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Male Breast Disease: What the Radiologist Needs to Know

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A B S T R A C T

The male breast is susceptible to a variety of benign and malignant processes, many of which clinically present as a palpable finding, focal pain, or breast enlargement. Gynecomastia is the most common abnormality in the male breast and must be distinguished from malignancy. Imaging of the symptomatic male breast begins with a diagnostic mammogram in a patient ≥25 years and targeted ultrasound in a patient <25 years. If the breast finding is incompletely imaged or occult at mammography, targeted ultrasound must be performed. Similarly, if the breast finding is suspicious at targeted ultrasound in a younger patient, mammography must be performed. After a complete diagnostic evaluation, suspicious findings require biopsy because of overlap in clinical and imaging features of benign and malignant pathologies. Although no breast cancer screening program exists for men due to the <1% incidence of breast cancer, transgender male to female patients >50 years and treated with exogenous hormone therapy for >5 years should undergo breast cancer screening. This paper will review the anatomy of the male breast, appropriate imaging of the symptomatic male breast, gynecomastia and other benign conditions, and male breast cancer and other malignant conditions. Finally, we will discuss imaging of the transgender patient.

Introduction

At birth, the male and female breasts are identical. The breast extends from the anterior 2nd rib superiorly and the anterior 6th rib inferiorly to the sternum medially and the midaxillary line laterally. In the neonate, mild gynecomastia is a transient, common finding, related to transplacental passage of maternal estrogens prior to birth.[1] During puberty, the female breast forms a developed ductal system and lobules due to stimulation from estrogen and progesterone. Androgens have an antagonistic effect on development of male breast tissue during late puberty, but a second peak of gynecomastia occurs in early puberty due to an imbalance of estrogens and androgens. Adolescent gynecomastia is usually self-limiting.[1] The mature male breast is composed of skin, primitive ducts, stroma, and fat (Fig 1). Similarly, the mature female breast is composed of skin, stroma, and fat with the addition of developed ducts, lobules, and Cooper's ligaments. Therefore, unlike female breasts, male breasts rarely develop lobular pathology, including fibroadenomata, phyllodes tumors, cysts, lobular neoplasia, and lobular carcinoma.[2] Male patients can develop breast carcinoma, although rarely (<1% incidence), due to the epithelial components of the primitive ducts.

This paper will review the appropriate imaging evaluation of the male breast and describe specific benign and malignant pathologies that the radiologist may encounter in the male breast. In addition, we will discuss the male to female (MtF) transgender patient and breast cancer screening and imaging in the transgender patient.

Imaging the Male Breast

The American College of Radiology (ACR) Appropriateness Criteria are evidence-based imaging guidelines intended for referring clinicians and radiologists to choose the most appropriate imaging test and/or treatment for a patient's specific clinical scenario. Because the incidence of male breast cancer is low, no screening program exists. Therefore, all male breast imaging is diagnostic and performed on symptomatic patients. The most recent ACR Appropriateness Criteria for the evaluation of the symptomatic male breast were published in 2015 and are shown in Table 1.[3] Imaging evaluation is not indicated in male patients presenting with typical symptoms of gynecomastia or pseudogynecomastia. If the patient is <25 years old and presents with an indeterminate breast mass, imaging should begin with targeted ultrasound at the site of clinical concern and only proceed to bilateral mammogram when the ultrasound finding is suspicious. If the patient is ≥25 years old with an indeterminate breast mass, imaging should begin with bilateral mammogram and only continue to targeted ultrasound when the mammogram finding is indeterminate or suspicious or when the mammogram is negative. When breast cancer is suspected based on physical examination, imaging should begin with bilateral mammogram and then proceed to targeted ultrasound. Ultrasound is helpful in further characterization of mammographic findings and in guiding biopsy of suspicious findings. Breast magnetic resonance imaging (MRI) is usually not appropriate in the evaluation of male breast disease, as the data to support its clinical use and accuracy are limited.[3]

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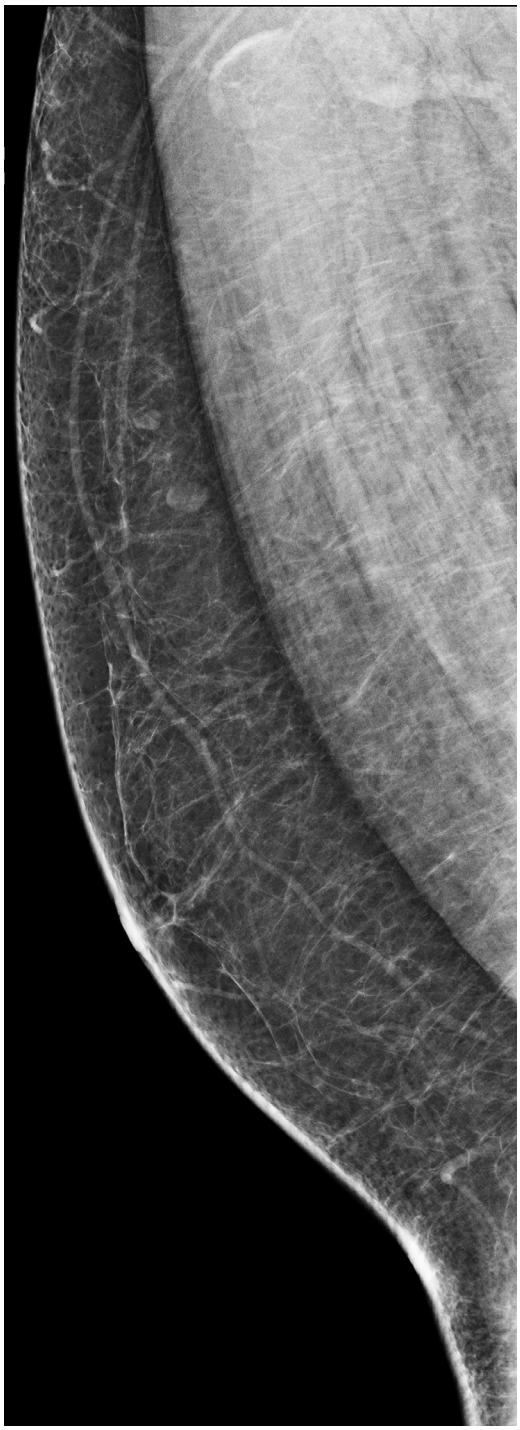


FIG 1. Normal male mammogram. MLO view demonstrates normal fat and lack of fibroglandular tissue in male patient. MLO, mediolateral oblique.

Gynecomastia

Gynecomastia is the most common abnormality affecting the male breast. Approximately 57% of the male population >44 years of age have palpable breast tissue.[4,5] Gynecomastia is a benign proliferation of the ductal and stromal elements of the male breast, which may be unilateral, bilateral symmetric, or bilateral asymmetric. There are many causes of gynecomastia, including physiologic, hormonal, systemic, neoplastic, pharmacologic, and idiopathic (Table 2).[4,6] In contrast, pseudogynecomastia results from proliferation of the fatty elements of the breast in overweight or obese males. Clinically, patients with gynecomastia present with breast enlargement, pain, palpable mass, or swelling.[7] Imaging is *not* indicated if the patient presents with the typical history and physical examination findings of gynecomastia or pseudogynecomastia.[3] When mammography is performed, ultrasound is not necessary if the mammographic findings are typical of gynecomastia.

TABLE 1
ACR Appropriateness Criteria for symptomatic male breast[3]

Clinical scenario	Imaging procedure
Symptoms and physical exam of gynecomastia or pseudogynecomastia, any age	Imaging *not* indicated
<25-year-old, indeterminate breast mass; initial exam	Targeted US; bilateral MG if US doesn't answer question or is suspicious
≥25-year-old, indeterminate breast mass; initial exam	Bilateral MG; if MG specific for gynecomastia, US not indicated
≥25-year-old, indeterminate breast mass; MG indeterminate, suspicious, or negative	Proceed to targeted US
Physical exam suspicious for breast cancer, any age	Bilateral MG, then targeted US

ACR, American College of Radiology.

Three patterns of gynecomastia exist: (1) nodular, (2) dendritic, and (3) diffuse[4,6-8] (Fig 2). On mammography, nodular gynecomastia appears as a retroareolar, fan-shaped density that gradually blends into the surrounding fat.[4,6-8] The sonographic appearance of nodular gynecomastia consists of a subareolar, hypoechoic, and fan-shaped mass with surrounding fat[7]. Histologically, it is characterized by an early florid stage of intraductal epithelial hyperplasia and loose cellular stroma and periductal inflammation and edema.[6,8] If present for less than 1 year, this subtype of gynecomastia is reversible with removal of the causative agent. Dendritic gynecomastia appears as a retroareolar, flame-shaped density with prominent extensions radiating into the surrounding adipose tissue on mammogram.[4,6-8] On ultrasonography, dendritic gynecomastia appears as a retroareolar, flame-shaped mass with associated fingerlike projections[7]. If present for more than 1 year, this pattern of gynecomastia is irreversible, because it is composed of hyalinized, stromal fibrosis, and dilated ducts.[4,6-8] The diffuse pattern of gynecomastia appears similar to heterogeneously dense female breast tissue at mammography and is a combination of the nodular and dendritic patterns, usually a result of exogenous estrogen.[4,6-8]

Male Breast Cancer

Epidemiology

Male breast cancer is rare, accounting for <1% of male cancers and <1% of all breast cancers.[4-6,9-16] Men are usually diagnosed

TABLE 2
Selected causes of gynecomastia[4,6]

Physiologic	Puberty
	Senescence
Hormonal	Klinefelter syndrome
	Hypogonadism
Systemic	Cirrhosis
	Chronic renal failure
	Hyperthyroidism
Neoplastic	Adrenal cortical carcinoma
	Testicular tumor
	Pituitary adenoma
	Hepatocellular carcinoma
Pharmacologic	Hormonal: androgen inhibitor, exogenous estrogen, and anabolic steroids
	Cardiovascular: ACE inhibitor, amiodarone, spironolactone, and thiazide diuretics
	CNS: diazepam, haloperidol, and tricyclic antidepressant
	Anti-ulcer: cimetidine, ranitidine, and omeprazole
	Recreational: marijuana
Idiopathic	

ACE, angiotensin converting enzyme; CNS, central nervous system.

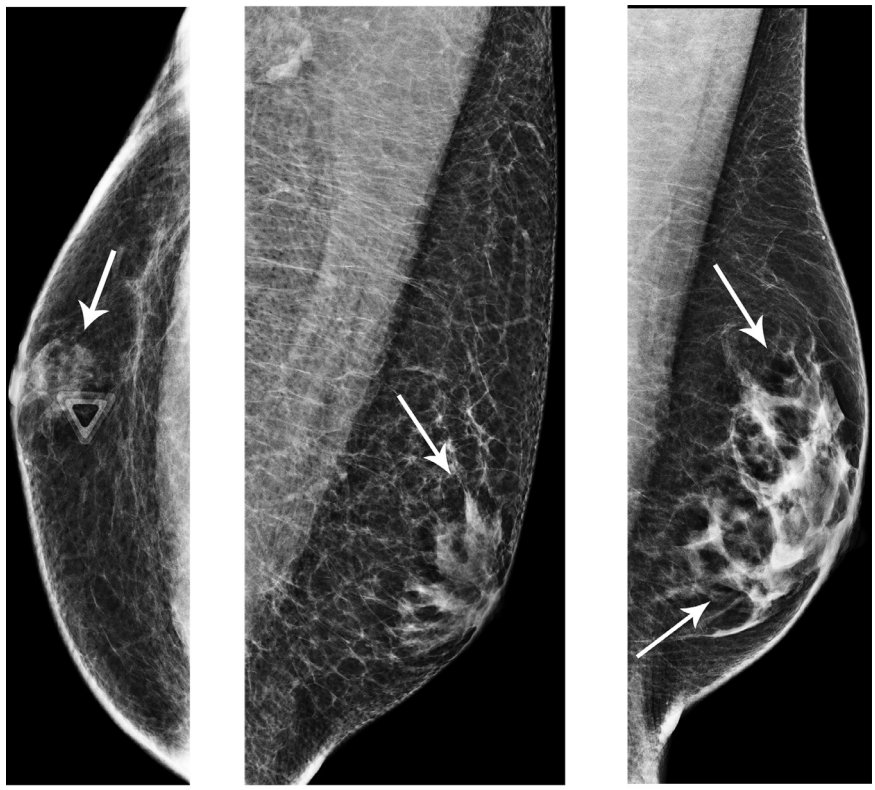


FIG 2. Types of gynecomastia. **(a)** Right craniocaudal (CC) view shows fan-shaped retroareolar density (arrow) in male patient with focal pain (triangle marker) and nodular gynecomastia. **(b)** Left MLO view shows flame-shaped retroareolar density (arrow) in male patient with dendritic gynecomastia. **(c)** Left MLO view shows heterogeneously dense parenchyma (arrows) and unilateral breast enlargement (contralateral breast not shown) in a 27-year-old male with diffuse idiopathic gynecomastia. MLO, mediolateral oblique.

5-10 years later than women.[6,9,10,13] According to the Surveillance, Epidemiology, and End Results database from 1973 to 2005, the median age of diagnosis in men is 67 years vs 61 years in women[10] with the literature reporting the mean age at diagnosis between 63 and 69 years.[6,11,12,16,17]

Risk Factors

Many risk factors for the development of male breast cancer have been reported in the literature. The well-established risk factors for breast cancer include age, race, family history and/or genetics, abnormal estrogen-to-androgen level, and radiation exposure.[4-6,9,10,13,16] Similar to female breast cancer, the incidence of male breast cancer increases with age.[4,5,9,10,13] At all ages, black men have an increased incidence of breast cancer compared to white men, 1.8 per 100,000 vs 1.1 per 100,000.[9,10] Family history and genetics, as in women, are important risk factors for men. Approximately 10% of men with breast cancer have a genetic predisposition, and 5%-10% of male patients with BRCA2 gene mutations develop breast cancer over their lifetime compared to 1%-5% with BRCA1 gene mutations.[9,10,13,16] Medical conditions that alter the estrogen-to-androgen ratio, including Klinfelter's syndrome (XXY), exogenous estrogen or testosterone use, obesity, orchitis and/or epididymitis, and prostate cancer treated with estrogens (eg, finasteride), have been reported to increase the risk of breast cancer.[9,10] Three to 3.5% of male breast cancer patients have Klinefelter's syndrome,[10,13] reflecting an approximately 50-fold increase in risk over men without the syndrome.[13] As in women, radiation exposure increases the risk of breast cancer[9,10]; atomic bomb survivors have an incidence of 1.8 per 100,000 person-years.[10] Data on other possible risk factors, including electromagnetic field exposure and occupation exposure, are mixed and inconclusive.[9,10]

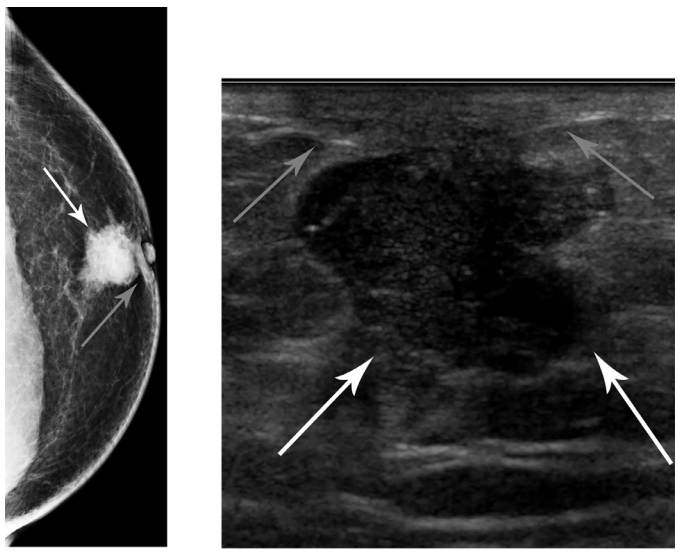


FIG 3. Nipple retraction and discrete mass in 59-year-old male with breast cancer. **(a)** Left MLO view shows an irregular, high density mass in the retroareolar breast (white arrow) with associated nipple retraction (gray arrow). **(b)** Irregular, hypoechoic mass (white arrow) with associated nipple retraction and skin thickening (gray arrow) at US. US-guided core biopsy demonstrated invasive ductal carcinoma, estrogen receptor (ER) and progesterone receptor (PR)+, and Her2neu-. MLO, mediolateral oblique; US, ultrasound.

Presentation

Due to the low overall incidence of male breast cancer, no breast cancer screening program exists for men. Men most often present with a painless and palpable mass (Fig 3).[3,9,11-14,17] Other presentations include bloody nipple discharge, nipple ulceration, nipple inversion or retraction (Fig 3), skin retraction, and palpable axillary lymph nodes.[3,9,11-14,17] Men are more likely to be diagnosed with later stage, node positive disease than women.[3,6,9-12,14] Approximately 50% of men have axillary nodal disease at presentation.[3,6,10-12,18]

Radiologic Appearance

For the evaluation of the symptomatic male breast,[3] men ≥25 years of age with a concerning physical examination should undergo bilateral diagnostic mammography followed by targeted ultrasound if the mammogram is inconclusive or suspicious. Men <25 years of age should undergo targeted ultrasound followed by bilateral diagnostic mammography if the ultrasound demonstrates a suspicious finding.[3] With imaging, it is important for the radiologist to appropriately distinguish male breast cancer from gynecomastia (Table 3).

The mammographic appearance of male breast cancer is varied, including a noncalcified mass (Fig 4), a mass with calcifications (Fig 5), and calcifications alone.[9,11,14,15,17] In 1 reported series,[11] a noncalcified mass was the most common finding (69%), followed by a mass with calcifications (29%) and calcifications alone (2%). Overall, calcifications are present in 9%-31% male breast cancer cases.[7,14,16,17,19] Calcifications in male breast cancer tend to be fewer in number and coarser than calcifications in female breast cancer, and they are more likely punctate and less often linear.[4,12,13,15-17] In 1 series, pleomorphic calcifications were seen in 47% of cases.[11] Therefore, even calcifications with a relatively benign appearance in women should be considered suspicious in men. The most common mammographic appearance of male breast cancer is a discrete mass

TABLE 3
Comparison of male breast cancer and gynecomastia

	Male breast cancer	Gynecomastia
Age	>60 years	Peripubertal and >50 years
Presentation	Soft or firm nontender mass, mobile or nonmobile	Soft, tender mass, and mobile
Laterality	Unilateral	Unilateral or bilateral, asymmetric or symmetric
Relationship to nipple	Eccentric	Retroareolar
MG appearance	Discrete mass	Fan- or flame-shaped density
Associated MG features	Calcifications, nipple retraction, axillary LAD	None
US appearance	Hypoechoic mass; axillary LAD may be present	Hypoechoic, irregular mass; no axillary LAD

LAD, lymphadenopathy; MG, mammogram; US, ultrasound.

FIG 4. Triple negative invasive ductal carcinoma in 76-year-old male with known recurrent lung cancer. **(a)** Axial CT chest with IV contrast performed for surveillance for lung cancer shows an irregular mass in the right lower inner breast (arrow) with loss of fat plane between the mass and the pectoralis major muscle, mammogram recommended. **(b)** Right MLO view shows an irregular, high density mass (white arrow) in the central inner breast (CC view not shown) with tenting of the pectoralis major muscle (black arrow). **(c)** Targeted US confirms an irregular, hypoechoic mass (white arrows) abutting the pectoralis major muscle (black arrows). US-guided core biopsy revealed invasive ductal carcinoma, triple negative. CT, computed tomography; MLO, mediolateral oblique; US, ultrasound.

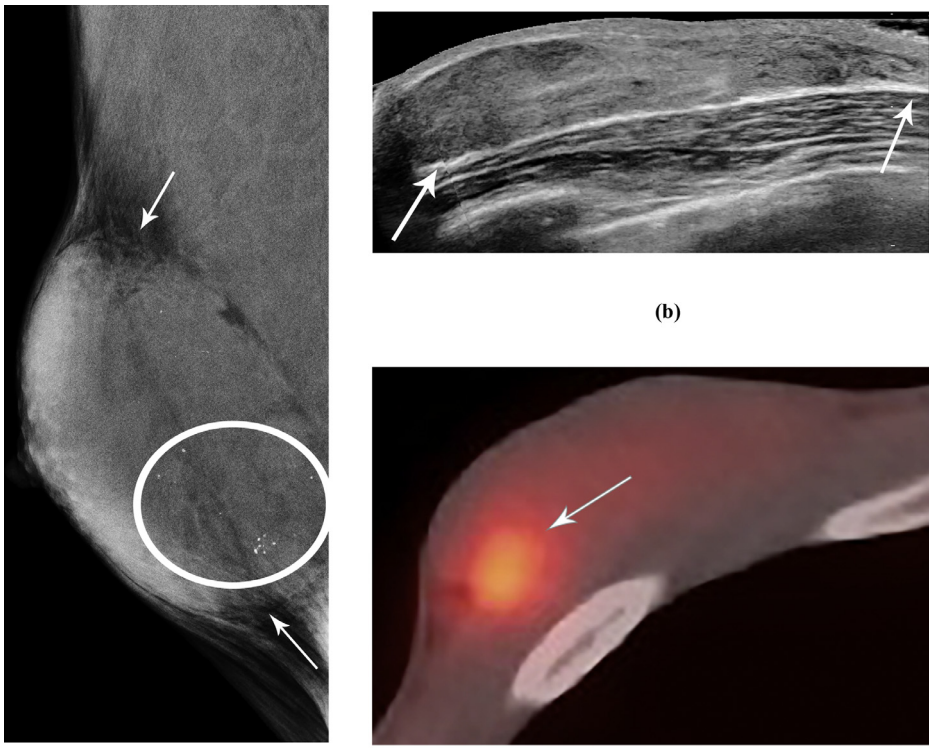


FIG 5. Mass with calcifications in 68-year-old male with breast cancer. **(a)** Right MLO view demonstrates large, irregular mass (white arrow) with associated group of coarse, heterogeneous calcifications (circle) in the lower outer quadrant. **(b)** Panoramic US confirms a large, irregular, and hypoechoic mass. US-guided core biopsy revealed invasive ductal carcinoma, ER+, progesterone receptor (PR) and Her2neu-. **(c)** Axial positron emission tomography (PET)/CT performed for synchronous diagnosis of esophageal cancer shows hypermetabolic mass (arrow) in the lower outer right breast at of site of biopsy-proven breast cancer. MLO, mediolateral oblique; PET, Positron emission tomography; US, ultrasound.

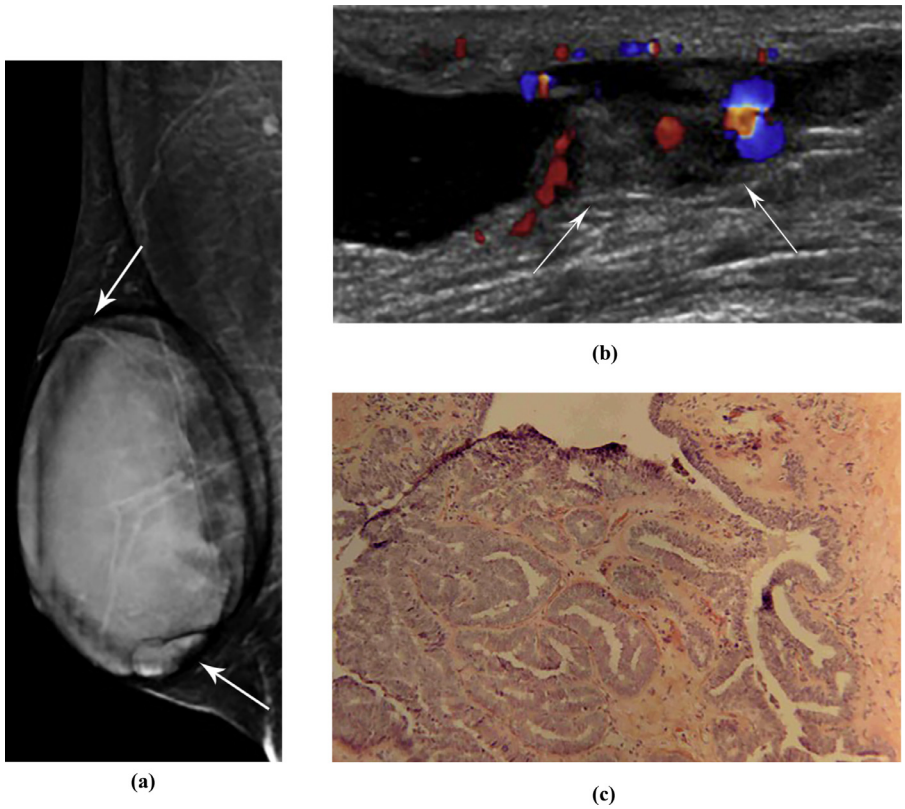


FIG 6. Complex cystic and solid mass in 57-year-old male with breast cancer. **(a)** Right MLO view shows a large, palpable, mass involving the majority of the breast (arrow). **(b)** Color Doppler US demonstrates a complex cystic and solid mass with internal vascularity (arrow). **(c)** 10× H&E-stained specimen from US-guided core biopsy reveals papillary proliferation of epithelial cells confined to ducts, consistent with intracystic papillary DCIS. H&E, hematoxylin and eosin; MLO, mediolateral oblique; US, ultrasound.

located in the subareolar breast or located eccentric to the nipple.[3,8,9,11-14,16,17] The mass is usually irregular with spiculated or indistinct margins; however, oval or round masses with circumscribed margins are not uncommon.[4,7,8,11-14,16,17] As with calcifications, masses with typically benign features should be considered suspicious in men.[7,8,11,12,14,17] Secondary signs of breast cancer may be seen, including nipple retraction, skin thickening, and axillary lymphadenopathy.[7,11,14,16-18]

The sonographic appearance of male breast cancer is similar to that in females. Masses tend to be solid with irregular shape, noncircumscribed margins, and hypoechoic echotexture and subareolar or eccentric to the nipple.[5-7,11-14,16,18] Because the male breast lacks lobules, lobular pathology, including cysts, is rare. Cystic masses must be viewed with suspicion, as neoplastic papillary lesions may manifest as cystic or complex cystic and solid masses (Fig 6).[11,14,16,18]

Histopathology and Treatment

Similar to female breast cancer, histologically, male breast cancer is usually invasive ductal carcinoma with other subtypes including ductal carcinoma in situ, papillary carcinoma, and rarely, invasive lobular carcinoma due to the lack of lobules in the male breast.[9-11,14,16,17] Male breast cancer is usually estrogen and progesterone receptor positive; HER2-neu receptor positivity is rare.[9-11,14]

Treatment of male breast cancer consists of surgery, radiation therapy, and systemic therapy. Due to limited data, treatment recommendations are often extrapolated from studies of female breast cancer.[9,10]

Other Male Breast Diseases

There are multiple benign and malignant entities that can develop in the male breast and axilla (Table 4). Some are discussed below.

TABLE 4
Selected other male breast disease[5,6,13]

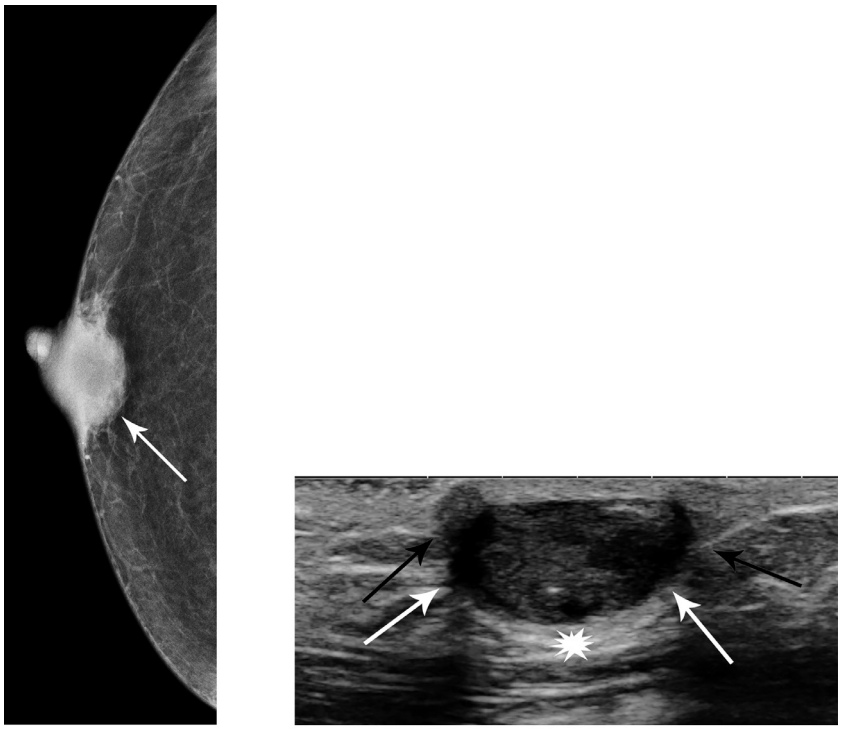
Skin and subcutaneous	Sebaceous or epidermal inclusion cyst
	Hematoma
	Lipoma or fat necrosis
Stromal and glandular	PASH
	Gynecomastia
	Mastitis and/or abscess
	Fibromatosis (desmoid)
Lymphatic	Intramammary lymph node
	Lymphoma
	Lymphatic malformation
Neural	Granular cell tumor
	Schwannoma
	Neuroma
Vascular	Hemangioma
	Angiolipoma
	Venous malformation
Miscellaneous	Glomus tumor
	Spindle cell tumor
	Metastasis

PASH, pseudoangiomatous stromal hyperplasia.

Benign

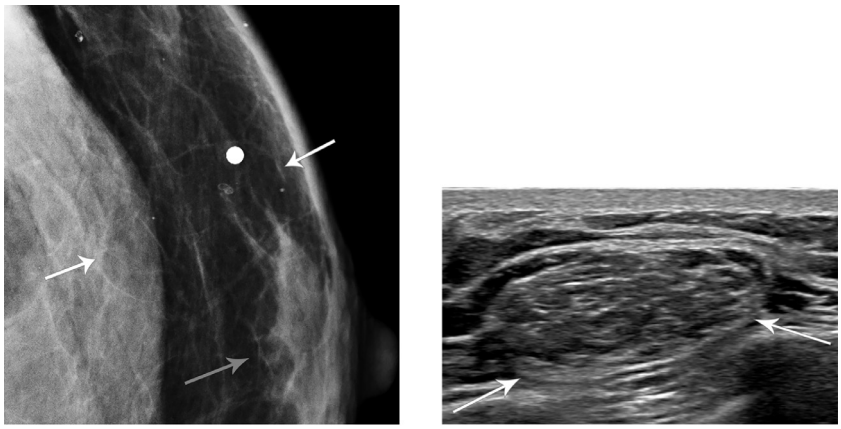
Dermal Cysts

Epidermal inclusion cysts and sebaceous cysts (Fig 7) are benign intradermal cysts regularly identified by the breast radiologist, particularly in the inframammary, axillary, and periareolar regions. While the 2 entities are indistinguishable at imaging, they differ at histopathology, arising from different aspects of the hair follicle.[20] Epidermal inclusion cysts may form after trauma, such as breast biopsy or breast surgery. In this case, they may be located deep in the breast parenchyma rather than in the dermis or hypodermis. Many patients will have a visible opening on the skin and/or a history of discharge.



(a) (b)

FIG 7. Epidermal inclusion cyst in 56-year-old male. **(a)** Right CC view shows an oval, high density mass in the retroareolar breast (arrow). **(b)** Subareolar US demonstrates an oval mass (white arrows) with increased through transmission (star). The mass is located within the skin because it forms an acute angle with the dermal line (black arrows). US, ultrasound.



(a) **(b)**

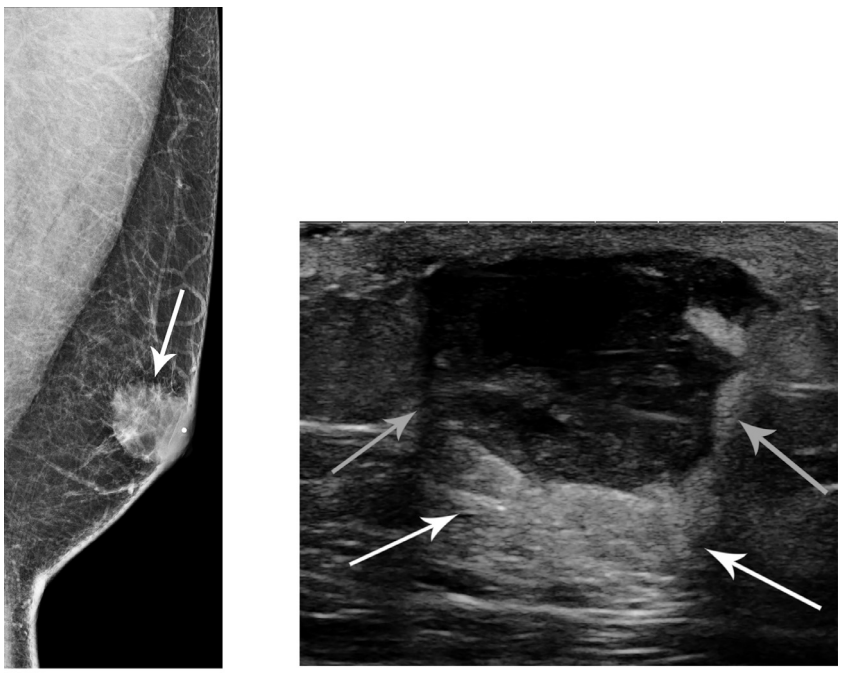
FIG 8. Lipoma in 72-year-old male. **(a)** Left CC view shows a palpable (metallic marker), radiolucent, encapsulated mass (white arrows) in the lower outer quadrant (MLO view not shown); note the retroareolar gynecomastia (gray arrow). **(b)** Targeted US confirms an oval, circumscribed, encapsulated, isoechoic mass, which is consistent with lipoma. MLO, mediolateral oblique; US, ultrasound.

At mammography, a dermal cyst typically presents as an oval, circumscribed mass. At ultrasound, they are seen as a superficial circumscribed mass either within the echogenic dermal layer or partially in the hypodermal tissue. Identification of a tract extending from the mass to the skin surface is diagnostic. The internal echo pattern of a dermal cyst ranges from anechoic to solid-appearing depending on the contents. When inflammation is present, the margin of the cyst may become ill-defined, and peripheral vascularity will be visible on color Doppler imaging. In some patients, aspiration or biopsy may be necessary if the imaging features are suspicious for malignancy. However, core needle biopsy should generally be avoided because rupture of cyst contents may cause an inflammatory reaction in the adjacent breast tissue.

Lipoma and Angiolipoma

Lipoma is the most common benign tumor of the male breast (Fig 8), composed of mature adipose tissue. It presents clinically as a soft, palpable subcutaneous mass. At mammography, lipomas are fat density masses that may be indistinguishable from adjacent fat or demonstrate a thin radiopaque capsule. Ultrasound usually shows a superficial isoechoic or mildly hyperechoic circumscribed mass with little to no internal vascularity. Imaging features are characteristic and biopsy is not needed. Some patients may opt for elective surgical excision.

Angiolipoma is an uncommon lipoma variant composed of mature adipose tissue admixed with vascular proliferation. The mammographic appearance varies depending on the ratio of fatty to vascular



(a) **(b)**

FIG 9. Left retroareolar mass mimicking male breast cancer in 41-year-old male smoker. **(a)** MLO view shows a retroareolar, round mass (arrow). **(b)** Corresponding irregular complicated fluid collection (gray arrows) with increased through transmission (white arrows) at US. US-guided core biopsy revealed abscess and infectious material. MLO, mediolateral oblique; US, ultrasound.

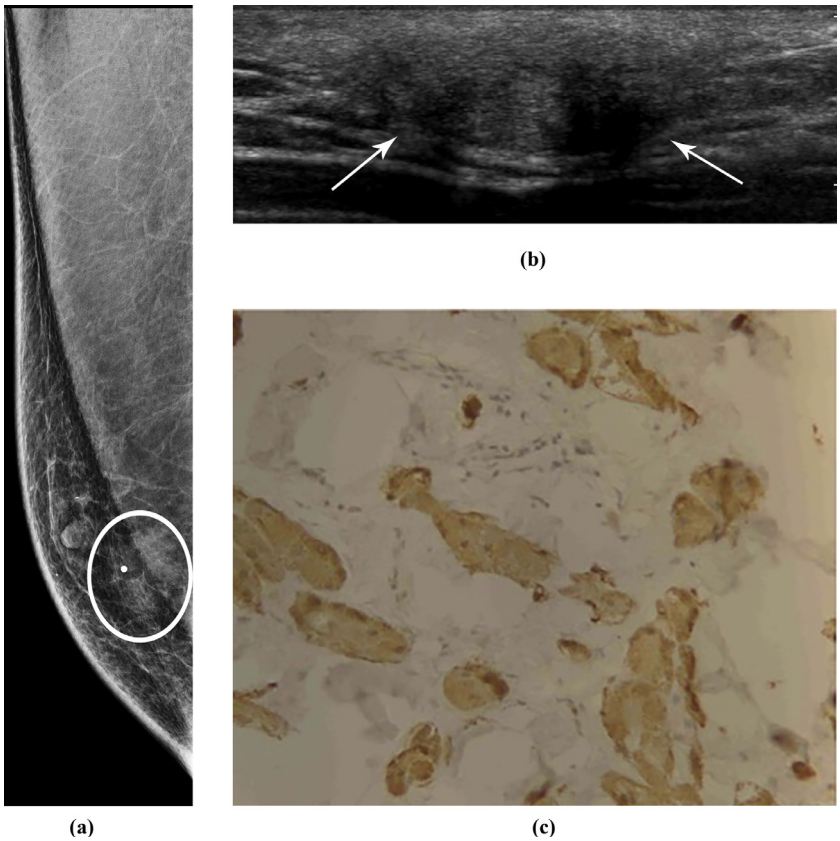


FIG 10. Eccentric mass mimicking male breast cancer in 50-year-old male. **(a)** Right MLO view shows a palpable (metallic marker), eccentric mass (circle) with **(b)** oval, hypoechoic mass with indistinct margins at US. US-guided core biopsy revealed granular cell tumor. **(c)** 20× immunohistochemistry-stained S100 specimen from US-guided core biopsy confirms neural origin of the tumor. MLO, mediolateral oblique; US, ultrasound.

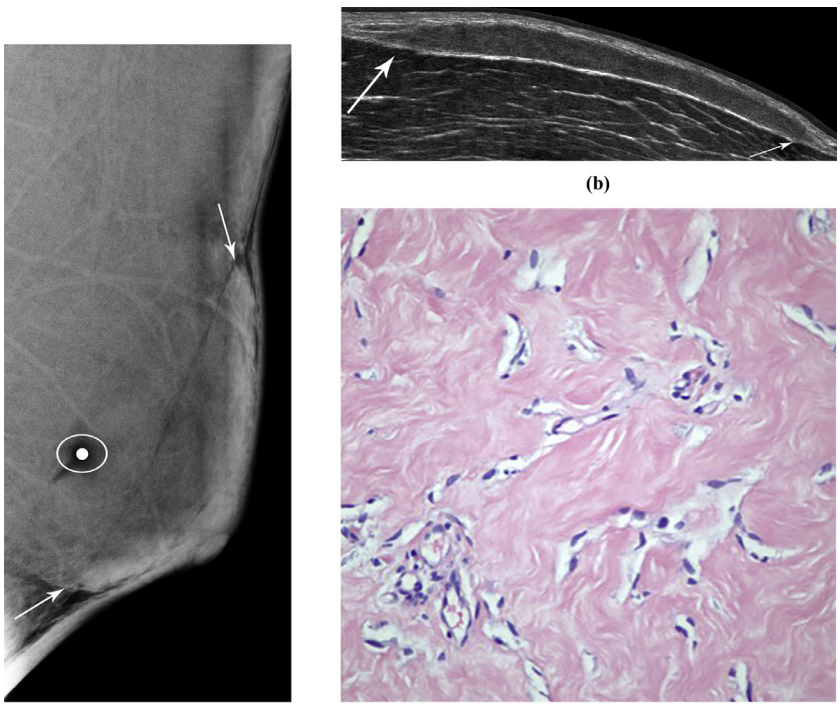


FIG 11. Enlarging breast mass mimicking male breast cancer in 27-year-old male. **(a)** Left MLO view with palpable (metallic marker) large, dense oval mass (arrows) involving the majority of the breast. **(b)** Panoramic US shows an oval, circumscribed, and hypoechoic mass (arrows). **(c)** 40X H&E-stained specimen from surgical excision shows proliferation of stroma mixed with benign ducts in PASH with gynecomastia-like changes. H&E, hematoxylin and eosin; MLO, mediolateral oblique; PASH, pseudoangiomatous stromal hyperplasia; US, ultrasound.

elements. On ultrasound, the most common presentation is an oval, circumscribed hyperechoic mass, and mimicking lipoma.[21,22]

Infection: Mastitis and Abscess

Mastitis and abscess can affect the male breast, most commonly in the subareolar location (Fig 9). Similar to the nonpuerperal subareolar abscess in females, squamous metaplasia of the distal duct epithelium leads to keratin plug formation, duct obstruction, rupture, and inflammation. Superinfection leads to abscess formation.[23] *Staphylococcus* infection is a common cause; however, recurrent abscesses can be polymicrobial and anaerobic. Mammogram typically shows an ill-defined subareolar mass. On ultrasound, an abscess is an irregular mass composed of complex, heterogeneous fluid with posterior acoustic enhancement. There is often peripheral hyperemia, overlying skin thickening, and increased echogenicity of the adjacent fat. Some abscesses appear to have solid components with internal blood flow on color Doppler imaging. In the case of diagnostic uncertainty, tissue sampling should be performed. Abscess treatment usually involves oral antibiotics and ultrasound-guided drainage.

Granular Cell Tumor

Granular cell tumor is a rare benign tumor of neural origin with only 5%-8% of cases arising in the breast.[13] It tends to arise in the upper inner quadrant due to the sensory distribution of the supraclavicular nerve. Clinically, patients present with a palpable mass that may mimic malignancy. Imaging features are variable, although mammogram and ultrasound usually show a solid mass (Fig 10).[24] Tissue sampling is required because of overlap of both clinical and imaging features with breast carcinoma.

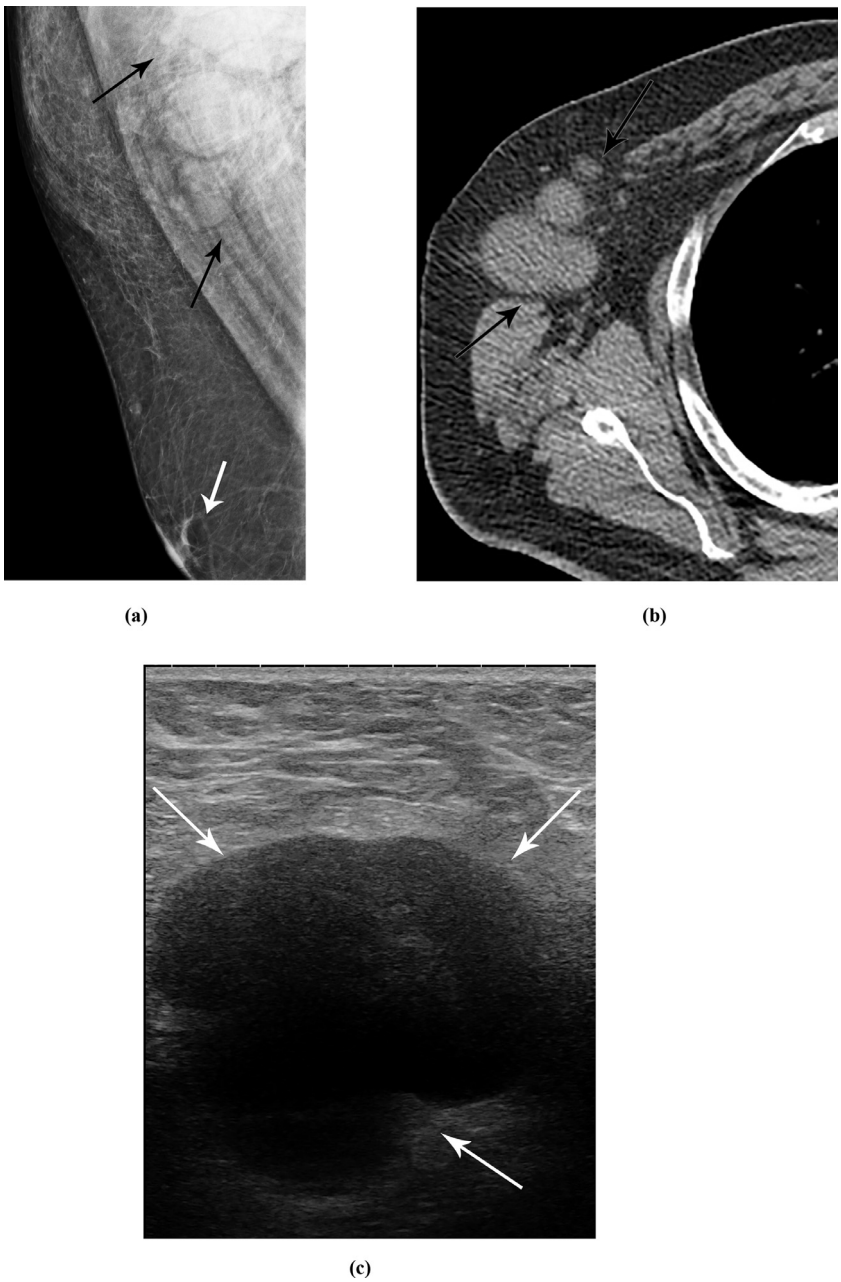


FIG 12. Axillary metastasis in 65-year-old male with history of ipsilateral scapular malignant melanoma 16 years prior. **(a, b)** Right exaggerated craniocaudal lateral (XCCL) view and axial CT chest without IV contrast show multiple, enlarged axillary lymph nodes (black arrows); note mild retroareolar gynecomastia at MG (white arrow in a). **(c)** Axillary US demonstrates a dominant enlarged, hypoechoic lymph node with loss of fatty hilum (arrows). CT, computed tomography; US, ultrasound.

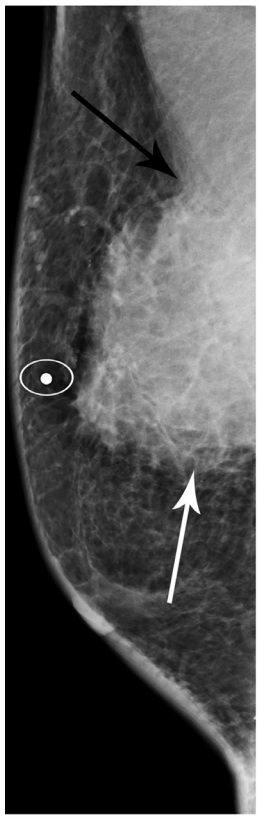
Pseudoangiomatous Stromal Hyperplasia

Pseudoangiomatous stromal hyperplasia is a benign, hormonally-dependent proliferation of fibroblasts, and myofibroblasts in the breast. The clinical presentation is variable, from a palpable lump to asymptomatic disease detected incidentally at biopsy. Imaging features are also variable, although the most common finding is a noncalcified oval, circumscribed mass at mammography and ultrasound.[25] In men, pseudoangiomatous stromal hyperplasia is commonly associated with gynecomastia (Fig 11), reportedly seen in up to 47% of biopsies from symptomatic patients with gynecomastia.[13]

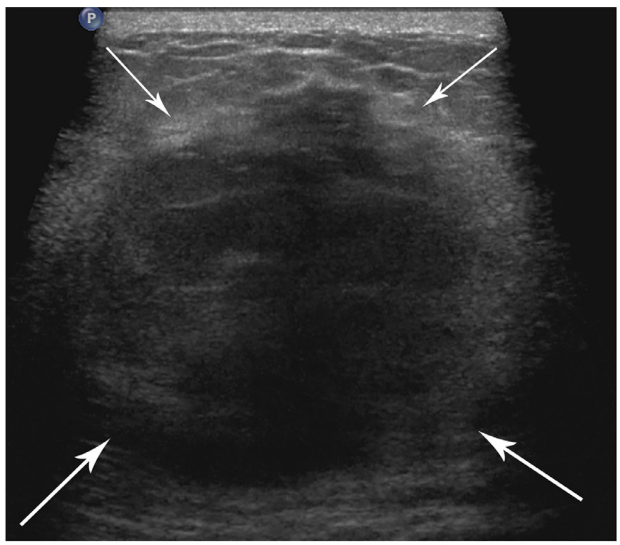
Malignant

Metastasis

Extramammary metastasis to the male breast is extremely rare.[26-28] The most common sources are melanoma and lung cancer.[27] Metastases may occur via either hematogenous or lymphangitic spread to the breast. Hematogenously spread metastases present as multiple, bilateral, oval or round masses, while lymphangitic spread presents as diffuse edema and skin and trabecular thickening.[13,26-28] Biopsy is necessary for diagnosis, as extramammary metastasis can



(a)



(b)

(c)

FIG 13. Rapidly enlarging palpable mass in 76-year-old male. **(a)** Right MLO view shows a large, palpable metallic marker (BB), and irregular mass (white arrow) in the upper central breast inseparable from the pectoralis major muscle (black arrow). **(b)** Irregular, mixed echogenic mass (white arrows) at targeted US. **(c)** Irregular, mixed density mass (white arrows) with loss of fat plane between mass and pectoralis major muscle (black arrows) on axial CT chest with IV contrast performed for staging. US-guided core biopsy and subsequent surgical excision revealed high grade sarcoma with focal leiomyomatous differentiation with extensive areas of hemorrhage and necrosis. CT, computed tomography; MLO, mediolateral oblique; US, ultrasound.

FIG 14. Screening mammogram in 59-year-old transgender MtF on cross sex hormone therapy for 5 years. Left CC view shows heterogeneously dense breast parenchyma (arrows). MtF, male to female.

mimic primary breast malignancy. Treatment will depend on the primary malignancy.

Enlarged or morphologically abnormal axillary lymph nodes should be viewed with suspicion and sampled for tissue diagnosis. Extramammary metastasis to the axilla (Fig 12) is more likely than metastasis from occult primary breast malignancy. Approximately 50% of men have axillary nodal disease at presentation of primary breast cancer.[3,6,10-12,18]

Leiomyosarcoma

Sarcomas represent <1% of primary breast tumors, with leiomyosarcoma representing a minority of primary breast sarcomas and an extremely rare pathology in the male breast with few published case reports in the literature. Leiomyosarcoma is a malignant tumor comprised of smooth muscle. Clinically, patients present with an enlarging, palpable, and firm breast mass. Imaging features are nonspecific, although mammogram and ultrasound usually demonstrate a solid mass[29-31] and necrosis may be present (Fig 13). Treatment involves wide local excision or mastectomy.

FIG 15. Transgender MtF patient with breast augmentation. Right MLO view shows prepectoral saline implants (stars); note the breast tissue is primarily fatty because the patient is not taking CSHT. CSHT, cross sex hormone therapy; MLO, mediolateral oblique; MtF, male to female.

Imaging in the Transgender Patient

The *Diagnostic and Statistical Manual of Mental Disorders, 5th edition* defines gender dysphoria in adolescents and adults as a difference between one's expressed gender and assigned gender with significant distress or problems functioning.[32] Transgender refers to a person identifying with a gender different from the sex assigned at birth. This may manifest as a person assigned female at birth but identifying as a male (female to male [FtM]) or a person assigned male at birth but identifying as a female (MtF). To transition means to change a person's gender role, which may involve cross sex hormone therapy (CSHT) and/or surgery to masculinize (FtM) or feminize (MtF) the body of the transgender person.

Radiologists and other physicians caring for transgender patients must be aware of the risk of breast cancer in this population and the appropriate breast cancer screening guidelines. Fenway Health is a community health center in Boston, MA with a mission to enhance the well-being of all people, especially the lesbian, gay, bisexual, and transgender population. As part of this mission, they formed the Transgender Health Program to provide support and comprehensive care to transgender patients, and they published a book about the medical care of transgender persons.[33]

For the FtM transgender patient who has not undergone mastectomy, mammographic screening is recommended according to the current guidelines for a natal female because breast tissue is present.[33] For example, the ACR and/or Society of Breast Imaging recommends annual screening mammography beginning at age 40 years,[34,35] while the United States Preventative Services Task Force recommends biennial screening mammography from age 50 to 74 years with a discussion between the patient and the patient's primary care physician about screening mammography between ages 40 and 50 years.[19] For FtM transgender patients who have undergone mastectomy, medical

providers should perform yearly chest and axillary examinations because residual breast tissue may be present.[33,36] For the MtF transgender patient, mammographic screening is recommended for patients beginning at age 50 years with >5 years of CSHT.[33] In a study of 5135 transgender veterans, there were 3 cases of breast cancer in the MtF population, all of whom presented with late stage disease and died from metastatic disease,[36] which emphasizes the importance of radiologist and medical provider knowledge of the breast cancer screening guidelines for transgender patients, especially MtF patients.[33,36]

MtF transgender patients may choose to undergo CSHT and/or breast augmentation to feminize their body. CSHT will cause growth of breast tissue, which may appear heterogeneously dense at mammography (Fig 14).[37] The mammographic appearance of breast tissue in MtF transgender patients undergoing CSHT should not be called gynecomastia, as the breast tissue contains lobules and is similar to natal female breast tissue.[37] Therefore, development of lobular pathology rarely seen in natal males, such as cysts and fibroadenomata, can occur.[37]

MtF transgender patients may undergo breast augmentation with breast implants (Fig 15). The mammographic appearance of breast implants will appear similar to breast implants in natal female patients. At the discretion of the plastic surgeon, the breast implants may be made of silicone or saline and may be placed in a retropectoral or a retroglandular position. Evaluation of implant integrity is the same as for natal female patients, with breast MRI without intravenous contrast as the most sensitive imaging modality for the detection of implant rupture.

Conclusion

Many different benign and malignant conditions affect the male breast, with gynecomastia representing the most commonly encountered pathology. Because men do not undergo breast cancer screening, all imaging of the male breast is diagnostic. Radiologists must be aware of the imaging features of gynecomastia and be able to distinguish it from breast cancer and other pathologies. Due to the overlap in clinical and imaging features of benign and malignant processes in the male breast, imaging findings that do not clearly represent gynecomastia or a known benign etiology, such as a dermal cyst or a benign fatty tumor, require complete diagnostic imaging with mammogram and ultrasound followed by tissue sampling.

There is increasing public awareness of patients who identify as transgender. In order to best care for these patients, radiologists and medical providers must be aware of breast cancer risk and appropriate screening recommendations in this population. Fenway Health recommends annual screening for MtF transgender patients beginning at age 50 years with >5 years of CSHT. For FtM patients, screening depends on mastectomy status of the patient: annual screening if no mastectomy has been performed and annual chest and axillary physical examination if the patient underwent mastectomy.

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