.ljmr.ly/ eISSN:2413-6096

Original Article

Comparison of Mammography, Ultrasonography, and both Combined in the Interpretation of Palpable Breast Mass

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ABSTRACT

Background: Breast cancer is the most common female malignancy in worldwide and the second leading cause of female cancer death in the United States (1, 14). On average, every two minutes a woman is diagnosed with breast cancer and one woman will die of breast cancer every thirteen minutes(13) In Libyan breast cancer is most common cancer in female (17) Although the majority of palpable lumps are benign, a new palpable breast mass is a common presenting sign of breast cancer. the aim of the study to reveal the role of USS and MG and both in evaluating palpable breast mass because both are available and more accurate in evaluated palpable breast mass depend on the aging and breast density .Materials and methods: prospective study between January 2018 and march 2019 In Department of Radiology in Benghazi medical center (BMC); used the Breast Imaging Reporting and Data System (BI-RADS) classification on fifty palpable breast masses in two models (USS and MG) and described each masses by selecting a single term from the Bl-RADS lexicon for description mass margin and shape. Kappa values were calculated to assess the agreement between BIRADS assessment category and agreement between descriptions of masses margin and shape .Additionally, another reader used same USS Bl-RADS lexicon for description mass margin to assessed Inter-observer variability. Result :Regarding BIRADS assessment category, agreement between the MG and combined (USS and MG) interpretations were moderate (K=0.4);agreement between USS and combined (USS and MG) was very good (k=0.84); agreement between BIRADs category of USS and MG in descriptive shape of palpable breast mass was moderate (k=0.50) while for margin fair agreement (k=0.26).poor Inter-observer variability(k=0.19) in USS Bl-RADS lexicon for description mass margin. Conclusion: USS better than MG in detected palpable breast mass so can be use as diagnostic tool for characterized palpable breast mass.

Keywords: Mammography, Ultrasonography, Breast Mass and cancer.

Citation: **Kutrani Faiza Mohamed , Elgbali Ebtisam, Geweref Nadya Ben, Buzgheia Mohamed H. Mohamed , Beheh Ali , Soof Fatma , Elbadri Seham. Comparison of Mammography, Ultrasonography, and both Combined in the Interpretation of Palpable Breast Mass**. https://doi.org/10.26719/LJMR.18.1-16 **Received**: 23/05/2024; **accepted**: 14/06/2024; **published**: 30/06/2024

INTRODUCTION

Breast cancer is the most common female malignancy in worldwide and the second leading cause of female cancer death in the United States (1, 14). On average, every 2 minutes a woman is diagnosed with breast cancer and 1 woman will die of breast cancer every 13 minutes(13) In Libyan breast cancer is most common cancer in female (17) Although the majority of palpable lumps are benign, a new palpable breast mass is a common presenting sign of breast cancer .
A palpable breast mass may become evident during breast self-examination or clinical breast examination. Determining if a mass is present by physical examination can be difficult, as all breast have variable combination of glandular tissue, fibers, and fat. True masses are generally asymmetrical in relation to the other breast(1), 'Mass' is a space occupying 3D lesion seen in two different projections(8). Malignant is a group of diseases that cause cells in the body to change and spread out of control. Most types of cancer cells eventually form painless mass; sometimes breast cancer spreads to underarm lymph nodes and causes a lump and less common when the tumor is small and most easily treated. Most breast cancers begin either in the breast tissue made up of glands for milk production, called lobules, or in the ducts that connect the lobules to the nipple. The remainder of the breast is made up of fatty, connective, and lymphatic tissues (14). Clinician dependent in the biopsy for mass characterize may be not need (benign) so the imaging evaluation is necessary in almost all cases to characterize the mass (19 ,9) for example ultrasound has high sensitivity in detection palpable breast mass(92.5%) in which it is used in differentiation between sold and cystic lesion .(10)

Ultrasonography is easily available, relatively cheaper and can take relatively less time.[9] In Woman Younger Than 30 Years of Age it is an important imaging modality in the assessment of palpable breast masses also during pregnancy ,lactation because has less risk of cancer and dense breast .[15] The main role has been differentiating cystic from solid breast masses which has 100% sensitivity and 100% specificity for differentiating purely cystic masses from solid masses (10).but in Woman 40Years old and Older used in evaluation of a palpable mass incompletely evaluated at MG ,evaluation of palpable lesions with associated MG asymmetry and no MG findings (2,4).

Mammography is recommended as the first imaging modality in the evaluation of palpable breast masses in women 40 years old and older, MG reveals a clearly benign cause of the palpable abnormality, such as calcified involution fibro adenoma, lymph node, lipoma, hamartoma, galactocele, or oil cyst, or if only fatty tissue is present in the area of concern, no further imaging is needed. For all other MG findings, including masses with probably benign or suspicious features, further evaluation with targeted USS is indicated. Normal mammographic findings are not sufficient to rule out malignancy in a non-fatty breast. If there is no mammographic finding at the site of the palpable lump, further workup with targeted ultrasound is required.(4).It can be used to look for micro calcifications and architectural distortion hence to determine the potential malignant nature of the lesion which proved to be an effective diagnostic tool for defining the benign and malignant characteristics of palpable breast mass(9) .

High rate of breast cancer in Libyan female patient with frequency of 20 %(24) and Most of the patients present with advanced disease and often young age. There is need to improve early detection to reduce breast cancer mortality (25).by using more available, cheap, and accurate modalities in Libyan (USS and MG) [26].

The aim of the study to reveal the role of USS and MG and both in evaluating palpable breast mass because both are available and more accurate in evaluated palpable breast mass depend on the aging and breast density.

METHODS

Case series study with prospective timing of data collection between January 2018 and march 2019 In Department of Radiology in Benghazi medical center (BMC).

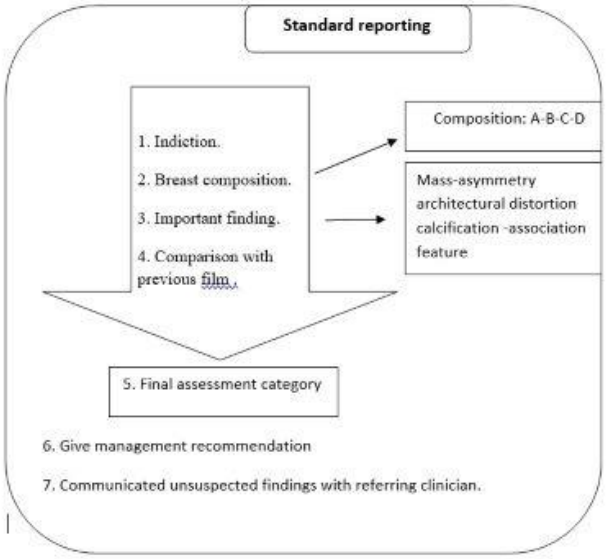
Case Selection:

Fifty cases studies were randomly selected for patients who underwent diagnostic MG and USS imaging with inclusion criteria: female 40ys old or older and had palpable breast mass (as referring from physician).

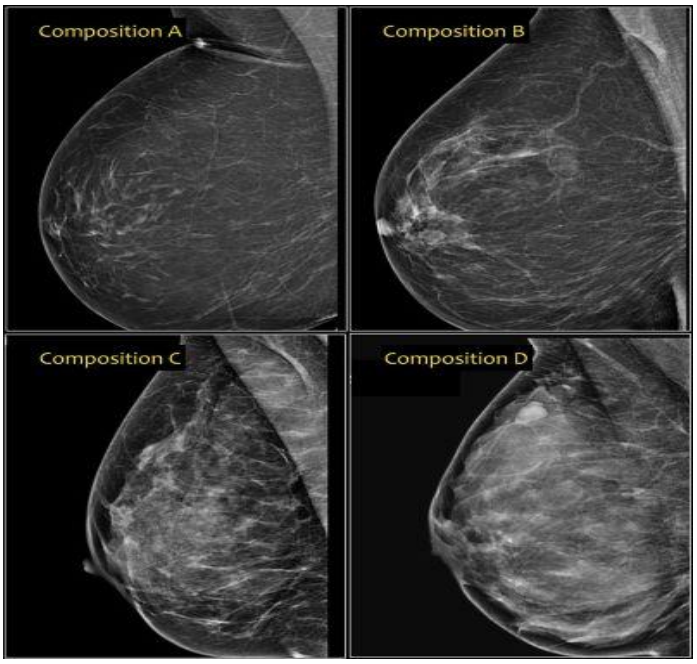
Procedure:

A-The ACR BI-RADS American College of Radiology (ACR) BIRADS (Breast Imaging Reporting and Data System) are designed to standardize breast imaging reporting to reduce confusion in breast imaging interpretations. It contains a lexicon for standardized terminology for mammography, breast US and MRI.

Use of approved terminology is key to the production of an understandable breast imaging report. The BI-RADS approach to reporting imaging examinations categorizes the overall composition of the breast and then describes non-calcified lesions by their basic shape, border characteristics, and density. Calcifications are described according to size, morphology, and distribution. The findings are then evaluated, and an assessment is rendered that includes the degree of suspicion for malignancy at imaging. Finally, the report indicates the management recommendation(s). [7]



Estimated overall breast density pattern on mammograms was categorized into four categories using a 4-level density scale of BI-RADS classification of density; type 1 (<25% fibro glandular tissue). Entirely fat, type 2(25-50%). Scattered fibro glandular, type 3 (50-75%). Heterogeneously dense and type 4. Extremely dense (>75%). [7, 8]



The imaging interpretation was based on the American College of Radiology (ACR) BIRADS (Breast Imaging Reporting and Data System) lexicon [6]. Breast lesions were classified into six categories according to the lesion margin and calcification status: BI-RADS 0 = unsatisfactory imaging, and additional imaging evaluations are needed; BI-RADS 1 = negative, no abnormality on imaging ; BI-RADS 2 = benign findings, presence of definite benign lesions without any signs of malignancy; BI-RADS 3 = probably benign lesions, including un-calcified lump with non-palpation and clear boundary and focal, asymmetric, clustering, round or dot-like calcifications, and a follow-up in a short time is suggested; BI-RADS 4 = suspicious abnormality without typical signs of malignancy, including palpable, solid lumps with some clear margins, palpable complex cysts, probable abscess, solid mass with irregular shape and infiltrating margin, and newly emerging clustered, tiny, polygonal calcifications, and biopsy should be considered; BI-RADS category 5 = highly suggestive of malignancy and appropriate actions should be taken[22,8,7]

final assessment categories

Category	Management	Likelihood of cancer	
0	Need additional imaging or prior examination.	Recall for additional imaging and /or await prior examination.	n/a
1	Negative	Routine screening	Essentially 0%
2	Benign	Routine screening	Essentially 0%
3	Probably benign	Short interval-follow up (6month)or continued	>0%but <2%
4	Suspicious	Tissue diagnosis	4a.low suspicious for malignancy (>2%to <10%) 4b. moderate suspicious for malignancy (>10%to <50%) 4c.high suspicious for malignancy (>50%to <95%)
5	Highly suggestive	Tissue diagnosis	>95%

	of malignancy		
6	Known of proven	Surgical excision when clinical appropriate	n/a

Mammography

Digital mammography with Cranio-caudal and Medio-Lateral Oblique views as standard view and spot compression and magnification views are typically obtained of the area of clinical concern as additional veiw.4

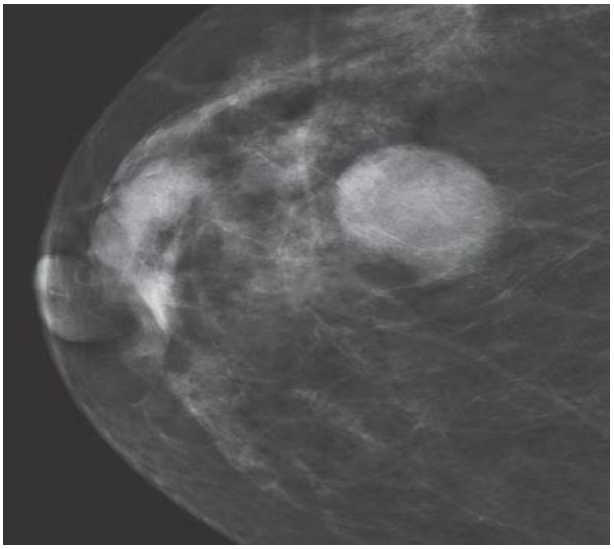


Figure2. Equal-density oval mass with mostly circumscribed borders20

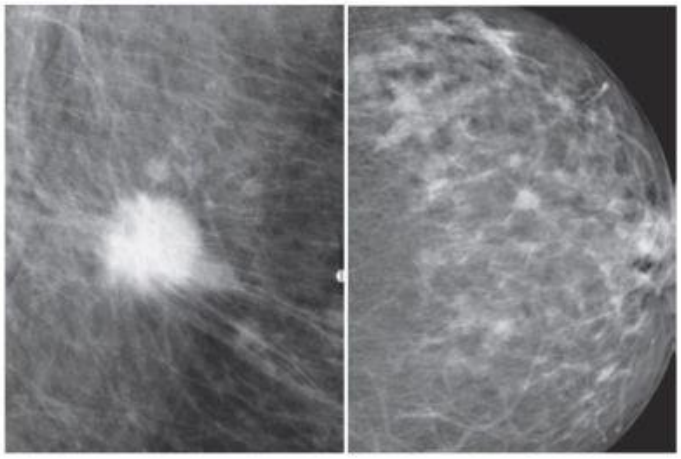


Figure 2. Round mass with speculated borders in the midbreast (arrow) on craniocaudally (CC) view .20

Sonography

GE Logiq P6 Ultrasound Machine with superficial probe 6-12MHZ we examination the whole breasts and axillary's regions was performed with the patient in the supine position and both arms elevated , In a patient with large breasts, the side to be examined is elevated on a cushion with antiradial Scanning Technique.[11,19]

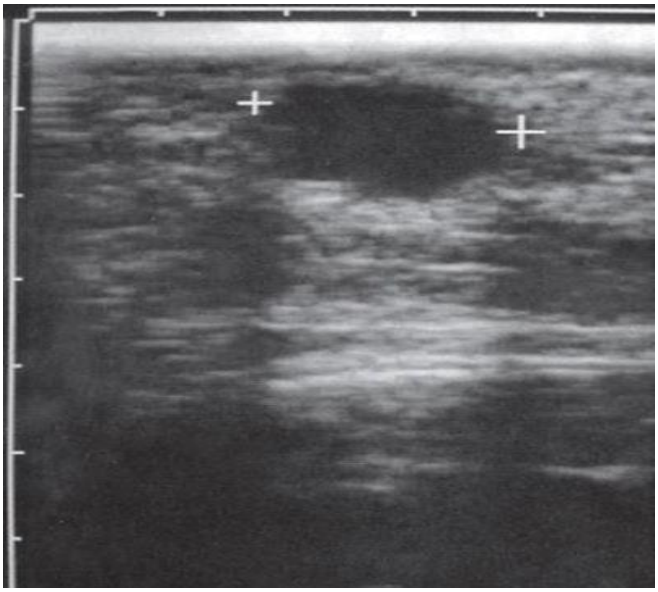


Figure 3. Cysts imaged

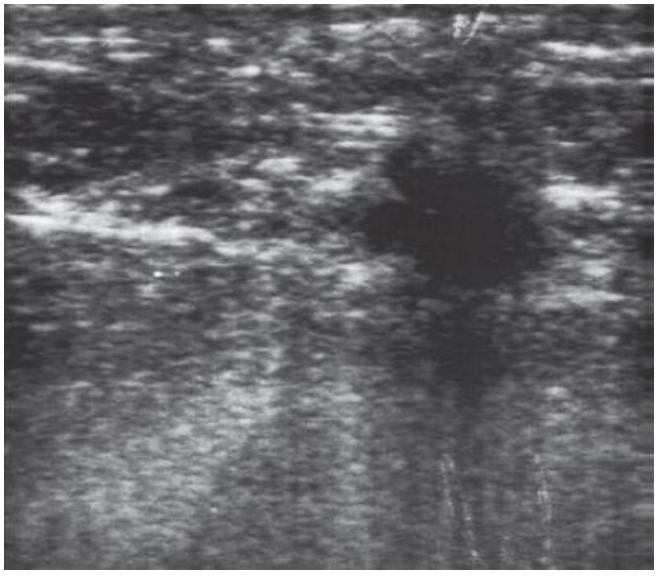


Figure 4. Hypoechoic with irregular margin mass

Data collection

data was obtained from standardize report imparted by two radiologist ;one expert radiologist from in mammography unit of medical Benghazi center (BMC) and other was one of years mammography training study .There was no time limit to the film reading. The observers read the images independently and without knowledge of the final diagnosis, with added name, age and family history in report.

Data analysis:

Data presentation: mean; frequency distribution table and cross tabulation; were used to describe and compare variables.

Statistics testing

significance testing such as Chi-square test was used to examine relationships of variables and Cohen's kappa statistic is a statistical measure designed to assess agreement between two or more observations for categorical or nominal data 6; a kappa (κ) value of equal to or less than 0.20 indicated a poor agreement; values from 0.21-0.40, fair agreement; 0.41-0.60, moderate agreement; 0.61-0.80, good agreement; and 0.81-1.00, very good agreement; P value significantly (if >0.05). Data analysis was performing using the Statistics Package Social Science (SPSS) program version 20.

RESULTS

Characteristics of the patient

50 of cases females Libyan patients complain of palpable breast mass with 40yrs old age or more with mean of age 84.9

Agreement between BIRADs category of MG and BIRADs category of both (MG and USS):

According to a ACR BI-RADS Standardized category classification in breast MG imaging data MG was 0 in 38 (33.3%) cases, category 1 in 1 (9%), category 2 in 12 (10.5%), category 3 in 13 (11.4%), category 4 in 19 (16.7%),category 5 in 30 (26.3%) and category6 in 1 (0.9%). In both (MG and USS) was 0 in 38 (33.3%) cases, category 1 in 1 (9%), category 2 in 12 (10.5%), category 3 in 13 (11.4%), category 4 in 19 (16.7%), category 5 in 30 (26.3%) and category 6 in 1 (0.9%). There was moderate agreement in which the Kappa value=0.4.

Agreement between BIRADs category of USS and BIRADs category of both (MG and USS):

According to a ACR BI-RADS Standardized category classification in breast USS imaging data, the USS was 0 in 38 (33.3%) cases, category 1 in 1 (9%), category 2 in 12 (10.5%), category 3 in 13 (11.4%), category 4 in 19 (16.7%),category 5 in 30 (26.3%) and category6 in 1 (0.9%). In both (MG and USS) was 0 in 38 (33.3%) cases, category 1 in 1 (9%), category 2 in 12 (10.5%), category 3 in 13 (11.4%), category 4 in 19 (16.7%), category 5 in 30 (26.3%) and category 6 in 1 (0.9%). There was very good agreement in which the Kappa value =0.84

Table 1. Agreement between BIRADs category of MG and BIRADs category of both (MG and USS)

			BOTH2					Total
			BIRDS 0	BIRADS2	BIRADS3	BIRADS4	BIRADS5	
MG2	BIRADS0	Count	2	5	7	2	2	18
		% of Total	4.0%	10.0%	14.0%	4.0%	4.0%	36.0%
	BIRADS2	Count	0	3	0	0	0	3
		% of Total	0.0%	6.0%	0.0%	0.0%	0.0%	6.0%
	BIRADS3	Count	0	1	3	2	0	6
		% of Total	0.0%	2.0%	6.0%	4.0%	0.0%	12.0%
	BIRADS4	Count	0	3	0	5	2	10
		% of Total	0.0%	6.0%	0.0%	10.0%	4.0%	20.0%
	BIRADS5	Count	0	0	1	0	12	13
		% of Total	0.0%	0.0%	2.0%	0.0%	24.0%	26.0%
	Total	Count	2	12	11	9	16	50
		% of Total	4.0%	24.0%	22.0%	18.0%	32.0%	100.0%

Chi-square test= 53.*P value = 000,* level of significance is at P < 0.05.The kappa value=0.4

Table 2. Agreement between BIRADs category of USS and BIRADs category of both (MG and USS) .

			BOTH2					Total
			BIRADS 0	BIRADS2	BIRADS3	BIRADS4	BIRADS5	
MG2	BIRADS0	Count	2	0	0	0	0	2
		% of Total	4.0%	0.0%	0.0%	0.0%	0.0%	4.0%
	BIRADS2	Count	0	12	1	0	0	13
		% of Total	0.0%	24.0%	2.0%	0.0%	0.0%	26.0%
	BIRADS3	Count	0	0	10	1	0	11
		% of Total	0.0%	0.0%	20.0%	2.0%	0.0%	22.0%
	BIRADS4	Count	0	0	0	8	4	12
		% of Total	0.0%	0.0%	0.0%	16.0%	8.0%	24.0%
	BIRADS5	Count	0	0	0	0	12	12
		% of Total	0.0%	0.0%	0.0%	0.0%	24.0%	24.0%
	Total	Count	2	12	11	9	16	50
		% of Total	4.0%	24.0%	22.0%	18.0%	32.0%	100.0%

Chi-square test= 159. *P value = 000,* level of significance is at P < 0.05. Kappa value =0.84

Agreement between BIRADs category of USS and MG in descriptive shape of palpable breast mass:

According to a ACR BI-RADS Standardized category classification in MG breast of imaging data was round in 6 (12 %) cases, oval in 10 (20%), irregular 15 (30%), and -ve in 19 (38%) while in USS round in 9 (18%) cases, oval in 18 (36%), irregular 23 (46%), and -ve in 0 (0%). There was moderate agreement in which the Kappa value was 0.50.

Table 3. Agreement between MG and USS for shape of the mass:

Shape	MG	USS	Kappa value
Round	6(%12)	9 (%18)	
Oval	10(%20)	18(%36)	
Irregular	15(%30)	23(%46)	K=0. 50
-ve	19(%38)	0(0%)	
Total	50 (100%)	(100%)50	

Agreement between BIRADs category of USS and MG in descriptive margin of palpable breast mass:

According to a ACR BI-RADS Standardized category classification in MG breast of imaging data was circumscribed in 11 (22%) case, microlobulated3 (6%), indistint3 (6%), spiculated9(18%), macrolobulated1 (2%), partially obscured in 5 (10%)and -ve 18(36%) while USS show circumscribed in 22 (44%) cases, microlobulated10 (20%), indistint5(10%), spiculated8(16%), macrolobulated4 (8%), partially obscured 0(0%) and -ve1(2%).

There was fair agreement in which the Kappa value was 0.26.

Table 4. Agreement and Uss2 in mass margin.

Margin	Frequency	Percent	Kappa value
MG			
circumscribed	11	%22	
micro lobulated	3	%6	K=27.0
indistinct	3	%6	
spiculated	9	%18	
Macro lobulated	1	%2	
partially obscured	5	%10	
-ve	18	%36	
USS			
Circumscribed	22	44%	
Micro lobulated	10	20%	
Indistinct	5	10%	
Spiculated	8	16%	
Macro lobulated	4	8%	
Partially obscured	0	0%	
-ve	1	2%	
Total	50	100%	

Margainuss1	Margainuss2						Total
	Circumscribed	Micro lobulated	Indistinct	Spiculated	Macrolubulated	-ve	
Circumscribed	17 34.0%	2 4.0%	2 4.0%	0 0.0%	2 4.0%	0 0.0%	23 46.0%
Obscured	0 0.0%	2 4.0%	1 2.0%	2 4.0%	0 0.0%	0 0.0%	5 10.0%
Micro lobulated	1 2.0%	0 0.0%	0 0.0%	0 0.0%	1 2.0%	0 0.0%	2 4.0%
Indistinct	3 6.0%	3 6.0%	0 0.0%	5 10.0%	0 0.0%	0 0.0%	11 22.0%
Spiculated	0 0.0%	2 4.0%	1 2.0%	1 2.0%	0 0.0%	0 0.0%	4 8.0%
Macrolubulated	1 2.0%	1 2.0%	1 2.0%	0 0.0%	1 2.0%	0 0.0%	4 8.0%
-ve	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 2.0%	1 2.0%
Total	22 44.0%	10 20.0%	5 10.0%	8 16.0%	4 8.0%	1 2.0%	50 100.0%

Chi-square test= 88. *P value = 000,* level of significance is at P < 0.05. Kappa value =0.19(poor agreement

Inter observed agreement in margin of palpable mass by USS.

According to a ACR BI-RADS Standardized category classification in USS breast of imaging data by reader2 and reader1, the circumscribed in {2(44%), 23(64%)} microlobulated10 (20%),5(10%)}, indistinct {5(10%),2(4%)}, spiculated {8(16%),4(8%)} macrolobulated4 (8%), 4(8%0}, and -ve 1{(2%),1(2%)} respectively . There was poor agreement in which the Kappa value =0.19.

DISSCUSION

Breast masses are common in female and amongst all the breast masses, malignant masses are the most feared [5]. Breast cancer, is an important health problem in Libya because it is most cause of death in women so we need early detection to reduce the breast cancer mortality ; although ,there are several limitation in this study , which no data archived in hospitals ,only one mammogram machine work in Benghazi 12, Also the follow up of patients is very variable due to the fact that patients are often partly or fully treated outside the hospital which made the

histopathological diagnosis, in other Libyan area or abroad 12 .

women comes with palpable breast mass need characterized the lesion by available ,cheap and accurate techniques which they are USS and MG ;we used the **ACR BI-RADS** American College of Radiology (ACR) BIRADS (Breast Imaging Reporting and Data System) which contains a lexicon for standardized terminology for description in USS ,MG and MRI :in ACR Appropriateness Criteria_ Moy et al. Palpable Breast Masses: There is no evidence to support the use of MRI of the breast without or with contrast as the next step in evaluating a palpable breast mass; in addition , it is generally more cost compare to MG and USS .

In the clinical examination and MG 5,USS descriptor the palpable mass shape, margin , orientation, and echo texture—that indicate whether a lesion is malignant, benign, or indeterminate which help observer in predict the malignance in breast mass [5,11,10]

Our results show a very good agreement in describing palpable breast mass on USS with combined (USS and MG) kappa value (K) =0.84, moderate agreement on MG with combined (USS and MG) kappa value (K)=0.4.

Agreement for mass shape by USS and MG moderate agreement kappa value (K) =0.45; Agreement for mass margin by USS and MG fair agreement kappa value (K) =0.26; Interobserver Variability in Description margin of palpable breast mass by USS was fair agreement kappa value (K) =0.19.

In African 2010 Gonzag found 80 palpable breast masses were evaluated at USS and information about the characteristic features of the masses was recorded. An impression about the diagnosis was made and results were correlated with histology findings which reported; the overall sensitivity of ultrasound in detecting breast lumps was 92.5%. The sensitivity and specificity of ultrasound for detecting breast carcinoma was 57.1% and 62.8% respectively; so USS is significant in differentiating cystic from solid breast masses. Ultrasound is also important in detecting suspicious breast masses and should therefore be used in the evaluation of symptomatic breast masses.[10]. Also Lehman et al. found USS is a highly effective imaging tool for guiding effective evaluation of women with palpable breast abnormalities and should be used for all women with suspicious findings at clinical breast examination .4.as well as the major advantage of USS is the ability to directly correlate the clinical and imaging findings. The sensitivity of mammography was 86% to 91%. The addition of US detects 93% to 100% of cancers that are occult on mammography.

Zhao et al 2015 to compared the MG and USS in the diagnosis of breast diseases The MG and US data were compared to surgical records using the results from post-surgical pathological examinations as the gold standard; who reported US was better than MG in the preoperative evaluation of breast diseases22

As known, dense breast tissue is common: approximately half of women younger than 50 years and a third of older women have dense breast parenchyma11 and USS appears superior to MG in

dense breast ;Dense fibro glandular tissue is the most important inherent limitation of MG in the diagnosis2; Emine devolli-disha et al .repotted USS has a significantly greater specificity than MG. USS has long been used as an effective diagnostic tool in the evaluation of palpable and MG abnormalities.so USS, it is more sensitive than MG in detecting lesions in women with dense breast tissue.2 also in 2015, Brem et al. show Breast density results in a decrease in the sensitivity of mammography for cancer detection with a significant increase in the risk of breast cancer. Ultrasound has long been a mainstay of breast imaging as a diagnostic tool, and it can and does detect mammographically occult breast cancer in women with dense breast tissue.[5, 6]

2013 *boonlikit* compared the agreement of screening breast MG + USS and reviewed MG alone who used kappa values to assess the agreement between BIRADS assessment category and BIRADS classification of density obtained from it. So agreement between MG + USS and reviewed MG alone in asymptomatic women is good and agreement of BI-RADS classification of density was good, with a Kappa value of 0.60.11

Berg ea tl to compare USS+MG and MG alone in women at elevated risk of breast cancer Which had heterogeneously dense breast tissue in at least 1 quadrant; found the addition of a single screening USS examination to MG for women at elevated risk of breast cancer , increased detection of breast cancers18

But in K. taori *et al*. confirms the higher combined sensitivity rate for USS and MG for detection of breast masses including malignancies and the specificity for USS in breast masses is 86.9% and for mammography it is 78.6%. Combining both the

modalities the specificity is 97.6% .(9) also in Skaane et al. (1) To analyze Interobserver agreement in the interpretation of palpable noncalcified breast masses by means of mammography, ultrasonography, and a combination of both methods . The kappa indices of 0.58 for MG (moderate) , 0.48 for USS (moderate), and 0.71 for both methods combined (good) ; Agreement was highest in the combined reading, intermediate in mammography, and lowest in ultrasonography1 Calas MJG et al agreement with previous study found kappa value for the BI-RADS classification in USS (0.389, fair) indicates the need for standardization4

In Summary ,the agreement for BIRADs category reported in our study by USS was higher than agreement by MG ;agreement for shape of palpable mass by USS and MG better than agreement for margin of palpable mass by USS and MG ; Interobserver Variability in Description margin of palpable breast mass by USS was fair.

CONCLUSION

USS better than MG in detected palpable breast mass so can be use as diagnostic tool for characterized palpable breast mass in my county if Not available MG

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م.ب.ط نموذج رقم (41)

رقم إشاري : .....

التاريخ : / /

وزارة الصحة

مركز بنغازي الطبي

مركز بنغازي الطبي

Dr. Faiza Mohamed Kutrani

The Research Ethics Board (REB) Benghazi Medical Center (BMC) reviewed and discussed your application documents to conduct a study entitled:

Comparison of Mammography, Ultrasonography, and both Combined in the Interpretation of Palpable Breast Mass

The REB approved your request to conduct the study in its present form in Benghazi Medical center.

The REB expects to be informed about any changes in your study protocol during the conduct of the study.

This letter constitutes ethical approval only and you should seek administrative permission from the research site separately.

Yours Sincerely

Dr. Abdelhakim Mostafa Elbarsha

Chairman of REB (BMC)

May 17th, 2020

Benghazi Medical Center Research Ethics Board

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