Imaging the Male Breast: Gynecomastia, Male Breast Cancer, and Beyond

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The number of men undergoing breast imaging has increased in recent years, according to some reports. Most male breast concerns are related to benign causes, most commonly gynecomastia. The range of abnormalities typically encountered in the male breast is less broad than that encountered in women, given that lobule formation rarely occurs in men. Other benign causes of male breast palpable abnormalities with characteristic imaging findings include lipomas, sebaceous or epidermal inclusion cysts, and intramammary lymph nodes. Male breast cancer (MBC) is rare, representing up to 1% of breast cancer cases, but some data indicate that its incidence is increasing. MBC demonstrates some clinical features that overlap with those of gynecomastia, including a propensity for the subareolar breast. Men with breast cancer tend to present at a later stage than do women. MBC typically has similar imaging features to those of female breast cancer, often characterized by an irregular mass that may have associated calcifications. Occasionally, however, MBC has a benign-appearing imaging phenotype, with an oval shape and circumscribed margins, and therefore most solid breast masses in men require tissue diagnosis. Histopathologic evaluation may alternatively reveal other benign breast masses found in men, including papillomas, myofibroblastomas, and hemangiomas. Radiologists must be familiar with the breadth of male breast abnormalities to meet the rising challenge of caring for these patients.

Supplemental Material

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Abbreviations: DCIS = ductal carcinoma in situ, FBC = female breast cancer, H-E = hematoxylin-eosin, IDC = invasive ductal carcinoma, ILC = invasive lobular carcinoma, MBC = male breast cancer, MLO = mediolateral oblique

TEACHING POINTS

- In the appropriate clinical setting, mammography is diagnostic for gynecomastia, which is the most common reason for presentation with a palpable lump, an area of focal pain, or breast enlargement; and mammography is highly sensitive in the male breast due to the typically lower amount of fibroglandular tissue compared with that in women.
- Although ductal and stromal proliferation in these patients may be extensive, males with gynecomastia rarely have substantial lobular proliferation due to a lack of progesterone.
- Gynecomastia is the most common cause of presentation with an area of palpable concern, breast pain, or breast enlargement in men.
- Axillary US should be performed in all male patients with breast masses suspicious for cancer because approximately one-half of MBCs involve the axillary lymph nodes.
- Papillary carcinoma has been reported to be twice as prevalent in patients with MBC than in those with FBC. This is thought to be due to the predominantly larger ducts that make up typical male breast tissue, in which these neoplasms tend to occur.

Introduction

Although the small number of men relative to women who present with breast concerns leads to difficulty in determining trends, diagnostic imaging has been reported (1,2) to have been increasingly used in recent years for evaluation of male breast concerns. Most male breast symptoms have benign causes, the majority of which are related to gynecomastia (3). Male breast cancer (MBC) is a rare cause of symptoms in men, but some data indicate that its incidence is increasing (1,4–8). MBC is more likely to be diagnosed at an advanced stage than is female breast cancer (FBC) (9,10). Therefore, an expedient diagnosis of cancer in symptomatic men presenting for imaging is of the utmost importance. MBC often demonstrates suspicious imaging features similar to those of FBC but occasionally has a deceptively benign imaging appearance, which has been theorized to contribute to a delay in diagnosis of MBC (11). These facts emphasize the importance of radiologist familiarity with the spectrum of imaging findings of benign and malignant breast abnormalities in men.

This article reviews male breast development, methods of imaging and pathophysiologic characteristics of the male breast, imaging of gynecomastia, and imaging findings of MBC and benign male breast abnormalities.

Male Breast Development

The male and female breasts develop identically until puberty, with the formation of rudimentary ducts draining to the nipple (12). In girls, an increase in estrogen at the onset of puberty causes ductal proliferation and branching. After menarche, progesterone produced by the corpus luteum induces lobular development and proliferation and hence formation of the terminal ductal lobular unit, which is the functional unit of the breast in women (13). Conversely, in boys, a substantial increase in testosterone at puberty causes ductal atrophy (Fig 1) (14). Therefore, typical male breast anatomy consists of a few sparse ducts beneath the nipple and components of the chest wall elsewhere (ie, skin and subcutaneous fat, nerves, blood vessels, lymphatic vessels, and underlying muscle).

Methods of Imaging the Male Breast

Males typically present for breast imaging due to a concern for a palpable breast abnormality, pain or a burning sensation, breast enlargement, or less commonly, nipple discharge (3,15). Imaging is not indicated in patients with a palpable breast concern and clinical findings consistent with gynecomastia or pseudogynecomastia with no associated features suspicious for cancer. Patients with equivocal or suspicious clinical findings require imaging evaluation. The American College of Radiology (ACR) recommends beginning with bilateral mammography for symptomatic men aged 25 years and older (16). There are two reasons for use of mammography at a slightly younger age in men than that recommended for women: *(a)* in the appropriate clinical setting, mammography is diagnostic for gynecomastia, which is the most common reason for presentation with a palpable lump, an area of focal pain, or breast enlargement; and *(b)* mammography is highly sensitive in the male breast due to the typically lower amount of fibroglandular tissue compared with that in women (17,18).

US is highly effective in men due to the relatively small size of the male breast, which allows good penetration with a high-frequency beam. US should be performed if suspicious findings are seen at mammography and is typically used for imaging-guided biopsy. Using warm gel decreases contraction of smooth muscle in the nipple-areolar complex, which reduces shadowing in the subareolar breast, where much of breast abnormality in men occurs. Additional techniques to optimize US evaluation of the subareolar male breast include methods proposed by Stavros (13), such as the peripheral compression technique, the rolled nipple technique, and the two-hand compression technique (Fig 2). These techniques improve subareolar visualization by causing the ultrasound beam angle to be perpendicular to the subareolar ducts. The latter two techniques also create better positioning of the nipple to reduce shadowing in the subareolar tissues and allow visualization of ducts in the nipple.

In symptomatic male patients younger than 25 years, US is recommended as the first-line imaging modality, given that less than 1% of MBC is diagnosed in male patients younger than 30 years (19). If US findings are indeterminate or suspicious, mammography should be performed.

Breast MRI is not commonly performed in men but is useful in demonstrating involvement of the chest wall after diagnosis of MBC (20). In addition, MRI can be performed in the rare event that a cause for pathologic nipple discharge is not elucidated with mammography and US in a man.

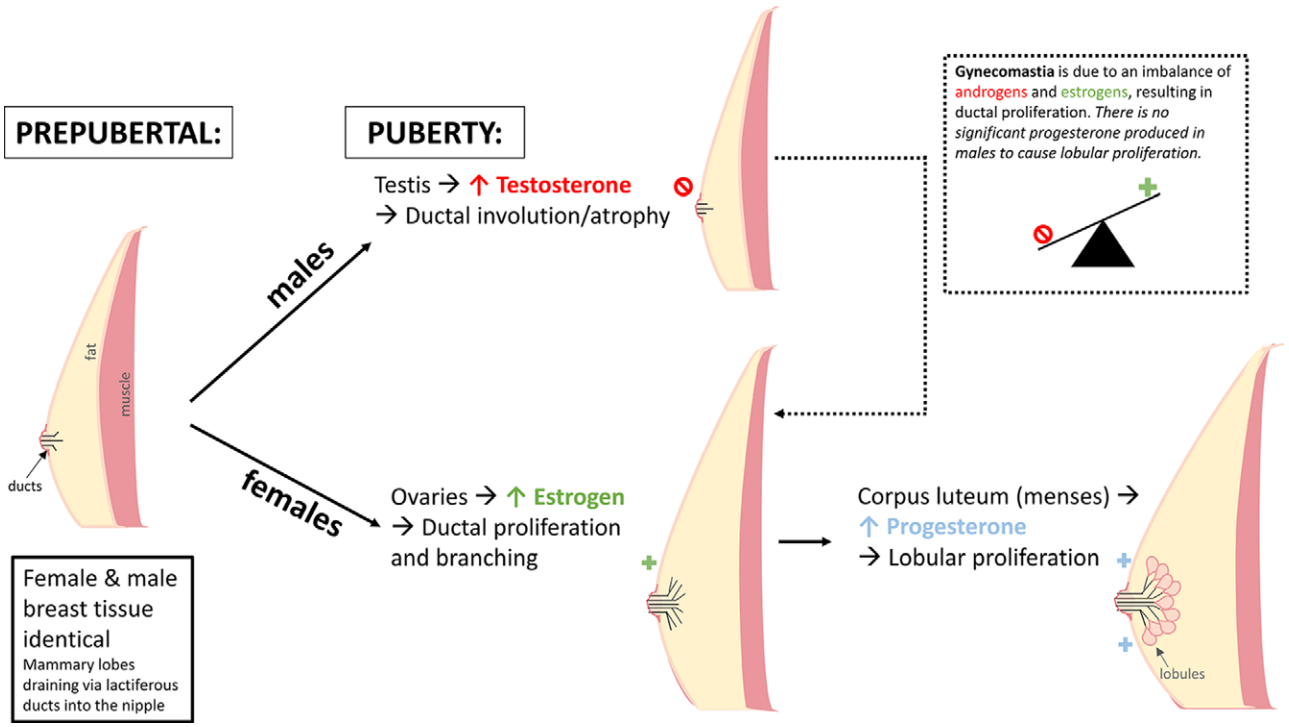


Figure 1. Normal breast development and gynecomastia. Illustration shows the typical development of the breasts in males and females, which diverges at puberty, when estrogen causes ductal proliferation in girls and a high level of testosterone causes atrophy of the ducts in boys. Later in female development, progesterone produced by the corpus luteum causes proliferation of the lobules in the terminal ductal lobular unit, which is the functional unit of the female breast and where FBC typically occurs. Conversely, normal male breast anatomy consists of a few sparse ducts beneath the nipple, and the components of the chest wall elsewhere (ie, skin and subcutaneous fat, nerves, blood vessels, lymphatic vessels, and underlying muscle). Gynecomastia occurs in male patients when an increased ratio of estrogens to androgens causes ductal proliferation (dotted arrow). No substantial lobular proliferation occurs in male individuals due to a lack of significant progesterone to cause this. This in turn influences the range of abnormalities typically seen in the male breast.

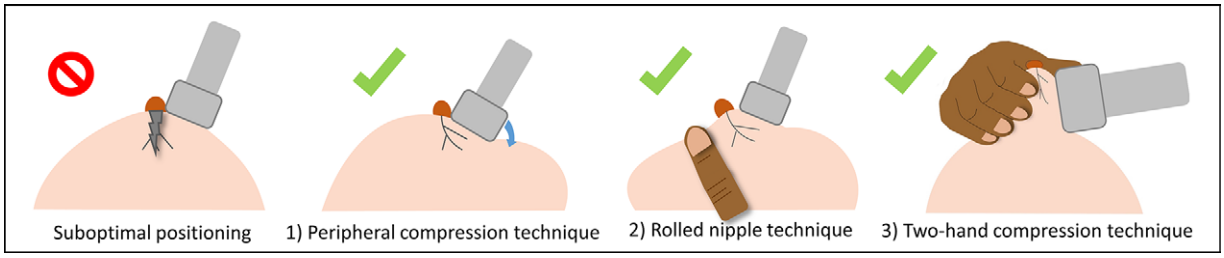


Figure 2. US techniques for evaluating the male breast. Illustration (far left) shows suboptimal positioning of the transducer for evaluation of the subareolar breast, causing the angle of the ultrasound beam to be close to parallel to the subareolar ducts, reducing the strength of the reflected beam the transducer receives to create an image, and potentially obscuring the subareolar tissue with shadowing from the nipple-areolar complex (gray "lightning bolt"). The following techniques for better visualization of the subareolar tissue are shown: *(1)* the peripheral compression technique (applying greater pressure on the peripheral end of the transducer to angle the probe-skin interface, *(2)* the rolled nipple technique (applying gentle pressure using the index finger on the opposite side of the nipple, and *(3)* the two-hand compression technique (gently compressing the subareolar breast between one hand and the transducer while angling the transducer vertically).

Gynecomastia

Gynecomastia is an increase in ductal and stromal tissue in male patients secondary to an increased ratio of estrogens to androgens (Fig 1). Gynecomastia may be physiologic (ie, related to an expected deviation from the normal hormonal balance in patients of specific age groups) or pathologic (ie, occurring when the inciting hormonal derangement is caused by extrinsic influences or intrinsic conditions resulting in a systemic increase in estrogen). Although ductal and stromal proliferation in these patients may be extensive, males with gynecomastia rarely have substantial lobular proliferation due to a lack of progesterone. Therefore, lobular abnormalities seen in women, such as fibroadenomas, phyllodes tumors, most fibrocystic changes, lobular carcinoma in situ, and invasive lobular carcinoma (ILC), are rarely seen in men (13,21,22).

Table 1: Causes of Pathologic Gynecomastia

Drugs
Leuprolide acetate
Cimetidine
Tricyclic antidepressants
Estrogen therapy
Thiazide diuretics
Spironolactone
Marijuana
Anabolic steroids
Digitalis
Statins
Neoplasms
Germ cell tumors
Leydig cell tumors
Sertoli cell tumors
Adrenocortical tumors
Pituitary tumors
Hepatoma
Obesity
Chronic kidney disease and dialysis
Hypogonadism
Klinefelter syndrome
Pituitary hormone deficiency
Cirrhosis
Hyperthyroidism
Idiopathic

Physiologic gynecomastia has a trimodal age distribution and can be infantile, pubertal, or senescent. In infants of both sexes, breast enlargement may occur due to the influence of hormones produced by the placenta. Excrescence of a milk-like substance from the neonatal breast, called "witch's milk," may occur (14). This is self-limited and usually resolves within a few months to 2 years. At puberty, the large increase in testosterone in boys may lead to an aromatization of testosterone to estradiol in peripheral tissues, causing proliferation of ductal tissue. Puberty is the most common cause of gynecomastia, which is seen in 30%–60% of pubescent boys (13). It typically resolves spontaneously within 2 years after normalization of hormone levels (14). With aging, physiologic gynecomastia commonly occurs due to waning levels of testosterone, typically occurring in men aged 50 years or older (13).

Pathologic gynecomastia has a multitude of causes. These include numerous medications, marijuana, and anabolic steroids; obesity; and common systemic conditions causing disordered metabolism and excretion of hormones, such as chronic kidney disease (23). Genetic abnormalities such as Klinefelter syndrome and hormone-producing neoplasms may be the culprit in other cases (24,25). All of these cause gynecomastia by increasing the ratio of estrogens to androgens. Table 1 lists common causes of pathologic gynecomastia. Pathologic gynecomastia can also be idiopathic (23,24).

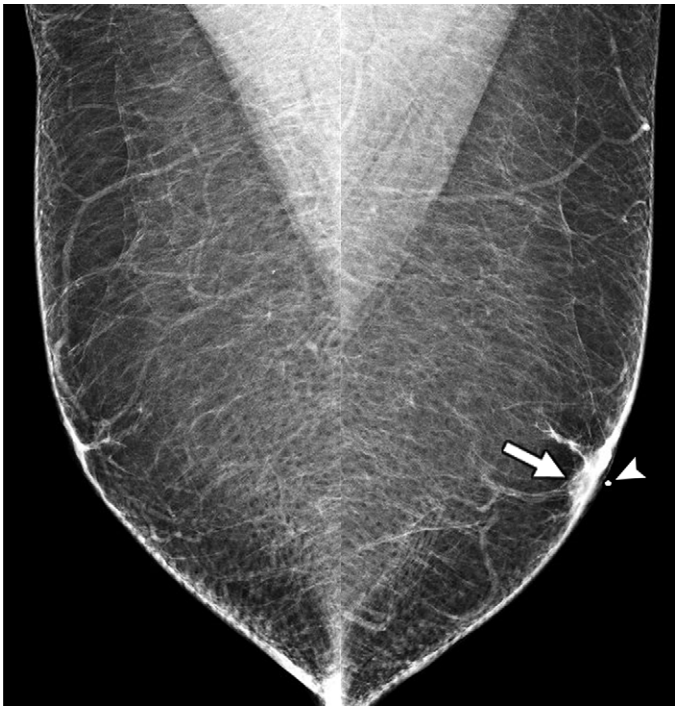


Figure 3. Pseudogynecomastia in a 35-year-old man with a palpable area of concern in the subareolar left breast. Bilateral mediolateral oblique (MLO) mammographic views show a diffuse increase in fatty tissue in both breasts, without an increase in ductal tissue. Subareolar density (arrow) in the left breast corresponds to the area of palpable concern as indicated by a BB skin marker (arrowhead), corresponding to a sebaceous cyst at US (not shown).

Pseudogynecomastia is a diffuse increase in fatty tissue in the breasts, without an increase in ductal tissue, which is seen in individuals who are overweight or have obesity (Fig 3). Gynecomastia is the most common cause of presentation with an area of palpable concern, breast pain, or breast enlargement in men (3,17). In rare cases, gynecomastia manifests with nipple discharge, although this is a highly suspicious symptom in men, frequently indicating malignancy or papilloma (26,27). Patients with gynecomastia who are undergoing imaging often present with unilateral symptoms, although at imaging gynecomastia is most commonly bilateral, and in such cases is slightly more commonly asymmetric (28,29). However, it may be unilateral at imaging, in which case it may be less easily distinguished from MBC (28–30). Physical examination of gynecomastia should reveal a soft, rubbery, mobile subareolar mass that is concentric to the nipple and may be tender. In these cases, if classic findings are also seen at mammography, this is diagnostic of gynecomastia, and US is not mandatory. Performance of US when these criteria are met has not been shown to yield any additional cancers and leads to more benign false-positive breast biopsies (18).

Three radiologic patterns of gynecomastia are commonly described: nodular, dendritic, and diffuse patterns. Nodular gynecomastia is the early florid phase, characterized histologically by ductal epithelial hyperplasia and periductal inflammation and edema, which has typically been present for less than 1 year and is reversible (25). It manifests as fan-shaped or triangular subareolar tissue at mammography that blends

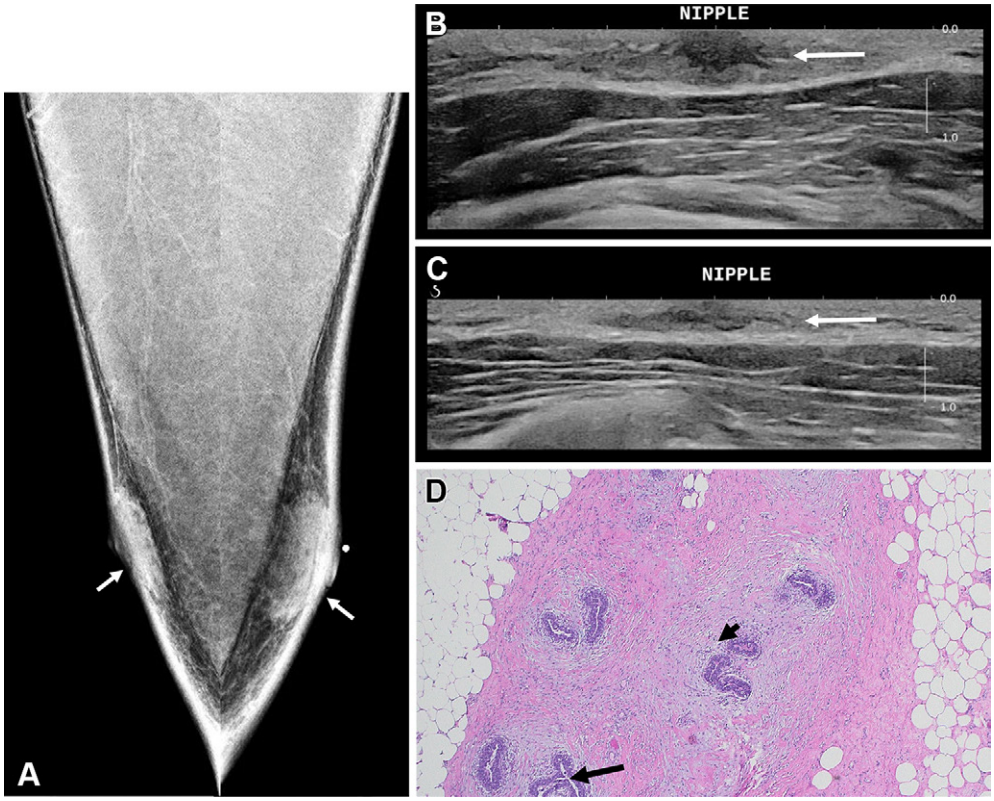


Figure 4. Nodular gynecomastia in an 18-year-old man with a palpable abnormality in the subareolar left breast. **(A)** MLO views of both breasts show fan-shaped subareolar dense tissue, greater on the left than on the right (arrows). The palpable area of concern on the left is indicated by a BB marker on the skin. **(B)** US image of the subareolar left breast shows triangular-shaped hypoechoic tissue extending from the nipple (arrow). **(C)** US image of the subareolar right breast shows a similar but less-pronounced appearance of the subareolar tissue (arrow), consistent with nodular gynecomastia. **(D)** Photomicrograph of a core needle biopsy specimen shows proliferation of periductal connective tissue with inflammation (short arrow) and mild epithelial proliferation (long arrow). (Hematoxylin-eosin [H-E] stain; original magnification, ×10.)

posteriorly into fat. US evaluation of nodular gynecomastia may demonstrate hypoechoic fan-shaped, disc-shaped, or triangular hypoechoic subareolar tissue (Fig 4) but may also have the appearance of a suspicious irregular mass, particularly when the US imaging technique is suboptimal. Periductal edema and increased vascularity are often present and are associated with symptoms of a tender palpable lump in these patients (13,31).

Dendritic gynecomastia has typically been present for longer than 1 year and is characterized histologically by ductal ectasia and stromal fibrosis. This is considered the quiescent phase of gynecomastia and may be palpable but is less commonly painful than is nodular gynecomastia. The development of fibrosis in this entity causes it to be irreversible. Dendritic gynecomastia is characterized mammographically by a flame-shaped density in the subareolar breast with fingerlike projections extending posteriorly into fat, and it may extend to involve the upper outer breast. A similar flame-shaped appearance of tissue is seen in the subareolar breast at US, and projections of this tissue extending into the fat may be visualized. Relatively more hyperechoic tissue is seen due to associated fibrosis, with less associated vascularity (Fig 5) (13,31).

Although nodular and dendritic gynecomastia both may have a suspicious appearance at US, scanning the contralateral breast with US can be helpful because it often shows similar although sometimes less pronounced findings. This provides reassurance that the symptomatic breast findings are related to gynecomastia, because bilateral breast cancer is rare in male patients (Fig 4) (19). In addition, use of the scanning techniques highlighted in Figure 2 can help to elongate the subareolar ducts and demonstrate a benign US appearance in a patient with gynecomastia (Fig 5) (13).

Diffuse glandular gynecomastia is the final pattern, which typically has features of both nodular and dendritic gynecomastia. Diffuse glandular gynecomastia is usually caused by long-standing treatment with exogenous estrogen, as may be seen in transgender women (31). Mammography and US demonstrate an appearance similar to female breasts with heterogeneously dense tissue (Fig 6) (31).

Treatment of gynecomastia typically begins with conservative measures of lifestyle and medication modification. Additional treatments include tamoxifen and other selective estrogen receptor modulators, aromatase inhibitors, and androgens. Surgical excision is sometimes performed in refractory cases (32).

Male Breast Cancer

MBC is rare, accounting for up to approximately 1% of cases of breast cancer and less than 1% of cancers in men. Authors of some reports (4–6) indicate that the incidence of MBC has been increasing, with the increase being greater than that of FBC according to Surveillance, Epidemiology, and End Results (SEER) data in recent decades. The average age at diagnosis is 65 years, higher than the average age at diagnosis of 60 years in women (9). Risk factors for MBC include advanced age, personal or family history of breast cancer, genetic mutations including *BRCA1* and *BRCA2* (*BRCA2* more commonly than *BRCA1*) (3,33); genetic syndromes including Klinefelter syndrome, Ashkenazi Jewish heritage and other ethnicities (34); and conditions including cirrhosis, obesity, testicular abnormalities, hyperprolactinemia, HIV infection, radiation therapy to the chest, treatment of prostate cancer, and environmental exposures (13) (Table 2). Many of these conditions involve an increased estrogen to androgen ratio, as is present

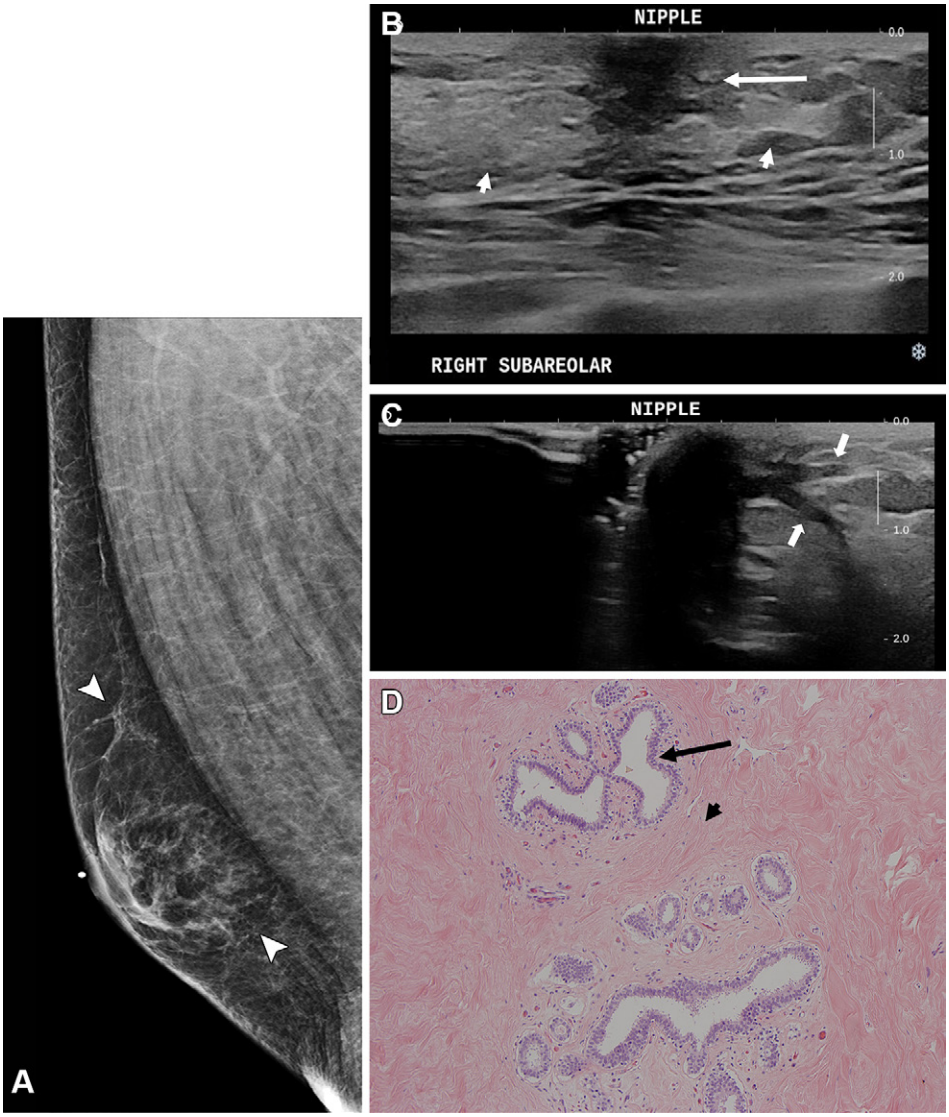


Figure 5. Dendritic gynecomastia in a 48-year-old man with a history of left mastectomy for invasive ductal carcinoma (IDC) who presented with a palpable abnormality and tenderness in the right breast. **(A)** MLO mammographic view of the right breast shows flame-shaped subareolar tissue, with projections extending posteriorly into fat (arrowheads). **(B)** US image shows corresponding subareolar findings initially considered suspicious for an indistinct antiparallel hypoechoic mass (long arrow), with surrounding hyperechoic tissue (short arrows). **(C)** However, use of scanning techniques such as the rolled nipple technique can help elongate the ducts (arrows) for better visualization, demonstrating that the findings represent benign gynecomastia. **(D)** Photomicrograph of dendritic gynecomastia shows hyalinized periductal stroma with associated fibrosis (short arrow) surrounding benign ducts (long arrow). (H-E stain; original magnification, ×10.)

Figure 6. Diffuse glandular gynecomastia in a 58-year-old man with hypertension undergoing long-term treatment with spironolactone who presented with bilateral palpable breast abnormalities (arrowheads). MLO bilateral mammographic views show heterogeneously dense breast tissue in the subareolar regions of both breasts extending posteriorly, with an appearance indistinguishable from that of a mammogram in a woman. The patient underwent bilateral mastectomy, with pathologic evaluation showing bilateral gynecomastia with fibrosis and no malignancy in either breast.

Table 2: Risk Factors for MBC

Advanced age
Personal history of breast cancer
Family history of breast cancer
Genetic and chromosomal mutations
BRCA1, BRCA2, CHEK2, PALB2, CYP17A1, PTEN mutations
Klinefelter, Kallman, and Cowden syndromes
Ashkenazi Jewish, Egyptian, or West African ethnicity
Excess estrogen or low testosterone
Cirrhosis
Obesity
High-dose estrogen therapy
Treatment of prostate cancer
Testicular abnormalities (torsion, trauma, orchitis, or undescended testes)
Inguinal hernia repair
Radiation to the chest
HIV infection
Hyperprolactinemia
Long-term environmental exposures
High temperatures
Electromagnetic fields

in gynecomastia, and gynecomastia may coexist with MBC in up to 40% of patients (35). However, a similar percentage of gynecomastia has been seen in males without MBC, and a causal link between MBC and gynecomastia has not been established (26,36).

Patients with MBC most commonly present with a palpable abnormality but may also present with nipple discharge (a symptom that is more commonly related to cancer in men, when present, than it is in women), nipple or skin retraction, skin changes including ulceration, and palpable axillary adenopathy (17,27,37). Axillary US should be performed in all male patients with breast masses suspicious for cancer because approximately one-half of MBCs involve the axillary lymph nodes (10,11).

In women, breast cancer typically arises in the terminal ductal lobular unit and most commonly occurs in the upper outer quadrant, where the greatest amount of fibroglandular tissue is present (38,39). In comparison, male breast tissue is predominantly located in the subareolar breast, and MBCs typically arise in the central ducts (11). Therefore, MBC is usually roughly subareolar, though it can be seen elsewhere in the male breast, most commonly in the upper outer quadrant (11,37,40). In comparison with gynecomastia, which is subareolar and usually concentric to the nipple, subareolar MBC is more likely to be eccentric to the nipple (13). MBC is typically not painful, a fact that may help to distinguish it from gynecomastia, which is often painful in its earliest phase (17). Differences in the clinical manifestations of MBC and gynecomastia are shown in Figure 7.

Men with MBC tend to present at a later stage than do women with FBC. A recent large population-based study by Weir et al (9) of male and female patients with breast cancer showed that MBC tumors are, on average, larger than FBC tumors and more frequently involve regional lymph nodes. This is likely due in part to the fact that men often delay pursuing medical attention for breast symptoms. In addition, the relatively smaller male breast size results in MBC more commonly involving surrounding structures such as the skin or chest wall, contributing to a higher stage at diagnosis (13). Although some studies have shown equivalent survival among patients with stage-matched MBCs and FBCs, other recent large studies have shown a worse prognosis in patients with MBC when compared with patients with age- and stage-matched FBC (9,41). In addition, although breast cancer mortality rates have improved for both men and women in recent decades, this has occurred to a lesser degree in male versus female patients (42).

Pathologic and Imaging Findings of MBC

Invasive Ductal Carcinoma

MBC is invasive ductal carcinoma (IDC) of no special type in approximately 85%–87% of cases (meaning that it demonstrates no specific cellular differentiation), compared with in approximately 74% of cases of breast cancer in women (43,44). Associated ductal carcinoma in situ (DCIS) may be present in up to 50% of cases of IDC in men and is often high grade (45). Up to approximately 92% of MBCs are positive for either estrogen or progesterone receptors. MBC is less likely to be ERRB2-positive (formerly, HER2-positive) and is much less likely to be triple negative than is FBC (9).

Imaging features of IDC in men are typically similar to those in women, with mammography often demonstrating an irregular high-density spiculated or indistinct mass or, less commonly, architectural distortion. It is usually subareolar but may be eccentric to the nipple and may involve the nipple or skin, with associated retraction and skin thickening (11). Calcifications may be associated with malignant masses in approximately 7%–29% of MBCs and have been reported to be coarser and less numerous than calcifications associated with FBC (11,37,46,47). At US, MBC is usually characterized by an irregular hypoechoic or, less commonly, complex cystic and solid mass, with angular, indistinct, or microlobulated margins and internal vascularity (11,46,48) (Fig 8). However, MBC may demonstrate falsely benign-appearing findings such as an oval shape and circumscribed margins at both mammography and US (11,17,40,46). Because benign breast masses in women that have these features, such as fibroadenomas, are rare in men, any solid mass detected in a male patient should be regarded with suspicion. Posterior features of MBCs have been reported to be variable, including enhancement, mild shadowing, a combined pattern, or no substantial posterior features (11,47,48).

Ductal Carcinoma in Situ

Pure DCIS comprises approximately 5%–10% of MBCs and is less common than it is in women, in whom 20%–25% of

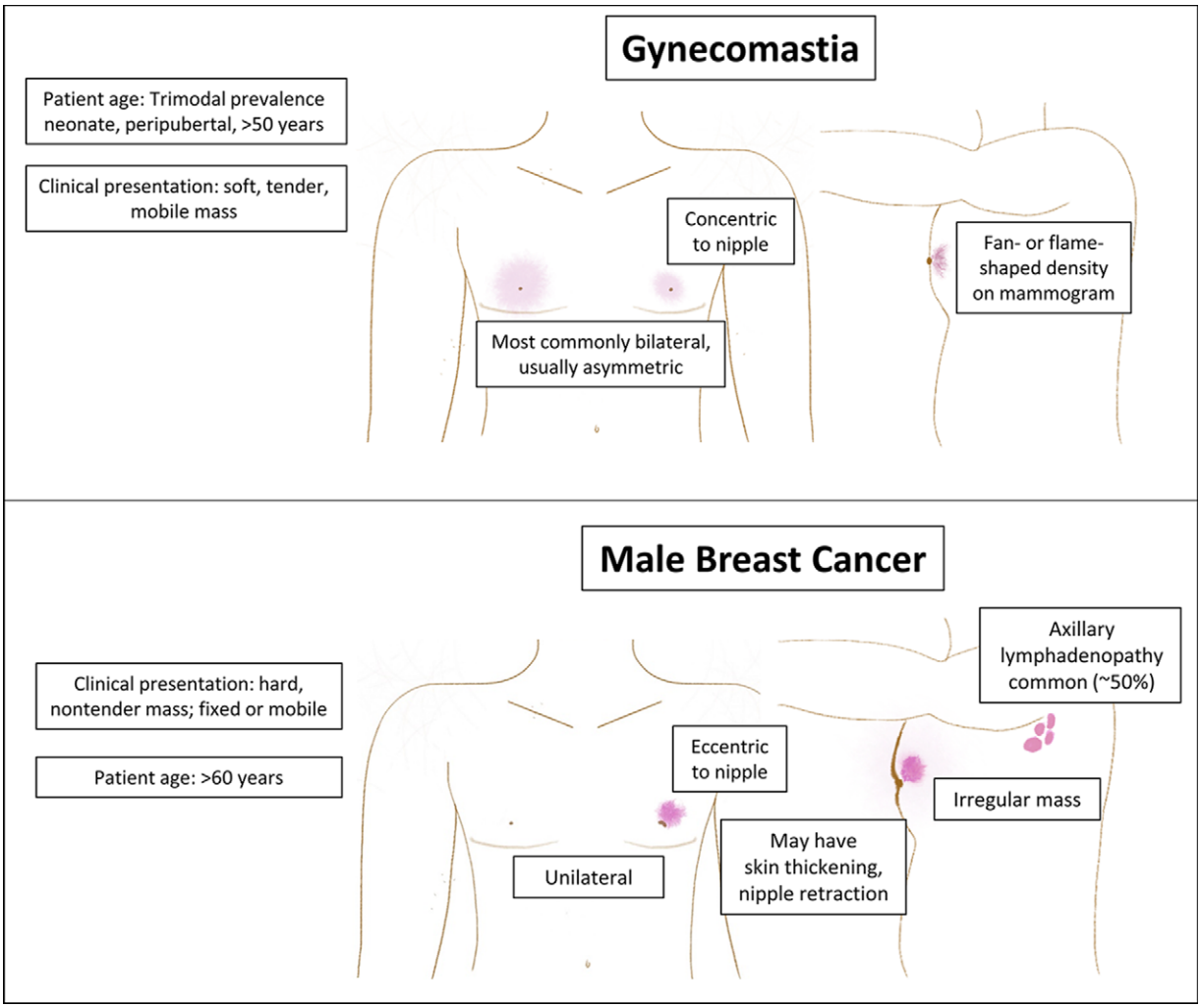


Figure 7. Illustration shows the clinical and imaging differences between MBC and gynecomastia.

breast cancers are DCIS (11,45,49,50). This may be partially related to the lack of breast cancer screening in men, in whom routine mammographic screening is not indicated due to the low prevalence of MBC in the general male population. Male patients with DCIS typically present with a palpable mass, nipple discharge (which may be bloody or clear), or both (45,51,52). Isolated DCIS in men is usually low or intermediate grade and often demonstrates papillary architecture that may have a superimposed cribriform pattern (45,52). Imaging features of DCIS in men include a circumscribed or indistinct hypoechoic mass or a mixed cystic and solid mass that may be predominantly cystic (Fig 9) (53). Therefore, careful scrutiny of any cystic breast mass for the presence of a solid component in male patients is required because benign parenchymal cysts are rare in male patients (22,54). Calcifications are uncommonly the sole mammographic manifestation of MBC, particularly in a patient with pure DCIS (1,51). Calcifications in a male breast should be viewed with suspicion unless they are definitively shown to be a benign process such as fat necrosis or skin calcifications, because benign causes of calcifications such as fibrocystic changes seen in women are infrequently seen in men (11).

Papillary Carcinoma

Papillary carcinoma comprises 2.5%–5% of MBCs and has been reported to be the second most common histologic subtype of breast malignancy in men. Papillary carcinoma has been reported to be twice as prevalent in patients with MBC than in those with FBC (4,44,55). This is thought to be due to the predominantly larger ducts that make up typical male breast tissue, in which these neoplasms tend to occur (55).

Encapsulated papillary carcinoma is a particular subtype of this disease composed of neoplastic cells arranged in papillary fronds over fibrovascular stalks, with lack of an associated myoepithelial cell layer in the papillae and the periphery of the involved duct. Because myoepithelial cells are absent, encapsulated papillary carcinoma appears to represent an invasive carcinoma. However, it is distinguished by the presence of a fibrous capsule surrounding the neoplastic cells. It is usually of low or intermediate grade and tends to have an indolent course similar to that of DCIS, and axillary metastases are rare (56). Therefore, this form of papillary carcinoma typically has a good prognosis. Invasion of cells through the fibrous capsule into the surrounding stroma may occur, in which case, the invasive component is most often IDC, no special type (Fig 10). In the absence of an invasive component,

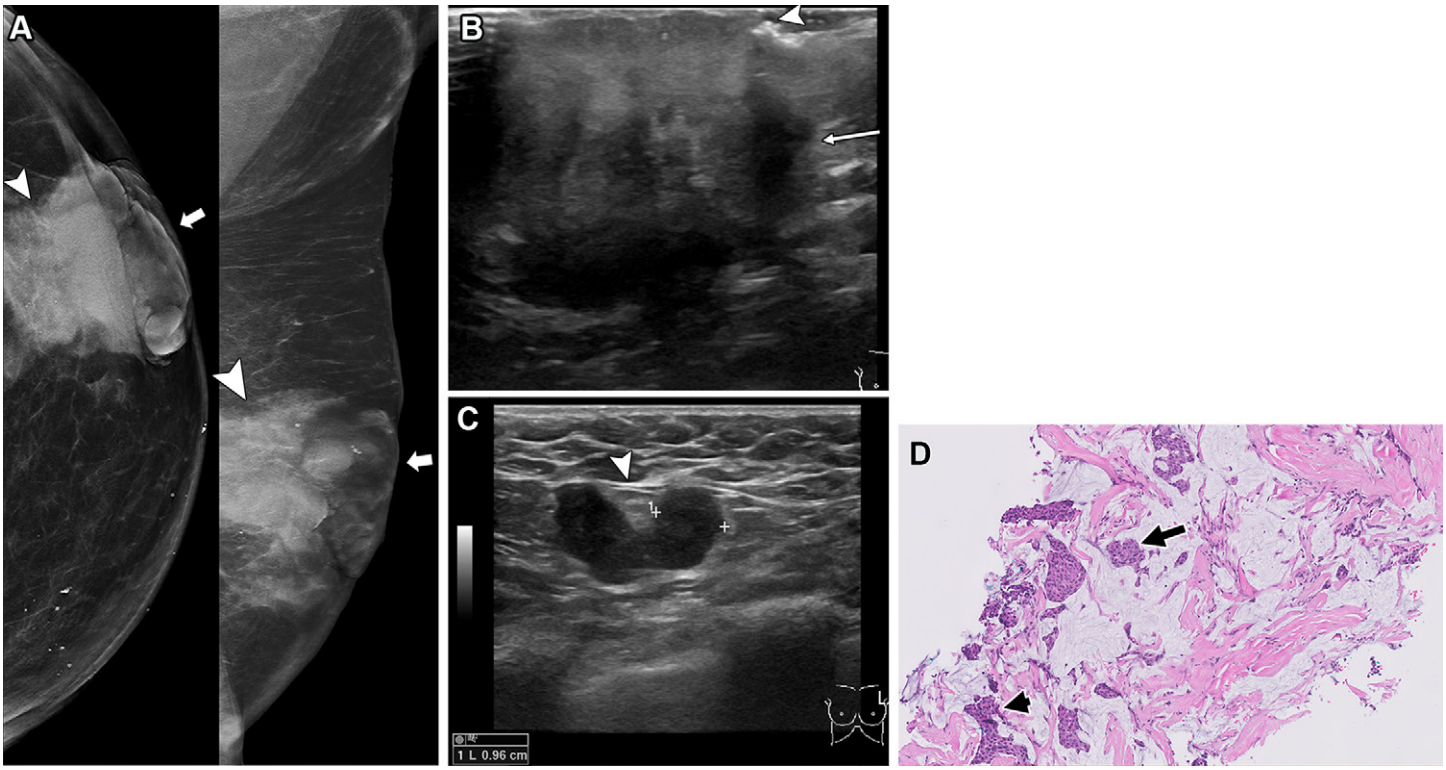


Figure 8. IDC with mucinous features in a 69-year-old man who presented with a palpable lump in the left breast. **(A)** Craniocaudal and MLO views of the left breast show a high-density irregular palpable subareolar left breast mass (arrowheads), with some indistinct margins, which involves the overlying skin and the nipple-areolar complex (arrows). **(B)** US image of the left breast shows a corresponding irregular hypoechoic mass with indistinct margins (arrow) that involves the overlying skin, which is thickened (arrowhead). **(C)** US image of the left axilla shows a morphologically abnormal lymph node with cortical thickening up to approximately 1 cm (calipers), with effacement of the echogenic fatty hilum (arrowhead). **(D)** Photomicrograph of left mastectomy specimen shows nests of tumor cells infiltrating the stroma (short arrow) while others nest in pools of mucin (long arrow), consistent with IDC with mucinous features. Pathologic examination of lymph node biopsy specimen (not shown) was positive for metastatic disease. (H-E stain; original magnification, ×4.)

World Health Organization guidelines (56) state that encapsulated papillary carcinoma should be staged as "pTis" (ie, identical to DCIS), to prevent overtreatment. Encapsulated papillary carcinoma manifests at mammography as a round or oval mass, with circumscribed or obscured margins, or may demonstrate indistinct margins if there is an associated invasive component. On US images, it may appear as a circumscribed complex cystic and solid or completely solid mass, or it may be seen as a mass with a dilated duct, with associated vascularity. Other variants of papillary carcinoma, including solid papillary carcinoma and invasive papillary carcinoma, can also be seen in men (57).

Invasive Lobular Carcinoma

ILC is rare in male patients, representing approximately 0.5%–1.5% of cases of MBC (vs 10%–15% of cases of FBC) because men generally do not develop breast lobules (43,55,58,59). ILC has been reported to occur in men with Klinefelter syndrome, who have an up to 50 times greater relative risk of MBC (59,60). ILC can also occur in men who have long-term exposure to estrogen (13). ILC typically manifests as a palpable abnormality in older men. Although lobular carcinoma in situ is often seen with ILC in women, it is rarely associated with ILC in men (61). ILC is characterized histologically by discohesive cells lacking the e-cadherin binding protein that invade in a single-file pattern. Due to this invasion pattern, ILC can be subtle or occult at mammography and US. More commonly, ILC may manifest mammographically as a spiculated mass, architectural distortion, or focal asymmetry and at US as an ill-defined hypoechoic shadowing mass or as shadowing without a mass (Fig 11) (25).

Other Male Breast Malignancies

Metastases to the male breast are rare (25). However, in patients with a known extramammary primary tumor, particularly in those with widespread metastatic disease, secondary involvement of the breast should be considered, given the rarity of primary MBC. Metastases to the breast are most commonly from lymphoma and melanoma but can also occur from prostate and lung cancer, among other types (44,62). At mammography and US, metastases to the breast may manifest as multiple mostly circumscribed masses; may appear as a solitary, round, relatively circumscribed mass (Fig 12); or may have an irregular shape and margins. Primary breast lymphoma and sarcomas may also occur but are rare in men.

Treatment of MBC

MBC is typically treated with mastectomy and much less commonly with breast conservation therapy. Treatment is otherwise largely extrapolated from evidence-based guidelines

Figure 9. DCIS in a 51-year-old man who presented with a palpable left breast mass. **(A)** Craniocaudal and MLO bilateral mammographic views show an irregular indistinct mass in the left breast at the 3-o'clock position, 1 cm from the nipple (arrows), corresponding to the patient's palpable abnormality (marked by a BB skin marker), and no suspicious findings in the right breast. **(B)** US image shows a corresponding mixed cystic and solid irregular mass (arrowhead) with peripheral vascularity. **(C)** Photomicrograph of a specimen from mastectomy of the left breast shows an intraductal proliferation consisting of a monotonous population of atypical cells (arrows) in a cribriform pattern. The findings are consistent with DCIS, cribriform and micropapillary type, intermediate nuclear grade. (H-E stain; original magnification, ×4.)

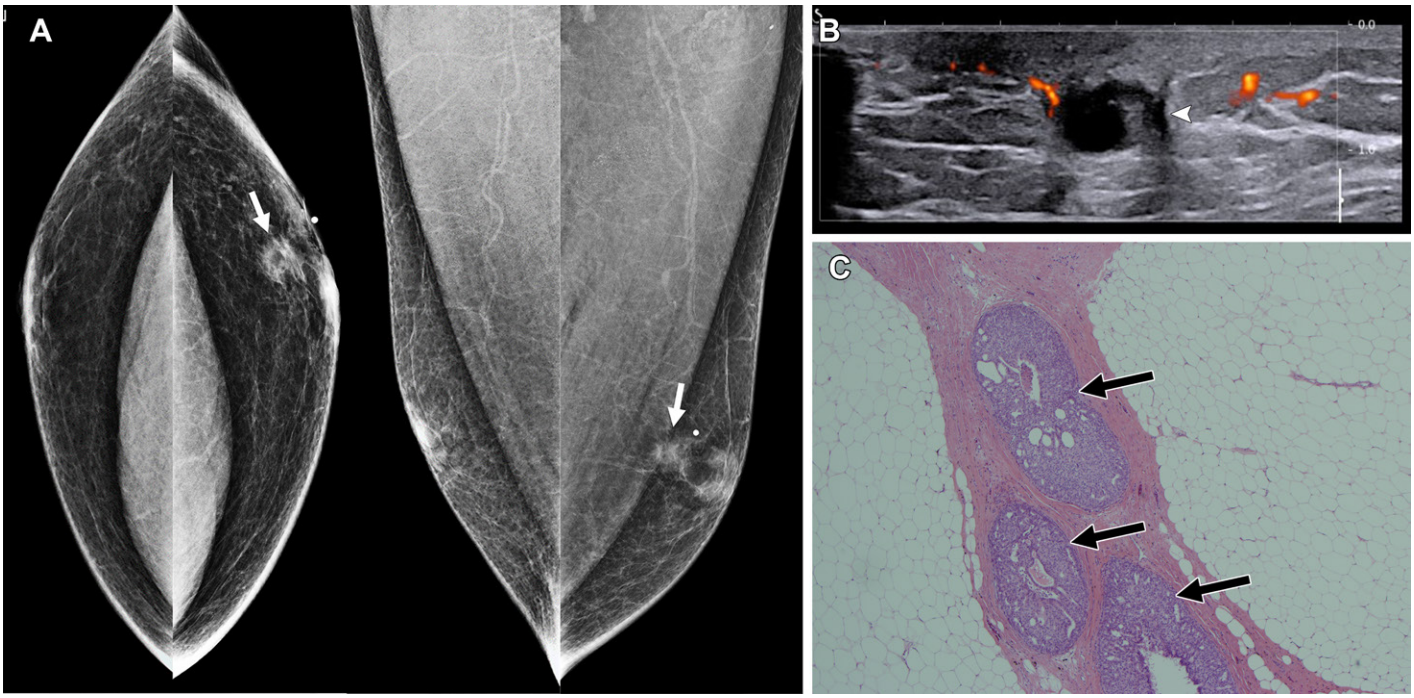
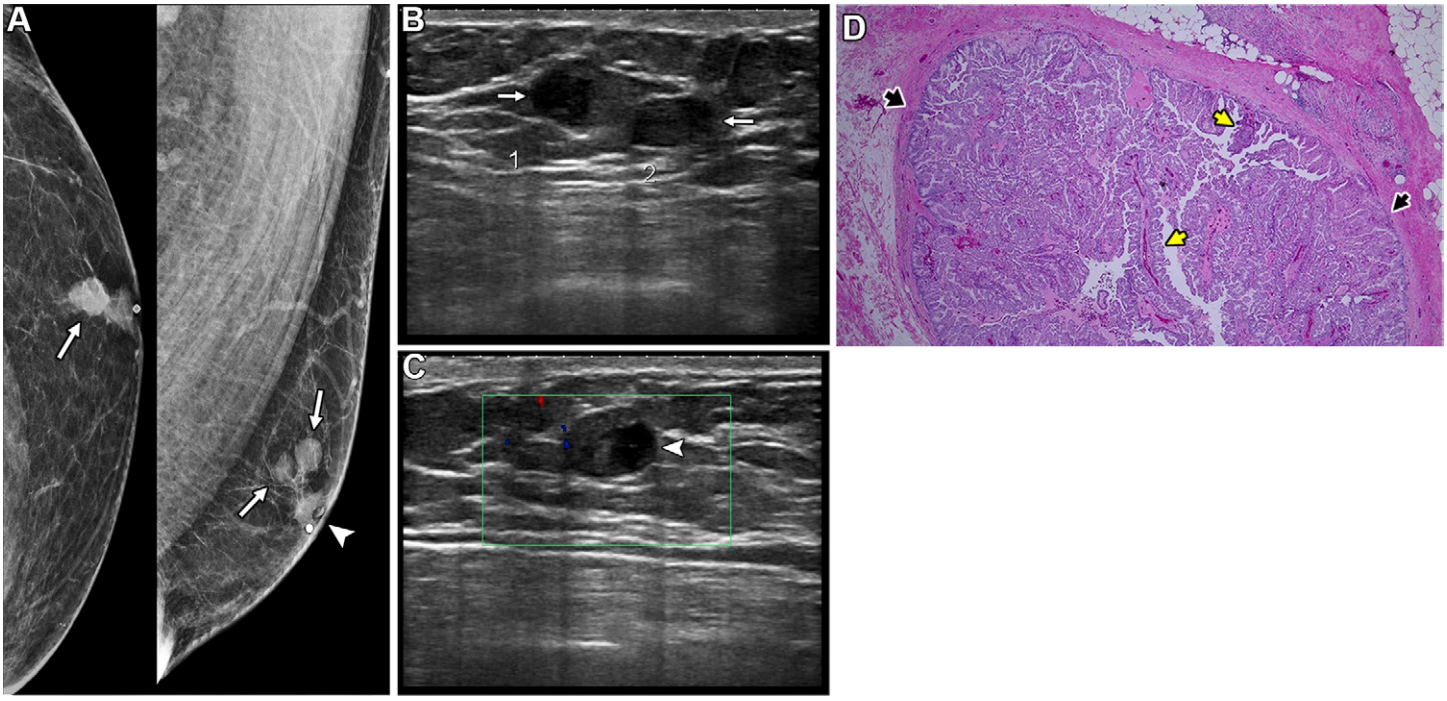


Figure 10. Encapsulated papillary carcinoma with foci of invasion and ductal carcinoma in situ (DCIS) of the left breast first seen at CT (not shown) in a 68-year-old man. **(A)** Craniocaudal and MLO views of the left breast show a bilobed subareolar left breast mass (arrows) with partially indistinct margins and associated mild nipple retraction (arrowhead), which corresponds to the finding at CT (not shown). The BB marker on the mammogram indicates the nipple. **(B)** US image shows two adjacent corresponding complex cystic and solid masses (arrows), with subtle posterior acoustic enhancement. **(C)** Doppler US image of the larger mass shows minimal peripheral but no substantial internal vascularity (arrowhead). **(D)** Photomicrograph of a specimen from left mastectomy shows the encapsulated papillary carcinoma. The lesion has a well-defined capsule (black arrows) and demonstrates a papillary and micropapillary architecture (yellow arrows). Two separate foci of IDC, no special type, grade 2, and DCIS were also present (not shown). (H-E stain; original magnification, ×200.) (Photomicrograph courtesy of Olaronke Akintola-Ogunremi, MD.)



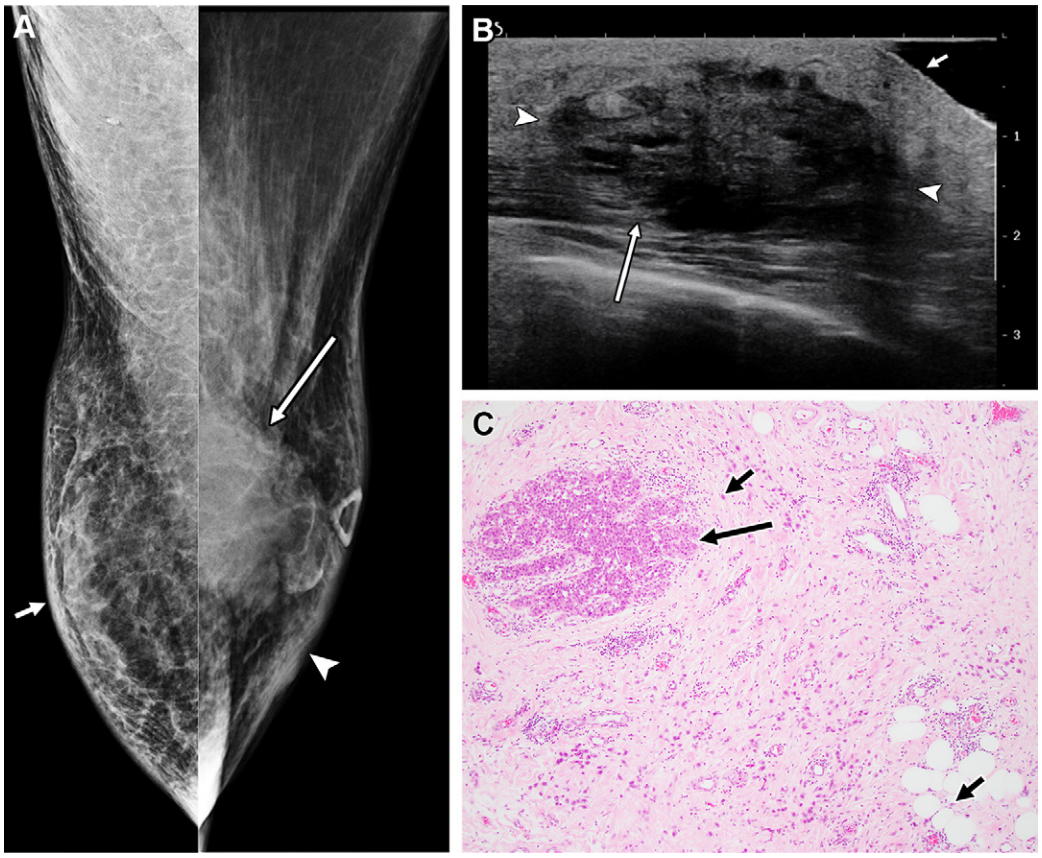


Figure 11. ILC in a man and ILC and lobular carcinoma in situ in a woman. **(A, B)** Pleomorphic ILC in an 80-year-old man with kidney failure who underwent prostatectomy for prostate cancer and presented with a new palpable mass in the left breast. Bilateral MLO mammograms **(A)** show an indistinct subareolar mass in the left breast (long arrow in **A**) corresponding to the palpable area of concern with a triangular-shaped skin marker. Skin thickening is noted over the left breast (arrowhead in **A**). Although the latter finding could be partly related to the patient's kidney failure, asymmetry with the right breast and the presence of a suspicious mass in the left breast raise concern for malignant skin involvement. There is dendritic gynecomastia in the subareolar right breast (short arrow in **A**). US image of the subareolar left breast **(B)** shows an irregular hypoechoic mass with indistinct margins (arrowheads in **B**) invading the underlying pectoralis muscle (long arrow in **B**) and involving the overlying skin, which is thickened (short arrow in **B**). Axillary US (not shown) did not show enlarged lymph nodes. Subsequent mastectomy showed pleomorphic ILC, grade 3/3, invading the overlying skin and nipple with ulceration and invading the underlying skeletal muscle, compatible with a T4b tumor. Five of six axillary lymph nodes were positive for metastatic disease. **(C)** Photomicrograph of a US-guided breast biopsy specimen in a woman with ILC and lobular carcinoma in situ shows discohesive neoplastic cells (short arrows) infiltrating in a single-file pattern around adipose tissue and around a preexisting lobular unit that is expanded by lobular carcinoma in situ (long arrow). Note that even in a patient with ILC, lobular carcinoma in situ rarely occurs in men due to lack of lobules. (H-E stain; original magnification, ×20.)

for treatment of FBC, given the rarity of MBC and difficulty in recruiting male patients for clinical trials. However, although most MBCs are hormone-receptor positive, endocrine therapy may be less commonly used than it is in women, which could contribute to poorer outcomes (9).

Benign Male Breast Entities

A variety of benign breast entities manifest in men and are typically detected when a male patient presents with a palpable breast abnormality. Many of these benign entities share imaging features with those found in women. However, some entities demonstrate specific clinical or imaging findings in men or are found more frequently in men with breast lesions that require biopsy, given the narrower range of typical abnormalities that occur in the male breast. Lipomas and angiolipomas, skin findings (eg, sebaceous cysts, epidermal inclusion cysts, and pilomatricomas), lymph nodes, and fat necrosis may be found in the male breast and demonstrate similar clinical and imaging findings to those found in the female breast (Figs S1–S6). Because of these similarities, these entities are not discussed in detail.

Abscess

Men with long-standing gynecomastia may develop chronic ductal ectasia and can develop any of the complications that

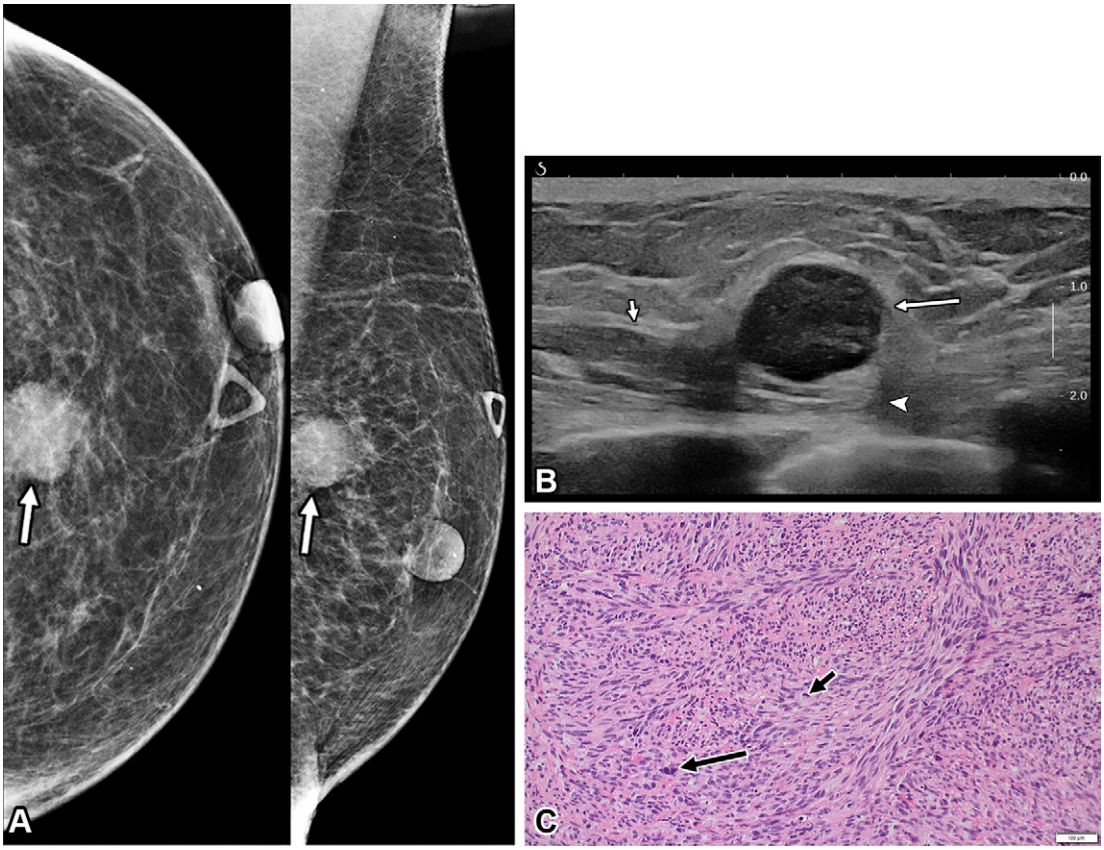


Figure 12. Melanoma metastasis to the breast in a 79-year-old man with a remote history of melanoma and a fluorodeoxyglucose (FDG)-avid mass in the left breast detected at a recent PET/CT examination (not shown). **(A)** Craniocaudal and MLO mammograms of the left breast show an oval indistinct mass in the posterior slightly upper inner left breast (arrows) that corresponds to the finding at PET/CT (not shown) and was found to be palpable at the time of this study; thus, a triangular-shaped skin marker was placed over the mass. **(B)** US image shows a corresponding oval circumscribed mildly heterogeneous hypoechoic mass (long arrow) with posterior acoustic enhancement (arrowhead) that abuts the pectoralis muscle (short arrow). **(C)** Photomicrograph of a left breast excisional biopsy specimen shows an atypical spindle cell proliferation with frequent large cells (long arrow) and mitoses (short arrow). (H-E stain; original magnification, ×10.) Ancillary studies (not shown) allowed confirmation of the diagnosis of metastatic melanoma.

are seen in women, including periductal mastitis and abscesses (13). A breast abscess is a localized infectious collection of fluid that occurs due to ductal ectasia and chronic obstruction that leads to secondary inflammation (63). Breast abscesses are rare in men, most occurring in the subareolar region, where the ductal tissue is primarily located in male patients (63,64). Risk factors include smoking, diabetes mellitus, and obesity (65). Patients usually present with mastalgia and a tender subareolar breast mass and may have associated nipple discharge (21). Mammography may show an ill-defined subareolar mass with adjacent trabecular thickening. US may show a corresponding irregular complex cystic and solid mass or hypoechoic fluid collection with mobile internal debris or fluid-fluid level (Fig 13). There may be increased echogenicity of the surrounding fat, and color Doppler US may show increased peripheral vascularity, with sparse or absent internal flow in the collection. Imaging findings can mimic malignancy or gynecomastia, particularly given the propensity of all three to manifest in the subareolar breast, and biopsy may be needed to exclude malignancy (13,66).

Treatment of breast abscesses includes antibiotic therapy and percutaneous drainage (63,64). Chronic subareolar abscesses may be complicated by the development of cutaneous fistulous tracts. Treatment of recurrent abscesses or cutaneous fistulous tracts requires complete surgical excision (64,65).

Hemangioma

Hemangiomas are benign vascular neoplasms formed by proliferation of endothelial-lined vascular channels (67). Hemangiomas are rarely found in the male breast, and patients typically present with a palpable painless mass (25,63,67). Hemangiomas are often superficial, in the dermis or subcutaneous fat (67). At mammography, they manifest as a circumscribed oval or lobulated mass that may contain calcifications or phleboliths (25,67). US typically shows a superficial circumscribed oval mass of variable echotexture, most commonly hypoechoic (Fig 14) (25,63,67). It is often difficult to distinguish between a hemangioma and an angiosarcoma at imaging and histologic examination. Clinical features that raise suspicion for angiosarcomas are skin discoloration or a

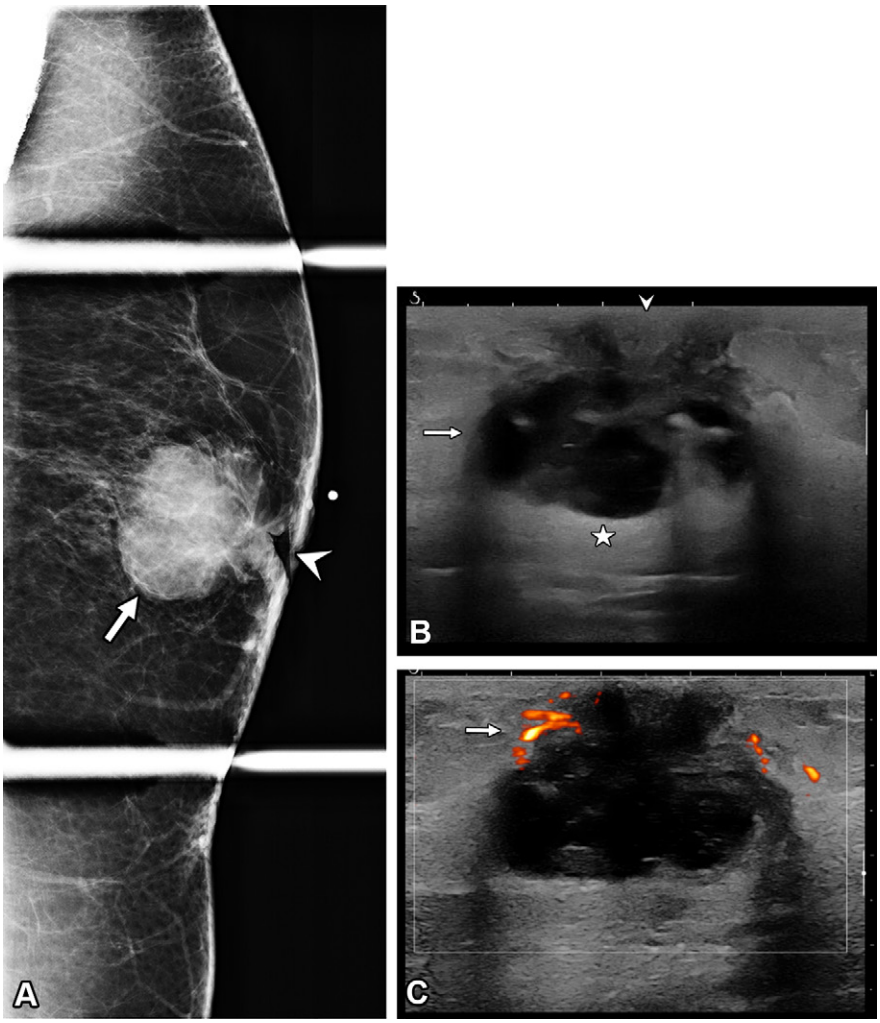


Figure 13. Breast abscess in a 57-year-old male smoker with a palpable mass in the left breast for 1 month and a history of chronic left nipple retraction for 1 year. Pertinent medical history included psoriatic arthritis and immunosuppressive treatment. **(A)** Spot compression tangential view of the palpable left breast abnormality (marked by a BB skin marker) shows an irregular, indistinct, high-density mass in the subareolar breast (arrow), with associated nipple retraction (arrowhead). **(B)** US image shows an irregular complex cystic and solid mass (arrow), with some slightly indistinct margins and posterior acoustic enhancement (☆). The overlying nipple (arrowhead) can be seen and appears intact. **(C)** Doppler US image shows peripheral increased vascularity (arrow) but no internal vascularity. Core needle biopsy specimen (not shown) demonstrated a pleomorphic population of inflammatory cells (neutrophils, lymphocytes, and histocytes) infiltrating the breast parenchyma with necrosis, consistent with an abscess.

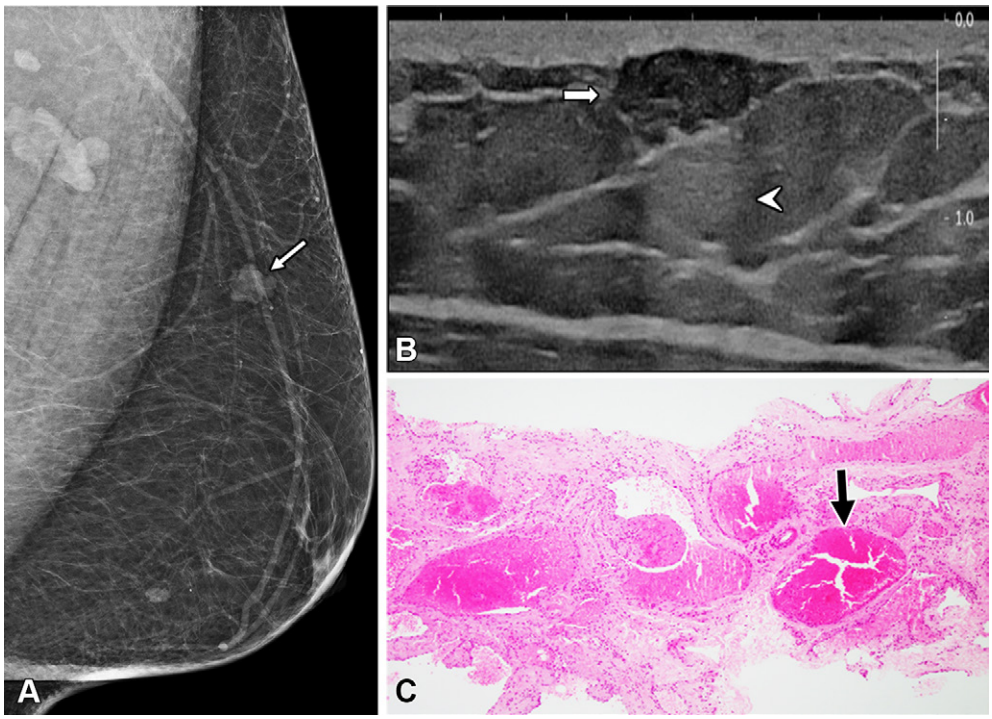


Figure 14. Hemangioma in a 61-year-old man with bilateral retroareolar breast pain. **(A)** Left MLO mammogram shows pseudogynecomastia. A microlobulated mass is seen in the upper left breast (arrow). **(B)** US image shows a corresponding superficial, parallel, microlobulated, hypoechoic mass (arrow) with minimal internal vascularity (not shown) and mild posterior acoustic enhancement (arrowhead). **(C)** Photomicrograph of a core needle biopsy specimen shows dilated vascular channels containing erythrocytes (arrow), consistent with a hemangioma. (H-E stain; original magnification, ×4.)

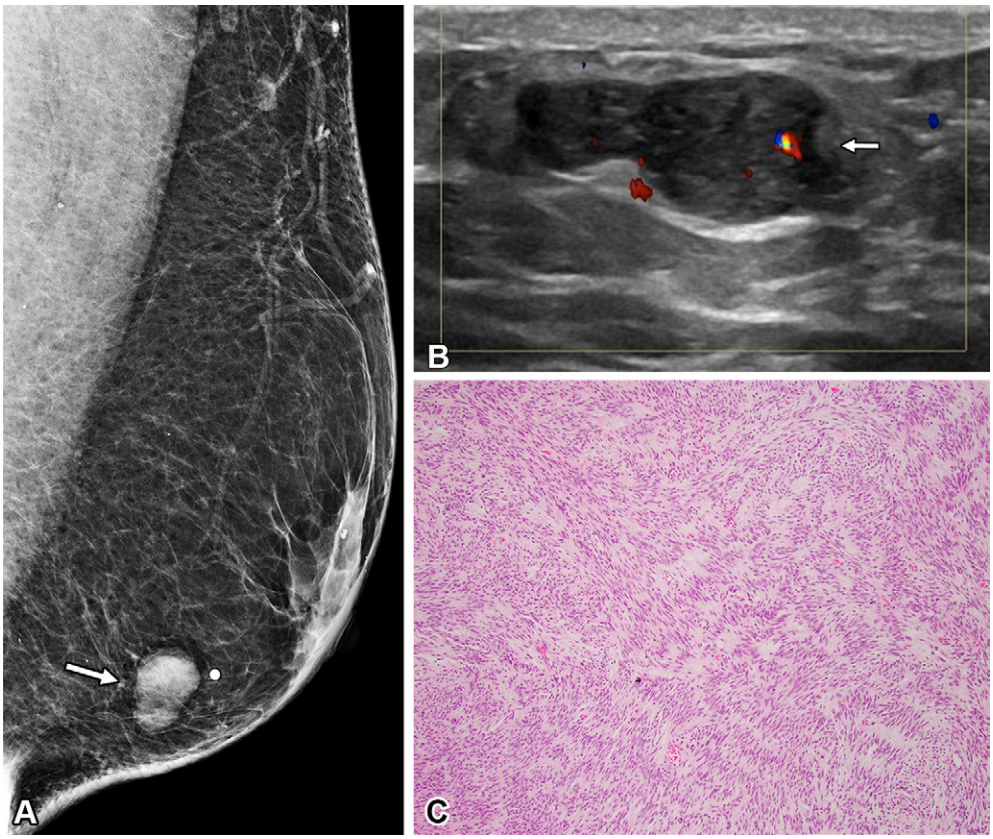


Figure 15. Myofibroblastoma in two patients. **(A, B)** In a 71-year-old man with a palpable breast mass, MLO mammogram **(A)** shows a circumscribed, high-density, bilobed mass in the lower left breast (arrow in **A**), corresponding to the palpable lump (BB skin marker). US image **(B)** shows an oval, parallel, circumscribed, hypoechoic mass with internal vascularity (arrow in **B**). **(C)** In another male patient, photomicrograph of a core needle biopsy specimen shows bland spindle cell proliferation resembling a schwannoma. (H-E stain; original magnification, ×10.) S100 staining (not shown) was negative, but estrogen receptor and smooth muscle actin staining (not shown) were positive, supporting a diagnosis of myofibroblastoma.

large palpable mass with an infiltrative imaging appearance (25,68). Treatment includes core needle biopsy with consideration for complete surgical excision to rule out a low-grade angiosarcoma (25,68).

Myofibroblastoma

Myofibroblastoma, also referred to as a stromal tumor, solitary fibrous tumor, or an atypical variant of a leiomyoma, is a rare benign spindle cell tumor that may occur in the breast (69,70). Some reports (63,67,70) indicate that myofibroblastoma of the breast may have the distinction of being more common in men than in women; however, others (71) have not substantiated this, and the rarity of the diagnosis limits identification of a sex predilection. Men with myofibroblastoma typically present in the 6th and 7th decades of life with a slowly growing painless and mobile breast mass (67,69). Mammography often demonstrates an oval noncalcified mass with circumscribed margins (67,69,71). US frequently demonstrates a circumscribed hypoechoic or mixed-echogenicity mass with posterior acoustic enhancement and sometimes internal vascularity (Fig 15) (67,69,71). However, imaging may sometimes demonstrate an irregular mass with indistinct, angular, or microlobulated margins (70). Core needle biopsy is needed to establish the diagnosis, although histologic diagnosis from core biopsy is difficult due to small samples and the tendency of these tumors to demonstrate a wide range of morphologic characteristics (69). Although this is a benign tumor, without malignant potential, it is often treated with surgical excision for complete histologic evaluation, with local recurrence being rare (2,63,69,71,72).

Intraductal Papilloma

Usual ductal hyperplasia associated with longstanding gynecomastia may, in rare cases, lead to formation of intraductal papillomas in men, which are benign neoplasms composed of a proliferation of ductal epithelium and myoepithelial cells, with a fibrovascular core (13,67,72). Patients typically present with spontaneous bloody or clear nipple discharge or a palpable subareolar mass. Mammography most frequently shows an equal- to high-density subareolar mass that may contain calcifications. At US, a papilloma most commonly appears as a hypoechoic mass in a dilated duct (Fig 16). Color Doppler US may show a vascular stalk extending from the intraductal mass to the wall of the duct, corresponding to the fibrovascular core. Papillomas may also appear as a complex cystic and solid mass or an intracystic mass. Percutaneous core needle biopsy is required for evaluation of a mass with these imaging features, because intraductal papillomas and papillary carcinomas can both have this appearance and cannot be differentiated at imaging. Treatment of intraductal papillomas without atypia at core biopsy in women is somewhat controversial and varies by institution. However, biopsy-proven intraductal papillomas and the associated duct should be excised in male patients to definitively exclude papillary carcinoma because this type of malignancy is more frequently seen among patients with MBC (73).

Pseudoangiomatous Stromal Hyperplasia

Pseudoangiomatous stromal hyperplasia (PASH) is a benign stromal entity rarely seen in the male breast and is formed by proliferation of stromal myofibroblasts, which is hypothesized to be secondary to hormone stimulation (74). Therefore, it is

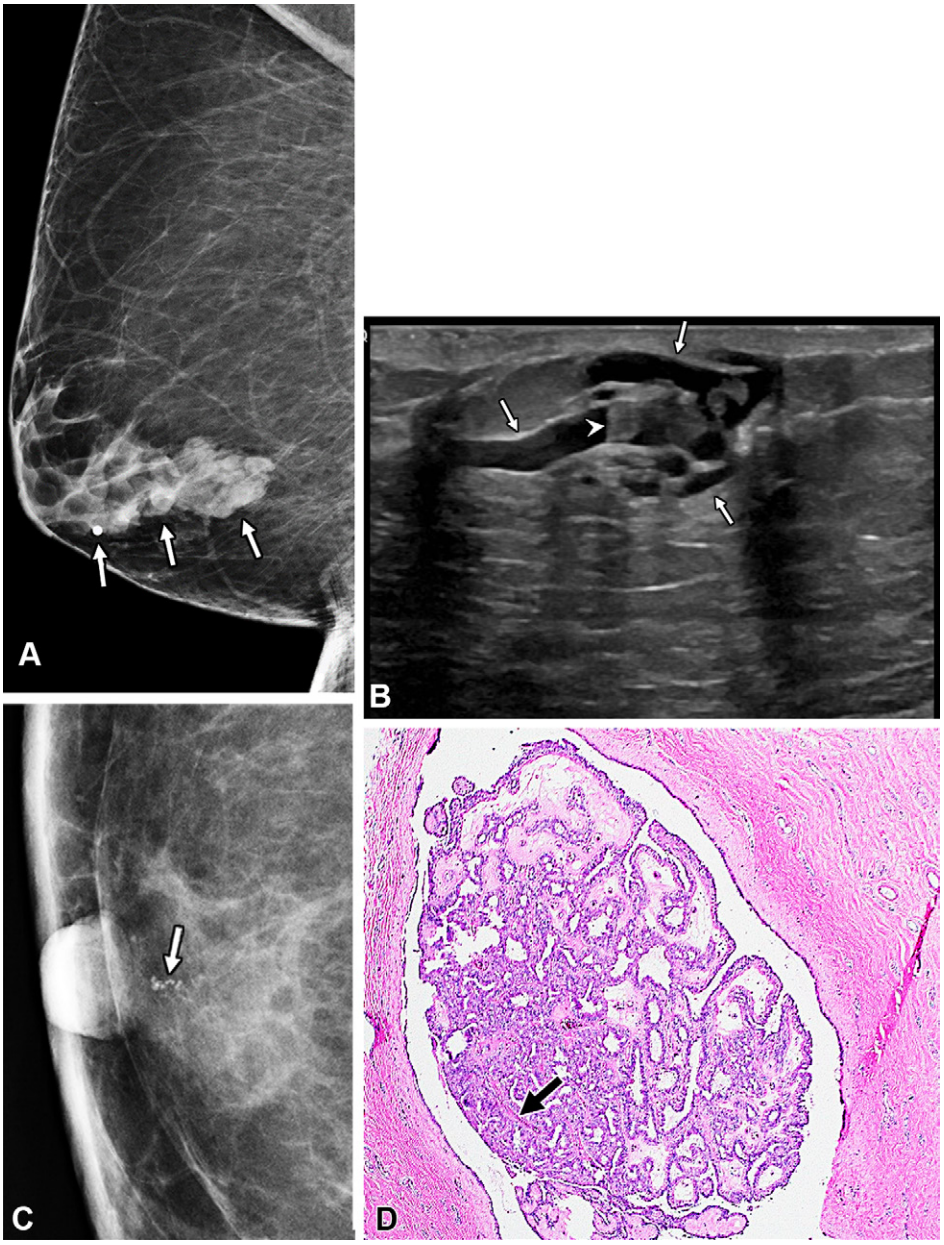


Figure 16. Intraductal papilloma in two male patients. **(A, B)** Right MLO mammogram **(A)** in a 56-year-old man with new right nipple discharge and a palpable subareolar right breast mass shows gynecomastia and serpiginous tubular structures extending from the subareolar breast into the deeper breast tissue in the 6-o'clock region (arrows in **A**). The anterior part of this finding corresponds to the palpable area of concern (BB skin marker). US image **(B)** of this area shows corresponding ductal ectasia (arrows in **B**) and an intraductal mass (arrowhead in **B**). **(C)** Cropped right lateral mammogram (spot magnification view) in another male patient with subsequent biopsy-proven intraductal papilloma without atypia shows associated amorphous calcifications (arrow). **(D)** Photomicrograph of a surgical specimen from the patient shown in **A** and **B** shows arborizing fronds lined by epithelial and myoepithelial cells with central fibrovascular cores (arrow), consistent with a papilloma. (H-E stain; original magnification, ×4.)

most commonly seen in premenopausal women and postmenopausal women taking hormone therapy but can be associated with gynecomastia in men. Other associations include HIV infection, cyclosporine therapy, and neurofibromatosis type 1 (25,67,74). PASH is often occult at imaging and is incidentally found microscopically at pathologic examination of a biopsy specimen of an adjacent lesion. Less commonly, a tumoral form can be seen. Male patients with this form of PASH may present with a palpable breast lump (2,67). Similar to tumoral PASH in women, the appearance at mammography and US in men can vary. At mammography, PASH can appear as a noncalcified mass with circumscribed margins, or less commonly, indistinct margins, or may appear as a focal asymmetry. US most often shows a hypoechoic oval mass with circumscribed margins, although PASH may appear at US as an irregular mass or as a heterogeneous or hyperechoic nonmass lesion (Fig 17) (25,75). Core needle biopsy is required to establish the diagnosis of PASH.

Parenchymal Cyst

Parenchymal cysts are fluid-filled structures lined by epithelium formed secondary to obstruction of the terminal duct lobular unit or a duct (76). Despite being the most common breast mass in women, breast parenchymal cysts are rare in men, which is likely attributed to the lack of mature lobules and underestimation due to the lack of breast cancer screening in men to identify occult cysts (22,54). The majority are associated with gynecomastia, although they may occur sporadically and are usually solitary. Men with breast cysts may present with a palpable mobile mass (54). Mammography shows a round or oval low- or equal-density mass with circumscribed margins (22). At US, a simple cyst appears as a round or oval anechoic mass with circumscribed margins and posterior acoustic enhancement, while a complicated cyst demonstrates low-level internal echoes or mobile echogenic foci representing internal debris (Fig 18). Parenchymal cysts should not contain a solid component, thickened

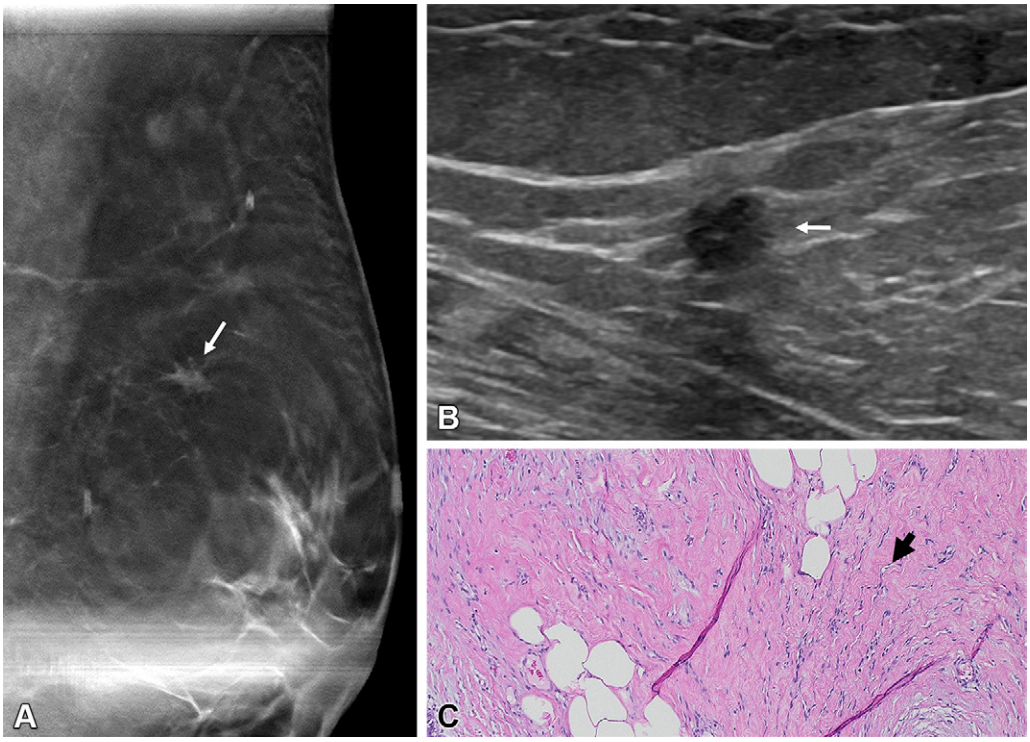


Figure 17. Pseudoangiomatous stromal hyperplasia (PASH) in a 70-year-old man with focal breast pain. **(A)** Left MLO mammogram (spot compression tomosynthesis view) shows an irregular mass in the upper breast (arrow) and gynecomastia. **(B)** US image shows an irregular hypoechoic mass with indistinct margins (arrow). **(C)** Photomicrograph of the surgical specimen shows gynecomastia with focal pseudoangiomatous stromal hyperplasia evidenced by fibrotic stroma with irregular spaces, some of which have fibroblasts (arrows), and which resemble vascular spaces but do not contain erythrocytes (hence, pseudoangiomatous). (H-E stain; original magnification, ×10.)

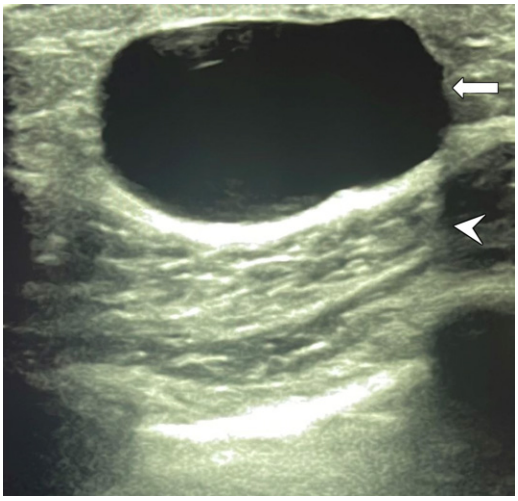


Figure 18. Parenchymal cyst in an 18-year-old man with a palpable subareolar breast mass. US image shows an oval, circumscribed, anechoic mass with an imperceptible wall (arrow), posterior acoustic enhancement (arrowhead), and no internal vascularity (not shown) in the subareolar left breast. There is no overlying tract noted through the skin. Aspiration was performed, yielding 4 mL of brownish fluid and complete resolution of the cyst. Cytologic results showed acute and chronic inflammation and macrophages, without evidence of malignancy. (Case courtesy of Hemali Desai, MD.)

walls, septa, or internal vascularity; the presence of any of these features should prompt tissue sampling to exclude an intracystic papilloma or papillary carcinoma (22). If a mass meets the criteria of a benign cyst at US, even in a male patient, fluid and tissue sampling may be avoided because true cysts have no malignant potential (22).

Fibroadenoma

Fibroadenomas, similar to other breast conditions of lobular origin, are rare in men, given the lack of lobular proliferation (77,78). They are believed to occur in association with hormonal imbalances or medications causing proliferative changes in the male breast (74,79). The majority of fibroadenomas in male patients are reported in patients receiving estrogen therapy, such as transgender women (male-to-female) or patients with prostate cancer (77–79). A small minority of reported cases of male fibroadenomas are idiopathic (74,77,79). Male patients may present with a painless, firm, and mobile breast mass (74). Imaging features of male fibroadenomas are the same as those in women. Mammography shows a circumscribed mass that may or may not contain calcifications, often seen in a man with gynecomastia. US typically shows an oval hypoechoic mass with circumscribed margins (Fig 19) (74,78). Color Doppler US often shows some internal vascularity (78). Tissue diagnosis is often required for confirmation because MBC sometimes appears with deceptively benign imaging features such as an oval shape and circumscribed-appearing margins (11).

Breast Imaging in Transgender Patients

Approximately 1.3 million adults in the United States are transgender (80). Transgender women (male-to-female) may undergo feminizing breast augmentation with exogenous hormone therapy to promote glandular hyperplasia, and/or placement of breast implants with or without fat grafting (Fig S7) (81). Breast augmentation by means of free silicone injection is banned in the United States by the U.S. Food and Drug

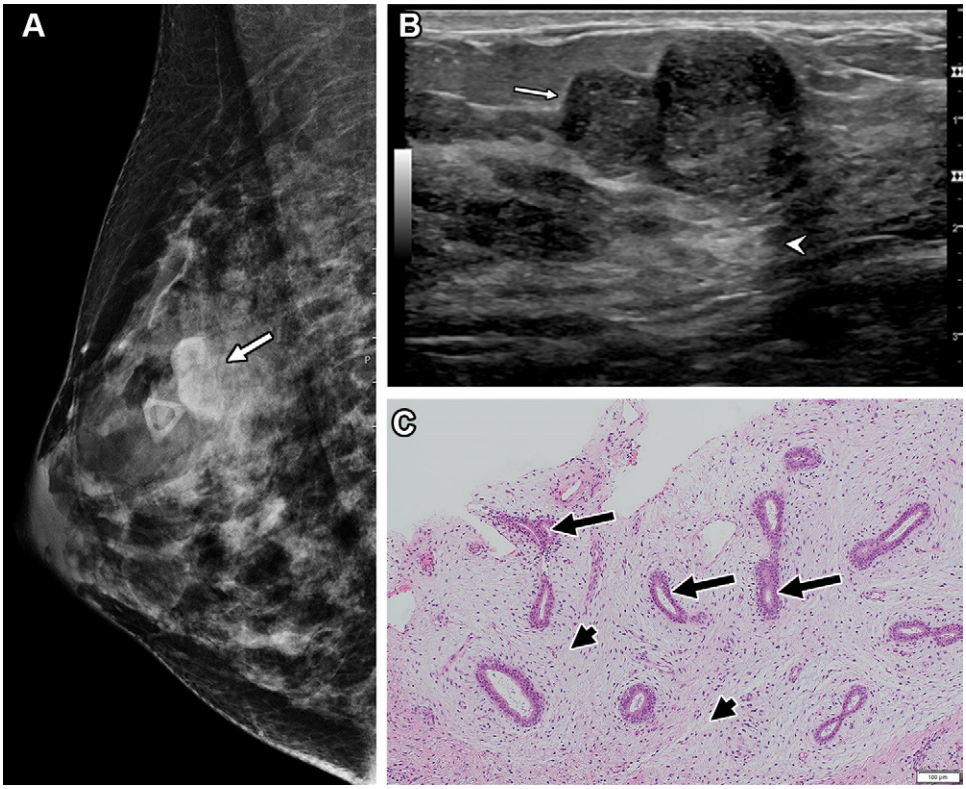


Figure 19. Fibroadenoma in a 36-year-old transgender woman who underwent more than 4 years of estrogen hormone therapy and presented with a palpable breast mass. **(A)** Right MLO mammogram shows an oval partially circumscribed and partially obscured mass in the upper right breast (arrow), corresponding to the palpable lump (triangular-shaped skin marker). The breast is heterogeneously dense due to diffuse glandular gynecomastia, symmetric to the contralateral breast (not shown). **(B)** US image shows an oval, parallel, hypoechoic mass with circumscribed margins (arrow) and mild posterior acoustic enhancement (arrowhead). **(C)** Photomicrograph of the core needle biopsy specimen shows stromal proliferation with fibromyxoid changes (short arrows) and associated ductal proliferation (long arrows), consistent with a fibroadenoma. (H-E stain; original magnification, ×10.)

Table 3: Breast Cancer Screening Guidelines for Transgender Women (Male to Female)

Entity	Recommendations
American College of Radiology	Annual screening mammography in transgender women with above-average risk for breast cancer with past or current hormone use ≥5 years beginning at 25–30 years of age Annual screening mammography may be appropriate in the above-described population group with no or <5 years of hormone use Annual screening mammography may be appropriate in transgender women at average risk with past or current hormone use ≥5 years beginning at age 40 years
University of California, San Francisco, Center of Excellence for Transgender Health	Biennial screening mammography beginning at age 50 years in patients with >5 years of hormone therapy
Fenway Health	Annual screening mammography beginning at age 50 years in patients with >5 years of hormone therapy

Administration, although it is still performed in some parts of the world. Free silicone causes a foreign body reaction, with tissue inflammation and secondary fibrosis that may require extensive débridement. Mammography shows calcified and noncalcified high-density silicone granulomas, while US shows a characteristic "snowstorm" appearance, with echogenic foci demonstrating posterior shadowing (Fig S2). MRI with silicone-specific sequences may be helpful for further characterization (Fig S8). The American College of Radiology, the University of California, San Francisco, Center of Excellence for Transgender Health, and Fenway Health have established screening guidelines for transgender women (Table 3) (82–84).

Transgender men (female-to-male) may opt to undergo masculinizing breast reduction or mastectomy. The breast cancer screening guidelines for transgender men without a history of mastectomy are the same as those for cisgender women of the same age and risk status. For a transgender man with a history of bilateral mastectomy, breast cancer screening with imaging is not recommended, similar to recommendations for cisgender women with a history of bilateral mastectomy.

Breast Cancer Screening in Men at High Risk

There are currently no universally adopted recommendations for screening mammography in men with increased risk of breast cancer, due to the low prevalence of MBC and limited studies supporting screening with imaging. The American Society of Clinical Oncology (ASCO) has recommendations for screening mammography in patients with a personal history of MBC, which differ on the basis of the presence or absence of known breast cancer–related genetic mutation (85). The National Comprehensive Cancer Network (NCCN) recommends annual clinical breast examinations beginning at age 35 for men with a known *BRCA1* or *BRCA2* pathogenic or likely pathogenic variant and advises consideration of annual mammographic screening in older men with gynecomastia and a family history of MBC (86). The recommendations of both organizations are summarized in Table 4.

Table 4: Breast Cancer Screening Guidelines for Men at High Risk

Entity	Recommendations
American Society of Clinical Oncology	Patients with a personal history of MBC and known breast cancer–related genetic mutation: Annual contralateral mammography in those treated with mastectomy Annual bilateral mammography in those treated with lumpectomy Patients with a personal history of MBC treated with lumpectomy and no known genetic mutation: annual screening mammography only of the ipsilateral treated breast
National Comprehensive Cancer Network	Annual clinical breast examination beginning at age 35 for men with a known *BRCA1* or *BRCA2* pathogenic or likely pathogenic variant In men with gynecomastia and a family history of male breast cancer, consider annual screening mammography beginning at age 50 years or 10 years before the earliest known diagnosis of breast cancer in a male relative (whichever comes first)

Authors of studies (1,87) have evaluated the utility of screening mammography in men at increased risk for breast cancer. These studies included men with a personal history of breast cancer, genetic mutation (notably *BRCA1* or *BRCA2*), and/or a first-degree relative with a history of breast cancer (1,87). In a retrospective study published in 2019, Gao et al (1) demonstrated a cancer detection rate of 18 per 1000 screening mammograms in 165 men at high risk (1). In that study, all five screening-detected cancers were early stage and node negative, compared with 58.3% involvement of axillary nodes in a second cohort of symptomatic patients with MBC detected at diagnostic imaging. In a retrospective study published in 2019, Marino et al (87) found a cancer detection rate of 4.9 per 1000 screening examinations in 165 men at high risk, which is comparable to the accepted cancer detection rate of 3–5 per 1000 examinations in women at average risk. The four screening-detected cancers in that study were also node negative. These studies indicate that routine screening mammography may be appropriate in men at high risk and would likely increase the proportion of clinically occult cases of low-stage MBC detected in this population (1,3,88).

Conclusion

A variety of breast abnormalities can be seen in men, and some entities demonstrate clinical or imaging findings specific to men in comparison to those seen in women. Gynecomastia is the most common cause of presentation for breast imaging in men, while MBC is a rare but important abnormality that must be excluded in symptomatic men. Gynecomastia and MBC share a predilection for the subareolar breast, and some cases of gynecomastia may demonstrate suspicious imaging findings similar to those of MBC, requiring biopsy. However, most cases of gynecomastia and MBC can be distinguished on the basis of other differences in clinical and imaging findings.

Other less common benign causes of male breast symptoms include abscesses, hemangiomas, myofibroblastomas, papillomas, and pseudoangiomatous stromal hyperplasia (PASH). Because lobules generally are not present in the male breast, common benign breast masses in women such as fibroadenomas and cysts are rare in men. In addition, MBC occasionally has deceptively benign-appearing imaging features such as mostly circumscribed margins and an oval shape. Thus, most solid breast masses in men require biopsy. In a male patient with a breast mass requiring biopsy, US evaluation of the ipsilateral axilla should be performed, given the high rate of involvement of the regional lymph nodes in MBC.

Men have increasingly presented for breast imaging in recent years. MBC incidence is rising, and men with MBC typically receive the diagnosis at a later stage than do women because of delayed presentation. Radiologists must be familiar with the varied clinical and imaging findings of MBC and other causes of male breast concerns to avoid further delay in diagnosis of MBC.

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