

# Imaging of giant breast masses with pathological correlation

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## ABSTRACT

Ultrasonography (US) and mammography are the two basic techniques for routine imaging in the diagnosis of breast diseases. A wide variety of breast conditions such as lipoma, hamartoma, cyst, fibroadenoma, phyllodes tumour, haematoma, abscess and carcinoma can result in solitary or multiple giant masses. These conditions may appear similar on physical examination. The clinical significance of these entities is that some lesions necessitate mastectomy but some lesions may require only local excision, aspiration or even conservative management. Imaging has enhanced our ability to characterise these lesions. The purpose of this pictorial review is to illustrate the causes of giant breast masses, and the role of US and mammography in diagnosis of these lesions.

**Keywords:** breast enlargement, breast neoplasms, ultrasonography, mammography, giant breast masses

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## INTRODUCTION

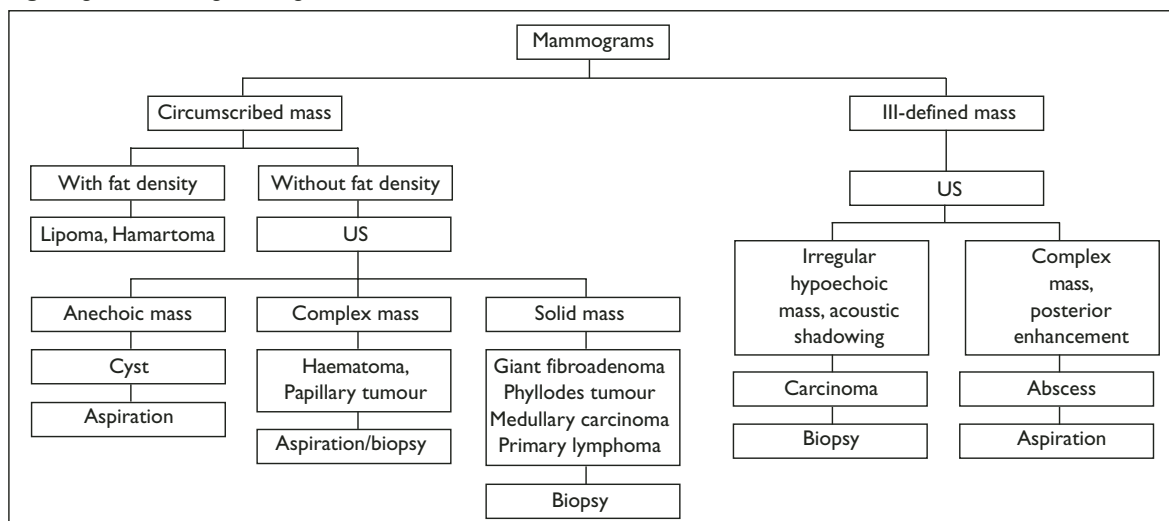
It is a tragic fact that in developing countries, many patients present late with giant breast masses i.e.

larger than 5 cm across. The lesions may be solitary or multiple, and either benign or malignant. Many of these conditions are indistinguishable on physical examination alone. Some of these lesions require mastectomy while others can be treated by local excision, aspiration or even conservative measures. This pictorial essay aims to illustrate via imaging the causes of giant breast masses, based on the experience in our institute.

## BASIC IMAGING APPROACH

Ultrasonography (US) and mammography are the two basic imaging techniques for routine diagnostic imaging of breast diseases. For women over the age of 35 years presenting with a palpable or suspected breast mass, mammography is often the first imaging investigation to be performed. From our experience, an algorithmic approach based on mammographical features, i.e. whether a mass is well-circumscribed or not, and the presence of fat density is proposed. US is used to determine whether the mass is a simple cyst, a complex mass, or a solid mass (Fig. 1). It should be emphasised, however, that a thorough clinical examination should be performed in conjunction with these imaging studies for a complete breast assessment.

Fig. 1 Algorithm for diagnosis of giant breast mass.



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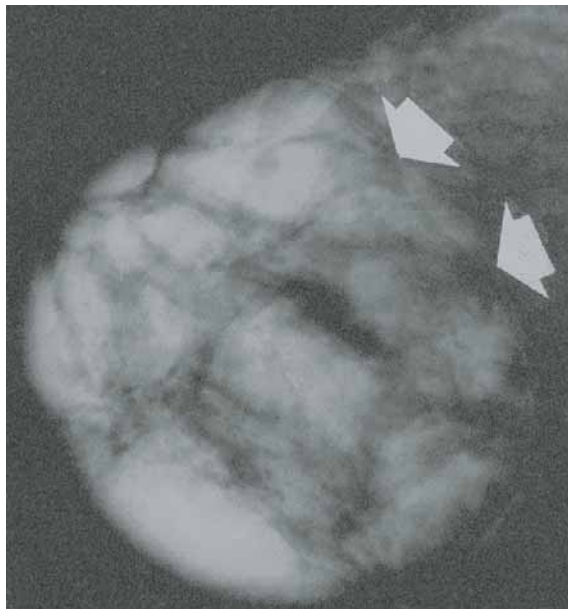
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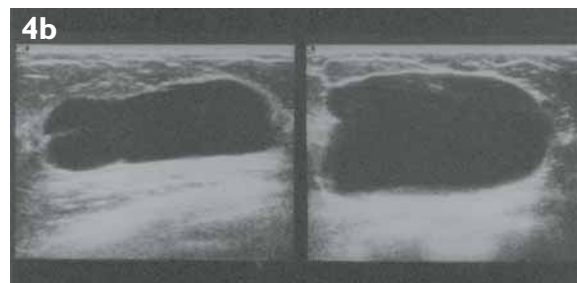
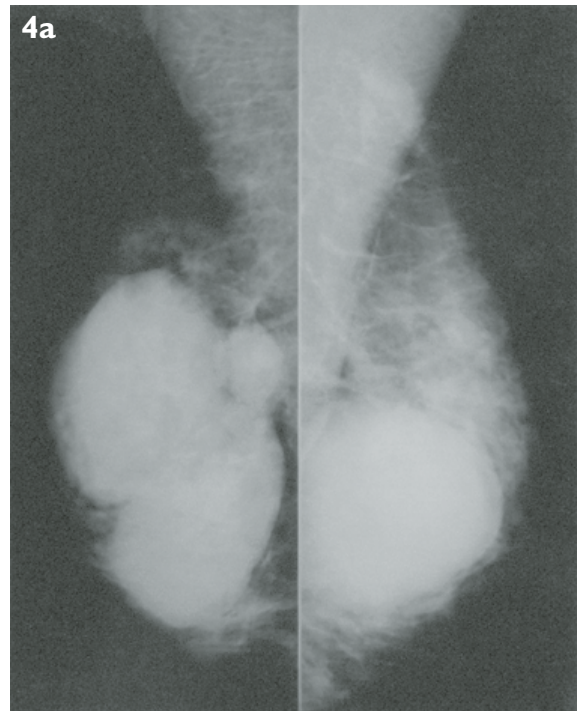
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**Fig. 2** Lipoma. 52-year-old woman who presented with a left breast mass. (a) Bilateral mediolateral oblique mammograms show a large sharply-outlined radiolucent mass occupying the upper quadrant of the left breast with a thin radiopaque capsule (arrows) and displacement of adjacent breast parenchyma. (b) Photograph of the gross specimen shows a circumscribed mass with a greasy yellowish cut surface.



**Fig. 3** Hamartoma. Right craniocaudal mammogram shows a huge circumscribed mass of mixed fat and soft tissue density (arrows) occupying almost the entire breast. This appearance has been described as the "breast within breast" lesion.



**Fig. 4** Multiple cysts. (a) Bilateral mediolateral oblique mammograms show multiple circumscribed masses in both breasts. (b) US images show anechoic well-defined masses with smooth walls and posterior acoustic enhancement.

**CIRCUMSCRIBED MASSES WITH FAT DENSITY**

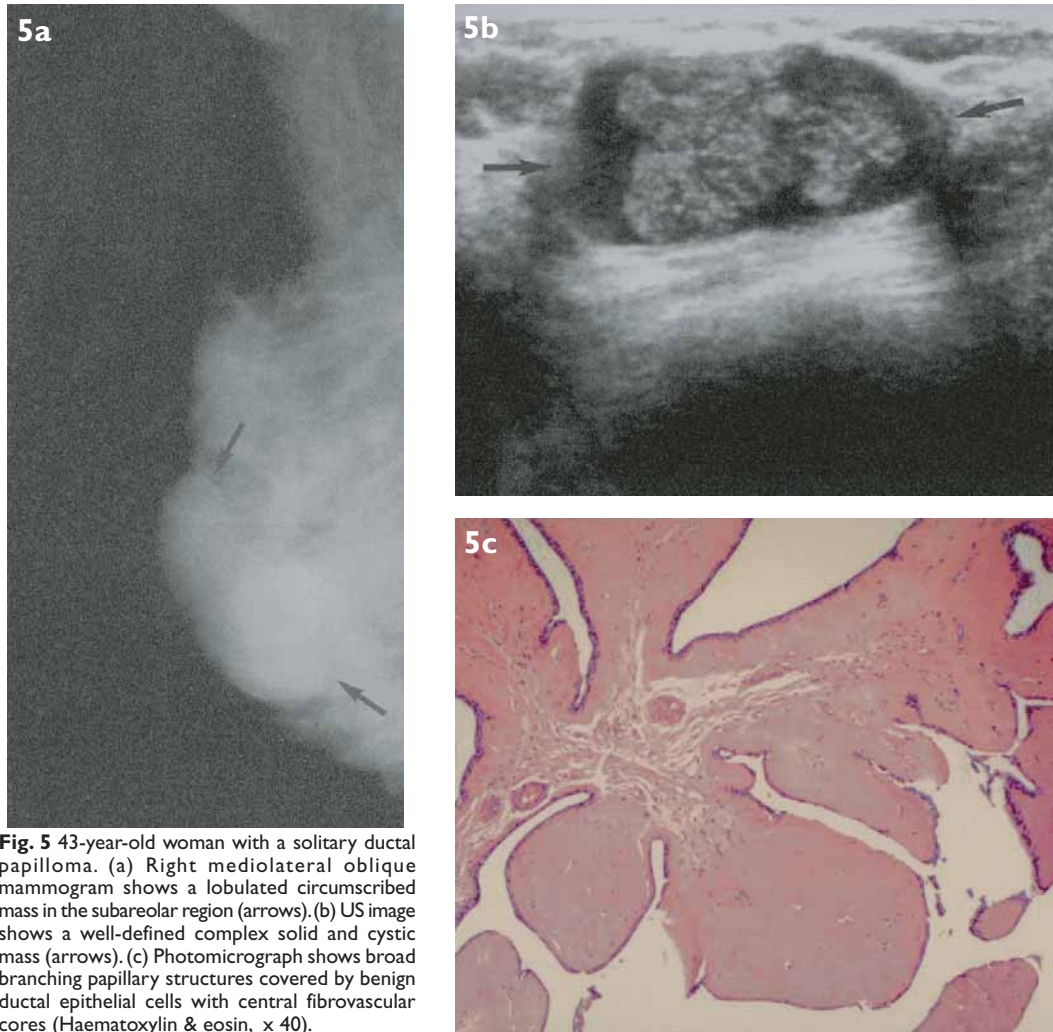
**Lipoma**

Lipomas are benign tumours composed of mature fat. Accurate mammographical diagnosis can be made when a totally-fatty circumscribed mass is found (Fig. 2). Further investigation is then unnecessary. Occasionally, lipomas may contain typical ring-like calcifications due to fat necrosis.

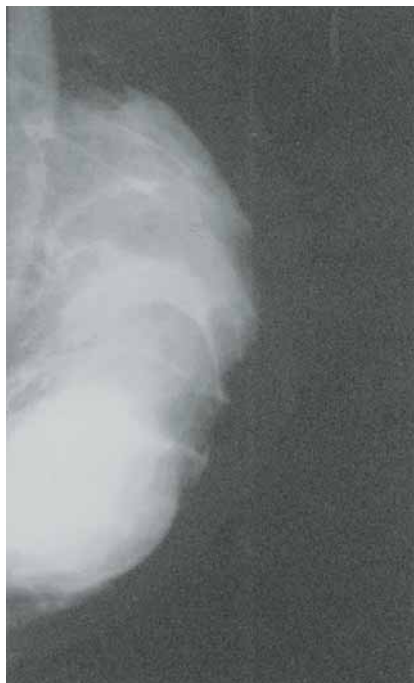
**Hamartoma**

Hamartomas (also called lipofibroadenoma and fibroadenolipoma) are rare benign lesions composed of variable amounts of fat, fibrous connective tissue, and glandular tissue. Hamartomas have characteristic mammographical appearances consisting of a

circumscribed mass of mixed fat and fibroglandular densities (Fig. 3). This appearance is sufficient to make a diagnosis and further investigation such as US or biopsy is not required<sup>(1)</sup>.



**Fig. 5** 43-year-old woman with a solitary ductal papilloma. (a) Right mediolateral oblique mammogram shows a lobulated circumscribed mass in the subareolar region (arrows). (b) US image shows a well-defined complex solid and cystic mass (arrows). (c) Photomicrograph shows broad branching papillary structures covered by benign ductal epithelial cells with central fibrovascular cores (Haematoxylin & eosin, x 40).



**Fig. 6** Organised haematoma. Left lateral mammogram shows a circumscribed mass.

## CIRCUMSCRIBED MASSES WITHOUT FAT DENSITY

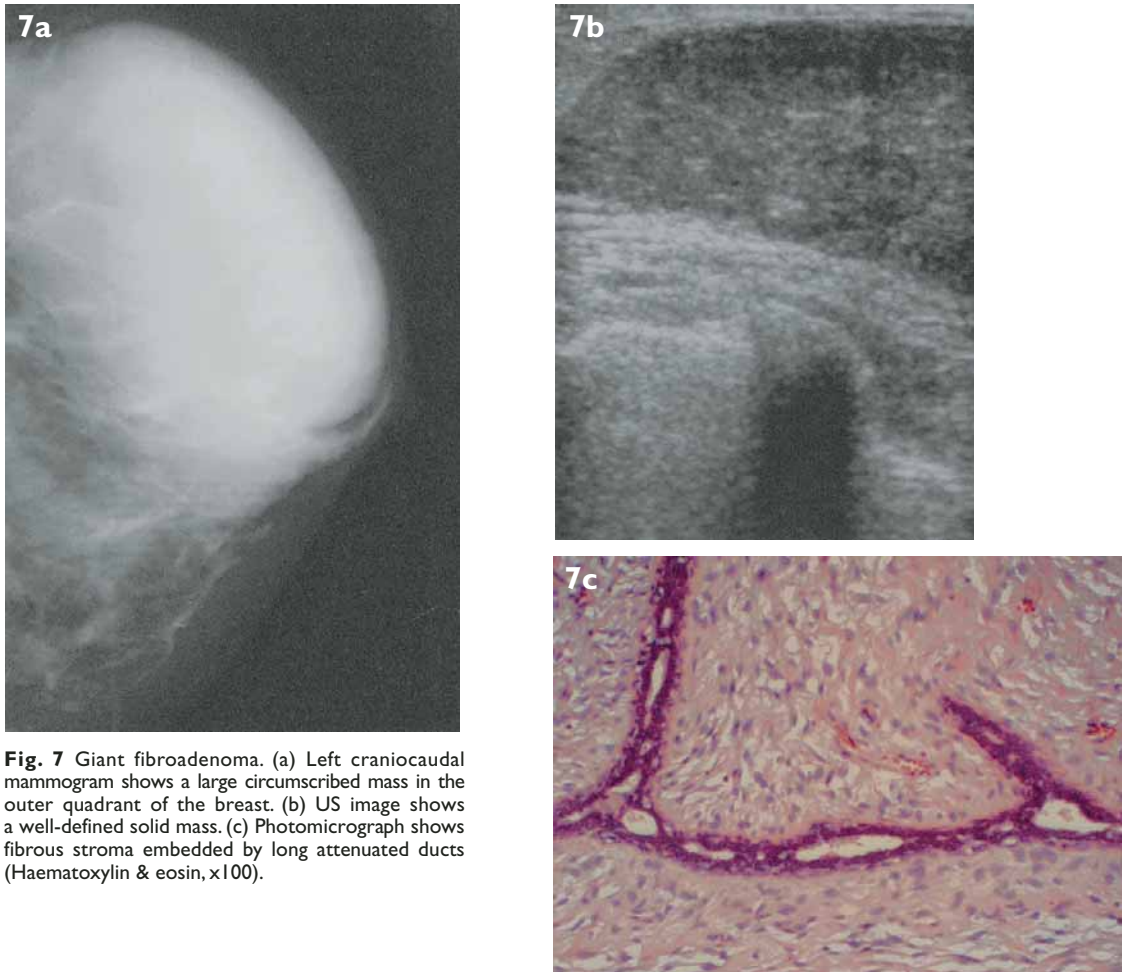
### Cyst

Cysts result from dilatation of the terminal ductal lobular unit, are lined by a single layer of epithelial cells, and contain clear or yellow transudate. They are often multiple and bilateral. On mammography, cysts appear as rounded or lobulated well-circumscribed masses (Fig. 4a) that cannot be differentiated from solid masses. US is 100% accurate in the diagnosis of a cyst with US criteria of smoothly-marginated rounded anechoic masses with posterior acoustic enhancement<sup>(2)</sup> (Fig. 3b). Cyst aspiration is both diagnostic and therapeutic. Cytologic evaluation of the cyst fluid is not recommended unless it is bloody<sup>(3)</sup>.

### Complex masses

#### *Papillary tumour*

Papillary tumours of the breast are rare. Two main types have been described: benign intraductal papilloma and malignant papillary carcinoma. Mammographical



**Fig. 7** Giant fibroadenoma. (a) Left craniocaudal mammogram shows a large circumscribed mass in the outer quadrant of the breast. (b) US image shows a well-defined solid mass. (c) Photomicrograph shows fibrous stroma embedded by long attenuated ducts (Haematoxylin & eosin, x100).

and US distinction between benign and malignant papillary tumours is difficult<sup>(4)</sup>. Both may be seen as well-circumscribed masses on mammography. On US, a complex cystic-solid mass is present (Fig. 5). Cytological differentiation between benign and malignant papillary tumour is also difficult<sup>(5)</sup>. Recently, Mercado et al<sup>(6)</sup> reported that stereotactic directional vacuum-assisted biopsy can reliably diagnose benign and malignant papillary lesions but the extent of malignant papillary lesion disease may be underestimated.

#### *Haematoma*

Mammographically, haematomas are seen as ill-defined soft tissue masses that become well-defined with organisation (Fig. 6). US features of haematoma are variable, with time-dependent complex appearances. They may be irregularly hyperechoic in the acute stage, becoming regularly hypoechoic with resolution.

#### **Solid masses**

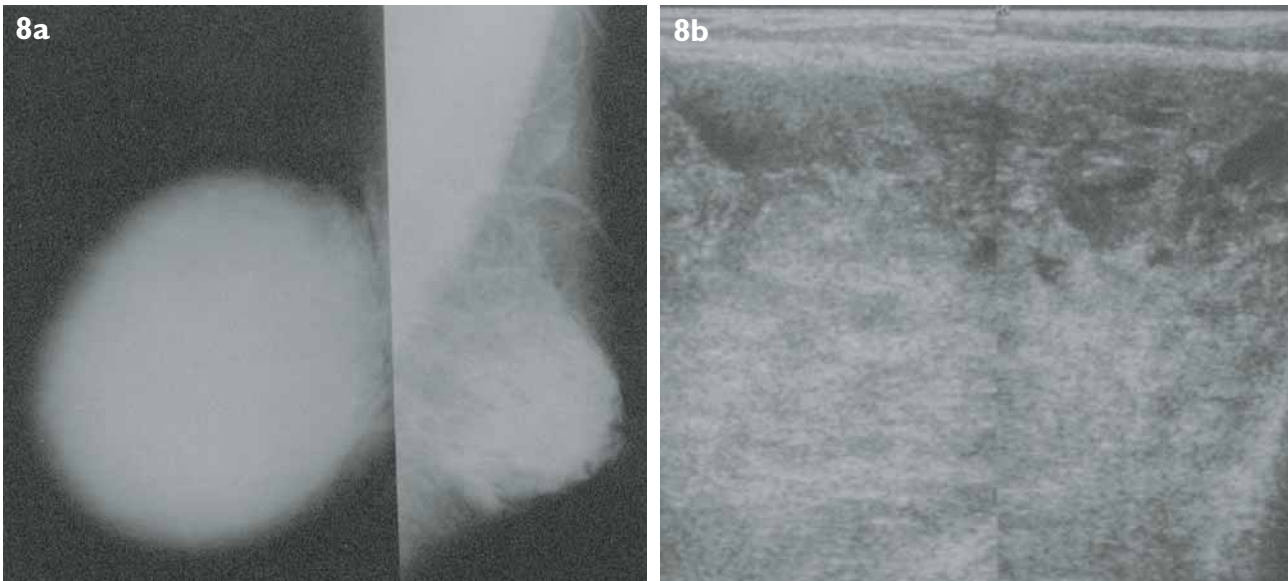
##### *Giant fibroadenoma*

Fibroadenomas comprise approximately 75% of all breast tumours among young female patients. Less

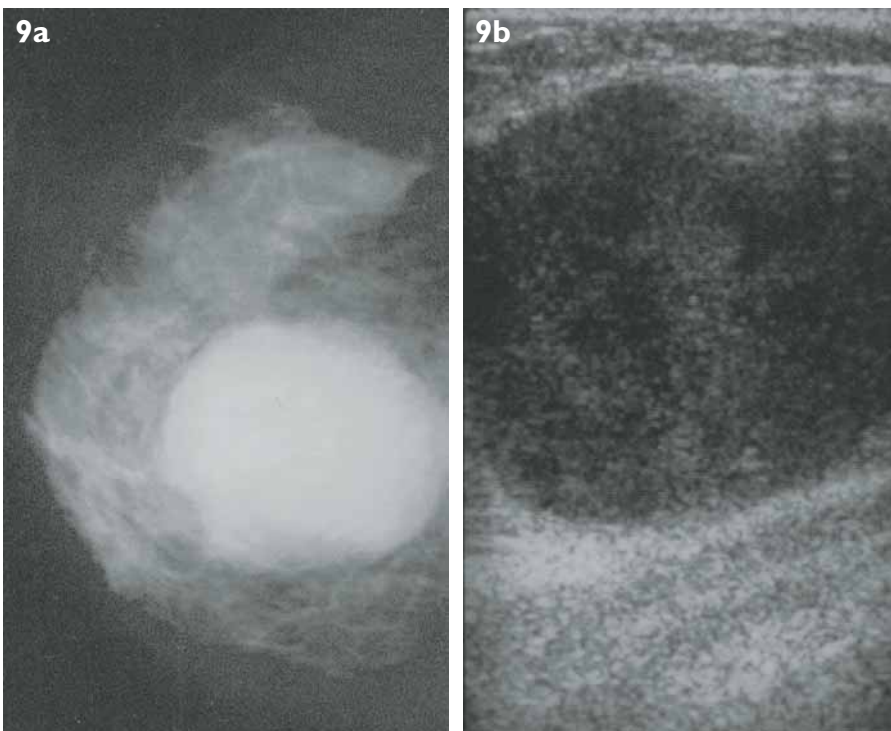
than 5% of fibroadenomas grow rapidly and display the clinical and histologic characteristics of giant fibroadenomas. Giant fibroadenoma is defined as a tumour either having a diameter greater than 5 cm and/or a mass weighing more than 500 grams<sup>(7)</sup>. Giant fibroadenoma is the most common cause of macromastia in young women. They appear as well-circumscribed masses on mammography, and are solid on US (Fig. 7).

##### *Phyllodes tumour*

Phyllodes tumours are histologically similar to fibroadenomas but have more cellularity and stromal proliferation. Approximately 20-50% are malignant. On mammography, they are seen as well-defined masses while on US, they appear as well-defined masses with low-level uniform or scattered internal echoes (Fig. 8). The diagnosis of phyllodes tumour may be suggested by the presence of fluid-filled, elongated spaces or clefts within a solid mass. These features are characteristic but not pathognomonic of the diagnosis. There are no known reliable imaging criteria to differentiate benign from malignant phyllodes tumours<sup>(8)</sup>.



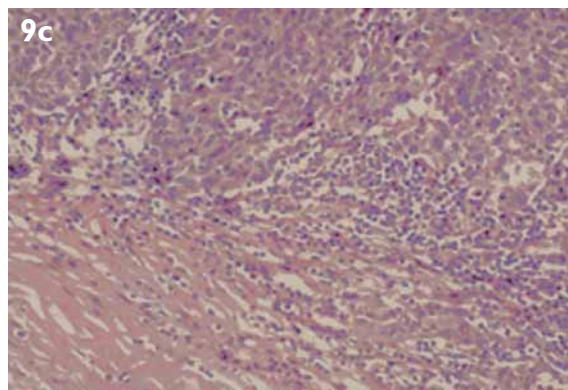
**Fig. 8** Benign phyllodes tumour. (a) Bilateral mediolateral oblique mammograms show a huge circumscribed mass occupying almost the entire right breast. (b) US image shows an inhomogeneously-echogenic mass.

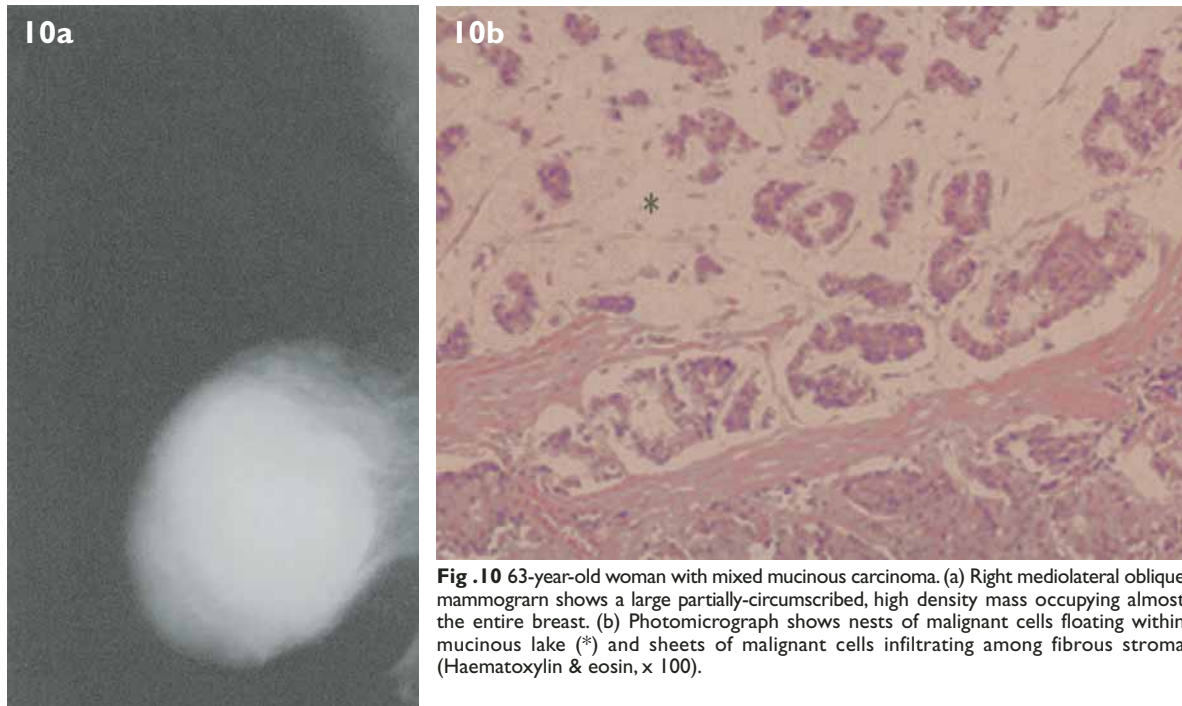


**Fig. 9** Medullary carcinoma. (a) Right craniocaudal mammogram shows a 5x6.5 cm well-circumscribed lobulated mass. (b) US image shows a circumscribed lobulated solid mass. (c) Photomicrograph shows syncytial sheets of malignant cells surrounded by band of fibrous tissue that is infiltrated by a moderate number of lymphocytes (Haematoxylin & eosin, X200).

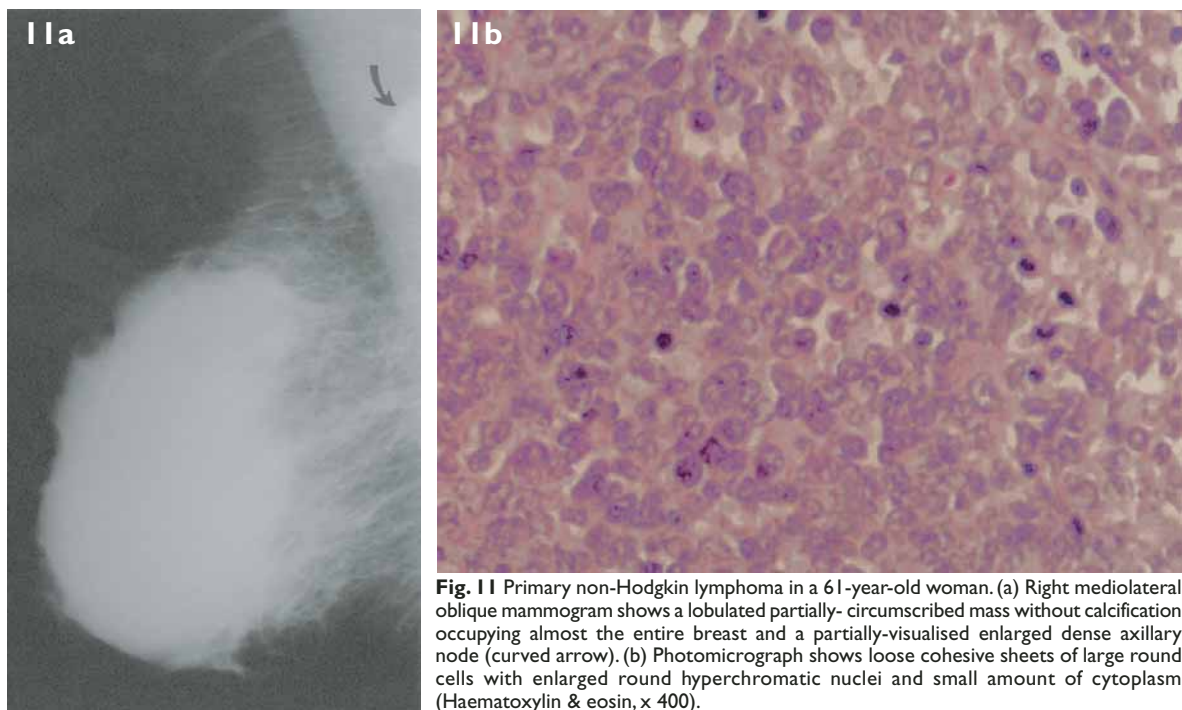
*Other malignant tumours*

These include various types of carcinoma such as the medullary and mucinous subtypes, and primary lymphoma<sup>(9-11)</sup>. All these malignant tumours, if presenting as giant breast masses, appear similar mammographically, being seen as large circumscribed masses that are solid on US (Figs. 9-11). A circumscribed mass without fat density on mammogram and that is solid on US may arise from many causes and cannot be differentiated from each other on the





**Fig .10** 63-year-old woman with mixed mucinous carcinoma. (a) Right mediolateral oblique mammogram shows a large partially-circumscribed, high density mass occupying almost the entire breast. (b) Photomicrograph shows nests of malignant cells floating within mucinous lake (\*) and sheets of malignant cells infiltrating among fibrous stroma (Haematoxylin & eosin, x 100).



**Fig .11** Primary non-Hodgkin lymphoma in a 61-year-old woman. (a) Right mediolateral oblique mammogram shows a lobulated partially- circumscribed mass without calcification occupying almost the entire breast and a partially-visualised enlarged dense axillary node (curved arrow). (b) Photomicrograph shows loose cohesive sheets of large round cells with enlarged round hyperchromatic nuclei and small amount of cytoplasm (Haematoxylin & eosin, x 400).

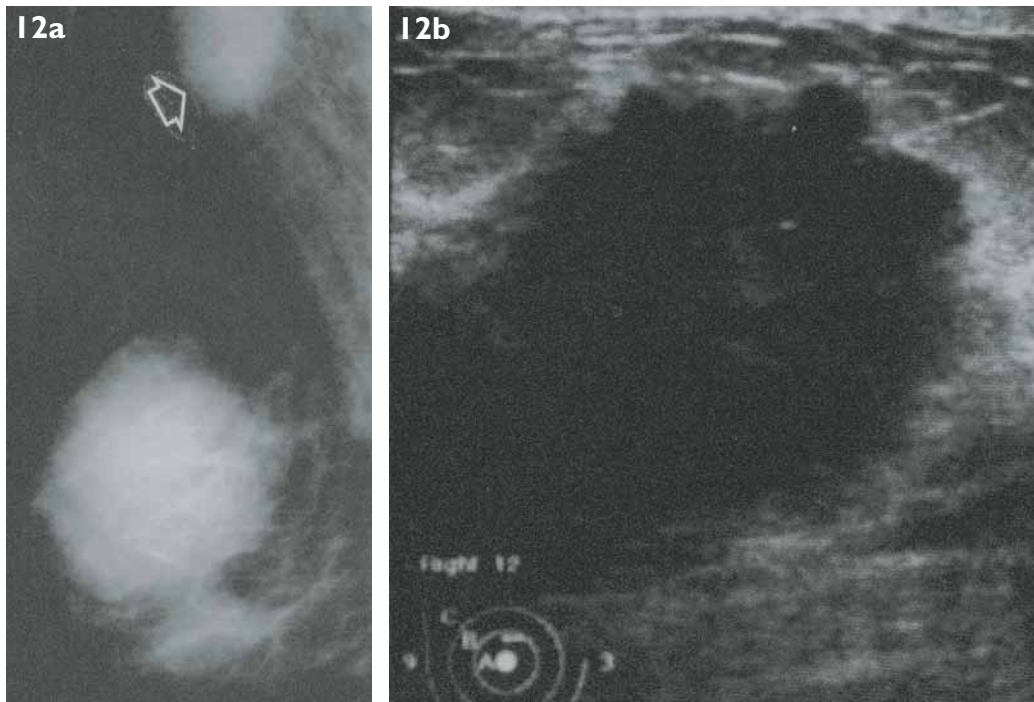
basis of imaging alone, though a giant fibroadenoma is more common in women younger than 35 years of age. A tissue diagnosis is warranted in this group. The value of needle biopsy (either fine-needle or core biopsy) depends on the management protocol of the surgeons. In a one-step procedure, open biopsy and frozen section are followed immediately by the appropriate surgical treatment. In a two-step procedure, the needle biopsy is

performed first, followed by definitive surgery at a later date<sup>(2)</sup>.

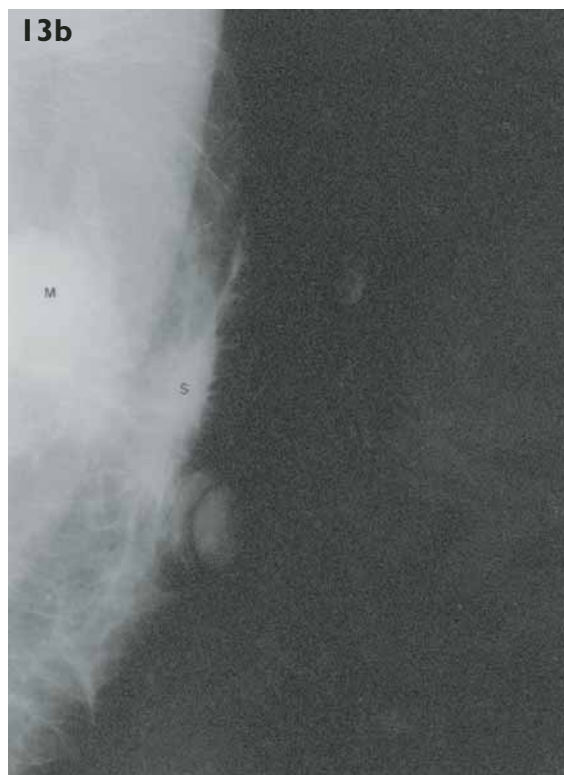
### ILL-DEFINED MASSES

#### Carcinoma

The typical mammographical appearance of invasive breast carcinoma is an irregularly-shaped mass with spiculated margins, associated with microcalcifications in 40%. US appearances are spiculation, a taller-than-



**Fig. 12** Breast carcinoma in a 51-year-old woman. (a) Right mediolateral oblique mammogram shows a large ill-defined mass and an enlarged axillary node (open arrow). (b) US image shows a hypoechoic mass with microlobulation.

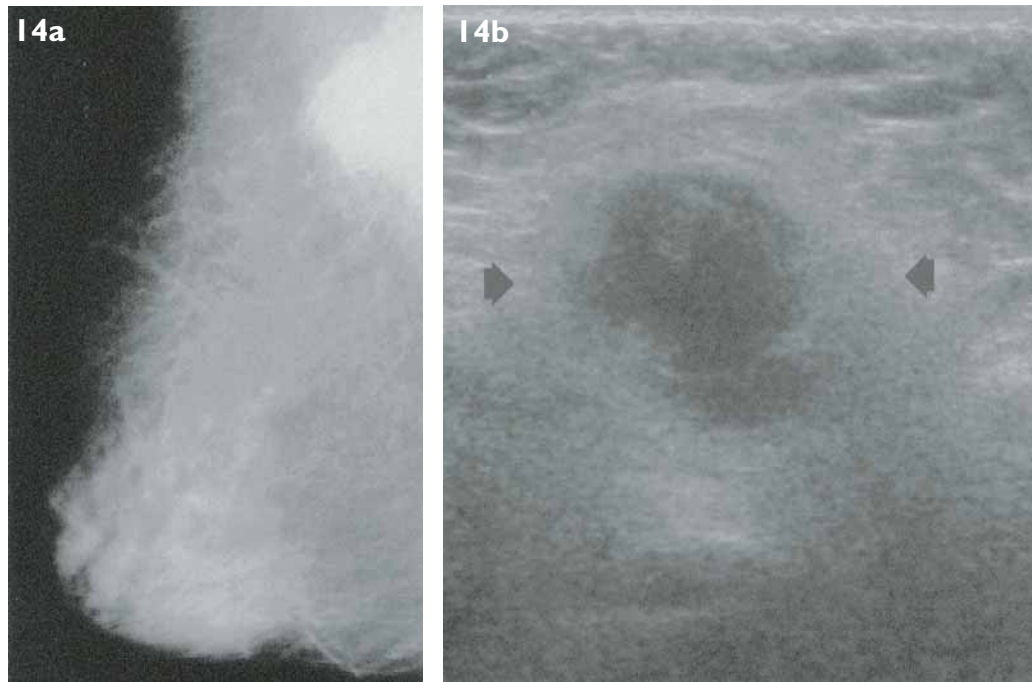


**Fig. 13** 39-year-old woman with multifocal carcinomas. (a) Photograph of the left breast shows bulging of the upper quadrant of the breast with nipple retraction. (b) Left mediolateral oblique mammogram shows a partially-circumscribed mass (M) in the superoposterior aspect of the breast and a spiculated mass (S) in the superoanterior aspect of the breast.

wide shape, marked hypoechogenicity, acoustic shadowing, angular margins, and microlobulations (Figs. 12 & 13). A tissue diagnosis is also warranted in this category.

#### **Abscess**

Abscess is a common condition associated with lactation. Non-lactating breast abscess is less common and more difficult to diagnose than the lactating type. Mammography is usually indicated to exclude malignancy. The mammographic features include an ill-defined mass, focal area of increased density, spiculated mass, diffuse asymmetric density, circumscribed mass, architectural distortion, and skin thickening and retraction. US plays an important role in differentiating between an abscess and carcinoma. Abscesses usually appear as ill-defined



**Fig. 14** 72-year-old woman with breast abscess. (a) Right mediolateral oblique shows an ill-defined mass in the posterior aspect of the breast. (b) US shows an ill-defined mass (arrows) with a central irregular hypoechoic area and posterior acoustic enhancement. Needle aspiration yielded pus.

masses and have central hypoechoic areas with either septations or low-level internal echoes, and posterior enhancement<sup>(12)</sup> (Fig. 14). Aspiration and appropriate antibiotic treatment are helpful to avoid unnecessary surgery.

### CONCLUSION

Both benign and malignant breast lesions can present as giant masses. When detected on mammography, an algorithmic approach incorporating with US is helpful for investigating these patients.

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