Current Breast Cancer Reports (2023) 15:69–84
https://doi.org/10.1007/s12609-023-00482-6

Pictorial Review of Male Breast Disease

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Accepted: 21 February 2023 / Published online: 10 March 2023

Abstract

Purpose of Review Many processes in the male breast are similar to those encountered in female patients, with a few notable differences. While the majority of male breast pathology is benign, a working knowledge of varying imaging presentations of both benign and malignant pathology is necessary to guide appropriate management. The focus of this review is to highlight the classic mammographic and sonographic appearances of benign and malignant pathologies in the male breast.

Recent findings Mammography is the initial modality of choice for symptomatic male patients who are 25 years of age or older. In patients younger than 25, however, ultrasound should be performed first. Screening mammography for the general male population is not currently widely recommended due to the low prevalence of breast cancer in men. Additionally, although no current guidelines exist regarding the utilization of breast magnetic resonance imaging (MRI) in men, it can be used as an adjunct imaging modality for treatment planning in patients with breast cancer.

Summary Mammography and ultrasound are the mainstay imaging modalities for evaluating the symptomatic male breast. Core needle biopsy can be performed in cases of suspicious findings.

Keywords Male breast cancer · Invasive ductal carcinoma · Gynecomastia

Introduction

Male breast cancer accounts for less than 1% of all diagnosed breast cancer cases [1]. According to the American Cancer Society, it is estimated that 2,800 men and 297,790 women will be diagnosed with breast cancer in 2023 [2]. While relatively rare compared to the number of cases in women, the incidence of breast cancer in men has increased by 40% from 1975 to 2015 according to the Surveillance, Epidemiology, and End Results (SEER) data [3]. In addition to breast cancer, multiple benign entities can be encountered in practice; therefore, it is essential for clinicians and radiologists to be aware of the various physical exam and imaging presentations of these pathologies to ensure appropriate diagnosis and management. In this review, we discuss the spectrum of both benign and malignant processes in the male breast as well as the imaging characteristics and key features necessary for accurate diagnosis.

Anatomy of the Male Breast

In utero, breast development occurs between 4–6 weeks gestation. After development of the mammary bud, the mammary-specific epithelial cells extend in a paired line between the bilateral axillary and inguinal regions and are termed the "milk lines" or ventral epidermal ridges [4]. At birth and in early childhood, the makeup of male and female breast tissue is indistinguishable, but marked differences begin to occur during the peripubertal period. In females, circulating estrogen and progesterone cause ductal proliferation and development of terminal duct lobular units. In males, however, testosterone exerts androgenic antagonistic effects on the comparatively low estrogen levels and results in involution of the lactiferous ducts [5]. Therefore, the breast tissue

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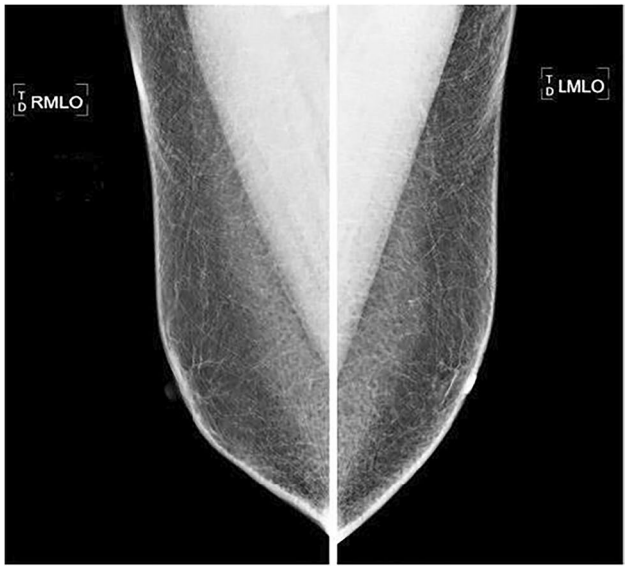

Fig. 1 Bilateral full-field digital mammography in the mediolateral oblique (MLO) projection of the normal male breast, which is composed almost entirely of adipose tissue. Note the well-developed triangular pectoralis muscles bilaterally

of an adult male consists primarily of adipose tissue with atrophic ductal epithelium (Fig. 1) [6]. The presence of ductal elements can predispose the patient to the development of invasive ductal carcinoma (IDC), ductal carcinoma in situ (DCIS), papillary lesions, and other proliferative processes. Given the infrequency of lobular elements in the male breast, processes arising in the lobules such as fibroepithelial lesions, cysts, radial scars, lobular carcinoma in situ (LCIS), and invasive lobular carcinoma (ILC) are quite rare [7]. Additionally, unlike the female breast, Cooper's ligaments are not present in the male breast.

Imaging Modalities

Mammography and Ultrasound

Due to its high sensitivity, specificity, and negative predictive value for detecting breast cancer, mammography is an excellent imaging modality for the symptomatic male breast. Digital breast tomosynthesis (DBT) has steadily replaced

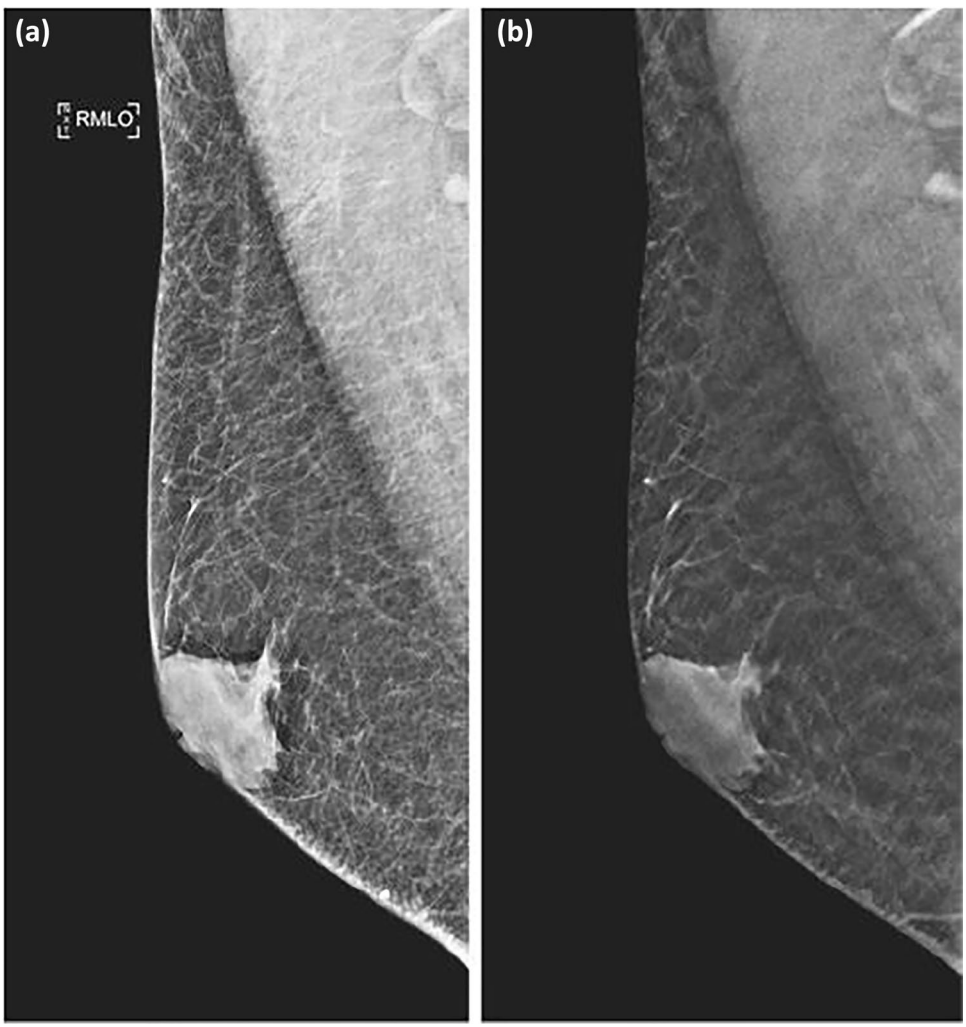

Fig. 2 (**a**, **b**) Full-field digital MLO view of the right breast (**a**), which demonstrates nodular gynecomastia in the retroareolar region. Digital breast tomosynthesis view (**b**) in the same projection, which confirms the presence of dense glandular tissue without evidence of an underlying mass

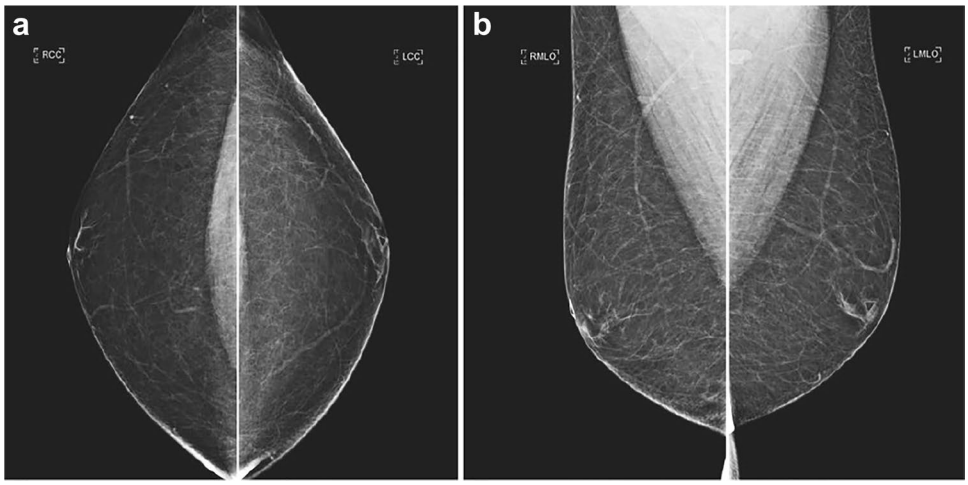

Fig. 3 (**a**, **b**) Bilateral standard craniocaudal (CC) (**a**) and MLO (**b**) projections of a male with bilateral palpable complaints, which are denoted by the triangular-shaped markers in the retroareolar regions. There is minimal gynecomastia in both breasts

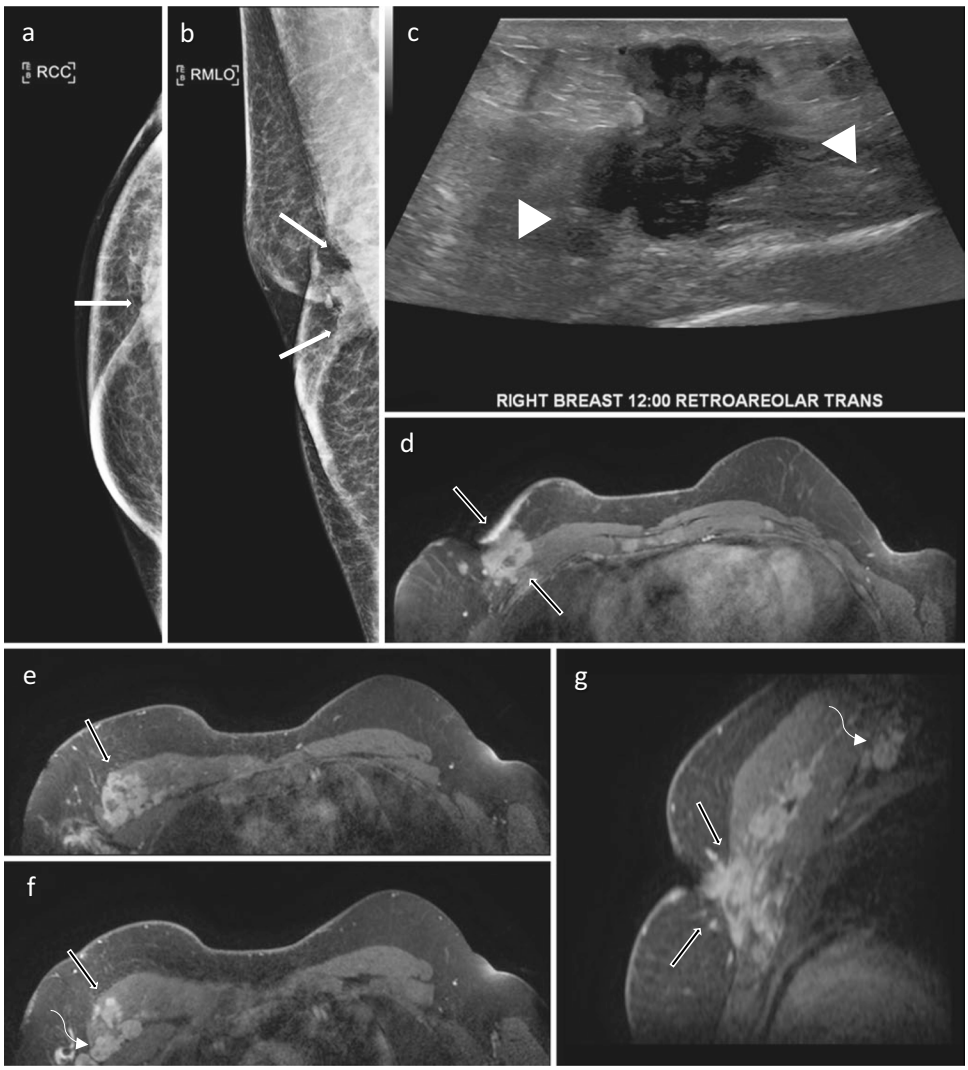

Fig. 4 (**a-g**) Invasive ductal carcinoma (IDC) in a 50-year-old male. Full-field digital mammographic images of the right breast in the CC (**a**) and MLO (**b**) projections, which demonstrate a high-density, irregular mass in the posterior breast with associated nipple retraction (white solid arrows). Targeted ultrasound (**c**) of this mass shows an irregular, hypoechoic mass with indistinct margins that is inseparable from the underlying pectoralis major muscle (white arrowheads). Axial (**d-f**) and sagittal (**g**) views of a contrast-enhanced breast MRI (T1-weighted with fat saturation) demonstrate an irregular, enhancing mass that correlates with the mammographic and ultrasound findings. There is associated invasion of the pectoralis major muscle and chest wall (open white arrows), as well as metastatic axillary lymphadenopathy (curved white arrows). Core needle biopsy of the right breast mass and right axillary lymph node revealed IDC and metastatic carcinoma, respectively

conventional mammography and is commonly used as the primary imaging modality (Fig. 2, [6]). Given the low breast cancer prevalence in men and lack of routine screening, little data exists regarding the yield of DBT when compared to conventional mammography. When compared to other modalities such as ultrasound and magnetic resonance imaging (MRI),

Fig. 5 Bilateral CC (**a**) and MLO (**b**) projections of a male with a palpable complaint in the right breast retroareolar region denoted by a triangular marker. Mammogram findings demonstrate asymmetric diffuse glandular gynecomastia in the right breast, with minimal gynecomastia in the left breast

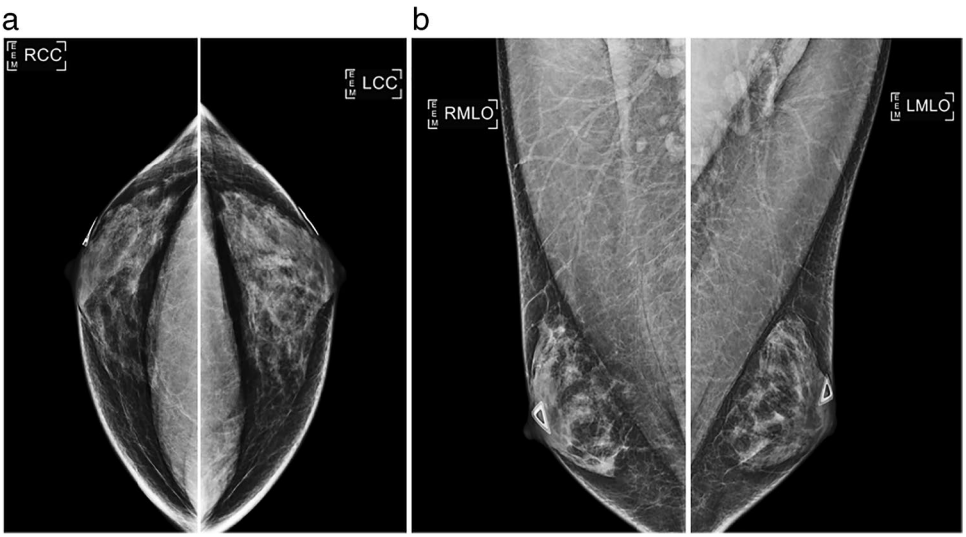

Fig. 6 Bilateral CC (**a**) and MLO (**b**) projections of a male with palpable complaints in both breasts denoted by triangular markers. Mammogram findings demonstrate symmetric diffuse glandular gynecomastia in both breasts

mammography is superior for the detection of calcifications, which can be seen in the setting of DCIS. If normal or classically benign processes are detected mammographically, this can preclude evaluation with other modalities and obviate the need for core biopsy. The same routinely obtained views for women are also performed in men and include craniocaudal (CC) and mediolateral oblique (MLO) views (Fig. 3a, b, [6]). Regardless of the laterality of a specific clinical concern, bilateral mammography is often performed to assess for symmetry and clinically occult contralateral pathology.

According to the American College of Radiology (ACR) Appropriateness Criteria, male patients 25 years of age or older with indeterminate clinical exam findings such as a palpable mass (that is not consistent with gynecomastia), pain, nipple discharge, or axillary lymphadenopathy should undergo mammography or DBT as the initial imaging modality [8, 9]. Depending on the mammographic findings, an ultrasound may or may not be recommended. Conversely, due to the low likelihood of developing breast cancer in patients under 25 years of age, initial imaging with ultrasound is recommended by the ACR [9]. If a concerning finding is identified on ultrasound, mammography or DBT can be performed at the discretion of the interpreting radiologist. Currently, routine breast cancer screening with mammography is not recommended for men.

Ultrasound is often used in conjunction with mammography. If a suspicious finding is found on mammography, ultrasound can aid in further characterization of the abnormality and determine whether core needle biopsy is indicated. Also, ultrasound is a reliable tool for evaluating the axillary nodal basins in the setting of invasive breast cancer, which informs staging and subsequent treatment decisions.

Table 1 Common causes of gynecomastia [6]

Physiologic
Neonatal
Puberty
Elderly
Medications and other drugs
Anabolic steroids
Cimetidine
Thiazide diuretics
Tricyclic antidepressants
Benzodiazepines
Spironolactone
Amiodarone
Finasteride
Marijuana
Endocrine disorders
Kleinfelter syndrome
Hypogonadism
Thyroid dysfunction
Systemic
Cirrhosis
Chronic renal failure
Neoplastic
Adrenal tumors
Pituitary tumors
Hepatocellular carcinoma
Lung cancer
Idiopathic

Magnetic Resonance Imaging

In female patients, breast MRI is routinely utilized in both the high-risk screening and diagnostic settings. In men, however, there are no established guidelines on the use of breast MRI. In most clinical scenarios involving the symptomatic male breast, a combination of mammography, ultrasound and core needle biopsy is sufficient for diagnosis and treatment planning. In male patients with breast cancer where a clinical question persists following conventional imaging, MRI may be useful to delineate disease extent (Fig. 4a-g, [6]).

Benign Conditions of the Male Breast

Gynecomastia

Gynecomastia is a common benign condition encountered during evaluation of the symptomatic male breast and is defined as proliferation of the stromal and ductal elements [10]. The most common presenting symptom is a palpable lump or swelling in the retroareolar region, which can often be tender. These findings can be unilateral or bilateral and often asymmetric (Figs. 5 and 6). Physiologically, gynecomastia occurs due to increased estradiol levels, most commonly seen in the infant, peripubertal stage, and in the elderly [11]. Many possible causes exist, some of which are listed in Table 1 [6, 12].

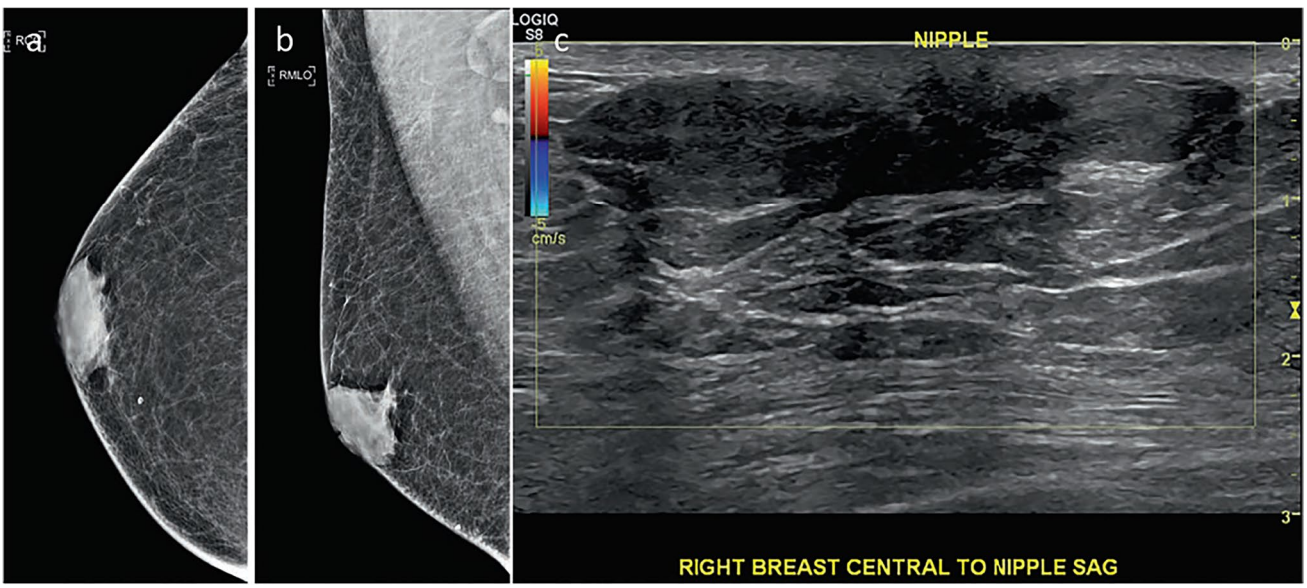

Fig. 7 (**a**-**c**) Full-field digital mammographic CC (**a**) and MLO (**b**) views of the right breast demonstrate early nodular gynecomastia. A sonographic image (**c**) of this abnormality shows a vague hypoechoic mass in the retroareolar region, consistent with gynecomastia

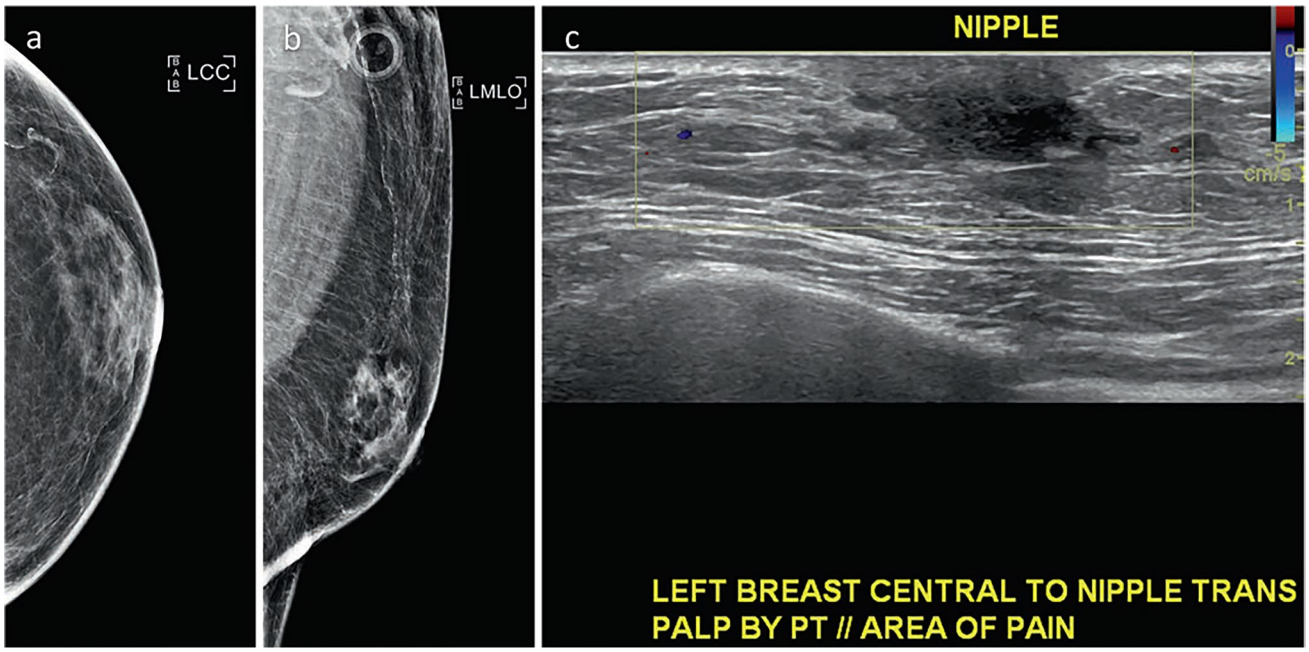

Fig. 8 (**a**-**c**) Full-field digital mammographic CC (**a**) and MLO (**b**) views of the left breast demonstrate the late dendritic pattern of gynecomastia in an 82-year-old man. A sonographic image (**c**) of a different patient shows a hypoechoic mass in the retroareolar region with finger-like projections into the adjacent fatty tissue and no associated vascularity, consistent with gynecomastia

The three classic patterns of gynecomastia are nodular, dendritic, and diffuse glandular. The nodular subtype is seen in the early phase when the causative agent is present for less than one year. Mammography findings demonstrate a fan-shaped or round density in the retroareolar region (Fig. 7a, b, [6]). Sonographically, a hypoechoic subareolar mass can be seen, sometimes with associated vascularity (Fig. 7c, [6]) [13]. The clinical and imaging findings are reversible if the causative agent is removed during this stage. Histologically, there is hyperplasia of the intraductal epithelium with surrounding edema [5].

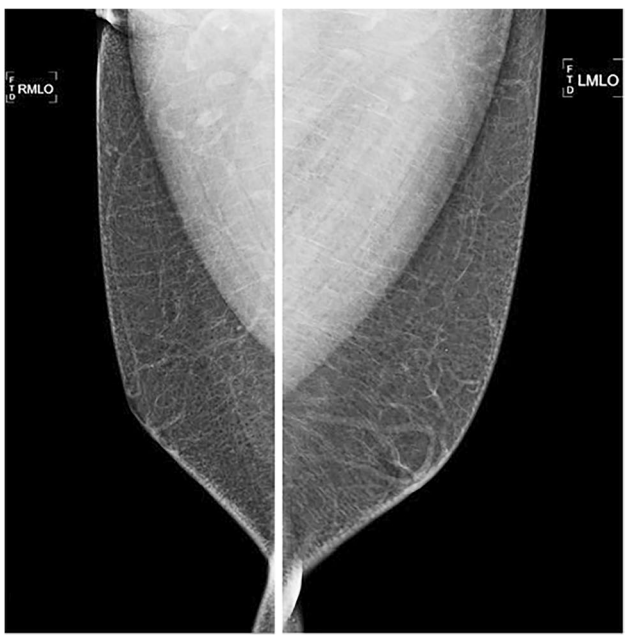

Fig. 9 Bilateral full-field MLO projections of a male patient with pseudogynecomastia. Note the sole presence of adipose tissue bilaterally without mass or glandular tissue

The dendritic pattern usually occurs in men whose symptoms persist for longer than one year, resulting in a flame-shaped subareolar density with fingerlike projections on mammogram (Fig. 8a, b, [6]). Ultrasound findings may appear as a triangular shaped hypoechoic mass also with fingerlike extensions into the normal fatty tissue (Fig. 8c, [6]). Histologically, there is ductal proliferation and hyalinized, fibrotic stroma, which is usually irreversible both clinically and radiographically [8].

The diffuse glandular pattern is similar to that of a heterogeneously dense female breast both by mammogram (Fig. 6) and ultrasound, and is commonly secondary to exogenous estrogen. This pattern may also include a combination of findings characteristic of nodular and dendritic gynecomastia.

In contrast, pseudogynecomastia is defined as unilateral or bilateral proliferation of fatty tissue without a palpable mass, most commonly related to obesity. No stimulation of ductal or stromal elements has occurred [14]. Mammography demonstrates an entirely fatty breast without mass or the retroareolar findings typically seen in gynecomastia, which have been described above (Fig. 9, [6]).

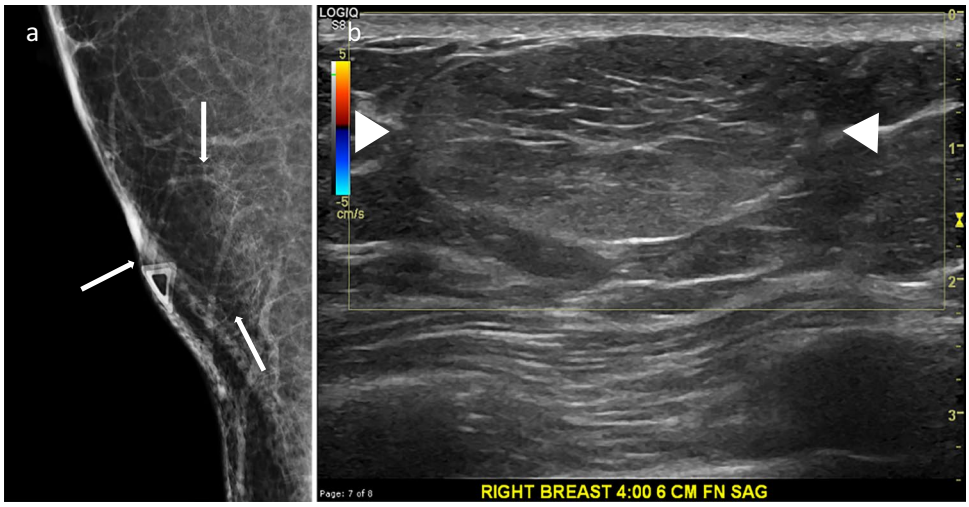

Fig. 10 (**a**, **b**) Lipoma in a 42-year-old male who presented for evaluation of a palpable complaint. A coned-down digital mammographic image of the right breast in the latero medial (LM) projection (**a**) demonstrates an oval, fat-density mass with a thin pseudocapsule (white arrows) that corresponds to the palpable complaint, which is denoted by the overlying triangular marker. A targeted sonographic image (**b**) shows an oval mass with a circumscribed margin and no internal vascularity (white arrowheads) that is iso- to hyperechoic

Treatment of gynecomastia should first include a thorough medical history including medications, both prescription and recreational, as well as diet to evaluate for physiologic or iatrogenic causes. If a specific inciting agent can be identified, its removal may result in gynecomastia regression provided that this causative agent has not been present for an extended period, usually over one year. Reduction mammoplasty and liposuction are surgical alternatives in patients who do not respond to more conservative treatment efforts [15].

Lipoma

Lipomas are mesenchymal tumors composed entirely of adipose cells and are the second most common benign breast entity in males [16]. These may be incidental findings on imaging or palpated on physical exam as a painless, soft, mobile mass. When seen with mammography, lipomas are typically oval, circumscribed masses with a thin capsule and internal density similar to that of the surrounding breast fat (Fig. 10a). On ultrasound, the typical appearance is an oval

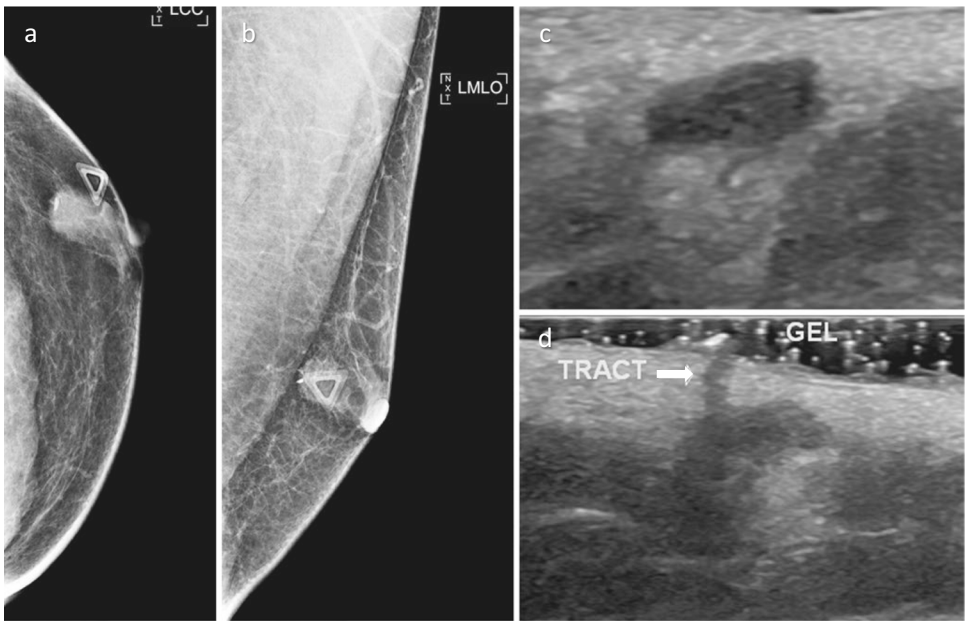

Fig. 11 (**a**-**d**) Epidermal inclusion cyst (EIC) in a male who presented for evaluation of a palpable complaint. Full-field digital mammographic CC (**a**) and MLO (**b**) views of the left breast demonstrate a circumscribed, oval mass that corresponds to the palpable complaint denoted by the triangular marker. Targeted sonographic images (**c**) of this area show a circumscribed, hypoechoic mass in the skin with an associated tract (**d**) (white arrow) to the skin surface, consistent with an EIC

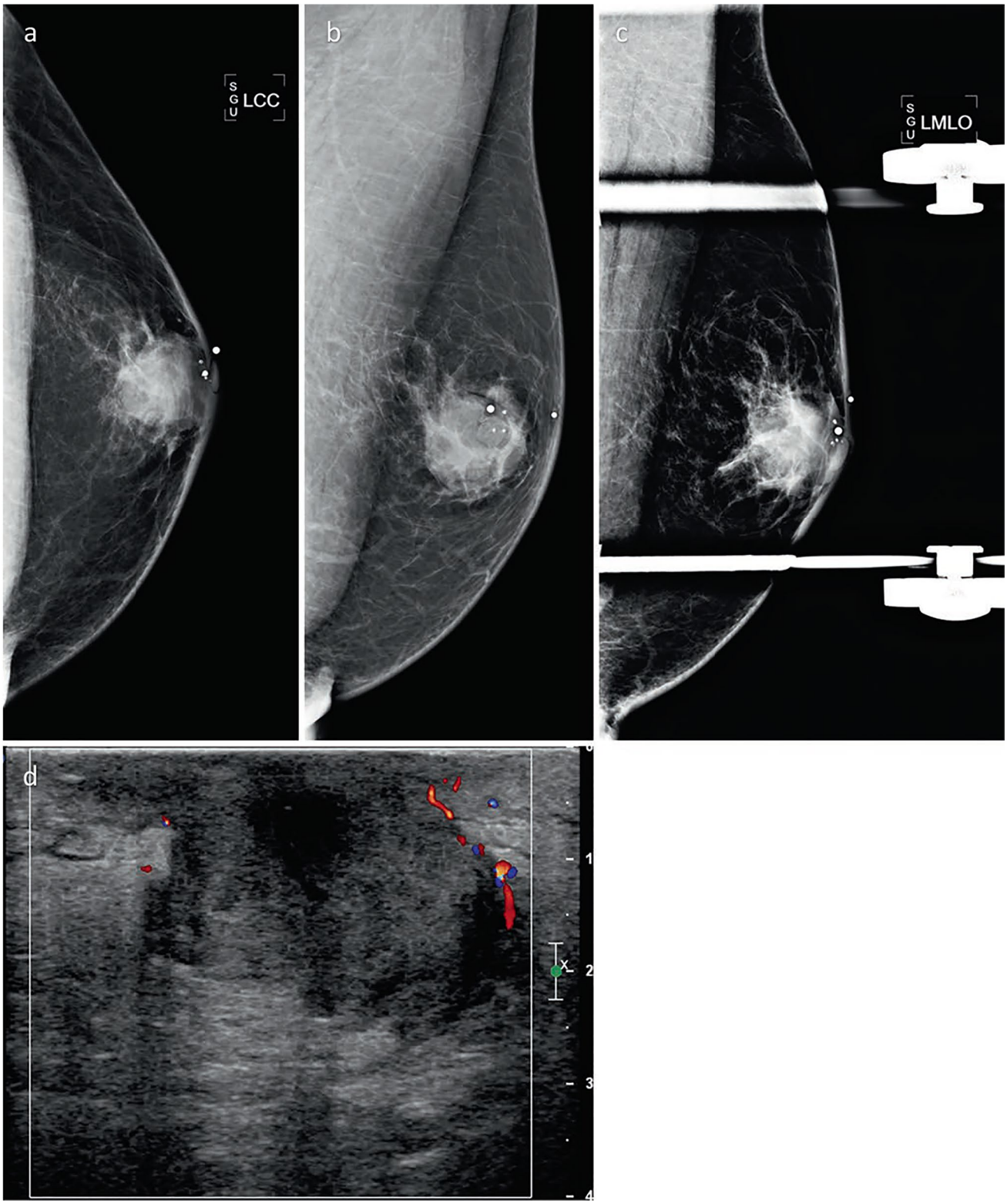

Fig. 12 (**a**-**d**) Subareolar abscess in a 27-year-old immunocompromised male. Full-field digital mammographic CC (**a**) and MLO (**b**) views of the left breast, and spot compression in the MLO projection (**c**) demonstrate an irregular subareolar mass with surrounding trabecular thickening that corresponds to the palpable complaint denoted by a metallic BB marker. A sonographic image (**d**) of this area shows a heterogeneous fluid collection with adjacent hyperemia and increased echogenicity of the surrounding fat

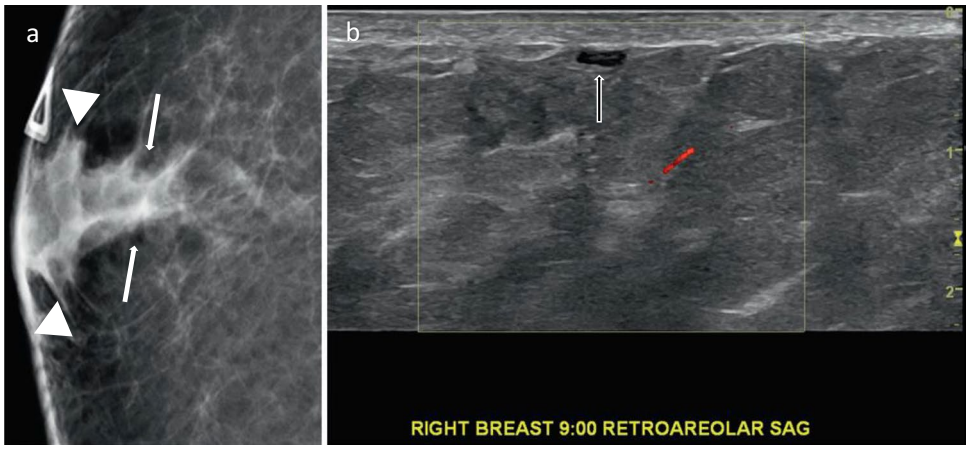

Fig. 13 (**a**, **b**) Pseudoangiomatous stromal hyperplasia (PASH) in a 54-year-old man who presented for evaluation of a palpable complaint. Coned-down digital mammogram of the right breast (**a**) demonstrates an irregular mass (white solid arrows) in a background of gynecomastia (white arrowheads), which corresponds to the palpable complaint denoted by the triangular marker. A targeted sonographic image (**b**) of this area shows a vague hypoechoic mass with an internal cystic component (open white arrow). Core needle biopsy of this mass yielded PASH

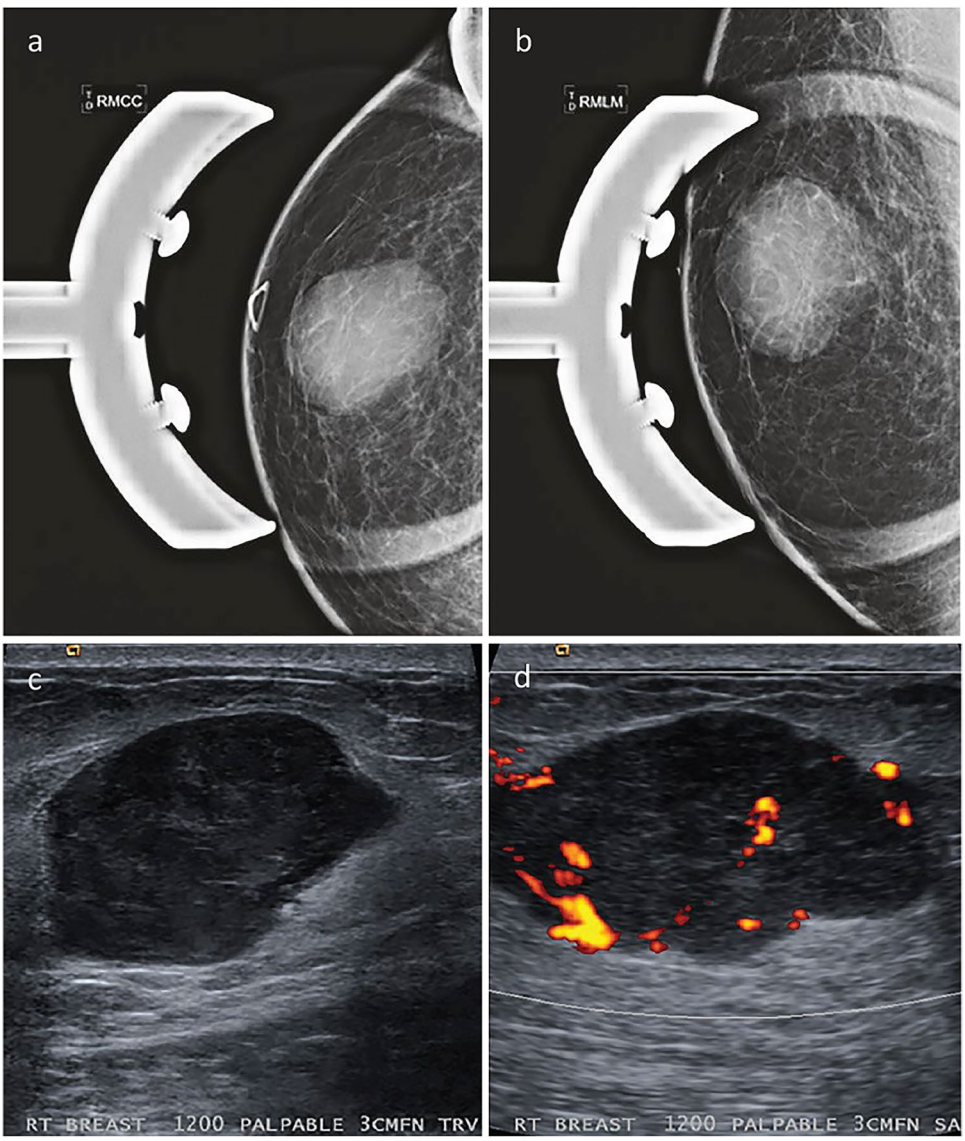

Fig. 14 (**a**-**d**) Myofibroblastoma in a 62-year-old male with a palpable, mobile mass in the right breast. Digital spot magnification views of the right breast in the CC (**a**) and LM (**b**) projections demonstrate an oval, circumscribed, high density mass that corresponds to the palpable complaint denoted by the triangular marker. Sonographic images of this area show an oval, circumscribed, hypoechoic mass (**c**) with internal vascularity (**d**). Core needle biopsy of this mass yielded myofibroblastoma

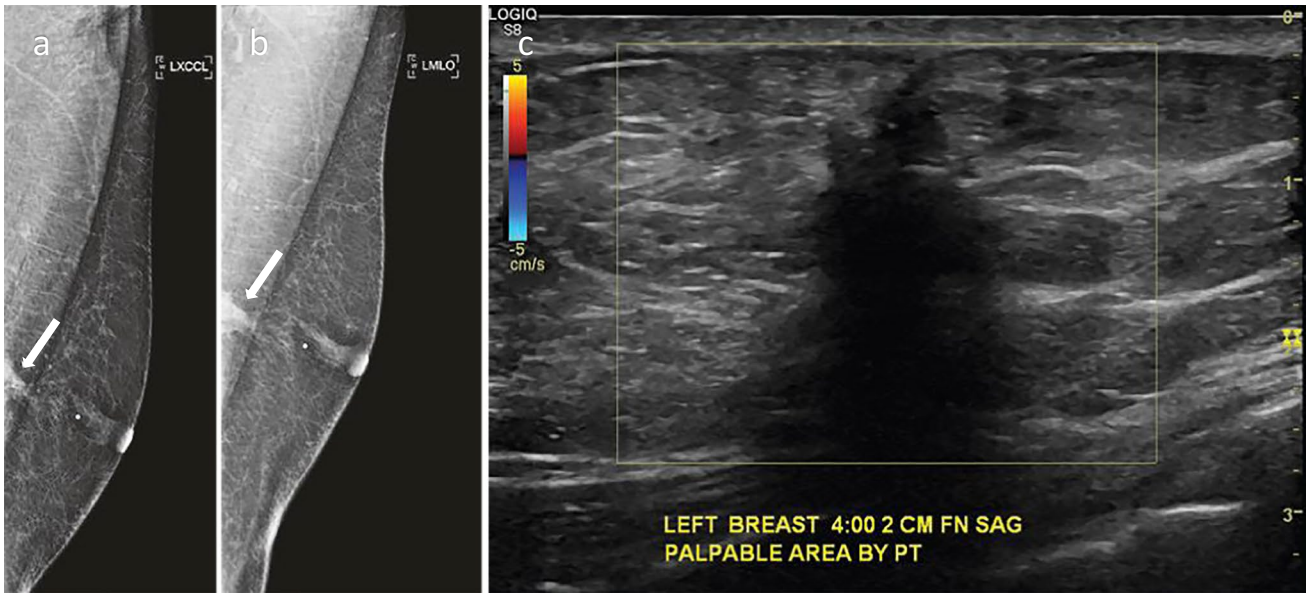

Fig. 15 (**a**-**c**) Nodular fasciitis in a 61-year-old male with a palpable mass in the left breast. Full-field digital mammographic laterally exaggerated craniocaudal (XCCL) (**a**) and MLO (**b**) projections of the left breast demonstrate an irregular, high density mass with an obscured margin (white arrows), which correlates with the palpable complaint denoted by the metallic BB marker. A targeted sonographic image of this area (**c**) shows an irregular, hypoechoic mass with angular margins and posterior acoustic shadowing but no internal vascularity. Core needle biopsy of this mass yielded nodular fasciitis

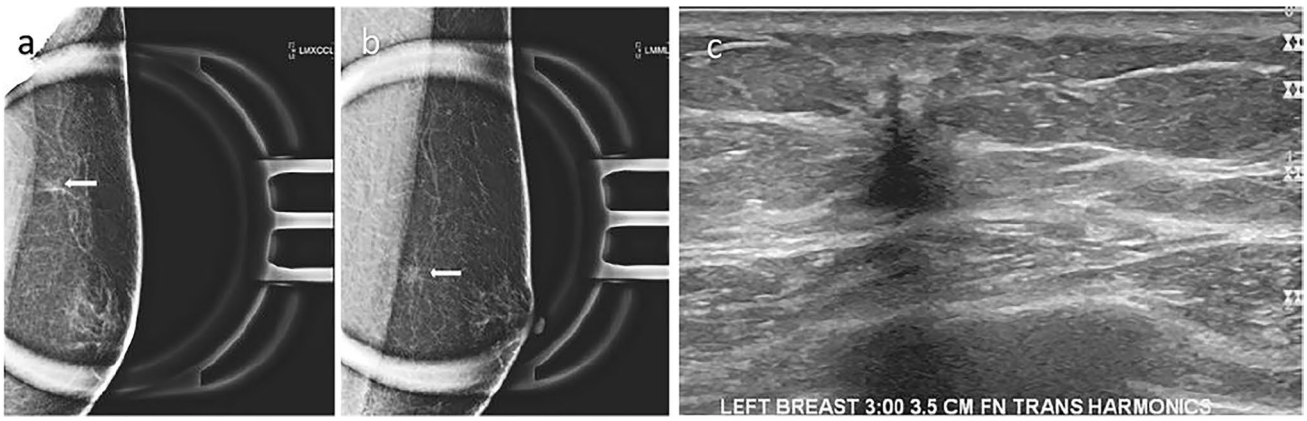

Fig. 16 (**a**-**c**) Granular cell tumor in a 71-year-old male that presented with left breast pain. Digital spot magnification mammographic views of the left breast in the XCCL (**a**) and mediolateral (ML) (**b**) projections demonstrate an irregular, high density mass with spiculated margins (white arrows). A targeted sonographic image of this area (**c**) shows an irregular, hypoechoic mass with spiculated margins and posterior acoustic shadowing. Core needle biopsy of this mass yielded granular cell tumor

mass that is homogenously isoechoic (or hyperechoic) to the adjacent breast fat, usually with absent internal vascular flow on Doppler imaging (Fig. 10b) [5].

Epidermal Inclusion Cyst

Epidermal inclusion cysts (EICs) are the third most common benign entity that can develop in the male breast [17]. These often arise from an obstructed hair follicle within the dermis. Mammographically, EICs present as an oval, circumscribed mass that is superficial in location (Fig. 11a, b, [6]). When a tract to the skin surface is present on ultrasound, this is considered a pathognomonic finding and no further imaging workup is necessary (Fig. 11c, d, [6]). If EICs are biopsied, mastitis (and possibly abscess) can occur due to the inflammatory response in the surrounding breast from the leaked internal contents [18].

Table 2 Risk factors for the development of breast cancer in males [6]

Demographic
Increased age
Family history (typically first-degree relative)
Genetics
BRCA mutations (higher risk in BRCA2 than BRCA1)
CHEK2 mutation
Klinefelter syndrome
Ashkenazi Jewish men
Hormonal
Exogenous estrogen
Liver disease
Obesity
Testicular abnormalities
Prior chest radiation

Abscess

Although rare in men, breast abscesses can occur secondary to the skin colonizing bacteria *Staphylococcus aureus*, and are commonly located in the subareolar region [19]. Physical exam findings include pain, swelling, erythema, and possibly nipple discharge. Common mammographic findings are an irregular retroareolar mass with associated skin thickening and increased trabeculations (Fig. 12a-c, [6]). With ultrasound, a hypoechoic/heterogeneous fluid collection and hyperemia of the surrounding tissues are common findings (Fig. 12d, [6]). Treatment usually involves antibiotics with or without percutaneous drainage [20]. In cases where the sonographic findings indicate internal vascular flow on Doppler imaging, a biopsy is necessary to exclude malignancy, as a complex cystic and solid mass can have a similar appearance.

Pseudoangiomatous Stromal Hyperplasia

Pseudoangiomatous stromal hyperplasia (PASH) is defined as benign proliferation of mesenchymal tissue/myofibroblasts in the breast [21]. Histologically, numerous slit-like spaces lined by spindle cells in a background of dense stroma are defining features [22]. It is hypothesized that the cause of PASH, specifically the proliferation of myofibroblasts, is hormonally driven [23]. Mammographically, PASH may present as an asymmetry or as a circumscribed or irregular mass that is frequently encountered in conjunction with gynecomastia, which further substantiates the hormonal imbalance theory (Fig. 13a, [6]). Ultrasound findings are nonspecific and typically demonstrate a hypoechoic mass that may have an internal cystic component (Fig. 13b, [6]) [24].

Myofibroblastoma

Myofibroblastomas are benign mesenchymal masses that arise from stromal elements in the breast parenchyma and are seen most commonly in the sixth to seventh decades of life, with equal prevalence between males and females [5]. Histologically, bland fascicles of spindle cells intermixed with thick hyalinized collagen bundles are identified [25]. On mammography, myofibroblastomas appear as oval or round circumscribed masses that are usually slow-growing (Fig. 14a, b, [6]). Ultrasound usually shows an oval or round, circumscribed mass that is hypoechoic to heterogeneous in echogenicity (Fig. 14c, [6]). Internal vascularity on Doppler interrogation is variable (Fig. 14d, [6]). Surgical excision is the definitive management, with no reported cases of malignant potential or local recurrence [26].

Nodular Fasciitis

Nodular fasciitis is a benign entity defined by reactive proliferation of fibroblasts, and most commonly occurs in the upper limbs, head and neck, and trunk [27]. Involvement of the breast is rare, but given the characteristic of rapid growth, distinction from malignancy can be difficult. On mammogram, the common finding is an irregular mass with obscured or spiculated margins (Fig. 15a, b, [6]) with a corresponding irregular, hypoechoic mass on ultrasound, also with margins that are not circumscribed (Fig. 15c, [6]) [28]. Given the lack of unique imaging characteristics to differentiate nodular fasciitis from breast cancer, core needle biopsy is the only reliable route to distinguish these two entities. Local excision is recommended and, once performed, there is a limited capacity for recurrence [29].

Granular Cell Tumor

A granular cell tumor is a rare benign soft tissue mass that mimics malignancy. These are believed to derive from Schwann cells and can occur anywhere in the body [30]. Clinical exam findings can include a firm mass with associated nipple/skin retraction [11]. Mammography and ultrasound findings are similar to those seen with breast malignancy, and core needle biopsy is necessary to establish the diagnosis (Fig. 16a-c, [6]).

Male Breast Cancer

When compared to breast cancer in women, breast cancer in men is much rarer and accounts for < 1% of all breast cancer cases. According to the American Cancer Society, the number of both male and female breast cancer has

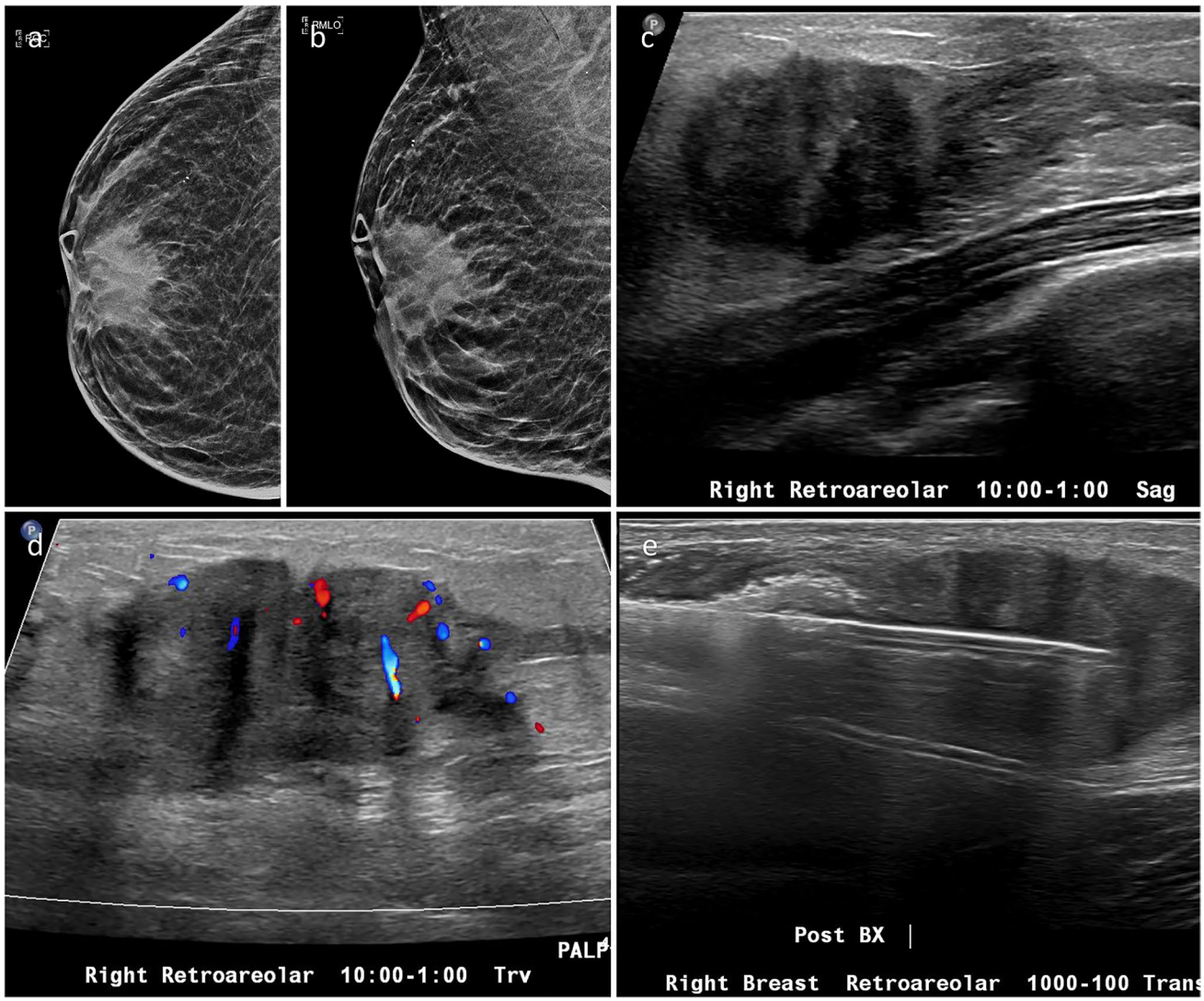

Fig. 17 (**a**-**e**) Invasive ductal carcinoma (IDC) in a 66-year-old male with a palpable mass in the right breast. Digital mammographic views of the right breast in the CC (**a**) and MLO (**b**) projections demonstrate an irregular, high density mass with spiculated margins, which correlates with the palpable complaint denoted by the triangular marker. Sonographic images of this area (**c**) show an irregular, hypoechoic mass with indistinct margins and internal vascularity (**d**). Ultrasound-guided core biopsy of this mass (**e**) yielded IDC

risen over the last 20 years [31]. The median age of diagnosis in men and women is 67 years and 62 years, respectively [32]. While the exact etiology of male breast cancer is unknown, several risk factors have been identified that can lead to the development of breast cancer in men, with the most common being advanced age, hormonal imbalance, radiation to the chest, and a family history of breast cancer [33]. These and other examples are included in Table 2 [6].

The majority of male breast cancer cases are estrogen (ER) and progesterone receptor (PR) positive, but human epidermal growth factor receptor 2 (HER-2) negative. Several clinical and histologic similarities exist between male and female breast cancer, but men tend to have lower grade, higher stage, later onset, and more hormone receptor positive disease when compared to women [32]. Treatment is similar for both men and women, and depends on both the stage of the disease and the histologic/molecular subtype.

Invasive Ductal Carcinoma

Invasive ductal carcinoma (IDC) is the most common type of male breast cancer and comprises approximately 80% of all breast cancer diagnoses in men [34]. On core

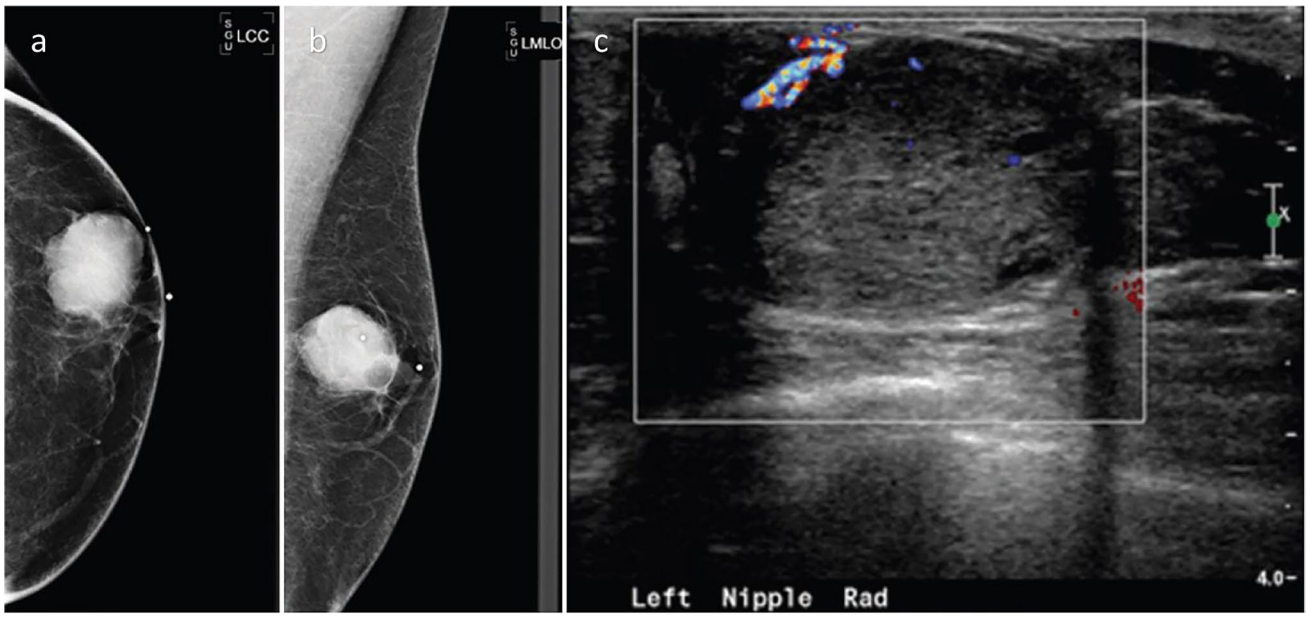

Fig. 18 (**a**-**c**) Papillary carcinoma in a 63-year-old male with a palpable mass in the left breast. Digital mammographic views of the left breast in the CC (**a**) and MLO (**b**) projections demonstrate an irregular, high density mass that is eccentric to the nipple, which correlates with the palpable complaint denoted by the metallic BB marker. A sonographic image of this area (**c**) shows an oval, hypoechoic mass within a dilated duct. Core needle biopsy of this mass yielded papillary carcinoma

needle biopsy, approximately 35–50% of male breast cancers will have associated ductal carcinoma in situ (DCIS). However, isolated DCIS without an invasive component only comprises 5% of all male breast cancers and usually presents as suspicious microcalcifications, which are best identified on mammography [35]. Male patients tend to present with more advanced clinical findings when compared to women, and may have symptoms such as a palpable mass, skin/nipple retraction, nipple discharge, or unilateral palpable axillary lymphadenopathy [36].

The typical mammographic appearance of IDC is an irregular, spiculated, high density mass that can be central or eccentric to the nipple (Fig. 17a, b). Associated microcalcifications may be present, which would raise suspicion for associated DCIS, as described above. On ultrasound the most common finding is an irregular, hypoechoic mass with a margin that is not circumscribed (Fig. 17c, d). Core needle biopsy either utilizing mammography or ultrasound guidance (Fig. 17e) is recommended if the imaging findings are suspicious for malignancy.

Papillary Carcinoma

Invasive papillary carcinoma, a subtype of IDC, is the second most common invasive cancer in males and interestingly has a higher incidence (5–7.5%) when compared to women [37]. On mammogram, these may present as a high density mass with circumscribed, obscured, or spiculated margins (Fig. 18a, b, [6]). On ultrasound, a common appearance is a hypoechoic mass with an associated cyst or dilated duct, or a complex cystic and solid mass (Fig. 18c, [6]). It can be difficult to distinguish a benign intraductal papilloma from papillary carcinoma, therefore, core needle biopsy is recommended [38].

Invasive Lobular Carcinoma

Invasive lobular carcinoma (ILC) is rare in men due to the lack of lobular and acinar development in the male breast, and comprises 1% of all male breast malignancies [39]. ILC can present mammographically in a variety of appearances: irregular mass with spiculated margin, architectural distortion, or be mammographically occult (Fig. 19a-c, [6]). Sonographically, the most common appearance is an irregular, hypoechoic mass with margins that are not circumscribed (Fig. 19d, e, [6]). Typically, the appearance of ILC is less distinct than that of IDC, which more commonly presents as a well-defined solid mass.

Conclusion

In the symptomatic male breast with indeterminate or concerning clinical findings, further evaluation with imaging is recommended. Fortunately, most conditions involving the

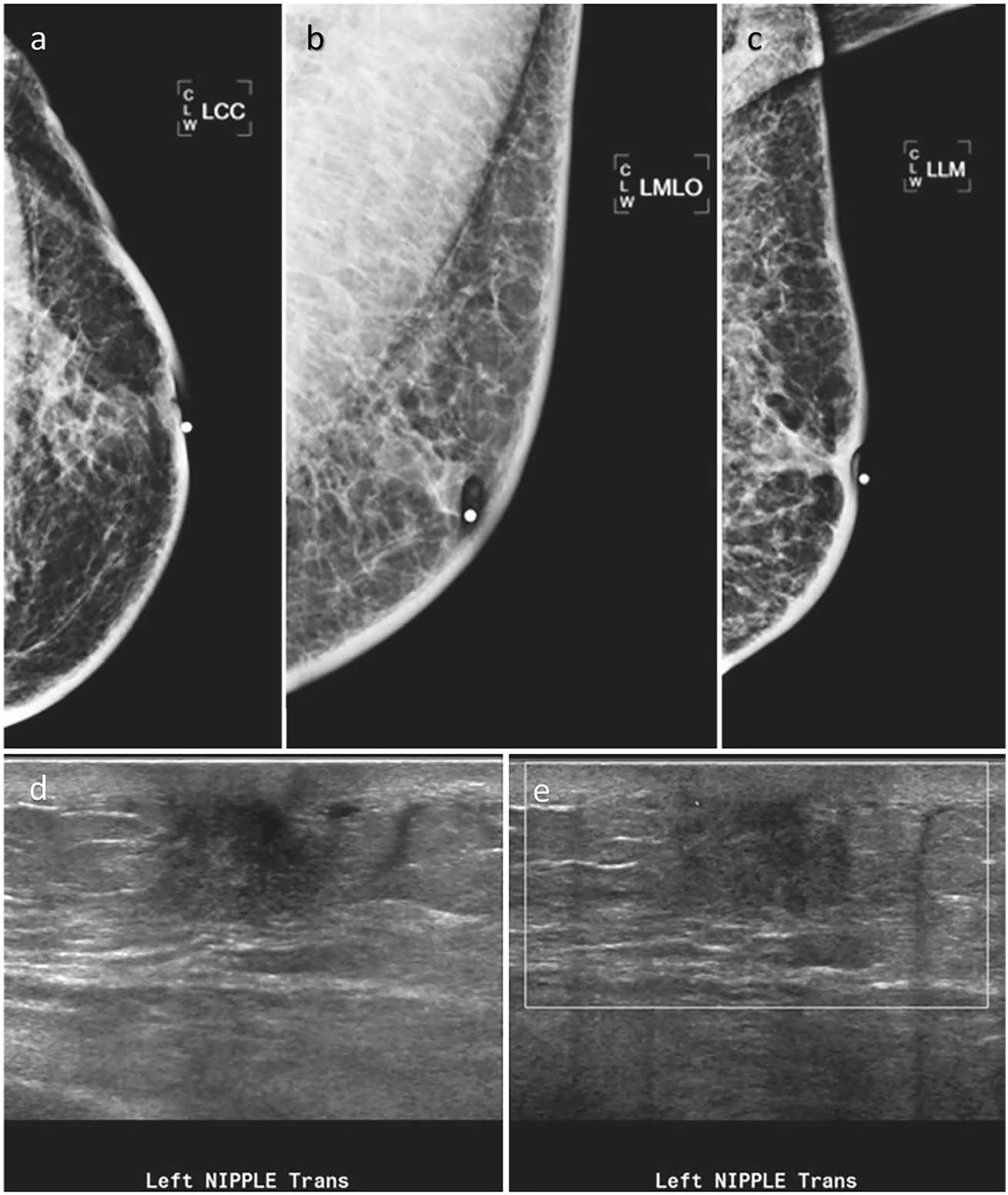

Fig. 19 (**a**-**e**) Invasive lobular carcinoma (ILC) in a 63-year-old male that presented for evaluation of left breast induration. Digital mammographic views of the left breast in the CC (**a**), MLO (**b**), and LM (**c**) projections demonstrate a focal asymmetry in the central breast with nipple retraction (the nipple is denoted by the metallic BB marker). Sonographic images of this area (**d**) show an irregular, hypoechoic mass with indistinct margins and minimal internal vascularity (**e**). Core needle biopsy of this mass yielded ILC. (Case courtesy of Karan Saluja, MBBS, MD)

male breast are benign and male breast cancer is rare. Familiarity with the breadth of presentations of both benign and malignant disease processes in the male breast is essential for clinicians and radiologists to ensure appropriate work-up and accurate diagnosis.

Declarations

Conflict of Interest There are no conflicts of interest to disclose by the authors.

Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

1. Esposito A, Ablah E, Okut H, Tenofsky PL. Characteristics, treatment and outcomes of HER2 positive male breast cancer. Am J Surg. 2022.
2. American Cancer Society: Key Statistics for Breast Cancer in Men. 2023 [Available from: https://www.cancer.org/cancer/breast-cancer-in-men/about/key-statistics.html].
3. Konduri S, Singh M, Bobustuc G, Rovin R, Kassam A. Epidemiology of male breast cancer. Breast. 2020;54:8–14.
4. Javed A, Lteif A. Development of the human breast. Semin Plast Surg. 2013;27(1):5–12.
5. Viana MP, Tucunduva TCM, Torres US, Aguillar VLN, Bresciani BH, Shimizu C, et al. Imaging of male breast disease: the good, the bad and the ugly - A pictorial review. Clin Imaging. 2020;68:45–56.
6. Ortiz-Perez T, Roark A, Watson A. Imaging of the Symptomatic Male Breast. In: Shetty M, editor. Breast & Gynecological Diseases: Springer; 2021.
7. Kopans D. Breast imaging. 3rd ed. Baltimore: Lippincott Williams & Wilkins; 2007.
8. Swamy N, Rohilla M, Raichandani S, Bryant-Smith G. Epidemiology of male breast diseases: A 10-year institutional review. Clin Imaging. 2021;72:142–50.
9. Expert Panel on Breast I, Niell BL, Lourenco AP, Moy L, Baron P, Didwania AD, et al. ACR Appropriateness Criteria((R)) Evaluation of the Symptomatic Male Breast. J Am Coll Radiol. 2018;15(11S):S313-S20.
10. Madhukar M, Chetlen A. Multimodality imaging of benign and malignant male breast disease. Clin Radiol. 2013;68(12):e698-706.
11. Kim SH, Kim YS. Ultrasonographic and Mammographic Findings of Male Breast Disease. J Ultrasound Med. 2019;38(1):243–52. **This pictorial review highlights several benign and malignant processes in the male breast, with excellent corresponding mammographic and sonographic images**.
12. Sansone A, Romanelli F, Sansone M, Lenzi A, Di Luigi L. Gynecomastia and hormones. Endocrine. 2017;55(1):37–44.
13. Zehr KR. Diagnosis and Treatment of Breast Cancer in Men. Radiol Technol. 2019;91(1):51M-61M.
14. Ng AM, Dissanayake D, Metcalf C, Wylie E. Clinical and imaging features of male breast disease, with pathological correlation: a pictorial essay. J Med Imaging Radiat Oncol. 2014;58(2):189–98.
15. Prasetyono TOH, Budhipramono AG, Andromeda I. Liposuction Assisted Gynecomastia Surgery With Minimal Periareolar Incision: a Systematic Review. Aesthetic Plast Surg. 2022;46(1):123–31.
16. Safak KY. Mammography Findings of Male Breast Diseases. J Breast Health. 2015;11(3):106–10.
17. Ak M, Yurtsever C, Cakir OF, Yurtsever N. Epidermal inclusion cyst in male breast: how to differentiate from other male breast lesions. Radiol Case Rep. 2022;17(10):3919–22.
18. Rahman AN, Shokouh-Amiri M, Wiley E, Green L. Epidermoid Cyst in Male Patient Mimicking a Suspicious Breast Mass and Consequences of Biopsy. J Clin Imaging Sci. 2019;9:50.
19. Boakes E, Woods A, Johnson N, Kadoglou N. Breast Infection: A Review of Diagnosis and Management Practices. Eur J Breast Health. 2018;14(3):136–43.
20. Versluijs-Ossewaarde FN, Roumen RM, Goris RJ. Subareolar breast abscesses: characteristics and results of surgical treatment. Breast J. 2005;11(3):179–82.
21. Maciolek LM, Harmon TS, He J, Sadruddin S, Nguyen QD. Pseudoangiomatous Stromal Hyperplasia of the Breast: A Rare Finding in a Male Patient. Cureus. 2019;11(6): e4923.
22. Jones KN, Glazebrook KN, Reynolds C. Pseudoangiomatous stromal hyperplasia: imaging findings with pathologic and clinical correlation. AJR Am J Roentgenol. 2010;195(4):1036–42.
23. Bowman E, Oprea G, Okoli J, Gundry K, Rizzo M, Gabram-Mendola S, et al. Pseudoangiomatous stromal hyperplasia (PASH) of the breast: a series of 24 patients. Breast J. 2012;18(3):242–7.
24. Owji SC, Shroff N, Robinson AS, Posleman Monetto FE. Pseudoangiomatous stromal hyperplasia in a healthy young adult male. Radiol Case Rep. 2022;17(9):2919–22.
25. Yan M, Bomeisl P, Gilmore H, Sieck L, Kuchta Z, Harbhajanka A. Clinicopathological and radiological characterization of myofibroblastoma of breast: A single institutional case review. Ann Diagn Pathol. 2020;48: 151591.
26. Wargotz ES, Weiss SW, Norris HJ. Myofibroblastoma of the breast. Sixteen cases of a distinctive benign mesenchymal tumor. Am J Surg Pathol. 1987;11(7):493–502.
27. Lin W, Bao L. Nodular fasciitis of the breast: the report of three cases. BMC Womens Health. 2022;22(1):54.
28. Choi HY, Kim SM, Jang M, Yun BL, Ahn HS, Park SY, et al. Nodular Fasciitis of the Breast: A Case and Literature Review. Ultraschall Med. 2015;36(3):290–1.
29. Zhao M, Yin X, Wen Y, Ru G, Meng X. Nodular fasciitis of the breast: Report of two cases illustrating the diagnostic implications for USP6 gene rearrangement and brief review of the literature. Exp Mol Pathol. 2021;123: 104690.
30. Neelon D, Lannan F, Childs J. Granular Cell Tumor. StatPearls. Treasure Island (FL)2022.
31. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. CA Cancer J Clin. 2020;70(1):7–30.
32. Khan NAJ, Tirona M. An updated review of epidemiology, risk factors, and management of male breast cancer. Med Oncol. 2021;38(4):39. **This review compares the biology, clinical presentation, genetics, and management of male breast cancer and female breast cancer**.
33. Abdelwahab Yousef AJ. Male Breast Cancer: Epidemiology and Risk Factors. Semin Oncol. 2017;44(4):267–72.
34. Nguyen C, Kettler MD, Swirsky ME, Miller VI, Scott C, Krause R, et al. Male breast disease: pictorial review with radiologic-pathologic correlation. Radiographics. 2013;33(3):763–79.

35. Mathew J, Perkins GH, Stephens T, Middleton LP, Yang WT. Primary breast cancer in men: clinical, imaging, and pathologic findings in 57 patients. AJR Am J Roentgenol. 2008;191(6):1631–9.
36. Giordano SH. A review of the diagnosis and management of male breast cancer. Oncologist. 2005;10(7):471–9.
37. Romics L Jr, O'Brien ME, Relihan N, O'Connell F, Redmond HP. Intracystic papillary carcinoma in a male as a rare presentation of breast cancer: a case report and literature review. J Med Case Rep. 2009;3:13.
38. Blaumeiser B, Tjalma WA, Verslegers I, De Schepper AM, Buytaert P. Invasive papillary carcinoma of the male breast. Eur Radiol. 2002;12(9):2207–10.
39. Senger JL, Adams SJ, Kanthan R. Invasive lobular carcinoma of the male breast - a systematic review with an illustrative case study. Breast Cancer (Dove Med Press). 2017;9:337–45.