammary crease area in the right breast, shows a round well-defined high-density lesion with a posterior and inferior location. The lesion appeared solid, with homogeneous hyperechogenicity at US. Results of pathologic analysis indicated a desmoid tumor or fibromatosis.



The most frequent mammographic manifestation is a clearly circumscribed mass, but indistinct margins and spiculation also have been noted (13). US images may show a hypoechoic circumscribed mass that resembles a fibroadenoma (14) (Fig 17).

Fibromatosis

Fibromatosis, also known as extraabdominal desmoid tumor, is a low-grade infiltrative spindle-cell tumor composed of fibroblasts and collagen. The mean age of patients at diagnosis is 37 years (15).

Patients typically manifest a palpable firm or hard lump that is suspected of malignancy. The lesions tend to develop in the pectoralis fascia, in which they may be fixed and, thus, cause retraction of both the pectoralis muscle and the skin or nipple.

Many patients report a history of minor trauma to the breast or prior breast surgery. There is some association between augmentation mammoplasty and the development of fibromatosis in the capsule around the breast implant (16). On mammograms, fibromatosis appears as a round or irregular noncalcified mass, usually with indistinct margins or marginal spiculation (Fig 18).

At histopathologic analysis, spindle cells and collagen are present. The edges of the lesion show spiculation, evidence of extension into the surrounding breast tissue and fat. Glandular elements in the periphery of the mass may be engulfed. Mitotic activity is inconspicuous, a finding that helps to differentiate fibromatosis from fibrosarcoma (2).

Fibromatosis is treated surgically with complete local excision, and it may recur locally if excision is incomplete. Fibromatosis recurs in approximately one-fourth of cases (15).

Conclusions

The radiologic-pathologic correlation of findings in various fibrous lesions, their clinical manifestations, and their management have been discussed. Fibroepithelial lesions are encountered daily in a mammography practice and are most often benign. Fibroadenoma is the most common lesion in this group. Many of these lesions may mimic carcinoma either clinically or at mammography, but none are associated with an increased risk of lobular or intraductal breast cancer. Fibromatosis and phyllodes tumors require complete excision with a broad margin, or they may recur locally. Within this lesion category, the only malignancy is the malignant form of phyllodes tumor, which metastasizes in 25% of cases.

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