

Breast Cysts with Masses versus Breast Masses with Cysts: Sonographic Sub-types of Complex Breast Cysts with Pathologic Correlations

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Abstract

Background: Cystic lesions of the breast are generally classified as simple, complicated or complex. A complex breast cyst is however defined as a lesion which contains both cystic (anechoic) and solid (echogenic) components. There is a need to understand the sonographic criteria and differential diagnoses of complex cysts which have varying risks of malignancy, as against simple or complicated cysts which are typically benign. **Objectives:** To examine the sonographic subdivisions of complex breast cysts, correlating with histopathological diagnosis as seen in Ahmadu Bello University Teaching Hospital, Zaria. **Materials and Methods:** A 5-year retrospective review of 106 women who had complex breast cysts diagnosed on high resolution ultrasound (Mindray DC- 8, 2013; transducer frequency 7.5–12 MHz). The lesions were categorized as: Type 1 (cysts with thick wall or septa), Type 2 (cysts with a small mural nodule), Type 3 (cystic and solid lesion with >50% cystic component), Type 4 (cystic and solid lesion with >50% solid component). The final diagnosis was either by short term ultrasound follow-up, Ultrasound-guided fine needle aspiration cytology/core biopsy or excision biopsy. **Results:** Out of a total of 248 patients with breast cysts, 106 women had complex cysts. 27 (25.4%) patients had cysts with either thick wall or septa or both; 11 (10.4%) had a small intra-mural nodule; 14 (13.2%) had solid-cystic mass with >50% cystic component and 54 (50.9%) had solid-cystic mass with >50% solid component. Overall 66% were benign while 34% were malignant. The commonest pathology to present as a complex breast cyst was invasive ductal carcinoma not otherwise specified. **Conclusion:** Complex cysts are associated with varying risks of malignancy. Also, a certain pathology could exhibit sonographic features of any of the subdivisions (Type 1-4). Therefore, meticulous attention should be paid to other associated imaging findings as well as detailed history and thorough clinical examination.

Keywords: Breast, complex cysts, ultrasound, pathology

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INTRODUCTION

Symptomatic and asymptomatic cysts are a usual finding in women between 30 and 50 years old. Ultrasound imaging is a reliable discriminatory tool between solid masses and cystic lesions. Simple cysts are uniformly anechoic, with a thin wall and no echogenic components; while complicated cysts are simple cysts which contain moving or layering debris. These two types of cysts are usually straightforward to diagnose on ultrasound and are generally dismissed as benign. However, there exists a third, intermediate group of cystic breast lesions which show both cystic (anechoic) and solid (echogenic) components, and they are described as complex cysts. The solid component could be thick wall or septations (>0.5mm)

or both, a mural nodule (intra-cystic mass), or a mass with varying proportions of cystic and solid components.^[1,2] Each subdivision of complex cyst has different malignancy risks and each involves several pathologies. Ultrasound-guided biopsy is the method of choice for obtaining tissue for histologic confirmation. According to the American college of Radiology Breast Imaging Reporting and Data System (ACR BI-RAD),^[3]

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complex cysts are assigned category of 4 (suspicious abnormality) which has a probability of malignancy between 2% and 95% and usually warrant biopsy. Sometimes biopsy may also be required for a cyst whose sonographic features are of a probably benign lesion (BI-RADS 3), where history is inadequate or when sonographic features overlap. Complex cysts particularly need to be differentiated from complicated cysts (BI-RADS 3) which are managed by ultrasound follow-up only.

Our objective was to present the differential diagnosis of the complex cystic masses with clinical and pathologic correlations seen at our institution.

MATERIALS AND METHODS

Following ethical approval, we conducted a search of the ultrasound data bases of our institution for patients with cystic breast lesions between January 2016 and December 2019. We also reviewed their medical records and final pathological diagnosis.

The patients had breast ultrasound scans using a Mindray DC-8 2013 machine with a transducer frequency 7-12.5MHz. Two radiologists (11 and 3-years' experience in breast imaging) reviewed the ultrasound images and the findings were recorded by consensus.

The complex cysts were grouped into 4 categories using sonographic features, according to the criteria by Hsu *et al.*^[1] and Berg *et al.*:^[2]

1. Type 1: lesions with a thick (>0.5mm) outer wall or internal septa or both
2. Type 2: Cysts containing a small solid, mural component
3. Type 3: lesions containing mixed cystic and solid components, with greater than 50% cystic component (intra-cystic masses)
4. Type 4: lesions made up of greater than 50% solid components or predominantly solid mass but contains a central or eccentric cystic foci.

Mammograms (MLO and CC views) where available were reviewed and recorded.

RESULTS

There was a total of 106 patients (105 females and 1 male) had palpable lesions that were diagnosed as complex cysts. The patients ranged in age from 4 years to 74 years, with a mean age of 35.76 ± 12.3 years. The lesions involved the right sided in 62 (58.5%), left side in 40 (37.7%) and bilateral in 4(3.8%) patients. Single lesion was seen in 76(71.7%), while they were multiple in (28.3%).

Twenty-seven (25.4%) patients had lesions were with thick walls or thick septations (Type 1); 11(10.4%) had small mural component (Type 2); 14 (13.2%) of the patients that had intra-cystic mass (Type 3 cyst) and 54 (50.9%) had predominantly (>50%) solid masses with cystic foci Table 1.

Out of all diagnoses of the complex cysts, commonest pathology was invasive ductal carcinoma (IDC). The overall incidence of malignancy in the study population was 34%.

Cystic masses with thick walls or septations (Type 1)

Among the Type 1 complex cysts, 85.1% were benign [Table 1], and included: abscess [Figure 1], granulomatous inflammation, galactocele, hematoma, epidermoid cyst and congenital cystic lymphangioma. Table 2 IDC [Figure 2] was seen 3(14.8%) patients.

Cystic masses with small mural nodule (Type 2)

In the Type 2 category, 7 (63.6%) were benign [Table 1] and included Intra-ductal papilloma [Figure 3], galactocele and abscess. Malignancy was recorded in 4 (36.4%) patients: 2 (IDC) and 2 intra-cystic papillary carcinoma (IPC) Table 2.

Masses with mixed cystic and solid components (>50% cystic component)

Out of 14 (13.2%) patients that had intra-cystic mass (Type 3 cyst), 9 (64.3%) were benign, including galactocele, Intra-cystic ductal papilloma [Figure 4], fibrocystic disease, oil cyst, abscess while 5 (35.7%) were malignant (IDC) Table 2.

Cystic masses (>50% solid components) or predominantly solid mass but contains a central or eccentric cystic foci

Type 4 complex cysts comprised of 54 (50.9%) cases of which 31 (57.4%) were benign and 23(42.6%) were malignant Table 1.



Figure 1: A 28-year-old woman who presented with one week history of a painful breast lump, fever. Ultrasound scan showed a cystic mass with thick irregular wall, especially posteriorly. Fine needle aspiration cytology yielded pus

Table 1: Cyst classification: Benign versus malignant

Cyst type	Benign, n (%)	Malignant, n (%)	Total
1	23 (85.1)	4 (14.8)	27 (25.4)
2	7 (63.6)	4 (36.4)	11 (10.4)
3	9 (64.3)	5 (35.7)	14 (13.2)
4	31 (57.4)	23 (42.6)	54 (50.9)
Total	70 (66.0)	36 (34)	106 (100)

The most frequent pathologies were fibroadenoma 17(51.5%), Figure 5. Others were fibrocystic disease, abscess, galactocele, phyllloides tumor. The malignancies were IDC (20), Figure 6, and ductal carcinoma in situ DCIS (3) Table 2.

Abscess, galactocele and IDC had sonographic features of all the 4 types of complex cysts.

Overall, 70 (66%) of the total 106 women with complex cystic masses had varying benign pathologies. Out of 36 (34%) diagnosed malignancies. IDC not otherwise specified (NOS) constituted 30/36 (83.3%), DCIS 4/36 (11.1%), and IPC 2/36 (5.6%).

Concordancy rate

Our sonographic findings were concordant with histology in all but 2 cases. The first case was sonographically diagnosed as galactocele (based on history of cessation of lactation) but turned out histologically as intraductal papilloma; while the second was diagnosed as fibroadenoma on ultrasound but confirmed to be benign phyllloides tumor on histology.

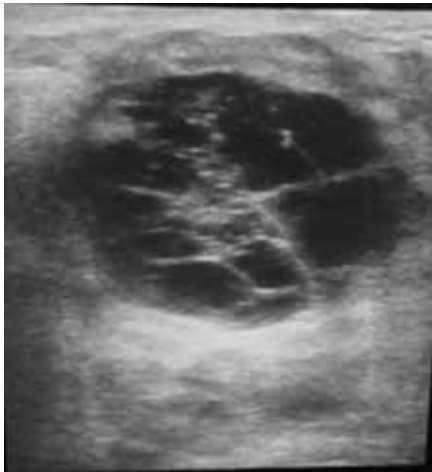


Figure 2: A 45-year-old patient with a painless left breast lump. Ultrasound scan showed a cystic mass with thick internal septae and indistinct margins. Histology was invasive ductal carcinoma

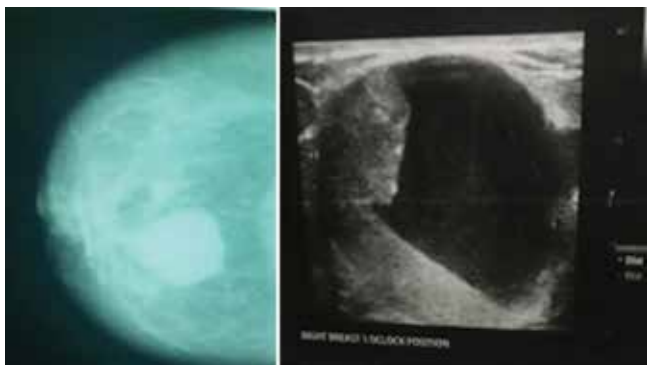


Figure 4: A 48-year-old patient with a right painless breast mass. Medio-lateral and oblique mammograms showed a high density cystic mass with circumscribed margins. Ultrasound scan revealed a predominantly cystic mass (>50%) with large solid component and layered portion. Histology was intra-ductal papilloma with hemorrhage

DISCUSSION

The three types of cysts that are identified are: simple cysts which are round or oval anechoic masses, with thin sharply defined walls, and contains no solid components while complicated cysts are simple cysts which contain low level echoes/debris that may layer or thin septa (<0.5mm). Complex cysts, which is the third type, on the other hand, contains a definite solid portion which could be; a thick (>0.5mm) wall/septa or both, a mural nodule, or solid-cystic masses in varying proportions. According to ACR BI-RADS,^[3] complex cysts are classified as category 4 but in our series, we classified other complex lesions as BI-RADS 5 category because of highly suggestive sonographic appearances of malignancy, while 2 patients had already biopsy-proven malignancies and they were assigned BI-RADS 6.

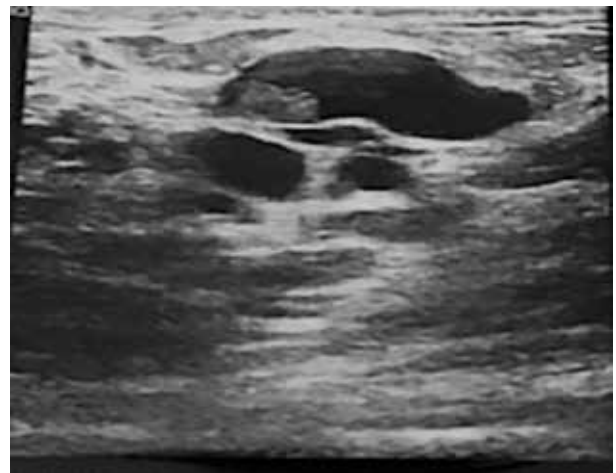


Figure 3: A 33-year-old patient who presented with a peri-areolar breast lump. Ultrasound showed a dilated duct with a small intra-ductal mass. Histology was intra-ductal papilloma.

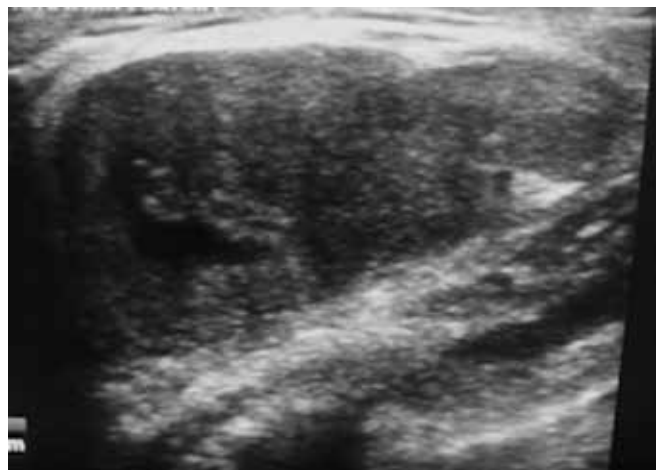


Figure 5: A 31-year-old patient who presented with a right breast mass noticed three weeks prior. Breast ultrasound shows an oval shaped hypoechoic mass, with an eccentric cystic focus. Histology revealed a complex fibroadenoma

From our study, complex cysts accounted for 106/248 (42.7%) of all the cystic lesions that were recorded during the 5-year review period. The 106 cases of complex cysts were: abscess/ inflammatory cysts (25), galactocele (8), fibrocystic disease (7), intracystic papilloma (5), hematoma (1), fat necrosis (3), fibroadenoma (17), Phylloides (2), congenital cystic lymphangioma (1), IDC (30), DCIS (4), IPC (2). Our results show that although the majority (66%) of the masses were benign, the commonest pathology was IDC.

In the ACRIN 6666 experience,^[4] the complex cysts accounted for 44% of the total cystic lesions. They were: 5 thick-walled cysts, 7 intra-cystic masses, 3 mixed cystic and solid masses, 3 hypoechoic masses with tiny cystic foci, 1 intraductal mass, and 1 postsurgical collection. There was no recorded malignancy. However, other studies have reported varying



Figure 6: A 62-year-old patient with a painless breast lump of 18-months duration. Ultrasound revealed a complex mass, with >50% solid components and cystic spaces. Histology confirmed invasive ductal carcinoma, with areas of necrosis

prevalences of malignancy from 16% by Hsu^[1] and between 23% and 31% by Doshi *et al.*^[5]

The highest incidence of malignancy (42.6%) was seen in Type 4 category, with reports of 18-61% in previous studies.^[1,2,6,7] On the other hand, the highest incidence of benign masses (85.1%) was encountered in Type 1 complex cysts.

Infection with abscess was the commonest benign condition. This was mostly associated with lactation. The usual clinical history is of a breastfeeding woman presenting with a painful breast lump and fever. The diagnosis is made clinically, however, ultrasound is useful to confirm abscess formation and guide percutaneous drainage. An abscess appears on ultrasound as an anechoic mass with a thick wall [Figure 1], or septa. There is surrounding vascularity on Doppler interrogation, suggesting peripheral hyperemia. Other associated findings include focal skin thickening and enlarged reactive lymph nodes with normal morphology. Straightforward abscess is distinguishable from a necrotic tumor which will have the greater part as a solid component. In addition, there would be other associated sonographic features of malignancy. Our management protocol of percutaneous Ultrasound-guided drainage and short term follow-up after antibiotic treatment was successful in all our cases.

The other lesions in Type 1 category were: inflammatory cysts, galactocele, hematoma, epidermoid cyst and congenital cystic lymphangioma.

The malignancy in Type 1 complex cyst were recorded in 4/27 (14%) patients, who had IDC NOS. Similar figure was recorded by Hsu *et al.* (14%)^[1] but lower figures in reports of Chang *et al.* (26%)^[6] and Berg *et al.* (30%)^[2]

Types 2 and 3 complex cysts were benign in about 64% and malignant in 36% of the cases.

Intra-cystic papilloma was the commonest pathology among Type 2 complex cysts, as was found by previous authors.^[8-10] About

Table 2: Sonographic and pathologic correlations of 106 complex cysts

Benign pathology	Type 1	Type 2	Type 3	Type 4	Total
Papilloma	0	4	1	0	5
Hematoma	1	0	0	0	1
Galactocele	4	1	1	2	8
Fibrocystic disease	0	0	3	4	7
fibroadenoma	0	0	0	17	17
Oil cyst	0	0	1	2	3
Abscess/inflammatory	17	1	3	4	25
Phylloides	0	0	0	2	2
Congenital	1	0	0	0	1
Epidermoid cyst	1	0	0	0	1
Malignant					
IDC	3	2	5	20	30
IPC	0	2	0	0	2
DCIS	0	1	0	3	4
Total (%)	27 (25.4)	11 (10.4)	14 (13.2)	54 (50.9)	106 (100)

IDC: Invasive ductal carcinoma, IPC: Intra-cystic papillary carcinoma, DCIS: Ductal carcinoma *in situ*

8-9% of all cystic breast lesions were found to be papillomas according to Berg *et al.*^[2] while in our study, it constituted 2%. The patients are usually between 40 and 50 years old^[8] and the mean age of our patients was 39.4 years.

On ultrasound, papillomas have a variable appearance, either as an intra-ductal mass, complex solid and cystic mass(es) or as solid mass(es). Doppler interrogation demonstrates a vascular stalk in the solid component.

The other diagnoses of Type 2 complex cysts were: galactocele, abscess, IDC and invasive papillary carcinoma.

The pathologies which constituted Type 3 complex cysts were: fibrocystic disease, galactocele, intraductal papilloma, oil cyst, abscess and infiltrating ductal carcinoma (4/14).

Results from our study show that Type 4 complex cyst (solid –cystic masses with >50% solid component) was the most prevalent sub-division. Among this category, 57% of the cases were benign and the commonest benign mass was a fibroadenoma with cysts. According to Dupont *et al.*^[11] and Pinto *et al.*,^[12] cysts within a fibroadenoma range from 6.6% to 11% and it is referred to as a complex fibroadenoma. Complex fibroadenomas are said to be smaller and more commonly seen in older women than simple fibroadenomas. This was observed to be related to the time interval between the onset of the cellular pathology inherent to fibroadenoma formation and the regression of the mass over the years.^[13] Dupont *et al.*^[11] reported a relative risk of malignancy of 3.1 (95% confidence interval, 1.9–5.1) in complex fibroadenomas when compared with the general population. Fibroadenomas with cysts could be indistinguishable from phylloides tumor sonographically and even on cytology, because phylloides tumors also have the tendency for cyst formation although more commonly with the malignant phylloides.^[14-17]

The other benign lesions in the Type 4 subdivision include: galactocele, oil cyst, abscess, phylloides. However, the incidence of malignancy (43%) is comparable with the finding of 41% by Hsu *et al.*^[1]

We observed as with other authors that the larger the solid component of the cysts, the higher the incidence of malignancy.^[1,4,6,18]

Thus, the incidence of malignancy increased from Type 1 to Type 4 complex cyst. Because of the elevated risk, biopsy done in all our patients with Type 4 complex cysts.

Infiltrating ductal carcinoma (IDC) and ductal carcinoma in situ (DCIS) are the most common malignancies to present as complex cystic and solid masses.^[19]

The prevalent pathology in our study was IDC (20), DCIS (3). Careful attention to other associated sonographic features are important to discern between the possibility of a benign Type 4 cyst and malignant lesion. Hsu *et al.*^[1] observed that lesion diameter >2m, uncircumscribed margin, presence of other

mammographic signs were indicative of malignancy. From our study, we observed that irregular margins, skin thickening and edema, abnormal axillary lymph nodes were associated with histological diagnosis of malignancy. Thus, the patients with any one feature was assigned BI-RADS 5 (highly suggestive of malignancy).

Our study also shows a good concordance rate between ultrasound findings and pathological diagnosis (104/106) except for 2 cases. One was of benign phylloides tumor which was diagnosed on ultrasound as fibroadenoma because of extreme difficulty to distinguish the two. In another case of intraductal papilloma, the patient also had a history of recent cessation of breastfeeding and the initial imaging diagnosis was galactocele. The variable imaging characteristics of intraductal papilloma could also make the diagnosis challenging. Both cases initially had ultrasound guided core biopsy but eventually an excisional biopsy because of radio-pathological discordancy.

CONCLUSION

Complex cystic masses comprise of a wide spectrum of benign and malignant conditions. We also found that each subdivision carry a malignancy risk from 14% in Type 1 to 42% in Type 4 therefore complex cysts merit biopsy. Therefore, complex cysts should be assigned as BI-RADS 4 in accordance with ACR BI-RADS classification and BI-RADS 5 as the case may be. However, to avoid high biopsy rates for benign lesions, careful attention to history, clinical examination and further imaging like mammography or MRI should be employed. USS guided Core Needle Biopsy is the method of choice for obtaining tissue sample but where there is a radio-pathologic discordance, a repeat core- needle biopsy or surgical biopsy should be done.

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Conflicts of interest

There are no conflicts of interest.

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