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Review Article

Emergency Breast Imaging, What Radiologists Need To Know

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ABSTRACT

Awareness by the general radiologist of the various emergent conditions of the breast would enable a better management and appropriate referral, rather than postponing management till a breast radiologist is available for consultation. Early referrals are essential to prevent deterioration of complications including severe infection and even sepsis. There has been a lack of consensus in the past regarding appropriate management and delays in treatment have resulted in worse outcomes which could have been avoided.

Keywords: Mastitis, Breast abscess, Puerperal mastitis, Inflammatory carcinoma, Ultrasound

INTRODUCTION

Breast-specific emergencies are uncommon but proper management and intervention by the emergency room doctor and radiologists is crucial, and good communication with the breast imaging radiologist can improve the outcome. The most common presentations are mastitis and breast abscess. In some large and busy setting, this type of communication requires some improvement. With the understanding that almost all breast radiologists work on an out patient daytime basis in most practices we wanted to educate the emergency radiologists who encounter these clinical presentation and increase their awareness and fill the gap in communication with the Breast radiologists.

Breast emergencies may require urgent diagnosis and management such as percutaneous biopsy or trauma, emergencies related to infection and milk fistula. It is important for the emergency room radiologist to recognize the clinical and imaging findings of breast emergencies and complications to be able make a timely diagnosis and to understand what can be performed before referral to a breast radiologist on an outpatient basis. It is also important to be able to differentiate the infection from inflammatory breast cancer and the best ways to address the issue to avoid missing an inflammatory cancer.

The purpose of this article is to review the various types of breast emergencies and the characteristic imaging appearances along with the most common interventions and recommended management and possible complications. The emergency situation we are discussing includes inflammatory conditions, mastitis and abscess mimickers, breast pain, discharge, post-biopsy complications, and presentations related to breast implants. In this review, we are discussing suggestions to close the loop of communication between the emergency radiologist and breast radiologist and to emphasize the importance of the follow-up of the presumed infection.

INFLAMMATORY CONDITIONS

Mastitis and breast abscess

Mastitis is an inflammatory condition of the breast that may be either infectious or non-infectious in origin.

Puerperal mastitis

Puerperal mastitis is the inflammation of the breast during pregnancy or lactation. Infectious mastitis is most commonly an acute presentation, occurring during lactation. It may progress to tissue necrosis and abscess formation. Patients present with erythema of the breast with pain, tenderness, warmth, fever, and leukocytosis. A purulent nipple discharge may be present.[1,2] There are 2–33% of breastfeeding women who may experience lactational mastitis.[3]

Non-puerperal mastitis

Mastitis may also occur in non-lactating patients (non-puerperal mastitis) secondary to a variety of etiologies. They include periductal mastitis and idiopathic granulomatous mastitis, both of which primarily affect young women.[4] It encompasses all the causes of inflammatory changes in the female breast and mammilla not related to lactation. This inflammation of the breast is often neglected because of the lack of typical clinical signs and symptoms.[5] There is often an underlying duct ectasia or breast cysts, which can rupture, leading to chemical inflammation process rather than an infectious inflammation. Secondary bacterial infection may occur presenting with localized inflammation, pain, redness, and warmth.[2] Mastitis is classified into subareolar and peripheral mastitis.

Subareolar mastitis

Non-puerperal subareolar mastitis and abscess are a benign entity often associated with prolonged morbidity.[6] Squamous metaplasia of the ducts leads to keratin accumulation with eventual rupture and leakage of ductal contents into the surrounding breast stroma, resulting in abscess formation. This may be complicated with rupture and the formation of a sinus tract. A recurring subareolar abscess and sinus formation have been referred to as "Zuska's Disease" or periductal mastitis.[7]

Peripheral breast abscess

Most peripheral breast abscesses are similar to infections elsewhere in the body and are managed similarly. Risk factors would include diabetes, smoking, obesity, or skin conditions such as hidradenitis (clogged sweat glands), acne, or trauma. Furthermore, African-American race is a risk factor.[8]

IMAGING OF MASTITIS AND BREAST ABSCESS

On ultrasound, mastitis usually shows features of cellulitis, skin thickening, subcutaneous edema dilated ducts, heterogeneous tissue, edema, and increased vascularity. Enlargement of lymph nodes should also be expected as a reactive process which should be differentiated from malignant lymph nodes and that can be challenging.[9]

The sonographic appearance of a breast abscess is similar to abscess formation elsewhere in the body as a hypoechoic complex collection with internal echoes, debris, and some acoustic enhancement and peripheral thick wall and increased vascularity in the surrounding soft tissues [Figure 1].

Mammography can show skin thickening, an asymmetric density, or a mass; these signs are not specific for carcinoma and may reflect only the underlying infection and breast abscess.[8]

The presence of microcalcifications is unusual for mastitis or an abscess. The presence of suspicious microcalcifications is a more specific sign and should warrant a biopsy to rule out carcinoma.[8]

Similarly, unresolved findings such as a mass or an area of sonographic vague shadowing after treatment should also prompt histologic evaluation.

Mammogram should be deferred until after the acute phase subsides. It is recommended to evaluate for cancer especially if patient is over age 40.[10]

MANAGEMENT OF PUERPERAL MASTITIS

The patient should be referred to a lactation specialist, as all patients should receive supportive care (analgesia, ± warm

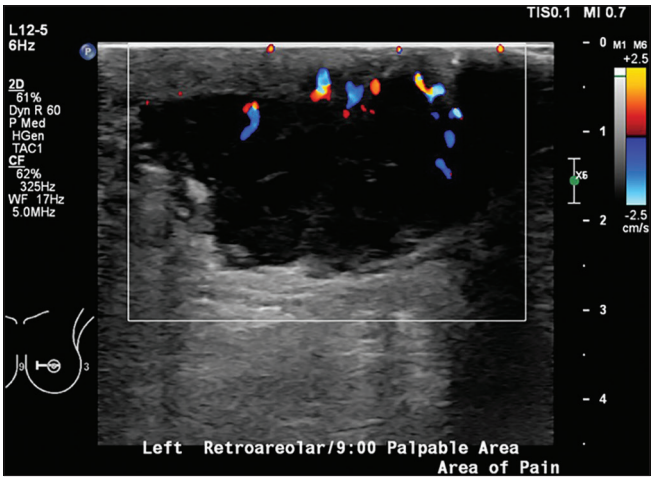

Figure 1: A 37-year-old female with the left breast pain and redness. Ultrasound image shows a complex mixed echogenicity collection with a peripheral vascularity and thick septations consistent with an abscess in the left breast.

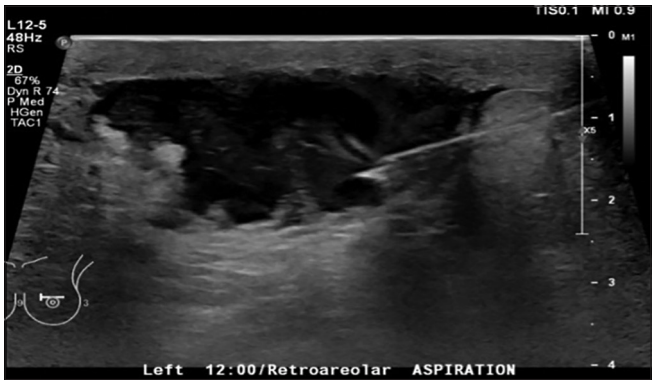

Figure 2: Same patient. Ultrasound-guided abscess aspiration using 18-gauge needle.

compress, and expression of the milk from the affected breast). Continued breastfeeding should be encouraged in the presence of mastitis and generally does not pose a risk to the infant. Flow of milk would minimize the chances of developing an abscess. If symptoms are not severe or prolonged and in the absence of systemic signs of infection (and/or negative culture), patients may not need further treatment.[10]

If symptoms are severe, prolonged, or in the presence of signs of systemic disease; patients should be treated with antibiotics in accordance with culture results and sensitivities.[10]

MANAGEMENT OF BREAST ABSCESS

This is an area of overlap between specialties and can be directed by the PCP, surgeon, or directly by a breast radiologist, the latter should be able to perform an ultrasound-guided drainage and subscribe antibiotic treatment on an outpatient basis. Empirical oral antibiotic is recommended immediately after aspiration and culture. The best results occur in abscesses smaller than 3 cm. Aspiration should be attempted for the treatment of abscesses of all sizes. Lidocaine is used for local anesthesia before aspiration. The procedure is performed using an 18-gauge needle.[11]

Viscous collections may require a larger gauge needle to completely drain the cavity [Figure 2]. Once emptied, the cavity is flushed with saline 2–3 times until the aspirate appears clear. In abscesses larger than 3 cm, direct instillation of antibiotics into the abscess cavity yields higher success rates.[8]

Using an oblique tract to approach, the cavity helps reduce the incidence of fistula formation. Aspiration and flushing can be repeated if the abscess persists on follow-up ultrasound.[11]

Surgical incision and drainage were the first line of treatment in the past but are now used only after three to five failed aspiration attempts.[8]

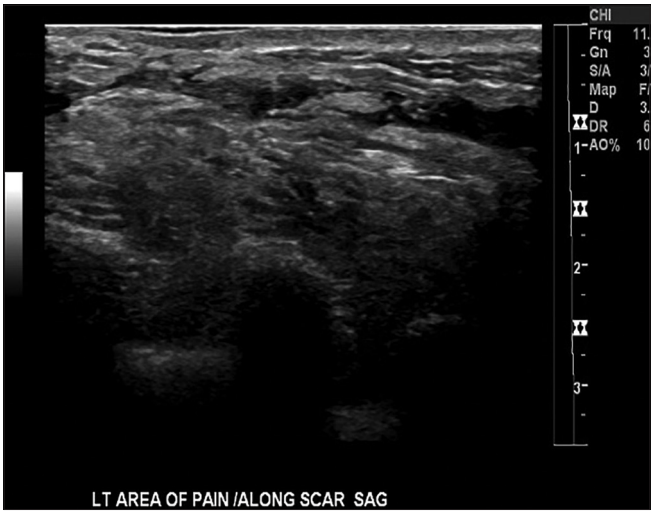

Figure 3: Ultrasound of the left breast of a 47-year-old female who presented with the left breast pain, local redness, and warmth, which resolved later with antibiotic treatment, consistent with mastitis.

FOLLOW-UP RECOMMENDATIONS OF SUSPECTED INFECTION

Mastitis

For routine cases of mastitis, a biopsy is not usually indicated.[10] If symptoms do not fully resolve with supportive treatment and antibiotics, imaging should be pursued to exclude an underlying malignancy or a developing abscess. At our department, we perform a follow-up US in 7–10 days of antibiotics [Figure 3].

Breast abscess follow-up

Puerperal abscesses

Puerperal abscesses respond better to treatment than non-puerperal abscesses, and clinical follow-up after aspiration is usually sufficient.[8]

Non-puerperal abscesses

If there is good clinical response to aspiration and antibiotics, clinical and imaging follow-up with ultrasound is continued every 7–14 days until complete resolution occurs.[8] For atypical presentation, uncertain diagnosis, or a potential complication (e.g., recurrent infection or treatment failure), a biopsy may be warranted.[10]

MASTITIS/ABSCESS MIMICKERS IN EMERGENCY SETTINGS

Infected epidermal inclusion/sebaceous cyst

Epidermal inclusion cysts are thought to arise from the infundibulum of the hair follicle with true epidermis lining and

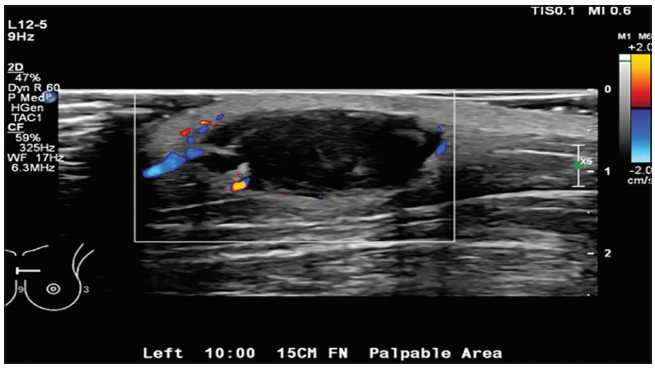

Figure 4: A 33-year-old female with red raised localized swelling in the left breast. Ultrasound demonstrates an underlying heterogeneously hypoechoic mass with peripheral vascular flow consistent with an infected sebaceous cyst.

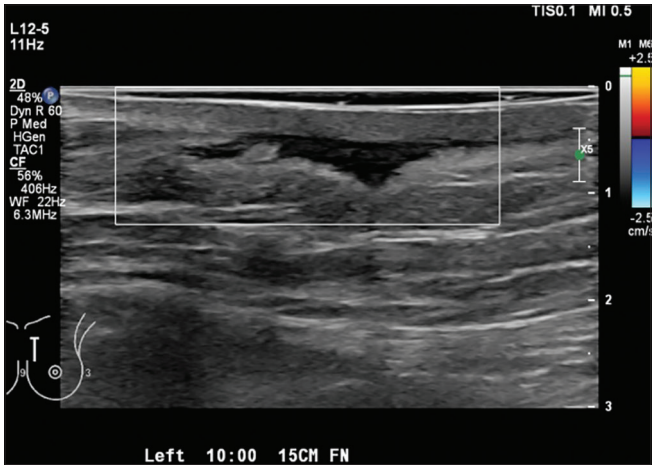

Figure 5: Same patient of Figure 3, 2 weeks later after antibiotic treatment (resolving sebaceous cyst).

contain keratinous material. They may arise spontaneously or result from a prior trauma. Sebaceous cysts are less common than epidermal inclusion cysts and are not distinguishable from epidermal inclusion cysts on imaging or clinical features.[12]

When a sebaceous cyst gets infected [Figures 4 and 5], the patient may present with inflammatory signs, redness, edema, warmth, and pain. It is more superficial and localized than the deeper abscess.

On mammography, sebaceous cysts appear as circumscribed iso to hyperdense mass. On tangential images, they are contiguous with the dermis. On ultrasound, the epidermal inclusion cyst may appear as a well-circumscribed mass. A characteristic "claw" of dermal tissue that wraps around the margin of the lesion is a good sign to suggest a dermal origin.[12]

Mondor's disease

Benign and self-limiting, superficial thrombophlebitis: Patients present with pain and cord-like palpable structures.

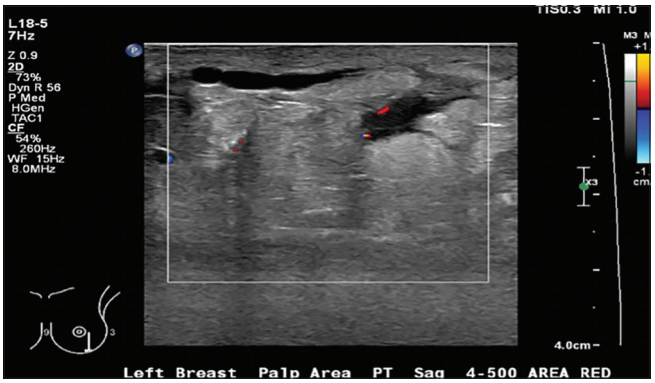

Figure 6: A 45-year-old female with pain and cordlike palpable area in the left breast. Ultrasound shows a beaded superficial anechoic tubular structure (arrow) which is not seen after 10 days follow-up. The appearance suggests a diagnosis of thrombophlebitis of a superficial vein and adjacent edema (cellulitis).

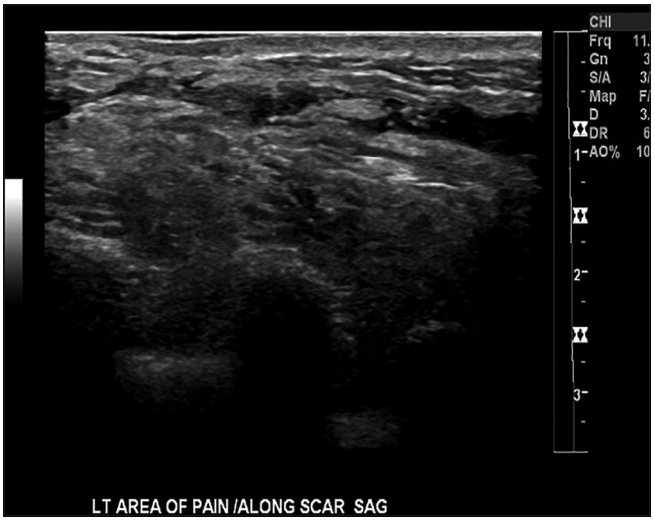

Figure 7: A 65-year-old female. There is an area of pain and the palpable ridge in the upper chest wall there is a long tubular structure filled with echogenic material. The appearance, together with the clinical presentation, strongly suggests a diagnosis of thrombophlebitis of a superficial vein.

Ultrasound may show a dilated superficial vessel distended with a thrombus or anechoic beaded superficial vein [Figures 6 and 7]. A short-term follow-up should be obtained until resolution.[13]

Infected galactocele

Galactoceles [Figure 8] are the most common lesions in lactating women. On cessation of breastfeeding, milk may retain and stagnate, causing ductal dilatation and development of cysts or galactoceles. Furthermore, infection is a relatively common complication. Galactoceles may appear sonographically similar to abscesses but would follow a ductal distribution. Diagnosis is made based on the clinical history and aspiration of mixed milky and purulent material from the cyst.[14]

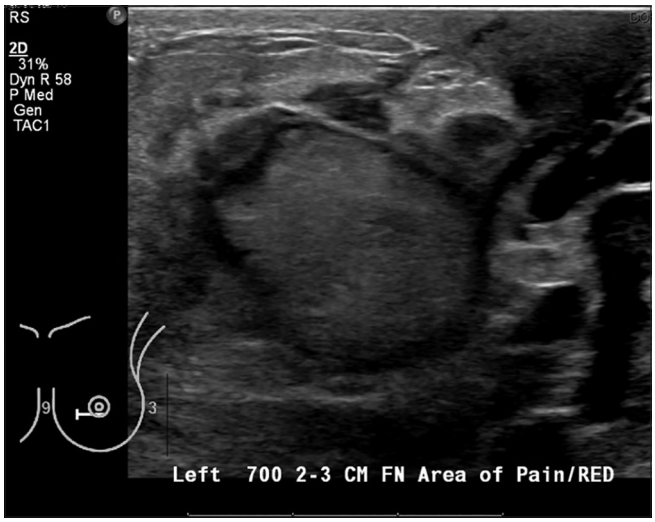

Figure 8: A 38-year-old lactating female with a recent pain and fullness in the left breast. Ultrasound shows an oval-shaped isoechoic mass with hypoechoic rim located near the left areola consistent with galactocele.

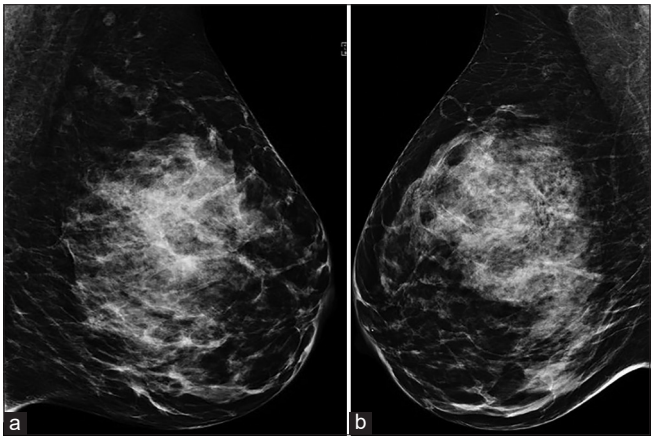

Figure 10: A 35-year-old female presents with the left breast thickening. (a and b) Bilateral MLO mammographic views with normal appearance of a dense breast.

Figure 9: A photograph of the left breast. A 62-year-old female presents with 3–4 weeks of the left breast redness and warmth, not responding to antibiotic, later was biopsied and showed invasive carcinoma with dermal lymphatic invasion.

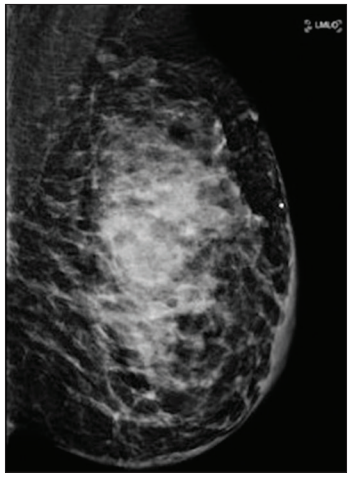

Figure 11: Same patient of Figure 9 presented with inflammatory symptoms in the left breast 4 months later left breast MLO view, there is increased skin thickening and trabeculations, reflecting diffuse edema.

Inflammatory breast cancer

Patients with inflammatory breast cancer have rapid onset of symptoms. Breast erythema and edema, often with no palpable mass, typically may involve one-third or more of the breast. Histopathologically, it is an invasive carcinoma.[15]

Inflammatory cancer should be carefully distinguished from mastitis. Diagnostic features include a rapid onset of erythema (redness) involving one-third or more of the breast [Figure 9], edema (swelling), an orange peel appearance (ridged or pitted skin), and/or abnormal breast warmth, with or without a lump that can be felt. There are symptoms that mimic inflammation, but there is no true inflammatory component to inflammatory breast cancer.[15] Usually patients have less pain, skin thickening more diffuse.

If there is no response or an incomplete response to antibiotic treatment within 1–2 weeks, malignancy such as IBC should be considered.[8] A biopsy should be performed by the breast radiologist.

The typical mammographic appearance of inflammatory breast cancer includes diffuse enlargement of the breast, increased trabeculation, asymmetrical diffuse increased density [Figures 10, 11, 12, 13 and 14], skin thickening, and

enlarged lymph nodes.[8]

The breast radiologist should communicate results with the patient and insure communication with the referring physician or the breast surgeon.

OTHER EMERGENCY CONDITIONS

Breast localized thickening or pain

A common presentation is breast pain, thickening or both are seen in young women with no sonographic correlate.[16] At our practice, if the presentation is a lump or thickening in a young woman with a negative ultrasound, we recommend a follow-up examination in 3 or 6 months and possible biopsy if the palpable abnormality persists.

Figure 12: Same patient of Figure 9, ultrasound images show diffuse skin thickening, diffuse ill-defined suspicious shadowing.

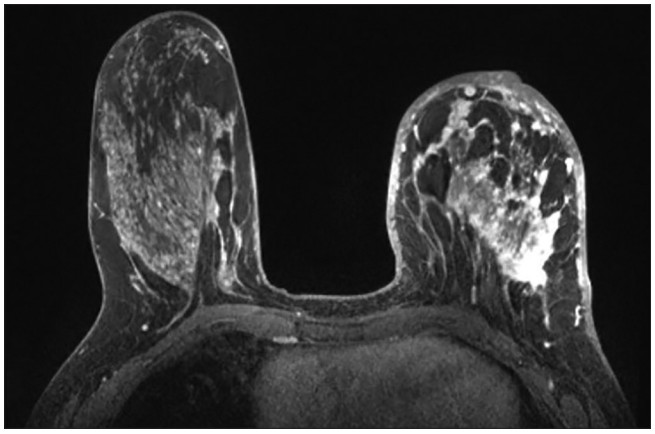

Figure 13: Same patient of Figure 9, axial post-contrast digital subtraction MR image, shows an asymmetrical, slightly larger left breast with diffuse skin thickening and parenchymal enhancement. This is consistent with an infiltrative process, later biopsy-proven invasive carcinoma with dermal lymphatic invasion.

According to ACR appropriateness criteria, if pain is non-cyclical, or focal breast pain, the ACR suggests the following. Women less than 30 years of age, ultrasound should be performed first and mammography may be indicated in patients under 30 when a suspicious lesion is found on ultrasound. In the 30–39-year-old age group, adding mammography is appropriate. Mammography should be performed with ultrasound in patients age 40 and older or in a patient of any age who would normally qualify for a mammogram.[16]

Breast discharge

Nipple discharge is of concern if it is bloody, serous, red, pink, brown or clear, spontaneous, persistent, or unilateral.[17] Workup should include ultrasound, mammogram, and ductogram of any unilateral discharge [Figures 15 and 16]. This discussion is beyond the scope of our review, and patients should be referred to the breast clinic.

Post-biopsy complications

Milk fistula

Biopsy with a core needle during lactation can be unavoidable and milk fistula can occur [Figure 17]. Management of milk fistula is mainly conservative, as it often resolves spontaneously and some cases may need cessation of breastfeeding and bromocriptine may be needed.[18]

Post-biopsy hemorrhage or pseudoaneurysm

Post-biopsy hematoma is not uncommon and to achieve hemostasis, manual compression after biopsy is usually performed.[19] At mammogram, hematoma appears as a new density at the biopsy site [Figure 18]. At ultrasound,

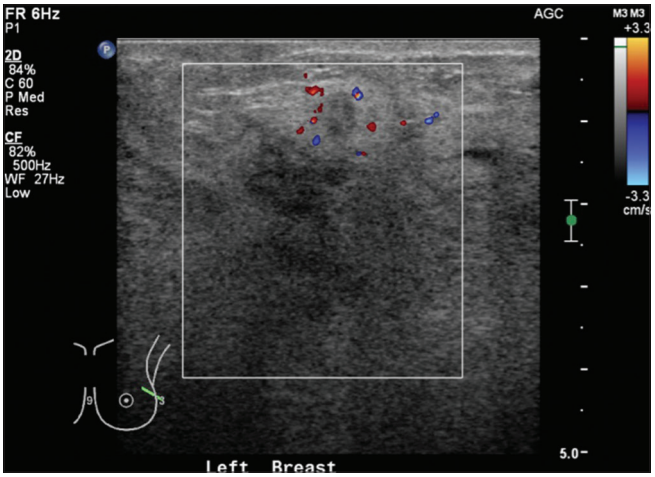

Figure 14: A 56-year-old female who presented with signs of the left breast inflammatory process. Diffuse left breast edema and skin thickening, increased vascularity, no response to antibiotic. Biopsy results of invasive ductal cancer (inflammatory cancer).

Figure 15: A 33-year-old woman presents with the right breast spontaneous discharge and vague pain. Ultrasound showed two small cysts. Mammogram was postponed until after obtaining a pregnancy test.

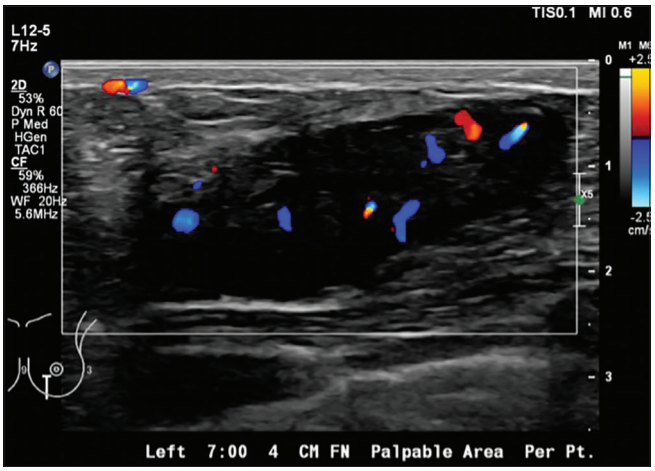

Figure 17: Ultradound and Doppler image of a 24 year old lactating woman with a Left breast vascular mass for which FNA with inconclusive results. This was followed by a core biopsy using 18-gauge needle. Immediately after the biopsy there was milky bleed from the biopsy site which resolved in less than 48 hours.

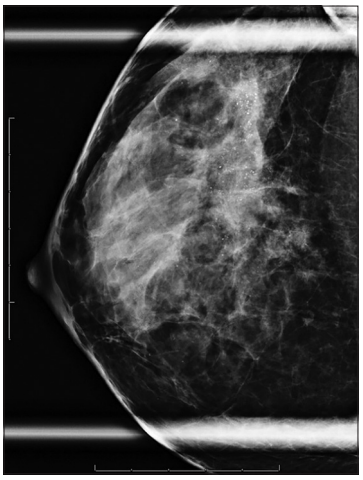

Figure 16: Same patient of Figure 15, two weeks later the patient returned for diagnostic mammogram with extensive right breast calcifications, which was subsequently biopsied and revealed extensive DCIS.

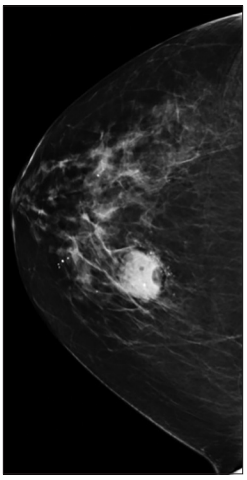

Figure 18: Right breast mammogram shows a post biopsy hematoma representing a new mammographic mass.

hematoma may show a new hypoechoic collection at the biopsy site [Figure 19]. Hematomas after core biopsy can be avoided or minimized by manual compression, and administration of lidocaine with epinephrine. A compression bandage may also be applied across the breast for a few hours or overnight to ensure continued hemostasis.[19]

An observation for 30 min before discharge is preferred in our practice. Surgical intervention is rarely needed to stop the bleeder.

A pseudoaneurysm is basically a hematoma that communicates with the arterial lumen. On mammography, a circumscribed mass adjacent to a blood vessel can be seen. Ultrasound may show pulsating anechoic lesions, to-and-fro Doppler pattern. Management options for pseudoaneurysm include surgical repair, sonographically guided compression therapy, percutaneous thrombin or alcohol injection, and coil embolization.[20]

Dixon and Khan suggested using ultrasound to monitor pseudoaneurysm may negate the need for invasive treatment. El Khoury *et al*. suggested that radiological treatments are more successful than sonographically guided compression and surgery, and that simple monitoring may offer the chance of spontaneous occlusion without the need for invasive intervention.[21,22]

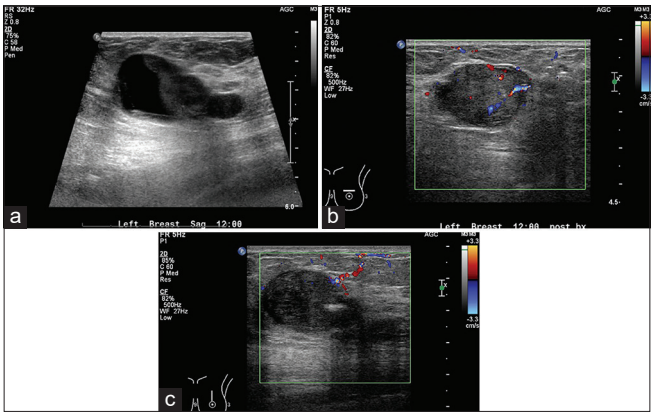

Figure 19: A 55-year-old female presented with a left breast mass. Ultrasound of a pre-biopsy (a and b) and post-biopsy (c): The left breast cavitary vascular mass which bled after the first pass. Note that the blood filled the cavity when comparing (a with c). Prolonged compression after the biopsy prevented more significant bleeding.

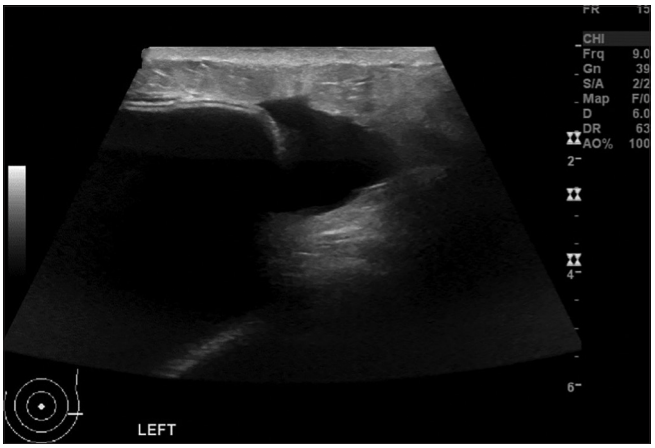

Figure 21: 55 year old patient who has a history of infiltrating ductal carcinoma of the left breast, status post bilateral breast reconstruction with bilateral nipple sparing mastectomy and immediate insertion of postoperative adjustable implants. There is now skin redness and fever. She presents for evaluation of fluid collection. Ultrasound imagng shows a collection in the lateral aspect of the left chest wall, along with the clinical picture raised the possibility of an infected seroma. At our institution we aspirate the fluid for microbiology analysis and recommend follow up in 2 weeks.

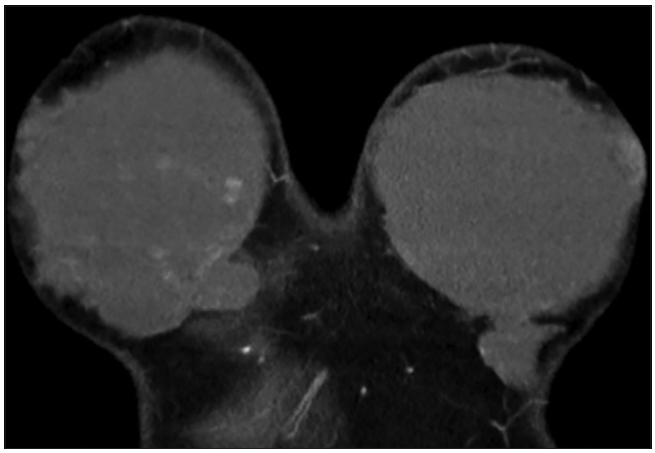

Figure 20: CT chest coronal reformat; 50 year old female presents after trauma to chest. She has a history of bilateral silicon implants. There are abnormal bulges through the inferior left breast and inferomedial aspect of the right breast with concerning for traumatic implant rupture. MRI evaluation and Surgical consultation were recommended.

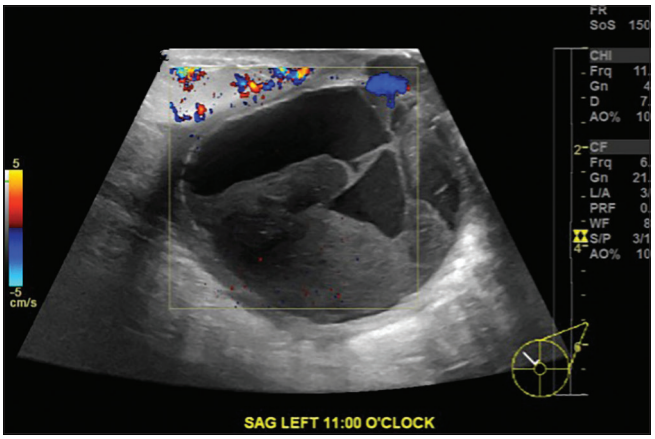

Figure 22: A 59 year old female with breast pain and redness in the region of the surgical bed, status post partial mastectomy. In the region of surgical bed, ultrasound shows a thick walled complex fluid collection at 11-12:00 O'Clock position, with mixed solid and fluid components consistent with infected seroma.

Presentations related to breast implants

Chest trauma and implant rupture

Trauma of the breast can present with a lump due to hematoma, blistering, or ulceration. On mammogram, a band-like density can be seen which would evolve into fat necrosis and oil cysts later. Proper evaluation of a silicone implant rupture should include ultrasound and MRI.

Traumatic rupture of a breast silicone implant may be noticed on the initial chest CT scan performed as a part of the initial trauma series and should be addressed in the report for surgical consultation [Figure 20].

FDA recommends that patients with silicone breast implants should receive MRI screening for a "silent rupture" 3 years after the initial implant surgery and every 2 years after that.[23]

POST-IMPLANT SURGERY COMPLICATION

Post-implant surgery hematoma is rare, if large it may present to the emergency department and may need evacuation/surgical intervention. Diabetes, obesity, older age (>65 years) and nicotine use, and the presence of a large seroma increase the risk of post-operative infection.[24] For any suspicion of infection, a drainage should be obtained and sent to microbiology.

A post-surgical infection may be complicated by abscess formation, usually within 1–2 weeks after surgery, presenting as a fluctuant tender mass at the surgical site.[24]

Ultrasound is the first modality used for evaluation. Ultrasound appearance of cellulitis may appear as edema with linear hypo or anechoic fluid interspersed between fat lobules of the breast. This may be indistinguishable from normal post-operative appearance; clinical correlation is important. The appearance of infected seroma on ultrasound ranges from an anechoic fluid collection to a heterogeneous complex fluid collection [Figures 21 and 22]. In infected seroma, debris and hypervascularity may be key to detect a drainable infected collection.[24]

CONCLUSION

- Emergency radiologist awareness of common breast presentations in the ED is very important. The main presentations are infection in lactating and non-lactating women including mastitis, cellulitis, or chronic granulomatous mastitis. Evaluation of an abscess and drainage may provide immediate relief
- Inflammatory cancer may mimic infection and differentiation is very important. Follow-up in the breast clinic after a course of antibiotic treatment is the best way to deal with this possibility
- Mondor's disease is an easily missed diagnosis given its rarity. Follow-up in the non-emergency clinic is appropriate
- Biopsy of a mass in a lactating woman may lead to milk fistula. However, if the finding is suspicious, biopsy recommendation should always be made regardless of this possibility. This is usually referred to the breast clinic
- Identification of ruptured breast implants on CT should always be kept in mind
- Patients present with pain or discharge in the ED are quite common. If ultrasound is negative for mass, a follow-up mammogram on non-emergent basis would be reasonable.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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