

National Education Curriculum

Specialty Curricula

Breast

Breast

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Rationale: Accurate assessment and performance of breast sonograms require a comprehensive knowledge of breast anatomy, physiology, and pathophysiology. An understanding of clinical indications for breast sonograms, sonographic techniques, sonographic characteristics of normal and abnormal breast structures, relevant outside data, and interventional procedures is essential for the performance of high-quality examinations. A familiarity with breast cancer prognosis and staging, treatment options, and posttreatment evaluation is necessary to provide comprehensive and quality patient care.

Section I: Anatomy and Physiology

1. Distinguish the anatomic components of the breast and surrounding structures.
2. Explain the physiology of the breast and its components.
3. Identify the sonographic appearance of normal breast structures.
4. Examine embryologic development of the breast.
5. Define congenital and developmental variants of the breast.
6. Describe age-related and hormonal changes that occur with the breast.
7. Describe pregnancy-related changes that occur with the breast.

I. ANATOMY AND PHYSIOLOGY

- A. Primary Function
 1. Milk production for nourishment of maternal offspring
- B. Normal Breast Structures
 1. Areolar complex/nipple
 - a. Montgomery glands
 - i) Location
 - ii) Function
 2. Tissue layers
 - a. Skin
 - b. Subcutaneous fat/premammary zone
 - c. Mammary zone/parenchymal layer
 - i) Location
 - ii) Contents
 - iii) Function
 - d. Retromammary zone
 - i) Location
 - ii) Contents
 - e. Muscle layers
 - i) Pectoralis major
 - ii) Pectoralis minor
 - iii) Serratus anterior
 - iv) External oblique
 - f. Rib cage and intercostal muscles
 3. Cooper ligaments
 - a. Structural location

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4. Ductal system
 - a. Lobar/lactiferous duct
 - b. Extralobular terminal duct
 - c. Intralobular terminal duct
 - d. Terminal ductules/acini
 - e. Terminal ductual lobular unit (TDLU)
 - i) Function
 - ii) Relevance to pathology
5. Lymphatic system
 - a. Lymph nodes
 - i) Axillary nodes
 - Level I
 - Level II
 - Level III
 - ii) Interpectoral (Rotter) nodes
 - iii) Internal mammary (parasternal) nodes
 - iv) Supraclavicular nodes
 - v) Intramammary nodes
 - b. Lymphatic drainage
 - i) From deep to superficial networks
 - ii) Lymphatic drainage routes to other areas
 - Levels of nodes
 - iii) Alternate channels for lymphatic drainage
 - Internal mammary (parasternal) nodes
 - Interpectoral (rotter) nodes
 - Supraclavicular nodes
 - iv) Sentinel lymph node
 - Purpose
6. Vasculature
 - a. Arterial supply
 - i) Medial mammary arteries
 - ii) Lateral mammary arteries
 - b. Venous drainage
 - i) Deep veins
 - ii) Superficial veins

C. Sonographic Appearance of Normal Breast Structures

1. Nipple

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2. Skin
3. Fatty tissue
4. Fibroglandular tissue
5. Pectoralis muscles
6. Ribs
7. Cooper ligaments
8. Ducts
9. TDLUs
10. Lymph nodes
11. Arteries
12. Veins
- D. Embryologic Development
 1. Weeks 4-6
 - a. Formation of the mammary ridge and ducts
 2. Weeks 6-8
 - a. Involution of mammary ridges
 - b. Invagination of chest wall mesenchyme
 3. Weeks 12-16
 - a. Differentiation of smooth muscle of the nipple and areola
 - b. Development of epithelial buds and bud branching
 4. Weeks 16-20
 - a. Development of hair follicles, apocrine glands, and Montgomery glands
 - b. Appearance of primitive elements of breast parenchyma
 5. Weeks 28-40
 - a. Epidermis depresses into shallow mammary pit
 - b. Nipple-areolar complex enlarges and develops pigmentation
 - c. Main ducts canalize
 - d. Lobules begin differentiation
- E. Congenital and Developmental Variants
 1. Amazia
 2. Amastia
 3. Poland syndrome
 4. Polymastia
 5. Macromastia/juvenile hypertrophy
 6. Athelia
 7. Polythelia
 8. Nipple inversion/flattening

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9. Premature thelarche/early ripening
 10. Physiologic gynecomastia
- F. Age-Related and Hormonal Changes
1. Maternal hormone stimulation immediately after birth
 2. Prepubertal breast tissue composition
 3. Pubertal breast development
 - a. Thelarche
 - b. Estrogen and progesterone stimulation
 - c. Tanner stages
 4. Breast tissue composition in young, nulliparous adults
 5. Breast tissue composition with increasing age and parity
 6. Postmenopausal breast tissue composition
 - a. Without hormone replacement therapy (HRT)
 - b. With HRT
- G. Pregnancy-Related Changes
1. Transformation of terminal ducts to acini
 2. Lactiferous duct from each lobe carries milk towards the nipple
 3. Pathway of milk when breastfeeding
 4. Involution of acini

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Section II: Indications

1. Identify indications for diagnostic ultrasound of the breast and axilla.
2. Identify indications for whole-breast ultrasound.

II. INDICATIONS

- A. Palpable Breast and/or Axillary Mass
- B. Breast Pain
- C. Skin and/or Nipple Changes
 - 1. Redness
 - 2. Hardness
 - 3. Retraction
 - 4. Nipple discharge
- D. Evaluation of Abnormalities Detected on Other Imaging Tests (e.g., mammography, breast MRI)
- E. Initial Imaging Evaluation in Patients Under 30 Years of Age Who are at Low Risk for Developing Breast Cancer
- F. Evaluation of Symptoms in Lactating and Pregnant Patients
- G. Evaluation of Problems Associated with Breast Implants
- H. Guidance During Breast and Axillary Interventional Procedures
- I. Treatment Planning for Radiation Therapy
- J. Identification of Abnormal Axillary Lymph Nodes in Patients with Newly Diagnosed or Recurrent Breast Cancer
- K. Whole-Breast Ultrasound
 - 1. Screening, as an adjunct to mammography
 - 2. Patient types who would benefit from this modality

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Section III: Sonographic Examination and Technique

1. Explain the patient positioning used during sonographic evaluation of the breast.
 2. Explain the effects of transducer frequency on image resolution and penetration.
 3. Describe sonographic techniques used for breast evaluation.
 4. Examine image optimization techniques used in breast sonography.
 5. Identify common artifacts seen on breast ultrasound.
 6. Describe annotation methods used in breast sonography.
 7. Explain the methods used to document breast lesions.
 8. Describe advanced and emerging technologies used in breast sonography.
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III. SONOGRAPHIC EXAMINATION AND TECHNIQUE

- A. Patient Positioning
 1. Supine-oblique or contralateral-oblique
 - a. Purpose of steep oblique
 - b. Supine position
 2. Scanning in the position in which a palpable lesion is evident may be necessary
 3. Positional changes (from supine to lateral decubitus or upright) specific to the patient's clinical presentation
- B. Transducer Selection
 1. High-resolution
 2. Linear array
 3. Broad bandwidth
 4. High frequency
- C. Palpation
- D. Image Optimization
 1. Gain/TGC
 2. Focal zone selections
 3. Depth
 4. Harmonic imaging
 5. Spatial compounding
 6. Speed of sound correction
 7. Appropriate transducer pressure
 - a. Pressure for d-Doppler evaluation
 - b. Pressure to alleviate artifactual shadowing
 - c. Purpose of alternating compression and release techniques
 - d. Alternating compression and release maneuvers
 8. Artifacts
 - a. Types

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- b. Reduction techniques
 - 9. Acoustic standoff
 - 10. Doppler settings
 - a. Optimizing flow
 - 11. Split-screen imaging
 - 12. Extended field-of-view (EFOV)
 - 13. Vocal fremitus
 - 14. Subareolar imaging
- E. Image Documentation
 - 1. Laterality
 - a. Right/left
 - 2. Scan plane
 - a. Radial/antiradial
 - b. Longitudinal/transverse
 - 3. Clockface location
 - 4. Body marker/location on diagram of breast
- F. Lesion Documentation
 - 1. Laterality
 - 2. Scan plane
 - 3. Clockface location
 - 4. Two orthogonal views
 - 5. Distance from nipple
 - 6. Depth
 - 7. Size
 - a. Dimensions in three orthogonal planes
 - 8. Vascularity
 - a. Color Doppler
 - i) Presence or absence of flow
 - ii) Vessel distribution
 - b. Power Doppler
 - i) Presence or absence of flow
 - ii) Vessel distribution
 - c. Spectral Doppler
 - i) Arterial waveform analysis
 - ii) Venous waveform analysis
- G. Advanced and Emerging Technologies
 - 1. Elastography
 - a. Strain elastography

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- b. Shear-wave elastography
- 2. Three-dimensional imaging
 - a. Multiplanar formatting
 - b. Reconstructed coronal plane
 - c. Volume rendering
- 3. Contrast-enhanced ultrasound (CEUS)
- 4. Fusion imaging
- 5. Computer-aided detection (CAD)
- 6. Whole-breast ultrasound for screening and staging
 - a. Handheld, conventional scanning
 - b. Semiautomated scanning
 - c. Automated scanning
- 7. Quantitative transmission (QT) ultrasound imaging
- 8. Optoacoustic (OA) ultrasound imaging

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Section IV: Integration of Data

1. Evaluate pertinent clinical signs and symptoms in patients presenting for breast sonograms.
2. Identify risk factors for developing breast cancer.
3. Correlate sonographic findings with other imaging modalities.

IV. INTEGRATION OF DATA

- A. Clinical Signs and Symptoms
 1. Palpable mass
 - a. Compressibility
 - b. Mobility
 2. Breast pain
 3. Skin and/or nipple changes
 - a. Redness
 - b. Hardness
 - c. Retraction
 - d. Nipple discharge
 4. Breast implant changes
 - a. Shape
 - b. Contour
 - c. Size
 - d. Firmness
 - e. Mobility
- B. Risk Factors for Developing Breast Cancer (females)
 1. Increasing age
 2. Personal and/or family history of breast cancer
 3. Personal history of biopsy-proven high-risk lesion
 4. Mammographically dense breast tissue
 5. Early menarche
 6. Late menopause
 7. Nulliparity or late pregnancy
 8. Exogenous estrogen use
 9. Transgender considerations
 10. Genetic predisposition
 - a. Breast cancer gene mutations
 - i) Breast cancer gene 1 (BRCA1)
 - ii) Breast cancer gene 2 (BRCA2)
 - b. Ashkenazi Jewish heritage

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- c. Li-fraumeni syndrome
- C. Risk Factors for Developing Breast Cancer (males)
 - 1. BRCA2 gene mutation
 - 2. Klinefelter syndrome
 - 3. Family history of breast cancer
 - 4. Testicular conditions
 - 5. Estrogen therapy
 - 6. Transgender considerations
- D. Correlation with Other Imaging Modalities
 - 1. Mammography
 - a. Standard screening exam for breast cancer
 - b. 2D mammography/full-field digital mammogram (FFDM)
 - i) Screening exam
 - Craniocaudal (CC) view
 - Mediolateral oblique (MLO) view
 - ii) Diagnostic exam
 - Spot compression view
 - Magnification view
 - 90-degree lateral view
 - c. 3D mammography/digital breast tomosynthesis (DBT)
 - d. Contrast-enhanced mammography
 - e. Sonographic-mammographic correlation of size, shape, location, and surrounding tissue density
 - 2. Magnetic resonance imaging (MRI)
 - a. Contrast-enhanced MRI
 - i) High sensitivity for detecting breast cancer
 - ii) Can be used as an adjunct to mammography in screening for cancer in high-risk patients
 - iii) Limitations
 - b. Noncontrast MRI
 - i) High sensitivity for assessing implant integrity
 - 3. Ductography
 - a. Correlation with pathologic nipple discharge when mammographic and sonographic findings are equivocal or negative
 - 4. Molecular breast imaging (MBI)
 - a. Evaluation of the local extent of breast cancer and monitoring response to neoadjuvant chemotherapy
 - b. Evaluation of the unresolved clinical concerns in patients with equivocal or

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negative mammographic and sonographic findings

- c. Replacement of contrast-enhanced MRI in patients at a high risk for breast cancer

5. Positron emission tomography (PET)

- a. Dedicated breast PET – positron emission mammography (PEM)
 - i) Useful for evaluating local extent of breast cancer and monitoring response to neoadjuvant chemotherapy
- b. Positron emission tomography/computed tomography (PET/CT)
 - i) Useful for whole-body cancer staging

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Section V: Describing Sonographic Findings

1. Describe sonographic findings using the ACR BI-RADS® ultrasound lexicon.
 2. Assess sonographic features most characteristic of benign lesions.
 3. Assess sonographic features most suspicious for malignancy.
 2. Evaluate axillary lymph nodes for normal and abnormal characteristics.
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V. DESCRIBING SONOGRAPHIC FINDINGS

- A. Tissue Composition (Whole-Breast Screening Ultrasounds Only)
 - 1. Homogeneous background echotexture – fat
 - 2. Homogeneous background echotexture – fibroglandular
 - 3. Heterogeneous background echotexture
- B. Breast Lesion Characterization
 - 1. Shape
 - a. Oval
 - b. Round
 - c. Irregular
 - 2. Orientation
 - a. Parallel (to chest wall)
 - i) Wider-than-tall
 - ii) Horizontal orientation
 - b. Nonparallel (to chest wall)
 - i) Taller-than-wide
 - ii) Vertical orientation
 - 3. Margin
 - a. Circumscribed
 - b. Not circumscribed
 - i) Indistinct
 - ii) Angular
 - iii) Microlobulated
 - iv) Macrolobulated
 - v) Spiculated
 - 4. Echo pattern
 - a. Anechoic
 - b. Hyperechoic
 - c. Complex cystic and solid
 - d. Hypoechoic
 - e. Isoechoic
 - f. Heterogeneous

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- 5. Posterior features
 - a. No posterior features
 - b. Enhancement
 - c. Shadowing
 - d. Combined pattern
- C. Calcifications
 - 1. Within a mass
 - 2. Outside of a mass
 - 3. Within a duct
- D. Associated Features
 - 1. Architectural distortion
 - 2. Duct changes
 - 3. Skin changes
 - a. Skin thickening
 - b. Skin retraction
 - 4. Edema
 - 5. Vascularity
 - a. Absent
 - b. Internal vascularity
 - c. Peripheral vasculature
 - 6. Elasticity assessment
 - a. Soft
 - b. Intermediate
 - c. Hard
- E. Axillary Lymph Node Characterization
 - 1. Size
 - 2. Shape
 - 3. Cortical thickness
 - 4. Margin
 - 5. Observation of hilar compression or displacement
 - 6. Symmetry of size, number, and shape of nodes as compared to contralateral axilla
 - 7. Assessment of vascularity with color Doppler

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Section VI: ACR BI-RADS® Assessment Categories

1. Differentiate the ACR Breast Imaging Reporting and Data System (BI-RADS®) assessment categories.
 2. Describe typical sonographic findings for each of the assessment categories.
 3. Identify the recommended follow-up for each of the assessment categories.
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VI. ACR BI-RADS® ASSESSMENT CATEGORIES

- A. Category 0: Incomplete – Need Additional Imaging Evaluation
- B. Category 1: Negative
- C. Category 2: Benign
- D. Category 3: Probably Benign
- E. Category 4: Suspicious
 - 1. Category 4A: Low Suspicion for Malignancy
 - 2. Category 4B: Moderate Suspicion for Malignancy
 - 3. Category 4C: High Suspicion for Malignancy
- F. Category 5: Highly Suggestive of Malignancy
- G. Category 6: Known Biopsy-Proven Malignancy

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Section VII: Pathology and Pathophysiology

1. Discuss the etiology and prevalence of various pathologic conditions in the breast.
 2. Assess the clinical findings of various pathologic conditions in the breast.
 3. Identify the mammographic findings of various pathologic conditions in the breast.
 4. Describe the sonographic findings of various pathologic conditions in the breast.
 5. Identify differential diagnoses for various pathologic conditions in the breast.
 6. Evaluate the assessment and treatment for various pathologic conditions in the breast.
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VII. PATHOLOGY AND PATHOPHYSIOLOGY

A. Benign Conditions and Masses

1. Cystic masses and fibrocystic change
 - a. Simple cyst
 - b. Fibrocystic change
 - c. Complicated cysts
 - i) Sebaceous cyst
 - ii) Epidermal inclusion cyst
 - iii) Galactocele
 - iv) Acorn cyst
 - v) Milk of calcium
 - vi) Oil cyst/lipid cyst
 - vii) Clustered microcysts
 - viii) Clustered macrocysts
2. Solid masses and conditions
 - a. Fibroadenoma
 - b. Adenoma
 - c. Secretory (lactating) adenoma
 - d. Pseudoangiomatous stromal hyperplasia (PASH)
 - e. Hamartoma
 - f. Lipoma
 - g. Hemangioma
 - h. Papillary lesions
 - i) Intracystic papilloma
 - ii) Intraductal papilloma
 - iii) Peripheral papillomatosis
 - iv) Juvenile papillomatosis
3. Inflammatory masses and conditions
 - a. Mastitis
 - b. Abscess

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- c. Mondor disease
 - d. Diabetic mastopathy
 - 4. Trauma-related masses and conditions
 - a. Hematoma
 - b. Seroma
 - c. Pseudoaneurysm
 - d. Arteriovenous malformation (AVM)
 - e. Fat necrosis
 - f. Postsurgical scar
 - 5. Gynecomastia
- B. Premalignant/High-Risk Lesions
 - 1. Lobular carcinoma in situ (LCIS)
 - 2. Atypical ductal hyperplasia
 - 3. Atypical lobular hyperplasia
 - 4. Atypical papilloma
- C. Locally Aggressive Lesions
 - 1. Fibromatosis
 - 2. Myoepithelial neoplasm
 - 3. Myofibroblastoma
 - 4. Phyllodes tumor
- D. Malignant Conditions and Masses
 - 1. Noninvasive malignancies
 - a. Ductal carcinoma in situ (DCIS)
 - b. Paget's disease
 - 2. Invasive malignancies
 - a. Invasive ductal carcinoma (IDC)
 - b. Invasive lobular carcinoma (ILC)
 - c. Special-type IDCs
 - i) Tubular carcinoma
 - ii) Medullary carcinoma
 - iii) Colloid carcinoma
 - iv) Papillary carcinoma
 - Intracystic
 - Intraductal
 - d. Inflammatory carcinoma
 - 3. Male breast cancer
 - 4. Metastatic carcinoma

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- a. Spread of cancer from a breast primary
- b. Spread of cancer to the breast

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Section VIII: Interventional Procedures

1. Describe common ultrasound-guided interventional procedures used to diagnose or treat breast pathology.
 2. Explain the role of the sonographer in performing these ultrasound-guided interventional procedures.
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VIII. INTERVENTIONAL PROCEDURES

A. Types

1. Cyst aspiration
2. Fine-needle aspiration
3. Core needle biopsy
4. Vacuum-assisted biopsy (VAB)
5. Marker/clip placement
6. Preoperative localization
 - a. Wire localization
 - b. Nonwire localization (NWL)
 - c. Specimen imaging
7. Percutaneous drainage
8. Injection for sentinel lymph node biopsy
9. Brachytherapy catheter/balloon placement

B. Sonographer's Role

1. Review of prior imaging
2. Screening for contraindications
3. Explanation of procedure
4. Informed consent
5. Examination room setup
6. Time out
7. Preliminary scan
8. Infection control
9. Imaging guidance
10. Image documentation
11. Postprocedural care

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Section IX: Cancer Staging and Prognostic Factors

1. Examine the tumor markers relevant to breast cancer staging and prognosis.
 2. Describe the anatomic staging criteria used for breast cancer.
 3. Describe the prognostic staging criteria used for breast cancer.
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IX. CANCER STAGING AND PROGNOSTIC FACTORS

A. Tumor Markers

1. Estrogen receptors (ER) and progesterone receptors (PR)
 - a. ER status
 - b. PR status
 - c. Prognosis for ER/PR-positive tumors
 - d. Prognosis for ER/PR-negative tumors
2. Human epidermal growth factor receptor 2 (HER2)
 - a. HER2 status
 - b. Prognosis for HER2-positive tumors
 - c. Prognosis for HER2-negative tumors
3. Triple-negative breast cancer (TNBC) – ER/PR/HER2-negative
 - a. Negative hormone receptor status (ER/PR-negative)
 - b. Negative HER2 receptor status (HER2-negative)
 - c. Prognosis

B. American Joint Committee on Cancer (AJCC) Staging Criteria

1. Anatomic staging
 - a. TNM system
 - i) Tumor (T) size
 - ii) Nodal (N) status
 - iii) Distant metastases (M)
 - b. Anatomic stage groups 0-IV
2. Prognostic staging
 - a. Includes tumor grade and tumor markers in addition to TNM
 - b. Tumor grade
 - i) Assessed using nottingham histologic score system
 - ii) Grades 1-3
 - c. Tumor markers
 - i) HER2 status
 - ii) ER status
 - iii) PR status

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- d. Prognostic stage groups 0-IIA

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Section X: Treatment Options

1. Evaluate surgical treatment options for breast cancer.
 2. Assess the role of radiation therapy in treating breast cancer.
 3. Describe medical treatment options for breast cancer.
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X. TREATMENT OPTIONS

A. Surgical

1. Lumpectomy (partial or segmental mastectomy)
 - a. Breast-conserving surgery (BCS)
 - b. Removal of breast cancer and surrounding margin of benign tissue
2. Mastectomy
 - a. Total
 - i) Removal of breast tissue only
 - ii) Axillary nodes and pectoral muscles remain intact
 - b. Modified radical
 - i) Complete removal of breast tissue and level I and II axillary nodes
 - ii) Pectoral muscles remain intact
 - c. Radical
 - i) Complete removal of breast tissue, level I and II axillary nodes, and pectoral muscles
3. Sentinel lymph node biopsy
 - a. Removal of first draining lymph node(s)
4. Axillary lymph node dissection (ALND)
 - a. Removal of level I and level II axillary lymph nodes
5. Oncoplastic surgery
 - a. Lumpectomy or mastectomy, combined with breast reconstruction

B. Radiation Therapy (XRT)

1. External beam radiation
 - a. Treats the entire affected breast
 - b. Boost treatment may be given to high-risk areas
2. Accelerated partial breast irradiation (APBI)
 - a. Types
 - i) Brachytherapy
 - Localized form of high-dose radiation delivered internally
 - Performed following lumpectomy
 - Intracavitary and interstitial delivery methods
 - ii) Intraoperative radiation therapy (IORT)

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- Single dose of radiation delivered at time of lumpectomy in the operating room
- iii) Intensity-modulated radiotherapy (IMRT)
 - Radiation dose modulated across the treatment field to deliver stronger doses to the tumor bed

C. Medical

1. Endocrine/hormonal therapy
 - a. Treatment for hormone receptor-positive disease (ER-positive and/or PR-positive tumors)
2. Chemotherapy
 - a. Neoadjuvant chemotherapy
 - i) Administered prior to surgery to shrink primary tumor and eradicate occult micrometastases
 - b. Adjuvant chemotherapy
 - i) Administered after surgery to eradicate micrometastases
3. Targeted drug therapy
 - a. HER2-targeted therapy
 - b. Hormone receptor-positive drug therapy
 - c. TNBC-targeted therapy

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Section XI: Postoperative and Posttreatment Evaluation

1. Explain the role of sonography in evaluating patients with breast implants.
 2. Explain the role of MRI in evaluating patients with breast implants.
 3. Describe complications that can arise in the augmented breast.
 4. Describe complications that can occur with autogenous breast reconstruction.
 5. Identify common imaging findings seen following treatment for breast cancer.
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XI. POSTOPERATIVE AND POSTTREATMENT EVALUATION

A. Breast Implants

1. Types

- a. Saline
- b. Silicone
- c. Multilumen

2. Placement sites

- a. Subglandular/prepectoral
- b. Submuscular/retropectoral

3. Normal sonographic appearance

4. Artifacts

5. Complications

- a. Capsular contracture
- b. Herniation
- c. Migration
- d. Rupture

i) Saline

- Clinical findings
- Mammographic findings
- Sonographic findings

ii) Silicone

- Intracapsular rupture
 - Silicone migration
 - Sonographic findings
 - MRI findings
- Extracapsular rupture
 - Silicone leakage
 - Sonographic findings
 - MRI findings

e. Breast implant-associated anaplastic large cell lymphoma (BIA-ALCL)

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- B. Autogenous Breast Reconstruction
 - 1. Tissue transfer procedures
 - a. Types
 - i) Perforator-only flaps
 - ii) Myocutaneous flaps
 - b. Complications
 - 2. Fat grafting procedure
 - a. Complications
- C. Post Neoadjuvant Chemotherapy or Endocrine Therapy Imaging
 - 1. Mammographic findings
 - 2. Sonographic findings
- D. Lumpectomy Site Imaging
 - 1. Mammographic findings
 - 2. Sonographic findings
- E. Irradiated Breast Imaging
 - 1. Mammographic findings
 - 2. Sonographic findings

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Abbreviations

A

ACR	American College of Radiology
AJCC	American Joint Committee on Cancer
ALND	Axillary Lymph Node Dissection
AVM	Arteriovenous Malformation

B

BCS	Breast Conserving Surgery
BIA-ALCL	Breast Implant-Associated Anaplastic Large Cell Lymphoma
BI-RADS®	Breast Imaging Reporting and Data System
BRCA1	Breast Cancer Gene 1
BRCA2	Breast Cancer Gene 2

C

CAD	Computer-Aided Detection
CC	Craniocaudal
CEUS	Contrast-Enhanced Ultrasound

D

DBT	Digital Breast Tomosynthesis
DCIS	Ductal Carcinoma In Situ

E

EFOV	Extended Field-Of-View
ER	Estrogen Receptors

F

FFDM	Full-Field Digital Mammogram
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H

HER2	Human Epidermal Growth Factor Receptor 2
HRT	Hormone Replacement Therapy

I

IDC	Invasive Ductal Carcinoma
ILC	Invasive Lobular Carcinoma
IMRT	Intensity-Modulated Radiotherapy
IORT	Intraoperative Radiation Therapy

L

LCIS	Lobular Carcinoma in Situ
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M

MBI	Molecular Breast Imaging
MLO	Mediolateral Oblique
MRI	Magnetic Resonance Imaging

N

NWL	Nonwire Localization
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O

OA	Optoacoustic
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P

PASH	Pseudoangiomatous Stromal Hyperplasia
PET	Positron Emission Tomography
PET/CT	Positron Emission Tomography/Computed Tomography
PR	Progesterone Receptors

Q

QT	Quantitative Transmission
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T

TDLU	Terminal Duct Lobular Unit
TGC	Time Gain Compensation
TNBC	Triple-Negative Breast Cancer
TNM	Tumor-Nodal-Metastases

V

VAB	Vacuum-Assisted Biopsy
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X

XRT	Radiation Therapy
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