Breast cystic lesions: Not so simple after all? An ultrasonographic tactical approach

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Abstract

A wide spectrum of breast diseases breast diseases have or exhibit at some point in their natural history a complex cystic aspect. Through the lens of B-mode and Doppler ultrasound with sonoelastographic augmentation, conditions ranging from the utterly benign fibrocystic change to the most intricate encysted or cystically degenerated cancerous lesions, are covered in detail in this review. The aim of this paper is to familiarize the practitioner with the ultrasonographic aspects of complex breast cystic masses and to implement a gradual, strategic approach in the diagnostic algorithm.

Keywords: complex breast cysts; B-mode ultrasound; sonoelastography

In the following article, we discuss the most common diagnostic difficulties encountered in the ultrasonographic evaluation of breast cysts. We propose a gradual, multi-levelled approach with the aim of improving the differential diagnosis, ruling out malignancy and increasing the diagnostic confidence.

Cysts are the most frequently encountered masses in the female breast. They are dilated, fluid-filled peripheral ductal segments derived from the terminal ducto-lobular unit (TDLU) as a result of fibrocystic change [1]. Most commonly they are part of a pathologic cluster that bounds together cysts, apocrine metaplasia, adenosis and stromal fibrosis in the spectrum of benign breast disease [2]. Breast cysts affect approximately 7% of female patients at reproductive age with a peak incidence between 40 and 50 years [3,4].

Although mammographic assessment can be useful in detecting cystic masses and depicting conspicuous microcalcification, ultrasound is the reference imaging method in evaluating cystic breast masses [5].

At ultrasound, depending on the intricacy of structural alterations, cystic breast lesions are assorted as either simple, complicated or complex, according to the Breast Imaging Reporting and Data System of the American College of Radiology (ACR BI-RADS® lexicon) [6].

Five criteria must be met so that one may classify a breast cystic lesion as simple [7]. A simple cyst is defined as a sonolucent, well circumscribed round or oval mass, with a thin, imperceptible outer capsule, distal enhancement and thin acoustic edge shadows (fig 1).
Table I. Ultrasonographic checklist for breast cystic lesions

<table>
<thead>
<tr>
<th>Non-suspicious (More probably BENIGN) BIRADS 3</th>
<th>Suspicious (More probably MALIGNANT) BIRADS 4a,b,c, BIRADS 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness of the cyst wall and intracystic septae</td>
<td>&gt; 0.5 mm, hyperechoic</td>
</tr>
<tr>
<td>Mural nodules</td>
<td>FIRST, CHECK MOBILITY to differentiate a mural nodule from debris due to pus or haemorrhage angiulated, irregular</td>
</tr>
<tr>
<td>Wall attachment of mural nodules</td>
<td>smooth</td>
</tr>
<tr>
<td>Cyst capsule</td>
<td>intact, hyperechoic</td>
</tr>
<tr>
<td>Echotexture of the mural nodule</td>
<td>hypoechoic, lacy</td>
</tr>
<tr>
<td>Vascularization of the mural nodule</td>
<td>avascular/single vessel</td>
</tr>
</tbody>
</table>

Any other overlying architectural changes label the lesion as either complicated – when proteinaceous content is present – or complex – in case of mixed fluid-solid lesions or intracystic growths that raise suspicion for malignancy [8,9].

However, these designations cannot, in most cases, convey the benign or malignant nature of the lesion and a more elaborate characterization is imperative. Subsequently, a correct assignment into the BI-RADS® scheme impacts the therapeutic management and the natural history of breast cystic disease. A tactical outlook is the key to optimal ultrasound characterization.

**LEVEL 1. Exclusion of pseudo-complex cystic lesions due to artefactual internal echoes**

At this entry level, the purpose is to rule out pseudo-complex cysts and solid lesions concealing as cysts due to artefactual internal echoes. This can be achieved by appropriately balancing the gain, with „isoechoic fat” serving as marker for correct attunement. Volume averaging and speckle artifacts can be suppressed with the use of newer high-resolution transducers. Reverberation echoes, appearing particularly in flattened, near-field cysts can be counterfeited by decreasing compression [8].

**LEVEL 2. Findings conspicuous of malignancy, frameable as BI-RADS 4a, 4b, 4c or 5**

Four major ultrasonographic features should be checked to rule out findings suspicious of intracystic neoplasm (Table I).

1. **Thickness.** Evaluation of outer wall/internal septation thickness is pivotal. A width of more than 0.5 mm is suspicious. Thick, isoechoic septae must be differentiated from thin hyperechoic septae/borders representing clusters of simple cysts in relation to fibrocystic change (fig 2).

2. **Mural nodules.** In the presence of an apparent mural nodule the differential diagnosis should be made with debris. This is usually dependent and mobile when changing position of the patient.

   Most mural nodules are the result of papillary apocrine metaplasia (PAM) present in the context of benign breast disease. Other intracystic papillary lesions (ICPL) such as encysted papillomas and encysted carcinomas, although rare, must be ruled out.

   The intactness of a thin echogenic capsule, a smooth attachment to the cyst wall, a hypoechoic and lacy aspect and a thin echogenic line at the inner margin of the nodule, all plead in favour of PAM.

   The lack of an echoic capsule, a relationship of the mural nodule with nearby mammary ducts, the so-called „keyhole appearance”, an angiulated and irregular attachment to the cyst wall, increased echogenicity and coarseness when analyzing texture, all advocate for an ICPL (fig 3).

3. **Vascularization.** A fibrovascular stalk is present in the case of vascular lesions such as papillomas and carcinomas, whereas paucivascularity is characteristic of PAM. A single vessel versus multiple vessels in the stalk can be ancillary findings for appropriate dichotomization of the lesion as benign or malignant (fig 4).
4. Complexity. A complex appearance given by a microcystic – microlobulated texture can be the result of volume-averaging of conglomerated microcysts, PAM and fibrosis, but it might also be the case of high-grade in situ malignancy. Sporadically, malignancies that have suffered cystic/haemorrhagic degeneration can result in mixed cystic-solid, complex aspects (fig 5) [7].

Depending on the age and/or serous content, hematomas and seromas – either post-interventional or post-traumatic changes – can, particularly in advanced subacute or chronic stages, exhibit thick, irregular wall/septae, contour irregularities and/or mural nodularity. However, at Doppler interrogation, neither of these findings show vascular internal flow (fig 6) [10].

Whenever thick septae, mural vascular nodules and complex lesions are encountered, biopsy should be performed, followed by histopathologic examination.

LEVEL 3.A. Findings suggestive of inflammation or infection, frameable as BI-RADS 3

Three ultrasonographic findings are indicative of inflammation or infection: the presence of a uniformly thickened isoechoic cyst wall, hyperemia at this level attestable by colour or power Doppler and the presence of fluid debris (precipitated leukocytes or erythrocytes), which has a dependent position in the cyst at shifts in patient position [9].

Particular caution should be exercised in the differentiation of infection or inflammation from abscedation, with the former appearing on a previously well-defined cystic structure and the latter being the result of colliquative necrosis in pristine breast parenchyma. In most cases an inflamed or infected cyst is unilocular, whereas a breast abscess is usually multilocular (fig 7).

In these cases, the proper sequence of procedures for adequate diagnosis and treatment is aspiration followed by Gramm stain, culture and antibiogram.
LEVEL 3.B. Non-infectious and non-inflammatory findings, frameable as BI-RADS 3

PAM, manifesting as an eccentric, static wall thickening with concavity towards the inside, also known as the “acorn cyst” is assigned with BI-RADS 3 [11].

In case of diffuse, low-level internal echoes filling the entire cyst, a correct segregation of either cystic or solid lesions cannot be made, thus the lesion must be assigned BI-RADS 3. Fibroadenomas, encysted papillomas, PAM entirely filling the cyst and foam/gel cysts (cysts containing echogenic fluid) are part of this category (fig 8).

While fibroadenomas and encysted papillomas have demonstrable internal flow, PAM and foam/gel cysts do not display such a characteristic. Solid lesions are usually elliptical, have normal through-transmission and fine echotexture, whereas cystic lesions are usually round, have enhanced through-transmission and a coarse texture.

The senologist can opt for short interval follow-up, aspiration or biopsy.

LEVEL 4. Findings attributable to benign alterations, frameable as BI-RADS 2

Simple cysts and cysts with thin, hyperechoic septae (conglomerates of simple cysts) are always considered benign.

Punctate, immobile or position-shift dependent intracystic microcalcifications, – the latter commonly known as “milk of calcium”– and in more advanced cases, extensive, “eggshell” calcifications, are also part of the benign spectrum, sometimes even better depicted with ultrasound than on mammographic studies (fig 9) [7]. They appear in oil cysts, galactoceles, as well as complicated (haemorrhagic or inflamed) cysts.

Fat-fluid or fluid-debris levels, usually appearing in galactoceles and fibrocystic disease, are typical benign findings. Mobile cholesterol crystals are also definitely benign ultrasonographic features. The mobility of such crystals is more evident using high transmit power, i.e. power or colour Doppler (fig 10).

Cysts of skin origin, such as sebaceous cysts are also benign findings, which can display a wide variety of ultrasonographic aspects from purely anechoic to coarse hyperechoic [12].

In these situations, a return to the screening program is optimal.

LEVEL 5. Sonoelastographic assessment

Complementing B-mode ultrasound, when correctly performed by trained radiologists, elastography, wheth-
Breast ultrasound strain-elastography is particularly useful in the case of complicated cysts, where a blue-green-red (BGR) pattern and an elasticity score (Tsukuba score) of 1-3 usually downgrades the lesion to BI-RADS 2 and elasticity scores of 4-5 are suspicious for malignancy and upgrade the lesion into the BI-RADS scheme to at least 4a (fig 11).

Complex cysts, however, are classified according to their conventional ultrasound attributes, irrespective of their alarming or reassuring elastographic appearance and elasticity score [14].

**LEVEL 6. Indeterminate findings**

In case of indeterminate findings, the designation should always be that of the higher BI-RADS category and the management accordingly.

**Conclusion**

Although complex cystic masses are commonly encountered lesions at breast ultrasound, they still pose great diagnostic difficulty, even for the experienced radiologist.

By integrating conventional ultrasonographic features with sonoelastographic properties into the BI-RADS score, following a multi-levelled approach, through proper risk stratification, the adequate management of breast cystic disease can be achieved.

**References**