BREAST IMAGING

Developed by the
Ad Hoc Committee on Resident and Fellow Education of the
Society of Breast Imaging

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Breast Imaging Residency Training Curriculum

By means of either lectures, conferences, textbooks, syllabi, journal reprints, videotapes, teaching files, and other teaching materials. the resident should become familiar with the following topics in breast disease:

1. *Epidemiology*

    - Risk factors and incidence.
    - Staging and survival rates.

2. *Breast Anatomy, Pathology, and Physiology*

    - Breast development.
    - Normal breast anatomy and histology. Alteration with age, pregnancy, menstrual cycle, and hormonal effects.
    - Pathologic and mammographic appearance and clinical significance of benign breast conditions such as adenosis, ductal hyperplasia, fibroadenoma, cysts, papilloma, hamartoma, lipoma, ductal ectasia, radial scar, fat necrosis.
    - Atypical ductal hyperplasia (ADH), lobular neoplasia (LCIS) and other histologic risk factors.
    - Pathologic and mammographic appearance, clinical features significance, and prognosis of ductal carcinoma in situ (DCIS) subtypes.
    - Pathologic and mammographic appearance, clinical features and prognosis of invasive carcinoma including invasive ductal carcinoma (NOS), mucinous, medullary, papillary, tubular, and invasive lobular carcinoma.

- Other types of breast cancer such as Paget's disease and inflammatory carcinoma.
- Histologic grading.
- Pathologic staging.
- Multifocal and multicentric carcinoma.
- Extensive intraductal component (EIC): definition, significance, mammographic assessment.

3. *Mammographic Equipment and Technique*

- Features of dedicated mammographic units including target, filtration, phototiming and grids.
- Familiarity with ACR Recommended Specifications for New Mammography Equipment.
- Characteristics of mammographic film screen systems.
- Mammographic positioning: Technique for CC and MLO views. Viewbox criteria: assessment of proper positioning, compression, exposure, contrast, sharpness, noise.
- Breast compression: rationale.
- Selection of technical factors.
- Film processing including extended processing.
- Factors affecting contrast, density, noise, sharpness.
- Need for dedicated high-intensity viewboxes, viewbox masking and magnifying glass.

4. *Mammography Quality Control*

- Purpose and frequency of performance of those quality control tests performed by technologist: phantom images, processor sensitometry, etc.
- Mammographic appearance of artifacts such as roller marks, grid lines, motion unsharpness, noise, dust, poor screen-film contact, pickoff and scratches.
- Requirements and standards for ACR Mammography Accreditation and FDA MQSA certification.
- Familiarity with ACR Mammogrphy Quality Control Manual.

5. *Mammographic Interpretation*

- Normal mammographic anatomy and parenchymal patterns.
- Mammographic features of typically benign calcifications such as those due to adenosis, fibroadenomas, fat necrosis, secretory disease, sebaceous gland calcification and dystrophic calcification.
- Mammographic features of intermediate concern and higher probability of malignancy microcalcifications.

- Significance of distribution of calcifications.
- Mammographic features of benign masses and densities such as asymmetric breast tissue, radial scar, hematoma, abscess, cyst, fibroadenoma, intramammary lymph node, hormonal replacement therapy, phyllodes tumor, hamartoma, gynecomastia, lipoma, fat necrosis, edema, ductal ectasia, intracystic papilloma, Mondor's disease, etc.
- Mammographic appearance of malignant masses, densities and architectural distortion due to in situ and invasive ductal carcinoma including subtypes and invasive lobular carcinoma, metastases to the breast.
- Knowledge of ACR BIRADS Lexicon.
- Mammographic features of the altered breast secondary to benign biopsy, breast conservation, reduction mammoplasty, breast augmentation. Signs of implant leakage.

6. *Problem Solving Mammography*

- ACR Practice Standards for Diagnostic Mammography.
- Technique, value, and indications for supplementary mammographic views such as tangential, 90° ML, spot compression, exaggerated craniocaudal, cleavage, etc. "Blind" areas of the breast.
- Technique for documentation of clustered skin calcifications.
- Criteria and methods for distinguishing focal asymmetric densities, asymmetric breast tissue, and breast masses.
- Technique for evaluation of implants, breast parenchyma, and implant leakage.
- Masses: Criteria and methods for assessment by mammography and ultrasound, likelihood of malignancy, .
- Calcifications: Criteria for mammographic assessment.
- Magnification mammography: Advantages and disadvantages, technique, dose, indications.
- Localization of lesions seen on only MLO or CC view. Triangulation.
- Criteria for biopsy and follow-up of masses, calcifications, and soft tissue densities.
- Ability to perform breast physical examination.
- Evaluation and management of a palpable mass with no mammographic findings.

7. *Breast Ultrasound*

- Equipment and physical principles.
- Technique.
- Need for hands-on experience.

- Indications.
- Normal sonographic anatomy.
- Features of cysts.
- Benign and malignant solid masses: features and reliability in distinguishing.
- Limitations: Detection and differentiation of microcalcifications, screening.
- Need for correlation with mammography.
- Criteria and reliability for evaluation of implant rupture.
- ACR Standards for Breast Ultrasound.

8. *Interventional procedures*

Principles, indications and contraindications, equipment, technique, advantages, disadvantages, accuracy, preparation and follow-up for:

- Needle-wire localization.
- Stereotactic core biopsy and/or FNA.
- Ultrasound guided core biopsy and/or FNA. Importance of correlation of pathologic, mammographic and sonographic findings and history in determining patient management.
- Mammographic and sonographic-guided cyst aspiration.
- Galactography.
- Specimen radiography, including paraffin block radiography.
- Pneumocystography.
- ACR Standards for Stereotactic Biopsy.
- ACR Image-Guided Breast Biopsy Accreditation Program

9. *Mammographic Reporting and Medicolegal Aspects of Mammography*

ACR BIRADS lexicon terms for:

- Mass shape, margins, density.
- Typically benign, intermediate concern and higher probability of malignancy calcifications.
- Distribution modifiers for calcifications.
- Associated findings.
- Lesion location.
- Categorization of breast composition.
- Final assessment categories.
- Medicolegal aspects of screening, problem-solving mammography and interventional procedures.

10. *Screening Mammography*

- Theory: Lead time bias, length bias, selection bias, survival rates, prevalence vs incidence screening, definition of lead time.
- Definition of sensitivity, specificity, positive predictive value, negative predictive value, accuracy, interval cancers, false negative rate, false positive rate.
- Relative efficacy of physical examination, breast self-examination, mammography.
- Randomized clinical trials, case control studies, follow-up studies: purpose, methods, results.
- Controversies regarding screening women aged 40-49 years.
- Radiation risk, biopsy rates, recall rates, cost-effectiveness of screening, value of second reading.
- Screening guidelines of ACR, ACS, NCI, etc.
- Mammography Audit: Desirable goals for positive predictive value (PPV), percent stage 0 or 1 tumors, percent minimal carcinomas, percent node positivity, prevalent and incident cancer rates, recall rates, sensitivity and specificity.
- ACR Practice Standards for Screening Mammography.

11. *Breast MRI*

- Indications:
- Technique
- Characteristics of benign and malignant breast masses
- Implant rupture.

12. *Therapeutic Considerations*

- Role of breast imaging in selection and monitoring of breast cancer treatment and post-treatment follow-up.
- Basic understanding of breast cancer treatment options.
- ACR Standards for Breast Conservation Therapy.
- ACR Standards for Diagnosis and Management of Ductal Carcinoma In Situ of the Breast (DCIS)
- ACR Standards for Diagnosis and Management for Invasive Breast Carcinoma.

13. *ACR Appropriateness Criteria for Women's Imaging-Breast Topics*

14. *Patient Management Principles*

- Patient interaction and communications.
- Informed consent for invasive procedures.
- Follow-up procedures for positive findings.

Other Recommendations for Residency Training in Breast Imaging

1. Formal conferences (lectures, case presentations) - mandatory.

2. Two, full-time equivalent months spent in breast imaging during four year residency are mandatory. Three full-time months are desirable. By the end of their residency training, residents should have interpreted a minimum of 1,000 mammographic examinations.

3. Teaching file available - mandatory.

4. Mammographic-pathologic correlation is mandatory. A mammographic-pathologic conference is highly desirable.

5. Direct observation or video of mammographic positioning for routine and supplementary views - mandatory.

6. Performance of needle localization - mandatory.

7. Performance of breast ultrasound - mandatory.

8. Performance of cyst aspiration - highly desirable.

9. Performance of ultrasound-guided and stereotactic-guided core biopsy - desirable.

10. Mammography textbooks available in department library - mandatory.

11. Reprint file or reference library including breast imaging - mandatory.

12. Log of procedures performed and mammograms and sonograms interpreted by each resident during breast imaging rotation - highly desirable.

Breast Imaging Fellowship Curriculum

1. Minimum of equivalent of 6 months fellowship training in breast imaging are highly desirable. Twelve months are desirable.

2. Performance of needle localization, cyst aspiration, stereotactic and ultrasound-guided core biopsy and/or FNA, - mandatory.

3. Performance of galactography - highly desirable.

4 Teaching medical students and residents - highly desirable.

5. Participation in research projects - highly desirable. .

6. Interpretation of breast MRI - highly desirable.

7. Performance of technologists' quality assurance tests - mandatory.

8. Knowledge of quality assurance tests performed by medical physicist.

9. Observation of breast surgery and radiation therapy - desirable.

10. Familiarity with Agency for Health Care Policy and Research (AHCPR) Practice Guideline No. 13, Quality Determinants of Mammography - mandatory.

11. Ability to operate sonographic equipment - mandatory.

12. Ability to perform positioning and set technique for mammographic examination - desirable.

13. Familiarity with computer-aided detection and diagnosis (CAD) - desirable.

14. Familiarity with priniciples of digital mammography - desirable.

15. Familiarity with radionuclide breast scans - desirable.

16. In depth knowledge of all topics in the Breast Imaging Residency Training Curriculum