Imaging in breast cancer

Mammography

and

Ultrasound

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A mammogram report is a key component of the breast cancer diagnostic process.

A mammogram report cannot determine whether a woman has breast cancer, it may indicate whether a breast abnormality is present, and if so, it may characterize, that abnormality.

The aim is to describe information and terminology that may appear on a mammogram and to describe BI-RADS category on a mammogram.
Understanding the terminology of a mammogram report including:

- Mass or nodule
- Well–defined, Ill-defined, Speculated, irregular, lobulated
- Calcification (Microcalcification)
- Monomorphic and polymorphic (Pleomorphic), cluster, linear, braconching …..
- Architectural distortion
- Density (Focal density)
- Asymmetry
- Skin thickening and skin retraction
- Nipple retraction
- Axillary lymphadenopathy
Report organization based on BI-RADS system

The reporting system is designed to provide an organized approach to image interpretation and reporting. We should describe:

![Image of Report Organization diagram]

- Indication
- Breast composition
- Findings
- Comparison to previous study
- Overall Assessment and Management recommendations
Sensitivity of Mammography

- 85% - 90% in fatty replaced breasts
- 65% in dense breasts
Primary Signs of Cancer on Mammography

- Mass
- Calcifications
Secondary Signs of Cancer on Mammography

- Nipple Inversion
- Architectural Distortion
- Skin Thickening
- Axillary Adenopathy
- Skin Retraction
- Tissue Asymmetry
- Developing “Neodensity”
Breast composition

• Almost entirely fat (less than 25%)

• Scattered fibro glandular densities (25% to 50% glandular)

• Heterogeneously dense (51% to 75% glandular)

• Extremely dense (75% glandular)
Breast masses

Important features that help in differential diagnosis and appropriate management of breast masses include:

- Shape
- Margins
- Radiographic density
- Size and number
- Location
Breast masses

Shape

- Round
- Oval
- Lobular
- Irregular
Breast cyst

Fibroadenoma

Invasive ductal carcinoma
Breast masses

Margin

- Circumscribed
- Lobulated
- Obscured
- Indistinct, Ill-defined
- Spiculated
Breast masses

Margin

• The most important features in determining the differential diagnosis and management.

• Circumscribed or well-defined margins: sharply demarcated margins with abrupt transition between the lesion and surrounding tissue.

• Ill-defined margins: poor definition of the margins, there may be infiltration by the lesion.

• Speculated margins: characterized by lines radiating from the margins of a mass.
Breast masses

• Circumscribed masses are usually benign.

• Speculated margins are more likely malignant.

• Circumscribed carcinoma and speculated benign masses.

• Microlobulated margin is suspicious for malignancy (undulation in the 2-to-4-mm range).

• Ill-defined margins are more suspicious.

• Spot compression magnification views may be necessary.

Fat necrosis

Colloid carcinoma
Fibroadenoma

Medullary carcinoma

Invasive ductal carcinoma
Breast masses

Radiographic density of breast masses

- The use of density for radio opaque masses has some limitation.
- Carcinomas with equal density or lower density compared with fibro glandular tissue
- Fat-containing mass are benign.
Lipoma. Well-defined mass of lipid density
Breast masses

Circumscribed masses

Several factors should be considered:

• Dose the mass contain fat or calcification and the type of calcification?

• Ultrasound is valuable.

• Circumscribed masses with fat or both fat and soft tissue density are always benign.
Breast masses

Ill-defined masses

Differential diagnosis include:

- Carcinoma
- Abscess
- Hematoma
- Fat necrosis
- Fibrocystic changes
- Focal fibrosis and pseudo tumor
- Spot compression magnification views are often helpful specially in dense breast.
- Ultrasound is useful. Biopsy is recommended in solid lesions.
Breast masses

Speculated masses

The highest probability of malignancy. Differential diagnosis includes:

- Carcinoma
- Radial scar
- Postoperative scar
- Fat necrosis
- Fibrocystic changes
- Focal fibrosis
- Hematoma
- Chronic infectious disease

Benign lesions can present as speculated masses.
Invasive ductal carcinoma
Breast masses

Number and distribution of breast masses

• Multiple bilateral circumscribed (partially circumscribed) masses are almost always benign.

• Differential diagnosis: cysts, fibroadenomas, lymph nodes, papillomas

• Metastasis can be multiple (usually ill-defined).

• Multiple masses with ill-defined or speculated margins: multifocal or multicentric breast carcinoma, metastasis of another primary malignancy.
Multiple breast cysts
Calcification

- Localization
- Size
- Number
- Morphology
- Dissemination
Calcifications Morphology

Benign
- Skin
- Vascular
- popcorn
- plasmacell mastitis
- fat necrosis
- milk of calcium
- dystrophic
- eggshell
- suture

Intermediate Concern
- Amorphous
- Coarse heterogenous

Malignant
- fine linear
- branching
- pleomorphic
Arterial Calcification

• Typically in two parallel lines
• Usually bilateral, but often asymmetric
• Early arterial calcification may be difficult to distinguish from suspicious micro calcification.
Duct ectasia

- Usually bilateral and symmetric, large calcification
- Nipple retraction or inversion
- Periductal or intraductal
- Periductal (radiolucent centers as non calcified duct Lumina)
- Linear with long axis pointing towards the nipple, branching, oval or round, often with radiolucent center.
Cyst

- Thin peripheral rim or homogeneous density
- Calcification is not frequent, usually less than 1 cm
Fibroadenoma

- The most common benign tumor under 25 years of age
- Coarse nodular calcification
- Early, peripheral calcification
- Advanced, popcorn calcification
- Mixoid degeneration, calcification without soft tissue
- Microcalcification

Coarse nodular calcification in a fibroadenoma
Calcifications morphology

Intermediate (suspicious):
- Amorphous
- Heterogeneous

Malignant:
- Fine linear
- or branching
- pleomorphic
Intermediate (suspicious) calcifications

Amorphus calcifications

• The calcification that most radiologists have problems dealing with are these of intermediate.

• Analyze the calcification to decide those that have a more chance of malignancy.

• Usually have an amorphous or coarse heterogeneous appearance, Without a clearly defined shape or form

• Small or hazy in appearance
<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>60% benign</td>
<td>Especially when diffuse and bilateral or multiple bilateral clustered. Usually FCC (fibrocystic changes). Associated mass suggests papilloma, fibroadenoma, or sclerosing adenosis.</td>
</tr>
<tr>
<td>20% high risk</td>
<td>Atypical duct hyperplasia, atypical lobular dysplasia, lobular carcinoma in situ.</td>
</tr>
<tr>
<td>20% malignant</td>
<td>Low grade DCIS, 10% IDC (invasive ductal carcinoma) usually with associated mass.</td>
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</tbody>
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High probability of malignancy

- Fine pleomorphic calcifications
- Vary in size and shape, usually <0.5 mm in diameter
- Fine, linear or branching calcifications
- Highly suggestive of malignancy (BI-RADS 5)
calcifications in DCIS
Cluster microcalcifications

- There is continued confusion regarding management of a cluster of calcifications.
- A cluster is defined as 3-5 micro calcifications within an area no larger than 0.5-1 cm.
- The greater the number of micro calcification the greater the likelihood of malignancy (DCIS) with or without invasion.
- Cluster dose not mean that the lesion is malignant.
- The morphology is important for appropriate management.
  - Biopsy
  - Short inter wall follow up
  - Routine screening mammography
Cluster microcalcifications
Distribution of microcalcifications

**Diffuse or scattered:** scattered in the whole breast parenchyma, usually punctuate.

**Regional:** scattered in a larger volume (>2 cm) of breast tissue.

**Clustered:** at least 3-5 calcifications occupy a small volume of tissue <1 cm.

**Linear:** calcium in a duct with a linear shape

**Segmental:** calcium in ducts and branches of a segment or lobe

*Cluster, linear or segmental, tend to be more suspicious for malignant than regional or diffuse distribution.*
Architectural distortion

• The normal breast architectural is distorted with no definite mass. This includes speculations radiating from a point, focal retraction or distortion of the edge of the parenchyma.

• Can be an associated findings.
Additional findings

- Skin retraction
- Nipple retraction
- Skin thickening
- Trabecular thickening
- Axillary adenopathy

In the absence of a history of previous surgery or radiation therapy these findings generally represent malignancy or mastitis and abscess formation.
Impression and recommendation:

- This section describes the radiologist’s overall assessment of the findings and often including a classification of the mammogram using the BI-RADS system developed by the American College of Radiology.

- Some radiologist’s may give specific instruction on what actions should be taken.
Final assessment

BI-RADS: 0

- Need additional imaging evaluation and or prior mammograms.

When additional imaging studies are completed, a final assessment is made.
Final assessment

BI-RADS 1

- Negative. The breast are symmetric and no mass, architectural distortion or suspicious calcification are reported.
Final assessment

BI-RADS 2

• Benign findings:

Involuting, calcified fibroadenoma, fat containing lesion such as oil cyst, lipoma, galactoceles, hamartoma, benign calcifications, intra mammary lymph nodes, architectural distortion clearly related to prior surgery.
Final assessment

BI-RADS 3

Probably benign finding

- Short interval follow-up is recommended (<2% risk of malignancy).
- Lesion placed in this category includes:
  - Non palpable, well defined mass (unless it can be shown to be a cyst or intra mammary lymph node or another benign findings)
  - Focal asymmetry which becomes less dense on spot compression view
  - Cluster of punctuate calcifications (monomorph)

A well-defined mass with a cluster of punctate calcifications
Final assessment

• Suspicious abnormality, biopsy should be recommended.

• BI-RADS 4 is reserved for findings that do not have the classic appearance of malignancy but have a wide range of probability of malignancy (2-95% malignant).

• **BI-RADS 4 (4 A, 4 B, 4C)**

Amorphous calcifications

Follow up: multiple pleomorphic calcifications. DCIS
Final assessment

BI-RADS 5

Highly suggestive of malignancy. Appropriate action should be taken. B1- RADS 5 is reserved for findings that are classic breast cancers (>95% malignant).

BI-RADS 5 include:

- A suspicious, irregular high-density mass
- A segmental or linear of fine linear micro calcification
- A cluster with pleomorphic micro calcification
- An irregular speculated mass with pleomorphic calcifications

A spiculated mass with pleomorphic calcifications
Final assessment

BI-RADS 6

Known biopsy proven malignancy

- B-RADS 6 is reserved for lesions identified on the imaging study with biopsy proof of malignancy prior to definitive therapy.

- Example: during the course of the treatment the tumor may be less visible, while we know we are dealing with cancer.
Note:

• The false negative rate of mammogram is approximately 10%.

• Dense breast may obscure underlying neoplasm.

• Management of a palpable abnormality must be based on clinical assessment.
Uses of ultrasound in breast imaging

- Palpable masses
- Mammographically detected masses
- Dense breasts
- Young patients
- Pregnant/ lactating woman
- Breast implants
- Guided aspiration/ biopsy/ localisation
Cystic or solid?

An oval mass and a round mass with circumscribed margins are evident in the upper quadrant of the breast on this medio-lateral view.
Simple cyst

Typical fibroadenoma
cancer
Dense/white breasts

Fatty/ dark breasts
- Young patients (<30/35yrs)
- Should be first investigation; mammogram only if ultrasound equivocal
- Palpable lesions in young woman most commonly cysts or fibroadenomas
Limitations of breast ultrasound

- Many cancers are not visible on ultrasound
- Microcalcifications
CANNOT REPLACE REGULAR SELF EXAMINATION AND MAMMOGRAPHY AS PRIMARY SCREENING TOOL FOR BREAST CANCER!!!!