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## PICTORIAL ESSAY

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# Imaging Appearances of Breast Disorders During Pregnancy and Lactation

P Chatpitanrut<sup>1</sup>, P Kongmehbol<sup>2</sup>, M Muttarak<sup>2</sup>

<sup>1</sup>Department of Radiology, Naresuan University, Phitsanulok, Thailand. <sup>2</sup>Department of Radiology, Chiang Mai University, Chiang Mai, Thailand

## ABSTRACT

*Tumours or disorders affecting the breasts in pregnant or lactating women are usually similar to those occurring in non-pregnant women, but some lesions are unique to pregnancy and lactation such as lactating adenomas and galactoceles. During pregnancy and lactation, breasts change due to increasing hormone levels, which may make breast evaluation difficult. It is crucial to differentiate malignancy from benign breast lesions for proper management. Therefore, the appropriate investigation of breast complaints, and knowledge of breast disorders and their imaging spectrum during pregnancy and lactation are essential to provide the correct diagnosis.*

**Key Words:** Lactation; Mammography; Pregnancy; Ultrasonography

## 中文摘要

### 乳腺疾病於孕期和哺乳期的影像學表現

P Chatpitanrut, P Kongmehbol, M Muttarak

女性懷孕或哺乳期間影響乳房的腫瘤或疾病表現通常與非妊娠婦女的類似，但一些病變只會發生在懷孕或哺乳期間，例如泌乳性腺瘤和積乳囊腫。孕期及哺乳期間，乳腺組織因體內激素水平增高而發生變化，令檢查乳房變得困難。檢查關鍵是惡性腫瘤與良性病變的鑑別，從而施行適當治療。因此，合理觀察孕期和哺乳期病人乳腺主訴症狀，認識這期間的乳腺疾病及其影像學特徵譜，對疾病的正確診斷必不可少。

## INTRODUCTION

During pregnancy and lactation breasts change under the influence of increased hormones, resulting in glandular proliferation, ductal distention, vascular hyperplasia, and stromal involution. These changes may make physical examination and imaging interpretation

difficult.<sup>1-3</sup> Although most breast disorders detected during pregnancy and lactation are benign, and some benign lesions, such as galactoceles and lactating adenomas are unique to pregnancy and lactation, breast cancer occurring during pregnancy is increasing due to older age at the onset of childbearing.<sup>4</sup> In addition, some

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**Correspondence:** Dr P Kongmehbol, Department of Radiology, Chiang Mai University, Intavaroros Road, Chiang Mai, 50200, Thailand.

Tel: 66-53-945450. Fax: 66-53-946559. E-mail: mailto:ann@gmail.com

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benign lesions observed in non-pregnant women such as fibroadenomas, hamartomas, and axillary breast tissue may increase in size during pregnancy and lactation. Therefore, it is important for radiologists to know the appropriate investigations and imaging appearances of breast disorders related to pregnancy and lactation to provide correct diagnosis and proper management. This pictorial essay illustrates the spectrum of imaging appearances of breast disorders affecting pregnant and lactating women.

## IMAGING APPROACHES

A palpable lump is the most common indication for imaging study in pregnancy and lactation in order to avoid unnecessary biopsy for a benign lesion or to arrange a prompt biopsy to avoid a delayed diagnosis of carcinoma. Other indications include inflammatory changes suspicious of breast abscess, bloody nipple discharge, and axillary adenopathy. Ultrasonography (US) is the imaging modality of choice in the investigation of suspicious breast lesions in pregnant and lactating women because of its safety and high sensitivity. Although the sensitivity of mammography in pregnant and lactating women is decreased due to increased parenchymal density, it should be performed if malignancy is suspected. Mammography is effective in the detection of microcalcifications or subtle architectural distortion that may not be commonly depicted with US.<sup>1-3,5,6</sup> Magnetic resonance imaging (MRI) is not routinely used in pregnancy because intravenous gadolinium crosses the placenta. The American College of Radiology recommends the use of MRI only in situations where the risk-benefit ratio is clear. In lactating women, contrast-enhanced MRI can be safely performed and it is safe to continue breastfeeding after receiving gadolinium.<sup>7</sup>

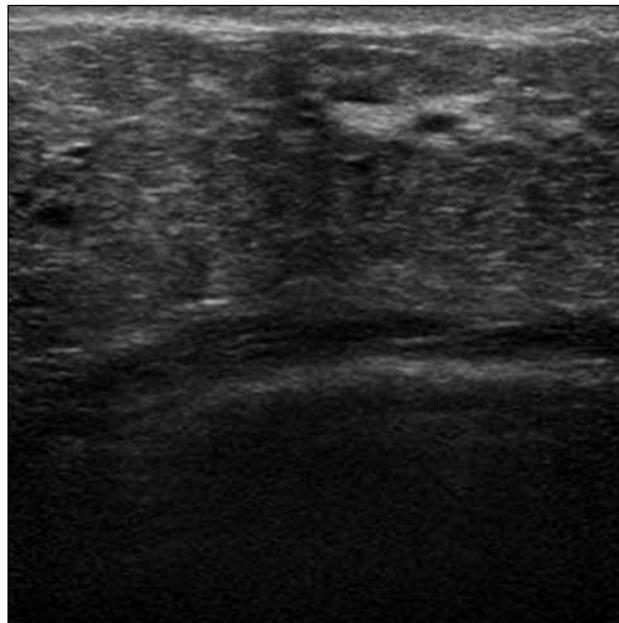
## NORMAL IMAGING APPEARANCES OF THE BREAST IN PREGNANCY AND LACTATION

The breast parenchyma during pregnancy is characterised by proliferation of fibroglandular tissue, which is seen as diffuse hypoechogenicity on US (Figure 1) and increased density on mammogram. In contrast, during lactation, the fibroglandular tissue appears as diffuse hyperechogenicity (Figure 2) with prominent ducts and vascularity.<sup>2,5</sup>

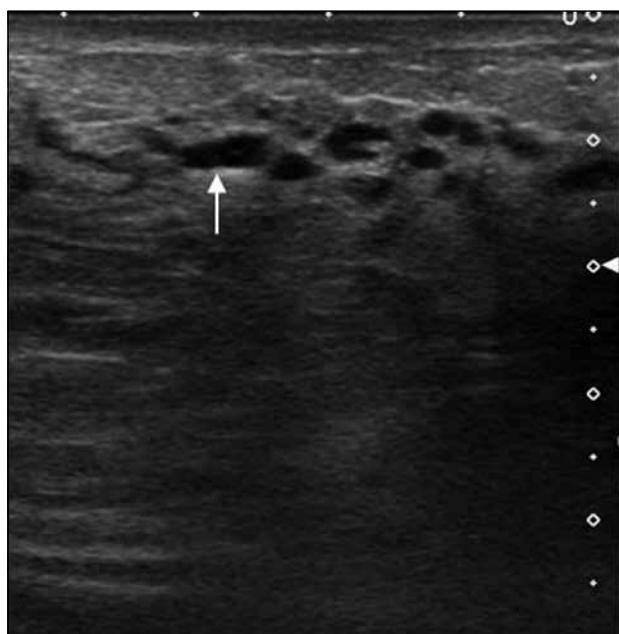
## BENIGN LESIONS

### Galactocele

A galactocele is the most common benign breast lesion



**Figure 1.** An ultrasound image of the breast during pregnancy shows diffuse hypoechogenicity due to proliferation of fibroglandular tissue.



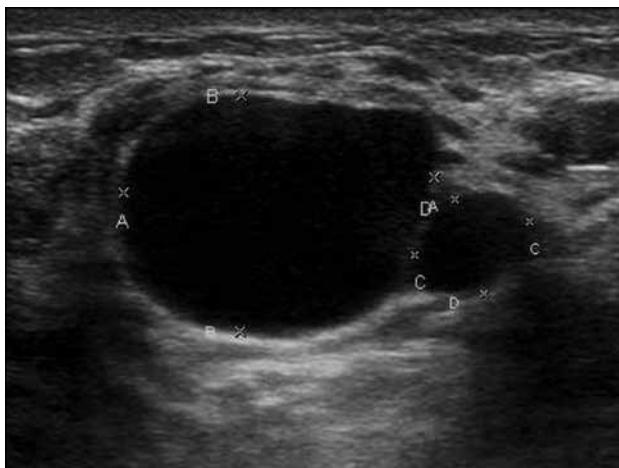
**Figure 2.** An ultrasound image of the breast during lactation shows diffuse hyperechogenicity with ductal prominence (arrow).

in lactating women. A galactocele is a cyst in the terminal ducts composed of cuboidal or flat epithelium containing milk, and probably resulting from ductal obstruction. Leakage of fluid content causes chronic inflammation and fat necrosis. A galactocele is often

detected a few weeks or months after cessation of breastfeeding, or during lactation and can present in the third trimester.<sup>5,6</sup> Patients may present with a painful or painless palpable mass.<sup>2,6</sup> Aspiration of milk is both diagnostic and therapeutic.

Variable imaging appearances of a galactocele are observed because of variable amounts of fat, protein, and water content in the cyst. On US, a galactocele can appear as a simple cyst, a complicated cyst, a complex cyst, a homogeneous or heterogeneous

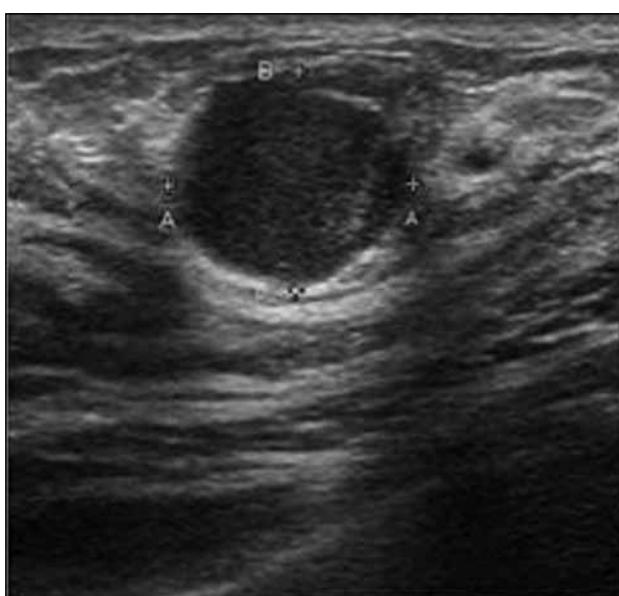
echogenic mass, or a hypoechoic mass with posterior acoustic shadow simulating carcinoma (Figures 3-7, 8a). In questionable case, fine-needle aspiration demonstrating abundant secretory material with foamy macrophages and few epithelial cells can help confirm diagnosis of a galactocele (Figure 8b). A galactocele can be infected because of its rich nutrient content. An infected galactocele is well demonstrated on US as a complicated cyst with a thickened wall (Figure 9). Needle aspiration obtains mixed purulent and milky fluid. On mammogram, a galactocele may appear as



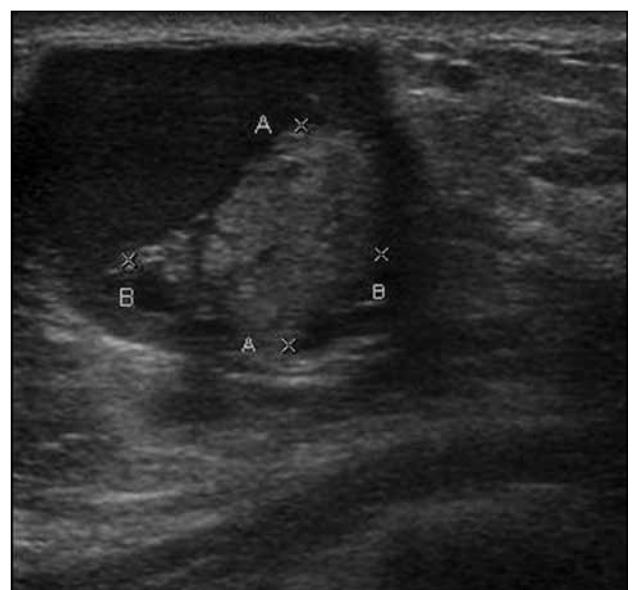
**Figure 3.** An ultrasound image of a 29-year-old woman who had been breastfeeding for 2 months shows two circumscribed anechoic masses with posterior acoustic enhancements that suggest simple cysts. Aspiration of the larger cyst under ultrasound guidance obtained milky content.



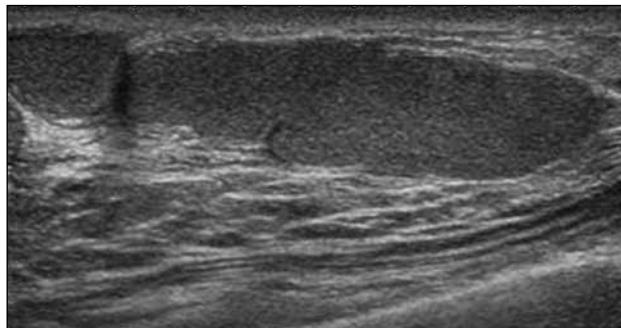
**Figure 5.** An ultrasound image of the breast shows a galactocele presenting as a circumscribed septated cystic mass.



**Figure 4.** An ultrasound image of the breast shows a complicated cystic appearance of a galactocele.



**Figure 6.** An ultrasound image of the breast shows a complex cystic appearance of a galactocele.

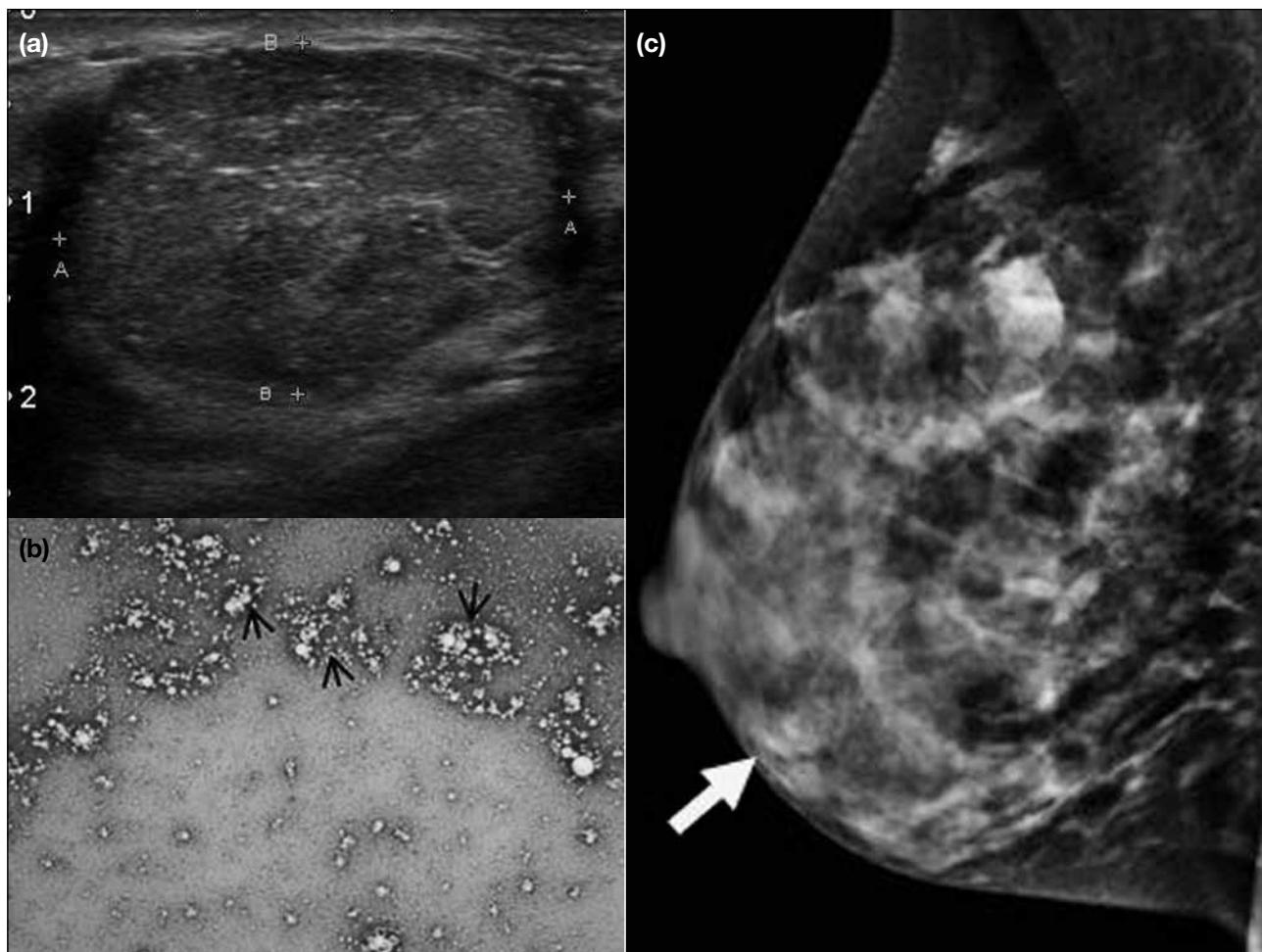


**Figure 7.** An ultrasound image of the breast shows a galactocele presenting as a homogeneous echoic mass without enhancement, simulating a solid mass. Aspiration of the mass obtained milky fluid.

a cystic mass with fat-fluid level, a circumscribed fat-containing mass simulating lipoma (pseudolipoma), or a mass with fat and fibroglandular density similar to a hamartoma (pseudohamartoma) [Figure 8c]. In a chronic galactocele, the cyst wall may calcify, which may or may not be uniform (Figure 10).

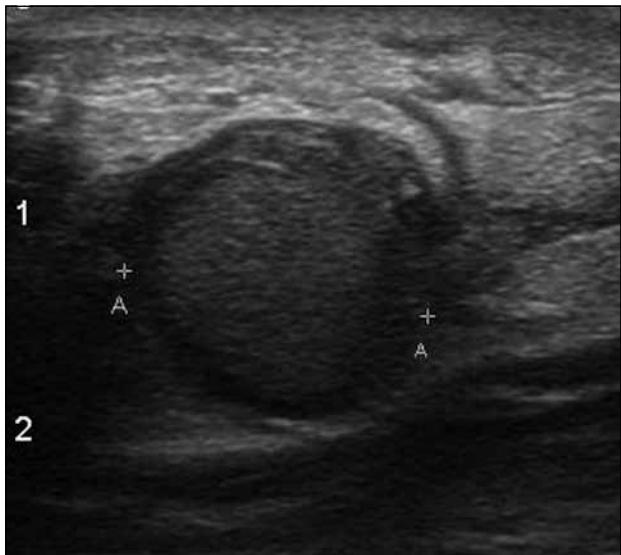
### Mastitis and Breast Abscess

Infection is common during lactation, but is uncommon during pregnancy. *Staphylococcus aureus* is the most common causative organism, followed by *Streptococcus* species. These common pathogens are present in the nose and throat of the nursing babies and infect the breast via the damaged epithelial interface of the nipple-areola complex. Patients often have a history of cracked



**Figure 8.** A 21-year-old lactating woman presented with a palpable right breast mass. (a) An ultrasound image of the right breast mass shows a circumscribed heterogeneous echogenic mass without posterior enhancement mimicking a solid lesion. Galactocele was highly suspected. However, the mass looks like a solid lesion, so right mammogram was performed to identify fat-containing density of a galactocele. (b) A photomicrograph shows lipid-laden secretory material, with a bubbly appearance (arrows). No atypical cells are seen (Wright stain; original magnification,  $\times 200$ ). (c) Right mediolateral oblique mammogram shows a circumscribed mass of mixed fat and fibroglandular density (arrow) similar to a hamartoma (pseudohamartoma). Aspiration under ultrasound guidance obtained milky content.

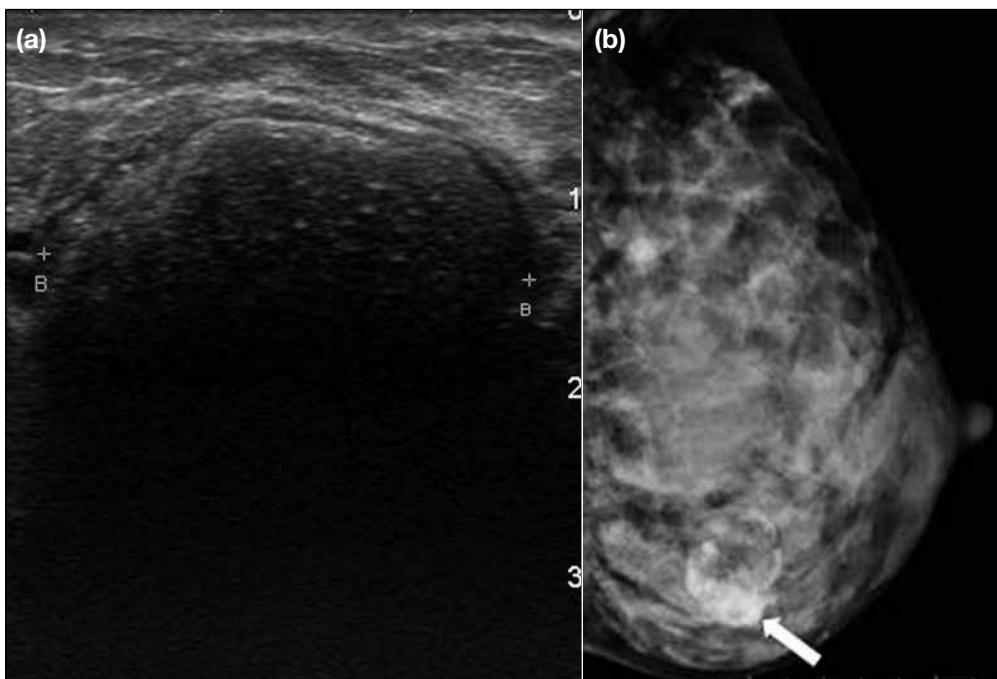
nipple or skin abrasion. Stagnated milk is an excellent culture medium for bacterial growth.<sup>2,5</sup> Clinically, patients with mastitis may present with diffuse or localised area of breast pain, redness, and induration and may have flu-like symptoms.



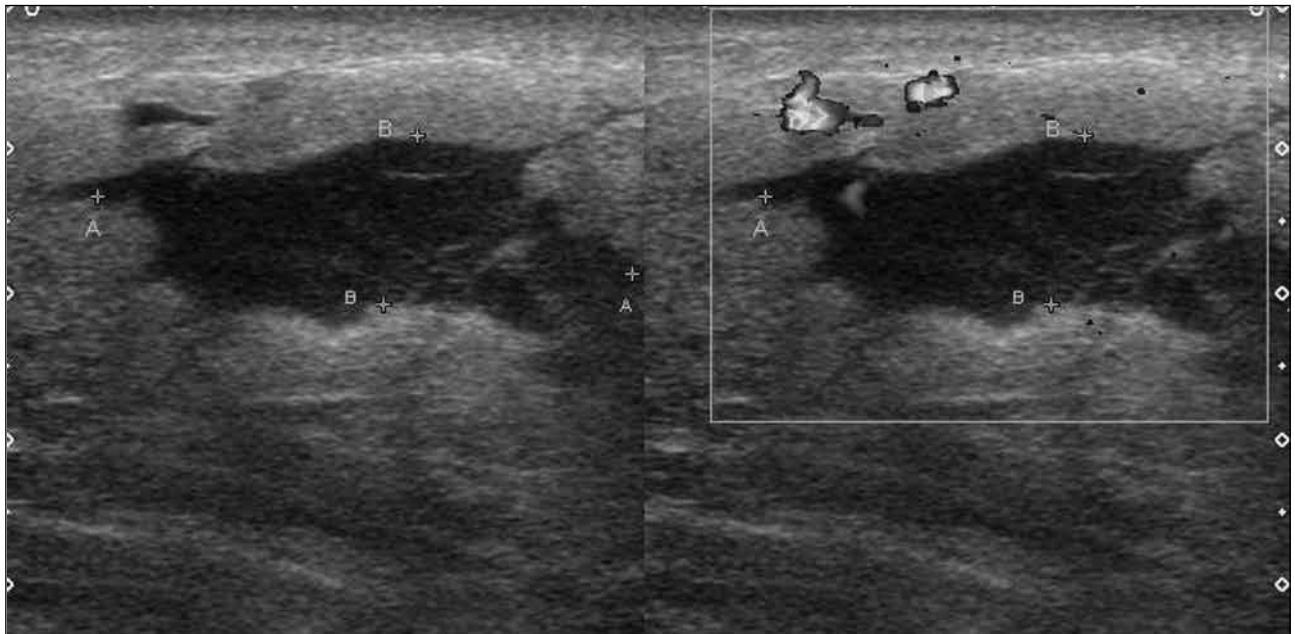
**Figure 9.** A 27-year-old woman who stopped breastfeeding for 15 months presented with a palpable right breast mass. An ultrasound image shows a thickened-wall echogenic cystic mass with increased echogenicity of the adjacent pre-mammary fat. Aspiration under ultrasound guidance obtained 0.5 ml of curd-like yellow fluid, and cytology analysis revealed an infected galactocele.

On US, mastitis is seen as skin thickening, decreased parenchymal echo, increased fat echogenicity, and increased vascularity. If mastitis does not resolve with antibiotics treatment, it will evolve into an abscess formation. US plays an important role in determining whether abscess formation is suspected. Abscess appears as an ill-defined, irregular hypoechoic or anechoic mass with posterior enhancement and peripheral increased vascularity (Figure 11). Sometimes, liquid-debris (fluid-debris) levels can be demonstrated in the abscess. Mammography is performed only if malignancy is suspected. Abscess may appear on mammogram as an ill-defined mass, asymmetrical density, architectural distortion, skin thickening, or axillary adenopathy (Figure 12). These findings are not specific and may not be differentiated from carcinoma. Presence of microcalcifications is more specific for carcinoma.

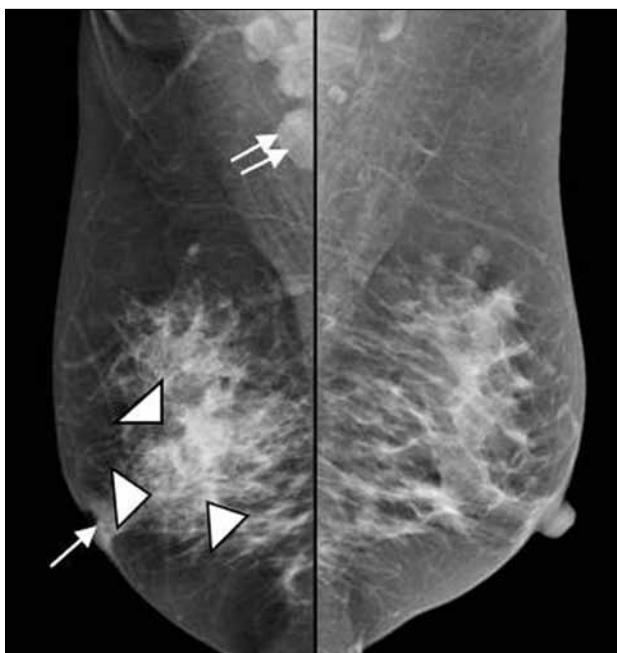
Surgical drainage combined with antibiotics is effective to treat breast abscess, but a surgical wound may interfere with breastfeeding. Needle aspiration of pus under US guidance may provide successful treatment. Breastfeeding should be continued because it helps improve inflammation and promote drainage. If there is no improvement after adequate treatment, inflammatory carcinoma should be excluded and biopsy should be performed.



**Figure 10.** A 31-year-old woman who had been breastfeeding for 3 months presented with a chronic calcified galactocele presenting as a palpable left breast mass. (a) An ultrasound image of the left breast mass shows a marked hypoechoic mass with posterior acoustic shadow simulating carcinoma. A mammogram was performed to clarify the nature of the mass. (b) Left mediolateral oblique mammogram demonstrates a circumscribed fat-containing mass with coarse calcification (arrow).



**Figure 11.** A 32-year-old woman during lactation for 1 month presented with a left breast mass and pain. Composite ultrasound images of the left breast show an irregular hypoechoic mass with posterior enhancement and increased peripheral vascularity. The premammary fat is cloudy and the skin is thickened. Diagnosis of breast abscess was confirmed when ultrasound-guided aspiration showed small amount of thick pus (not shown). Gram stain of the pus revealed Gram-positive cocci.

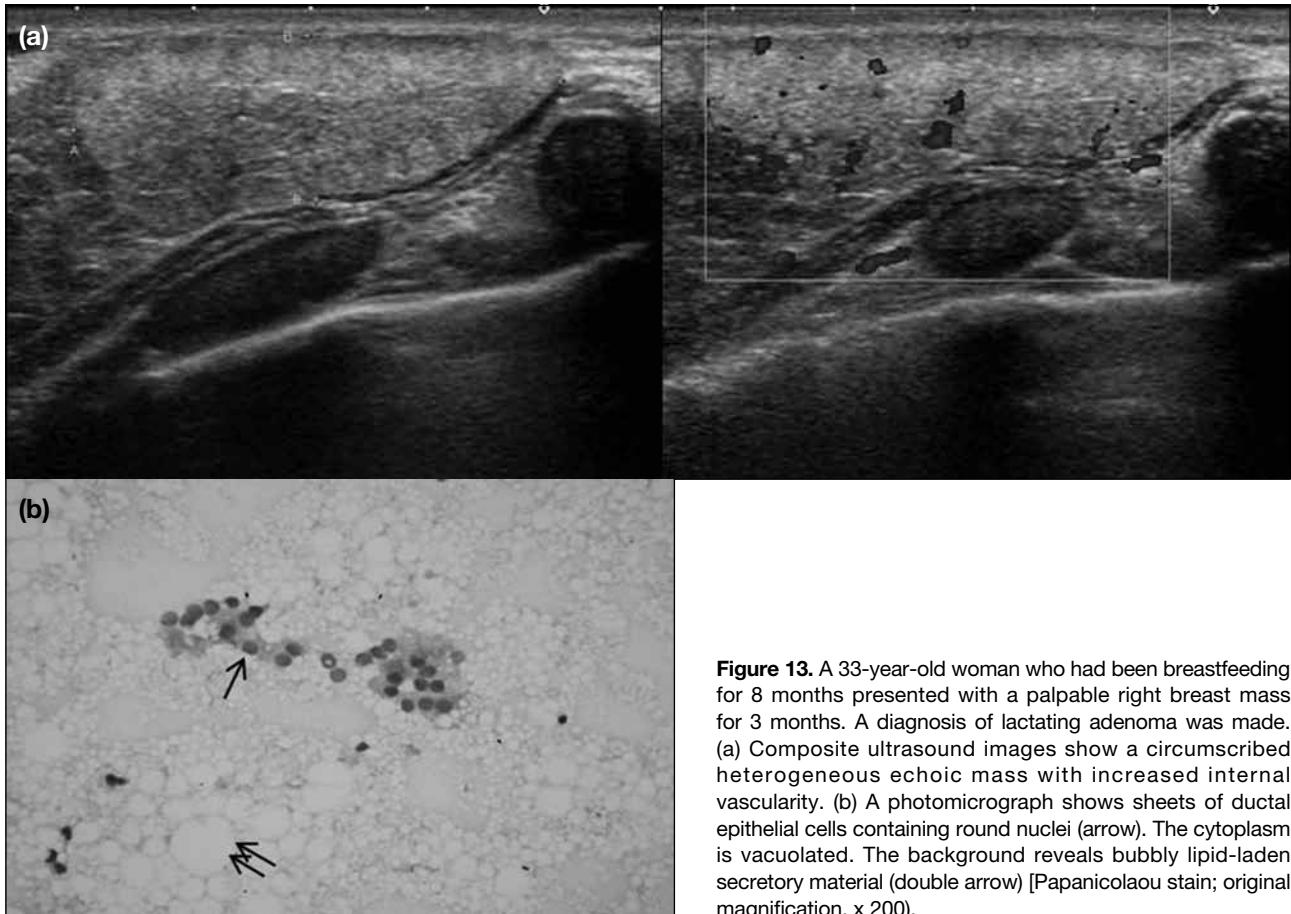


**Figure 12.** A 40-year-old lactating woman with a palpable right breast mass. Bilateral mediolateral oblique mammograms show asymmetric increased density of the right breast (arrowheads) with nipple retraction (arrow) and increased density of the right axillary lymph nodes (double arrow). An ultrasound image of the right breast (not shown) reveals an ill-defined, irregular hypoechoic lesion with hypoechoic tract connected between the lesion and skin. Mastitis with early abscess formation of the right breast is suspected based on mammogram and ultrasound appearances. Ultrasound-guided aspiration obtained pus confirming diagnosis of abscess.

### Lactating Adenoma

A lactating adenoma is an uncommon benign breast tumour occurring during pregnancy or lactation. The aetiology of the tumour is controversial as it has been suggested to be a variant of fibroadenoma, tubular adenoma, lobular hyperplasia, which undergoes lactational changes under hormonal influences, or it arises de novo.<sup>5,6,8</sup> Grossly, a lactating adenoma is a well-circumscribed rubbery or firm mass. At histology, lactating adenoma is composed of densely packed lobules that exhibit secretory hyperplasia and are separated by thin connective tissue. US appearances of lactating adenoma are variable. Most lesions are well-circumscribed, homogeneously or heterogeneously hypoechoic (Figure 13) with acoustic enhancement, but a few tumours may have malignant features such as ill-defined, irregular or angulated margins, and acoustic shadowing.<sup>2,5,6,8</sup> On mammogram, a lactating adenoma is often seen as a circumscribed mass without calcification. Radiolucent density represents the fat content of milk secondary to lactational hyperplasia that may be seen in the mass.

Patients are often treated conservatively because a lactating adenoma often regresses spontaneously after pregnancy and lactation. A lactating adenoma does not increase the risk of developing breast cancer and coexistence with malignancy is very rare. However, a

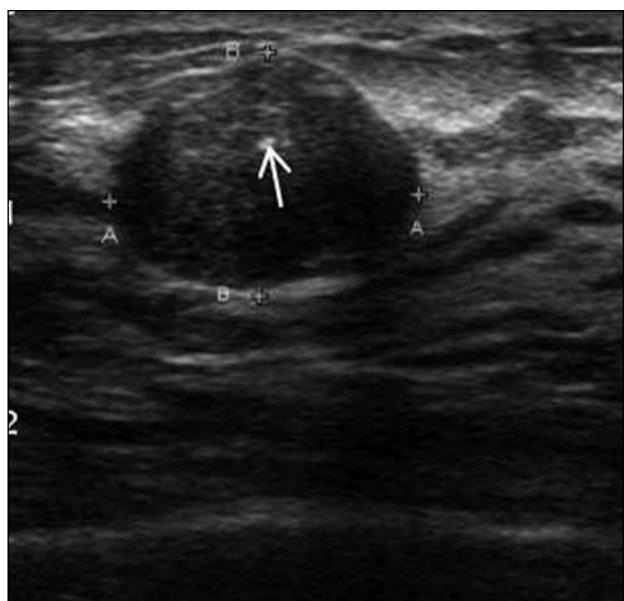


**Figure 13.** A 33-year-old woman who had been breastfeeding for 8 months presented with a palpable right breast mass for 3 months. A diagnosis of lactating adenoma was made. (a) Composite ultrasound images show a circumscribed heterogeneous echoic mass with increased internal vascularity. (b) A photomicrograph shows sheets of ductal epithelial cells containing round nuclei (arrow). The cytoplasm is vacuolated. The background reveals bubbly lipid-laden secretory material (double arrow) [Papanicolaou stain; original magnification,  $\times 200$ ].

lactating adenoma may undergo infarction, necrosis, and haemorrhage, presenting as a rapidly growing mass simulating malignancy.<sup>9,10</sup>

### Fibroadenoma

Fibroadenoma is the most common tumour detected during pregnancy or lactation.<sup>5</sup> Due to hormonal influence, fibroadenomas may enlarge and become clinically palpable during pregnancy or lactation. The imaging appearance of a fibroadenoma during pregnancy is the same as fibroadenoma in non-pregnant women. The typical appearance of a round or oval circumscribed mass and thin echogenic capsule, sometimes with a gentle lobulated margin, can be seen (Figure 14). Infarction within the fibroadenoma may occur if the tumour growth is rapid and the mass may become painful. Radiological changes in this setting include irregular or more lobulated margin, heterogeneous echoes on US, marked hypoechoogenicity, and increased vascular flow.<sup>5,6</sup> Core biopsy is suggested for definitive diagnosis of infarcted fibroadenoma.



**Figure 14.** An ultrasound image of a pregnant woman with a palpable breast mass shows a circumscribed hypoechoic mass with an internal hyperechoic focus of calcification (arrow). Fine-needle aspiration revealed fibroadenoma.

## MALIGNANT TUMOURS

### Pregnancy-associated Breast Cancer

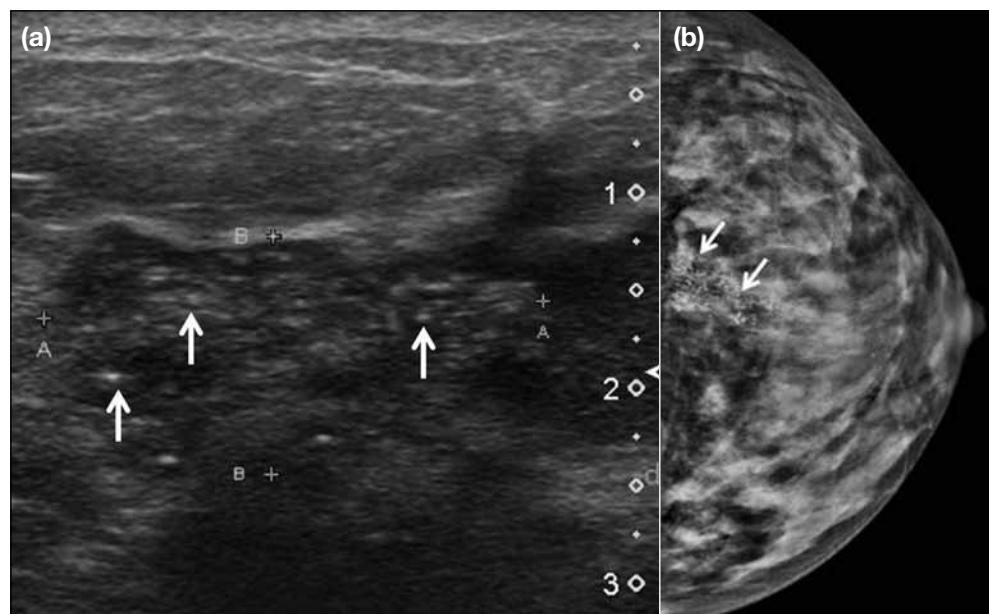
Pregnancy-associated breast cancer (PABC) is a breast cancer that is diagnosed during pregnancy or within 1 year after giving birth. PABC occurs in up to 3% of all breast malignancies. The risk is age-related, and older pregnant women have a higher risk than younger pregnant women.<sup>3,5</sup> PABC tends to be more aggressive and has a poorer prognosis than breast cancer in non-pregnant women. There is a high prevalence of hormone receptor-negative and HER2/neu-positive tumours and they have a high grade on histology in more than 50% of cases. Biological effects during pregnancy induce more aggressive growth. Recurrence is common and it usually occurs within 2 to 3 years after diagnosis.

PABC patients almost always have a palpable mass. Less common symptoms are swelling or diffuse breast enlargement and redness, which suggests locally advanced breast carcinoma.<sup>5</sup> Imaging findings of PABC are similar to those of breast cancer in non-pregnant women. US is the first imaging tool used for pregnant women with a palpable mass. The typical US appearances of malignancy such as spiculated margin, hypoechoogenicity, irregular shape, posterior acoustic shadow, and non-parallel orientation can be present. Some of the non-typical malignant features can be found in PABC due to physiological changes of

breast parenchyma during pregnancy such as parallel orientation and posterior acoustic enhancement.<sup>6</sup> Mammography should be performed if there are suspicious findings on US because the mammogram can better demonstrate the presence of microcalcifications and architectural distortion (Figure 15). Mammogram can also detect some other findings such as multifocal / multicentric cancers or bilateral cancers that may be missed by US alone. Radiation from mammography produces very little risk to the fetus when using proper abdominal shielding.<sup>11,12</sup>

## CONCLUSION

Both benign and malignant breast disorders can occur in pregnancy and lactation, similar to those seen in non-pregnant women. However, some breast disorders during pregnancy and lactation are unique. Knowing the anatomical and physiological changes during pregnancy and lactation are essential. US is the first imaging modality in the evaluation of breast problems during pregnancy and lactation. Mammography should be performed if malignancy is suspected. MRI is used only in a situation in which the risk-benefit ratio is clear. Familiarity with the imaging spectrum of breast disorders during pregnancy and lactation is very helpful for radiologists to provide the correct diagnosis and avoid delayed diagnosis of breast cancer and unnecessary surgery for benign lesions.



**Figure 15.** A 7-month pregnant woman presented with a palpable mass in her left breast. (a) An ultrasound image shows an irregular hypoechoic mass with microcalcifications (arrows). Since the ultrasound findings were suspicious of malignancy, left mammogram was done. (b) Left craniocaudal mammogram shows a dense breast with segmental distribution of pleomorphic microcalcifications (arrows) at the central posterior aspect of the breast. Fine-needle aspiration revealed ductal carcinoma.

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