Breast Anatomy & Pathology
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Mammary Glands
- Accessory glands - functions to secret milk
- Modified apocrine sweat gland vs. sebaceous gland

Size & Attachment
- Variation in shape and size
  - Hormones
  - Age
- Attachment & Location
  - 2nd or 3rd rib
  - 6-7th rib
  - Inframammary crease

Milk Line
- Milk line extends from the armpits in axilla to groin

Surface Anatomy
- The skin
  - Sweat glands
  - Sebaceous glands
  - Hair follicles
- Nipple
  - 15-20 orifices
- Areola
  - Morgagni's tubercles

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Muscle Association
- Anterior
  - Pectoralis major
  - Pectoralis minor
  - Serratus anterior
- Laterally
  - Serratus anterior
  - Latissimus dorsi

Deep Anatomy
- Adipose /fatty tissue – between lobes
- Glandular tissue – within lobes
- Lymphatic vessels
- Blood vessels
- Cooper's Ligaments

Lateral & Medial Lymphatic Drainage
- Lateral – pectoral group of axillary nodes
- Medial – internal mammary lymph nodes
- Medial – mediastinal nodes or to the other breast

Lymph Node
- Size
  - Less than 2 cm
- Shape
- Kidney appearance
- Significance
  - Route a malignant disease leaves the breast

The Prepuberty Breast
- No lobules
- Small ducts within fibrous tissue

Most Important Hormones
- Estrogen
- Ductal proliferation
- Progesterone
  - Lobular proliferation & growth
Breast Anatomy & Physiology

Breast – Ductal System
- Lobule (TDLU) – milk production
- Segmental/mammary ducts
- Ampulla – pouch-like sac
- Lactiferous/ connecting duct
- Nipple orifice- to exterior

Affecting Breast Tissue Composition
- Menarche
- Hormonal fluctuation
  - (Normal or synthetic)
- Pregnancy
- Lactation
- Perimenopause & Menopause
- Weight gain/loss

Changes in the Breast
- Can be benign or malignant
- Refers to any pathological change
- Change in normal development will show mammographically will show as:
  - A mass density
  - Focal architectural distortion
  - Tenting of breast parenchyma

Benign vs. Malignant
- Benign
  - No change over time
- Malignant
  - Significant change over time

Changes Leading to Malignancy
- Epithelial hyperplasia
- Atypical epithelial hyperplasia
- Carcinoma in situ
- Infiltrating lobular or ductal ca
- Metastases - the cancer leaves the breast

Location of Breast Cancers
- Main location
  - TDLU
- Other sites
  - Fibrous tissue
  - Connective tissue
  - Larger ducts
**Types of Changes**
- New lesion
- Enlarging lesion
- Change in margin of a lesion
- Developing spiculations
- Developing microcalcifications

**Density of a Mass**
- Low density
  - Tends to indicate benign lesion
- High density
  - Tends to indicate malignant lesions

**Identify?**
- Patient had a lumpectomy. Follow-up mammogram shows multiple high density structures.
  - A. Malignant calcification
  - B. Sutures
  - C. Artifacts
  - D. Benign calcifications

**Identify?**
- Patient had recent breast surgery. Mammogram shows...
  - A. Saline implants
  - B. Silicone implants
  - C. Large cyst
  - D. Benign lesion

**Identify?**
- 72 yo with multiply breast surgeries. Complains of palpable lump. Is it:
  - A. Cyst
  - B. Hematoma
  - C. Direct injection of silicone
  - D. Ruptured implants

**Silicone Leakage**
- Silicone can leak very slowly from a ruptured silicone gel implant
Identify?

Margins of Benign & Malignant Breast Lesions

- Circumscribed
- Obscured
- Microlobulated

- Microlobulated
- Indistinct
- Spiculated

Shapes of Benign or Malignant Breast Lesion

- Round
- Oval
- Lobulated

- Lobulated
- Irregular
- Spiculated

Definitive Classification of Lesions

- Histological analysis
  - Microscopic analysis of organ and body tissues
- Cytological analysis
  - Analysis of cells

Circular or Oval Lesion

- Often symptomatic
- Poorly outlined/obscured
- Multiple
- Lobulated
- Solitary

Mammographic Characteristics

- Radiolucent
- Radiolucent and radiopaque combined
- Low density radiopaque
- High density radiopaque
Mammographic Examples
- Circular oval lesion
- Large cysts
- Small fibroadenoma
- Stellate lesion

Mammographic Examples
- High-density radiopaque lesion
- Carcinoma
- Abscess
- Galactocele - calcified
- Hematoma - calcified
- Epidermoid (sebaceous) cyst
- Mixed density lesions
- Fibroadenoma

Identify?
- Patient had surgery 5 yrs ago. Was involved in a minor car accident a few days ago. Currently experiencing breast pain.
  - A. Cyst
  - B. Ruptured cyst
  - C. Ruptured implant
  - D. Malignant lesion

Ruptured Implant

Identify?
- Non-palpable lesion discovered on imaging. Biopsy reveals it is a benign lesion.
  - A. Lymph node
  - B. Cyst
  - C. Hematoma
  - D. Fibroadenoma

Lymph node

Identify?
- Patient feels a definite area of increased density on medial aspect of right breast. No history of trauma. Lesion is...
  - A. Cyst
  - B. Hematoma
  - C. Fibroadenoma
  - D. Focal asymmetric density

Focal asymmetric density (FAD)

Identify?
- Patient has increased density – similar to a large mass – in left breast. Histological analysis showed it to be a mixed benign lesion – fat and glandular tissue.
  - A. Cyst
  - B. Fibroadenoma
  - C. Hematoma
  - D. Hamartoma

Hamartoma (also known as a fibroadenolipoma)
Identify? Identify the pathology 
A. nipple retraction 
B. FAD 
C. hematoma 
D. tenting 

Nipple retraction

Identify? 
What is demonstrated here and what is a possible cause? 
A. lumpectomy 
B. mastectomy 
C. Nipple retraction 
D. radial scar

Nipple retraction – possible breast carcinoma

Identify? 
3 faces elderly woman- young lady-man

Identify? 
Patient had a recent breast infection and shortly developed a palpable mass in right breast. A biopsy showed the area to be fatty acids and glycerol.
A. Lymph node 
B. Fat necrosis 
C. Abscess 
D. Cyst

Fat Necrosis

Identify? 
• Patient has a large cyst. The radiologist noted a thin dark line around the lesion. This line represents...
• A. Halo 
• B. A sign of malignancy 
• C. Signs of an infection 
• D. Effects of a biopsy

The halo often represent a benign lesion.

–Thin capsule – curved radiopaque line around the lesion.

Benign Circular /Oval Lesions Summary
• Radiolucent e.g. Lipoma, oil cyst, galactocele. 
• Radiolucent & radiopaque e.g. Lymph node, fibro-adeno-lipoma (Hamartoma), galactocele, and hematoma. 
• Low density e.g. Fibroadenoma, cyst. 
• Spherical or ovoid with smooth borders e.g. Cyst. 
• Halo sign e.g. Cyst. Exceptions: intracystic carcinoma, papillary carcinoma, carcinoma within a fibroadenoma. 
• Capsule e.g. Fibroadenoma. Exceptions are: abscess, hematoma and epidermoid cyst.
Malignant Circular/oval Lesion Summary

- High-density e.g. Invasive ductal carcinoma, sarcoma
- Smooth or lobulated and randomly orientated e.g. Sarcomas

Skin Lesions

- Can mimic a breast lesion and should be marked
  - Keratosis
  - Moles
  - Skin tags
  - Epidermoid (sebaceous) cysts

Identify?

- Patient had a large crusted lesion on her breast. It is...
  - A. Keratosis
  - B. Moles
  - C. Skin tags
  - D. Epidermoid

Keratosis

Identify?

- Radiologist noted a lesion behind the patient’s nipple. A physical exam and repeat mammogram with a BB proved it to be:
  - A. Keratosis
  - B. Moles
  - C. Skin tags
  - D. Epidermoid

Skin Tag

Identify?

- Patient had recent cardiac surgery...
  - A. Pacemaker
  - B. Port-a-cath
  - C. Artifact
  - D. Abscess

Pacemaker

Say the color not the word...

YELLOW  BLUE  ORANGE  BLACK  RED  GREEN
PURPLE  YELLOW  RED  ORANGE  GREEN  BLACK
BLUE  RED  PURPLE  GREEN  BLUE  ORANGE

Right brain tries to say the color & the left brain tries to say word
**Identify?**
- Patient has breast cancer and is undergoing treatment...
  - A. Pacemaker
  - B. Port-a-cath
  - C. Artifact
  - D. Abscess

**Identify?**
- This patient has severe kyphosis and was difficult to position. The image was repeated because the...
  - A. shoulder
  - B. chin
  - C. patients’ hair
  - D. lymph nodes

**What Do You See?**
- 4 perfectly round circles

**Spiculated/stellate Lesions**
- Central tumor with radiating structures
- Ill defined borders

**Locate the lesion...**

**Locate the lesion...**
Benign Spiculated/stellate Lesions Summary

- No solid, dense or distinct central mass
- Translucent oval or circular area at center e.g. Radial scar
- Very fine linear densities or lower density spicules e.g. Radial scars or traumatic fat necrosis
- Never associated with skin thickening or skin retraction e.g. Radial scars (exception traumatic fat necrosis)
Malignant Spiculated/stellate Lesions Summary
- Distinct central mass e.g. Invasive ductal carcinoma (IDC)
- Sharp, dense, fine lines, variable length radiating in all directions e.g. IDC
- Spicules reaching the skin or muscle may cause localized skin thickening or skin dimpling e.g. IDC
- Commonly associated with malignant-type calcifications

Calcifications
- Clustered
- Single
- Unilateral
- Bilateral
- Change over time
  - Variation in density, distribution, number, morphology or size

Evaluation of Calcifications
- Density
  - Low or high density radiopaque and any combination in between
- Distribution
  - Scattered or localized
- Number
  - Single or clusters
- Size
  - Microcalcifications – mm to Macrocalcifications – cm

Calcification Morphology
- Course
  - Larger than 0.5mm in diameter
- Linear or rod-like
  - Over 1mm in diameter/associated with ducts
- Round
  - Punctuate if smaller than 0.5mm

Calcification Morphology
- Amorphous or indistinct
  - Multiple flake-like irregular clusters. Micro or macro
- Intermediate concern
- Pleomorphic or granular
  - Different shapes, irregular in form, size and density
  - Typically malignant
- Casting type
  - Fine, linear branching/fragmented irregular contours
  - Typically malignant

Main Causes of Calcifications
- Cystic changes
- Dermal calcification
  - Calcified apocrine cysts
  - Calcified sebaceous glands
- Calcified fibroadenoma
- Sutural - associated with radiation or surgery
Sclerosing Adenosis
- Ductal epithelia hyperplasia/sclerosing adenosis
- Calcifications as a result of increased cellular activity

Ductal Ectasia
- Ductal ectasia/plasma cell mastitis
- Large calcification
- Periductal or intraductal
- Linear and fragmental

Vascular Calcifications
- Arteries
- Veins
- Mammographically as distinctive parallel lines or broken tubular lines

Oil Cyst
- High-density
- Lucent center
- Eggshell-like
- Sharply outlined, spherical or oval

Identify?
- Radiologist identified this lesion as benign on the ML. They are...
  - A. IDC
  - B. Milk of calcium
  - C. Fibrocystic changes
  - D. Dermal calcifications

Identify?
- 60 yo with benign lump in her breast.
  - A. lymph node
  - B. Fibroadenoma
  - C. Calcified sebaceous glands
  - D. Fibrocystic changes

Milk of calcium - benign tea-cup shaped calcifications
Fibroadenoma
Identify?

- On biopsy the calcifications proved to be common benign type...
  A. Milk of calcium
  B. Fibrocystic changes
  C. Hematoma
  D. Galactocele

Fibrocystic changes

Identify?

- Patient had benign calcifications scattered within one lobe...
  A. Sebaceous glands calcified
  B. Hematomas
  C. Galactoceles
  D. Fibrocystic changes

Fibrocystic changes

Identify?

- These ring-like calcifications are typical located in the skin of the breast...
  A. Hematoma
  B. Oil cyst
  C. Calcified sebaceous glands
  D. Fibroadenoma

Calcified sebaceous glands

Identify?

- Patient has a history of breast surgery and no palpable lumps. These calcifications had slowly change from radiolucent to radiopaque.
  A. Microhematoma
  B. Galactocele
  C. Oil cyst
  D. Fibroadenoma

Microhematoma

Identify?

- Patient has old history of trauma. These calcifications were originally radiolucent.
  A. Hematoma
  B. Oil cyst
  C. Calcified sebaceous glands
  D. Fibroadenoma

Developing oil cyst
Identify?

Patient had bilateral breast calcifications. They were recognized as benign. No follow-up necessary.
A. Oil cyst
B. Large hematoma
C. Ductal ectasia
D. Calcified sebaceous glands

Ductal ectasia also called plasma cell mastitis

Benign Calcifications Summary
- Smooth, high uniform density e.g. Plasma cell mastitis.
- Evenly scattered homogenous e.g. Calcified arteries.
- Sharply outlined, spherical or oval e.g. Oil cysts.
- Pear like/teacup shape on ML e.g. Milk of calcium.
- Bilateral and evenly scattered following the course of the ducts e.g. Plasma cell mastitis.
- Ring-like, hollow e.g. Sebaceous gland calcified.
- Eggshell like e.g. Oil cyst, papilloma.
- Large bizarre size e.g. Hemangiomas

Identify?

Pleomorphic or granular type calcifications

Identify?

Casting type calcifications

Identify?

Pleomorphic or granular type calcifications

Thickened Skin Syndrome
- Entire breast or localized
- Peau d’orange appearance
- Associated with increased density
- Caused by benign or malignant changes

Normal skin is 0.5-2 mm thick
**Benign Skin Thickening**
- Bilateral
- Cardiac failure
- Renal failure
- Vena cava obstruction
- Radiation treatment

**Types of Breast Cancer**
- Ductal – 90% of all breast cancer
- Lobular – 5-10% of breast cancer

**Ductal Carcinoma (DCIS)**
- The cancer is confined to the ducts and does not invade the duct walls
- Poorly differentiated (high grade) – Comedo DCIS – often includes microcalcifications
- Well-differentiated (low-grade)

**Invasive or Infiltrating Ductal Carcinoma (IDC (NOS))**
- The cancer has spread from the ducts into the surrounding stromal tissue or even to the pectoral fascia and muscle
- Often associated with a tumor

**Lobular Carcinoma (LCIS)**
- Not seen mammographically in 50% of the cases
- Cancer grows within lobules but do not penetrate through the lobule wall

**Invasive Lobular Carcinoma (ILC)**
- 10% of all breast cancers
- Difficult to perceive mammographically
- Spider web appearance
Other Breast Carcinomas

- Inflammatory
- Medullary
- Colloid Comedo
- Tubular
- Mucinous
- Papillary carcinoma
- Paget’s disease

Inflammatory Carcinoma

- 1-4% of all breast cancers
- Presents as swelling, warmth, erythema and skin thickening

Medullary Carcinoma

- 3% of all breast cancers
- Associated with good prognosis even if large at detection
- Rarely metastasize
- Mammographically are round or lobulated non-calcified areas – well circumscribed

Mucinous/Colloid

- 2% of all breast cancers
- May be associated with DCIS with or without microcalcifications

Papillary Carcinoma

- 0.9% of all breast cancers
- Circumscribed masses in older women
- Similar to a complex cyst
- Nipple discharge
- Slow growing with good prognosis

Tubular

- 0.6% of all breast cancers
- Nonpalpable - type of well-differentiated IDC
- Similar to a radial scar on the mammogram
- Slow growing – good prognosis

Sarcomas or Phyllloides Tumors

- Less than 1% of all breast cancers
- Begins in the stroma tissues
- Metastasize to bone, lung
- 25% of phyllloides are benign

Lymphoma

- 0.1-0.5% of all breast cancers
- Seen as single or multiple nodes - incompletely circumscribed

Mets to Breast

- Cross lymphatic metastases from one breast to another
- Blood borne metastases
- Seen as a rounded mass
- Rarely seen as calcification (except ovarian metastases)

Bilat Breast Ca

- Seen in patients irradiated at a young age
- Develops about 15 years after radiation treatment

Paget’s Disease

- 1% - 4% of all breast cancers
- Unrelated to Paget’s disease of the bone
- Nipple discharge
- Erythema, scaling of nipple
- Deformed, retracted nipple
Interesting Case 1

Breast Filariasis
- Caused by a parasitic worm
- Transmitted by mosquito
Early Symptoms - pain, erythema
Late symptoms - lymphoedema

Interesting Case 2

Advanced Breast Cancer
With nipple retraction

Interesting Case 3

Advanced breast cancer
CC

Interesting Case 3a

MRI

Interesting Case 4a

Fibroadenolipoma – Ultrasound & Mammogram

Creative Shawls
Interesting Case 4b
Fibroadenolipoma MRI

Interesting Case 5
- Varicose Veins

Interesting Case 6
- Static

Interesting Case 7
- Bilateral breast implants – calcified as a result of leakage

Interesting Case 8
Old method of imaging using long cones with the patient lying on the x-ray table

Interesting Case 9
Old method of imaging 1975
Interesting Case 10
Xeromammography- MLO & CC

Radical Mastectomy & Effects

Summary
- We are not interpreters
- We aid in the interpretation
  HOWEVER
- Our understanding will enhance our skills
- Study of breast anatomy
- Clinical history
- Ensuring previous mammograms

Thank You!
Reference: