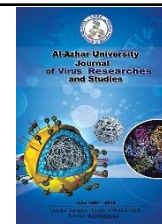




## Al-Azhar University Journal for Virus Research and Studies



### Cystic Breast Lesions: Combined Mammographic-Sonographic Evaluation and BI-RADS Assessment

Shimaa A. Esmail\*<sup>1</sup>, Mohammed A. Abboud<sup>2</sup>, Mohammed A. Ahmed<sup>3</sup> and Mohamed H. Tawfik<sup>2</sup>

<sup>1</sup>Resident of Radiodiagnosis at MOH

<sup>2</sup>Department of Radiodiagnosis, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

<sup>3</sup>Department of Surgery, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt

\*E-mail: dr.sh.ahmed89@gmail.com

#### Abstract

Cystic breast lesions (CBLs) have been recognized as the most frequent female benign breast lesions. Complex cystic breast masses are suspicious findings that usually need biopsy. The aim of this study is to analyze the features of different types of cystic breast lesions at mammography and ultrasonography (US) and to determine its appropriate Breast Imaging Reporting and Data System (BI-RADS) categories. This is a prospective study, 25 patients with different types of CBLs were included. All lesions were subjected to mammography, ultrasonography, Doppler internal vascularity and biopsy. The study was conducted for a period of one year from September 2020 to September 2021 and was approved by our institution's ethics committee. 25 different cystic breast lesions were found, six lesions (24%) were simple cysts, one lesion (4%) was clustered microcysts, seven lesions (28%) were complicated cysts, and eleven lesions (44%) were complex solid and cystic type. It was found that all simple, clustered microcysts and complicated cysts are benign, while 4 out of 11 complex cysts of the study were proved malignant. The PPVs for malignancy in simple, clustered microcysts and complicated cysts is 0%. While the PPVs for complex cyst was 36%. The accuracy of sonography in detecting and allowing correct diagnosis of breast cyst has been reported to be almost 100%. Complex cystic breast masses are suspicious ultrasound findings that usually need biopsy.

**Keywords:** Cystic breast lesions, Breast Complex Cystic Lesion, Mammography, Breast sonography; BI-RADS.

#### 1. Introduction

Cystic breast lesions (CBLs) are commonly observed on ultrasound (US) examinations performed for the evaluation of palpable or

mammographically detected breast masses. [1]. In 2003 The American College of Radiology (ACR) established the BI-

RADS-US (Breast Imaging Reporting and Data System) in different varieties of cystic breast lesions (CBLs), including simple cyst, complicated cyst and complex cyst. Appropriate categorization of CBLs is very important for general radiologists because the clinical practice in the management of each subtype differs. [2]

Simple, complicated and clustered cysts are typically benign; however, complex cystic masses containing mixed cystic and solid components are indeterminate between 23% and 31% are associated with malignancy; therefore, biopsy is required. Simple cysts are circumscribed anechoic masses with posterior acoustic enhancement and absent vascularity. Simple cysts are benign, requiring no further assessment unless aspiration is requested due to symptoms. [3]

A complicated cyst is defined in the 5th edition of the ACR Breast Imaging Reporting and Data System (BI-RADS) Atlas as an otherwise simple cyst with debris or homogeneous low-level echoes that may shift with patient position without suggestion of a solid component and can be classified as benign. [4]

The (BI-RADS) defines complex cystic lesions at US as cystic masses containing a solid component, even if discreet, are classified as ACR BI-RADS category 4 (ACR4) and considered suspicious for malignancy. [5]

The term complex cyst is not a pathological classification; it is a sonographic diagnosis with variations in definition and classification. In this study, we used a classification which is a modified version from classification of Berg.,et al [6] which states that complex cystic breast masses are classified into 3 types: type I cysts have a thick wall, thick internal septa ( $\geq 0.5$  mm), or both; type II masses contain mixed cystic and solid components and are at least 50% cystic; type III masses are predominantly solid complex lesions (at least 50% solid components) including peripheral cystic components [7]. This paper aims to analyze the features of different types of cystic

breast lesions at mammography and ultrasonography (US) and to determine its appropriate Breast Imaging Reporting and Data System (BI-RADS) categories.

## 2. Patients and Methods

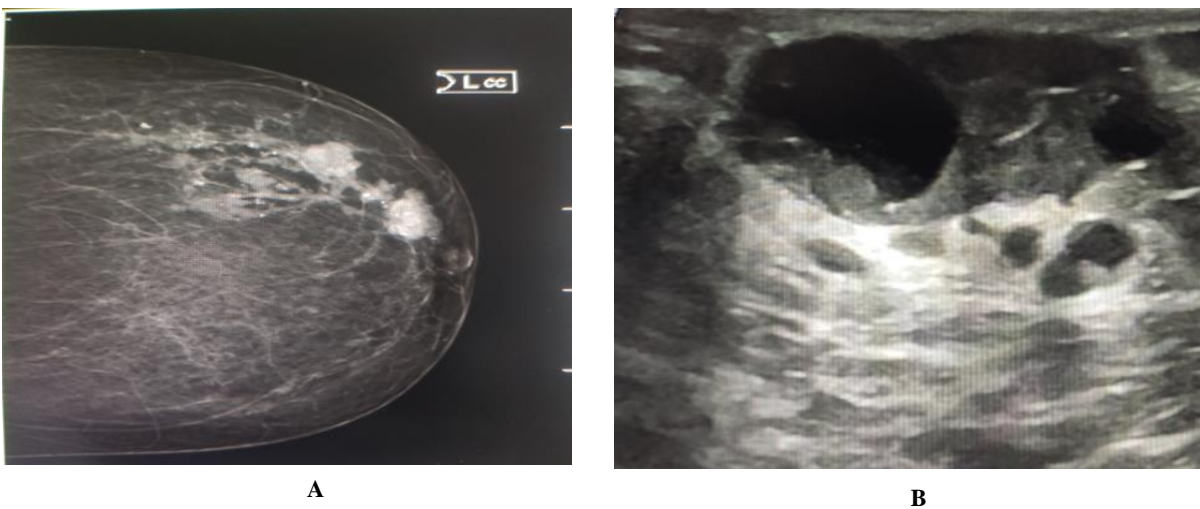
This is a prospective study was conducted on 25 patients with different types of cystic breast lesions. All lesions were subjected to full thorough history taking, mammography (Fujifilm AMULET Innovality digital mammography machine) high resolution ultrasonography of both breasts and color Doppler examination with ultrasonographic equipment (GE LOGIC P5 machine) and Ultrasound guided fine-needle aspiration biopsy and/or ultrasound guided core-needle biopsy and histopathological examination of the biopsied tissues. The study was conducted for a period of one year from September 2020 to September 2021. And was approved by our institution's ethics committee. All patients gave their informed consent before inclusion in the study.

## 3. Results

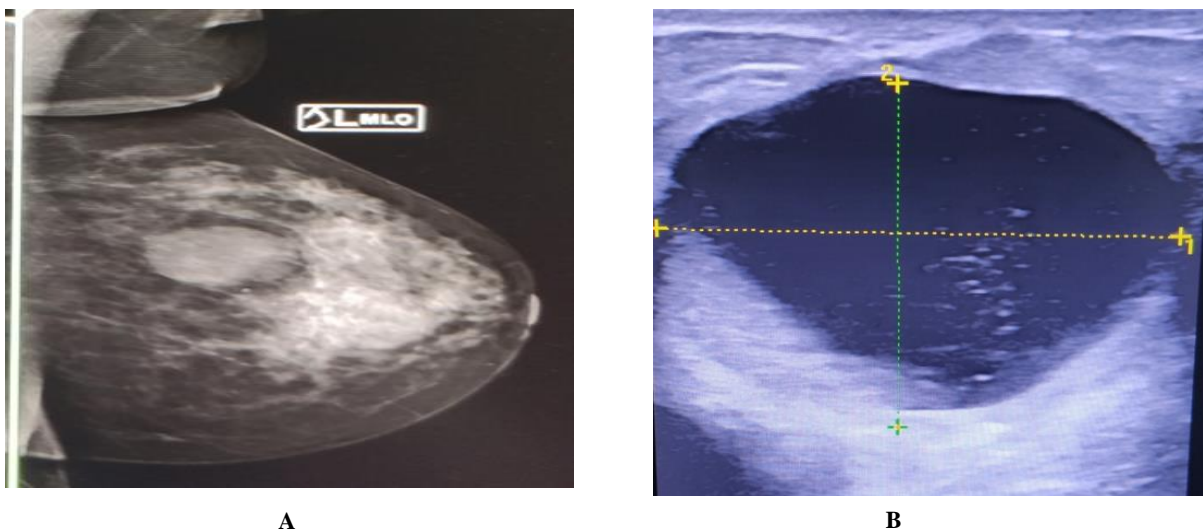
Among the 25 studied lesions, the histological analysis showed there were 21 benign (84%) and 4 malignant (16%) lesions. (Table1).The malignant lesions included ductal carcinoma insitu (DCIS) in one patient and invasive ductal carcinoma (IDC) in three patients (Figure 1) The histological diagnoses of the remaining 21 benign lesions were; fibrocystic changes (FCC) in 11 patient (Figure 2), fibroadenoma in 3 patients (Figure 3), fat necrosis in 2 patient, galactocele in one patient(Figure 4), hematoma in one patient, Focal adenosis in one patient, abscess in one patient (Figure5) and intraductal papilloma in one patient (Figure 6).

**Table (1):** Distribution of the studied cases according to pathological result. (n=25).

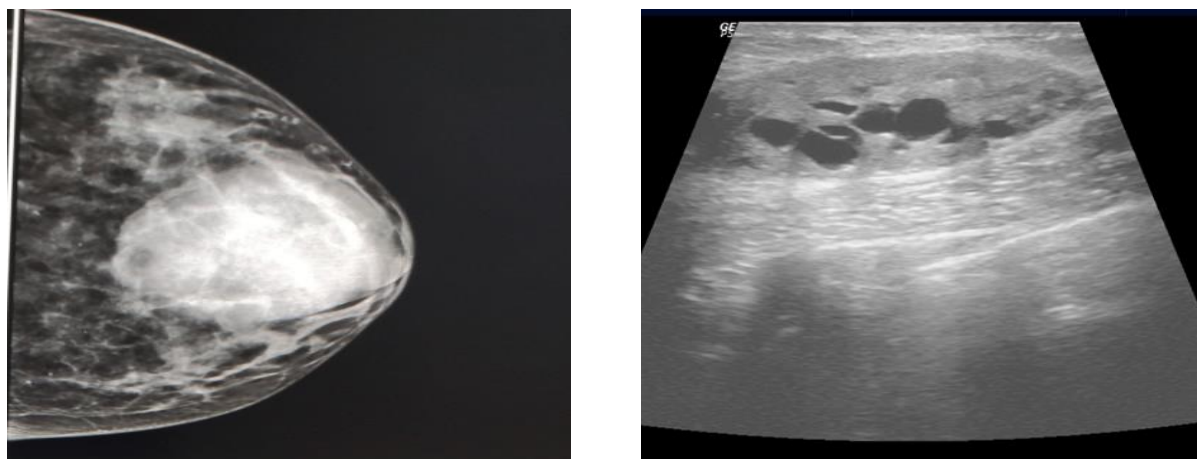
Pathological Result	No.	%
<b>Benign (n=21)</b>		
FCC	11	52.4
Fibroadenoma	3	14.2
Fat necrosis	2	9.52
Abscess	1	4.76
Focal adenosis	1	4.76
Intraductal papilloma	1	4.76
Galactocele	1	4.76
hematoma	1	4.76
<b>Total</b>	<b>21</b>	<b>100</b>
<b>Malignant (n=4)</b>		
DCIS	1	25
IDC	3	75
<b>Total</b>	<b>4</b>	<b>100</b>



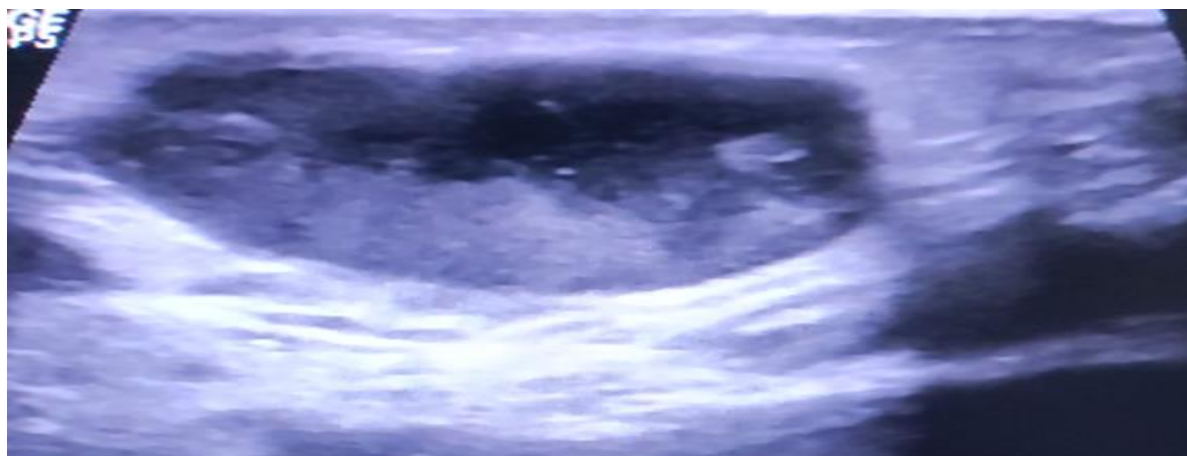
**Figure (1):** (A) CC view of left breast shows multiple irregular shape masses, located at outer quadrant of left breast along the same axis associated with malignant amorphous microcalcifications (intralesional with segmental distribution). (B) Conventional US showed one of the masses on (A) as a predominantly solid lesion with peripheral cystic changes (type III) complex cystic lesion at the left retroareolar region has irregular shape, non-circumscribed margins and detected internal vascularity by color Doppler. It was categorized as BIRADS 4c.US guided CNB proved to be IDC.



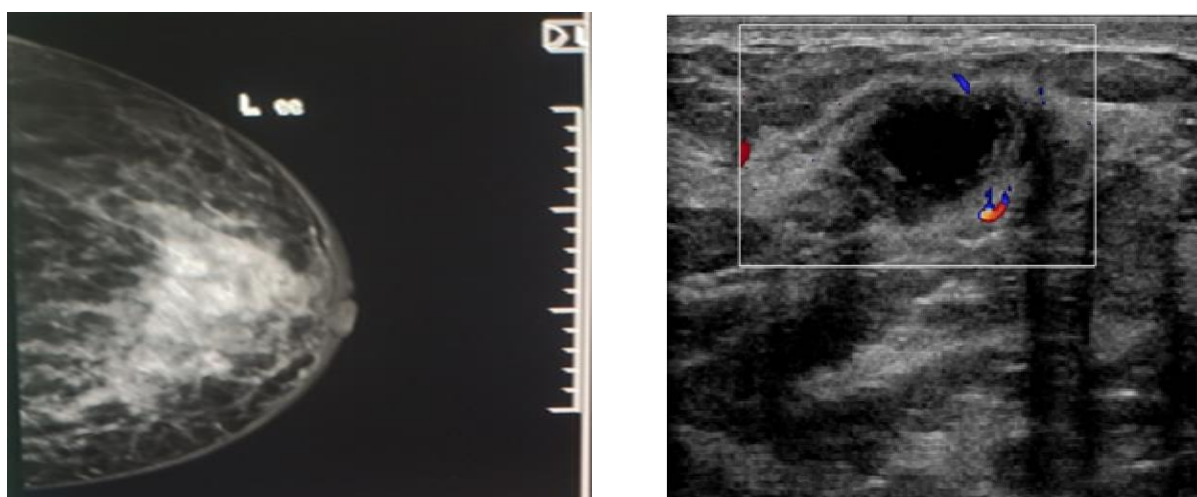
**Figure (2):** (A) left MLO view shows circumscribed oval mass located at upper quadrant. (B) US showed a complicated cyst with low level internal echoes.US guided FNAC proved to be fibrocystic changes.



**Figure (3):** (A) left CC view shows a well circumscribed equal density oval mass lesion located at left retroareolar region. (B) conventional US demonstrate an oval a predominantly solid lesion with central cystic changes (type III). US guided CNB proved to be fibroadenoma.

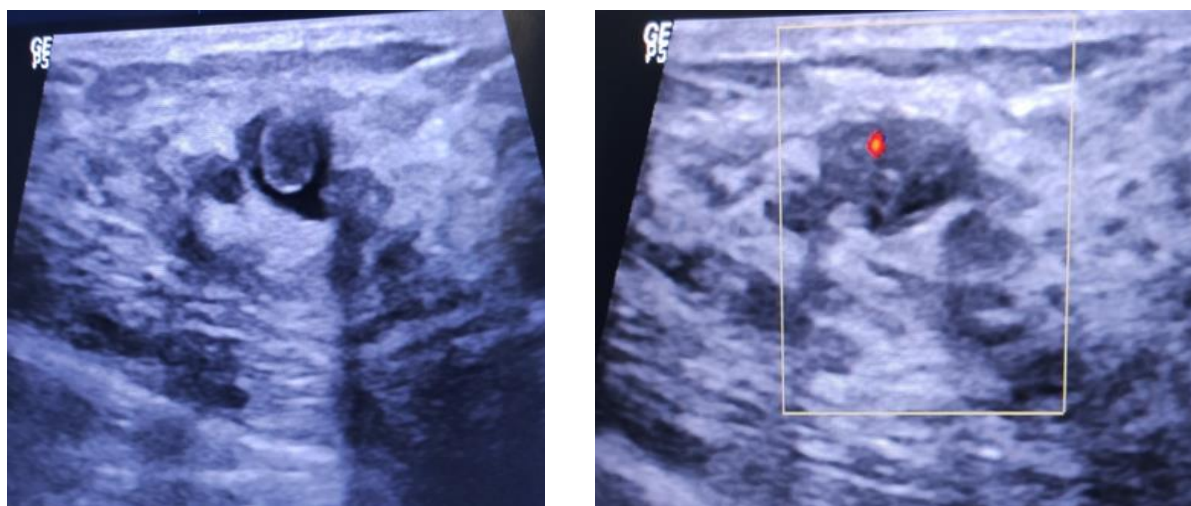


**Figure (4):** 25-year-old female giving history of recent weaning with painful right breast lump. Ultrasound shows a circumscribed oval mass with low level internal echoes and posterior enhancement as well as a focal echogenic area representing a fat plug (black arrow) consistent with complicated cyst, findings are consistent with galactocele.



**Figure (5):** 39-year-old diabetic female with painful left breast swelling, (A) Craniocaudal view of left breast show left asymmetric density and skin thickening. (B) Color Doppler US showed a complex cystic lesion with thick wall (type I), regular shape, circumscribed margin, posterior acoustic enhancement and increased peripheral vascularity with no suspicious axillary LN. It was categorized as BIRADS 4a. US guided FNAC proved to be breast abscess.





**Figure (6):** Conventional and color Doppler US showed a complex cystic lesion at the right retroareolar region with one pedunculated solid mural component (type II), regular shape, circumscribed margin, posterior acoustic enhancement and detected vascularity at its pedicle with no suspicious axillary LN. It was categorized as BIRADS 4b. US guided FNAC proved to be benign suggestive of benign intraductal papillary lesion.

Mammography was performed for all 25 patients and the results were distributed as follows: (table 2). 4 lesions (16%) were not seen at mammography, 3 of them being simple cyst type (fibrocystic changes), and 1 of complex type (was proved as intraductal papilloma by histopathological study). All 6 patients have bilateral dense breasts. 14 lesions (56%) were detected as mass density, 4 of them being of complex type (3 fibroadenomas and 1 FCC). 6 patients of complicated type (5 FCC, and 1 galactocele) .3 patients of simple type (2

Oil cyst and 1 FCC). And 1 case of clustered microcysts 4 lesions (16%) were detected as mass with microcalcifications, all of them being of complex type and all of 4 cases proved to be malignant by histopathology (3 cases were IDC and one case was DCIS). 3 lesions (12%) were detected mammographically as focal asymmetries with 2 cases being of complex type (1 was focal adenosis and 1 was abscess). 1 case of complicated type (hematoma).

**Table (2):** Distribution of different studied groups according to the mammographic findings (n=25).

Mammography	Simple n=6		Complicated n = 7		Clustered n=1		Complex n=11		Total n=25	
	No	%	No	%	No	%	No	%	No	%
Negative	3	12	0	0	0	0	1	4	4	16
Mass density	3	12	6	24	1	4	4	16	14	56
Mass with microcalcifications	0	0	0	0	0	0	4	16	4	16
Focal Asymmetry	0	0	1	4	0	0	2	8	3	12

**Table (3):** Relation between pathological results and ultrasound features.

Ultrasound Features	Benign N (21)		Malignant N (4)		Total N (25)	
	No	%	No	%	No	%
<b>Shape</b>						
Irregular shape	3	50	3	50	6	100
Regular shape	18	95	1	5	19	100
<b>Total</b>	<b>21</b>	<b>100</b>	<b>4</b>	<b>100</b>	<b>25</b>	<b>100</b>
<b>Margin</b>						
Not circumscribed	1	20	4	80	5	100
Circumscribed	20	100	0	0	20	100
<b>Total</b>	<b>21</b>	<b>100</b>	<b>4</b>	<b>100</b>	<b>25</b>	<b>100</b>
<b>Posterior acoustic enhancement</b>						
No	5	83	1	17	6	100
Yes	16	84	3	16	19	100
<b>Total</b>	<b>21</b>	<b>100</b>	<b>4</b>	<b>100</b>	<b>25</b>	<b>100</b>

**Table (4):** Relation between histopathological findings and US types for 11 complex cystic breast lesions.

Pathological results of complex cyst(n=11)	Type I (n=2)		Type II (n=3)		Type III (n=6)	
	NO	%	NO	%	NO	%
<b>Benign (n = 7)</b>	<b>(no =2)</b>		<b>(no =2)</b>		<b>(no =3)</b>	
Abscess	1	50	0	0	0	0
FCC	1	50	0	0	0	0
Fibroadenoma	0	0	1	33.3	2	33
Focal adenosis	0	0	0	0	1	17
Intraductal papilloma	0	0	1	33.3	0	0
<b>Malignant (n = 4)</b>	<b>(n=0)</b>		<b>(n=1)</b>		<b>(n=3)</b>	
DCIS	0	0	0	0	1	17
IDC	0	0	1	33.3	2	33
<b>Total</b>	<b>2</b>	<b>100</b>	<b>3</b>	<b>100</b>	<b>6</b>	<b>100</b>

The ultrasonographic features of the studied lesions, was compared with the pathological results and were summarized in Tables 3. As regard Doppler internal vascularity, 25 lesions were found to be as follow: 19 lesions (76%) showed no internal vascularity by Doppler study while 6 lesions (24%) showed internal vascularity by Doppler study (4 were malignant and 2

were benign). The relation between the pathological results and types of complex cysts are summarized in (Table 4). All type I complex cysts (n=2) were benign, and the histopathological findings confirmed that one case (50%) was breast abscess, and the other one (50%) was FCC. Type II complex cyst lesions (n=3) (complex cystic breast lesion with solid component less than

50%), two lesions were benign the histopathological findings confirmed that one was intraductal papilloma (33.3%) and the other was fibroadenoma (33.3%); and one lesion was malignant (33.3%) the histopathological findings confirmed that it was IDC. Three lesions of type III (n=6) were benign, and the histopathological

findings confirmed that two of them (33%) were fibroadenomas and one (17%) were focal adenosis while the other three lesions (50%) were malignant, and the histopathological findings confirmed that two of them (33%) were IDC and one (17%) was DCIS.

**Table (5):** Relation between pathological results and primary BIRADS category.

BIRADS	Benign n (21)		Malignant n (4)		Total n (25)	
	N	%	N	%	N	%
II	6	100	0	0	6	100
III	8	100	0	0	8	100
IV	7	64	4	36	11	100
<b>Total</b>	<b>21</b>	<b>100</b>	<b>4</b>	<b>100</b>	<b>25</b>	<b>100</b>

**Table (6):** Relation between pathological results and primary BIRADS category.

Type of cyst:	Benign (n=21)		Malignant (n=4)		PPVs
	No	%	No	%	
Simple	6	100	0	0	0.0
Clustered microcysts	1	100	0	0	0.0
Complicated	7	100	0	0	0.0
Complex	7	64	4	36	36

The relation between the assigned BIRADS category and the histopathological analysis of all cyst lesions were discussed in table 5. All the 6 lesions (100%) which were classified as BIRADS II, as well as all the 8 lesions (100%) which were classified as BIRADS III are proved to be benign. The 11 lesions were classified as BIRADS IV; four of them (36%) were malignant and 7 lesions (64%) were benign. The PPV for malignancy in each type in our study are summarized in table 4. The PPVs for

malignancy in simple, clustered microcysts and complicated cysts is 0%, while the PPVs for complex cyst were 36 % (Table .6).

#### 4. Discussion

ESP This study aimed at the analysis of the features of cystic breast lesions at mammography, ultrasonography and to determine its appropriate Breast Imaging Reporting and Data System (BIRADS)

categories This study was carried out on 25 patients with clinically and mammographically detected breast lesion that was diagnosed by ultrasonography as cystic breast lesion, of ages ranging from 22 years to 70 years with mean age of 42 years. Taşkın et al., 2010[8] found that average age of 60 women was  $45 \pm 8$  years who have breast cyst. Concerning the bilaterally, In the present study it was found that unilateral affection was found in 68% of the cases while bilateral affection was in 32% of them. The right breast had the highest incidence in the unilateral cases, being 44%, the remaining 24% were in the left breast. Starvik et al., 2009[9] found that 93.7% of the cases were unilateral, while only 3.3% were bilateral. The left side had an incidence of 53.3%, while the right side was 43.3%. Mammography was performed for all 25 patients and the results were distributed as follows: 4 (16%) lesions were not seen at mammography. Twenty-one (84%) lesions were manifested as masses (n= 14), mass with microcalcifications (n=4) and as focal asymmetries (n = 3). Hsu et al., 2011[10] where from 143 lesions with mammographic correlations, 44 (31%) lesions were not seen at mammography. Ninety-nine (69%) out of 143 lesions were evident mammographically and manifested as masses (n = 84), as groups of microcalcifications (n = 3), as masses with microcalcifications (n = 10), and as focal asymmetries (n = 2). On comparing the results according to the ultrasonographic features, concerning the margin of the cysts, all the four malignant lesions in our study 100% (4 of 4), had a non-circumscribed margin; this comes in harmony with the reported results of Hsu et al., 2011[10] where 77 cases were reported with non-circumscribed margin, were 38% of which (29 of 77) were pathologically proven to be malignant, while only 5% (4 of 75) of cases with circumscribed margins were proved to be malignant . Six of the reported cases had intra-lesional vascularity by color Doppler, 66.7% of which (4 of 6) were pathologically proven to be malignant. Stating that intra-lesional

vascularity is a good positive. On analysis of relationship between cyst type and pathological results of present study, it was found that all simple, clustered microcysts and complicated cysts are benign, while 4 out of 11 complex cysts of the study were proved malignant. So simple cyst, the vast majority of asymptomatic cysts, complicated and clustered microcysts can be dismissed as benign findings provided strict criteria are used; any suspicious change should prompt biopsy. Yao, et al., 2017[11] found that of 79 complex cysts with solid component, 28 were malignant. Concerning the pathological result, we found that benign cysts were 84 % of the cases, the majority of benign lesions was fibrocystic disease with 44 % (11 of 25), and malignant cysts were 16 % of the cases (4 of 25). Kumar, et al., 2010[12] found that fibrocystic diseases were 41% of cases and neoplastic lesions 7.4% of cases. Upon analyzing the relation between the type of complex cyst and the assigned BIRADS category and the histopathological analysis we found that: Type I complex cysts in our study were assigned BIRADS 4a .and all the type I cases were histopathological found to have benign features. Opposing to Chang et al., 2007 [13] which reported that 25.9% their type I cysts were pathologically proven to be malignant. Whereas for Type II three lesions were assigned BIRADS 4, Histopathology reported that 67% had benign features, and 33% had malignant features (IDC) as well which is in accordance with the BIRADS categorization. Pongrattanaman, S., & Prueksadee, J., 2013[7] reported that 38% (14 of 37) of type II complex cyst were pathologically proven to be malignant. Type III complex cysts (6 lesions) in our study were assigned BIRADS4, histopathology reported that 50% of them (3 of 6) had benign features , and 50% ( 3 of 6) had malignant features .The most common benign histopathological diagnosis reported for type III complex cyst was fibroadenoma 33% of type III, and the most common malignant histopathological diagnosis for type III was IDC 33% of type



III .Yao, et al., 2017[11] reported fibrocystic changes as the most common benign diagnosis in type III complex cysts (20.7% of type III) (6 of 29 lesions) and IDC as the most common malignant diagnosis for type III cysts (17.2% of type III cysts) (5 of 29 lesions) . The PPVs for malignancy in simple, clustered microcysts and complicated cysts is 0%. While the PPVs for complex cyst was 36%, the values were increasing from type I to type III with a 50 % for type III and a 0% for type I, stating that the risk of malignancy increases with the increase in cyst type, which was in harmony with Hsu et al., 2011[10] where they reported the PPV to increase with the increase in the type of complex cyst.

### 5. Summary and conclusion

- Breast cysts are amongst the more common reasons for referral to a breast clinic.

- Cyst cannot be reliably diagnosed with mammography alone, further evaluation with ultrasound is necessary.
- The accuracy of sonography in detecting and allowing correct diagnosis of cyst has been reported to be almost 100%.
- Sonography is the modality of choice for diagnosing the presence of an intracystic growth and in characterizing and guiding biopsy of these lesions
- Simple, clustered microcysts and complicated cysts can be dismissed as benign findings since 100% of the cases were found to be benign by histopathological assessment.
- Complex cystic breast masses are suspicious ultrasound findings that usually need biopsy.

### References

1. Doshi, D. J., March, D. E., Crisi, G. M., & Coughlin, B. F. (2007). Complex cystic breast masses: diagnostic approach and imaging-pathologic correlation. *Radiographics*, 27(suppl\_1), S53-S64.
2. Chen, M., Zhan, W. W., & Wang, W. P. (2014). Cystic breast lesions by conventional ultrasonography: sonographic subtype-pathologic correlation and BI-RADS Assessment. *Archives of medical science: AMS*, 10(1), 76.
3. Vachhani, P. G., Shah, A., Kelly Fabrega-Foster, M. D., & Harvey, S. (2017). Cysts with masses and masses with cysts: an imaging review of cystic breast masses. *Appl Radiol*, 46(10), 8-18.
4. Aujero, M. P., Tirada, N., & Khorjekar, G. (2019). Asymptomatic complicated cysts in postmenopausal women: is tissue sampling unnecessarily high? *Academic radiology*, 26(7), 900-906.
5. Zhang, Y., Zhao, C. K., Li, X. L., He, Y. P., Ren, W. W., Zou, C. P., ... & Xu, H. X. (2017). Virtual touch tissue imaging and quantification: value in malignancy prediction for complex cystic and solid breast lesions. *Scientific reports*, 7(1), 1-10
6. Berg, W. A., Campassi, C. I., & Ioffe, O. B. (2003). Cystic lesions of the breast: sonographic-pathologic correlation. *Radiology*, 227(1), 183-191.
7. Pongrattanaman, S., & Prueksadee, J. (2013). Sonographic-pathologic correlation of complex cystic breast lesions. *Asian Pacific Journal of Tropical Disease*, 3(1), 51-55.
8. Taşkın, F., Köseoğlu, K., Özbaş, S., Erkuş, M., & Karaman, C. (2010). Complex breast cysts: sonographic findings and histopathologic results.

9. Satvik, P. G. (2009). Benign Breast Disease: A comparative Study of Clinical Findings, Ultrasonography and Histopathology (Doctoral dissertation, RGUHS).
10. Hsu, H. H., Yu, J. C., Lee, H. S., Lin, W. C., Chang, W. C., Tung, H. J., ... & Hsu, G. C. (2011). Complex cystic lesions of the breast on ultrasonography: feature analysis and BI-RADS assessment. *European journal of radiology*, 79(1), 73-79.
11. Yao, J. P., Hao, Y. Z., Chang, Q., Geng, C. Y., Chen, Y., Zhao, W. P., ... & Zhou, X. (2017). Value of ultrasonographic features for assessing malignant potential of complex cystic breast lesions. *Journal of Ultrasound in Medicine*, 36(4), 699-704.
12. Kumar, R. (2010). A clinicopathologic study of breast lumps in Bhairahwa, Nepal. *Asian Pac J Cancer Prev*, 11(4), 855-8.
13. Chang, Y. W., Kwon, K. H., Goo, D. E., Choi, D. L., Lee, H. K., & Yang, S. B. (2007). Sonographic differentiation of benign and malignant cystic lesions of the breast. *Journal of ultrasound in medicine*, 26(1), 47-53.