



431

## Radiology Team

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## Lecture 6: Radiology of The Breast



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◆ Important

◆ Doctor's notes

◆ Team's notes

All the images are from the slides

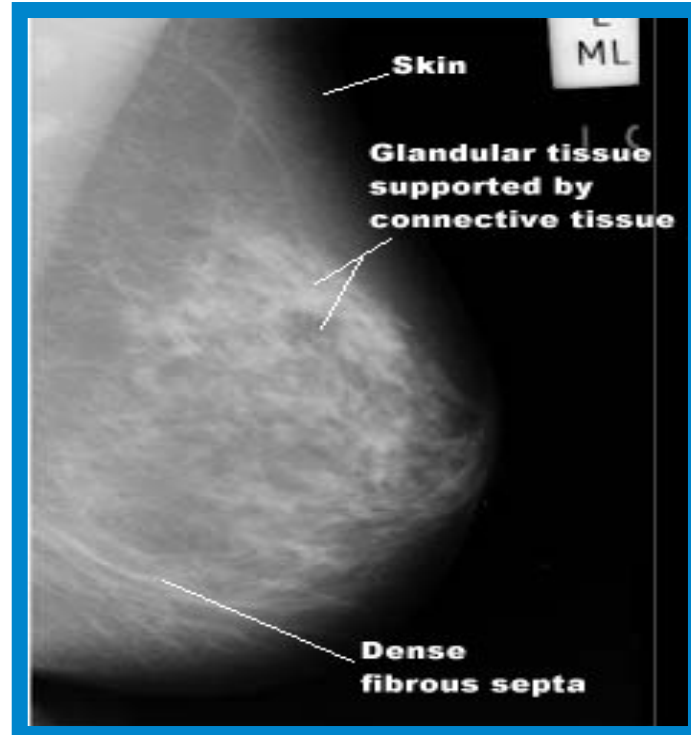
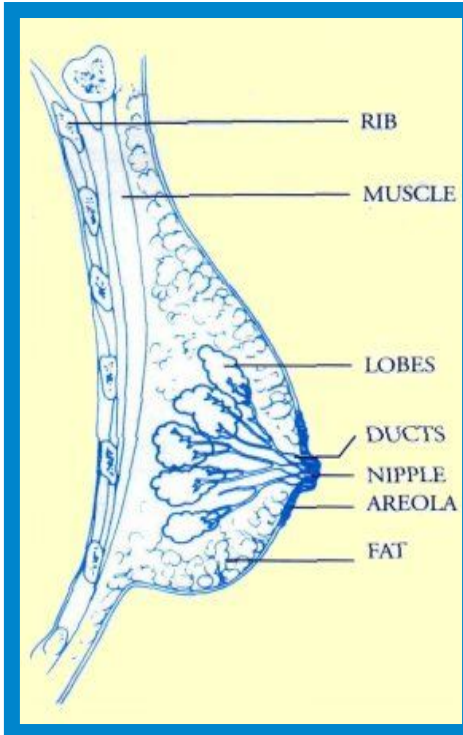
## OBJECTIVES:

- \* TO UNDERSTAND the **ANATOMY** of the breast radiology/imaging based.
- \* To highlight the **SUITABLE MODALITY** for **AGE** and disease of the breast.  
(Because the breast changes with age)
- \* To understand the **ROLE OF RADIOLOGY** in diagnosing breast lesions particularly breast cancer.

## Anatomy:

### Normal mamography of the breast :

Glandular tissue prtected by fat.

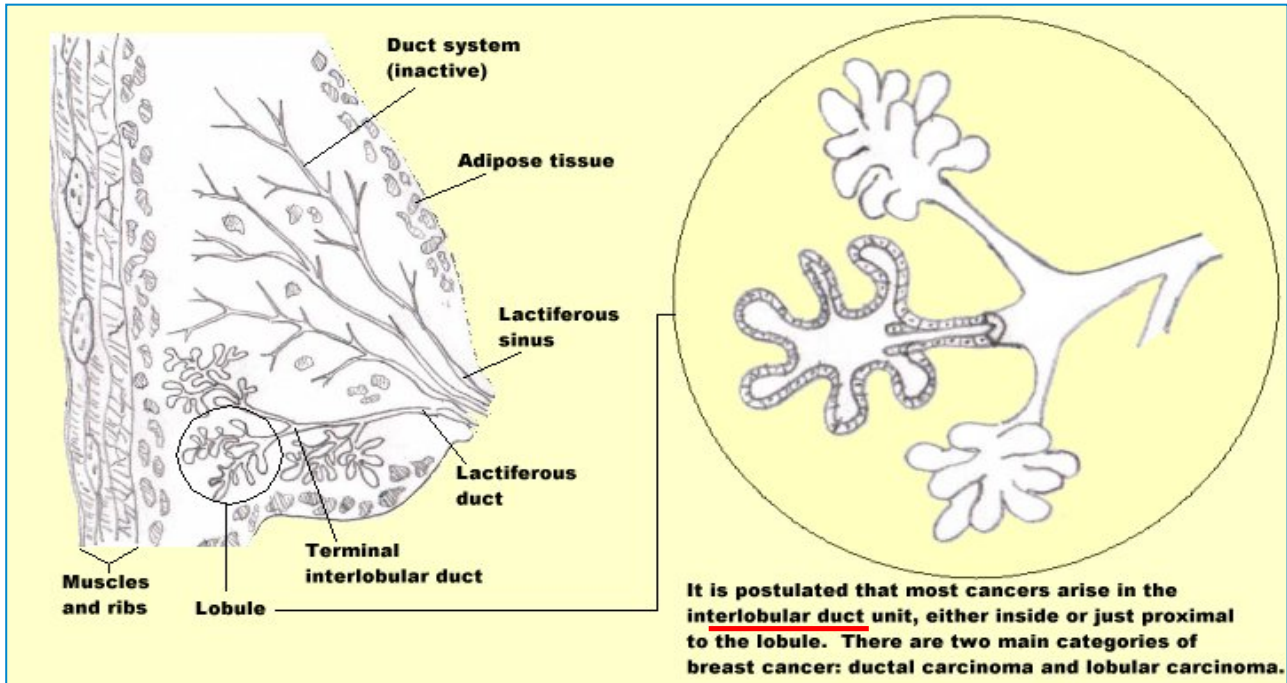


### On mammogram:

- ❖ The **fat** appears **grey/black** according to the amount.
- ❖ The **glandular tissue** is **white** in younger females because there is more glandular tissue, while in **older females** there is **more fat**.

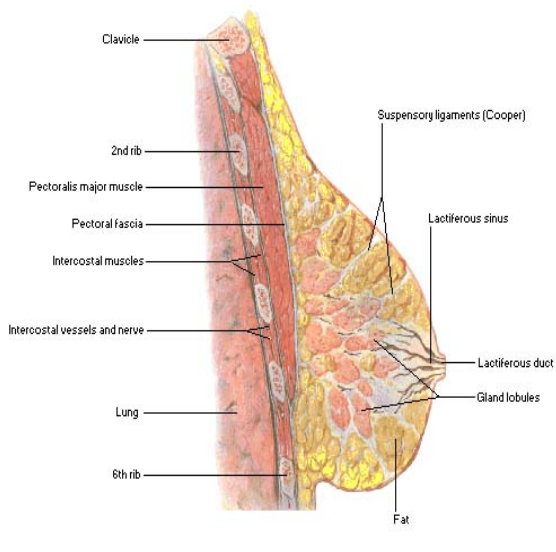
This is an old patient, the glandular tissue is atrophied and more fat is present, so all the structures are grey/black in color.

Since malignant tumors appear white, they are easily seen in older women.



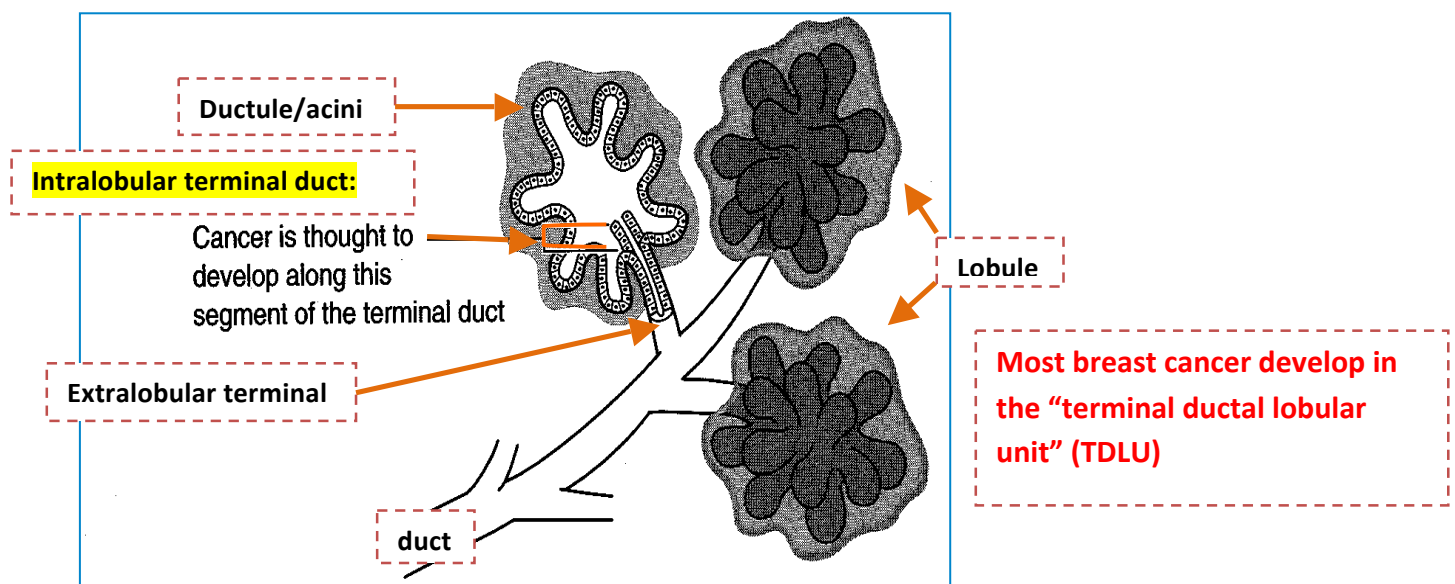
Breast is formed of glands which are surrounded by fat and attached to the chest wall.

- Glandular tissue increases and decreases in size due to hormonal effect.
- 95 % of malignancies in the breast arises from The interlobular duct unit.



*A. N. S.*  
@Howartis

**Where in the Breast does cancer develop?** Interlobular duct is the source of malignancy.



The epithelium inside the lobules is histologically distinct from the epithelium in the extralobular ducts.  
Breast cancer can be divided into two major groups.



## IN SITU

Tumor cells have not invaded the basement membrane.

**Tumor cells remain confined to the ducts or lobules.**

Better prognosis than invasive.



## INVASIVE:

Tumor cells invade the breast stroma.

They have the potential to metastasize and result in death of the patient.

### Ductal cancer evolves over time

Clinical and molecular research have demonstrated that there is likely often a linear progression of sequential stages of epithelial proliferation.

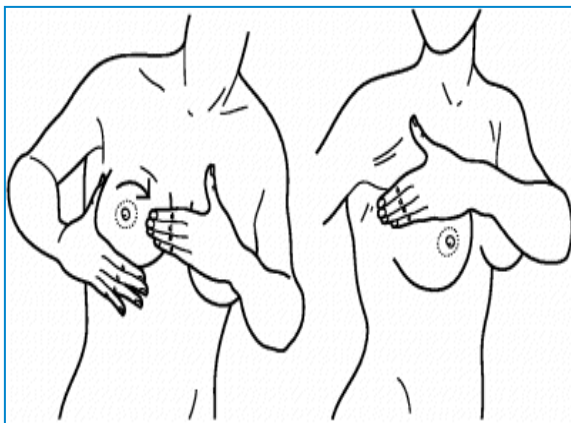
Note: Normal and Atypical Ductal Hyperplasia have no findings.



### The Four Pillars of Diagnosis:

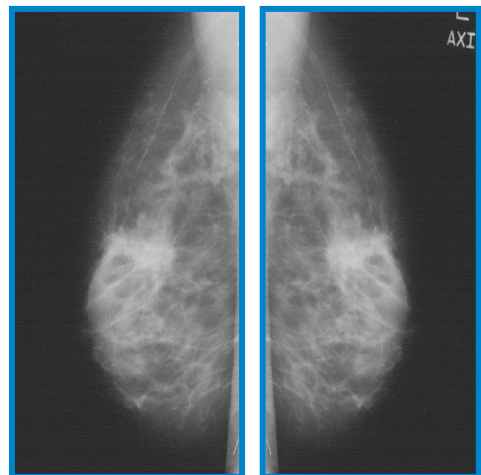
#### Clinical or Self Examination (PE)

The most important method for early detection



#### Mammography (MG)

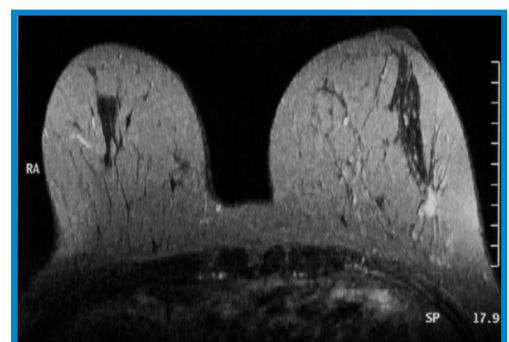
Gold standard



#### Ultrasound (US)



#### Magnetic Resonance Imaging (MRI)



#### 2. Mammography: (again, it's the gold standard)

- \* Screening mammography: for patients at risk
- \* Diagnostic mammography: patient presents with palpable mass or symptoms (nipple bleeding)



### 3. **Ultrasound:**

For malignant lesions and biopsy

### 4. **MRI:**

A very accurate modality

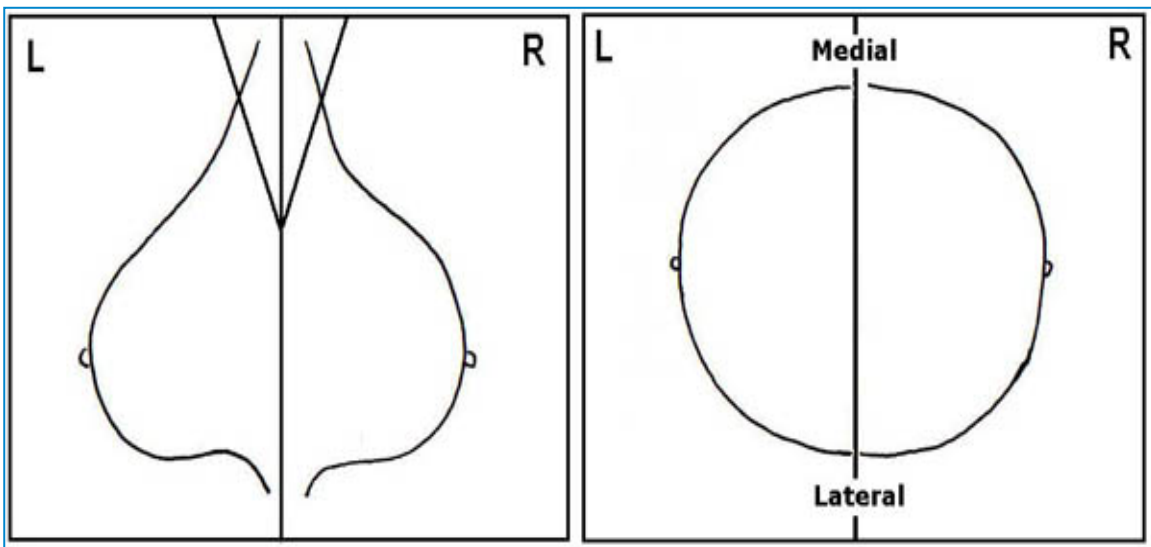
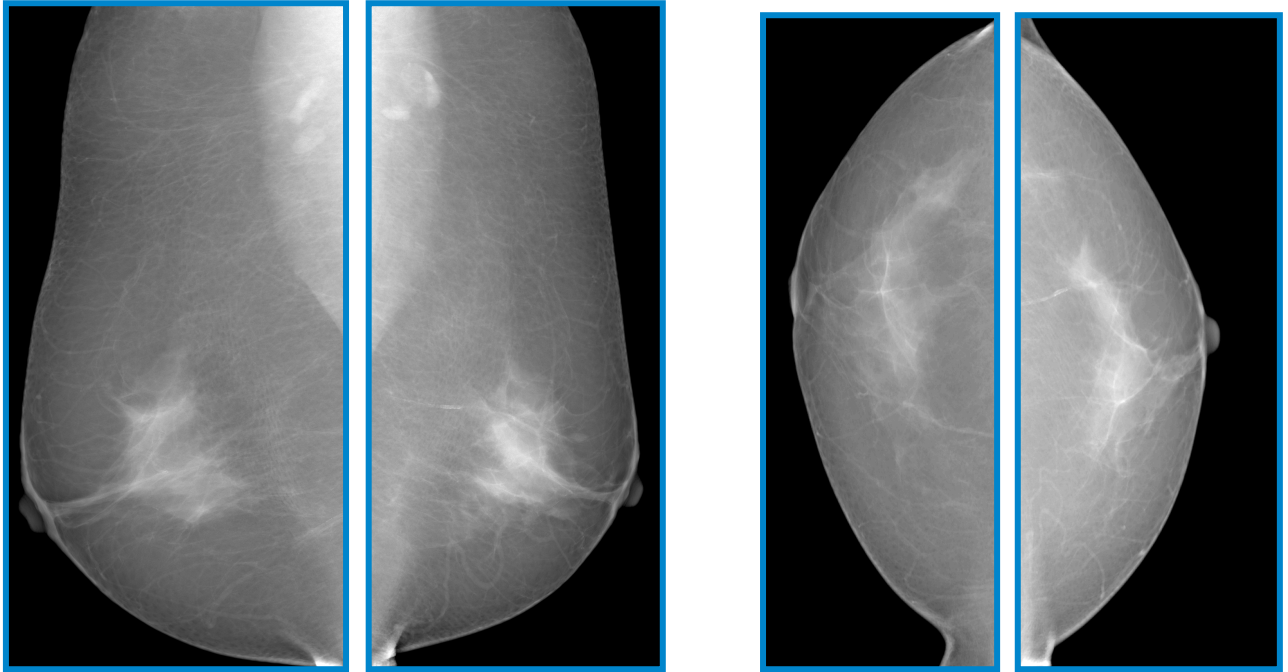
## **Menu of Tests:**

- \* **Mammography:** (contraindicated in pregnancy)  
Can rule IN cancer, but can't rule it OUT.
- \* **Ultrasound.**
- \* CT scan (w/ and w/o contrast) (used in malignant lesions and to detect metastasis)
- \* **MRI** (w/ and w/o Gd contrast).
- \* Ultrasound- or MR-guided biopsy and wire localization.
- \* Bone radionuclide scan.
- \* Lymphoscintigraphy.

### **1- Mammography:**

- \* X-ray examination of the breast is carried out with dedicated equipment designed to demonstrate soft tissues of the breast to advantage.
- \* A normal mammogram shows ductal and connective tissue in a background of fat.
- \* With increasing age, glandular tissue atrophies and cancers become easier to identify.
- \* The mammographic appearances of the normal breast vary greatly from one patient to another.
- \* **In younger patients, it is best to start with ultrasound because they have more glandular tissue, which makes detecting abnormalities difficult.**
- \* **With older patients, start with mammography.**

## Viewing Methods



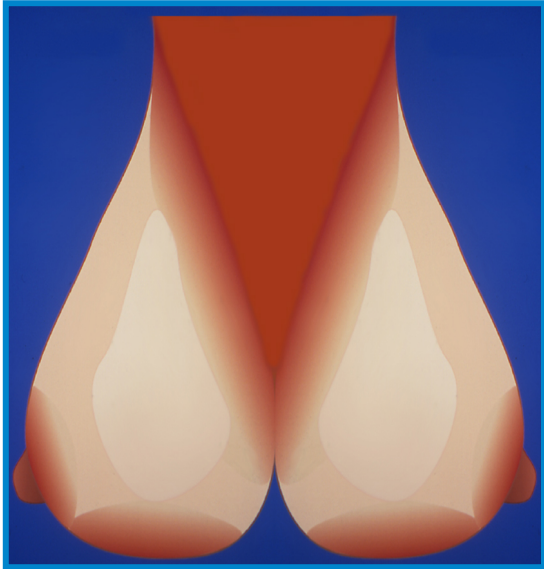
**Mediolat.obliques**

**Cranio-caudal views**

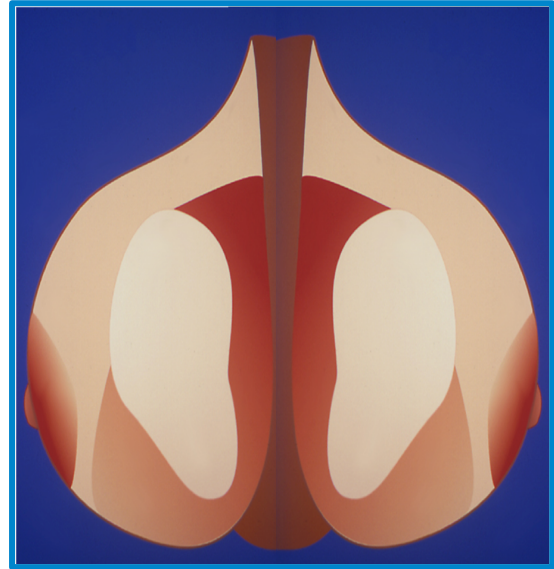
### **2 views :**

1. **Mediolateral view ( tube is medially , film is laterally )**
  2. **Cranio-caudal view ( tube is above the breast , film is under the breast )**
- \* Breast is compressed to decrease the thickness (for a better visualization) , And to decrease the amount of radiation to the breast.
  - \* Don't forget to compare both sides.
  - \* Always examine both breast, don't examine one breast because 3 – 7% of patients have bilateral lesions, which may cause metastasis if missed.

## Review Areas

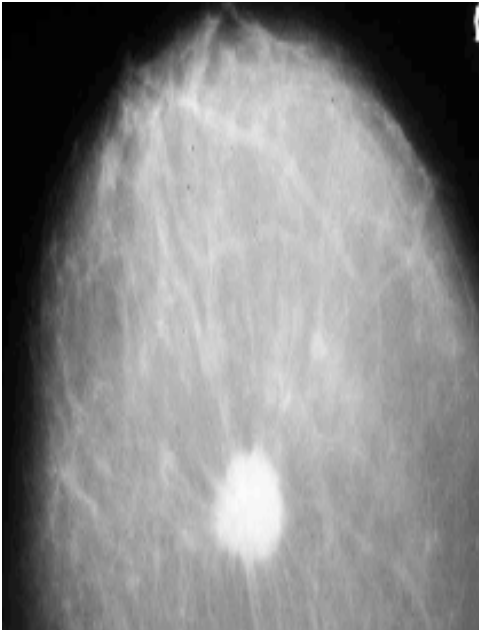



Mediolat.obliques



cranio-caudal views

**FIRST** Decide if there is a mass (compare both breasts):

| <u>MASS</u>   | <u>ASSYMETRICAL DENSITY</u>  |
|---|--|
| CONVEX borders  | Ill-defined or irregular   |
| Denser towards center   | Amorphous density  |
| Distorts related parenchyma   | No   |
| Seen in <b>multiple projections</b>   | No   |
| Still seen in focal compression view  | Tissues spread over it.  |
|  |  |



IF a mass is palpable at the site of focal asymmetry we must take a **BIOPSY**.

## **2-Ultrasound:**

### **Indications for Breast Ultrasound:**

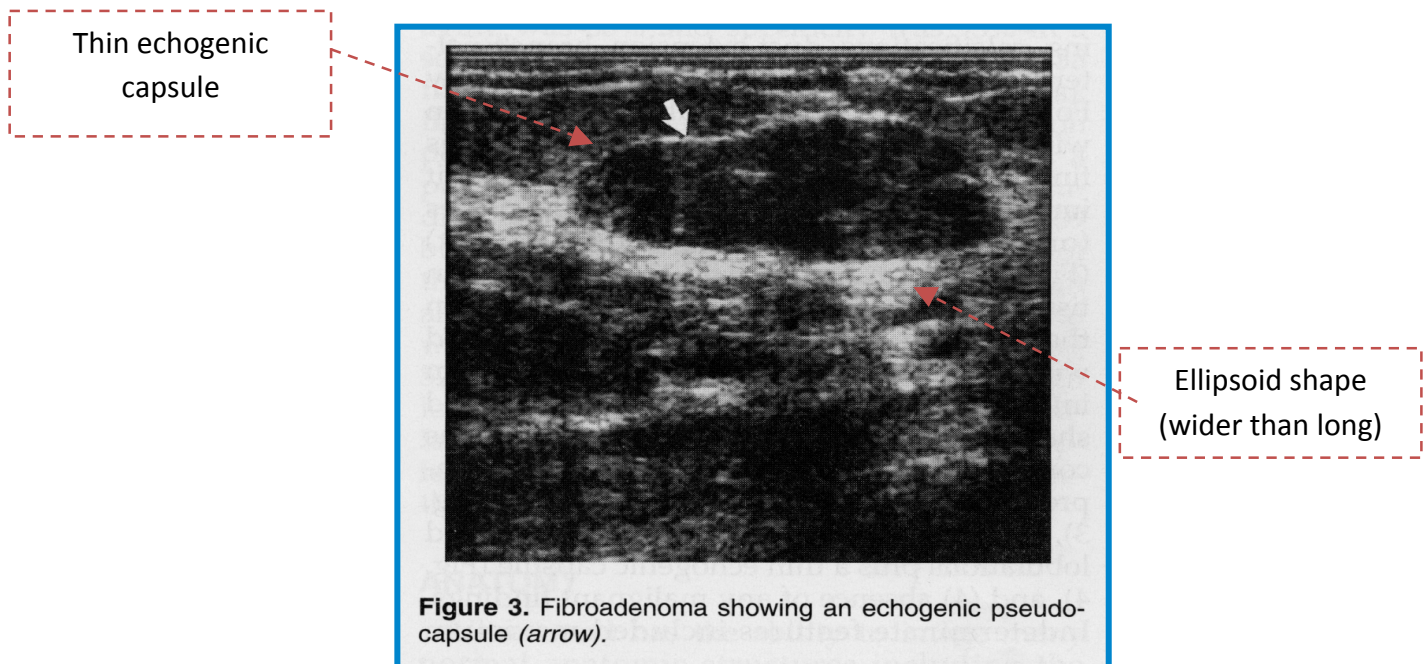
- \* Differentiation of both palpable and mammographic lesions as either **cystic or solid**.
- \* Subsequent characterization and classification of solid nodules according to certain sonographic features.
- \* **Evaluation of palpable breast mass in patient younger than age 30.**
- \* Interventional procedures (BIOPSY).

### **Methods: Identification of Malignant Features:**

- \* First, they identified lesions with any of the following malignant features:
- \* Spiculation (asymmetric teeth like projections (asymmetric star) that indicates malignancy).
- \* They are not round , usually they are **Angular margins**
- \* **Hypoechoogenicity**
- \* Shadowing
- \* Calcification
- \* Duct extension
- \* Branch pattern
- \* **Microlobulation**

### **Example:**

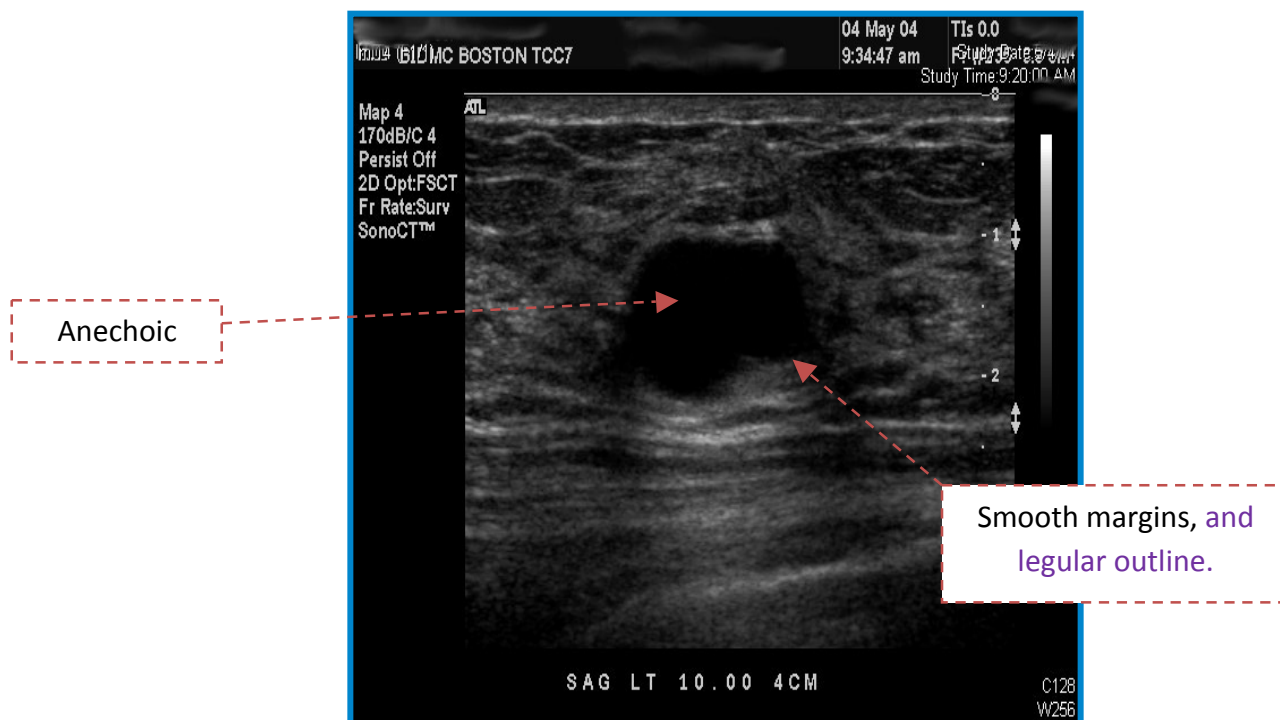
- 1- **Benign fibro adenoma on ultrasound: (Most common benign solid mass of the breast)**



If it was rounded, no speculation, and no calcification → most likely benign.

## 2- Simple cyst on breast ultrasound :

(Cystic lesion well defined, smooth margins, anechoic )



- \* Hyperechogenic: non-malignant mass
- \* Hypoechoic: could be mal. Or non-mal.
- \* Anechoic: cyst (Complete black hollow)
- \* Hypoechoic: solid mas (few small hyperechogenic structures)

## 2- MRI of the Breast:

High-field strength (1.0 – 1.5 Tesla) necessary, resulting in:

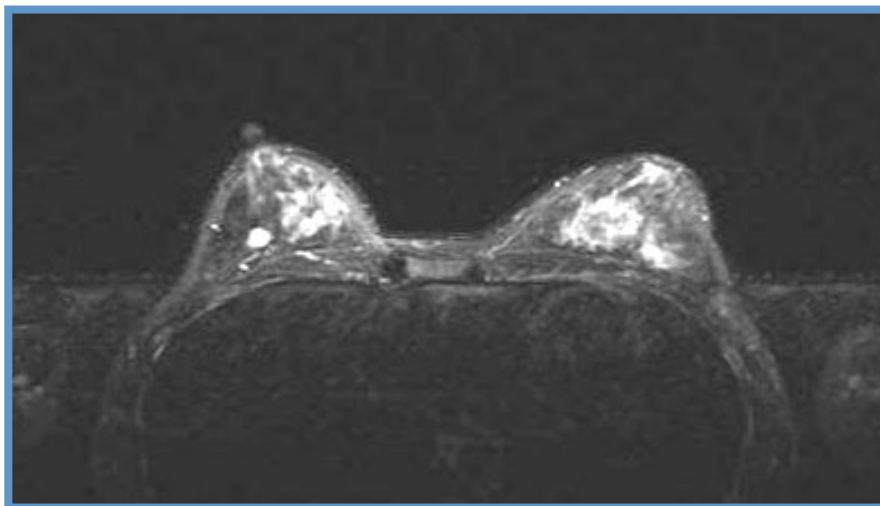
- \* A higher signal-to-noise-ratio.
- \* Shorter acquisition time.
- \* Better separation of fat and water peaks.
- \* Better contrast characteristics. (T1 time increases)
- \* Mammogram is not good in young women less than 45 years old, because we cannot see the speculation clearly due to the dense stromal breast tissue. The best modality for these groups is MRI.



← The patient lies on prone position (on her stomach), and the breast can be compressed here to get better visualization.

MRI is not good in pregnancy because of the use of contrast and it's hard to lie in the prone position.

**Static Imaging**  
**STIR (Short tau inversion recovery)**  
**(No contrast)**

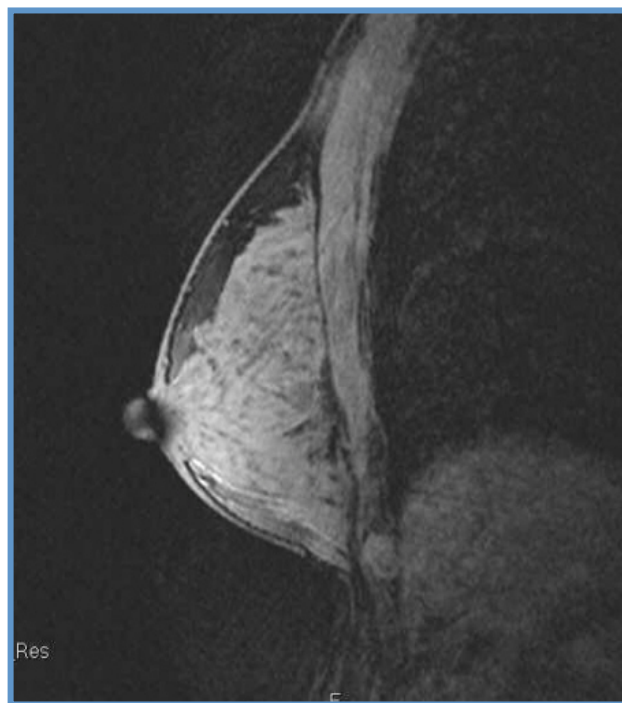


**High resolution Imaging**  
**(No Contrast)**

**Flash 3D Vibe**



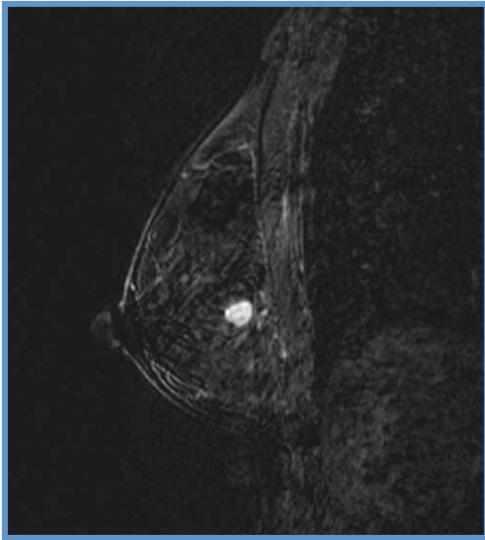
**Flash 3D HR**



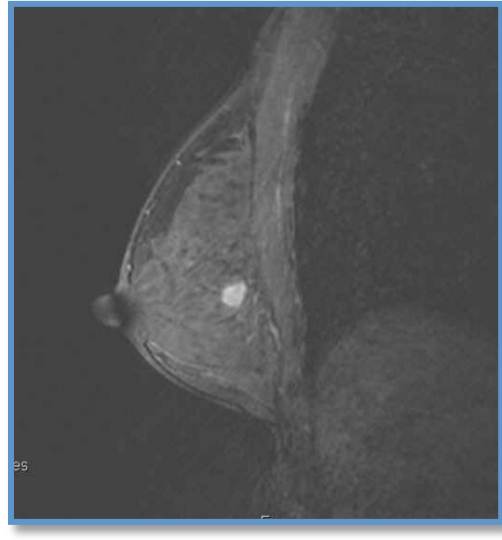


## Dynamic Imaging (With contrast)

Post contrast with fat-suppression



Flash 3D HR



Fat suppression: a modality in MRI that lets you eliminate the opaqueness of the fat.

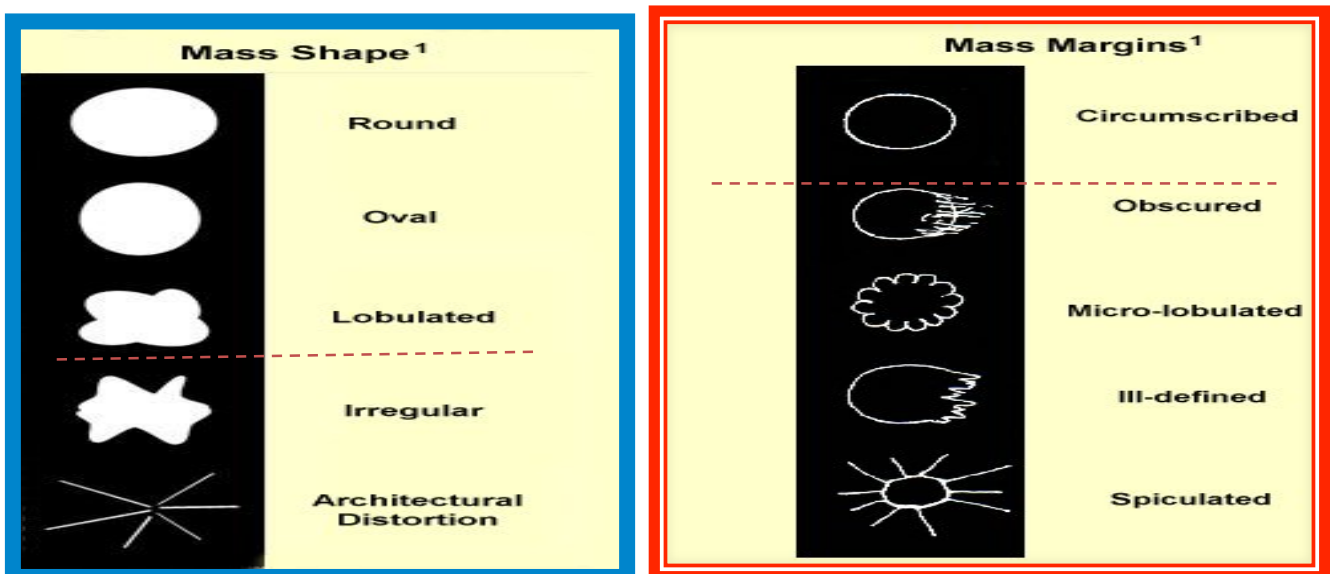
### IN the search of MALIGNANCY:

We look for:

- 1- **Mass lesion** to know if it is benign or malignant (characters).
- 2- **Calcification** to know if it is benign or malignant (characters).

### MASS:

**Characters of masses** (What's important is margins of the mass NOT the shape)



(What's above the line can be malignant or benign, and below the line is characterized as a malignant mass only)

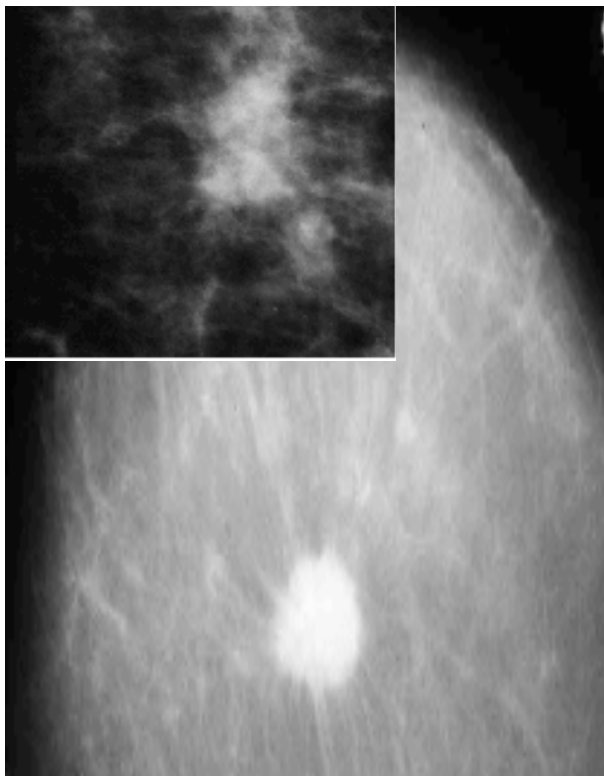
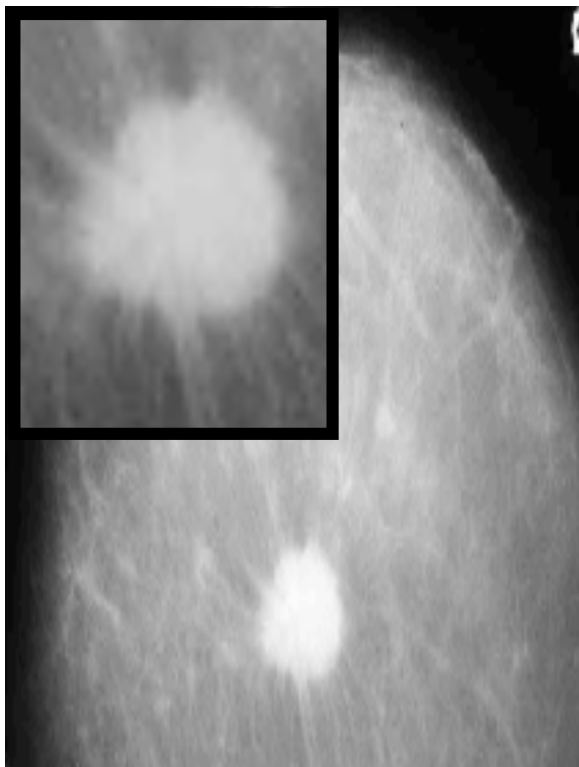
**Margins (most important character):**

If the margins are obscured by breast tissue → compression/magnification views.

**1-Spiculated margins:**

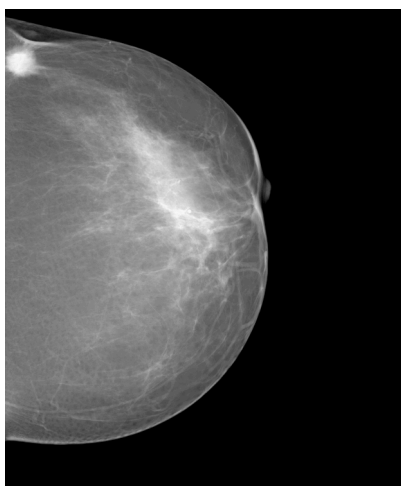
Classical carcinoma More common in: invasive > tubular > lobular.

**Spiculated mass Invasive Ductal Ca**

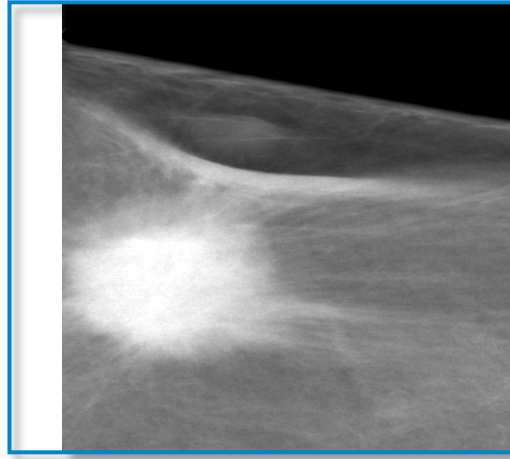
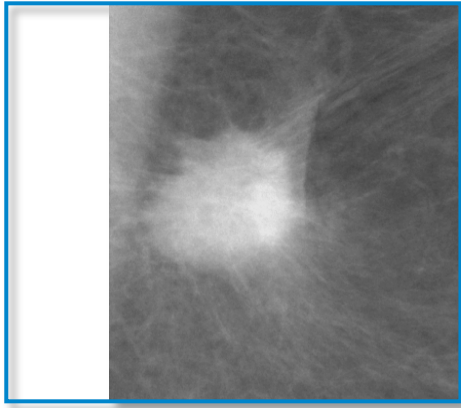


- \* Malignant because its speculated.
- \* If we are not sure we do a method called **compression magnification view** to see if there is speculation.

Skin dimpling is obvious with the speculated mass lesions (only in malignant lesions).



- **Compression and magnification view**
- **You can see dimpling**
- **This is a malignant mass lesion**



DD :

\*FAT necrosis (previous surgical biopsy)

\*SCARS (previous surgery)

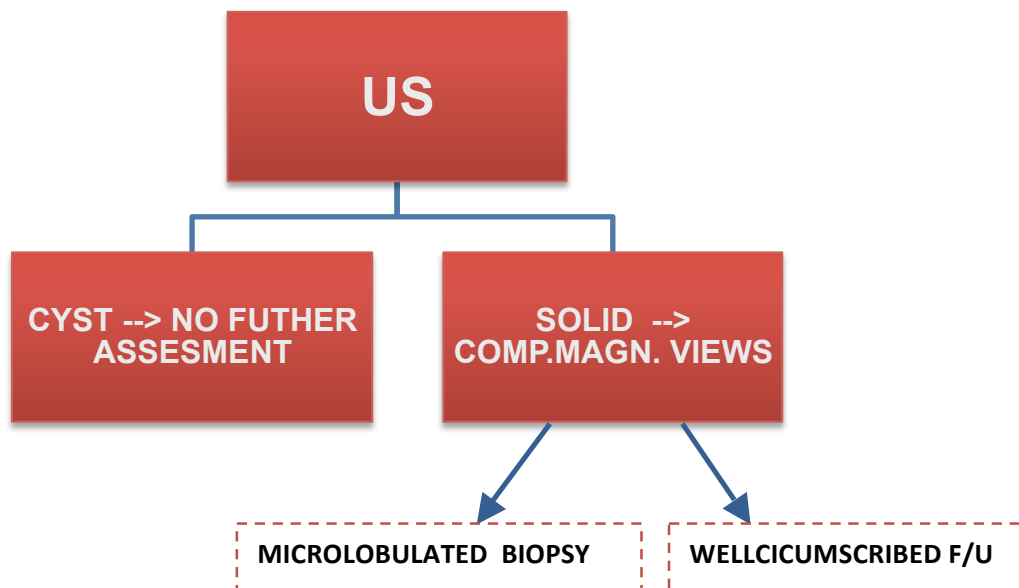
- ◆ Radio-opaque mark
- ◆ Previous scar
- ◆ Any increase in size----> biopsy

\*RADIAL SCAR (complex sclerosing lesions)

← Wasn't mentioned by the doctor. And he said there are some slides that he won't talk about and they are there for reading.

## 2-Well-circumscribed (well-defined) margins:

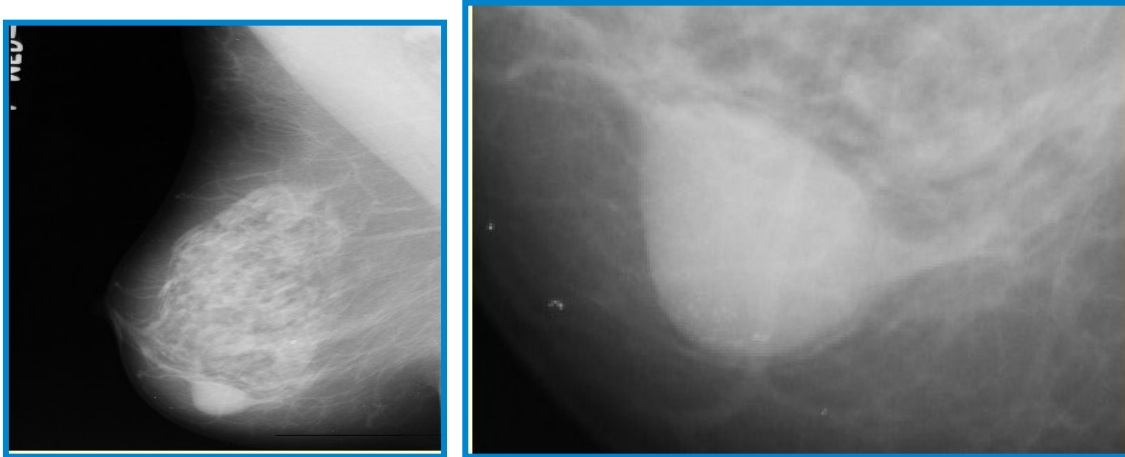
- \* Almost always benign.
- \* 5% of them may be malignant.



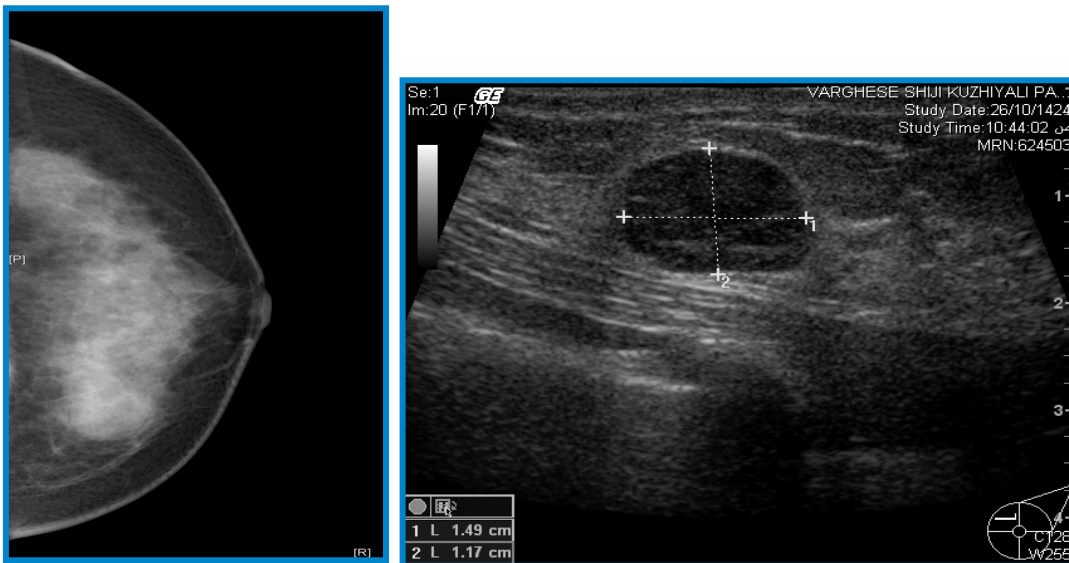


**EXAMPLE:**

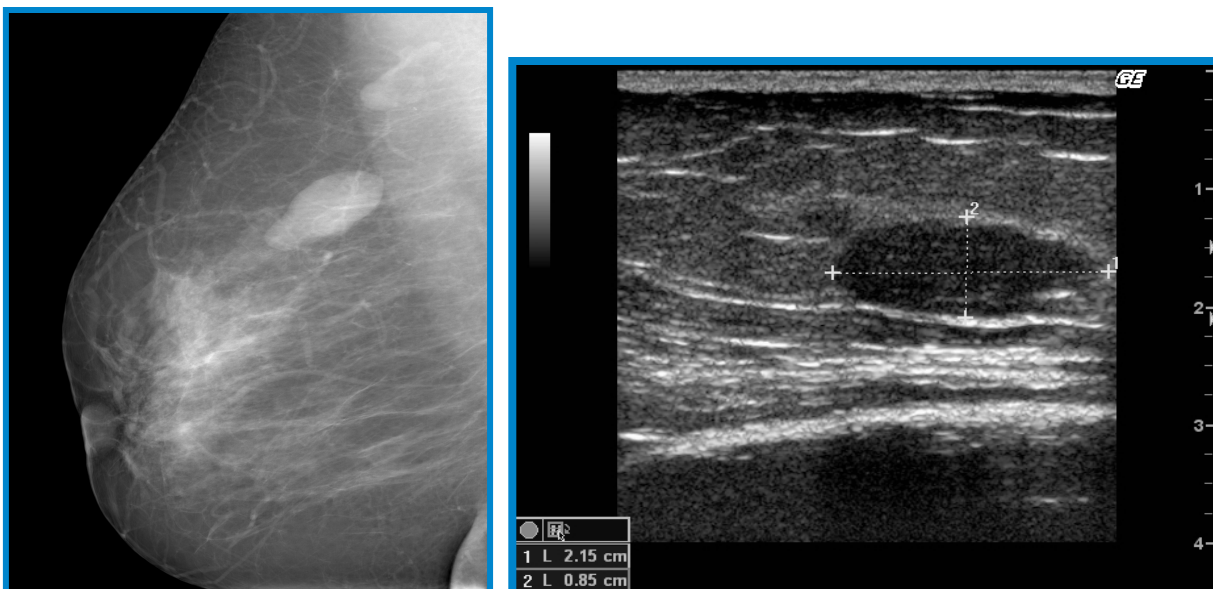
**1/ OVAL WELL-CIRCUMSCRIBED: Benign tumor**



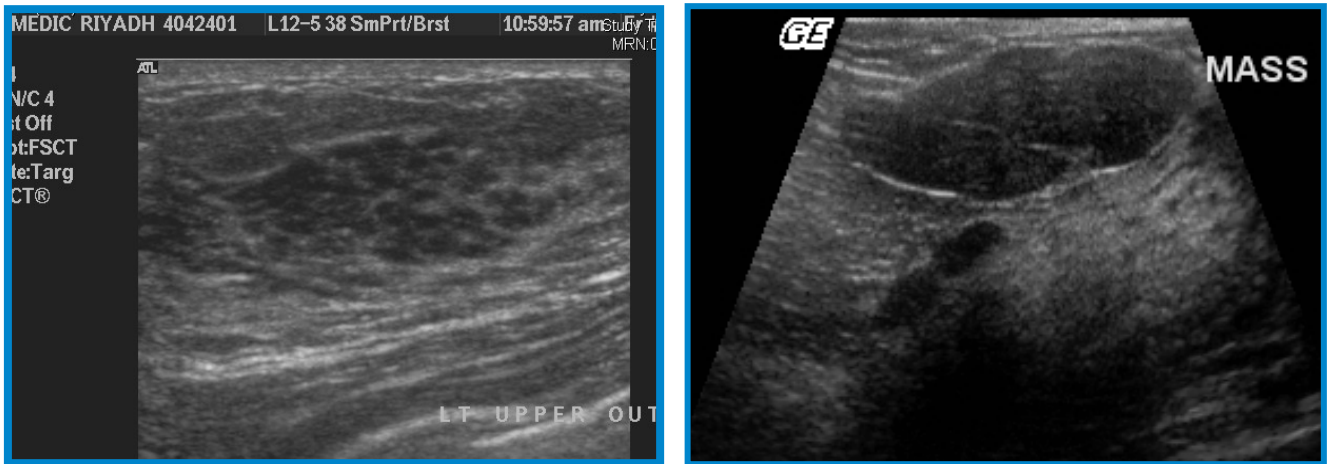
**2/ Large Fibroadenoma BENIGN:**



**3/ Fibroadenoma BENIGN:**



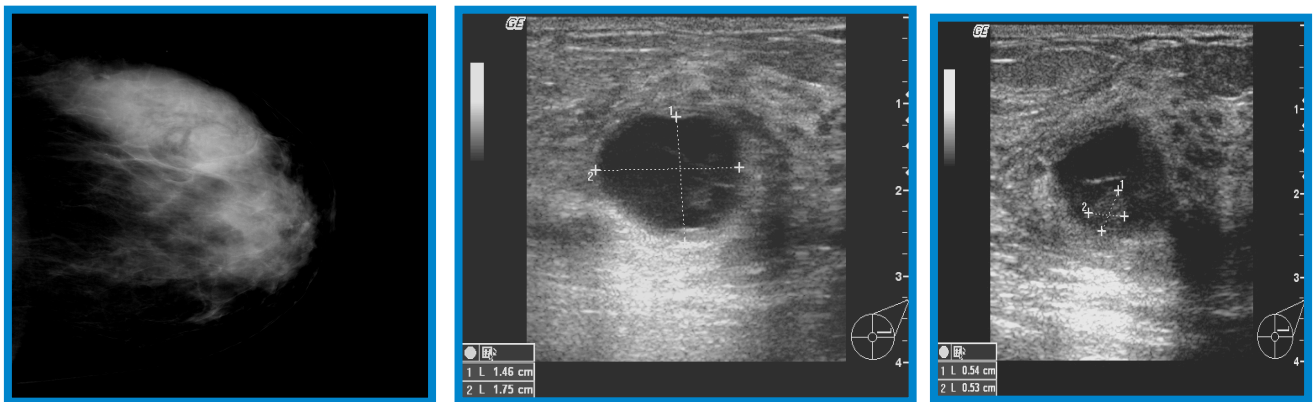
#### 4/ Hamartoma (fibroadenolipoma):



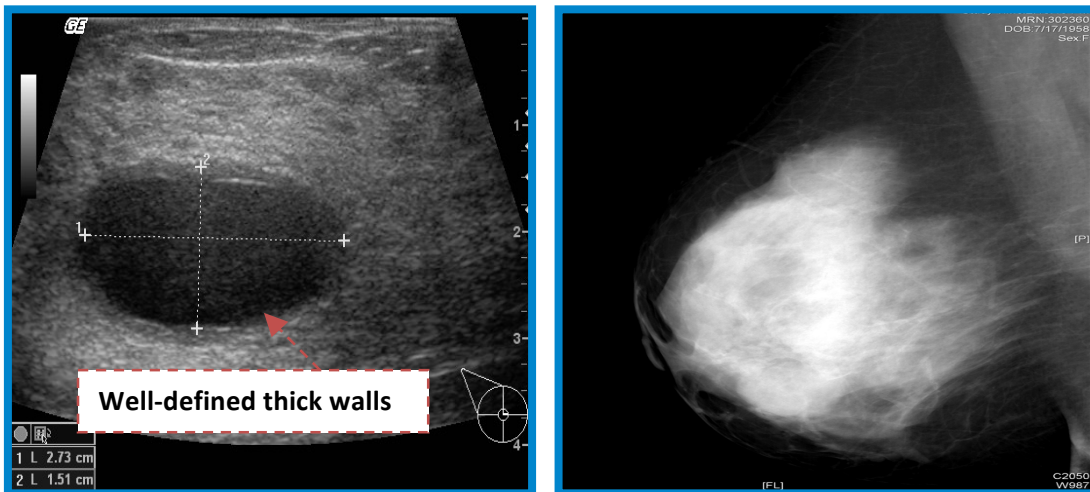
On ultrasound, a sharply defined, heterogeneous oval mass is seen, or the lesion may manifest as normal glandular tissue.

#### 5/ Cyst:

Hemorrhagic cyst in dense breast



#### 6/ Complicated cysts US



Complicated cysts have thick walls, dark fluid, and are well defined masses. May result in hemorrhage. We used mammography in the right pic, but it wasn't clear so we used US to see the lesion which is not speculated and well defined thick walls and it is Benign.

## The density categories used: (not imp)

- \* High density: clearly higher than surrounding, suspicious.
- \* Equal density: density not appreciably different, neutral significance.
- \* Low density: density lower, but not fat containing, neutral significance.

## NUMBER OF MASSES:

- \* **FACT**  
Multiple well-defined masses are probably benign.
- \* **FACT**  
Multiple primary malignant lesions are obviously ill-defined or stellate lesions.
- \* **FACT**  
**BENIGN AND MALIGNANT LESIONS CAN COEXIST!!!**

## Calcifications:

### Size

- \* **Micro calcifications**: 0.5 mm or less. Associated with a **malignant** process
- \* **Macro calcifications**: 2.0 mm or larger. Associated with a **benign** process.
- \* The smallest visible calcifications on a mammogram is approximately 0.2 - 0.3 mm

Scattered calcification: benign

Clustered calcification: malignant (important sign of malignancy)

The doctor didn't mention the following. And he said there are some slides that he won't talk about and they are there for reading.

### Number:

- \* Any number of calcifications less than four will rarely lead to the detection of breast cancer in and of itself.
- \* Two or three calcifications may merit greater suspicion if they exhibit worrisome morphologies.

### Morphology:

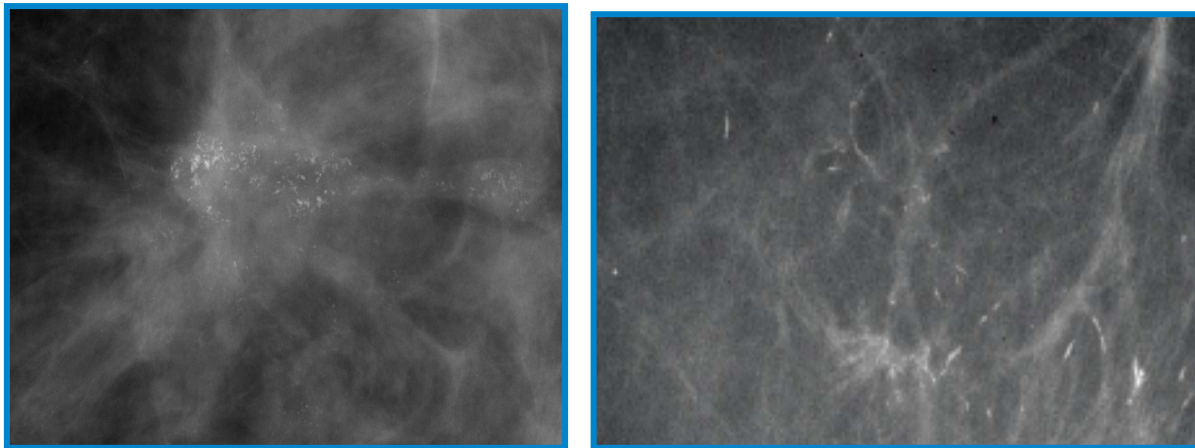
- \* **Most important indicator in differentiating benign from malignant.**
- \* Round and oval shaped calcifications that are also uniform in shape and size are likely benign.
- \* Irregular in shape and size **CALCIFICATIONS** fall closer to the malignant end of the spectrum.
- \* It has been described that calcifications associated with a malignant process resemble small fragments of **broken glass** and are rarely round or smooth.

### ACR BIRADS Classification:

The American College of Radiology (ACR) Breast Imaging Reporting and Data System (BIRADS) has classified findings of calcifications into three categories:

1. Typically benign;
2. Intermediate concern; and
3. Higher probability of malignancy.

## MALIGNANT MICROCALCIFICATION:



- \* **CLUSTERED : > 5 in 1cm<sup>2</sup>**
- \* **Branching interrupted ill defined ductal.**

### Questions:

1/ A 57-year-old woman comes for an annual visit with no breast complaints.

Which of the following imaging studies is an appropriate screening study?

- (a) ultrasound examination of both breasts
- (b) magnetic resonance imaging of both breasts
- (c) screening mammography of both breasts
- (d) breast screening is not appropriate for a patient of this age

2/ a 40-year-old woman came to the clinic with a family history of breast cancer for breast screening.

Which of the following is the best modality for imaging?

- (a) ultrasound examination of both breasts
- (b) magnetic resonance imaging of both breasts
- (c) screening mammography of both breasts
- (d) breast screening is not appropriate for a patient of this age

3/ In characterizing a suspicious mass lesion for malignancy by imaging which of the following is the most important?

- (a) Shape
- (b) Margin
- (c) Size
- (d) None of the above

Answers:

- 1) C
- 2) B
- 3) B

