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Clinical Radiology
The Royal College of Radiologists

Recommendations for cross-sectional imaging in cancer management, Second edition

Breast cancer

Faculty of Clinical Radiology

Contents

Please note that the protocol for breast imaging on page 3 was updated on 12/4/19 changing column 1 of row 1 to TSE T1W from TSE T2W.

Breast cancer

Clinical background

Breast cancer is the most common cancer in the UK and the second biggest cause of cancer deaths in women.[1] In 2011, there were 49,936 new registrations of breast cancer in women in the UK, and 349 in men (Cancer Research UK, 2013).[1] Nearly one-third of cancers were diagnosed via the NHS Breast Screening Programme, with detection of more than 15,600 cancers in women aged 50–70.[2]

Patients with T1 and T2 primary breast tumours (that is, less than 5 cm) have a low incidence of distant metastatic disease at the time of diagnosis of less than 2%.[3] Patients presenting with T3 and T4 tumours have an incidence of metastatic disease at the time of diagnosis of between 15–20%.3 Overall, approximately 4% of patients presenting with breast cancer will have metastatic disease detectable at the time of diagnosis.[3] In patients with T1 and T2 tumours, screening for asymptomatic metastases is difficult to justify on clinical grounds and generates false-positive findings. Detection of metastases at an asymptomatic stage in bone and central nervous system (CNS) has not been shown to prolong survival.

Who should be imaged?

At the time of diagnosis of breast cancer, the investigations commonly used – mammography and ultrasound – together with clinical examination and histology will establish local disease stage. The size of the primary tumour will guide choice of therapy; early breast cancer may be treated with surgery while more locally advanced tumours will often be treated with neoadjuvant chemotherapy before surgery in an attempt to downsize local disease and reduce the requirement for mastectomy.

Diagnostic investigations for breast cancer include ultrasound, mammography and biopsy. Needle core biopsy is preferred rather than fine-needle aspiration cytology (FNAC) for most solid lesions and for lesions suspicious for cancer because of the higher sensitivity and specificity achieved in most centres and because of the importance of oncological information, including tumour type, grade and receptor status obtained with histology. In units where appropriate expertise exists, FNAC is an acceptable alternative to needle core biopsy in the initial evaluation of symptomatic breast lesions and in patients presenting with a lump in the axilla alone with no known clinical abnormality of the breast. Centres using cytology should demonstrate appropriate sensitivity and specificity.

These diagnostic investigations may be used for staging local disease. There is frequently some discrepancy between the estimated tumour dimensions on clinical examination, ultrasound and mammography, and all three techniques should be taken into consideration before assigning local disease stage.

'Routine' CT staging for asymptomatic patients with early-stage disease (T1/T2) is not indicated.[4] If symptoms develop, the appropriate investigation should be requested. Even in patients with advanced disease (T3/T4), including inflammatory carcinoma, routine CT is not generally done. A bone scan with liver ultrasound is performed first by most centres.

Breast MRI does not form part of the initial imaging assessment of patients in the symptomatic breast clinic. It may, however, be useful in the further investigation of some breast lesions. MRI should be carried out according to local policy agreed by the multidisciplinary team.[3,4]

Staging objectives

- To establish size of tumour.
- To assess for skin and chest wall involvement.
- To assess for multifocality and multicentricity of tumour.
- To establish nodal status with respect to nodal involvement and anatomical site.
- To assess for distant metastatic disease in patients who are symptomatic or considered at unusually high risk of having metastatic disease.

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Staging

Axillary nodal status is assessed with ultrasound, with biopsy or FNAC of morphologically suspicious nodes.

MRI
MRI is the most sensitive method of detecting multifocal invasive carcinoma and is used in selected cases. Breast MRI scanning should be considered in patients with:

- Suspected multifocal/multicentric cancer where the treatment strategy may be altered (for example, when breast conservation would be preferred)
- Mammographically occult cancers
- Radiographically dense breasts
- Lobular cancers.
- Positive axillary nodes with no breast primary detected on mammography or ultrasound
- Monitoring neo-adjuvant chemotherapy.

A dedicated breast coil should be used.

Single-dose contrast 0.2 ml/kg patient body weight. Temporal resolution of each dynamic scan not more than 90 seconds.

Protocol for breast imaging

Sequence	Plane	Slice thickness	Field of view
TSE T1W	Axial	4 mm x 0	Both breasts
TSE T2W	Axial	4 mm x 0	Both breasts
Dynamic contrast-enhanced T1 gradient echo + fat sat x 6	Axial	4 mm x 0	Both breasts
Delayed T1 gradient echo + fat sat post-contrast	Axial	4 mm x 0	Both breasts

CT
'Routine' staging for asymptomatic patients with early-stage disease is not indicated. If symptoms develop, the appropriate investigation should be requested; for example, for bone pain, isotope bone imaging; for breathlessness, chest X-ray (CXR) initially; and thoracic CT, if radiograph is normal and lymphangitis is suspected; and for symptomatic brachial plexopathy, MRI is the preferred investigation. If staging CT scanning is performed, the supraclavicular fossa, chest and liver should be examined using intravascular (IV) contrast medium.

- 100–150 ml of intravenous iodinated contrast medium injected at 3–4 ml/sec.
- MDCT is commenced at 20–25 seconds (neck and chest) and 70–80 seconds (abdomen and pelvis) post-injection.
- Using MDCT, slice thickness will depend on scanner capability. In general, sections are acquired at 1.25–2.5 mm and reformatted at 5 mm for viewing.

Values of $CTDI_{vol}$ should normally be below the relevant national reference dose for the region of scan and patient group (see Appendix and section on Radiation protection for the patient in CT in Section 2).

PET-CT
^{18}FDG PET-CT is not routinely indicated for primary tumour/axillary staging because its accuracy is limited.[5] ^{18}FDG PET-CT is becoming recognised as the most accurate imaging modality for detecting metastatic disease recurrence and it is particularly useful for the definition of small volume (less than 1 cm) involved nodal disease and lytic bone metastases. The modality is currently used predominantly for the assessment of patients with equivocal imaging or clinical findings, frequently providing a definitive assessment regarding the presence or absence of active recurrent metastatic disease. It can also be useful in the assessment of multi-focal disease or suspected recurrence in patients with dense breasts, differentiation of treatment induced brachial plexopathy from tumour infiltration in

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symptomatic patients with an equivocal or normal MR, assessment of extent of disease in selected patients with disseminated breast cancer before therapy and assessment of response to chemotherapy in patients whose disease is not well demonstrated using other techniques; for example, bone metastases.

Follow-up

- It is recommended by the National Institute for Health and Care Excellence (NICE)[3] that routine surveillance following treatment for breast cancer should be by annual mammography until the patient enters a national screening programme. Patients diagnosed with early breast cancer who are already eligible for screening should have annual mammography for five years.
- The rationale for early detection of local recurrence is that treatment may be more effective and there may be a survival benefit, since mammography may detect recurrence with better prognostic factors than clinical examination.
- The risk of local recurrence is determined by the prognostic factors of the primary tumour and the type of treatment given. Overall the risk of local recurrence in the treated breast is between 0.5% and 1% per annum when new primaries are included and is lifelong.[3]
- Up to a third of clinically occult local recurrences are detected by mammography alone. It is most likely to detect recurrence in the conserved breast, and this usually has similar mammographic features to the original primary disease. It is not effective in detecting superficial and skin recurrence either in the conserved breast or on the chest wall following mastectomy.
- MRI can be expected to have significantly higher sensitivity for recurrence than other imaging techniques but is also likely to have a high false-positive rate with a high proportion of benign biopsies. MRI is not currently recommended for routine surveillance but is used for further assessment and problem-solving when other investigations have equivocal findings. Both mammography and MRI are more likely to result in false-positive findings in the conserved breast in the first 18 months after radiotherapy. Mammography is also useful for confirming the absence of recurrence. Ultrasound may be used to attempt to characterise areas of breast with palpable abnormality following treatment and to guide fine needle aspiration for cytology or repeat biopsy. Surveillance ultrasound is not indicated but may be used when the primary tumour was occult on mammography.

Tips

- There is no demonstrable survival benefit derived from intensive imaging follow-up aimed at early detection of metastases in asymptomatic patients.
- Follow-up imaging after treatment for non-metastatic breast cancer should be directed by clinical symptoms.

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