



# RADIOLOGY

TEAM 435

## Radiology of the breast

[ Color index: **Important** ★ | **Notes** | Extra ]

[ [Editing file](#) ]

### ● Objectives:

- Radiological anatomy of the breast.
- To highlight the suitable modality for each age.
- Role of imaging/radiology in diagnosing breast lesions particularly breast cancer

### ● Resources:

- 435 girls/boys slides
- 434 team

### ● Done by:

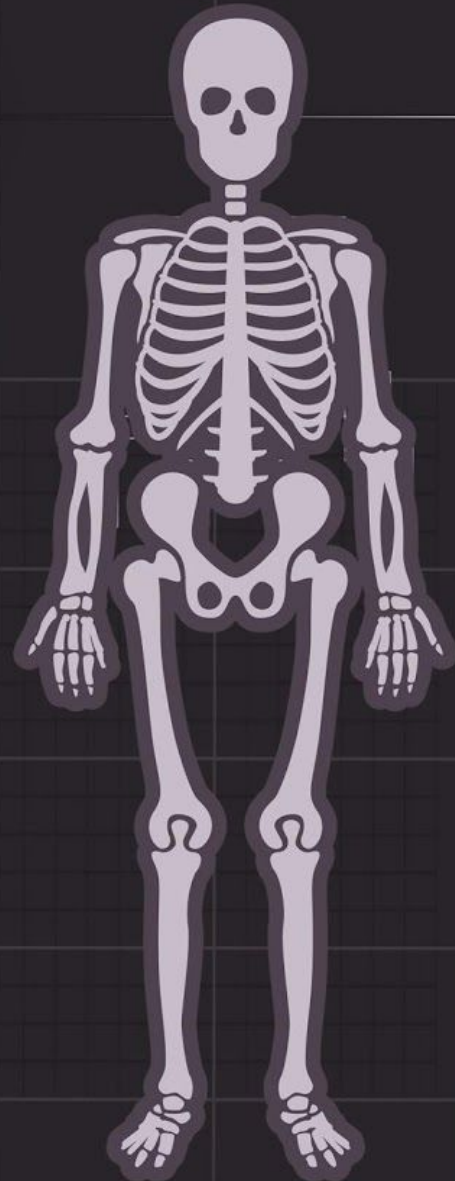
- Shahad aldakhyil

### ● Team Leader:

- Amjad Alduhaish
- Mohammed Alsahil

### ● Revised by:

- Faisal Alqahtani



# Anatomy

## Brief anatomy :

### - Borders:

- o Upper border: Collarbone.
- o Lower border: 6th or 7th rib.
- o Inner border: edge of sternum.
- o Outer border: mid-axillary line.

- Divisions: each breast is divided into 5 segments.

### o 4 quadrants:

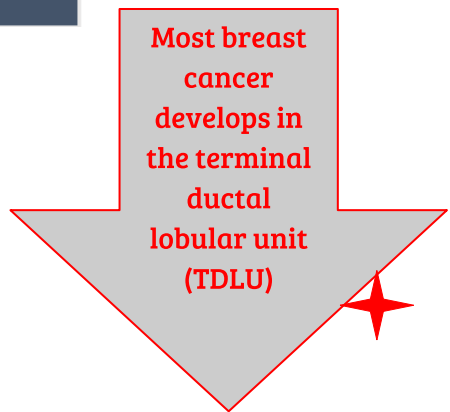
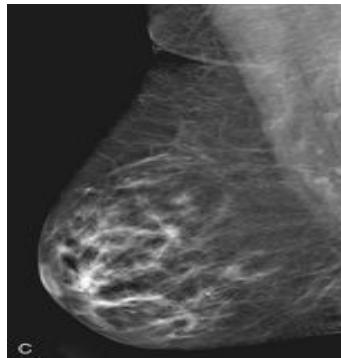
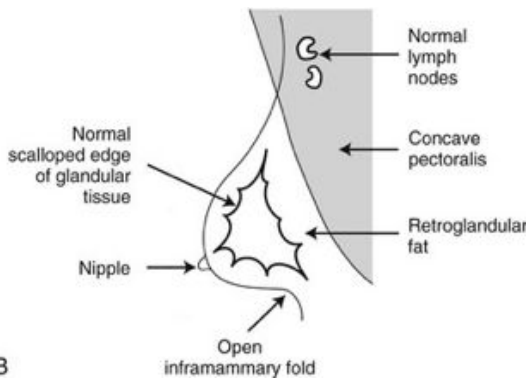
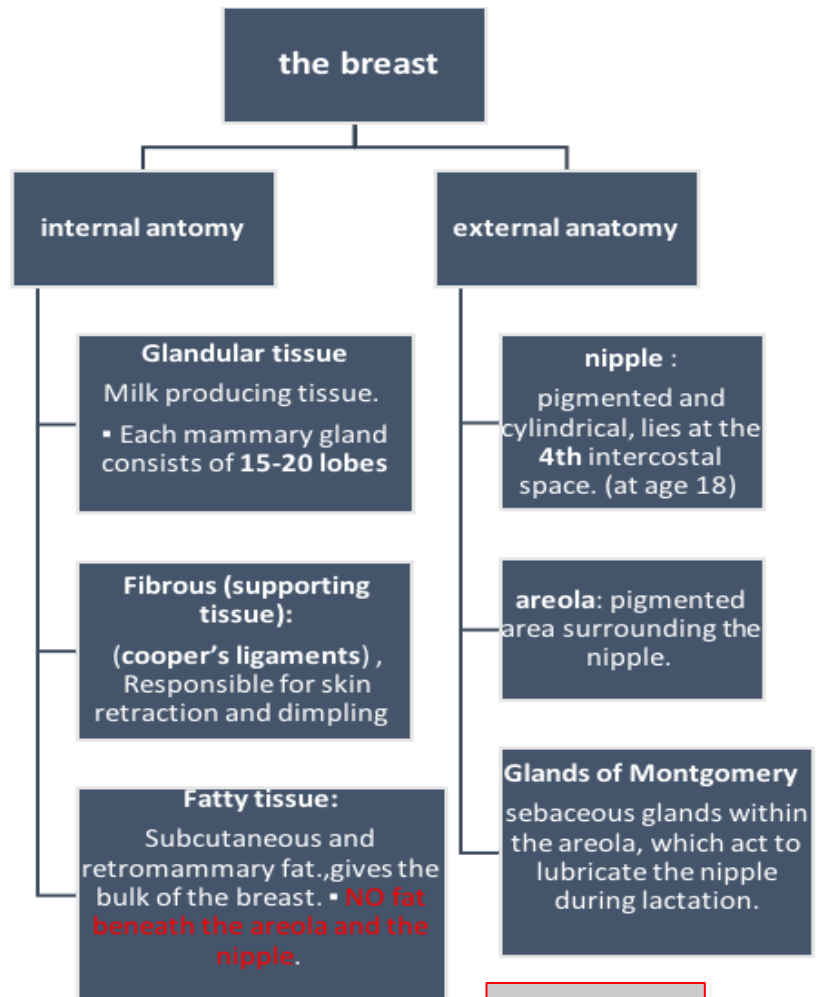
- 2 inner: upper inner & lower inner.
- 2 outer: upper outer & lower outer.

✓ Majority of breast tumors arise in the upper outer quadrant.

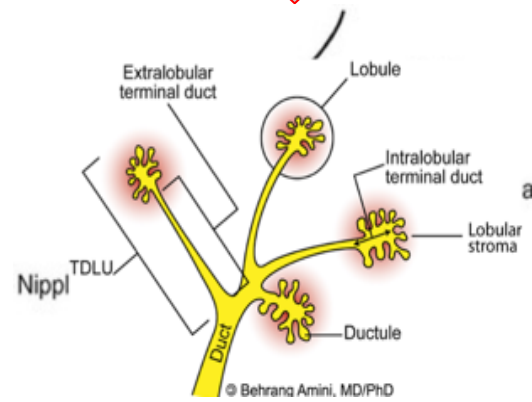
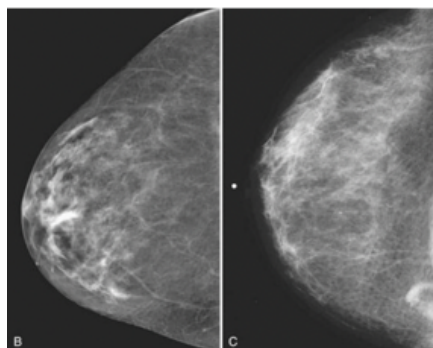
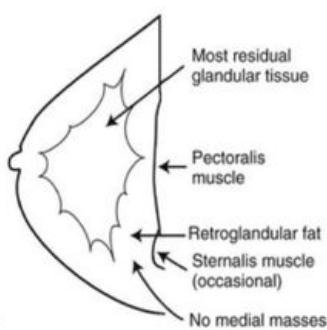
### o Tail of spence (the axillary tail)

- Terminal ductal lobular unit is composed of:

- 1- intralobular terminal ducts
- 2- acini



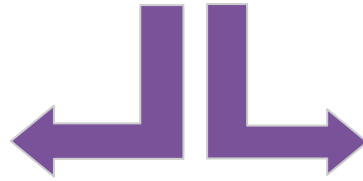
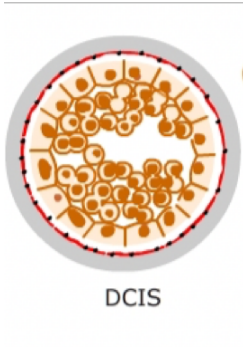
B



**Breast cancer can be divided into two major groups**

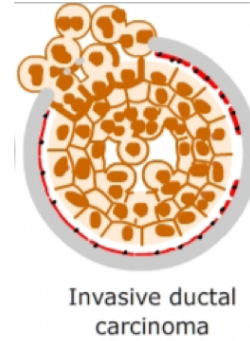
**IN SITU**

Tumor cells, they do not invade the basement membrane. Tumor cells remain confined to the ducts or lobules

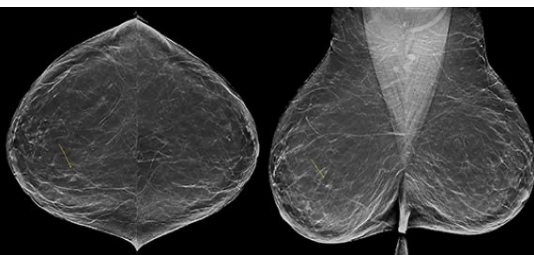


**INVASIVE**

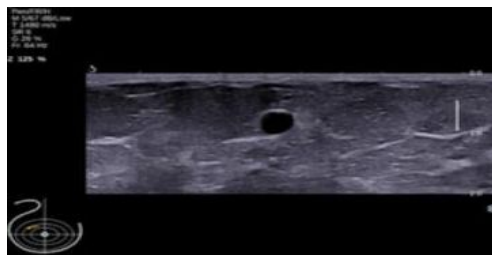
Tumor cells invade the breast stroma. They have the potential to metastasize and result in death of the patient



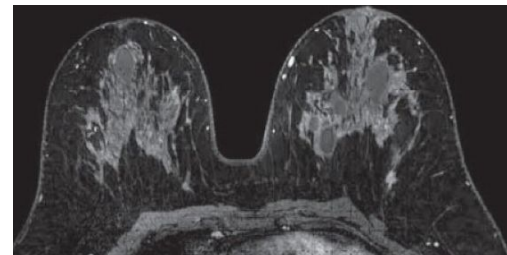
**Breast imaging**



mammogram

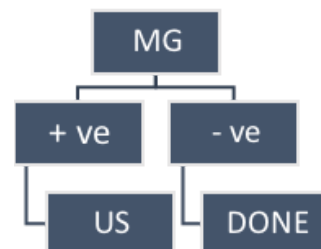
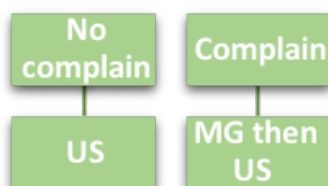
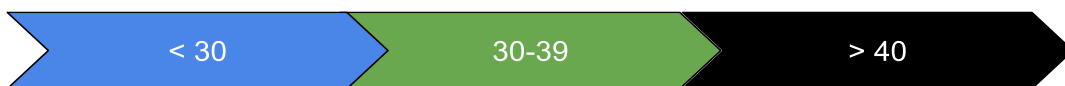


ultrasound



MRI

**Modality and Age (important)**



# Mammogram

## - Mammogram indicator :

### ❖ Screening [ **The patient has no Complaints** ]

1- patients 40 Y.O and above not necessary to have a history of breast cancer

2- young patients with first degree relative ( mother/sister) diagnosed with breast **cancer (especially if they're premenopause)** or even if they have one of these syndromes : **cowden syndrome** (multiple hamartoma syndrome) or Li-Fraumeni syndrome.

and if the pt has a history of radiation in her childhood (chest radiation)

we start the screening 10 years before the first relative was diagnosed with a minimum age 25 y/o

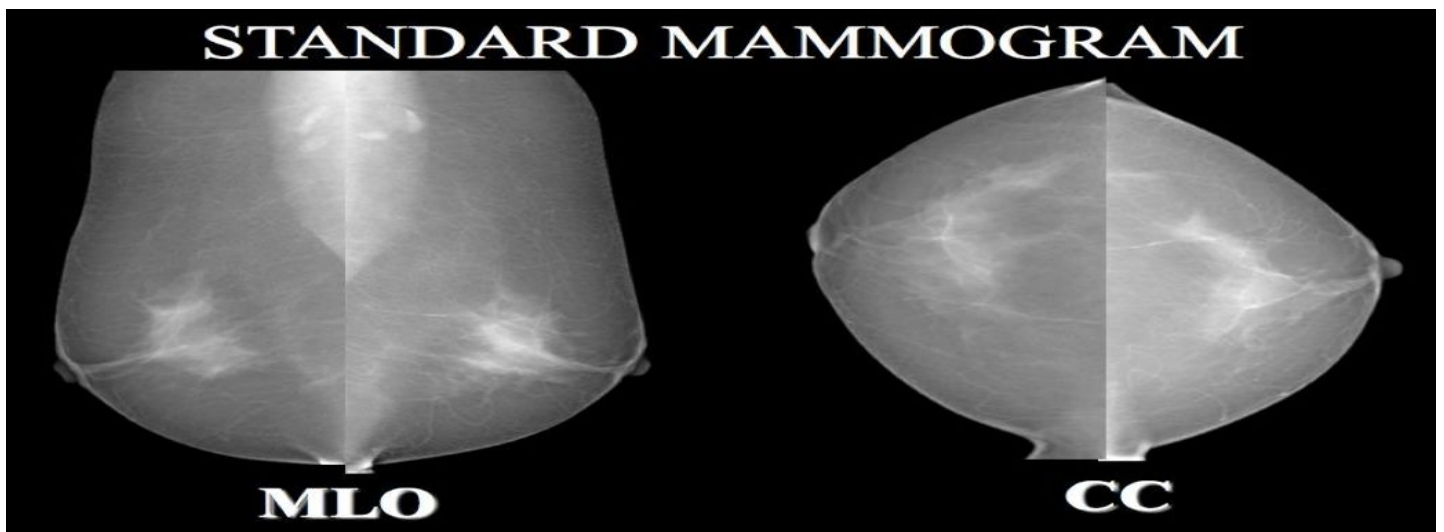
### ❖ Diagnostic [ **The patient has a complaint** ]

1- palpable mass

2- nipple discharge

3- skin changes if the color of the discharge is ( white, green, brown ) it's OK , but if it is ( RED, YELLOW, CLEAR ) it's NOT OK!!!  
قالت:هذي اشياء زايده في الاخير ركزوا بس عالسلايدز

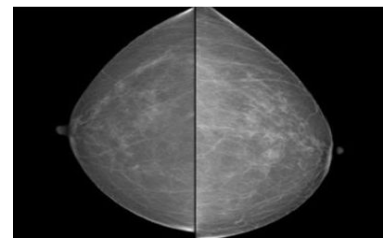
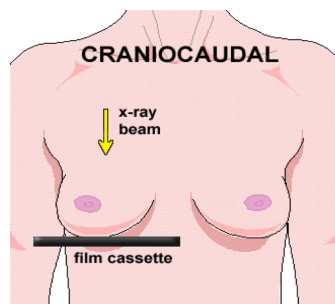
## - views :



### in cranial-caudal (CC):

Only in 15-20% of cases you can appreciate Pectoralis major muscle

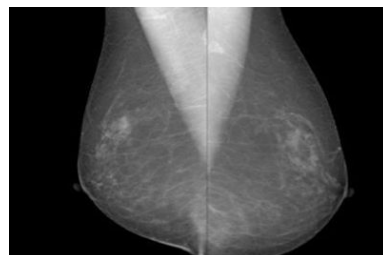
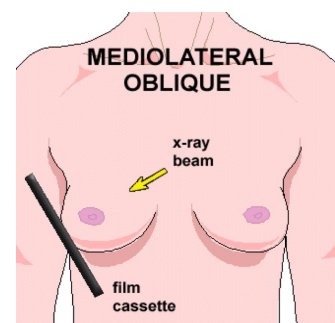
-The breast is compressed from up to down, with Zero angulation.

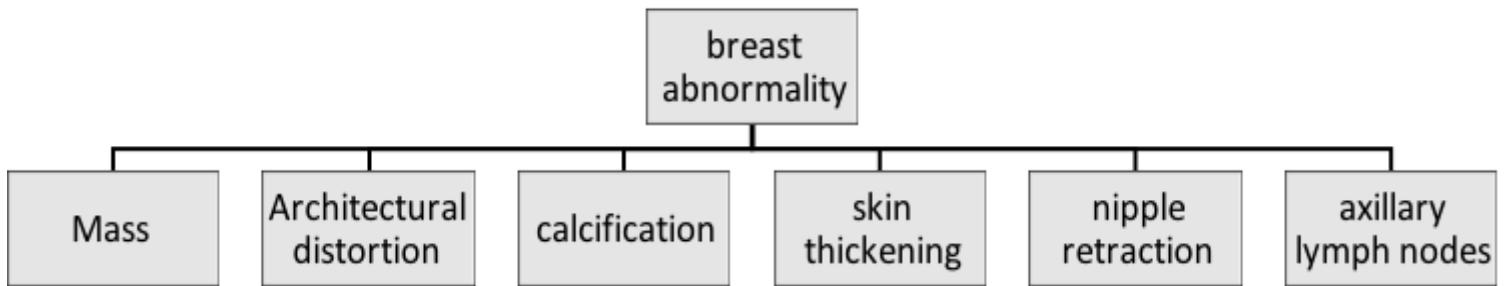


### in mediolateral-oblique (MLO):

You can appreciate Pectoralis major msc and the Axillary lymph nodes.

-The breast is compressed from medial to lateral, with 45 degree angle.





**nipple inversion:** بتقولك المريضة انه من انولدت وهي كذا

**nipple retraction:** هذي جديده توها طلعت لها

**calcifications:** only seen in mammogram

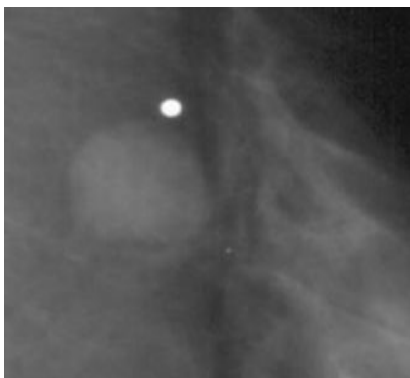
**1/ MASS:** both views CC & MLO ,

persist [ spot compression view ] (AKA compression mammogram, cone views, or focal compression views where they apply the compression to a smaller area of tissue for better evaluation)

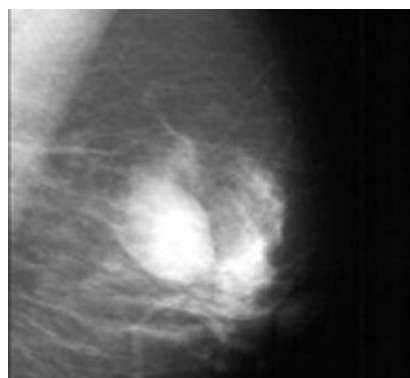
- Shape
- Margins (the most important feature)
- Density

### MASS SHAPE

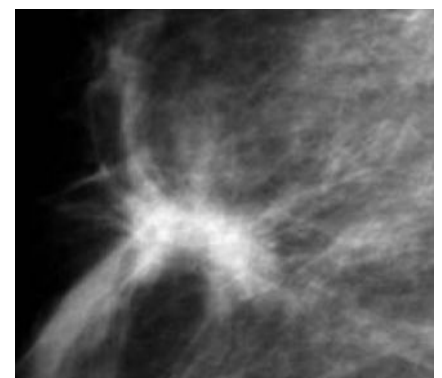
ROUNDED



OVAL

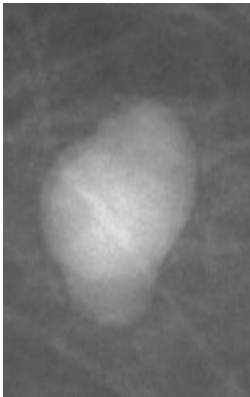
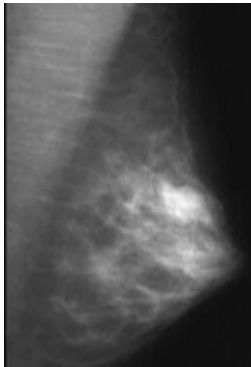
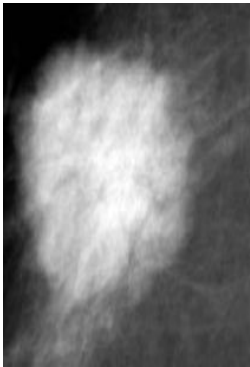
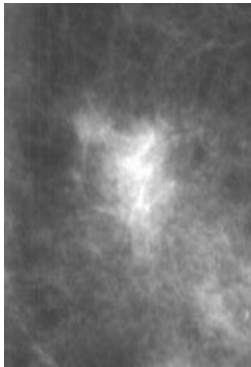
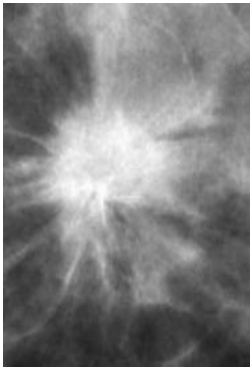


IRREGULAR ( suspicious )

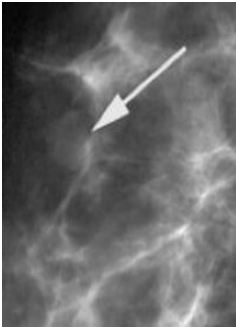
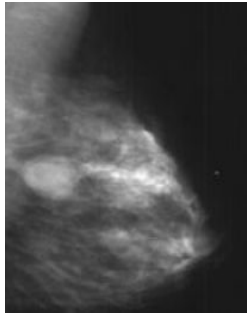
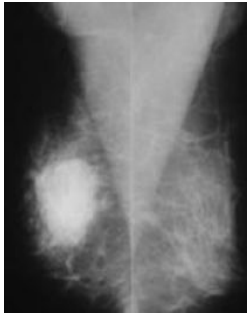




## MASS MARGIN

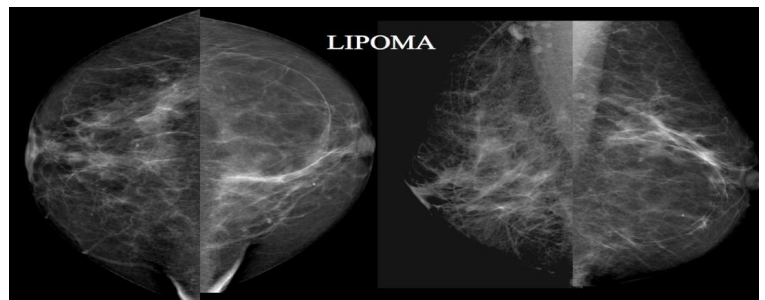
Circumscribed	Obscured	Microlobulated (suspicious)	Indistinct (more suspicious)	Spiculated (most suspicious)
<p>Abrupt transition between lesion and tissue. DDx: 1. Cyst 2. Fibroadenoma 3. Lipoma</p>	<p>Margins (suspected to be circumscribed) hidden by adjacent or superimposed normal tissue?! Ask for <b>compression or magnification views.</b></p>	<p>Margin undulated with short cycle 1- 2 mm.</p>	<p>Ill defined. Possible infiltration.</p>	<p>lines radiating from margins of a mass (from a <b>DENSE</b> center). DDx 1. Cancer 2. Fat necrosis (post-surgery/trauma/fat injection)</p>
				

## MASS DENSITY

fat only	mixed density	low dense	equal dense	high dense <span style="color: red;">(suspicious)</span>
<p><b>DDx</b></p> <p>1. Oil cyst/fat necrosis. 2. Lipoma.</p> <p style="color: red; font-weight: bold; margin-top: 20px;">if you see a mass, its benign!</p>	<p><b>DDx:</b></p> <p>1. Hamartoma (it's breast within breast) 2-Lymph node 3-Fat necrosis 4. Galactocele (lactating women come to u complaining of mass that will decrease in size after she lactating )</p> <p style="color: red; font-weight: bold; margin-top: 20px;">if you see a mass, its benign!</p>	<div style="text-align: center;">  </div> <p style="color: blue;">DDX: cyst</p> <p style="color: red; font-weight: bold; margin-top: 20px;">cancer is less likely but still possible</p>	<div style="text-align: center;">  </div> <p style="color: blue;">DDX: cyst fibroadenoma cancer</p> <p style="color: red; font-weight: bold; margin-top: 20px;">cancer is less likely but still possible</p>	<div style="text-align: center;">  </div> <p style="color: blue;">cancer</p> <p style="color: red; font-weight: bold; margin-top: 20px;">suspicious for malignancy</p>

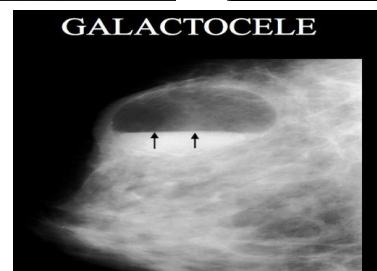
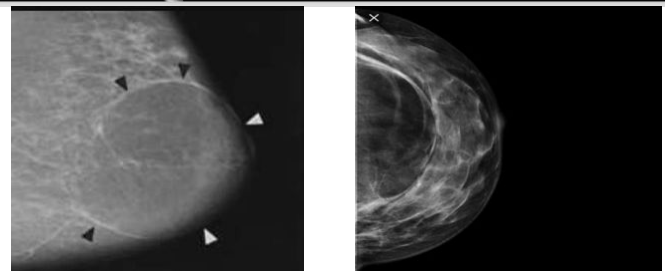
### Lipoma:

Lucent (gray) lesion with thin dense (white) capsule



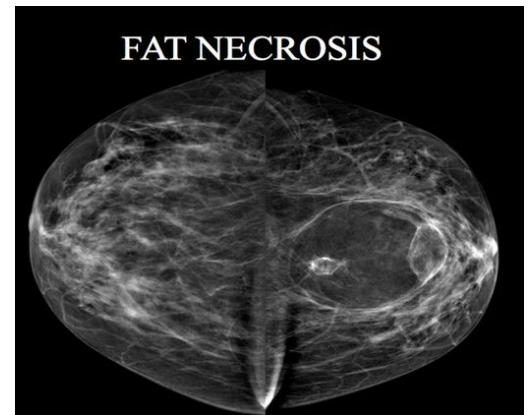
### Galactocele:

Fat-Fluid Level, just like water and oil,  
Fat is oil so it will flow  
And milk which represents water will go down, high risk of INFECTION



### Fat necrosis:

The only difference between fat necrosis and lipoma is the presence of **dystrophic calcification** in case of fat necrosis.



**HAMARTOMA (fibroadenolipoma):** -Description:  
on mammo: Partially circumscribed oval mass with some obscured margins.

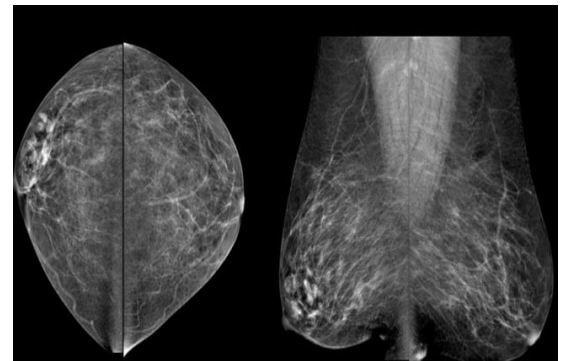
-in US, a sharply defined, heterogeneous oval mass is seen, or the lesion may manifest as normal glandular tissue

-**benign lesions** composed of various native fibrofatty tissues, but growing in a disorganized way.

-**It is not considered a malignant tumor.**

-mostly asymptomatic.

-no need for biopsy or follow up



## 2/ ARCHITECTURAL DISTORTION:

- ◀ Lines radiating from a point.
- ◀ Focal retraction/ distortion of parenchymal edge.
- ◀ Main findings or associated findings.

Differential diagnosis:

1. Breast cancer.

2. Radial Scar (complex sclerosing lesion). **it's benign but associated with increase risk of breast cancer in the future and should to do excision+follow up**

3. Surgical Scar.

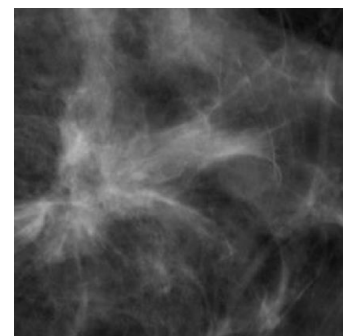
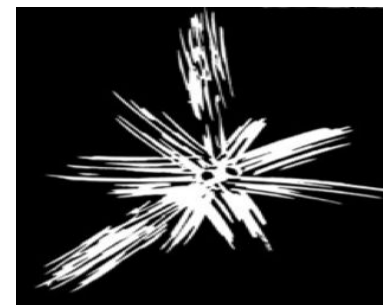
-How to differentiate between architecture distortion & Spiculated mass?

In architecture distortion the lines are radiating **from a LUCENT center**

-(if u see architectural distortion ask the pt if she has ever had a surgery,

because if she has it will be not necessary to do further investigation or biopsy,

**the surgery might be the cause of the distortion)**





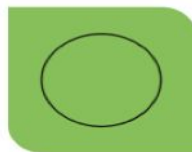
### 3/ BENIGN CALCIFICATION:



**Skin**



**Vascular**



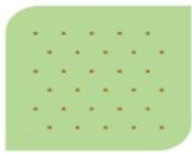
**Rim**



**Popcorn**



**Rod-Like**



**Punctate**



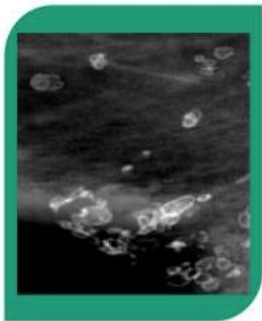
**Milk of calcium**



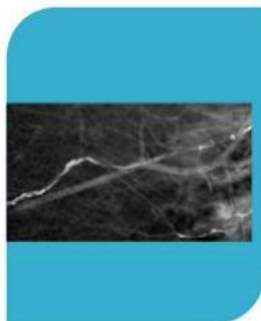
**Suture**



**Dystrophic**



**Skin**



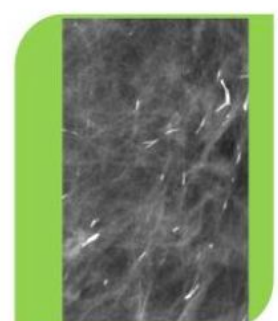
**Vascular**



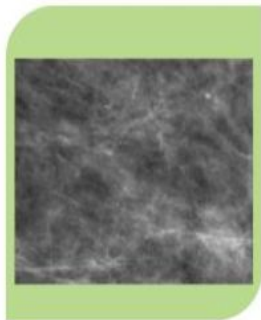
**Rim**



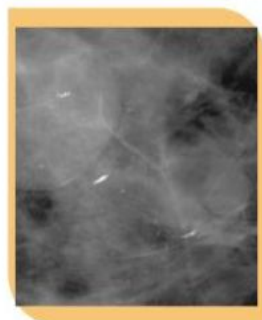
**Popcorn**



**Rod-Like**



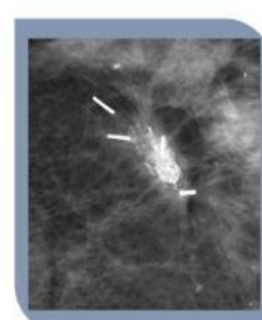
**punctate**



**Milk of calcium**





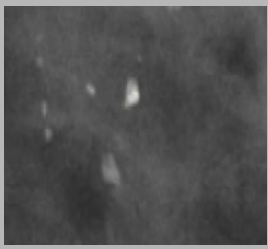
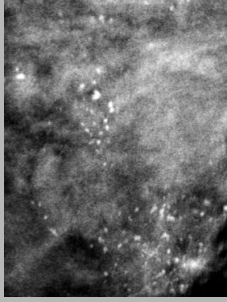


**Suture**



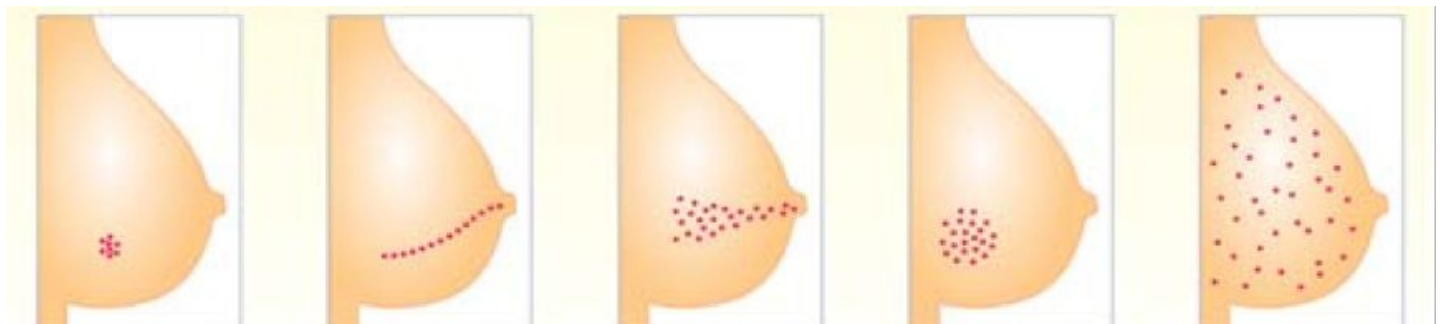
**Dystrophic**

- 1- **skin**: ring-like with central lucency
- 2- **Rim**: DDx: Fat necrosis/Oil cyst
- 3-**Popcorn**: involuted fibroadenoma
- 4- **Rod-like**: sharply demarcated
- 5-**Punctate**: tiny dots
- 6- **Milk of calcium**: layering
- 7- **Suture**: post surgery
- 8- **Dystrophic**: Fat necrosis

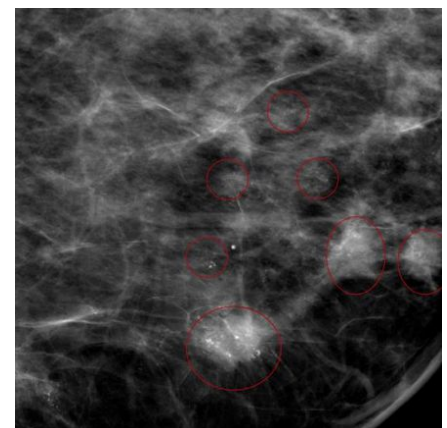
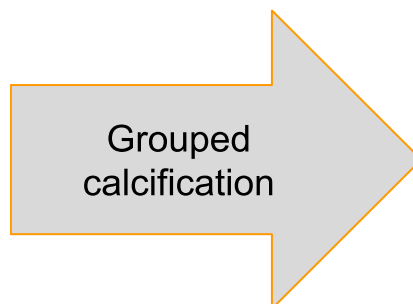
## 4/SUSPICIOUS CALCIFICATION:

  <p><b>amorphous</b> The dots here are smaller than in the punctate calcification</p>	 <p>coarse heterogeneous , looks like the popcorn but smaller in size, Irregular in shape</p>	 <p>fine pleomorphic ( different in size, shape, density)</p>	  <p>fine branching and linear branching (<b>most suspicious</b>)</p>
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## 5/DISTRIBUTION OF CALCIFICATIONS



<p><b>Grouped</b> &lt; 2cm ( must be 5 calcification or more to consider it group )</p>	<p><b>linear</b> <b>SUSPICIOUS</b></p>	<p><b>Segmental</b> <b>SUSPICIOUS</b></p>	<p><b>Regional</b> &gt; 2cm</p>	<p><b>Diffused</b> Entire breast</p>
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**size :**

- Micro calcifications are associated with malignant processes; Macro calcifications are associated with benign processes. 0.5 mm or less to have a high probability of association with cancer.
- 2.0 mm or larger are typical of a benign process.
- The smallest visible calcifications on a mammogram is approximately 0.2 - 0.3 mm

**Morphology:**

- 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

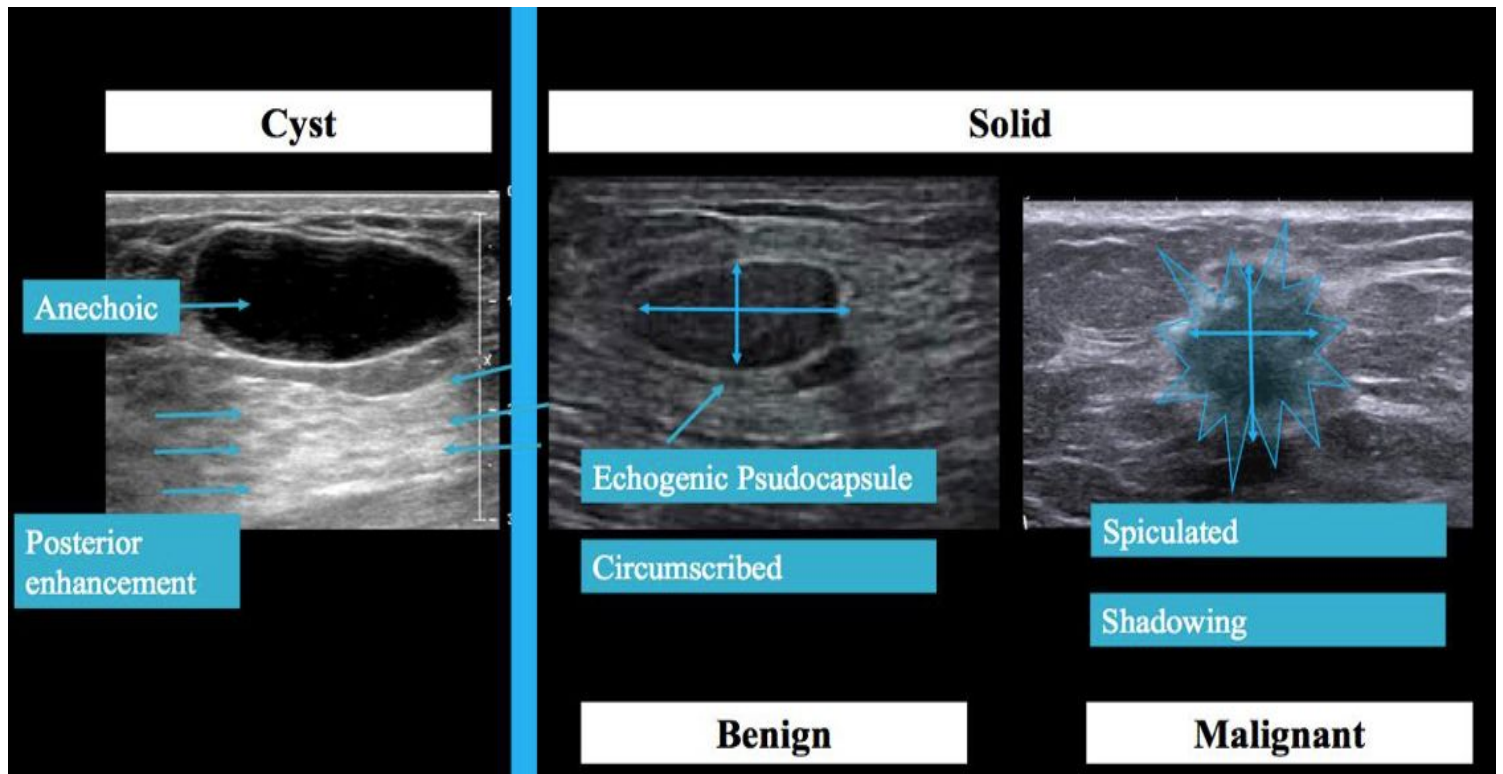
## Ultrasound

**BREAST Ultrasound INDICATIONS:**

1. Differentiation of both palpable and mammographic lesions as either cystic or solid.
2. Evaluation of solid masses according to certain sonographic features.
3. Initial imaging evaluation of palpable breast masses in patients under 30 years and in lactating and pregnant women.
4. Screening for occult cancers in certain populations, including of women with heterogeneously or extremely dense breasts.
5. Follow-up of breast cancer treated with neoadjuvant chemotherapy.
6. Guidance for breast biopsy and other interventional procedures.

### MALIGNANT VS BENIGN SONOGRAPHIC FEATURES OF SOLID MASSES

MALIGNANT	BENIGN
Spiculation	Circumscribed, hyperechoic tissue
Angular margins	Parallel oriented –wider than taller
Hypoechoogenicity	Gently curving smooth lobulations
Shadowing	Thin echogenic pseudocapsule
Calcification	
Duct extension	
Branch pattern	
Microlobulation	



## MRI

### MRI indications :

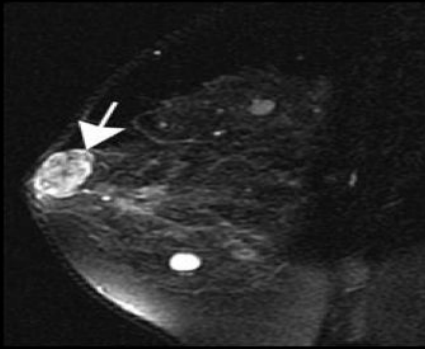
1. Staging.
2. High risk patients.
3. Response to therapy.
4. Post operative to differentiate surgical scar versus recurrence
5. Occult breast cancer.
6. Assess the contralateral breast.
7. Breast implant.

### MRI breast-Minimum equipment :

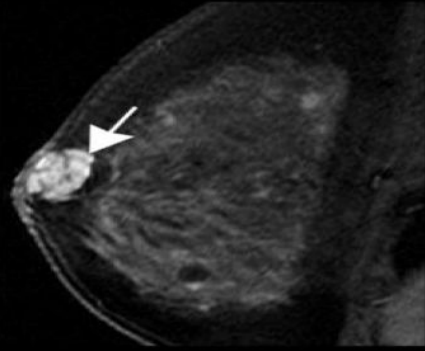
- System with field strengths 1.5 T
- Dedicated bilateral breast surface coil
- Prone positioning.
- Images obtained prior to gadolinium and multiple phases following gadolinium administration (**Dynamic**).







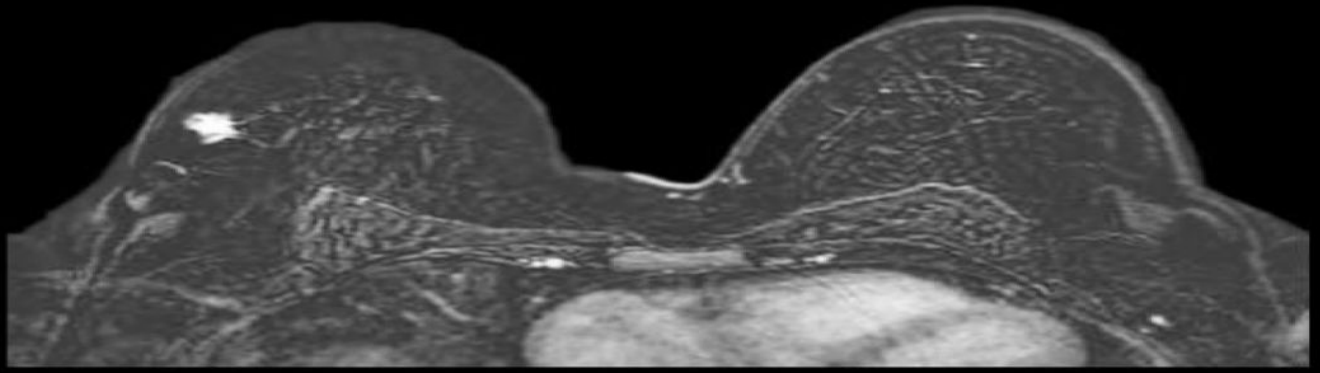
**T2 Fat Saturation**



**T1 fat sat with Gadolinium**

Fluid will appear hypointense which indicates cyst!

**Subtracted images = Enhanced – Unenhanced Images**



## BI-RADS (important)

### Breast Imaging Reporting And Data System

- 0 = **Incomplete** Additional imaging/view is needed.
- 1 = **Negative** Routine screening recommended.
- 2 = **Benign** Routine screening recommended.
- 3 = **Probably Benign (< 2% malignant)**; probably benign, follow up at 6 month intervals for 2 years, if stable, can be downgraded to BIRADS 2. (if the mass was stable for 2 years then I can send the pt home and tell her to come after one year)
- 4 = **Suspicious of Malignancy (≥ 2 to 95%)**; biopsy recommended
- 5 = **Highly Suspicious of Malignancy (> 95%)**; highly suspicious, biopsy recommended
- 6 = **Known Biopsy-Proven Malignancy** known malignancy (example: patient diagnosed with breast cancer and is on chemotherapy, imaging was done to assess response to chemotherapy; the cancer is still there but is bigger/smaller/ or stable).

\* From 4-6 biopsy should done

However if the patient had breast cancer in the past and is status post treatment and surgery and current imaging only has post surgical changes with no suspicious findings then this is BIRADS 2 (she's already diagnosed with cancer and just come to follow up)