

MAMMOGRAPHY

by Dr Mahasen Al-Najar

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.

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

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
- ◉ Advise 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

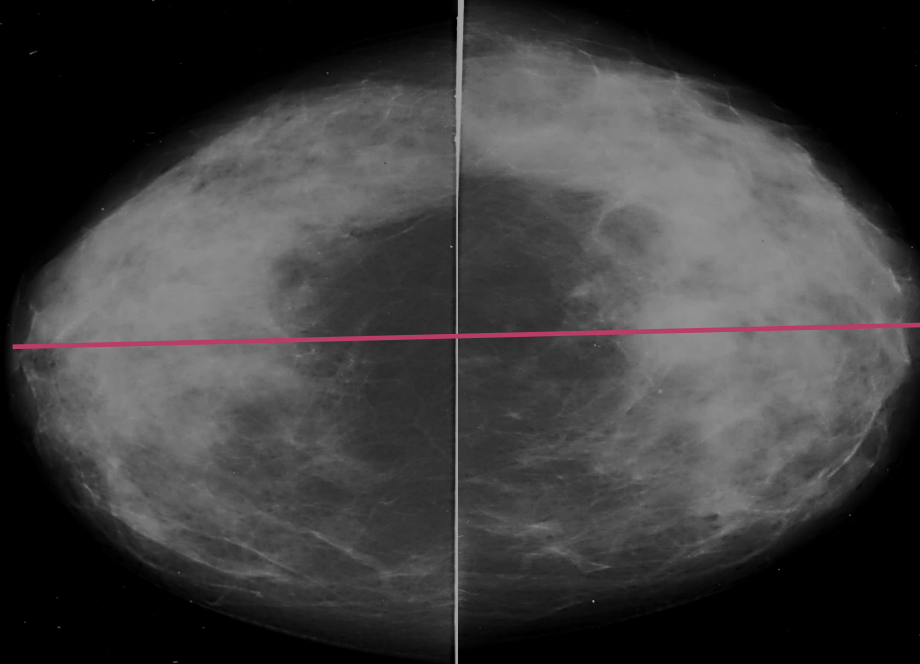
- ◉ Cranio-caudal View (CC)
- ◉ Medial-lateral Oblique (MLO)

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KODAK MIN-R 2000 SCREEN 0753004079Y18576

WL: 2533 WW: 2761

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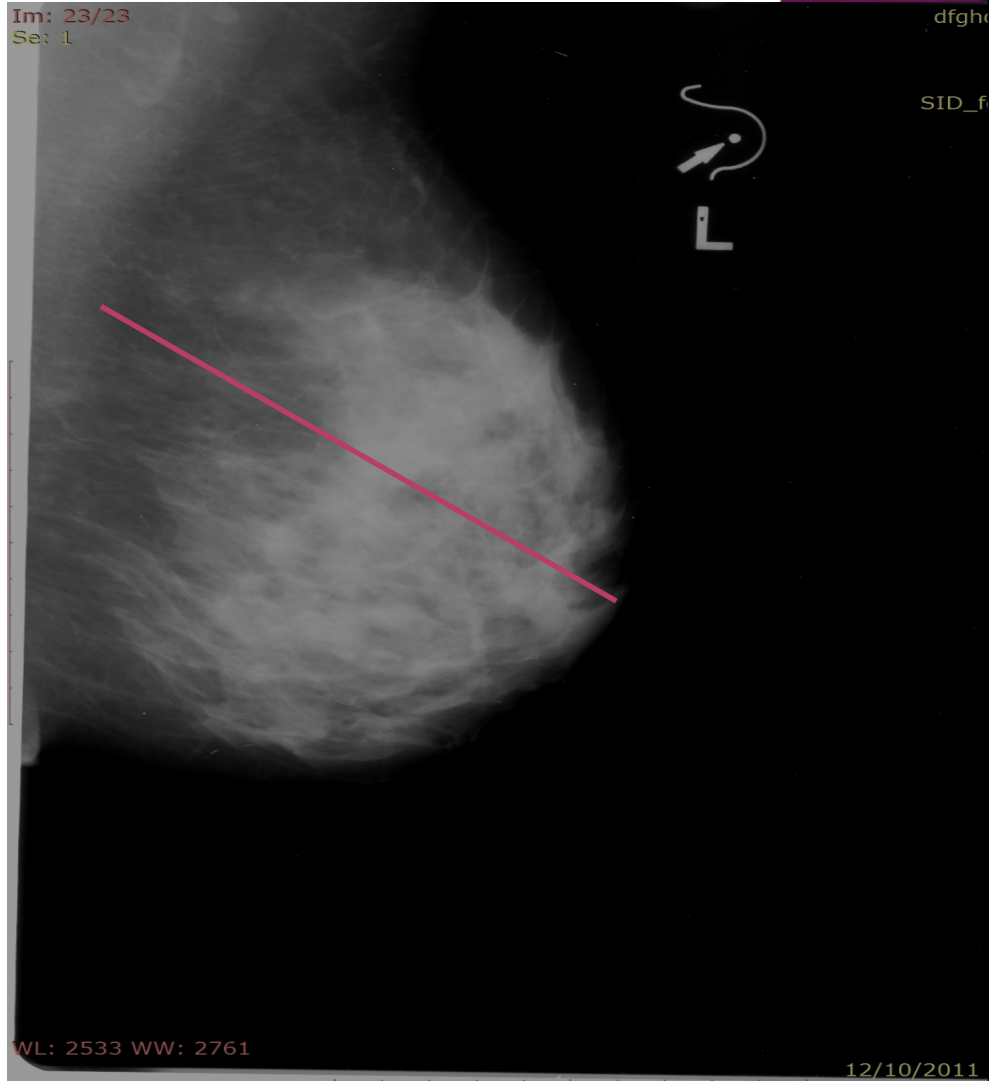
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WL: 2533 WW: 2761

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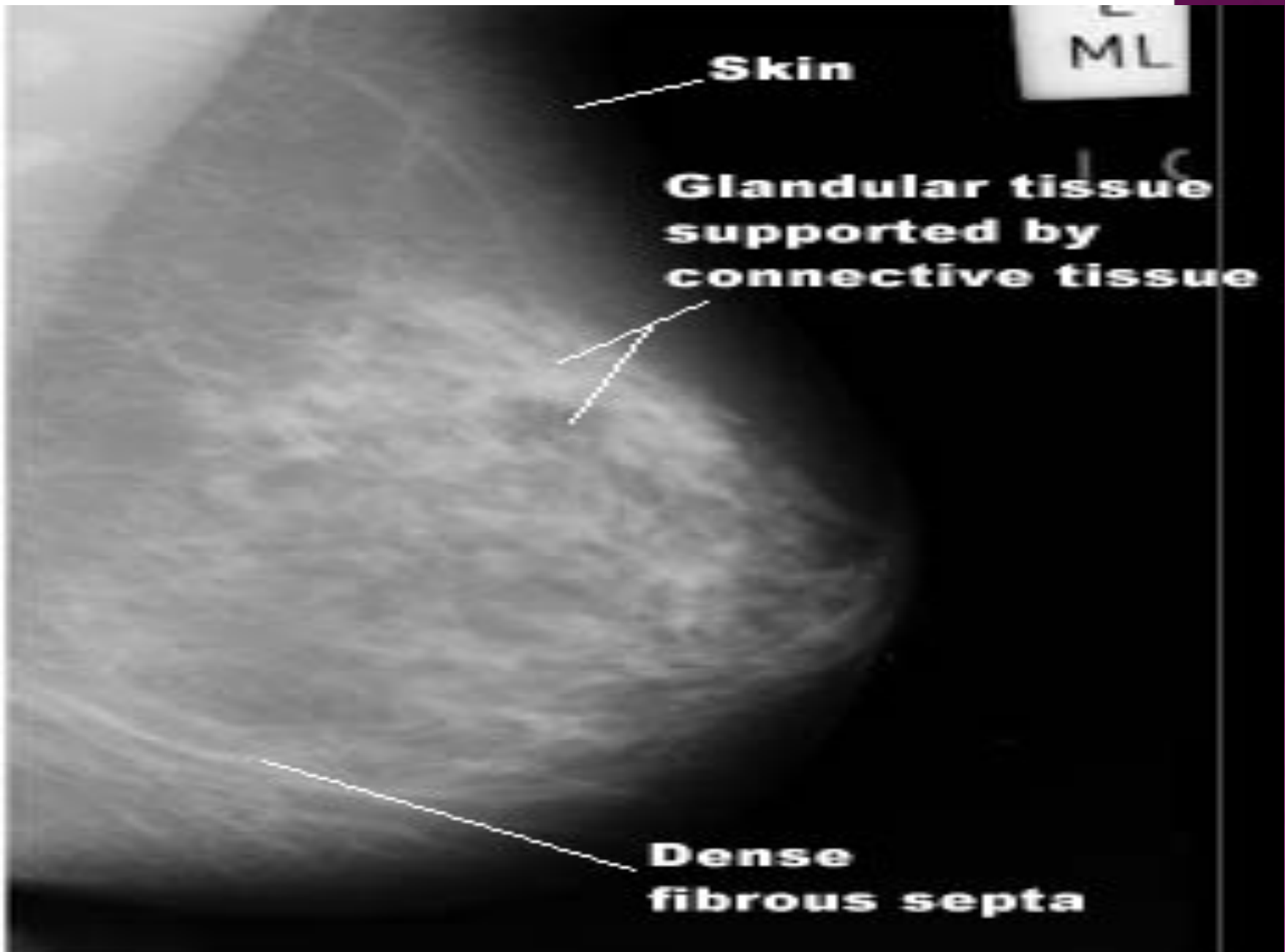
WHAT IS THE RISK OF MAMMOGRAPHY?

- 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.

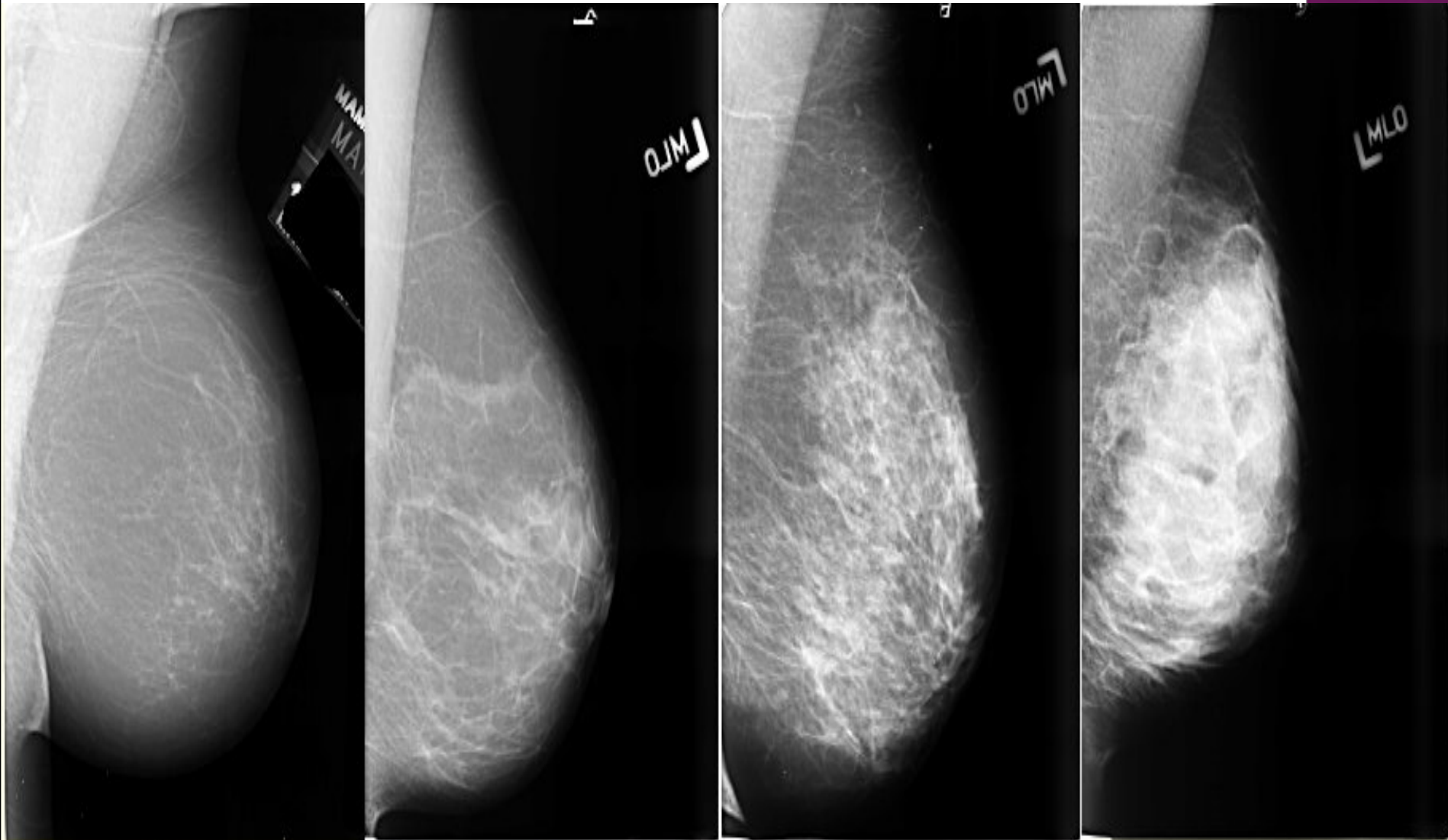
APPEARANCES OF MAMMOGRAM



SENSITIVITY OF MAMMOGRAPHY

- ◉ 85% - 90% in fatty replaced breasts
- ◉ 65% in dense breasts

FATTY & DENSE BREAST



Breast composition and its mammographic appearance.¹

PRIMARY SIGNS OF CANCER ON MAMMOGRAPHY

◎ 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 Shape¹



Round



Oval



Lobulated



Irregular



Architectural
Distortion

Mass Margins¹



Circumscribed



Obscured



Micro-lobulated

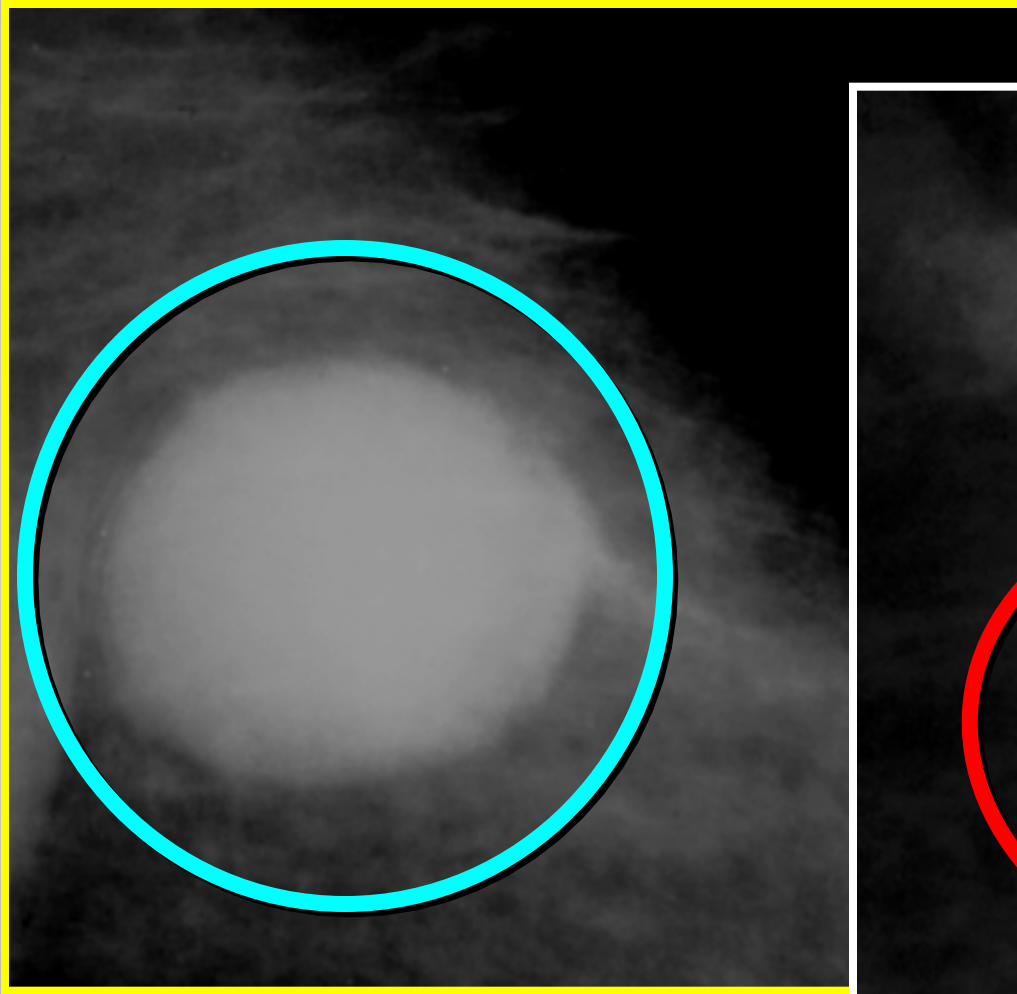


Ill-defined



Spiculated

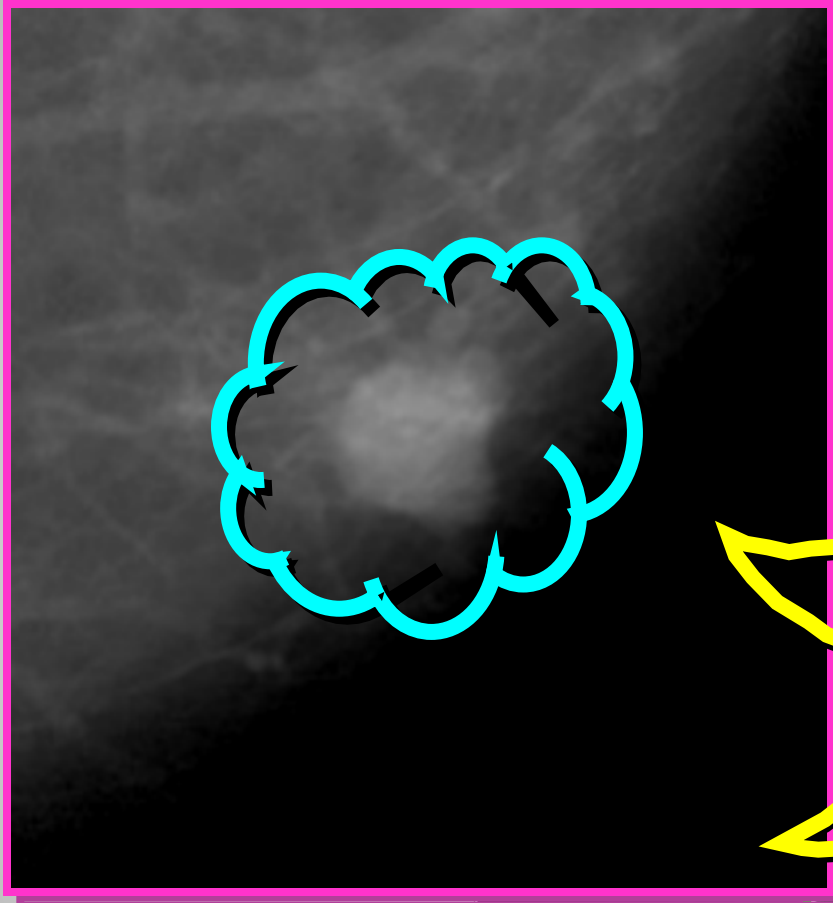
ROUND



OVAL



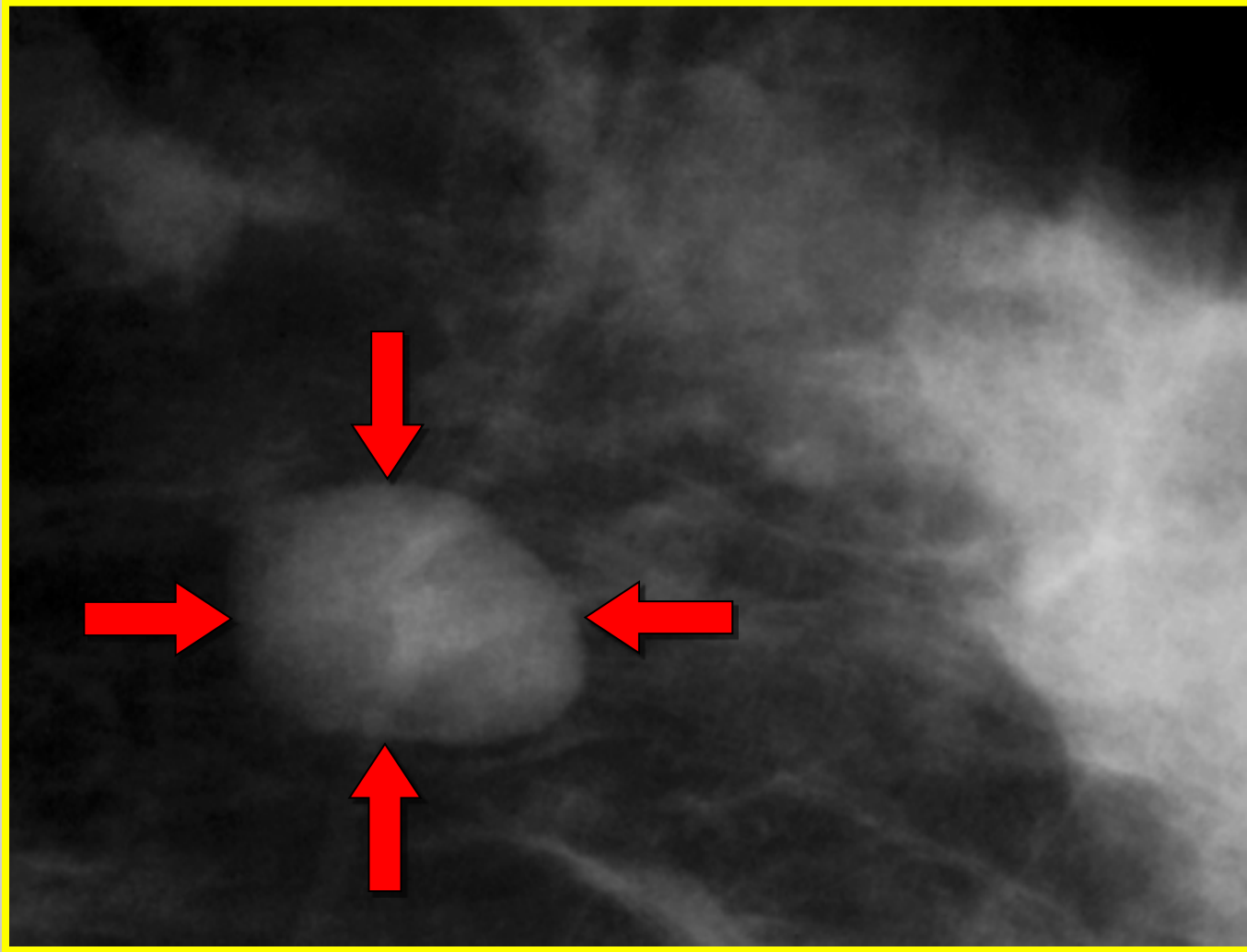
LOBULAR



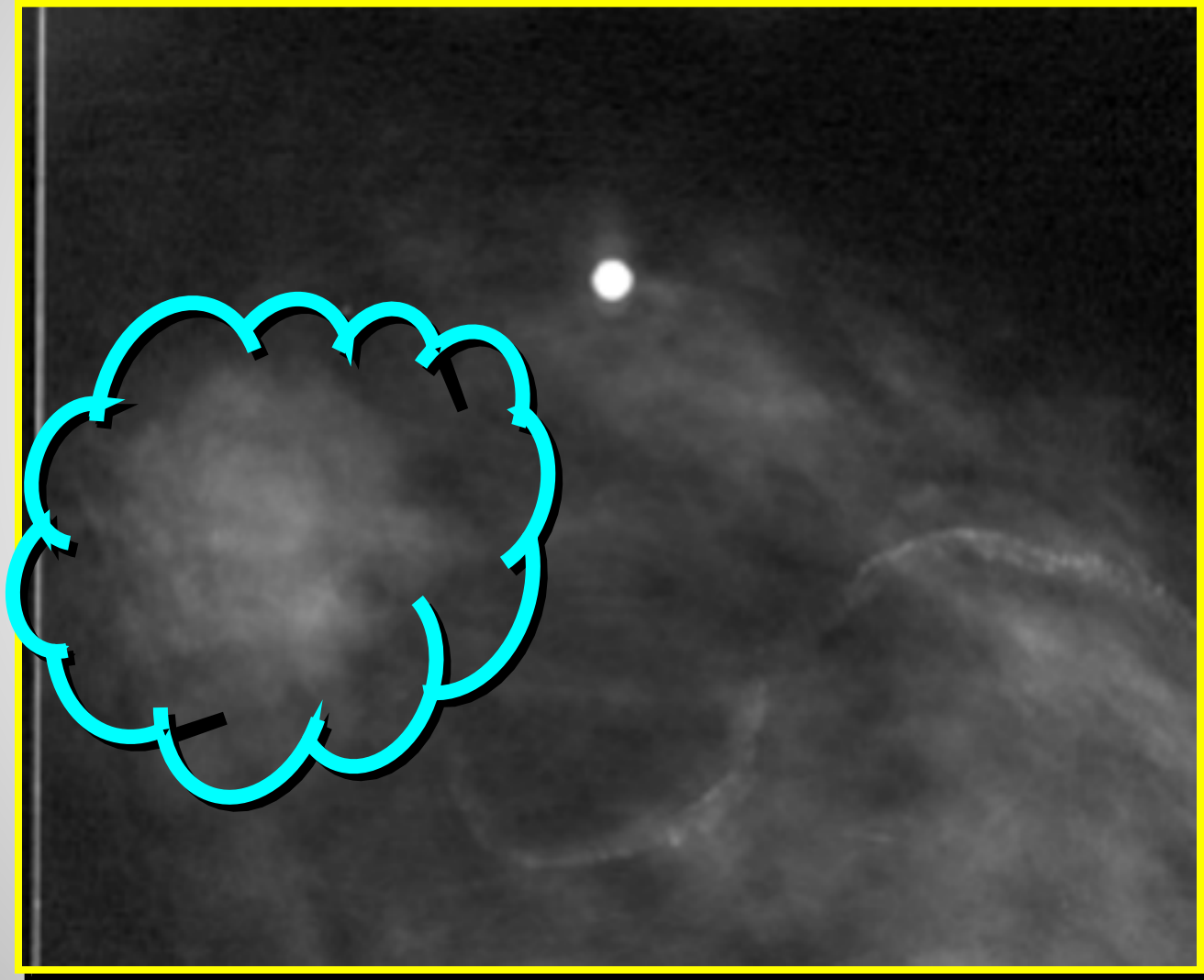
IRREGULAR



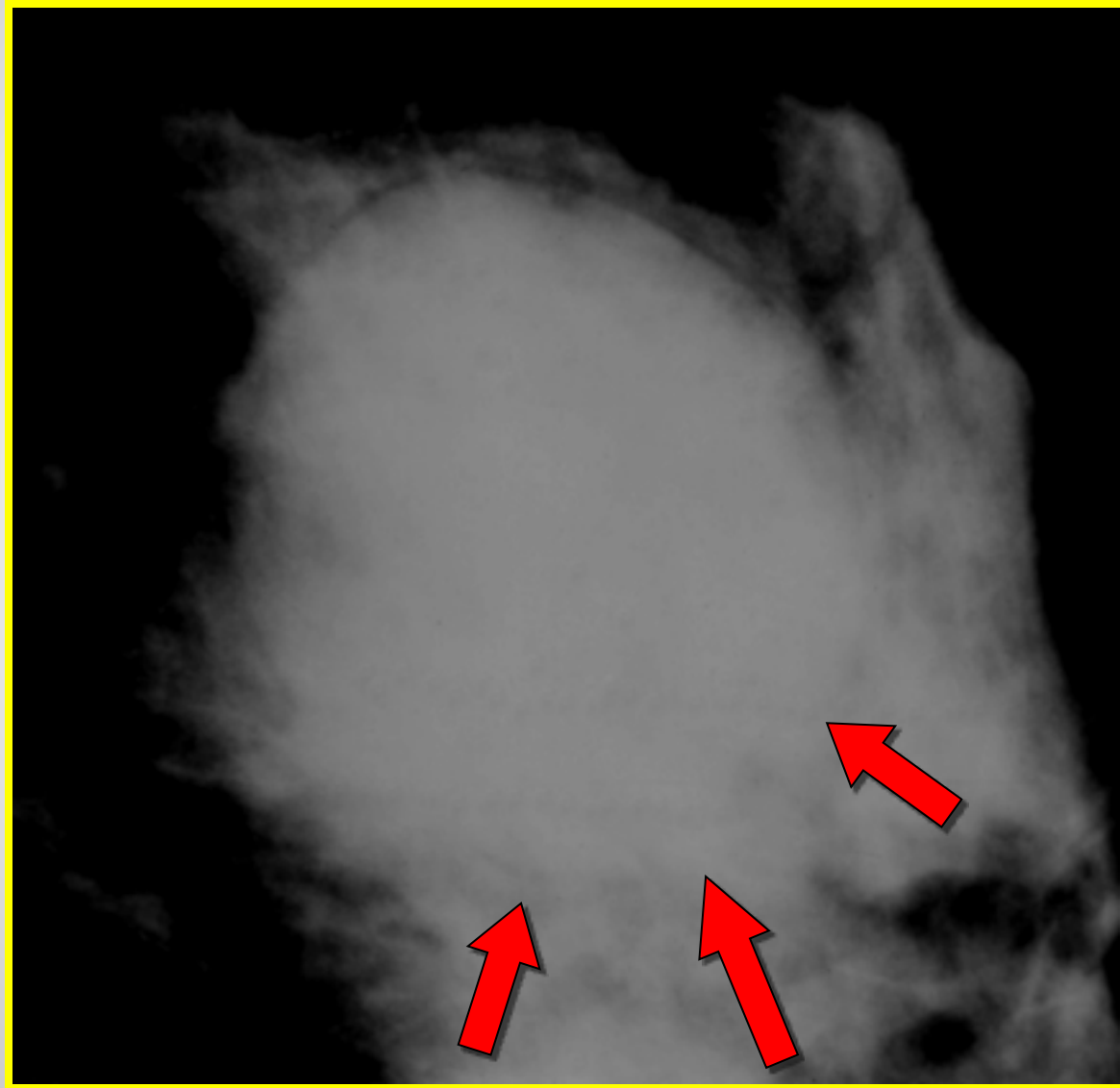
CIRCUMSCRIBED



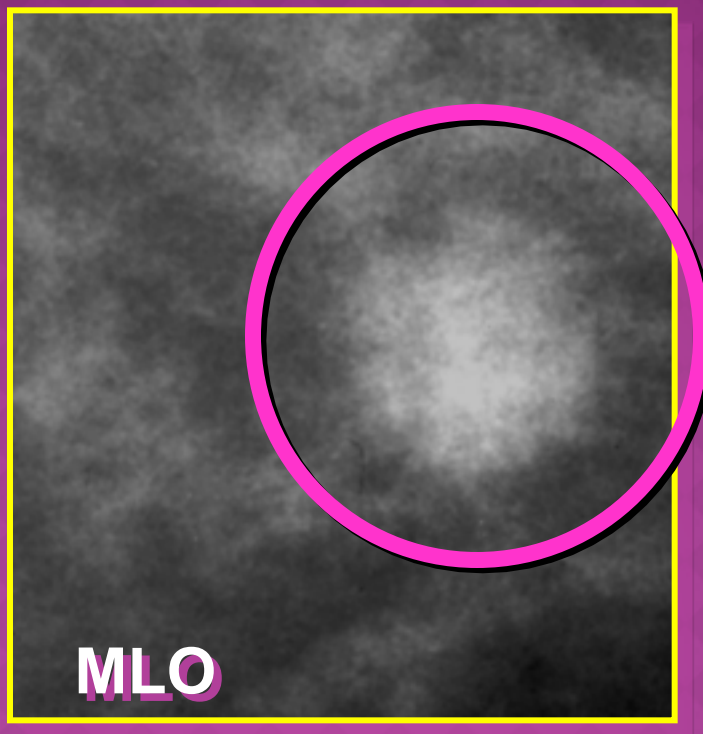
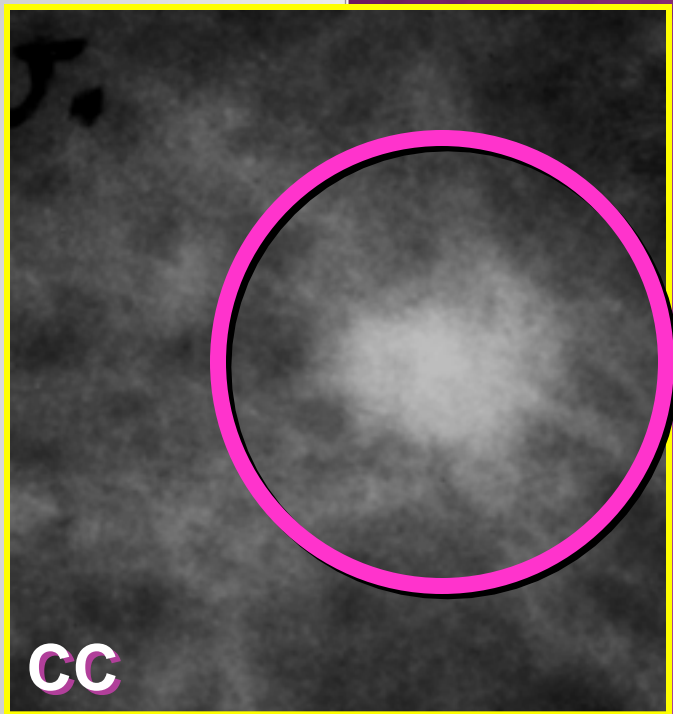
MICROLOBULATED



OBSCURED

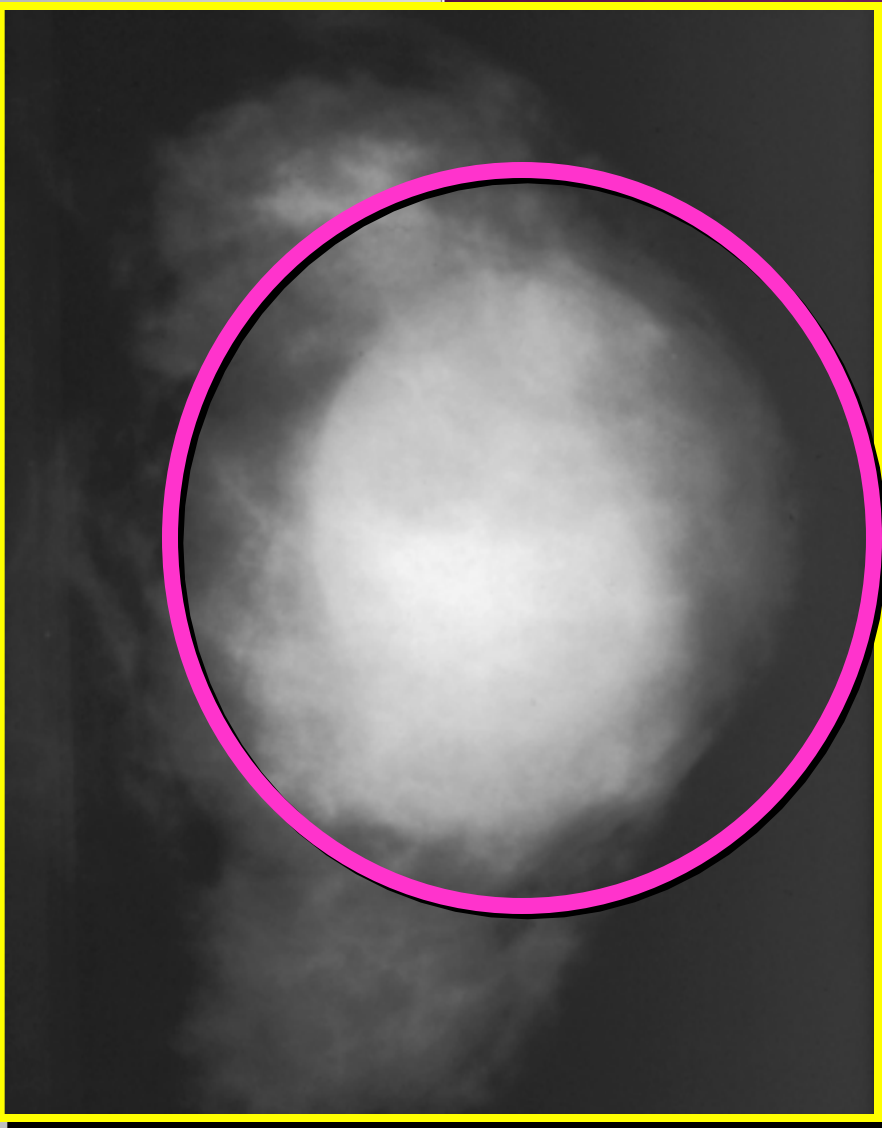


INDISTINCT



SPICULATED



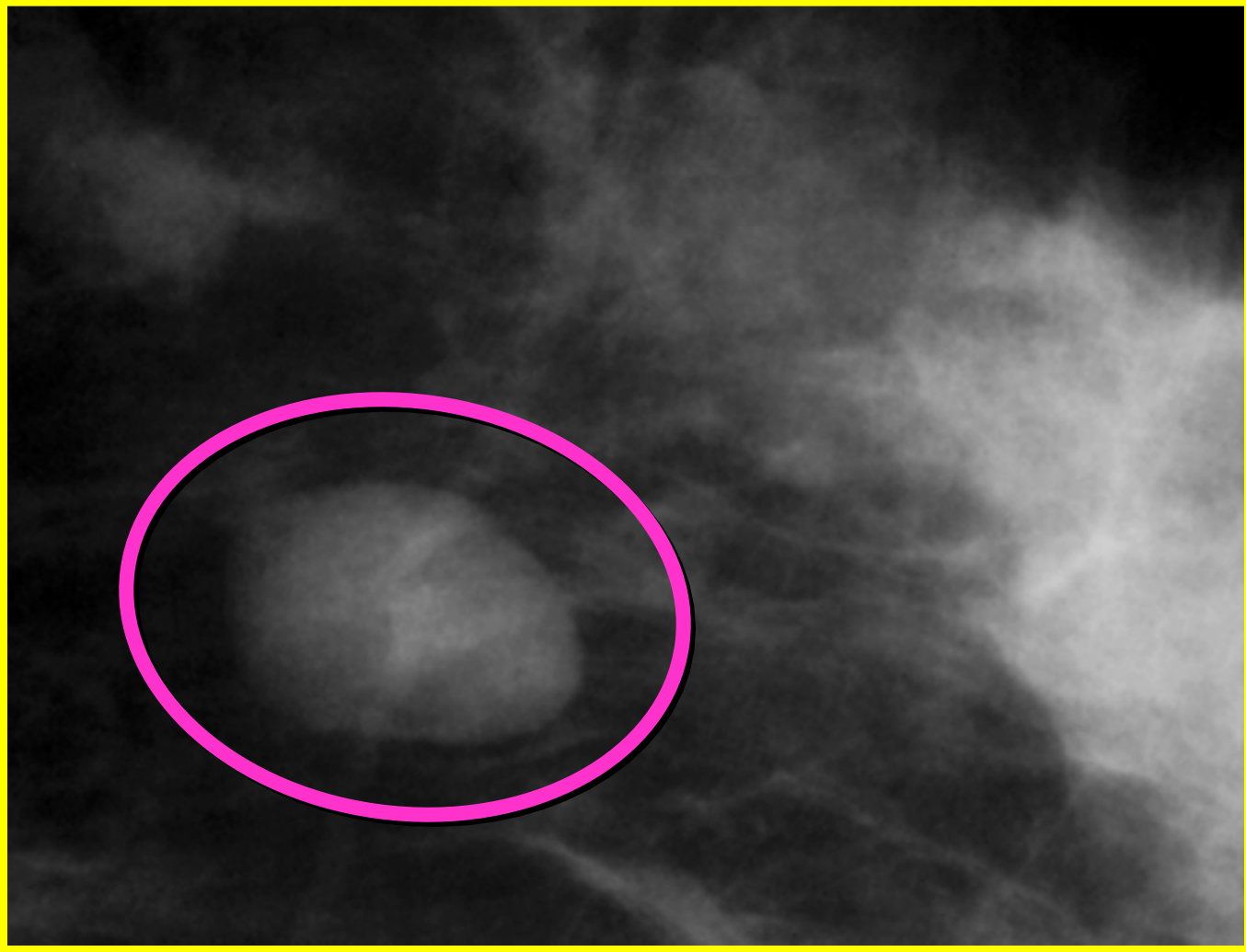


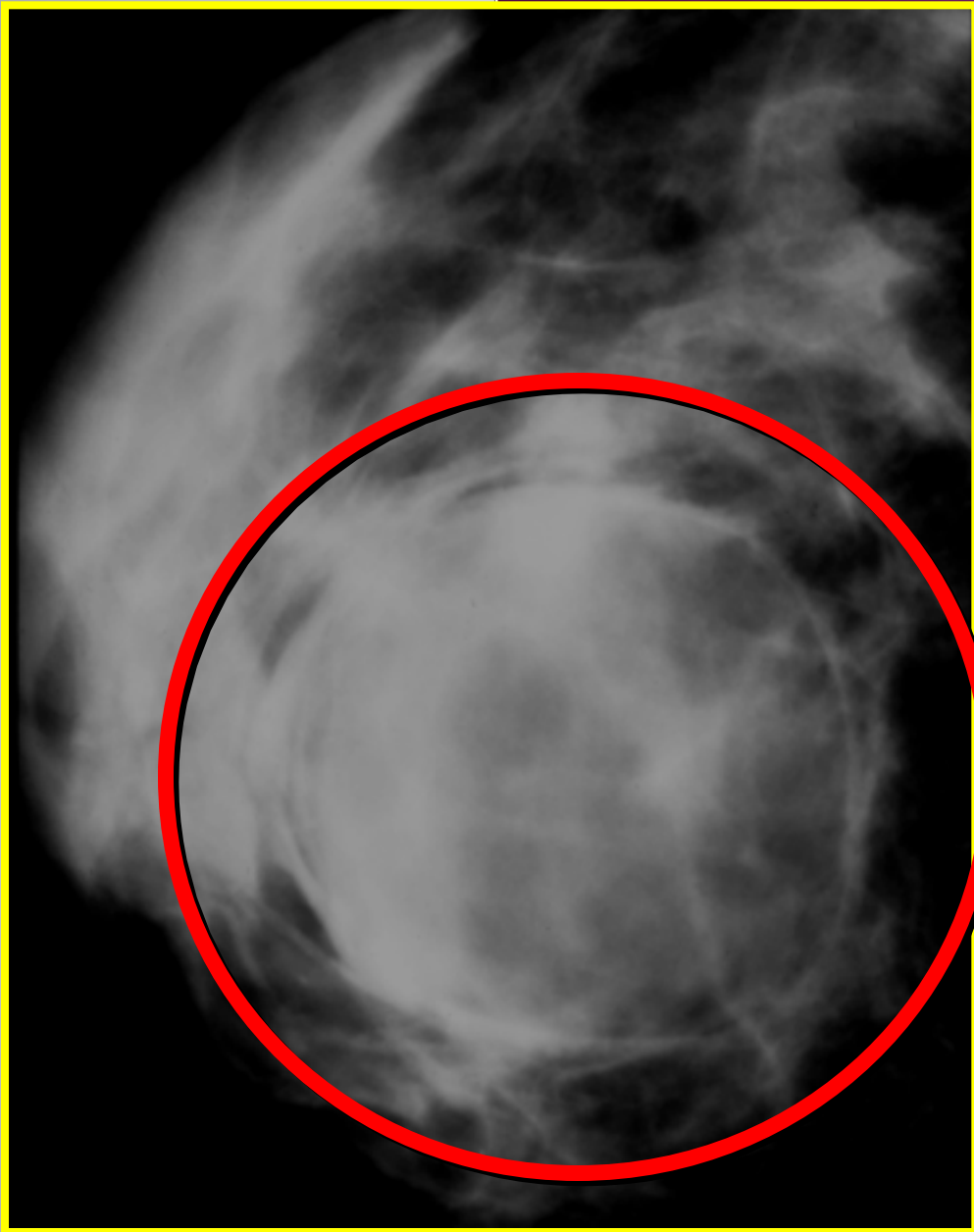
**HIGH
DENSITY**

EQUAL DENSITY



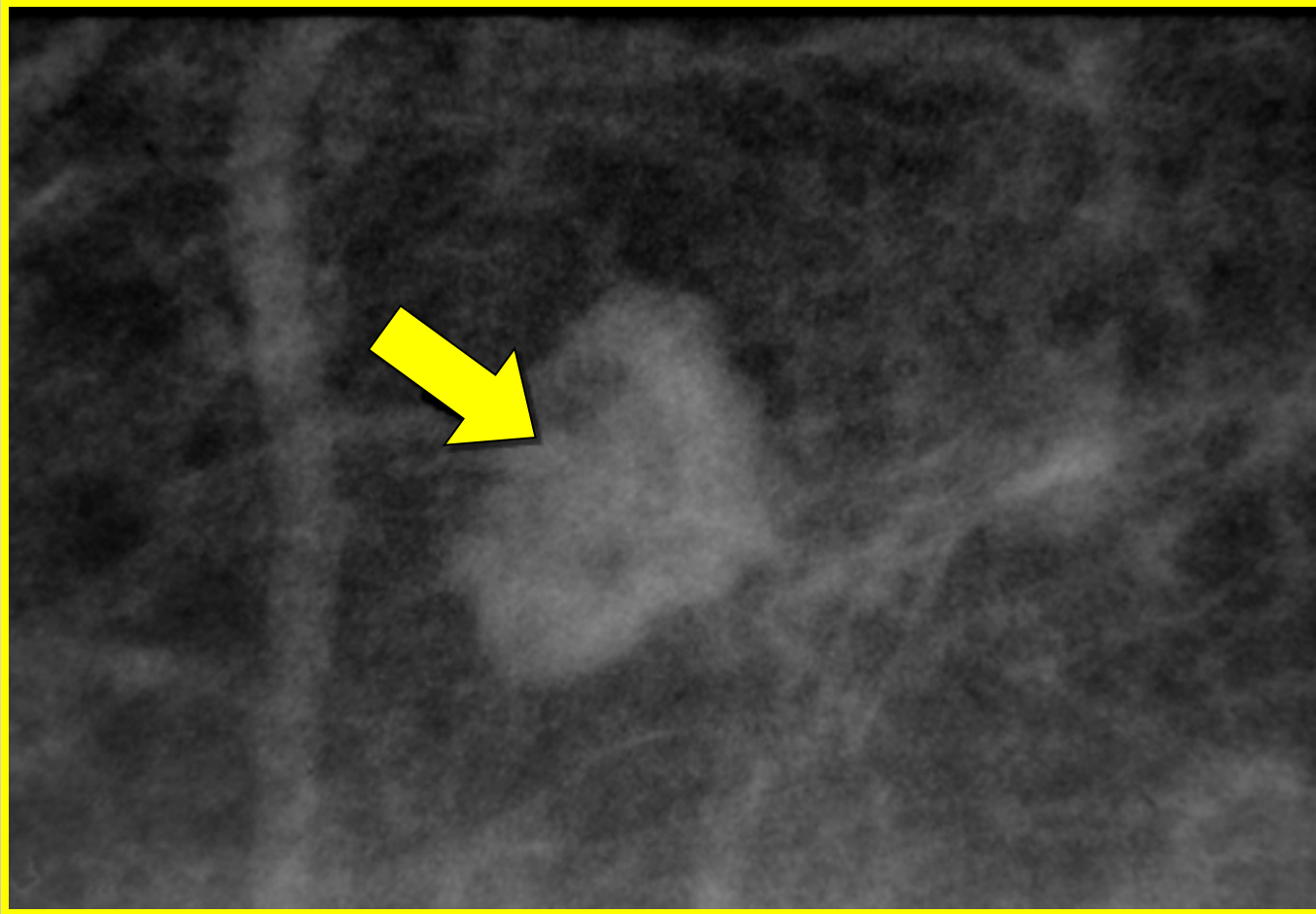
LOW DENSITY





**FAT-
CONTAINING**

INTRAMAMMARY LYMPH NODE



MASSES: BI-RADS DESCRIPTORS

SHAPE:

- → **Round, oval, lobular, irregular**

MALIGNANT

BENIGN

- → **Circumscribed, microlobulated, obscured, indistinct, spiculated**

DENSITY:

- → **High, equal, low, fat-containing**

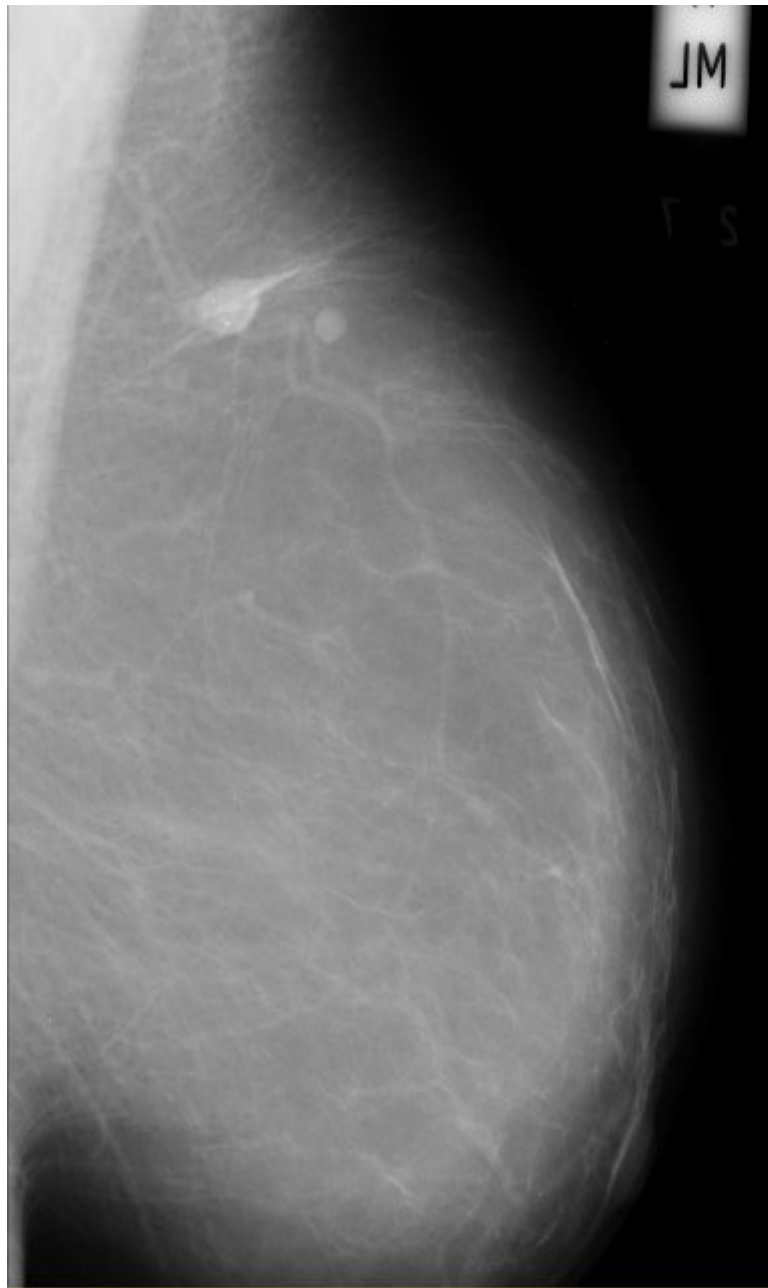
BI-RADS LEXICON: MASSES

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

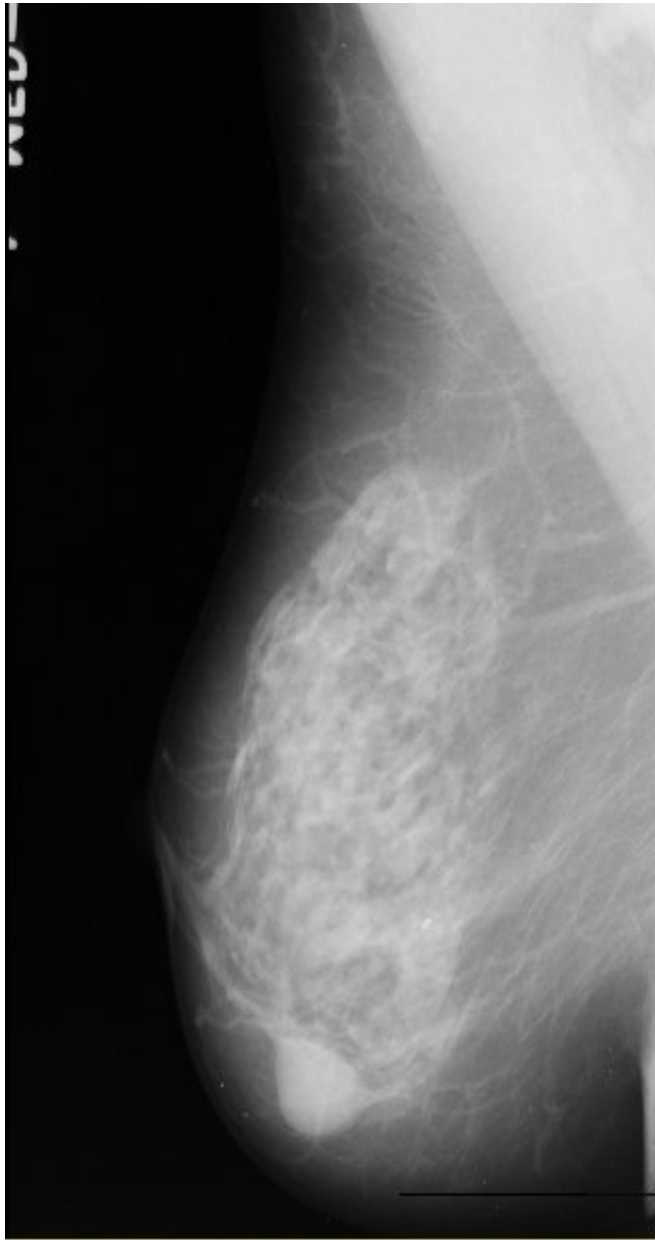
e.g., if mass **PARTLY**

→ **CIRCUMSCRIBED & PARTLY**

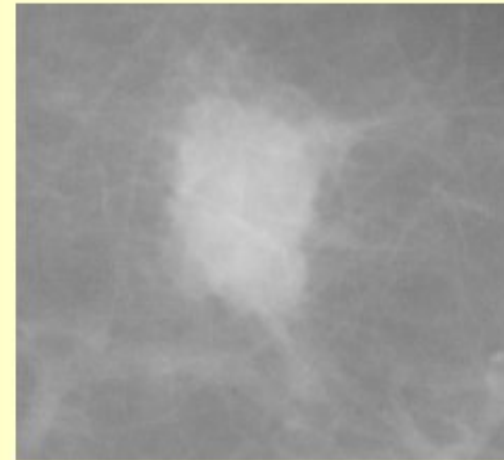
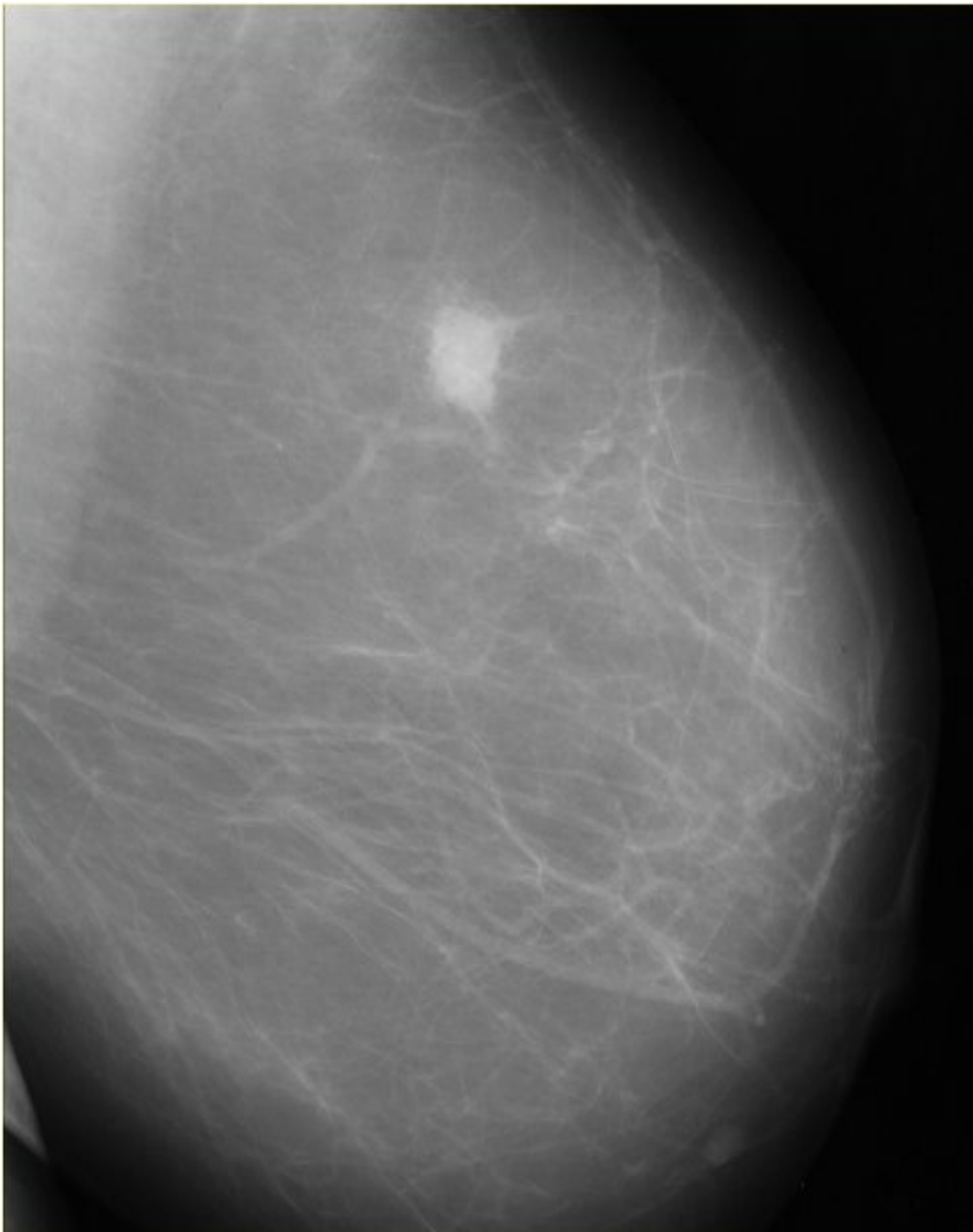
INDISTINCT, take further action based on **INDISTINCT MARGINS**



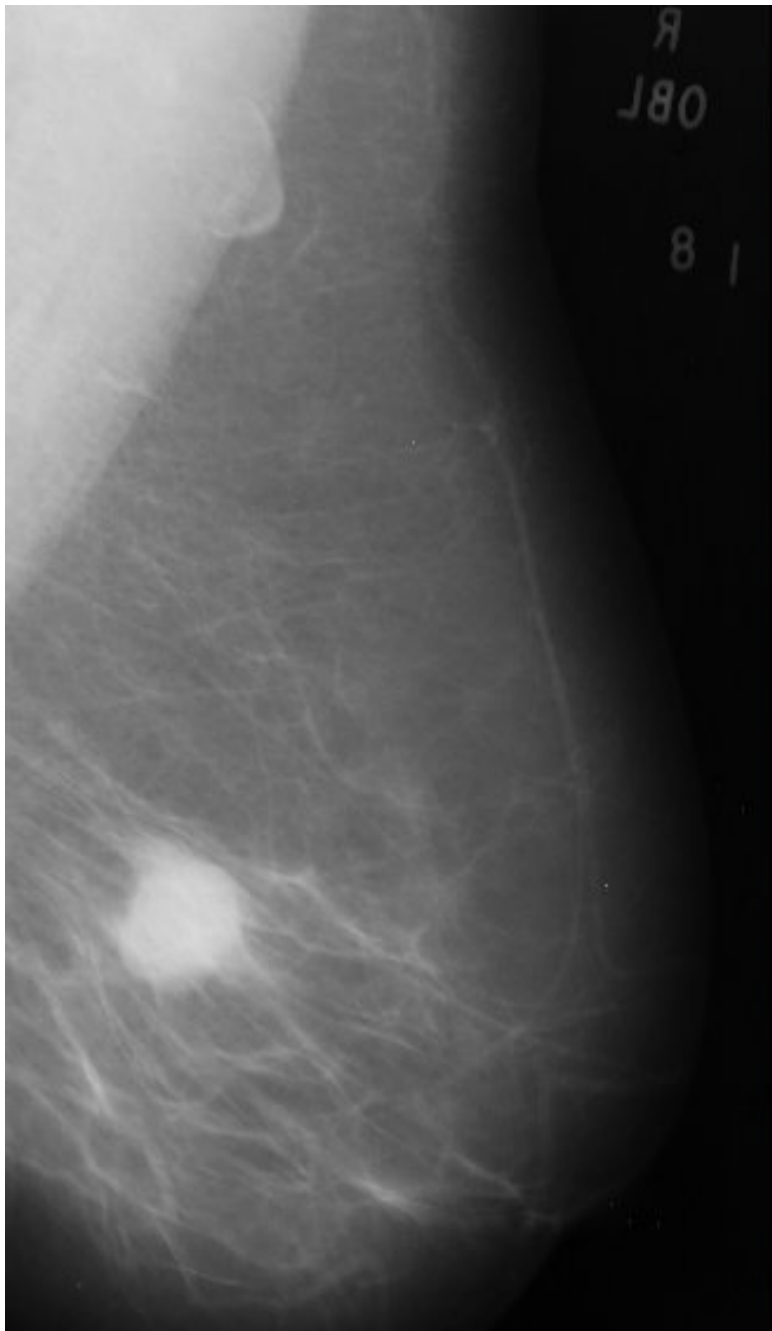
An oval mass and a round mass with circumscribed margins are evident in the upper quadrant of the breast on this medio-lateral view.¹



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



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



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



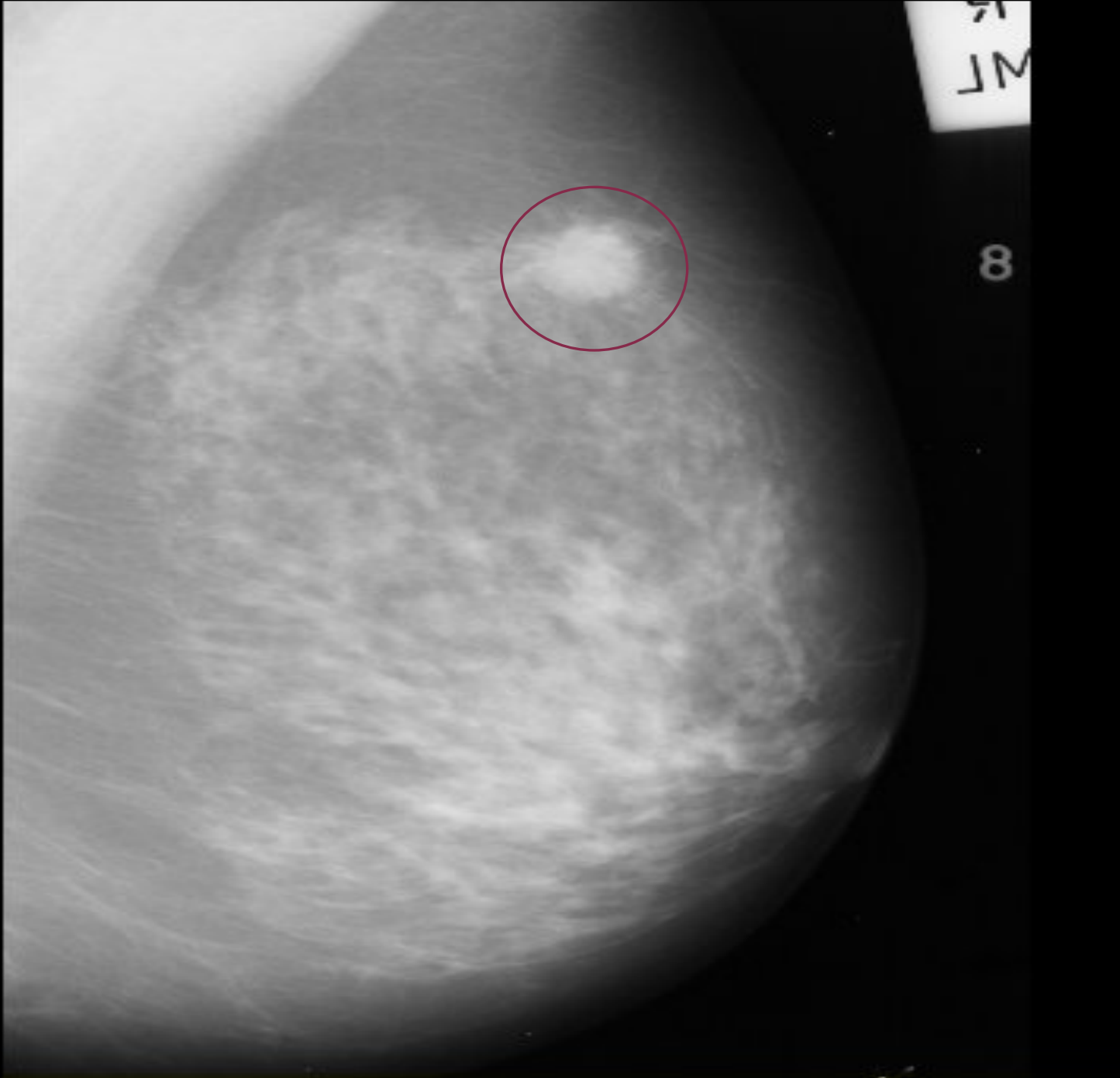
91
JM

8



This lesion's margin is ill-defined.¹



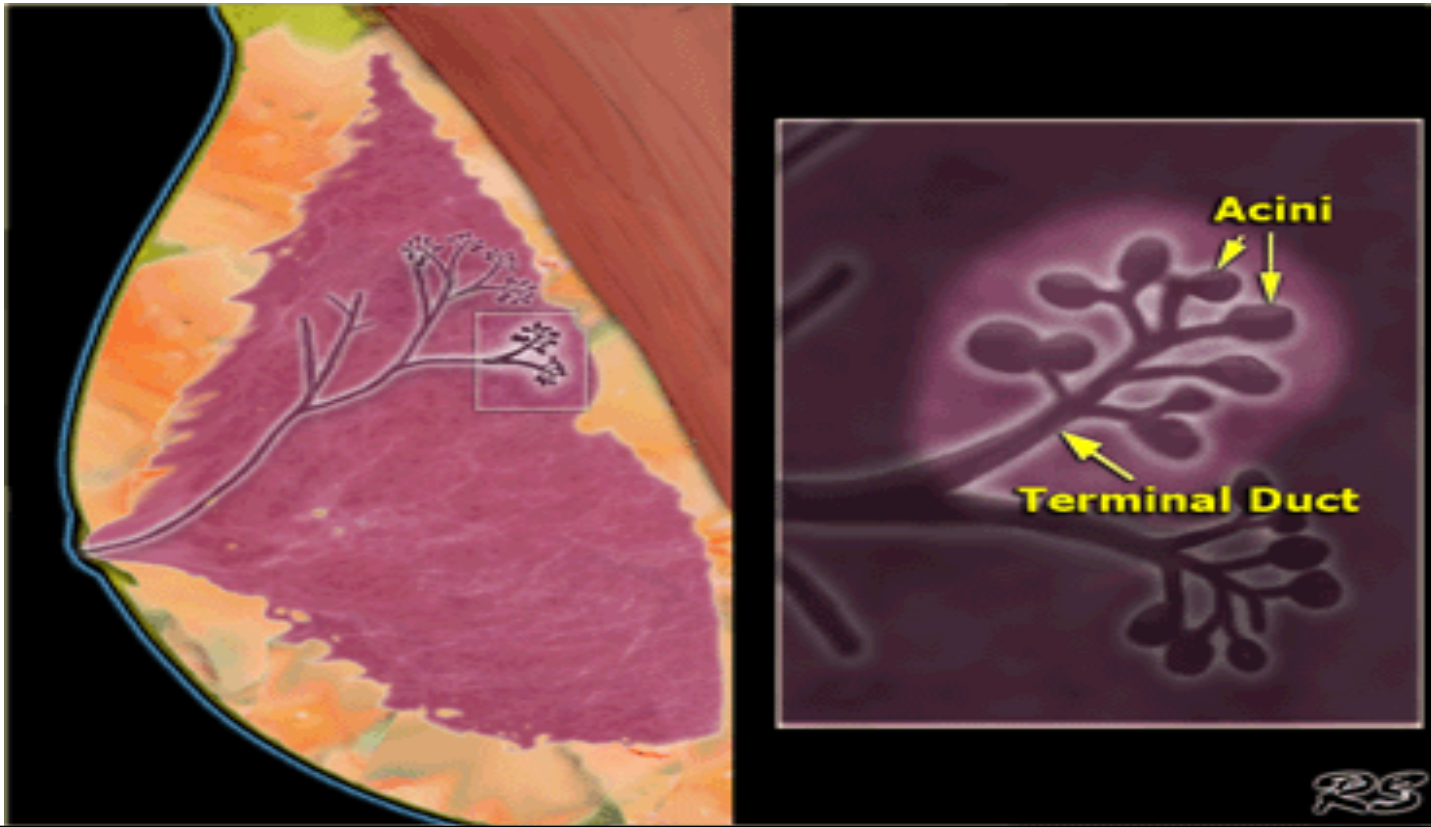


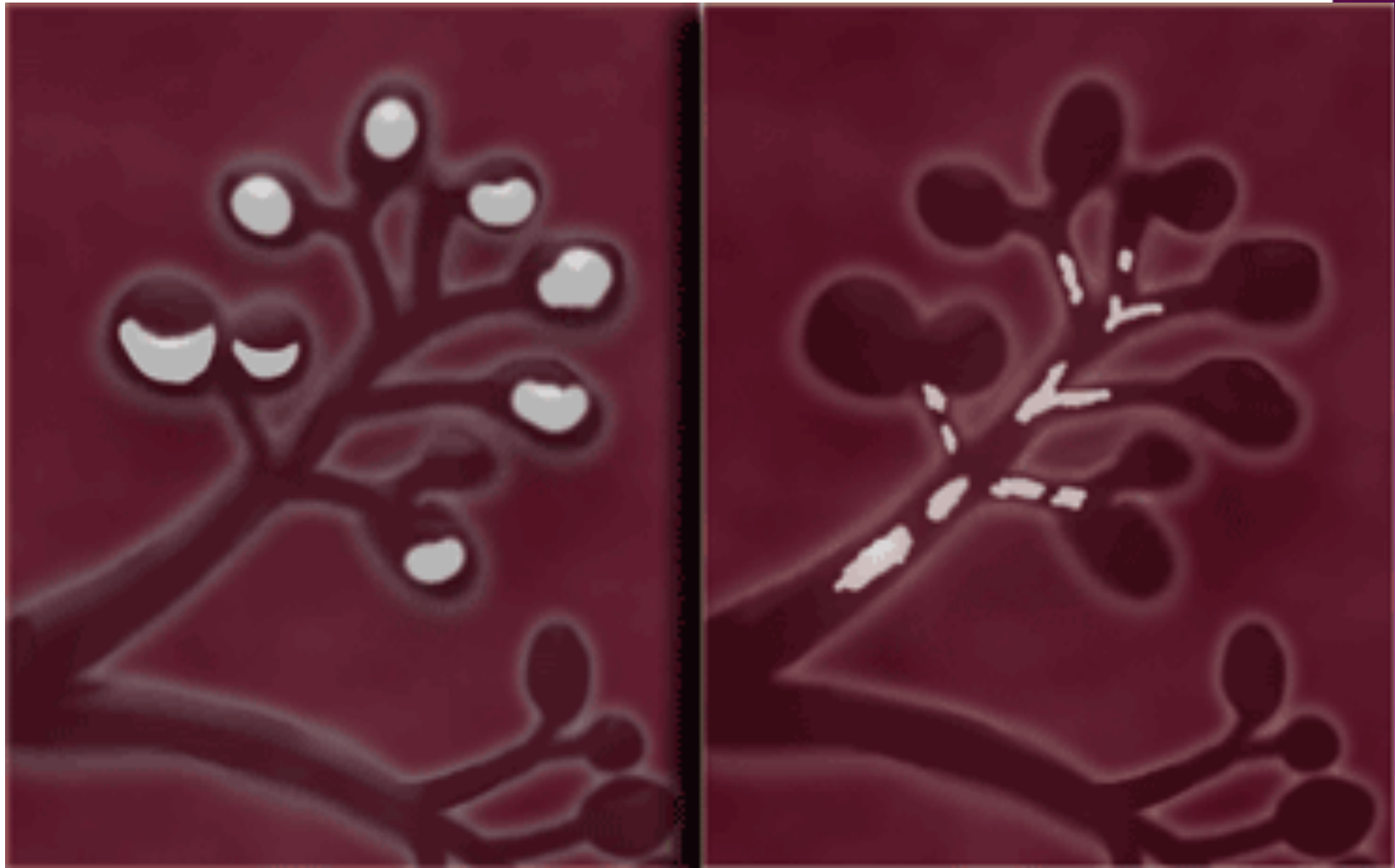
Spiculated
mass

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

Morphology

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

Calcifications Morphology

Benign

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

Malignant

fine linear
branching
pleomorphic

Intermediate Concern

Amorphous
Coarse heterogenous

Distribution

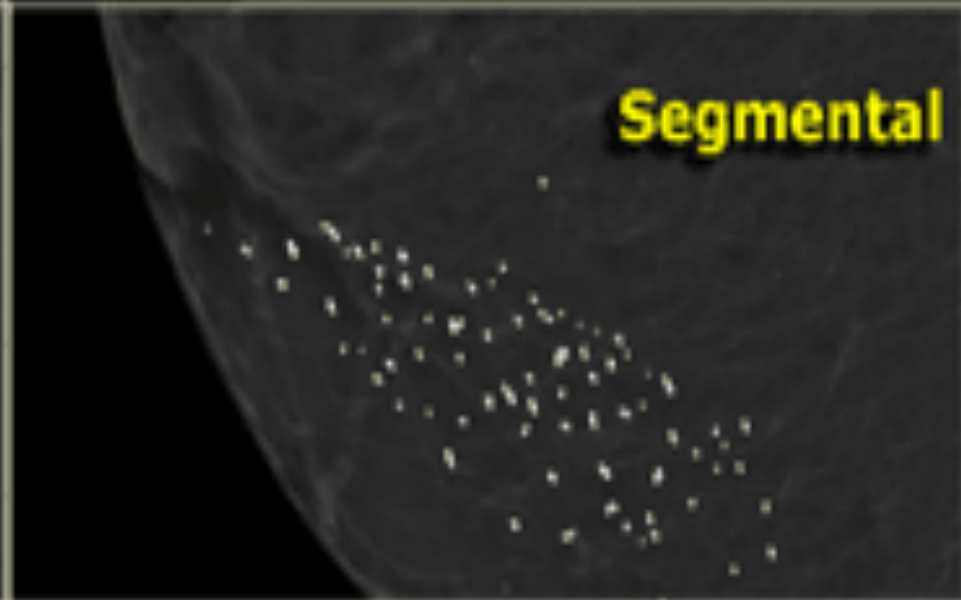
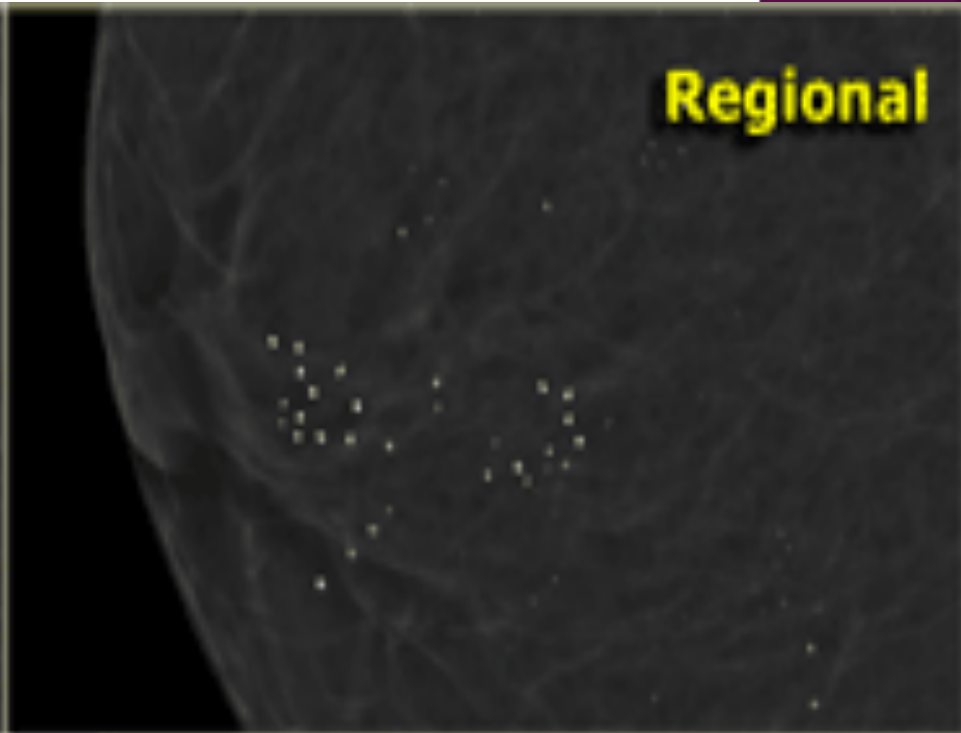
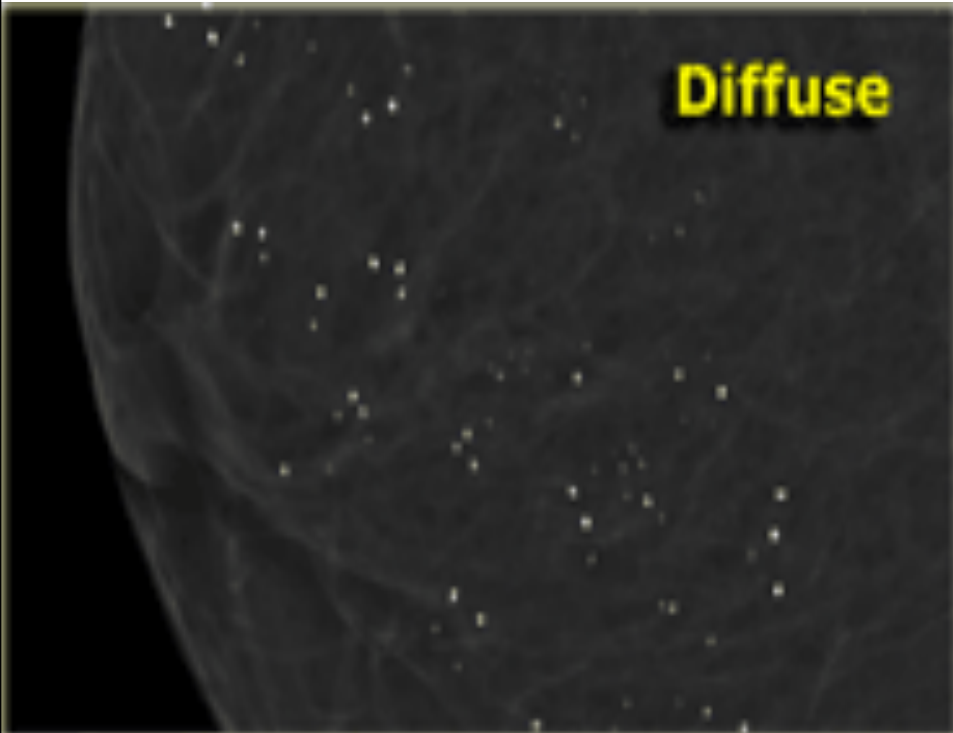
Diffuse

Regional

Clustered

Segmental

Linear



Calcifications Distribution

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graph TD; A[Calcifications Distribution] --> B[Benign]; A --> C[Intermediate Concern]; A --> D[Malignant]; B --> E[Diffuse]; B --> F[Regional]; C --> G[Clustered]; D --> H[Linear]; D --> I[Segmental]
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Benign

Intermediate Concern

Malignant

**Diffuse
Regional**

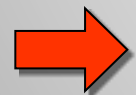
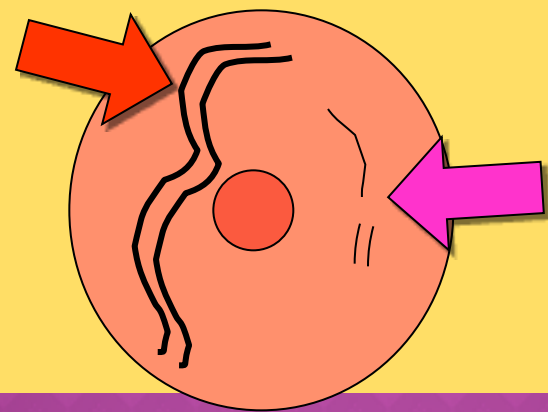
Clustered

**Linear
Segmental**

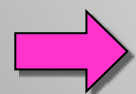
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

skin, vascular, coarse (popcorn like)
large rod



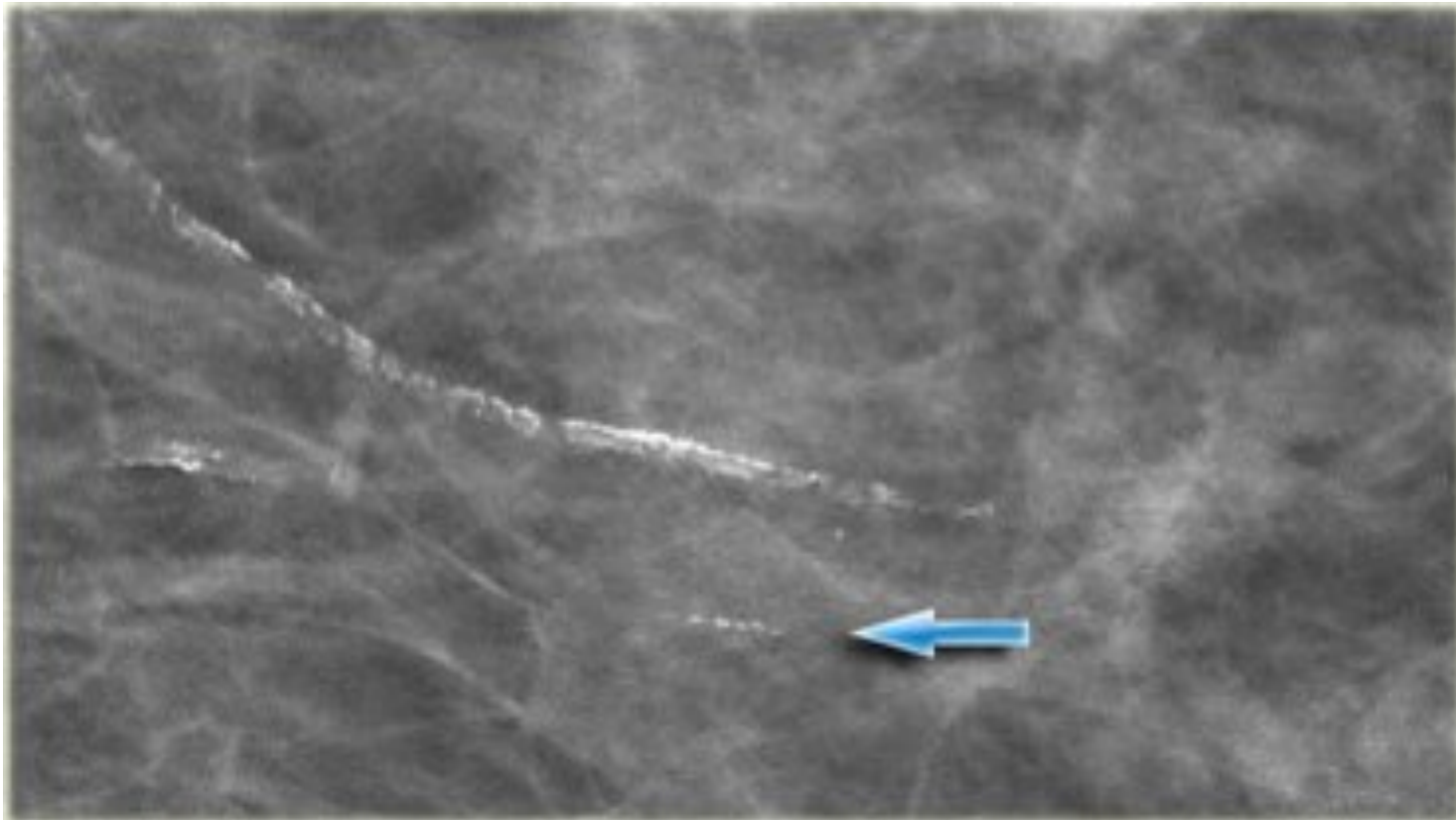
Usually “railroad track” appearance



Can be fragmented

BENIGN CALCIFICATIONS

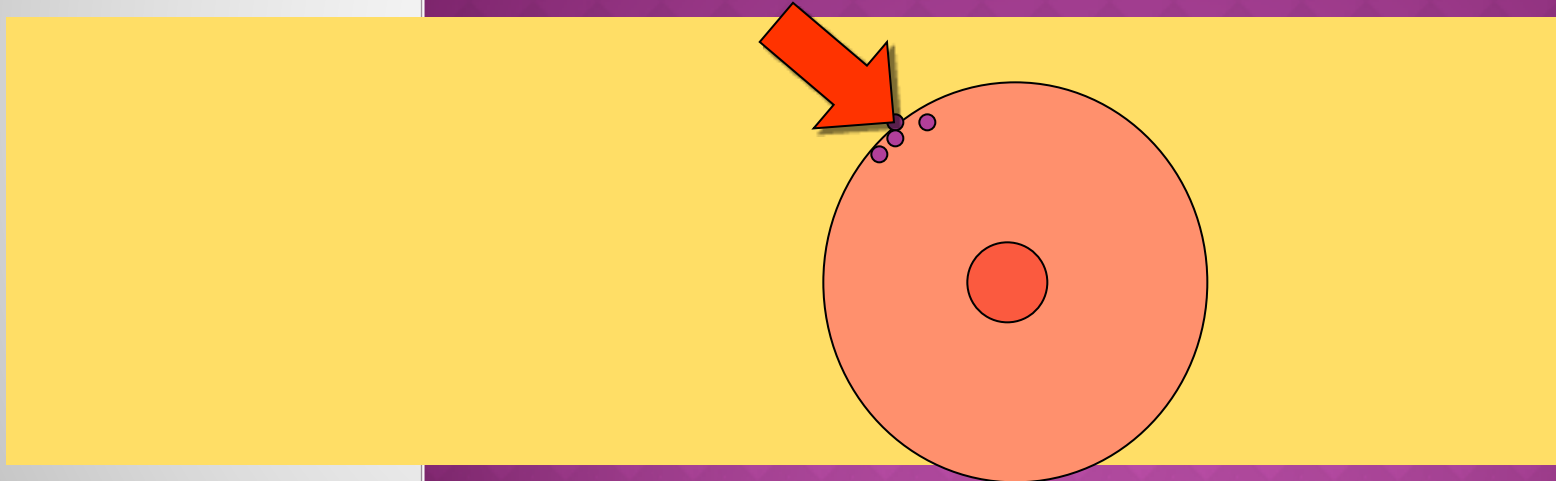
Vascular Calcifications



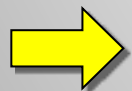
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

DESCRIPTORS: CALCIFICATIONS

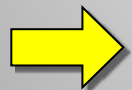
TYPICALLY BENIGN:



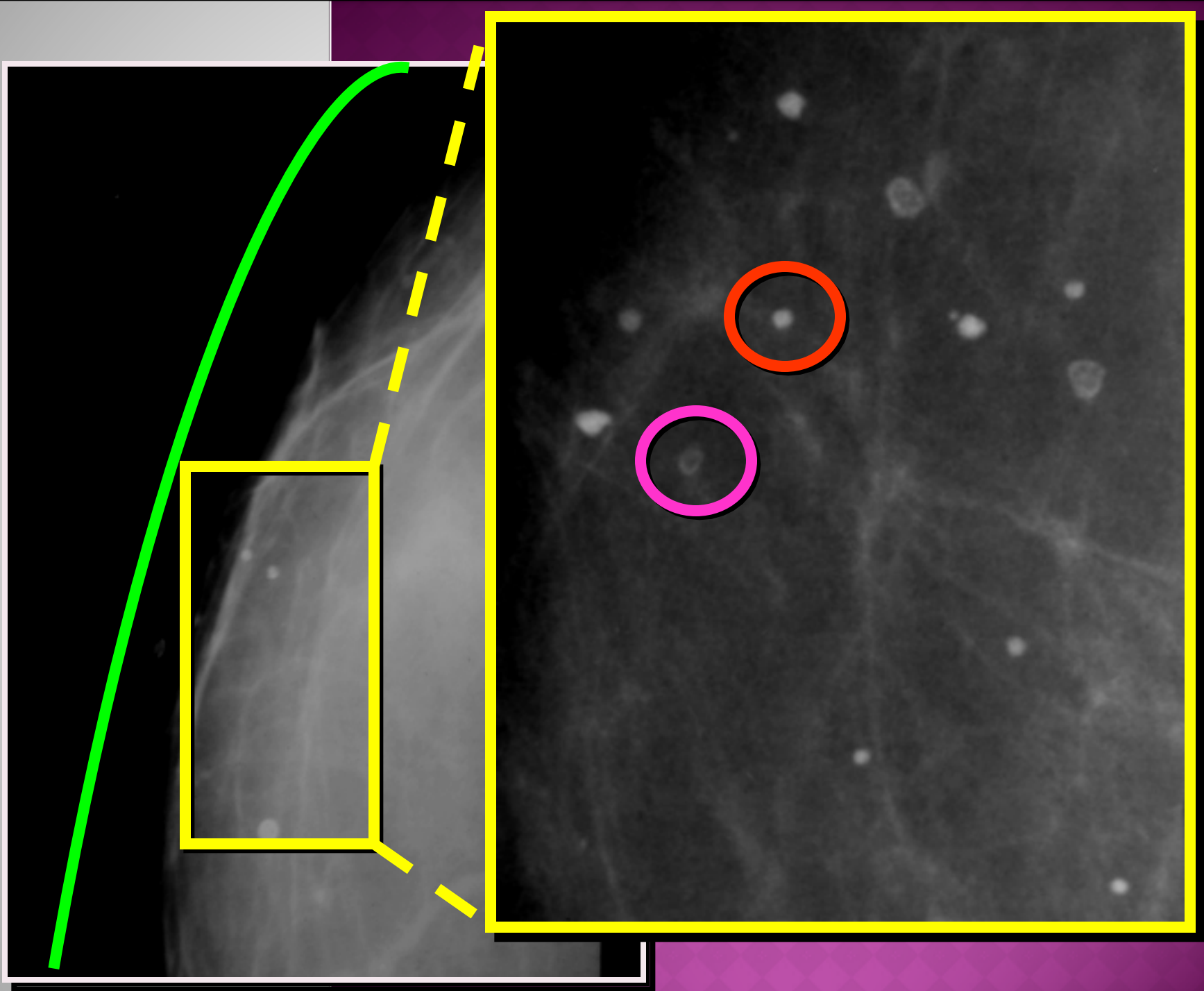
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Round, dense, sometimes egg-shell



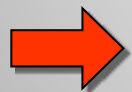
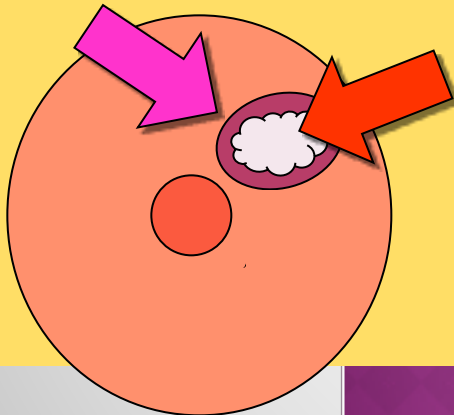
Often within 1 cm of skin in one view



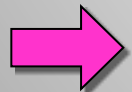
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

coarse (popcorn-like)

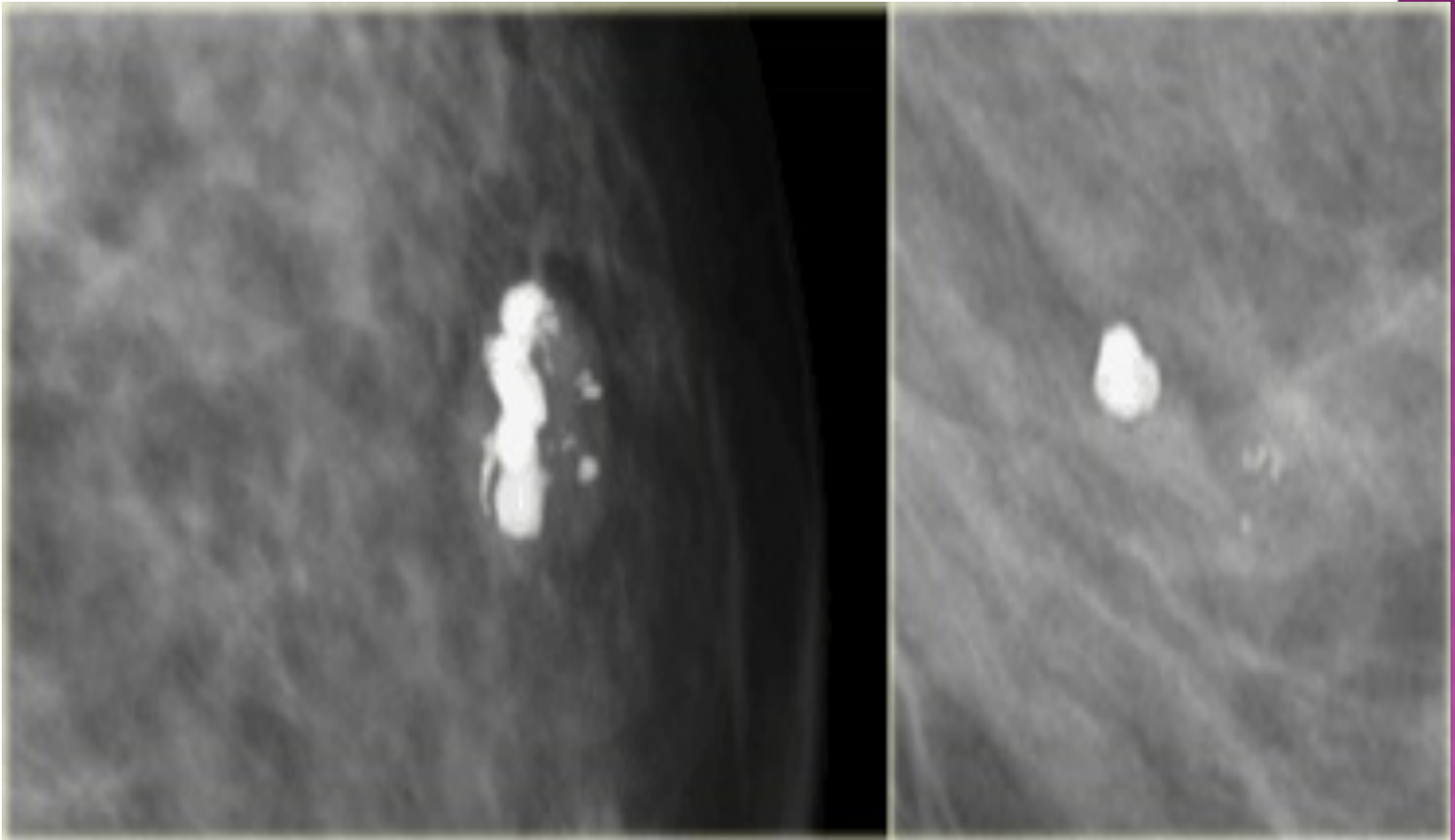


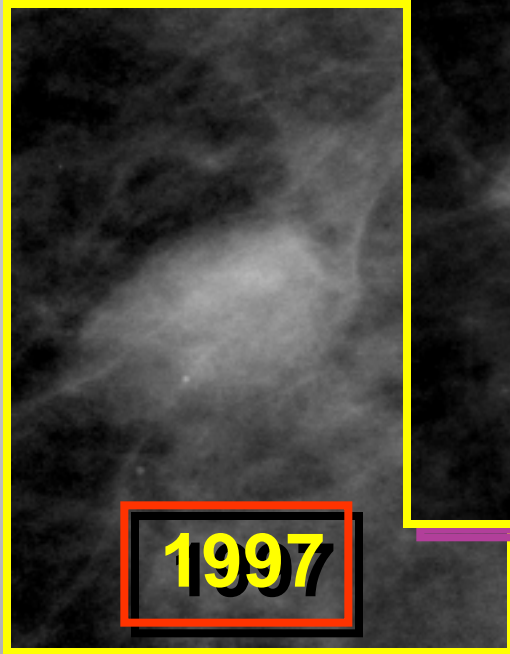
Created by involuting fibroadenoma



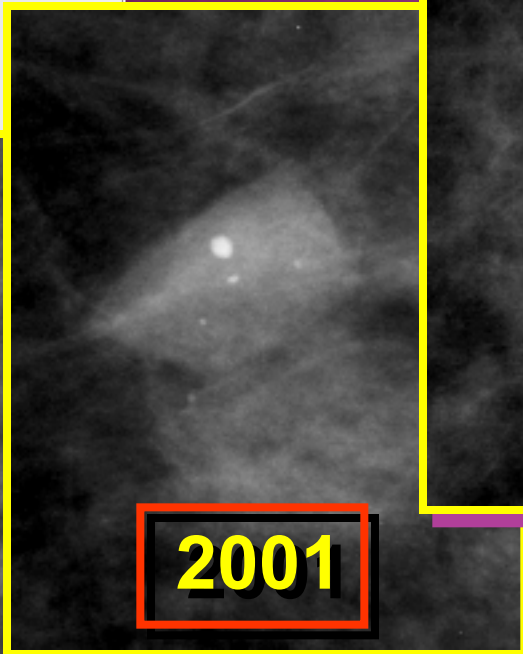
May see smooth soft tissue mass

COARSE OR 'POPCORN-LIKE'

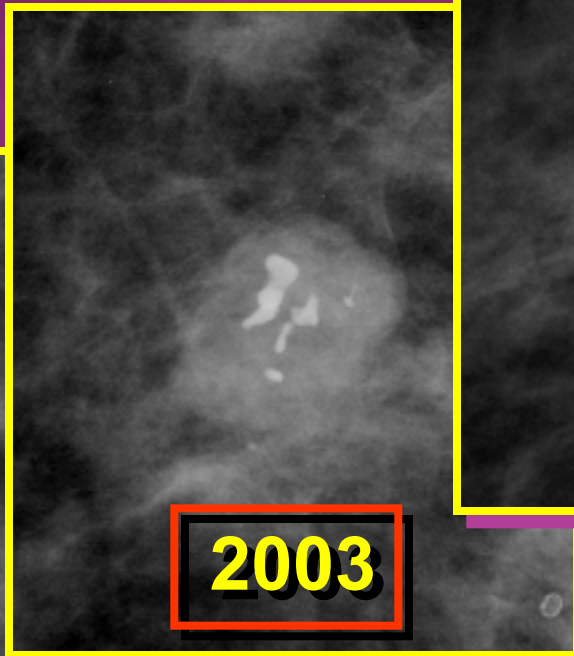




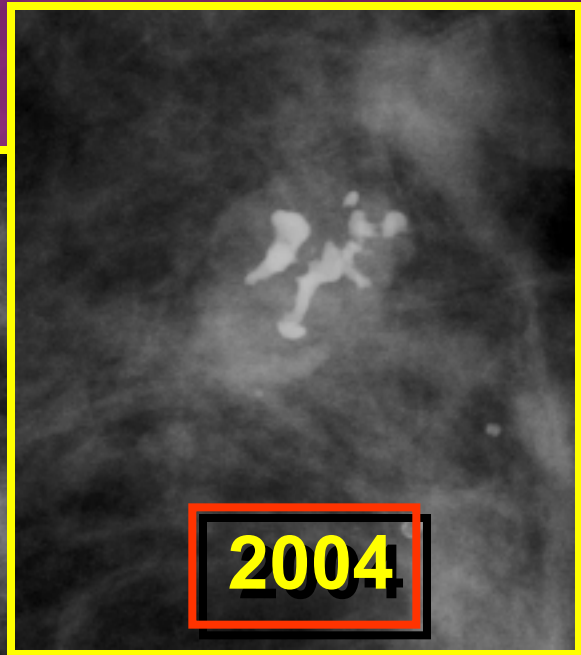
1997



2001



2003

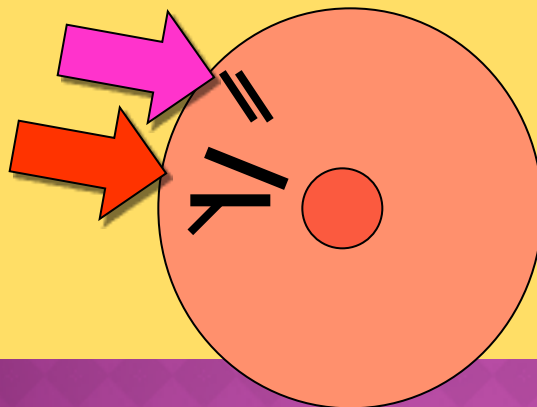


2004

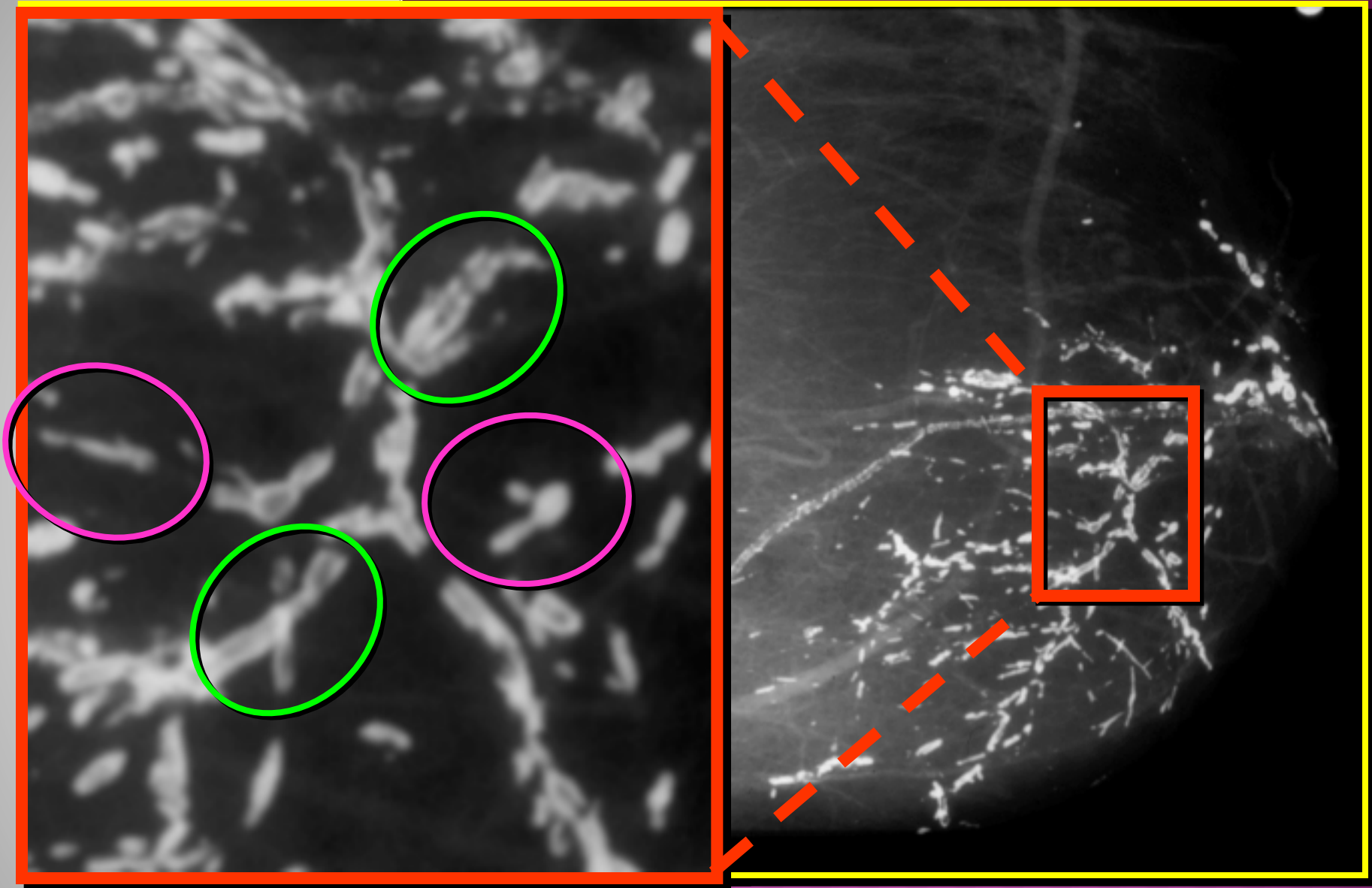
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

large rods,



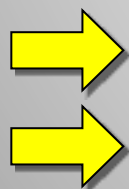
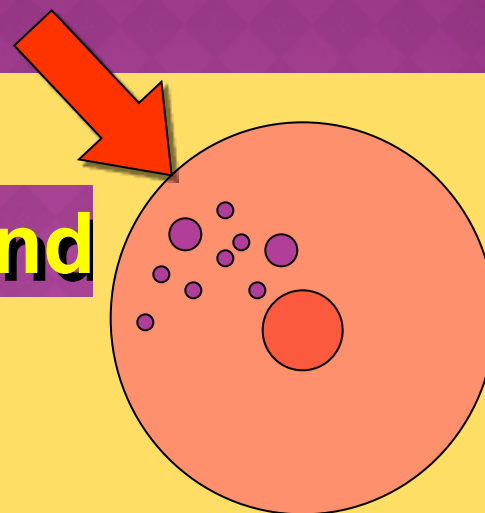
- ➔ **Secretory calcs., due to Plasma Cell Mastitis**
- ➔ **Segmental, bilateral, & intraductal or periductal**



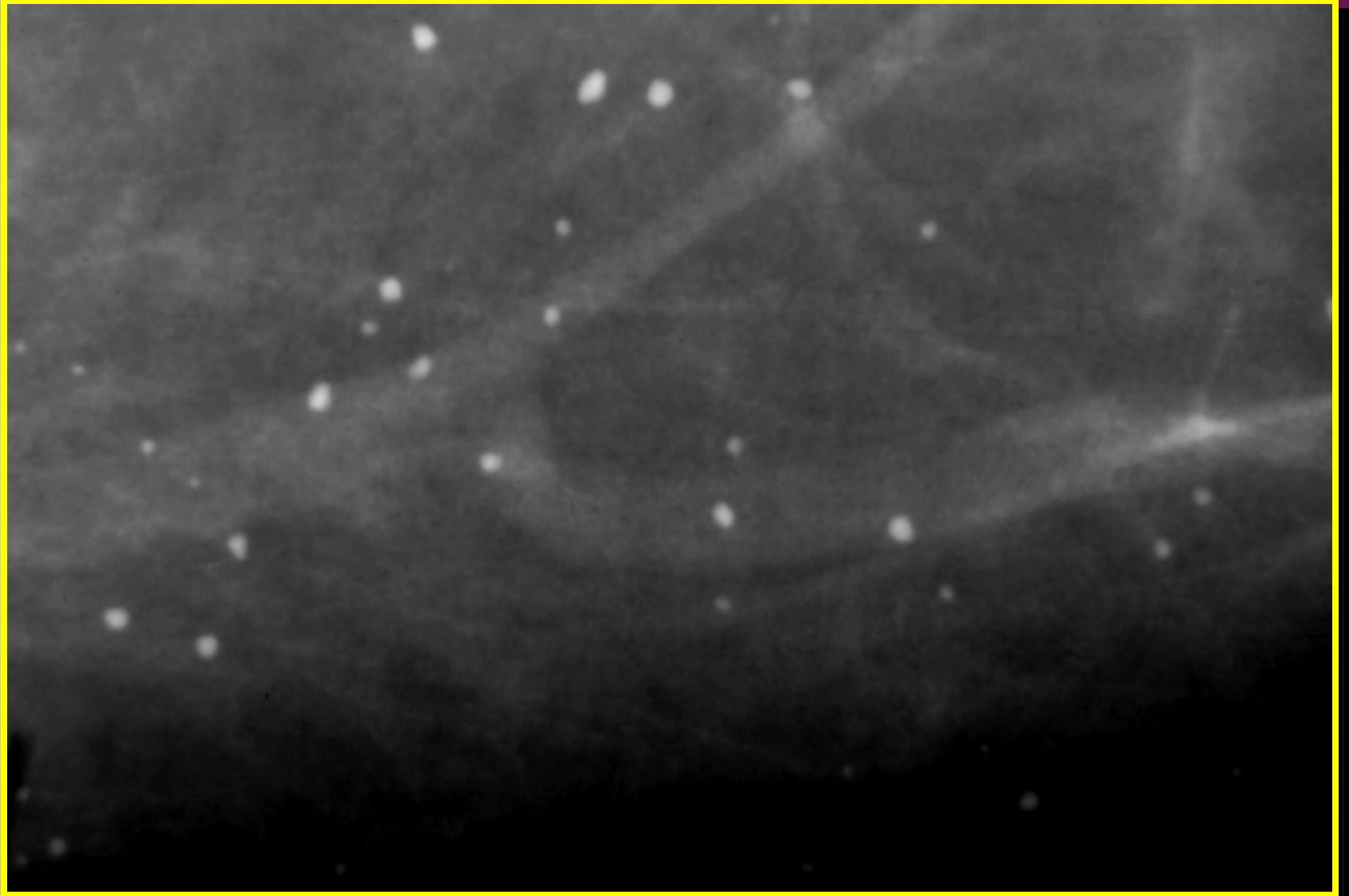
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

round

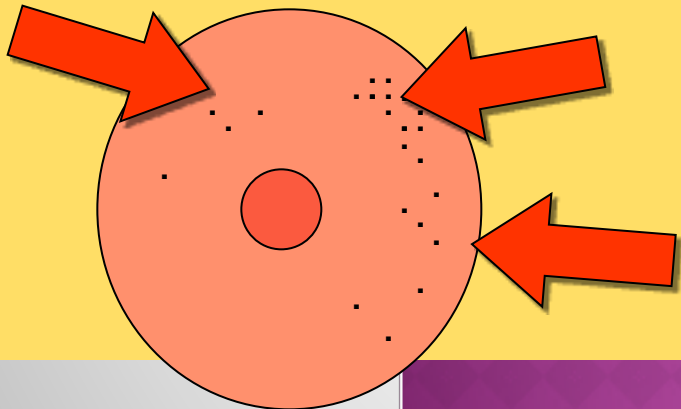


Dense, scattered or clustered, mixed sizes
May be difficult if small and clustered



EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

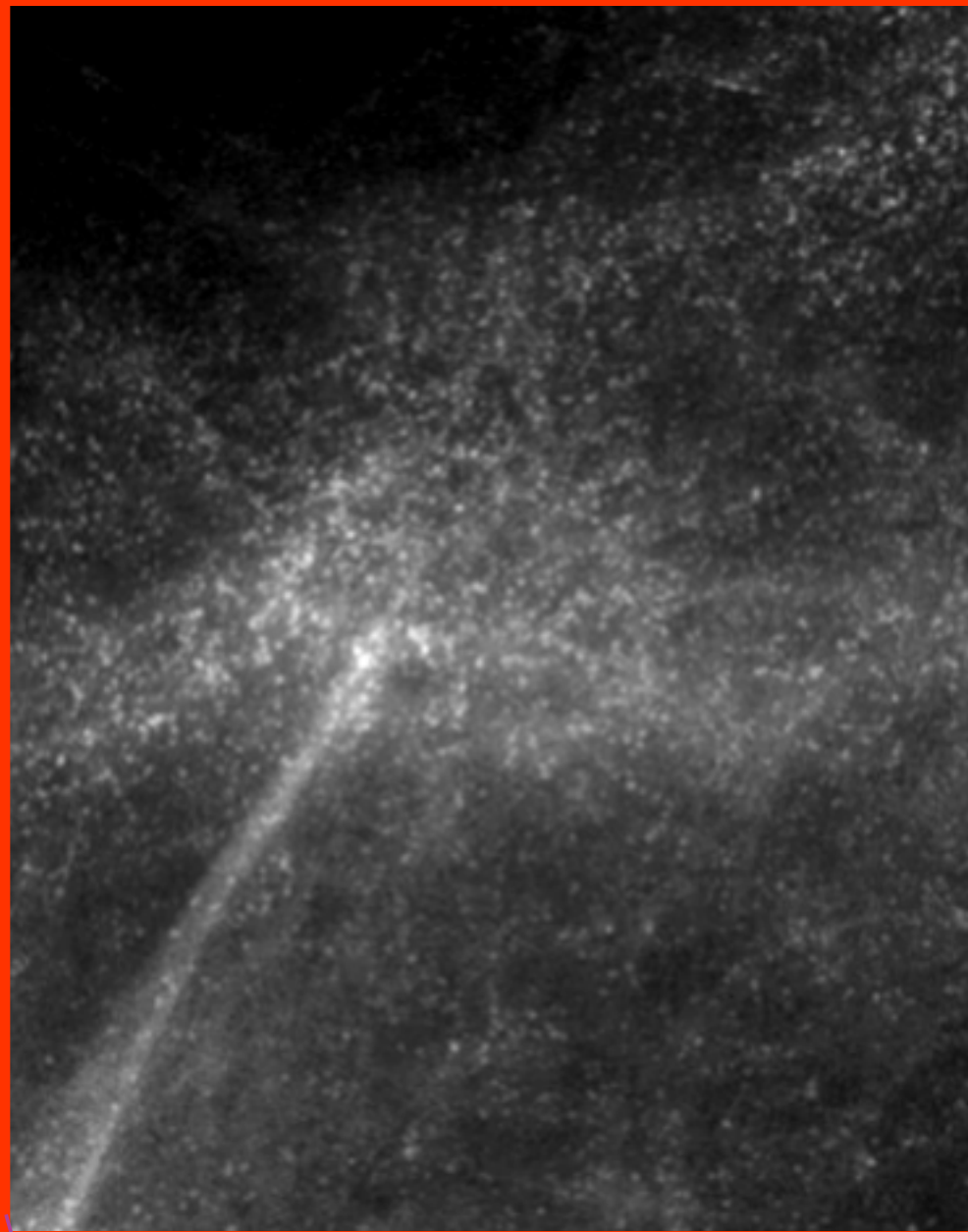
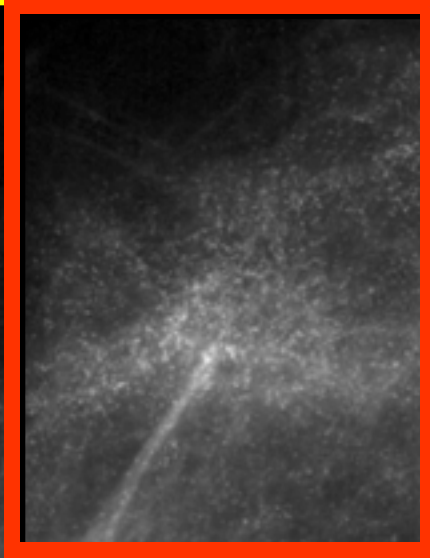
TYPICALLY BENIGN:



punctate

-  **Scleros. Adenosis: “Starry nite”, bilat., scattered**
-  **Much harder if unilateral and focally clustered**

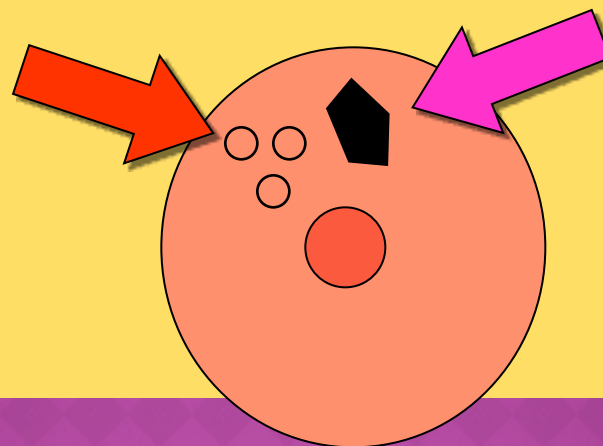
RIGHT CC



EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

“eggshell” or

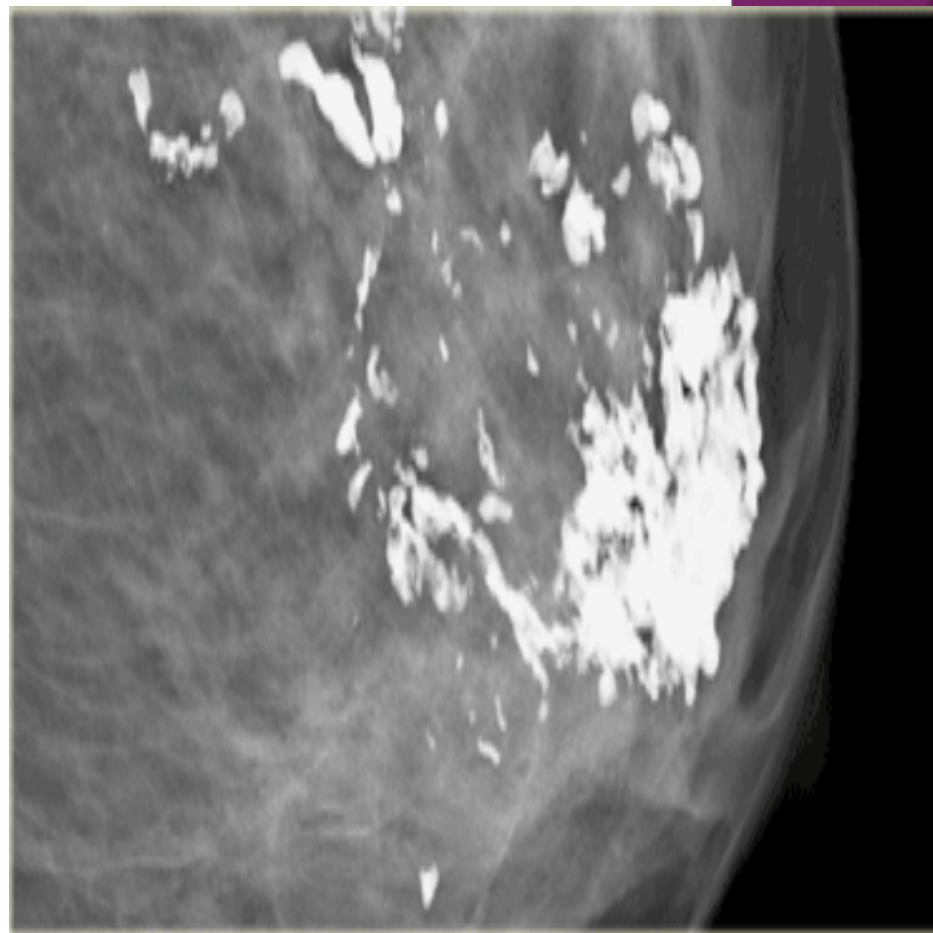
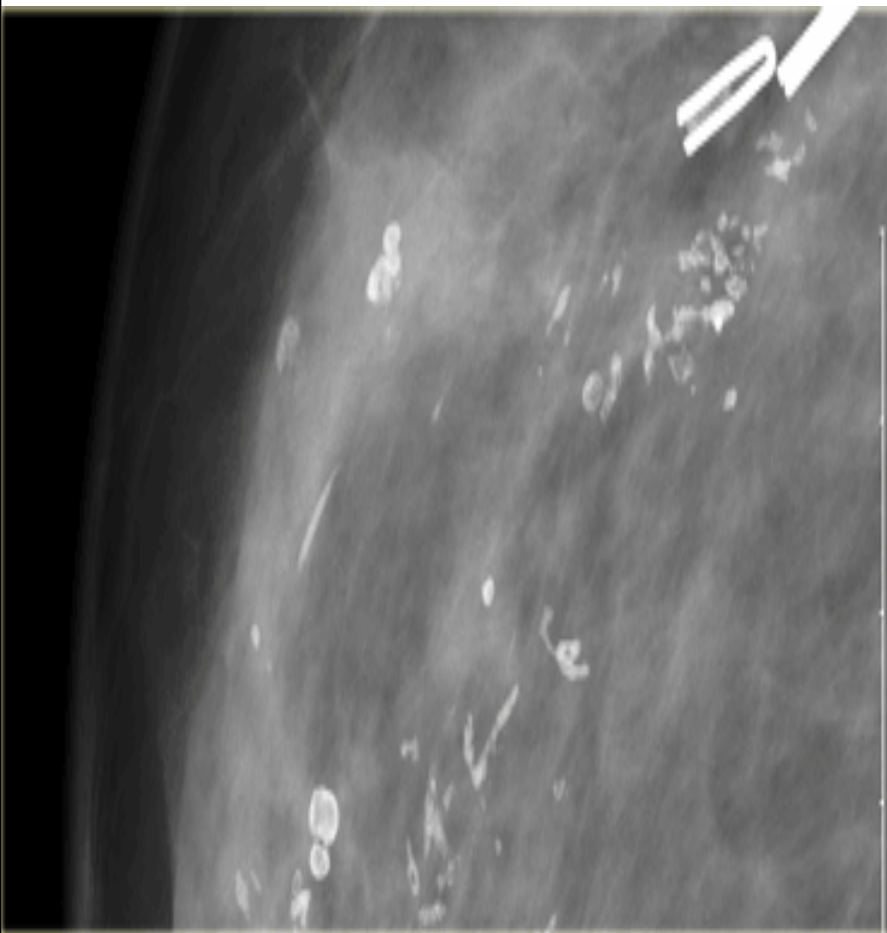


-  **Due to calcified oil cyst or sebaceous gland**
-  **May be associated with dystrophic calcification**

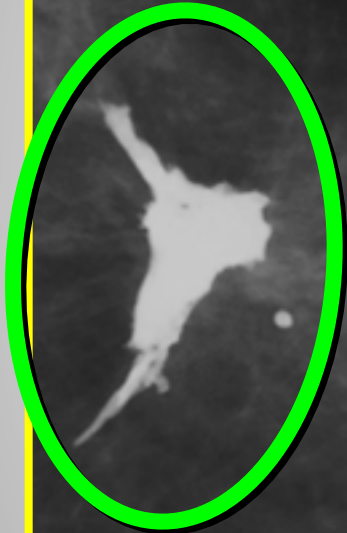
Eggshell or Rim Calcifications



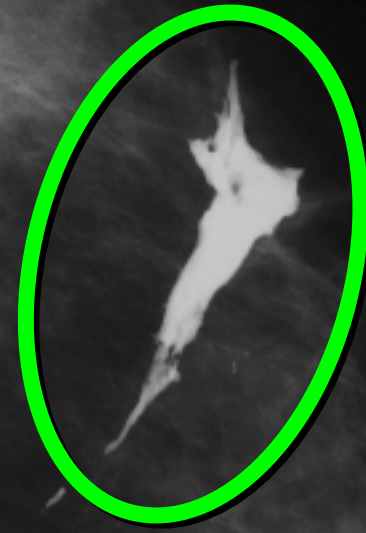
Dystrophic calcifications



CC



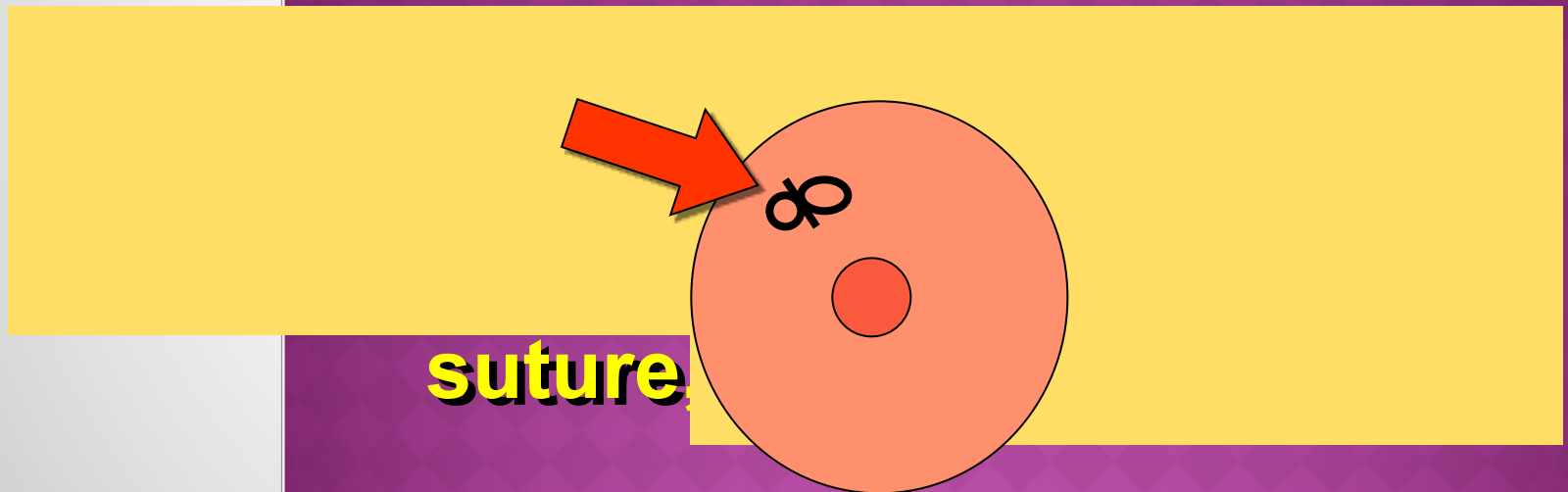
MLO



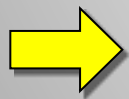
MANY YEARS POST-SURGERY

EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

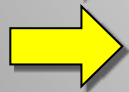
TYPICALLY BENIGN:



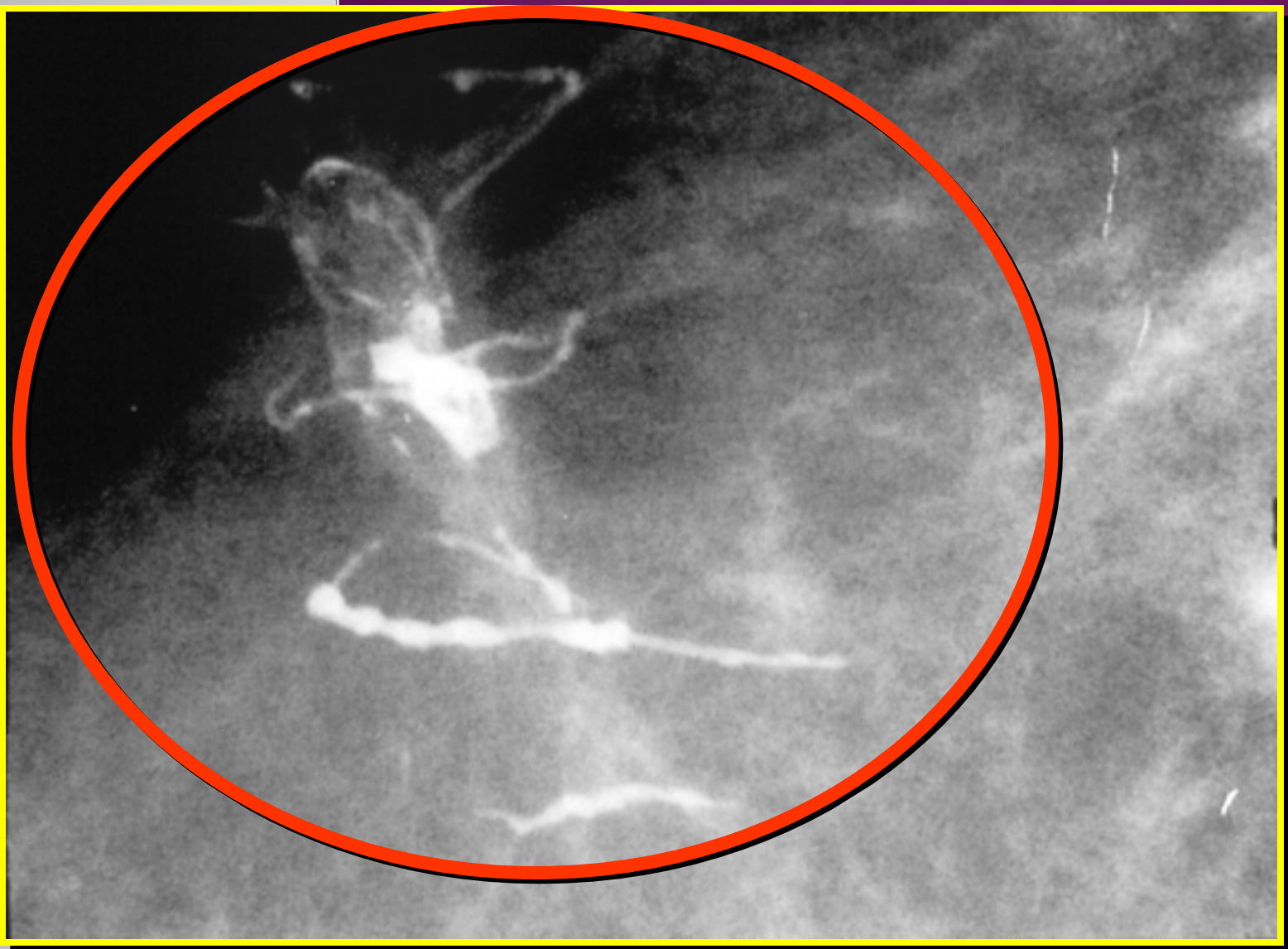
suture



Calcium forms around surgical suture



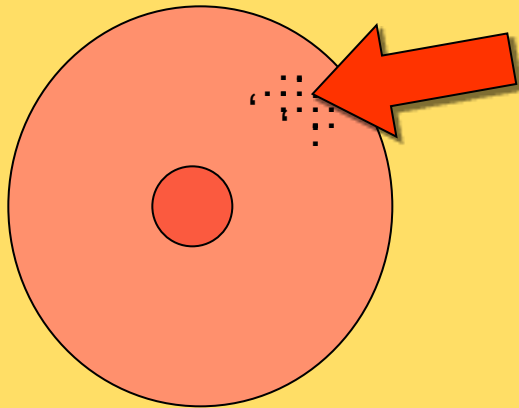
Rare, but can occur post-radiation



EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

INTERMEDIATE CONCERN:

Amorphous or indistinct



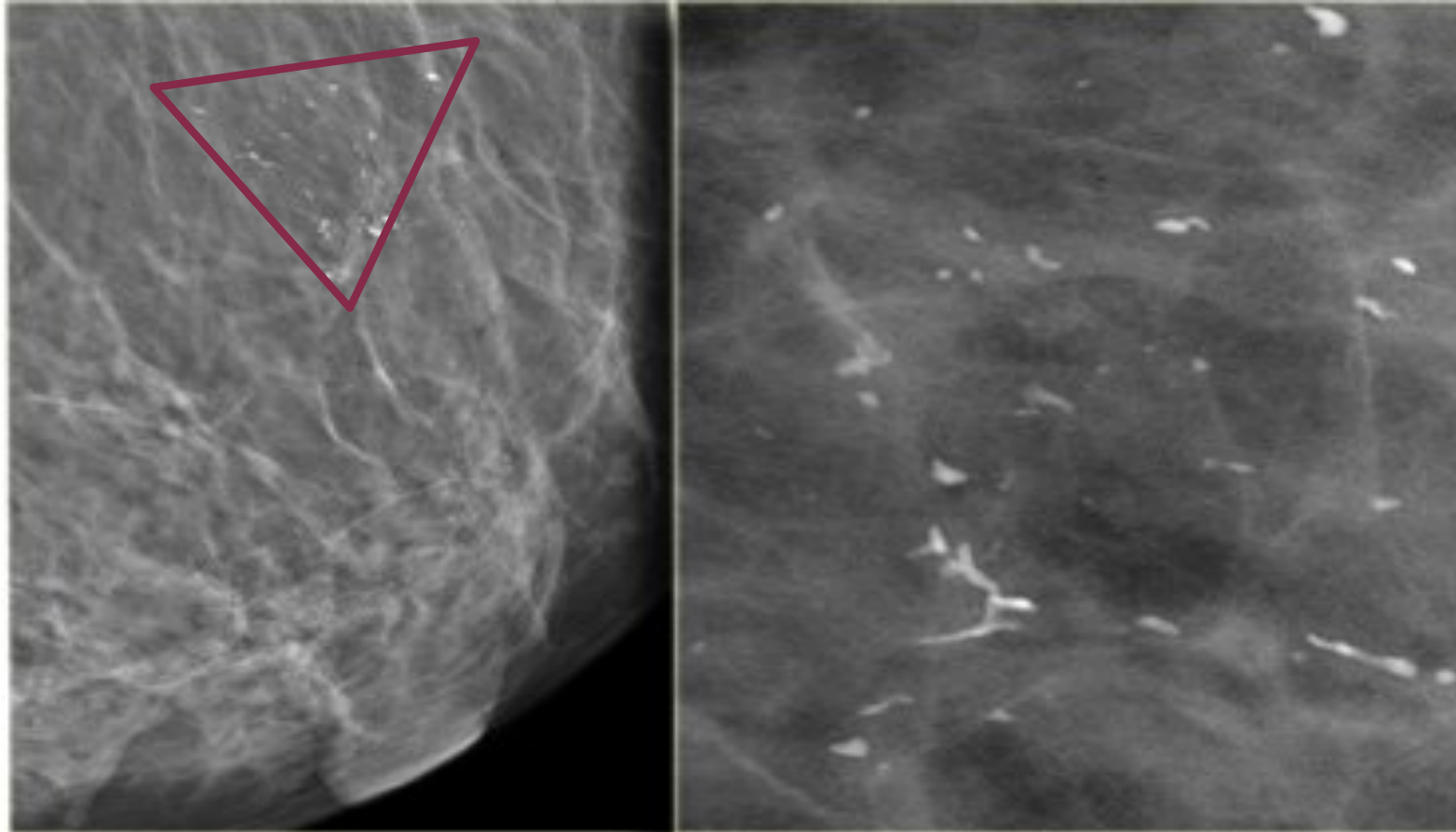
- Powdery, tight clusters
- Low-grade DCIS
- Hard to distinguish from sclerosing adenosis and fibrocystic changes

Low grade Cribriform DCIS



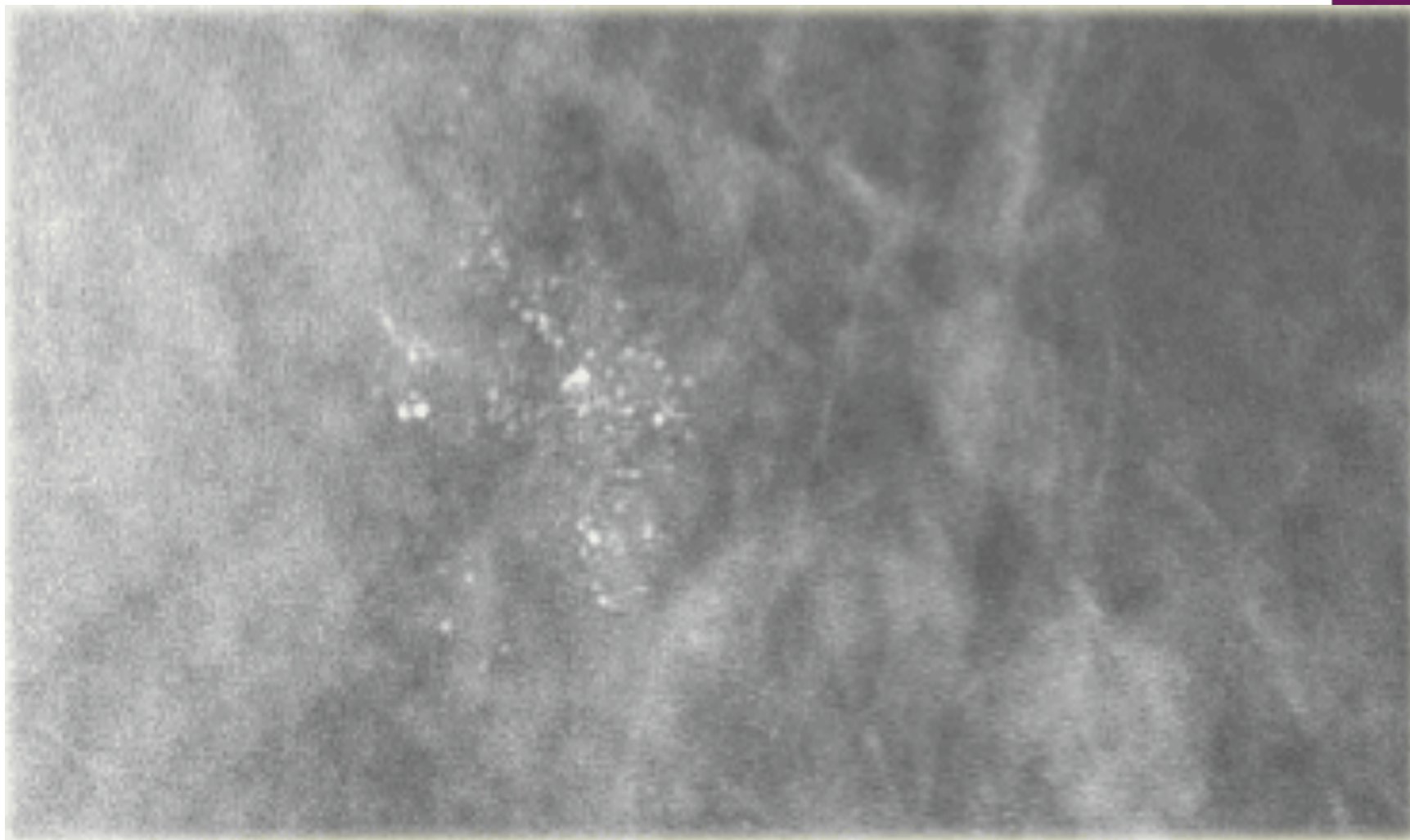
Coarse granular microcalcifications

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



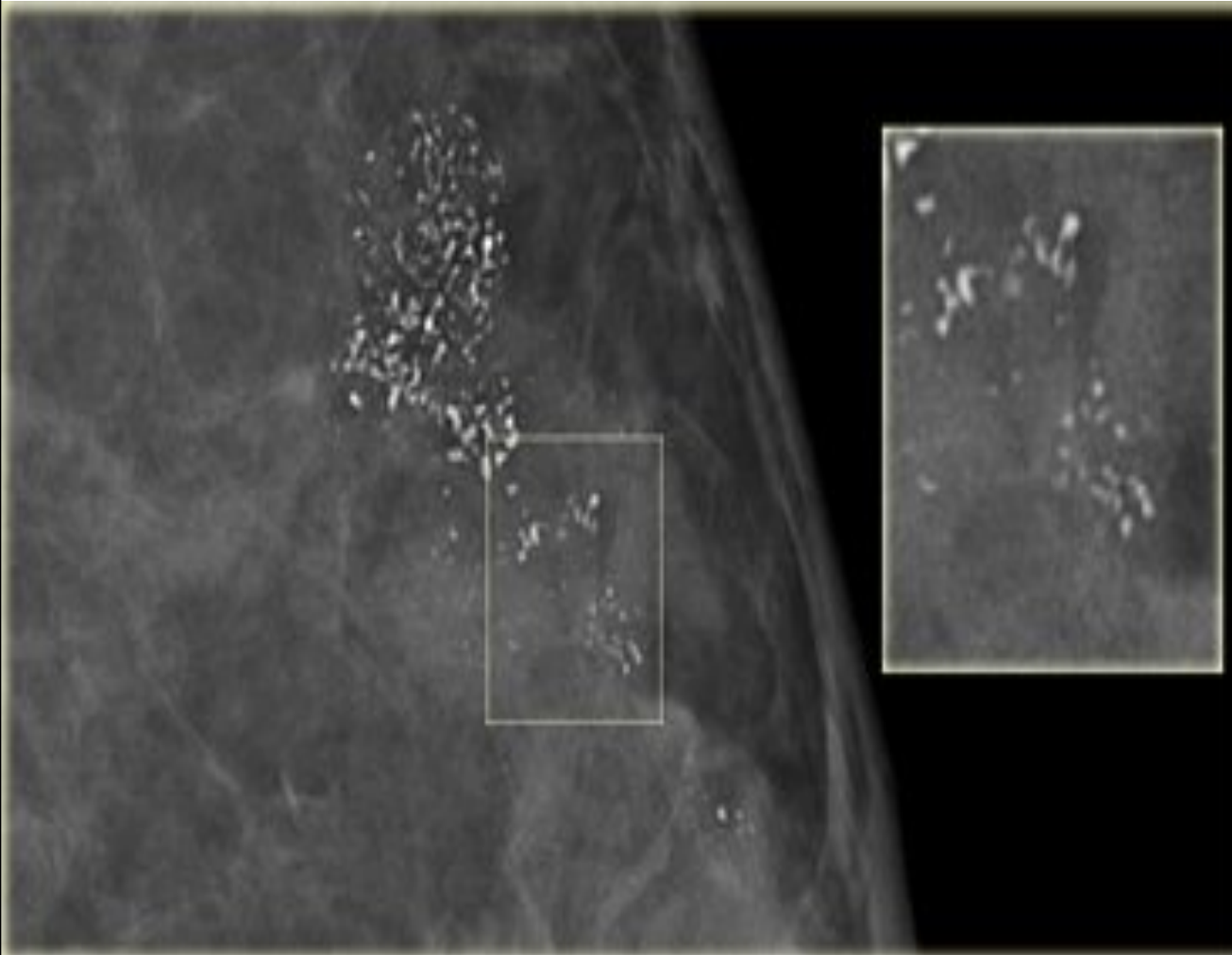
coarse heterogeneous calcifications in a segmented distribution.
These calcifications were classified as BI-RADS 4.
Biopsy showed calcifications within fibrous stroma.

High probability of malignancy



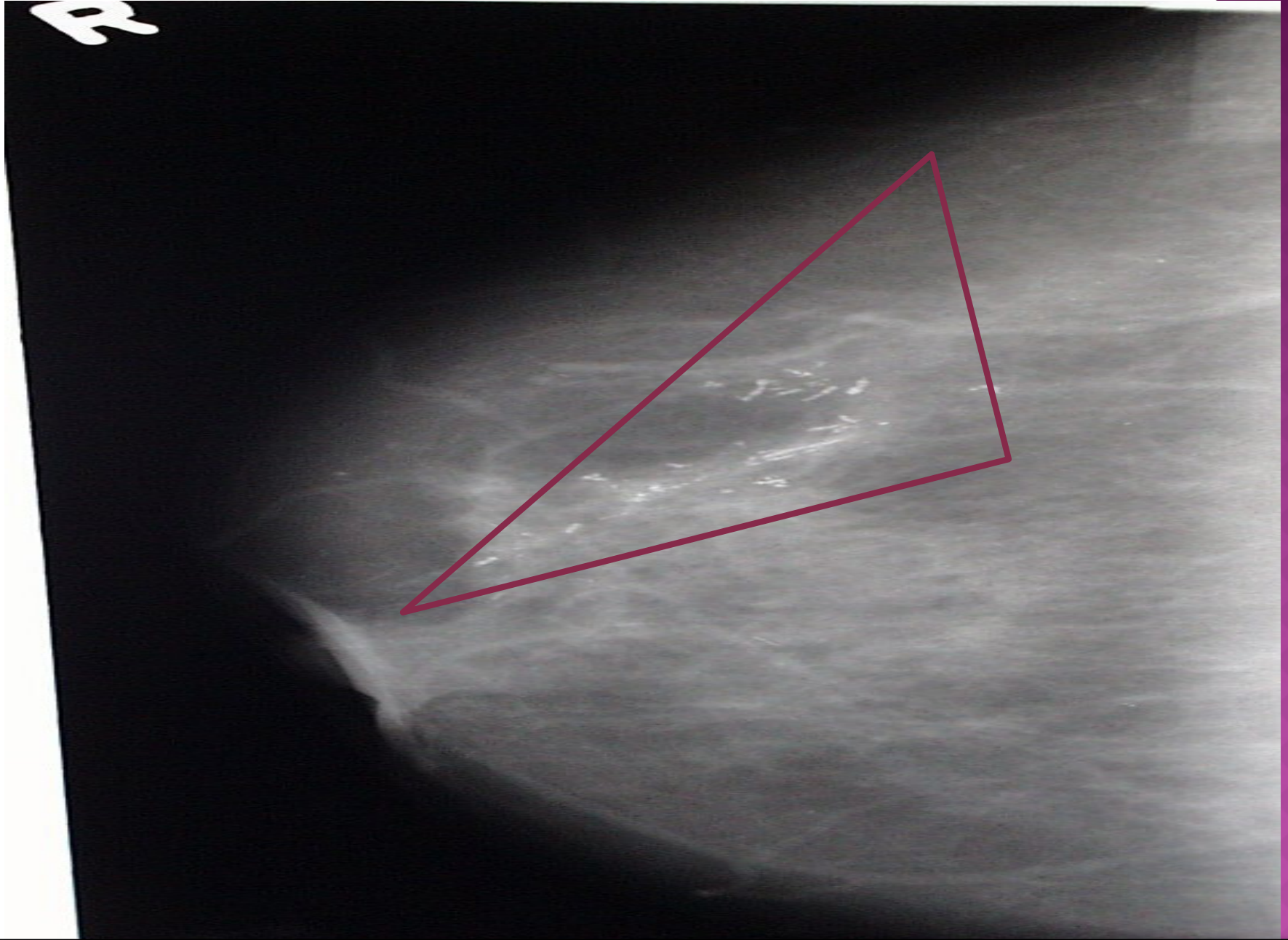
Amorphous and fine pleomorphic calcifications (Bi-RADS 4)
Biopsy: fibrocystic changes

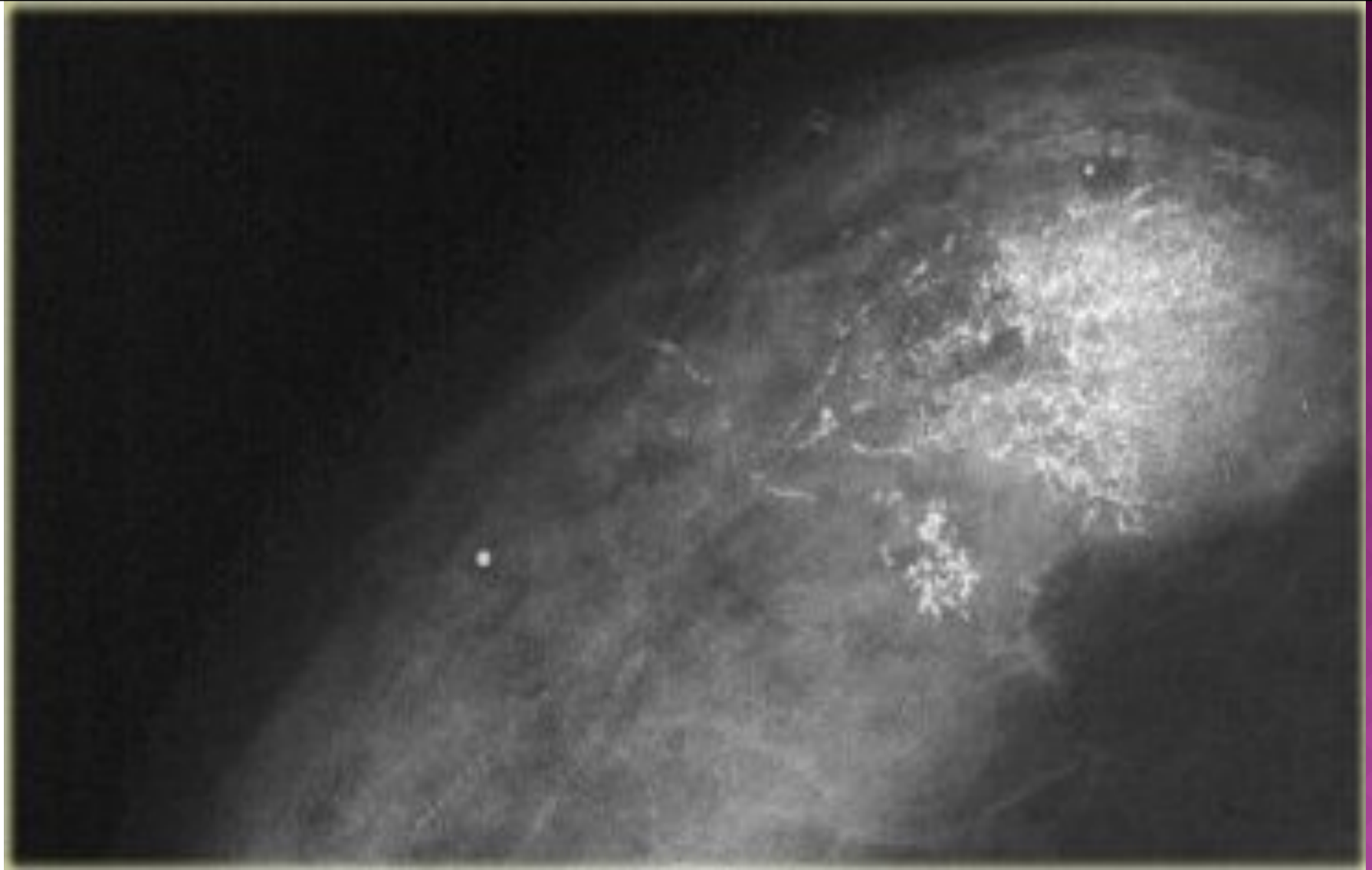
Fine Linear or Fine Linear Branching



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





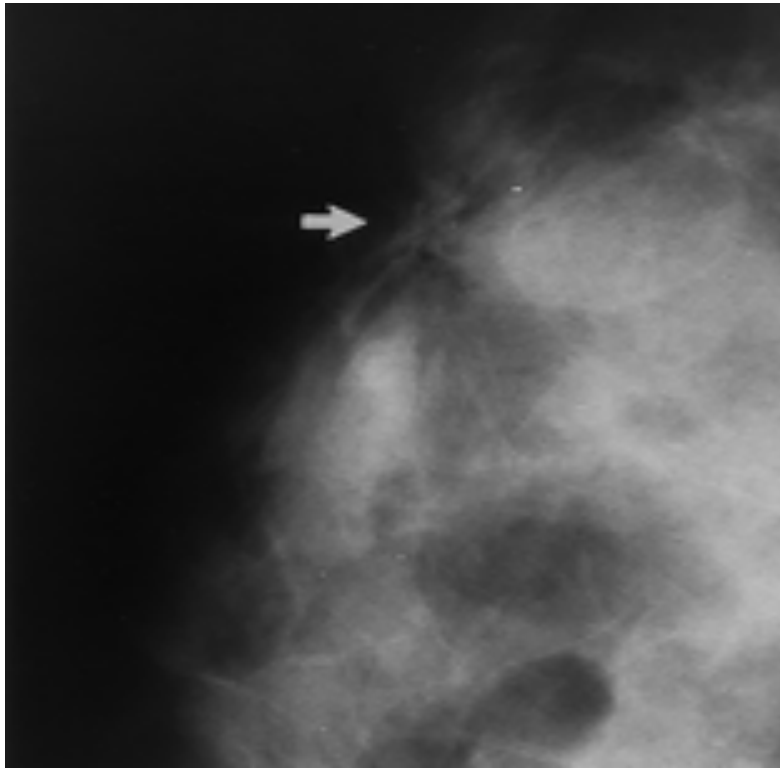
Fine linear and branching calcifications in a segmental distribution highly suggestive of malignancy (BI-RADS 5). Extensive high grade DCIS was found at biopsy.

SECONDARY SIGNS OF CANCER ON MAMMOGRAPHY

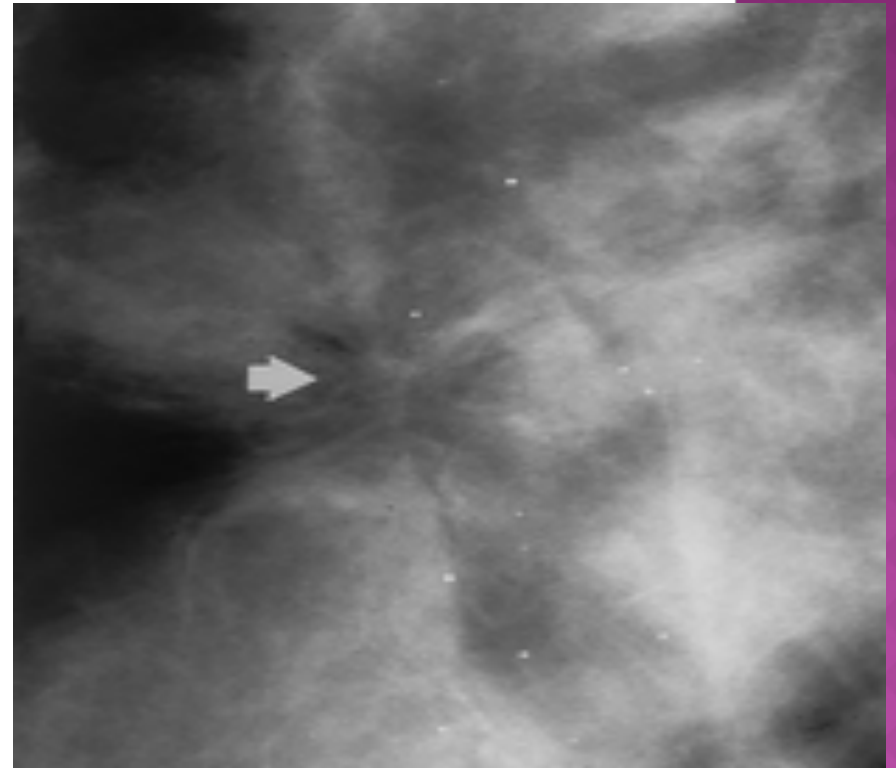
- ◉ Nipple Inversion
- ◉ Architectural Distortion
- ◉ Skin Thickening
- ◉ Axillary Adenopathy
- ◉ Skin Retraction
- ◉ Tissue Asymmetry
- ◉ Developing “Neodensity”

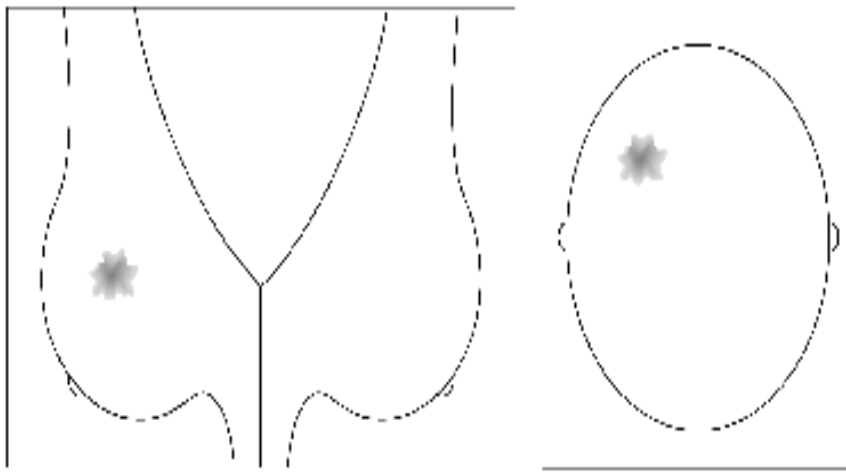
ARCHITECTURAL DISTORSION

ML view

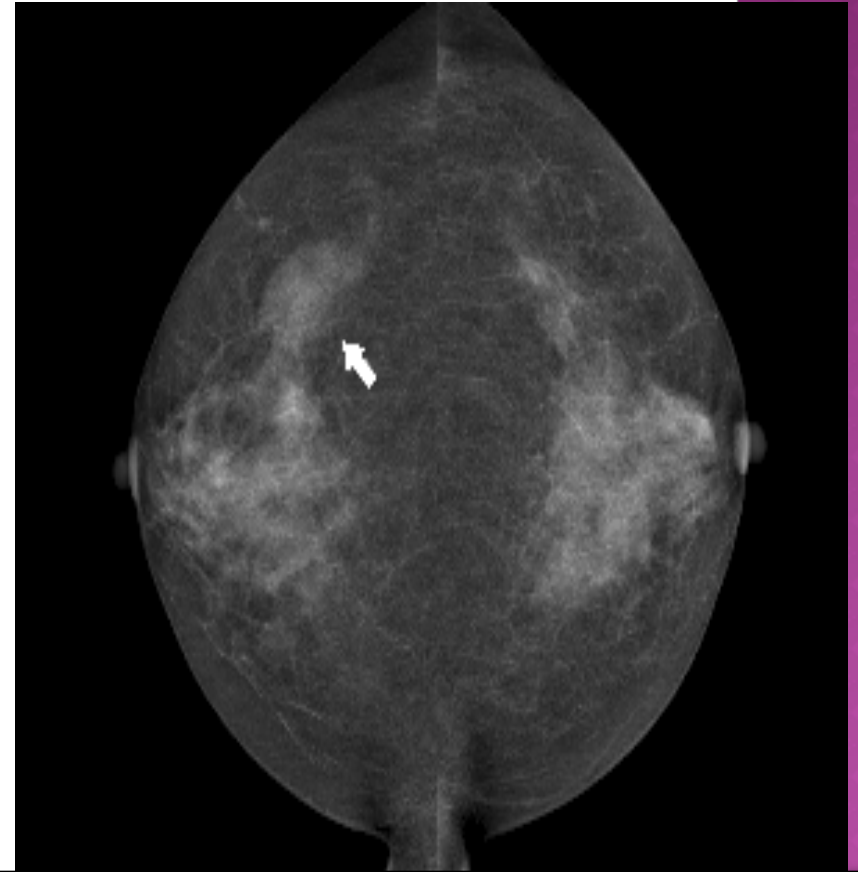


CC view



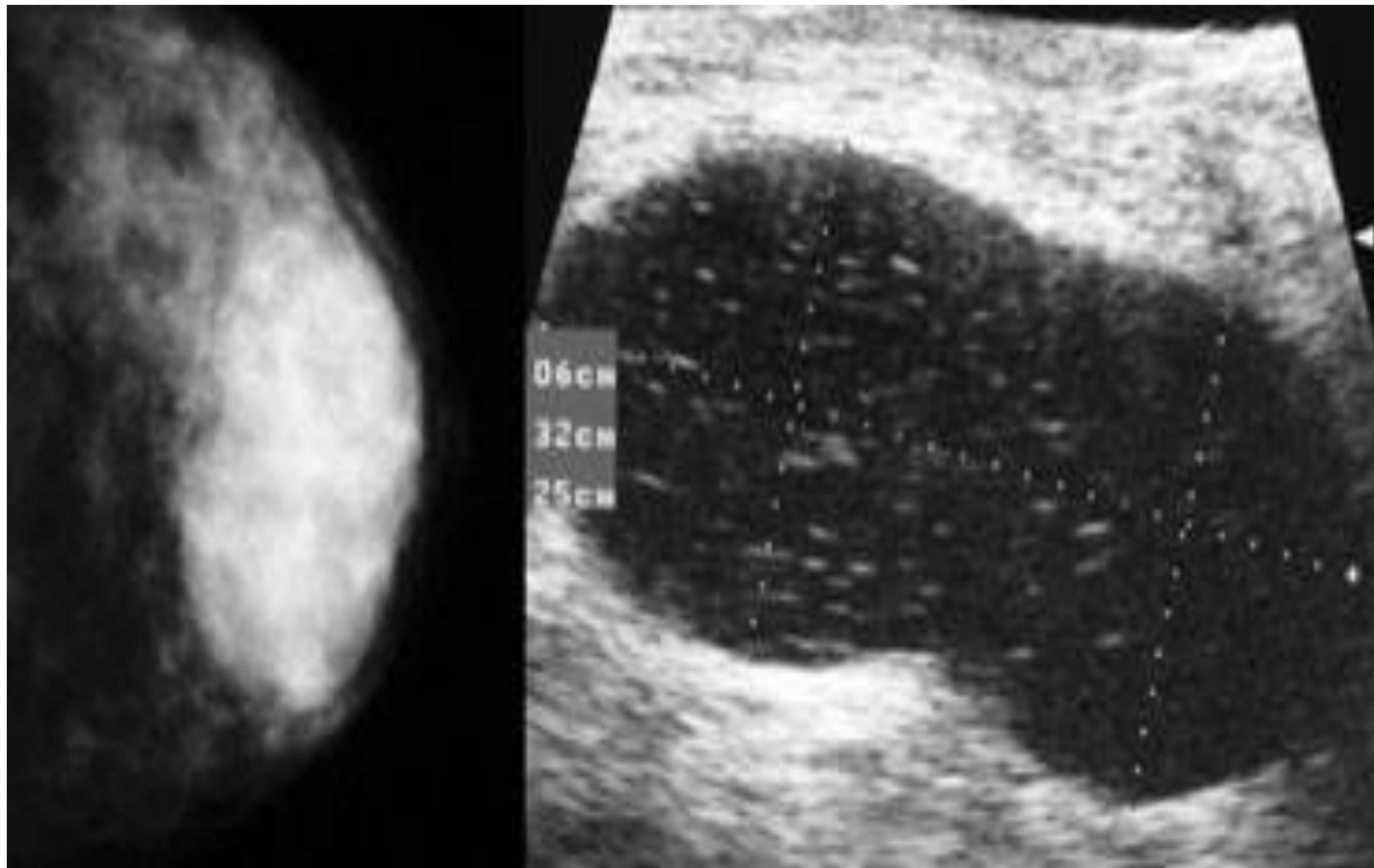


Focal asymmetry

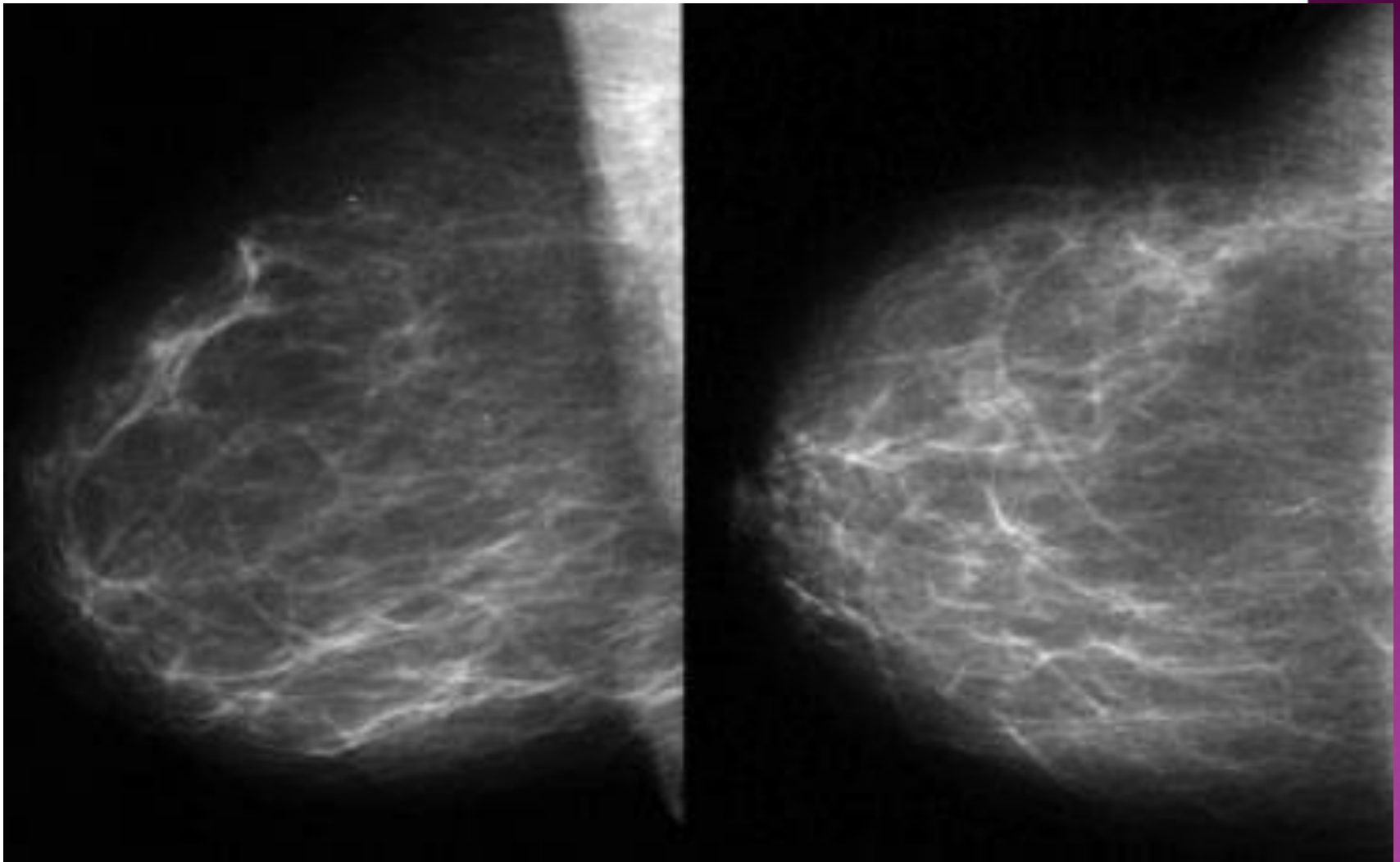


Final Assessment Categories

- 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**



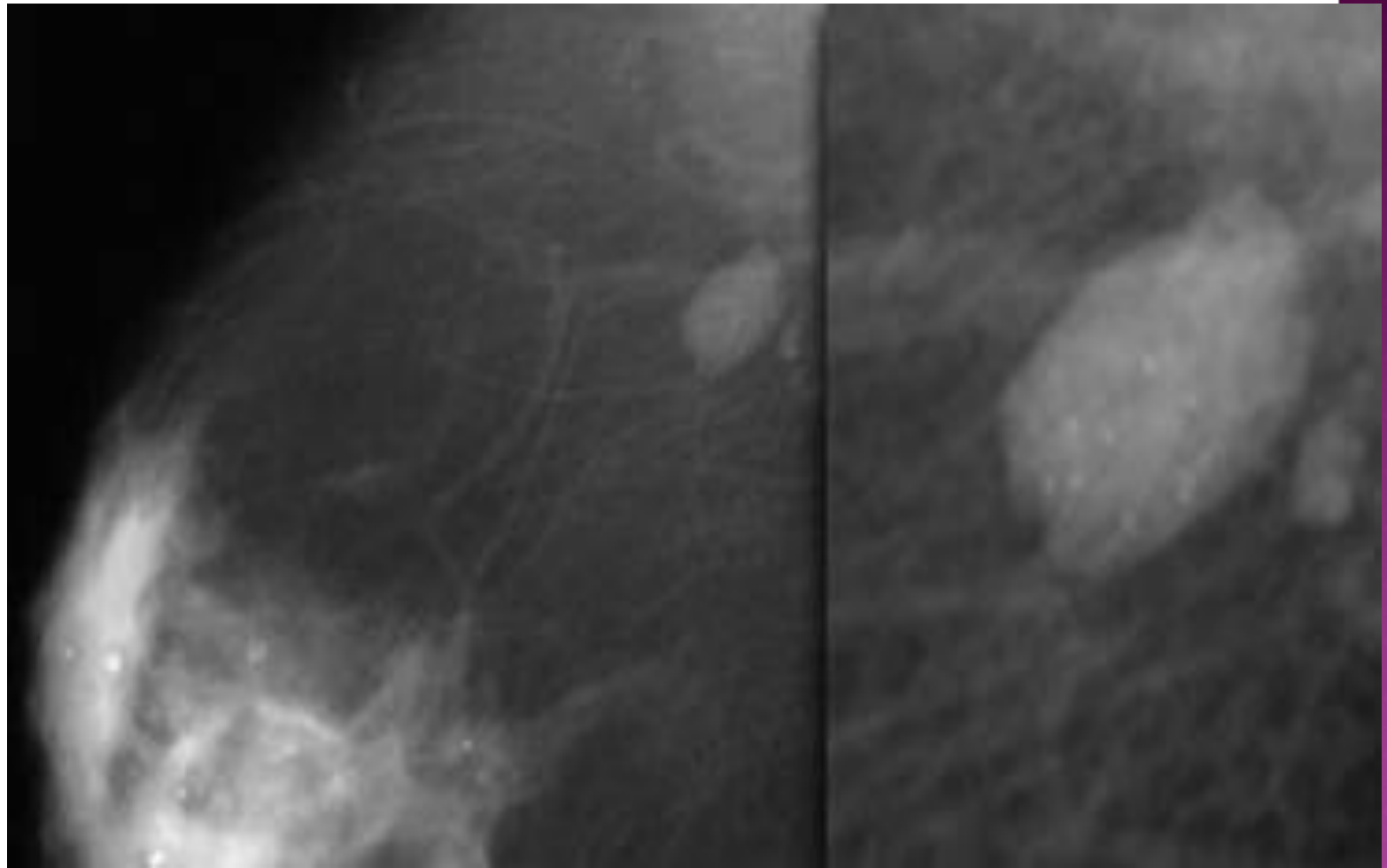
BI-RADS 0 at screening.
Additional ultrasound after referral was performed allowing final assessment. (BI-RADS 2)



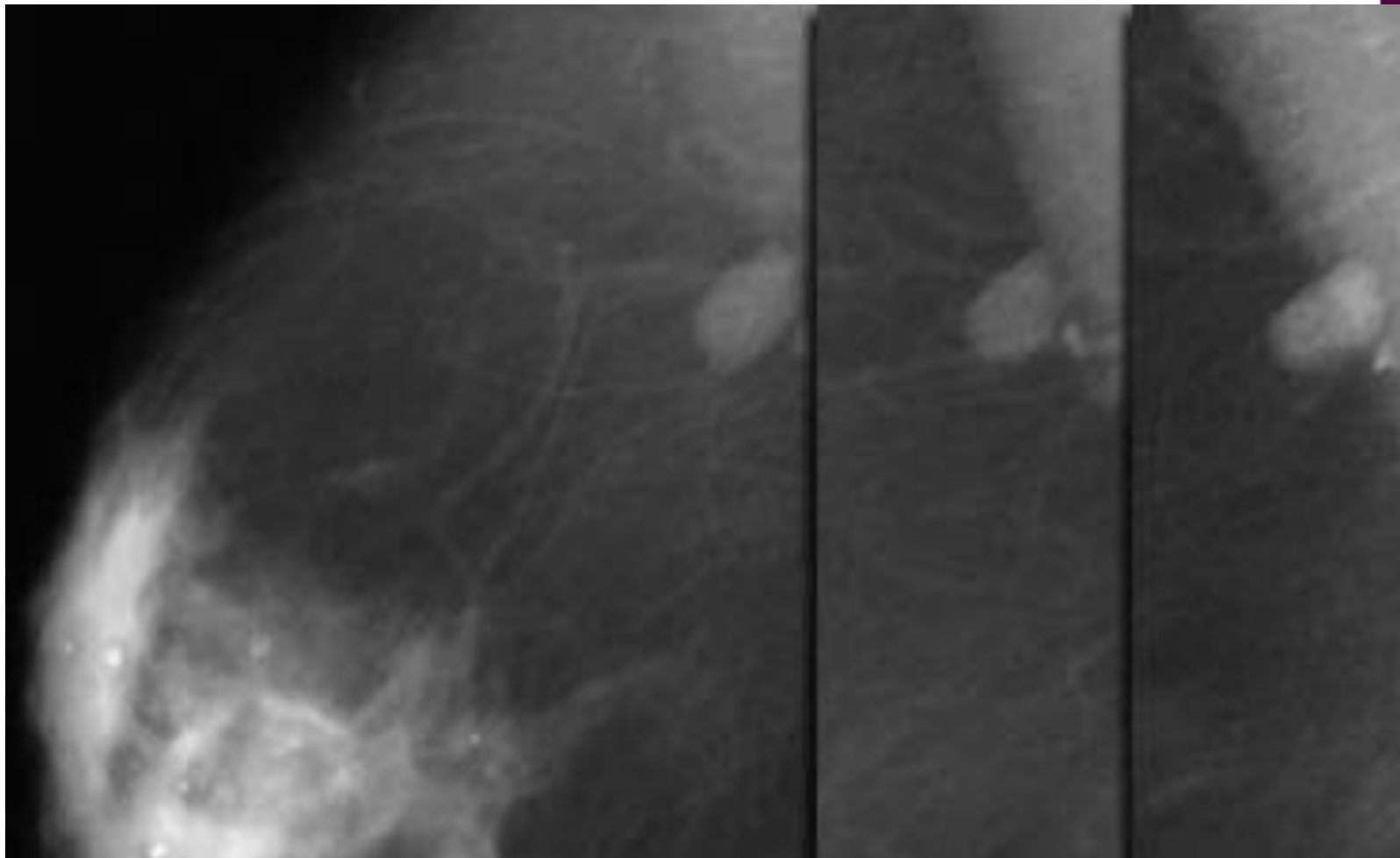
BI-RADS Category 1



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

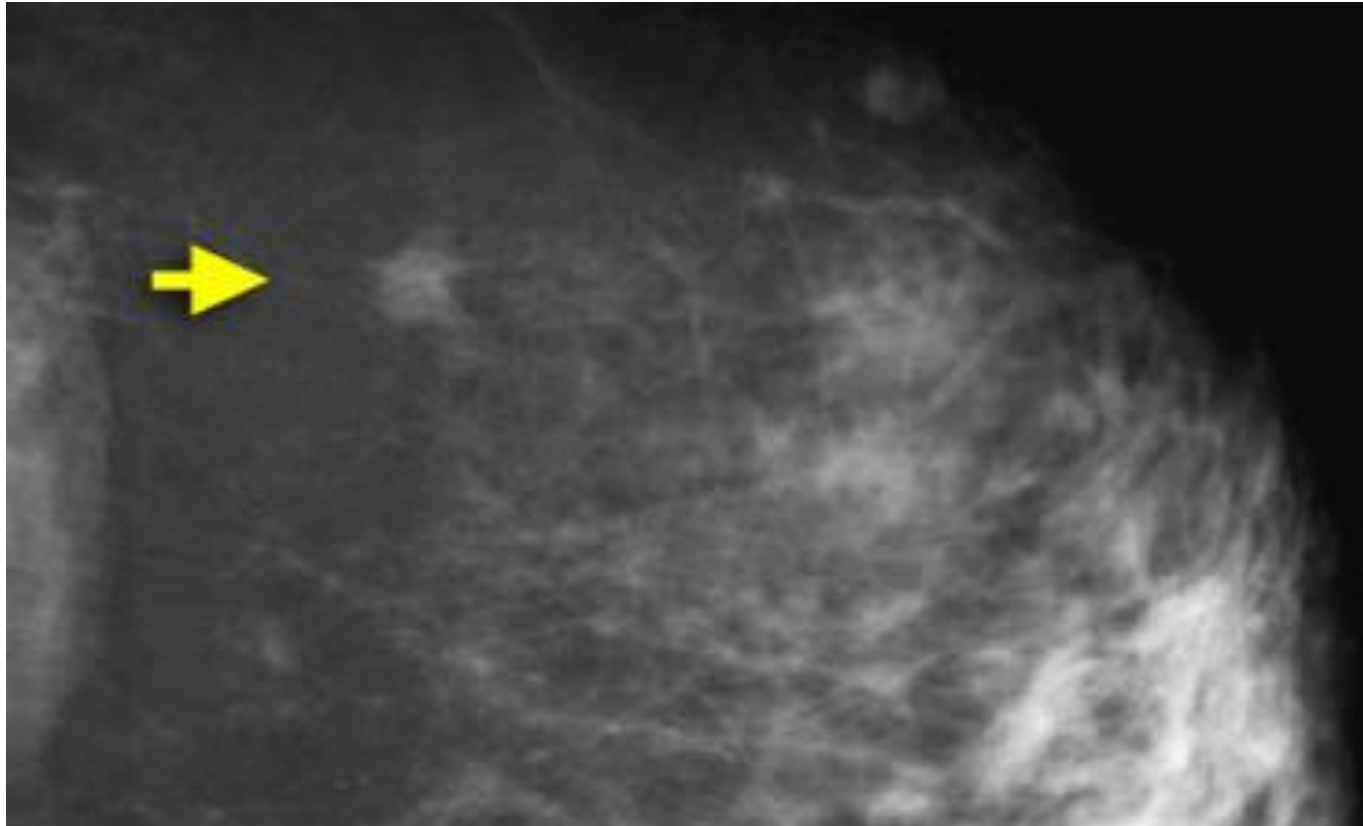


BI-RADS 3. Non-palpable sharply defined lesion with a cluster of punctate calcifications.

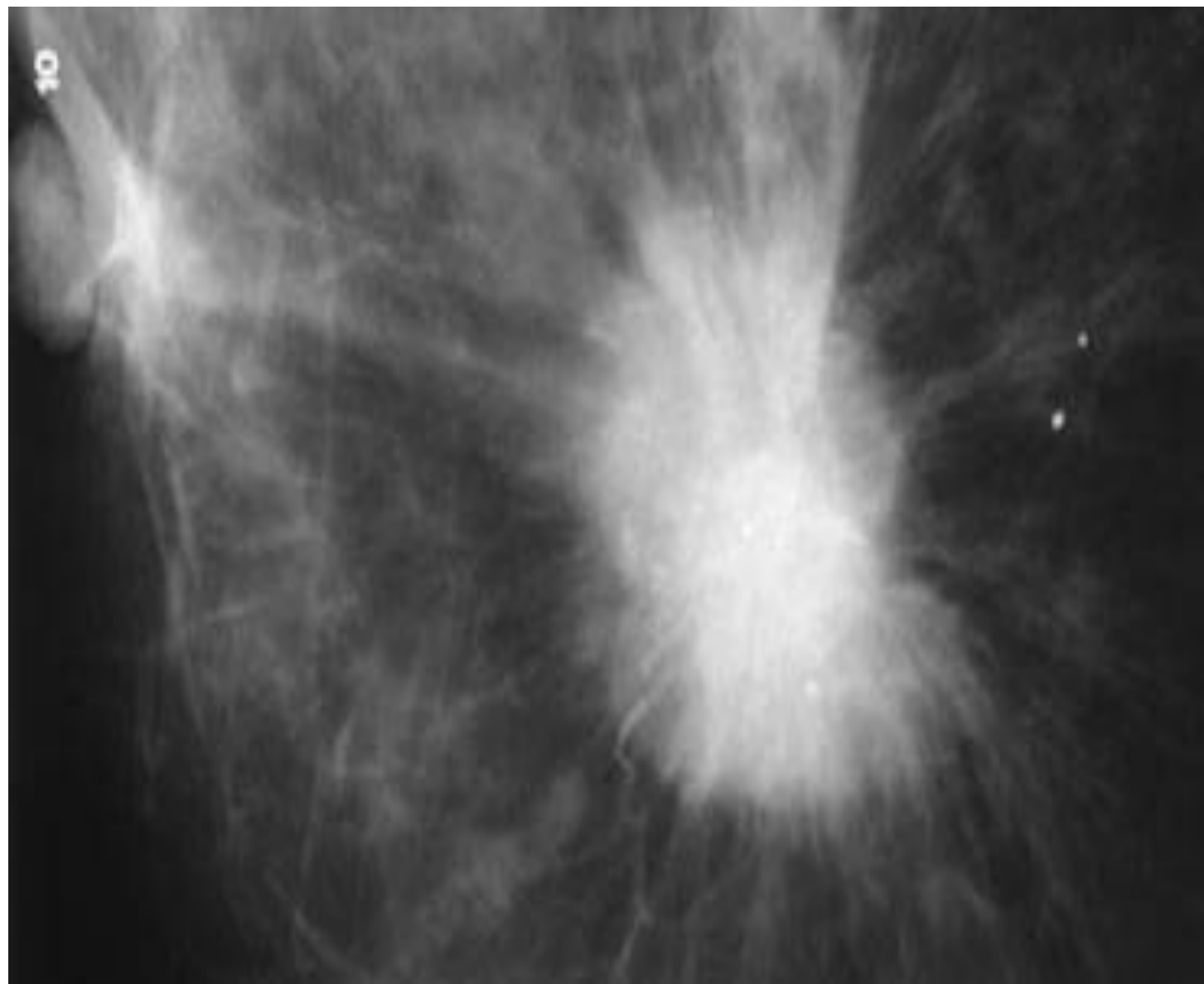


Follow up at 6, 12 and 24 months showed no change. Final assessment was changed to a Category 2.

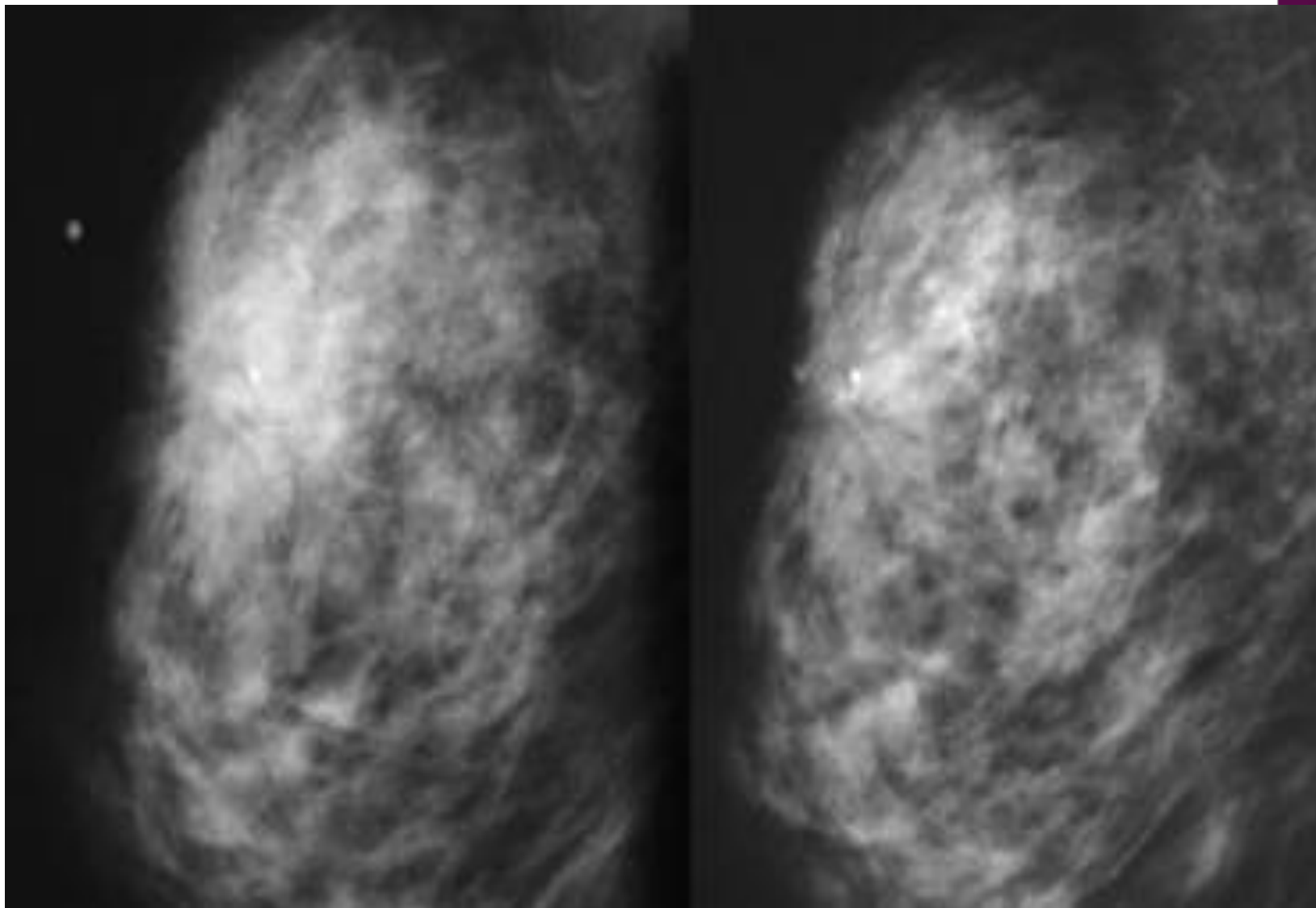
BI-RADS 4 is reserved for findings that do not have the classic appearance of malignancy but have a wide range of probability of malignancy (2 - 95%).



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).



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

