**INDICATIONS**

**Symptoms**
- Palpable mass/thickening
- Focal Pain
- Nipple discharge

Women under 30, targeted ultrasound is the first study, mammography as needed

Women over 30, bilateral mammogram is the first study, targeted ultrasound to follow

**Abnormal Mammogram**
- Mass
- Developing asymmetry/focal asymmetry
- Architectural distortion
- Calcifications

**Abnormal Imaging**
- MRI
- Nuclear medicine
- CAT Scan
- Contrast Enhanced Mammography (CEM)
- Other

**Follow up**
- Probably benign masses (BIRADS 3) - 6 month f/u to assess for stability/2 year
- Abscess following antibiotic therapy
- Hematoma/seroma
- Trauma - bruise

**Known or Suspected Malignancy (BIRADS 4,5,6)**
- Determination of extent, multifocality
- Evaluation of axillary lymph nodes
- Monitoring response to neoadjuvant chemotherapy - breast, axilla and chest wall
- Screening chest wall lymph nodes after therapy
**INDICATIONS**

**Guidance**
- Cyst aspiration/FNA
- Pre biopsy needle localization/Savi scout placement
- Core biopsy
- Intra operative localization
- Tumor ablation

**INDICATIONS**

**Implants**
- Silicone implants
  - MRI more sensitive for rupture

**INDICATIONS**

**Dense Breasts**
- Almost entirely fat
- Scattered
- Heterogeneously dense
- Extremely dense

**Whole Breast Screening Ultrasound**
- Dense breasts- heterogeneously or extremely
- High risk women who cannot get an MRI
Indication - palpable lump

palpable lump

palpable lump - inframammary fold

palpable mass near chest wall
Indication- abnormal mammogram

mass on the mammogram near the chest wall

circumscribed mass

goes away on spot compression?
obscured mass

mainly well circumscribed?

normal tissue

CXR in the ER

ductogram
IMPLANTS

RUPTURE

INDICATION

Cyst or Solid
Benign or Malignant
the not so simple cyst

not a cyst

not a cyst

Cyst

Not a Cyst
NORMAL ANATOMY

- 15-20 LOBES
- nipple - ducts - TDLU - lobule
Within or under the skin? 
Clue sign

Sebaceous cyst

Nipple

Stand off gel/pad

Breast bud

Infant breast hemangioma

9 yo palp lump under nipple

4 month old with palpable mass and overlying blue tint on skin
Male patient

Chest Wall Ultrasound

Inflammatory Breast Cancer
**TECHNIQUE**

- Real time, hand held transducer
- 7.5 - 18 MHz
- Dynamic focus
- High resolution imaging

**TECHNIQUE**

- Patient supine, semi-erect, sitting or on side
- Ipsilateral arm above head
- Shoulder elevated

**TECHNIQUE**

- Radial
- Anti-radial
- Sagittal
- Transverse

- Label according to mammographic clock
- Label distance from nipple/areolar margin
- Label area of clinical concern (palpable mass, pain)
TECHNIQUE

- Focal zone
- Gain
- TGC
- Adequate depth for far field
- Gel pad for near field
- Compression
- Position change

TECHNIQUE

- Color and Spectral Doppler
- Spatial Compound Imaging
- Harmonic Imaging
- Extended field
- 3D
- Elastography
- Contrast Enhanced Imaging
Posterior Acoustic Features

- no enhancement
- enhancement
- shadowing
- combined pattern

Fibroadenoma

DOPPLER - absent, internal, peripheral

- Confirmation solid vs. cystic
- Lymph node, abscess
- Pre biopsy
- Vessel Characterization - contrast agents

Intraductal debris or mass

Papilloma
Intracystic Papillary Carcinoma

Thick walled cyst?

Cyst with debris?

Intracystic Papillary Carcinoma color and spectral Doppler
**COMPUND IMAGING**

- electronic steering of transducer array allowing for multiple scanning angles
- reduction of speckle, clutter and artifacts
- improves detail of mass margins
- calcification
- posterior enhancement less apparent

**HARMONIC IMAGING**

- transmit at one frequency, receive at multiples of that frequency
- 6MHz transmit/12MHz receive
- reduces clutter and reverb within cysts, increases lesion conspicuity, marginal definition
- good to “clean up” cysts

**EXTENDED FIELD**

- Panoramic image
- good for locating multiple masses, correlating with mammogram
- implants
Ultrasound Technology—continuing work

- Artificial Intelligence (AI)
- Whole Breast Imaging/ABUS
- Improved Lesion Detection/Characterization - vascularity-contrast, calcifications
- Computer Aided Detection
- Guidance for tumor ablation - cryotherapy
- Biopsy devices

ACR BI-RADS  Breast Imaging Data and Reporting System

Tissue Composition
Homogeneous/ fat/glandular
heterogeneous
Masses - Shape
- oval, round, irregular

Masses - Orientation
- parallel
- not parallel

Masses - Margin
- Circumscribed
- Not circumscribed
- indistinct
- angular
- microlobulated

Echo Pattern
- Anechoic
- Hyperechoic
- Complex cystic and solid
- Hypoechoic
- Isoechoic
- Heterogeneous

Calcifications
- in a mass
- outside of a mass
- intraductal

Associated Features
- architectural distortion
- duct changes
- skin changes
- thickening
- retraction
- edema
- vascularity
- elastography assessment
- soft
- intermediate
- hard
Special Cases

- simple cyst
- clustered microcyst
- complicated cyst
- mass in or on skin
- foreign body including implants
- lymph nodes: intramammary and axillary
- vascular abnormalities: Mondors, AVM's
- post surgical fluid collection
- fat necrosis

Clustered Microcysts

Assessment Categories: BI-RADS

- Category 0 - Incomplete
  - need additional imaging evaluation: additional imaging and/or prior films

- Category 1: Negative
  - nothing to comment on, no change, no significant findings

- Category 2: Benign
  - also negative, but describes a characteristically benign finding such as:
    - simple cyst
    - intramammary lymph node
    - implant problem
    - stable, probable fibroadenoma
    - stable post-surgical change
Category 3: Probably Benign

- Solid mass with circumscribed margins, oval shape, parallel (probable fibroadenoma)
- Non-palpable complicated cysts, and clustered microcysts

Management of a Probably Benign Mass found at Ultrasound (non-palpable)

- If a mass is obscured >25% at mammography, or if only seen on US, then US features determine management
- If no malignant features at US, follow-up US at 6, 12, 24 mos
- 0.2% false neg rate

Category 4: Suspicious

- 3-95% chance of malignancy

Category 4 Subdivisions

- 4A: lesion needing intervention with a low suspicion for malignancy (2-10%)
- 4B: moderate suspicion for malignancy (10-50%)
- 4C: high suspicion for malignancy (50-95%), but not classic

Category 5: Highly Suggestive of Malignancy

- High probability of being cancer (>95% chance of malignancy)