
PICTORIAL ESSAY

Conditions that Mimic Primary Breast Carcinoma on Mammography and Sonography

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ABSTRACT

There are a number of benign conditions or non-mammary malignancies that share similar appearances to those seen in primary breast carcinoma, causing diagnostic confusion. This pictorial review aims to describe and illustrate the mammographic and sonographic appearance of these conditions, namely pyogenic abscess, tuberculosis of the breast, granulomatous mastitis, lymphocytic mastitis, fat necrosis, ovarian metastasis, multiple myeloma, primary lymphoma of the breast, sclerosing adenosis, and radial scar.

Key Words: Adenosis, Fat necrosis, Lymphoma, Mastitis, Mastopathy, Metastasis, Multiple myeloma, Ovarian carcinoma, Pyogenic abscess, Tuberculosis

INTRODUCTION

This pictorial review aims to describe and illustrate the mammographic and sonographic appearance of the breast conditions that mimic primary carcinoma of the breast. They are classified into 5 groups, as follows: inflammatory disease of the breast, fat necrosis, haematogenous metastasis to the breast, primary lymphoreticular breast malignancies, and miscellaneous conditions.

Inflammatory Disease of the Breast

Inflammation of the breast can be divided into infective and non-infective causes. Granulomatous mastitis and lymphocytic mastitis comprise the non-infective inflammatory conditions.¹

Infective

Breast abscess — acute bacterial infection of the breast, typically occurs 2 to 3 weeks after lactation commences. The infective process usually spreads along the ductal system and it usually occurs in the subareolar region. The most common pathogen is *Staphylococcus aureus*. Progression of infection may result in abscess formation. Mammographic features can overlap with those of

carcinoma.² Asymmetrical density or architectural distortion may be seen (Figure 1a). Ultrasound shows multiple well-circumscribed hypoechoic areas corresponding to abscess formation (Figures 1b and 1c). Fine needle aspiration would confirm the presence of pus.

Tuberculosis of the breast can be primary or secondary. Both of these conditions are uncommon, even in Asia where tuberculosis is epidemic. Primary tuberculosis usually affects young women between the ages of 20 and 50 years.³ Clinically, patients may present with a firm, poorly defined mass with associated skin or nipple retraction that suggests carcinoma. Fistula and sinus tract formation are seen in advanced disease. Nodular, disseminated, and sclerosing forms are described.^{3,4} Mammographical presentation may mimic solitary carcinoma (Figures 2a and 2b), inflammatory cancer, and scirrhous carcinoma, and the definitive diagnosis relies on histological and microbiological examinations via fine needle aspiration.

Non-infective

Idiopathic granulomatous mastitis (IGM) is a relatively rare condition. It occurs more often in pregnant or lactating patients, or in women taking oral contraceptives.⁵ The aetiology of this condition is still unknown, but it is thought to be autoimmune in origin.¹ The typical mammographic appearance is an ill-defined focal asymmetrical density, relatively sparing the retroareolar region (Figure 3a). Ultrasound demonstrates

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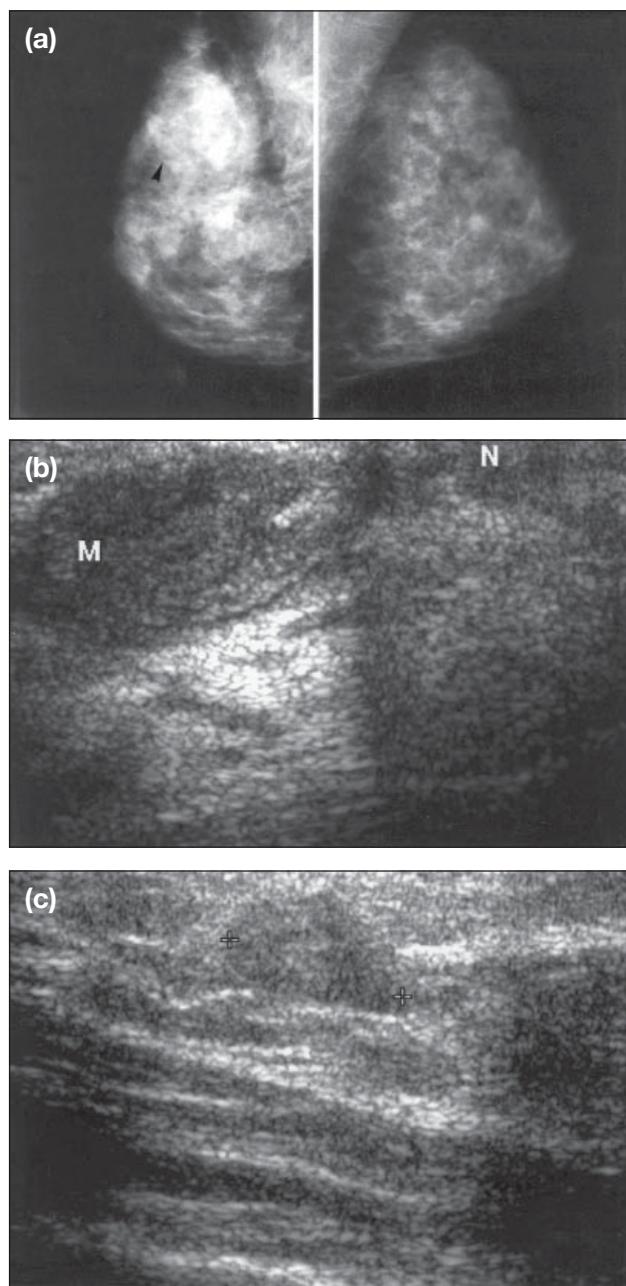


Figure 1. Pyogenic abscess. (a) Bilateral medio-lateral oblique mammogram of a 30-year-old postpartum woman shows focal asymmetrical density and mild architectural distortion at the superior aspect of the right breast (small black arrowhead). (b) Ultrasound study of the right breast shows multiple oval hypoechoic masses with posterior enhancement. M represents the largest abscess at the subareolar region, which extends to the nipple (N). (c) A smaller abscess is shown.

an irregularly shaped mass with posterior shadowing (Figure 3b), which may cause diagnostic confusion. Conditions such as tuberculosis, fungal infection, sarcoidosis, and granulomatous reaction in carcinoma must be ruled out.⁶ Ultrasound-guided core biopsy is needed for confirmation of the diagnosis. Treatment consists of excisional biopsy or steroids.

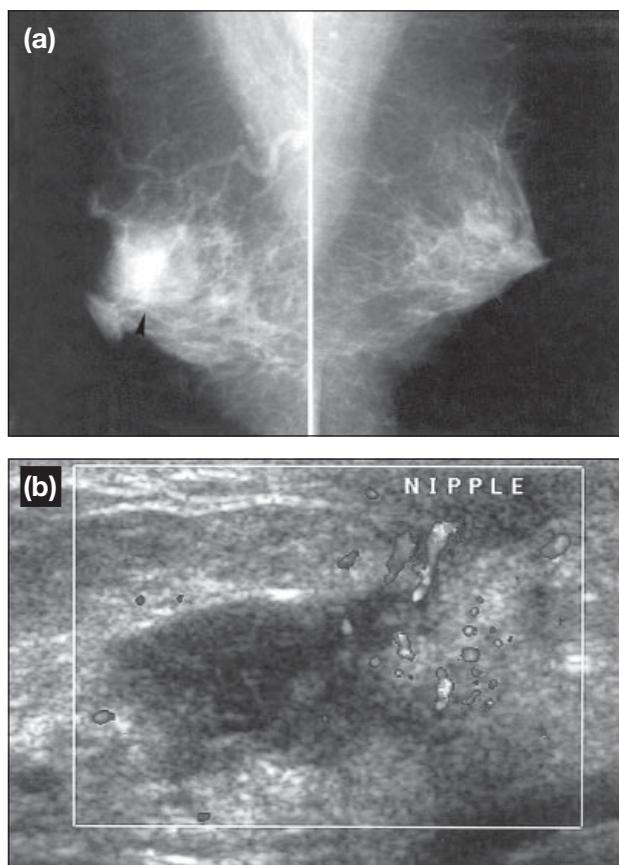


Figure 2. Tuberculosis of the left breast. (a) Bilateral medio-lateral oblique views show a moderately dense mass with ill-defined outline immediately beneath the nipple (large black arrowhead). There is minimal architectural distortion. No microcalcification is detected. (b) Ultrasound study shows an irregular, poorly-defined heterogeneous hypoechoic lesion, suspicious of malignancy. Extension to the nipple is noted. Fine needle aspiration reveals greenish pus.

Lymphocytic mastitis is an uncommon condition strongly associated with type I diabetes mellitus (DM),⁷ therefore, it is believed to be autoimmune in origin and is also known as diabetic mastopathy.⁸ Patients are usually young and premenopausal, presenting with a painless firm mass in the breast. Mammogram usually depicts retroareolar focal asymmetrical density (Figure 4a). Ultrasound may show an indeterminate mass, sometimes with irregular outline and posterior shadowing (Figure 4b) resembling malignancy. Core biopsy is essential for confirmation of this condition.

Fat Necrosis

Fat necrosis is a benign condition resulting from minor trauma. A spectrum of mammographic appearance and ultrasound pattern can be identified. The most common mammographic finding is radiolucent oil cyst.⁹ Other mammographic appearances are a round or asymmetrical opacity, heterogeneity of subcutaneous tissues and dystrophic microcalcifications (Figure 5a). Suspicious

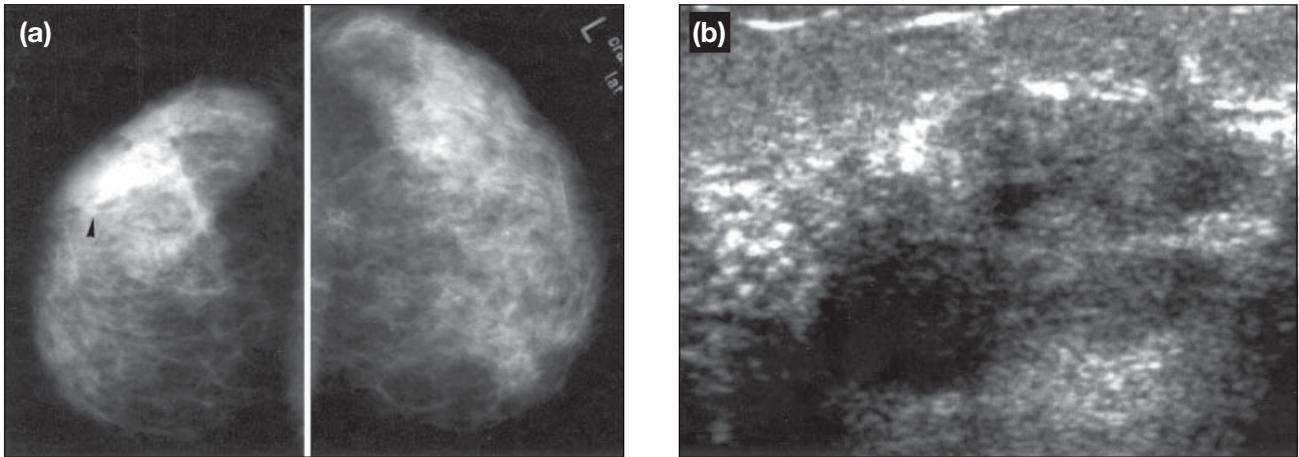


Figure 3. Granulomatous mastitis. (a) Cranio-caudal views of both breasts of a 28-year-old postpartum woman show asymmetry of the breasts with increased density over the lateral aspect of the right breast (small black arrowhead). Typically the asymmetrical density on mammogram seldom involves the retroareolar region. (b) Ultrasound study shows an irregular hypoechoic mass with ill-defined outline and mild posterior shadowing, suspicious of malignancy. Core biopsy confirmed the diagnosis of granulomatous mastitis.

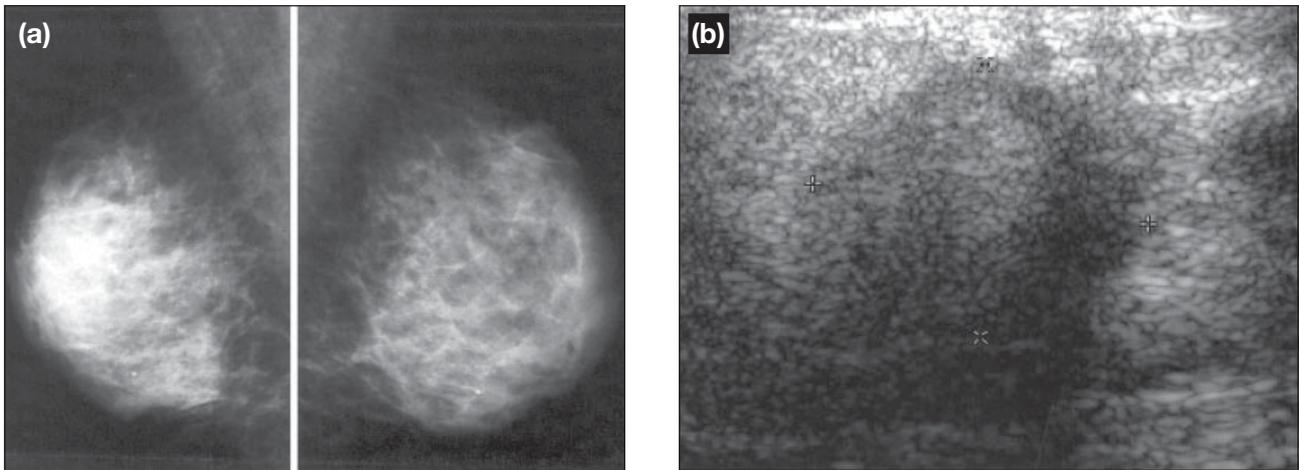


Figure 4. Lymphocytic mastitis (diabetic mastopathy). (a) Bilateral medio-lateral oblique views show ill-defined asymmetrical density at the retroareolar region of the right breast, which is the typical location of diabetic mastopathy. (b) Ultrasound study shows an irregular mass with posterior shadowing at the subareolar region, resembling carcinoma. Core biopsy confirmed the diagnosis of lymphocytic mastitis.

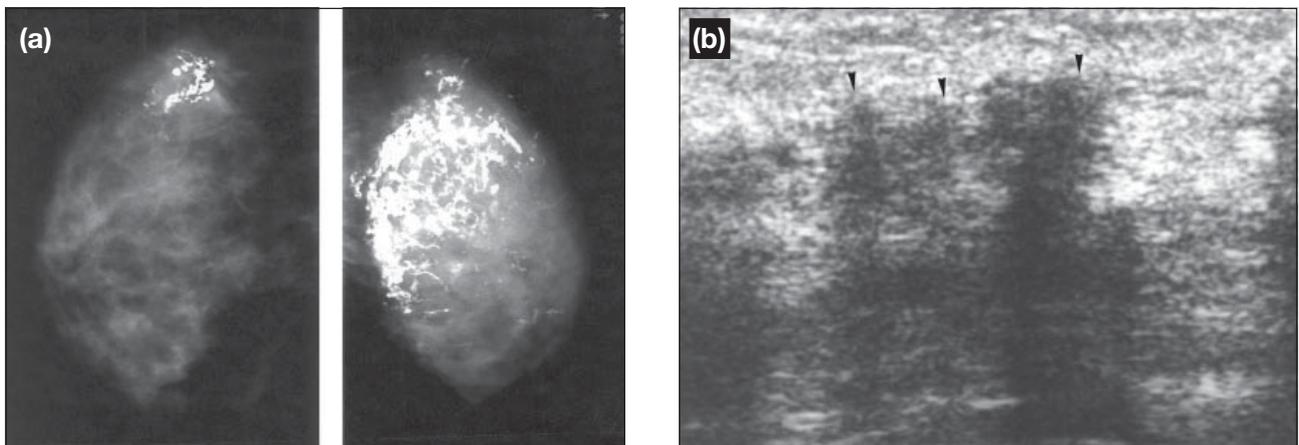


Figure 5. Fat necrosis. (a) A 25-year-old woman presented with a painful swollen left breast, clinically resembling inflammatory carcinoma. Cranio-caudal views of both breasts show extensive dystrophic calcifications, more severe on the left breast. (b) Ultrasound study shows extensive shadowing throughout the left breast (small black arrowheads), obscuring details. Core biopsy confirmed the diagnosis of fat necrosis.

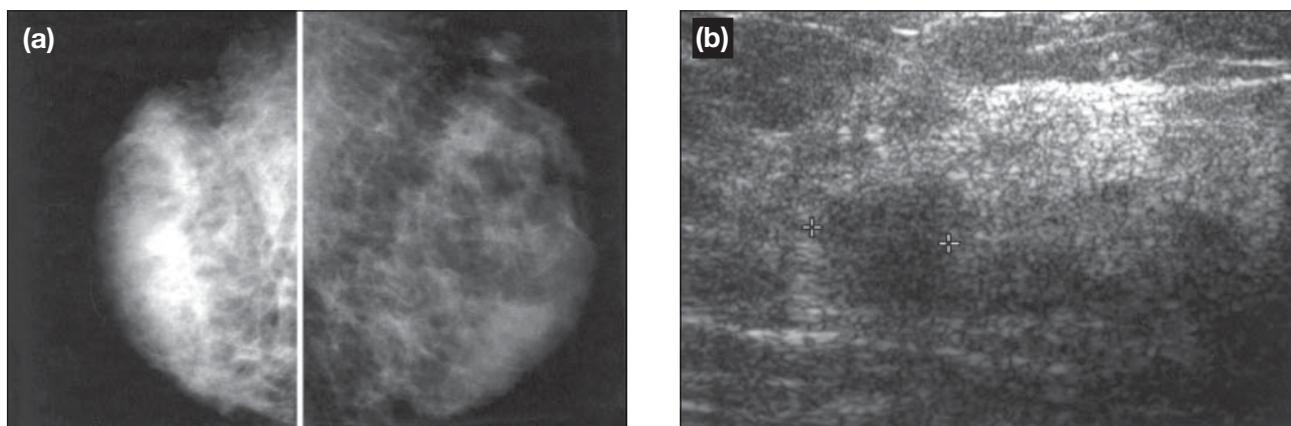


Figure 6. Ovarian metastasis. (a) A 39-year-old woman with a known history of malignant ovarian tumour with brain metastases presented with hardening of the whole right breast. Bilateral medio-lateral oblique views show shrinkage of the right breast with increased density over the superior and central regions. (b) Ultrasound study shows a round hypoechoic mass with irregular outline in the right breast. Biopsy confirmed ovarian metastases.

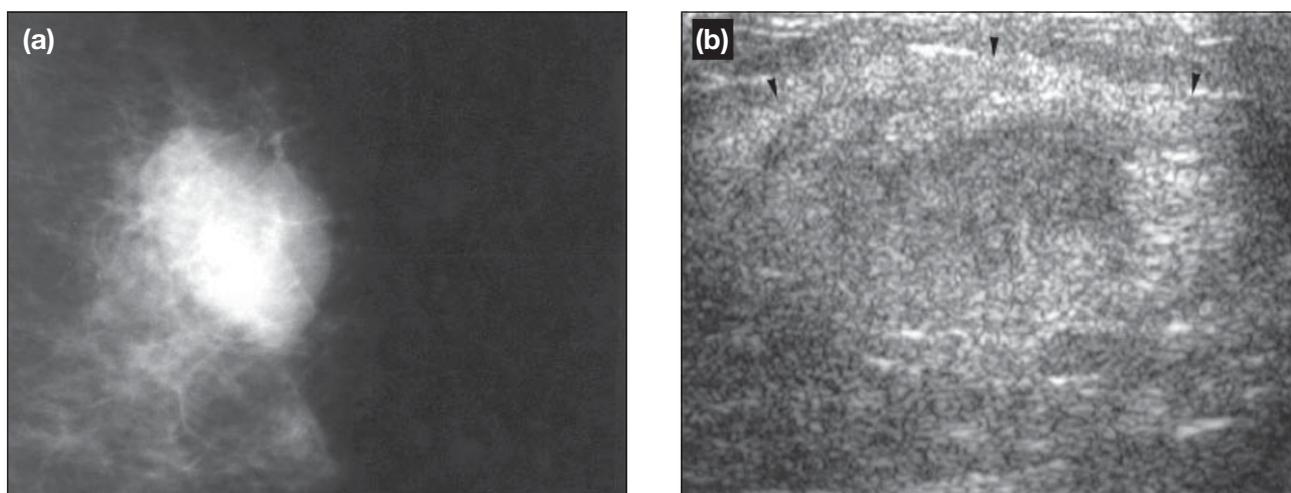


Figure 7. (a) Typical appearance of multiple myeloma on mammogram, presented as lobulated mass, resembling a benign lesion. (b) Ultrasound study of the same patient shows a hyperechoic mass (small black arrowheads), suggestive of multiple myeloma.

spiculated masses and focal areas of architectural distortion can also occur in fat necrosis, resembling carcinoma. Sonographic features of fat necrosis are also complicated. Solid masses, complex cystic masses with internal mural nodules, complex cystic masses with internal echogenic bands, anechoic masses with posterior acoustic enhancement, anechoic masses with posterior acoustic shadowing and marked posterior shadowing caused by dystrophic calcifications (Figure 5b) are all described.^{9,10} Core biopsy is essential for diagnosis of fat necrosis.

Haematogenous Metastasis to the Breast

Haematogenous metastasis to the breast is uncommon. The primary tumour can be ovarian or lung carcinoma, melanoma, or metastatic lymphoreticular malignancy such as lymphoma, leukaemia, and multiple myeloma. Ovarian carcinoma and multiple myeloma have been selected as illustrations for this article.

Ovarian carcinoma with metastasis to the breast is rare, but it signifies widespread disease.¹¹ Patients with this condition usually present with a firm irregular breast mass with both mammographic and sonographic appearances indistinguishable from primary breast carcinoma. In our patient, mammogram showed shrinkage of the right breast with coarsened trabeculi, resembling inflammatory carcinoma of the breast (Figure 6a). Sonography showed indeterminate masses in the right breast (Figure 6b). Core biopsy and histology confirmed ovarian metastasis. Multiple myeloma is a common lympho-immunoproliferative disorder, but breast involvement is rare as part of the disseminated disease.¹²

The typical mammographic appearance is round to lobulated nodules (Figure 7a), and sonographic appearances vary from hypoechoic, heterogeneous to hyperechoic

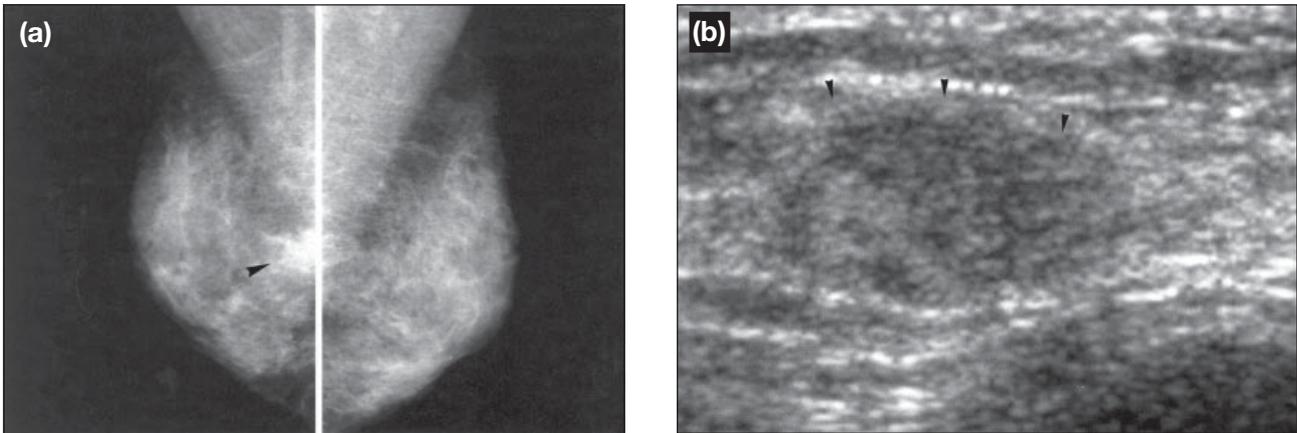


Figure 8. Multiple myeloma indistinguishable from primary breast carcinoma. (a) Bilateral medio-lateral oblique views show a spiculated mass at the retroglandular region of the left breast (large black arrowhead). (b) Ultrasound study of the same patient shows a heterogeneous mass with a relatively well-defined outline and without posterior shadowing. Histology showed multiple myeloma.

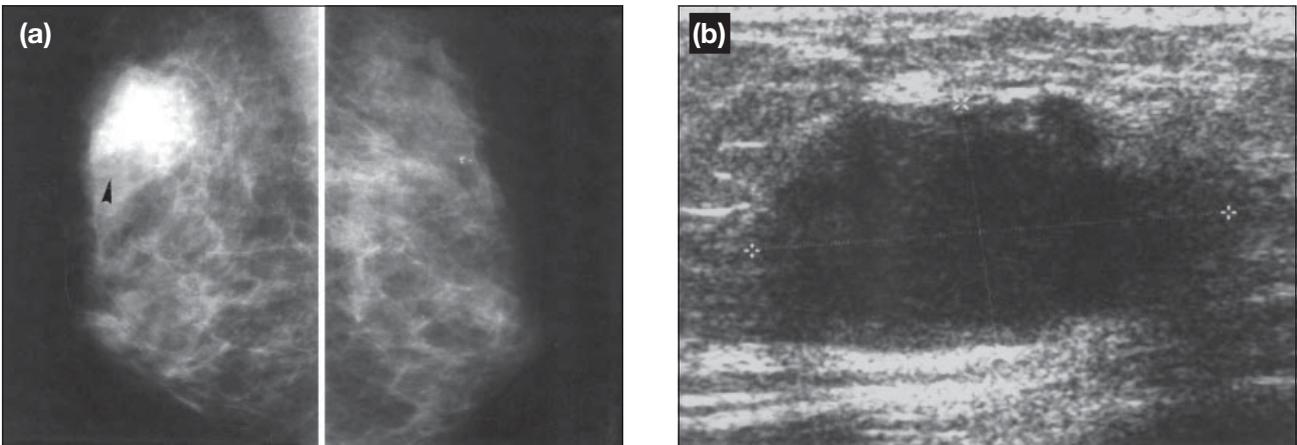


Figure 9. Primary lymphoma of the right breast. (a) Bilateral medio-lateral oblique views show a 2.5 cm high-density mass with ill-defined outline at the superior aspect of the right breast (large black arrowhead). (b) Ultrasound appearance of primary lymphoma shows a hypoechoic irregular mass with posterior enhancement at the superior quadrant of the right breast, suggestive of malignancy.

masses (Figure 7b). This appearance can mimic both benign and malignant lesions. Multiple myeloma can also have an atypical appearance such as a spiculated mass (Figure 8a), which cannot be distinguished from primary carcinoma of the breast. Sonography may give a clue if a heterogeneous or hyperechoic mass is noted (Figure 8b). Core biopsy is essential for diagnosis.

Primary Lymphoreticular Breast Malignancies

Primary lymphoma and leukaemia can be found in the breasts. Primary lymphoma of the breast has a reported incidence of 0.12% to 0.53%,¹³ which is most common among primary lymphoreticular malignancy of the breast. B-cell non-Hodgkin's lymphoma has the highest incidence.¹⁴ Mammographic appearances vary from oval or lobulated nodules to patterns simulating carcinoma with marginal spiculation (Figure 9a).¹⁵ Sonography reveals hypoechoic masses (Figure 9b).

Miscellaneous

Sclerosing Adenosis

Sclerosing adenosis is defined as a benign lobulocentric lesion of disordered acinar, myoepithelial, and connective tissue elements.¹⁶ This condition may be associated with other benign breast disorders such as atypical lobular hyperplasia or lobular carcinoma in situ, and occurs as part of a spectrum of fibrocystic changes. It may manifest as a clinical palpable mass or, more commonly, as clusters of punctate microcalcifications at mammography, simulating low-grade ductal carcinoma in situ (DCIS) [Figures 10a and 10b]. It may present as a spiculated lesion on mammogram, which mimics infiltrative carcinoma (Figures 11a and 11b).¹⁷ Jensen et al concluded that sclerosing adenosis was associated with increased risk of infiltrating carcinoma.¹⁸ With concomitant atypical hyperplasia, the relative risk rises markedly.¹⁸ Stereotatic-guided core biopsy is essential for correct diagnosis of this condition.

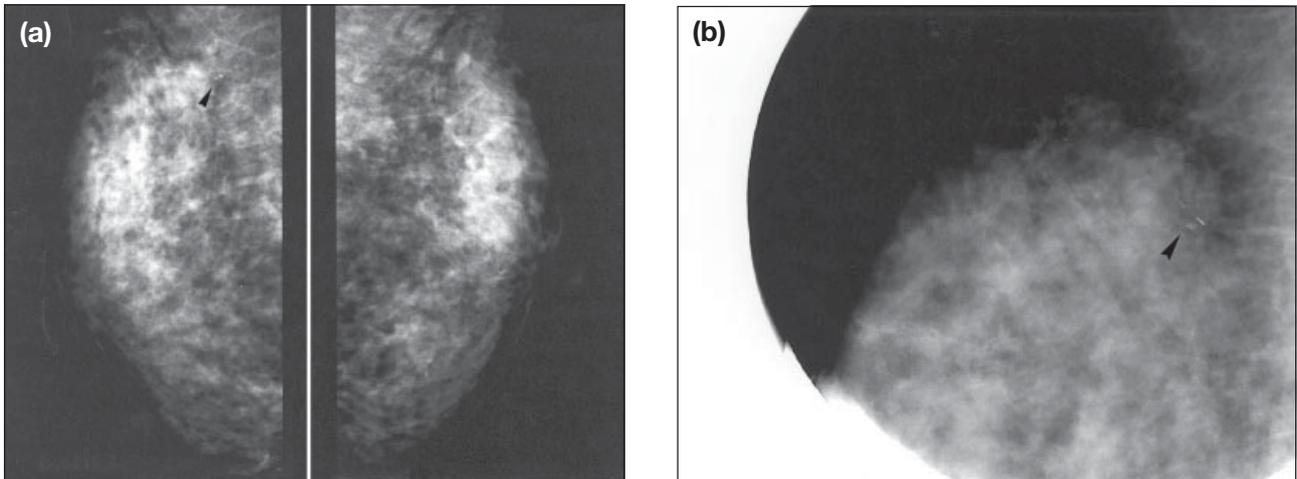


Figure 10. Sclerosing adenosis in a patient presenting with right mastalgia who was referred for screening mammogram. (a) Bilateral medio-lateral oblique views show a faint cluster of microcalcifications at the superior aspect of the right breast (small black arrowhead). (b) A magnified view shows linear microcalcifications (large black arrowhead), resembling ductal carcinoma in situ.

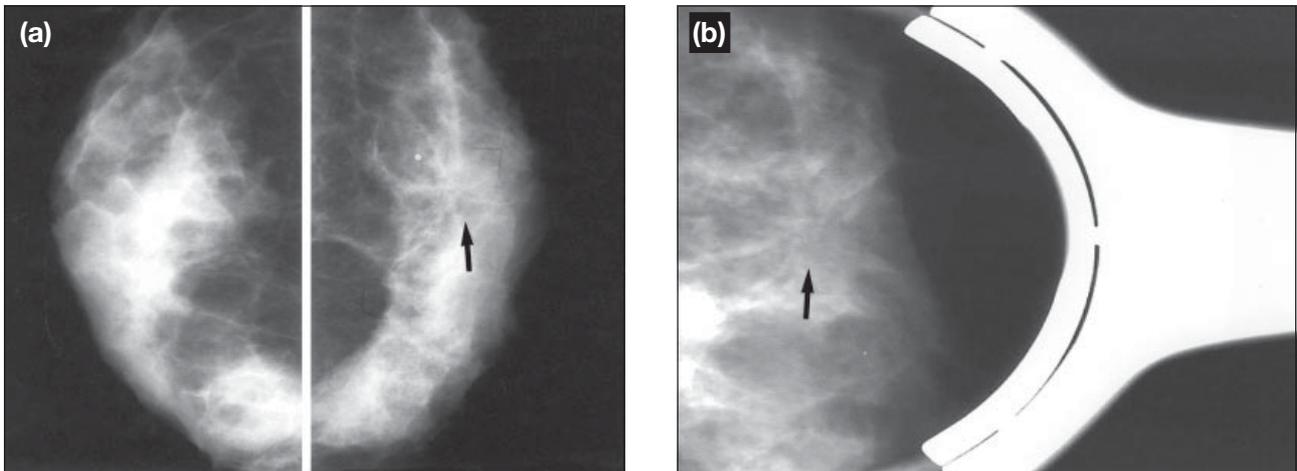


Figure 11. Sclerosing adenosis. (a) Bilateral crano-caudal views show architectural distortion at the central region of the left breast (black arrow). (b) A magnified view confirms the presence of architectural distortion (black arrow). Stereotatic-guided core biopsy confirmed the diagnosis of sclerosing adenosis.

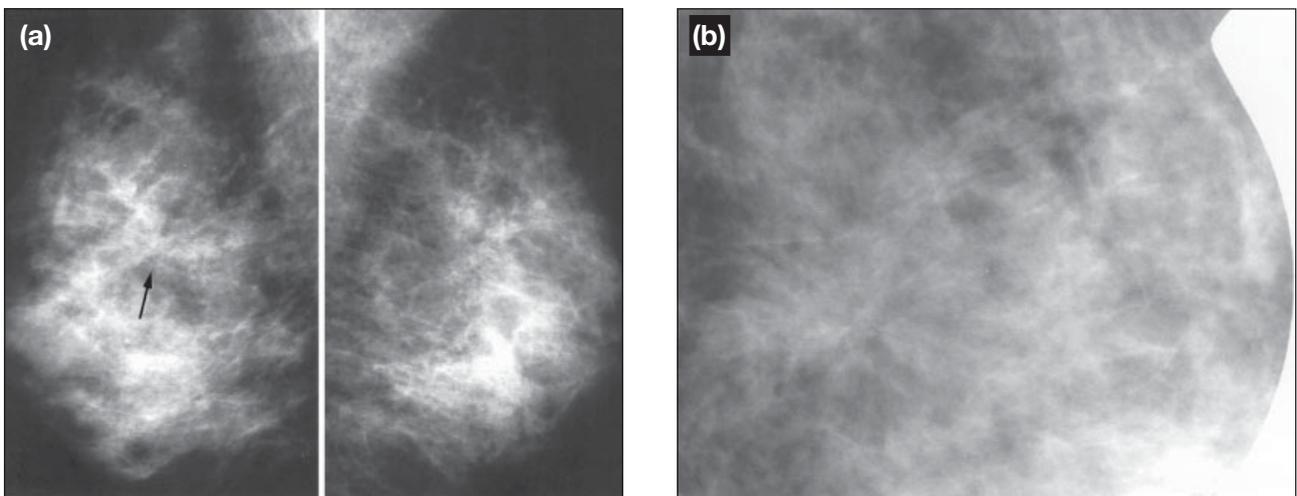


Figure 12. Radial scar. (a) Bilateral medio-lateral oblique views show vague architectural distortion at the central region of the right breast (small black arrow). (b) A magnified view shows the typical 'black star' appearance of the lesion. Wire-localised excisional biopsy is suggested.

Radial Scar

The reported prevalence of radial scar is 0.1 to 2.0 per 1000 screening.¹⁹ Radial scar is characterised by long, thin spicules radiating from a central translucent area on mammography, creating the appearance of a 'black star' (Figures 12a and 12b), resembling carcinoma of the breast. Typically, there is no discrete central mass. The diagnostic criteria suggested by Tabár and Dean also included absence of clinical palpable mass or skin changes.²⁰ Radial scars were shown to be associated with atypical hyperplasia and carcinoma in situ. The reported radial scar with concomitant carcinoma ranged from 8% to 31%.¹⁹ Wire-localised complete excision of the radial scar is mandatory for these patients.

CONCLUSION

In summary, a number of conditions may mimic primary carcinoma of the breast, causing diagnostic confusion. They can present as a spiculated mass, asymmetrical density, architectural distortion, or abnormal microcalcifications on mammogram or indeterminate to malignant-looking mass on sonography. Mammographers should be familiar with all these conditions so that core biopsy can be performed to obtain the correct diagnosis for certain conditions. Wire-localised excisional biopsy is recommended for radial scar instead of core biopsy.

REFERENCES

1. Bassler R. Mastitis. Classification, histopathology and clinical aspects. *Pathologie* 1997;18:27-36.
2. Nguyen SL, Doyle AJ, Symmans PJ. Interstitial fluid and hypoechoic wall: two sonographic signs of breast abscess. *J Clin Ultrasound* 2000;28:319-324.
3. Hale JA, Peters GN, Cheek JH. Tuberculosis of the breast. Rare but still extant. Review of the literature and report of an additional case. *Am J Surg* 1985;150:620-624.
4. Tabar L, Ket K, Nemeth A. Tuberculosis of the breast. *Radiology* 1976;118:587-589.
5. Poniecka AW, Krasuski P, Gal E, Lubin J, Howard L, Poppiti RJ. Granulomatous inflammation of the breast in a pregnant woman: report of a case with fine needle aspiration diagnosis. *Acta Cytol* 2001;45:797-801.
6. Imoto S, Kitaya T, Kodama T, Hasebe T, Mukai K. Idiopathic granulomatous mastitis: case report and review of the literature. *Jpn J Clin Oncol* 1997;27:247-277.
7. Kudva YC, Reynolds C, O'Brien T, et al. 'Diabetic mastopathy' or sclerosing lymphocytic lobulitis: strongly associated with type I diabetes. *Diabetes Care* 2002;25:121-126.
8. Schwartz IS, Strauchen JA. Lymphocytic mastopathy: an autoimmune disease of the breast? *Am J Clin Pathol* 1990;93:725-730.
9. Bilgen IG, Ustun EE, Memis A. Fat necrosis of the breast: clinical, mammographic and sonographic features. *Eur J Radiol* 2001;39:92-99.
10. Soo MS, Kornguth PJ, Hertzberg BS. Fat necrosis in the breast: sonographic features. *Radiology* 1998;206:261-269.
11. Cormio G, Di Vagno F, Melilli GA, Loverro G, Cramarossa D, Selvaggi L. Ovarian carcinoma metastatic to the breast. *Gynecol Obstet Invest* 2001;52:73-74.
12. Pasquini E, Rinaldi P, Nicolini M, et al. Breast involvement in immunolymphoproliferative disorders: report of two cases of multiple myeloma of the breast. *Ann Oncol* 2000;11:1353-1359.
13. Liberman L, Giess CS, Dershaw DD, Louie DC, Deutch BM. Non-Hodgkin lymphoma of the breast: imaging characteristics and correlation with histopathologic findings. *Radiology* 1994;192:157-160.
14. Watson A, Fraser S. Primary lymphoma of the breast. *Australas Radiol* 2000;44:234-236.
15. Meyer E, Kopans B, Long C. Mammographic appearance of malignant lymphoma of the breast. *Radiology* 1980;135:623-626.
16. Gunhan-Bilgen I, Memis A, Ustun EE, Ozdemir N, Erhan Y. Sclerosing adenosis: mammographic and ultrasonographic findings with clinical and histopathological correlation. *Eur J Radiol* 2002;44:232-238.
17. Cyrlak D, Carpenter PM, Rawal N. Breast imaging: case of the day. *Radiographics* 1999;19:245-247.
18. Jensen RA, Page DL, DuPont WD, Rogers LW. Invasive breast cancer risk in women with sclerosing adenosis. *Cancer* 1989;64:1977-1983.
19. Alleva DQ, Smetherman DH, Farr GH, Cederbom GJ. Radial scar of the breast: radiologic-pathologic correlation in 22 cases. *Radiographics* 1999;19 (Suppl):27-35.
20. Tabár L, Dean PB. Teaching atlas of mammography. New York: Thieme Verlag; 1983.