CARCINOMA  BREAST

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Female Breast Anatomy

- Breasts consist mainly of fatty tissue interspersed with connective tissue.
- There are also less conspicuous parts:
  - lobes
  - ducts
  - lymph nodes
Normal Breast

Breast profile

A ducts
B lobules
C dilated section of duct to hold milk
D nipple
E fat
F pectoralis major muscle
G chest wall/rib cage

Enlargement

A normal duct cells
B basement membrane (duct wall)
C lumen (center of duct)
Breast Gland

- Each breast has 15 to 20 sections (lobes) arranged like the petals of a daisy.
- Inside each lobe are many smaller structures called lobules.
- At the end of each lobule are tiny sacs (bulbs) that can produce milk.
• Lobes, Lobules and bulbs, are linked by a network of thin tubes (ducts)

• Ducts carry milk from bulbs toward dark area of skin in the center of the breast (areola)

Ducts join together into larger ducts ending at the nipple, where milk is delivered
Cooper’s Suspensory Ligaments
Fixed to skin & underlying fascia by fibrous bands

a. Cooper’s (Suspensory) Ligaments
b. Ligaments may retract when breast tumors are present
Anatomy, continued ...

STRUCTURE:

1. Outer surface convex, skin covered

2. Nipple:
   a. At fourth intercostal space
   b. Small conical/cylindrical prominence below center
Nipple location

4th intercostal space
“Tail of Spence”

Axillary Tail
BREAST is a Fatty Tissue: surrounds surface, fills spaces between lobes

a. Determines form & size of breast

b. No fatty deposit under nipple & areola
Breast: Fatty Tissue
Normal breast physiology and anatomy

- Symmetry and balance
- Size
  - weight
  - menstrual cycle
  - pregnancy and lactation
- Texture
- Shape
  - age
VESSELS & NERVES:

1. Arteries: derived from thoracic branches of three pairs of arteries
   
   a. Axillary arteries
      
      1) continuous with subclavian a.
      2) gives rise to external mammary
         ( = lateral thoracic) artery
b. Internal mammary (thoracic) arteries

1) first descending branch of subclavian artery

supply intercostal spaces & breast

3) used for coronary bypass surgery

c. Intercostal arteries:

1) numerous branches from internal & external mammary arteries

2) supply intercostal spaces & breast
Arterial Supply to the Breast


External mammary (thoracic) a.
Vessels & Nerves, continued ...

2. Veins:
   a. form a ring around the base of the nipple ("circulus venosus")
   b. Large veins pass from circulus venosus to circumference of mammary gland, then to
      c. *External mammary vein* to *axillary vein*
         or
      d. *Internal mammary vein* to *subclavian vein*
Veins draining the Breast

- Subclavian vein
- External mammary vein
- Subclavicular lymph node

(b) Anterior view
3. Innervation: derived from:

a. anterior & lateral cutaneous nerves of thorax
b. spinal segments T3 – T6
Lymphatic System

- **Lymph ducts**: Drain fluid that carries white blood cells (that fight disease) from the breast tissues into lymph nodes under the armpit and behind the breastbone.

- **Lymph nodes**: Filter harmful bacteria and play a key role in fighting off infection.
Structure, continued ...

4. **Lymphatics: clinically significant!**

   a. Glandular lymphatics drain into
      anterior axillary (pectoral) nodes →
      apical nodes →
      deep cervical nodes →
      subclavicular (subclavian) nodes

   b. Medial quadrants drain into
      parasternal nodes
Lymph Nodes of the Breast

- Subclavian nodes
- Axillary nodes
- Lateral pectoral nodes
- Parasternal nodes
Lymphatics, continued ...

- Superficial regions of skin, areola, nipples:
  form large channels & drain into pectoral nodes.

NOTE: axillary nodes also drain lymph from arm.
Lymph Nodes and Lymph Drainage

Axillary Nodes

(b) Anterior view
Pathology

• Types – from epithelium
  Atrophic schirrous
  Schirrous
  Medullary
  Mucinous
  Inflammatory
• Sarcoma – from connective tissue
Histology Grading

• Nottingham Modification of Bloom & Richardson Grading System - Good Prognostic Indicator
• Consists Of :-
  Tubular Formation
  Nucleus Size/ degree of pleomorphism
  Mitotic Count
• Score Consists of :- I to III
  The sum of the score is used to classify tumor grade

Grade I  = 3 – 5
Grade II = 6 – 7
Grade III = 8 – 9

Histological Grade is a strong predictor
• Women with Grade I – 10 Year survival 85 %
• Women with Grade III – 10 Year survival < 45 %
Routes of Metastasis

• From medial lymphatics to parasternal nodes
  – Then to mediastinal nodes
• Across the sternum in lymphatics to opposite side via cross-mammary pathways
  – Then to contralateral breast
• From subdiaphragmatic lymphatics to nodes in abdomen
  – Then to liver, ovaries, peritoneum
Major Routes of Metastasis

- Axillary Lymph Channels
- Subdiaphragmatic Lymph Channels
- Channels to Contralateral Breast
Breast Cancer

- The most common form of cancer among women
- The second most common cause of cancer related mortality
- 1 of 8 women (12.2%)
- One third of women with breast cancer die from breast cancer
Breast carcinoma

• **most frequent malignant tumor in females** (followed by cervix and colon)

• highest incidence – **developed countries**
  (USA 84.8/100 000F/Y, Western Europe 64.7/100 000F/Y)

• 2\textsuperscript{nd} killer among cancers (1\textsuperscript{st} = lung ca)

• risk factors: genetic predisposition (breast ca in close (1\textsuperscript{st} degree) relatives), proliferative changes, early menarche, late menopause, history of ca (breast, ovary, endometrium)

• **importance of preventive controls**! – early diagnosis → better prognosis
Risk Factors for Breast Cancer

- Female (1% male)
- Aging
- Relative (mother or sister)
- Menstrual history
  - early on set
  - late menopause
- Child birth
  - After the age of 30
Risk Factors for Breast Cancer

- Radiation exposure
- Breast disease
  - Atypical Hyperplasia
  - Intraductal carcinoma in situ
  - Intralobular carcinoma in situ
- Obesity
- Diet
  - Fat
  - Alcohol
Exogenous Estrogen

- Hormonal replacement therapy (HRT)
  - 30% increased risk with long term use
- Oral Contraceptives (OC)
  - Risk slight
  - Risk returns to normal once the use of OC’s has been discontinued
Genetics

- BRCA-1
- BRCA-2
- P53, Rb-1
- Her-2/neu, c-erbB2, c-myc
RISK FACTORS FOR CARCINOMA BREAST

• MAJOR FACTORS (three fold increase in risk)
• Female sex
• Age
• Previous history of breast cancer
• Parity
• Multiple papillomatosis
• Family history
• INTERMEDIATE RISK FACTORS:
  • Menstrual history (early menarche, late menopause)
  • Radiation exposure
  • History of cancer of ovary, uterus, colon
  • Body weight
  • Atypical hyperplasia

• MINOR FACTORS:
  • OCP’s
  • Alcohol
Abnormal signs and symptoms

- Puckering
- Dimpling
- Retraction
- Nipple discharge
- Thickening of skin or lump or “knot”
- Retracted nipple
Abnormal signs and symptoms

- Change in breast size
- Pain or tenderness
- Redness
- Change in nipple position
- Scaling around nipples
- Sore on breast that does not heal
- Retraction sign: “dimpling” involving skin, nipple or areola
- Mobility of mass
  a. Benign = movable
     1) not attached
     2) not invasive
  b. Malignant = attached
     1) May grow into bone
- Consistency of mass
  a. Cysts = fluctuant; compressible
  b. Fibroadenoma = rubbery
  c. Carcinoma = firm, hard (like gravel)

- Axillary area lymph node enlargement
Physical signs:

a. Slowly growing, painless mass
b. May demonstrate retracted nipple
c. May be bleeding from nipple
d. May be distorted areola, or breast
e. Skin dimpling in more advanced stages with retraction of Cooper’s ligaments
LEFT BREAST

Upper inner quadrant
Upper outer quadrant
Tail
Lower inner quadrant
Lower outer quadrant
Physical signs, continued ...

f. Attachment of mass

g. Edema of skin
   1) with “orange skin” appearance (peau d’orange)
   2) due to blocked lymphatics

h. Enlarged axillary or deep cervical lymph nodes
Signs and Symptoms

Most common:
lump or thickening in breast. Often painless

Change in size or contours of breast

Discharge or bleeding

Redness or pitting of skin over the breast, like the skin of an orange

Change in color or appearance of areola

Lump in breast or underarm area

Change in size or shape of breast

Nipple changes

Inversion

Crusting

Discharge or bleeding from the nipple
Staging of Breast Cancer

• The American Joint Committee on Cancer (AJCC) has designated staging by TNM
  • T = tumor size
  • N = lymph node involvement
  • M = metastasis
Stage 1

- Tumor ≤ 2.0 cm in greatest dimension
- No nodal involvement (N0)
- No metastases (M0)
Breast -- CS Size and Extension
T1 Examples

Stage II

- Tumor > 2.0 ≤ 5 cm or
- Ipsilateral axillary lymph node (N1)
- No Metastasis (M0)
Breast -- CS Extension
T2 Example

Stage III

- Tumor > 5 cm (T3)
- or ipsilateral axillary lymph nodes fixed to each other or other structures (N2)
- involvement of ipsilateral internal mammary nodes (N3)
- Inflammatory carcinoma (T4d)
Breast -- CS Extension
T3 Example

Stage IV (Metastatic breast cancer)

- Any T
- Any N
- Metastasis (M1)
Breast -- CS Extension 40
Extension to chest wall (T4a)

Chest wall includes
  - Ribs
  - Intercostal muscles
  - Serratus anterior muscle

Does NOT include
  - Pectoral muscle (Ext 30)

Breast -- CS Extension 51-52
Extensive skin involvement (T4b)

Breast -- CS Extension 61-62
Chest wall and skin involvement
(T4c)

61  Chest wall plus skin involvement ≤ 50% of breast or NOS
    (codes 40 + 51)

62  Chest wall plus skin involvement > 50% of breast
    (codes 40 + 52)

Progression to Breast Cancer
Types of breast cancer

• In situ
  – Intraductal (DCIS)
  – Intralobular (LCIS)

• Invasive
  – Infiltrating ductal carcinoma
  – Tubular carcinoma
  – Medullary carcinoma
  – Mucinous carcinoma
Breast carcinoma - classification

- **IN SITU**
  - Ductal
  - Lobular
- **INVASIVE**
  - Ductal invasive
  - Lobular invasive
- **DUCTAL**
  - Ductal in situ (intraductal)
- **LOBULAR**
  - Lobular in situ
+ other types (12)
Carcinoma in situ

- preinvasive - does not form a palpable tumor
- not detected clinically (only X-ray – screening !!)
- multicentricity and bilaterality (namely LCIS)
- continuum: *bland hyperplasia* - *increasing atypism* - *carcinoma in situ*
- no metastatic spread (basement membrane)
- risk of invasion depending on grade
Ductal Carcinoma in situ (DCIS)

Illustration © Mary K. Bryson
Range of Ductal Carcinoma in situ

- Normal cells
- Ductal hyperplasia
- Atypical ductal hyperplasia
- Ductal Carcinoma in situ
- DCIS-MI (DCIS with microinvasion)
- Invasive ductal cancer

Illustration © Mary K. Bryson
Invasive carcinoma

**Invasive ductal carcinoma**

- largest group (65 to 80 % of mammary carcinomas)
- mid to late fifties
- stellate, white, firm (desmoplasia)
- less often circumscribed, soft (medullary ca)
- hormonally dependent (estrogen, progesterone)

**Invasive lobular carcinoma**

- uniform cells, infiltrative growth (linear arrangement - indian file pattern)
Invasive Ductal Carcinoma

(IDC - 80% of breast cancer)

- The cancer has spread to the surrounding tissues
- *Carcinoma* refers to any cancer that begins in the skin or other tissues that cover internal organs

Illustration © Mary K. Bryson
Invasive Lobular Carcinoma (ILC)

Lobular cancer cells breaking through the wall.
Cancer Can also Invade Lymph or Blood Vessels

Illustration © Mary K. Bryson
Invasive carcinoma

- other types: tubular, mucinous, medullary, inflammatory – together about 10% of breast ca

- metastases: regional lymph nodes (axillary, parasternal), lungs, liver, bone marrow, brain

- treatment: surgery (radical – mastectomy, breast conserving surgery – lumpectomy),
  - radiotherapy
  - antihormonal therapy (Tamoxifen)
  - chemotherapy
Breast -- CS Extension 71-73
Inflammatory carcinoma

“Diffuse dermal lymphatic involvement causing edema and reddening of the skin”

Breast -- CS Lymph Nodes
Examples

Code 25 -- 1-3 movable axillary LN only (N1a)

Code 71 -- Microscopic int. mam. nodes; no pos axillary LN (N1b)

Code 72 -- Microscopic int. mam. nodes; 1-3 pos axillary LN (N1c)

Breast -- CS Lymph Nodes
Examples

Code 50
4-9 fixed/matted axillary LN only (N2a)

Code 74
Clin pos int. mam. nodes; no pos axillary LN (N2b)

Breast -- CS Lymph Nodes
Examples

Code 75 -- Infraclavicular nodes (N3a)
Code 76 -- Internal mammary and 4+ axillary nodes (N3b)
Code 80 -- Supraclavicular nodes (N3c)

Paget’s disease of the nipple

- Result of intraepithelial spread of intraductal carcinoma
- Large pale-staining cells within the epidermis of the nipple
- Limited to the nipple or extend to the areola
- Pain or itching, scaling and redness, mistaken for eczema
- Ulceration, crusting, and serous or bloody discharge
Cystosarcoma phyllodes (phyllodes tumor)

- Initial description - over 150 years ago - fleshy tumor, leaf-like pattern and cysts on cut surface

- Circumscribed, connective tissue and epithelial elements (× fibroadenomas = greater connective tissue cellularity), 1-15 cm

- Less than 1% of breast tumors

- Benign, malignant
  - Low grade
  - High grade

- Metastases are hematogenous
Proliferative changes

- ductal and lobular hyperplasia
- atypical ductal and lobular hyperplasia
- higher risk for the cancer than "normal" population
- associated w. microcalcifications (!mammography!)
- incidental histological finding
- atypical hyperplasia = precancerous lesion
Methods of Detection

- Clinical exam by MD or nurse
- Mammography
- Monthly breast self-exam (BSE)
Clinical examination

• Performed by doctor or trained nurse practitioner
• Annually for women over 40
• At least every 3 years for women between 20 and 40
• More frequent examination for high risk patients
Breast Self Examination

• Opportunity for woman to become familiar with her breasts
• Monthly exam of the breasts and underarm area
• May discover any changes early
• Begin at age 20, continue monthly
When to do BSE

- Menstruating women - 5 to 7 days after the beginning of their period
- Menopausal women - same date each month
- Pregnant women – same date each month
- Takes about 20 minutes
- Perform BSE at least once a month
- Examine all breast tissue
Why don’t more women practice BSE?

• Fear
• Embarrassment
• Youth
• Lack of knowledge
• Too busy, forgetfulness
Mammography

• X-ray of the breast
• Has been shown to save lives in patients 50-69
• Data mixed on usefulness for patients 40-49
• Normal mammogram does not rule out possibility of cancer completely
Mammography-more guidelines

• Mammogram facility guidelines
• Avoid mammogram week before period
• Don’t wear deodorant powder or cream
• Bring a list of the places and dates of other mammograms, biopsies you’ve had before
• If you don’t hear from the MD within 10 days, call the facility
Mammography Equipment
Computer-Aided Diagnosis

- Mammography allows for efficient diagnosis of breast cancers at an earlier stage.
- Radiologists misdiagnose 10-30% of the malignant cases.
- Of the cases sent for surgical biopsy, only 10-20% are actually malignant.
- CAD systems can assist radiologists to reduce the above problems.
What Mammograms Show

Two of the most important mammographic indicators of breast cancers

- **Masses**
- **Microcalcifications**: Tiny flecks of calcium - like grains of salt - in the soft tissue of the breast that can sometimes indicate an early cancer.
Detection of Malignant Masses

Malignant masses have a more **spiculated** appearance.
Mammogram - Difficult Case

- Heterogeneously dense breast
- Cancer can be difficult to detect with this type of breast tissue
- The fibroglanular tissue (white areas) may hide the tumor
- The breasts of younger women contain more glands and ligaments resulting in dense breast tissue
Mammogram – Easier Case

• With age, breast tissue becomes fattier and has fewer glands
• Cancer is relatively easy to detect in this type of breast tissue
Different Views

**Side-to-Side**

MRI - Cancer can have a unique appearance – many small irregular white areas that turned out to be cancer (used for diagnosis)

**Top-to-Bottom**
Treatment

Natural History

• Tumor Doubling time – 100 days
• Nodule of 1 cm to form – 8 years
• Metastasis can occur if the tumor size exceed 0.5 cm

• HALSTED CONCEPT – It is a locoregional disease involving lymph nodes, & then systemic spread occurs. So treatment is Radical Mastectomy
• FISSURE CONCEPT – Does not spread in an orderly stepwise manner. Systemic spread occurs early even before lymphatic spread. So treatment is Multi Disciplinary
Treatment for Stage I & II

- Surgery – MRM
  - QUART (Quadrantectomy, for Axilla RT)
- Structures to be preserved – Biopsy specimen
Multimodality Treatment For Advanced

- Radiotherapy
- Chemotherapy
- Hormone therapy

Adjuvant therapy

Neo-Adjuvant therapy
Thank You