IMAGING AND TISSUE DIAGNOSIS OF THE BREAST

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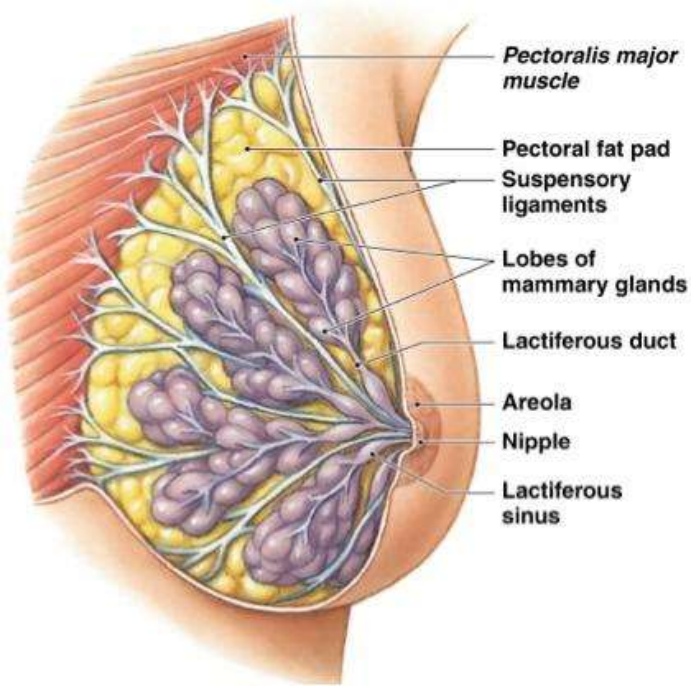
OUTLINE

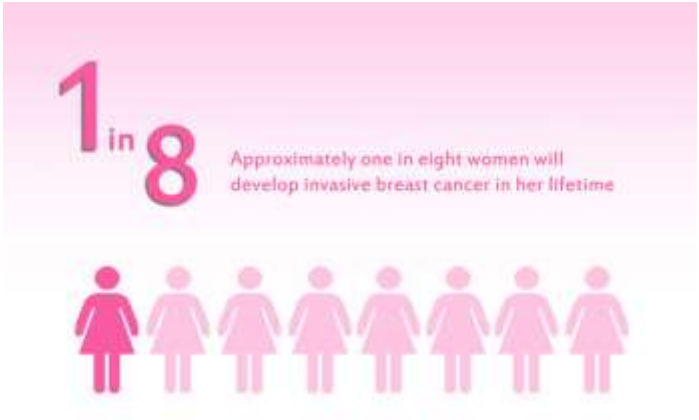
- Introduction(Epidemiology and Classification ,Presentation of Breast Cancer)
- Imaging and Diagnosis
- Screening protocol
- Tissue biopsy

- Breast Structure
  - Gland → Ductal and Lobular structures
  - Fat
  - Connective tissue
  - lymphatic tissue



BREAST CANCER EPIDEMIOLOGY?

- Most common non-skin cancer in women in U.S.
- 2nd leading cancer killer among women (lung is number 1).
- Over 232,000 cases were reported in 2013, > 99% in women.
- 1 in 8 women will be diagnosed with breast cancer in her life



Breast Cancer

Non Invasive Carcinoma

- DCIS
- LCIS

Invasive Carcinoma

- Invasive ductal carcinoma
- Invasive lobular carcinoma

DCIS

- Malignant cells are confined to ductal wall and not invading the BM
- 83% of in-situ cases diagnosed between 2008-2012
- Considered a precancerous lesions
- Incidence increases in correlation with the use of screening mammography
- 20%-53% with untreated DCIS progress to invasive cancer over 10 years or more

LCIS

- Cancerous cells are confined to breast lobules
- It is no more considered a precancerous lesion
- It considered a marker of increased risk for carcinoma
- 13% of in-situ carcinoma diagnosed between 2008-2012

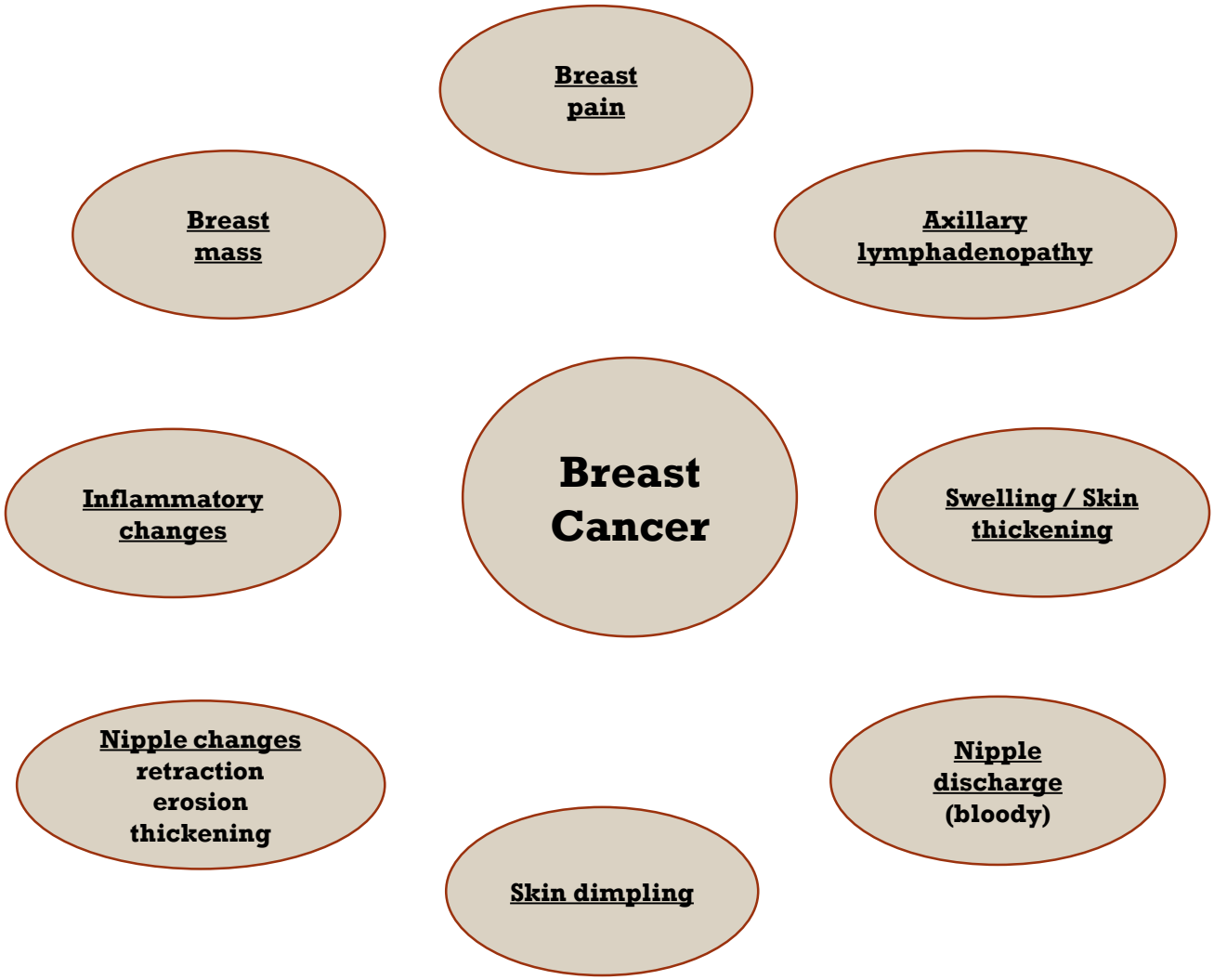
INVASIVE CARCINOMA

- Most common type of breast carcinoma
- Cancerous cells invade walls of glands or duct into surrounding tissue
- The prognosis is strongly influenced by the extent of tumor spread (stage of the disease)

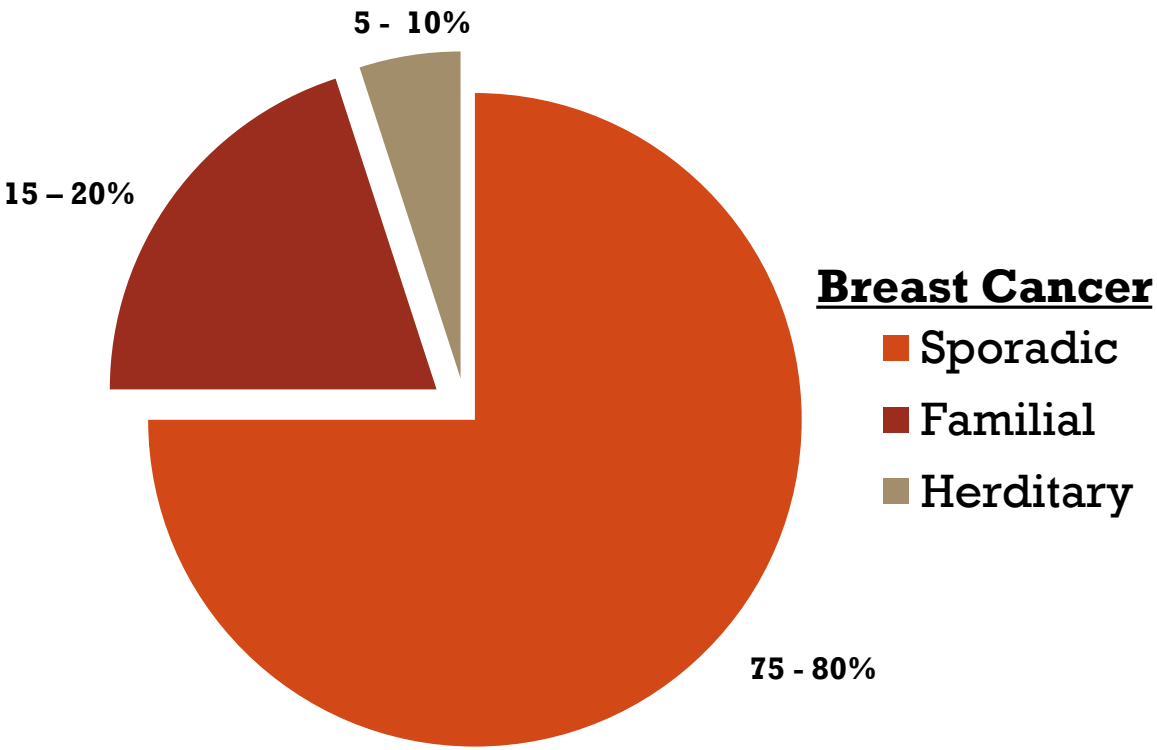
PRESENTATION

- Typically; small tumors are asymptomatic and usually discovered during screening.

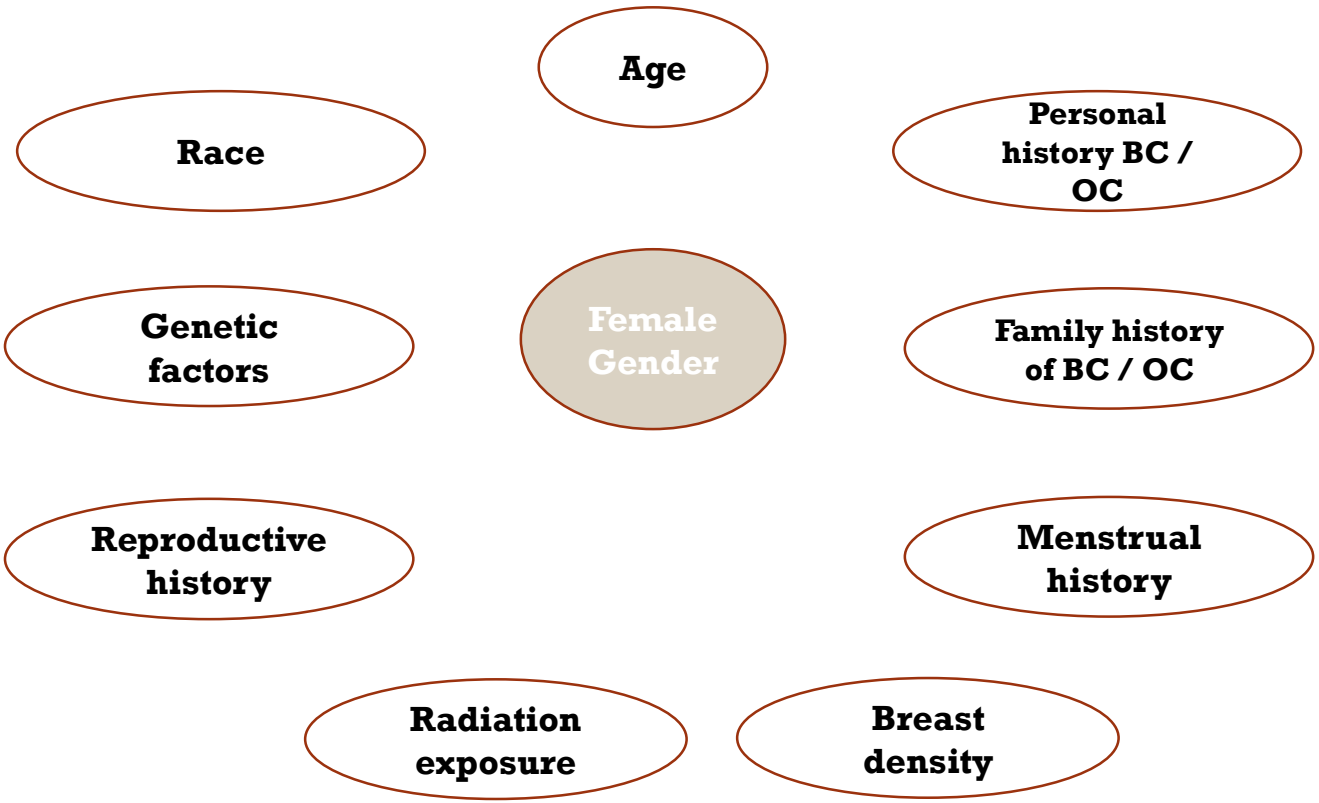
- Symptomatic or palpable tumors are generally present in advanced stage.
  - Generally, more aggressive treatment will be required


Breast pain
Breast mass
Axillary lymphadenopathy
Breast Cancer
Inflammatory changes
Swelling / Skin thickening
Nipple changes
retraction
erosion
thickening
Nipple discharge
(bloody)
Skin dimpling

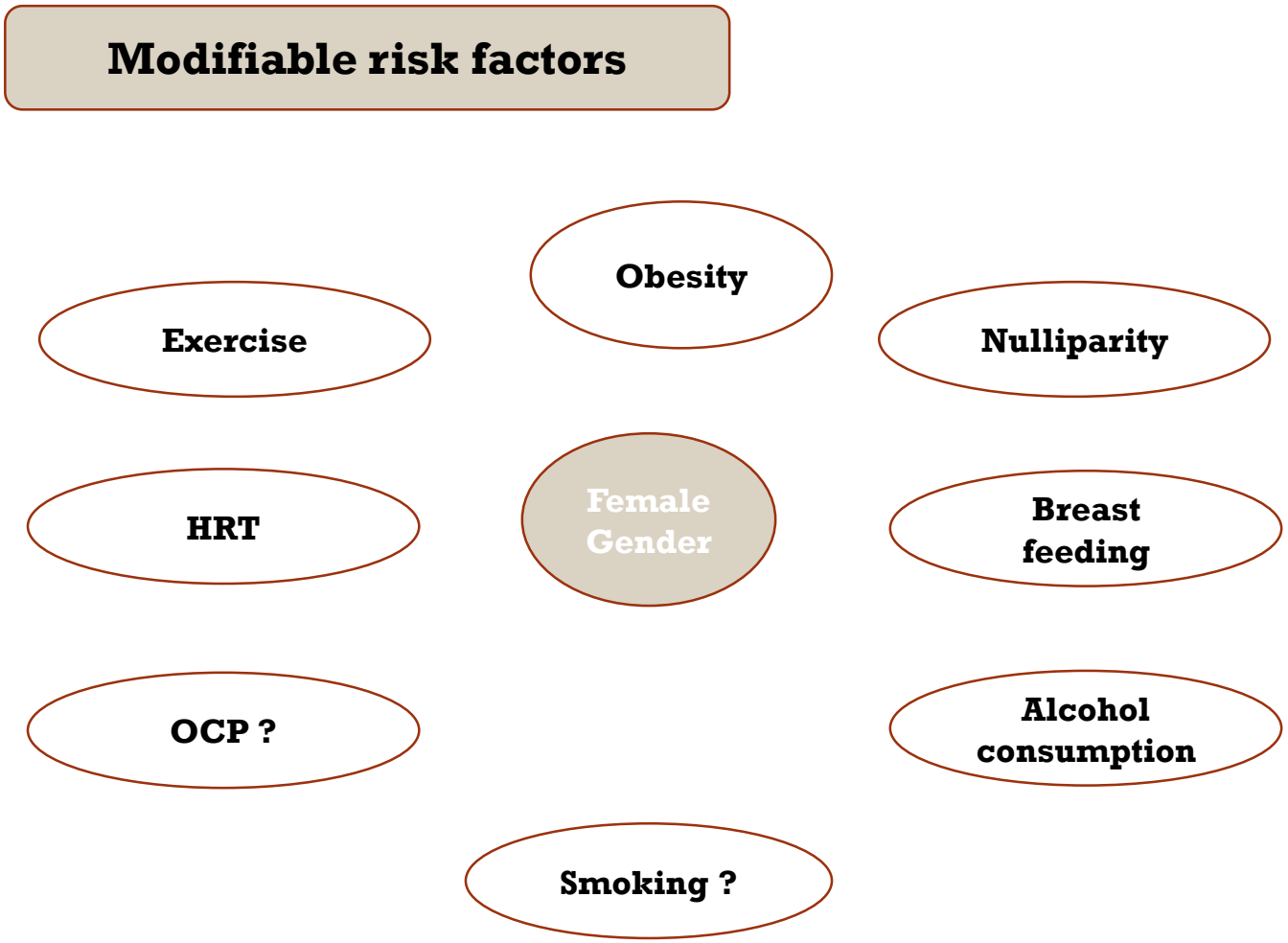
Risk Factors


5 - 10%
15 – 20%
75 - 80%
Breast Cancer
Sporadic
Familial
Herditary

Non modifiable risk factors



Modifiable risk factors

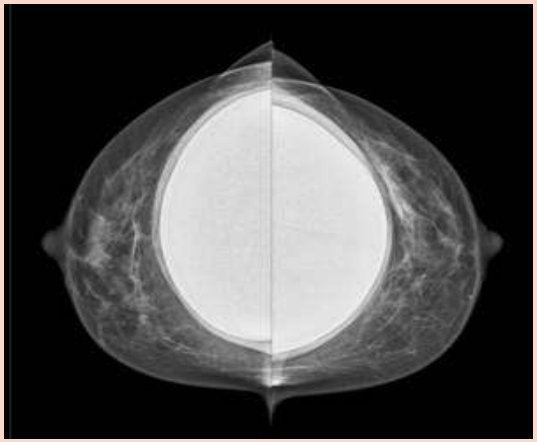


RADIATION

- The link between radiation exposure and breast cancer has been demonstrated in studies of atomic bomb survivors and women who have received high-dose radiation therapy to the chest
- Girls and women treated with high-dose radiation to the chest between 10 and 30 years of age, such as for Hodgkin lymphoma are at increased risk for breast cancer
- Breast cancer risk among women with such exposure starts to rise about 8 years after radiation treatment and continues to be elevated for more than 25 years

Breast implants

- Can be associated with rare type of lymphoma
- Implant displacement view



IMAGING STUDY

- **There are 3 types of Imaging studies**

1- Mammogram

2- Ultrasound

3- Magnetic Resonance Image (MRI)

And there's additional imaging studies:

4-contrast enhanced mammogram

5-molecular imaging

MAMMOGRAM

- The only imaging modality that has been proven to significantly reduce breast cancer mortality in age-appropriate asymptomatic women is annual screening mammography

- A **screening mammogram** is an x-ray examination of the breast of an asymptomatic woman, while a **diagnostic mammogram** is done in a patient with signs or symptoms of breast disease , a possible abnormality detected on screening mammography or other imaging.

- However, the sensitivity of mammography can be limited in dense breast tissue, due to the **presence of overlapping fibroglandular tissue** which reduces conspicuity of abnormalities. Another factor influencing cancer visibility is the tumor growth pattern.

- Tumors which do not produce a mass are often difficult to detect on mammography .
- Depending on these two factors:
- **breast density**
- so we don't use it in women under 30 or in lactating one because of high density (except in highly suspicious cases)

- **tumor growth pattern**
- the false-negative rate of mammography ranges from 8% to 66% in symptomatic women.

- Film Mammography
- Digital Mammography
- 3D Digital Mammography
- (Breast Tomosynthesis)

- **Breast tomosynthesis (3D digital mammography)**
- *Special imaging machines can combines the 2D images into a three-dimensional (3D) image.
- *Distribution and density of fibroglandular breast tissue does not decrease sensitivity of DBT because the overlapping tissue effect is reduced by tomographic technique. Due to the basic principle of DBT which is reducing the anatomical noise, the sensitivity and specificity were increased, thus the lesions were better visualized and more accurately categorized according to the BI-RADS criteria.

- **Is digital better?**
- Yes, for women who are:
- < 50 years old
- Premenopausal
- Dense breasts

- **Sensitivity?**
- Film mammography 54%
- Digital mammography 79%

- **Factors impact breast mammogram sensitivity:**
- Breast density
- Postmenopausal HRT
- Breast implants

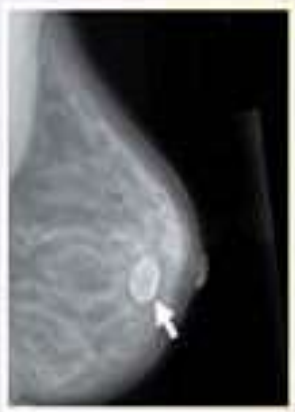
- **Issues related to mammography screening:**
- False-positive results
- + On average, 10% of women will be recalled from each screening examination for
- further testing (most often additional mammographic views of areas of suspicion)
- + Only 5% of these women will have cancer

- Overdiagnosis
- + Detection of cancers that would not cause a woman any harm in her lifetime and that would not have progressed or otherwise been detected in the absence of screening
- + Estimates of the rate of overdiagnosis are highly variable, ranging from <5% to more than 30%

- Radiation exposure
- +The dose required for a mammogram is very small and the risk of harm is minimal
- Limitations
- + Not all breast cancer will be detected by a mammogram
- + some breast cancers that are screen-detected still have poor prognosis.
- + Most women will never be diagnosed with breast cancer, but will undergo regular screening and may experience one or more “false alarms.”

- Findings on Mammogram:
- Mass
- Calcification (micro/macro)
- Architectural distortion OR combination of three beside breast density.
- We must describe every finding in detail.
- Ex: malignant findings like>> irregular, lobulated mass, multiple micro- calcification

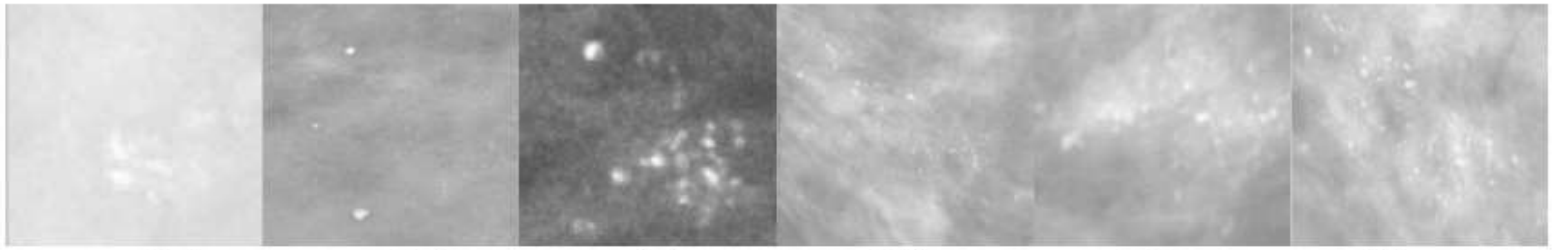
Normal mammogram



Benign cyst (not cancer)

Breast calcifications

Breast cancer



(a) **(b)** **(c)** **(d)** **(e)** **(f)**

Fig. 6 (a) to (c) are benign breast calcification images, and (d) to (f) are malignant breast images

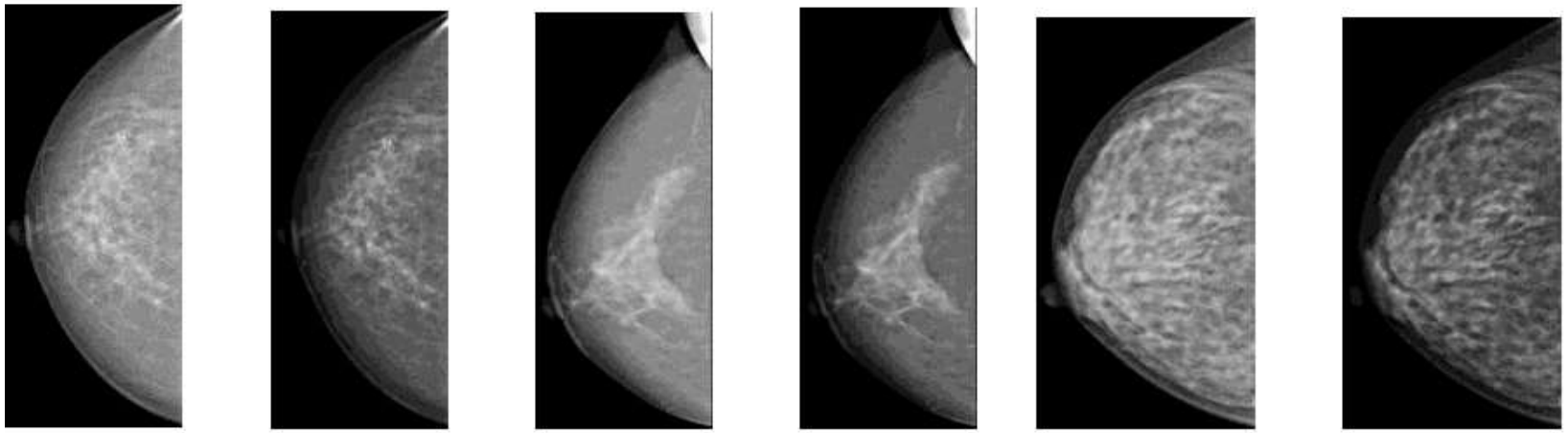


Fig. 7 The result of cubic curve contrast enhancement

- AFTER THAT : BI-RADS classification
- BI-RADS: Breast Imaging Report And Data System classification

Final Assessment Categories			
Category		Management	Likelihood of cancer
0	Need additional imaging or prior examinations	Recall for additional imaging and/or await prior examinations	n/a
1	Negative	Routine screening	Essentially 0%
2	Benign	Routine screening	Essentially 0%
3	Probably Benign	Short interval-follow-up (6 month) or continued	>0 % but ≤ 2%
4	Suspicious	Tissue diagnosis	4a. low suspicion for malignancy (>2% to ≤ 10%) 4b. moderate suspicion for malignancy (>10% to ≤ 50%) 4c. high suspicion for malignancy (>50% to <95%)
5	Highly suggestive of malignancy	Tissue diagnosis	≥95%
6	Known biopsy-proven	Surgical excision when clinical appropriate	n/a

- **Contrast Enhanced Mammography (CEM)**

- is an imaging technique that uses iodinated intravenous (IV) contrast in combination with a standard digital mammogram .

- Some cancers that are not visible on standard mammograms or tomosynthesis can be seen with contrast enhancement .

- The iodinated contrast agents used are identical to the contrast agents used for CT scans , but different from the gadolinium - based contrast agents used in MRI .

- CEM can be used to assess the extent of cancer in women with newly diagnosed breast cancer and to monitor response to ncoadjuvant chemotherapy prior to surgery .

- CEM can be used to evaluate breast symptoms or abnormalities seen on mammograms

- Immediately before the CEM , an IV is placed into an arm vein for injection of a contrast agent.
- When the contrast is injected , the patient may momentarily feel warm all over , experience a need to urinate and sense a metallic taste in her mouth . Imaging starts about two minutes after the contrast injection .
- Cancers typically have more vessels and leaky vessels relative to normal tissue and therefore more contrast agent Areas where there is more of the contrast agent appear white on the " iodine - only " image .
- Normal breast tissue (dense and non dense) and benign (noncancerous) lesions will usually appear dark on CEM . For this reason , most cancers are easier to see on the " iodine only " images than on a standard mammogram or tomosynthesis .

- **Benefits**
- CEM has a higher cancer detection rate compared to standard mammography and to the combination of mammography and breast ultrasound .
- Cancer detection rate have an appearance and accuracy similar to standard digital mammograms . Compared to MRI , CEM shows the same or nearly the same cancer detection rates and can be performed at a lower cost than MRI
- CEM is a relatively short examination , lasting about 10 minutes , and much less than the 30-40 minutes required for a standard breast MRI

- Findings detected on CEM may be seen with ultrasound or in retrospect on 2D mammography or tomosynthesis .
- They can then be targeted for biopsy using these imaging methods , if needed .
- When a suspicious CEM finding cannot be seen on these other imaging exams , direct CEM guided biopsy is appropriate.
- CEM should not be used to avoid biopsy of suspicious calcifications . Some cancers may be visible only as calcifications on the low energy images and not show contrast enhancement on the " iodine - only " images

- iodinated contrast agents carry some risks .
- Women with poor kidney function or a history of prior iodinated contrast reaction should avoid it .
- In women over age 60 or with a history of diabetes , hypertension , or family history of kidney disease (such as polycystic kidney disease) , a drop of blood obtained when the IV line is started will typically be used to check kidney function prior to administering contrast .
- Mild allergic reactions , such as hives , occur in about 1 % of patients within a few minutes of contrast administration .
- Severe allergic reactions resulting in anaphylaxis and possibly death are rare .

BREAST MRI

Breast magnetic resonance imaging (MRI) is a useful tool for :

1- detection and characterization of breast disease

2- assessment of the local extent of the disease

3- evaluation of treatment response,

4- guidance for biopsy and localization.

- Reported **sensitivity** of this modality in detection of invasive breast cancer has approached **100%** in several series and that is one of the reasons why breast MRI is important in preoperative staging.

MAGNETIC RESONANCE IMAGING (MRI)

- MRIs should supplement, but not replace, mammography screening
- Annual MRI screening in addition to mammography for women at high lifetime risk (20%-25% or greater) beginning at 30 years of age.
- Women at moderately increased risk (15%-20% lifetime risk) should be considered case by case.
- MRI screening is not recommended for women whose lifetime risk of breast cancer is less than 15%.
- A recent study indicates that while MRI use in community practice is increasing for high-risk women, it is often used in women who are not at high risk for breast cancer.

American Cancer Society Risk Criteria for Breast MRI Screening as an Adjunct to Mammography[2,18]

Women at high lifetime risk (~20%-25% or greater) of breast cancer include those who:

- Have a known *BRCA1* or *BRCA2* gene mutation
- Have a first-degree relative (mother, father, brother, sister, or child) with a *BRCA1* or *BRCA2* gene mutation, but have not had genetic testing themselves
- Had radiation therapy to the chest when they were between 10 and 30 years of age
- Have Li-Fraumeni syndrome or Cowden syndrome, or have a first-degree relative with one of these syndromes

Women at moderately increased (15%-20% lifetime risk) risk include those who:

- Have a lifetime risk of breast cancer of 15% to 20%, according to risk assessment tools that are based mainly on family history
- Have a personal history of breast cancer, ductal carcinoma in situ (DCIS), lobular carcinoma in situ (LCIS), atypical ductal hyperplasia, or atypical lobular hyperplasia
- Have extremely dense breasts or unevenly dense breasts when viewed by mammograms

Breast MRI findings may be complex due to **physiologic** or **postoperative changes**, meaning that areas of normal breast parenchyma in premenopausal women may appear focally enhanced, a feature that may lead to a **false-positive** finding and a decrease of breast MRI specificity.

- Transiently enhancing foci have been observed in the breasts of many healthy women, especially during the second half of the menstrual cycle. Therefore, **to minimize false-positive results, breast imaging should be performed during the)first half of the menstrual cycle (days 3-14**
- **Disadvantages: cost and availability**

The limitation of breast MRI is **low-to-moderate specificity** ranging from **37% to 97%.**

- Low specificity (False Positive) could be a possible cause of overtreatment.

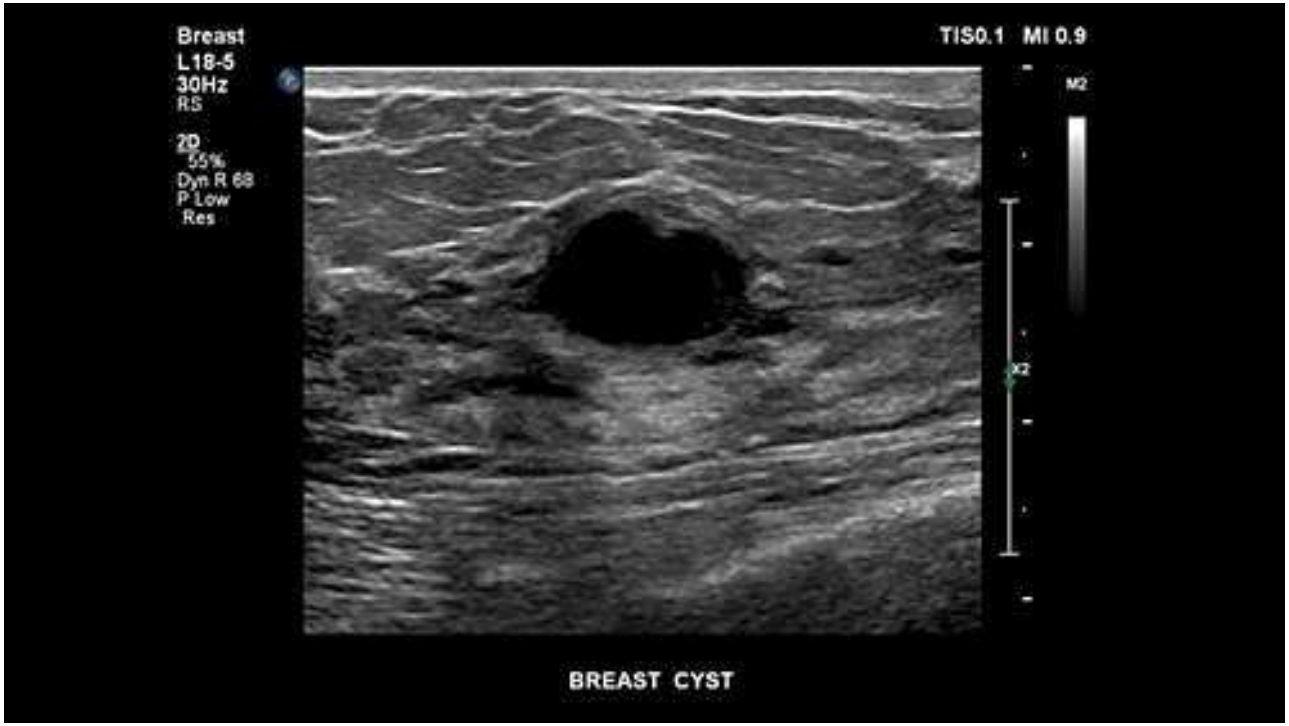
ULTRASONOGRAPHY(U.S)

- Breast ultrasound uses sound waves to make images of the breast.
- It is often used as a follow-up test after an abnormal finding on a mammogram or clinical breast exam.
- Breast ultrasound can tell the difference between a liquid-filled cyst and a solid mass (which may or may not be cancer).

- **Ultrasound is safe, noninvasive and does not use ionizing radiation.**
- **We use it to woman with Breast lump younger than~ 30y, why?! Because of Breast density**

ULTRASONOGRAPHY

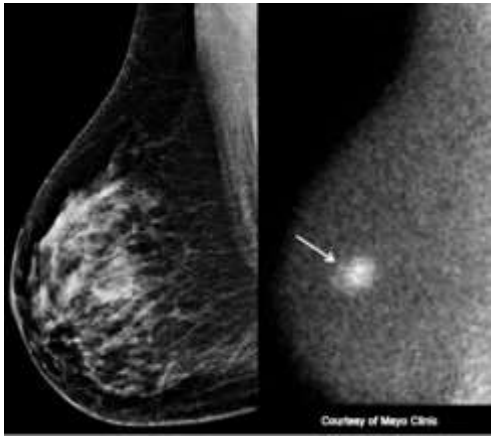
- Sometimes used to evaluate abnormal findings from a screening or diagnostic mammogram or physical exam.
- In combination with mammography, higher sensitivity is achieved when screening women with dense breast tissue *(MMx: 78%, US: 49%, MMx+US: 91%)*
- Also increases the likelihood of false-positive results
- The use of ultrasound instead of mammograms for breast cancer screening is not recommended


Breast
L18-5
30Hz
RS
2D
55%
Dyn R 68
P Low
Res
TIS0.1 MI 0.9
M2
BREAST CYST

MOLECULAR BREAST IMAGING (MBI)

- is a specialized nuclear medicine mammography technique that requires intravenous injection of a radioactive agent and uses a specialized gamma-camera imaging system. Some centers use MBI for complementary screening of women with dense breasts.
- MBI is used to further evaluate the findings Shown on mammography and breast ultrasound
- MBI may be used in women when a breast MRI is recommended but cannot be performed
- The American College of Radiology notes that MBI is usually unsuitable for screening due to a relative lack of evidence and increased radiation exposure.

- The short-lived radioactive tracer 99m Tc-sestamibi accumulates in cancer cells more than normal cells, allowing cancer to be seen due to differences in metabolism.
- MBI does not look at the anatomy of the breast as a mammogram or breast ultrasound does. This technique examines the functional behavior of the breast tissue because the radiotracer accumulates in areas of rapid cell division such as cancers. The radioactive tracer emits invisible gamma rays, and a gamma camera is used to detect these gamma rays. Areas where there is more intense radiotracer uptake are visible on MBI, even in dense breast tissue, and may represent cancer



This 65-year-old woman has heterogeneously dense breasts, with no abnormality seen on mammography (left image, MLO view - meaning image taken from a side angle). MLO MBI image (right) obtained after i.v. injection of 8 mCi (300 MBq) 99m Tc-sestamibi shows intense uptake of radiotracer (arrow) in a 1.9 cm grade 2 invasive ductal cancer with negative axillary node biopsy

- Starting about 5 minutes after intravenous injection of the radiotracer, similar to mammographic positioning but with less compression, each breast is gently stabilized between two detectors, or between one detector and a compression paddle (Breast Specific Gamma Imaging [BSGI]), for about 7 to 10 minutes per view (for a total of 28 to 40 minutes for a routine examination)

ADVANTAGES OF MOLECULAR IMAGING

- MBI, performed with a low-radiation-dose protocol to make benefits of the test outweigh the risk
- Have more specificity(detects an additional 7 to 8 cancers per thousand women screened compared to mammography alone).
- MBI can be helpful for women who need but cannot tolerate MRI due to kidney failure, claustrophobia, pacemakers, or other metallic implants.

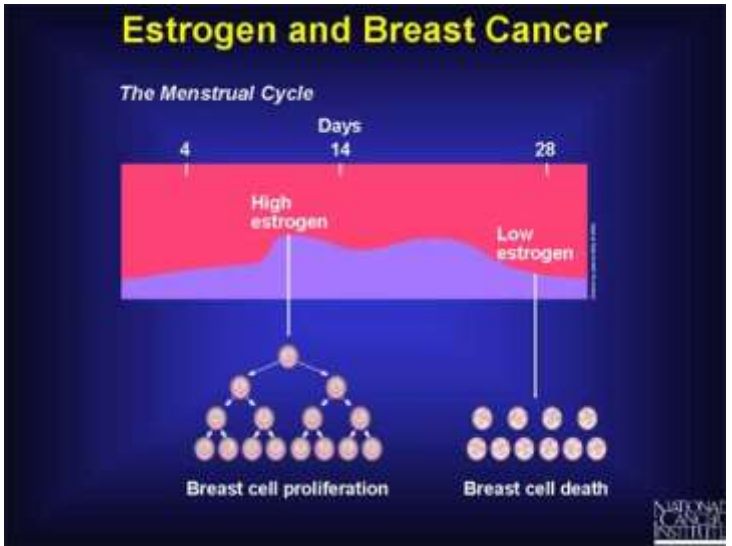
DIADVANTAGES

- Not widely available.
- Requires IV radioactive tracer.
- Exposure to ionizing radiation

Radiation source	Approximate dose to the breast[1]	Estimated effective dose[2]
2D digital mammography	3.8 mGy	0.5 mSv
Tomosynthesis (3D) mammography	3.8 mGy	0.5 mSv
Contrast-enhanced mammography	4.5 to 6.8 mGy	0.5 to 0.8 mSv
MBI (with 8 mCi 99mTc-sestamibi)	1.1 mGy	2.1 mSv
Annual natural background	–	Average: 3 mSv (Range: 2 to 10 mSv)

CAUTIONS:

- Among premenopausal women undergoing MBI, the radiotracer uptake can be higher in normal breast tissue during the latter half of their menstrual cycle, which may complicate interpretation of the test. To avoid this, premenopausal women undergoing MBI may wish to schedule their test earlier in their menstrual cycle (typically days 7 to 14 after the period starts)
- MBI is not used in women who are pregnant.



MAMMOGRAPHIC BREAST DENSITY

- Given the importance of breast density as a risk factor for breast cancer and increasing attention to screening strategies based on density, a brief background on breast density is provided.
- Breast density is defined based on a subjective estimate made by an interpreting radiologist of the relative amount of radiopaque breast parenchyma in relation to radiolucent fatty tissue comprising each breast. This measure does not correlate with physical breast examination findings of breast firmness.
- So Women with high-density breast tissue face two major challenges;

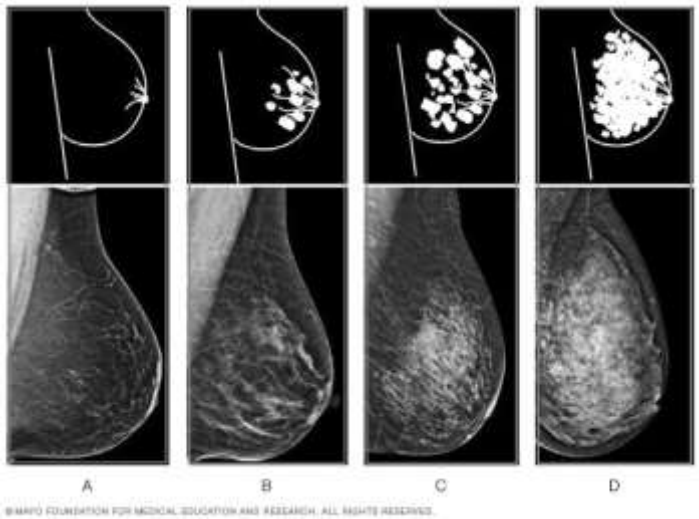
(a) late diagnosis of breast cancer due to poor sensitivity of mammographic screening where dense tissue can obscure cancers, and

(b) higher risk for developing breast cancer.

- According to the American College of Radiology (ACR), breast density should be subjectively classified into one of four categories by interpreting radiologists under the Breast Imaging Reporting and Data System (BI-RADS):

  - Almost entirely fatty
  - Scattered fibroglandular densities
  - Heterogeneously dense
  - extremely dense .

- There is inter- and intra-reader variability in radiologists' interpretation of breast density. Nevertheless, women who fall into the latter two categories are commonly lumped together and considered to have "dense breasts." About 43% of women aged 40–74 in the U.S. have heterogeneously or extremely dense breasts by mammography



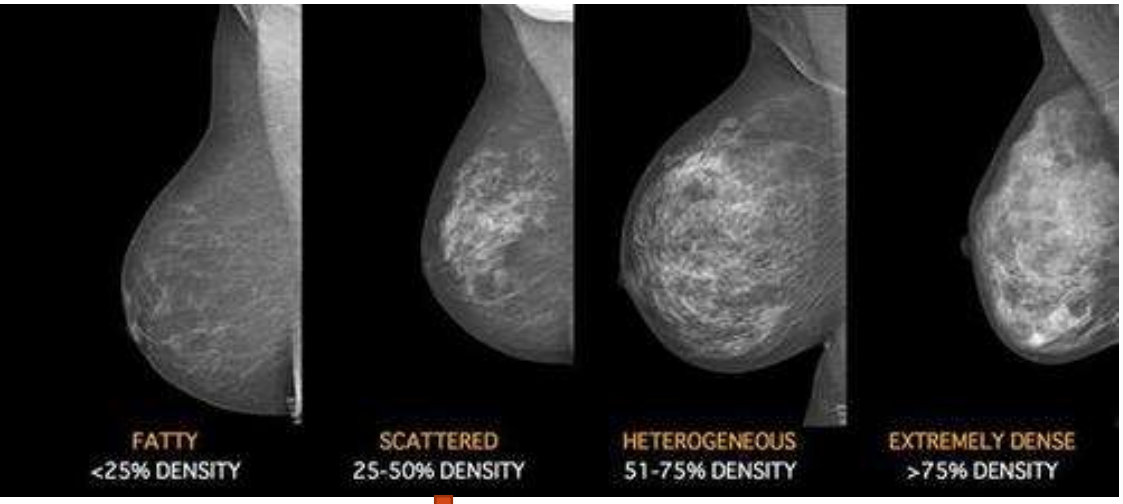
Density Prevalence by Age

	Distribution of BI-RADS Breast Density Categories			
Age	**Almost Entirely Fatty**	**Scattered Fibroglandular Densities**	**Heterogeneously Dense**	**Extremely Dense**
40–44 years	8%	36%	44%	13%
45–49 years	8%	37%	43%	12%
50–54 years	12%	42%	38%	8%
55–59 years	15%	47%	33%	5%
60–64 years	18%	49%	29%	4%
65–69 years	18%	50%	28%	3%
70–74 years	20%	53%	24%	2%
75–79 years	20%	53%	25%	3%
80–84 years	18%	54%	26%	2%
85+ years	19%	54%	25%	3%

- Breast density is influenced by a variety of factors;
- decreases with increasing age
- increases with hormone replacement therapy
- decreases with increasing body mass index (BMI).
- Other modifiable factors influencing breast density include hormonal replacement therapies (HRT) as tamoxifen for chemoprevention,diet changes

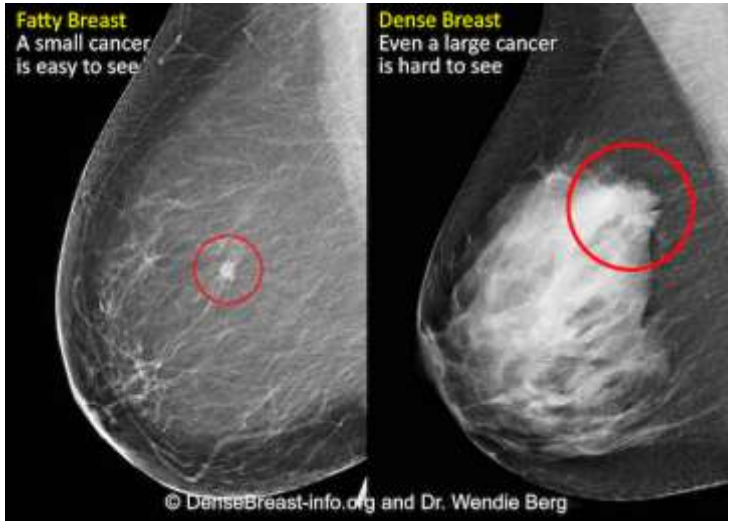
Factors affect breast density	
❑ Genetics	
❑ Increase Age ❑ Pregnancy ❑ Menopause ❑ Obesity ❑ Tamoxifen	Decrease in Breast Density
❑ Alcohol ❑ Combined HRT	Increase in Breast Density

BI-RADS (Breast Imaging Reporting and Data System)



1.1-2 times higher risk for BC

2.1-4 times higher risk for BC



THE CHALLENGE ASSOCIATED WITH SCREENING HIGHLY DENSE BREASTS

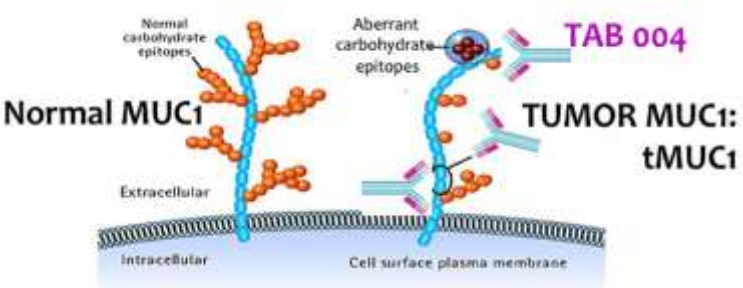
- Screening for breast cancer is predominantly done by mammography and clinical breast exams which has increased the chances of survival.
- While mammograms have resulted in early diagnosis for many women, 27% of breast cancers are missed in women with dense breasts due to lesion obscuration.
- Given these challenges, multi-modal screenings offer the best chance of enhancing breast cancer screening effectiveness.

- Magnetic resonance imaging (MRI), ultrasonography, and digital breast tomosynthesis (DBT) can all be great supplemental tools for breast cancer screening in women with dense breasts, but they all have several disadvantages too.
- Compared to mammography, ultrasound has high sensitivity to detect breast cancer regardless of breast tissue density; however, the specificity is low, which results in high false-positive rates .
- So combining breast cancer screening methods have displayed promising results. In a recent study , ultrasonography in adjunction to mammography significantly increased the number of breast cancers detected in women with MD, compared to mammography alone.
- The combined screening methods detected 27% additional cancers, but the lack of specificity still remains a limitation of this adjunctive therapy .
- Screening mammography is limited because of its two-dimensional nature. Recent breast cancer screening method includes the DBT which is a three-dimensional (3D) X-ray imaging technology that creates a 3D cross section of the breast tissue, allowing for better all-over visualization of the breast.
- Therefore, DBT limits the possibility for missing tumors because of the overlap of breast tissue seen in the 2-D imaging of the traditional screening mammogram. It has been observed that women undergoing DBT in addition to mammography had significantly lower false positive cancers reported than women going through digital mammography alone . Unfortunately, DBT uses twice as much radiation as conventional mammography, and most insurance companies are unwilling to pay for the extra cost. Thus, adoption is limited. Another disadvantage is that interpretation of the DBT X-ray images is greatly dependent on the radiologist's expertise, and is, therefore, highly variable. Thus, there remains a pressing need for the development of additional non-invasive tests that can be used in conjunction with mammography.

Imaging Modality	Advantages	Disadvantages
Digital breast tomosynthesis	- Improved cancer detection - Reduced false-positives - Obtained during standard mammogram exam - Widely available - Being adopted as a primary screening modality	- Additional ionizing radiation when added to digital mammography - Additional out-of-pocket costs if payers do not cover it
Screening ultrasound	- Widely available - Improved cancer detection - No ionizing radiation	- Highly operator-dependent - Increased false-positives - Increased benign biopsies - Additional out-of-pocket costs if payers do not cover it
Magnetic resonance imaging	- Highest sensitivity for detecting additional cancers - No ionizing radiation	- Not widely available - Requires intravenous gadolinium injection - Increased false-positives - Increased benign biopsies - Additional out-of-pocket costs if payers do not cover it
Contrast-enhanced spectral mammography	- Improved cancer detection - Obtained during standard mammogram exam	- Not widely available - Requires intravenous contrast injection - Additional out-of-pocket costs if payers do not cover it - Additional ionizing radiation when added to digital mammography
Molecular breast imaging	- Improved cancer detection - Potentially improved specificity	- Not widely available - Requires intravenous radioactive tracer injection - Additional ionizing radiation

NEW, EMERGING BIOMARKER FOR EARLY DETECTION OF BREAST CANCER IN WOMEN WITH DENSE BREASTS

- TAB 004 is an antibody developed to target tumor-associated MUC1 (tMUC1), an antigen that is present at high levels in the serum of cancer patients, including pancreatic and breast cancer .
- MUC1 is present on the surface of normal cells, and contains extensive *O*-glycan branching on its N-terminus domain.
- However, in a tumor microenvironment, MUC1 loses its O-glycan branching and dissociates from its C-terminus domain, which is attached by hydrogen bonding. The low glycosylation on tMUC1 exposes its variable number tandem repeat (VNTR) region, which allows TAB 004 to bind and be detected . TAB 004 specifically recognizes tMUC1 across all breast cancer subtypes and is not affected by tissue density. Thus, tMUC1 can serve as a biomarker that can aid in BC diagnosis in women with dense breast tissue.
- TAB 004-based ELISA has been developed to monitor circulating levels of tMUC1 in patients with and without breast cancer across high and low density tissue to aid in the early detection of BC in conjunction with mammography
- In a longitudinal screening study, the results showed that the tMUC1 biomarker test could detect breast cancer 2 years prior to diagnosis by screening mammography



BREAST CANCER SCREENING

Screening Protocol

Individualized

- **What ?**
- **When ?**
- **How often?**

- ❑ **Age**
- ❑ **Estimated Risk**
- ❑ **Individual risk factors**
- ❑ **Family history**
- ❑ **Genetics**

AMERICAN CANCER SOCIETY SCREENING RECOMMENDATIONS FOR WOMEN AT AVERAGE BREAST CANCER RISK

- These guidelines are for women at average risk for breast cancer. For screening purposes, a woman is considered to be at average risk if she doesn't have a personal history of breast cancer, a strong family history of breast cancer, or a genetic mutation known to increase risk of breast cancer (such as in a BRCA gene), and has not had chest radiation therapy before the age of 30. (See below for guidelines for women at high risk.)

- Women between 40 and 44 have the option to start screening with a mammogram every year.
- Women 45 to 54 should get mammograms every year.
- Women 55 and older can switch to a mammogram every other year, or they can choose to continue yearly mammograms. Screening should continue as long as a woman is in good health and is expected to live at least 10 more years.
- All women should understand what to expect when getting a mammogram for breast cancer screening – what the test can and cannot do.
- Clinical breast exams are not recommended for breast cancer screening among average-risk women at any age.

CLINICAL BREAST EXAMINATION (CBE)

- The American Cancer Society no longer recommends CBE for average-risk asymptomatic women

- Compared to mammography alone, CBE plus mammography has been shown to detect only a small proportion of breast cancer tumors and increases the probability of false-positives

- Clinicians are encouraged to use this time to counsel women on the importance:
  - Identifying alarming breast changes
  - Discussing potential benefits, harms, and limitations of screening mammography
  - Address other important aspects of preventive services

BREAST SELF-AWARENESS

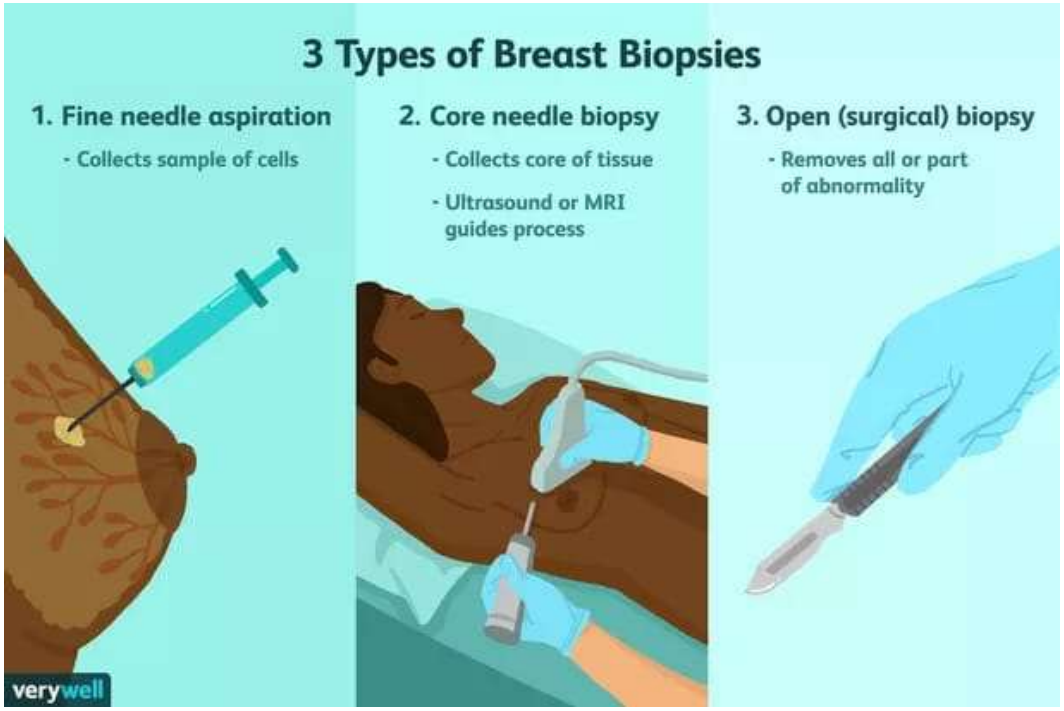
- The American Cancer Society no longer recommends that all women perform monthly breast self-exams (BSE)
- All women should become familiar with both the appearance and feel of their breasts and report any changes promptly to their physician.
- Experts have concluded that self-awareness seems to be at least as effective for detecting breast cancer as structured BSE
- Women who detect their own breast cancer usually find it outside of a structured breast self-exam while bathing or getting dressed.

- If symptoms develop, women should contact a doctor immediately, even after a recent normal mammogram.

- Most lumps are not abnormal, and for women who are still menstruating, they can appear and disappear with the menstrual cycle.

- Most breast lumps are not cancerous

BIOPSY


3 Types of Breast Biopsies
1. Fine needle aspiration
- Collects sample of cells
2. Core needle biopsy
- Collects core of tissue
- Ultrasound or MRI guides process
3. Open (surgical) biopsy
- Removes all or part of abnormality
verywell

BIOPSY

1. **Fine-needle aspiration (FNA) 21-23G needle:**

We will talk about it later

2. **Core-needle biopsy 14G needle:**

Breast cancer detections for women with suspicious lesions mai nly depend on two non-operative pathological tests-fine needle aspiration cytology (FNAC) and core needle biopsy (CNB).

The aim of this systematic review was to compare the sensitivity and specificity of CNB and FNAC in this setting

3. Open (surgical) biopsy:

An open biopsy may be incisional(involving the removal of part of the abno rmality) or excisional (removing all of the abnormality).

WHAT ARE INDICATION FOR BIOBSY ?

- A breast lump
- Breast dimpling
- An orange peel appearance to the breast
- Skin thickening on the breast
- Nipple changes, such as a retracted nipple
- Nipple discharge
- A red rash or sores on the breast
- Enlarging veins on the breast
- A change in size, shape, or weight of a breast
- An enlarged lymph node in the armpit

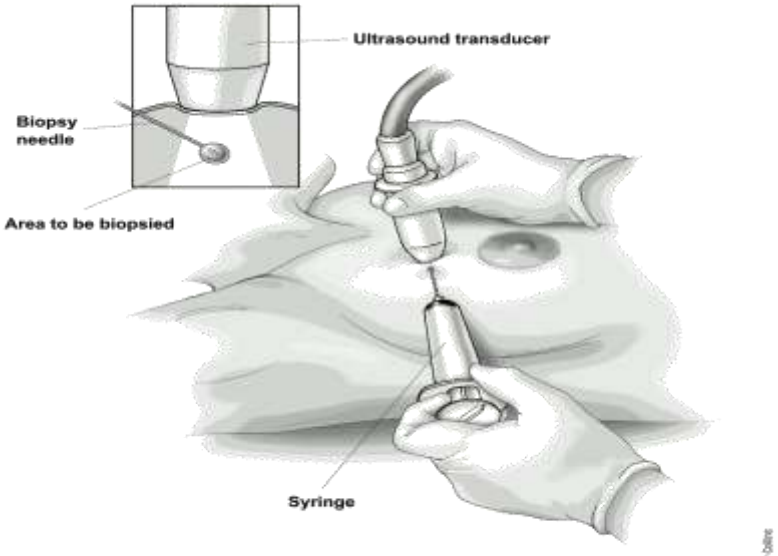
BIOPSY

FINE-NEEDLE ASPIRATION (FNA)

What is an FNA breast biopsy?

- This involves inserting a thin needle through the skin in order to collect a sample of cells. It is particularly helpful in distinguishing fluid-filled cysts from solid masses .
- If the area to be biopsied can be felt, the needle can be guided into it while the doctor is feeling it.

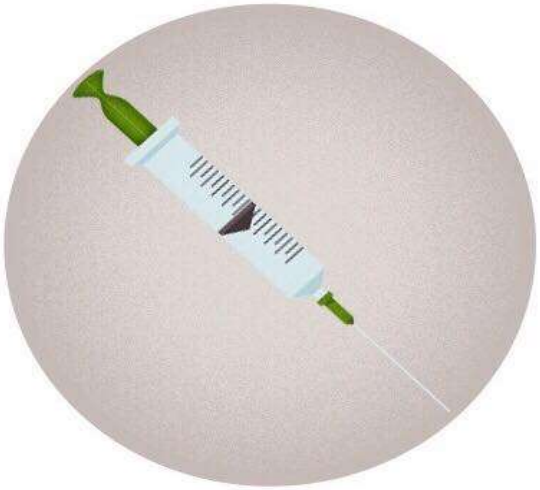
- If the lump can't be felt easily , the doctor might watch the needle on an **Ultrasound** screen as it moves toward and into the area. This is called an **Ultrasound-guided biopsy .**



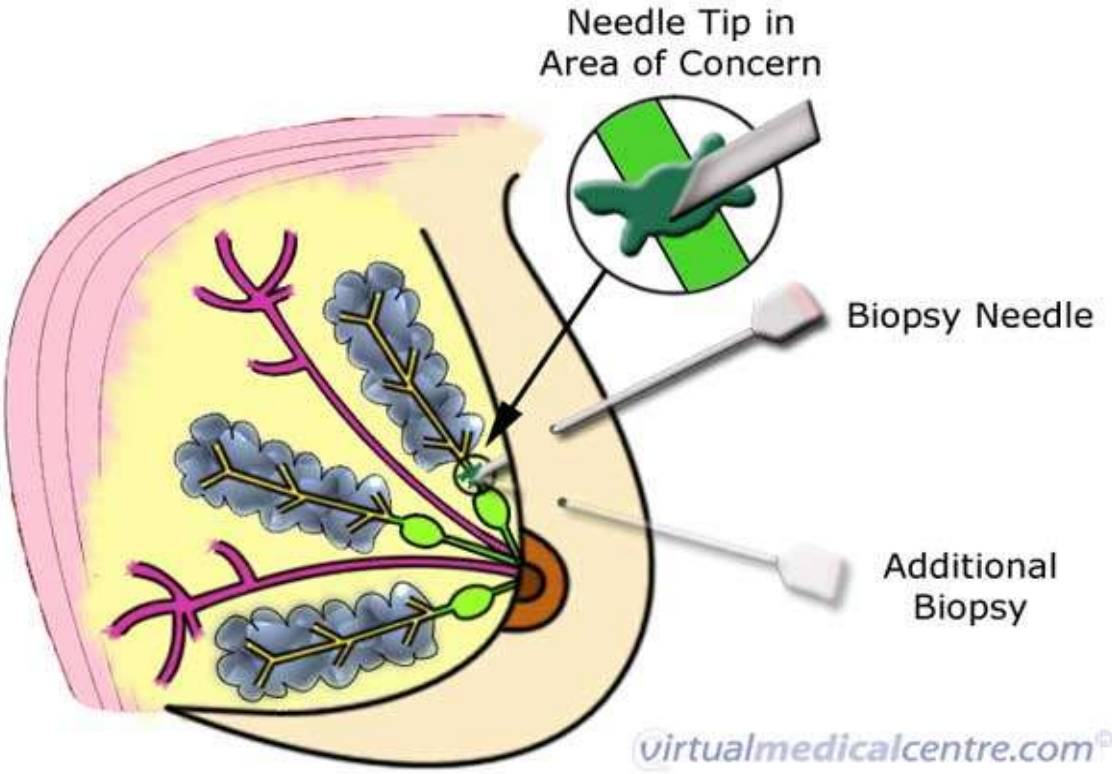
Fine needle aspiration using ultrasound

- The type of needle used for fine needle aspiration biopsy has a hollow interior and is much finer than a regular needle used to draw blood.

Fine-Needle Aspiration



- A **vacuum** or **negative pressure** is created in the needle and with an in and out motion of the needle, the sample is taken. Several needle insertions may be required to ensure that the sample is adequate.
- There are generally no complications with this procedure, though you may experience some tenderness or bruising over the needle insertion site.


Needle Tip in
Area of Concern
Biopsy Needle
Additional
Biopsy
virtualmedicalcentre.com

ASPIRATE SAMPLES MAY BE DESCRIBED AS ONE OF THE FOLLOWING TYPES:

Cytology categories	Explanation
C1	Inadequate
C2	Benign
C3	Atypical, probably benign
C4	Suspicious, favor malignancy
C5	Malignant

Advantages FNAC :

- rapidity of diagnosis,
- high acceptance,
- cost-effectiveness,
- ability to sample multiple areas at a single go,
- Less invasive/less painful secondary to smaller needle size
- Can be performed in the clinic or office
- Appropriate for patients who are being anticoagulated with low risk of hematoma/bleeding
- Can be used to sample axillary tissue
- therapeutic aspiration is also possible in case of a cyst .

The major limitation of FNAC is

- **(1)** its inability to diagnose some benign or borderline breast lesions and their distinction from the malignant lesions.. Another major limitation is
- **(2)** the highly variable range of sensitivity and diagnostic accuracy of FNA smears depending on the experience of the cytopathologist.
- **(3)** A variable and sometimes high rate of false negativity due to sampling error or error of interpretation have also prompted many clinicians to raise fingers against the efficiency of FNAC.

FALSE-POSITIVE AND FALSE-NEGATIVE RATES

The false-positive and false-negative rates of FNAC are different in different studies. However, most of the recent studies show a low **false-positive rate** of FNAC ranging from **0% to 2.5**.

The **false-negative rate** of FNAC is, however, variable, high and is in the range of **5–10%** although an even higher rate over and above **15%** has also been documented .. The reason for false negativity can be either (a) sampling error or (b) an interpretative error.

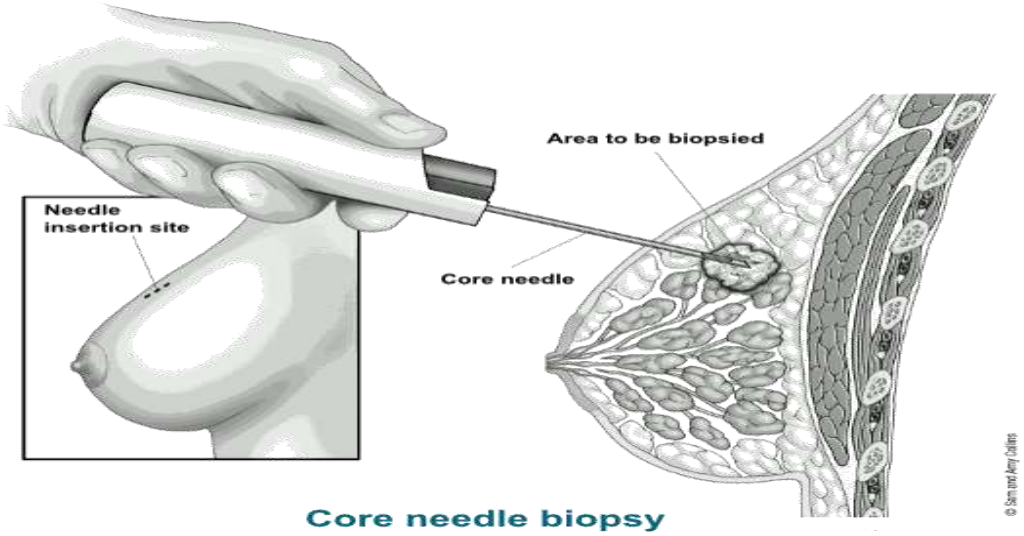
Core-needle biopsy

- **Core biopsy** is another method of 'tissue diagnosis' – that is, a way of sampling the cells in a suspicious lump or mass. It is sometimes used instead of fine needle aspiration biopsy, or vice versa.

- This requires the use of a larger needle than a fine needle biopsy and removes a core of tissue, rather than a collection of cells.

Core-Needle Biopsy

As with Fine Needle Aspiration , Ultrasound or Mammographic guidance may be needed to locate the lump or area to be sampled. Core biopsy is done under local anesthetic . The procedure usually takes between 30 minutes and 1 hour . A core biopsy may result in a small, very fine scar where the incision was made.



Core needle biopsy

- The **sensitivity** of core-needle biopsies performed using either stereotactic or ultrasound guidance is 97–99 percent
- The **rate of complications** (hematoma formation, bleeding, and infection) after core-needle biopsy is less than 1.5 percent (median).
- The **false-positive rate** in CNB is **low** and in most of the studies comparable to FNAC.
- The **false-negative rate** in CNB is also **variable** and many of the studies register a rate even higher than that of FNAC .

- False-negatives can result from

(1) core needle sampling errors,

(2) failure to recognize imaging-histology discordances, and

(3) inappropriate follow-up periods for benign biopsies

- In previous studies of US-guided 14-gauge CNBs with at least 2 years of follow-up, the **false-negative rates has ranged from 0.1% to 2.5%**

INTERPRETING RESULTS

Findings may be listed on the report as:

- **Normal**
- **Benign (noncancerous) breast conditions**
- **Benign breast conditions that increase the risk of cancer**
- **Carcinoma in situ**
- **Cancer**

THANK YOU ..