MAMMOGRAPHY

by Dr Mahasen Al-Najar

Modified slides

Done by: Touleen Qatawneh

WHAT IS MAMMOGRAPHY?

Mammography is x-ray imaging of the breast designed to detect tumors or other abnormalities. Mammography can be used either for screening or for diagnostic purposes.

without symptoms

with symptoms

Symptoms of breast Ca.

1- Skin Retraction
2- Mass
3- Discharge
4- nipple retraction
5- Lymph node enlargement
6- Pain

WHAT IS A SCREENING MAMMOGRAPHY ?

A screening mammogram is an x-ray of the breast used to detect breast changes in women who have no signs or symptoms of breast cancer. It usually involves two x-rays of each breast.

HOW ARE SCREENING AND DIAGNOSTIC MAMMOGRAMS DIFFERENT?

A diagnostic mammogram is an x-ray of the breast that is used to check for breast cancer after a lump or other sign or symptom of breast cancer has been found.

A diagnostic mammogram also may be used to evaluate changes found during a screening mammogram

AT WHAT AGE SHOULD YOU BEGIN SCREENING MAMMOGRAPHY?

Breast cancer screening guidelines*				
Age	Breast cancer risk	Mammo – grams	Clinical breast exams	Breast self-exams
20 -39	Average	Not needed	Every three years	Consider performing on a regular basis to increase breast health awareness
20-39	High	May be needed. Talk with doctor	Every year	
40 or older	Average to high	Every one to two years	Every year	

*Ref. Mayoclinic.com

Before the age of 40, we use ultrasound as a screening tool. Before the age of 40, the breast is more dense (more fibroglandular tissue; therefore, mammograms will not show the pathology clearly).

WHAT ARE THE FACTORS THAT INCREASE THE RISK OF BREAST CANCER?

- The risk of breast cancer increases gradually as a woman gets older. Most breast cancers occur in women over the age of 50
- Personal hx of breast cancer
- Family hx
- Certain breast changes on biopsy as atypical hyperplasia
- Genetic alterations as BRCA1, BRCA2
- Reproductive and menstrual hx

- Long-term use of menopausal hormone therapy
- Breast density
- Radiation therapy
- Body weight
- Physical activity level
- Alcohol

HOW TO PREPARE FOR MAMMOGRAPHY ?

- It is advised to schedule mammography when the breasts are least likely to be tender, which is usually during the week after menstrual period, to allow better compression

- Advice the patient not to apply deoderants, powders,lotions or perfumes under the arms or on the breasts on the day of the test

Mammography machine

X-Ray Tube

Compression Paddle

Film Holder

Foot Peddles

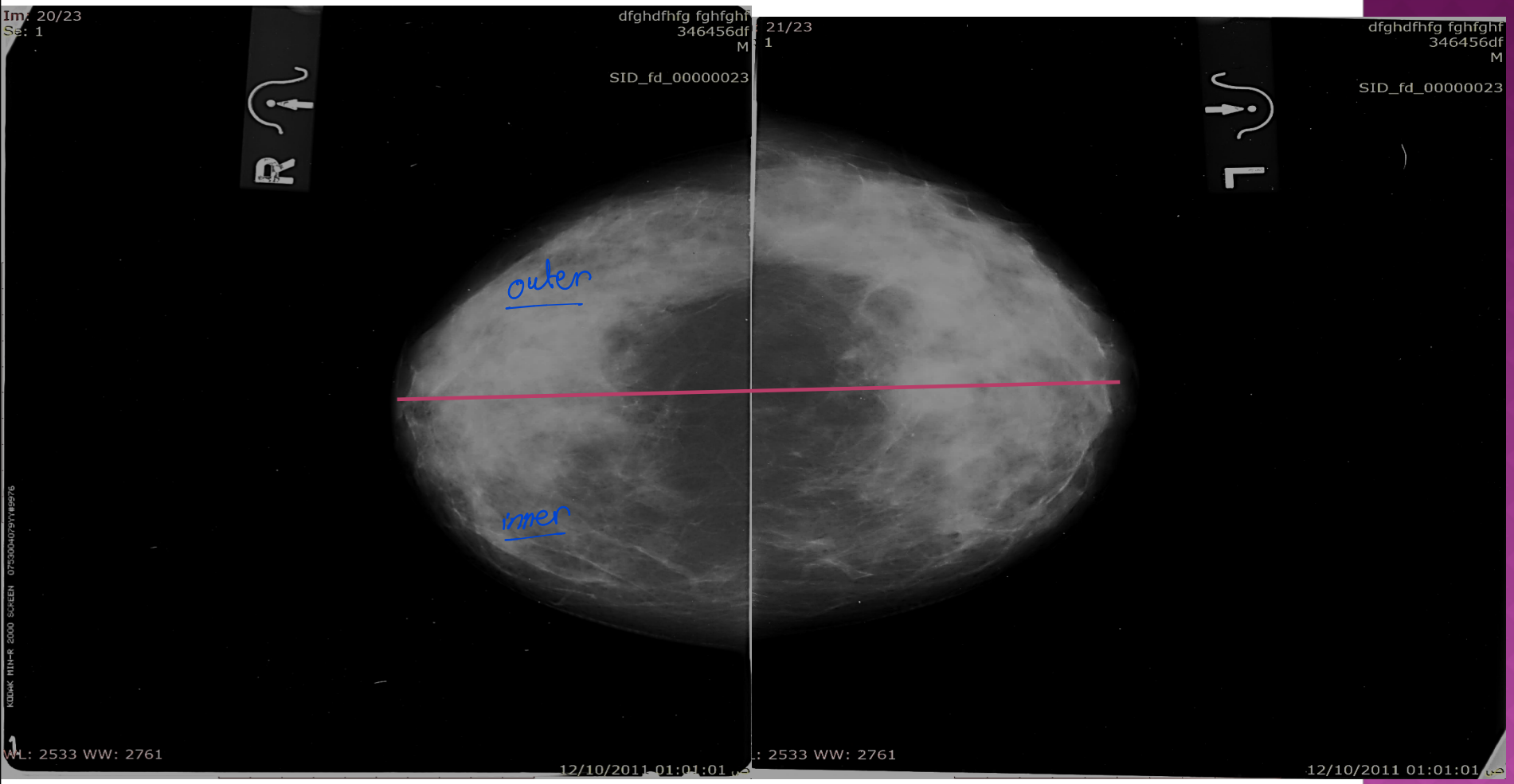
HOW IS MAMMOGRAPHY DONE?

MAMMOGRAM STANDARD VIEWS

- Cranio-caudal View (CC)
- Medial-lateral Oblique (MLO)

The two views in radiographic imaging depend on the direction/orientation of external radiation beam relative to the body.

① cranio_caudal

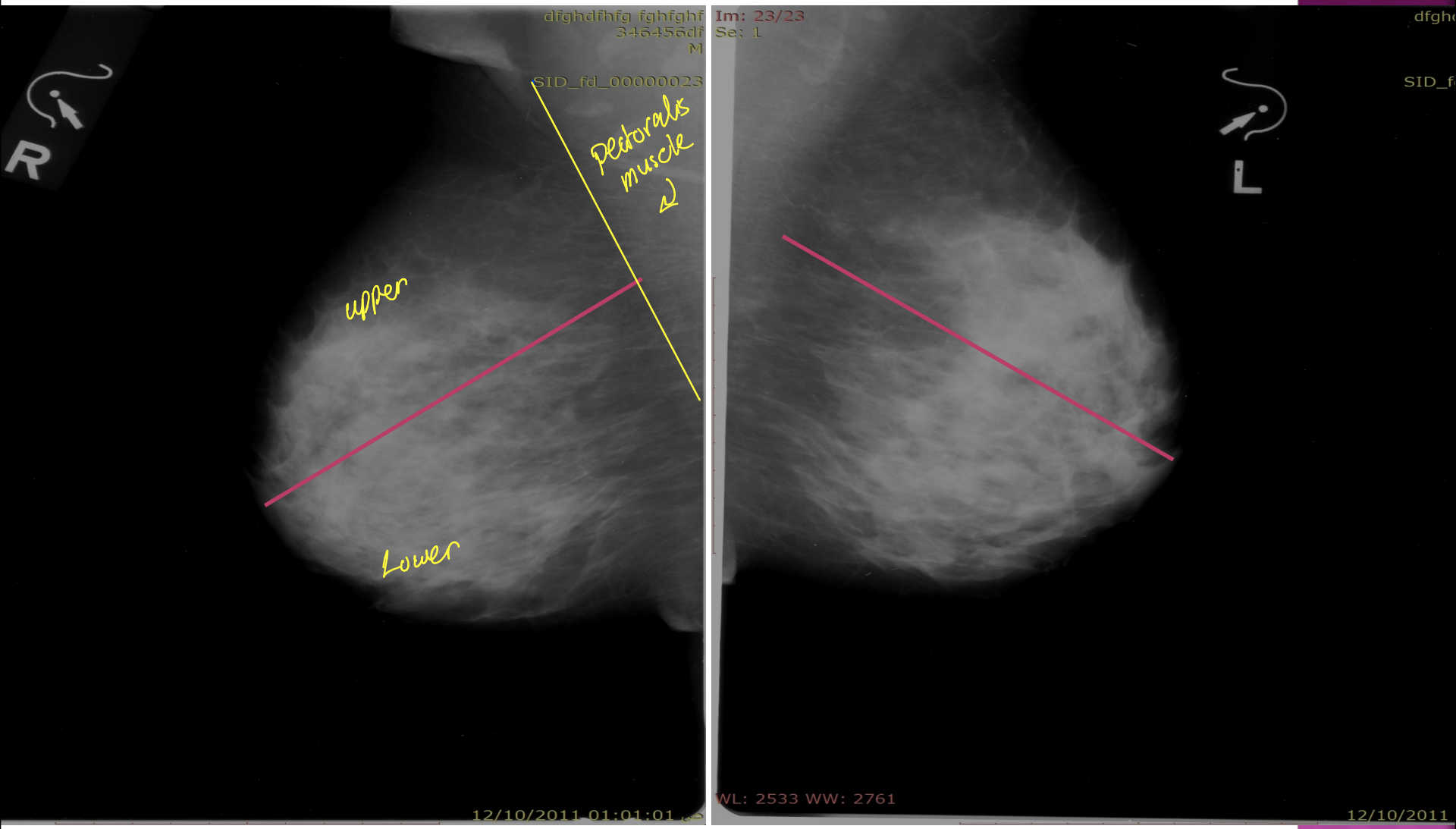


1- semi circular appearance

2- The imaginary line devided the breast into inner and outer quadrants

3- pectoralis muscle not visible

② medial-lateral oblique ——→ tear drop in shape



① The line devide the breast into upper and lower quadrants

② Pectoralis muscle and axillary lymph nodes can be seen

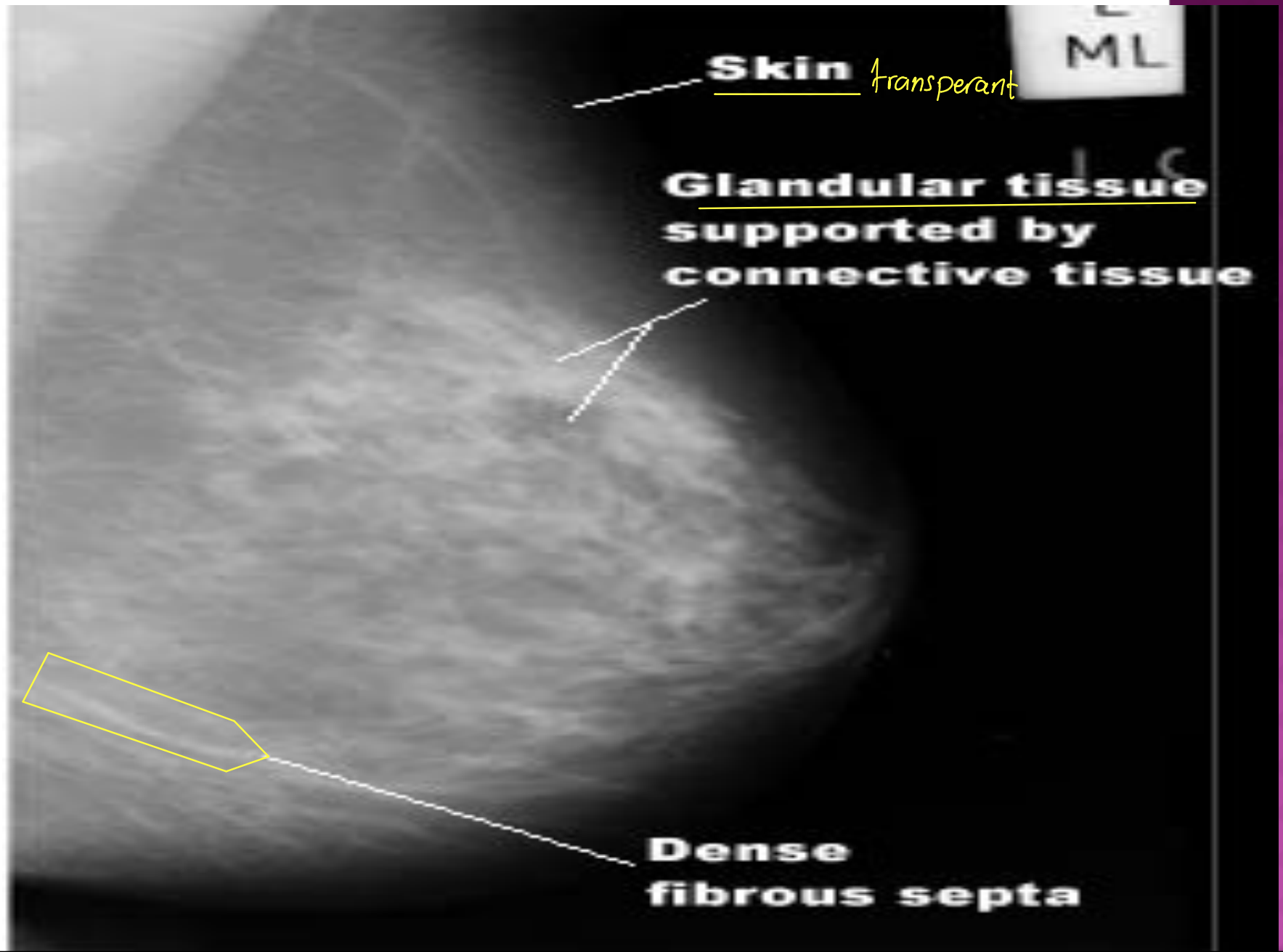
WHAT IS THE RISK OF MAMMOGRAPHY?

- Mammography exposes the breast to low dose radiation. But the dosage is very low, and for women over age 40, the benefits of regular mammography outweigh the risks posed by this amount of radiation
- The allowed dose for each view is 300 mrad

WHAT ARE THE BENEFITS OF SCREENING MAMMOGRAMS?

- Several large studies conducted around the world show that breast cancer screening with mammograms reduces the number of deaths from breast cancer for women ages 40 to 69, especially those over age 50.

APPEARANCES OF MAMMOGRAM Normal



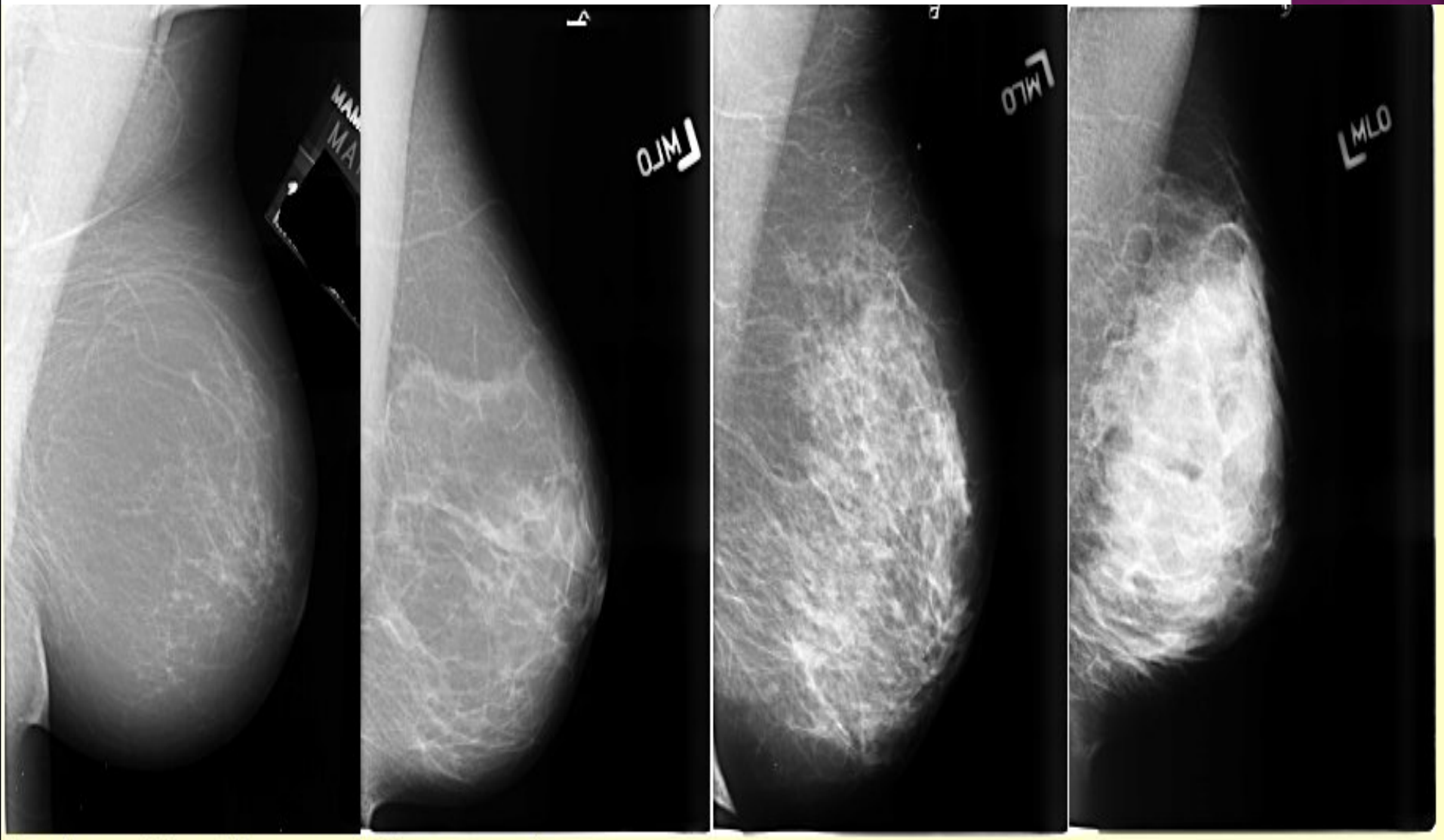
SENSITIVITY OF MAMMOGRAPHY

The sensitivity of an image is measured based on the amount of fibroglandular tissue present in the breast. The more the fibroglandular tissue, the less sensitive the image.

- 85% - 90% in fatty replaced breasts Pathology can be seen
- 65% in dense breasts Pathology can't be seen

ACR system:
ACR 1: fatty breast; usually in older females; <25% glandular tissue. Highly sensitive
ACR2: low amounts of fibroglandular tissue; 25-50% fibroglandular tissue
ACR3: heteregenous breast; 50-75% fibroglandular tissue
ACR4: dense breast; >75% glandular tissue; sensitivity decreases to 60%.

FATTY & DENSE BREAST



Breast composition and its mammographic appearance.[1]

PRIMARY SIGNS OF CANCER ON MAMMOGRAPHY

1) Mass
2) calcification

- **Mass**:

a Mass is a space occupying lesion seen in two different projections. we describe :

- **Form**: Round, oval ,lobular or irregular

- **Margin**: 1- Circumscribed (well-defined or sharply-defined) margins

2-Indistinct (ill defined) margins

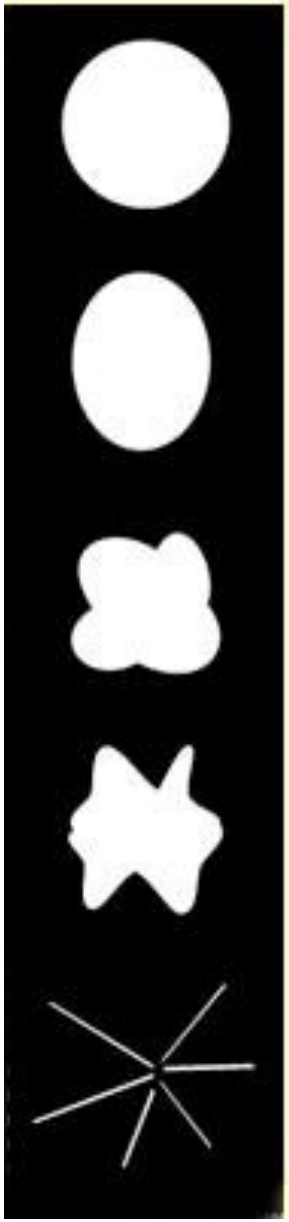
3-Spiculated Margins

4-Microlobulated: margin with small lobulations

5-parenchymally overlapped: margin is partly or completely hidden under parenchyma

- **Density**: High density (hyperdense) , Isodense, hypodense, fat equivalent as oil cyst, lipoma, galactocele

Mass Shape[1]



Round

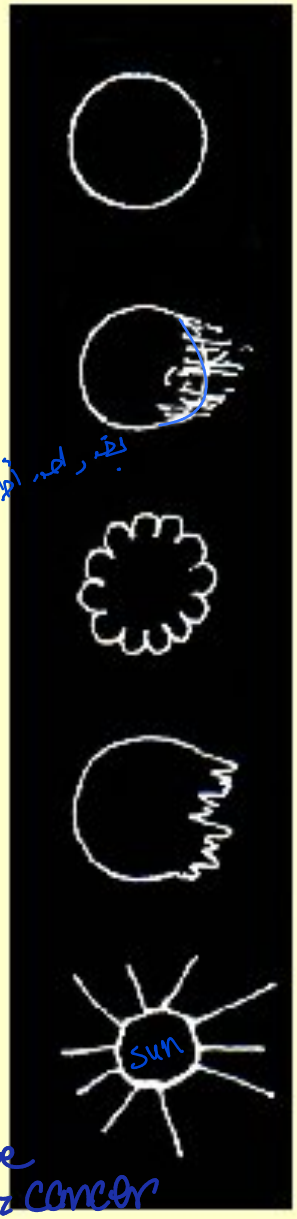
Oval

Lobulated

Irregular

Architectural Distortion

Mass Margins[1]



Circumscribed

Obscured
part of the margin is covered due to an overlap between the mass and the breast parenchyma.

Micro-lobulated

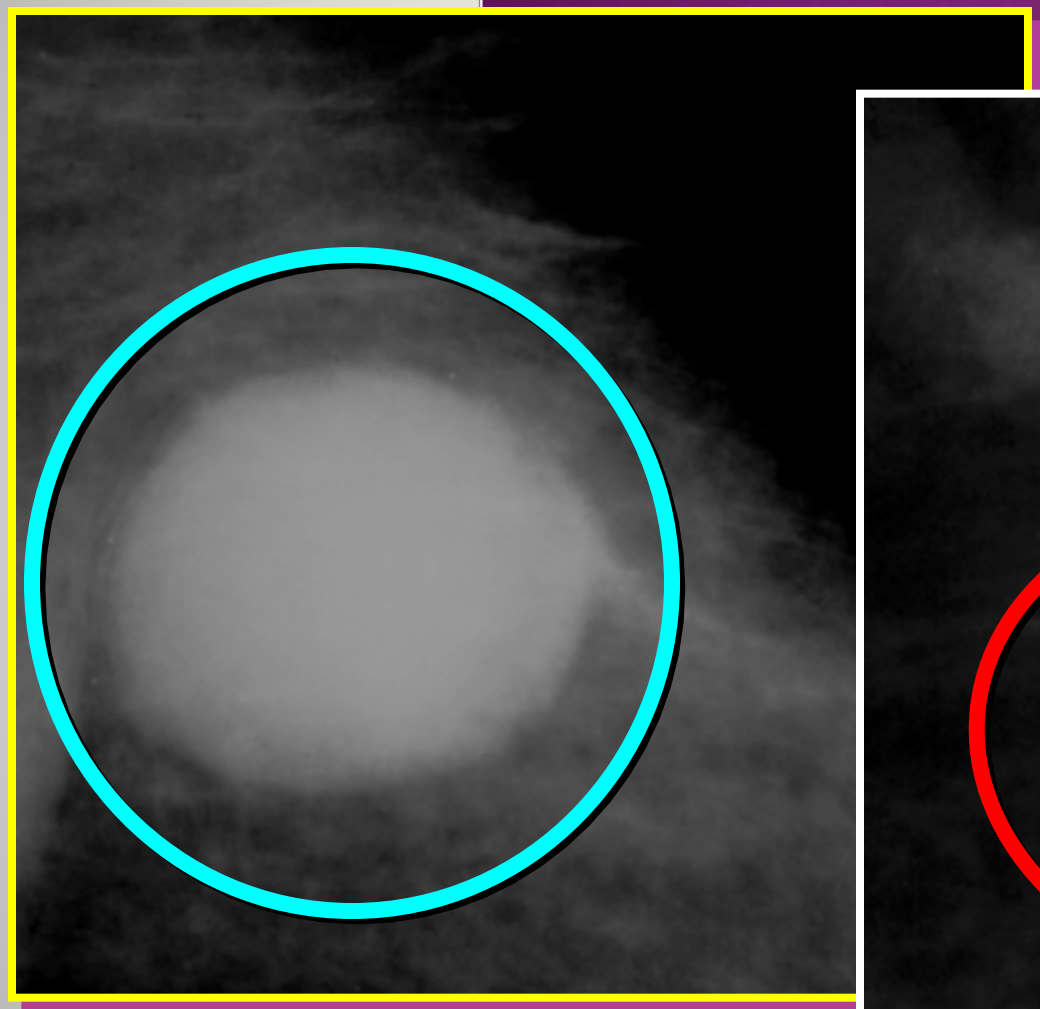
Ill-defined
the edges of the mass cannot be defined

Spiculated
1) short
2) tappering
3) ...

one spicule → cancer

hypo - hypo ← mass

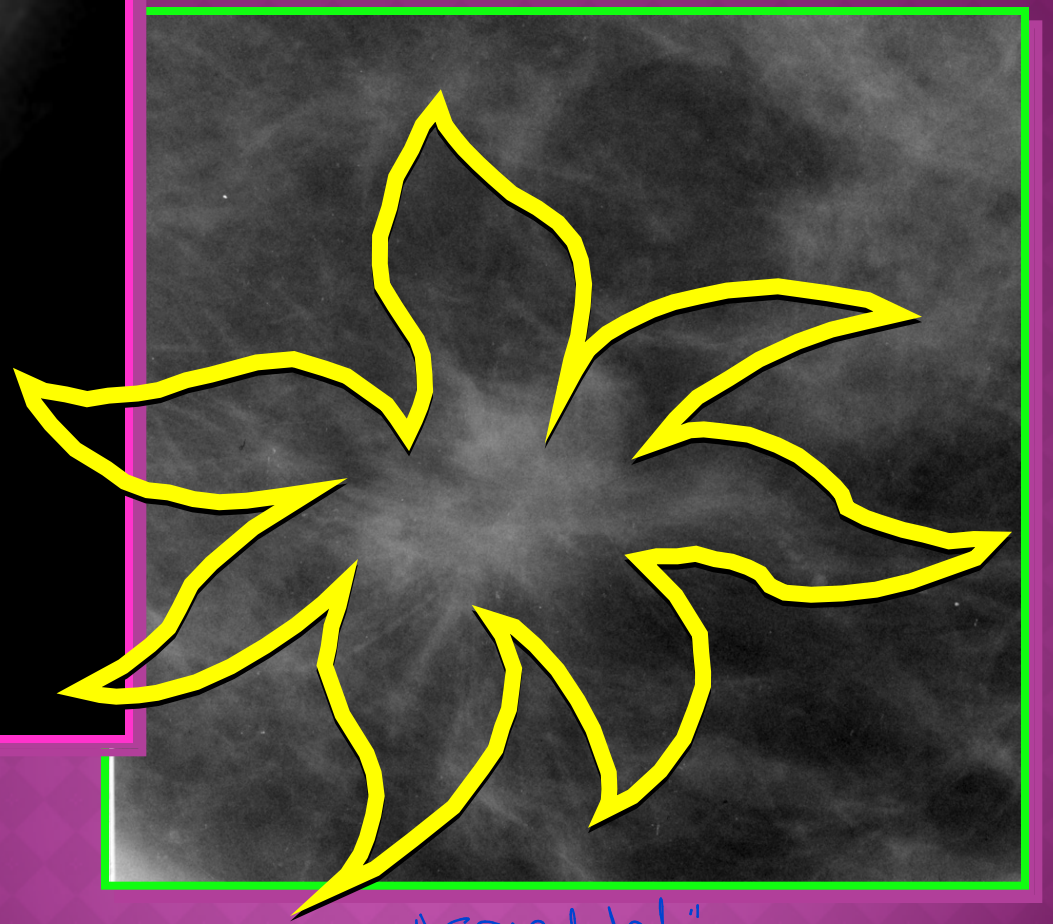
ROUND



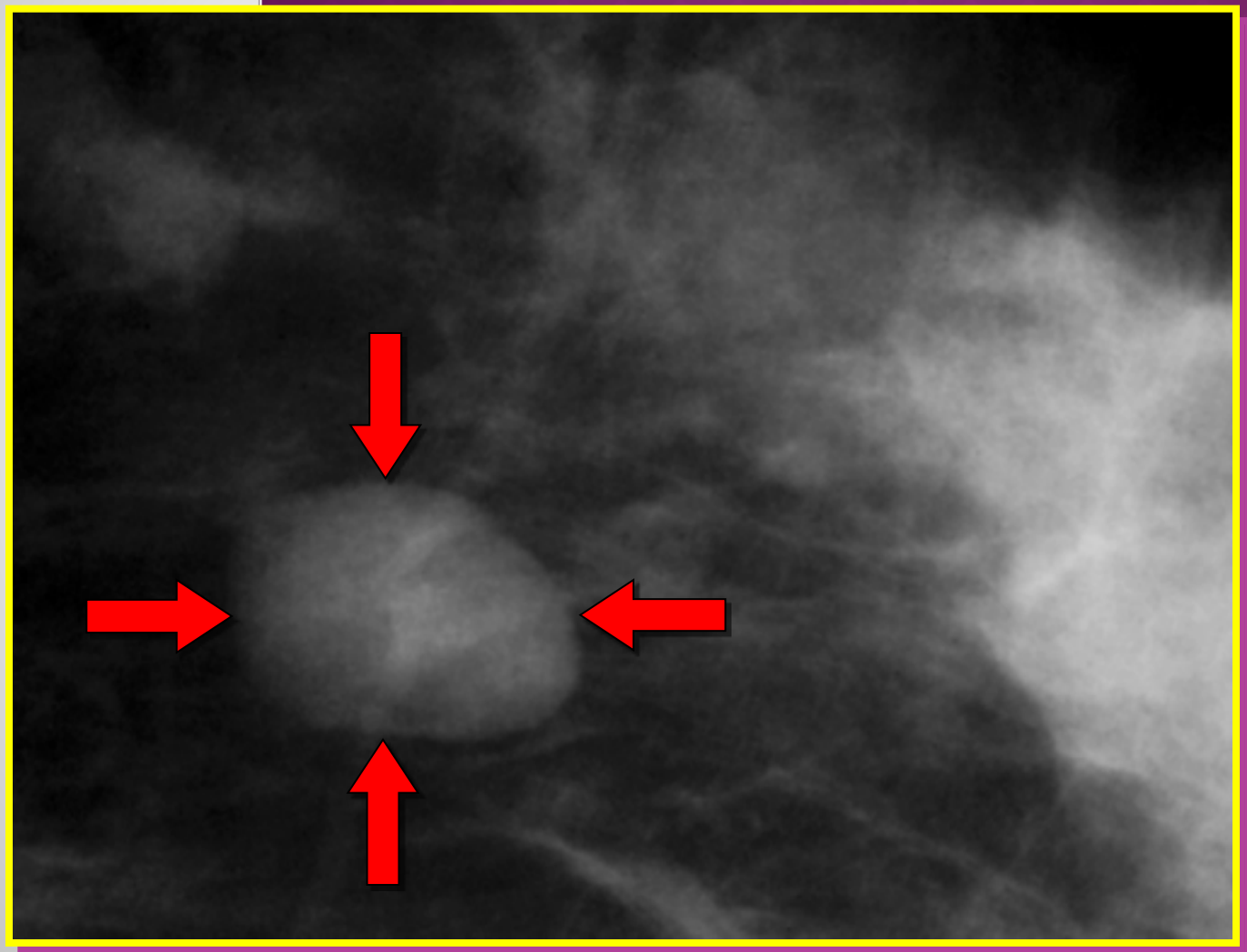
OVAL

LOBULAR

IRREGULAR

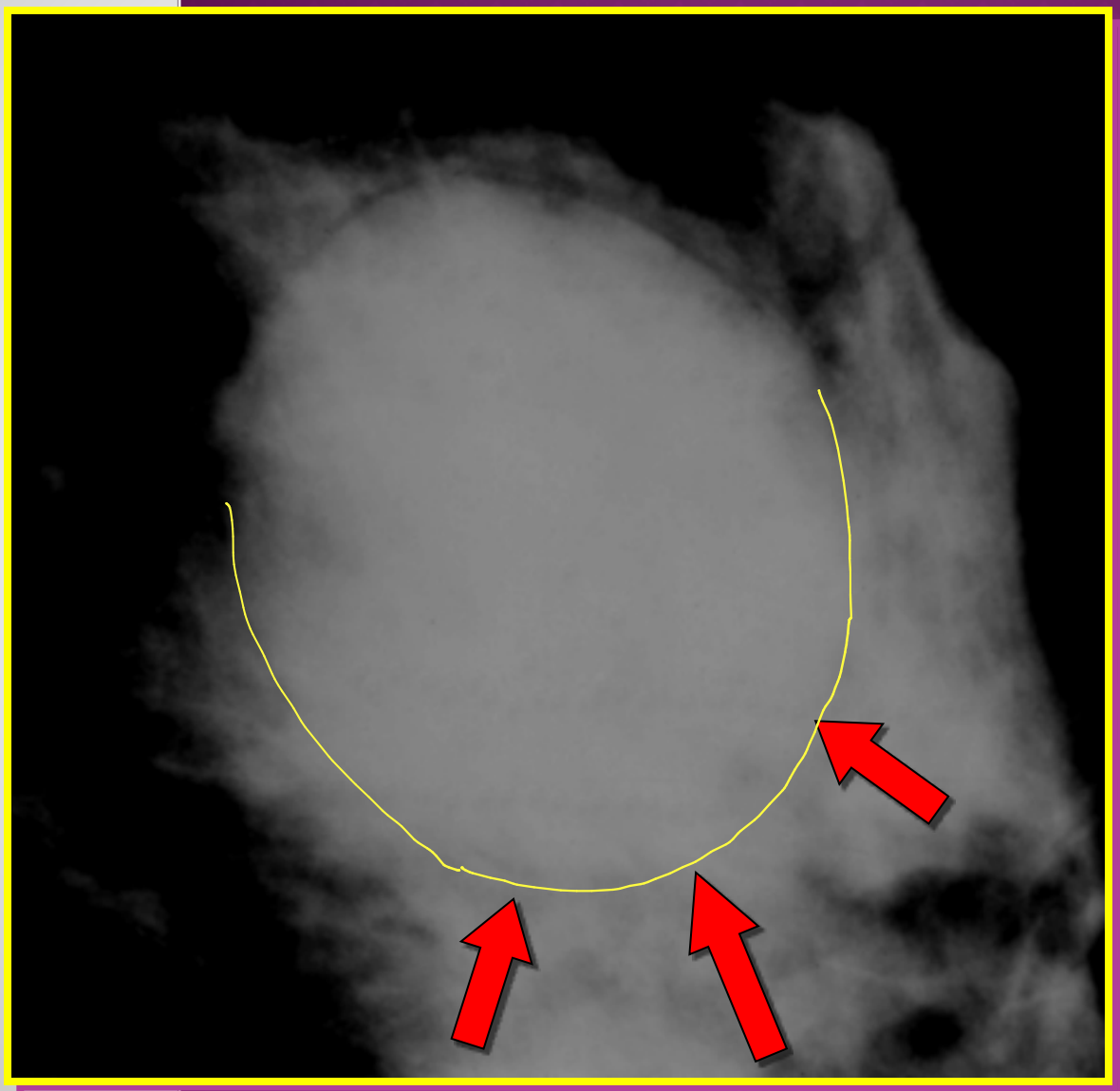


CIRCUMSCRIBED

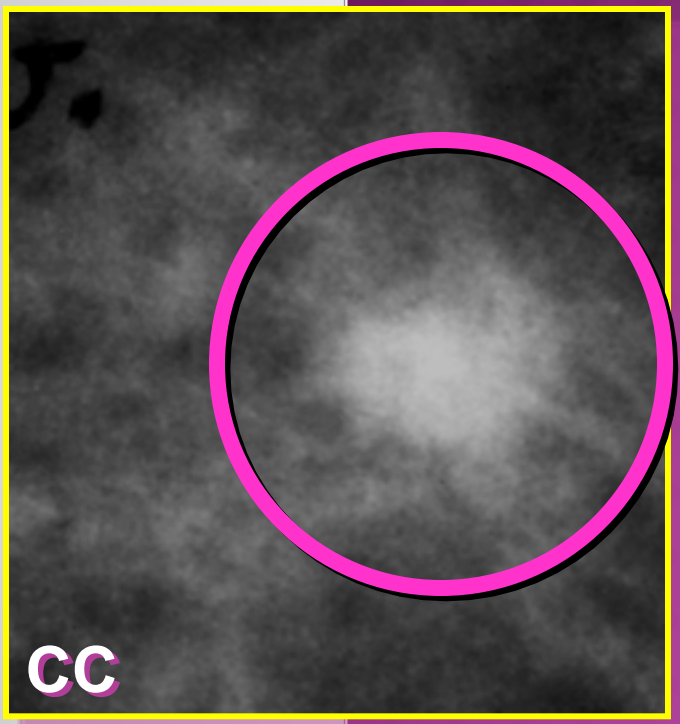


MICROLOBULATED

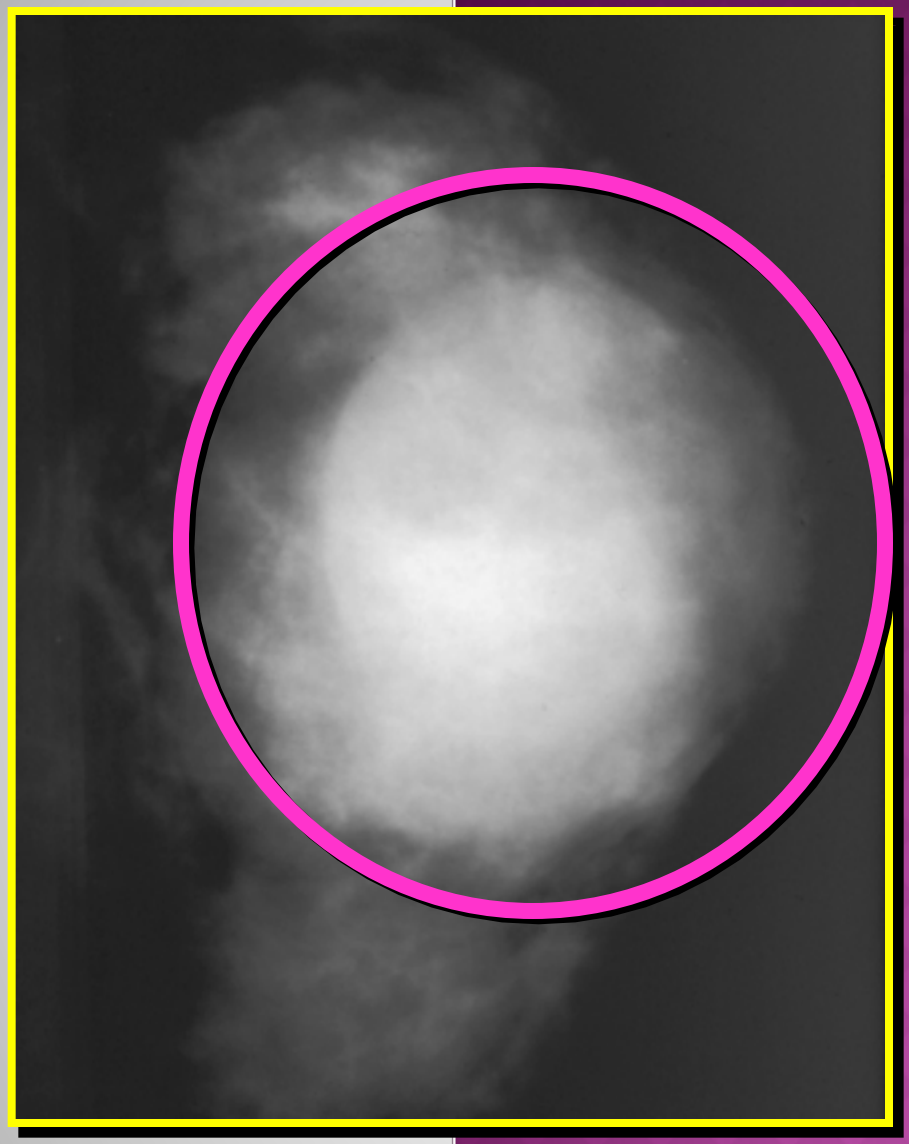
OBSCURED



INDISTINCT



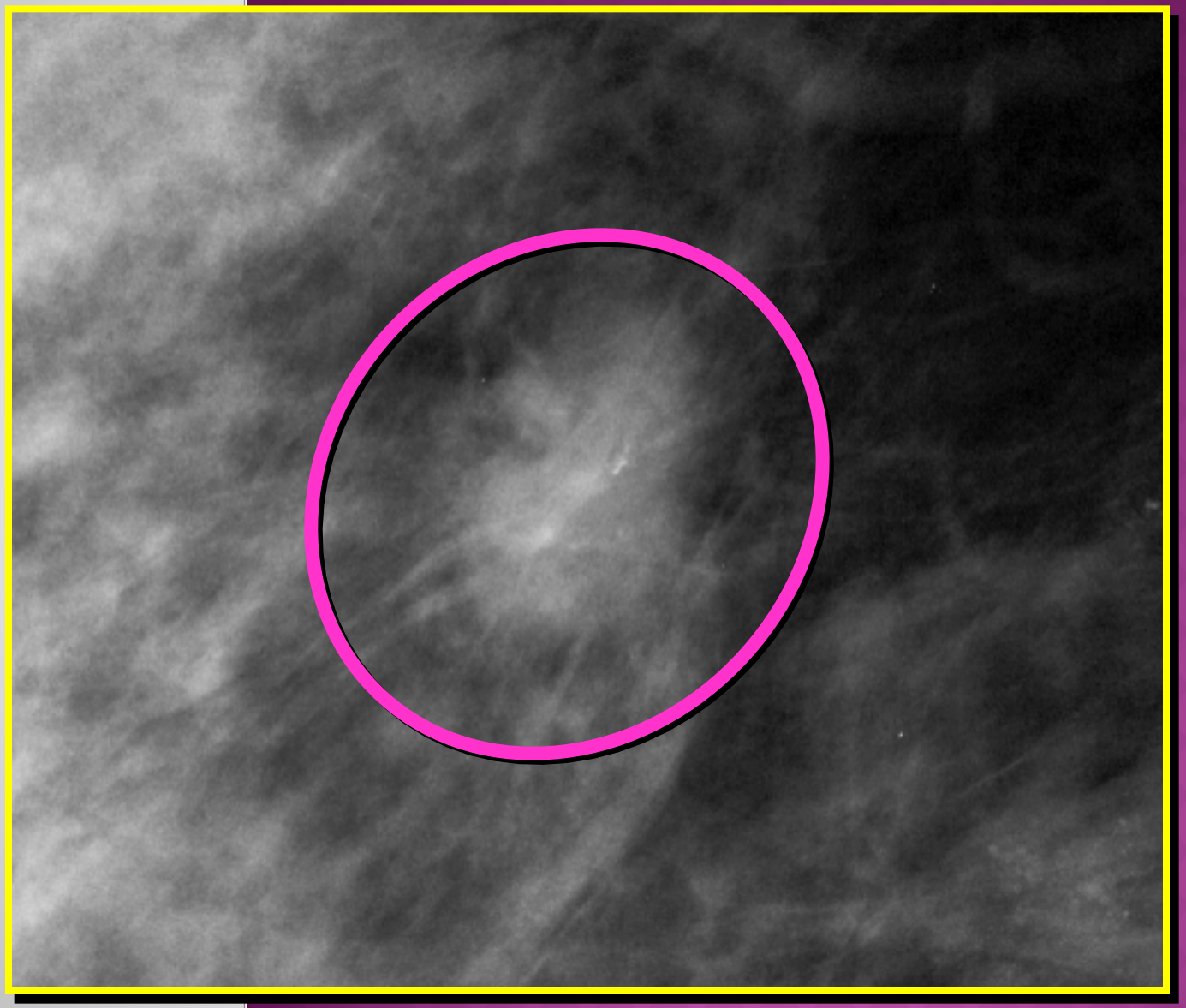
SPICULATED



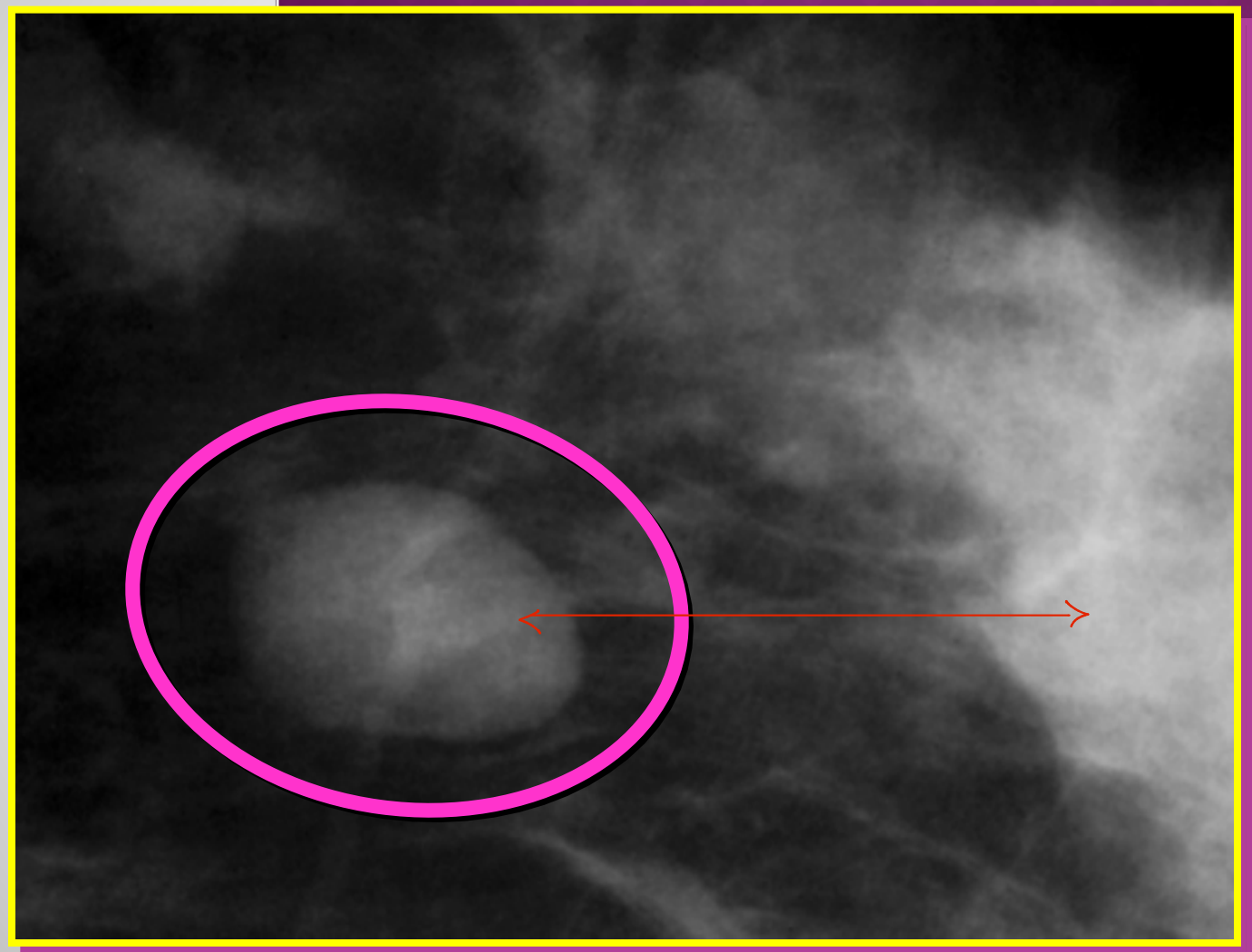
HIGH DENSITY

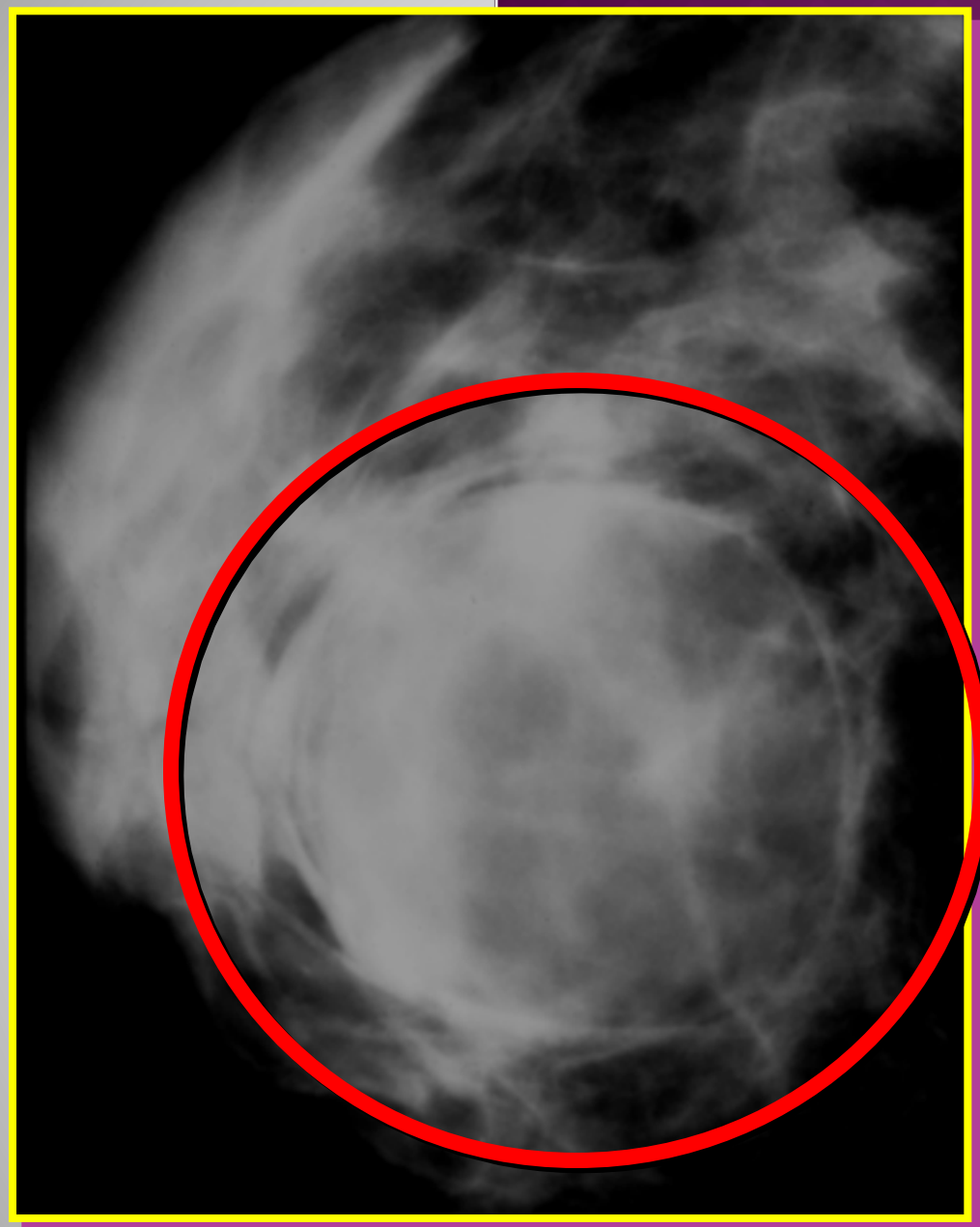
EQUAL DENSITY

The density of the mass is assessed relative to the adjacent tissues



LOW DENSITY



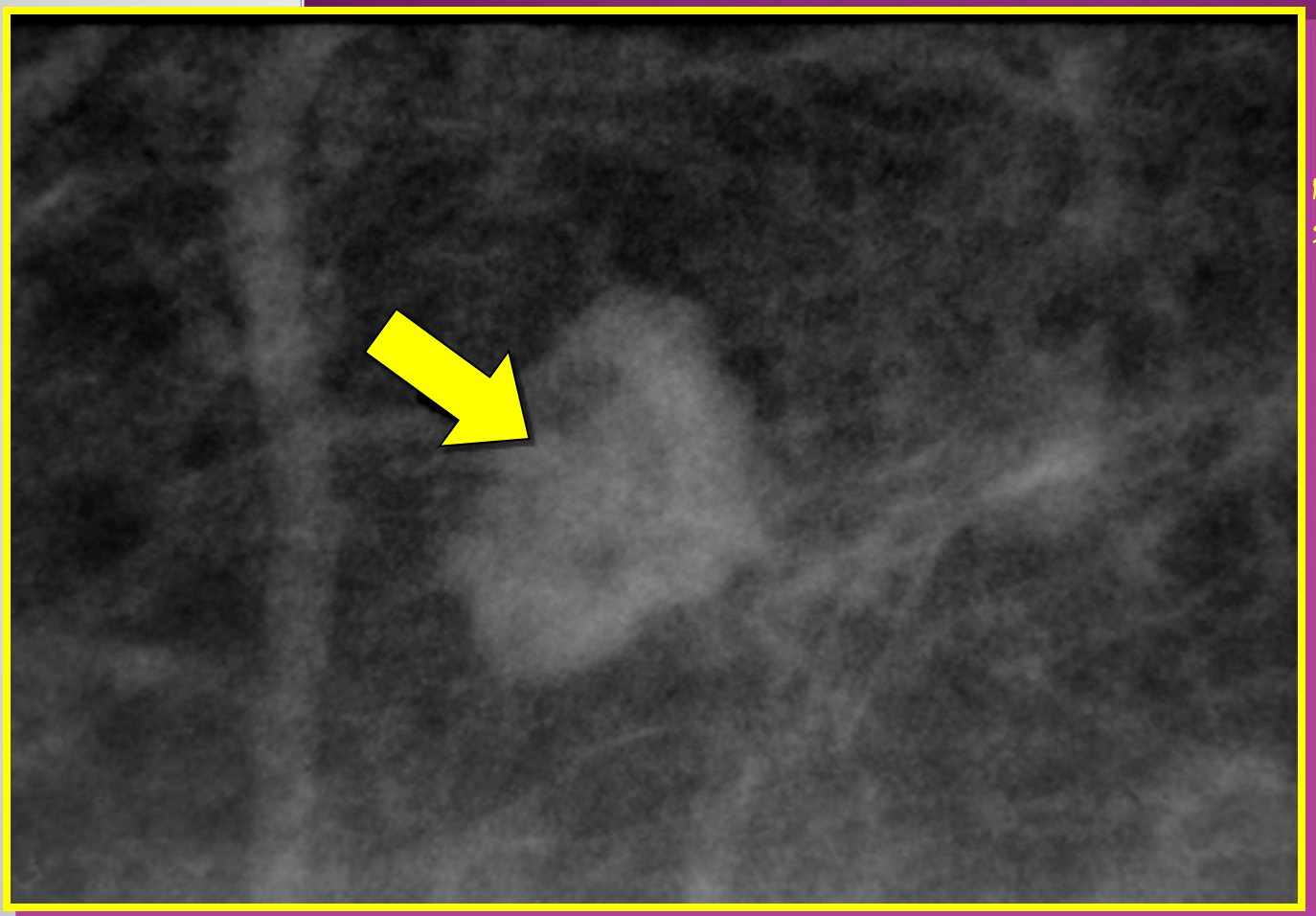


FAT-CONTAINING

* Lipoma / cyst

No density (transparent)

INTRAMAMMARY LYMPH NODE



*Lobular

LN →

1- Hyperdense cortex

2- Fatty hilum

LN → on MRI, CT, Xray appear the same

MASSES: BI-RADS DESCRIPTORS

SHAPE:

- ➡ Round, oval, lobular, irregular

Benign

Malignant

MALIGNANT

BENIGN

- ➡ Circumscribed, microlobulated, obscured, indistinct, spiculated

DENSITY:

- ➡ High, equal, low, fat-containing

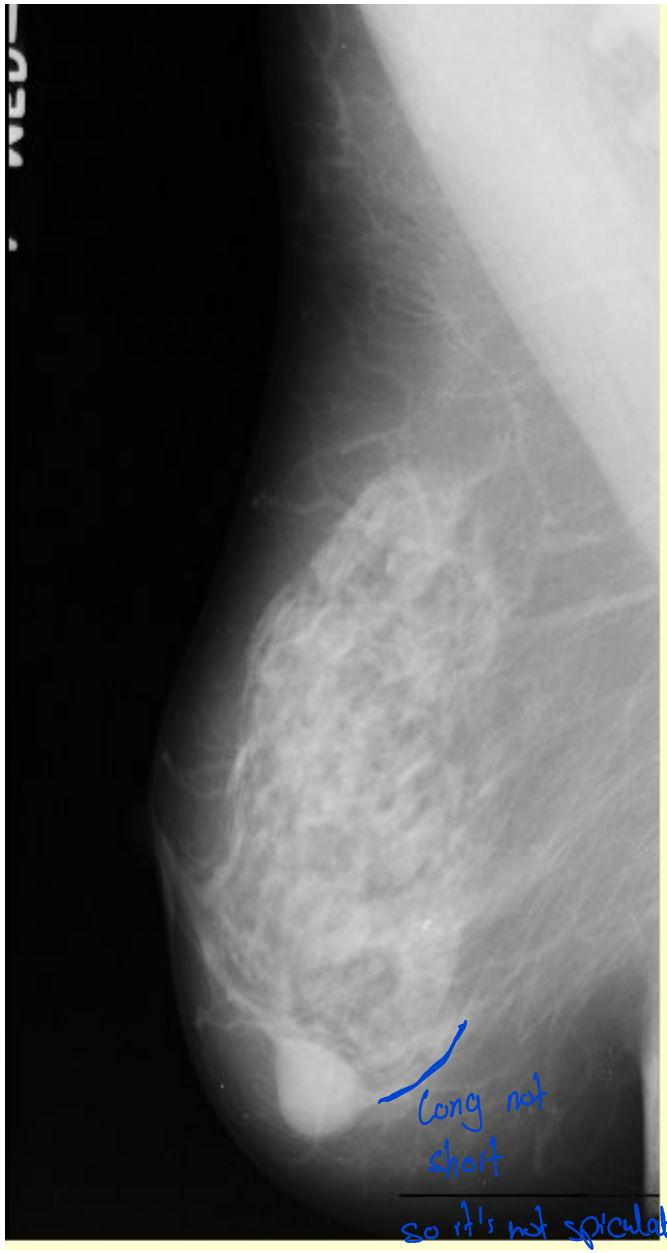
BI-RADS LEXICON: MASSES

- For final assessment & further management decisions, use descriptor(s) with MOST WORRISOME FINDINGS

e.g., if mass PARTLY CIRCUMSCRIBED & PARTLY INDISTINCT, take further action based on INDISTINCT MARGINS

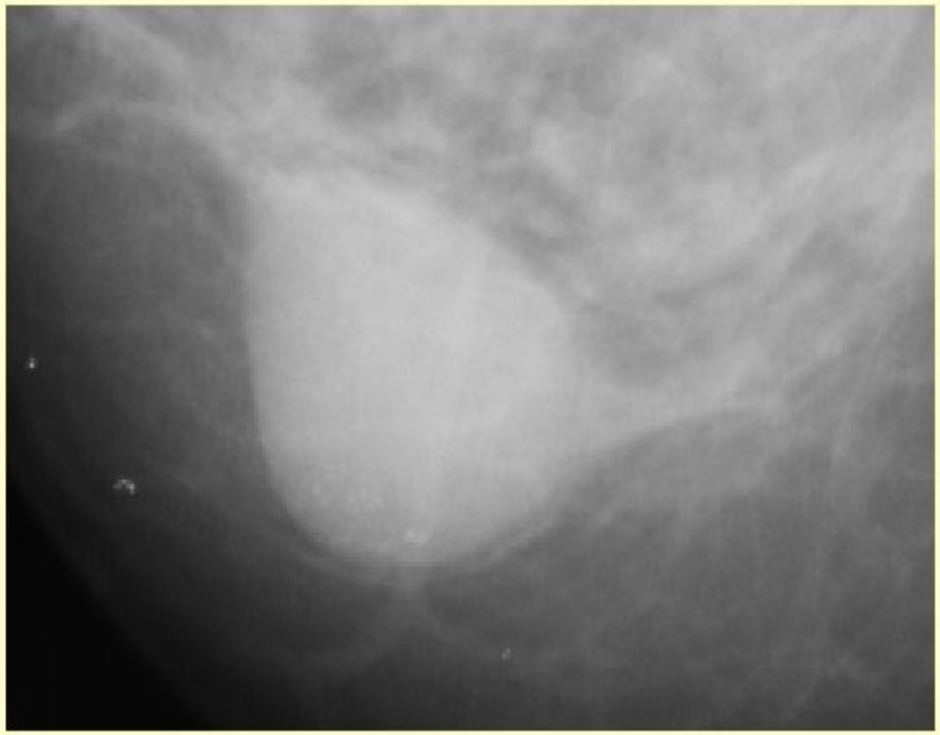
An oval mass and a round mass with circumscribed margins are evident in the upper quadrant of the breast on this medio-lateral view.[1]

Fatty, rounded, spiculated



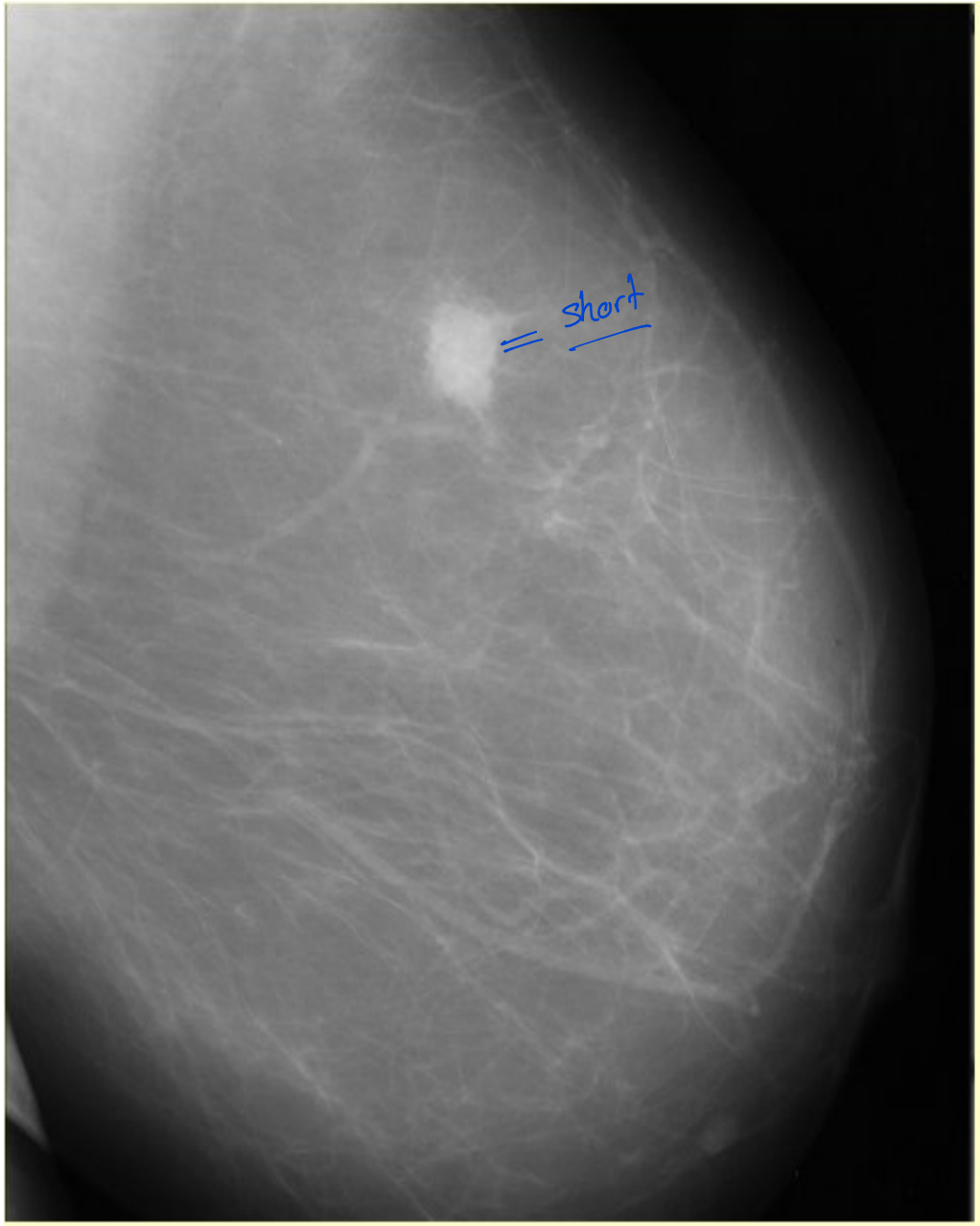
long not short

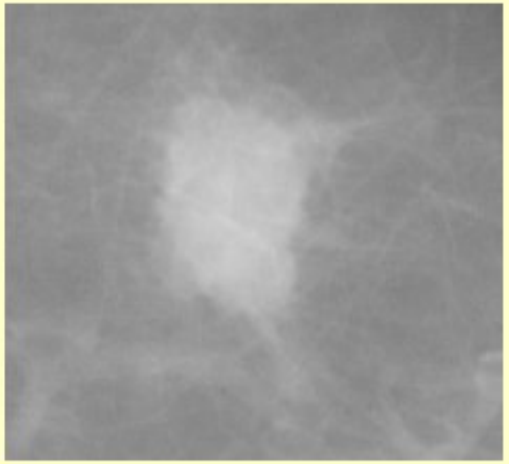
so it's not spiculated



This large round to oval mass has a well-defined circumscribed margin.[1]

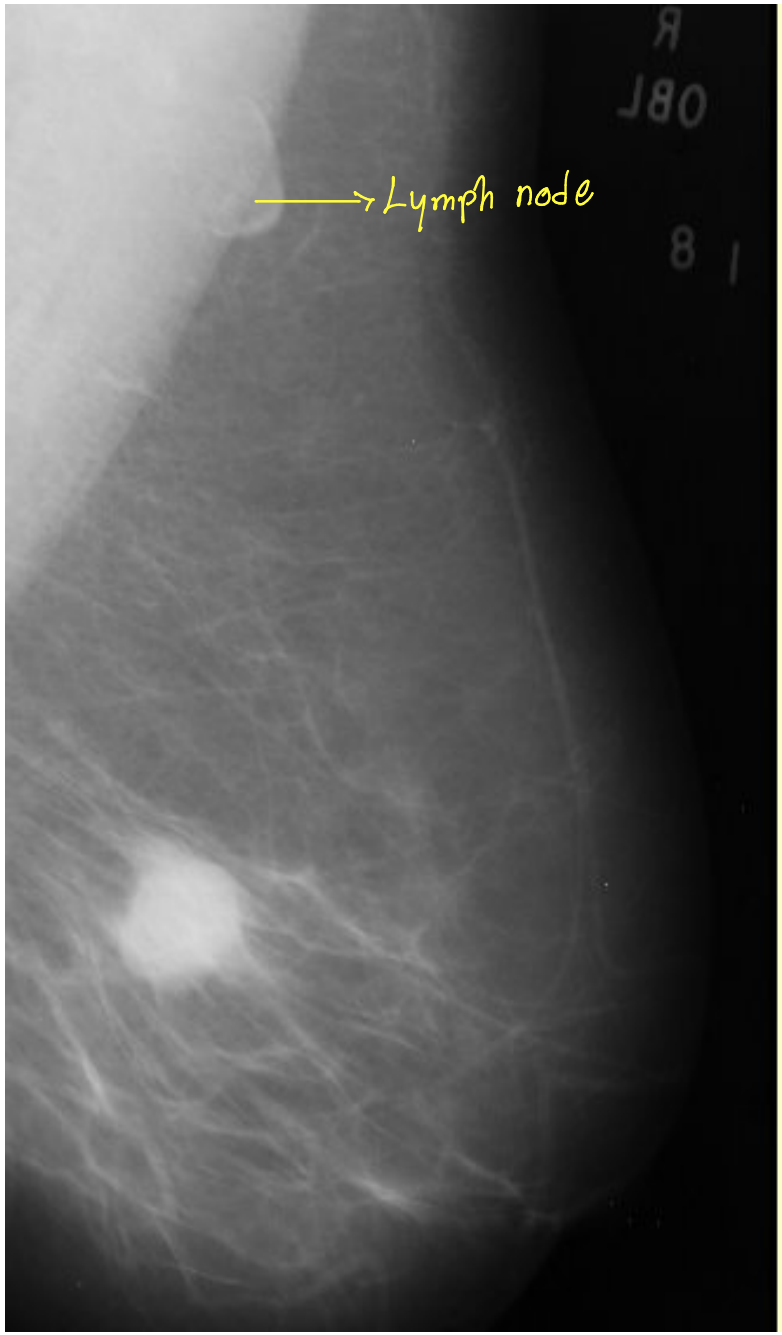
Medio-Lateral / dense, oval well defined mass





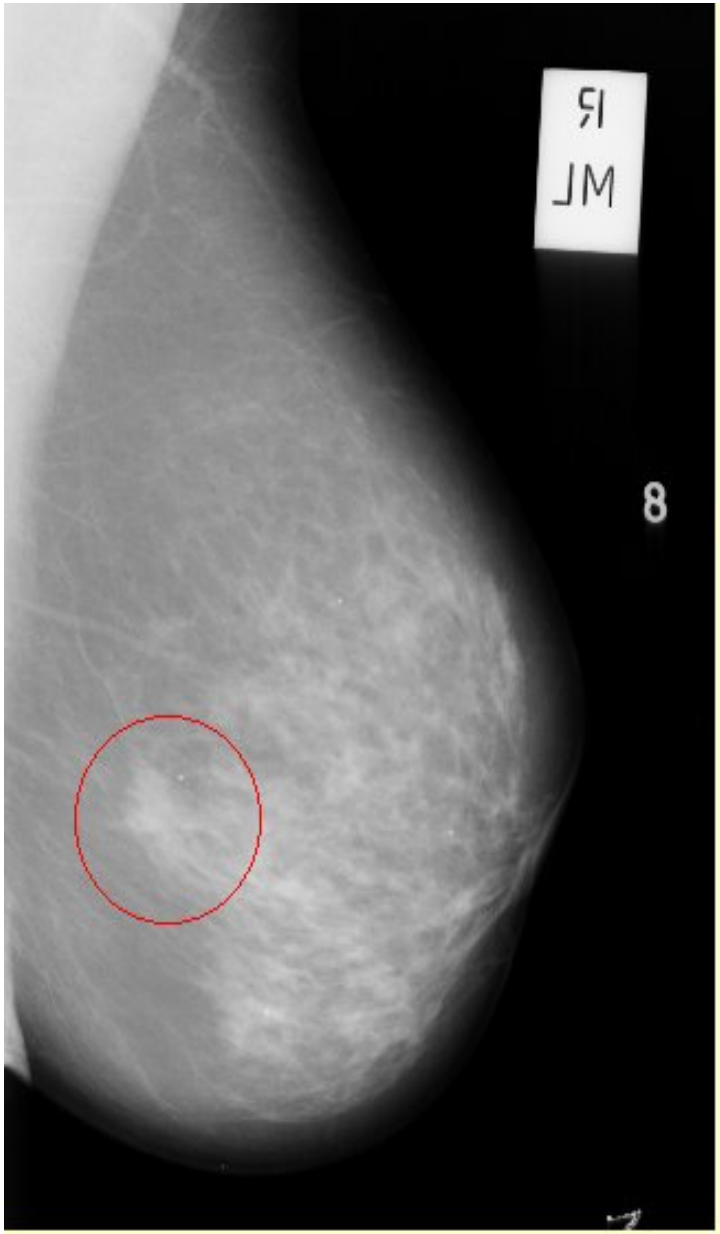
The margin of this solitary mass is lobulated. The undulations are better appreciated on magnification.[1]

- oval / Lobulated
- spiculated

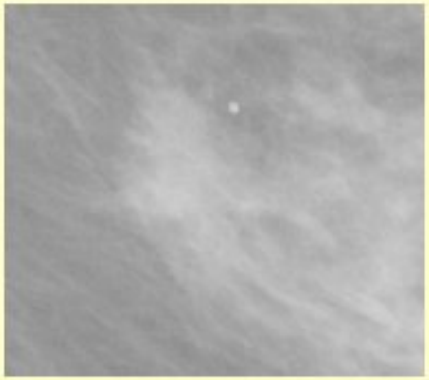


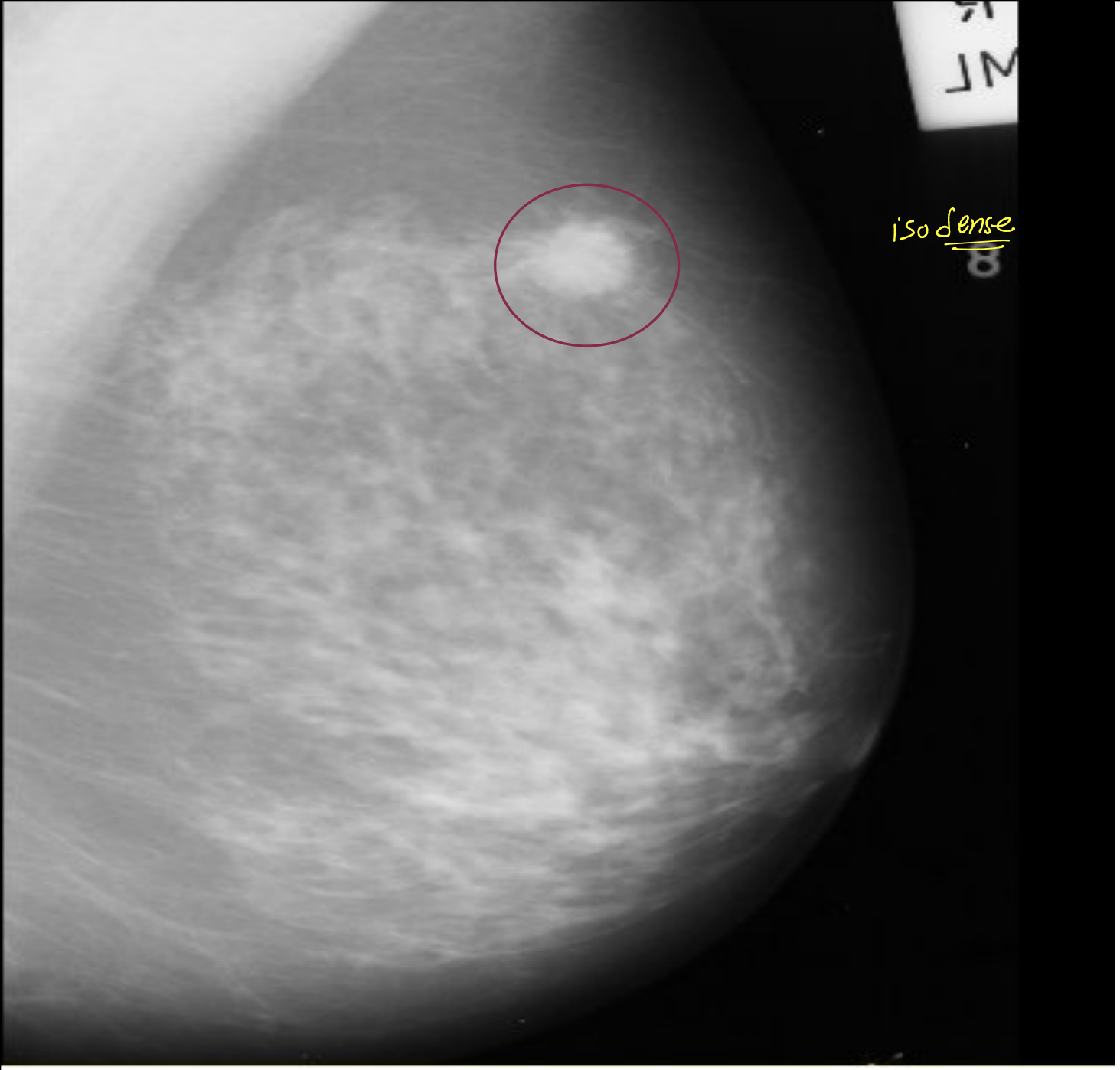
oval
obscured

This oval mass appears to have its well-circumscribed margin obscured by overlapping tissue. This lesion was diagnosed as being malignant.[1]



This lesion's margin is ill-defined.[1]



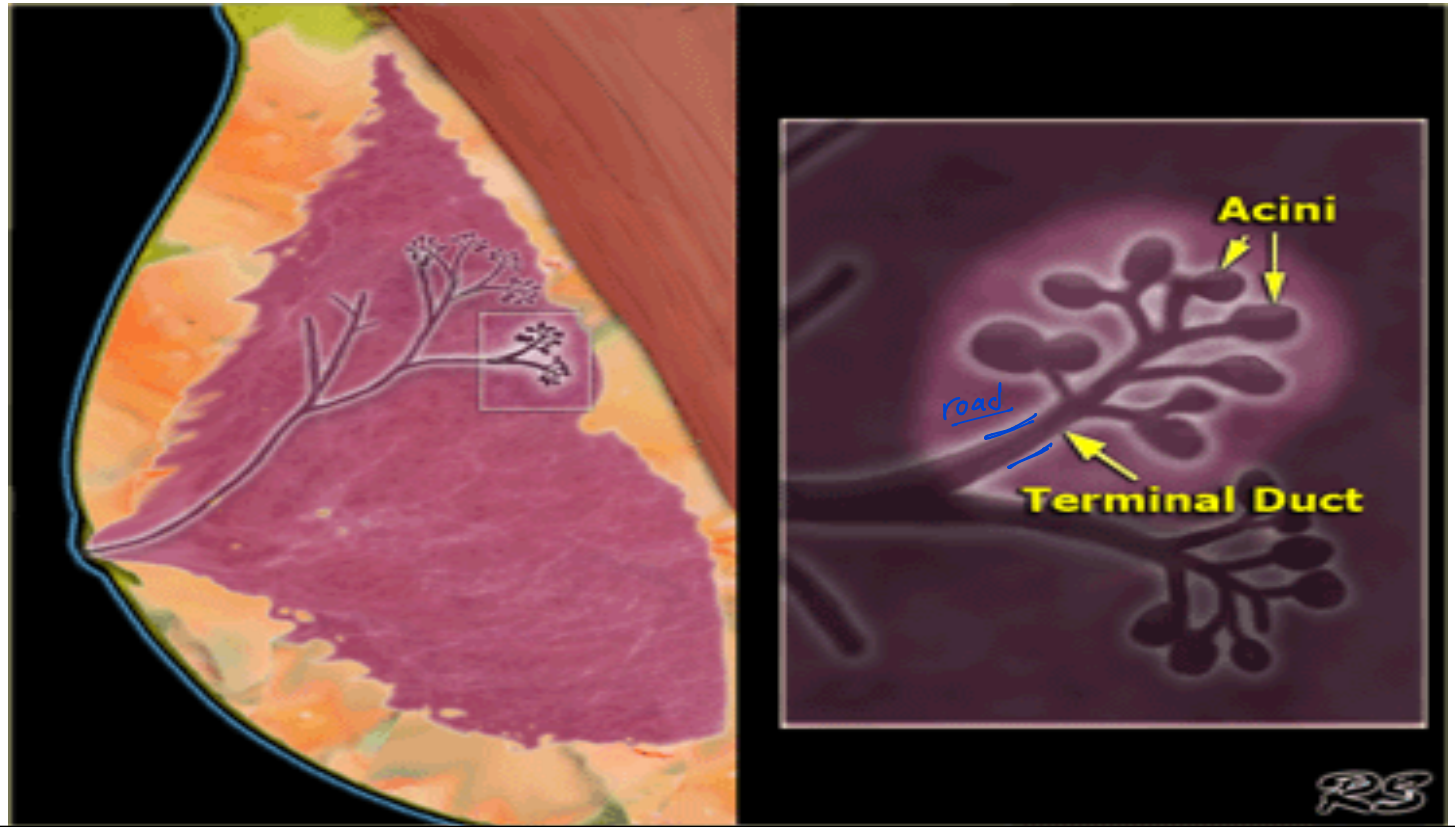


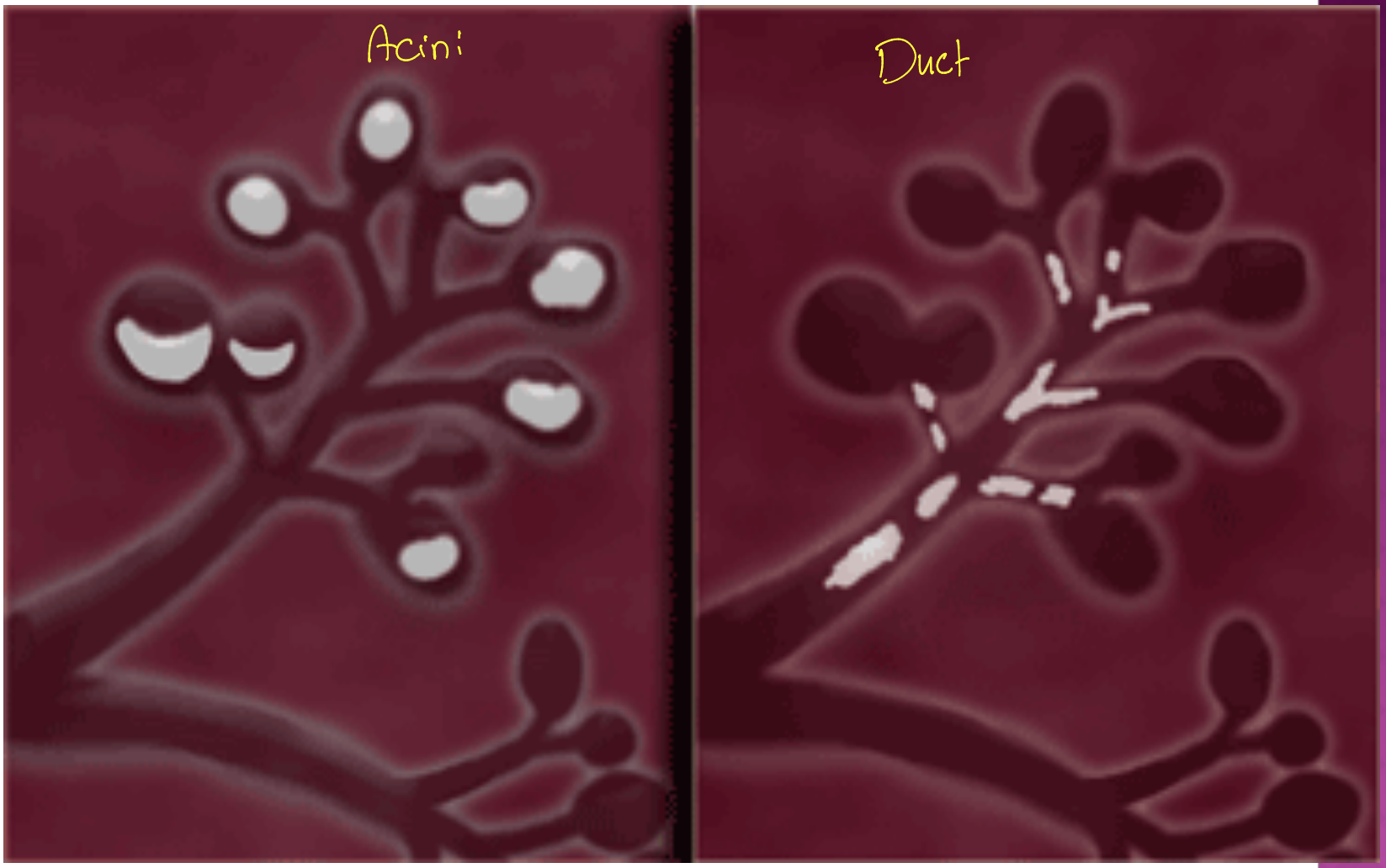
Spiculated mass

CALCIFICATIONS

Terminal ductal lobular unit

The basic functional unit in the breast is the lobule, also called the terminal ductal lobular unit (TDLU





LEFT: Lobular calcifications: punctate, round or 'milk of calcium'
RIGHT: Intraductal calcifications: pleomorph and form casts in a linear or branching distribution

DIAGNOSTIC OF CALCIF. APPROACH

① Morphology
② Distribution

Morphology

The form of calcifications is the most important factor in the differentiation between benign and malignant.

موجودين ورا بس حطيتهم مرة وحدة
From dossier

Morphology:

1. Benign:
    - Skin calcifications: round or oval calcifications within 1 cm of the skin
    - Round calcification away from the skin
    - Eggshell calcifications away from skin: indicate fat necrosis
    - Vascular calcifications: railoroad appearance; they appear as either continuous or fragmented masses; increase with age
    - Popcorn calcifications: also called coarse calcifications; the presence of a popcorn calcification inside an isodense/hypodense well circumscribed mass is diagnostic of an involutingfibroadenoma which is a benign lesion.
    - Plasma cell mastitis: large rod calcifications
    - Dystrophic: ill defined calcifications usually following a surgery or a biopsy
    - Suture calcifications: calcifications at a suture site. Now rarely seen due to the use of absorbable sutures.
2. Intermediate risk:
    - Amorphous calcifications: powder like calcifications; can indicate sclerosingadenosis (benign) or low grade DCIS (malignant). They need to be biopsied.
3. Malignant calcifications:
    - Pleomorphic: multiple calcifications that are irregular; crushed stone appearance. Indicate high grade DCIS
    - Fine linear branching calcifications; indicate high grade DCIS

Calcifications Morphology

Benign

Skin
Vascular
popcorn
plasmacell mastitis
fat necrosis
milk of calcium
dystrophic
eggshell
suture

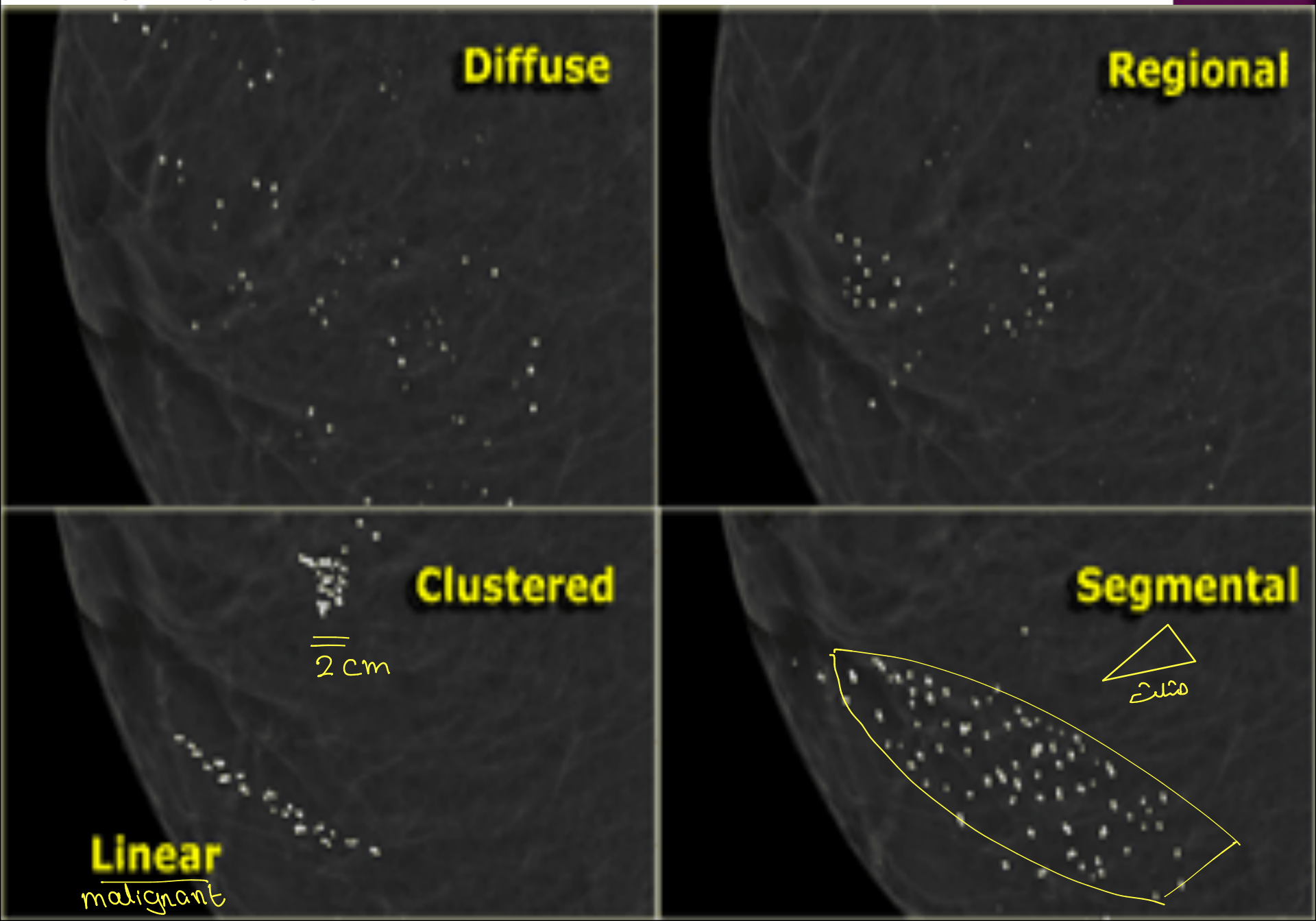
Intermediate Concern

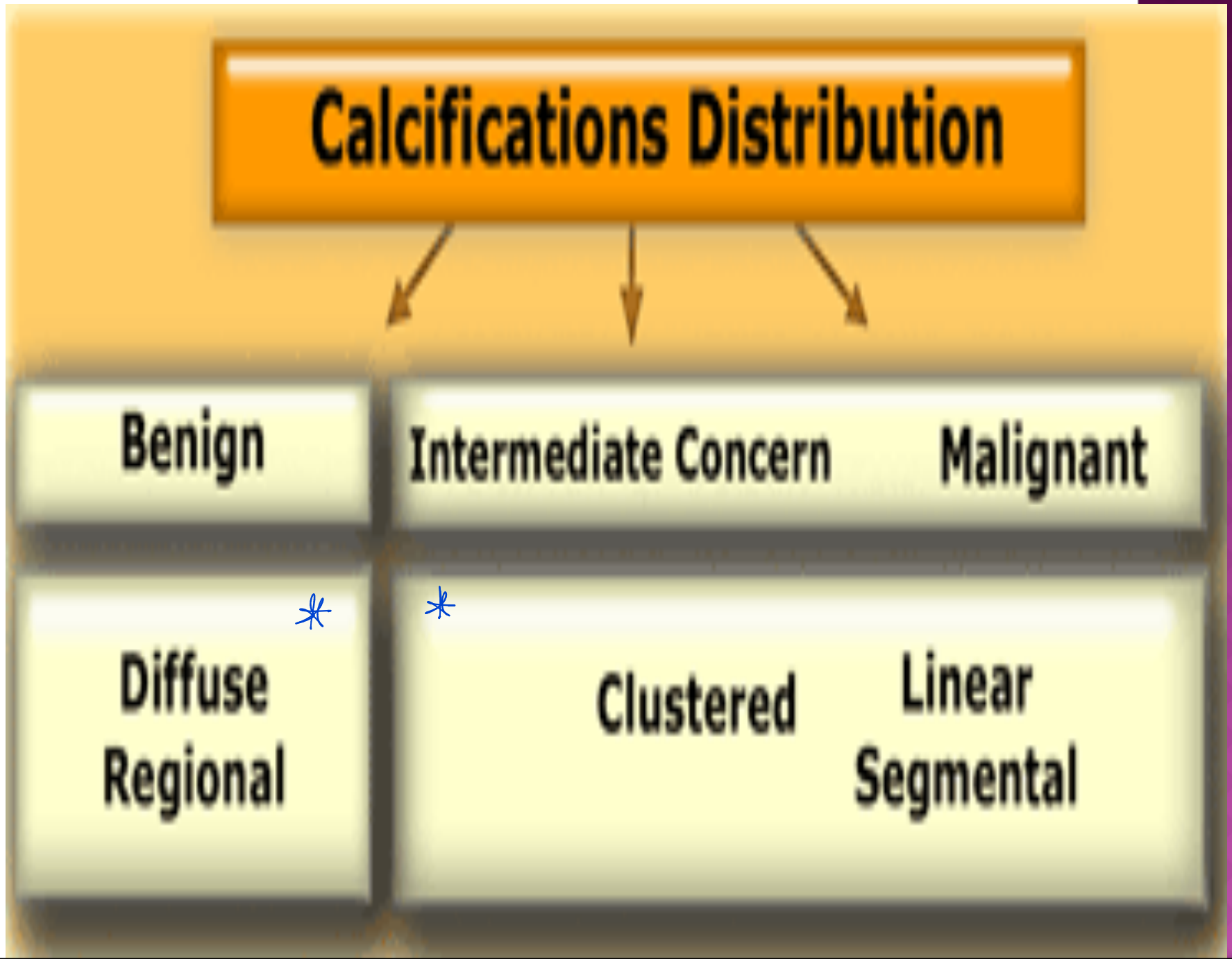
Amorphous
Coarse heterogenous

Malignant

fine linear
branching
pleomorphic

Distribution

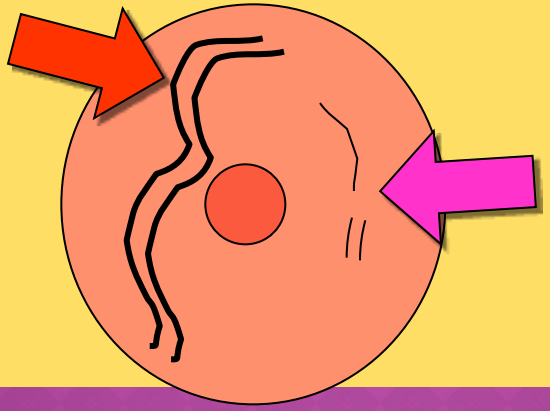



Calcifications Distribution
Benign
Intermediate Concern
Malignant
Diffuse
Regional
Clustered
Linear
Segmental

EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

- Skin
- vascular,
- large rod
- coarse (popcorn-like)



Usually “railroad track” appearance

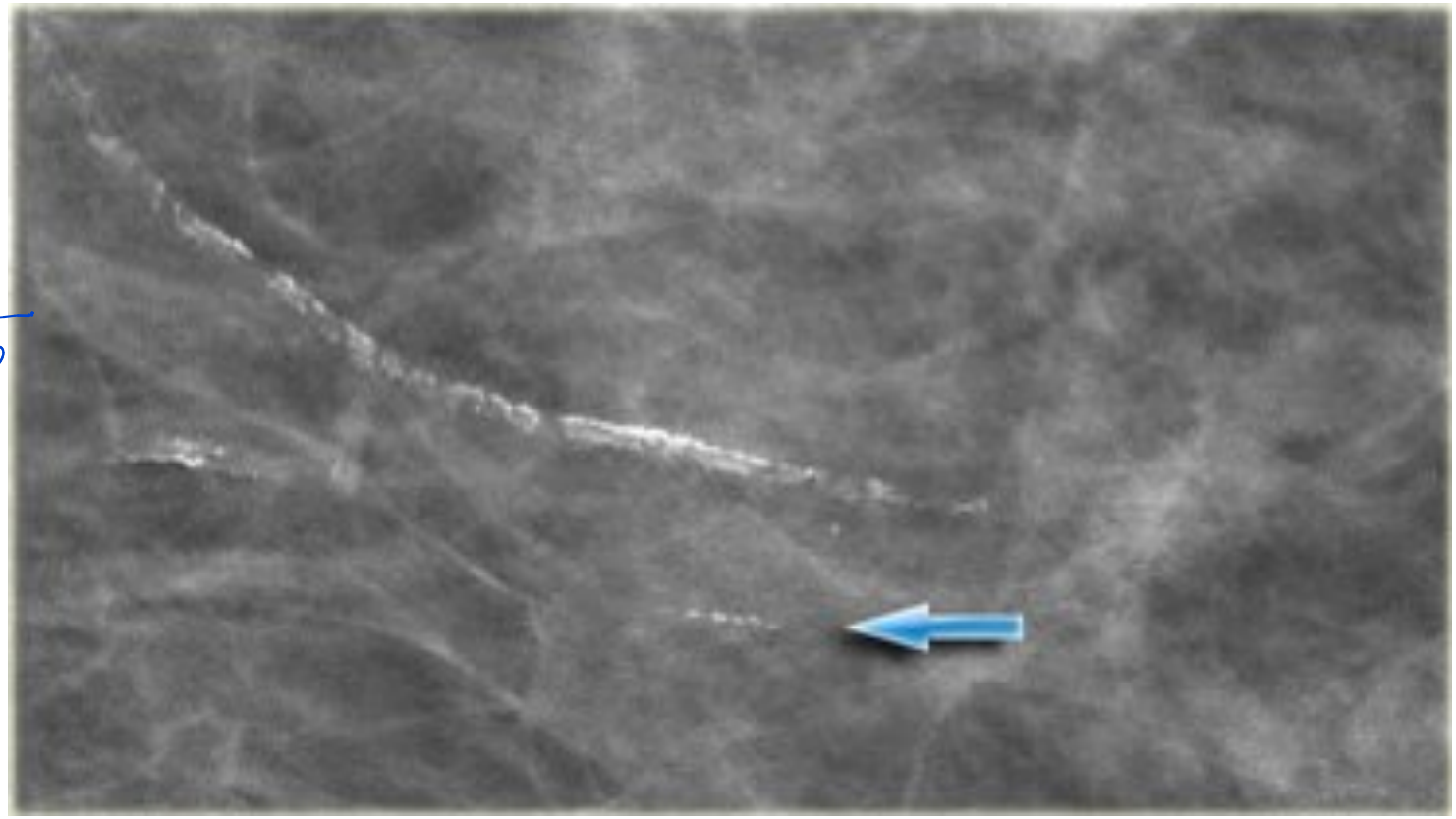
Can be fragmented

BENIGN CALCIFICATIONS

Rail road track appearance

Vascular Calcifications

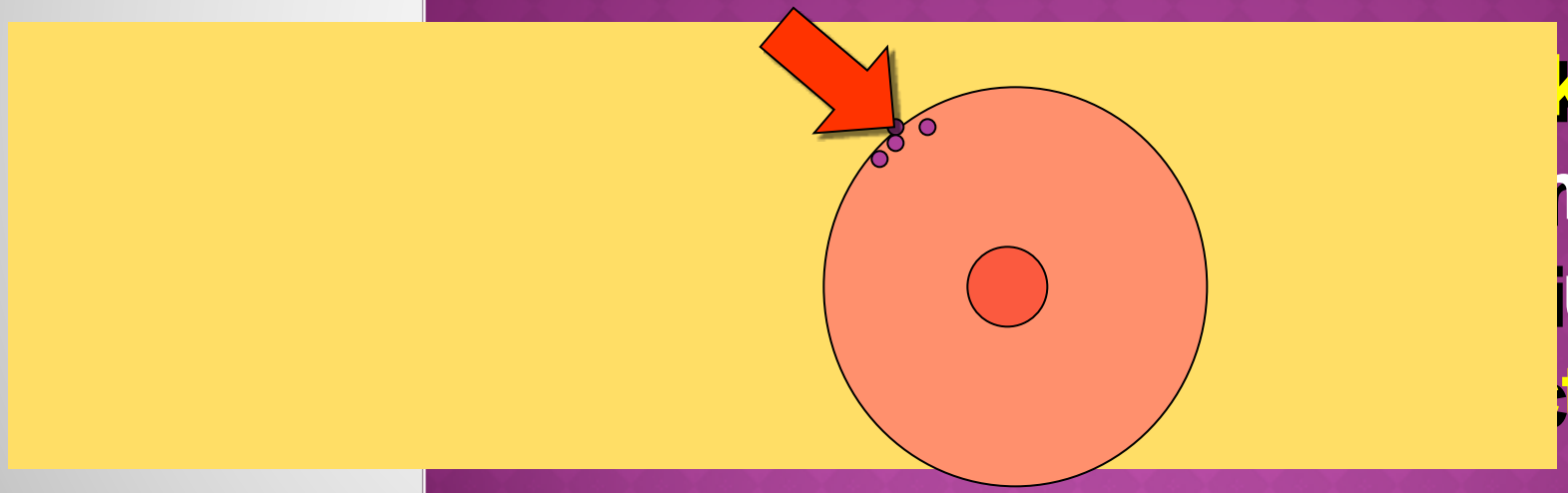
Benign due to aging



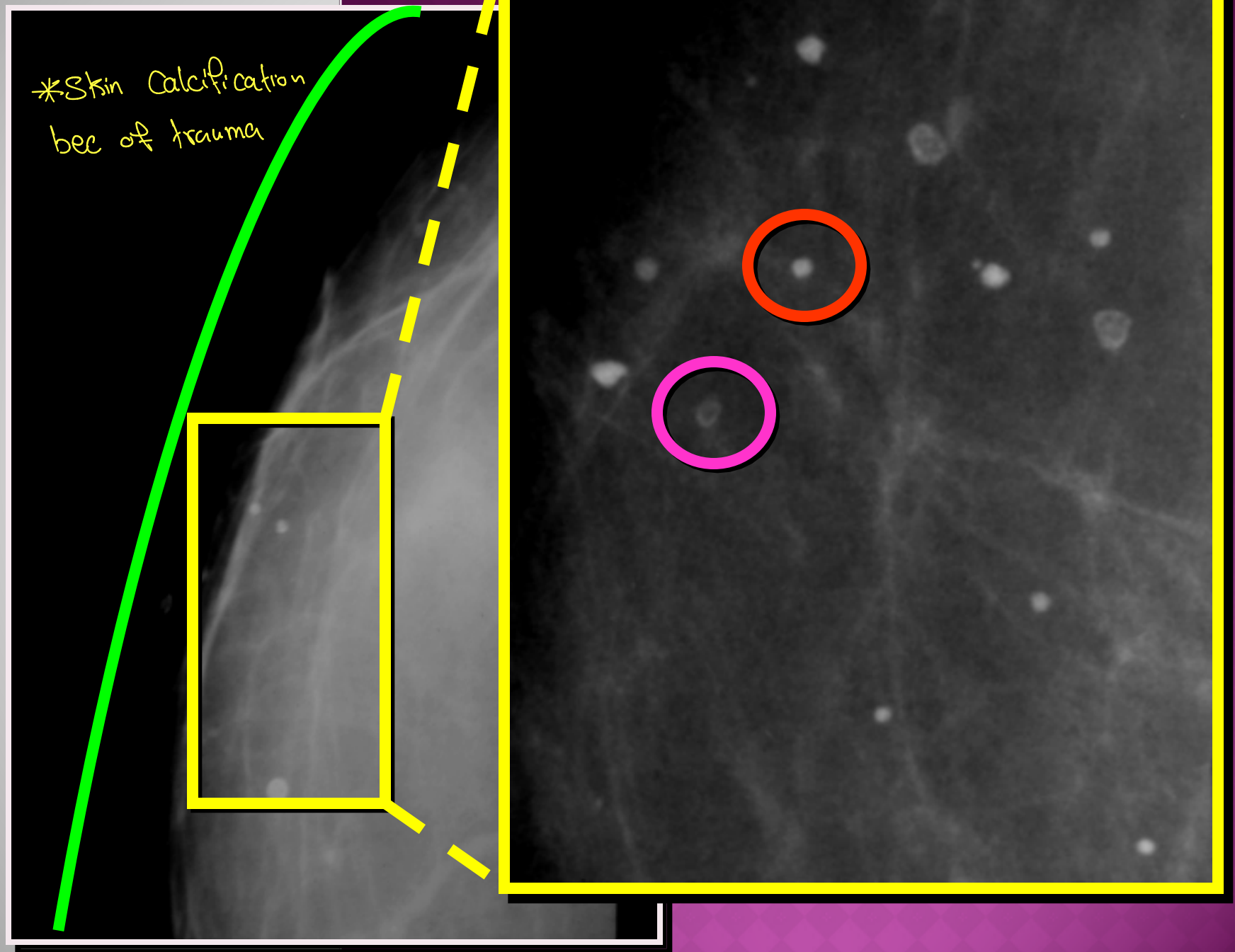
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

DESCRIPTORS: CALCIFICATIONS

TYPICALLY BENIGN:



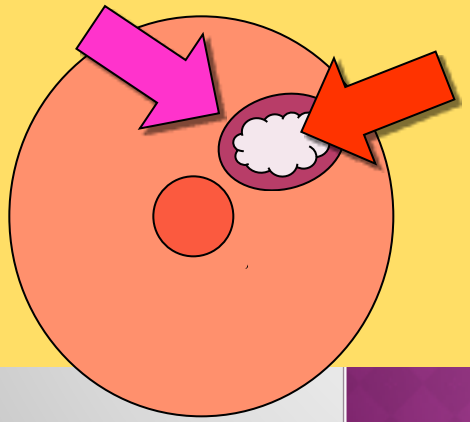
- Round, dense, sometimes egg-shell
- Often within 1 cm of skin in one view


*Skin Calcification
bec of trauma

EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

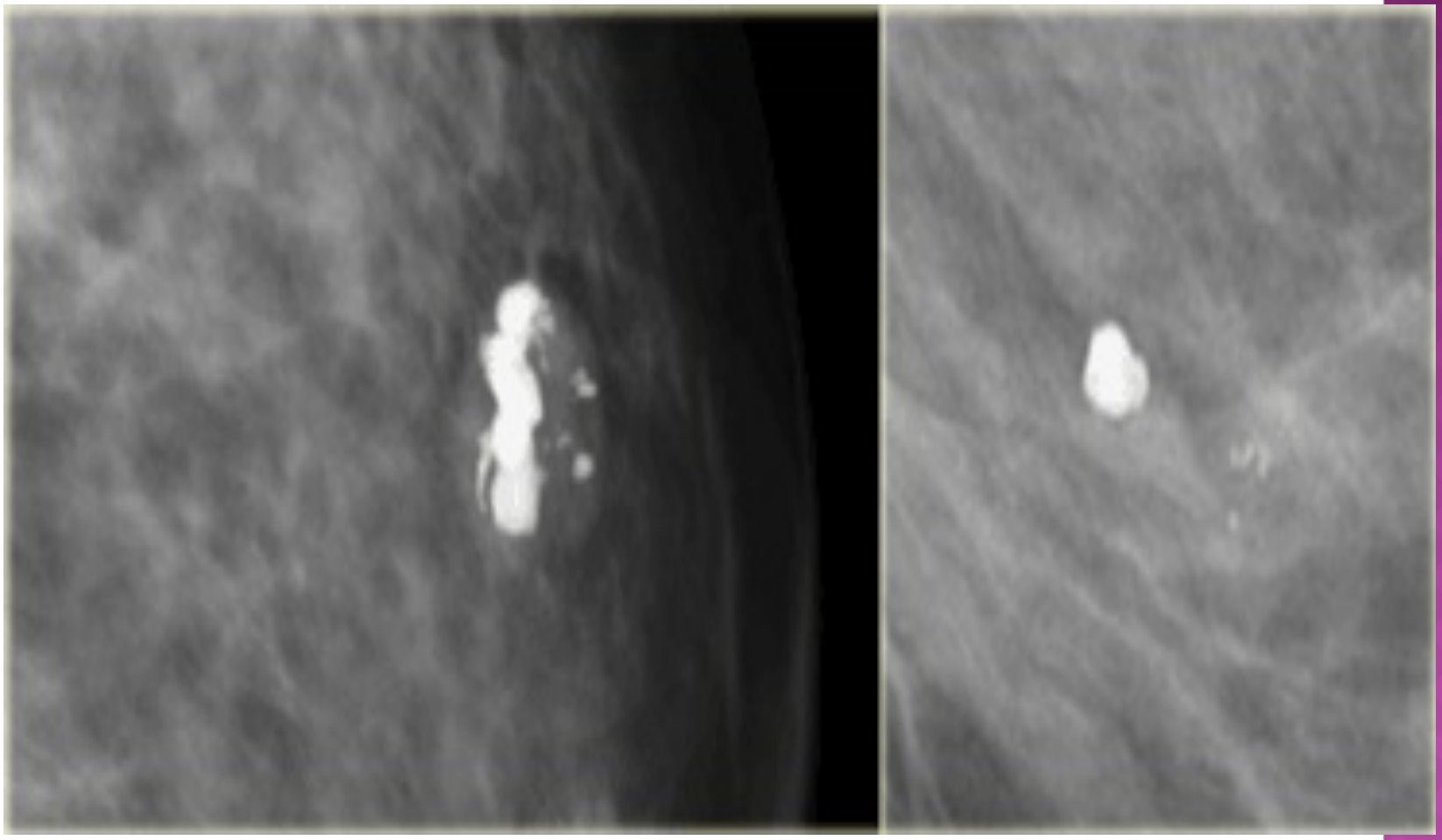
coarse (popcorn-like)

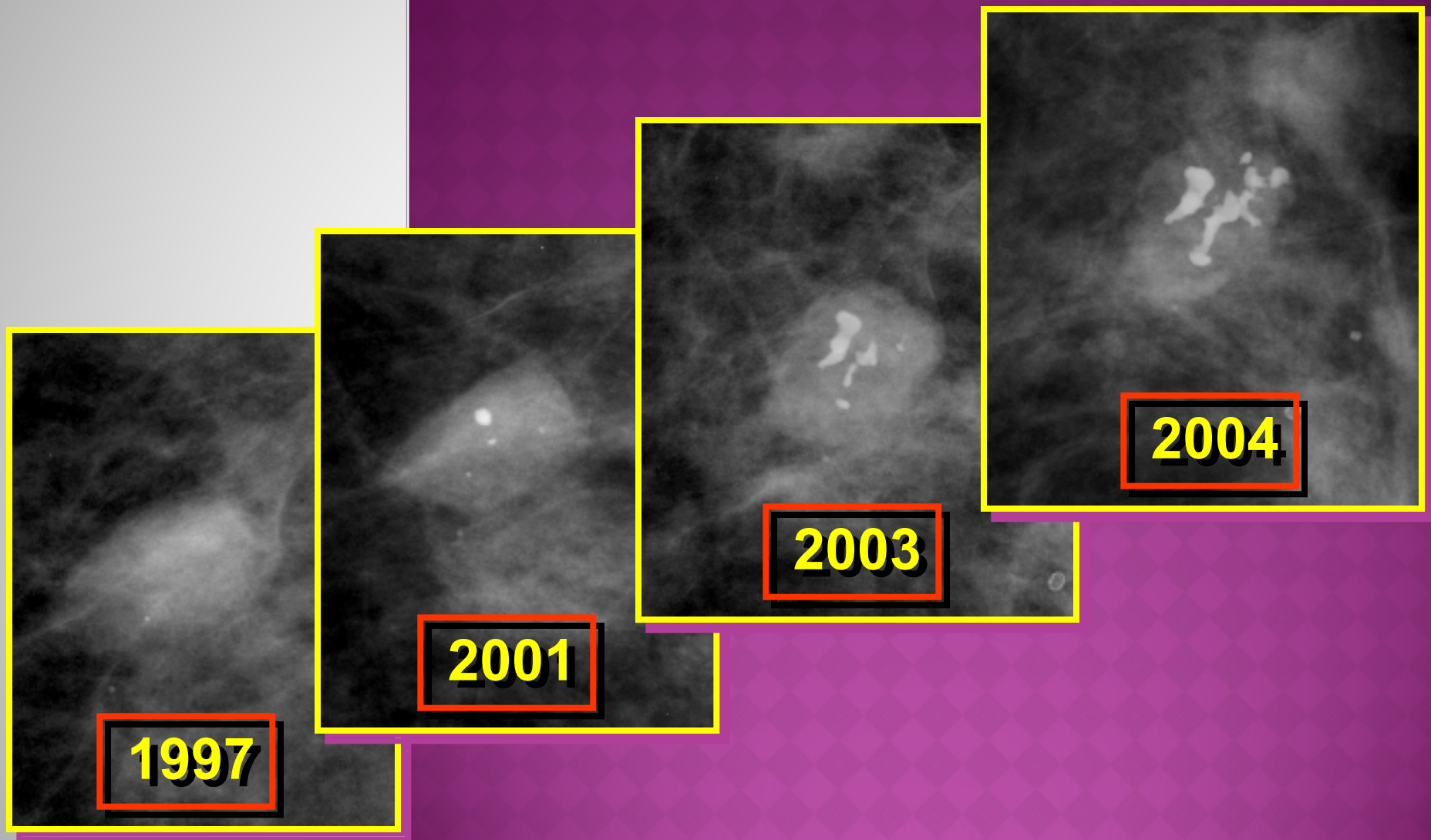


- Created by involuting fibroadenoma
- May see smooth soft tissue mass

COARSE OR 'POPCORN-LIKE'

Also → Called Coarse

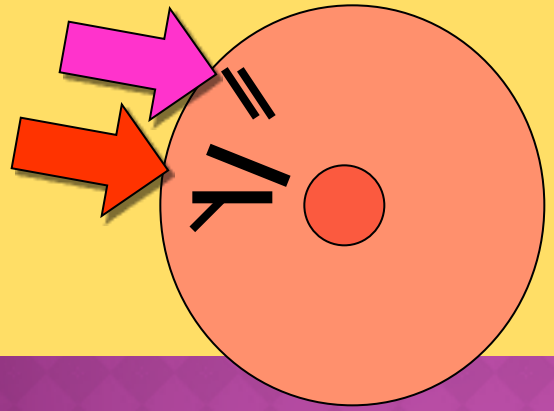



1997
2001
2003
2004

EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

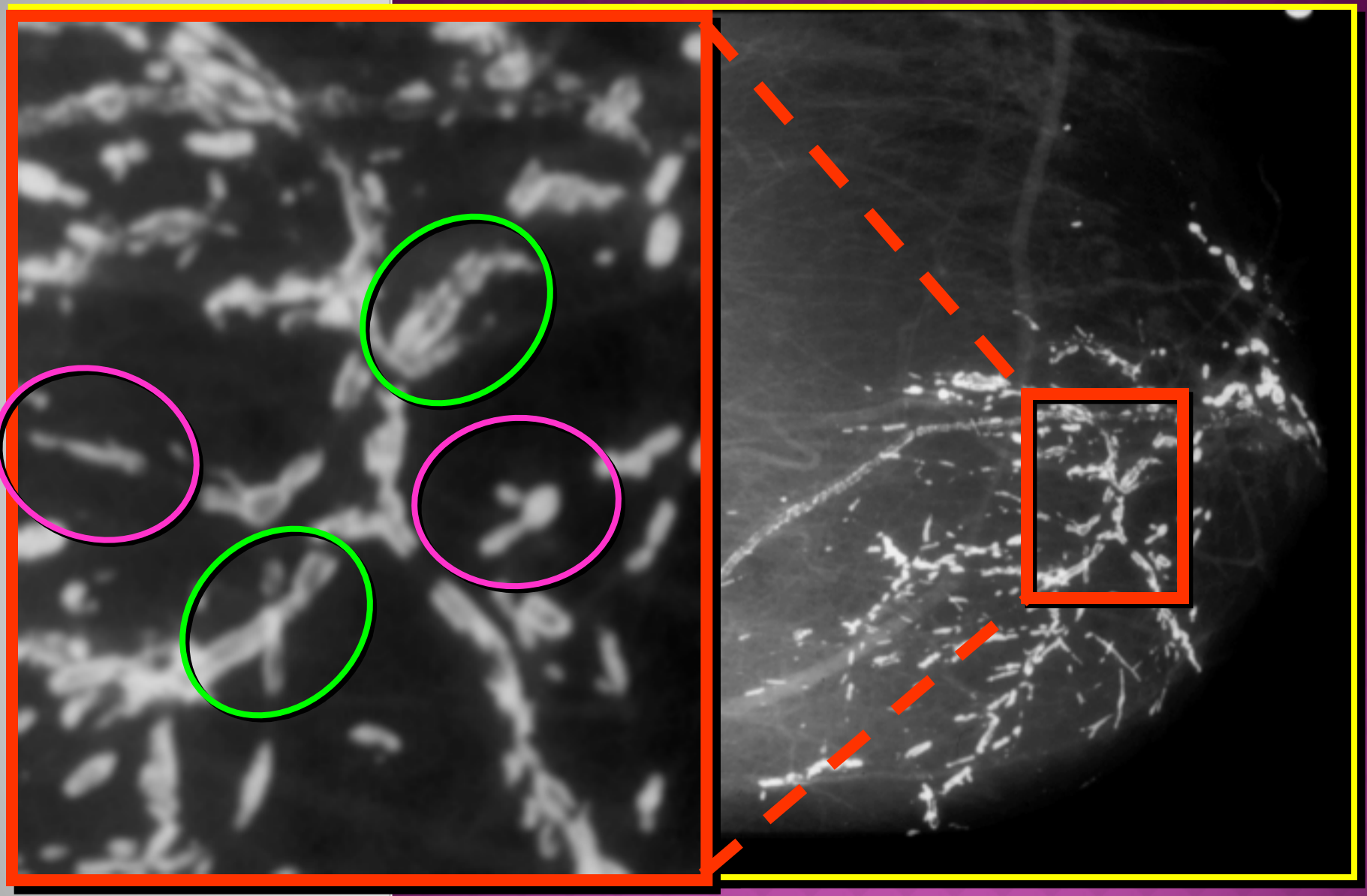
TYPICALLY BENIGN:

large rods,



- Secretory calcs., due to Plasma Cell Mastitis
- Segmental, bilateral, & intraductal or periductal

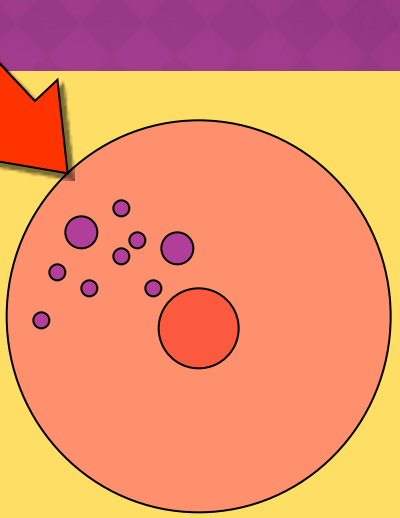
Broken road appearence



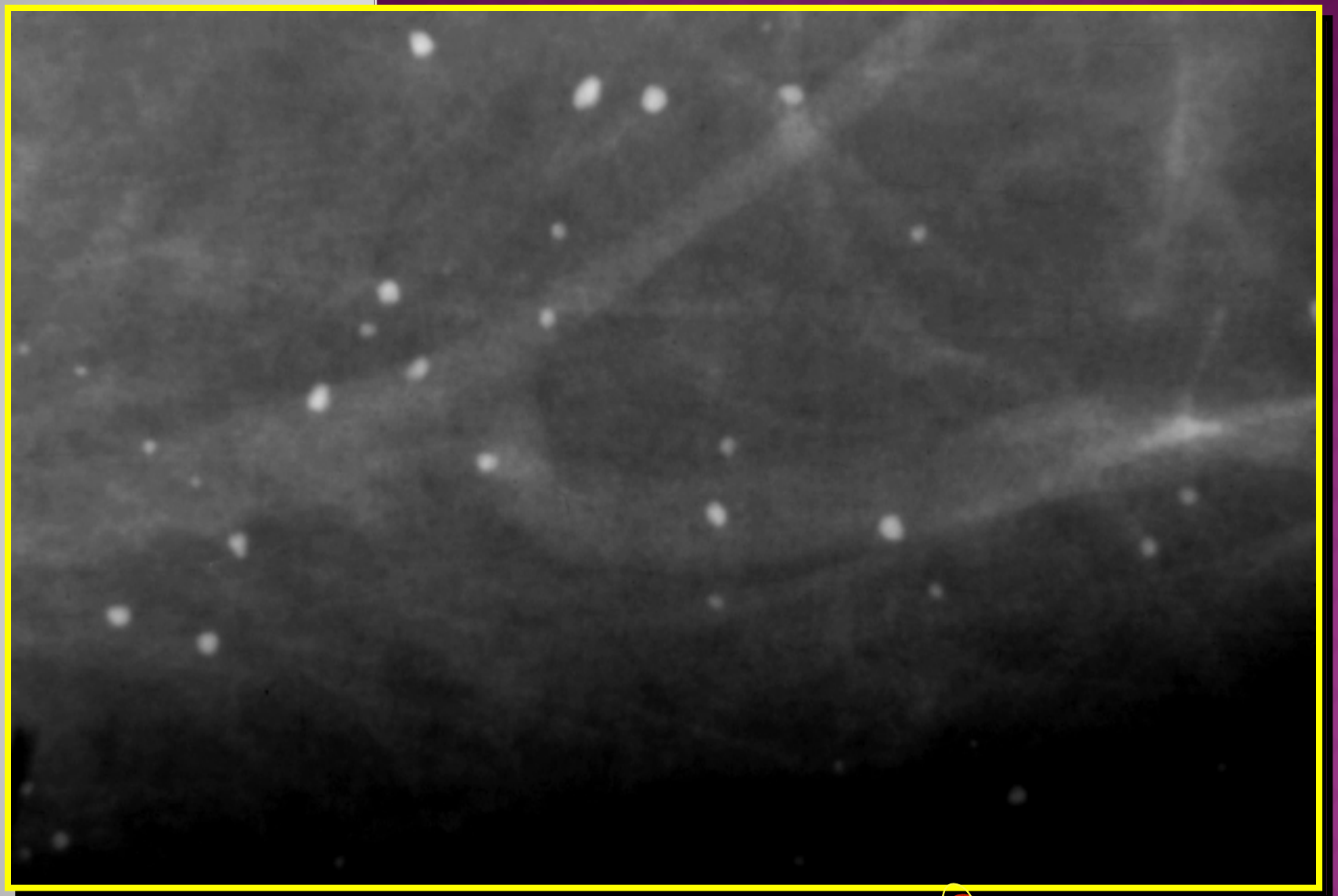
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

round



- Dense, scattered or clustered, mixed sizes
- May be difficult if small and clustered



Causes Trauma
Calcified cyst / submucous gland
?

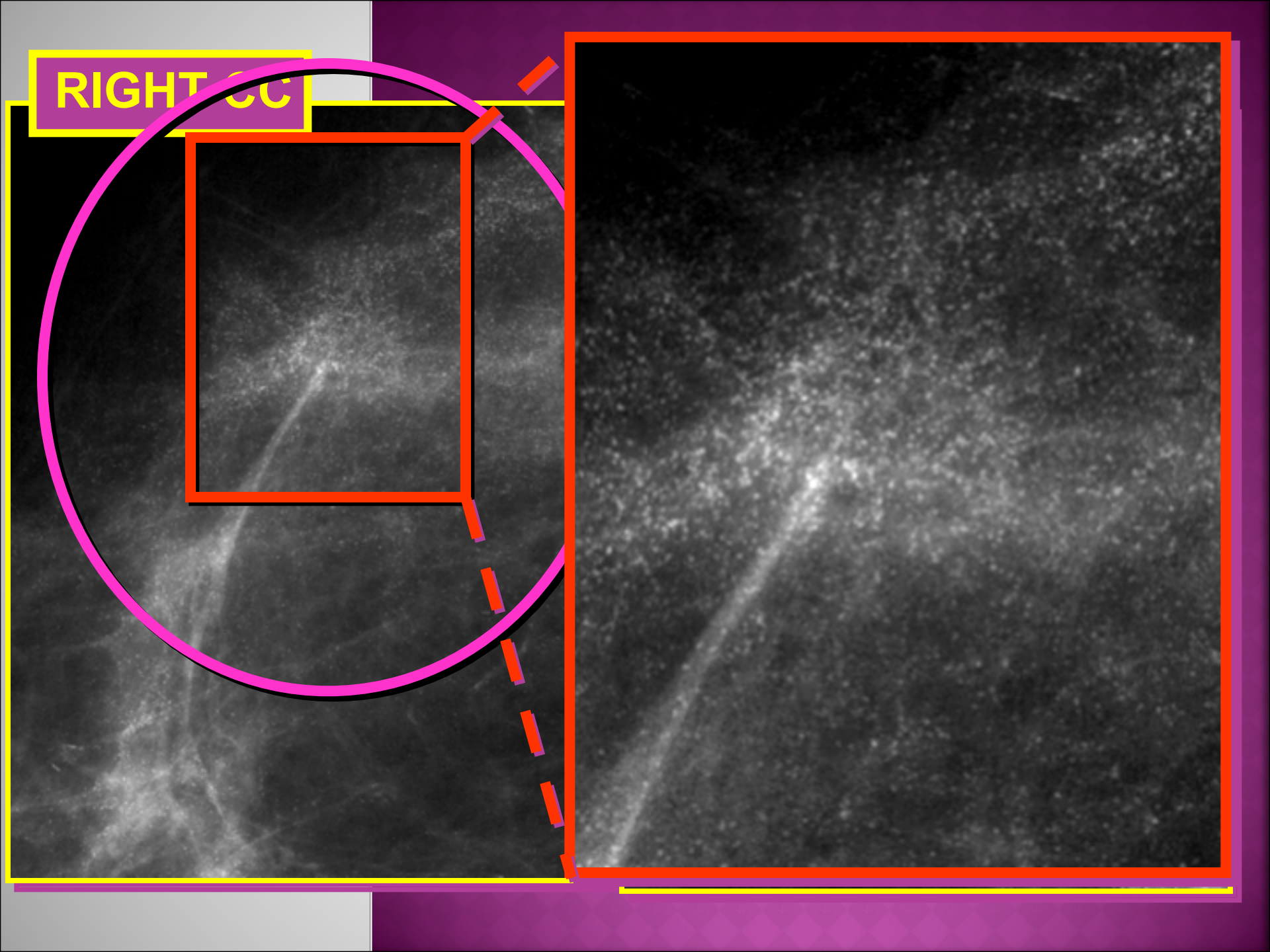
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

punctate

Scleros. Adenosis: “Starry nite”, bilat., scattered

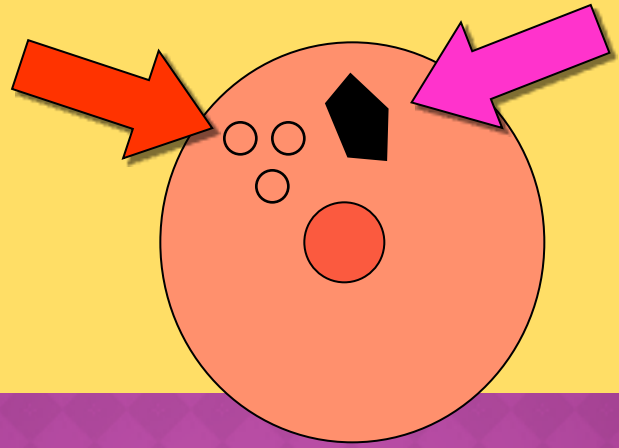
Much harder if unilateral and focally clustered


RIGHT CC

EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

"eggshell" or

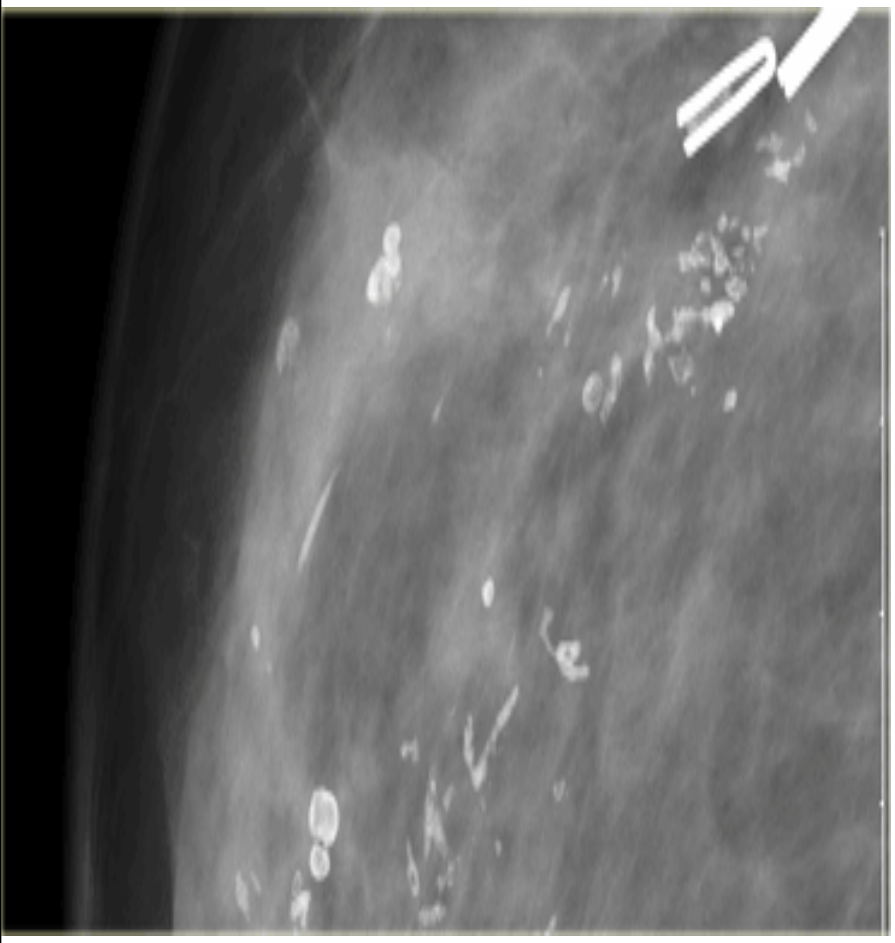


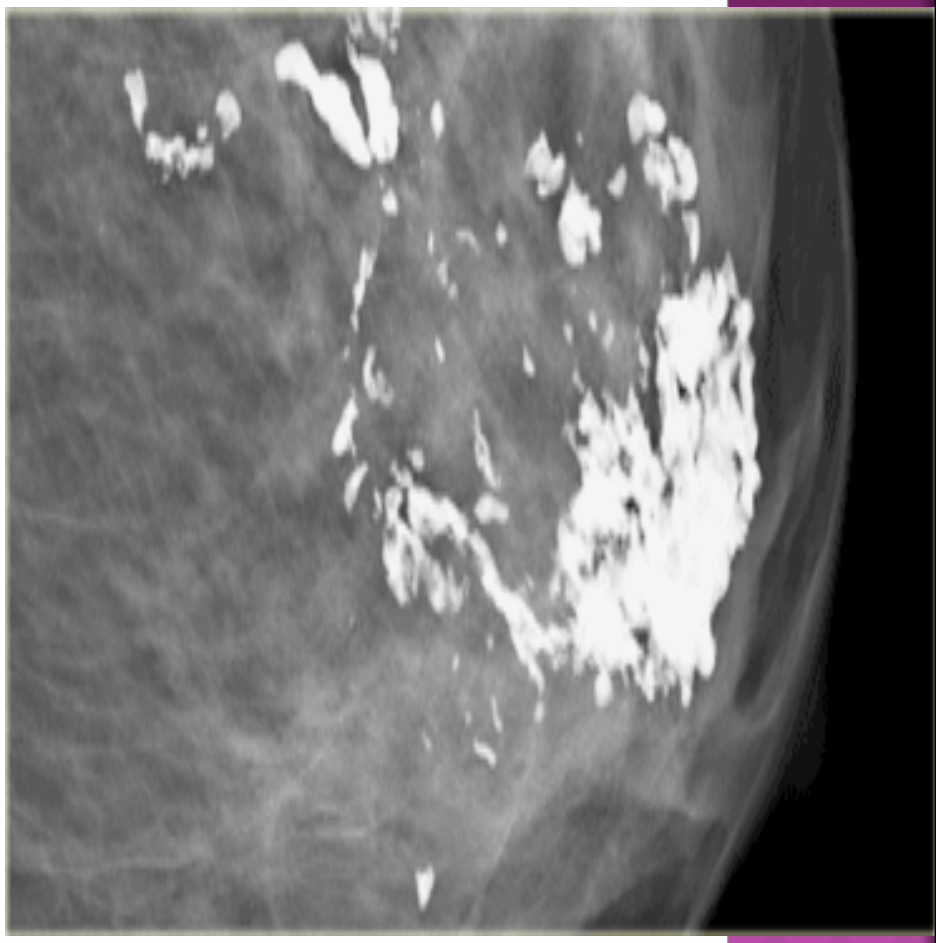
Due to calcified oil cyst or sebaceous gland

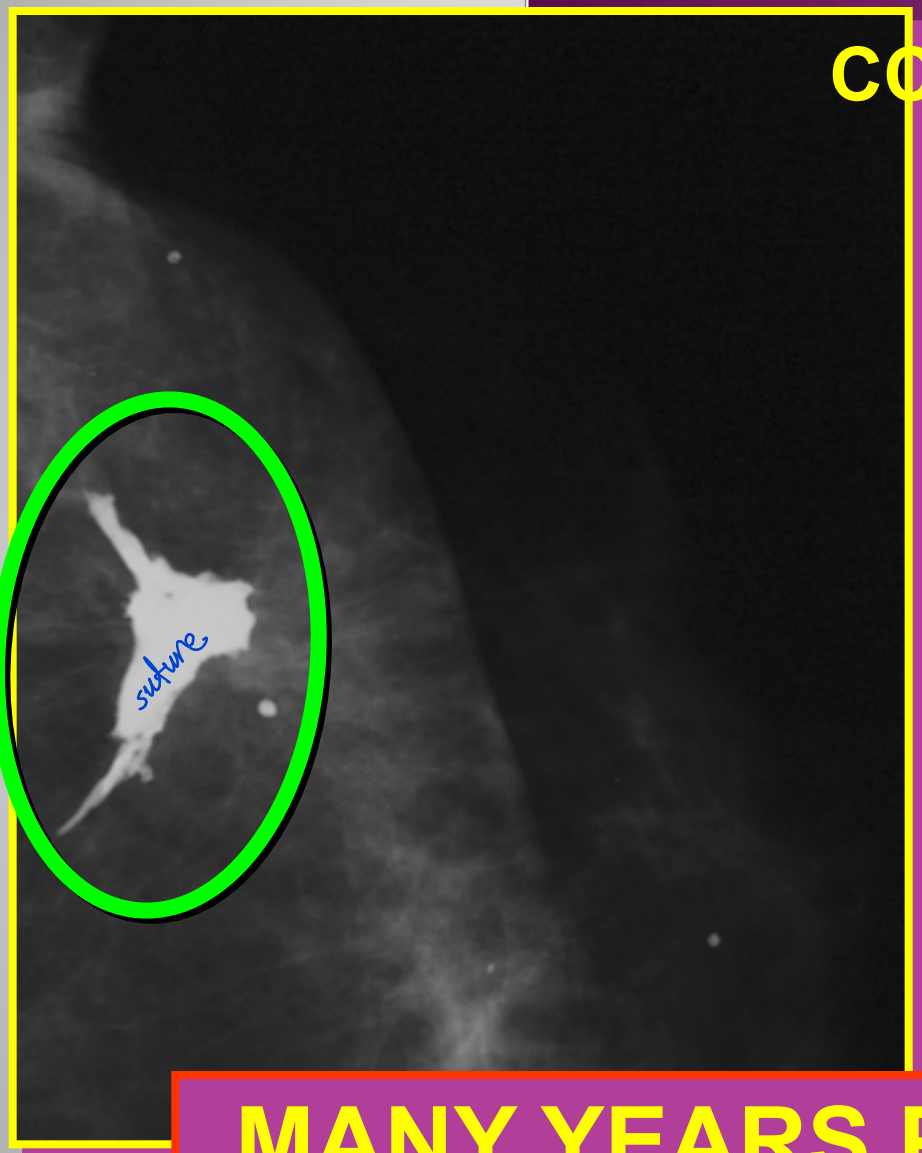
May be associated with dystrophic calcification

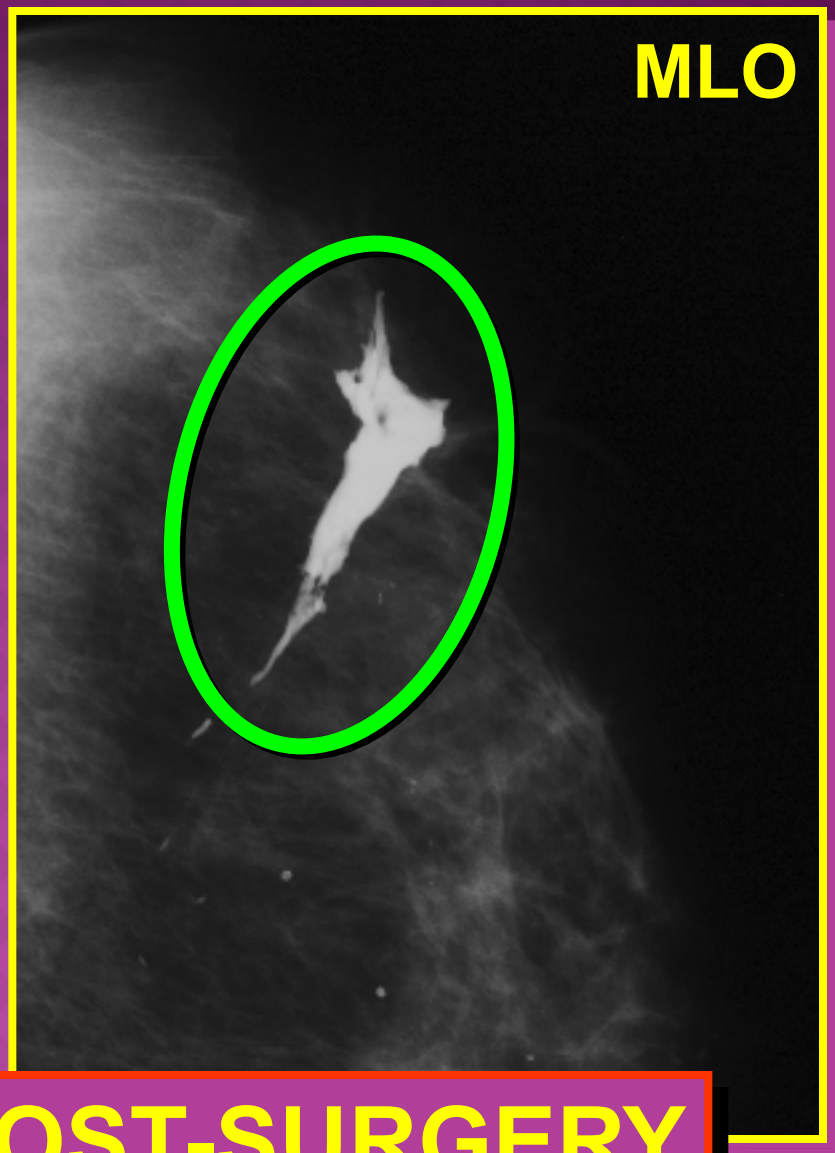
Eggshell or Rim Calcifications

Dystrophic calcifications





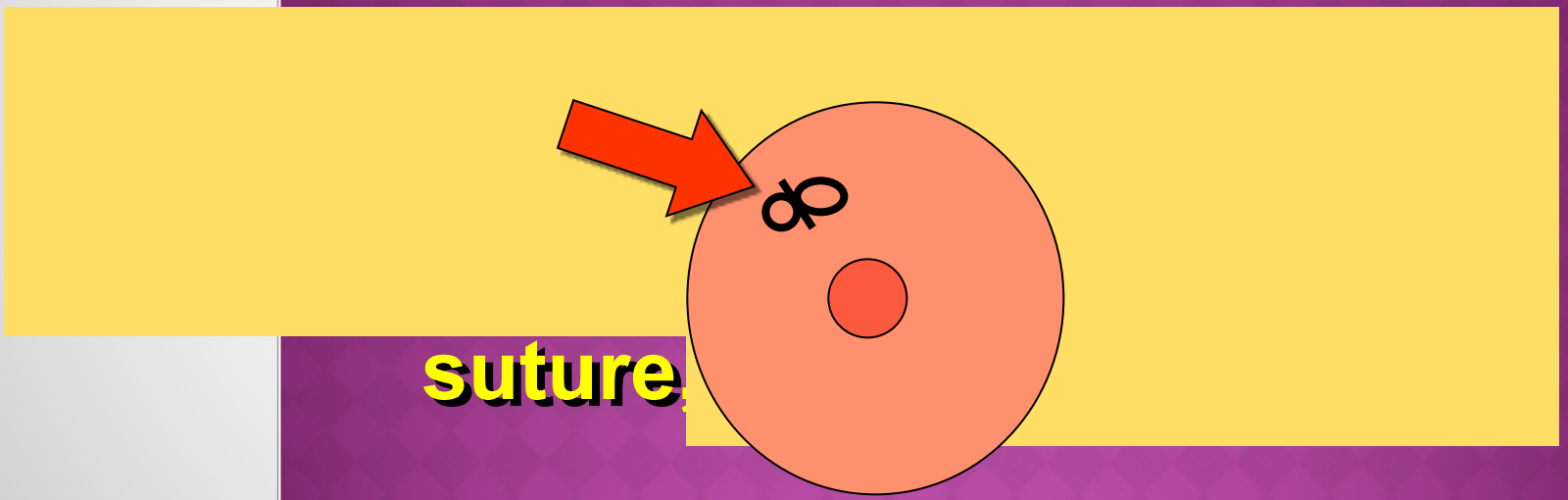




MANY YEARS POST-SURGERY

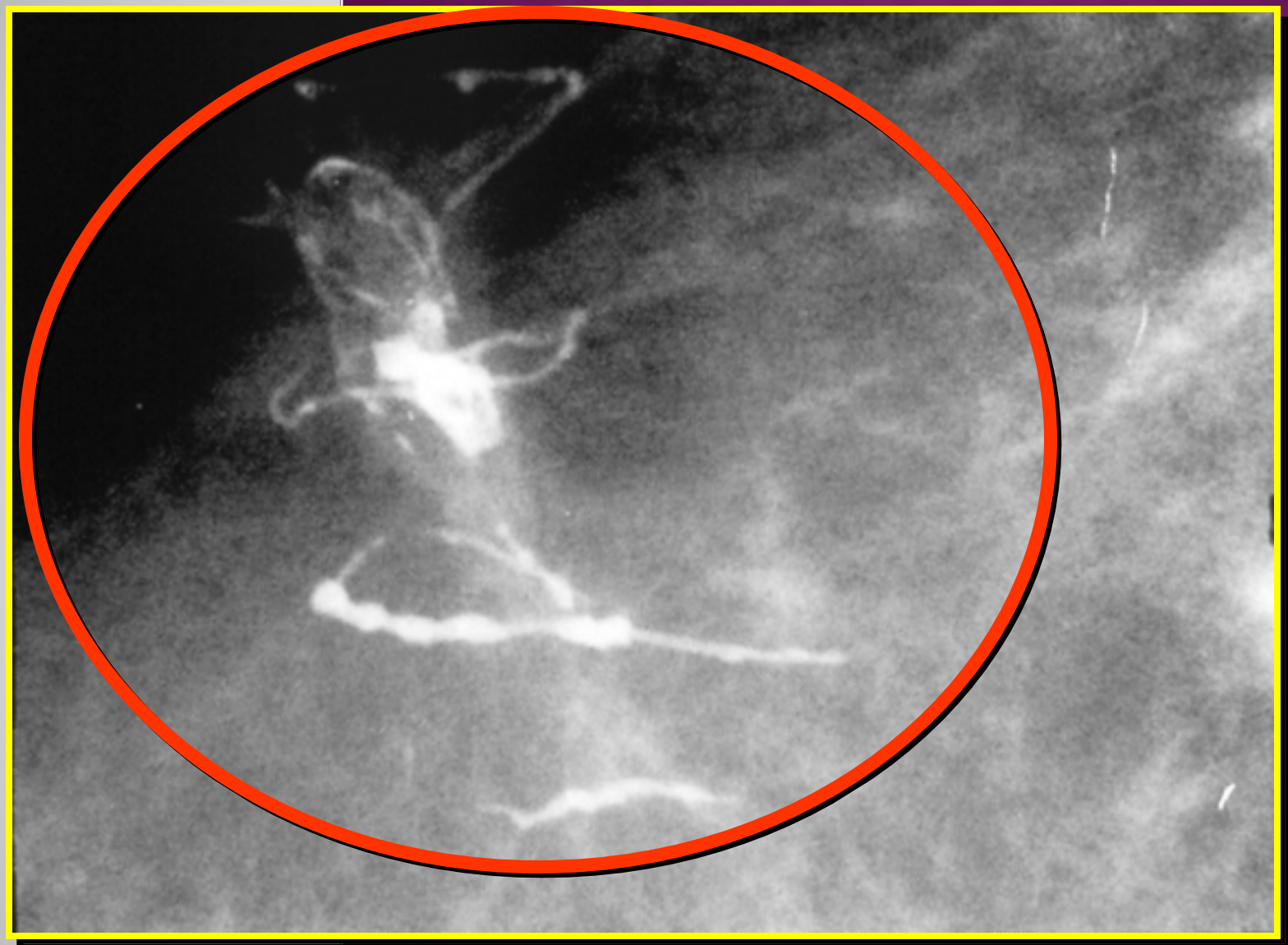
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:



- Calcium forms around surgical suture
- Rare, but can occur post-radiation

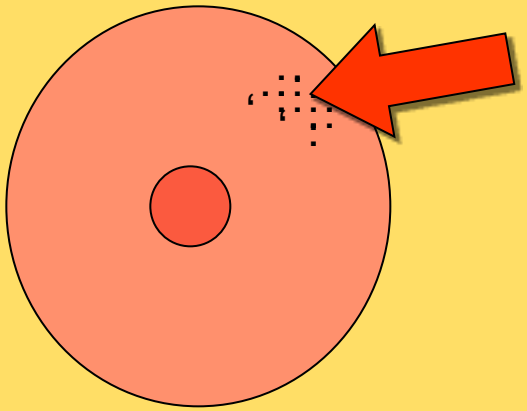
Post surgery



EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

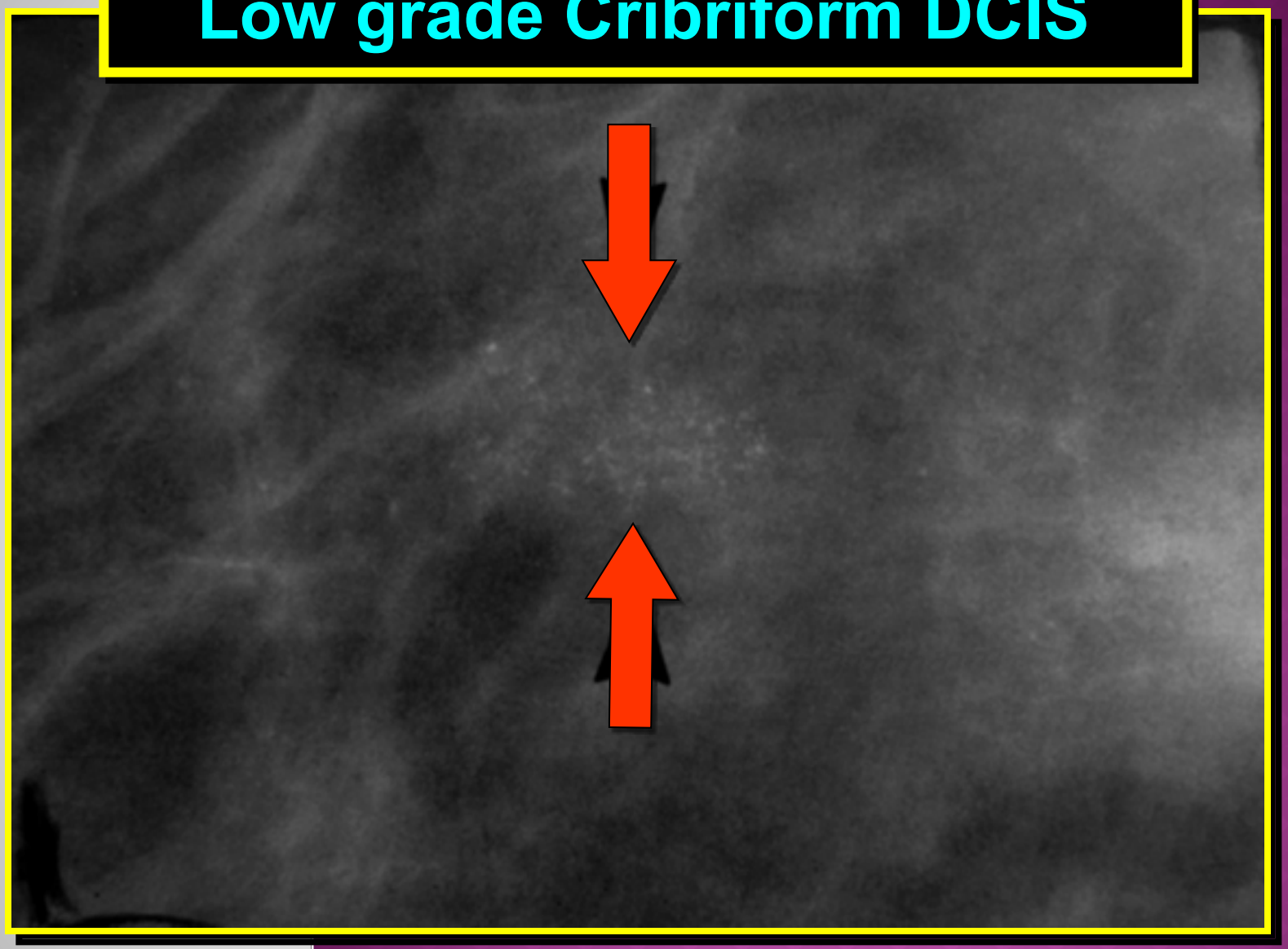
INTERMEDIATE CONCERN:

Amorphous or indistinct



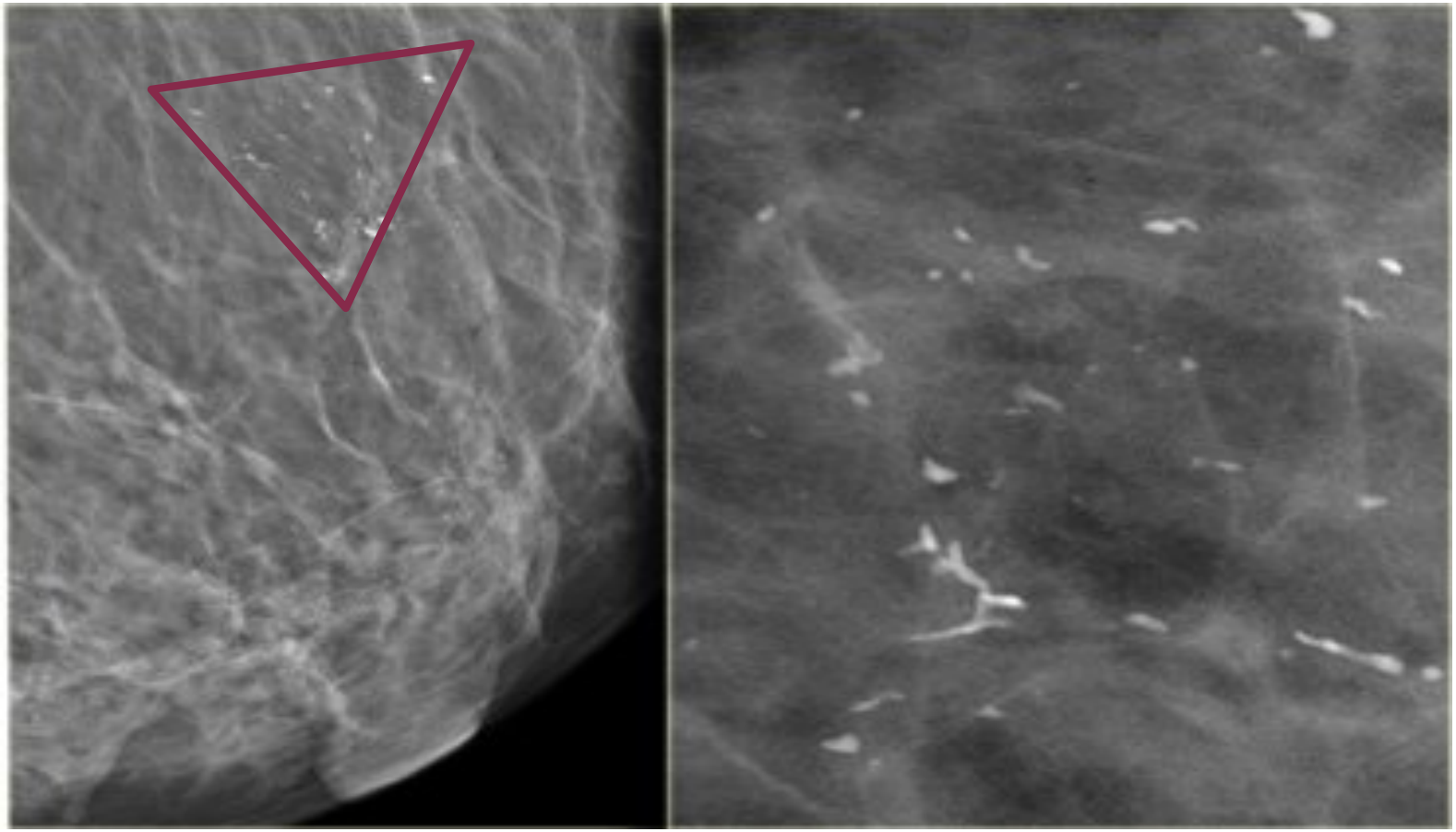
- Powdery, tight clusters
- Low-grade DCIS
- Hard to distinguish from sclerosing adenosis and fibrocystic changes

Low grade Cribriform DCIS



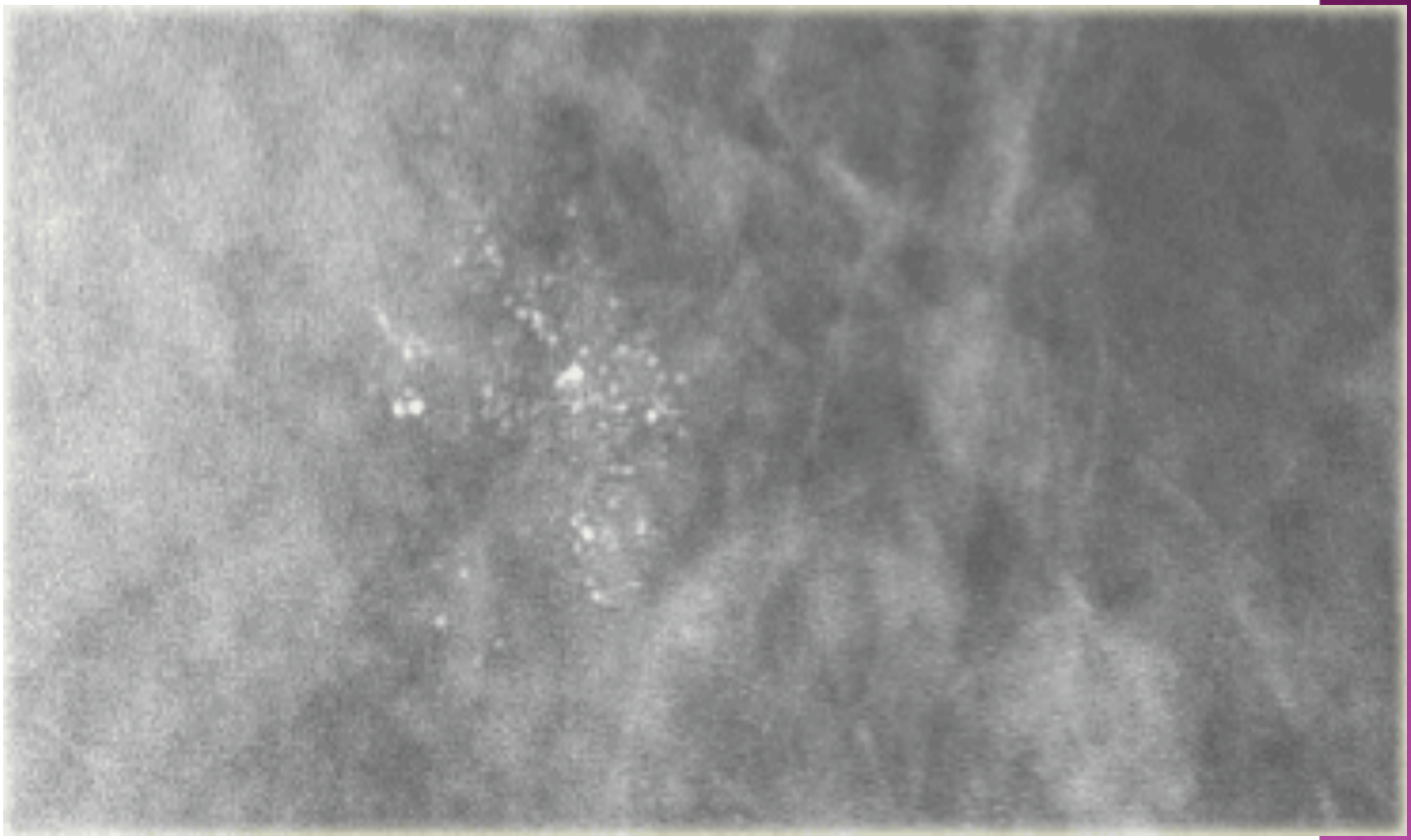
Coarse granular microcalcifications

DDx : Fibroadenoma, fibrosis, fat necrosis (post traumatic) , DCIS



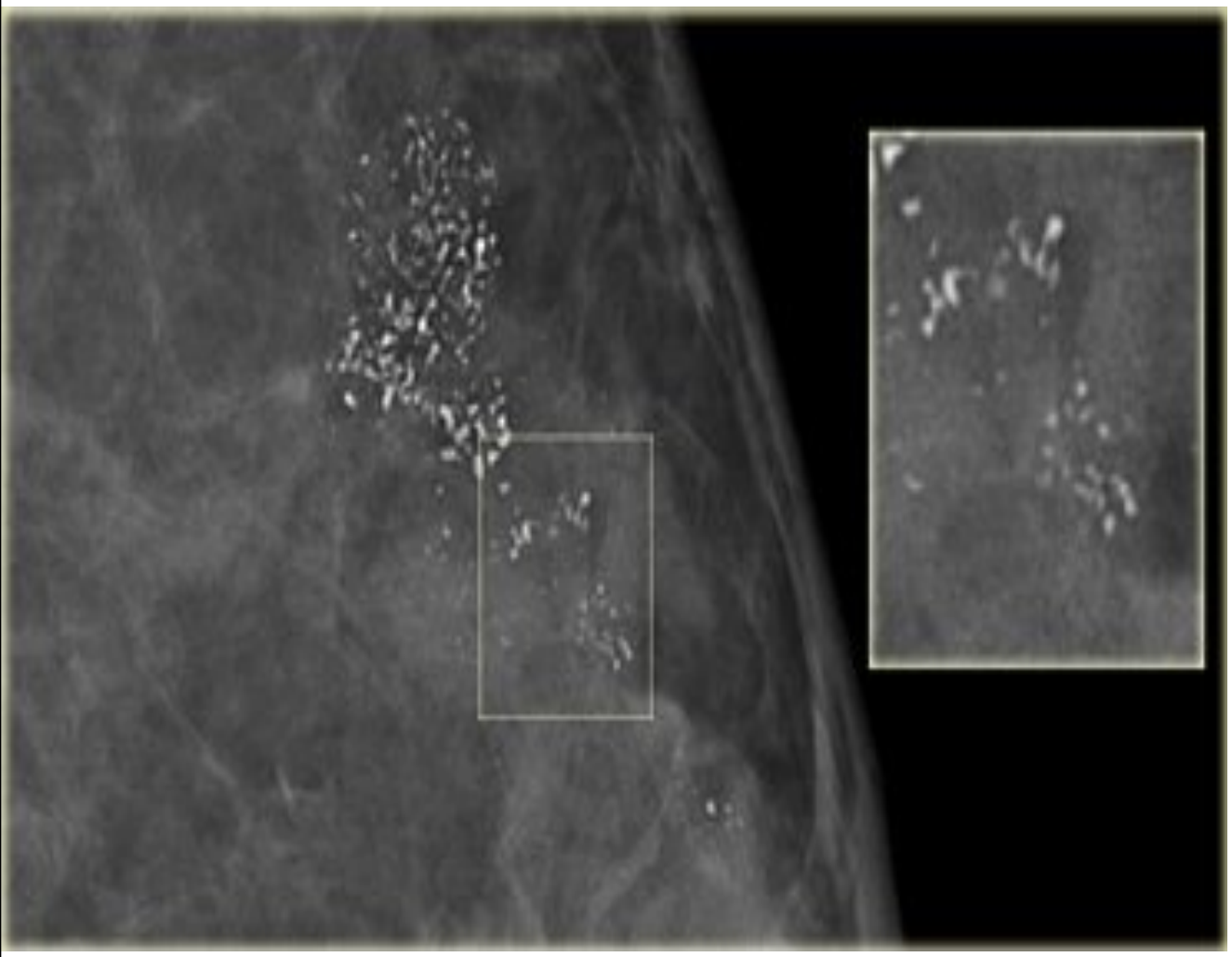
coarse heterogeneous calcifications in a segmented distribution.
These calcifications were classified as BI-RADS 4.
Biopsy showed calcifications within fibrous stroma.

High probability of malignancy



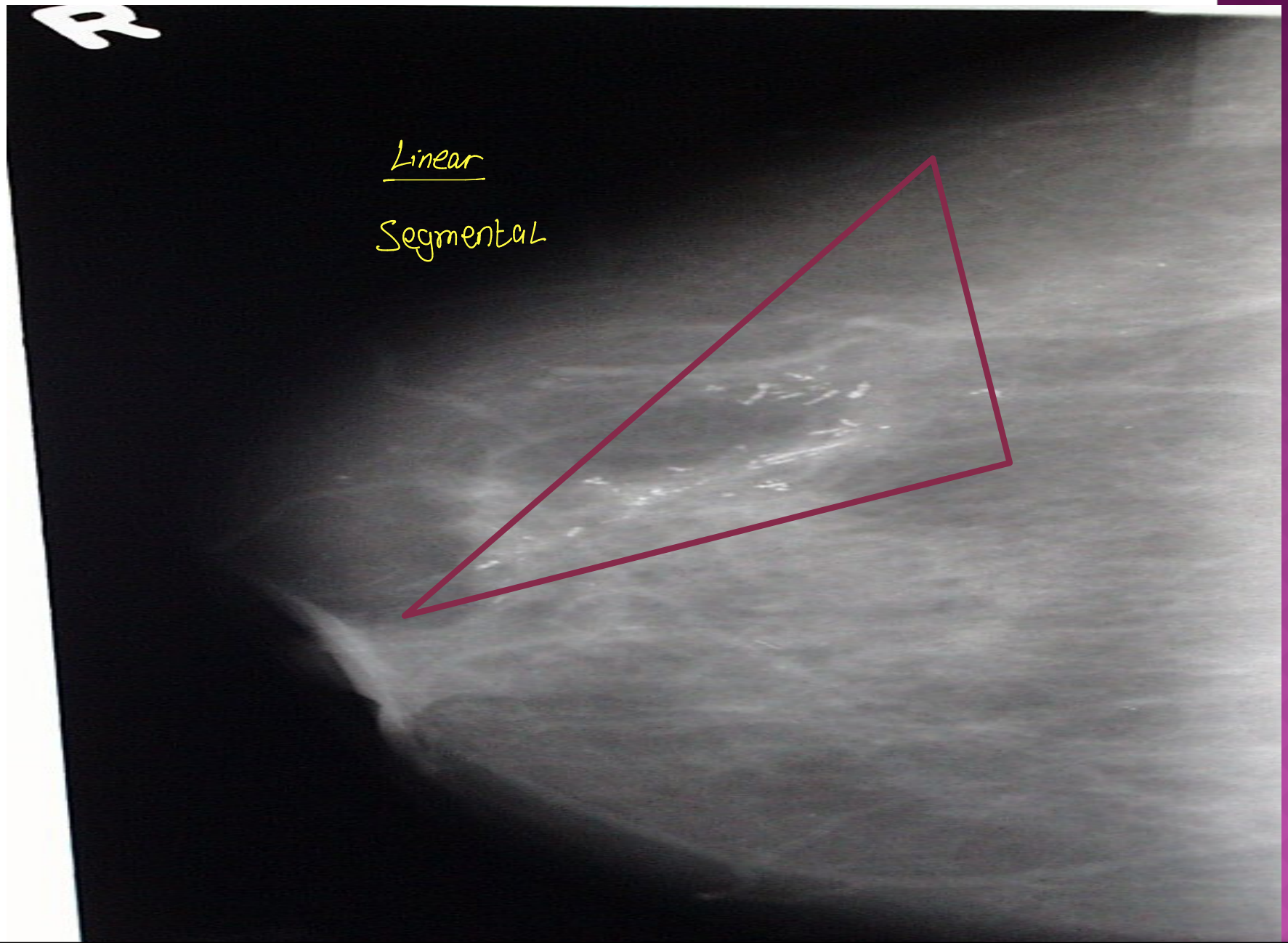
Amorphous and fine pleomorphic calcifications (Bi-RADS 4)
Biopsy: fibrocystic changes

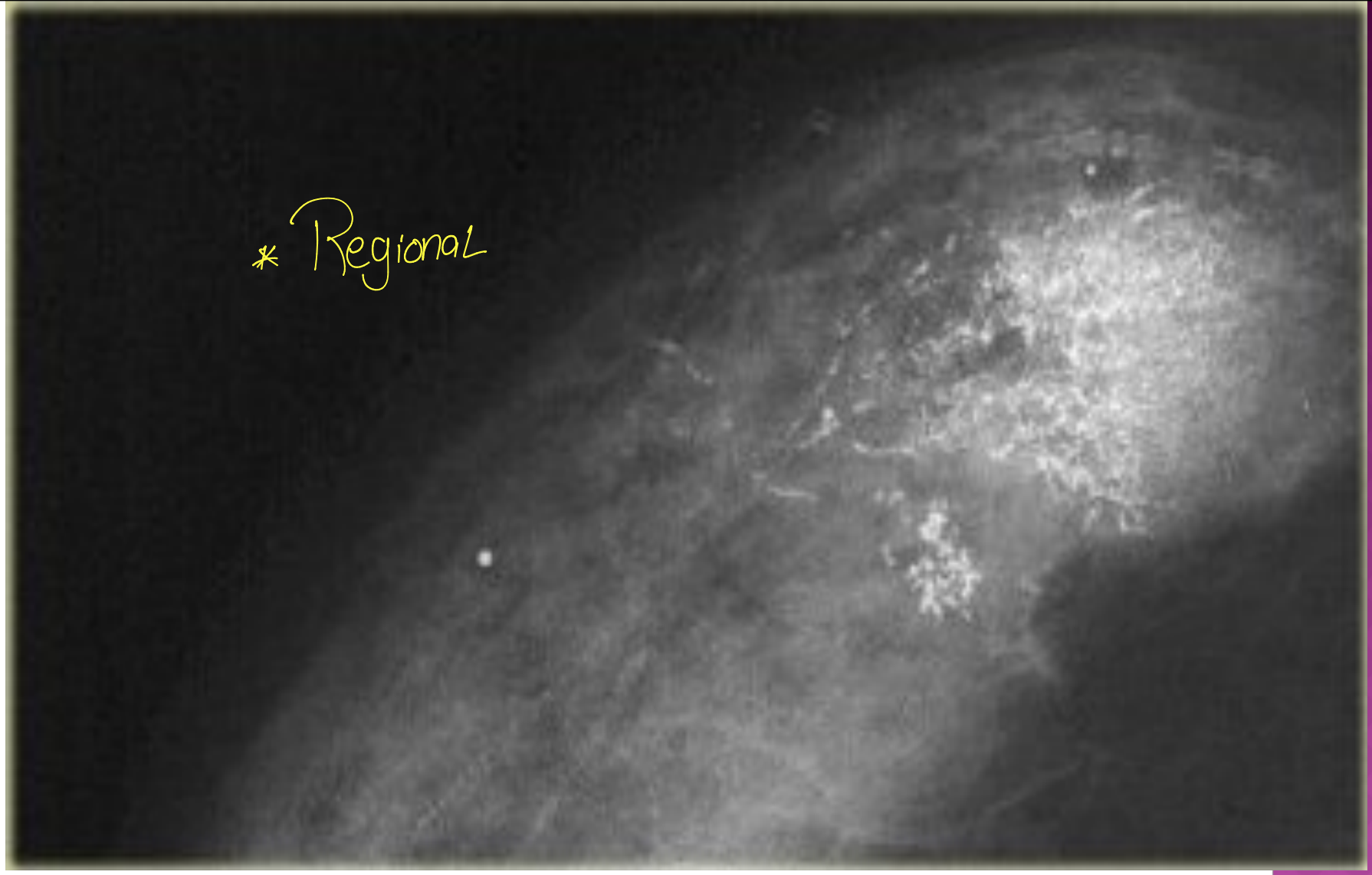
Fine Linear or Fine Linear Branching



calcifications in a segmental distribution. Some have a linear shape and some have a branching morphology. This is highly suggestive of malignancy (BI-RADS 5).

MALIGNANT CALCIFICATIONS





Fine linear and branching calcifications in a segmental distribution highly suggestive of malignancy (BI-RADS 5). Extensive high grade DCIS was found at biopsy.

SECONDARY SIGNS OF CANCER ON MAMMOGRAPHY

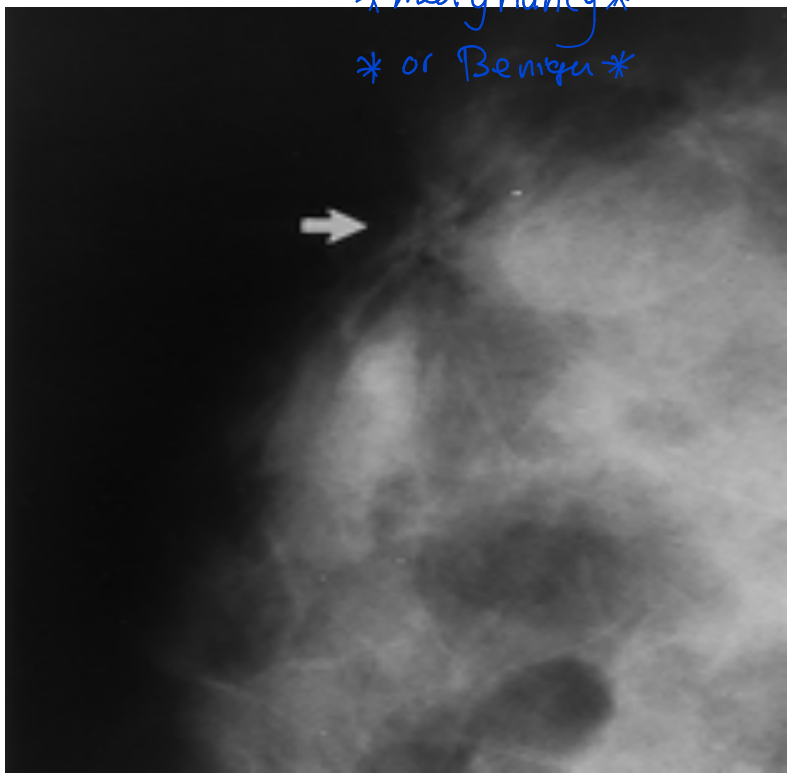
- Nipple Inversion
- Architectural Distortion
- Skin Thickening
- Axillary Adenopathy
- Skin Retraction
- Tissue Asymmetry
- Developing “Neodensity”

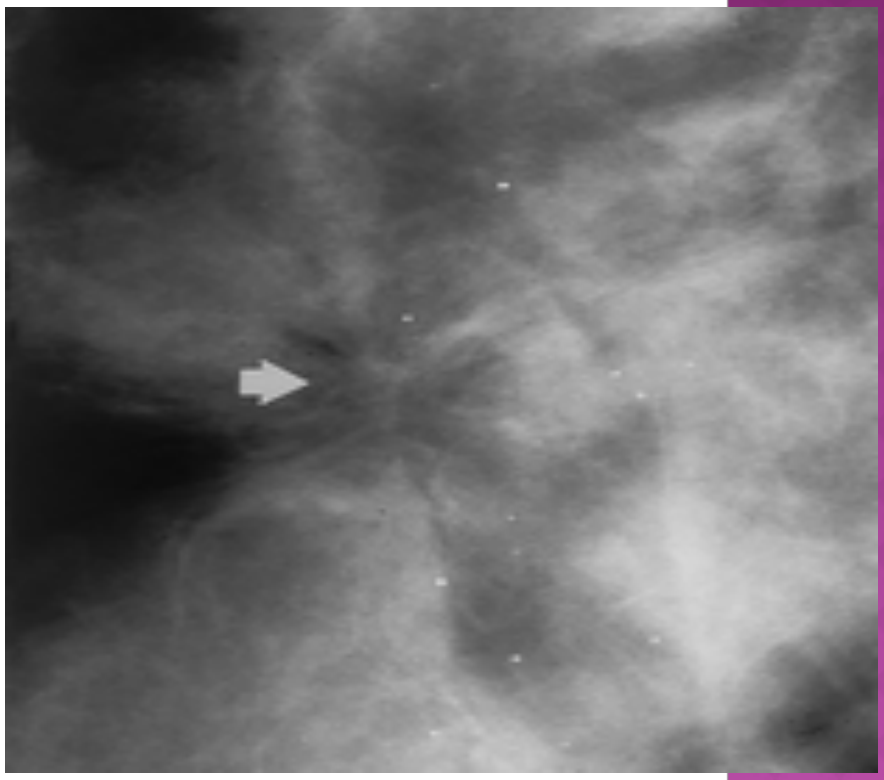
ARCHITECTURAL DISTORSION

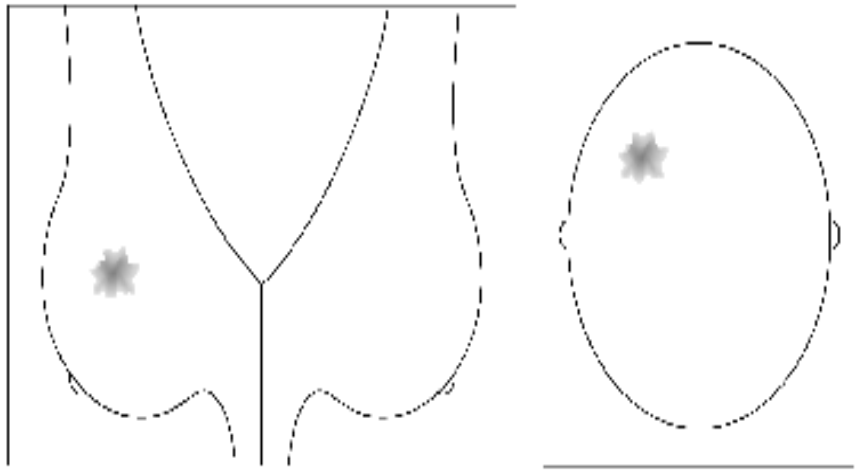
means that the normal anatomy and tissue arrangement is pulled, twisted, or disrupted, but without a clear mass being seen. Instead of the usual smooth and symmetric appearance, the structures look distorted.

ML view

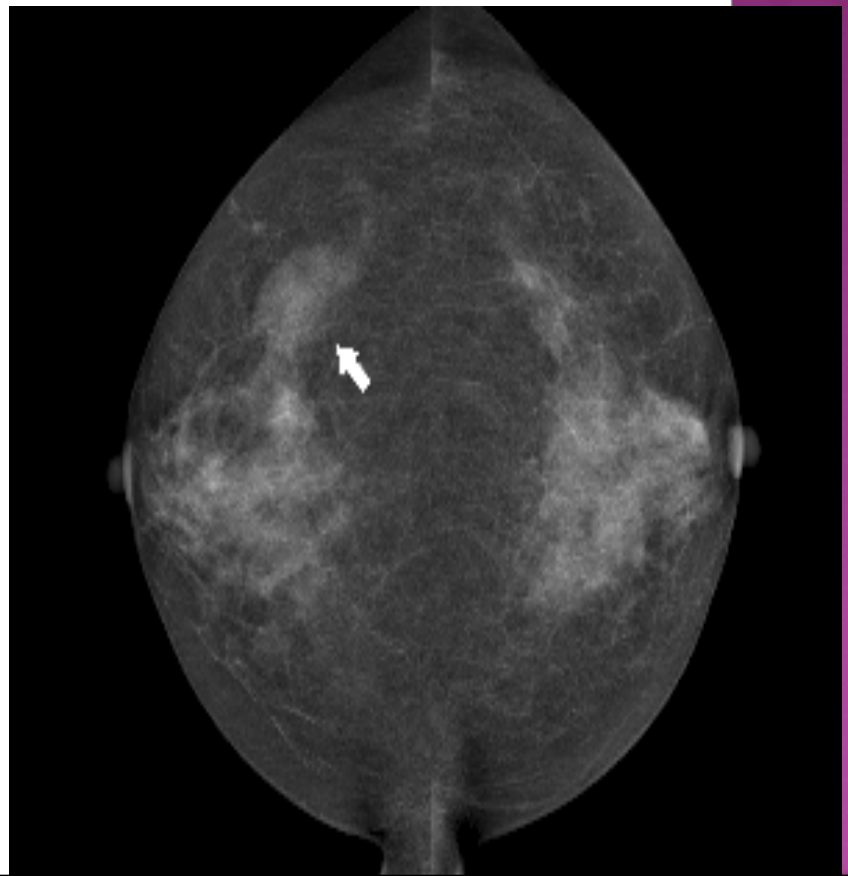
CC view







Focal asymmetry



very important

Final Assessment Categories

0 = Need Additional Imaging Evaluation
or Prior Mammograms For Comparison

1 = Negative
There is nothing to comment on

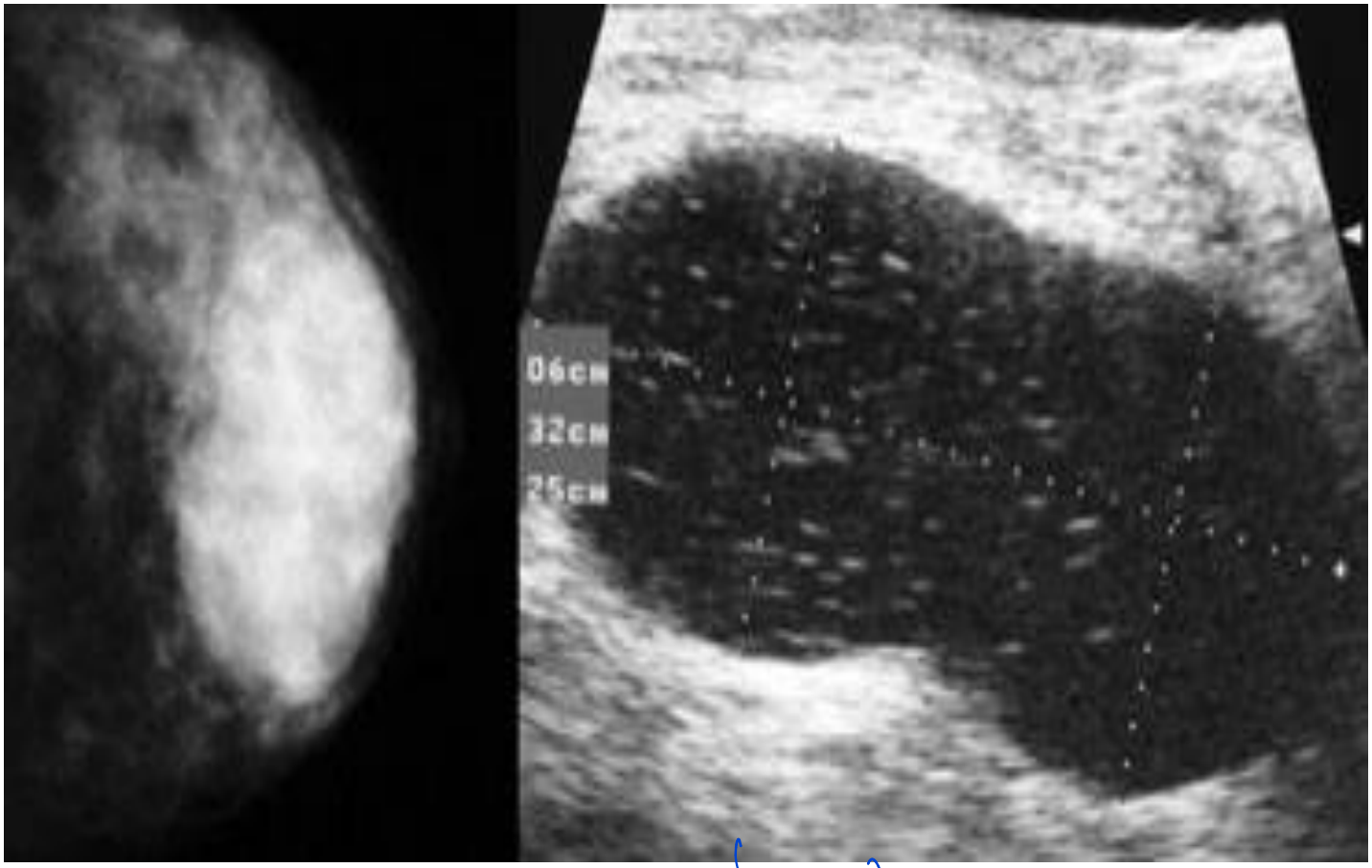
2 = Benign Finding

3 = Probably Benign Finding (<2% malignant)
Initial Short-Interval Follow-Up Suggested

4 = Suspicious Abnormality (2 - 95% malignant)
Biopsy Should Be Considered

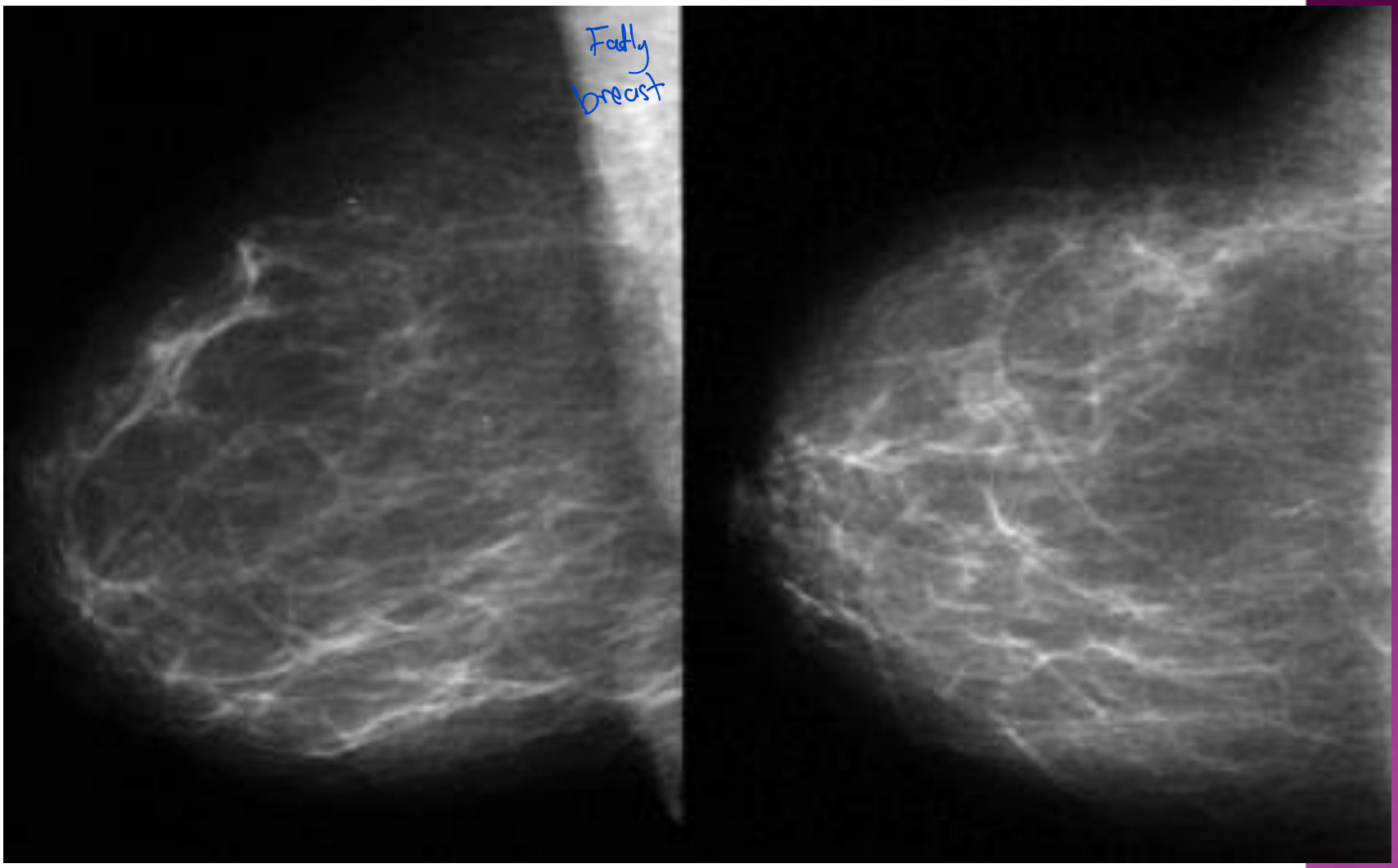
5 = Highly Suggestive of Malignancy(>95% malignant)
Appropriate Action Should Be Taken

6 = Known Biopsy – Proven Malignancy



↳ cyst

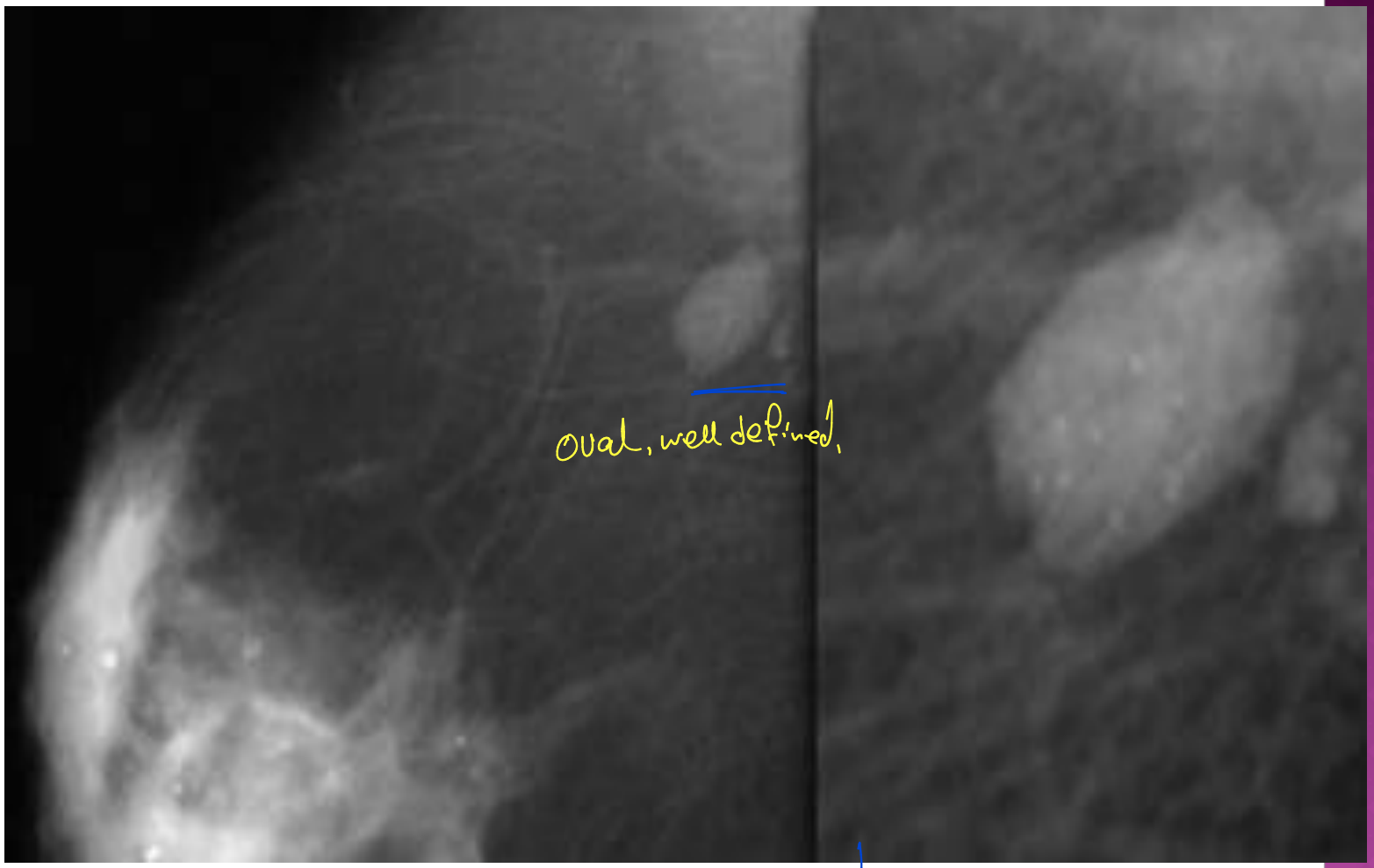
BI-RADS 0 at screening.
Additional ultrasound after referral was performed allowing final assessment. (BI-RADS 2) Benign



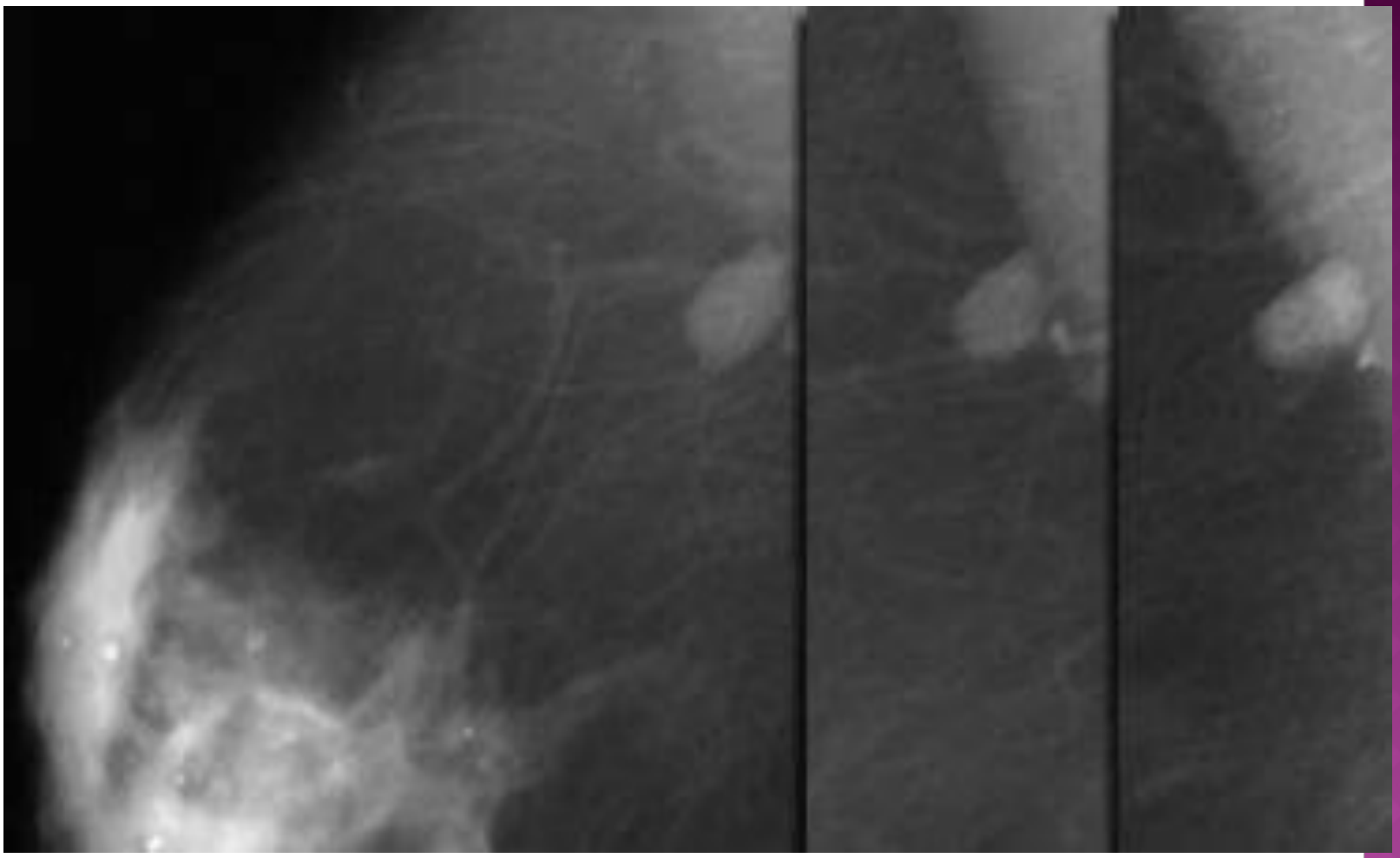
BI-RADS Category 1

ultrasound
cyst

BI-RADS Category 2. A mass seen on mammogram proved to be a cyst.

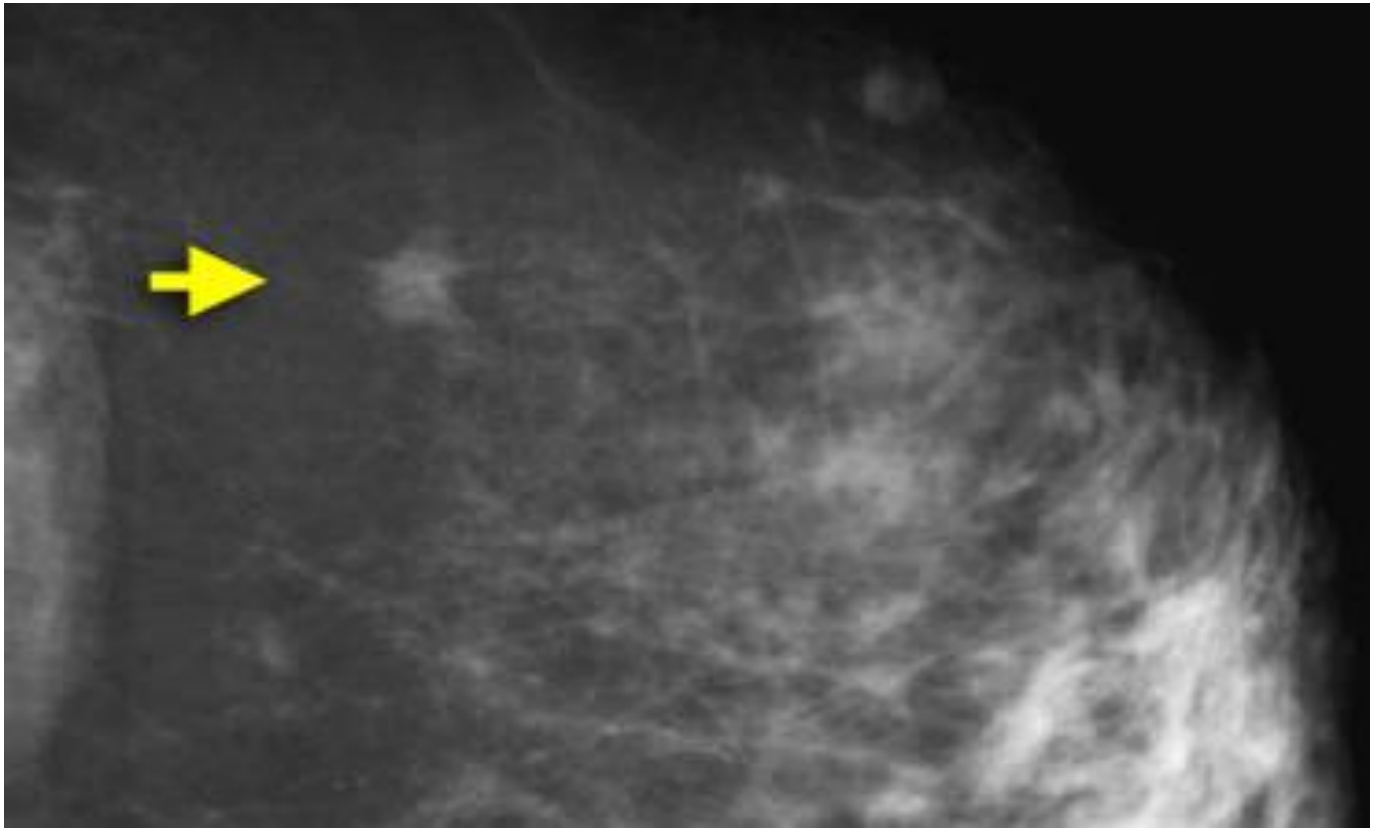


BI-RADS 3. Non-palpable sharply defined lesion with a cluster of punctate calcifications.



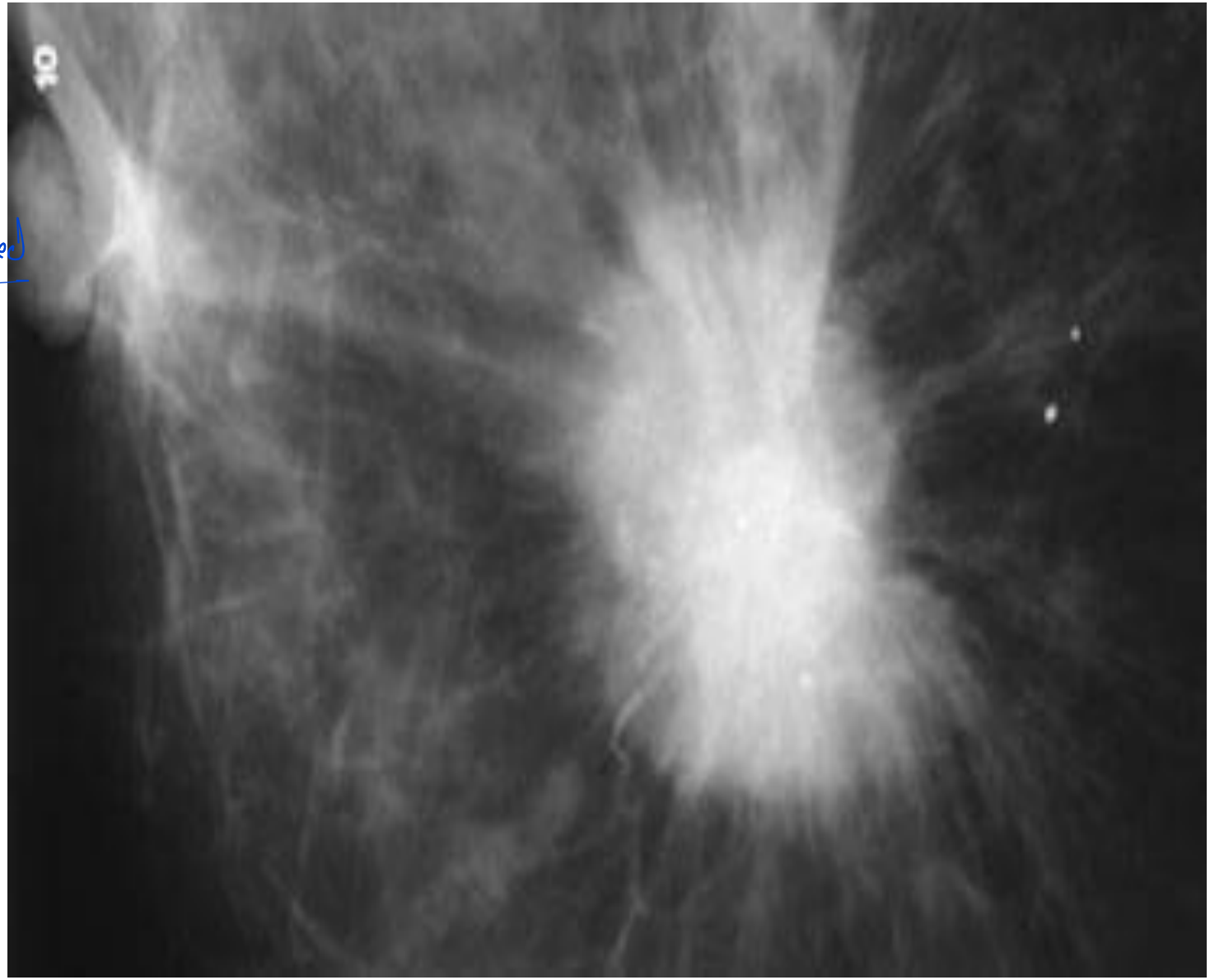
Follow up at 6, 12 and 24 months showed no change. Final assessment was changed to a Category 2.

BI-RADS 4 is reserved for findings that do not have the classic appearance of malignancy but have a wide range of probability of malignancy (2 - 95%).

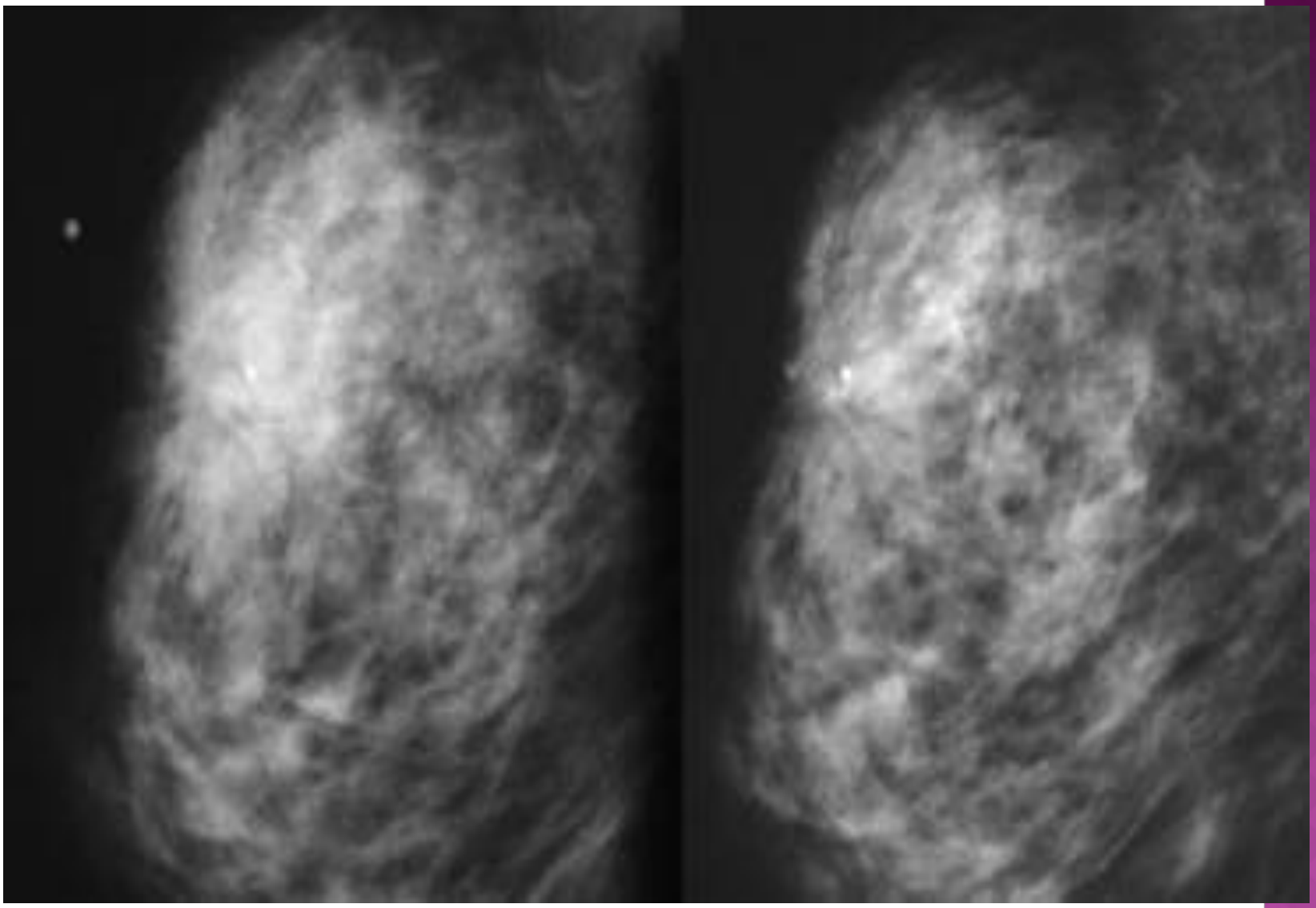


Category 4: There is an abnormality suspicious for malignancy, but a benign lesion, although unlikely, is a possibility (for instance ectopic glandular tissue within a heterogeneous breast).

spiculated



Classic breast ca, BI-RADS 5



LEFT: initial mammogram with marker on palpable mass. Biopsy proven carcinoma.
RIGHT: Follow up after chemotherapy. Tumor is hardly visible, still BI-RADS 6

Tutorial