Breast imaging
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Assessment of symptomatic women

- **Classification**: Benign or Malignant cause of the symptoms? Tripple assessment

- **Staging**: Characterizing the cancer: size, multiplicity, lymph node status
Breast imaging techniques

- Mammography
- Ultrasonography
- MRI
- Tomosynthesis
- Contrast enhanced spectral mammography
- Breast CT, optical imaging, foto-acoustic imaging, breast specific gamma imaging, thermography, phase-contrast mammography...
Mammography

- X-ray imaging technique
- Attenuation differences of tissues with different densities
- Women age > 30–35
Mammographic views

- Mediolateral oblique (MLO)
- Spot compression
- Magnification view
- Lateral (ML or LM)
Breast cancer appearances on mammography

- Soft tissue mass
- Architectural distortion
- Focal asymmetry
- Microcalcifications
Microcalcifications of high-grade DCIS

Microcalcification can be the only sign of DCIS (+/- associated soft tissue mass)
Soft tissue mass

The importance of prior mammograms

4 mm ILC
Associated features

Pathological lymph node

Skin retraction

Unilateral oedema, skin thickening
Diagnostic classification scores

1. Normal
2. A lesion having benign characteristics
3. An abnormality present of indeterminate significance
4. Features suspicious of malignancy
5. Malignant features

European guidelines for quality assurance in breast cancer screening and diagnosis (4th ed)
Mammography of the male breast

- Male breast cancer (life time risk 1/1,000)
- Gynecomastia (mostly adolescent boys, elder men)
Mammography

The most common medical imaging method

Advantages

The whole breast is examined

Enables comparison with prior examinations

Sensitive for microcalcifications

Fast, cheap and accessible

Disadvantages

Radiation - not suitable for young women

Limited sensitivity in dense breasts
PAD: 13 mm IDC G2, LN-
Mammography

Tomosynthesis

X-ray source

Pivot

Compression paddle

Breast

Detector

Pseudo-3D
PAD: 30 mm IDC G3, LN+
Tomosynthesis

Provides a better mammogram

Advantages

Increased sensitivity

Improved preoperative staging

Use the same unit for mammography and tomosynthesis

Next screening modality?!

Disadvantages

Radiation based method

Not 100% sensitivity!

Reading time x 2-4
1. Mucinous cancer

2. Benign cyst
Ultrasonography

- Uses pulses of high-frequency sound waves that are reflected in various degrees in different types of tissues

- Indications:
  - Young women (age <30–35)
  - Dense breasts
  - Characterize/classify lesions seen on mammography
  - Lymph node assessment
  - Guidance at interventional procedures (FNAC, biopsy, preoperative localization, etc)
Lymph node assessment
Ultrasonography

**Advantages**

- Young women
- Dense breasts
- Characterize dense lesions seen on mammography
- Guide at interventional procedures

**Disadvantages**

- Microcalcifications
- Operator dependent
- False positives
Breast MRI

- Dynamic contrast-enhanced MRI (Gadolinium)
- Study the contrast dynamics
- High sensitivity (90%), specificity (72%)

Peters et al. 2008 Radiology
Gadolinium contrast enhancement
Contrast dynamics

Probability of cancer:

- Typ Ia,b: 6%
- Typ II: 64%
- Typ III: 87%

Kuhl CK et al. Radiology 1999
Indications for breast MRI

• Problem solving in case of inconclusive findings on conventional imaging.

• Screening of the contralateral breast in women with histological evidence of unilateral breast cancer.

• Evaluation of the breasts in case of metastases of an unknown primary carcinoma.

• Evaluation of therapy response in patients treated with neoadjuvant chemotherapy.

• Exclusion of local recurrence after breast-conserving therapy.

• Screening of women with a lifetime risk of 20% or more to develop breast cancer, including mutation carriers.

Pre-operative staging with MRI

- Tumour size can be underestimated with mammography and ultrasound, especially invasive lobular carcinoma
- MRI is accurate in estimating tumour extension (multifocality, multicentricity)
- Pre-operative MRI is clinical practice in many countries
- Meta-analysis clearly shows that pre-operative MRI does not reduce the risk of BC recurrence
- Pre-operative MRI is associated with increased odds of receiving ipsilateral mastectomy and contralateral prophylactic mastectomy

Houssami N et al J Clin Oncol 2014
Houssami N et al Breast Cancer Res Treat. 2017
• MRI signal changes in deep nuclei linked with repeated administration of Gd contrast agents

• The clinical significance remains unknown

Assessment of breast implants

Ruptured implant
Breast MRI

Advantages
- No ionizing radiation
- Dense breasts
- High sensitivity

Disadvantages
- Microcalcifications
- Specificity
- Accessibility
- Expensive
- Gadolinium
Contrast enhanced spectral mammography

- Iodinated contrast agent
- Dual energy
- Similar sensitivity and better specificity than MRI

Advantage compared to MRI:
- Increased specificity
- Microcalcifications
- Accessibility
- Cost-effective

"Poor mans MRI"
Triple assessment

1. Medical history and clinical breast examination

2. Imaging – mammography and/or ultrasonography

3. Non-excision biopsy – fine needle aspiration (FNA) cytology and/or core biopsy
   - Sensitivity 99.6%

Core needle biopsy

- High sensitivity (97%)
- Ultrasound guided
- Stereotactic biopsy
Ductography

Indications:

• Unilateral, single-pore, spontaneous nipple discharge (bloody or clear)

Aim:

• Localize the origin of the secretion

• To identify intraducutal abnormalities:
  – papillomas
  – DCIS
Screening for metastatic disease

• Incidence of metastatic disease in early-stage BC <2%

• Whole body screening (CT) justified: N2 disease, T4 tumour, or local and regional recurrence

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Summary

• Mammography and ultrasonography are the cornerstones of breast imaging

• New imaging techniques can provide additional value

• MRI has high sensitivity and can be a problem solver in the clinic

• Triple assessment should be used
Thank you for your attention!

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