Use the orange arrow to open and hide your control panel.

Join audio:
- Choose “Mic & Speakers” to use your computer
- Choose “Telephone” and dial using the information provided

Submit questions and comments via the Questions panel.

Your Participation
- Submit your text questions and comments using the Questions Panel anytime during the presentation
- Submitted questions will be addressed by the moderator at the end of the presentation
- The live Q&A will end no later than 10:30 a.m. PT
- Any remaining questions can be sent to email@csrt.org after the webinar.

Thank you to our educational sponsor for this webinar:

HOLOGIC®

DIGITAL BREAST IMAGING & BREAST IMAGING MODALITIES

Olive Peart MS, RT(R) (M)
http://www.opeart.com

EARLY DETECTION
- Visual detection
- Advanced breast cancer

STANDARD TREATMENT
- Cauterization
- Exorcism
- Topical pain relieving ointment
- Special diets
THE RENAISSANCE - 1500S

- Radical mastectomy as treatment option
- Cauterization to control bleeding

QUOTE FROM LORENZ HEISTER

- 18th century German Physician
- "Most females can stand the operation with the greatest courage and without hardly moaning at all.
- Others, however, make such a clamor that they may dishearten even the most undaunted surgeon and hinder the operation.
- To perform the operation, the surgeon should be steadfast and not allow himself to become discomforted by the cries of the patient."

DISCOVERY OF RADIATION

- Roentgen discovery of x-rays in 1895
- Becquerel and Curie - work in isolating radium from uranium
- Radiation treatment as a cure

X-RAY IMAGING - THE BREAST

- Radiography – a sub-specialty in 1900's
- X-ray imaging after World War II
- Analog tubes
- Filters removed
- Direct exposure films without a grid
- High radiation dose

BENEFIT VS. RISKS OF DETECTION

- Unpredictable examination
- Low sensitivity
- High radiation dose
- Damage to the breast skin

RECOMMENDATION FOR MAMMOGRAPHY

- 1963 - HIP of new York began the first mammography trial
- 1971 - HIP reports the mammography reduces breast cancer deaths by 31% in women over 50
- Carcinogenic effects of mammography outweighed by benefits
DEDICATED UNITS

- Better imaging techniques
- Improved contrast
- Increased resolution
- Increased sensitivity
- Decrease radiation dose to breast
- Reduced radiation risk

BREAST SCREENING

- Mammogram
  - Gold Standard
- Various imaging method
  - Analog
  - Digital mammography – CM or DM
  - Digital tomosynthesis including C view imaging

DISADVANTAGES OF MAMMOGRAPHY

- Cancer is visualizes as a white area within the background density of the breast
- Sensitivity will depend on breast density, patient age or hormone status
- Mammography tends to understate the multifocality of a lesion
- Inadequate compression and poor positioning will affect interpretation

IMAGING MODALITIES

- CAD technology
- Ultrasound
- MRI
- Molecular imaging
  - PEM – FDG
- Breast scintigraphy/
  - Lymposcintigraphy/sentinel node mapping
- Computed tomographic laser mammography

DIGITAL MAMMOGRAPHY

There are three types of Digital Systems
- Digital Mammography
  - Cassetteless system
  - Built-in detector technology
- Computer Mammography
  - Mammography Unit with IP plus Computer Reader (CR)
    - The IP is physically removed from the unit and inserted into the CR
  - Photon Counting System

COMPUTED MAMMOGRAPHY

- The image is captured on a IP using an analog mammography unit
  - IP (CR cassette)
  - Photostimulable phosphor (PSP)
- Processing reader
- Computer
- Display monitor
**COMPUTED MAMMOGRAPHY CONSIDERATIONS**
- Less expensive method of digital mammography
- A number of systems available
- Multi detectors
  - 18 x 24 cm
  - 24 x 30 cm

**COMPUTER PROCESSING READER**
- Opens IP removes the PSP scans, reads, and erases the exposed PSP
- Process takes about 60 sec.
- After scanning the PSP it returned to the IP and the IP is ejected from the CR reader

**ERASURE**
- Some electrons will remain in the higher state
- High intensity light will complete erase the PSP allowing reuse
- IPs must be erased every 48 hrs to remove background radiation even if not used
- The IPs must be erased before using if the last time of erasure is unknown

**ADVANTAGES OF CM**
- No silver based film or chemicals
- Digital storage - reduced film storage costs
- Correction for over or under exposure – fewer retakes & lower overall dose to the patient
- Faster image acquisition
- Wide latitude allows imaging of a range of thicknesses on one exposure
- Images can be enhanced digitally to aid in interpretation.
- Images can be stored & transmitted electronically

**DISADVANTAGES OF CM**
- Handling & transport of IP- can introduce artifacts eg scratches
- CM has inherent geometric unsharpness & resultant lower spatial resolution as compared to film/screen
- SNR issues due to sensitivity to scattered radiation
- IPs are expensive and can be damaged if dropped
- Repeated use results in image artifacts

**DIGITAL IMAGING - FFDM**
- Image is captured on a built-in digital detector (no cassettes)
FFDM CONSIDERATIONS

- Fixed detector size
- Adjustment for small breast
- Imaging the pectoral muscle on MLO
- Manufacture options
  - GE
  - Hologic
  - Siemens
  - GIOTTO
  - Planmed Nuance

FFDM – INDIRECT CAPTURE

- X-ray beam strikes the scintillator e.g. cesium iodide
- Cesium iodide converts x-ray to light
- Light strikes a Photoconductive material e.g. amorphous silicon – i.e. photomultiplier or photodiode also called TFD
- TFD converts light to electrons
- Electron migrate to the thin film transistor (TFT)
- TFT displays the digital signal

FFDM – DIRECT CAPTURE

- X-ray beam strikes the photoconductor e.g. Amorphous selenium
- Amorphous selenium converts x-ray to electrons
- Electron migrate to the thin film transistor (TFT)
- TFT displays the digital signal

ADVANTAGES OF FFDM

- No plates to drop or damage
- No plates to be transferred
- Has increase DQE over CM
- Very efficient in converting x-ray input signal into a useful out image

DISADVANTAGE OF FFDM

- Image lag or memory effect
- The charge is trapped in the metastable band and is released slowly over time.
- Image lag time varies and is shorter for flat-panel digital detectors based on indirect conversion

PHOTON COUNTING CAPTURE

- Crystalline silicon detector
- Photon counting electronics
- Multi-slit collimator
- Eliminates 97% of scatter without using grid
- Tungsten anode/Al filter
ADVANTAGE OF PHOTON CAPTURE

- Ergonomic design
- Warm detector
- Lower radiation dose
  - 40% less than FFDM
- Robust
- Temperature tolerant
  - 10–50 degree C
  - 14–122 degree F
- No ADC – no lost signals
- No ghost image – 100% fill factor

IMPORTANT CONSIDERATION

- Positioning in digital is just as important as in analog imaging
- Digital can legally be performed only at facilities that are certified
- Technologist needs documented training

CONTRAST ENHANCED MAMMOGRAPHY

- Utilizes the association of cancer with increase vascularity
- Cancers need oxygen and food
- Iodinated contrast agents injected into an arm vein

NEED FOR COMPUTER AIDED DETECTION

- 5-10% of potentially detectable breast cancers can be overlooked by radiologists on a screening mammogram
- Double reading will reduce the failure to perceive an abnormality but double reading is expensive

CAD – COMPUTER AIDED DETECTION

- Combining digital technology with computers to pre-read the mammograms
- The computer will display suspicious areas, in effect acting as a second reader

HOW IT WORKS

- The breast is mapped for a normal reference
- The image is analyzed
- Microcalcifications and abnormalities are enhanced
- Normal structures are de-emphasized
USES OF CAD

- CAD technology works with both digital analog mammography imaging systems, also with MRI and Ultrasound
- A analog mammography image can be fed into a digitizer which sends the signals to the CAD system

SENSITIVITY VS. SPECIFICITY

- High sensitivity will increase the false positive rate
- High specificity will reduce the number of false positives

SOUND & ULTRASOUND

- Sound is a mechanical longitudinal wave
- Measured units - hertz (Hz)
- Ultrasound uses high frequency sound waves

PRINCIPLE OF ULTRASOUND

- Based on piezoelectric effect
- Crystals vibrate and produce sound waves
- Sound sent through tissues bounce back
- Returning echo causes crystals to vibrate in proportional strength
- Computer analyzes the strength of returning echoes

THE TRANSDUCER

- Converts electrical energy to acoustic pulses
- Receives the reflected echo and converts it to electrical signals
- Breast imaging uses
  - High frequency transducer (≥10 MHz & above)
  - Linear array transducer

ULTRASOUND VS. X-RAY

- Ultrasound uses:
  - No ionizing radiation
  - There are no documented risks or harmful bioeffects
  - Sound cannot travel through a vacuum – a gel must be applied to the skin to act as a conductor
USE OF ULTRASOUND

- Adjunctive imaging used in screening dense breast
- To determine if a mass seen on the mammogram is fluid-filled or solid
- To assess implants for leaks

LIMITATIONS OF ULTRASOUND

- Only as good as the sonographer
- Sonographer must be able to differentiate between real and artificial echoes
- No nice landmarks
- Sound does not travel in a vacuum – gel needed
- Dedicated training needed to scan and interpret the images

IMAGING DIFFICULTIES

- Cannot image microcalcifications
- Breathing and body size can affect imaging
- Normal folds or reverberations can suggest rupture on implant imaging
- The lactating breast can suggest pseudolesions

DOPPLER EFFECT

- The use of high frequency sound to image moving structure such as blood flowing in a vessel
- Assigning different colors to blood flow
- Depends on velocity and direction – (To vs. Away from the transducer)

Color Doppler

THE SOMO·VIEWER* WORKSTATION

Acquire Images
- Automated Image Acquisition
- 15cm Field-Of-View Transducer
- Image Complete Breast in ~5 Minutes
- Total exam time ~ 15 Minutes

Interpret Images
- Accurate Image Interpretation
- Review 3D Image Sets on WorkStation
- Read Entire Case in ~3 Minutes
MOBILE UNIT

SINGLE USE MESH MEMBRANE

AP Scanning

LATERAL & MEDIAL SCANNING

3 VOLUMES PER BREAST

VOLUMES COMBINED

RADIOLOGIST REVIEW SOMO•VIEWER*

- Multiple Slices
- Coronal Plane
- 2mm slice thickness, adjustable
- 1mm overlap between slices

* Trademark of General Electric Company
**SOMO·VIEWER REPORT***

- DICOM pdf format
- Customizable
- 3 dimensions of lesions location
- 2mm slice thickness, adjustable
- 1mm overlap between slices

* Trademark of General Electric Company

---

**Education Requirements to perform ABUS***

ACR accredited Breast Centers & Centers of Excellence:

<table>
<thead>
<tr>
<th>Sonographer or Mammography Technologist - Breast Ultrasound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
</tr>
<tr>
<td>ARDMS certification and current registration, or</td>
</tr>
<tr>
<td>ARRT post-primary certification and current registration</td>
</tr>
<tr>
<td>in breast sonography, or ARRT certification and current</td>
</tr>
<tr>
<td>registration (or unrestricted state license) and MQSA</td>
</tr>
<tr>
<td>qualified AND 5 CEUs specific to breast ultrasound</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Continuing Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular performance of breast ultrasound exams</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Continuing education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compliance with CE requirements of state certifying</td>
</tr>
<tr>
<td>organization AND</td>
</tr>
<tr>
<td>- CE includes credits pertinent to the technologist’s</td>
</tr>
<tr>
<td>ACR accredited clinical practice</td>
</tr>
</tbody>
</table>

---

**BENEFITS OF ABUS***

- Minimal compression
- Patient can breathe normally
- No ionizing radiation
- Non-invasive test - no contrast
- Can visualize dense breast tissue and abnormalities
- Provides a global representation of the entire breast
- Provides easy correlation between other imaging modalities

* Trademark of General Electric Company

---

**CASE 1**

- 60-year-old woman with negative screening mammogram
- BI-RADS Density 3, BI-RADS Assessment 1
- Routine Annual Follow-Up Recommended

Case courtesy of Judy Dean MD
IMPLEMENTATION/ADOPTION

- Patient Selection:
  - Increased breast density: BI-RADS® III or IV
  - Not appropriate for fatty breasts regardless of risk
  - Does Not Replace Mammography

ELASTOGRAPHY

- Uses information from the ultrasound signal used to produce an image displaying the elastic properties of breast tissue
- Differences in tissue stiffness
- Cancers hard vs. Normal breast tissue

CASE 1 CONCLUSION

- Abnormal 3D ABUS
- BI-RADS 4, Immediate Management Recommended
- Ultrasound-guided core needle biopsy performed
- Pathology revealed Invasive Lobular Carcinoma
MAGNETIC RESONANCE IMAGING (MRI)

- No x-ray
- Complex magnetic properties
- Imaging performed with a paramagnetic compound – major element includes gadolinium

WHAT IS MRI?

- The interaction of body tissue with radio waves in a magnetic field
- Echoes or signals from the body are continuously measured by the MRI scanner
- A digital computer reconstructs the echoes into images of the breast

WHY CONTRAST?

- Malignant lesions enhance and wash out rapidly
- Benign lesions enhance and wash out slowly

THE PROCEDURE

- The patient lies prone on the table with the breast falling into specialize breast coils
- The table slides into the bore
- Numerous points are sampled
- The examination can last 30-40 mins

USES OF BREAST MRI

- Staging tool to evaluate treatment options
- Locate retroareolar cancer
- Detect multifocal/multicentric diseases
- Detect recurrence
- Evaluate dense breast

USES OF BREAST MRI

- To evaluate positive surgical margins for residual cancer
- To evaluate the effects of chemotherapy response
- To distinguish post-operative or post-radiation scarring from cancer
- To evaluate implants
RISKS AND COMPLICATIONS
- Metallic dangers
- Poorly visualizes the axillary nodes
- Cannot image calcifications
- Expensive
- Time consuming
- Uses contrast – danger of NSF (nephrogenic systemic fibrosis)

CONTRAINDICATIONS TO MRI
- Cardiac pacemakers
- Aneurysms clips (intracranial)
- Intraocular ferrous foreign bodies
- Pregnant patients should consult their physician before imaging

LIMITS OF BREAST MRI
- High sensitivity but low specificity
- MRI will enhance fibroadenomas, and areas of inflammation

MAGNETIC RESONANCE SPECTROSCOPY (MRS)
- Noninvasive imaging
- Measures the functional breast cancer byproduct – choline
- Uses high-field MR scanners
- Prevents unnecessary breast biopsies

MOLECULAR IMAGING
- Mammography findings are characterized by the difference in appearance between normal and suspicious breast tissue
- In molecular imaging the findings are based on how cancerous cells function
  - Positron Emission Mammography (PEM)
  - BSGI - breast scintigraphy or scintimammography
  - Lymphoscintigraphy – sentinel node mapping

POSITRON EMISSION MAMMOGRAPHY (PEM)
- Uses fluorodeoxyglucose (FDG), a radioactive tracer that is injected into the arm vein
- Special gamma scanners detect the radiation emitted
**PEM TECHNOLOGY**
- Cancerous tissue uses vast amounts of sugar
- Radioactive substance is metabolized in the body like sugar
- The tracer will go to the tissues that are most active

**USE OF FDG-PEM**
- For patients with ambiguous mammogram
- To stage lymph node involvement
- Detect current and/or recurrent metastases
- Discriminating fibrotic scar, necrosis or tumor
- Staging and restaging
- Imaging augmented breast

**ADVANCES IN PEM IMAGING**
- Combination or fusion technologies – combining PEM and CT or MRI
- Enables functional information of PEM to be fused with high-resolution anatomic images of CT or MRI
- MRI offers high sensitivity with no radiation risks

**PRECAUTIONS OF FDG-PEM**
- Patient must fast before the scan
- Patient must lie still for 60-90 minutes after the FDG injection
- No vigorous exercise allowed 48 hours prior to a PEM scan

**LIMITS OF FDG-PEM**
- Tumor size and cell type affects PEM accuracy - cannot detect cancers smaller than 1 cm
- PEM cannot replace sentinel node mapping
- Inflammation/infection/surgery distort PEM results

**BREAST-SPECIFIC GAMMA IMAGING (BSGI) SCINTIMAMMOGRAPHY**
- 20 to 25 mCi injection of the drug technetium-99m(Tc99m) sestamibi
- Tracer accumulates in malignant lesions
- Mild compression of breast
### Uses of Scintimammography
- Patients with indeterminate mammogram not referred for biopsy
- Patients with dense breast
- Breast cancer staging to detect
  - multifocal disease
  - axillary node involvement
  - extent of primary lesion
  - secondary lesions

### Disadvantage of Scintimammography
- Does not detect lesions smaller than 1 cm
- Some benign diseases give a false positive results
- Skin folds or muscles can mimic axillary uptake
- The radiopharmaceutical must be properly injected
- Uses 8-10 times the radiation of mammogram

### Breast Molecular Imaging (BMI)
- Uses a gamma camera incorporated in a dual head breast imaging system
- Reports an 88% accurately in detecting lesions 10 mm in diameter.
- Lesions 2-4 mm will not be detected with this technology

### Radiation Dose
- A single BSGI examination poses a risk that is 20 to 30 times greater than that from digital mammography in a woman 40 years of age.
- Risk from a single PEM screen is 23 times higher.
- Intravenous injections of radioisotopes expose all organs of the body to gamma ray emissions
  - Mammography with lower-energy x-rays exposes only the breasts.
  - Using gamma camera system with dual detectors and special collimators offer a much lower radiation dose
  - 2 to 4 mCi

### Lymphoscintigraphy
- Sentinel node mapping
- The injection of a radiopharmaceutical into the subareolar lymphatic plexus (or lesion)
- The tracer travels to the sentinel node – identifying that node for dissection and eliminating the need for extensive lymph node dissection

### Limitation of Lymphoscintigraphy
- Poor visualization of deep lymphatic system
**2D MAMMOGRAPHY**

- Limited by tissue superimposition
- Overlapping tissue can mask tumors
- False negative
- Overlapping structures can mimic tumors
- False positive

**WHY BREAST TOMOSYNTHESIS (3D MAMMOGRAPHY)?**

- Tissue superimposition hides pathologies in 2D
- Tissue superimposition mimics pathologies in 2D

**3D IMPROVES VISIBILITY BY REDUCING TISSUE SUPERIMPOSITION**

**BREAST TOMOSYNTHESIS**

- Sequence of projection images are acquired
- Projections are reconstructed in 3D volume
- Structures located at different depth will project at different locations

**DBT — VISUALIZATION**

- A DBT reconstruction
  - 30-80 slices parallel to the detector plane
  - 1 mm slice thickness
  - 100 µm in-plane pixel size

**3D PRINCIPLE OF OPERATION**

- X-ray tube moves in an arc across the breast
- A series of low dose images are acquired from different angles
- Total dose approximately the same as one 2D mammogram
- Projection images are reconstructed into 1 mm slices
ADVANTAGES

• Reduces recall rate
• Increases breast cancer detection rate
• Benign lesions seen clearly
• Eliminates overlapping structures

HOLOGIC DIGITAL TOMOSYNTHESIS

• 15 exposures in 4 sec
• Tube sweeps from -7 to 0 to +7
• The x-ray beam is continuously “on”
• No movement of the patient
• Tomo does not use grid
  • Options: 2D, 3D, COMBO or C view

SLABBING

• Slice #1 is closest to the detector.
• Highest slice # is closest to compression paddle
• Reconstruction is always in 1mm thick slices:
  • A breast 4 cm thick = 40 mm = 40 + 6 = 46 slices
  • A breast 5 cm thick = 50 mm = 50 + 6 slices = 56 slices
• Slices can be slabbed together to visualize calcifications
FACTORS CONTRIBUTING TO MOTION UNSHARPNESS

- Inadequate Compression
- Poor Positioning
- Exposure Time
- Patient Movement
- Heart Motion

2D VS 3D – MOTION UNSHARPNESS

2D Mammography
- Acquisition time is brief
- Captures a moment in time
- One image
- Technologists/radiologists adept at detecting motion
- Repeats are left up to the Technologist

3D Tomosynthesis
- Longer acquisition time
- Multiple image data set
- Images acquired over a period of time
- 3D motion occurs at about the same rate as 2D
- Presents the same issues as 2D motion, EXCEPT that motion may go undetected

TOMOSYNTHESIS AND MOTION

- Motion can occur at one point, multiple points or throughout the duration of the entire projection series
- Motion can occur at different areas of the breast, which may or may not impact breast tissue
- Repeats for motion increase radiation dose
- Potential to miss breast cancer
APPRECIATING 3D MOTION: QC REVIEW

- Motion can be visible on both projection & tomosynthesis datasets
- Tomosynthesis Reconstruction
  - More difficult to detect/confirm motion on reconstruction
  - Unsharpness in the tomosynthesis dataset
  - Non-linear movement of calcifications
  - Objects or lesions look sharp in one view, but not the opposing view
- Projection Series
  - Most efficient way to detect motion
  - Review series at Selenia® Dimensions® System

TOMOSYNTHESIS AND MOTION

- Radiologists do not routinely review the projection dataset where motion can be confirmed or ruled-out
- Projection dataset may not be available to the radiologist
  - It is up to the technologist to detect motion and repeat when advised

APPRECIATING 3D MOTION

Projection Series

- The x-ray tube moves in a path parallel to the chest wall
- The resulting breast image(s) and objects should move smoothly along this same pathway
  - Medial to Lateral / Lateral to Medial
  - Anterior/posterior movement of the breast images or objects indicates motion
APPRECIATING 3D MOTION

- Chest wall
  - Movement of the Pectoral Muscle
  - Structures that shift in and out of view
- Inframammary fold
  - Abdomen motion
  - Determine if it impacts the inferior and posterior breast
- Calcifications
  - Should move in a straight line parallel to the chest wall
  - More evident with large chunky calcifications
- Axilla
  - Lymph Nodes shift back and forth or out of view

REVIEWING PROJECTION IMAGES FOR MOTION

- Review the 15 Projections
- Cine Mode
- Moderate to fast speed
**REducing Motion**

- Inform the patient
- Describe tube movement
- Explain how motion will affect the image
- Instruct the patient in the breathing technique
- Explain that STOP BREATHING means just that
- Patient SHOULD NOT take in a breath & hold it

**Breathing Technique**

- Compress exposure controls
- While the x-ray tube is moving into position to start the tomosynthesis:
  - Instruct patient to STOP breathing for the 3D acquisition
  - At the conclusion of the tomosynthesis sweep
  - Instruct patient to breathe
- As the tube moves to center, listen for the completion of the grid movement
- Then instruct the patient to stop breathing for the 2D acquisition

**C-View Option**

- The C-view offers a reconstructed 2-D image of the breast without the additional radiation
- Conventional digital = 2-D
  - COMBO = 2-D + 3-D
- Alternative reduced dose option
  - 3-D + C view

**C-View**

- Perform a standard tomosynthesis scan
- Reconstruct tomosynthesis slices
- Synthesize 2D image
- Available in any tomosynthesis view

**Advantages of C-View**

- Scan Time Reduction
  - 4 sec vs. 12 sec
  - Lowers Risk of Patient Motion

- Patient Dose Reduction
  - 1.45 mGy vs. 2.65 mGy

**Image Comparison: Case 1**
**AVERAGE GLANDULAR DOSE**

- ESE for a typical single exposure
  - ≈ 800-1200 mrad (8-12 mGy)
- Glandular dose
  - ≈ 500 mrad (1.0 mGy)

- ACR recommends
  - 0.3 rad (300 mrad or 3 mGy) with a grid
  - 0.1 rad (100 mrad or 1 mGy) without a grid

**RADIATION DOSE**

- 1.2 mGy – 2D
- 1.45 mGy – 3D
- 2.65 mGy – COMBO

- Imaging implants in 3D = more radiation to patient because lower kVp used

**DRAWBACKS OF HOLOGIC DBT**

- Motion artifacts hard to detect at radiologist workstation
- Projection vs reconstruction images
- Radiologist views reconstruction images
- Large number of images
- Degraded imaging of calcifications
- Slabbing will help
- Tomo not possible for FB, Mag and if the breast is more than 24.5 cm
- Total exposure time for COMBO = 12 sec

**GE SENOCARE**

- 9 exposures to acquire 3D MLO
- 25 degree scan angle
- Mo/Rh x-ray tube
- Uses a step-and-shoot system
- Eliminates focal spot motion blur

**COMPARISON – GE & HOLOGIC**

- While the gantry moves the x-ray beam is pulsed
- Results in longer exposure time (10 seconds)
- More chance of patient motion

**VISUALIZATION OF CALCIFICATIONS**
**FDA APPROVED SEQUENCE**
- Two 2D CC
- Two 3D MLO
- Radiation dose similar to 2D mode
- In the step-and-shoot method after each image the movement resumes and x-ray tube moves to the next position

**GE SENOCARE STATS**
- Image size
  - 24 x 30 cm
- Angular range
  - +/-12.5
- Target/filter
  - Mo/Mo, Mo/Rh & Rh/Rh
- Filter material/thickness
  - Mo: 0.03mm Rh: 0.025mm
- kVp
  - Mo/Mo: 24-30 Mo/Rh: 26-32 Rh/Rh: 26-40

**GE SENOCARE STATS**
- Image size
  - 24 x 30 cm
- Angular range
  - +/-12.5
- Target/filter
  - Mo/Mo, Mo/Rh & Rh/Rh
- Filter material/thickness
  - Mo: 0.03mm Rh: 0.025mm
- kVp
  - Mo/Mo: 24-30 Mo/Rh: 26-32 Rh/Rh: 26-40

**V-PREVIEW**
- 3D image generated from the raw DBT projection data set

**SIEMENS**
- MAMMOMAT Inspiration
- Offers the largest angular range - 50°
- Highest number of projections images – 25
- Results: 25 projections for 3D reconstruction
- 50% dose by using the Tungsten/Rhodium

**SIEMENS STATS**
- 5 different dose levels: Mo/Mo, Mo/Rh, or W/Rh.
- Direct-to-digital amorphous selenium (aSe)
- High Detective Quantum
**OTHER OPTIONS**

- Individualized OpComp®
- Stops compression automatically
- Compresses only as long as a woman’s breast is soft and pliable

**PHILIPS MICRODOSE TOMOSYNTHESIS**

- X-ray tube
- Multislit pre-collimator
- Image receptor
- Scan arm rotates about the detector in one arc
- Tomo angle of 11˚
- Continuous slit scanning

**MICRODOSE STATS**

- Image size: 21 lines x 24 cm
- Target/filter: W/Al
- Filter material/thickness: 0.5 mm Al
- Tube voltage: 26-38

**POTENTIAL USES OF DBT**

- Detection / Screening
- Especially women with dense breasts
- Diagnostic work-up
- Characterization & Problem solving
- Reduce recall rate
  - Report of 8.7 - 30% at some facilities
- Reduce false positive rate
  - 13% reduction at some facilities

**DISADVANTAGE OF DBT**

- Higher radiation dose
- Significant increase in reading time
- CAD can help
- Possibility of motion
- Difficulty imaging large breast

**IMPORTANT CONSIDERATION**

- Positioning in DBT digital is critical
- DBT can legally be performed only at facilities that are certified
- Technologist needs documented training
**FDA APPROVE DBT UNITS**

- Siemens Mammomat Inspiration with Tomosynthesis Option (DBT) System
  - 4/21/15
- GE SenoClaire Digital Breast Tomosynthesis (DBT) System
  - 8/26/14
- Hologic Selenia Dimensions Digital Breast Tomosynthesis (DBT) System
  - 2/11/11

**MQSA PERSONNEL TRAINING**

- Personnel need 8 hours of initial training prior to independently using any new DBT unit
- FDA’s Division of Mammography Quality Standards (DMQS) recognizes
  - Common features of different DBT systems
  - Features unique to each specific system.
  - Training must include both the common features of DBT and the unique features of the particular DBT system

**REIMBURSEMENT FOR DBT**

- Medicare’s reimbursement for DBT beginning in 2015 is $30.39 for the professional component and $56.13 when billed using the national Medicare fee schedule
- Payments are made in addition to the regular reimbursement for the associated digital mammogram
- Documentation of DBT must be included in the report
  - Either a screening or diagnostic digital mammogram for reimbursement under the new Medicare rules, since the codes CMS has defined are to be used as add-on codes.
  - There is no way to receive reimbursement from Medicare for a standalone DBT exam when it is performed separately.

**CONCLUSION**

- Mammography is still the most comprehensive tool in the fight against breast cancer
- DBT has the potential to reduce false negative and positive readings

**REFERENCES & IMAGE SOURCE**

- Hologic.com
  - Images and data courtesy of:
    - Netherlands Cancer Institute – Antoni van Leeuwenhoek Hospital, Amsterdam, Holland
    - Massachusetts General Hospital, Boston, MA USA
    - Centre de Radiologie et d’Echographie du Docteur Joussier, Paris, France
    - Dartmouth Hitchcock Medical Center, Lebanon, NH USA
    - Magee Women’s Hospital, Pittsburgh, PA USA
    - University of Iowa Health Care, Iowa City, IA USA
    - Yale University School of Medicine, New Haven, CT USA

**THANK YOU!!**
Submit your text questions and comments using the Questions Panel anytime during the presentation.

- Submitted questions will be addressed by the moderator at the end of the presentation.
- The live Q&A will end no later than 10:30 a.m. PT.
- Any remaining questions can be sent to email@csrt.org after the webinar.

**REGISTER NOW!**

**RAD Talks**

November 2016

- **ACCESS** the conference on your time – from anywhere!
- **INTERACT** with fellow participants in discussion forums & the virtual exhibit hall
- **EARN** 15+ Category A CEU Credits – over half of the biannual requirement!

LEARN MORE AND REGISTER NOW – WWW.CSRT.ORG