The male breast is susceptible to many of the same pathologic processes as the female breast. Many of these conditions have mammographic, ultrasonographic (US), and magnetic resonance imaging findings that allow differentiation between clearly benign conditions and those that require biopsy. Gynecomastia is the most common abnormality of the male breast and has characteristic imaging features that usually allow differentiation from malignancy. Mammography is the initial imaging modality for a clinically suspicious mass. A palpable mass that is occult or incompletely imaged at mammography mandates targeted US. Suspicious or indeterminate masses require biopsy, which can usually be performed with US guidance. Approximately 0.7% of breast cancers occur in men. Men with breast cancer often present at a more advanced stage than do women owing to a delay in diagnosis. Benign breast neoplasms that may occur in men include angiolipoma, schwannoma, intraductal papilloma, and lipoma. Benign nonneoplastic entities that may occur in the male breast include intramammary lymph node, sebaceous cyst, diabetic mastopathy, hematoma, fat necrosis, subareolar abscess, breast augmentation, venous malformation, secondary syphilis, and nodular fasciitis. Familiarity with the salient features of the classic benign male breast conditions will allow accurate imaging interpretation and avoid unnecessary and often invasive treatment.

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Abbreviations: CC = craniocaudal, H-E = hematoxylin-eosin, MLO = mediolateral oblique

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1From the Department of Radiology, Baystate Medical Center, 759 Chestnut St, Springfield, MA 01199 (C.N., M.E.S., V.I.M., C.S., R.K., J.A.H.); and Department of Radiology, Oregon Health and Science University, Portland, Ore (M.D.K.). Presented as an education exhibit at the 2011 RSNA Annual Meeting. Received June 8, 2012; revision requested July 5 and received August 17; accepted October 25. For this journal-based SA-CME activity, the authors, editor, and reviewers have no relevant relationships to disclose. Address correspondence to C.N. (e-mail: c_nguyen80@hotmail.com).

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Introduction
The rudimentary and totipotential mammary glands of males and females are identical at birth and are composed of mammary lobes that drain via lactiferous ducts into the nipple (1). In boys, a 30-fold increase in testosterone level during the peripubertal period ordinarily causes significant involution and atrophy of the ducts in the male breast (2). In girls, peripubertal estrogen secreted by the ovaries stimulates ductal proliferation and branching, and progesterone stimulates development of terminal ductal–lobular units. Transient elevation of serum estradiol at the onset of puberty may cause proliferation of subareolar ducts and stroma in boys. This condition usually resolves spontaneously, as increasing testosterone effects counteract transient estradiol effects as boys move through puberty into adulthood (3).

Normal adult male breasts are composed of skin, subcutaneous fat, atrophic ducts, and stromal elements, but the preponderance of skin and fat elements accounts for the typical mammographic appearance of the normal male breast. Cooper ligaments are absent in male breasts. Breast lobular development, a process stimulated by estrogen and progesterone, is rare in men. Therefore, breast conditions related to lobular proliferation, such as fibroadenoma, phyllodes tumor, invasive lobular carcinoma, and lobular carcinoma in situ, are extremely uncommon in men. Conditions related to ductal and stromal proliferation, such as gynecomastia, invasive ductal carcinoma, ductal carcinoma in situ, and papillary neoplasm, may occur in men (1,2).

In this article, we review the imaging and pathologic features of a gamut of benign and malignant processes involving the male breast. Specific topics discussed are gynecomastia, male breast cancer, benign breast neoplasms, and benign nonneoplastic breast conditions. Emphasis is placed on male breast cancer, with a discussion of its epidemiology, characteristic imaging features, and initial management.

Gynecomastia
Gynecomastia, the most common abnormality of the male breast, is caused by benign proliferation of ductal and stromal tissue elements, resulting in breast symptoms and imaging findings that may be unilateral or bilateral. Some of the most common causes of gynecomastia are listed in Table 1. Patients typically present with unilateral or less commonly bilateral breast pain, a breast mass or masses, or breast enlargement. Gynecomastia is most commonly seen during puberty and senescence but can manifest during infancy or at any age change, depending on precipitating factors.

Table 1  Common Causes of Gynecomastia

<table>
<thead>
<tr>
<th>Physiologic causes</th>
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</thead>
<tbody>
<tr>
<td>Neonatal period or infancy</td>
</tr>
<tr>
<td>Puberty</td>
</tr>
<tr>
<td>Senescence</td>
</tr>
<tr>
<td>Drugs</td>
</tr>
<tr>
<td>Marijuana</td>
</tr>
<tr>
<td>Anabolic steroids</td>
</tr>
<tr>
<td>Leuprolide acetate (Lupron Depot*)</td>
</tr>
<tr>
<td>Thiazide diuretics</td>
</tr>
<tr>
<td>Cimetidine</td>
</tr>
<tr>
<td>Tricyclic antidepressants</td>
</tr>
<tr>
<td>Estrogen therapy</td>
</tr>
<tr>
<td>Spironolactone</td>
</tr>
<tr>
<td>Digitalis</td>
</tr>
<tr>
<td>Cirrhosis</td>
</tr>
<tr>
<td>Hypogonadism</td>
</tr>
<tr>
<td>Klinefelter syndrome (XXY)</td>
</tr>
<tr>
<td>Pituitary hormone deficiency</td>
</tr>
<tr>
<td>Neoplasms</td>
</tr>
<tr>
<td>Germ cell tumors</td>
</tr>
<tr>
<td>Leydig cell tumor</td>
</tr>
<tr>
<td>Sertoli cell tumor</td>
</tr>
<tr>
<td>Adrenocortical tumors</td>
</tr>
<tr>
<td>Pituitary tumors</td>
</tr>
<tr>
<td>Hepatoma</td>
</tr>
<tr>
<td>Hyperthyroidism</td>
</tr>
<tr>
<td>Chronic renal disease and dialysis</td>
</tr>
<tr>
<td>Idiopathic causes</td>
</tr>
</tbody>
</table>

Note.—Adapted, with permission, from reference 4. *Abbott Laboratories, North Chicago, Ill.
At clinical examination, gynecomastia usually manifests as a concentric, easily compressible, mobile, soft, subareolar mass. Masses due to other conditions such as cancer are usually eccentric to the nipple-areolar complex. Pseudogynecomastia, more commonly seen in overweight or obese individuals, manifests as unilateral or bilateral breast enlargement rather than a discrete mass, since this condition is caused by benign diffuse proliferation of normal fatty tissue rather than stimulation of ductal and stromal elements. Symptoms such as nipple retraction, bleeding, and nipple discharge are more commonly seen in association with other conditions such as breast cancer or papilloma.

The three characteristic patterns of gynecomastia seen at mammography are nodular, dendritic, and diffuse glandular. The nodular pattern typifies the early, florid phase of ductal and stromal proliferation in patients with gynecomastia of less than 1 year’s duration. At mammography, it appears as a fan-shaped subareolar density that blends into the surrounding subcutaneous fat, resulting in indistinct borders. Histologically, nodular (florid) gynecomastia is characterized by proliferation of the intraductal epithelium, periductal inflammation, and surrounding edema. These findings correspond to the classic clinical symptom of a painful breast mass or enlargement. This early phase of gynecomastia is reversible if the stimulus is eliminated.

Dendritic gynecomastia represents the quiescent, fibrotic phase, which is characterized histologically by stromal fibrosis and dilated ducts. At mammography, this pattern classically manifests as a “flame-shaped” subareolar density radiating from the nipple with linear projections interdigitating into the deeper adipose tissues. The dendritic pattern may extend into the upper outer quadrant. Owing to acquired fibrosis, this later phase of gynecomastia usually causes irreversible clinical and mammographic abnormalities.

Diffuse glandular gynecomastia is typically seen in patients receiving high-dose estrogen therapy. At mammography, this pattern is characterized by...
heterogeneously dense breasts consisting of both nodular and dendritic components that closely resemble female breasts. The sonographic appearance of diffuse glandular gynecomastia can mimic that of malignancy. However, absence of a discrete mass at clinical examination and absence of secondary signs of malignancy help differentiate this benign condition from malignant processes (2).

Careful analysis of clinical and imaging data, including careful attention to the patient’s medical history and use of both prescription and recreational drugs, usually allows differentiation of gynecomastia from malignancy (Table 2). Gynecomastia has a bimodal prevalence, with the first peak near puberty and the second near age 50 years. Given the low prevalence of breast cancer in younger men, nearly all patients under the age of 30 years who present with breast symptoms will have gynecomastia.

Although the majority of patients present with unilateral symptoms, mammographically detectable gynecomastia is usually bilateral and is often asymmetric. In most instances, breast cancer is unilateral. In the uncommon scenario in which the patient presents with concurrent gynecomastia and breast cancer, laterality will be less useful and proper management will be dictated by the results of clinical examination, mammography, and sonography. Occasionally, gynecomastia cannot be differentiated from malignancy at imaging (Figs 2, 3), and biopsy is necessary to confirm the diagnosis.

On the basis of a combination of morphology and distribution, mammography allows differentiation between benign and malignant breast disease in male patients with a high sensitivity (92%) and specificity (90%) (6). Although gynecomastia can manifest as a diffuse increase in tissue density within the breast, its most common mammographic appearance is a fan-shaped contiguous region of increased tissue density that extends posteriorly from the nipple-areolar complex along the nipple line and occasionally extends into the superolateral quadrant of the breast. Male breast cancer can occasionally develop in the subareolar region, but most breast cancers and other breast conditions occur in other parts of the breast and tend to spare the subareolar region and nipple. Any peripheral or eccentric masses or noncontiguous foci of asymmetric density are concerning for processes other than gynecomastia and may need biopsy to exclude malignancy.

<table>
<thead>
<tr>
<th>Features</th>
<th>Gynecomastia</th>
<th>Breast Carcinoma</th>
<th>Both Gynecomastia and Breast Carcinoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient age</td>
<td>Bimodal prevalence: peripubertal and &gt;50 y</td>
<td>&gt;60 y</td>
<td>Increasingly common at 60 y</td>
</tr>
<tr>
<td>Clinical appearance</td>
<td>Soft tender mass; mobile mass</td>
<td>Soft or firm nontender mass; mobile or non-mobile mass</td>
<td>...</td>
</tr>
<tr>
<td>Relationship of lesion to the nipple</td>
<td>Central</td>
<td>Eccentric</td>
<td>Subareolar</td>
</tr>
<tr>
<td>Laterality</td>
<td>Most commonly bilateral</td>
<td>Usually unilateral</td>
<td>...</td>
</tr>
<tr>
<td>Mammographic appearance</td>
<td>Fan- or flame-shaped density</td>
<td>Discrete mass</td>
<td>Irregular margins</td>
</tr>
<tr>
<td>Secondary mammographic findings</td>
<td>Usually none</td>
<td>Calcifications, skin thickening, nipple retraction, axillary adenopathy</td>
<td>...</td>
</tr>
<tr>
<td>US appearance</td>
<td>Hypoechoic irregular mass; usually no axillary adenopathy</td>
<td>Most commonly a hypoechoic mass, similar to the appearance of breast cancer in women; suspicious axillary lymph nodes may be evident</td>
<td>Vascular, complex, cystic mass</td>
</tr>
</tbody>
</table>

Table 2 Clinical and Imaging Features of Gynecomastia and Male Breast Carcinoma
Treatment of gynecomastia typically includes evaluation for physiologic causes such as hormonal imbalance during puberty. Spontaneous regression occurs in the majority of these cases. In a patient with an identifiable cause, discontinuation of the offending medication or treatment of the underlying medical condition typically results in regression, unless the process has reached the irreversible fibrotic phase. Androgens, selective estrogen-receptor modulators, and aromatase inhibitors may have some benefit for patients whose disease is refractory to other hormonal or medical manipulations. Reduction mammoplasty is indicated in patients with unacceptable symptoms and disease that is refractory to medical treatments (4).

**Male Breast Cancer**

Approximately 0.7% of all breast cancers are diagnosed in men. The incidence of male breast cancer in the United States increased from 0.85 to 1.3 per 100,000 men between 1973 and 2000. The female-to-male ratio for breast cancer is 100:1 in whites and 70:1 in blacks (7). According to cancer statistics for 2010, approximately 1970 new cases of male breast cancer are diagnosed yearly (8).

Risk factors for breast cancer include Klinefelter syndrome, 
*BRCA1* or *BRCA2* mutation, a family history of breast cancer in a first-degree male or female relative, hyperestrogenism, advanced age, a history of chest irradiation, and
Infiltrating ductal carcinoma in a 76-year-old man with a 1-month history of a palpable breast mass. (a) Right MLO mammogram shows a subareolar mass with ill-defined margins (arrow). Enlarged and morphologically abnormal-appearing axillary lymph nodes are evident (arrowhead). (b) US image shows the heterogeneous solid mass with ill-defined margins and internal vascularity (arrows). US also showed multiple morphologically abnormal axillary lymph nodes. (c) Photomicrograph (original magnification, ×100; H-E stain) shows an invasive pattern of pleomorphic glandular cells with numerous mitoses and prominent nuclear pleomorphism. The cells grow as sheets (black arrows) or in a linear invasive pattern (“Indian file”) (white arrows).

a history of exogenous estrogen treatment for feminization purposes. A positive family history increases the breast cancer risk two- to fourfold. Male breast cancer is usually unilateral, occurring bilaterally in less than 1% of cases (5,7–9).

In men, breast cancer is typically diagnosed at an age approximately 5–10 years older than the age at which it is diagnosed in women, with a mean age at diagnosis of approximately 67 years. In addition, men usually present at a more advanced stage of cancer than do women owing to a delay in diagnosis. It has been reported that approximately 50% of men have axillary nodal metastasis at initial evaluation (7).

Infiltrating ductal carcinoma not otherwise specified makes up approximately 80% of breast cancer cases in men (Figs 4, 5), making it the most common histologic subtype of male breast cancer. Ductal carcinoma in situ is the second most common subtype (Fig 6), accounting for about 5% of all cases (10). Other less common subtypes include infiltrating mammary carcinoma with mixed features (Fig 7) and invasive papillary carcinoma (10). Metastasis to the breast from an extramammary primary malignancy is extremely rare.
Figure 6. Ductal carcinoma in situ in a 56-year-old man with intermittent spontaneous bloody nipple discharge. (a) Left mediolateral mammogram (coned-down magnification view) shows a focal, lobulated, subareolar mass (arrow) with evidence of both punctate and coarse calcifications. (b) Photomicrograph (original magnification, ×200; H-E stain) shows intraductal proliferation of monotonous cells with a moderately increased nuclear-to-cytoplasmic ratio and an intact myoepithelial cell lining.

Figure 5. Focal infiltrating ductal carcinoma with an associated hemorrhagic component in an 88-year-old man with a breast mass and bloody nipple discharge. (a) Left CC mammogram shows a dense mass with partially indistinct margins (arrow). (b) Color Doppler image shows the complex cystic mass (arrows) with posterior acoustic enhancement (arrowheads) and indistinct margins. (c) MR image shows the complex subareolar mass (arrow) with a thick, nodular, enhancing rim. T1W = T1-weighted.
Male breast cancer most commonly manifests as a painless palpable mass. Other signs and symptoms include nipple ulceration or retraction, nipple discharge, skin thickening, and palpable axillary lymph nodes (10).

Mammography is the initial modality for imaging. Bilateral CC and MLO mammographic views should be obtained. Palpable masses that are occult or incompletely imaged at mammography as well as those with suspicious mammographic findings require targeted US. Any suspicious masses seen at either or both imaging modalities require a biopsy, which can usually be performed with US guidance (2,7).

Treatment of male breast cancer depends on the stage of disease at the time of diagnosis and the hormone receptor status of the tumor (7).

**Benign Breast Neoplasms**

**Angiolipoma**

Angiolipoma accounts for 5%–17% of benign fatty tumors in the body; however, it is extremely rare in the breast (11). It typically manifests as a mass of mixed fat and soft-tissue density at mammography (Fig 8a) and as a homogeneous echogenic mass at US (Fig 8b). Because of its benign nature, angiolipoma can be treated with simple excision or follow-up with imaging (11,12).

**Schwannoma**

Schwannoma is a rare male breast neoplasm that arises from Schwann cells of peripheral nerve sheaths. Only 2.6% of schwannomas are intramammary (13). Neurofibromatosis type 2–related schwannomas are more cellular than the sporadic type and have a higher potential for malignant transformation. Such transformation (known as malignant peripheral nerve sheath tumor) is rare but is associated with a poor prognosis, with a 5-year survival rate of 34% (14,15).

In men, schwannoma manifests as a smooth, soft, painless mass. Mammography typically shows a nonspecific, well-defined, round or oval mass (Fig 9a). The typical sonographic appearance is a well-defined, hypoechoic, solid mass with variable acoustic enhancement (Fig 9b). Rarely, a central cystic component is identified (13–16).
Figure 8. Angiolipoma in a 49-year-old man with a nontender palpable mass. (a) Left MLO mammogram (coned-down magnification view) shows a mass of mixed fat and soft-tissue density (arrow) in the upper outer quadrant of the breast. (b) US image shows the well-circumscribed, homogeneous, echogenic mass (arrows). (c) Photomicrograph (original magnification, ×100; H-E stain) of the surgical specimen shows multiple adipocytes (⁎) and capillaries (arrows), findings consistent with an angiolipoma.

Figure 9. Schwannoma in a 33-year-old man with a soft palpable mass. (a) Right CC mammogram (spot magnification compression view) shows a subcentimeter well-defined mass (circle) at the 9-o’clock position. (b) US image shows the complex hypoechoic mass (arrows) with eccentric internal vascularity. (c) Photomicrograph (original magnification, ×2; H-E stain) of the specimen shows a spindle cell lesion with a true capsule and areas of hypercellularity (arrows, Antoni A appearance) and hypocellularity (⁎, Antoni B appearance), findings characteristic of a schwannoma.
Intraductal Papilloma
Intraductal papilloma is a benign neoplasm characterized histologically by epithelial proliferation, which is supported by a fibrovascular core and uniformly distributed myoepithelial cells. As in women, breast papillomas in men usually manifest as nipple discharge or a palpable subareolar mass. Most intraductal papillomas are solitary and are located in the central breast.

US is more sensitive than mammography or galactography for detection of papillomas, which typically manifest as an intraluminal mass within a dilated duct (Fig 10). A “stalk” of internal vascularity can be seen at color Doppler imaging. A US study with negative results in a patient with nipple discharge does not allow exclusion of intraductal papilloma, since false-negative results can occur when the duct is not distended with fluid at the time of examination, thus making the mass inconspicuous. Owing to the potential sampling error and histologic underestimation associated with core-needle biopsy, surgical excision is now a common treatment for all papillary lesions (17).

Lipoma
Lipoma is a benign tumor composed of mature fat cells and typically manifests clinically as a soft, nontender, palpable mass (1). At mammography, it has a characteristic appearance of a well-encapsulated, radiolucent, fat-density lesion (Fig 11), which corresponds to a mildly hyperechoic, relatively avascular, oval mass at US. However, lipomas may also be hypoechoic or isoechoic relative to subcutaneous fat. Lipomas do not require surgical excision unless they are cosmetically unacceptable (1).

Benign Nonneoplastic Breast Conditions

Intramammary Lymph Node
Intramammary lymph nodes are usually located in the upper outer quadrant of the breast but can be located anywhere in the breast. Mammographically detectable normal lymph nodes are oval or reniform, with denser peripheral margins that represent the cortex and more lucent centers that represent fat in the hilum (Fig 12a).

At US, normal lymph nodes have homogeneous, thin (thickness <2–3 mm), echogenic cortices and echogenic hilum (Fig 12b) (1). Intramammary lymph nodes that measure more than 1.0 cm in short-axis dimension (without fatty replacement), are round or irregular, or demonstrate cortical thickening (thickness >2–3 mm) at US are considered abnormal (18,19).
Sebaceous Cyst

A sebaceous cyst is a benign intradermal lesion secondary to an obstructed sebaceous gland. It is typically smaller than an epidermal inclusion cyst; however, these two entities are often indistinguishable at imaging. At US, it appears as a round or oval, well-circumscribed, hypoechoic mass in the subcutaneous tissue immediately adjacent to the skin (Fig 13).

Although there should be no demonstrable internal blood flow at color Doppler imaging, there may be significant surrounding hyperemia if the cyst is inflamed. It is considered a “do not biopsy” lesion when the imaging findings are characteristic, owing to an increased risk of inflammatory response in the surrounding breast tissue with possible abscess development if the cyst is ruptured (5).

Diabetic Mastopathy

Diabetic mastopathy is a rare fibroinflammatory breast disease in men. It is typically seen in patients with long-standing type 1 diabetes. At mammography, it may appear as a nonspecific discrete mass or regional asymmetry (Fig 14a). At US, it may appear as single or multiple masses...
that are hypoechoic to subcutaneous fat and hypo- or avascular (Fig 14b). Posterior acoustic shadowing may be present.

Diabetic mastopathy may simulate breast cancer and often requires core biopsy to prove the diagnosis. Histologically, it is characterized by stromal sclerosis with dense lymphocytic infiltration. Once the diagnosis is established with biopsy, surgical excision is typically not indicated, as there is no associated increased risk of malignancy (20).

**Posttraumatic Hematoma and Fat Necrosis**

Hematomas and fat necrosis are benign processes usually related to breast trauma or breast surgery. Patients may report a discrete event that has caused either of these conditions. However, trivial or incidental trauma can cause clinical symptoms and imaging abnormalities if the patient has a systemic coagulopathy or is undergoing anticoagulation.

Acutely, hematomas and fat necrosis may manifest as atypical masses associated with trabecular accentuation and skin thickening; the mammographic appearance can simulate breast cancer or a breast abscess (Fig 15a) (1). Over time, hematomas can evolve into more discrete masses with internal fluid-fluid levels, which reflect conversion of acute blood to serum. As a sequela of injury to breast fat, fat necrosis may also evolve into a more discrete mass but will contain internal fat-fluid levels, which reflect liquefying necrotic fat.

At US, both conditions can appear as a circumscribed mass with an internal fluid-debris level, which is often associated with internal septa (Fig 15b). Whenever a fluid-debris level is detected, one should make liberal use of decubitus views and other changes in the patient’s position to confirm the mobility of the internal contents and ensure that there is no underlying adherent solid tissue. Detection of internal flow at color Doppler imaging suggests an underlying neoplasm.

Chronic hematoma and fat necrosis have a variable mammographic appearance, which can include (a) persistent round, oval, or lobulated masses; (b) foci of architectural distortion, which reflect fibrosis and desmoplastic change; and (c) dystrophic calcifications.

**Subareolar Abscess**

A subareolar abscess is a localized infection secondary to ductal ectasia, chronic obstruction, and inflammation (21). Common clinical features include pain, nipple swelling, and nipple discharge. *Staphylococcus aureus* and *Staphylococcus epidermidis* are the most common causative organisms.

At mammography, a subareolar abscess usually appears as an ill-defined subareolar mass with surrounding trabecular thickening (Fig 16a). At US, it usually appears as an incompletely circumscribed mass containing complex fluid (Fig 16b). Doppler imaging often shows accentuation of peripheral vascularity, with sparse to absent internal flow. However, occasionally abscesses may have accentuated internal flow, making the diagnosis of infection less certain and therefore requiring tissue sampling.
Figure 15. Subacute hematoma with fat necrosis secondary to traumatic injury in a 40-year-old man with a 3-month history of a breast mass after direct trauma to the breast. (a) Right mediolateral mammogram shows a mass with a fluid level (arrow). (b) US image shows a large solid-cystic mass (arrowheads) with internal echoes and a fluid-debris level (arrow). Nonadherent avascular debris was seen at color Doppler imaging when the patient was in the decubitus position. During aspiration, a fat-fluid level was noted in the syringe.

Figure 16. Subareolar abscess mimicking malignancy in a 64-year-old man with nipple swelling and brownish nipple discharge. (a) Left tangential mammogram (magnification view) shows an irregular subareolar mass (arrow) with surrounding trabecular thickening (arrowheads). (b) US image shows a complex, hypoechoic, solid-cystic subareolar mass (arrows) with posterior acoustic enhancement (arrowheads) and internal vascularity, findings suspicious for malignancy. Excision demonstrated an obstructed duct with chronic inflammation and squamatization.
Because of their predilection for a subareolar location, breast abscesses can simulate gynecomastia, but corollary findings such as skin thickening and regional erythema and the sonographic appearance should enable correct diagnosis. Treatment includes antibiotic therapy and percutaneous US-guided drainage. Recurrent abscesses are treated with surgical excision of the abscess and regional lactiferous ducts to prevent recurrence (21).

**Augmented Male Breasts**

In transsexual patients, hormonal therapy may be used as a nonsurgical alternative for breast augmentation. This process includes administration of 17β-estradiol to stimulate proliferation of breast glandular tissue and administration of cyproterone acetate to suppress androgen secretion (22). This pharmacologic regimen may result in mammographically dense male breasts that are indistinguishable from female breasts (Fig 17).

In addition to hormonal therapy and in lieu of surgically placed breast implants, a common practice in South America and Southeast Asia is direct injection of highly viscous fluids such as mineral oil (paraffin, petroleum jelly, industrial silicone, and automobile transmission fluid). At mammography, such injected fluids may appear as extensive microcalcifications and coarse calcifications (Fig 18).

Long-term complications of self-injected mineral oil are extensive tissue inflammation and necrosis, a condition known as sclerosing lipogranulomatosis. Pathologically, this condition is characterized by marked tissue fibrosis, inflammation, and formation of sclerosing lipogranulomas. The treatment of sclerosing lipogranulomatosis includes radical débridement of affected areas and split-thickness skin grafting or, in some cases, mastectomy (23,24).
Venous Malformation

Venous malformation is the most common vascular malformation seen in the male breast. It is characterized physiologically by slow internal flow without associated arteriovenous shunting. Histologically, venous malformations are characterized by multiple ectatic thin-walled channels with flattened endothelial cells (25, 26). Patients usually report a long-standing history of unilateral painless breast enlargement.

At mammography, a venous malformation appears as multiple tubular densities (Fig 19a). At US, a venous malformation appears as multiple anechoic, tubular cystic spaces (Fig 19b), which have internal vascularity at color Doppler imaging (Fig 19c). At spectral Doppler analysis, these cystic spaces demonstrate slow venous flow, thus allowing differentiation of venous malformation from lymphatic malformation, which lacks flow at color Doppler imaging.

Owing to their slow-flow nature, venous malformations tend to be associated with phleboliths and thrombosis. Moreover, in contrast to lymphatic malformations, venous malformations enhance after intravenous administration of contrast material.

In addition, in cases of lymphatic malformation, a fluid-debris level can sometimes be identified as a sequela of prior hemorrhage (25).

Secondary Syphilis

Mammary syphilis is an uncommon male breast condition caused by the bacterium Treponema pallidum. It can be transmitted in utero or during vaginal delivery, a condition termed congenital syphilis. Alternatively, it can be acquired by direct contact of infected secretions or mucocutaneous lesions with the subcutaneous tissues of the host during a sexual encounter, a condition termed acquired syphilis. Nearly all new reported cases of acquired syphilis in adults are sexually transmitted (27).

Primary syphilis typically occurs about 21 days after acquisition of the infection and manifests clinically as a painless chancre at the site of inoculation. Secondary syphilis usually develops weeks to several months later and manifests as periareolar cutaneous mucous excrescences, skin thickening, and nipple ulceration.
At mammography, diffuse skin thickening and diffuse asymmetry of the background pattern of the affected breast are seen (Fig 20). The clinical and mammographic features of syphilis can mimic those of Paget disease, inflammatory breast carcinoma, and subareolar abscess. Prompt treatment with penicillin is essential to prevent transmission as well as the delayed complications of tertiary syphilis (27,28).

**Nodular Fasciitis**

Nodular fasciitis is a benign, reactive proliferation of fibroblasts that was described by Konwaler et al (29) in 1955. It most commonly involves the forearm and rarely affects breast tissue. Clinically, nodular fasciitis manifests as a firm palpable mass (30).

Mammography demonstrates a poorly defined irregular density (Fig 21a). US shows an irregular, heterogeneous, solid, hypoechoic mass. Because the clinical and imaging findings mimic those of breast cancer, core biopsy is usually necessary to confirm the diagnosis (30).

**Conclusion**

Most breast conditions in men are benign conditions, many of which have characteristic imaging features that allow differentiation from malignancy. Appropriate use of mammography, US, and, when appropriate, MR imaging in workup of male breast lesions will enable the radiologist to confidently identify the small subset of patients who require biopsy to confirm or exclude malignancy. Although gynecomastia is the most common condition involving the male breast, a variety of other benign and malignant disease entities have been reported in the literature and are illustrated herein.

Familiarity with the salient features of the classic benign male breast conditions will allow accurate imaging interpretation and avoid unnecessary and often invasive treatments. In addition, with an understanding of the embryology, anatomy, and physiology of the male breast, radiologists can more confidently assess male patients with breast-related symptoms and better correlate pathology results from breast biopsy with clinical and imaging data.

**References**

At clinical examination, gynecomastia usually manifests as a concentric, easily compressible, mobile, soft, subareolar mass. Masses due to other conditions such as cancer are usually eccentric to the nipple-areolar complex. Pseudogynecomastia, more commonly seen in overweight or obese individuals, manifests as unilateral or bilateral breast enlargement rather than a discrete mass, since this condition is caused by benign diffuse proliferation of normal fatty tissue rather than stimulation of ductal and stromal elements. Symptoms such as nipple retraction, bleeding, and nipple discharge are more commonly seen in association with other conditions such as breast cancer or papilloma.

A US study with negative results in a patient with nipple discharge does not allow exclusion of intraductal papilloma, since false-negative results can occur when the duct is not distended with fluid at the time of examination, thus making the mass inconspicuous.

Intramammary lymph nodes that measure more than 1.0 cm in short-axis dimension (without fatty replacement), are round or irregular, or demonstrate cortical thickening (thickness >2–3 mm) at US are considered abnormal.

Whenever a fluid-debris level is detected, one should make liberal use of decubitus views and other changes in the patient’s position to confirm the mobility of the internal contents and ensure that there is no underlying adherent solid tissue. Detection of internal flow at color Doppler imaging suggests an underlying neoplasm.

At spectral Doppler analysis, these cystic spaces demonstrate slow venous flow, thus allowing differentiation of venous malformation from lymphatic malformation, which lacks flow at color Doppler imaging. Owing to their slow-flow nature, venous malformations tend to be associated with phleboliths and thrombosis.