

**CME Article**

# Benign breast lesions mimicking carcinoma at mammography

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**ABSTRACT**

Many benign breast lesions pose diagnostic challenges. These lesions include abscess, haematoma, radial scar, post surgical scar, diabetic mastopathy, focal fibrosis, sclerosing adenosis, granular cell tumour, extra-abdominal desmoid tumour, medial insertion of pectoralis muscle and sternalis muscle, and axillary lymphadenopathy (due to HIV infection, collagen vascular lesions, tuberculous and bacterial lymphadenitis). Radiologists should be familiar with the characteristic imaging features of these benign lesions, and should include these benign lesions in the differential diagnosis whenever malignant-appearing findings are encountered. Correlation of the patient's clinical features with the mammographical findings and additional use of ultrasonography, fine-needle aspiration biopsy or core biopsy are helpful in establishing the final diagnosis and obviating unnecessary surgical intervention. In some of these lesions, surgery may be avoided while in others, the appropriate surgical procedure may be planned. This pictorial essay aims to illustrate the mammographical features of these lesions in a group of proven cases.

**Keywords:** benign breast lesions, breast lesions, breast tumour, mammography, ultrasonography

*Singapore Med J 2007;48(10):958-968*

**INTRODUCTION**

Most of the lesions that occur within the breast are benign. Many of these have typical appearance on mammography and rarely require further evaluation. However, some of these benign lesions cannot be differentiated from carcinoma and need further evaluation or biopsy to arrive at the diagnosis. These benign lesions include:

- Radial scar
- Sclerosing adenosis
- Diabetic mastopathy

- Fat necrosis
- Surgical scar
- Abscess
- Extra-abdominal desmoid tumour
- Granular cell tumour
- Haematoma
- Medial insertion of pectoralis muscle and sternalis muscle
- Axillary nodal hyperplasia and lymphadenitis

Radiologists should be familiar with the characteristic imaging of these benign lesions and should include these benign lesions in the differential diagnosis whenever malignant-appearing findings are encountered. Correlation of the patient's clinical features with the mammographical findings and the additional use of ultrasonography (US), fine-needle aspiration biopsy (FNAB) or core biopsy are helpful in establishing the final diagnosis and obviating unnecessary surgical intervention. In some of these lesions, surgery may be avoided while in others, the appropriate surgical procedure may be planned. Knowledge of these lesions can help radiologists narrow the differential diagnosis and decide whether or not to do a biopsy for a certain condition.

**RADIAL SCAR**

Radial scar (RS) is a benign lesion that is often mistaken for carcinoma because of its spiculated appearance. Tabar and Dean listed the mammographical characteristics that may help to differentiate RS from carcinoma, which include: varying appearances in different projection, no discrete central mass, long thin radiating spicules against a background of a radiolucent centre that creates a 'black star appearance', and absence of a palpable mass or skin changes.<sup>(1)</sup> Associated microcalcifications have been reported.<sup>(2-5)</sup> RS is typically planar in configuration,<sup>(6)</sup> therefore, it may have varying appearances on the orthogonal view (Fig. 1a). On US, RS is seen as an irregular hypoechoic mass<sup>(7)</sup> (Fig. 1b). Nevertheless, imaging is unreliable in differentiating RS from carcinoma, since carcinoma may mimic the typical RS. Conversely, RS may have both a dense centre and associated microcalcifications, similar to carcinoma. Contrast-enhanced magnetic resonance mammography

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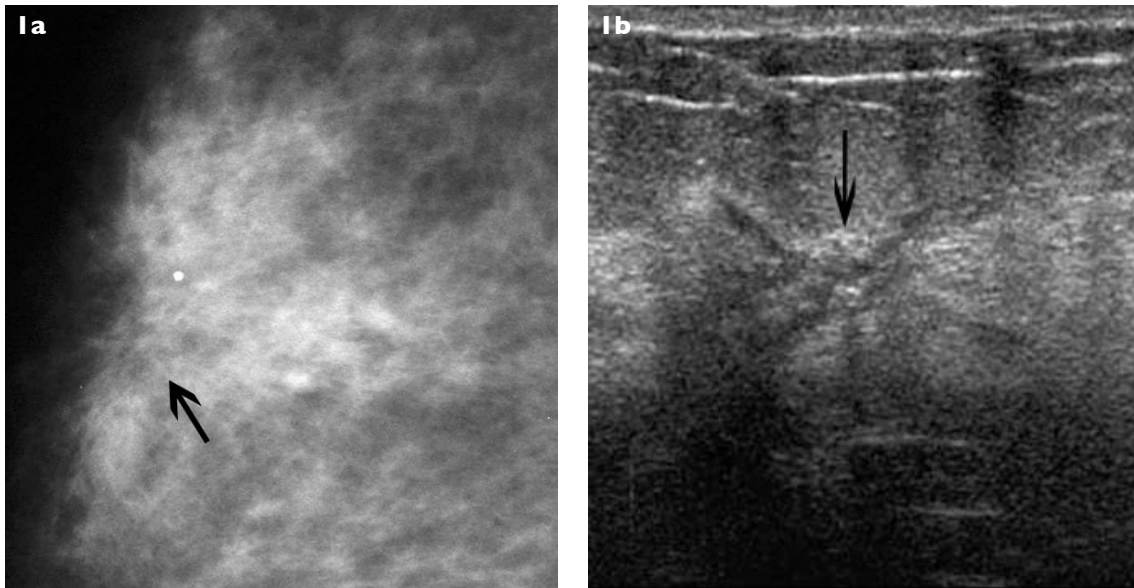
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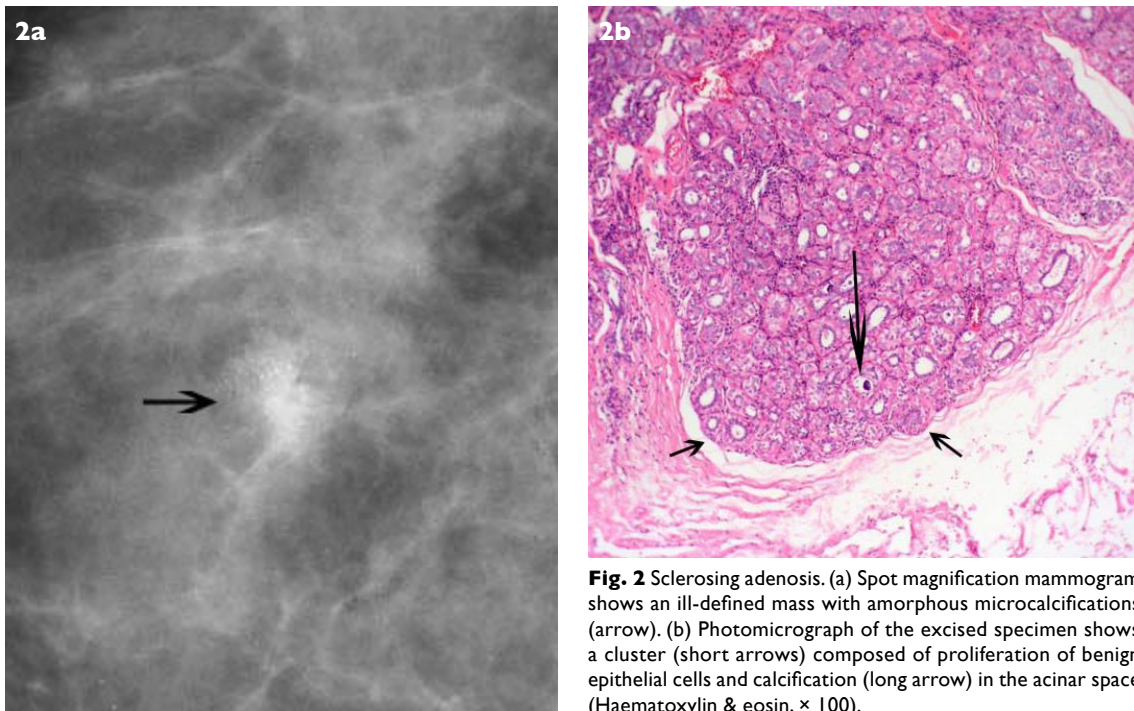
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**Fig. 1** Radial scar in a 51-year-old asymptomatic woman. (a) Spot magnification mammogram shows an area of architectural distortion with central lucency (arrow). (b) US image shows a hypoechoic spiculated lesion (arrow).



**Fig. 2** Sclerosing adenosis. (a) Spot magnification mammogram shows an ill-defined mass with amorphous microcalcifications (arrow). (b) Photomicrograph of the excised specimen shows a cluster (short arrows) composed of proliferation of benign epithelial cells and calcification (long arrow) in the acinar space (Haematoxylin & eosin,  $\times 100$ ).

(CE-MRM) has been reported to be superior to mammography in differentiating RS from carcinoma.<sup>(8)</sup> Breast carcinomas are usually enhancing, but RS is non-enhancing, at CE-MRM. However, some carcinoma foci existing within RS may not enhance. Therefore, surgical biopsy is recommended in all mammographically-visible spiculated lesions that do not develop after surgical biopsy.<sup>(4-6,8)</sup> At pathological

examination, RS has a central fibroelastic core and radiation of distorted ducts and lobules, which are composed of benign proliferation such as sclerosing adenosis, atypical ductal hyperplasia, cyst formation and papillomatosis.<sup>(2-6)</sup> To permit the precise pathological diagnosis of RS, excisional biopsy of the entire lesion is preferable to FNAB or core needle biopsy because of its pathological heterogeneity.<sup>(3-6)</sup>



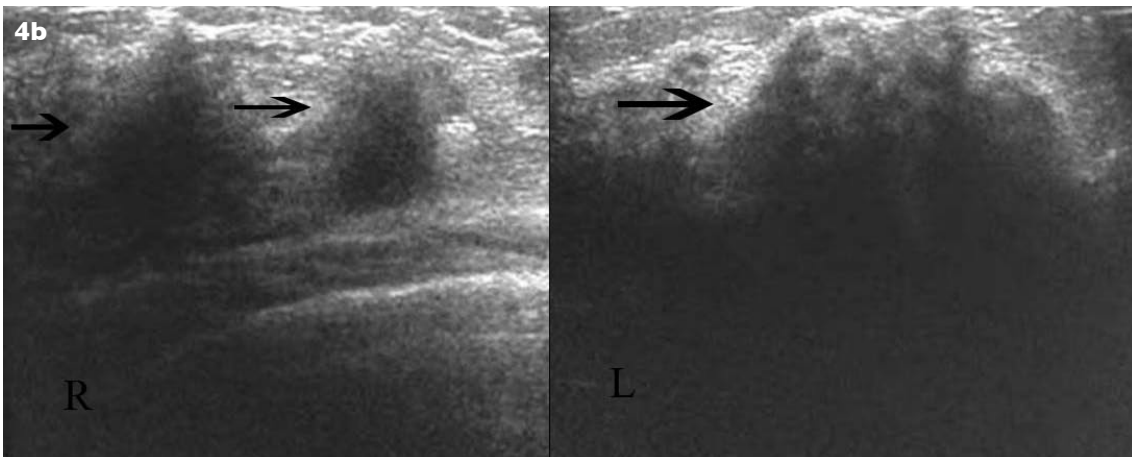
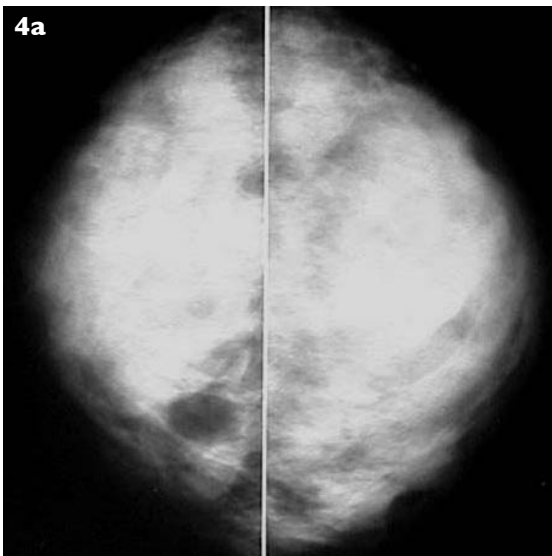
**Fig. 3** Sclerosing adenosis. Left CC mammogram shows an area of architectural distortion mass (arrow). Excisional biopsy revealed sclerosing adenosis with atypical ductal hyperplasia.

**SCLEROSING ADENOSIS**

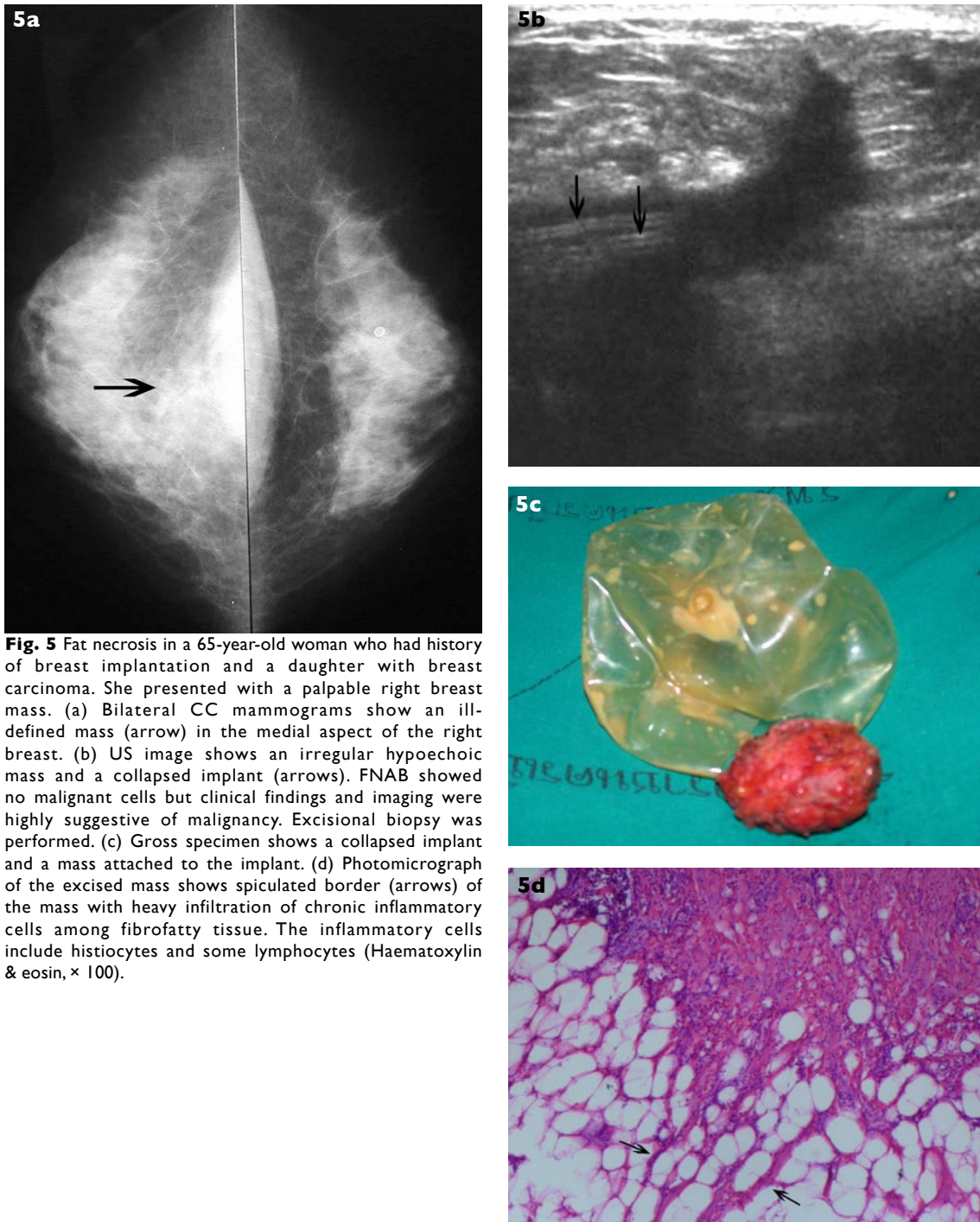
Sclerosing adenosis is a form of fibrocystic change, and is a combination of adenosis and stromal sclerosis.<sup>(9)</sup> Adenosis refers to epithelial and myoepithelial proliferation of the lobules. As a result of sclerosis which develops in the evolution of adenosis, the lobules become irregular and distorted. The mammographical appearances of sclerosing adenosis include microcalcifications, a circumscribed mass, discrete mass with ill-defined margins, spiculated mass, asymmetrical focal density, and focal architectural distortion.<sup>(9-11)</sup> These findings cannot be differentiated from carcinoma, and biopsy is mandatory (Figs. 2-3). On US, sclerosing adenosis may appear as a focal acoustic shadowing without a mass configuration, well-circumscribed oval or lobulated contour, microlobulation and irregular mass or irregular mass with posterior acoustic shadowing.<sup>(11)</sup>

**DIABETIC MASTOPATHY**

Diabetic mastopathy is an unusual form of stromal fibrosis with lymphocytic infiltration, and typically occurs in premenopausal women with longstanding type I diabetes mellitus.<sup>(12)</sup> Rare cases of diabetic mastopathy have also been reported in association with type II diabetes mellitus and other autoimmune diseases.<sup>(13)</sup> Patients present with solitary or multiple, non-tender, hard masses, suspicious for carcinoma. Further investigations with a mammogram shows a dense breast<sup>(13,14)</sup> (Fig. 4a), and US shows an irregular hypoechoic mass with posterior acoustic shadow (Fig. 4b). Logan and Hoffman noticed marked acoustic shadowing, even more than what is normally seen in most carcinomas.<sup>(14)</sup> FNAB shows a marked resistance to the in-and-out motion of the



**Fig. 4** Diabetic mastopathy in a 36-year-old woman with longstanding type I diabetes mellitus, presented with palpable masses in both breasts. (a) Bilateral craniocaudal (CC) mammograms show a dense breast without a visible mass. (b) Composite US images of the right (R) and left (L) breasts show irregular masses with marked hypoechoogenicity (arrows) and posterior acoustic shadowing.



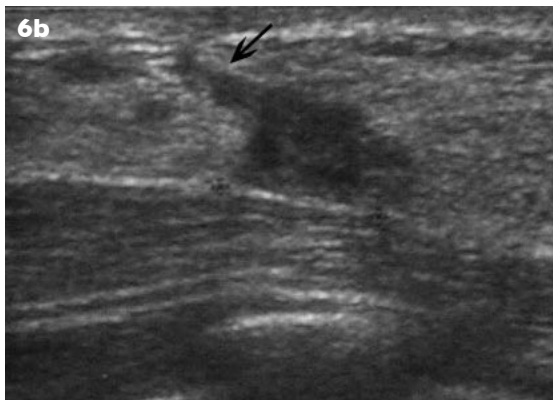
**Fig. 5** Fat necrosis in a 65-year-old woman who had history of breast implantation and a daughter with breast carcinoma. She presented with a palpable right breast mass. (a) Bilateral CC mammograms show an ill-defined mass (arrow) in the medial aspect of the right breast. (b) US image shows an irregular hypoechoic mass and a collapsed implant (arrows). FNAB showed no malignant cells but clinical findings and imaging were highly suggestive of malignancy. Excisional biopsy was performed. (c) Gross specimen shows a collapsed implant and a mass attached to the implant. (d) Photomicrograph of the excised mass shows spiculated border (arrows) of the mass with heavy infiltration of chronic inflammatory cells among fibrofatty tissue. The inflammatory cells include histiocytes and some lymphocytes (Haematoxylin & eosin,  $\times 100$ ).

needle, and yields sparse material which is inadequate for cytological diagnosis.<sup>(15)</sup> It has been proposed that, in the right clinical setting, a negative FNAB is sufficient for diagnosing diabetic mastopathy.<sup>(14,15)</sup> Radiologists' awareness of these findings may help avoid unnecessary surgical biopsy.

#### **FAT NECROSIS**

Fat necrosis is a nonsuppurative inflammatory process that often occurs as a result of blunt trauma, surgery, or radiation. However, not all patients present with a

clear history of trauma. Fat necrosis is important both clinically and radiologically because it is often confused with carcinoma.<sup>(16,17)</sup> The clinical manifestations vary from being asymptomatic, appearing only as a mammographical abnormality, to mobile or fixed hard masses mimicking carcinoma. Fat necrosis has a wide spectrum of mammographical appearances, including oil cyst, spiculated mass indistinguishable from carcinoma (Fig. 5a), calcifications of variable size and morphology, and localised skin thickening.<sup>(16,18)</sup> US features of fat necrosis include a solid mass (round, oval



**Fig. 6** Surgical scar. (a) Left mediolateral oblique (MLO) mammogram shows a spiculated mass (arrow) after breast conserving therapy for one year. (b) US image shows a hypoechoic mass with a hypoechoic tract (arrow) connecting to the skin at the incision site.

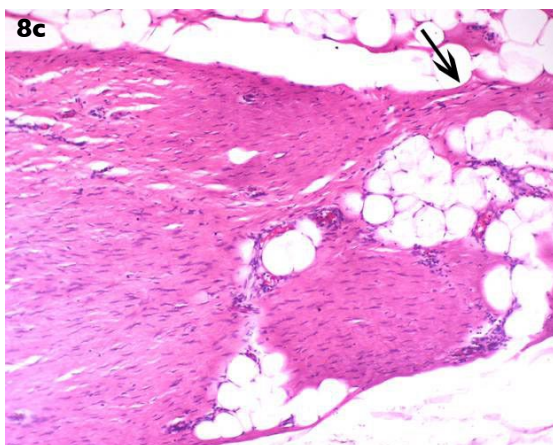
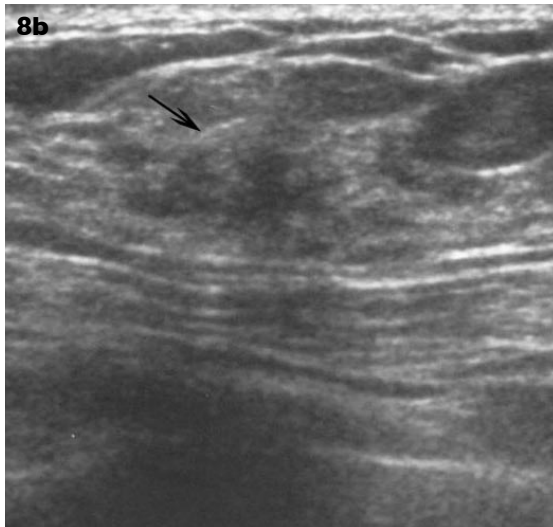
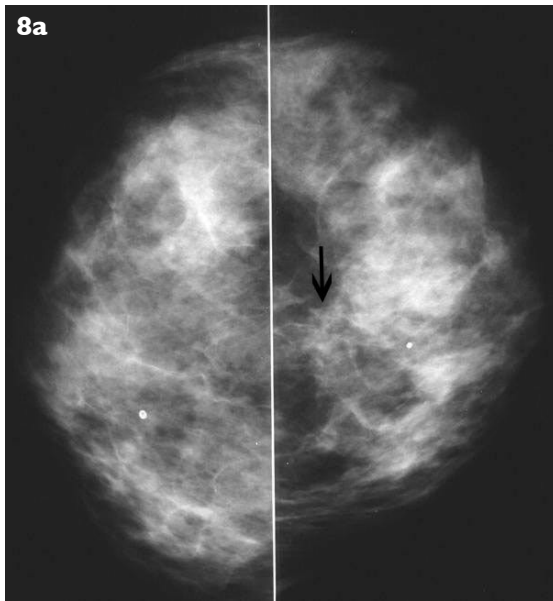
**Fig. 7** Abscess in a 65-year-old woman who had a history of right mastectomy for breast carcinoma. (a) Left MLO mammogram shows an ill-defined mass (arrow) in the subareola. From history of previous breast carcinoma and mammographic finding, the lesion was likely to be carcinoma. (b) US image shows a complex mass with posterior enhancement and skin thickening. Pus was obtained on aspiration.

or ill-defined) (Fig. 5b), anechoic mass with posterior acoustic enhancement, anechoic mass with posterior acoustic shadowing, cystic with internal echoes, cystic with mural nodule, and increased echogenicity of the subcutaneous tissues.<sup>(18,19)</sup>

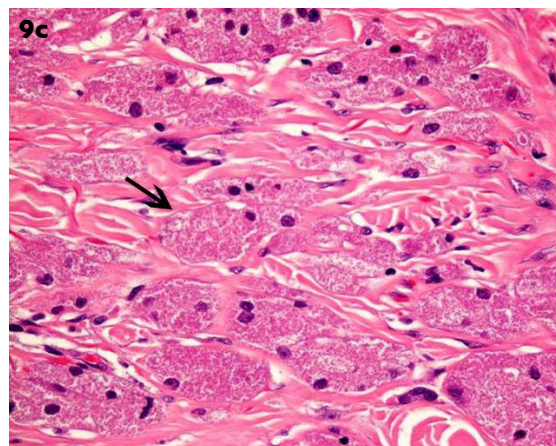
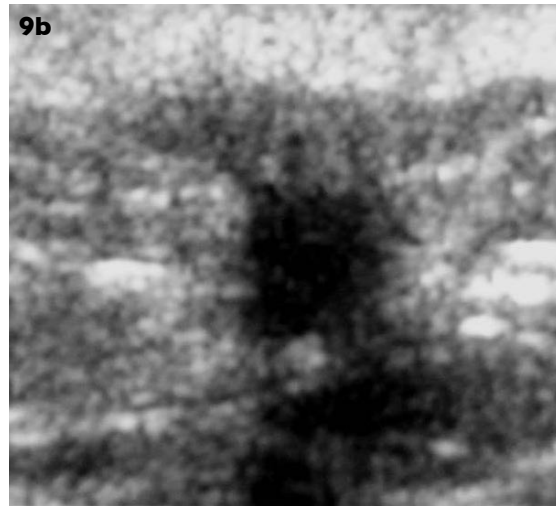
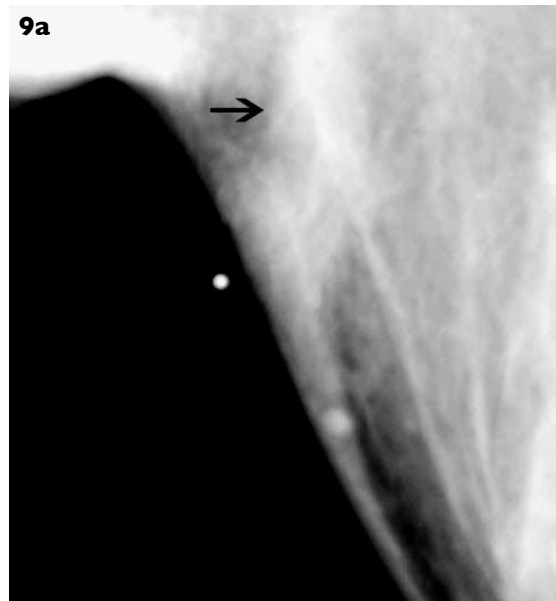
**SURGICAL SCAR**

A surgical scar is an area of fibrosis that is seen on mammogram as an area of architectural distortion, or

an ill-defined or spiculated mass (Fig. 6a) mimicking carcinoma. History of previous biopsy and correlation of the biopsy site with the mammographically-seen lesion are helpful in the differential diagnosis. A surgical scar should be located in relative proximity to the incision site.<sup>(20)</sup> Finding of a post-surgical scar in patients with breast cancer treated with conservation therapy may be suspicious of tumour recurrence. On mammography, a benign surgical scar looks different



**Fig. 8** Extra-abdominal desmoid tumour in a 47-year-old woman who presented with a left breast mass. (a) Bilateral CC mammograms show an area of architectural distortion (arrow) in the inner quadrant. (b) US image shows an irregular hypoechoic mass (arrow). FNAB showed no malignant cells but clinical finding and imaging were suggestive of malignancy. Excisional biopsy was performed. (c) Photomicrograph shows an infiltrative border (arrow) mass composed of benign spindle-shaped cells (Haematoxylin & eosin,  $\times 100$ ).



**Fig. 9** Granular cell tumour in a 54-year-old woman who presented with a left breast mass for one year. (a) Cleavage view mammogram shows an ill-defined mass (arrow) in the medial aspect of the left breast. (b) US image shows an irregular hypoechoic mass. (c) Photomicrograph shows large tumour cells (arrow) with abundant granular cytoplasm (Haematoxylin & eosin,  $\times 400$ ). (Courtesy of Dr Alice Tang, Department of Radiology, North District Hospital, Hong Kong and Dr Gary MK Tse, Department of Anatomical and Cellular Pathology, Prince of Wales Hospital, Hong Kong.)



**Fig. 10** Haematoma in a 65-year-old woman with a history of excisional biopsy of the right breast mass one month ago, presented with a palpable mass. (a) Right MLO mammogram shows a large spiculated mass. (b) US image shows a complex mass with mild posterior enhancement. Altered blood was aspirated.

on the mediolateral oblique (MLO) and craniocaudal (CC) views but a recurrent tumour always looks worrisome in both projections.<sup>(20,21)</sup> On US, a surgical scar appears as an irregular hypoechoic mass with acoustic

shadowing, similar to carcinoma. Finding of a hypoechoic tract connecting from the mass lesion to the thickened skin at the incision site (Fig. 6b) is helpful in diagnosis of a surgical scar. Magnetic resonance (MR) imaging with gadolinium enhancement is helpful in differentiating the scar from carcinoma. A scar is either avascular or hypovascular, whereas a carcinoma is hypervascular. However, both scar and carcinoma tend to enhance during the first 18 months after therapy. Fortunately, recurrent tumours rarely occur earlier than 18 months following adequate therapy.<sup>(21)</sup>

### BREAST ABSCESS

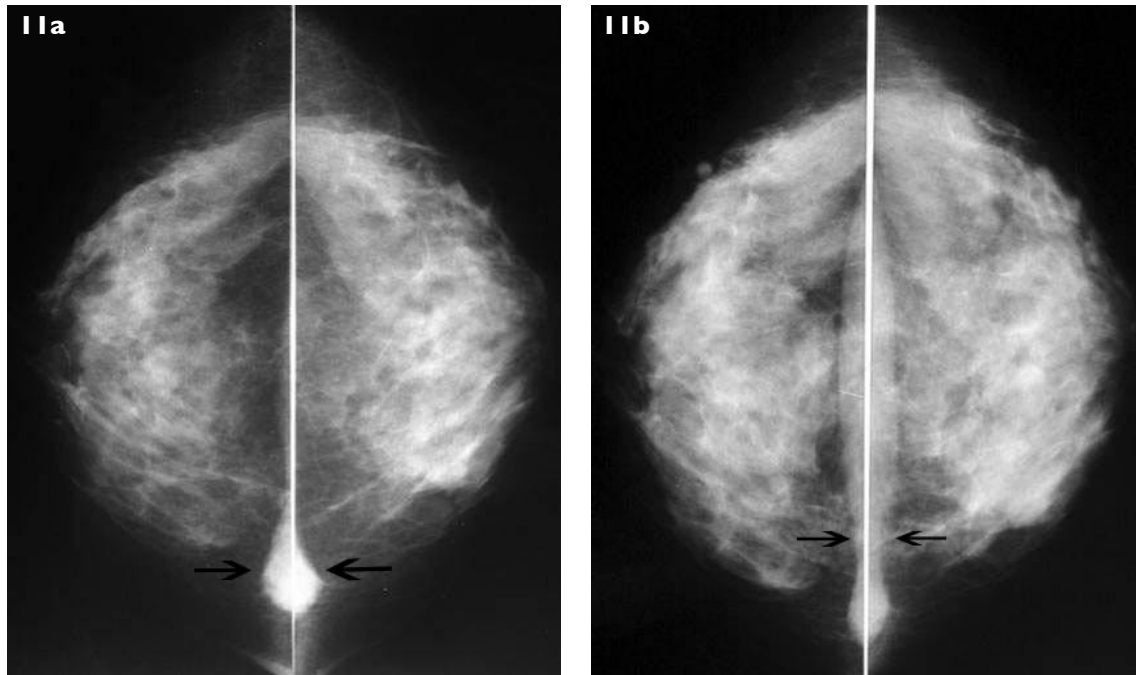
Breast abscess is common during lactation and the diagnosis is usually made clinically. Abscess in the non-lactating period is less common and more difficult to diagnose.<sup>(22)</sup> Patients may not have clinical signs of inflammation, and imaging is usually performed to exclude malignancy. Mammograms show an ill-defined mass or an area of focal increased density with distortion (Fig. 7a). These findings cannot be differentiated from those of carcinoma. US is helpful in differentiating abscess from carcinoma. Abscess is usually seen as an ill-defined echogenic mass with central irregular hypoechoogenicity or septations with or without posterior acoustic enhancement, or a complex mass (Fig. 7b); while carcinoma usually appears as an irregular hypoechoic mass, with or without posterior acoustic shadowing.

### EXTRA-ABDOMINAL DESMOID TUMOUR

Extra-abdominal desmoid tumour or fibromatosis is a benign infiltrative connective tissue tumour. The tumour occurs frequently from the aponeurosis of the rectus abdominis muscle. Fibromatosis of the breast is an extremely rare lesion that may arise from the mammary tissue or represent an extension of a lesion arising deep in the aponeurosis of the chest wall or shoulder girdle. Clinically, the patient presents with a palpable firm mass that is sometimes fixed to the pectoralis muscle or with skin retraction, a finding suggestive of malignancy.<sup>(23-25)</sup> On mammography, fibromatosis appears as a spiculated mass (Fig. 8a) simulating carcinoma. On US, it manifests as an irregular hypoechoic mass with posterior acoustic shadowing (Fig. 8b) and resembles carcinoma. Therefore, biopsy is necessary for diagnosis.

### GRANULAR CELL TUMOUR

Granular cell tumour is an unusual benign tumour originating from Schwann cells. The tumour often occurs in the tongue and many soft tissues of the body, but approximately 8% occurs in the breast.<sup>(23)</sup>



**Fig. 11** Medial insertion of pectoralis muscle. (a) Bilateral CC screening mammograms of a 45-year-old asymptomatic woman show triangular densities (arrows) in the medial aspect of both breasts. (b) Repeat CC mammograms with pulling of more breast tissue show bilateral medial triangular densities continuous with the body of pectoralis muscles (arrows).

Mammographic findings include round circumscribed mass, or irregular mass with ill-defined or spiculated margins (Fig. 9a) that is indistinguishable from a carcinoma. Microcalcifications are usually not present. A variety of US findings have been described, ranging from a circumscribed solid mass with posterior enhancement to a poorly-defined mass (Fig 9b) with acoustic shadowing.<sup>(23,26)</sup>

#### HAEMATOMA

Haematoma may result from blunt, surgical trauma, or in patients on anticoagulant therapy.<sup>(20)</sup> On mammograms, acute haematoma is seen as an ill-defined mass (Fig. 10a) which may mimic carcinoma. Knowing the clinical history and awaiting the passage of time can help in the differential diagnosis. Haematoma becomes well-defined as the lesion organises and decreases in size within weeks. On US, an acute haematoma is seen as a heterogeneous echogenic mass (Fig. 10b). With time, haematoma appears as a fluid collection with low-level echogenicity, fluid-fluid levels, or septations.

#### MEDIAL INSERTION OF PECTORALIS MUSCLE AND STERNALIS MUSCLE

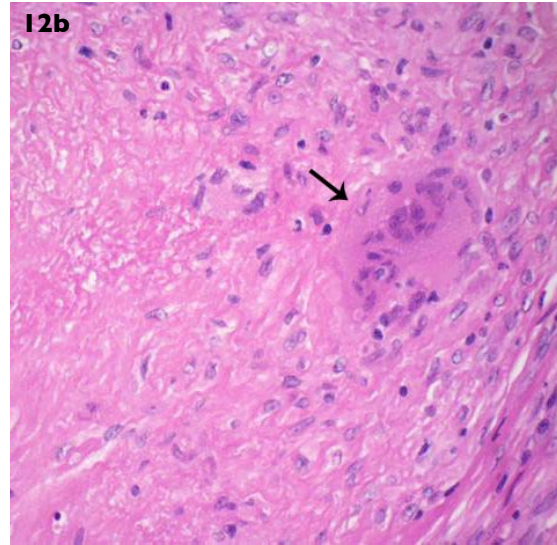
The pectoralis muscle is seen in approximately 30% of cases on the CC view as a convex structure along the chest wall portion of the image. Occasionally,

the medial portion of this muscle is seen as a triangular area of increased density in the medial aspect of the breast (Fig. 11), which may mimic carcinoma.<sup>(27,28)</sup> This focal area of asymmetric pectoralis muscle is included because of vigorous retraction of the breast and slight external rotation during positioning for the CC view. The sternalis muscle is another uncommon anatomical variant of the chest wall musculature that may appear as a focal density in the medial aspect of the breast on the CC view.<sup>(29)</sup> This muscle is present in approximately 8% of both males and females, and is of uncertain function.

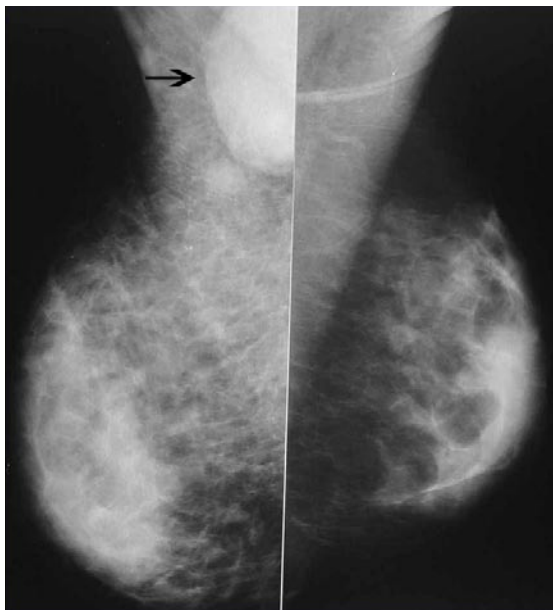
#### AXILLARY LYMPHADENOPATHY

Axillary lymph nodes are frequently seen on the routine MLO view as well-defined masses containing a central or eccentric hilar fat. Abnormal axillary nodes are suggested by an increased nodal density and loss of hilar fat density. However, abnormality of the axillary nodes can occur from many causes, including lymphoid hyperplasia from acute and chronic infections, lymphoproliferative disorders (lymphoma and leukaemia), metastasis from primary breast carcinoma and non-mammary primary tumours.<sup>(30)</sup> On mammograms, it is difficult to differentiate between benign and malignant lymphadenopathy (Figs. 12–13). The presence of macrocalcifications indicates tuberculous infection. The presence of microcalcifications and





**Fig. 12** Tuberculous lymphadenitis in a 50-year-old woman who presented with right axillary mass for one year. (a) Right MLO mammogram shows enlarged right axillary nodes with increased density and macrocalcification (arrow). (b) Photomicrograph of the excised node shows aggregation of epithelioid histiocytes with caseous necrosis and multinucleated giant cell (arrow) (Haematoxylin & eosin, × 400).



**Fig. 13** Lymph node hyperplasia in a 32-year-old woman with history of HIV infection and who presented with right axillary mass. Bilateral MLO mammograms show diffuse increased density and coarse trabeculation in the right breast and enlarged, increased density of the right axillary lymph nodes (arrow). Biopsy showed lymphoid hyperplasia.

spiculated margins is suggestive of primary breast carcinoma metastasis to the axillary nodes.<sup>(30,31)</sup> Migration of gold particles from the treatment of rheumatoid arthritis or migration of silicone from

ruptured implants to axillary nodes may mimic calcifications in lymph nodes, therefore the clinical history is helpful in the differential diagnosis.

**CONCLUSION**

Many benign breast lesions may mimic primary breast carcinoma, hence causing diagnostic confusion. Mammographers should consider benign and systemic causes in the differential diagnosis when malignant-appearing lesions are encountered. Familiarity of these benign lesions and correlation with the patient’s clinical manifestations may help mammographers to decide whether or not to perform biopsy for certain conditions.

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**SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME**  
**Multiple Choice Questions (Code SMJ 2007010B)**

	True	False
<b>Question 1.</b> Concerning radial scar of the breast:		
(a) It usually results from surgery.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Patients are usually asymptomatic.	<input type="checkbox"/>	<input type="checkbox"/>
(c) A spiculated mass with central lucency is pathognomonic for radial scar.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Surgical excision should be performed in a lesion suggestive of radial scar because imaging is unreliable to differentiate it from carcinoma.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 2.</b> Concerning sclerosing adenosis:		
(a) It is a form of fibrocystic change.	<input type="checkbox"/>	<input type="checkbox"/>
(b) On mammography, it is seen as microcalcifications or a discrete mass.	<input type="checkbox"/>	<input type="checkbox"/>
(c) It has variable US appearances.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Imaging is reliable to differentiate it from carcinoma.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 3.</b> Concerning diabetic mastopathy:		
(a) It typically occurs in post-menopausal women.	<input type="checkbox"/>	<input type="checkbox"/>
(b) It can occur in women with both type I and type II diabetes mellitus.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Mammography usually shows a spiculated mass.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Excisional biopsy can be avoided in women with a typical history, imaging findings, and FNAB which shows a marked resistance to in-and-out motion of needle.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 4.</b> Concerning breast abscess:		
(a) Abscess occurring in the lactating period may not need an imaging study.	<input type="checkbox"/>	<input type="checkbox"/>
(b) In non-lactating abscess, patients may present with a palpable lump without signs of inflammation.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Mammography cannot differentiate it from carcinoma.	<input type="checkbox"/>	<input type="checkbox"/>
(d) US is more reliable than mammography in differentiating it from carcinoma.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 5.</b> Concerning axillary adenopathy:		
(a) Normal axillary nodes are usually seen on the craniocaudal view mammogram.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Axillary adenopathy is suggested by an increased nodal density and loss of hilar fat.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Benign and malignant adenopathy may be similar on mammograms.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Breast carcinoma may present as axillary adenopathy without a palpable mass in the breast.	<input type="checkbox"/>	<input type="checkbox"/>

**Doctor's particulars:**

Name in full: \_\_\_\_\_

MCR number: \_\_\_\_\_ Specialty: \_\_\_\_\_

Email address: \_\_\_\_\_

**SUBMISSION INSTRUCTIONS:**

(1) Log on at the SMJ website: [www.sma.org.sg/cme/smj](http://www.sma.org.sg/cme/smj) and select the appropriate set of questions. (2) Select your answers and provide your name, email address and MCR number. Click on "Submit answers" to submit.

**RESULTS:**

(1) Answers will be published in the SMJ December 2007 issue. (2) The MCR numbers of successful candidates will be posted online at [www.sma.org.sg/cme/smj](http://www.sma.org.sg/cme/smj) by 15 December 2007. (3) All online submissions will receive an automatic email acknowledgment. (4) Passing mark is 60%. No mark will be deducted for incorrect answers. (5) The SMJ editorial office will submit the list of successful candidates to the Singapore Medical Council.

**Deadline for submission: (October 2007 SMJ 3B CME programme): 12 noon, 25 November 2007**