Sonographic Features of Breast Abscesses with Emphasis on “Hypoechoic Rim” Sign

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Key Words
breast abscess; breast pathology; ultrasound

Background. There are only limited reports on the ultrasound (US) features of breast abscess. The purpose of this paper is to review the US features of breast abscess with emphasis on “hypoechoic rim” sign which is more commonly seen in chronic abscess.

Methods. In a period of 10 years, 20,998 patients were referred for breast US examinations. Medical records identified 204 patients in whom breast abscess was diagnosed. All patients were examined using high-resolution real-time US scanners. The initial ultrasound reports and hard copy images were all carefully reviewed. The gradation of the echogenicity of the abscess was classified from grade 0 to grade 5. The contours of the lesions were described as smooth, macrolobulated, microlobulated, irregular, zig zag, spiculate or indistinct. The wall thickness was measured to document the presence of “hypoechoic rim” which denoted a wall thickness greater than 2 mm. The associated findings and other acoustic phenomena related to the lesion were recorded.

Results. One hundred and thirty-six patients (136/204) having specific aspiration and/or biopsy/histopathological results were included in the study. All of the 136 patients showed abnormal US findings (100%). Most lesions showed grade 1 or grade 2 echogenicity (117, 86%). The contour of the abscess was usually smooth (42, 31%), macrolobulated (42, 31%), or irregular (22, 16%). A hypoechoic rim was noted in 18 lesions (13%). Focal skin thickening was chiefly noticed in 91% of superficial abscesses (39/43) and 17% of intramammary abscesses (14/84). Diffuse skin thickening was exclusively evident in the breasts coexisting with mastitis. Hypoechoic in the sternal streaks were not a common finding (7%), occurring in acute abscesses. The other findings included surrounding hypoechoic amorphous tissue (26%), posterior wall enhancement (71%), distal enhancement (60%) and lateral shadows (57%).

Conclusions. US plays an important role in the clinical diagnosis of breast abscess and aids significantly in the management of inflammatory breast diseases. Presence of the hypoechoic rim surrounding a fluid space or a central area of low-level echoes (ie, grade 1 to grade 3) is indicative of a chronic abscess.

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Breast abscess is typically associated with postpartum mastitis during lactation. Abscesses have been reported to develop in 5-11% of lactating women with infectious mastitis. The diagnosis of...
breast abscess can usually be easily made based on the clinical presentation related to the infectious nature such as local heat, swelling, pain, and redness of the overlying skin, and occasionally systematic in fec tion signs. However, some patients may present with atypical clinical symptoms and signs, and may clinically mimic malignant disease. Many women are therefore referred for imaging study (especially ultrasound) to obtain a diagnosis. There are only limited reports on the ultrasound (US) features of breast abscess. 3-6 Although typical abscesses on US are rarely misinterpreted, a considerable overlap of the imaging appearances between abscess and malignancy has been reported. 3,7 The purpose of this paper is to review the US features of breast abscess with emphasis on “hypoechoic rim” sign which is more commonly seen in chronic abscess.

Methods

Between 1987 and 1996, a total of 20,998 patients were referred to our ultrasound (US) division for establishing diagnosis of breast problems. Medical records identified 204 patients in whom breast abscess was diagnosed. Their clinical symptoms and signs included local swelling or palpable lump (136), breast pain or tenderness (122), skin redness and/or local heat (67), fever (21), and general malaise (8). The charts were retrospectively reviewed to determine the age at diagnosis, and delivery date if available. The clinical findings and intervals between onset of symptoms and imaging were extracted from the medical records. Patients with postoperative infection were excluded. All patients were examined using high-resolution real-time US scanners equipped with 7.0, 7.5, or 10.0 MHz transducers (Diasonics DRF400, Milpita, CA, USA; ATL UM8, Bothell, WA, USA; Acuson L28 or XP10, MountainView, CA, USA; Diasonics Spectra or VST Mas ter Se ries; ATL UM9 HDI; Hewlett-Packard GP8500, Andover MT, USA). In some patients, an autotransmitted US scanner (Labsonics, In di a nap o lis, In di ana, USA) was also used to encompass the whole territory of the breast lesion which was too large to dem onstrate on real-time US. The initial ultrasound reports and hard copy images were all carefully reviewed. An abscess was presumed to be present when a focal lesion or mass was identified on US. The echogenicity of the abscess was documented. The grading of the echogenicity was classified as follows: Grade 0 (Gr 0): no visible internal echoes; Grade 1 (Gr. 1): minimal internal echoes with the level less than the subcutaneous fat; Grade 2 (Gr. 2): equal to the subcutaneous fat but less than the fibro-glandular tissue; Grade 3 (Gr. 3): greater than the subcutaneous fat but less than the fibro-glandular tissue; Grade 4 (Gr. 4): equal to the fibro-glandular tissue; and Grade 5 (Gr. 5): greater than the fibro-glandular tissue. The grading system was modified from that proposed by Ueno et al. 8 If the lesion is relatively heterogeneous in echotexture, it was graded according to its major part. The contours of the lesions were described as smooth, macrolobulated, microlobulated, irregular, zig zag, spiculate, or indistinct. If a distal wall was identifiable, the wall thickness was measured to document the presence of “hypoechoic rim” which de noted a wall thickness greater than 2 mm and a wall echogenicity lower than the surrounding breast parenchyma. The associated findings and artefacts related to the lesion were recorded, e.g., skin changes, posterior wall or distal enhancement, lateral shadow, etc. The presence of surrounding tissue changes was re viewed. In patients who had undergone biopsy the histopathology was reviewed by an experienced pathologist.

Results

One hundred and thirty-six patients (136/204) having specific aspiration and/or biopsy/histopathological results were included in the study. Patients ranged in age from 18 to 75 years (mean 32 years). Fifty-nine of these 136 pa tients (43%) were during their lactating period at the time of ultrasound examination. Seventy-seven (57%) were not related to lactation. The other 68 pa tients (68/204) were not enrolled because of lack of aspiration and/or biopsy confirmation, although the clinical findings could be typical of infection. In the 136 patients enrolled, aspiration was done in 79, biopsy in 23, both aspiration and biopsy in
and surgery in 69 patients in whom prior aspiration and/or biopsy was done in 50. Histopathological studies were conducted in 107 patients.

All of the 136 patients showed abnormal US findings (100%). Focal pathologies with suggestive US features of abscess were noted in 113 patients (83%). Twenty-three patients (17%) with poorly delineated wall were all related to the presence of mastitis (Fig. 1A). Superficial abscesses were encountered in 43 patients (32%); intramammary and retromammary abscesses were in 84 (65%) and 4 patients (3%), respectively. Most lesions showed Gr. 1 or Gr. 2 echogenicity (117, 86%). There were 13 Gr. 3 lesions (10%) and 4 Gr. 4 lesions (3%). The contour of the abscess was usually smooth (104, 76%) showed variable wall thickness (Table 1). An abscess with smooth contour was more commonly seen in nonlactation abscess (p < 0.01). A relatively thick wall (> 2 mm) or hypoechoic rim was noted in 18 lesions (13%) in which histopathological studies had been conducted in 12 patients (Fig. 2). The wall was composed of variable amount of acute fibrinous exudates containing foamy cells, and the surrounding granulation tissue contains an infiltrate of chronic inflammatory cells. There were some as so ciated findings on US, such as focal or diffuse skin thickening, surrounding soft tissue changes, and arti facts related to the abscesses (Table 2). Focal skin thickening was chiefly noted in relation to superficial abscess (Table 3). A relatively thick wall (> 2 mm) or hypoechoic rim was noted in 18 lesions (13%) in which histopathological studies had been conducted in 12 patients (Fig. 2).

Table 1. Results of breast US studies in 136 patients with breast abscess

<table>
<thead>
<tr>
<th>US Findings</th>
<th>Lactation abscess (n=59)</th>
<th>Non-lactation abscess (n=77)</th>
<th>p valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echogenicity</td>
<td>Gr.0</td>
<td>0 —</td>
<td>0 —</td>
</tr>
<tr>
<td></td>
<td>Gr.1</td>
<td>28 (47%)</td>
<td>36 (47%)</td>
</tr>
<tr>
<td></td>
<td>Gr.2</td>
<td>22 (37%)</td>
<td>33 (43%)</td>
</tr>
<tr>
<td></td>
<td>Gr.3</td>
<td>7 (12%)</td>
<td>6 (8%)</td>
</tr>
<tr>
<td></td>
<td>Gr.4</td>
<td>2 (3%)</td>
<td>2 (3%)</td>
</tr>
<tr>
<td></td>
<td>Gr.5</td>
<td>0 —</td>
<td>0 —</td>
</tr>
<tr>
<td>Contour</td>
<td>smooth</td>
<td>10 (17%)</td>
<td>32 (42%)</td>
</tr>
<tr>
<td></td>
<td>macrolobulated</td>
<td>16 (27%)</td>
<td>26 (34%)</td>
</tr>
<tr>
<td></td>
<td>microlobulated</td>
<td>2 (3%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td></td>
<td>irregular</td>
<td>15 (25%)</td>
<td>7 (9%)</td>
</tr>
<tr>
<td></td>
<td>zigzag</td>
<td>2 (3%)</td>
<td>2 (3%)</td>
</tr>
<tr>
<td></td>
<td>spiculate</td>
<td>0 —</td>
<td>0 —</td>
</tr>
<tr>
<td></td>
<td>indistinct</td>
<td>16 (27%)</td>
<td>7 (9%)</td>
</tr>
<tr>
<td>Wall thickness</td>
<td>paper thin (&lt;1 mm)</td>
<td>12 (20%)</td>
<td>25 (32%)</td>
</tr>
<tr>
<td></td>
<td>≥1, &lt; 2 mm</td>
<td>25 (42%)</td>
<td>24 (31%)</td>
</tr>
<tr>
<td></td>
<td>≥ 2 mm (ie, hypoechoic rim)</td>
<td>6 (10%)</td>
<td>12 (16%)</td>
</tr>
</tbody>
</table>

a p value of < 0.01 was considered significant (Chi-square test and Yates’ correlation).

Table 2. The associated US findings and artifacts related to lesions (n=136)

<table>
<thead>
<tr>
<th>US Findings</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin thickening.</td>
<td></td>
</tr>
<tr>
<td>focal</td>
<td>53 (39)</td>
</tr>
<tr>
<td>diffuse</td>
<td>23 (17)</td>
</tr>
<tr>
<td>Surrounding soft tissue change</td>
<td></td>
</tr>
<tr>
<td>hypoechoic poorly defined tissue</td>
<td>36 (26)</td>
</tr>
<tr>
<td>hypoechoic interstitial streaks</td>
<td>9 (7)</td>
</tr>
<tr>
<td>Acoustic phenomena</td>
<td></td>
</tr>
<tr>
<td>posterior wall enhancement</td>
<td>97 (71)</td>
</tr>
<tr>
<td>distal enhancement</td>
<td>82 (60)</td>
</tr>
<tr>
<td>Lateral shadows</td>
<td>78 (57)</td>
</tr>
</tbody>
</table>
hancement (71%), distal enhancement (60%), and lateral shad ows (57%). Pos te rior wall en hance ment was a com mon find ing in well-liquefied ab scesses (Fig. 1B), which was fre quently as so ci ated with dis tal en -
hance ment (Fig. 1B, 1C). Lat eral shad ows were ev i -

dent in 57% of ab scesses; all of them were as so ci ated with dis tal en-
hance ment (Fig. 1B).

Discussion

In fec tions of the breast are rare ex cept dur ing the
postpartum pe riod. These in clude mas ti tis (lac tat ing
mas ti tis), in fected se ba ceous cyst, ab sc ess, and other
rel atively rare in fec tions, eg, tu ber cu lo sis, syphi lis,
fun gal or vi ral in fec tions. Breast ab sc ess is the sec ond
most com mon in fec tious dis ease of the breast af ter
mas ti tis. It oc curs most com monly dur ing lac tat ing as
a re sult of rup ture of over filled lactiferous ducts, and
frequently de vel ops follow ing lactational mastitis.
How ever, this com mon dis ease en tity can also oc cur
in nonlactating women of all ages. Micro scop ically
ab sc ess con sists of a cav ity filled with ne crotic de bris
and white blood cells (chiefly neu tro phils). The ad ja-
cent paren chyma un der goes acute and chronic in flam-
ma tory change. The sur round ing ing tis sue changes may

Fig. 1. Various pre sen ta tion of ab sc ess and its con tors: (A) Color Doppler US of a breast with mas ti tis with fo cal small
ab sc ess (large ar row). The back ground of breast stroma shows hypoechoic poorly de fined ed ema tous tis sue
(small ar rows) sug gest ive of mas ti tis. (B) An ab sc ess with smooth con tour (large ar rows). Di tal en hance ment
and lat eral shad ows (small ar rows) are also ev i dent. (C) An ab sc ess with macrolobular con tour (ar rows). Di tal
en hance ment can be dem on strated. (D) An ab sc ess with ir regul ar con tour (large ar row). The back ground of the
breast shows dense glan du lar tis sue (small ar rows).
progress to granulation and fibrosis if the disease process prolongs.1

Generally there are three types of abscess based on its location in the breast: superficial, intramammary, and retromammary. Regardless of the location, a breast abscess must be treated adequately to prevent recurrence. The treatment consists of antibiotic therapy, incision and drainage. A deeply located abscess should be treated with drainage. A superficial abscess is usually treated with incision to expose the abscess cavity and local antibiotic dressing. Broad-spectrum antibiotics or specific antibiotics are admin-

Fig. 2. An abscess with relatively thick wall (2 mm): (A) an echogenic abscess with thick wall which presents as a hypoechoic rim (arrows). (B) The microscopic photomicrograph shows a thick fibrous wall (large arrows) corresponding to the hypoechoic rim on ultrasound. The abscess cavity contains acute and chronic inflammatory cells (small arrows). HE stain, 100×.

Fig. 3. Skin thickening in breasts with abscess: (A) focal thickening (arrows) on color Doppler US. (B) Diffuse thickening (arrows) on single crystal wide field-of-view scan with Labsonics® automated scanner.

Fig. 4. Hypoechoic interstitial streaks (small arrows) surrounding a hypoechoic abscess (large arrow).
is termed based on the results of cul tures and sen siti ty tests. In case of lact at ing ab scess, breast-feeding may be con tin ued if the in ci sion and drain age tube is far enough from the areolar re gion to be un in volved in nurs ing. If nurs ing must be dis con tin ued, the wall of the abscess wall is dis con tin ued if the in ci sion and drain age tube is far enough from the areolar re gion to be un in volved in nurs ing. If nurs ing must be dis con tin ued, the wall of the abscess wall is dis con tin ued if the in ci sion and drain age tube is far enough from the areolar re gion to be un in volved in nurs ing. If nurs ing must be dis con tin ued, the wall of the abscess wall is dis con tin ued if the in ci sion and drain age tube is far enough from the areolar re gion to be un in volved in nurs ing. If nurs ing must be dis con tin ued, the wall of the abscess wall is dis con tin ued if the in ci sion and drain age tube is far enough from the areolar re gion to be un in volved in nurs ing. If nur-

The hypoechoic rim dem on strated on US cor re sponded to the infl am ma tory tissue seen on histo pa thol ogy in 12 out of 18 pa tients. In the other 6 pa tients, only US-guided fine need le as pi ra tion was done to con firm its ab scess na ture. The rel a tively thick hypoechoic rim sur round ing the nearly anechoic fluid space is usu ally more vas cu lar and more fi brous than the breast stroma pe riph eral to the hypoechoic rim. In 37 pa tients with out sig nif i cant rim (ie, < 1 mm wall thick ness), 8 had histopathologist study. All showed less gran u la tion tis sue sur round ing the ab scess cavity. The hypoechoic rim the re for re sents a rel a tively thick layer of gran u la tion tis sue sur round ing the ab scess cavity. The hypoechoic rim the re for re sents a rel a tively thick layer of gran u la tion tis sue sur round ing the ab scess cavity. The hypoechoic rim the re for re sents a rel a tively thick layer of gran u la tion tis sue sur round ing the ab scess cavity. 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clude: skin thickening, increased echogenicity of the subcutaneous fat, decreased echogenicity of the originally relatively hyperechoic breast stroma in acute phase or surrounding hyperechoic zone in a relatively chronic abscess. Hypoechoic or nearly anechoic streaks representing interstitial edema may be encountered in acute phase. This finding has not been described until the recent report by Nguyen et al., to refer this as “interstitial fluid”. How ever, we are not sure if these hypoechoic streaks are related to fluid itself or simply edema because both our series and Nguyen’s report found no corresponding histopathological study on this US phenomenon.

Infection can also occur on a pre-existing focal breast lesion such as a cyst, a galactoceles, or a dilated duct. In fected cyst, infected galactoceles, or dilated ducts with infection usually show smooth and sharp margins. The contents may have minimal to moderate echogenicity. The contours help differentiate from an acute abscess. However, it is not always possible to distinguish these conditions from an abscess based on the US pattern, unless US study prior to the infection is obtainable. In conclusion, US plays an important role in confirmation of the clinical diagnosis of breast abscess and aids in the management of inflammatory breast diseases. Presence of the hypoechoic rim surrounding a fluid space or a central area of low-level echoes (i.e., Gr. 1 and 2) is indicative of a chronic abscess.

References