Benign & Malignant Lesions of the Breast

Smriti Hari
Associate Professor
Radiology
A.I.I.M.S.
Benign Breast Diseases

- Major application of mammography is to detect early breast cancer
  - Limited role in benign breast diseases
  - Most are diagnosed and managed clinically

- Mammography can identify suspicious features in the disease otherwise considered benign
  - This will lead to biopsy
Fibrocystic Disease

- **Mammogram**
  - Normal
  - Dense breast, nodular opacities

- **US**
  - Normal
  - Periductal hypoechoic cuff

*Imaging findings do not correlate with histopathology*
Fibroadenoma: Mammography

- Well defined
- Round/ oval/ lobulated
- Moderate density
- Halo
- Coarse calcification
Fibroadenoma: US

- Round/oval
- Thin border
- Hypoechoic
- Distal enhancement
Fibroadenoma: MRI

Not required

- Homogenous, well defined mass
- Natural history

  - Myxoid FA (gelatinous interstitial matrix)
  - Progressive fibrosis
  - Sclerotic /fibrotic FA

- Signal Intensity
  - Low on T1 and T2 (sclerotic)
  - Low on T1, High on T2 (myxoid)
Cyst: Mammography

- Sharp margins
- Round oval
- Low density
- Rim calcification

Many large cysts may not be apparent on mammogram
**Cyst: US**

- Round/ oval
- Thin wall
- Anechoic lumen
- Distal enhancement

*Few debris, thin septations, angular shape do not make it complex cyst*
Intraductal Papilloma

- **Mammography**
  - Normal
  - Dilated duct
  - Mass

- **Ductogram**
  - Dilated duct
  - Filling defect
Papilloma

- Ultrasound
  - Dilated duct
  - Intraductal nodule
Duct Ectasia

- Mammography
  - Normal
  - Dilated duct
  - Rod calcification

[Image of mammogram]
Duct Ectasia

Dilated ducts on Ultrasound, Ductogram
Acute Mastitis

- Mammography is difficult to perform
- Dense breast
- Abscess: poorly defined mass

Ultrasound is preferred
Abscess

- Ultrasound
  - Solid mass
  - Complex cyst
  - Echogenic debris
Galactocele

- US
  - Complex cyst
  - Solid mass
Tuberculosis

- Mammography/Ultrasound
  - Dense breast
  - Skin & interstitial thickening
  - Irregular spiculated mass

*Biopsy is always required*
Lipoma

- Thin walled
- Hypodense
- Difficult to detect

Fat containing mass is never malignant
Fat Necrosis

- Post surgery/trauma
- Eggshell calcification
- Spiculated mass
Radial Scar

- Spiculated lesion
- No mass

*Percutaneous biopsy has no role*
Rare Benign Diseases

- Amyloidosis, WG, Sarcoidosis
- Granulomatous mastitis
- Diabetic mastopathy

- Non specific imaging findings
  - Asymmetric densities
  - Skin and interstitial thickening
  - Spiculated masses, calcifications

*Biopsy is always required*
Malignant Lesions of Breast
Breast Cancer

- # 1 cancer in females
- Incidence in India 22-29 cases/100,000/year

Risk factors
- Age/sex
- Family history (with/without mutations)
- Estrogen overexposure (early menarche, late menopause, nulliparity, less breast feeding, HRT)
Basic knowledge of pathology and treatment of breast cancer is essential
  Each has impact on others

Breast Cancer Imaging

Pathology

Imaging

Treatment
Diagnosis of Breast Cancer

- Detection
  - Screening Mammography
  - Clinical Breast Examination (CBE)
  - Self Breast Examination (SBE)

- Definitive diagnosis
  - Image guided biopsy
Screening Mammography

- Mammography is the only imaging modality which has
  - Proved to be effective for cancer screening
  - Undergone multiple large randomized controlled trials (RCT)
  - Level 1A evidence for its use
# Mammography Screening RCTs

<table>
<thead>
<tr>
<th>RCT</th>
<th>Years of start</th>
<th>Number of women</th>
<th>Age group</th>
<th>Mammography Interval (Months)</th>
<th>Early Mortality reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIP, New York, USA</td>
<td>1963</td>
<td>62,000</td>
<td>40-64</td>
<td>12</td>
<td>29%</td>
</tr>
<tr>
<td>Two county, Sweden</td>
<td>1978</td>
<td>162,981</td>
<td>40-74</td>
<td>24</td>
<td>37%</td>
</tr>
<tr>
<td>Malmo, Sweden</td>
<td>1976</td>
<td>42,000</td>
<td>45-69</td>
<td>18</td>
<td>18%</td>
</tr>
<tr>
<td>Stockholm, Sweden</td>
<td>1981</td>
<td>59,176</td>
<td>40-64</td>
<td>24</td>
<td>20%</td>
</tr>
<tr>
<td>Gothenburg, Sweden</td>
<td>1982</td>
<td>52,000</td>
<td>39-59</td>
<td>18</td>
<td>14%</td>
</tr>
<tr>
<td>Edinburg, UK</td>
<td>1978</td>
<td>45,130</td>
<td>45-64</td>
<td>12</td>
<td>16%</td>
</tr>
<tr>
<td>NBSS 1, Canada</td>
<td>1980</td>
<td>50,430</td>
<td>40-49</td>
<td>12</td>
<td>nil</td>
</tr>
<tr>
<td>NBSS 2, Canada</td>
<td>1980</td>
<td>39,476</td>
<td>50-59</td>
<td>12</td>
<td>30%</td>
</tr>
</tbody>
</table>
Mammography Screening

- Reduces breast cancer deaths by 28-45%*
  - Slightly less in 40-50 years age group

Recommendations
- ACR, ACS: Annual, 40-75 years
- USPSTF: Biannual, 50-75 years
- Eastern Europe: Biannual, 50-70 years

*Cancer 2001;91:1724-31
Mammography Screening: Disadvantages

- False positive mammogram
  - Leads to recall for additional imaging and/or biopsy
  - Increases anxiety in women

- Increased detection of DCIS
  - Unnecessary biopsy and surgery in some of these

- Does not detect all cancers
  - Interval cancers rate is about 20%

- High cost
  - Not feasible in poor countries
USG Screening

- Ultrasound only is unsuitable for screening
  - Micro calcifications and small masses are not detected
  - Operator dependant, limited reproducibility

- However, addition USG to mammography increases cancer detection rate by 40%*
  - With some increase in false positive results (from complicated cysts)

*JAMA 2008;299:2151-63
Familial Breast Cancers

- 10-15% of all breast cancers
  - Half of them are due to BRCA1 and BRCA2 mutations

- Implications
  - Cancer occurs in 45-85% women with these mutations
  - Aggressive and young age cancers
  - Chemoprevention, bilateral prophylactic mastectomy
Mammography alone is ineffective for screening of women with BRCA mutations.

MRI screening is most effective:
- MRI sensitivity for cancer detection is 94%#.
- (CBE 50%, mammography 59%, USG 65%)
- Annual mammogram + Annual Breast MRI (six months apart)
- Screening started at 25-30 years of age

#JAMA 2004;292:1317-25
Ductal Carcinoma in situ (DCIS)

- Precursor of IDC

- Mammography
  - Linear branching calcification (most common)
  - Mass

- USG
  - No specific features

- MRI
  - Mass or non mass enhancement
Lobular Carcinoma in Situ (LCIS)

- Not a true cancer
  - Does not become invasive cancer
  - However, it increases the risk of invasive cancer (anywhere in both breasts)

- No clinical or imaging findings
  - Always incidentally detected on breast biopsy
Invasive Ductal Carcinoma

- Most common breast cancer
  - 85% of all

- Intense desmoplastic reaction
  - Hard mass on palpation
  - Spiculated mass on imaging

- Mammography
  - Irregular mass, pleomorphic calcifications or both

- MRI
  - Mass with heterogeneous or rim enhancement
Invasive Lobular Carcinoma

- Difficult to diagnose (both on CBE and imaging)
  - Multicentricity and bilaterality is common
  - Aggressive, early metastases

- Mammography
  - Asymmetric density
  - Poorly defined mass
  - No calcifications

- MRI
  - Mass or non mass lesion
  - Variable, unreliable contrast enhancement
Rare Breast Cancers

- Aggressive, rapid growing
  - Medullary
  - Undifferentiated

- Slow growing, better prognosis
  - Tubular
  - Mucinous (colloid)
  - Papillary

No specific imaging features
Inflammatory Breast Cancer (IBC)

- Young age, aggressive, early metastases
- Diffuse infiltration of dermal lymphatics
  - Inflammation, erythema, sloughing of skin
  - Diffuse edema of the breast
- Diagnosis is clinical
  - However, tumor is difficult to localize on CBE
  - Dense breast on mammography
  - Ultrasound and MRI are more accurate
Triple Negative Breast Cancer (TNBC)

- Negative for ER, PR, HER2
  - Common in younger age
  - Aggressive, rapid growth, early metastases
  - Multicentricity is common
  - Refractory to treatment, early recurrences

- Difficult to diagnose on imaging
  - Well defined or ill defined mass
  - No spiculations, calcification
  - May appear benign on USG, MRI
Staging of Breast Cancer

**T Stage**
- T1 < 2 cm
- T2 2-5 cm
- T3 >5cm
- T4 Chest wall/skin involvement

**N stage**
- N1 Mobile, axillary LN
- N2 Fixed axillary LN or internal mammary LN
- N3 Infra or supra clavicular LN

**M stage**
- M0 No distant metastases
- M1 Distant metastases

**Stage**
- I - T1N0
- II - up to T3 or N2
- III - T4 and/or N3
- IV - distant metastases
Treatment of Breast Cancer

- Surgery is the primary treatment modality
  - Breast Conservation Surgery (BCS)
  - Mastectomy

- Local adjuvant therapy
  - Radiotherapy
  - To prevent local recurrence

- Systemic adjuvant therapy
  - Chemotherapy and/or Hormone therapy
  - To prevent distant recurrence
Pre-operative Breast Imaging

- Imaging is required in a diagnosed case to rule out Additional lesions
  - Multifocal
  - Multicentric
  - Contralateral

- Mammography is the primary modality
Preoperative Staging: Breast MRI

- Detects mammographically occult additional cancers
  - Ipsilateral 20%*
  - Contralateral 13%*

- Changes management to from BCS to mastectomy

- High false positives
  - Leads to unnecessary more extensive surgery
  - Desirable, not mandatory

*Eur Radiol 2012;22:26-38
Preoperative Staging: Breast MRI

- Particularly useful in
  - Dense breast, Large tumors
  - Invasive lobular carcinoma

- Advantages
  - Accurate assessment of size & local spread
  - Detected additional foci in 41% patients*
  - Changed management in 26% patients#

*AJR 2005;184:868-77
#Cancer 2003;98:468-73
Unifocal Clinically and on Mammography, Multifocal on MRI
Axillary Lymph Node Dissection

- An integral part of breast cancer surgery (both BCS and mastectomy)

- Main cause of surgical morbidity
  - Lymphedema, paraesthesia, painful and restricted shoulder movements, contractures
  - Affect 40% patients
  - Difficult to treat

- Sentinel Lymph node mapping and axillary ultrasound (with FNAC) have important role to decrease ALND related morbidity
After lump excision
Positive margins after BCS
Mammography and USG are difficult to perform and interpret
MRI is most accurate*

*AJR 2004;182:473-80
Locally Advanced Breast Cancer (LABC)

- Unresectable but without distant metastases
  - Chest wall invasion (T4a)
  - Skin invasion (T4b)
  - Invasion of both (T4c)
  - Inflammatory breast cancer (T4d)
  - Fixed matted axillary/ supraclavicular LNs (N2/N3)

- Treated with Neo adjuvant chemotherapy (NACT)
  - Downstages and make tumour suitable for surgery
NACT: Role of Imaging

- Assess response to chemotherapy
  - Mammography, MRI, PET

- Clip placement
  - Image guided clip placement is required in rapid responders
  - If tumor disappears completely, the clip is used for hook-wire localization before surgery
MR Spectroscopy - Response to NACT

Pre-therapy

Post-therapy
DVI - Response to NACT

Responder case

Pre-therapy

After III NACT
Non-responder case

Pre-therapy

I NACT

III NACT
Follow-up Breast Imaging

- Mammography is the primary modality
  - Mammogram six months after BCT and annually thereafter

- Scar after BCT is an expected finding
  - Often spiculated
  - No mass
  - Size and shape is different in two views
Post Treatment Changes

- Due to Surgery
  - Scar
  - Smaller size, deformity of the breast
  - Fat necrosis

- Due to RT
  - Increased breast density
  - Skin thickening
  - Trabecular thickening
Seroma

- Fluid collection at lumpectomy site
- May persist up to 2 years
- Round/oval mass on mammogram
- Simple/complex cyst on ultrasound
- Should not be aspirated
Breast Reconstruction after skin sparing mastectomy

TRAM Flap

Implant
Recurrence

- Rare after BCS (2-7% at 10 years)
- Mammography is usually sufficient
  - New opacity
  - Increased density/ size of scar
  - New suspicious calcifications
- MRI/ PET in equivocal cases
- Biopsy
Recurrence
Metastatic Breast Cancer (MBC)

- Stage IV
  - Spread beyond breast, axilla, chest wall

- Metastatic sites
  - Bone (most common)
  - Liver
  - Lung
  - Brain
  - Pleura, peritoneum
  - Any organ
Metastatic Work up

- Chest x-ray
- Bone scan
- Ultrasound of abdomen and pelvis

- CT, PET-CT, MRI
  - For stage III or symptomatic women
  - To assess the response to treatment
Bone Metastases

- Bone scan is primary modality
  - Highly sensitive
  - High false positives from degenerative or inflammatory lesions
  - X-ray, CT, MRI required to evaluate these

- Most are lytic, other are mixed or sclerotic
Liver Metastases

- Hypovascular
  - Diffuse fatty infiltration may modify the appearance

- Focal fatty infiltration is a challenge
  - May simulate metastasis
  - No mass effect
  - MRI in equivocal cases
Lung Metastases

- **Usual**
  - Multiple nodules

- **Unusual are common**
  - Lymphangitis
  - Airspace consolidation
  - Intrabronchial
  - Intravascular
Rare Breast Malignancies
Paget’s Disease

- Central ductal ca that grows along the ducts to nipple and areola
- Eczema, scaling, erosion
- Mammogram and ultrasound are useful to localize the mass or calcifications
Phyllodes Tumour

- Fibro-epithelial tumor with benign (recurrence in 20%) and malignant variants

- Rapidly growing tumour of considerable size in middle-aged females

- Similar to giant fibroadenoma on mammogram and ultrasound
Intracystic carcinoma
Metastases to Breast

- **Primary site**
  - Melanoma
  - Lung
  - Stomach
  - Cervix
  - Ovary
  - Lymphoma

- Bilateral, multiple masses on imaging

- No spiculations or calcifications
Conclusion

- Limited role of breast imaging in benign breast diseases
- Primary role of breast imaging is for breast cancer
  - Detection
  - Diagnosis and staging
  - Selection and delivery of the treatment
  - Post treatment follow-up
- Basic knowledge of pathology and treatment of breast cancer is essential