Ultrasound features of retroareolar breast carcinoma

R. Ferre a,∗, M. Pare b, B. Mesurolle b

a Department of Radiology, Thunder Bay Regional Health Center, 930 Oliver Road, Thunder Bay, Ontario, Canada
b Radiology Department, MUHC, McGill University, Montreal, Quebec, Canada

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Breast carcinoma; Nipple areolar complex; Retroareolar carcinomas; Ultrasound; Breast imaging

Abstract
Purpose: The goal of this study was to report the ultrasound features of retroareolar breast carcinoma (RABC).
Materials and methods: The ultrasound examinations of the breast of 53 women with RABC were reviewed. They had a mean age of 67.2 years ± 13.4 (standard deviation [SD]) (range: 46–85 years). RABC were defined as carcinomas located less than 2 cm from the nipple on mammogram.
Results: Among the 53 RABC, 42 (42/53; 79%) were invasive ductal carcinomas, 6 (6/53; 11%) were invasive lobular carcinomas, 4 (4/53; 8%) were ductal carcinomas in situ and 1 (1/53; 2%) was intracystic papillary carcinoma. The mean size of RABCs was 22.5 mm ± 8.2 (SD) (range: 7.2–54.8 mm). RABCs presented as a mass (53/53; 100%) with an irregular shape (44/53; 83%), a non-parallel orientation (37/53; 70%), non-circumscribed margins (50/53; 94%), a hypoechoic echotexture (46/53; 87%), posterior attenuation (45/53; 85%) and increased vascularity (37/53; 70%) on Doppler ultrasound.
Conclusion: On ultrasound, RABC have a presentation similar to that of breast carcinoma in other locations.

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The nipple is an important anatomic landmark routinely used for localization in breast ultrasound by measuring the lesion-to-nipple distance. However, it is considered as a challenging region with special features and specific breast diseases [1–5].

Retroareolar breast carcinomas (RABC) account for 8% of all breast cancers and are considered more difficult to detect than cancers located elsewhere in the breast [3,6–9]. Contrary to clinical examination that is considered sensitive for the detection of retroareolar masses, RABC can be missed on mammogram and ultrasound [3,5]. Despite continuous and significant improvement in breast ultrasound that include the development of high frequency transducers, compound imaging and speckle reduction algorithms [4,10,11], the investigation of the retroareolar area with ultrasound remains challenging and can be affected by many artifacts [12].

The goal of our study was to report the ultrasound features of RABC.

Material and methods

Patients

This retrospective study was approved by our Institutional Review Board. The files of all women with breast carcinoma who had ultrasound-guided biopsy and metallic clip placement from January 2012 to December 2013 in our institution were reviewed in order to identify those with RABCs. A total of 967 women with breast cancers were initially identified. Women were excluded when the distance between the clip and the nipple was >2 cm. Women were included when they had mammogram and breast ultrasound prior to biopsy.

The study population ultimately consisted of 53 women with a mean age of 67.2 years ± 13.4 (standard deviation [SD]) (range: 46–85 years).

Imaging protocol

Mammographic protocol

All mammograms were performed using a full-field digital mammography system (Selenia Dimensions, Hologic Inc., MA, USA). Standard craniocaudal and mediolateral oblique views were routinely obtained and additional views were obtained when needed.

Ultrasound technique

Breast ultrasound was performed to evaluate specific abnormalities discovered either at clinical examination, on mammograms or on breast magnetic resonance imaging (MRI) examination, as part of the initial work-up of women diagnosed with breast carcinoma, or as an adjunct to screening mammograms in women with heterogeneously or extremely dense breasts. The entire breast was scanned [12,13]. All included women had ultrasound-guided biopsy of breast lesions with metallic clip placement before surgery. A clip marker (SurosTM, Argon Medical Device, Plano, TX, USA) was left within all biopsied lesions.

Ultrasound examinations were performed using a high resolution equipment (Aplio™, Toshiba Medical Systems, Otawara, Japan) with high frequency (7.5–13 MHz) linear array transducers (PLT1204AX, Toshiba Medical System). B-mode, Doppler and strain elastography were routinely used during ultrasound examinations, particularly in order to help identify subtle lesions prior biopsy.

Imaging analysis

Images were reviewed in a consensus reading by two radiologists specialized in breast imaging who were blinded to the final histopathological diagnosis. All post biopsy mammograms were reviewed to determine the location of the biopsied carcinoma relative to the nipple. The distance between the clip marker in the biopsied area and the nipple was measured by a radiologist. A cursor was placed between the clip marker (located within the lesion) and the nipple. A lesion was considered retroareolar when the distance between the clip marker in the biopsied lesion and the nipple was ≤2 cm on mammogram (Fig. 1) [1,5,8].

The mammographic characteristics of breast lesions and breast parenchymal density were evaluated according to the BI-RADS lexicon [13].

Conventional ultrasound images were analyzed by two radiologists (R. F., B. M.) in consensus, and classified into appropriate categories according to the BI-RADS to indicate probability of malignancy. BI-RADS 3 indicated probably benign; BI-RADS 4A/4B/4C, low/moderate/high suspicion for malignancy; and BI-RADS 5, highly suggestive of malignancy [14].

Finally, ultrasound findings were correlated with the results of clinical examination and those of other imaging studies.

Statistical analysis

Data were entered in a spreadsheet program (Excel, Microsoft). Qualitative data were expressed as mean, SD and range. Qualitative data were expressed as raw numbers, proportions and percentages.

Results

Among the 53 RABC, 42 (42/53; 79%) were invasive ductal carcinomas, 6 (6/53; 11%) were invasive lobular carcinomas, 4 (4/53; 8%) were ductal carcinomas in situ and 1 (1/53; 2%) was intracystic papillary carcinoma. The mean size of RABCs was 22.5 mm ± 8.2 (SD) (range: 7.2–54.8 mm).

Among the 53 RABCs, 29 (29/53; 54%) presented as palpable mass on clinical examination (14 associated with nipple inversion or retraction and 1 with nipple discharge), 17 (17/53; 33%) were initially mammographically detected (5 clusters of pleomorphic microcalcifications, 5 spiculated masses, 3 distortions, 2 focal asymmetries, 1 mass associated with a distortion and 1 mass associated with microcalcifications) (Figs. 2 and 3), 4 (4/53; 8%) were incidentally sonographically detected (without mammographic or clinical correlation), and 3 (3/53; 6%) were initially detected on MRI (1 mass and 2 non-masses) (Table 1).

On ultrasound, RABCs corresponded to masses (53/53; 100%) displaying the classic appearance of breast carcinoma with an irregular shape (44/53; 83%), a non-parallel
Ultrasound features of retroareolar breast carcinoma

Figure 1. Mammogram shows retroareolar carcinoma. Craniocaudal (a) and medial lateral oblique (b) view show a spiculated irregular mass (arrow) containing intralesional calcifications. The mass measures 17 mm and is located in the retroareolar region at less than 2 cm from the nipple and associated with nipple inversion.

Figure 2. 60-year-old woman in whom screening routine mammogram demonstrated a small irregular spiculated mass in the retroareolar area. Histologically the lesion was low-grade invasive ductal carcinoma; a: ultrasound image of the right breast shows an irregular, spiculated non-parallel hypoechoic mass (arrow); b: color Doppler ultrasound shows increased vascularity breast lesion (arrow).

Discussion

Our results show that RABC displays a classical appearance of breast carcinoma on ultrasound. Data available about RABCs are scarce, and more specifically regarding ultrasounds findings [14]. A clear definition of retroareolar location on ultrasound does not exist. This is because retroareolar location has been defined based on mammographic criteria [15]. A lesion is considered retroareolar when located within two centimeters from the nipple-areolar complex [16]. In addition, the last version of BI-RADS lexicon within the mammographic part, defined the retroareolar region as being as a central location in the anterior breast close to the nipple [14].

The retroareolar region is situated two cm posterior to the nipple-areolar complex, a major landmark in the breast, specialized in collecting and expressing breast milk during lactation [6]. The nipple-areolar complex contains essentially Montgomery glands opening at Morgagni tubercles, smooth muscle, nerves sensory endings and Sappey plexus, the retroareolar lymphatic system [1].

Our results suggest that RABCs tend to be larger than breast carcinomas in other locations and mostly clinically palpable, consistent with the results of Gies et al. [14]. Our results also suggest that RABCs are more difficult to diagnosed on ultrasound although their superficial location would presumably suggest the opposite.
Figure 3. 70-year-old woman referred for abnormal screening mammogram; a: left craniocaudal magnified view demonstrates linear pleomorphic calcifications in a retroareolar location (arrow); b: ultrasound shows microcalcifications located within a dilated duct (arrow); c: color Doppler ultrasound displays vascular rim (arrow).

Table 1 Detection modality and presentation of retroareolar carcinomas in 53 women.

<table>
<thead>
<tr>
<th>Detection modality</th>
<th>Presentation</th>
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</thead>
<tbody>
<tr>
<td>Physical examination 29/53 (54)</td>
<td>Palpable mass: 14</td>
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<tr>
<td></td>
<td>Palpable mass + nipple inversion or retraction: 14</td>
</tr>
<tr>
<td>Mammogram 17/53 (33)</td>
<td>Mass: 6</td>
</tr>
<tr>
<td></td>
<td>Mass + calcifications: 2</td>
</tr>
<tr>
<td></td>
<td>Calcifications: 4</td>
</tr>
<tr>
<td></td>
<td>Architectural distortion: 5</td>
</tr>
<tr>
<td>Ultrasound 4/53 (8)</td>
<td>Mass: 4</td>
</tr>
<tr>
<td>Magnetic resonance imaging 3/53 (6)</td>
<td>Mass: 1</td>
</tr>
<tr>
<td></td>
<td>Non-masses: 2</td>
</tr>
</tbody>
</table>

Numbers in parentheses are percentages.

Several factors may explain why ultrasound of the retroareolar region is challenging. Acoustic shadowing is one main cause and is related to the geometric shape of the nipple, the presence of crevices and irregular surfaces that may generate a mass-like appearance with posterior acoustic shadowing. The use of compound mode cancels a large part of attenuation related to nipple erection and interfaces. Second, ducts have a radial orientation that limits ultrasound evaluation given the beam direction. Third, there are multiples interfaces related to large convergent ducts.

Stavros et al. described several maneuvers that may improve the detection and characterization of retroareolar lesions [16]. These techniques are based on angulation of the transducer in order to generate an ultrasound beam perpendicular to the long axis of the ducts [17,18]. The peripheral compression technique helps visualize the peripheral retroareolar duct segments. It is performed with a nipple compression on the lateral end of the probe. The transducer is held with an angle. The beam is then perpendicular to the duct and simultaneously the probe keeps contact and pressure. The two-handed compression technique helps visualize the central retroareolar duct segments. The two-handed compression technique compresses the duct of interest between the non-scanning hand and the probe that is slid distally to include the nipple. The rolled nipple technique depicts the portion of the mammary duct within the nipple. The probe rolls the nipple toward the finger of the contralateral hand. In addition, a large amount of gel and gentle pressure of the nipple are helpful as for any other location.
Our study has some limitations. One is due to the retrospective nature and possible inclusion bias and the analysis of static ultrasound images only. Second, radiologists reviewing the ultrasound examinations were aware of the diagnosis of RABC. Third the population size was limited thus limiting the spectrum of ultrasound findings of RABC. Finally, sonoelastography was not used in the analysis, so that the potential role of this technique in the detection of retroareolar breast carcinoma is not known [19].

In conclusion, RABC display the usual ultrasound appearance of breast carcinomas in other locations. With awareness of the complexity of the region, and knowledge of specific manoeuvres when doing breast ultrasound and appropriate settings to be used, breast imagers would be able to more appropriately scan the retroareolar regions and detect RABC at an earlier stage.

Disclosure of interest
The authors that they have no competing interest.

References