Sonographic Features and Diagnostic Analysis of Benign Chronic Inflammatory Breast Lesions in Nonlactating Women

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Introduction

Benign chronic inflammatory breast lesions are not frequently encountered in clinical practice in nonlactating women. However, they are involved in a wide spectrum of pathological categories, with etiologies ranging from infection to chemical stimulation. In clinical practice, kinds of these different pathologic categories of lesions can be easily confused with each other or misdiagnosed as malignant breast diseases and the therapeutic strategies are different. It is important to differentiate these lesions from each other and from malignant diseases. Ultrasound (US) is an important tool to observe the morphological appearance for breast lesions. The aim of this study was to find some valuable sonographic features of these lesions and to analyze the diagnostic potency of US, especially for the differentiation from malignant disease.

Methods

Patients

This retrospective study was approved by the Institutional Review Board of Ethics Committee of Sir Run Run Shaw Hospital. A total of 45 women with different pathological categories of benign inflammatory breast lesions made biopsy or surgery in our hospital between December 1, 2010 and March 31, 2014, were included in this study. Women who were pregnant or lactating were excluded from this study. The data on clinical symptoms, bacteria cultivation, and pathological results are listed in Table 1.

Breast ultrasound technique

An US examination of the affected breast was performed on all 45 women using a GE Voluson E8 ultrasound scanner (General Electric Kretztechnik, Zipf, Austria) with a 10–12 MHz probe or a Philips iU22 ultrasound scanner (Phillips Medical Systems, Bothell, WA, USA) with a 10–12 MHz probe. The sonographic findings, the Breast Imaging Reporting and Data System (BI-RADS) scores and the US diagnoses were recorded. All of the US exams were performed by radiologists who had 2–25 years of experience in breast US.

Literature searching

A literature search was undertaken in the PubMed database between January 1990 and December 2013. Key words used for the search strategy were breast, mammary, mastitis, inflammatory, granulomatous mastitis, ductal ectasia, lipid granuloma, fat necrosis, foreign body granuloma, localized abscess and US.

Results

Ultrasound evaluation

The sonographic findings of the lesions are listed in Table 1. In patients with granulomatous mastitis, the lesions tended to be large, irregular, dispersed, and always had abundant blood supply. Sonographic examination showed a lobulated or irregular mass in 2 of 10 patients, an irregular hypoechoic mass with multiple tubular extensions in five patients, and parenchymal distortion without a discrete mass in three patients. However, in patients with fat necrosis, localized abscesses or foreign body granulomas, the most common finding on sonography was localized masses with coarse margins and showed avascularity or low blood supply. In patients with ductal ectasia, the lesions showed as dilated ducts with mass-like lesions filled in. Of all the patients, only one existed calcifications.

Sonographic diagnostic analysis

Of all 45 patients, 18 (40%) were diagnosed with mastitis after sonographic examination. A diagnosis of inflammation was
made in 80% (8/10) of patients with granulomatous mastitis and 50% (8/16) of patients with nonspecific inflammatory granulation tissue hyperplasia. Of all 45 patients, 12 (26.7%) were suspected of having malignant lesions with BI-RADS category 4b or above. BI-RADS 4b or above was made in 5 of 12 patients with fat necrosis, 2 of 3 patient with localized abscess, and 1 of 1 patients with foreign body granulomas.

**Literature review**

Forty-one articles about ultrasonic appearance of benign chronic inflammatory breast lesions in nonlactating women were searched out. All of the reports focused on a single pathological category of benign inflammatory breast lesions and most were retrospective and descriptive such as case reports or case series analyses.

**Discussion**

Based on the sonographic imaging of the 45 patients, we found kinds of the different pathological lesions in nonlactating women had some special morphological appearance and were helpful for the differentiation diagnosis, especially from the malignancy.

In the current study, the sonographic findings of granulomatous mastitis tended to be large, irregular, and hypoechoic, with a diffuse tendency. It could be a lobulated or irregular mass, an irregular hypoechoic mass with multiple tubular extensions, or parenchymal distortion without a discrete mass. Similar description was found in Hovanessian Larsen et al.’s study. They thought the sonographic imaging could be explained by the pathological procedure of granulomatous mastitis – the supplicative inflammatory reactions are centered on mammary lobules and ease to extend into the adjacent perilobular and interlobular tissue.

Different from the lesions of granulomatous mastitis, the three most common sonographic shapes in patients with fat necrosis was cystic nodules with sharp margins, solid masses with a boundary echo, and complicated echogenicity accompanied

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**Table 1: Clinical and sonographic parameters of the different pathological types of benign chronic inflammatory breast lesions in nonlactating women**

| Clinical and sonographic parameters | IGM* | FN | FBG | MDE | LA | NIGH |
|------------------------------------|------|----|-----|-----|----|------|
| Age                                | 24–38| 19–76| 55  | 35–57| 27–63| 25–58|
| Pain (yes/no)                      | 7/3  | 3/9 | 0/1 | 0/3 | 1/2 | 10/6 |
| Bacteria cultivation (yes/total)   | 0/5  | 0/1 | 0/0 | 0/1 | 0/1 | 2/6  |
| Size (cm, mean ± SD)               | 4.73 ± 1.85| 2.06 ± 0.6| 2.77| 3.71 ± 4.80| 2.33 ± 1.78| 3.81 ± 1.73|
| Echogenicity                       |      |     |     |     |     |      |
| Anechoic                           | 0    | 3   | 0   | 1   | 0   | 0    |
| Hypoechoic                         | 4    | 4   | 1   | 0   | 2   | 6    |
| Complicated                        | 6    | 5   | 0   | 2   | 1   | 10   |
| Echotexture                        |      |     |     |     |     |      |
| Homogeneous                        | 1    | 4   | 0   | 1   | 1   | 3    |
| Heterogeneous                      | 9    | 8   | 1   | 2   | 2   | 13   |
| Margin                             |      |     |     |     |     |      |
| Distinct                           |      |     |     |     |     |      |
| Sharp                              | 0    | 4   | 0   | 0   | 0   | 3    |
| Coarse                             | 0    | 7   | 1   | 0   | 3   | 2    |
| Irregular                          | 6    | 1   | 0   | 3   | 0   | 4    |
| Indistinct                         | 4    | 0   | 0   | 0   | 0   | 7    |
| Boundary echo (yes/no)             | 0/10 | 9/3 | 1/0 | 0/3 | 3/0 | 5/11 |
| Calcification (yes/no)             | 0/10 | 1/10| 0/1 | 0/3 | 0/3 | 0/16 |
| Vascularity                        |      |     |     |     |     |      |
| Abundant                           | 6    | 1   | 0   | 0   | 0   | 6    |
| Minor                              | 1    | 7   | 1   | 1   | 1   | 5    |
| Absent                             | 1    | 4   | 0   | 2   | 2   | 4    |
| Not recorded (NE)                  | 2    | 0   | 0   | 0   | 0   | 1    |
| First diagnosis                    |      |     |     |     |     |      |
| Inflammation                       | 8    | 2   | 0   | 0   | 0   | 8    |
| Benign cystoid lesion              | 0    | 2   | 0   | 0   | 0   | 0    |
| Fibroadenoma                       | 0    | 1   | 0   | 0   | 0   | 0    |
| Intraductal papilloma              | 1    | 0   | 0   | 3   | 0   | 2    |
| BI-RADS 4a*                        | 0    | 2   | 0   | 0   | 1   | 3    |
| BI-RADS 4b or above                | 1    | 5   | 1   | 0   | 2   | 3    |

*IGM: Idiopathic granulomatous mastitis; FN: Fat necrosis; LA: Localized abscess; MDE: Mammary ductal ectasia; FBG: Foreign body granuloma; NIGH: Nonspecific inflammatory granulation tissue hyperplasia; SD: Standard deviation; †BI-RADS: Breast imaging-reporting and data system.
with a thick hyperechoic encysted band. In pathology, fat necrosis is often caused by the leakage of the duct contents and the local stimulus response always results in a localized granuloma or a central necrosis with inflammatory reaction zone around it. Bilgen et al. described a wider distribution of sonographic presentations in fat necrosis lesions, including increased echogenicity of the subcutaneous tissues, anechoic masses with posterior acoustic shadowing, solid-appearing masses, and cystic masses.[3]

In mammary duct ectasia (MDE), the periductal inflammation is the principal pathological expression. In the current study, all three cases appeared dilated ducts with mass-like lesions filled in. In Ballesio’s[4] study, they thought the appearance of MDE on ultrasonography depended on the stage of the disease. In the acute MDE, duct content could vary from anechoic to isoechoic with surrounding fatty tissue. Chronic MDE was characterized on US as having dilated ducts or mass-like lesion filled with echogenic material.

In our studies, the etiology of localized abscesses was unclear. They hadn’t a history of acute inflammation, breast trauma or surgical procedure. In ultrasonography, they appeared as localized hypoechoic masses, all with a boundary echo, sometimes with thick liquid in the central.

In the current study, one group of lesions was described as nonspecific inflammatory granulation tissue hyperplasia. Most of the patients had histories of redness, swelling, or pain in the local breast and were sensitive to antibiotics. Some samples had positive results from bacteria cultivation. They were considered to be the chronic transfer of acute mastitis. In these cases, the ultrasonography showed great heterogeneous. They could be localized masses, irregular masses, tubular lesion or diffuse lesion.

The clinical and radiological findings of benign inflammatory breast lesions in nonlactating women sometimes could be easily confused with malignant diseases. Based on our data, US for patients with granulomatous mastitis had high diagnostic reliability. We thought positive symptoms in local breast and the dispersed appearance on sonogram might help to suggest the diagnosis of inflammation. However, lesions with tubular morphology in these patients were still difficult to differentiate from inner ductal papillomas or intraductal carcinoma. Positive symptoms and absence of calcification may be helpful. Dursun et al. revealed that MRI was also helpful. The time-signal intensity curve for IGM was frequently benign.[4]

However, the lesions of fat necrosis, localized abscesses or foreign body granulomas were often confused with malignant diseases. In the current study, the features of avascularity or low blood supply in these lesions could help to differentiate them from malignance. According the previous reports, mammographic findings may also be helpful. With mammography, Bilgen et al. reported only 28/144 (19.4%) patients with fat necrosis were classified as BI-RADS category 4b, much lower than 41.7% in current study.[3] According to a study by Soo et al., if complex masses with echogenic bands are observed in patients with a history of trauma, fat necrosis should be considered. If a mass with anechoic shadowing that corresponds to a mammographically oil cyst, it should be followed up with routine mammography or US. However, if a sonographically solid lesion are suggestive, a fat necrosis mass will be indistinguishable from a malignant lesion and a biopsy is indicated.[5]

The distinctions between duct ectasia and intraductal carcinoma have not been described well in previous literature. The absent of blood flow in tubular masses and the absent of calcification could be helpful.

In summary, US is a valuable modality in evaluating benign chronic inflammatory breast lesions in nonlactating women, especially in patients with granulomatous mastitis. However, the sonographic features of fat necrosis, foreign body granulomas, and localized abscesses can be easily confused with malignance. Color Doppler, mammography and MRI may be helpful.

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