Breast imaging in general practice

Nehmat Houssami, MBBS, FAFPHM, FASBP, PhD, is Associate Clinical Director, NSW Breast Cancer Institute, Westmead Hospital, Honorary Senior Lecturer, Screening and Test Evaluation Program, School of Public Health, University of Sydney, New South Wales.

Meagan Brennan, BMed, FRACGP, DFM, FASBP, is a breast physician, NSW Breast Cancer Institute, Westmead Hospital, New South Wales. meaganb@bci.org.au

James French, MBBS, FRACS, is a breast and endocrine surgeon, NSW Breast Cancer Institute, Westmead Hospital, New South Wales.

Peter Fitzgerald, MBBS, FRANZCR, DDU, is a radiologist, NSW Breast Cancer Institute, Westmead Hospital, New South Wales.

This is the fourth article in a series of breast disorders with an emphasis on diagnosis and management in the general practice setting. This article provides guidance for general practitioners on the role of breast imaging in screening and the investigation of breast symptoms, with an emphasis on indications for imaging and common abnormal findings. It is presented as a summary of key facts supplemented by a mini-atlas of breast imaging to facilitate use of imaging in routine general practice.

The distinction between breast imaging for screening and breast imaging for the assessment of breast symptoms is an important one. Screening is an assessment for women who have no breast symptoms. These women are being assessed, usually using mammography alone, with the aim of detecting breast cancer at an early stage. Women with breast symptoms are being assessed, often using both mammography and ultrasound, to provide an explanation for their symptoms and exclude breast cancer as a cause. Breast imaging is interpreted in the context of the clinical picture. Imaging findings dismissed as inconsequential in the screening setting may take on a different significance in a symptomatic patient.

Screening mammography

With the increasing trend toward a preventive approach to health care, and the knowledge that early detection of breast cancer leads to better outcomes for patients, general practitioners play a critical role in informing women about breast screening. This includes discussing the potential benefits, as well as the possible negative outcomes, of screening for breast cancer.

Evidence from randomised controlled trials shows that early detection using screening mammography reduces death from breast cancer by about a third.[1] Screening for breast cancer is usually targeted at women aged 50–69 years where there is definite evidence of benefit (significant reduction in breast cancer deaths). Women aged 40–49 or 70 years and over may also choose to be screened. Policy and practice in screening women aged 40–49 years varies between countries and services – in Australia, women in this age range are generally eligible for screening, but are not routinely actively recruited. One of the controversies about screening women aged 40–49 years is that the benefit is less than that expected in older women (50–69 years) and some of the associated harm is more frequent in this age group.[2]

Screening is generally recommended every 2 years unless there is a personal or strong family history of breast cancer, when annual mammography may be recommended. Recommendations about screening women at elevated risk for breast cancer vary as there is little evidence to support choice of appropriate screening frequency and (for younger women) choice of best screening method. Screening women at substantially increased risk and/or younger women using new imaging technologies (eg. ultrasound or breast magnetic resonance imaging [MRI]) continues to be an area of evolving research and some controversy, and will be covered later in this series. However, to date, mammography remains the only validated screening test for breast cancer.

In women having screening, breast cancer prevalence is about 0.5% (ie. about 1 in 200 women who are screened will be diagnosed as having breast cancer).[3] For

women recalled for further assessment with a 'positive' screening mammogram, about 10% will be found to have a breast cancer.[4] Recalled women will usually have further imaging (mammographic work-up with or without ultrasound) and may also have a clinical examination and needle biopsy.

The process of being recalled and undergoing further investigation can be very distressing for the nine out of 10 women who are recalled but do not have breast cancer, and this distress is one of the negative outcomes associated with screening.

Patients and their GPs need to be aware that mammographic screening will not detect all cancers. Interval breast cancers (cancers found between screening episodes, usually presenting as clinically evident cancers) are an inherent part of any screening program and do not necessarily represent 'missed' cancers.[5] A screening mammogram will have one of two results:

- 'recall for further assessment', or
- 'no recall'.

No recall does not necessarily mean the mammogram was normal; it simply means there were no changes indicating a high probability of malignancy. Other findings that are abnormal but unlikely to represent cancer (eg. lesions showing 'benign' or 'probably benign' features) are not reported on these mammograms. These findings however, may be significant in a symptomatic patient, and would usually be reported on a diagnostic, as distinct from a screening, mammogram. In addition, in a diagnostic setting, mammographic abnormalities categorised as 'probably benign' would usually be correlated with breast ultrasound. This is not done routinely in a screening program.

Investigation of breast symptoms

The prevalence of breast cancer in women with breast symptoms is relatively high, with published estimates between 2 and 10%.[6–8] All new breast symptoms and clinical abnormalities must be appropriately investigated. Women with breast symptoms should be referred for diagnostic assessment rather than being referred to a breast screening service.

The 'triple test' approach, the combination of clinical examination, breast imaging and nonsurgical biopsy is essential to maximise accurate diagnosis. Interpretation of the triple test result is critical; if there is any inconsistency, or all three parts of the triple test are not definitely benign, referral for further assessment is required.[9,10]

Mammogram or ultrasound?

General practitioners have the primary responsibility for investigating women with breast symptoms and initiating the triple test. Breast imaging is often the key component of

Table 1. Mammography

- The only proven screening test for early detection of breast cancer
- Accuracy varies according to the nature of the breast tissue: dense (very glandular) breast tissue may limit ability to visualise or accurately identify cancer using mammography (*Figure 5, 8*)
- two views of each breast is standard: mediolateral oblique (MLO) (*Figure 10*) and craniocaudal (*Figure 8, 20*) views, which capture most of the breast tissue
- Standard views may be supplemented by additional or work-up views to improve diagnostic accuracy[12] by improving interpretation of a definite lesion, or by resolving areas on the mammogram caused by overlapping tissue
- May be used for image guided biopsy and for placement of guide wires before surgical biopsy particularly for lesions seen on mammography but not ultrasound
- Digital mammography is a relatively new technique using a computer to acquire, store and display images (not yet widely available in Australia)

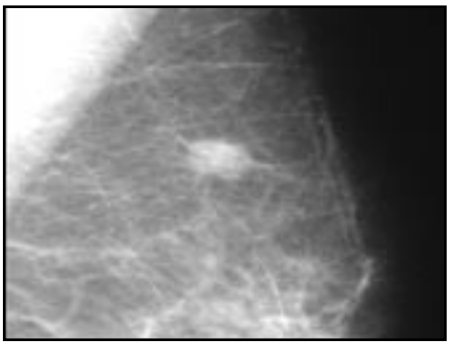

Figure 1. Stellate or spiculated density. This appearance is typical of a breast malignancy

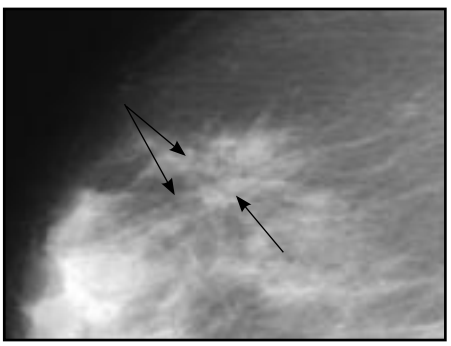

Figure 2. Stellate or spiculated lesion. This malignant lesion has long thin spicules and a less dense central mass compared with the stellate lesion in *Figure 1*. The differential diagnosis is a radial scar which is a benign complex sclerosing lesion. This is an example of overlap in imaging features between malignant and benign

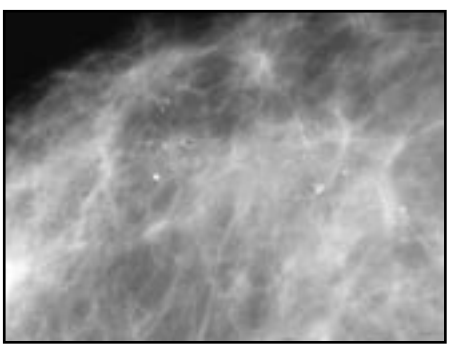

Figure 3. Stellate lesion and microcalcification. Magnified view of a segment of breast demonstrating scattered calcification of highly variable morphology. This appearance is suspicious of ductal carcinoma in situ (DCIS). In addition, there is a stellate lesion which suggests an invasive cancer in the same quadrant

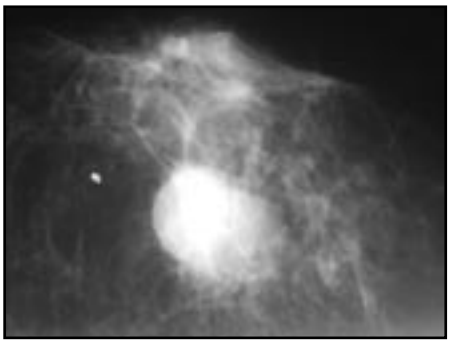

Figure 4. Irregular mass. This invasive cancer is demonstrated as a poorly defined (irregular) mass or density (note: the borders are only partially seen). The differential diagnosis is a phyllodes tumour – a tumour with variable behaviour (may be benign or locally invasive). This is an example of overlap between malignant and benign imaging features

Table 2. Breast ultrasound

- Imaging test of choice for young women and women who are pregnant or lactating
- Useful in the evaluation of a specific lump or lesion in women of any age
- Very accurate when clinically guided or directed to an identified abnormality
- Highly operator dependent
- Allows differentiation between cystic and solid lesions, and assists in distinguishing between benign and malignant solid lesions
- Preferred over mammography for image guided intervention such as biopsy and localisation because it:
  - avoids radiation
  - allows 'real time' visualisation of needle or wire tip in relation to lesion
  - avoids compression of the breast and is more comfortable for the patient
  - is usually a quicker procedure than mammographic intervention procedures

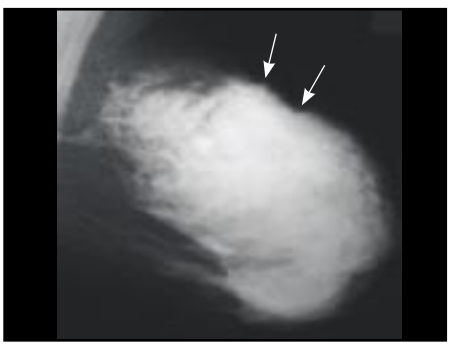

Figure 5. MLO view of a very dense (white) breast – the cancer (top arrow) can be easily missed in such dense tissue, but is partly perceived because of an indirect sign – the tent sign – or 'v' shaped distortion (lower arrow) of the normally smooth outline of the breast. Such distortion can also be a result of surgical scarring

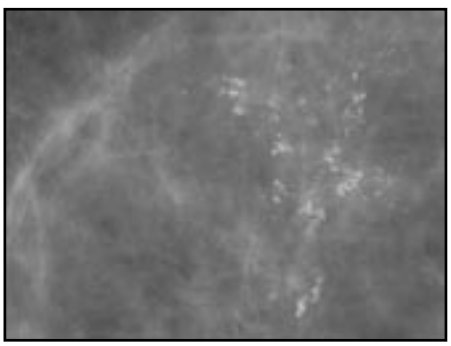

Figure 7. Suspicious microcalcification scattered in clusters, some having a powderish appearance. The appearance is suggestive of DCIS; image guided core biopsy was done to establish the diagnosis pre-operatively to assist in planning treatment

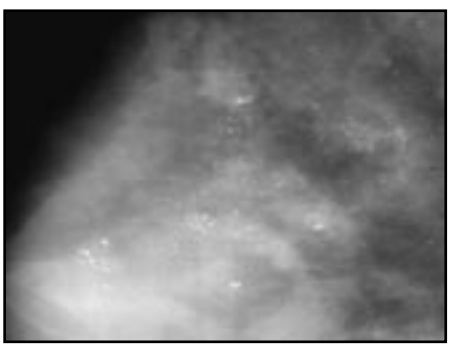

Figure 6. Microcalcification – a magnified view of a segment of breast demonstrating widespread scattered calcification of variable morphology. This appearance is highly suspicious of ductal carcinoma in situ (DCIS), and suggests this may be of intermediate to high grade DCIS. Image guided core biopsy is usually needed to confirm the diagnosis before surgical management

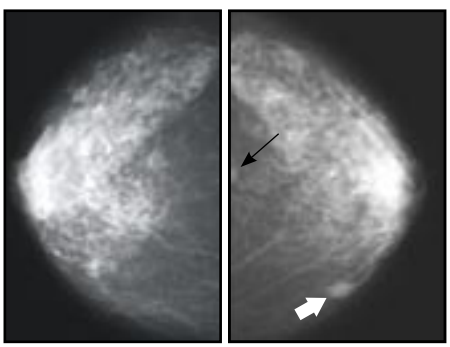

Figure 8. Arrow shows an asymmetric density in these craniocaudal films; the same area on the opposite side contains only fatty tissue. This asymmetric density represents a small cancer, but the same appearance could also be caused by asymmetric glandular tissue (an example of overlap between malignant and benign). Block arrow shows a well defined (oval) density consistent with a benign lesion (in this case, a fibroadenoma)

Spot check

Women who have breast symptoms should be referred for diagnostic assessment rather than being referred to a breast screening service

triple testing as it may dictate whether biopsy or further intervention is warranted. Choosing the appropriate imaging investigation for the patient is therefore critical. In general, the age of the patient is a guide to the appropriate first line imaging investigation:

- women over 35 years: mammography is the imaging test of choice
- women under 35 years: ultrasound is the more accurate test[10]
- women with palpable findings: mammography and ultrasound are often used in combination.

The patient's age is a guide only, and appropriate imaging is determined by the clinical setting. For example, mammography would not be used as a first line test in a woman aged 40 years if she is pregnant, yet mammography may be recommended in a woman aged 32 years who has a strong family history of breast cancer.

Mammography (*Table 1*) and ultrasound (*Table 2*) used in combination will correctly identify about 95% of breast cancers in symptomatic women.[11] Therefore, a small

but significant proportion of breast cancers will not be diagnosed on imaging alone and clinical opinion is crucial in determining whether further testing such as biopsy is needed, despite normal imaging findings.

Common abnormal findings on breast imaging

The appearance of breast cancer on mammography or ultrasound

There are many histological types of breast cancer, and this is reflected in the highly variable appearance of breast cancer on imaging. Some of the possible features that breast cancer may show on mammography and ultrasound are:

- stellate or spiculated lesion (+/- calcification) (*Figure 1–3*)
- irregular mass or density (*Figure 4*)
- distortion or disturbance of architecture (*Figure 5*)
- calcifications (+/- mass) (*Figure 6, 7*)
- asymmetric density (*Figure 8*)
- circumscribed mass or density (*Figure 9*).

Benign vs. malignant imaging features

There is considerable overlap in the appearance of malignant and benign lesions on imaging. This applies to masses and densities, as well as to microcalcification, all of which are common findings on breast imaging (*Figure 2, 4, 8*).

- Malignant masses and densities can be difficult to distinguish from benign lesions or an island of normal breast parenchyma. Features such as the border or margin of the lesion (smooth vs. irregular border) and whether there is associated microcalcification or distortion are important to assess when trying to classify lesions
- Superimposition or overlap of glandular tissue may create an appearance that is difficult to distinguish from a true lesion. It is common for the baseline craniocaudal and/or mediolateral oblique mammographic views to suggest the presence of a lesion, but to find on further views this area represents an island of normal breast parenchyma rather than a real lesion
- Microcalcification is an extremely common finding on mammography (it may also be seen on ultrasound). In the majority of cases it represents a benign process such as fibrocystic change or fibroadenoma (*Figure 10–13*). Microcalcification may also represent invasive or in situ breast cancer (*Figure 6, 7*).

  It is not possible or justifiable to biopsy all calcification. Biopsy is therefore performed on calcification that is suspicious or equivocal in appearance such as irregular clusters or those that have a 'cast-like' appearance. Image guided core biopsy is usually the method of choice for sampling such microcalcification.

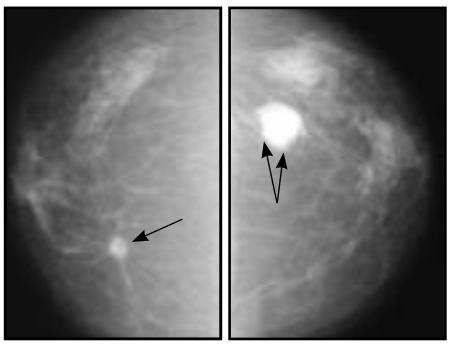

Figure 9. Bilateral breast cancer (note: the breast tissue is of minimal density with glandular tissue predominantly replaced with fat tissue). The small cancer in the right breast is a low density lesion with fine radiating spicules. The larger breast cancer in the left breast is a dense lesion with lobulated borders (arrowed)

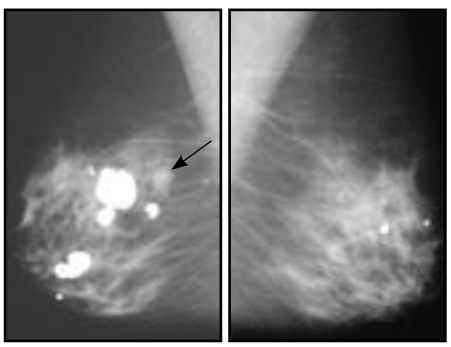

Figure 10. MLO films showing completely calcified lesions (typical appearance of calcified fibroadenomas) so called 'popcorn' calcification within both breasts. In the right breast there is a low density mass (indicated by arrow) with microcalcification and irregular borders; this is a malignant lesion. Multiple benign lesions should not detract from careful viewing of the entire breast to identify the (less subtle) lesion indicating a cancer

Table 3. When to refer

- Any new discrete palpable lump in a woman of any age (usually requires biopsy to complete the triple test)
- Any imaging report describing a breast lesion as atypical or suspicious of malignancy
- Imaging report of a solid mass in an area of clinical interest, even if it has imaging features suggestive of a benign lesion such as a fibroadenoma
- Inconsistencies between the imaging and clinical findings, eg.
  - normal imaging in the presence of a significant clinical finding
  - possible discordance between the size or location of the clinical area and the lesion reported on imaging
  - discordance between mammography and ultrasound where both performed, eg. size or location of lesion on one imaging test does not correlate with the other imaging test

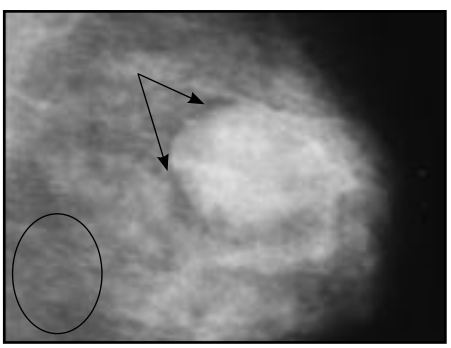

Figure 11. Benign density and microcalcification. A magnification view showing two findings: scattered punctuate uniform calcification (circled) – typical benign features, and a benign mass with well defined borders (arrows point to a dark 'halo' surrounding the lesion; typical of a benign lesion such as a fibroadenoma or cyst)

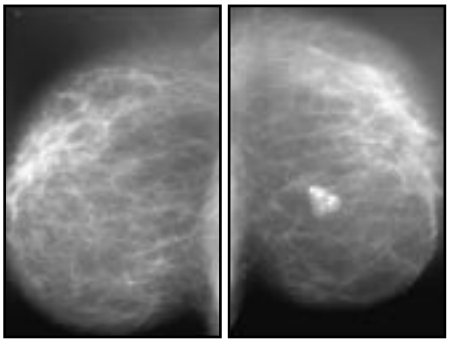

Figure 12. Very atrophic breast tissue (almost entirely fat replaced) showing a typical partially calcified fibroadenoma. This lesion does not require intervention

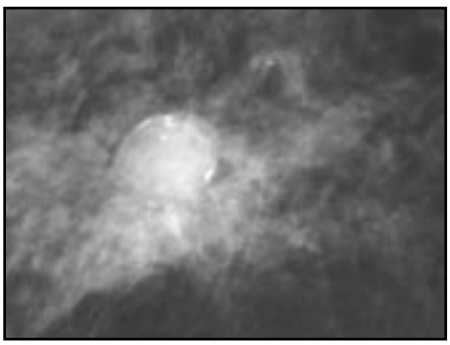

Figure 13. Another example of benign appearing calcification. This is the calcified capsule of a cyst

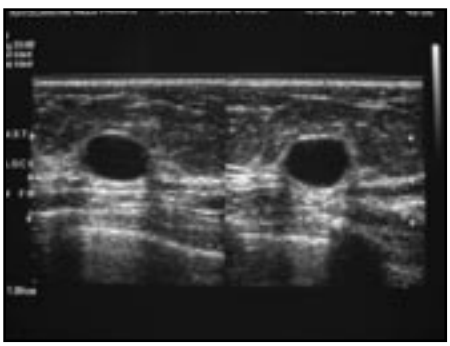

Figure 14. Simple cysts are characterised on ultrasound as: anechoic lesion (black hole); smooth, well defined borders and very thin capsule; posterior enhancement (transmission of ultrasound through fluid gives the appearance of enhancement or 'white' deep to the lesion)

Spot check

A small but significant proportion of breast cancers will not be diagnosed on imaging alone. Therefore, biopsy may be needed, despite normal imaging findings

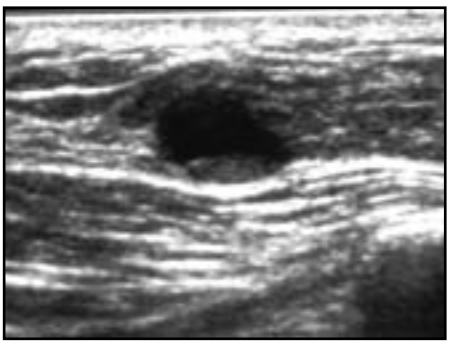

Figure 15. A sonographic complex (atypical) cyst, the walls (or cyst capsule) are thickened. This may indicate inflammation or other benign processes, but may very occasionally represent a malignancy. This lesion should be biopsied

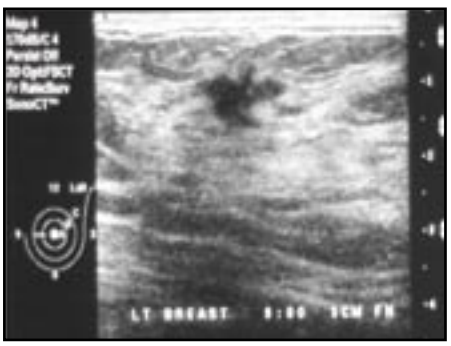

Figure 16. Solid lesion with stellate borders – this is a malignant sonographic appearance (note: this lesion is extremely hypoechoic; it is less echoic ['less white'] than the surrounding normal parenchyma)

Breast ultrasound – commonly reported findings

Cysts

Cysts are extremely common findings on ultrasound, particularly in women in their 40s. Most cysts seen on imaging are incidental findings and are not symptomatic. Cysts may be simple (with typical sonographic features of a cyst [*Figure 14*]), or complex cystic lesions (which have atypical features such as thickened walls [*Figure 15*]). Aspiration or needle biopsy is required only for cysts that:

- are symptomatic (causing a palpable lump or pain)
- are very large
- have atypical or suspicious features on ultrasound such as an irregular margin or features suggesting it may be solid, or have a solid component (eg. an internal nodule).[12,13]

Hypoechoic lesions

Hypoechoic lesions are frequently identified on ultrasound. These are lesions with less echo texture than the surrounding fat (it is a descriptive rather than a diagnostic term) (*Figure 16*). Hypoechoic lesions may represent solid lesions that may be benign (*Figure 17*) or malignant, or cystic lesions with

Table 4. Image guided breast interventions

- Fine needle aspiration biopsy
  - used to collect a specimen for cytology (21–25 gauge needle)
  - usually performed under ultrasound guidance
- Cyst aspiration
  - used to drain symptomatic (palpable or tender) cysts
  - used to sample fluid from atypical cystic lesions (atypical on imaging) for cytology
  - similar procedure to fine needle aspiration biopsy
- Core biopsy methods
  - all obtain cores of tissue for histopathology
  - core biopsy methods available include 'standard' core biopsy (14 or 16 gauge) and vacuum assisted core biopsy (also referred to as Mammotome®) (11 gauge)
- Pre-operative localisation
  - impalpable breast lesions seen only on mammogram or ultrasound can be localised pre-operatively to facilitate accurate surgical biopsy of the abnormal area
  - lesion can be marked with placement of a hook wire in the lesion

echoes within their cavity (eg. from thickened fluid or debris).

Management of a hypoechoic lesion depends on the most likely nature (imaging diagnosis) of the lesion. However, if a hypoechoic lesion has suspicious features (eg. irregular margins) or corresponds with a lump or clinically abnormal area of the breast, then needle biopsy should be done (*Figure 18, 19*).

When to refer

All women with a new breast symptom such as a palpable lump should be referred for breast imaging. The imaging findings must be correlated with the clinical findings, with the triple test approach in mind. Any of the outcomes listed in *Table 3* should prompt referral for further investigation or treatment. Referral would usually be to a specialist breast clinic or a breast surgeon. In some cases, further investigation can be done by the GP in conjunction with a radiologist who is able to perform breast biopsy procedures (*Table 3*).

Image guided breast intervention

Image guided biopsy is increasingly used in breast diagnosis and treatment (*Table 4*). It is used to assess impalpable breast lesions or those that are palpable and require more accurate sampling. Image guided intervention may be used to:

- confirm the diagnosis of malignancy and allow progress to definitive treatment
- establish a benign diagnosis thus avoiding unnecessary surgery
- allow localisation of impalpable lesions for excision.

Conflict of interest: none declared.

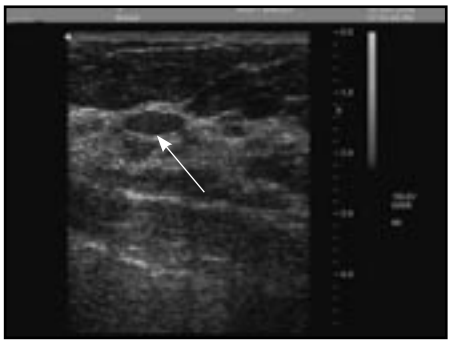

Figure 17. Benign lesion – oval, smooth, well defined solid lesion. These are typical benign sonographic features, typical of a fibroadenoma

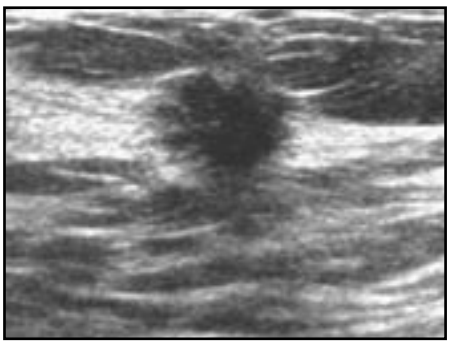

Figure 18. Solid, hypoechoic, irregular lesion interrupting the surrounding architecture – a malignant sonographic appearance

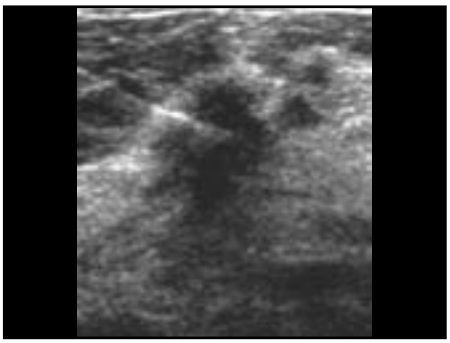

Figure 19. The lesion from Figure 18 is being investigated with US guided fine needle biopsy (note: the needle tip in the lesion)

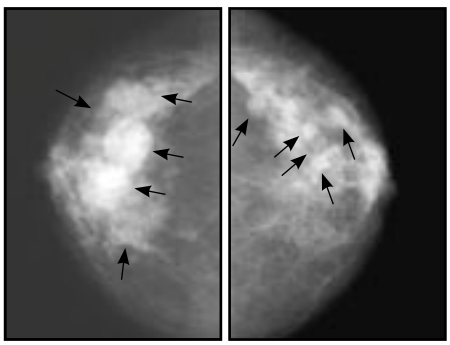

Figure 20. Craniocaudal films showing multiple round densities (indicated by arrows) within both breasts, suggestive of multiple cysts. An ultrasound would generally be performed to characterise these lesions and confirm that they are cystic in nature

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Correspondence
Email: afp@racgp.org.au