

DISCUSSION

Although breast lesions are commonly detected because of their hypoechogenicity, some lesions may present with hyperechogenicity due to their histological components. Hyperechogenicity has been shown to be highly predictive of benignity; however, hyperechoic lesions can occasionally be malignant.⁽⁸³⁾

Several benign lesions of the breast can be hyperechoic, in particular, lesions containing adipose tissue, such as lipoma,⁽⁸⁴⁾ fat necrosis,⁽⁸⁵⁾ and hibernoma,⁽⁸⁶⁾ lesions containing fibrotic tissue, such as focal fibrosis and pseudoangiomatous stromal hyperplasia,⁽⁸⁷⁾ vascular lesions, such as hemangioma,^(88,34) and lesions containing a combination of the above, such as hamartoma (glandular, adipose, and fibrous tissue)^(89,90) and angioliipoma (vascular and adipose tissue).^(24,34)

As regard malignancy several theories explained the hyperechogenicity of such lesions; histopathologic abnormalities such as tumor cellular heterogeneity (e. g., cribriform pattern, tubular structure, solid nests, and scirrhous pattern of cancer cells) may play an important role in producing the hyperechoic pattern⁽⁹¹⁾ because of the many interfaces that can be well assessed with the high contrast of dedicated probes.⁽⁸⁴⁾ Another possible explanation may be the presence of an extremely thick echogenic border containing strands of collagen fibers, proliferating tumor cells, and fatty inclusions surrounding a minimal nearly imperceptible hypoechoic central core of fibrohyalinosis with sparse tumor cells.⁽⁵⁰⁾ However, studies correlating sonographic images and histologic whole-mount sections of hyperechoic cancers are needed to support this hypothesis.

The aim of this study was to evaluate the ultrasonographically hyperechoic lesions of the breast to detect whether they are always pathologically benign or they can be malignant, and to detect sonographic features those are able to predict malignancy in hyperechoic breast lesions.

The ages of patients of the current study ranged from 20 to 72 years. The most commonly affected age group was the fifth decade (26.6%).

The symptoms of the patients in the present study were variable; the most frequent complaint was breast lump which accounted for 46.6% of patients; this matched with Bassett 2000 who found that breast lump is found in the majority of women who develop benign and malignant breast lesions, and that the first and sometimes the only symptom that the patient discovers is a breast lump.⁽⁹²⁾

As regards The clinical history of patients of the current study, it was found that history of previously managed breast cancer was reported in 7/30(23.3%) among these patients 3/7 diagnosed to have infiltrating ductal carcinoma either at the scar site or at the contralateral side, 2/7 patients diagnosed as breast lipoma either on the same or the contralateral side. Traumatic fat necrosis and infected seroma were diagnosed in the remaining 2/7 patients in the same side as a result of radiotherapy and lumpectomy respectively. A history of lactation was given by 5/30(16.7%) patients who were diagnosed as galactocele and focal mastitis; 3/5 for galactocele and 2/5 for focal mastitis and this matched other previous studies in which it was found that eighty percent of patients presenting with a palpable breast mass during pregnancy and lactation will have findings of benign disease⁽⁹³⁻⁹⁵⁾ and galactocele is the most common benign breast mass in the lactating patient.⁽⁹⁶⁾ Mastitis with or without abscess formation is commonly seen during lactation and is less frequently seen during pregnancy.^(96,97)

The use of oral contraceptive pills was a history of 4/30(12.14%) patients forming the current study group from them 2/4 patients were diagnosed as breast lipoma while traumatic fat necrosis and focal mastitis was diagnosed in the other 2/4 patients. Previous studies have found that women using oral contraceptives (birth control pills) have a slightly greater risk of breast cancer than women who have never used them. This risk seems to go back to normal over time once the pills are stopped. Women who stopped using oral contraceptives more than 10 years ago do not appear to have any increased breast cancer risk.⁽⁹⁸⁾ In the present study, no patient using oral contraceptive pills had breast cancer and breast lesions in these patients had no relationship with the use of oral contraceptives.

Breast trauma was a history of 3/30(9.9%) patients forming the current study group who were diagnosed as traumatic fat necrosis in 2/3 patients and breast hematoma in the remaining 1/3 patient.

One patient gave a history of fibrocystic breast disease associating traumatic fat necrosis. In a previous study, nine women who sustained injury to the breast are presented, illustrating some of the manifestations of traumatic injury to the female breast, the majority of which are attributable to fat necrosis⁽⁹⁹⁾ and this matched the findings of the present study.

The final diagnoses of different breast lesions included in the present study, were reached by histopathological diagnosis. Malignancy was detected in 4 patients (13.3%) among whom there were no patients below 30 years old. All of the patients ranged from 65 to 72 years old. Bleyer 2006 noted that breast cancer can occur virtually at any age, and to many observers it appears that breast cancer is increasing among younger women and affecting them earlier in life.⁽¹⁰⁰⁾

Bleyer 2006 was conducting his statistical study on all breast cancer cases recorded by national cancer institute (NCI) of United States between 1975 and 2000, but our study was concerned with only recording malignant cases among hyperechoic lesions.⁽¹⁰¹⁾

In the present study mammography was only performed in 26/30 patients and detected focal mass lesions in 7/26 (26.6%) patients, focal asymmetric density was detected in 2/11(18.18%), mass with clustered calcifications was detected in one patients (9.09%), an area of lucency in one/11 patient (9.09%), and fat containing lesion with surrounding fibrosis in one /11 patient (9.09%).

Mercidyl 2002 reported mammographic findings as mass in 19%, focal density in 64%, Calcifications in (18%) and mass with calcification in 2%.⁽¹⁰²⁾ Harvey 2008 stated that 53% of his cases were of asymmetric density.⁽²⁰⁾

In the present study, the mammographic criteria of malignant breast lesions were dense irregular spiculated masses in 4 patients (12.14%) and one of these patients had clustered microcalcifications with the mass, Mercidyl 2002 report matched results of the current study in that a spiculated mass without calcifications was strongly associated with an invasive cancer, but it could also be associated with radial scar.⁽¹⁰²⁾

Clusters of microcalcifications were encountered in one malignant case out of the total 4 malignant cases (25%). In accordance with this study, Cahill 1981 reported that 20-25% of clustered microcalcifications are associated with malignant lesions and that microcalcifications detection can help the radiologist to detect early breast cancer.⁽¹⁰³⁾

Kaiser 1999 stated that breast skin thickening can be a manifestation of breast carcinoma, particularly the infiltrating lobular type, although it has been also seen in other types of breast cancer, including inflammatory breast cancer and Paget disease. Skin thickening has also been documented as the sole finding in post surgical changes, post irradiation changes, lymphoma, and in combination with other findings in breast infection.⁽¹⁰⁴⁾

Linda 2011 stated that breast US has been a standard complementary procedure to mammography.⁽¹⁰⁵⁾

Rotten 1993 has pointed out that an advantage of ultrasound is its capability to image mammographically dense breast, and that the accuracy of US is not influenced by the amount of fibroglandular tissue.⁽¹⁰⁶⁾

Crystal 2003 concluded from their study that the importance of US in the determination of palpable mass has grown in the last years, and it should become the first line method in the mammographic dense breast.⁽¹⁰⁷⁾ As in his study performed between January 2000 and January 2002, 1517 asymptomatic women with dense breasts and negative mammography and physical examination findings underwent physician-performed breast sonography as an adjunct screening test. Of 1517 women examined, seven breast cancers were diagnosed (cancer-detection rate 0.46%). Four carcinomas were detected in high-risk women and three in women with baseline risk.

Studies performed by Buchberger 1999 proved that US should be considered the modality of choice to initiate the evaluation of a palpable mass in a woman younger than 35 years old, in whom mammography is less useful.⁽¹⁰⁸⁾ as he found additional cancers in 4.1 per 1000 ultrasound examinations among 8103 patients which were not detected clinically or by mammography.⁽³⁵⁾ Additional lesions were found in 5% of all examinations, and in 3.3% an interventional diagnosis was required.

The first large study including 750 patients and using modern high-resolution ultrasound equipment and standardized diagnostic criteria was published by Stavros 1995.⁽⁷⁵⁾ In 625 benign and 125 malignant lesions, ultrasound differentiated malignant from benign lesions with a sensitivity of 98.4% and a negative predictive value of 99.5%.

US has been reported to be quite helpful in assessing inflammatory breast conditions and in guiding for needle aspiration of associated abscesses and/or drainage.⁽¹⁰⁹⁾

In the current study US was useful and essential as there were 15 cases reported as being inconclusive by mammography but ultrasound revealed lesions and masses. Also it provided more information about lesions found by mammography.

In the present study, sonographic evaluation depended on mass shape, margins, homogeneity and the presence of posterior shadowing. The sonographic criteria of malignant breast lesions were irregular shape, ill defined margins, heterogenous pattern and posterior acoustic shadowing; another sign of malignancy was the presence of suspicious axillary nodes which was found in one patient (12.14%) of the current study group.

In this study mass borders were classified as well defined, ill-defined and lobulated borders. Well defined borders were found in 25 lesions (83.3%), all of them were benign, while 4 lesions (12.14%) were described as having ill-defined borders, all of them were malignant. Lastly one mass (3.3%) was macrolobulated that proved to be benign.

In the study published by Egan 1984, a lesion that was well circumscribed by ultrasound was three times more likely to be benign than malignant.⁽¹¹⁰⁾ In the current study 100% of well defined lesions were benign. Chen 2003 found that ill-defined border was an appearance of breast carcinoma.⁽¹¹¹⁾

Stavros 1995 also detected microlobulations as a malignant feature. The lobulations were described as small, (1-2mm size) numerous lobulations, and they are often seen in the peripheral part of the lesion. He stated also that the risk of malignancy increases with increase in the number of lobulations.⁽⁷⁵⁾

The current study was performed upon 30/1250 female patients who visited the breast clinic of main Alexandria University hospital from the first of April 2013 to the end of March 2014. Thirty three patients/1250 patients were diagnosed to have hyperechoic breast lesions by breast ultrasound and their incidence was (2.6%). This incidence is in concordance with Rahber 1999. and Stavros 1995, who stated that at sonography, only 0.6% – 5.6% of breast masses are echogenic.^(18,75) It also agreed with Linda 2011⁽¹⁰⁵⁾ who found that 25 (0.6%) out of 4511 biopsied lesions were hyperechoic at US.

In the current study it was found that 4 out of 30 hyperechoic lesions (12.14%) were diagnosed by biopsy as invasive ductal carcinoma. A lot of debate has been elicited in the literature considering the rate of hyperechogenicity in malignant lesions. Linda 2011⁽¹⁰⁵⁾ reported a higher incidence of malignancy among hyperechoic lesions of the breast. She reported 9 malignant hyperechoic lesions/25 patients forming her study group (36%). An incidence which is higher than that reported in the present study (13.3%).

On the other hand, other reports,^(82,105) in particular, Soon 2004⁽¹¹²⁾ who found two (0.5%) hyperechoic nodules among 393 screen-detected breast cancers and hyperechoic-to-hypoechoic breast cancer ratio of 1:180. Also Skaane 1998⁽¹¹³⁾ Found that four (2%) of 194 invasive ductal carcinomas were hyperechoic. He concluded that more useful information can be obtained by comparing tumor echogenicity with that of fatty tissue and not fibroglandular tissue. He considered extensive hypoechoic was a prominent feature of malignancy.⁽¹¹³⁾ These data contradicted with those from other studies who showed that hyperechoic lesions are always benign in nature^(19,75,113). In their landmark study on 750 sonographic nodules, Stavros 1995⁽⁷⁵⁾ found that none of the 42 markedly hyperechoic lesions was malignant, concluding that hyperechogenicity was the benign feature with the highest (100%) negative predictive value for malignancy.

Similarly, Rahbar 1999⁽¹⁸⁾ showed that hyperechogenicity was a reliable predictor of benignity but was reported in only 2% of masses, and therefore too infrequent to be generally applied. More recently, Hong 2005⁽¹⁹⁾ and Del Frate 2006⁽¹¹⁴⁾ found no malignancies among six and 10 hyperechoic lesions, respectively. These discrepancies can be attributed to differences in population characteristics and in the definition of hyperechogenicity used: In their study, Stavros 1995 emphasized that a lesion has to be homogeneously more echogenic than adipose tissue to be correctly defined as hyperechoic and recommend strict application of this criterion. Conversely, in other studies, the definition of hyperechogenicity is slightly different (i.e., superior to fibroglandular tissue)⁽¹¹⁴⁾ or less well standardized.^(112,114)

In the current study, lesion echogenicity was defined according to the appearance relative to subcutaneous adipose tissue. This was applied according to the reports of Linda 2011⁽¹⁰⁵⁾ and Stavros 1995.⁽⁷⁵⁾

The analysis of sonographic features showed that hyperechoic malignancies demonstrate non-parallel orientation and non-circumscribed margins more frequently than do benign hyperechoic nodules. These results suggest that, in case of hyperechoic nodules, the same sonographic features used for characterization of hypoechoic or isoechoic nodules should be applied to distinguish malignant from benign masses.^(18,19,75)

In addition, Linda 2011 found that the presence of focal hypoechoic areas within the hyperechoic lesion was more frequent in case of malignant nodules, although, the difference did not reach statistical significance. This finding had been already emphasized by Stavros 1995,⁽⁷⁵⁾ who reported that small malignant nodules can have a very small isoechoic or hypoechoic central nidus and a thick hyperechoic ill-defined halo. Therefore, the presence of hypoechoic areas should be included among suspicious sonographic features when evaluating a hyperechoic lesion. But in the present study, Central nidus of hypoechogenicity was found in some lesions which was diagnosed histopathologically to be malignant.

In the current study mammogram succeeded in detection of 11/26 patients who underwent mammography with a sensitivity 100.0%, specificity 86.36%, positive predictive value of 57.14%, and negative predictive value of 100.0%. As regards ultrasonography, evaluation of the diagnostic yields was outside the scope of the current study. As all of the patients forming the study group were selected based upon ultrasonographic detectability and no other gold standard was present for assessment of the statistical parameters of ultrasonography.

In literatures there were no studies determining the diagnostic yields of mammography in hyperechoic breast lesions but other studies determined its diagnostic yields in both hypo and hyperechoic lesions such as the study of Stavros 1995 which was performed on 747 patients, the mammographic sensitivity was 76.8%.⁽⁷⁵⁾ And the study done by Rahber 1999 on 161 patients, the mammographic sensitivity was 89% while its specificity was 42%.⁽¹⁸⁾

SUMMARY

Although breast lesions are commonly detected because of their hypoechogenicity, some lesions may present with hyperechogenicity due to their histological components. Hyperechogenicity has been shown to be highly predictive of benignity; however, hyperechoic lesions can occasionally be malignant.

The aim of this study was to evaluate the ultrasonographically hyperechoic lesions of the breast to detect whether they are always pathologically benign or they can be malignant, and to detect sonographic features those are able to predict malignancy in hyperechoic breast lesions.

This study was performed upon 30 patients diagnosed by ultrasound to have hyperechoic breast lesions from 1250 female patients who attended breast clinic of main Alexandria university hospital starting from the first of April 2013 to the end of March 2014. All 30 patients were subjected to full history taking, clinical examination including general and local breast examination, mammographic examination in which four projections were obtained, Two views for each breast (craiocaudal and mediolateral oblique), ultrasonographic examination including Doppler ultrasound (Ultrasonographic examination based on the definition of hyperechogenicity as it is increased echogenicity in relation to subcutaneous fat) and Ultrasound guided fine needle aspiration cytology and core needle biopsy.

All the 30 hyperechoic lesions are histopathologically diagnosed as the following: 10/30 patients were diagnosed as breast lipomas, 7/30 patients were diagnosed as traumatic fat necrosis, 4/30 patients were diagnosed as infiltrating ductal carcinomas, 3/30 patients were diagnosed as focal mastitis, 3/30 patients were diagnosed as galactocele, 3/30 patients were diagnosed as breast abscess, breast hematoma and infected seroma one for each diagnosis.

In this study mammography was performed upon 26 patients. The examined 26 patients showed positive mammographic findings in 11 patients (42.3%) while the remaining 15 mammograms (57.7%) were diagnosed as negative. Two/11 (18.9%) positive mammograms showed well defined mass shadows. These two patients were histopathologically diagnosed as galactocele and breast hematoma and their mammographic findings were true negative for malignancy.

Irregular speculated mass lesions were expressed in four out of 11 (36.3%) positive mammograms. One of these four lesions was associated with clustered microcalcifications. All these four lesions were histopathologically diagnosed as invasive ductal carcinomas, so their mammographic findings are true positive for malignancy.

Rounded moderately defined homogenous hypodensity was detected in one out of eleven (9.09%) positive mammograms. This patient was histopathologically diagnosed as breast lipoma, so this finding is true negative for malignancy.

Another one out of the eleven (9.09%) positive mammograms showed fat containing globular lesion with a fibrous scar of previous surgery. This patient was histopathologically diagnosed as traumatic fat necrosis and this finding was true negative for malignancy. And one out of eleven patients has ill defined margins and histopathologically diagnosed as breast abscess and this finding was false positive for malignancy.

The remaining 2/11(18.18%) positive mammograms showed focal asymmetric density, these two mammograms were histopathologically diagnosed as traumatic fat necrosis and their findings were false positive for malignancy. So on mammography true positive cases for malignancy were 4/26 patients, True negative cases for malignancy were 19/26 patients, false positive for malignancy in 3/26 patients and there were no false negative cases for malignancy. with a sensitivity of 100.0% , specificity 86.36% , positive predictive value of 57.14%, and negative predictive value of 100.0 %

On ultrasonography Ten/30 patients were diagnosed histopathologically as lipomas on US they showed oval shape, well defined margins, homogenous pattern and hyperechoic echotexture with no posterior shadowing. These sonographic findings came in concordance with the histopathological diagnosis as benign lesions. So US succeeded in prediction of the benign nature of the lesions (true negative) 100% US diagnostic accuracy.

Histopathological diagnoses in 7/30 hyperechoic lesions were traumatic fat necrosis, the sonographic findings of these patients were oval shape, well defined margins, heterogeneous pattern but mainly hyperechoic and no posterior shadowing were detected in these lesions. The sonographic findings and histopathological diagnosis were concordant, so US succeeded in prediction of the benign nature of the traumatic fat necrosis (true negative) 100% diagnostic accuracy.

Infiltrating ductal carcinoma was the histopathological diagnosis of 4/30 patients whose ultrasonographic findings were irregular shape, ill defined margins, heterogeneous pattern and hyperechoic echotexture was the main, posterior shadowing was also found in these lesions, the sonographic findings here succeeded in prediction of the malignant nature of these lesions (true positive for malignancy).

Focal mastitis was the histopathological diagnosis of 3/30 patients , and galactocele was the histopathological diagnosis of other 3/30 patients, in all of these patients US showed oval shaped, well defined , hyperechoic, homogenous lesion with no posterior shadowing, these US findings predicted benignity of these lesions which was confirmed by histopathology, therefore US succeeded in prediction of the benign nature of these lesions (true negative for malignancy).

Hematoma and infected seroma were the histopathological diagnoses of 2/30 hyperechoic lesions, sonographically they were oval, well defined, heterogeneous (mainly hyperechoic). These sonographic findings were confirmed by histopathology so US succeeded in prediction of these lesions' benign nature (true negative for malignancy).

Breast abscess (1/30 lesions) was sonographically oval shaped, with macrolobulated margins, homogenous, hyperechoic with no posterior shadowing; these findings suspected benignity of the lesion and histopathological diagnosis as breast abscess confirmed this suggestion, so US succeeded in prediction of the benign nature of this lesion. (true negative for malignancy).

Sonography showed no false cases for malignancy; true positive results for malignancy were found in 4/30 patients and true negative results were found in 26/30 patients.