BICOE – Breast Imaging Center of Excellence

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Introduction

• Objectives
• Program Requirements
• Physicists Role
• Physicists Required Tests
  – Stereotactic Breast Biopsy
  – Ultrasound

Educational Objectives

• Understand the annual test requirements for stereotactic breast biopsy systems.
• Understand the testing requirements for breast ultrasound systems.
• 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

What do you get?

- Free participation in the National Mammography Database (NMD)
- Marketing tools
- National Recognition

National Mammography Database

- Receive routine medical audit reports that exceed FDA audit data collection requirements
  (Examples: Sample Facility Report, Sample Physician Report)
- Compare performance to peer facilities
- Target specific areas of improvement
- Implement successful quality improvement programs

Ref: http://www.acr.org/accreditation/locus/NMD-Participation.aspx
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
  - Semi-annual testing by service engineer or physicist

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

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

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>1 stereotactic breast biopsy survey over a 12 month period</td>
</tr>
<tr>
<td>81%</td>
<td>2 stereotactic breast biopsy surveys over a 24 month period</td>
</tr>
<tr>
<td>0%</td>
<td>3 stereotactic breast biopsy surveys over a 24 month period</td>
</tr>
<tr>
<td>13%</td>
<td>3 stereotactic breast biopsy surveys over a 36 month period</td>
</tr>
<tr>
<td>0%</td>
<td>4 stereotactic breast biopsy surveys over a 36 month period</td>
</tr>
</tbody>
</table>

Answer

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

Ultrasound - Physicist

• No requirements yet!

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)
Stereotactic Breast Biopsy

- Annual testing required by physicist
- ACR QC Manual available

Stereotactic Breast Biopsy Annual Test

- 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

- 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

- Image Quality Evaluation
- Artifact Evaluation
- 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
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?

0% 1. 1 mm
13% 2. 2 mm
0% 3. 3 mm
0% 4. 4 mm
88% 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 0.05, then seek service correction.

Beam Quality – Half Value Layer

• HVL ≥ 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>&lt; 3 cm</td>
<td>1024</td>
<td>28</td>
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<tr>
<td>&gt; 7 cm</td>
<td>1024</td>
<td>34</td>
<td>N/A</td>
<td>No – 400 mAs</td>
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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

• Action Limit: If $\frac{SNR(f)}{SNR(\text{Center})} > 1.15$ or $< 0.85$, seek service correction.

Both 512 and 1024 modes

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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<td>N/A</td>
<td>No – 400 mAs</td>
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What is the maximum allowable dose per view to a 4.2 cm compressed breast as recommended by the ACR?

0% 1. 1.5 mGy
0% 2. 2.0 mGy
0% 3. 2.5 mGy
100% 4. 3.0 mGy
0% 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

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

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Fibers</th>
<th>Spec Groups</th>
<th>Masses</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>12%</td>
<td>2.0</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>82%</td>
<td>3.0</td>
<td>3.0</td>
<td>2.5</td>
</tr>
<tr>
<td>0%</td>
<td>3.5</td>
<td>3.5</td>
<td>3.0</td>
</tr>
<tr>
<td>0%</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
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**Answer**

- 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
Physicist Report or Service Engineer Report

As part of accreditation, facilities must submit a copy of the service engineer’s most recent preventative maintenance report or the medical physicist’s most recent equipment survey. Although the ACR will not initially use this information to determine whether a facility passes or fails accreditation, it may be used in the future to set criteria.
What is the recommended frequency for equipment surveys of ultrasound equipment for the ACR’s breast ultrasound accreditation program?

0% 1. Quarterly
8% 2. Semiannually
2% 3. Annually
0% 4. Every other year
0% 5. None

Answer

• 2. Semi-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
Uniformity

Anechoic Void Perception

Ring Down – Dead Zone