BICOE – Stereotactic Breast Biopsy and Breast Ultrasound Accreditation

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Introduction

• Objectives
• Program Requirements
• Physicists Role
• Testing Requirements

Educational Objectives

• Understand the annual test requirements for stereotactic breast biopsy systems.
• Understand the testing requirements for breast ultrasound systems for BICOE.
• Help facilities obtain the designation of Breast Imaging Center of Excellence.
What is it? - Requirements

• ACR Accreditation in:
  – Mammography – ACR or State Accreditation
  – Stereotactic Breast Biopsy
  – Ultrasound
    • Must include ultrasound guided breast biopsy

Physicists Role

• Mammography Accreditation
  – Annual testing (required)
  – QC Program Review (required)
  – Dose Measurement (required)

• Stereotactic Breast Biopsy Accreditation
  – Annual Testing (required)
  – QC Program Review (required)
  – Dose Measurement (required)

Physicists Role

• Ultrasound Accreditation (by June 2014)
  – The ACR strongly recommends that QC be done under the supervision of a qualified medical physicist. The qualified medical physicist may be assisted by properly trained individuals in obtaining data, as well as other aspects of the program
  – Annual testing (required)
MQSA Physicist

- **Initial Requirements**
  - Mammography – MQSA
  - Stereotactic Breast Biopsy – ACR
  - Ultrasound - None

- **Continuing requirements**
  - Mammography – MQSA
  - Stereotactic Breast Biopsy – ACR
  - Ultrasound - None

Stereotactic Breast Biopsy Physicist

- **Initial Qualifications**
  - Qualified to perform Mammography surveys under MQSA
  - Perform one (1) hands on survey of a stereotactic breast biopsy unit under a QMP or at least 3 independent surveys prior to 6/1/97

- **Continuing Experience**
  - Upon renewal 2 SBB surveys over a 24 month period

- **Continuing Education**
  - Upon renewal 3 CEU’s in SBB every three years

Ref: [http://www.acr.org/accreditation/stereotactic/stereotactic_breast_reqs.aspx](http://www.acr.org/accreditation/stereotactic/stereotactic_breast_reqs.aspx)

What are the minimum continuing experience requirements for the physicist performing stereotactic breast biopsy system surveys for the ACR Accreditation program?

- **%**
  1. 1 stereotactic breast biopsy survey over a 12 month period
  2. 2 stereotactic breast biopsy surveys over a 24 month period
  3. 3 stereotactic breast biopsy surveys over a 24 month period
  4. 3 stereotactic breast biopsy surveys over a 36 month period
  5. 4 stereotactic breast biopsy surveys over a 36 month period
Answer

2. 2 stereotactic breast biopsy surveys over a 24 month period

Ref: Stereotactic Breast Biopsy Program Requirements: American College of Radiology
http://www.acr.org/accreditation/stereotactic.aspx

Ultrasound - Physicist

• Still no requirements listed!

Stereotactic Breast Biopsy Program Requirements

• Quality Assurance Questionnaire
• Test Image Data Sheet
• Dosimeter
• Clinical Images (on film)
• Phantom Images (on film)
• Medical Physicists Annual Survey Report
• Daily, Weekly Tech QC (one month)
• Monthly, Quarterly, Semi-annual Tech QC records (one year)
Technologist Quality Control

- Daily – Localization Accuracy Test
- Phantom Imaging (weekly)
- Printer QC (monthly)
- Visual Checklist (monthly)
- Compression (semi-annually)
- Repeat Analysis (quarterly)
- Zero Alignment Test (per manufacturer)
- Dark Room Testing (if using film screen)
Upright Stereo Biopsy
Stereotactic Breast Biopsy

- Annual testing required by physicist
- ACR QC Manual available

Ref: Stereotactic Breast Biopsy Quality Control Manual
1999 American College of Radiology
Stereotactic Breast Biopsy Annual Test – Prone Table

- Unit Assembly Evaluation
- Collimation Assessment
- Focal Spot Performance and System Limiting Spatial Resolution
- kVp Accuracy
- Beam Quality Assessment (Half Value Layer)

Stereotactic Breast Biopsy Annual Test – Prone Table

- Automatic Exposure Control (AEC) or Manual Exposure Assessment
- Uniformity of Screen Speed (Screen Film Systems)
- Digital Receptor Uniformity (For Digital Image Receptors)
- Breast Entrance Exposure, Average Glandular Dose, and Exposure Reproducibility

Stereotactic Breast Biopsy Annual Test – Prone Table

- Image Quality Evaluation
- Artifact Evaluation
- Localization Accuracy Test
Stereotactic Breast Biopsy Annual Test – Upright Add On

- Unit Assembly Evaluation
- Beam Quality Assessment (Half Value Layer)
  - With paddle and at kVp for stereo phantom
- Breast Entrance Exposure, Average Glandular Dose
- Image Quality Evaluation (with mini phantom)
- Localization Accuracy Test

Unit Assembly Evaluation

- Mechanically Stable
- Moving parts
- Locks/Detents
- Image receptor no vibes
- Compressed breast thickness indicator
- No rough edges
- Technique charts
  - 512/1024 modes
- Radiation shielding
- Needle guides support needle

Collimation

CR Image
Collimation

If any edge of radiation field deviates more than 5 mm from the edge of the image receptor, or if any edge of the compression paddle projects into the X-ray field by more than 5 mm, then seek service adjustment.

What is the maximum allowable alignment deviation of the radiation field edge to the image receptor for a stereotactic breast biopsy system?

- 1. 1 mm
- 2. 2 mm
- 3. 3 mm
- 4. 4 mm
- 5. 5 mm

Answer

- 5. 5 mm

Ref: Stereotactic Breast Biopsy Quality Control Manual 1999, Medical Physicist Section, Collimation Assessment, American College of Radiology
Focal Spot Performance and System Limiting Resolution

Action Limit: Note any significant degradation from previous measurement and seek service.

kVp

Action Limit: If the mean kVp differs from the nominal by more than +/- 5% of the nominal kVp, or if the coefficient of variation exceeds 0.52, then seek service correction.

Beam Quality – Half Value Layer

- HVL $\geq$ kVp/100
Automatic Exposure Control (AEC)

Technique Chart

<table>
<thead>
<tr>
<th>Breast Thickness</th>
<th>Exposure Mode</th>
<th>kVp Setting</th>
<th>Density Control Setting</th>
<th>Phototimed (Yes or No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3 cm</td>
<td>512</td>
<td>26</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>3 to 5 cm</td>
<td>512</td>
<td>28 - 30</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>5 to 7 cm</td>
<td>512</td>
<td>30 - 32</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>&gt; 7 cm</td>
<td>512</td>
<td>34</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>1024</td>
<td>28</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>3 to 5 cm</td>
<td>1024</td>
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<td>1024</td>
<td>32 - 34</td>
<td>N/A</td>
<td>Yes</td>
</tr>
<tr>
<td>&gt; 7 cm</td>
<td>1024</td>
<td>34</td>
<td>N/A</td>
<td>No – 400 mAs</td>
</tr>
</tbody>
</table>

AEC Performance

• Select kVp
• Use AEC and make exposure
• Measure mean pixel value in center of field
• Meet manufacturers specifications
AEC

• Ideally, clinical techniques (whether AEC or manual) should keep exposure times under 2 seconds while meeting manufacturers signal requirements

Ref: Stereotactic Breast Biopsy Quality Control Manual 1999

Digital Field Uniformity

Both 512 and 1024 modes

• Action Limit: If SNR(I) / SNR(Center) is > 1.15 or < 0.85, seek service correction.

Digital Field Uniformity

• May require manufacturers service manual for procedure.
Breast Entrance Exposure Average Glandular Dose, and Exposure Reproducibility

- Use AEC to expose Phantom
- Find closest manual technique
- Replace phantom with ion chamber
- Make 4 exposures
Dose

- We check both 512 and 1024 modes
- Made change to technique chart to get 1024 mode to be less than 300 mrad
- “The average glandular dose to an average (4.2 cm compressed) breast should not exceed 3 mGy (300 mrad) per view for film-screen or digital image receptors”

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What is the maximum allowable dose per view to a 4.2 cm compressed breast as recommended by the ACR?

1. 1.5 mGy
2. 2.0 mGy
3. 2.5 mGy
4. 3.0 mGy
5. 3.5 mGy
Answer

4. 3.0 mGy

Ref: Stereotactic Breast Biopsy Quality Control Manual, Medical Physicist Section
Breast Entrance Exposure, Average Glandular Dose, and Exposure Reproducibility

Image Quality Evaluation

Required Minimum Scores-Film Screen

- **Mammography Accreditation Phantom**
  - 4.0 Fibers
  - 3.0 Specs
  - 3.0 Masses
  - Total: 10.0

- **Mini-phantom**
  - 2.0 Fibers
  - 2.0 Specs
  - 2.0 Masses
  - Total: 6.0
**Required Minimum Scores - Digital Receptor**

- **Mammography Accreditation Phantom**
  - 5.0 Fibers
  - 4.0 Specs
  - 3.5 Masses
  - Total: 12.5

- **Mini-phantom**
  - 3.0 Fibers
  - 3.0 Specs
  - 2.5 Masses
  - Total: 8.5

**What are the minimum scores for a digital receptor when using the mini-phantom?**

1. 1.0 Fibers, 1.0 Spec groups, 1.0 Masses
2. 2.0 Fibers, 2.0 Spec groups, 2.5 Masses
3. 3.0 Fibers, 3.0 Spec groups, 2.5 Masses
4. 3.5 Fibers, 3.5 Spec groups, 3.0 Masses
5. 4.0 Fibers, 4.0 Spec groups, 4.0 Masses

**Answer**

- 3. 3.0 Fibers, 3.0 Spec groups, 2.5 Masses

Ref: Stereotactic Breast Biopsy Quality Control Manual, Medical Physicist Section Image Quality Evaluation
Artifact Evaluation

- Note any artifacts or non-uniformities in the field.
- Both 512 and 1024 modes

Localization Accuracy Test

Localization - Prefire
Localization - Postfire

Add On Biopsy Systems

Beyond Annual Mammo Testing
- HVL at Phantom kVp with Stereo Paddle
- HVL Measurement for Tomo Biopsy
- Dose Measurement for Phantom for Both
- Image Quality with Stereo Phantom
- Localization
**TomoTomosynthesis Guided Biopsy**

- FDA approved
- No ACR Accreditation Program
- No Manufacturers QC Program
  - Do what you think is best

**Breast Ultrasound Accreditation**
Changes to Breast Ultrasound Program – Effective June 2014

• Acceptance Testing
• Quality Control Tests
• Annual Survey

Acceptance Testing

• Initial performance testing of newly installed imaging equipment must be performed and should be completed before clinical use
Continuing Quality Control

• A continuous QC program is essential to assure the proper functioning of all ultrasound equipment and to identify problems before the diagnostic utility of the equipment is significantly impacted\(^7\). Routine QC is typically performed by appropriately trained sonographers or equipment service engineers.

• In addition to testing done for the annual survey, all scanners and all transducers in routine clinical use should be tested quarterly, but must be tested at least semiannually.

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5 Tests for the Technologist

1. Physical and Mechanical Inspection
2. Image Uniformity and Artifact Survey
3. Geometric Accuracy (mechanically scanned transducers only)
4. Ultrasound scanner Electronic Display Performance
5. Primary Interpretation Display Performance\(^*\)
   - Only required if located at the facility where ultrasound is performed

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Annual Survey

• The QC tests listed in the table below are required (unless they are designated as optional) and must be performed at least annually on all machines and transducers in routine clinical use.
Program Requirements – Annual Survey

• Physical and Mechanical Inspection
• Image Uniformity and Artifact Survey
• Geometric Accuracy
• System Sensitivity
• Ultrasound Scanner Electronic Image Display Performance
• Primary Interpretation Display Performance

Program Requirements – Annual Testing

• Contrast Resolution (Optional)
• Spatial Resolution (Optional)
• Evaluation of QC Program

Starting June 2014 what is the recommended frequency for equipment surveys of ultrasound equipment for the ACR’s breast ultrasound accreditation program?

0% 1. Quarterly
0% 2. Semiannually
0% 3. Annually
0% 4. Every other year
0% 5. None
Answer

- 3. Annually

Ref: Stereotactic Breast Biopsy Accreditation Program Requirements
http://www.acr.org/accreditation/breast.aspx

Electrical – Mechanical Condition

- Power cord
- Wheel Locks, Brakes
- Housing
- Scan Head Cable, Plugs
- Scan Head Housing, Window
- Monitor
- Air Filters
- VCR
- Printer Function

System Sensitivity – Depth of Pen
Anechoic Void Perception

Ring Down – Dead Zone

Lateral Resolution
Evaluation of Sites QC Program

- Review semiannual QC results