Pictorial review: the imaging findings of male breast lesions

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Learning objectives

• To become familiar with the normal appearance of the male breast.
• To illustrate the spectrum of male breast lesions.
• To highlight the mammographic and ultrasonographic findings that may allow differentiation between benign and malign male breast lesions.
Background

Although the male breast is anatomically rudimentary and physiologically not functional, it may be affected by many diseases.

Gynaecomastia and carcinoma are its main diseases.

Gynaecomastia is the most common disease (80%). Breast carcinoma accounts for <1% of all breast cancer and <1% of all cancer cases in men. However, carcinoma is the second breast disease in men (3%).

The vast majority of other diseases arise from skin or subcutaneous tissues, such as lipoma and epidermal inclusion cyst.

Less than 1% of breast imaging examinations are performed in men. So a wide experience in male breast imaging may be difficult. As in women, differentiation between benign and malignant lesions is critical.
Mammographic and ultrasonographic findings of the normal male breast and various male breast lesions are illustrated. We proceed to review the clinical and imaging features of the main diseases of the male breast and others unusual lesions. The final diagnosis was made based on clinical-radiological follow-up or histopathological results.

NORMAL MALE BREAST:

The normal adult male breast is characterized mammographically by radiolucent fat and a few strandlike subareolar densities, representing residual ducts and fibrous tissue. The pectoral muscle may be prominent. Intramammary lymph nodes can also be found in the normal male breast. In contrast to the female breast, Cooper's ligaments are not present (Fig 1).

At ultrasound, the normal mammary disk appears as a triangular, hypoechoic area which is centred with respect to the nipple and measures less than 8mm.

These findings are classified as BI-RADS® category 1.

MALE BREAST DISEASE:

The presenting symptoms in men with breast disease are breast pain, breast mass, breast enlargement, axillary mass, nipple retraction and nipple discharge. These symptoms may be due to both benign and malignant diseases (Fig 2 and 3).

GYNAECOMASTIA:

Concept: Gynaecomastia is the potentially reversible enlargement of the male breast.

Incidence: this is the most frequent pathology of male breast, affecting 40-60% of the male population. It can be considered as a normal finding rather than a pathological alteration at three times of life (physiological gynaecomastia):

- Newborn or neonatal gynaecomastia.
- Adolescent or puberal gynaecomastia.
- In older men or senile gynaecomastia.

Histopathology: There are two phases:

Florid or early phase: reversible hyperplasia of the intraductal epithelium with loose cellular stroma and surrounding edema.
Fibrous or late phase: ductal proliferation with dense, fibrotic stroma.

Pathogenesis and associated conditions: Gynaecomastia is considered as possibly resulting from an imbalance of estrogens and androgens, with a relative excess of the female hormone (Fig 4).

Clinical diagnosis: Gynaecomastia usually presents as a soft mobile tender subareolar mass or as a progressive painless enlargement of the breast.

Gynaecomastia can be unilateral or bilateral, bilaterally symmetric or asymmetric.

The hallmark of gynaecomastia is that the subareolar tissue is freely mobile, unattached to the skin and central and symmetric location under the nipple.

Nevertheless, it is sometimes attached to the skin or the nipple and may also be changes such as thickening of the skin and retraction of the nipple, resembling a carcinoma.

The clinical examination of the breast in pseudoynaecomastia reveals the absence of a solid disc of subareolar tissue and a fatty consistency.

Mammography: Three mammographic patterns of gynaecomastia have been described:

- Nodular or triangular pattern (correlates with the florid histological phase): Fan shaped density radiating from the nipple, symmetric or more prominent in the upper, outer quadrant. The density usually blends into the surrounding fat but it may be more spherical (Fig 5).
- Dendritic pattern (correlates with the fibrous histological phase): Flame-shaped with prominent linear views (dendrites) that irradiate and penetrate into the depths of the adipose tissue towards the upper outer quadrant of the breast (Fig 6).
- Diffuse pattern: dense nodular parenchyma in an enlarged breast, simulating mammography findings of a heterogeneously dense female breast. It can be distinguished from a dense female breast by the absence of Cooper’s ligaments (Fig 7).

Pseudogynaecomastia: Enlarged breast with predominance of radiolucent fat and absence of dense retroareolar tissue (Fig 8).

Mammographies with findings typical of gynaecomastia and pseudogynaecomastia are classified as BI-RADS® category 2.

Ultrasound: There are two characteristic ultrasound patterns.

- Focal and hypoechogenic pattern: initial glandular hyperplasia in ultrasound is manifest by a decrease in echogenicity. It starts in the retroareolar region...
and extends into the breast producing a hypoechogenic image of nodular or slightly triangular morphology (Fig 9).

- Diffuse and hyperechogenic pattern: the development of fibrosis manifested as a diffuse increase in echogenicity, similar to the ultrasound findings of dense female breast (Fig 10).

In pseudogynaecomastia the subcutaneous adipose tissue has increased thickness and echographically a diffuse hypoechogenicity crossed by irregular echogenic striae can be observed.

The ultrasound images of men with findings characteristic of gynecomastia and pseudogynaecomastia are classified as BI-RADS® category 2.

**LIPOMA:**

**Incidence:** This is the second most frequent cause of benign lesions of the breast in men.

**Clinical diagnosis:** Usually asymptomatic. Slow growth. They present as soft, mobile and well-circumscribed masses.

**Mammography:** They can be difficult to detect in breasts with a large fat component. They present a fine capsule that surrounds the radiolucent fatty tissue.

**Ultrasound:** Solid hyperechogenic and homogeneous lesions, with well-defined margins, without posterior sound attenuation (Fig 11 and 12).

Ultrasound images and mammographies with findings characteristic of lipoma are classified as BI-RADS® category 2.

**EPIDERMAL INCLUSION CYST:**

**Concept:** Lesion of cutaneous or subcutaneous location.

**Incidence:** This is the third most frequent cause of benign lesions in the male breast.

**Clinical diagnosis:** Soft, rounded mass, fixed to the skin but mobile in relation to the underlying tissue.

**Mammography:** Dense rounded well-defined masses, with a diameter of between 1 and 5 cm, located peripherally in relation to the skin.

**Ultrasound:** Well-defined and hypoechogenic mass, with good sound transmission. The lesion can have heterogenous echogenicity and present the appearance of a complex or solid lesion. The extension of the mass into the dermis is an important finding that is visualised in 86% of cases and suggests a cutaneous origin. The lesion is located
between the two echogenic lines that represent the surface and deep layers of the dermis (Fig 13 and 14).

When imaging findings are characteristic of epidermal inclusion cyst, this is classified as a BI-RADS® category 2.

**INFLAMMATION AND ABSCESS:**

**Clinical diagnosis:** Pain, swelling, reddening of the breast and fever. Cold abscesses do not respond as quickly to antibiotic treatment as the acute phase and after several weeks a residual mass can persist, making it difficult to rule out carcinoma.

**Mammography:** Focal thickening of the skin and areola with increased retroareolar density. The abscesses appear as masses with ill-defined margins and punctate calcifications. They can also manifest without a clearly defined mass, as a density that irradiates out from the nipple and can be confused with gynecomastia. In these cases, thickening of the skin is suggestive of an abscess (Fig 15).

**Ultrasound:** Complex predominantly cystic masses, with good sound transmission.

**BREAST CANCER:**

**Incidence:** It accounts for <1% of all breast cancer and <1% of all cancer cases in men. It is the second most frequent breast pathology after gynaecomastia.

**Histopathology:** Approximately 85% of carcinomas are ductal infiltrating carcinomas and only 7% are intraductal.

**Clinical diagnosis:** This typically manifests as a non-painful, hard, immobile unilateral mass in the subareolar region, eccentric to the nipple.

Other signs may be present, as retraction or inversion of the nipple, thickening or ulceration of the skin, nipple discharge and axillary lymphadenopathy.

**Mammography:** The most frequent form of presentation is the mass (85% of cases), usually located in the subareolar region, eccentric to the nipple. The margins are usually ill-defined or spiculated, although it can be circumscribed in 15% of cases. The lesion can be rounded, oval or irregular, with frequent lobulations. Associated findings such as thickening or ulceration of the skin, retraction of the nipple and axillary adenopathies may be present. Calcifications are found in 30% of cases. These tend to be less numerous, coarser, more disperse and less frequently of linear morphology than the calcifications found in breast cancer in women.

**Ultrasound:** The findings are similar to those for breast cancer in women. This generally appears as a hypoechogenic and heterogeneous mass, located in the subareolar region.
eccentric to the nipple. The borders of the lesion are usually ill-defined. However, they can also have well-defined margins and present lobulations. Acoustic transmission is variable.

The most frequent form of presentation of breast cancer in mammography and ultrasound is as a lesion of BI-RADS® category 4 or 5 (Fig 16-20). However, 15% of cases can present as a mass of BI-RADS® category 3 (Fig 21).

**OTHER INUSUAL LESIONS**

It is important to emphasise that other rarer benign and malignant lesions of the male breast can be classified as categories 3, 4 and 5, simulating a carcinoma. In these cases, biopsy is mandatory.

Fibroadenoma and phyllodes tumour are very rare in men because lobular development is rare in men. **Tubular adenoma** most often affects young women or women in reproductive age. They are very uncommon in men (Fig 22).

**Fibromatosis** usually manifests as a single palpable, very firm, non-tender mass that is sometimes fixed to the pectoral fascia. Skin retraction may also be present, a finding that suggest breast cancer. The lesion tends to recur locally if it is not widely excised. Fibromatosis simulates malignancy at mammography as an irregularly shaped, uncalcified, high-density spiculated mass and at US as an irregular, hypoechoic mass with posterior acoustic shadowing. Fibromatosis is extremely uncommon in the male breast (Fig 23).

**Fat necrosis** can vary from a lucent nodule to an irregular spiculated soft-tissue density mass. Calcification can occur (Fig 24).

At mammography, **hamartomas** are typically well-circumscribed, round to oval masses containing both fat and soft-tissue density with a thin, radiopaque pseudocapsule that becomes visible around a portion of the mass when fat is present on both sides. At US, they manifest as a sharply defined, heterogeneous oval mass or as normal glandular tissue (Fig 25).
Fig. 1: Normal male breast. Mammograms only show radiolucent fat. No ductal or glandular opacities are present. No Cooper’s ligaments are present.

**Fig. 2:** Benign pathology.


<table>
<thead>
<tr>
<th>BENIGN PATHOLOGY (97%)</th>
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<tr>
<td>Gynaecomastia (86%)</td>
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<tr>
<td>Pseudogynecomastia (5%)</td>
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<tr>
<td>Lipoma (3%)</td>
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<tr>
<td>Epidermal inclusion cyst (2%)</td>
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<tr>
<td>Inflammation and abscess (1%)</td>
</tr>
<tr>
<td>MALIGNANT PATHOLOGY (3%)</td>
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</tr>
<tr>
<td>Carcinoma</td>
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<td>Metastasis</td>
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<td>Lymphoma</td>
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**Fig. 3:** Malignant pathology.

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**CAUSES OF NON-PHYSIOLOGICAL GYNAECOMASTIA**

<table>
<thead>
<tr>
<th>Category</th>
<th>Causes</th>
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<tr>
<td>HORMONAL</td>
<td>Klínefelter syndrome</td>
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<td></td>
<td>Hypogonadism</td>
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<tr>
<td>SYSTEMIC DISEASE</td>
<td>Chronic renal insufficiency</td>
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<td></td>
<td>Cirrhosis</td>
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<tr>
<td>NEOPLASMS</td>
<td>Hormone-producing testicular tumours</td>
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<td>Suprarenal carcinoma</td>
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<td>Hypophyseal adenoma</td>
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<td></td>
<td>Hepatocellular carcinoma</td>
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<td>PHARMACOLOGICAL TREATMENTS</td>
<td>Cimetidine</td>
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<td>Spironolactone</td>
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<td>Tri-cyclic antidepressants</td>
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<td>Cannabis</td>
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<td>Diuretics</td>
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**Fig. 4:** Causes of non-physiological gynaecomastia.

**Fig. 5**: Left unilateral gynaecomastia: Nodular o triangular pattern.

Fig. 6: Right unilateral gynaecomastia: Dendritic pattern.

Fig. 7: Bilateral symmetric gynaecomastia: Diffuse pattern. This pattern is found in men receiving estrogen therapy, such as patients with advanced prostate cancer or in transgender men, as in the case presented. In these situations the relatively rapid increase of the breast generally has a conical or pyramidal shape, as opposed to the more rounded shape of the female breast.

Fig. 8: Bilateral pseudogynaecomastia more pronounced in the left breast.

**Fig. 9:** Gynaecomastia: Focal and hypoechogenic pattern.

Fig. 10: Gynaecomastia: Diffuse and hyperechogenic pattern.

**Fig. 11:** Lipoma in the male breast. 28 year old male patient who complains of breast lump. The ultrasound is classified as BI-RADS® category 2 as it appears as a hyperechoic and homogeneous solid lesion, with well-defined margins. No further posterior sound attenuation or distortion of adjacent breast tissue is appreciated.

**Fig. 12:** Lipoma. 55 year old male with soft nodule in the inferointernal quadrant of the left breast. Mammography of the left breast shows pseudogynaecomastia. An ultrasound shows a well-circumscribed echogenic nodule. BI-RADS® category 2. It is common for lipomas not be visible on the mammogram since they may be masked by surrounding lucent fat.

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Fig. 13: Epidermal inclusion cyst. 30 year old man who complains of a hard, mobile, yet painless nodule in the left breast that has developed over the last year. Mammography and ultrasound show a nodule which is well-circumscribed in relation with the skin. BI-RADS® category 2.

**Fig. 14:** Epidermal inclusion cyst. 30 year old man who complains of lump in his left breast. Mammography and ultrasound show a nodule which is well-circumscribed in relation with the skin. BI-RADS® category 2.

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Fig. 15: Breast abscess. The mammogram shows a right gynaecomastia and a large poorly defined mass in the left breast (BI-RADS® category 4).

**Fig. 16:** Infiltrating ductal carcinoma. The mammograms of the right breast in this patient showed a spiculated nodule classified as BI-RADS® category 5. Diagnosis: histologically proven infiltrating ductal carcinoma.

Fig. 17: Infiltrating ductal carcinoma. The left CC and MLO mammogram shows a partially well-circumscribed mass with calcifications (BI-RADS® category 4). Ultrasound-guided biopsy of the mass. The tip of the needle is visible.

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**Fig. 18:** Bilateral carcinoma. The mammography of this man shows bilateral retroareolar nodules, the right one causes nipple retraction (images A and B). They are solid nodules by ultrasound (image C). They were classified as BI-RADS® category 4 and we performed a core needle biopsy guided by ultrasound (image D), resulting in invasive ductal carcinoma in both nodes.

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**Fig. 19:** Infiltrating ductal carcinoma. 67 year old man who complains of a right axillary node. The node was biopsied and the histology was of metastatic carcinoma, of probable breast origin. The mammography shows a right retroareolar partially well-defined nodule with a small lobulation. There was nipple retraction and multiple enlarged axillary lymph nodes. BI-RADS® category 4. The CT shows the 1 cm nodule of the right breast and axillary lymphadenopathies. Postsurgical changes after axillary biopsy.

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Fig. 20: A 62 year old man consults about lump in his left breast. The mammograms of the left breast show a subareolar nodule with retraction of the nipple and the pectoral muscle. BI-RADS category 4. We performed core needle biopsy guided by ultrasound resulting in infiltrating ductal carcinoma.

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Fig. 21: Infiltrating ductal carcinoma. The mammography shows a circumscribed subareolar nodule eccentric to the nipple. There is nipple retraction. On ultrasound the nodule is solid and has well-defined borders. It was classified as BI-RADS® category 3. Circumscribed solid nodules classified as BI-RADS® category 3, unlike in women, should be biopsied in men, given the high positive predictive value for this category described in these patients.

**Fig. 22:** The mammography of this patient (images A and B) shows a significant bilateral gynaecomastia and a circumscribed nodule in the left breast. On ultrasound (image C) the nodule is solid and well-defined. We performed a core needle biopsy under ultrasound guidance (image D) resulting in tubular adenoma.

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**Fig. 23:** Recurrence of fibromatosis. This is a 36 year old male with a history of desmoid tumor removal in the right breast three years ago. He sought consultation due to two nodes. Physical examination showed two hard masses adhered to deep planes in the upper outer quadrant of the right breast. The mammogram showed two spiculated nodules and gynecomastia. On the ultrasound, the nodules had irregular borders with acoustic shadowing. BI-RADS category 5. The lesions were biopsied with ultrasound-guided needle biopsy. The CT scan was performed to plan a more aggressive surgery.
Fig. 24: Fat necrosis. 37 year old patient that seeks consultation for a painless lump in the right breast that appeared one year ago. The patient underwent surgery. The pathology results showed fat necrosis and gynaecomastia.

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Fig. 25: Hamartoma. 21 year old male with right breast mass. The mammography shows a well-circumscribed mass with areas of fat in it. On ultrasound the lesion is oval, well defined and echogenic. BI-RADS® category 2.

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Conclusion

Mammography and ultrasound are the first line imaging modalities to evaluate the male breast. Knowledge of the radiological findings of male breast diseases may allow us to differentiate benign from malign lesions, diagnosing carcinoma in early stages and avoiding unnecessary procedures.
References

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