



Breast Imaging Review Article

Unusual Male Breast Lesions

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ABSTRACT

Most of male breast masses are benign with gynecomastia being the most common entity encountered. Primary male breast cancer accounts for less than 1% of the total number of breast cancer. Male breast can be affected by a variety of conditions affecting the female breast with less frequency due to the lack of hormonal influence and consequent glandular sub-development. Imaging features of male breast masses are quite similar to the female breast. Therefore, using the knowledge of the female breast and applying it may help in the diagnosis and management of male breast abnormalities. In this article, we aim to review a variety of unusual male breast masses. We discuss the demographics of male breast tumors, describe the diagnostic algorithm for evaluating male breast masses, and review the imaging features of rare breast masses and mimickers of male breast cancer.

Keywords: Male breast, Mammogram, Ultrasound, Benign, Malignant

INTRODUCTION

Despite the rudimentary anatomical structure and physiological non-functionality of male breast, it is susceptible to the same variety of conditions affecting the female breast with less frequent occurrence, which is likely due to absence of hormonal influence and therefore glandular sub-development.^[1]

Breast lesions in most men are benign, of which gynecomastia represents the most prevalent condition.^[2] Nevertheless, male breast cancer comprises approximately 1% of all breast cancers around the world, and accounts for less than 0.2% of all cancer-related deaths among men.^[3]

Gynecomastia and invasive ductal carcinoma (IDC) are classified as the usual male breast masses; other circumstances can then be considered unusual lesions. Gynecomastia is a benign proliferation of breast tissue elements (i.e., duct and stroma), which affect up to 65% of men (peripubertal and >50-year-old). It presents clinically as a bilateral, compressible, concentric, tender, and mobile mass, and can be classified into three subtypes: Florid gynecomastia (acute and reversible), dendritic gynecomastia (chronic and irreversible), and diffuse glandular gynecomastia (mimicking female breast).^[4,5] On the other hand, IDC comprises the majority of male breast carcinomas (74–95%), and of all mammary cancers; IDC is considered the most common type of breast cancer in both men (especially at an older age) and women.^[6,7]

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In this article, we review a variety of unusual male breast lesions. We discuss pertinent anatomy, demographics, and optimal radiological work-up. Our goal is to describe the following mass correlates: a) Clinical and histopathological manifestations, b) risk factors, and c) multimodality imaging findings.

ANATOMY

The normal male breast is typically composed of skin, subcutaneous fat which make up most of men's breast volume, atrophic ducts due to peripubertal testosterone level rise, stromal elements, neurovascular structures, lymphatic vessels, and the absence of fibrocollagenous septa (i.e., Cooper's ligaments). By contrast, ducts, stroma, and glandular tissue predominately constitute women's breasts as a result of peripubertal estrogen and progesterone-dependent proliferation.^[4,5] Similar to the female breast, the male breast borders extend from the second rib superiorly to the sixth rib inferiorly, with the sternum situated medially and the mid-axillary line laterally.^[2]

DEMOGRAPHICS

Whereas breast cancer is considered the most commonly diagnosed malignancy of women,^[8] it accounts for less than 1% of all cancers in men, with an incidence of 0.02% in Saudi Arabia in 2014, 0.2% in Canada and 0.97% in United States of America in 2017.^[9-11]

Due to the very low prevalence of breast cancer in men, there are currently no established screening programs. Approximately 4–15% of male breast cancers are reported to be connected to BRCA gene mutations “specifically BRCA2,” with those carrying BRCA having a higher risk of developing breast cancer and may benefit from screening. Male breast cancer is associated in up to 20% of cases with family history of breast cancer.^[12] Other causes of breast cancer in men include cryptorchidism, and Klinefelter's syndrome.^[1] In contrast to women, men have a worse prognosis when breast cancer is diagnosed, as they present at a more advanced stage of the disease.^[13]

Gynecomastia risk factors include physiologic causes (e.g., puberty and senescence), drug use (e.g., cardiovascular agents such as digoxin and antihypertensives, marijuana, anabolic steroids, estrogen therapy, and psychotropic categories of drugs including antidepressants and anxiolytics), cirrhosis, hypogonadism (e.g., Klinefelter syndrome and pituitary hormone deficiency), neoplasms (e.g., Leydig and Sertoli cell tumors), hyperthyroidism, chronic renal disease, and idiopathic causes.^[4,5]

RADIOLOGIC WORKUP

The imaging characteristics of male breast lesions are similar to those of the female breast. Findings on physical examination are

essential to ensure the appropriateness of radiological workup for the evaluation of palpable masses and nipple discharge in men, including ultrasonography, mammography, and ultrasound guided biopsy.^[14] Other than gynecomastia, most of the male breast abnormalities are masses and microcalcifications, with non-retroareolar abnormalities being usually suspicious.

If the clinical indications suggest gynecomastia or pseudogynecomastia with painful palpable lump of up to 2cm in diameter in the discrete area of subareolar tissue, which is usually bilateral but may also be unilateral,^[1] mammography should then be the first imaging modality in men >25 years of age. Ultrasound and biopsy are unwarranted in patients with a classical mammographic appearance of gynecomastia and contributes to unnecessary costs.^[15] Additional imaging evaluation with ultrasound and biopsy may be necessary to further evaluate, if the imaging findings are not suggestive of gynecomastia, suspicious, inconclusive, equivocal or if he is <25 years of age. Ultrasound is typically sufficient for the diagnosis and biopsy planning.^[16]

In a recent review by Shin *et al.*, role of breast MRI was discussed in a limited subset of patients. The indications were limited to posterior cancers with limited assessment of the underlying muscle, occult breast carcinoma presenting with axillary lymph node metastasis, evaluation in cases of inflammatory breast cancer of suspected skin invasion, and evaluation of residual disease post-surgery. The decision to do MRI should be individualized based on clinical necessity.^[17] In our practice, MRI is not considered as part of the workup of breast cancer cases as surgical management is mastectomy despite the disease size and location.

Core needle biopsies (CNBs) are reliable and correlate well with surgical specimen pathology. In cases of suspicious imaging findings and atypical gynecomastia, biopsy is considered regardless of lesion location. Gynecomastia, lipomas, cysts, benign appearing intramammary nodes, and epidermal inclusion cysts are typically not biopsied.

CLASSIFICATION OF MALE BREAST LESIONS

Table 1 shows the list of male breast masses (usual and unusual) differentiated according to the benignity and malignancy nature of the mass. For the purposes of this review article, unusual male breast masses are grouped according to their mammographic appearances [Figure 1] and described based on the fifth edition of BI-RADS lexicon.^[18]

Circumscribed masses

Equal/high density

Papilloma

Intraductal or intracystic papilloma (IP) is a rare benign male breast mass clinically presents as a solitary, painful or

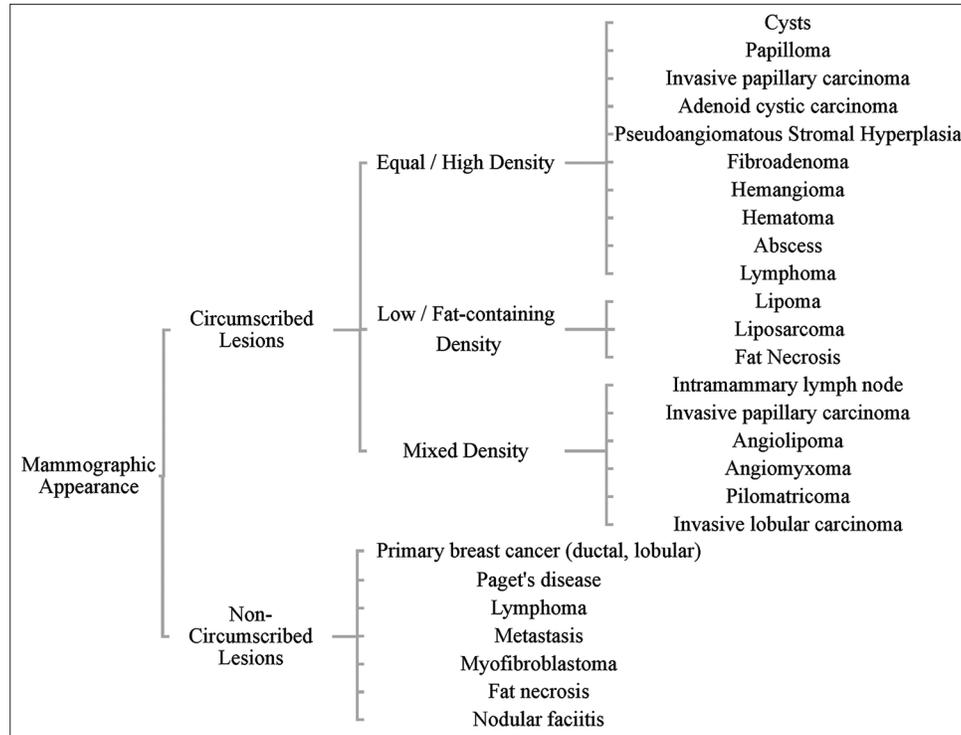


Figure 1: Classification of male breast masses according to mammographic appearance.

Table 1: Classification of male breast masses.

Benign	Malignant/high risk
Gynecomastia	Liposarcoma
Pseudogynecomastia	Paget's disease
Lipoma	Lymphoma
Hematoma	Metastasis
Fat necrosis	Invasive ductal carcinoma
Intramammary lymph node	Invasive lobular carcinoma
Abscess	Adenoid cystic carcinoma
Epithelial cyst	Verrucous carcinoma
Hemangioma	Ductal carcinoma <i>in situ</i>
Fibroadenoma	Atypical ductal hyperplasia
Angiolipoma	Invasive papillary carcinoma
Angiomyxoma	
Myofibroblastoma	
Nodular fasciitis	
Pilomatricoma	
Pseudoangiomatous stromal	
Hyperplasia	
Papilloma	

painless mass located in the central or subareolar area of the breast with or without nipple discharge, and histologically characterized by a finger-like fibro-vascular cores covered by an epithelial and myoepithelial cell layer.^[5,19,20] IPs occur as a result of blockage of the lactiferous duct secondary to secretions from papilloma.^[21]

Mammographic features of papillomas include circumscribed, sometimes partly obscured, and iso to hyperdense subareolar masses with or without microcalcifications.^[19,20] US is more sensitive in detecting papillomas [Figure 2a], compared to mammography or galactography [Figure 2b],^[5] with features including oval, circumscribed intraductal hypoechoic mass with intralesional or perilesional vascularity on color Doppler. Cystic changes may also be present [Figure 2c],^[5,19,21]. Magnetic resonance imaging features of Papilloma are shown in [Figure 2d].

Surgical excision is the common treatment approach for all papilloma masses in male patients, due to the potential under-sampling encountered following CNB.^[5,19,22]

Cutaneous cyst

Breast cutaneous cyst is an epidermal inclusion cyst that is considered to be the third most common benign breast mass in men.^[23] It originates as a result of the implantation of epidermal fragments into the dermis due to previous skin trauma (e.g., insect bites or surgical wound) and obstructed hair follicles or pores.^[24,25] In histopathology, it is composed of laminated keratin surrounded by stratified squamous epithelium.^[24] Clinically, patients with cutaneous cysts present with small lump.^[25]

In mammography, it manifests as a superficial circumscribed, isodense, cutaneous mass with no associated calcifications [Figure 3a and b]. In ultrasound, it appears as a solid,

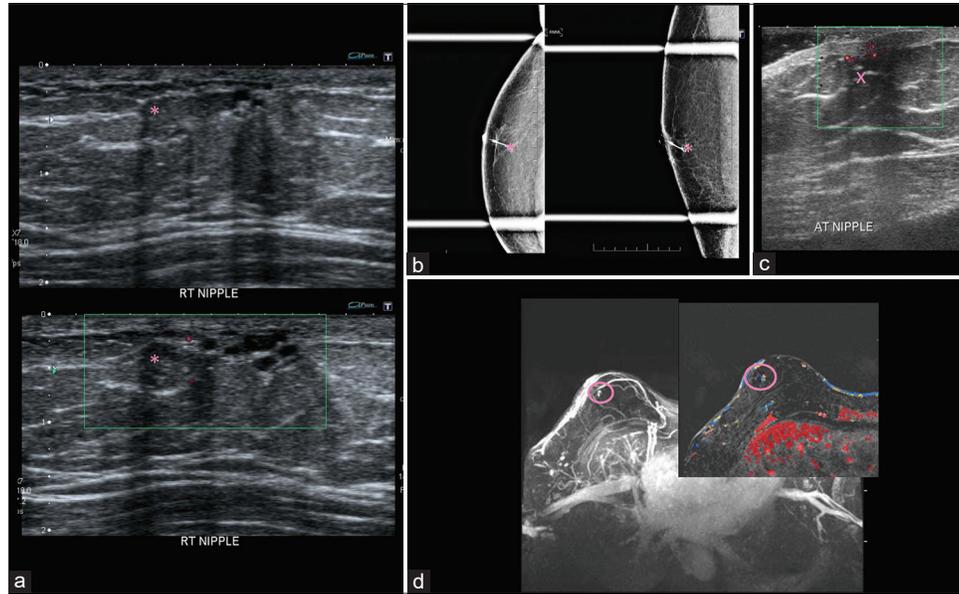


Figure 2: Papilloma: 24-year-old presented with unilateral nipple discharge. (a) Ultrasound (US) showed intra-ductal hypoechoic mass with perilesional vascularity in color Doppler (asterisks). Core biopsy showed papilloma. 55-years-old (b-d); (b) Galactography shows intra-ductal persistent filling defect (asterisks); (c) US showed intra-ductal hypoechoic mass with intra-lesional vascularity in color Doppler (cross mark); (d) MRI shows wash out post-contrast administration (ellipsoids). Core biopsy showed papilloma.

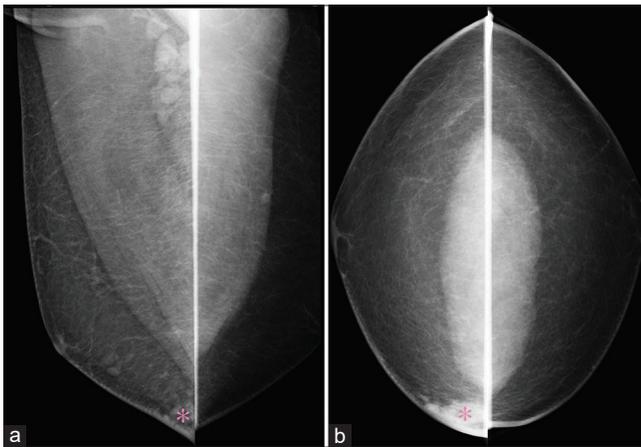


Figure 3: Cutaneous cyst: 26-year-old male presented with non-tender right breast lump. (a and b) Mammograms show isodense large cutaneous mass with no associated calcifications (asterisks). Clinical exam revealed suspicion of slow flow venous malformation.

circumscribed, simple or complex and hypoechoic mass in the dermis with a thin tract opening to the skin.^[24,25] If ruptured, a cutaneous cyst may lead to inflammation and abscesses, with the rare likelihood of malignant squamous cell carcinoma transformation. If symptomatic, it is usually excised surgically.^[25]

Pseudoangiomatous stromal hyperplasia (PASH)

PASH was initially described in 1986.^[26] It is a benign rare stromal mass formed by myofibroblastic proliferation that may present as a mass (tumor-forming PASH) or that may

be an incidental microscopic finding.^[27] The predisposing factors are believed to involve abnormal hormonal reactions of breast's myofibroblasts. Gynecomastia has been found to be associated with microscopic foci of PASH in a relatively high proportion of cases (20–47% of cases of gynecomastia). Rarely, PASH presents as a solitary mass.^[4,28,29] PASH is also associated with other conditions including human immunodeficiency virus, response to cyclosporine therapy, and neurofibromatosis type 1.^[4,28,30-32]

On a mammogram, PASH is typically seen as a round to oval or infrequently irregular, circumscribed or partially circumscribed, isodense mass or developing asymmetry, with no associated microcalcifications or architectural distortion [Figure 4a].^[2,4] In an ultrasound, it commonly appears as oval, circumscribed, homogeneous hypoechoic mass with no posterior acoustic features, and with associated features including low vascularity in color Doppler [Figure 4b and c].^[2,4] Nevertheless, PASH may appear less frequently as a heterogeneous mass with increased echotexture or echogenic area with hypoechoic central areas.^[4]

Radiological follow-up is advised in cases of incidentally detected PASH with concordant imaging-biopsy results, and with a negative family history of breast cancer. However, cautious approach should be taken in patients with strong family history of breast cancer and in lesions larger than 2 cm. As PASH may recur after excision in up to 5.2% of cases, excisional margin of 1–2 cm may minimize recurrence.^[4]

PASH can be associated with infiltrating carcinoma, given its hormonal dependence. Thus, “in cases of PASH recurrence,

repeat biopsy with extensive sampling should be performed to exclude missed breast cancer.^{9[4]}

Hemangioma

Vascular breast masses are typically categorized as angiosarcoma or hemangioma.^[33] With an incidence of 11% noted in postmortem studies,^[34] hemangioma is a benign rare tumor or malformation of mature vessels, which can be differentiated on the basis of vascular channel size into two subtypes-capillary or cavernous (i.e., most common subtype).^[4,33,34] In men, these masses are detected as an incidental finding or more likely as a palpable mass at clinical examination.^[4] Hemangiomas can be associated with calcifications due to phlebolith formation.^[35] Histopathological examination shows features consisting of dilated vascular channels filled with erythrocytes and lined with endothelial cells.^[4,34]

The mammographic features of hemangiomas include an oval, circumscribed, and isodense masses located superficially with variable calcifications (punctate, round, and coarse) or without calcifications [Figure 5a]. In ultrasound, these masses appear as superficial oval, circumscribed or non-circumscribed, hypoechoic or ill-defined hyperechoic with distal shadowing, and sometimes with internal bright echoes representing calcifications [Figure 5b].^[4,34,36]

Angiosarcoma as a malignant vascular mass may have variable signal intensity on T1-weighted MR images, and increased signal intensity on T2-weighted MRI, which makes it difficult or challenging to differentiate from hemangiomas,

thus, along with imaging, pathological studies are necessary to warrant the diagnosis.^[4,35] Since angiosarcoma (low-grade) may have similar characteristics on pathologic examination, researchers recommend management with core biopsy [Figure 5c], and ultimately surgical excision, especially if the mass is palpable to exclude well-differentiated angiosarcoma.^[4]

Fibroadenoma

Male breast' fibroadenoma is a rare lesion of both estrogen and progesterone receptors stimulation.^[37] It is commonly associated with gynecomastia.^[38] Previous literature reports on fibroadenomas of male breast are scarce, with cases reported involving those on sex reassignment surgery (male-to-female transsexuals), iatrogenic fibroadenomas due to estrogen therapy for prostate carcinoma, idiopathic cases with no drug intake or other signs of any carcinoma, and idiopathic fibroadenoma with gynecomastia, adenocarcinoma of the rectum, and polyposis coli associations.^[38-40]

Fibroadenoma may present clinically as a firm, rubbery, lobulated, and freely mobile lumps in the subareolar area, with no associated nipple discharge.^[38] Histopathologically, fibroadenomas are manifested as florid ductal hyperplasia and focal secretory hyperplasia, with epithelial and stromal constituents. Ultrasonographic features are similar to those of female breast fibroadenomas including solid, oval, circumscribed, homogenous, and hypoechoic lesion, with macrolobulation.^[23,24,38] Sampling is performed for the differentiation from other associated disease.^[38]

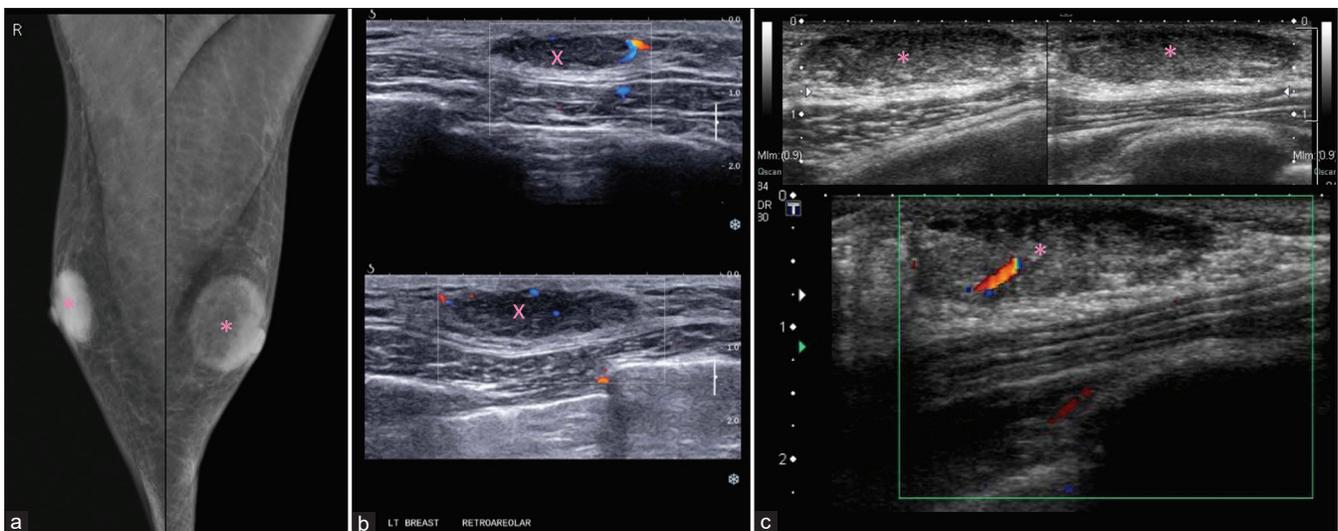


Figure 4: Pseudoangiomatous stromal hyperplasia (PASH): 40-year-old male with known pancreatic cancer, presented with bilateral breast masses (a and b); (a) mammogram shows bilateral oval circumscribed high-density masses in retro-areolar location (asterisks). No associated microcalcifications; (b) Color Doppler US show bilateral oval parallel oriented hypoechoic symmetrical masses with no posterior acoustic features and rim vascularity (cross marks). Core biopsy revealed PASH. (c) US color Doppler images of 13-year-old boy showing hypoechoic mass with no posterior acoustic features and internal vascularity (asterisks). Pathology revealed PASH.

Low/fat-containing density

Lipoma

Lipoma is the second most common benign male breast lesion after gynecomastia.^[23] It is composed of encapsulated, lipocytes or mature fat cells in histologic examination. It is typically asymptomatic, and if it is symptomatic, it manifests clinically as a small, subcutaneous, palpable, soft mass or sometimes hard mass if associated with calcifications and can show bilateral distribution.^[4,5,23,41]

Mammographically, lipoma appears as a circumscribed, fat-density mass with a thin isodense capsule [Figure 6b].^[4] If soft-tissue components or invasion are seen, liposarcoma should be suspected. In ultrasound, it has the appearance of an oval, circumscribed, homogenous, isoechoic or mildly hyperechoic, avascular mass, with a possible echogenic capsule [Figure 6a].^[4,5,23] Surgical excision is unnecessary.^[5]

Liposarcoma

Liposarcoma is a rare malignant breast mass accounting for <0.3% of all mammary sarcomas, and up to 20% of all malignancies of mesenchymal origin.^[42] It can originate from the interlobular stromal breast tissue or develop as a component of a phyllodes tumor, with occurrence in both men and women among ages 16–75 years, and with an incidence peak age of 47 years.^[42–44] Contrary to the phyllodes tumor, in which rapid growth is seen, liposarcoma presents clinically as a painful unilateral mass of slow growth and variable duration measuring between 8 cm (median size) reaching up to a maximum diameter of 12 cm. In the uncommon scenario, invasion of pectoral muscle, nipple retraction, and skin changes may also be seen.^[42] In histologic examination, a key characteristic in differentiating liposarcoma from others including fat necrosis is the presence of scalloped,

hyperchromatic, irregular lipoblasts nuclei with intracytoplasmic vacuoles highlighted with S100 stain.^[42] Depending on histological appearance, liposarcoma can be classified into five subtypes: (a) Well-differentiated, (b) pleomorphic, (c) round cell, (d) myxoid, and (e) dedifferentiated.^[42]

Although studies describing liposarcoma's imaging features may be limited or of nonspecific manifestations,^[4,43] mammographic manifestations of liposarcoma may include circumscribed or encapsulated hyperdense mass or mixed solid and fat density [Figure 6d and e]. In ultrasound, it appears as circumscribed or irregular, hyperechoic, heterogeneous, solid or complex cystic, and solid mass [Figure 6f].^[4,43,45]

The main treatment approach is surgical excision, with adjuvant radiation and chemotherapy mostly when there are positive surgical excision margins. Post-operative follow-up is performed to look for (a) local recurrence, which is associated with pleomorphic liposarcoma and infiltrative margins and (b) distant metastasis.^[42,43]

Mixed density

Pilomatrixoma

Pilomatrixoma (formerly known as pilomatrixoma or calcifying epithelioma of Malherbe) is a benign cutaneous adnexal mass that originates from hair follicle matrix cells. It is more frequently seen in the head and cheek, followed by the neck, and upper extremities and rarely affects the breast. Its peak incidence is in the first two decades of life in children and younger individuals.^[46–48] Pilomatrixoma presents clinically as a solitary firm mass of slow growth, and with painless nodule of the inner layer of the skin (i.e., dermis). It can be associated with discoloration (bluish or

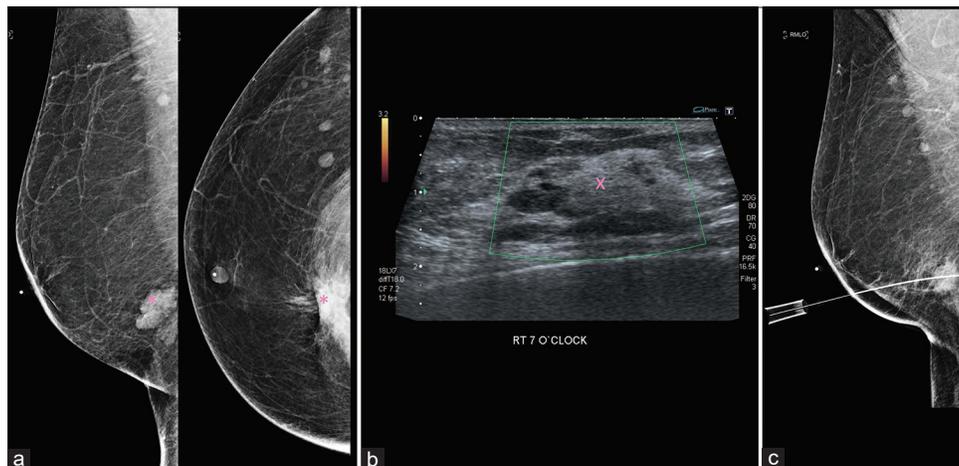


Figure 5: Hemangioma: 66-year-old male presented with palpable right breast abnormality. (a) Mammograms show deep micro-lobulated isodense mass with no calcification (asterisks); (b) US image shows indistinct heterogeneous mass with absent vascularity in color Doppler (cross mark); (c) Needle localization was performed. Biopsy showed hemangioma.

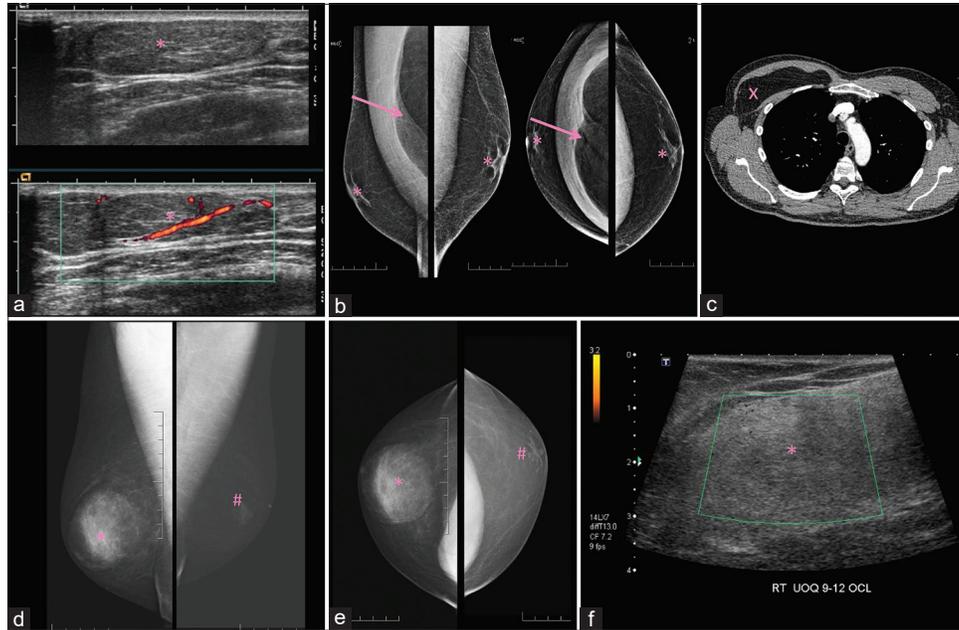


Figure 6: Lipoma: 72-year-old male presented with palpable mass. (a) US shows a circumscribed parallel slightly hyperechoic mass with posterior acoustic enhancement and internal vascularity (asterisks); pathology revealed lipoma. Lipoma: 49-year-old male (b and c). (b) Mammogram shows a large retro-pectoralis muscle pure fat containing mass (arrows), note incidental bilateral dendritic gynecomastia (asterisks). (c) Contrast-enhanced CT scan show an encapsulated retro-pectoral fatty mass with no solid components or calcifications (cross mark). Liposarcoma: 77-year-old male (d-f). (d and e) Mammograms show a circumscribed isodense mass with soft tissue components and fat (asterisks), note the left dendritic gynecomastia (number signs). (f) US show a circumscribed oval hyperechoic mass with absent vascularity in color Doppler (asterisk). pathology showed liposarcoma.

reddish) and myotonic dystrophy.^[47,48] In histology, it has chronological categorization, namely, early, fully developed, early regressive, and late regressive, with positive stains for S100 protein, LEF-1 antibodies, β -catenin, and with LEF & β -catenin gene mutation in most of the cases.^[46]

Mammographic characteristics of pilomatrixoma include a circumscribed, superficial, calcified mass as illustrated in Figure 7a and b. Ultrasonography features [Figure 7c] include a circumscribed, superficial, encapsulated, heterogeneously isoechoic to hyperechoic mass with posterior acoustic shadowing, hyperechoic calcifications, and hypoechoic capsule. MRI features [Figure 7d] include superficial heterogeneous hyperintense mass on T1 and T2-weighted images. With rare recurrence, wide local excision is the treatment of choice.^[46-48]

Angiolipoma

Angiolipoma (uncommon variant of Lipoma) is an extremely rare male breast mass accounting for 5–17% of all benign fat-containing body tumors and composed of fat cells (i.e. adipocytes) with vascular proliferations or angiomatous components. It clinically presents as a painless mass and histopathologically contains adipocytes and vessels, with intravascular hyaline thrombi.^[5,34,43]

In mammography [Figure 8a], it appears as oval or round circumscribed, encapsulated mass, with mixed fat and soft-tissue densities (isodensity) representing branching small vessels more in a sub-capsular location. In ultrasound [Figure 8b], it appears as oval or round, circumscribed, homogenous, and isoechoic to hyperechoic mass, which can mimic lipomas or hamartoma. Due to angiolipoma's non-specific imaging features, biopsy is necessary to confirm the diagnosis.^[34,43]

Due to the benign nature of angiolipomas, surgical excision and radiologic follow-up is the treatment of choice.^[4,5,34,43,43]

Angiomyxoma

Breast angiomyxoma, also known as breast myxoma, is an exceedingly rare slowly growing benign mesenchymal neoplasm. It is composed of fibroblasts or myofibroblasts, and thick-walled blood vessels.^[49] It clinically presents as a painless, large, and hard but mobile mass, with difficult differential diagnosis.^[50,51] It is locally aggressive, non-metastasizing mass with a high recurrence rate. Microscopic, clinicopathological, and immunoreactivity features are important in differentiating aggressive angiomyxoma from other tumors of mesenchymal origin and myxoid background.^[49] Histological manifestations include hypocellular myxoid stroma with scattered spindle-shaped cells.^[51]

Mammographically, it appears as an oval circumscribed non-calcified high-density mass with no skin thickening and as seen in Figure 8c. On color Doppler ultrasound, it appears as an oval hypoechoic mass with mild posterior acoustic enhancement and rim vascularity as shown in Figure 8d. First-line treatment options include complete surgical resection of the mass. The high recurrence rate necessitates post-operative follow-up.^[49]

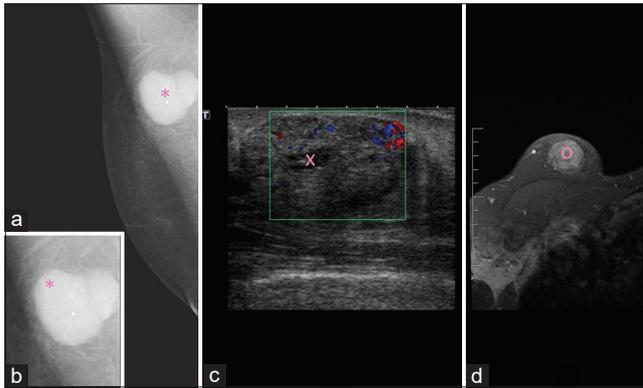


Figure 7: Pilomatricoma: 54-year-old male (a-d); (a) Mammogram shows circumscribed mass with associated amorphous microcalcifications (asterisk); (b) magnified mammographic view shows the microcalcifications better (asterisk); (c) US image show circumscribed parallel subcutaneous heterogeneous oval mass with no posterior acoustic feature and thin hypoechoic capsule (cross mark); (d) T2w MRI showing circumscribed superficial mass with heterogeneous high signal intensity (circle), pathology revealed Pilomatricoma.

Non-circumscribed masses

Lymphoma

Breast lymphoma is an extremely rare mass that can be primary where the breast is the only affected organ or secondary in which association with extra-mammary lymphoma is present.^[4,43,52] With primary breast lymphoma representing less than 0.5% of all breast malignancies, B-type non-Hodgkin lymphoma accounts for approximately 95% of the cases, of which 60 to 80% corresponds histopathologically to diffuse large B-cell lymphoma, followed by follicular lymphomas (~15%), mucosa-associated lymphoid tissue lymphomas (~12%), and Burkitt's lymphoma (~10%).^[53,54]

In contrast to primary breast lymphoma which may arise due to hormonal stimulation, or from mucosa-associated lymphatic tissue or from intra-mammary lymph nodes or from the lymphatic tissue adjacent to breast's ducts and lobules, secondary breast lymphoma is more common and manifest as multiple breast masses or enlarged axillary lymph nodes.^[4,43,52,54] Breast lymphoma affects older patients and occurs almost exclusively in women with a very rare occurrence in men.^[54] It clinically presents as a solitary palpable mass with palpable lymph nodes.^[43] Breast lymphoma imaging features can be non-specific, with mammographic appearance [Figure 9a] including irregular or lobular, equal or high-density mass, with no calcifications. Multiple asymmetry, dense intra-mammary masses, and architectural distortion have also been reported. Ultrasound

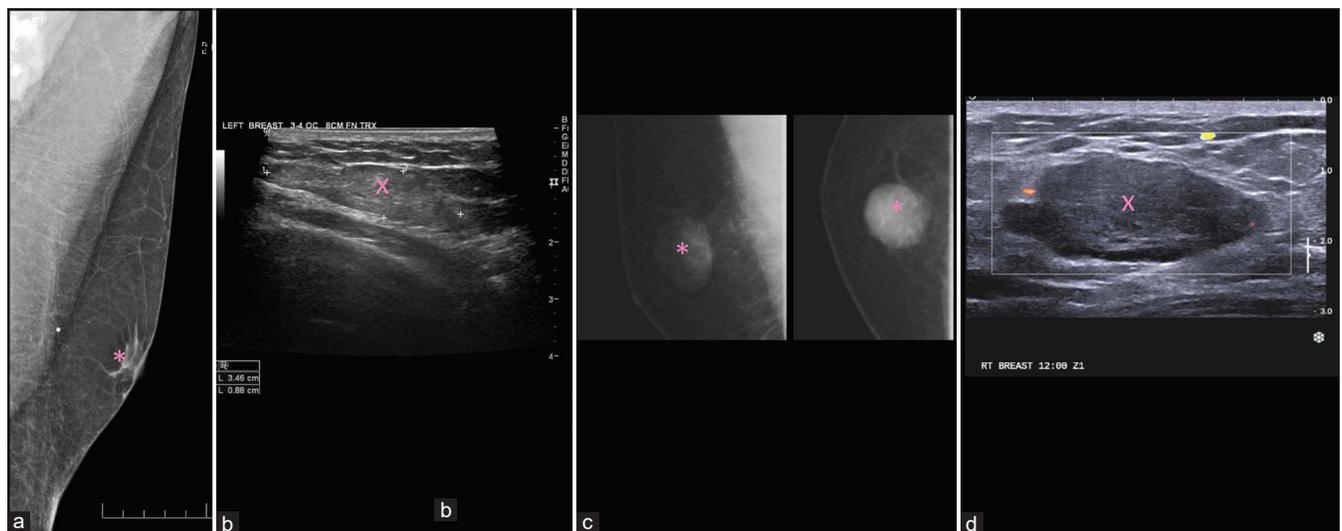


Figure 8: Angiolipoma: Male patient presented with palpable abnormality (a and b). (a) Mammogram corresponding to the palpable abnormality (BB marker), not incidental dendritic gynecomastia (asterisk). The palpable area shows breast fat with no masses. (b) US show circumscribed parallel slightly hyperechoic mass (cross mark). Pathology revealed angiolipoma. Angiomyxoma: 59-year-old male presented with firm right breast mass (c and d). (c) Mammogram shows an oval circumscribed high-density mass (asterisks). No associated microcalcifications or skin thickening. (d) Color Doppler ultrasound show an oval parallel oriented hypoechoic mass with mild posterior acoustic enhancement and rim vascularity (cross mark). Core biopsy revealed angiomyxoma.

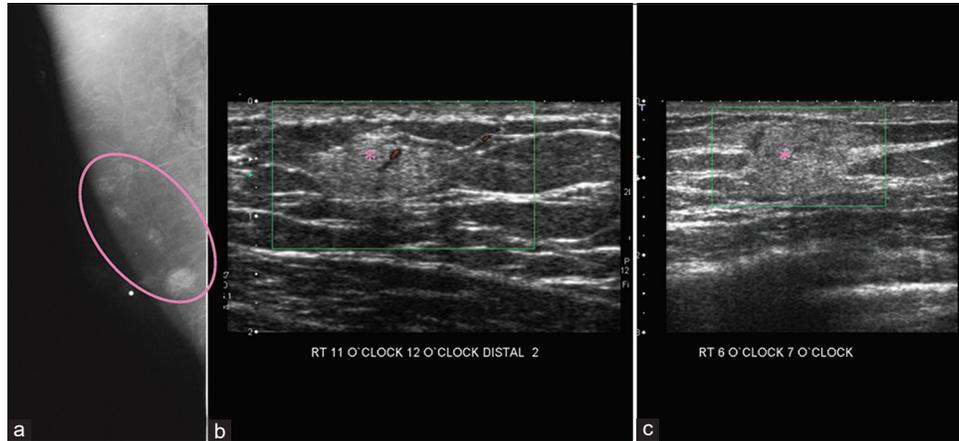


Figure 9: Lymphoma: 44-year-old male patient presented with palpable breast masses (a-c). (a) Mammogram shows multiple high and equal density irregular, indistinct masses (ellipsoid). (b and c) Representative ultrasound images show oval indistinct predominantly hyperechoic masses with mild internal vascularity in color Doppler (asterisks). Core biopsy showed breast lymphoma.

image [Figure 9b and c] typically reveals a solid, hypoechoic or hyperechoic or a mixed echogenicity mass with posterior acoustic enhancement. Other sonographic associated features include abnormal lymph node cortical thickening, and hypervascularity on Doppler images.^[2,4,43] The prognosis depends on the type of lymphoma diagnosed and histologic grade.^[55] Although breast lymphoma incidence is rare, treatments including chemotherapy, radiotherapy, and immunotherapy and surgery may occasionally achieve good control of the disease.^[53]

Metastasis

Metastasis from non-mammary primary tumors is a very rare condition representing between 0.5% and 3% of all breast malignancies in both men and women, of which only 5% have been reported in men.^[4] In a single institution in Italy and among a total of 47 men (average age of 62 years) diagnosed with breast cancer between the year of 1995 and 2014, metastatic disease was presented in 30% of the cases.^[56] Lymphomas, melanomas, and tumors of neuroendocrine origin are the most frequent types of non-mammary malignancies metastasizing to the breast.^[57] Primary prostate malignancy metastasizing to the breast is common in men, especially those on anti-hormonal therapy of advanced stages.^[4,57] In a recent study of 13 males (median age = 54) with non-mammary metastases to the breast, melanoma was the most frequent metastatic tumor, followed by lung, renal cell, Merkel cell, prostate, and papillary thyroid carcinomas.^[58]

Clinical presentation of breast metastasis includes palpable and freely movable mass commonly unilateral and solitary with tenderness, inflammation and pain, and with or without axillary involvement.^[58,59] In histologic examination, breast metastasis appears as a well-circumscribed mass with

multiple foci or as nodule often surrounded by pseudocapsule of fibroblasts origin.^[57,58]

Mammographic features of breast metastasis frequently include multiple or solitary, round or irregular, obscured or spiculated isodense masses without calcification [Figure 10a and c], and often with architectural distortion of bilateral or unilateral diffuse opacity.^[4,60] US features include oval or round or irregular, circumscribed or microlobulated or spiculated, hypoechoic masses with rim vascularity in color Doppler with no posterior acoustic features [Figure 10b and d], but nevertheless, posterior acoustic enhancement has been reported.^[60]

Diagnosis of breast metastasis should be confirmed with histopathological examination due to the long interval of approximately 2–4.5 years between the first diagnosis of primary non-mammary tumor and the discovery of breast metastases, and also given the different radiologic appearances of breast metastasis, which may lead to misdiagnosis for primary breast carcinoma or benign masses.^[4,57,58,60] Treatment of breast metastases vary, depending on the type and extent of the non-mammary primary tumors.^[4]

Ductal carcinoma in situ (DCIS)

DCIS is a very rare disease accounting for an average of 7% of all male breast cancers.^[61] It can be associated with gynecomastia, and clinically presents as a palpable retroareolar mass, typically associated with nipple discharge, and usually discovered at both advanced stage, and late age in men compared to women.^[62,63] In men, DCIS arises as a result of atypical proliferation of epithelial cells of the breast duct.^[64,65] Thirty to fifty percent of all male and female patients with DCIS develop invasive cancer in the following 10–20 years.^[64] The

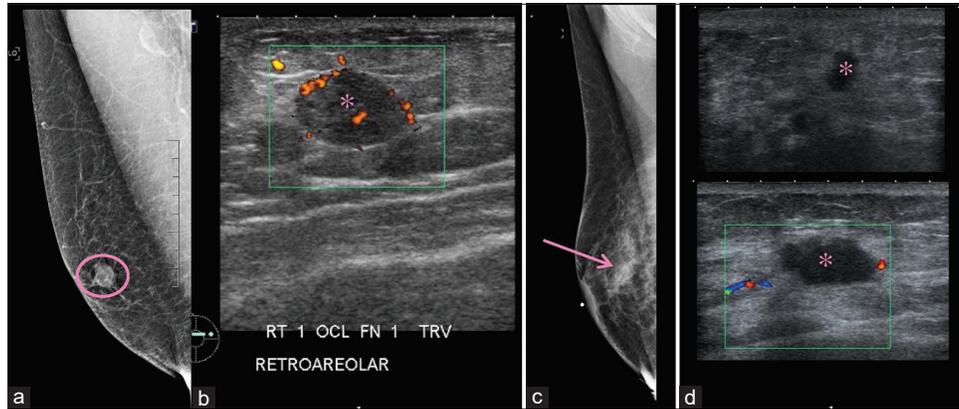


Figure 10: Metastasis (a-d): 66-year-old male patient with renal carcinoma (a and b). (a) Mammogram shows a round partially obscured isodense mass in retro-areolar location (ellipsoid). (b) US shows a circumscribed hypoechoic mass with internal and rim vascularity in color Doppler and no posterior acoustic features (asterisk). Pathology revealed renal cell carcinoma metastasis. 59-year-old male with nasopharyngeal carcinoma presented with breast masses (c and d). (c) Mammogram shows multiple obscured isodense masses (arrow). (d) US images show multiple irregular speculated and micro-lobulated hypoechoic masses with rim vascularity in color Doppler and no posterior acoustic features (asterisks). Pathology revealed nasopharyngeal carcinoma metastasis.

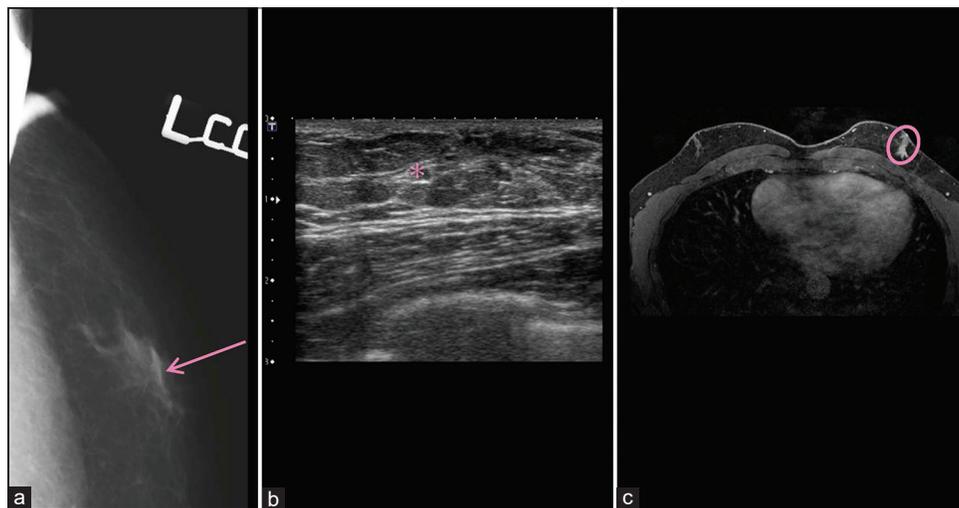


Figure 11: Ductal carcinoma In Situ: 41 year-old male (a-c). (a) Mammogram showed an asymmetry in the lateral aspect of the breast (arrow). (b) US image showed mildly thickened retro-areolar duct (asterisk). (c) T1w MRI showed segmental homogenous non-mass enhancement (ellipsoid). Pathology revealed ductal carcinoma *in situ*.

most common histopathological DCIS subtypes are papillary and cribriform, with or without classifications.^[61,62,66]

When malignant calcifications are present in male breast, they often have a benign or nonspecific appearance and can be heterogeneous, round or scattered, faint, and linearly oriented.^[64-66] A retrospective study of 11 male patients with DCIS, described the mammographic appearances of microcalcifications as pleomorphic with grouped or segmental distribution.^[67] An example of mammographic appearances of DCIS is shown in Figure 11a. In ultrasound imaging, DCIS commonly appears hypoechoic regardless of the histologic subtype,^[43] dilatation, and thickened

retroareolar duct is also present as seen in Figure 11b. In one of the cases presented herein, contrast-enhanced T1-weighted MR image revealed segmental homogenous non-mass enhancement [Figure 11c], which is usually seen with benign lesions. Mastectomy has been reported to be the best treatment option with a low incidence of recurrence.^[64,68]

CONCLUSION

Most of male breast lesions encountered in daily practice are benign conditions. Mammography should be the first-line radiological imaging study performed in men >25 years of

age. The mammographic and sonographic features of male breast lesions generally resemble those of female breast. Radiologists may utilize the knowledge pertaining to imaging features and workup of female breast lesions and apply it to those of male breast with higher level of suspicion.

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Declaration of patient consent

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Conflicts of interest

There are no conflicts of interest.

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