Original Article

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Radiology Section

Distribution of Different Types of Cystic Breast Lesions and their Imaging Features: A Retrospective Observational Study

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ABSTRACT

Introduction: Cystic disease of the breast is very common and present in women aged 35-50 years. They can be detected incidentally or present with lump, pain, or discharge. Confusion occurs in the appropriate classification and management of such cystic lesions. These lesions characteristically appear as circumscribed masses on mammography, but can be properly evaluated on ultrasound. Although the variable imaging features sometimes necessitate biopsy for confirmation of the diagnosis.

Aim: To estimate the prevalence of different types of cystic breast lesions and to study the imaging spectrum and features of cystic breast lesions.

Materials and Methods: This descriptive observational retrospective study was undertaken on all the women who presented for screening or diagnostic mammography and had ultrasonographically detected cystic component in the breast lesions. Based on the mammography and ultrasonographic features, cystic lesions were classified and final Breast Imaging Reporting and Data System (BI-RADS) category was assigned. Fine Needle Aspiration Cytology (FNAC) or biopsy was performed whenever required. The values were represented in number and percentage.

Results: Out of 836 women who had undergone mammography and Ultrasonography (USG), 134 patients were diagnosed with cystic breast lesions. Simple cyst with or without fine septa was most common type of cystic lesion present in 53 (39.6%) cases. It was followed by complex solid cystic lesion seen in 36 (26.8%) cases, complicated cyst 30 (22.4%) and complex cyst with thickened wall or septa in 15 (11.2%) cases.

Conclusion: Cystic breast lesions are common entities with variable and overlapping imaging characteristics, based on which they can be categorised as BI-RADS 2 to BI-RADS 5 lesions.

Keywords: Breast cyst, Complicated cysts, Complex cyst

INTRODUCTION

Breast Cysts (BC) are one of the most frequently encountered and accidentally detected breast conditions while performing an imaging investigation. The peak incidence occurs between 35 to 50 years of age [1]. Hormonal influence is the major factor determining the number and size of the cysts during the menstrual cycle explaining their prominence in premenstrual phase [1,2]. Postmenopausal women on hormone replacement therapy are also known to have BC [1,2]. These cysts may be asymptomatic or may present with pain, lump, or nipple discharge. Patients diagnosed with benign breast disease but having a family history of breast cancer have elevated risk for breast cancer [3-5].

Few studies report that in women, the lifetime prevalence of fibrocystic breast disease might be between 70-90%. Out of these, 20% are symptomatic and 10-30% developing sclerosing adenosis [6,7]. Simple and complicated cysts are more common. The majority of complicated and clustered microcysts are benign while complex cystic and solid masses or cysts with thick wall or septations are malignant in 36% of cases [8]. The challenge for the radiologist lies in differentiation of a complicated cyst from a complex cystic mass or benign cyst from a malignant cyst as it changes the patient's management. This differentiation is based on the imaging appearance of these lesions. Hence, present study aimed to estimate the prevalence of different type of cystic breast lesions and to study the imaging spectrum and features of cystic breast lesions.

MATERIALS AND METHODS

This retrospective descriptive observational study was undertaken at breast imaging unit of Department of Radiodiagnosis, Dr. Ram Manohar Lohia Institute of Medical Sciences Lucknow, Uttar Pradesh, India. Data of patients who had undergone mammography between March 2020-September 2021 was analysed in March-April 2022. The study was approved by the Ethics Committee of our institute (IEC no- 20/22) and the requirement for written consent was waived off as present study was retrospective in nature.

Inclusion criteria: All women who came to Department of Radiodiagnosis for screening or diagnostic mammography and had ultrasonographically detected cystic component in the lesion were included in the study.

Exclusion criteria: Cystic breast which were categorised as BI-RADS-3 but couldn't be followed atleast once during the study duration were excluded from the study. Similarly, BI-RADS 4 lesions which couldn't be followed-up after histopathological examination were also excluded from the study.

Image acquisition and interpretation: All the patients underwent digital mammography in two standard views: Medio Lateral Oblique (MLO) and Cranio-Caudal (CC) on digital mammography unit (GE Healthcare Senographe Essential 54020/CESM/SenoclaireA.6). Additional views like spot compression, tangential, axillary tail and cleavage views were also taken wherever necessary. A 3D Digital Tomosynthesis in a single view (MLO) was also performed in all the cases. Ultrasound examination with Doppler study was done on Supersonic AIXPLORER Multiwave Version12.2.0808 USG scanner using 2-10 Hz and 5-18 Hz probes.

In the present study, the content of the cyst (fluid or debris), thickness and vascularity of cyst wall and septa, soft tissue component, and vascularity were evaluated. Emphasis on the shape, margin, echogenicity, and presence of intralesional calcification within these cysts was also done. Based on the mammography and USG features, cystic breast lesions were categorised as follows [9,10].

Simple cyst: Round, oval, or smoothly lobulated avascular anechoic lesion with imperceptible wall and posterior acoustic enhancement.

Clustered microcyst: Circumscribed, microlobulated or oval mass composed of multiple small adjacent cysts separated by thin (<0.5 mm) septa.

Complicated cyst: Oval or round avascular mass with imperceptible walls, internal echoes or fluid-debris level, and posterior acoustic enhancement. Galactocele, oil cysts, acute fat necrosis, haematoma, filariasis, cysticercosis, and frank abscess were included in this category.

Complex cyst: Cysts with the thick wall (≥0.5 mm) and or thick septations (≥0.5 mm),

Cystic and solid masses: An intracystic mass or solid masses with cystic areas.

After assessing the clinical, mammography, and sonographic features, the final BI-RADS category was assigned as per 5th edition of ACR-BIRADS Atlas [11]. Biopsy was performed in the lesions with solid components or thickened walls or septa i.e., BI-RADS-4. Cystic lesions with BI-RADS-3 category and follow-up USG done after six months were included.

STATISTICAL ANALYSIS

Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0 Software. The values were represented in number and percentage.

RESULTS

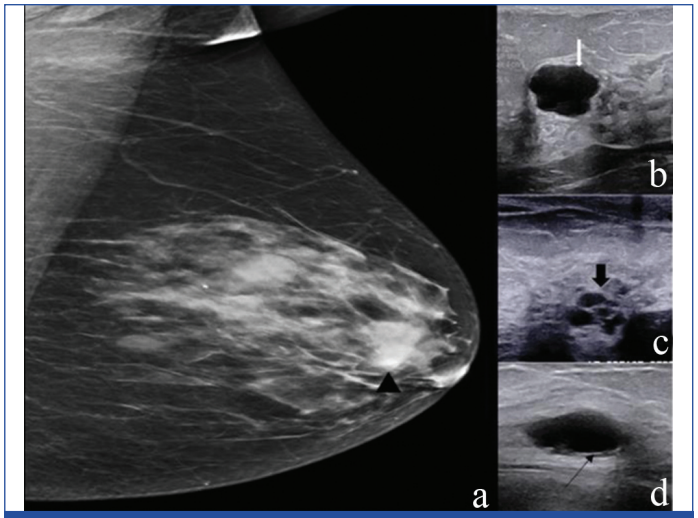
Out of 836 women who had undergone mammography and USG, 134 patients were diagnosed with cystic breast lesions. Their age ranged from 28-76 years with mean age of 45.68±8.07 years.

Simple cyst was the most common entity present in 53 (39.6%) cases of BC [Table/Fig-1]. Out of these, 43 (32.1%) cysts were anechoic without any internal content but 10 (7.5%) cases showed thin avascular septae or clustered microcysts [Table/Fig-2]. All these lesions were categorised as BI-RADS 2 lesions.

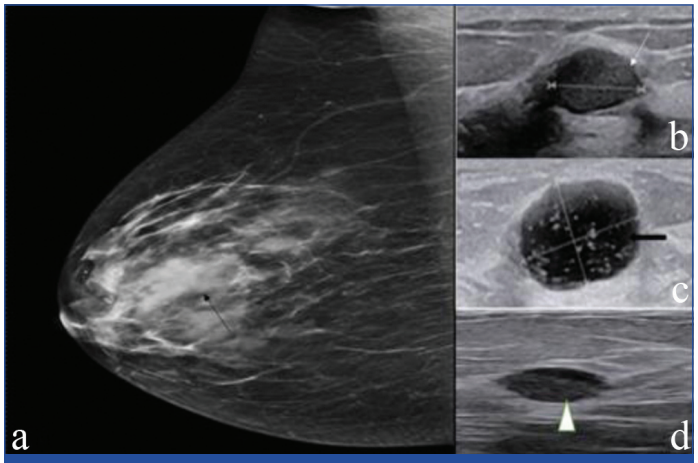
Type of cystic Lesion	Number of lesions based on imaging n (%)	Final diagnosis based on clinical, imaging or HPE features
Simple cyst without additional features	43 (32.1)	43
Simple cyst with thin septa or clustered microcysts	10 (7.5)	10
Complicated cysts	30 (22.4)	30
• Cysts with echoes	9 (6.7)	9
• Galactocele	4 (3)	4 (3+1*)
• Acute fat necrosis	4 (3)	4
• Oil cyst	7 (5.2)	7
• Haematoma	2 (1.5)	2
• Abscess	2 (1.5)	2
• Parasitic (Filariasis+cysticercosis)	2 (1.5)	2
Complex cysts with thickened wall or septa*	15 (11.2)	1-Invasive ductal carcinoma 14- Benign cyst
Cystic lesion with soft tissue*	36 (26.8)	
• Carcinoma	26 (19.4)	26
• Phyllodes	3 (2.2)	3
• Papilloma	5 (3.7)	5
• Granulomatous	2 (1.5)	2
Total	134	134

[Table/Fig-1]: Distribution of cystic breast lesions based on imaging features.
*cases that had undergone biopsy.
HPE: Histopathological features

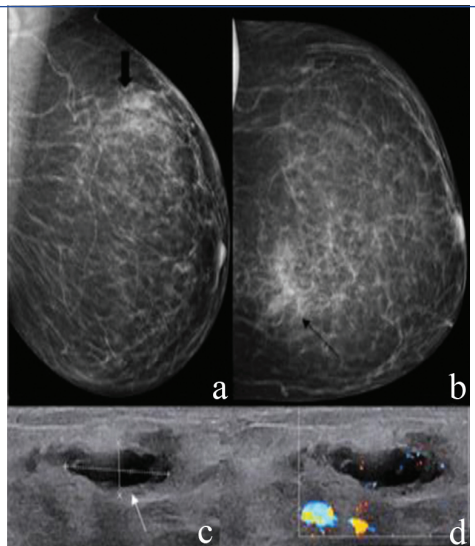
Complicated cysts with moving or homogenous echoes or fluid-debris level was seen in 30 (22.4%) of cases [Table/Fig-3]. Out of these, an oil cyst was most common seen in 7 (5.2%) followed by acute fat necrosis and galactocele 4 (3%) each [Table/Fig-4,5c,d]. Haematoma, Abscess [Table/Fig-5a,b] and parasitic cysts were present in 2 (1.5%) each. Parasitic cysts including filarial and



[Table/Fig-2]: Simple cyst: (a) Mammogram in MLO view shows well circumscribed lesion (black arrowhead); (b) USG correlation shows well defined anechoic lesion (white arrow) with posterior acoustic enhancement; (c) In another patient, USG shows clusters of multiple small cysts (black thick arrow); (d) Fine septa near the base of the simple cyst (black thin arrow).

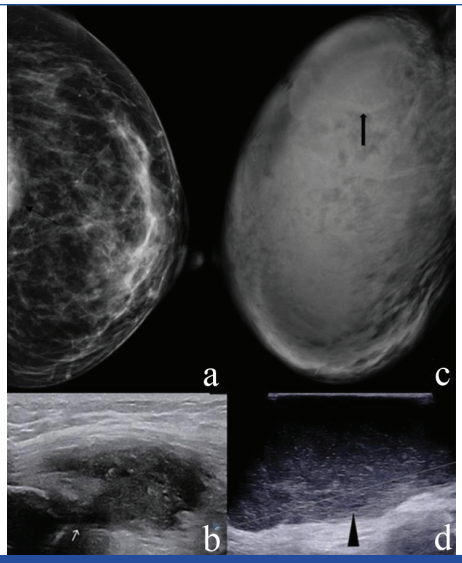


[Table/Fig-3]: Complicated cyst: (a) Mammogram in MLO view shows an obscured radiodense lesion (black thin arrow); (b) USG shows homogenous debris within the cyst (white arrow); (c) USG in different patients show free floating echoes within the cyst (black thick arrow); and (d) fluid debris level (white arrow head).

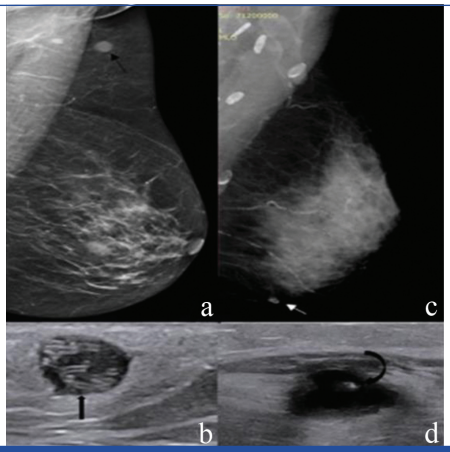


[Table/Fig-4]: Mammogram in MLO (a) and CC view (b) shows a small irregular lesion with adjacent trabecular thickening in upper inner quadrant (black thick and thin arrow). USG shows cystic lesion (white arrow) with adjacent inflamed echogenic fat lobules suggesting fat necrosis which was confirmed after biopsy (c) and (d).

cysticercosis were seen in one woman each [Table/Fig-6]. All these lesions were also categorised as BI-RADS 2 or 3. Out of four cases of galactocele, three showed typical features whereas one case was mimicking a solid lesion so BI-RADS category 3 was assigned and short-term follow-up was advised. However, considering her anxiety



[Table/Fig-5]: (a) Mammogram in CC view shows part of a radiodense lesion in retromammary region (black thin arrow); (b) USG shows a heterogeneous collection with moving echoes deep to pectoralis muscle with extension up to the intercostal space (white arrow) suggesting the possibility of abscess. Histopathology confirmed granulomatous abscess of tubercular aetiology; (c) Mammogram in MLO view of a lactating woman shows well-circumscribed oval lesion (black thick arrow); (d) USG shows a cyst with dense internal echoes suggesting the possibility of galactocele.



[Table/Fig-6]: (a) Mammogram shows a round lesion in the upper breast (black thin arrow); (b) USG shows a round cystic lesion with multiple curvilinear echogenic undulating structures representing the microfilariae; (c) Mammogram in MLO view shows multiple rice grain calcification in axilla and lower breast (white arrow); (d) USG shows thick-walled cystic lesion with eccentric echogenic focus suggesting a scolex (curved black arrow) in cysticercosis.

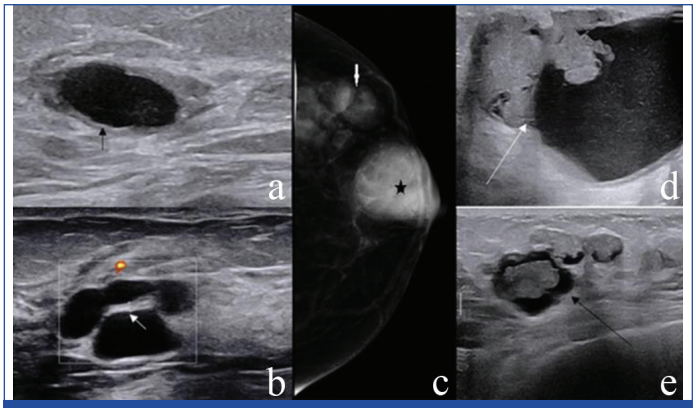
level the breast surgeon excised it and after histo-pathological examination it came out to be galactocele.

Complex cysts showing thickened wall or septae were seen in 15 (11.2%) cases and BI-RADS category 4a was assigned [Table/Fig-7a,b]. After FNAC or biopsy, only one case came out to be malignant (Invasive ductal carcinoma). Solid cystic lesions (cystic lesions with soft tissue component+solid lesions with cystic component) were identified in 36 (26.8%) cases. Out of these, imaging features suggested papilloma (BI-RADS 2) in 5 (3.7%) cases which were proven after micro-dichotomy [Table/Fig-8].

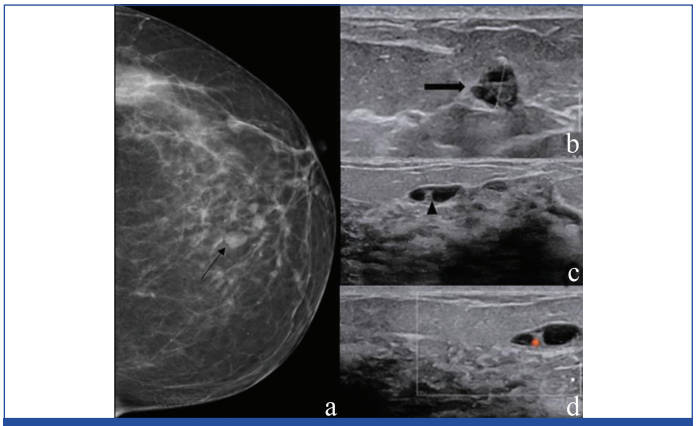
Clinical and imaging features suggested phyllodes in 3 (2.2%) and carcinoma in 26 (19.4%) cases and BI-RADS category 4 was assigned [Table/Fig-7,c-e, 9]. After Trucut biopsy or surgery (n=31), final diagnosis of phyllodes was made in 3 (2.2%) and carcinoma in 26 (19.4%) cases. Two cases were proven as granulomatous mastitis.

DISCUSSION

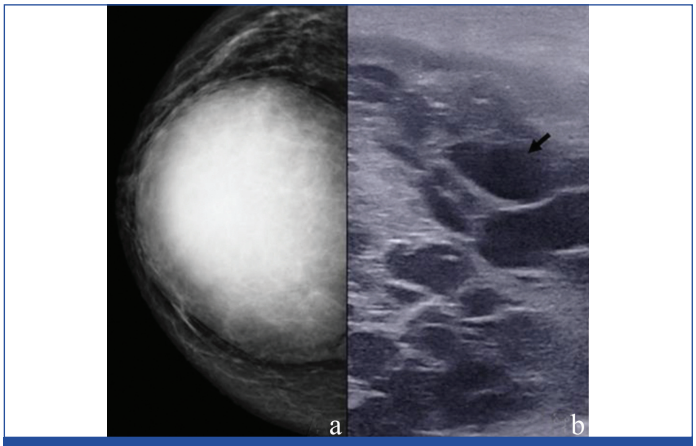
Cystic lesions of breast represent a broad clinicopathological entity including fibroglandular proliferation, developmental abnormalities, inflammatory, benign, and malignant pathology [10]. Mammography is helpful in characterisation of the masses and depiction of associated



[Table/Fig-7]: Ultrasound shows: (a) Complex cyst with thickened wall; and (b) Thickened septa (white thin arrow); (c) Mammogram shows multiple round circumscribed lesions, largest in retroareolar region (white arrow and black star); (d,e) USG shows multiple solid cystic lesions (white and black thin long arrow) and was categorised as BI-RADS 4. Histopathology confirmed intracystic papillary carcinoma.



[Table/Fig-8]: (a) Mammogram shows multiple round and oval lesions (black thin arrow); (b) USG correlate of same lesion shows cystic lesions with soft tissue nodule (black thick arrow); (c) USG in another patient shows a cyst with soft tissue nodule (black arrowhead); and (d) Vascular stalk. After biopsy, final diagnosis of intracystic papilloma was made.



[Table/Fig-9]: (a) Mammogram in MLO shows a large circumscribed radiodense lesion; (b) USG shows a huge solid mass with multiple cystic spaces (black arrow) suggesting the diagnosis of phyllodes which was confirmed after histopathological examination.

microcalcifications [12]. It also provides critical information required for further management of these lesions. If a lesion demonstrates fat component at mammography, it favours a benign aetiology (oil cyst or galactocele), and biopsy can be avoided [13,14]. USG is the modality of choice for the confirmation and characterisation of cystic lesions [15]. Colour Doppler interrogation can provide additional information by assessing the vascularity of the lesions, especially those with thickened wall or septae or soft tissue components. It is particularly helpful in differentiation of intracystic soft tissue component versus organised adherent debris in atypical cases [16]. USG can also help to depict intraductal extension, pectoralis muscle involvement, and status of the axillary lymph node.

In the present study, simple cysts were identified in 39.6% of cases which was higher as compared to the previous study by Hilton SV et al., [17]. But present study findings were close to those seen in the American College of Radiology Imaging Network (ACRIN) 6666 protocol. They had shown cysts in 37.5% women in the first round of screening USG and 47.1% over the three years [18]. These are BI-RADS 2 findings and do not require any follow-up. Intervention is required only if the simple cyst is increasing in size, symptomatic, or very large causing discomfort to the patient, in such cases, it should be aspirated or sent for FNAC. In the present study, complicated cysts were seen in 22.4% population which was higher as compared to ACRIN participants (14.1%). Out of these, 4.5% had shown fluid- debris level and 2.2% showed mobile echoes as compared to 7.4% and 6.1% seen in previous study [18]. Berg WA et al., mentioned the occurrence of complicated BCs in approximately 17% of ultrasonographically detected cysts which was close to present study results [19]. Of these complicated cysts, galactocele was identified in 3% of cases. The results were in accordance with previous studies where incidence was found to be 5.71% and 1.3%, respectively [20,21].

Acute fat necrosis in present study was found in 4 (3%), which was comparable to results from previous study which proved incidence to be 2.75% of all breast lesions [22].

Oil cysts, a particular type of fat necrosis, occur when injured fat cells release their lipid content into adjacent parenchyma. The lipids are broken down into fatty acids, which are bounded by a fibrous capsule that calcifies over time. In the present study, these cysts were seen in 7 (5.2%) cases. Oil cysts can straightforwardly document on mammography as round or oval, circumscribed, lucent masses with a thin capsule which may show egg-shell calcification due to saponification of the fatty acids. On USG, most oil cysts are smooth-walled hypo-echoic lesions without posterior features. Fat-fluid levels and rim calcifications may be seen [23].

A haematoma classically presents after surgery or trauma, but it may also occur spontaneously. The imaging appearance is determined by the age of the blood products and range from a simple cyst in hyperacute phase which rapidly becomes a complicated cyst and may transform to a complex cyst with internal debris and a thick echogenic wall with or without avascular mural nodule and septa. In a proper clinical setting these lesions may be categorised as BI-RADS 2 or 3 lesions and may be followed to resolution. However, if there is no history of recent trauma, aspiration with possible biopsy is warranted, requiring a BI-RADS4 classification in some cases [24]. In present study, it was seen in 2 (1.5%) cases and both women gave the history of some sort of trauma.

Breast abscess usually presents with pain, redness, and a palpable lump, while fever is infrequently encountered. Sometimes, clinical examination is not able to differentiate an abscess from mastitis, especially if the collection is deeply seated or is small. In the appropriate clinical setting for e.g., a palpable lump or a localised area of tenderness, USG is the first-line investigation as it is relatively painless, provides guidance for percutaneous drainage, and allows regular follow-up during the course of treatment. Mammography is recommended to exclude malignancy in women with atypical clinical presentation and in breastfeeding women when the clinical course is prolonged [25]. Mammography should be delayed until after the acute episode because of patient discomfort and suboptimal examination yield. The inflamed breast allows lower degree of breast compression and leads to increased mammographic radiopacity which can mask an underlying lesion [25]. Mammography can demonstrate cutaneous thickening, asymmetry, mass or architectural distortion. USG features include localised hypoechoic collection with a thick echogenic hypervascular periphery and avascular centre along with posterior acoustic enhancement [25]. In present study, such features suggesting the diagnosis of abscess were seen in 1.5% of cases of all cystic breast lesions.

Filariasis is a worldwide health problem, especially in tropical countries in Asia, Africa, and South America [26]. In India, filariasis is endemic in many states. Although disease is common in India but breast is an uncommon site. In the breast upper outer quadrant is most commonly affected, but central or periareolar nodules are also found [27]. In the present study, single case of breast filariasis (0.75%) in the upper outer quadrant of left breast was found. Its importance lies in the fact that filarial breast nodules can mimic a breast neoplasm and can pose a diagnostic dilemma. Therefore, a high index of suspicion, especially in patients from endemic areas, should be kept in mind so as to avoid unnecessary interventions. Although, present case showed typical features of the “filarial dance sign”.

Cysticercosis is a public health hazard and is endemic in a number of developing countries of Asia, Central Africa and South America. Human cysticercosis can affect any organ, but is particularly common in skeletal muscle, subcutaneous tissue, brain and eyes. Involvement of the breast is extremely rare [28]. Due to the rarity of this entity, these lesions are frequently misdiagnosed as complex cyst or even carcinoma posing serious concern and demanding unnecessary interventions [29].

In present study, complex cysts with thickened wall or septa were identified in 11.2% of all cystic breast lesions. Houssami N et al., found complex BCs in approximately 5% of breast ultrasound examinations [30] whereas in present study this proportion was 1.8%. These lesions were categorised as BI-RADS 4a and had undergone biopsy or FNAC although; only one case came out to be malignant. Rest of the cases proved to be fibrocystic disease, apocrine metaplasia, infective or inflammatory.

In the present study, solid-cystic lesions were seen in 26.8% cases. This proportion was significantly higher as compared to previous study which showed presence of solid-cystic lesions in only 2.8% (complex solid cystic lesions in 1.6% and solid lesions with tiny cystic areas in 1.2%) cases [18]. This higher number in present study can be explained by the fact that ours is a tertiary care centre and a larger proportion of women who attend Breast Imaging clinic for diagnostic purposes. In the present study, intraductal breast papilloma was present in 3.7% of all cystic lesions. In previous studies by Berg WA et al., and Omori LM et al., papillary lesions were identified in 8% and 9% of all cystic lesions, respectively [19,31]. On mammography, papillomas appear as well-defined, round, or oval lesions, directed towards the nipple, sometimes surrounded by a lucent “halo”. About 25% of papillary lesions can show calcification which can be microcalcification or coarse type [32]. On USG, papillomas appear as an intraductal mass, associated with ductal dilatation if the duct is occluded by the mass. Sometimes, these lesions can also appear as a solid mass, with a cystic component [33].

Phyllodes tumours of the breast are rare fibroepithelial tumours and constitute approximately 0.3-0.5% of all breast neoplasms [34,35]. In the present study, phyllodes tumour was identified in 2.2% of all cystic lesions and 8.3% of all lesions with solid cystic components. In previous studies by Buchberger W et al., and Liberman L et al., phyllodes tumour showed cystic components in 60% and 23% of cases, respectively [36,37]. On mammography, they appear as well-circumscribed round or lobulated masses with a radiolucent halo with or without coarse calcification. On USG, hypoechoic round or lobulated well-circumscribed lesion with echogenic rim and low-level homogenous internal echoes may be seen. Fluid-filled cystic clefts in a predominantly solid mass point in favour of phyllodes tumour.

Whenever a solid component is seen in a cystic lesion, it arise suspicion of malignancy which can be confirmed by histopathology. USG is the preferred imaging modality for malignancy prediction in complex cystic and solid breast lesions with high sensitivity (97.1%) but low specificity (32.7%) [38]. The rate of malignancy ranges from 23-31% as mentioned in previous research articles [18,39,40]. In a previous study, by Berg WA et al., and Omori LM et al., 23% and

43% of complex cystic masses were malignant [19,31]. Omori LM et al., also mentioned that out of 43% of malignant complex cystic masses, 42% showed cystic with solid components, and rest 58% presented as solid with cystic foci [31]. In the present study, 19.4% cases of all cystic lesions and 72.2% cases of solid cystic lesions were found malignant after pathological examination. Two cases were finally proved to be tubercular granulomatous mastitis which is an important differential in a country like ours, where tuberculosis is an endemic disease.

Limitation(s)

The sample size was small. Besides, ours is a tertiary care centre that gets referrals from a number of districts from Eastern Uttar Pradesh, so a large proportion of women attending the breast imaging clinic are symptomatic, and many of these women had already undergone some imaging investigation before coming to us. So, the proportion of solid cystic lesions was higher and is not representative of the general population.

CONCLUSION(S)

Present study highlighted the role of mammography and ultrasound in analysing the cystic breast lesions. Present study also emphasised that appropriate classification and BI-RADS categorisation of cystic breast lesions should be done by the radiologists to help the clinicians in deciding the appropriate management strategy.

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