Breast Overview

TERMINOLOGY

Abbreviations
- Terminal duct lobular unit (TDLU)
- Anterior mammary fascia (AMF)
- Posterior mammary fascia (PMF)
- Anterior suspensory ligaments (ASL) of Cooper
- Posterior suspensory ligaments (PSL)

IMAGING ANATOMY

Overview
- Breast
  - Conical, round, or hemispherical shape
  - Composed of 15-20 lobes, each encased in fascial sheath defined by AMF and PMF
  - Extends from 2nd or 3rd intercostal space to 6th or 7th intercostal space
  - Extends laterally to anterior axillary fold and medially to lateral sternum
  - Relationship to chest wall
    - Superior 2/3 overlies pectoralis major muscle
    - Lateral portion overlies serratus anterior muscle
    - Inferior-most margin overlies upper abdominal oblique muscles
  - Axillary tail of Spence
    - Extension of normal breast tissue toward axilla
  - Average breast size
    - Diameter: 10-12 cm
    - Thickness: 5-7 cm
    - Median: 5 cm thick with mammographic compression
  - Support and mobility relate to fascial attachments to skin and chest wall

Internal Contents
- Glandular elements
  - Extralobular ducts
  - TDLUs
  - Extralobular ducts and TDLUs contain 2 cell layers
    - Outer myoepithelial cell layer
    - Inner epithelial cell layer
- Stroma/connective tissue
  - Fat, connective tissue
  - ASL (Cooper ligaments) and PSL
  - Nerves, blood vessels, and lymphatics
- Interlobular tissue
  - Higher in collagen content
  - Relatively lower in cellular elements and hyaluronic acid
- Intralobular tissue
  - Higher in cellular elements and hyaluronic acid
  - Relatively lower collagen content

Zonal Anatomy
- Premammary (subcutaneous) zone
  - Most superficial zone
  - Anterior margin defined by skin, posterior margin defined by AMF
  - Contains subcutaneous fat, blood vessels, ASL
  - May contain ectopic ducts and TDLU
  - ASL
    - Formed from 2 leaflets of AMF inserting into dermis
- Mammary zone
  - Defined anteriorly by AMF and posteriorly by PMF
  - Contains fibroglandular tissue: Majority of ducts/TDLU, stromal fat, and stromal connective tissue
  - Subdivided haphazardly by interspersed ASL
- Retromammary zone
  - Most posterior of 3 zones
  - Defined anteriorly by PMF and posteriorly by chest wall
  - Contains fat and PSL, which attach PMF to chest wall

ANATOMY IMAGING ISSUES

Mammography
- Overall breast density reflects ratio between glandular elements (higher density) and fat (lower density)
  - Usually symmetric between breasts but wide range of normal
  - Fatty involution typically begins in lower outer quadrant
    - Progresses with age to upper outer quadrant
- American College of Radiology Breast Imaging and Reporting and Database System (BI-RADS)
  - Density categories
    - A: Almost entirely fat
    - B: Scattered fibroglandular densities
    - C: Heterogeneously dense, which could obscure detection of small masses
    - D: Extremely dense, which lowers sensitivity of mammography
  - ↑ fibroglandular density ↓ sensitivity of mammography and ↑ risk of developing breast cancer

US
- Thin, echogenic skin line: ≤ 2 mm
- ASL usually visible in subcutaneous zone
  - Subcutaneous fat lobule(s) surrounded by ligaments can present as palpable mass(es)
- Echogenicity defined relative to subcutaneous fat
- Interlobular stroma and glandular elements usually hyperechoic
  - Fibrotic tissue can be hyperechoic or hypoechoic
- Pectoral muscles and ribs visible as hypoechoic posterior structures

MR
- Fibroglandular tissue/muscle often shows physiologic enhancement
- Density and enhancement features of parenchyma vary with patient age and phase of menstrual cycle
- Ideally performed during follicular phase menstrual cycle
  - Less dense stroma and lower breast water content
- Describe fibroglandular tissue: Fatty, scattered, heterogeneous, extreme
- Describe background parenchymal enhancement (BPE)
  - Minimal, mild, moderate, marked
  - ↑ BPE predicts ↑ risk of developing breast cancer
  - ↑ false-positives, but sensitivity retained when BPE moderate or marked
(Top) CC tomosynthesis of normal breast with scattered fibroglandular density shows radially arrayed ducts leading to the nipple. Approximately 15-20 lobes comprise the glandular portion of the breast, each leading to a duct. Some ducts may fuse before leading to an orifice in the nipple. (Middle) CC tomosynthesis shows scattered fibroglandular density and nicely depicts normal zonal anatomy. (Bottom) MLO tomosynthesis shows normal zonal anatomy of the breast.
(Top) Radial US in the axillary tail (fatty portion) of the breast shows position of breast anterior to pectoralis muscles. (Middle) Radial US of the right breast (same patient) along the orientation of the ducts at the 9:00 position near the nipple demonstrates the 3 zones of the breast: Premammary, mammary, and retromammary. (Bottom) Normal transverse US at the level of the nipple shows subareolar ducts.
(Top) Sagittal T1 MR prior to contrast injection shows extensive high duct signal due to blood in a woman with bloody nipple discharge. 
(Middle) Sagittal STIR MR (same patient) shows magnetic susceptibility artifacts due to hemosiderin in the blood in ducts throughout several segments involved by DCIS. An incidental cyst is seen. (Bottom) Sagittal T1 C+ FS MR (same patient) shows extensive segmental nonmass enhancement in a clustered ring/periductal pattern. Findings were due to extensive low nuclear grade DCIS.