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Developmental Stages of Breast Tissue

- **Fetal breasts** have no glandular breast tissue, thus are completely fatty.

- **At puberty**, the nipple develops with an areola around it, as well as glandular tissue, forming the breast.

- **During pregnancy**, women’s breasts change due to hormones, causing them to become larger.

- **During the stage of lactation**, women’s breasts are more engorged, due to the milk being produced.

- **During menopause**, women are losing estrogen, breasts become more fatty and less glandular.

- **During post menopause**, women’s breasts lose their elasticity.
Primarily fatty breast with scattered islands of fibroglandular tissue
Extremely dense breast
Hormonal Influences

- There are five main types of hormones that influence the growth of glandular breast tissue. They are:
  - Birth control pills
  - Estrogen
  - Progesterone
  - Prolactin
  - Testosterone

- These hormones can create the look and feel of a person who still menstruates.

- Thyroid medications may also contribute to this indirectly.
Breast Augmentation or Reconstruction

- Breast augmentation makes mammography very difficult to achieve. This surgery is performed for aesthetic or post cancer resection purposes.
- Implants can be placed either behind or in front of the pectoralis muscle.
- If the implant is placed behind the muscle, the breast tissue is not compromised on a mammogram.
- There are two main types of implants.
  - Silicone
  - Saline
Patient had breast cancer on her left breast, and had a lumpectomy. She then had augmentation performed.
Silicon Implant
CXR with saline implants
Architectural Distortion

- The appearance on a mammogram of tissue spicules without an associated mass
- Caused by scarring from previous surgery, radial scar, and carcinoma.
Invasive carcinoma presenting as a subtle architectural distortion
Breast Anomalies

- **Asymmetry** of breasts can be seen on mammograms.
- An area on one breast can present more density than the same area on the contralateral breast.
- When asymmetry is associated with architectural distortion, calcifications, or an underlying mass, the probability of malignancy is greater and a biopsy should be considered.
- 6-month follow-up
Inverted nipples are located inside the breast tissue and do not protrude outward.

This anomaly can be a sign of breast cancer, or a benign condition.
Accessory nipples are sometimes found right next to the nipple, or on another location of the chest. These are benign conditions.
Physical Changes Due to Pathology

- Pain
- Lumps
- Thickening
- Discharge
- Skin changes
- Nipple and areola changes
- Edema
- Erythema
- Dimpling
Discharge

Common causes of abnormal nipple discharge

- Subareolar abscess
- Intraductal papilloma
Mammographic Pathology

- Masses
- Calcifications
- Nodules
- Other indicators of Pathology
Masses

- This pathology is determined by its
  - shape,
  - margins,
  - benign characteristics, and
  - malignant characteristics.
Masses

**Shape** of masses can have an appearance of:

- **Round or Oval**: signifying a possible fluid filled cyst, or a solid mass.
- **Lobulated or Irregular**: signifying a possible cancer, more so than a benign cyst.
- **Architectural distortion**: tissue overlapping on itself, or a possible cancer.
Masses

Margins of significant pathology masses can be:

- circumscribed (could be benign or ....)
- obscured or indistinct
- ill-defined (indistinct, possibly cancer)
- spiculated (cancerous)
- microlobulated (could be cancerous)
Benign form is mostly cyst

This large round to oval mass has a well-defined circumscribed margin.
An oval mass and a round mass with circumscribed margins are evident in the upper quadrant of the breast on this medio-lateral view.
- well circumscribed
- fibroadenoma
• indistinct
• invasive ductal carcinoma
- spiculated
- invasive ductal carcinoma
Masses

Masses of benign characteristics can be:
- encapsulation
- low density (fat content)
- mixed density (fat and fluid)
- well circumscribed
- low density
- fibroadenoma
- low to intermediate density
- cyst
• high density
• ductal carcinoma
circumscribed
Masses of malignant characteristics can be:

- Spiculated
- high density
- low density
- indistinct
Spiculated
Calcifications

Characteristics

- Benign characteristics (typical)
- Malignant characteristics (nondeterminate characteristics)
Calcifications

Characteristics are determined by:

- number (quantity)
- Size
- Shape

Distribution:
- clustered or grouped,
- segmental,
- regional,
- diffuse (scattered), or
- multiple groups
Calcifications

Group of calcifications
Calcifications

Benign characteristics of calcifications are regional:
- Coarse
- rim or eggshell
- milk of calcium (teacup-like)
- Dystrophic
- Vascular
- skin (superficial)
- Secretory
- fat necrosis
- punctate
Typically Benign

Skin

Vascular

Coarse

Large, rod-like

Round

Eggshell

Milk of calcium

Intermediate Concern

Amorphous, indistinct

Higher Probability of Malignancy

Pleomorphic, heterogeneous

Fine, linear and/or branching
Ductal rod-like calcifications
Milk of calcium or teacup calcifications
Coarse calcifications on the rim of a fibroadenoma
Calcifications

- Malignant are diffused and scattered:
  - Indistinct (amorphous)
  - Granular (clustered and pleomorphic)
  - Irregular
  - Casting
• Indistinct or amorphous calcifications
• immediate concern
- clustered
- pleomorphic
- malignancy
• casting
• fine, linear, and branching
• intraductal carcinoma
- Segmental distribution of fine, linear, branching calcifications
- Intraductal comedocarcinoma
Other Indicators of Pathology

- Contour changes
- Prominent ductal pattern
- Prominent venous or arterial pattern
- Skin changes
Breast Carcinomas

- Postulated development of breast cancer
- Pathological types
- Stromal cancer
- Other
- Diagnosis of breast carcinoma
- TNM classification of breast cancer
Postulated Development of Breast Cancer

- Epithelial hyperplasia (pre-cancerous)
- Atypical epithelial hyperplasia (pre-cancerous)
- Carcinoma in situ (small cancerous area found, but not spread)
- Invasive carcinoma (cancerous and spread to other areas)
Carcinoma
Intraductal carcinoma  fibroadenoma
Pathological Types

- Ductal carcinomas
  - medullary (neoplastic epithelial cells)
  - mucinous (adenocarcinoma produces mucin)
  - tubular
  - inflammatory
  - comedo (plugs of malignant cells produced from ducts)
- Lobular
- Paget disease (ductal carcinoma with eczematic nipple changes)
Stromal Cancer

- Sarcoma
  - Very rare (1%)
  - Cancerous connective tissue of the breast
Other Breast Carcinomas

- Lymphoid malignancy (breast cancer spread to the lymphatic system)
- Metastatic to the breast from other primary cancer
Intracystic papillary carcinoma
Duct Cell Carcinoma
Diagnosis of Breast Carcinoma

- Fine-needle aspiration
- Core biopsy
- Surgical biopsy
Needle biopsy

A needle is used to draw sample fluid and tissue from a lump to be studied.
Open Core Biopsy

Also called a lumpectomy, an open biopsy is a surgical procedure in which all or part of a lump is removed and tested for malignancy.
TNM Classification of Breast Cancer

(Tumor): Primary Tumor
- Clinical exam (physician)
- Diagnostic exam
  (mammogram/ultrasound/MRI)
- Surgery
- Post surgical treatment
- Re-treatment (radiation/chemotherapy)
- Autopsy
TNM Classification of Breast Cancer

(Node): Subclasses
- Regional lymph node involvement
- Regional lymph node metastasis
- Increasing degree of demonstrable lymph node abnormalities
TNM Classification of Breast Cancer

(M): Metastasis
- No evidence (not palpable or visual changes)
- Evidence of distant metastasis
- Assessment of distant metastasis cannot be met
Benign Breast Pathology

- Cyst
- Galactocele
- Fibroadenoma
- Lipoma
- Hamartoma (fibroadenolipoma)
- Papilloma
- Ductal ectasia
- Breast infection
- Abscess
- Hematoma
- Fat Necrosis
- Inflammation vs. Inflammatory cancer
- Radial scarring
Cyst:
- It is an abnormal sac containing gas, fluid or semisolid material.
- It appears as round or oval well-circumscribed masses, on a mammogram.
- Fine needle aspiration may be attempted, if the cysts are causing discomfort.
Cyst
Benign Breast Pathology

- **Galactocele:**
  - It is a retention cyst caused by occlusion of a lactiferous duct.
  - It develops during lactation.
  - It appears on the mediolateral projection as a fat/fluid level of fluid calcium level, a zone of water density in the inferior portion, and a fat density in the superior portion.
  - No treatment needed.
Benign Breast Pathology

- **Fibroadenoma:**
  - A benign neoplasm derived from glandular epithelium, in which there is a conspicuous stroma of proliferating fibroblasts and connective tissue elements.
  - This lesion represents the most common form of benign tumors of the breast.
  - It is seen on mammograms as well-circumscribed masses with round, oval or nodular borders.
  - No treatment is required.
Fibroadenoma
Common benign causes of breast lumps

- Fibroadenoma
- Cystic breast changes
Benign Breast Pathology

Lipoma

- A benign neoplasm of adipose tissue, comprised of mature fat cells.
- It is seen on a mammogram as a totally fatty circumscribed mass contained in a thin fibrotic capsule.
- No treatment is necessary.
Hamartoma (fibroadenolipoma):

- A focal malformation that resembles a neoplasm, but results from faulty development in the breast.
- On a mammogram, a hamartoma contains multiple areas of fatty and fibroglandular densities surrounded by a fibrotic pseudocapsule.
- If the appearance is typical, excision can be avoided, otherwise surgery may be necessary.
Hamartoma
Benign Breast Pathology

- **Papilloma**
  - It is a circumscribed benign epithelial tumor projecting from the surrounding surface. It usually occurs in the retroareolar region and may cause a serous or sanguineous nipple discharge.
  - On a mammogram it is usually no greater that several millimeters in size.
  - No treatment is necessary.
Papilloma
Galactography

Rt LM

Rt CC
Benign Breast Pathology

- **Ductal Ectasia** (secretory disease):
  - A dilation of a duct characterized by inspissated secretions, and a chronic interstitial inflammatory reaction involving the intermediate and larger ducts of the breast.
  - On a mammogram, it may manifest as thick, solid calcifications, which represent benign secretions within the ducts, or ring-like calcifications with lucent centers, which represent calcifications within the walls of the dilated ducts.
  - No treatment necessary.
Ductal Ectasia
Benign Breast Pathology

Breast infection

- A benign breast pathology and is an infection of microorganisms that have multiplied inside of the breast.
- The breast may have an appearance of redness and swelling. The patient may feel pain and have a fever.
- Treatment for this may be antibiotics.
Abscess

- It is a circumscribed collection of purulent fluid appearing in an acute or chronic localized infection of the breast.
- It is usually caused by Staphylococcus or Streptococcus and may appear as a spiculated or poorly defined mass.
- Treatment for this is an ultrasound-guided breast biopsy, to drain the fluid, and send it to pathology.
Benign Breast Pathology

- **Hematoma**
  - A localized mass of extravasated blood that is relatively or completely confined within the breast. The blood is usually clotted, and, depending on how long it has been there, may manifest various degrees of discoloration.
  - It may appear on a mammogram as a well-defined or poorly defined mass.
  - Treatment for this is an ultrasound guided fine needle aspiration, to confirm diagnosis, if the blood has not clotted.
Benign Breast Pathology

- **Fat necrosis**
  - The death of adipose tissue, characterized by the formation of small (1 to 4 mm), dull, chalky, gray or white foci.
  - On a mammogram, it may appear like a stellate mass, circumscribed mass, amorphous density, or architectural distortion. If there are central lucencies in the mass, or lipid cysts seen as round lucent areas surrounded by a thin fibrotic capsule, this suggests the correct diagnosis.
  - No treatment is necessary.
Fat Necrosis
Benign Breast Pathology

- Inflammation vs. Inflammatory cancer
  - Inflammation of the breast has redness, swelling, pain and heat.
  - Inflammatory cancer has edema, hyperemia, tenderness and rapid enlargement of the breast. Microscopically, there is extensive invasion of dermal lymphatics by the carcinoma.
Benign Breast Pathology

Radial Scarring

- A pathologic condition in which ductal elements surrounded by bands of fibrous connective tissue radiate from a central sclerotic focus.
- It is seen on a mammogram as a small stellate density.
- No treatment is necessary.
Radial Scarring
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