Role of ultrasound in diagnosis and management of inflammatory breast diseases

Ahmed A.A. Aziz[a], Rasha M. Kamal[b], Rania S. Mohammed[b]

Departments of [a]General Surgery, [b]Radiology, Faculty of Medicine, Cairo University, Cairo, Egypt

Correspondence to Ahmed A. Al Aziz, MD, Lecturer of General and Laparoscopic Surgery, Cairo University. Tel: +01001907892; e-mail: zizoo_81@hotmail.com

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Introduction
Inflammatory breast diseases are frequently encountered clinical complaints, and they range from benign to malignant forms, namely inflammatory breast carcinoma (IBC). It is crucial to differentiate IBC from other types of mastitis because there are major differences in its prognosis and treatment. Ultrasound (US) is one of the main diagnostic tools for discriminating benign and malignant mastitis. US-guided aspiration and core needle biopsy are the mainstay in diagnosis and management of inflammatory breast diseases.
Materials and methods
The study is a prospective study that included 48 patients referred to the Radiology Department, Women's Imaging Unit from the 'Surgical Breast Clinic', and surgical outpatient's clinics and wards in the period between January 2016 and July 2016. US examination was performed for all the cases by 8–12 MHz linear array transducer. Full field digital mammography was performed for 33/48 patients. US-guided core biopsies of the breast were performed in indicated cases. Drainage under US guidance and cytological assessment was performed also in certain cases.
Results
In all, 36/48 (75%) cases were finally diagnosed as benign mastitis, and 12/48 (25%) cases were finally diagnosed as malignant. Within the examined group, 40/48 (83.3%) cases underwent short-term first look follow-up US study after a course of antibiotic therapy: seven/40 (17.5%) patients showed complete resolution of the symptoms and the diagnosis of simple infectious mastitis was confirmed, whereas 33/40 (82.5%) patients showed no response to treatment.
Conclusion
US plays a specific role in diagnostic approach and management of inflammatory breast diseases. It is essential to discriminate benign from malignant etiologies as there are major differences in their prognosis and treatment options.

Keywords:
breast abscess, duct ectasia, inflammatory breast diseases, ultrasound

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Introduction

Breast involvement by inflammatory or noncurrent infectious diseases is not uncommon. 'Mastitis' is a frequently encountered complaint in clinical practice.

Although a significant problem especially among lactating women, there remains a paucity of scientific research into the anatomical, physiological, and pathological determinants of inflammatory breast disorders [1].

The radiological features of breast lesions caused by immunologic, reactive, and noncurrent infectious diseases often mimic those of malignancy, frequently constituting a diagnostic challenge even if the underlying disease is known [2] and usually require biopsy [1].

In general, 'Mastitis' is inflammation of the breast that may or may not be accompanied by infection. The term 'Mastitis' is often used synonymous with breast infection, but strictly speaking 'Mastitis' is inflammation of the breast irrespective of the cause [3].

Mastitis can be classified into three main types: the infectious, noninfectious, and malignant mastitis (MM) [4].

Infectious mastitis encompasses breast-specific and nonspecific forms of infections whether primary or complicating already present breast pathologies. This form of mastitis is more common during the child-bearing period especially during lactation. Patients in this group usually present with fulminant inflammatory manifestations and are usually treated with antibiotics,

hot fomentations, and various breast drainage procedures [4].

Noninfectious forms of mastitis encompasses another group of aseptic or chemical inflammatory breast disorders that do not necessarily occur during lactation, and thus do not usually present with fulminant inflammatory signs and do not usually resolve with antibiotics. Microbial infection may trigger some forms as periductal mastitis or complicate others as diabetic Mastopathy [4].

The third group of mastitis, which is the most serious form of mastitis, is MM usually accompanying the inflammatory breast carcinoma (IBC) or the very rare form of malignant breast abscess [4].

Any nonlactating female patient presenting with inflammatory breast symptoms that fail to respond to antibiotic therapy should be advised to go for both a mammography and ultrasound (US) examination immediately followed by a punch biopsy from the skin and aspiration from the subdermal lymphatics to exclude any possibility of IBC [4].

Materials and methods

The study is a prospective study that included 48 patients referred to the Radiology Department, Women's Imaging Unit from the 'Surgical Breast Clinic' and Surgical outpatient's clinics and wards in the period between January 2016 and July 2016. The study was approved by the Editorial Review Board of the Radiology Department of Kasr el Aini, Cairo University Hospitals.

Inclusion criteria were patients presenting with clinical signs of mastitis including redness, hotness, and focal or diffuse swelling of the breast with or without generalized constitutional symptoms with or without palpable breast masses.

Patients presenting with other sole mammary manifestations, for example, palpable mass lesions or nipple discharge, were not included in the study. According to the imaging findings recorded with US they were classified into benign and malignant forms of mastitis. Reference standard of diagnosis was histopathology after core or surgical biopsy, as well as follow-up studies for lesions for typical signs of simple mastitis. Histopathology results were then correlated with the imaging findings of US.

Methods

All patients were subjected to complete medical history and full clinical examination by their referring physicians. Cases were obliged to supply these data at the time of imaging.

Ultrasonography

USexamination was performed for all the cases by 8–12 MHz linear array transducer (General Electric Company, Easton Turnpike, Fairfield, Connecticut, United States). US reports should confirm (positive finding) or exclude (negative finding) the presence of the following:

(1) Echogenic edematous fat lobules.
(2) Interstitial edema.
(3) Ill-defined collections.
(4) Retroareolar duct system dilatation.
(5) Thickened skin (>2 mm) and its measurement.
(6) Masses and it confirm their cystic or solid nature.
(7) Abscess cavities.
(8) Fistulous tracts.
(9) Lymph node enlargement and its status.

US follow-up after a course of antibiotic therapy was performed for indicated cases to ensure condition amelioration.

Mammography

Full Field Digital Mammography was performed for 33/48 patients using GE Senograph 2000 Machine. Standard craniocaudal and mediolateral oblique views were obtained, with the axilla included in the latter.

Exclusion criteria: lactating and young patients were excluded as mammogram was not feasible for these patients.

US-guided core biopsies of the breast were performed in indicated cases using 14 G needle.

Drainage under US guidance and cytological assessment was performed also in certain cases.

Results

The study population included 48 patients with clinical symptoms and signs of mastitis.

Demographic data

Ages of these patients ranged from 22 to 73 years (mean age: 39.7±12.8), as shown in Table 1.

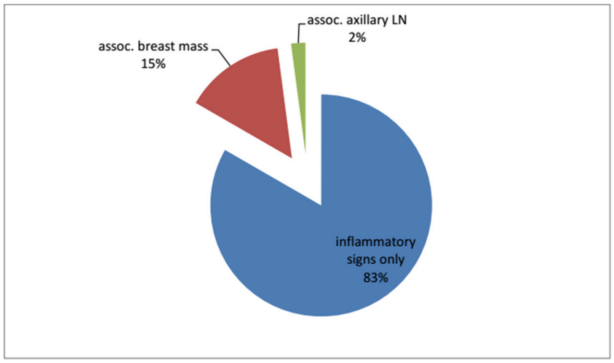
All patients presented with clinical signs of mastitis (pain, redness, hotness, and swelling). They were the

Table 1 Age of the studied group

Characteristics	Patient group (*n*=48)
Age (years)	
Range	22–73
Mean±SD	39.7±12.8

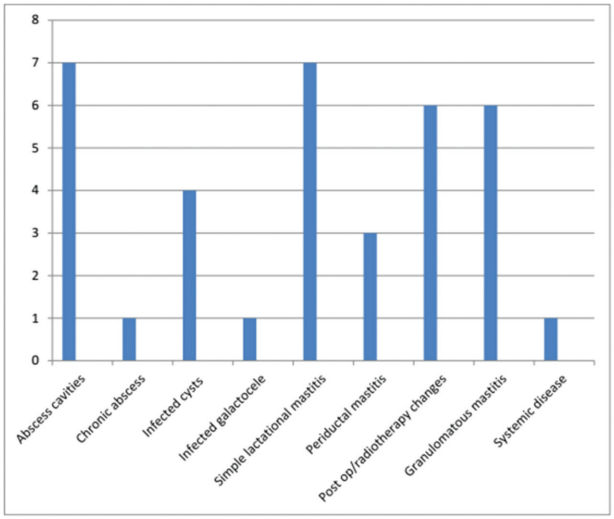
Lactating women comprised 20.8% (*n*=10/48).

Figure 1



Frequency of different clinical presentations. LN, lymph nodes.

Figure 2



Distribution of cases of benign mastitis included in the study.

sole signs in 40 (83.3%) patients. Seven (14.6%) patients had an additional palpable intramammary mass and another one (2.08%) patient had a palpable axillary mass, as represented in Fig. 1.

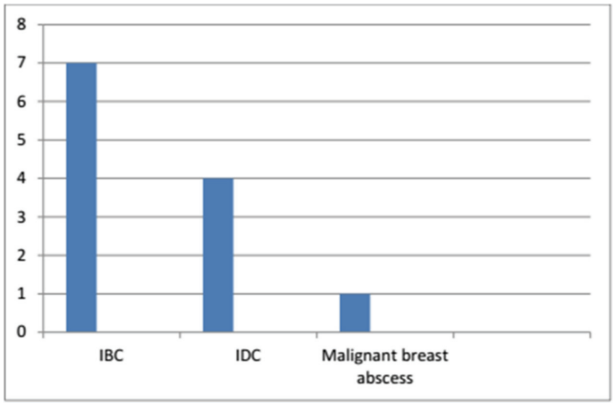
The study included one (*n*=1) pregnant female patient.

Final diagnosis

Final diagnosis was reached either by performing a short-term follow-up study or after revision of core biopsy/surgical specimens or cytology of fluid aspirates.

In all, 36/48 (75%) cases were finally diagnosed as benign mastitis, including the following:

Figure 3



Distribution of cases of malignant mastitis included in the study. IBC, inflammatory breast carcinoma.

Table 2 Response of the patients to antibiotic therapy

Characteristics	Patient group (*n*=48) [*n* (%)]
Antibiotic (positive)	40 (83.3)
Response	7 (17.5)
No response	33 (82.5)

(1) Abscess cavities (*n*=7).
(2) Chronic abscess (*n*=1).
(3) Infected cysts (*n*=4).
(4) Infected galactoceles (*n*=1).
(5) Simple lactational mastitis with or without abscess formation (*n*=7).
(6) Active Periductal mastitis (*n*=3).
(7) Postoperative/radiotherapy changes (*n*=6).
(8) Granulomatous mastitis (*n*=6).
(9) Systemic disease (*n*=1).

This is represented in Fig. 2.

In addition, 12/48 (25%) cases were finally diagnosed as malignant, as represented in Fig. 3, including the following:

(1) IBC (*n*=7).
(2) Invasive ductal carcinoma (*n*=4).
(3) Malignant breast abscess (*n*=1).

Ultrasound follow-up study

Within the examined group, 40/48 (83.3%) cases underwent short-term first look follow-up US study after a course of antibiotic therapy:

(1) A total of seven out of 40 (17.5%) patients showed complete resolution of the symptoms, and the diagnosis of simple IM was confirmed.
(2) In addition, 33 out of 40 (82.5%) patients showed no response to treatment.

This is shown in Table 2.

Core/surgical biopsy specimens and cytology of aspirates

Within the examined group, 17 out of 48 (35.4%) patients underwent core/surgical biopsy, whereas 19 out of 48 (39.6%) patients performed fine needle aspiration/drainage under US guidance, and cytological assessment of the aspirates was done, as shown in Table 3.

Descriptive and comparative analysis

Imaging findings identified on US were reported and their frequencies were calculated. The diagnoses (whether benign or MM) were postulated according to US. Findings were then correlated with the final diagnoses. In reference to this accuracy, measures were then calculated for US, namely sensitivity, specificity, and positive and negative predictive values.

(1) Cases that were diagnosed as benign inflammatory by US and proved to be benign inflammatory in the final diagnosis, either by aspiration cytology, histopathology, or follow-up, were considered as true negative cases.
(2) Cases that were diagnosed as malignant by US and proved to be malignant in the final diagnosis by histopathology were considered as true positive cases.
(3) Cases that were diagnosed as benign inflammatory by US and proved to be malignant in the final diagnosis by histopathology were considered as false negative cases.
(4) Cases that were diagnosed as malignant by US and proved to be benign inflammatory in the final diagnosis by aspiration cytology, histopathology, or follow-up were considered as false positive cases.

Ultrasonography

On US, signs of local or diffuse inflammatory changes were identified in all cases (48/48, 100%). These signs included echogenic edematous fat lobules that are delineated by dark interstitial edema lines.

Additional signs were also reported including:

(1) Ill-defined collections.
(2) Lymph node status.
(3) Skin thickness.
(4) Subdermal lymphatic layer thickness.
(5) Associated mass lesions.

Table 3 Frequency of core biopsy &and fine needle aspiration in cases included in the study

Characteristics	Patient group (*n*=48) [*n* (%)]
Core/surgical biopsy	
Fine needle	17 (35.4)
Aspiration/drainage	19 (39.6)

Ill-defined collections

The association between the final diagnosis and the presence or absence of ill-defined collection was studied.

(1) In benign inflammatory cases:
   (a) The presence of ill-defined collection was 21/22, 95.5%.
   (b) The absence of ill-defined collection was 15/26, 57.7%.
(2) In malignant cases:
   (a) The presence of ill-defined collection was 1/22, 4.5%.
   (b) The absence of ill-defined collection was 11/26, 42.3%.
(3) The presence of ill-defined collection (21/22, 95.5%) was higher in benign cases of mastitis than malignant cases (1/22, 4.5%).

Lymph nodes status

These results are shown in Tables 4 and 5 and Figs. 4 and 5.

(1) In benign inflammatory cases:
   (a) The presence of indeterminate axillary lymph nodes was 6/10, 60%.
   (b) The presence of nonspecific axillary lymph nodes was 29/30, 96.7%.
   (c) The presence of pathological axillary lymph nodes was 1/8, 12.5%.
(2) In malignant cases:
   (a) The presence of indeterminate axillary lymph nodes was 4/10, 40%.
   (b) The presence of nonspecific axillary lymph nodes was 1/30, 3.3%.
   (c) The presence of pathological axillary lymph nodes was 7/8, 87.5%.

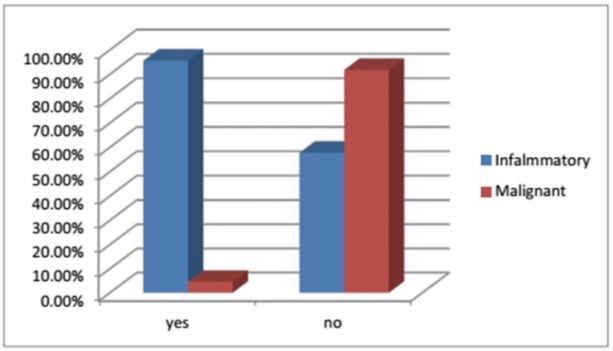
Table 4 Correlation between final diagnosis and the presence of ill-defined collection in the studied group

Final diagnosis	Collections [*n* (%)]	
	No (*n*=26)	Yes (*n*=22)
Inflammatory (*n*=36)	15 (57.7)	21 (95.5)
Malignant (*n*=12)	11 (42.3)	1 (4.5)

Table 5 Correlation between final diagnosis and the lymph node status

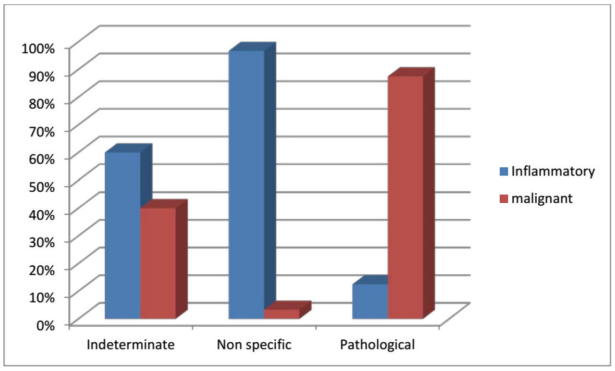
Final diagnosis	Indeterminate (*n*=10) [*n* (%)]	Nonspecific (*n*=30) [*n* (%)]	Pathological (*n*=8) [*n* (%)]
Inflammatory (*n*=36)	6 (60)	29 (96.7)	1 (12.5)
Malignant (*n*=12)	4 (40)	1 (3.3)	7 (87.5)

Figure 4



Frequency of ill-defined collections associated with benign and malignant mastitis cases.

Figure 5



Frequencies of the different lymph node status with benign and malignant mastitis cases.

(3) The presence of pathological axillary lymph nodes with prominent cortices and muffled hila was strongly indicative of a malignant pathology.
(4) Indeterminate axillary lymph nodes were a common association with severe benign mastitis. Resolution was the rule on follow-up US studies performed in 6/10 (60%) cases.

Skin and subdermal lymphatic thickening

A cut-off value of both skin thickness and subdermal lymphatic thickness was calculated with area under receiver operating characteristic (ROC) curve, sensitivity, and specificity as shown in Table 6 and Figs 6–8.

Associated mass lesions and abscess cavities

The correlation between the final diagnosis and associated mass lesions and abscess cavities is demonstrated in Table 7.

Final diagnosis

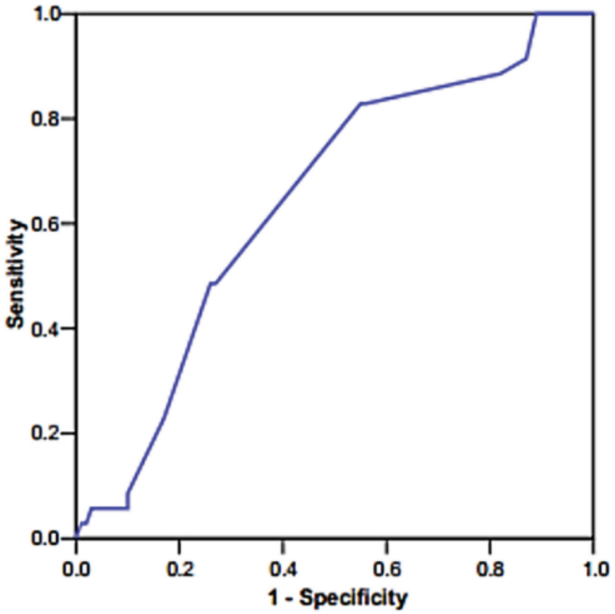
The association between the final diagnosis and US diagnosis is demonstrated in Table 8 and Fig. 9.

Table 6 Skin thickness and subdermal lymphatic studied parameters

	Cut-off value	Area under ROC curve	Sensitivity (%)	Specificity (%)
Thick skin	>3.5 mm	0.642	82.86	45
Subdermal lymph	>1 mm	0.920	80	94

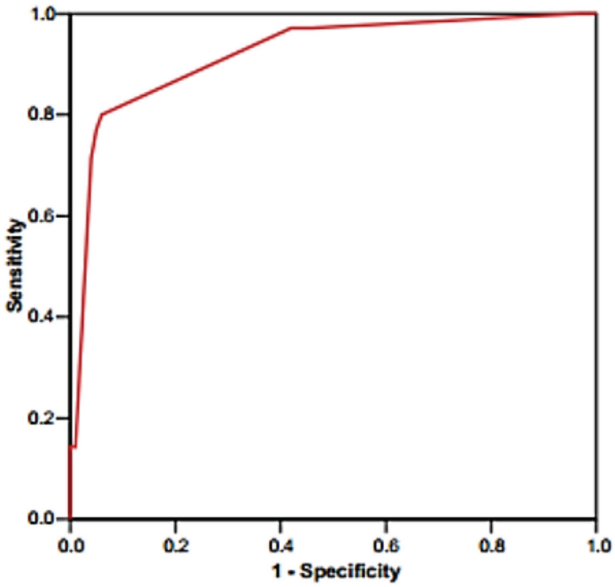
A cut-off value of skin thickness greater than or equal to 3.5 mm and subdermal lymphatic thickness greater than 1 mm were considered indicative of malignancy.

Figure 6



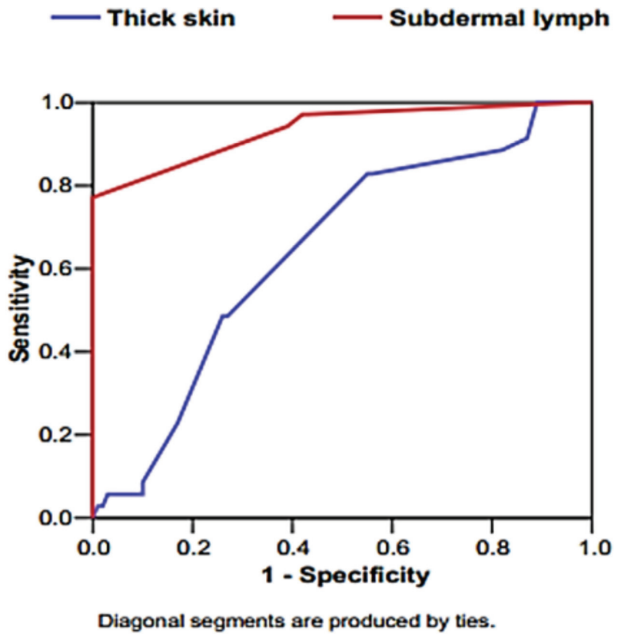
Receiver operating characteristic curve for thick skin.

Figure 7



Receiver operating characteristic curve for subdermal lymph thickness.

Figure 8



Receiver operating characteristic curves for both skin subdermal lymph thickness.

Table 7 Correlation between final diagnosis and associated lesions

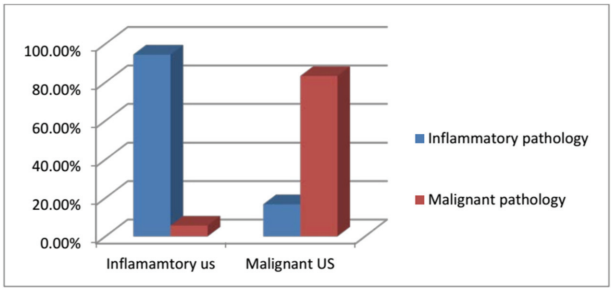
Final diagnosis	Associated [*n* (%)]	
	Mass lesions (*n*=4)	Abscess cavities (*n*=13)
Inflammatory (*n*=36)	1 (25)	12 (92.3)
Malignant (*n*=12)	3 (75)	1 (7.7)

Table 8 Association between final diagnosis and ultrasound in the studied group

Final diagnosis	US [*n* (%)]	
	Inflammatory (*n*=36)	Malignant (*n*=12)
Inflammatory (*n*=36)	34 (94.4)	2 (16.7)
Malignant (*n*=12)	2 (5.6)	10 (83.3)

US, ultrasound.

Figure 9



Association between final diagnosis and ultrasound in the studied group. US, ultrasound.

Mammography

In our study, mammography showed 87.5% sensitivity and 48% specificity in detection and characterization of inflammatory breast disorders. The low specificity is mainly attributed to the higher incidence of inflammatory breast disorders in young individuals where mammography is considered inappropriate and when performed is usually inconclusive.

Diagnostic indices:

$$\text{Sensitivity} = \frac{\text{number of true positive results (TP)}}{\text{number of true positive results (TP)} + \text{number of false negative results (FN)}} \times 100$$

The age of the patients included in the study ranged from 22 to 73 years (mean age: 39.7±12.8). Compared with only 1/33 (3.03%) false negative cases diagnosed by mammography, we had 13/33 (39.4%) false positive cases. False negative cases were cases that presented

Sensitivity for US=83.33%.

Sensitivity for mammography=87.5%.

$$\text{Specificity} = \frac{\text{number of true negative results (TN)}}{\text{number of true negative results (TN)} + \text{number of false positive results (FP)}} \times 100$$

with early IBC with early diffuse inflammatory signs and insignificantly enlarged axillary lymph nodes. False positive cases were mainly attributed to the relatively high number of chronic granulomatous mastitis cases and extensive aggressive forms of infective mastitis (13/33 39.4%) where the reactionary lymph nodes strongly resembled pathological lymph nodes that commonly associate with IBC.

Specificity for US=94.44%.

Specificity for Mammography=48%.

Positive predictive value=TP/(TP+FP)×100.

Positive predictive value for US=83.33%.

Positive predictive value for mammography=35%.

Discussion

The breast lesions caused by inflammatory disorders often clinically resemble a carcinoma; therefore, they constitute a diagnostic dilemma [2]. It is a challenge to distinguish acute mastitis from malignancy, especially form IBC, by clinical or imaging features [5].

These disorders range from benign up to malignant forms, namely IBC, which carries a grave prognosis. It is very important to distinguish IBC from other types of mastitis because there are major differences in its prognosis and treatment.

Inflammatory breast disorders were classified aiming to differentiate simple forms of mastitis from more complicated and malignant forms [4], where mastitis is classified into three main groups:

(1) Group 1: IM.
(2) Group 2: non-IM.
(3) Group 3: MM.

IM encompasses breast-specific and nonspecific forms of infections whether primary or complicating already present breast pathologies. This form of mastitis is more common during the child-bearing period especially during lactation. Patients in this group usually present with fulminant inflammatory manifestations and are usually treated with antibiotics, hot fomentations, and various breast drainage procedures [4].

Non-IM encompass another group of aseptic or chemical inflammatory breast disorders that do not necessarily occur during lactation, and thus do not usually present with fulminant inflammatory signs and do not usually resolve with antibiotics. Microbial infection may trigger some forms as periductal mastitis or complicate others as diabetic mastopathy [4].

The third group of mastitis, which is the most serious form of mastitis, is MM usually accompanying the IBC or the very rare form of malignant breast abscess [4].

In this study, we discussed the role of US in the evaluation of, and discrimination between, benign and malignant inflammatory breast disorders. Results were mainly compared with the final diagnosis, which was reached either by performing a short-term follow-up study or after revision of core biopsy/surgical specimens or cytology of fluid aspirates.

Total of 36/48 (75%) cases were finally diagnosed as benign mastitis, including:

(1) Abscess cavities (*n*=7).
(2) Chronic abscess (*n*=1).
(3) Infected cysts (*n*=4)
(4) Infected galactoceles (*n*=1).
(5) Simple lactational mastitis with or without abscess formation (*n*=7).
(6) Active periductal mastitis (*n*=3).
(7) Postoperative/radiotherapy changes (*n*=6).
(8) Granulomatous mastitis (*n*=6).
(9) Systemic disease (*n*=1).

Total of 12/48 (25%) cases were finally diagnosed as malignant, including:

(1) IBC (*n*=7).
(2) Invasive ductal carcinoma (*n*=4).
(3) Malignant breast abscess (*n*=1).

A few previous studies have reported various sonography and mammography features of mastitis. Described mammography findings are also vague and lack specificity. Mammography findings varied from ill-defined dense poorly demarcated areas of diffuse edema with extensive skin thickening to normal study.

Adding to this, patients with mastitis have painful, swollen, and dense breasts, and thus they cannot withstand adequate mammography compression. Therefore, mastitis patients are usually referred for an early US examination.

In our study, mammography showed 87.5% sensitivity and 48% specificity in detection and characterization of inflammatory breast disorders. The low specificity is mainly attributed to the higher incidence of inflammatory breast disorders in young individuals where mammography is considered inappropriate and when performed is usually inconclusive.

The age of the patients included in the study ranged from 22 to 73 years (mean age: 39.7±12.8). Compared with only 1/33 (3.03%) false negative cases diagnosed by mammography, we had 13/33 (39.4%) false positive cases. False negative cases were cases that presented with early IBC with early diffuse inflammatory signs and insignificantly enlarged axillary lymph nodes.

False positive cases were mainly attributed to the relatively high number of chronic granulomatous mastitis cases and extensive aggressive forms of infective mastitis (13/33, 39.4%) where the reactionary lymph nodes strongly resembled pathological lymph nodes that commonly associate IBC.

US was proven to be superior in the diagnosis of inflammatory breast disorders in previous studies [4]. By US, in addition to the general signs of mastitis, we have more discriminating signs that can differentiate between benign and malignant forms of mastitis, namely:

(1) The presence or absence of ill-defined collections, abscess cavities, and associated mass lesions.
(2) The lymph node status whether pathological, reactionary, or nonspecific.
(3) The presence or absence of significant skin thickening and dilated subdermal lymphatic layer.

The presence of ill-defined collection (21/22, 95.5%) was higher in benign infective mastitis cases than malignant cases (1/22, 4.5%). Its presence was a reliable sign in the exclusion of a malignant process.

Similar results were also reported by Kamal *et al.* [4], where ill-defined collections were not identified in MM.

In addition, Martins *et al.* [6] reported that the US findings of multiple irregular ill-defined collections with fingerlike aspects would suggest benign mastitis rather than carcinoma.

Globular axillary lymph nodes with prominent and thickened cortices and muffled hila are considered pathological.

Pathological lymph nodes (7/8, 87.5%) were higher in malignant cases. They were also identified in 1/8 (12.5%) benign mastitis cases that proved to be chronic nonspecific granulomatous mastitis after revision of biopsy specimens.

Bilgen *et al.* [7], in their study, diagnosed metastatic enlarged lymph nodes when they showed eccentric or absent hila and when the long to short axis ratio was less than 1.5.

Kamal *et al.* [4] found that lymph nodes with these criteria were higher in IBC, a sign that favored its diagnosis.

Associated abscess cavities confirmed the benign nature of mastitis (12/13, 92.3%), whereas the presence of associated mass lesions indicated a malignant nature (3/4, 75%).

Kamal *et al.* [4] found that the presence of abscess cavities in IM and the absence of masses are significant differentiating signs between infectious and MM. Kamal *et al.* [4] in 2009 deduced that US was superior to mammography in detection and measurement of skin thickening [4]. Wilson *et al.* [8] in 1982 reported that skin thickness should not exceed 2.5–3 mm; Robertson *et al.* [9] in 2010 confirmed the similar finding on mammography and MRI, and stated in addition that the thickness in patients with IBC frequently measures up to 13 mm.

In our study, a cut-off value of skin thickness greater than or equal to 3.5 mm was considered indicative of malignancy (area under ROC 0.668). A cut-off value of subdermal lymphatic thickness greater than or equal to 1 mm was also considered indicative of malignancy (area under ROC 0.920).

Out of the 48 cases included in the study, US results showed the following:

Two false negative (4.2%), two false positive (4.2%), 34 true negative (70.8%), and 10 true positive (20.8%) cases.

The calculated sensitivity and specificity of US are 83.33 and 94.44%, respectively.

The positive predictive value for US was 83.33% and the negative predictive value was 94.44%. US plays a fundamental role in the diagnostic workup of mastitis patients. An ideal US should ensure an accurate diagnosis, guide for interventional procedures whenever necessary, and should be used to monitor adequate management by short-term follow-up studies along the course of therapy. Kamal *et al.* [4] classified Mastitis patients management according to their US findings into three categories:

(1) Category 1: the patients were reassured and were given a short course of antibiotics and hot fomentations.
(2) Category 2: the patients were asked to come for a short-term follow-up study after completion of medical therapy or after performing ultrasound or operative intervention.
(3) Category 3: the patients were subjected to immediate interventional procedures. This classification depends

on US 'Diagnostic Workup' of mastitis cases passing through several sequential steps.

Mastitis is diagnosed on US examination when the following signs are encountered: interstitial edema lines that delineate the echogenic and edematous fat lobules with overlying focal or diffuse skin thickening. Next, other associated signs should be looked for.

If no other associated signs are seen, simple mastitis is diagnosed. The patient is assured and is asked to come for a short-term follow-up study after completing an antibiotic course. Complete resolution should be the rule. Nonresolution should raise the possibility of development of complications, infection by atypical organisms, or IBC. A biopsy should then be considered. If abscess cavities, infected cysts, or postoperative collections are encountered, they should be drained and followed up to ensure no re-collection. If pathological lymph nodes, dilated subdermal lymphatics, or mass lesions are encountered, we should directly resort to biopsy [10].

In our study, within the examined group, 40/48 (83.3%) cases underwent short-term first look follow-up US study after a course of antibiotic therapy:

In all, seven out of 40 (17.5%) patients showed complete resolution of the symptoms and the diagnosis of simple IM was confirmed, whereas 33 out of 40 (82.5%) patients showed no response to treatment.

Complete resolution is the rule after a short course of antibiotics if simple mastitis is the case.

When a patient is resistant to treatment, one of three conditions should be considered:

(1) The patient might have an unusual form of infection (e.g. granulomatous mastitis).
(2) She might have developed complications – for example, abscess cavity.
(3) She might have early malignant signs.

Therefore, US-guided diagnostic and therapeutic interventional procedures should then play a role.

In our study, within the examined group, 17/48 (35.4%) patients underwent core/surgical biopsy, whereas 19/48 (39.6%) patients performed fine needle aspiration/drainage under US guidance and cytological assessment of the aspirates was done.

US-guided biopsy is performed to evaluate suspicious mass lesions when present. Skin punch biopsies, axillary lymph node biopsy, and aspiration from the dilated subdermal lymphatic layer are performed to confirm the diagnosis of IBC. Abscess cavities, infected cysts, and postoperative collections are drained.

Treatment of breast abscesses is a difficult clinical problem. The surgical literature describes classic abscess treatment as that consisting of an incision over the point of maximal tenderness and digital disruption of abscess septa with the patient under general anesthesia. The abscess cavity is left open and packed with gauze, and there are subsequent dressing changes for up to 6 weeks during wound granulation.

Cosmetic results are often disappointing owing to scar formation. After the administration of antibiotics, abscess incision and drainage are still required because the abscess capsule prevents adequate contact between the antibiotic and the organisms. Even with this aggressive approach, the abscess recurrence rate is reported to be between 10 and 38% [11].

In our study, US has been shown to be useful in depicting abscesses in patients with mastitis and subsequently has been used to guide drainage. It is conceivable that US guidance may facilitate complete drainage of breast abscesses compared with blind aspiration because US enables visualization of multiple abscess loculations. It is possible that loculated abscess is the reason for recurrence after blind aspiration.

In all, six (46.2%) out of 13 patients diagnosed with breast abscess showed resolution of symptoms after US-guided complete aspiration.

In conclusion, US plays a specific role in diagnostic approach and management of inflammatory breast diseases. It is essential to discriminate benign from malignant etiologies as there are major differences in their prognosis and treatment options and the Ultrasound is so helpful in this discrimination, the U/S also act as a guide for interventional procedures whenever necessary and should be used to monitor adequate management by short term follow up studies along the course of therapy.

Summary and conclusion

Inflammatory breast disorders are a frequently encountered clinical complaints and can occur in healthy, nonlactating women of all ages.

They range from benign up to malignant forms and it remains a challenge to distinguish acute mastitis from malignancy, especially from IBC, by clinical or imaging features. It is very important to distinguish IBC from other types of mastitis because there are major differences in its prognosis and treatment

In our study, we verified the role of US in the diagnosis and management of inflammatory breast disorders, stressing on how to differentiate between benign and malignant etiologies.

Mammography plays a limited role in inflammatory breast disorders. It showed a low specificity. Mastitis usually hits patients at young ages where mammography examinations are usually not recommended.

Even at older ages, mammography findings described in mastitis are nonspecific.

On the other hand, ultrasonography plays a significant and important role in the diagnostic workup of inflammatory breast disorders. The following parameters were the crucial points of differentiation: (a) ill-defined collections, (b) skin thickening, (c) subdermal lymphatic thickness, (d) lymph nodes status and course of therapy.

In comparison, the sensitivity and specificity of mammography was 87.5 and 48%, respectively. The positive predictive value for mammography was 35% and the negative predictive value was 92.3%.

On the other hand, the calculated sensitivity and specificity of US was 83.33 and 94.44%, respectively. The positive predictive value for US was 83.33% and the negative predictive value was 94.44%.

To conclude, ill-defined collections, skin thickening, subdermal lymphatic thickness, and lymph nodes status are the crucial points of differentiation between benign and malignant etiologies of different inflammatory breast diseases.

US plays a specific role in diagnostic approach and management of inflammatory breast diseases. It is essential to discriminate benign from malignant etiologies as there are major differences in their prognosis and treatment options and the Ultrasound is so helpful in this discrimination, the U/S also act as a guide for interventional procedures whenever necessary and should be used to monitor adequate management by short term follow up studies along the course of therapy.

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Conflicts of interest
The authors have no commercial or other associations that might be a conflict of interest in relation to this article.

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