



Breast Sonography Examination

The purpose of *The American Registry of Radiologic Technologists® (ARRT)® Examination in Breast Sonography* is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of breast sonographers. The tasks typically performed were determined by administering a comprehensive practice analysis survey to a nationwide sample of breast sonographers. The results of the most recent practice analysis are reflected in this document¹.

The *Task Inventory for Breast Sonography* may be found on the ARRT's website (www.arrt.org). The content specifications identify the knowledge areas underlying performance of the tasks on the *Task Inventory for Breast Sonography*. Every content category can be linked to one or more tasks on the task inventory.

The table below presents the three major content categories covered on the examination, along with the number of test questions in each major category. The remaining pages of this document list the specific topics addressed within each major content category. The approximate number of test questions allocated to each topic appears in parentheses.

Content Category	Number of Scored Questions²
Patient Care	14
Patient Interactions and Management	
Image Production	101
Basic Principles of Ultrasound and Equipment	
Image Formation	
Evaluation and Selection of Representative Images	
Procedures	70
Anatomy and Physiology	
Pathology	
Surgical/Treatment Changes and Interventional Procedures	
Total	185

¹ A special debt of gratitude is due to the hundreds of professionals participating in this project as committee members, survey respondents, and reviewers.

² Each exam includes an additional 30 unscored (pilot) questions. On the pages that follow, the approximate number of test questions allocated to each content category appears in parentheses.



Patient Care (14)

1. Patient Interactions and Management (14)

- A. Patient's Rights and Safety
 - 1. verify patient's identity
 - 2. maintain confidentiality (*e.g., HIPAA)
 - 3. follow American Hospital Association (AHA) Patient Care Partnership (Patient's Bill of Rights)
 - 4. provide safe and sanitary conditions
 - 5. observe and monitor vital signs
 - 6. monitor auxiliary equipment
- B. Respond Regarding Accreditation of Ultrasound Facilities and Personnel
- C. Verification of Requested Examination
 - 1. sequence multiple imaging studies appropriately
 - 2. comparison of request to clinical indications for appropriateness
 - 3. review of pertinent patient history and data (e.g., lab values, allergies, medications, breast imaging studies)
 - 4. document physical observations and breast changes (e.g., palpation findings, scarring)
 - 5. obtain appropriate clinical history
- D. Explanation of Current Procedure
- E. Respond to Inquiries About Breast Sonography Versus Other Breast Imaging Modalities (e.g., 2D/3D mammography, CT, MRI, nuclear medicine)
 - 1. benefits
 - 2. limitations
 - 3. dense parenchyma
 - 4. new cancer diagnosis
- F. Breast Cancer
 - 1. epidemiology
 - a. incidence
 - b. risk factors
 - 2. detection
 - a. screening examinations (e.g., breast sonography, 2D/3D mammography, MRI)
 - b. breast palpation (e.g., patient, health care provider)
 - c. signs and symptoms
- G. Respond to inquiries about breast health referencing ACR and ACS accepted guidelines

*e.g., This is used here and in the remainder of this document to indicate examples of the topics covered, but not a complete list.



Image Production (101)

1. Basic Principles of Ultrasound and Equipment (42)

- A. Generation of Signal
- B. Ultrasound Wave Characteristics
 - 1. speed of sound (propagation speed)
 - 2. frequency
 - 3. geometry – reflection and refraction
 - 4. intensity of signal
 - 5. acoustic impedance
 - 6. attenuation coefficient
 - 7. pulsed
 - 8. Doppler
 - 9. specular reflectors
 - 10. amplitude
- C. Fundamentals
 - 1. relationship of speed of sound, frequency, and wavelength
 - 2. image resolution
 - a. axial
 - b. lateral
 - c. elevational
 - d. temporal
 - e. contrast (soft tissue)
 - 3. range equation
 - 4. dynamic range
- D. Ultrasound Unit
 - 1. console
 - 2. monitor
 - 3. transducers
 - a. piezoelectric effect
 - b. components
 - c. resonance frequency
 - d. beam characteristics (e.g., near zone/field, far zone)
 - e. focusing
 - f. array types

2. Image Formation (27)

- A. Transducer Selection
 - 1. frequency
 - 2. type
- B. Selection and Adjustment of Technical Factors
 - 1. power
 - 2. focal zone
 - 3. field of view (depth)
 - 4. time-gain compensation (TGC)
 - 5. overall (coarse) gain
 - 6. dynamic range
 - 7. harmonic imaging
 - 8. spatial compounding
- C. Safety and Bioeffects
- D. Patient Positioning
- E. Acoustic Transmission Media (e.g., stand-off)
- F. Image Orientation
- G. Image Annotation
 - 1. patient identification
 - 2. side (e.g., laterality)
 - 3. scan plane (e.g., radial or antiradial, transverse or longitudinal)
 - 4. clock face
 - 5. centimeters from the nipple
- H. Other Imaging Methods
 - 1. Doppler
 - a. spectral
 - b. color
 - c. power
 - 2. fremitus
 - 3. elastography (e.g., shear wave, strain)
 - 4. panoramic imaging
 - 5. 3D
- I. Image Display and Storage
 - 1. display
 - a. pre- and post-processing
 - b. brightness and contrast
 - c. display mode (e.g., Doppler, brightness)
 - 2. PACS

(Image Production continues on the following page.)



Image Production (continued)

3. Evaluation and Selection of Representative Images (32)

- A. Criteria for Diagnostic Quality
 - 1. demonstration of anatomic structure
 - 2. demonstration of pathologic conditions
 - 3. use of calipers
- B. Artifact Recognition
 - 1. shadowing
 - 2. enhancement
 - 3. reverberation
 - 4. color Doppler flash
 - 5. speed propagation
 - 6. edge shadowing
 - 7. other
- C. Modification of Technique to Optimize Images
- D. Correlation with Mammographic Findings
 - 1. triangulation
 - 2. image concordance
 - 3. ACR BI-RADS® classification
- E. Correlation with MR Findings
 - 1. quadrant
 - 2. depth
 - 3. size
 - 4. margin
- F. Correlation with CT
- G. Correlation with PET/CT and/or PEM
- H. Evaluation of Sonographic Equipment and Accessories
 - 1. equipment quality control
 - a. sensitivity (e.g., contrast resolution, detection of lesion, dead zone)
 - b. vertical and horizontal distance accuracy
 - c. focal zone
 - d. resolution (e.g., lateral, axial)
 - e. TGC characteristics
 - f. overall gain
 - g. dynamic range
 - 2. recognition of equipment malfunctions
 - 3. clean, disinfect, and maintain equipment (e.g., transducers, keyboard, monitor, filters)



Procedures (70)

1. Anatomy and Physiology (17)

- A. Ducts
- B. Fibroglandular Tissue
- C. Fat
- D. Skin
- E. Cooper Ligament
- F. Fascia
- G. Pectoralis Muscle
- H. Ribs
- I. Pregnancy Induced Changes
- J. Nipple
- K. Vascular System
- L. Lymphatic System
 - 1. sentinel lymph node(s)
 - 2. regional lymph nodes
- M. Axilla

2. Pathology (33)

- A. Benign Conditions and Sonographic Features (e.g., echogenicity, posterior acoustic features)
 - 1. cyst
 - 2. galactocele
 - 3. sebaceous cyst
 - 4. fibroadenoma
 - 5. papilloma
 - 6. lipoma
 - 7. hamartoma
 - 8. abscess and inflammation
 - 9. traumatic changes
 - 10. fat necrosis
 - 11. ductal ectasia
 - 12. edema
 - 13. diabetic mastopathy
 - 14. pseudoangiomatous stromal hyperplasia (PASH)
 - 15. phyllodes
 - 16. radial scar
 - 17. gynecomastia
 - 18. lymph nodes

- B. High Risk Conditions and Sonographic Features (e.g., echogenicity, posterior acoustic features)
 - 1. lobular carcinoma in situ (LCIS)
 - 2. atypical ductal hyperplasia (ADH)
 - 3. atypical lobular hyperplasia (ALH)
 - 4. papilloma
- C. Malignant Conditions and Sonographic Features (e.g., echogenicity, posterior acoustic features)
 - 1. ductal carcinoma in situ (DCIS)
 - 2. invasive ductal carcinoma
 - 3. invasive lobular carcinoma
 - 4. medullary carcinoma
 - 5. mucinous (colloid) carcinoma
 - 6. papillary carcinoma
 - 7. tubular carcinoma
 - 8. inflammatory carcinoma
 - 9. Paget's disease
 - 10. phyllodes
 - 11. lymphoma
 - 12. metastasis
 - 13. lymph nodes

3. Surgical/Treatment Changes and Interventional Procedures (20)

- A. Post-Surgical Changes (i.e., lumpectomy, axillary dissection, and mastectomy)
- B. Hematomas
- C. Breast Reduction
- D. Breast Augmentation
- E. Post-Radiation Changes
- F. Neo-Adjuvant Chemotherapy
- G. Hormonal Therapy (e.g., tamoxifen)
- H. Post Mastectomy Reconstruction (e.g., TRAM flap, latissimus dorsi)

(Procedures continue on the following page.)



Procedures (continued)

I. Interventional Breast Sonography Procedures

1. Fluid Aspiration
2. Fine Needle Aspiration
3. Core Biopsy
4. Vacuum-Assisted Biopsy
5. Clip Placement
6. Needle Localization



FOCUS OF QUESTIONS

Questions about each of the procedures listed on the left may focus on any of the following factors:

- A. Explain Procedure, Risks, and Benefits
- B. Verify Informed Consent
- C. Select and Prepare Equipment
- D. Perform Time Out Procedure
- E. Position Patient
- F. Practice Infection Control and Prevention
 1. aseptic technique
 2. sharps disposal
 3. biohazard disposal (OSHA Guidelines)
- G. Assist with procedure
- H. Provide Post-Procedural Care and Instructions
- I. Hemostasis