

Evaluating patients with breast concerns: Lump, pain, and mastitis

Discerning which breast conditions are benign from those that need referral to a breast specialist can be daunting. The initial assessment of the patient and their symptoms and signs can provide information that will assist the clinician in choosing the best path for the patient.

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IN THIS ARTICLE

Breast cyst

page 17

Fibroadenoma

page 18

Mastalgia

page 20

The vast majority of symptomatic breast conditions are benign, with the most common symptoms being palpable mass and breast pain. Clinicians, including primary care clinicians and gynecologists,



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play a crucial role by performing the initial assessment and subsequent therapies and referrals and serve as the mediator between the specialists and by being the patient's spokesperson. It is therefore important for clinicians to be aware of the various possible causes of these breast symptoms, to know which imaging tests to order, and also to understand the indications for biopsies and surgical referral.

Common types of breast lumps: Imaging workup and management

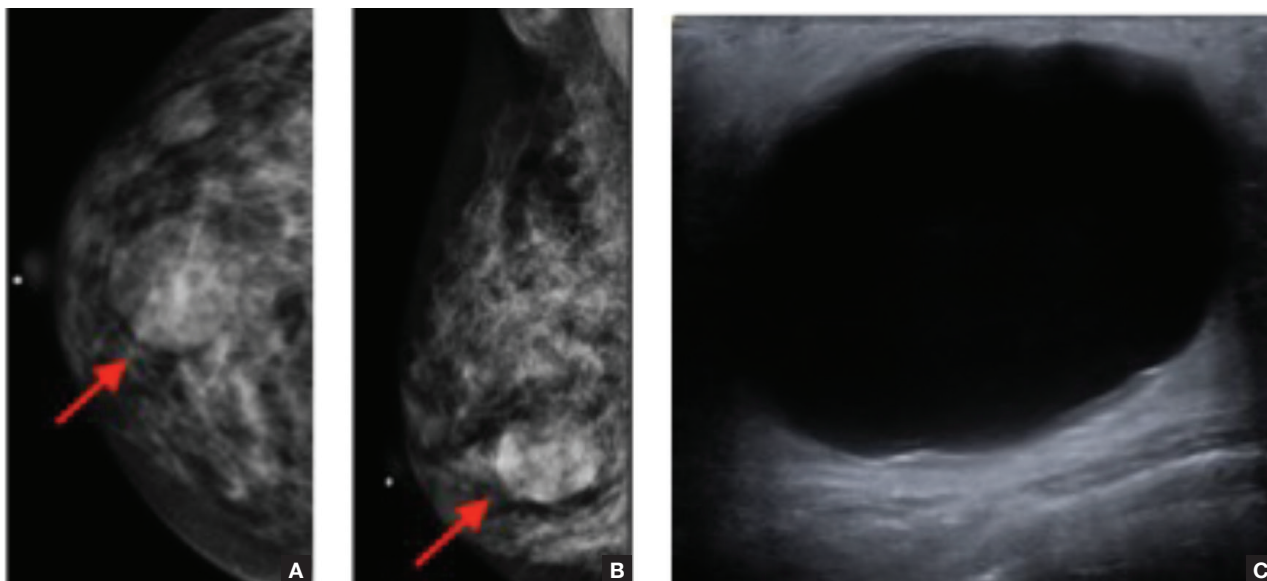
Accounting for 8% of women who present with breast symptoms, breast lump is the second most common symptom after breast pain.¹ The positive likelihood ratio of finding breast cancer is highest among women with breast lumps compared with any other breast symptoms. Therefore, anxiety is related to this symptom, and a thorough evaluation is recommended.¹ Cysts, fibroadenoma, and fat necrosis are 3 common benign causes of breast lumps.²

In this section, we review clinical presentation, imaging workup, and management strategies for common types of breast lumps.

CASE 1 Woman with tender breast lump

A 45-year-old woman presents with a breast lump

FIGURE 1 A 45-year-old woman with a tender right breast lump



Right breast diagnostic mammogram images (**A**, craniocaudal view; **B**, mediolateral oblique view) show circumscribed retroareolar mass in the area of palpable concern. Targeted right breast ultrasonogram (**C**, transverse image) shows an anechoic circumscribed mass with posterior acoustic enhancement consistent with a simple cyst.

of 6 months' duration that is associated with a change in size with the menstrual cycle and pain. Clinical examination reveals a 4 x 4.5-cm mass in the right breast in the retroareolar region, which is smooth with some tenderness on palpation.

Breast cyst

According to the American College of Radiology appropriateness criteria for an adult woman 40 years of age or older who presents with a palpable breast mass, the initial imaging study is diagnostic mammography with or without digital tomosynthesis, usually followed by a directed ultrasound. If the mammogram is suspicious or highly suggestive of malignancy, or in cases where the mammogram does not show an abnormality, the next recommended step is breast ultrasonography. Any suspicious findings on ultrasound or mammogram should be followed by an image guided biopsy. Ultrasonography also may be appropriate if the mammogram findings are benign or probably benign.

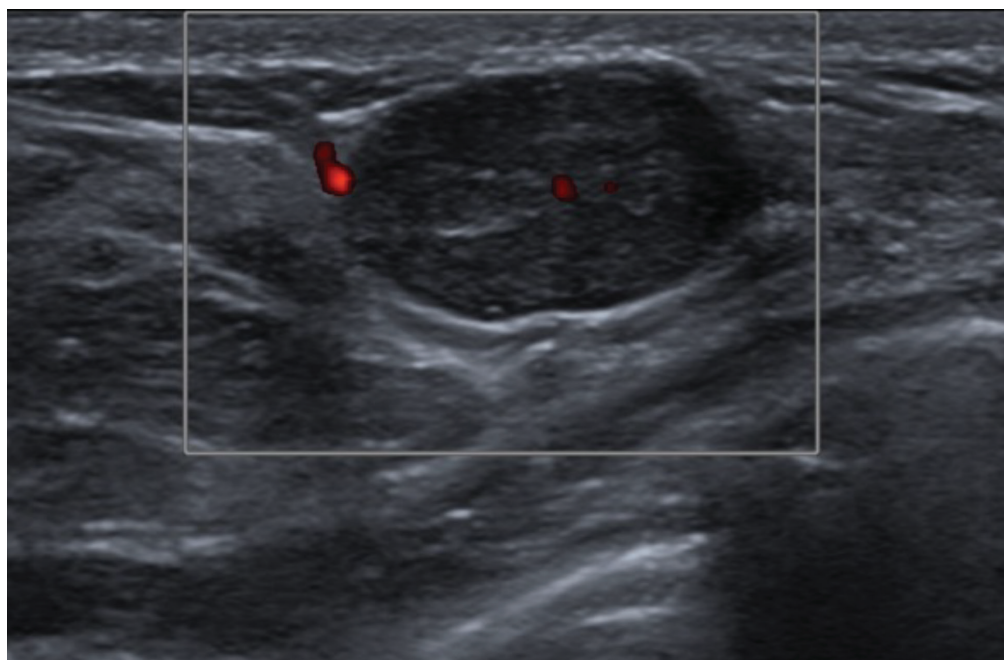
For an adult woman younger than age 30 who presents with a palpable breast mass, breast ultrasonography is the appropriate

initial imaging study. If the ultrasound is suspicious or highly suggestive of malignancy, then performing diagnostic mammography with or without digital tomosynthesis or ultrasound-guided core needle biopsy of the mass are both considered appropriate. However, no further imaging is recommended if the ultrasound is benign, probably benign, or negative. Breast ultrasonography or mammography is appropriate as the initial imaging test for adult women aged 30 to 39 years who present with a palpable breast mass.^{3,4}

Approximately 50% of women after age 30 may develop fibrocystic breast disease, and 20% of them can present with pain or lump due to a macrocysts. Simple cysts must be distinguished from complex cysts with the help of ultrasound as the latter are associated with 23% to 31% increased risk of malignancy.

In this 45-year-old patient, the initial mammogram demonstrated a circumscribed mass underneath the area of palpable concern (**FIGURE 1A, 1B**). Targeted breast ultrasonography was performed for further assessment, which depicted the mass as a benign simple cyst (**FIGURE 1C**).

CONTINUED ON PAGE 18

FIGURE 2 A 22-year-old woman with a painless right breast mass

Targeted right breast ultrasound with color Doppler shows an oval circumscribed hypoechoic solid mass, features that suggest fibroadenoma, particularly in younger patients.

FAST TRACK

On ultrasound, a simple cyst is an anechoic, well-circumscribed mass with a thin capsule and with increased through transmission. Patients with small and asymptomatic simple cysts do not need imaging follow-up and can return for routine screening mammograms.

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A breast surgeon, radiologist, or gynecologist can perform percutaneous aspiration if a cyst is large and symptomatic. A cyst with low-level internal echoes, fluid-fluid, or fluid-debris levels is considered a complicated cyst. Differential diagnosis also includes hematoma, fat necrosis, abscess, and galactoceles, depending on the clinical presentation. Fine-needle aspiration or short-interval follow-up^{5,6} is appropriate for complicated cysts, while incision and drainage is indicated in patients with infected cysts and abscesses. A cyst with a solid component is considered a cystic, solid mass, and core needle biopsy is recommended. The differential diagnosis for cysts with solid components includes intracystic papilloma, papillary carcinoma, ductal carcinoma in situ, and necrotic cancers.^{5,6}

CASE 2 Painless breast mass in a young woman

A 22-year-old woman presents with a 2-month history of breast lump, which is not associated with pain or nipple discharge. On examination, there is a 2 x 2-cm mass in the right breast at 12 o'clock, 2 cm from the nipple, which is mobile, smooth, and nontender on palpation.

Fibroadenoma

In this 22-year-old, the initial imaging of choice is breast ultrasonography. Breast ultrasonography can differentiate a cystic mass from a solid mass, and it does not involve radiation. Right breast targeted ultrasound showed a circumscribed oval homogeneous hypoechoic mass that is wider than tall (**FIGURE 2**). The patient desired surgical removal, and a pre-lumpectomy core needle biopsy revealed a fibroadenoma.

Fibroadenoma is the most common benign tumor of the breast. It is most often encountered in premenopausal women. Patients present with a painless breast lump, which is smooth and mobile on palpation.

Fibroadenoma can be followed expectantly with repeat ultrasound (to assess over time for growth) if it is small and asymptomatic. No further action is needed if it remains stable. If a patient desires surgical excision, a core needle biopsy is usually performed before lumpectomy.

Excisional biopsy or removal of the mass is recommended if the mass is greater than 3 or 4 cm, is symptomatic, or if there is an increase in size that raises clinical concern for phyllodes tumor. Imaging features that are concerning for phyllodes tumors are size greater than 3 cm, indistinct or microlobulated margins, and heterogeneous echo pattern.^{7,8} In cases in which the imaging features are concerning for phyllodes tumor and a core needle biopsy is not definitive, wide surgical excision is recommended for definitive diagnosis.⁸

CASE 3 Patient develops breast mass post-surgery

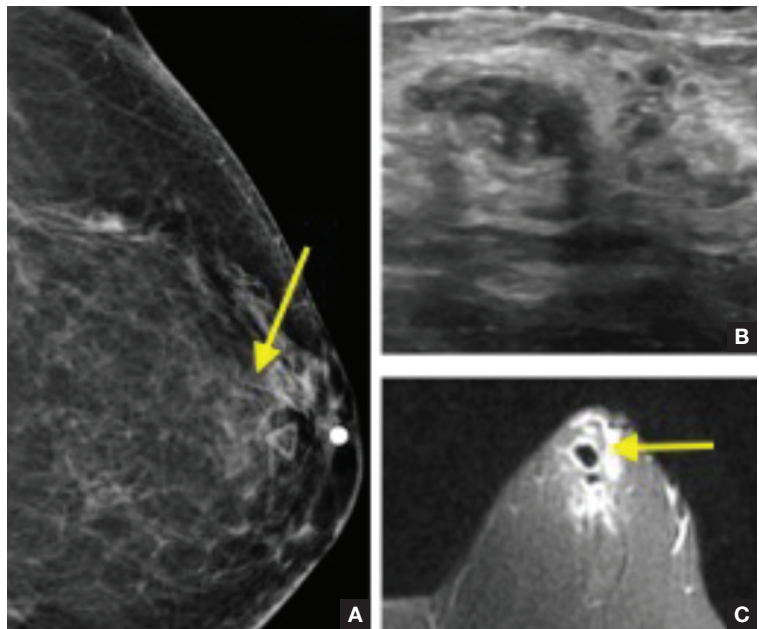
A 45-year-old woman presents with a tender left breast mass that she noticed 2 months after breast reduction surgery. It has been increasing in size since. On clinical examination, a 4 x 4-cm mass is found at the surgical scar site, which is indurated on palpation and tender.

Fat necrosis

In this 45-year-old, the initial test of choice is diagnostic mammography, which showed a somewhat circumscribed area with fat under the palpable marker (**FIGURE 3A**). Breast ultrasonography was performed for further evaluation, which was inconclusive as the ultrasound showed ill-defined areas of mixed echogenicity (**FIGURE 3B**). Breast magnetic resonance imaging (MRI) clearly demonstrated fat necrosis in the area of the palpable lump (**FIGURE 3C**).

Fat necrosis of the breast is an inflammatory process that is seen after breast trauma or surgery. It can present as an incidental mammogram finding or a palpable mass. The patient may give a history of trauma, breast reduction surgery, or breast cancer surgery followed by radiation treatment. On clinical examination, fat necrosis occasionally can

FIGURE 3 A 45-year-old woman with a left breast lump 2 months after breast reduction surgery



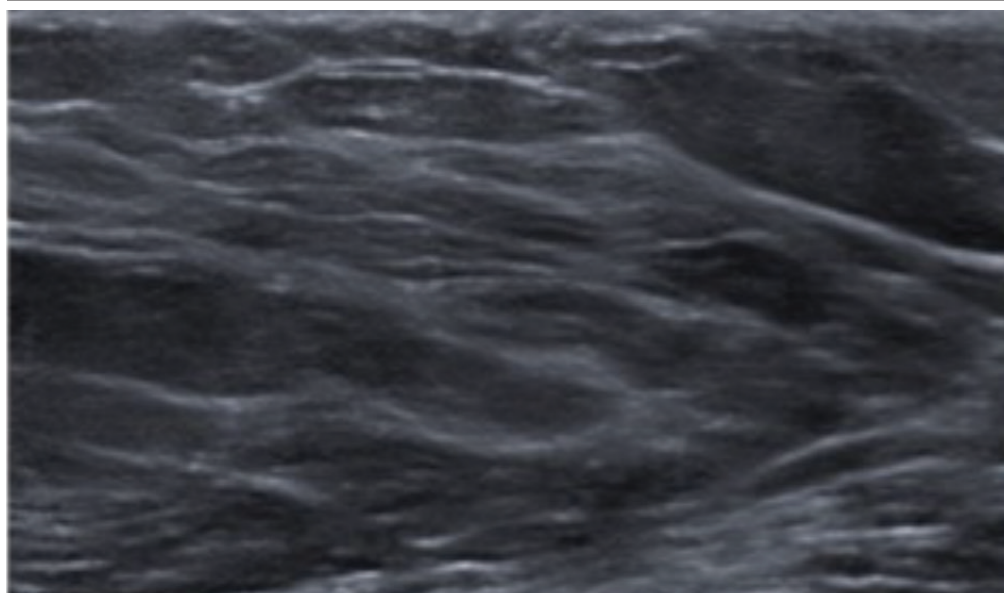
A diagnostic left breast mammogram (**A**, craniocaudal view) shows a somewhat circumscribed area with fat (yellow arrow) underneath the palpable marker. Targeted left breast ultrasound (**B**) shows the ill-defined area with mixed echogenicity in the palpable region. Inversion recovery axial MRI (**C**) shows edema with central areas of very hypointense fat (yellow arrow) in the palpable region, findings that are consistent with fat necrosis.

present as a firm mass with skin retraction or swelling concerning for cancer. Imaging features are variable depending on the stage of fat necrosis and inflammation.⁹⁻¹¹

A mammogram may demonstrate a circumscribed fat-containing mass, an ill-defined mass, asymmetry or calcified oil cyst, and dystrophic calcifications. On ultrasound, fat necrosis can appear as anechoic or hypoechoic or as a complicated cyst or a mixed cystic, solid mass. MRI demonstrates a circumscribed or irregular fat-containing mass, with or without enhancement, and architectural distortion.

When the imaging features are clearly benign—for example, a circumscribed fat-containing mass on mammogram or on ultrasound or, on MRI, marked hypointensity of fat in the center of a circumscribed mass when compared with surrounding fat (key-hole sign)—no further follow-up is needed. When the imaging features are indeterminate,

FIGURE 4 A 26-year-old woman with noncyclic upper outer left breast pain



The targeted left breast ultrasound shows normal breast tissue without any suspicious findings.

FAST TRACK

Causes of breast pain include hormonal changes, fibrocystic changes, musculoskeletal causes, lack of support, infection, and injury

however, a short-interval follow-up can be considered. In cases with irregular fat-containing mass with enhancement, core needle biopsy is indicated to exclude cancer. If the workup remains inconclusive and the level of clinical suspicion is high, surgical excision can be performed for a definitive diagnosis.¹²

Investigating breast pain: Imaging workup and management

Breast pain, or mastalgia, is the most common concern of women presenting to a breast clinic and accounts for approximately half of such encounters.¹³ Causes of breast pain include hormonal changes, fibrocystic changes, musculoskeletal causes (such as costochondritis), lack of support, infection, and injury. While mastalgia often causes patient concern, the risk of malignancy in a woman presenting with breast pain alone is low. Still, it is essential to rule out other findings suspicious for cancer (mass, skin changes, or nipple discharge) with a thorough history and breast examination.

In this section, we review clinical presentation, imaging workup, and management for breast pain.

CASE 4 Woman with noncyclic breast pain

A 26-year-old woman presents to the clinic with mastalgia. The pain is noncyclic and primarily located in the upper outer quadrant of her left breast. There is no history of breast cancer in her family. She has no suspicious findings on the breast examination.

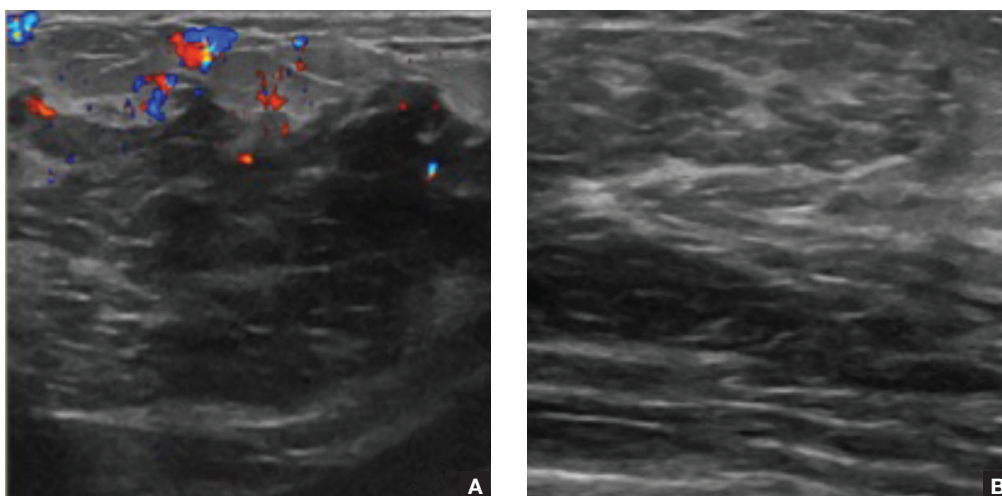
Mastalgia

The test of choice for this 26-year-old with focal left breast pain is targeted breast ultrasound. The patient's ultrasound image showed no suspicious findings or solid or cystic mass (**FIGURE 4**).

Two important characteristics of breast pain are whether it is noncyclical and whether it is focal. According to the American College of Radiology, no breast imaging is recommended for clinically insignificant cyclical, nonfocal (greater than 1 quadrant)/diffuse pain, as this type of mastalgia is not associated with malignancy.¹⁴

For patients age 40 or older, if they are not

FIGURE 5 A 27-year-old breastfeeding woman with upper inner left breast pain



Targeted left breast ultrasound (A) with color Doppler shows edema and hyperemia of subcutaneous tissues and ill-defined hypoechoic areas without drainable fluid collection. Comparison of an ultrasound image of the contralateral breast (B) shows normal glandular tissue.

up to date with their annual screening mammogram, then a mammogram should be performed. An imaging workup is warranted for clinically significant mastalgia that is non-cyclical and focal. Even then, no malignancy is identified in most patients with clinically significant mastalgia; in patients with breast pain as their only symptom, the prevalence of breast cancer is 0% to 3.0%.¹⁵⁻¹⁹

The initial imaging modality differs by patient age: younger than 30 years, ultrasonography; between 30 and 40 years, mammography or ultrasonography; and older than 40 years, mammography first followed by ultrasonography.¹⁴

Treatment of breast pain is primarily symptomatic, and evidence for specific treatments is generally lacking. Cyclical breast pain resolves spontaneously in 20% to 30% of women, while noncyclical pain responds poorly to treatment but resolves spontaneously in half of women.²⁰ Reassurance is important and wearing a supportive bra often can alleviate breast pain. In addition, reducing caffeine intake can be helpful.

As a first-line treatment, both topical (diclofenac) and oral nonsteroidal anti-inflammatory drugs effectively can relieve

breast pain. Supplements and herbal remedies (for example, evening primrose oil, vitamin E, flaxseed) have varying effectiveness and are of questionable benefit as few have trials to support their effectiveness.⁴ Danazol and tamoxifen have been shown to have some benefits but they also have adverse effects.²⁰ Surgery does not play a role in the treatment of mastalgia.

CASE 5 Breastfeeding woman with breast pain

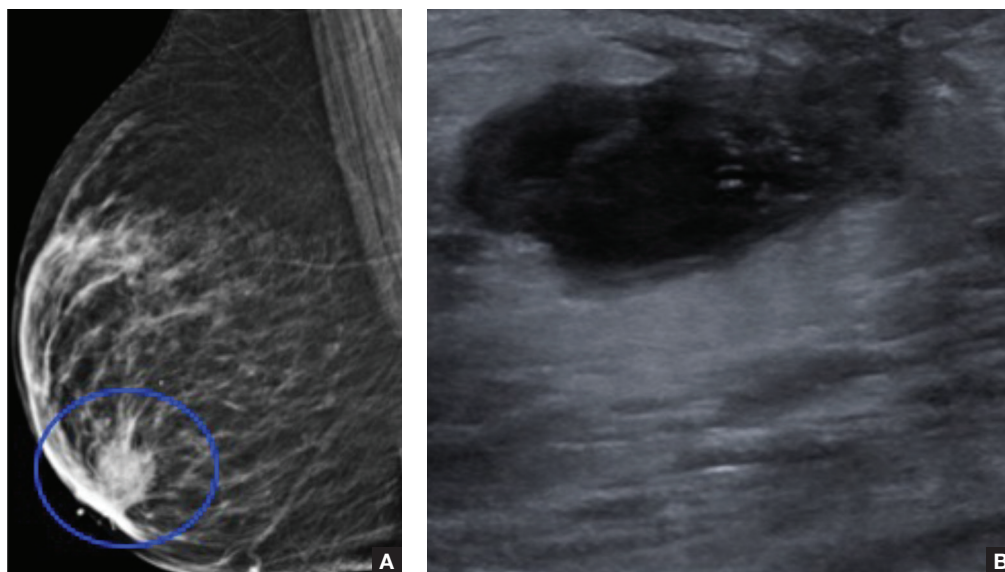
A 27-year-old postpartum woman presents with concerns for redness and pain in the upper inner left breast. She has been breastfeeding for the past few months. Breast examination demonstrates a 5-cm area of erythema and warmth but no fluctuance or masses.

Lactational mastitis

Targeted ultrasonography is the test of choice for this 27-year-old patient with focal breast pain, and the imaging revealed edema of subcutaneous tissues and ill-defined hypoechoic areas, likely inflamed fat lobules (FIGURE 5). These findings suggest uncomplicated lactational mastitis, which can be treated with antibiotics. Generally, the

FAST TRACK

Initial imaging modality differs by patient age: younger than 30 years, ultrasonography; between 30 and 40, mammography or ultrasonography; and older than 40, mammography first followed by ultrasonography

FIGURE 6 A 42-year-old woman with pain in the periareolar right breast

Mediolateral oblique view of right breast diagnostic mammogram (**A**) shows skin thickening around the nipple-areolar area and a retroareolar mass (blue circle). Targeted right breast ultrasound (**B**) shows a thick-walled anechoic fluid collection with internal echoes, indicative of an abscess.

FAST TRACK

The most important differential for mastitis is inflammatory breast cancer

mastitis will improve within days of starting the antibiotics; if it does not improve, repeat examination and ultrasound should be performed to look for formation of an abscess that may require aspiration.

CASE 6 Woman with painful periareolar mass

A 42-year-old perimenopausal woman describes having pain near the nipple of her right breast. She is a smoker and has no history of breast cancer in her family. Examination demonstrates a palpable, erythematous, painful, 3-cm periareolar fluctuant mass.

Nonpuerperal periareolar abscess

Appropriate initial imaging for this 42-year-old patient with focal pain is a diagnostic mammogram, which showed skin thickening and a retroareolar mass (**FIGURE 6A**). Further evaluation with targeted ultrasound showed a thick-walled anechoic collection with echoes compatible with an abscess (**FIGURE 6B**).

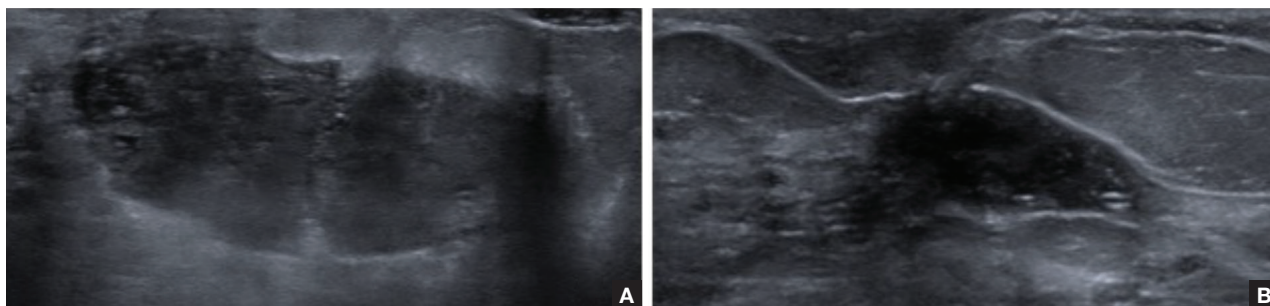
Mammographic findings in a patient with mastitis may be normal or demonstrate skin and trabecular thickening. Ultrasound imaging may show dilated ducts and

heterogeneous tissue secondary to inflammation and edema without a discrete fluid collection. In cases with breast abscess, in addition to the mammographic findings described above, a mass, or an asymmetry, may be seen, most commonly in a subareolar location. On ultrasound, a hypoechoic collection with mobile debris, no internal flow on Doppler, and thick hypervascular walls can be seen with abscess, occasionally giving the appearance of a complicated cyst or a mixed cystic, solid mass.

The most important differential for mastitis is inflammatory breast cancer. Most cancers appear solid but can have central necrosis, mimicking a complicated cystic mass on ultrasound. The location for mastitis or abscess is most frequently subareolar. The presence of microcalcifications in a mass indicates the possibility of cancer.

Contrast-enhanced MRI can be helpful to differentiate between infection and cancer, with cancers showing initial early enhancement and washout kinetics compared with infected collections that show no enhancement or peripheral enhancement with a plateau or persistent enhancement curves. When

FIGURE 7 A 39-year-old woman with left breast pain and swelling



Pre-biopsy ultrasound shows a hypoechoic mass with slightly indistinct margins (A). After oral steroids are initiated, repeat ultrasound shows a marked decrease in the mass dimensions (B).

clinical and imaging findings are unchanged after treatment of mastitis and abscesses, a core needle biopsy should be performed.^{21,22}

There are 2 categories of mastitis and breast abscess: lactational and nonpuerperal (all mastitis that occurs outside the lactational period). The World Health Organization definition of puerperal mastitis includes pain, local redness, warmth and swelling of the breast (usually unilateral), fever, and malaise.⁴ Concerning etiology, epithelial lesions in the nipple area caused by breastfeeding can allow pathogens to enter and cause infection. The most common microorganism is *Staphylococcus aureus*.⁴ Continued emptying of the breast is important, combined with early antibiotic therapy (dicloxacillin is often the first line; if the patient is penicillin allergic, use a macrolide such as clindamycin). If no improvement is seen in 48 to 72 hours, imaging should be performed.

In most cases, continuation of breastfeeding is possible. If mastitis has evolved into an abscess in a lactating woman, it can be aspirated under ultrasound guidance. Incision and drainage should be avoided unless the abscess persists after multiple aspiration attempts, it is large, or if the overlying skin is thin or otherwise appears nonviable.

Nonpuerperal mastitis includes peripheral, periductal, and idiopathic granulomatous mastitis (IGM). Peripheral mastitis behaves like infections/abscesses in other soft tissues, responds well to treatment (antibiotics and percutaneous drainage), and is

less likely to recur than periductal mastitis and IGM.^{21,23}

Periductal mastitis and abscess, also known as Zuska disease, has a pathogenesis distinct from other forms of mastitis. Squamous metaplasia of the usual cuboidal epithelium of the breast ducts leads to keratin plugging that can cause infection.²³ Risk factors include obesity, smoking, and macromastia. The typical presentation of Zuska disease is a woman with a history of chronic smoking and/or a congenital cleft in the central nipple.²³ Periareolar signs of inflammation (redness, swelling, warmth) may be accompanied by an abscess. These can recur and lead to chronic fistula formation, especially if there is a history of intervention (such as aspiration, incision, and drainage).

Treatment of Zuska disease includes symptom relief and antibiotics. If *S aureus* is present, infection with methicillin-resistant *S aureus* is likely, and treatment with clindamycin or amoxicillin/clavulanic acid is preferred. If abscess is present, aspiration (preferred, often under ultrasound guidance) or incision and drainage (if the skin is compromised) may be required. If disease is recurrent or associated with a chronically draining fistula, surgical intervention may be warranted, in which resolution requires removing the keratin-plugged ducts in and immediately below the central core of the nipple. Given the association between Zuska disease and smoking, cessation should be encouraged, although there is no guarantee that this will resolve the issue.²³

FAST TRACK

Peripheral mastitis behaves like infections/abscesses in other soft tissues, responds well to treatment (antibiotics, percutaneous drainage), and is less likely to recur than periductal mastitis and IGM

CASE 7 Patient with breast pain and swelling

A 39-year-old woman presents with left breast swelling and pain of 1 month's duration. On examination, there is a 6-cm area of edema, induration, and erythema.

Granulomatous mastitis

A diagnostic mammogram and ultrasound demonstrated an ill-defined hypoechoic mass (**FIGURE 7A**, page 23). Ultrasound-guided biopsy was performed, which showed granulomatous mastitis, negative for fungus and acid-fast bacilli. The patient was treated with prednisone and gradually improved (**FIGURE 7B**, page 23).

Granulomatous mastitis (GM) is a rare benign inflammatory process, with etiologies that include fungal infections, tuberculosis, Wegener granulomatosis, sarcoidosis, and idiopathic causes. Imaging can be nonspecific and show variable features. Mammograms can appear normal or show asymmetry or mass and skin thickening. Ultrasound can show heterogeneous parenchyma, ill-defined hypoechoic collection, or a mass with margins that can be circumscribed or indistinct or with tubular extensions, with or without

overlying skin thickening, fistulas, and reactive lymph nodes.²⁴

In this clinical setting, the differential diagnosis includes infectious mastitis, inflammatory breast cancer, foreign body injection granulomas, and diabetic mastopathy. Treatment involves drainage and fluid culture if there is a collection on imaging. A core biopsy is performed if imaging demonstrates a solid mass or fluid culture is negative and symptoms persist or recur. Oral steroids represent the mainstay of treatment if a core biopsy shows GM. However, immunosuppressants, including methotrexate, and surgery are options if initial treatment is not helpful.^{25,26}

Conclusion

Breast symptoms are common reasons for patient visits to obstetricians and gynecologists. With a good understanding of the various symptomatic breast diseases and conditions, and by having a close collaboration with radiologists and breast surgeons, clinicians can provide excellent care to these patients and thereby improve patient outcomes and satisfaction. ●

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