Breast Ultrasound for the Mammography Technologist

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Objectives

- Review current screening and diagnostic breast ultrasound guidelines
- Discuss current breast ultrasound equipment requirements
- Indicate the qualifications for performing breast ultrasound
- Illustrate optimized breast ultrasound scanning technique

Advancements in Breast Ultrasound

- Breast ultrasound - cystic vs. solid
- Technological advances in ultrasound equipment
  - High resolution linear array transducers
  - Permitting ultrasound of the breast to play a major role in the diagnosis of breast cancer
  - Characterization of masses
  - Give suspicion levels
  - Interventional procedures utilizing ultrasound preferred
  - Real-time needle imaging
  - Patient comfort
  - Time efficiency

Breast Ultrasound: Screening and Diagnostic

- Breast ultrasound screening is not considered standard of care in the United States
- Diagnostic breast ultrasound is a valuable adjunctive tool to mammography
- Mammography is still considered the standard of care for breast cancer screening in the USA

ACRIN 6666 Trial

- ACRIN (American College of Radiology Imaging Network) 6666 Trial - compares breast ultrasound screening plus mammography to breast ultrasound screening alone

Findings

- Diagnostic accuracy of Mammo + US was 93%
- Diagnostic accuracy of Mammo alone was 79%
- False positives increased with ultrasound screening

ACRIN 6666 Trial

“ultrasound screening does result in a significant cancer detection yield……” Dr. Wende Berg, Lead Investigator ACRIN 6666 Trial

- Ongoing data analysis
  - Cost effectiveness of US screening
  - The value of supplemental MRI after mammography and US
  - Further incidence screenings at 12 and 24 mos.
Annual Sonography + Mammography??

- Yonsei University College of Medicine in Seoul, South Korea
- Evaluated sonography’s role in the early detection of multiple-occurring, contralateral breast cancers

**FINDINGS:**
- Sensitivity of Mammo alone was 80%
- Sensitivity of Breast Ultrasound alone was 94%
- Of the metachronous breast cancers included in the study, 14% were detected by sonography alone
- Conclusion: Combination of annual sonography exams and mammography contributed to the early detection of cancers, particularly in women with dense breast tissue.


ACR Appropriate Indications for Breast Ultrasound

- Identification and characterization of palpable and non-palpable abnormalities and further evaluation of clinical and mammographic findings
- Guidance of interventional procedures
- Evaluation of problems associated with breast implants
- Treatment planning for radiation therapy


Breast Ultrasound as an Initial Imaging Technique

- Breast sonography is the initial imaging technique
  - Evaluate palpable masses in women under 30
  - Lactating
  - Pregnant


Breast Ultrasound Equipment

- High quality breast ultrasound requires
  - Transducers designed for high resolution and near-field imaging
    - Center frequency of at least 10 MHz (preferably higher)
  - Elevation plane close to the skin
  - Excellent spatial and contrast resolution
  - Capability of electronic focal zone(s) adjustment

Dis-advantages of Breast Ultrasound

- Operator-skill dependence
- Difficulty in providing reproducible results between different facilities
- Exam can be more time consuming
- Higher false-negative rate, when compared with mammography (more negative biopsies performed)
- Limited detection of DCIS

Operator Dependence

Breast sonographers should be:
- Qualified by appropriate training
- Demonstrated by certification
- Eligible for certification by a nationally recognized certifying body
ACR Accreditation for Breast Ultrasound Personnel Requirements

- Certified ARDMS
  OR
- Post-primary certification by the ARRT in breast sonography
  OR
- Certification by ARRT or unrestricted state license
  AND
  - Qualified to do mammography under MQSA
  - Physician must be in the department during breast ultrasound exams
  - Upon application for accreditation sonographers/technologists must have earned 5 ceus in breast ultrasound

ARDMS Certification Requirements for RTs

- Involved in 800 exams (at least 400 of which must involve hands-on scanning)
- 12 months of full-time, breast-ultrasound clinical experience (which is designated as 35 hours per week at least 24 weeks per year) in a breast-ultrasound setting
- 12 continuing education credit hours in breast ultrasound
- Clinical verification form – keep for 36 mos (audit)
- Formal letter of attestation
- Once approved you sit for two examinations (within 5 years)
  - Ultrasound Physics and Instrumentation Exam
  - Breast Specialty Examination
- Once certified will be RDMS(BR)

ARDMS Continuing Education Requirements for RDMS (BR)

- RDMS(BR) are required to accrue 30 CME per three year cycle in breast ultrasound
- Use a random audit system

ARDMS Breast Credential Information

- [http://www.ARDMS.org](http://www.ARDMS.org)
  - Click on Credentials and Examinations
  - Click on Breast

ARDMS Recertification??

- Evidence based continuing competency in healthcare becoming the norm
- ARDMS investigating a continuing competency model with input from all sonographers – recertification task force
- NO particular model chosen at this time however a typical assessment might occur in a 5 – 10 year timeline – not annually
- ARDMS is keeping us informed throughout the process and will provide ample notification prior to implementation

ARRT Breast Ultrasound Requirements

- Supporting discipline required
  - ARRT in Mammography
  OR
  - ARRT in Sonography
- 200 breast ultrasound exams and 10 interventional procedures within 24 months
- Documentation of ultrasounds performed
- Upon passing exam will be RT (MI/BS) (breast sonography)
ARRT Continuing Education Requirements for ARRT (BS)

- No education specific to ultrasound is required
- To maintain certification you must earn 24 credits per biennium
  - Credits do not need to be specific to the actual certificate held
  - Credits “must be relevant to the radiologic sciences and/or patient care” and be approved by an ARRT approved RCEEM (recognizing continuing education control mechanism)
  - ARRT no longer accept Category B for credit as of Jan 2008.

ARRT Contact Information

- [http://www.ARRT.org](http://www.ARRT.org)
  - Click on Practice Analysis
  - Click on Clinical Exp (post primary)
  - Click on Breast Sonography

Clinical Breast Ultrasound Experience

- Where you currently work
  - Under physician supervision
- Formal ultrasound program/school
  - Minimum of 1 year attendance

Breast Ducts and Lobules

- 15-20 lobes (more lobes sup and lat than med and inf)
- Each lobe contains approximately 20 – 40 lobules
- Terminal duct lobular units (TDLU) within the lobule

The Breast's Functional Unit - TDLU

- Made up of a lobule and it's terminal duct
- Numbers vary in the breast
  - Age
  - Hormones
- Most TDLU's present
  - Post ovulation
  - Pregnancy/Lactation
  - Early 20s
- TDLU #s increase due to
  - Postmenopausal HRT
  - Birth control pills
- Most breast pathology arises from the TDLU

Ductal System

- Central ducts drain the lobes
- The ducts lie in a radial pattern from the behind the nipple
- Certain segments of the ducts may not course radially but have a more random or tortuous pattern
Normal Anatomy

Advantages of Breast Ultrasound

- Ultrasound of the breast is able to show different tissue types
- Ultrasound of the breast can show the differences between cystic and solid

Mammography

- Mammography can show 4 densities on an image:
  - AIR
  - FAT
  - WATER (dense tissue)
  - METAL/CALCIUM
- Water densities are seen on the mammogram as dense tissue
- Summation of anatomy and pathology superimposed

Advantages of Breast Ultrasound

- Ultrasound of the breast can show
  - AIR
  - FAT
  - WATER
  - METAL/CALCIUM—limited in its sensitivity for fine calc — not used to evaluate AND
- BUS can distinguish among the different types of water densities by echogenicity, thickness and compressibility

Diagnostic Breast Ultrasound

- Targeted Scanning
  - Palpable Lump
  - Correlate to mammogram finding
  - Area of interest described by patient
  - 2nd look post MRI finding
- Whole Breast Scanning
  - Survey of the entire breast to look for disease/abnormality
  - Inflammatory CA/mastitis
  - Numerous lesions throughout the breast
  - Patient refuses mammography due to fear of radiation or implant rupture

Exam Room Preparation

- Comfortable temperature
- Clean linens
- Blankets
- Gel warmer
Patient History

- Obtain prior to scanning
  - Patient’s age
  - History of breast disease
  - Family history
  - Personal prior breast cancers
  - Personal prior breast surgeries

Transducers

- Probes are designed and manufactured for their specific use
- Breast ultrasound probes are designed specifically for small parts and near field imaging
  - Linear probes

Visual Assessment

- Check visually the patient’s breasts for
  - Size, shape and symmetry
  - Redness, dimpling or retraction
  - Surgical scarring
  - Look at nipple for signs of discharge

Positioning the Patient

- Contra lateral posterior oblique position
- Ipsilateral arm raised over the head
  - Thins and flattens the breast
  - Assures adequate penetration of the beam
  - Degree of obliquity varies depending upon
  - Breast size
  - AOI
  - Patient stays supine if a medial lesion

Gel

- Warmed ultrasound gel is applied to the skin over the area of interest:
  - We are NICE:
  - Keeps contact with transducer surface allowing sound waves to transmit
  - Keeps erectile tissues relaxed while scanning nipple/areola area

Correlation with Prior Imaging

- Review the patient’s mammogram and use as a roadmap
- Review the patient’s prior ultrasound to see location and size
- Correlate the ultrasound findings to the patient’s mammogram images
Correlate to the Mammogram

- For non-palpable abnormalities the sonographer should correlate these findings with the mammogram:
  - Size
  - Shape
  - Location
  - Surrounding tissue density (all 4 done to assure correlation)

**SIZE**

- Measure the abnormality seen on the mammogram with a ruler so you know the approximate size
- Mammograms show water densities as a summation of parenchyma and pathology
- As a result the measurement on the mammogram may appear larger

**SHAPE**

- Determine the shape of the abnormality
  - Smooth – well circumscribed
  - Lobulated
  - Spiculated
  - Taller than wide
  - Angular margins

Shape and Location Differences

Where To Scan

- Looked at mammograms and determined the location of the AOI (area of interest)
  OR
- Unable to determine exact clock location from the mammogram. Use one of three scanning approaches:
  - 30 degree wedge
  - 90 degree wedge
  - Entire hemisphere

How To Scan In Wedges

- Abnormality seen at 12 or 6 o'clock on the CC view
  - Only a slight rotation of the breast occurs so mammogram location is very accurate
  - Scan the patient at 12 or 6 o'clock in a 30 degree wedge

12 or 6 o'clock Lesion

- Abnormality seen at 3:00 or 9:00
  - Scan the patient at 3 and 9 o'clock in a 90 degree wedge

Fibrous Tissue

- Mammography abnormality seen at 3:00 or 9:00
  - Scan the patient at 3 and 9 o'clock in a 90 degree wedge
3 or 9 o’clock Lesion

RCC 12

90° 3

LCC 12

90° 3

COMPLICATED CYST

Scan in Hemispheres

- Lesion seen on only one view of the mammogram
- If lateral on the CC scan the entire lateral hemisphere of the breast
- If upper on the MLO scan the entire upper hemisphere of the breast
- TIP: If you have an ML or LM better to use that image than MLO – less lesion shift.

Lateral/Medial or Upper/Lower

AOI seen Laterally on RCC only
RT

AOI seen Above nipple on LMLO

Surrounding Tissue Density

- Observe on the mammogram the type of tissues that surround the area in question
  - Dense
  - Fatty
**Palpable Abnormality**

- Location of where to scan is more obvious
- Palpate the breast prior to scanning
  - Sometimes upright/sitting
- Palpate the breast during scanning
  - Assurance that what you feel you see on the monitor

**Fibrous Tissue**

4 – 5 mm cysts

**Fibrous Ridge of Tissue**

- #1 palpable finding in the breast
- Looks hyperechoic on US
  - Made up of interlobular stromal fibrous tissue
- Can feel linear on palpation
- Palpate AOI while scanning to prove finding
  - R/O normal or abnormal tissue

**The Importance of FAT**

- A reference that is present in most normal breasts
  - Not all breasts of same density, but all have some fat
- Fat is the frame of reference used for breast ultrasound imaging
- Fat will be the tissue to which all others are compared as to their echogenicity

**Echogenicity Terminology**

- Anechoic – NO echoes
- Hyperechoic – more echogenic than fat
- Hypoechoic – Less echogenic than fat
- Isoechoic – Same echogenicity as fat
Time Gain Compensation (TGC)

- Same brightness from top to bottom
- Fat = medium gray
- Mild sloping of the TGC
  - If TGC incorrectly adjusted
    - Cysts may become solid
    - Solids may look cystic

TGC TOO FLAT

Fat field fat will appear too hypoechoic

TGC TOO STEEP

Subcutaneous fat will appear too hypoechoic

TGC JUST RIGHT

AAHHHHHHHHHH Just Right
happy fat

TGC Settings - To STEEP

TGC Settings - Good
Conventional Scan Patterns

- **Longitudinal**
- **Transverse**

Scan Planes

- Radial and Antiradial Pattern
  - Correlates directly to the ductal system
  - Radial plane runs parallel to the ducts
  - Antiradial plane runs perpendicular to the ducts

Radial and Antiradial Scan Planes

- Scan parallel to the long axis of the ducts
  - **Duct extension** - projections of intraductal tumor…that project towards the nipple from the lesion
  - **Branch pattern** - multiple smaller projections away from the nipple

Gentle Yet Firm Transducer Pressure

- Thins the breast tissue
- Better sound penetration
- Forces tissues into a parallel plane
- Improves image quality
- For a deep posterior lesion
- To prove a fat lobule/lipoma
- Will compress up to 30%
- Helps eliminate shadow artifacts

Little To No Compression

- Superficial lesions best seen if no compression applied
- Use a large glob of gel or standoff pad if lesion is close to skin surface
- Utilizing color or power doppler requires a very light pressure so as not to restrict blood flow
Focal Zones

- Beneficial to use multiple focal zones
- Resolution improves
- Not more than 3 focal zones
- Where to focus
  - The most anterior zone should lie within the mid portion of the lesion, the same for a single focal zone
- Drawback to using multiple zones
  - Decreases the frame rate

Measuring

- One set of images without calipers
- The maximal dimensions of a mass should be recorded in at least two dimensions
  - Maximum diameter is going to give the best results when comparing to mammography images
- Three measurements:
  - RADIAL
    - 1st – Maximum diameter
  - 2nd – AP (top to bottom)
  - ANTRIRADIAL
    - 3rd – Orthogonal to 1st measurement

Annotation Requirements

The AIUM and the ACR Breast Ultrasound accreditation programs require the following four descriptions on breast ultrasound images:
1. Right or Left
2. Clock face position or Quadrant – 12, 10:30, UOQ, LIQ, etc
3. The scan plane (transducer orientation):
   - TR = transverse
   - LONG = longitudinal
   - AR = antiradial
   - OBL = oblique
4. The distance from the nipple in either centimeters or equal-width rings from the areola
   - SA = subareolar
   - A = axilla

(Some facilities also include lesion depth but this is not required)

Annotations

- RT 1:30/2 AR
- RT 10:00/6 RAD

Film/Image Labeling

- Image labeling should include a permanent identification label that contains:
  - Patient's first and last names
  - ID number or DOB
  - Examination date
  - Facility name and address (minimum city and state)
  - Right or Left breast
  - Transducer orientation and distance from nipple
  - Sonographer's identification number, initials, or other symbol.

Summary

- Breast ultrasound is a critical element in any comprehensive breast imaging facility
- Equipment must be specialized for performing breast ultrasound
- Breast ultrasound technique optimization is essential
- Those who perform breast ultrasound should be properly trained in optimization techniques and follow appropriate guidelines
Thank You