

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 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.

What is diagnostic mammogram?

- A diagnostic mammogram is used to check for breast cancer after a lump or other sign or symptom of breast cancer has been found like persistent focal pain , abnormal nipple discharge,, etc.
- A diagnostic mammogram also may be used to evaluate changes found on a screening mammogram, so additional mammographic views will be obtained like tomosynthesis, spot compression magnification views,, etc

Breast Cancer Screening Method

Breast Screening Method	Age	Duration
Breast Awareness (self breast exam)	25 year and above	Monthly
Clinical Encounter (clinical breast exam)	25 year and above	Annual
Mammogram	40 year and above	Every 1-2 years

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 particularly first degree relatives
- ◉ Certain breast changes on previous biopsy such as atypical hyperplasia
- ◉ Genetic alterations as BRCA1, BRCA2

- ◉ Reproductive and menstrual hx) early menarche before 13 yr and late menopause >55 yr)
- ◉ Long-term use of menopausal hormone therapy particularly more than 5 years
- ◉ Radiation therapy recieved in young females before age 30 for chest lymphoma
- ◉ Increased Body weight
- ◉ Low Physical activity level
- ◉ Alcohol intake

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 imaging because these may cause artefacts appearing like pathologic microcalcifications on mammogram

Mammography machine

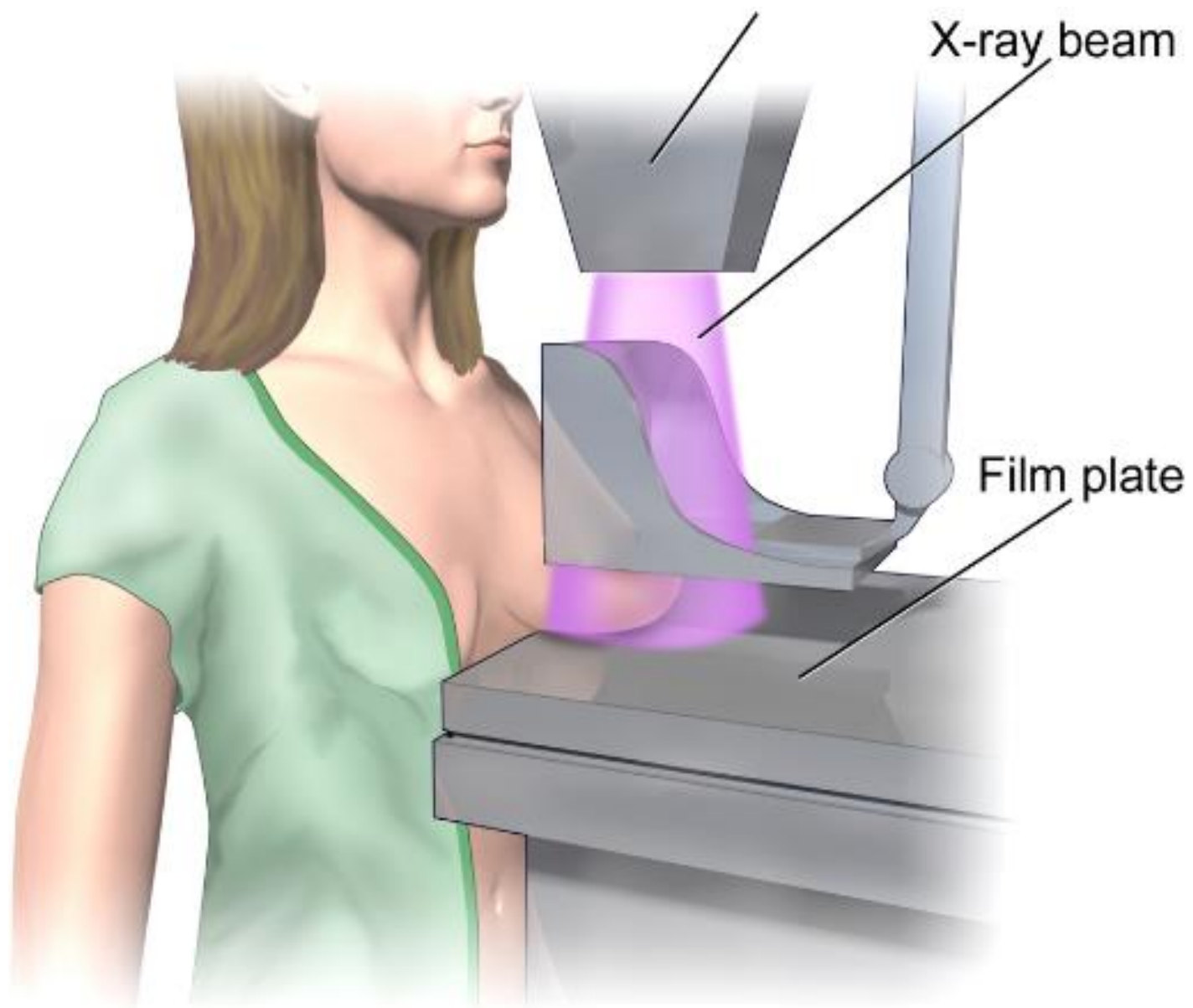
X-Ray Tube

Compression Paddle

Film Holder

Foot Peddles





MAMMOGRAM STANDARD VIEWS

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

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L

KODAK NID-F 2000 SCREEN 075004075114576

1
WL: 2533 WW: 2761

12/10/2011 01:01:01

WL: 2533 WW: 2761

12/10/2011 01:01:01



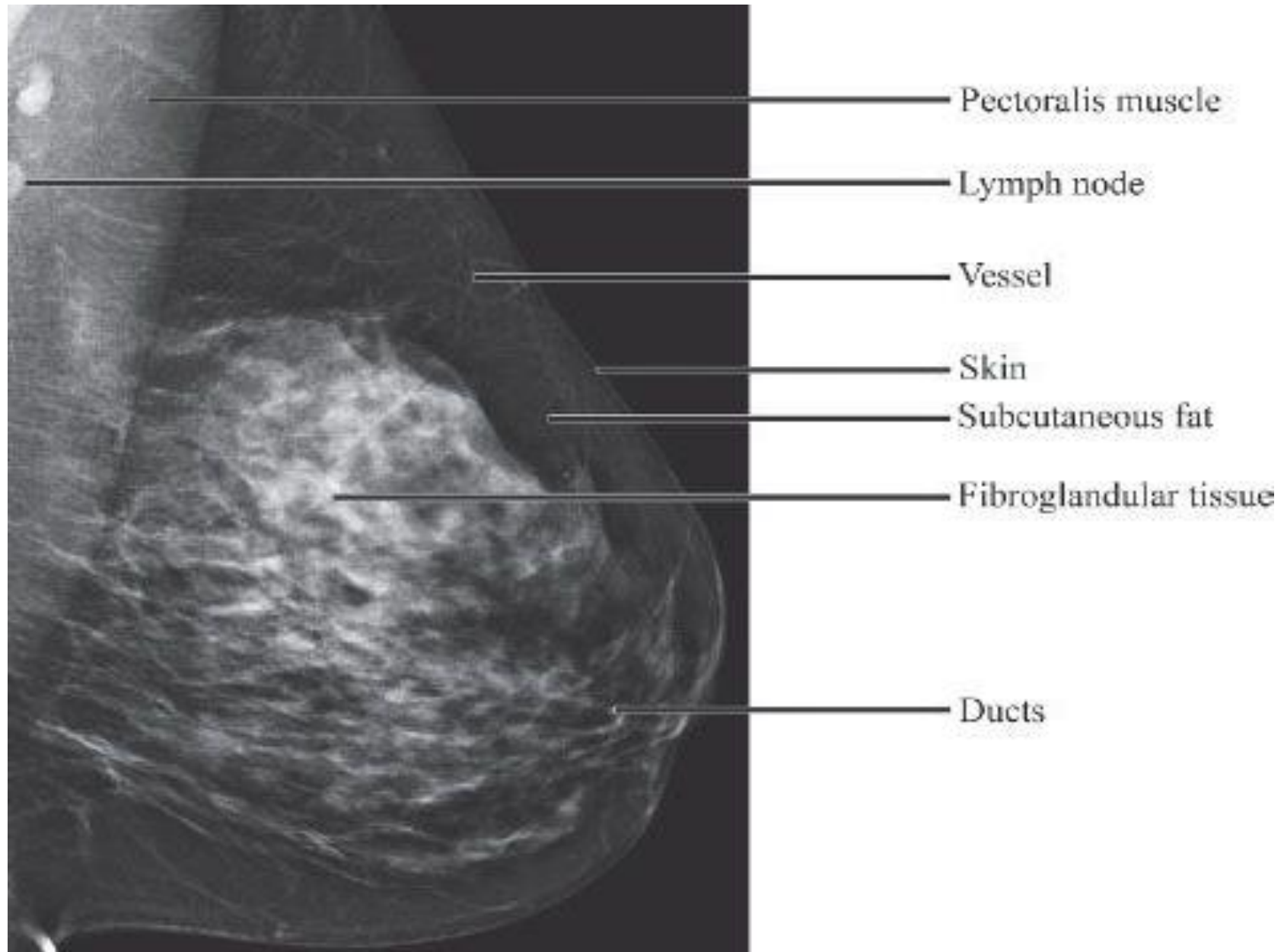
WHAT IS THE RISK OF MAMMOGRAPHY?

- ◉ 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

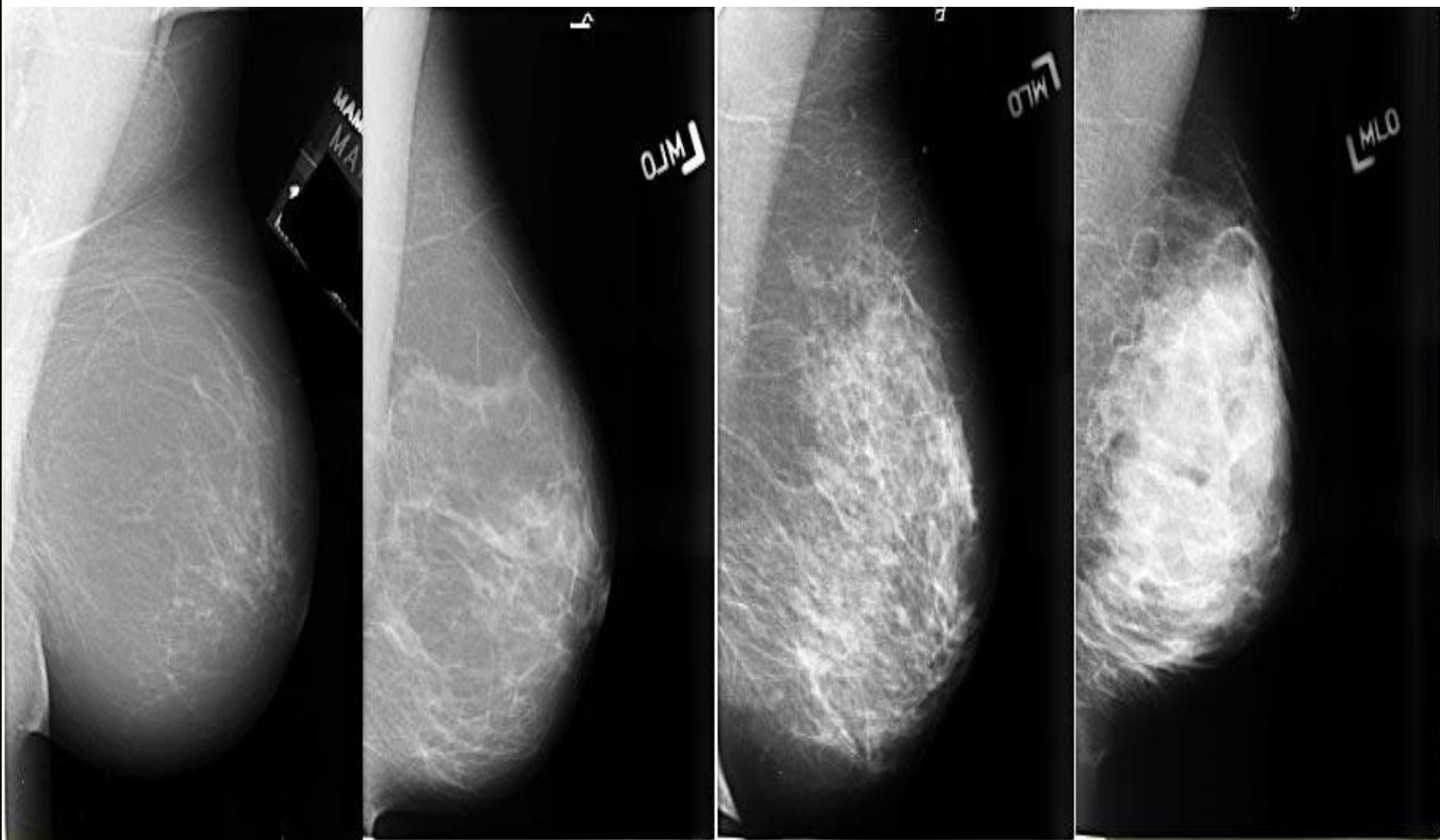
WHAT ARE THE BENEFITS OF SCREENING MAMMOGRAMS?

- 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



FATTY & DENSE BREAST



Breast composition and its mammographic appearance.¹

SENSITIVITY OF MAMMOGRAPHY

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

PRIMARY SIGNS OF CANCER ON MAMMOGRAPHY

◉ Mass:

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

◉ **Shape**: Round, oval ,lobular or irregular

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

2-Indistinct (ill defined) margins

3-Spiculated Margins like sunrays

4-Microlobulated: margin with small lobulations

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

◉ **Density**: how white it is compared to breast parenchyma:
High density (hyperdense) , Isodense, Hypodense

◉ fat equivalent as oil cyst, lipoma, galactoceles

Shape

Round



Oval



Lobular



Irregular



Margin

Circumscribed



Microlobulated



Obscured



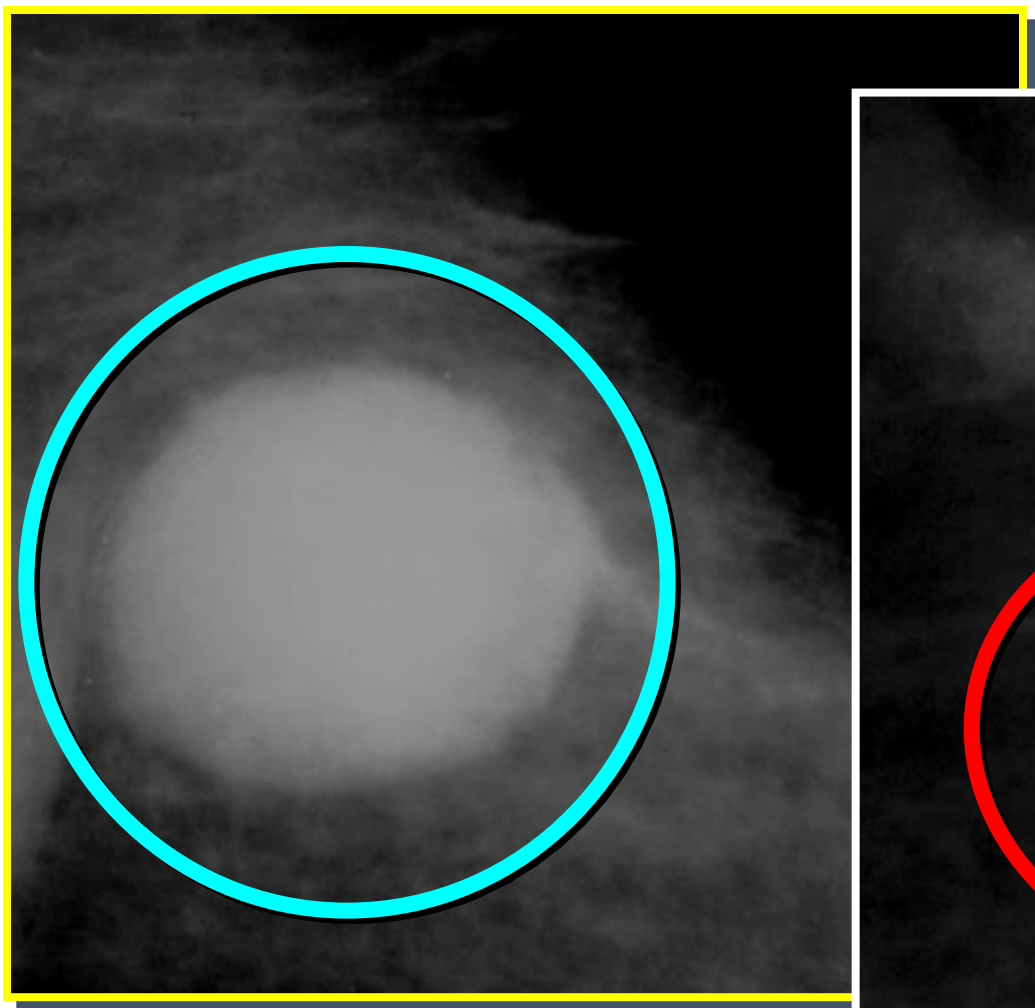
Indistinct,
ill-defined



Spiculated



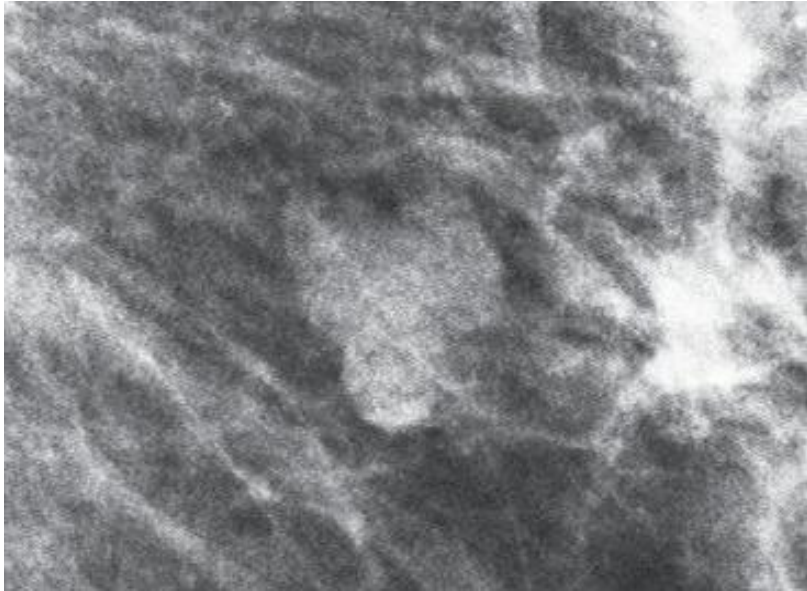
ROUND



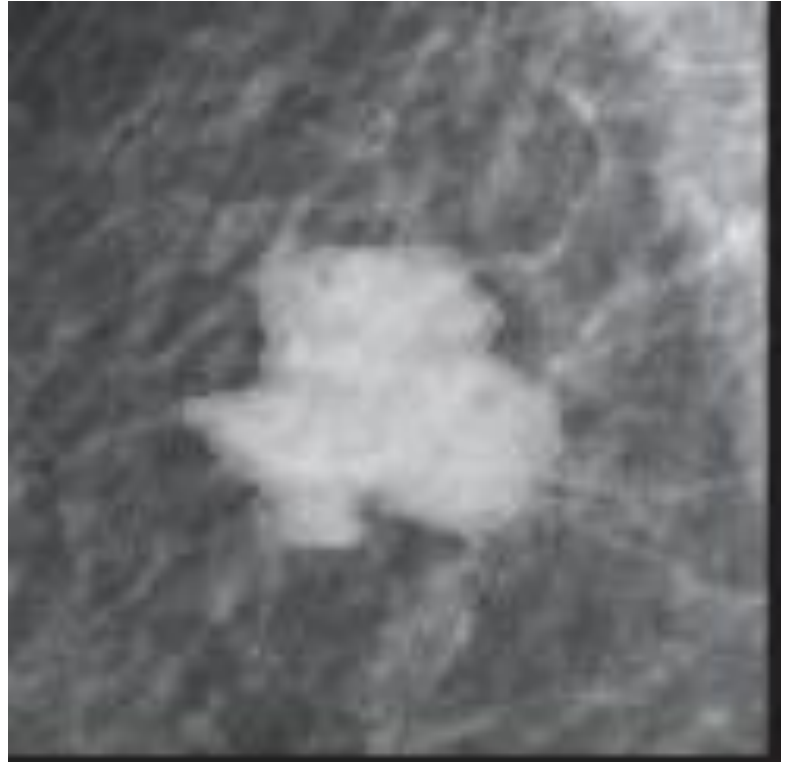
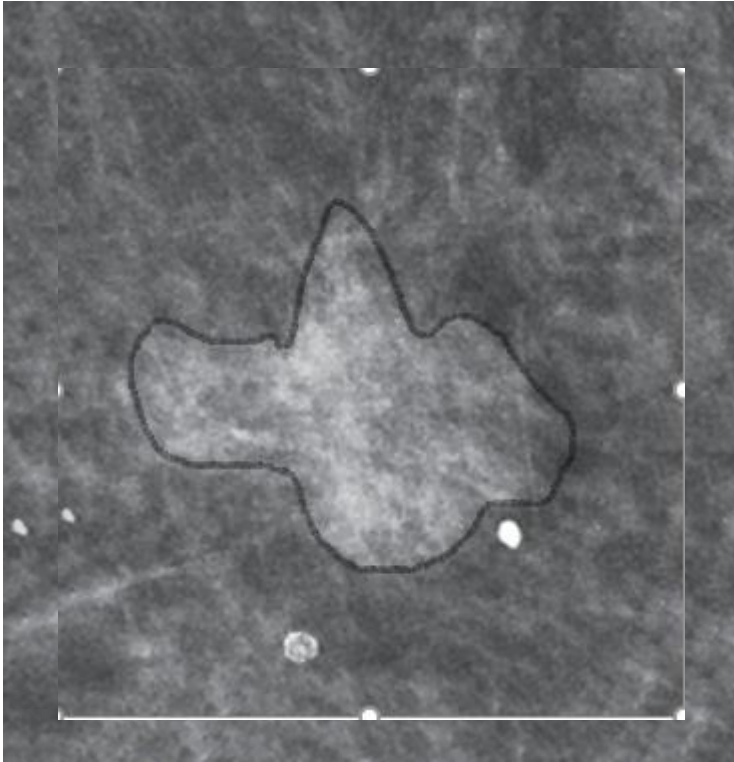
OVAL



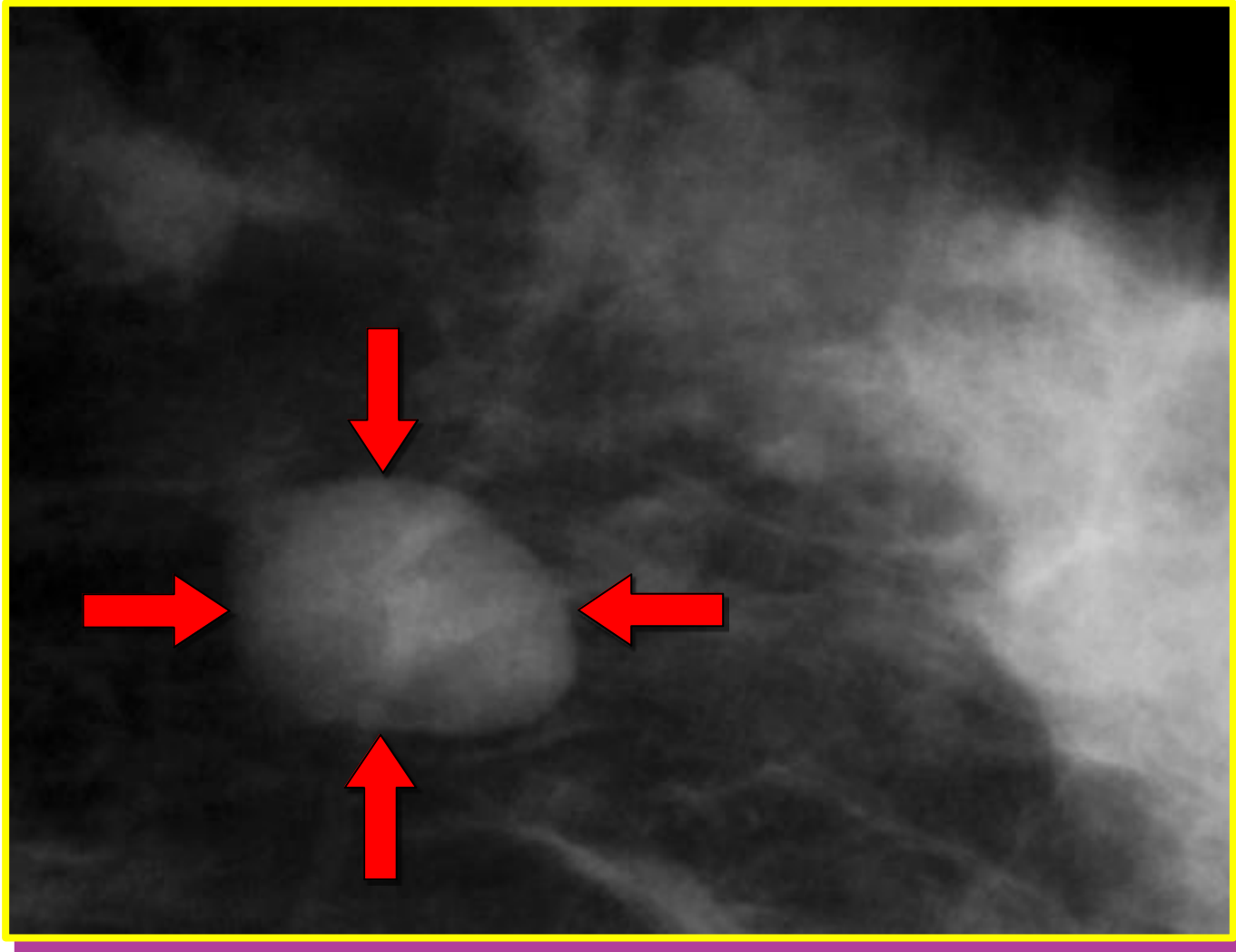
LOBULAR



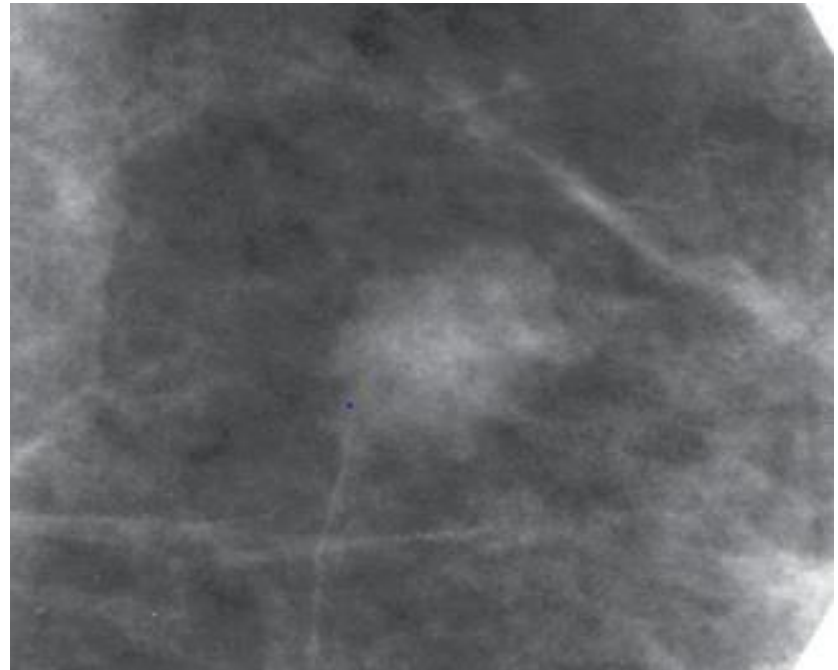
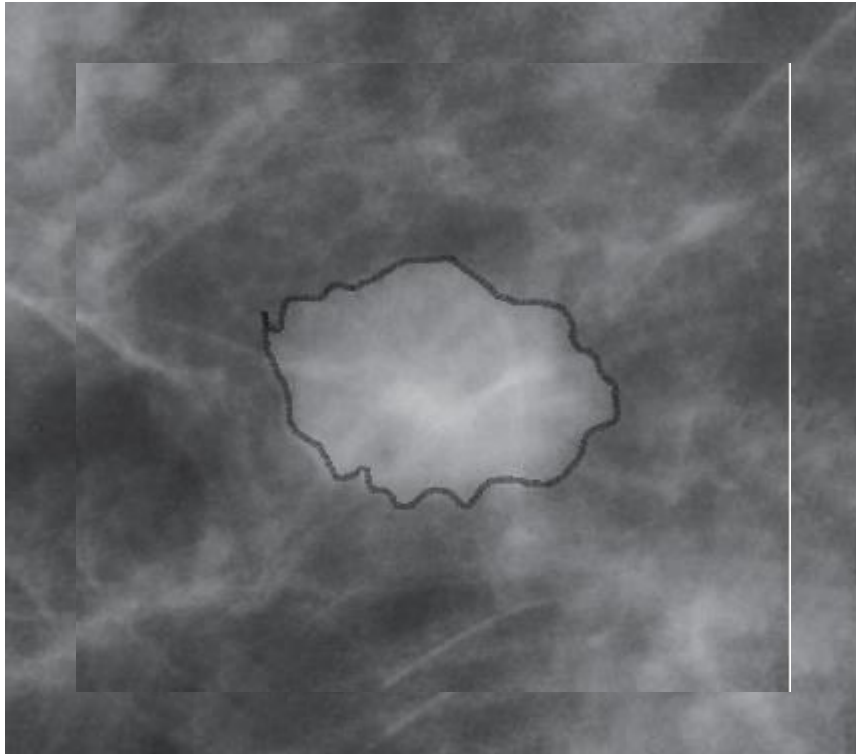
IRREGULAR

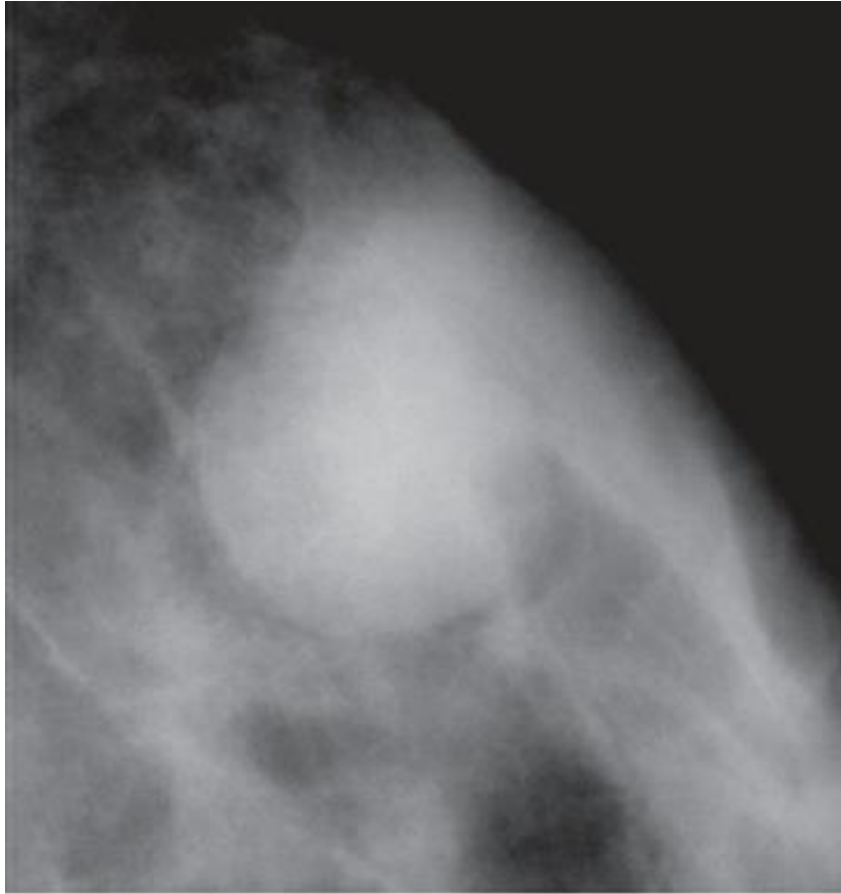


CIRCUMSCRIBED

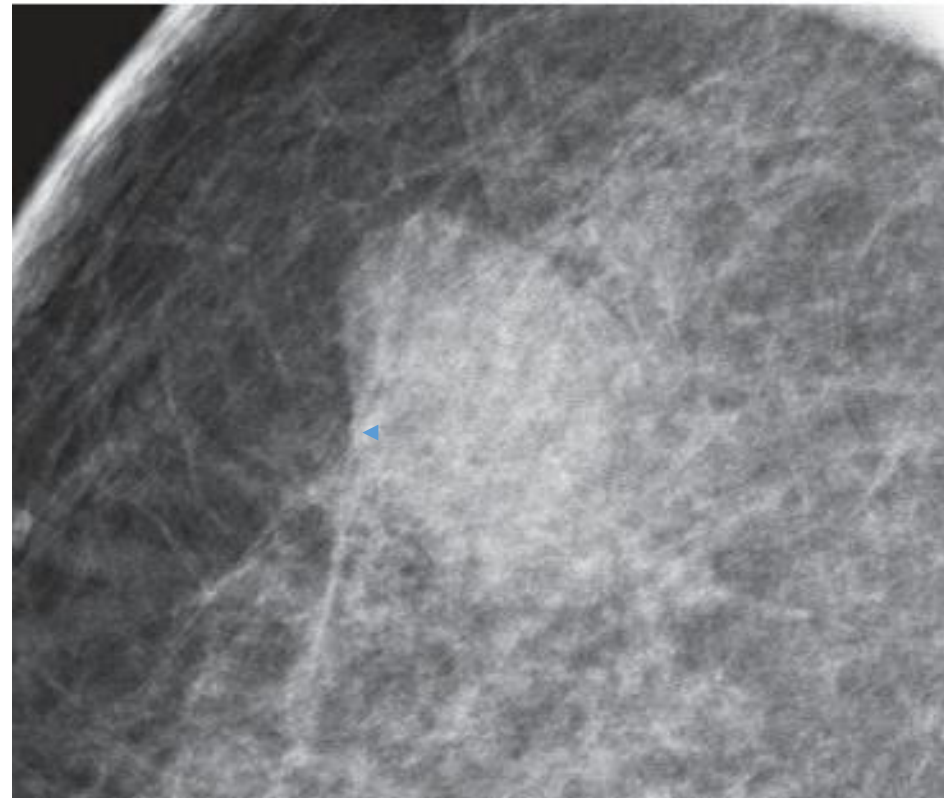


MICROLOBULATED

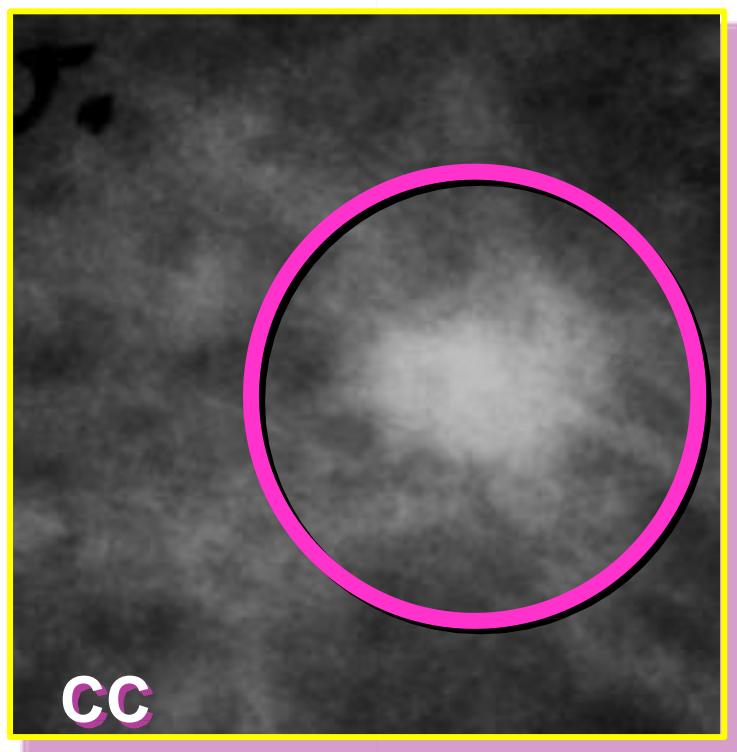




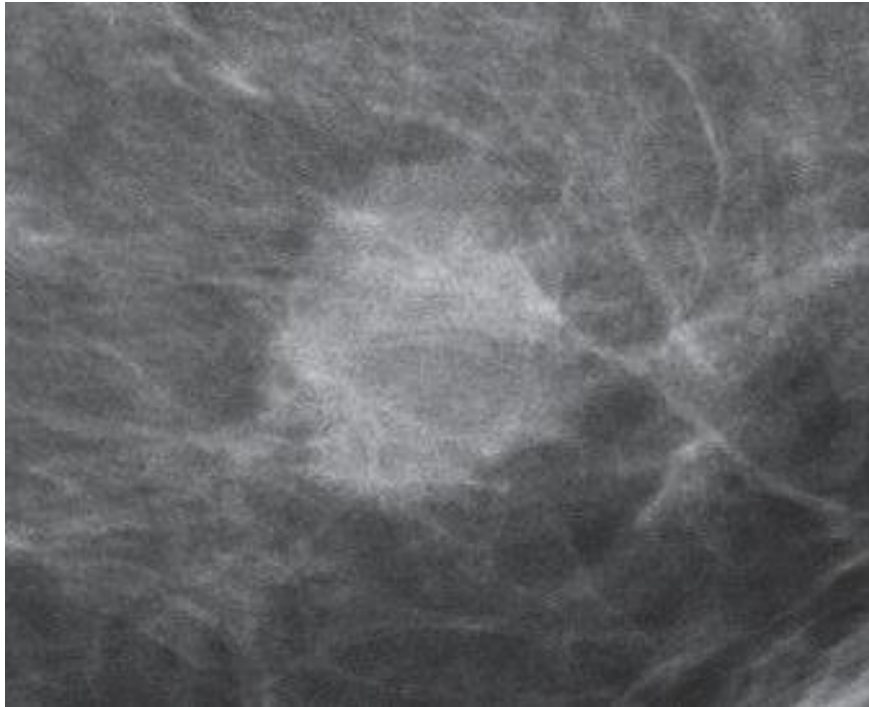
OBSCURED



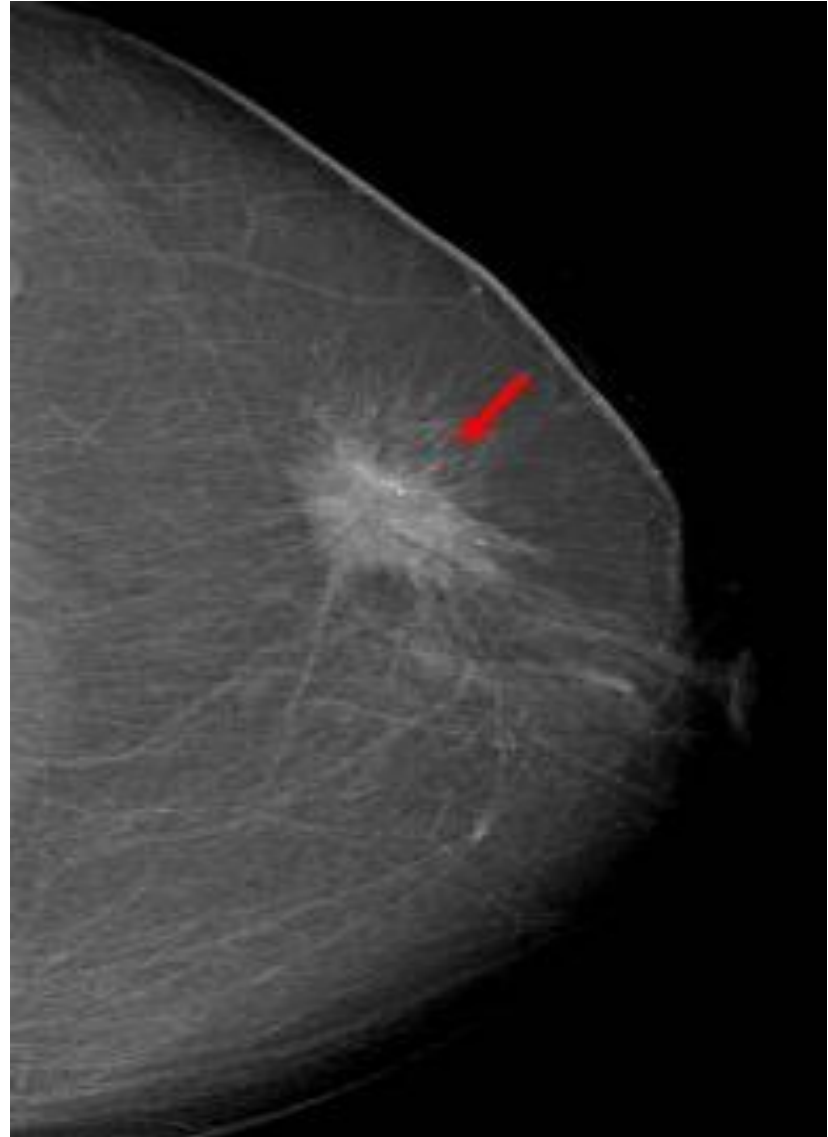
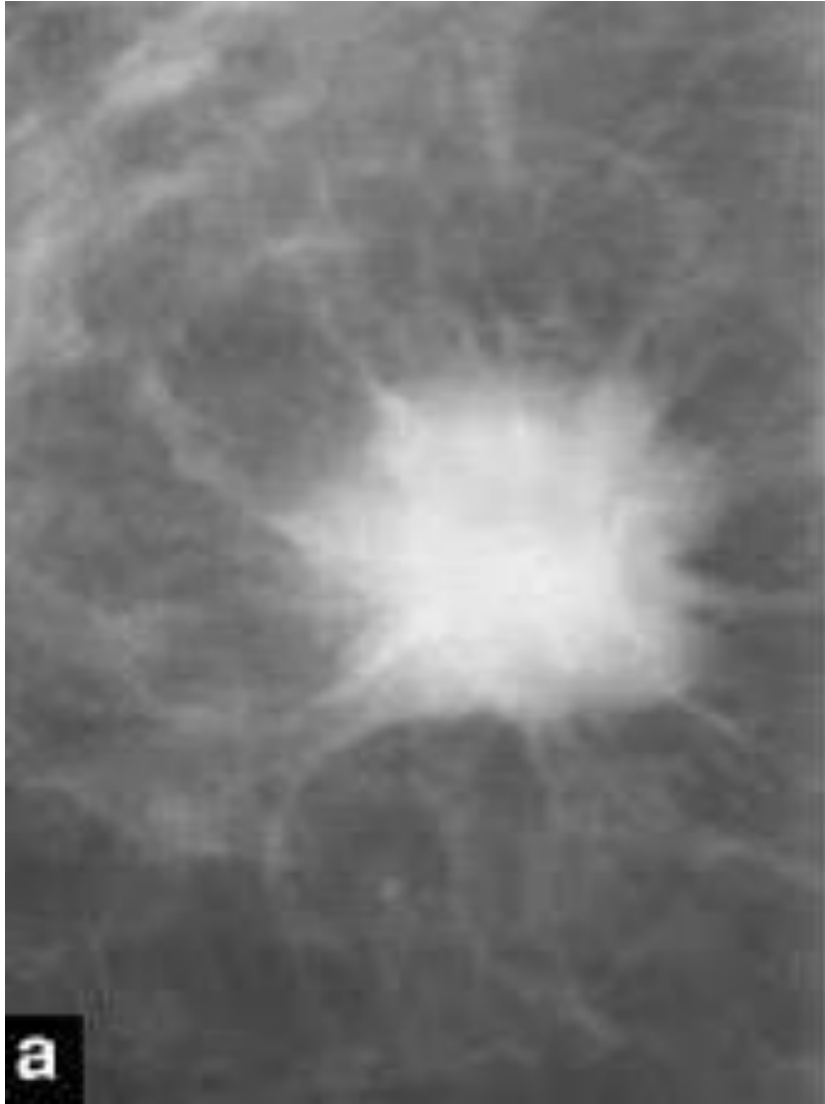
INDISTINCT



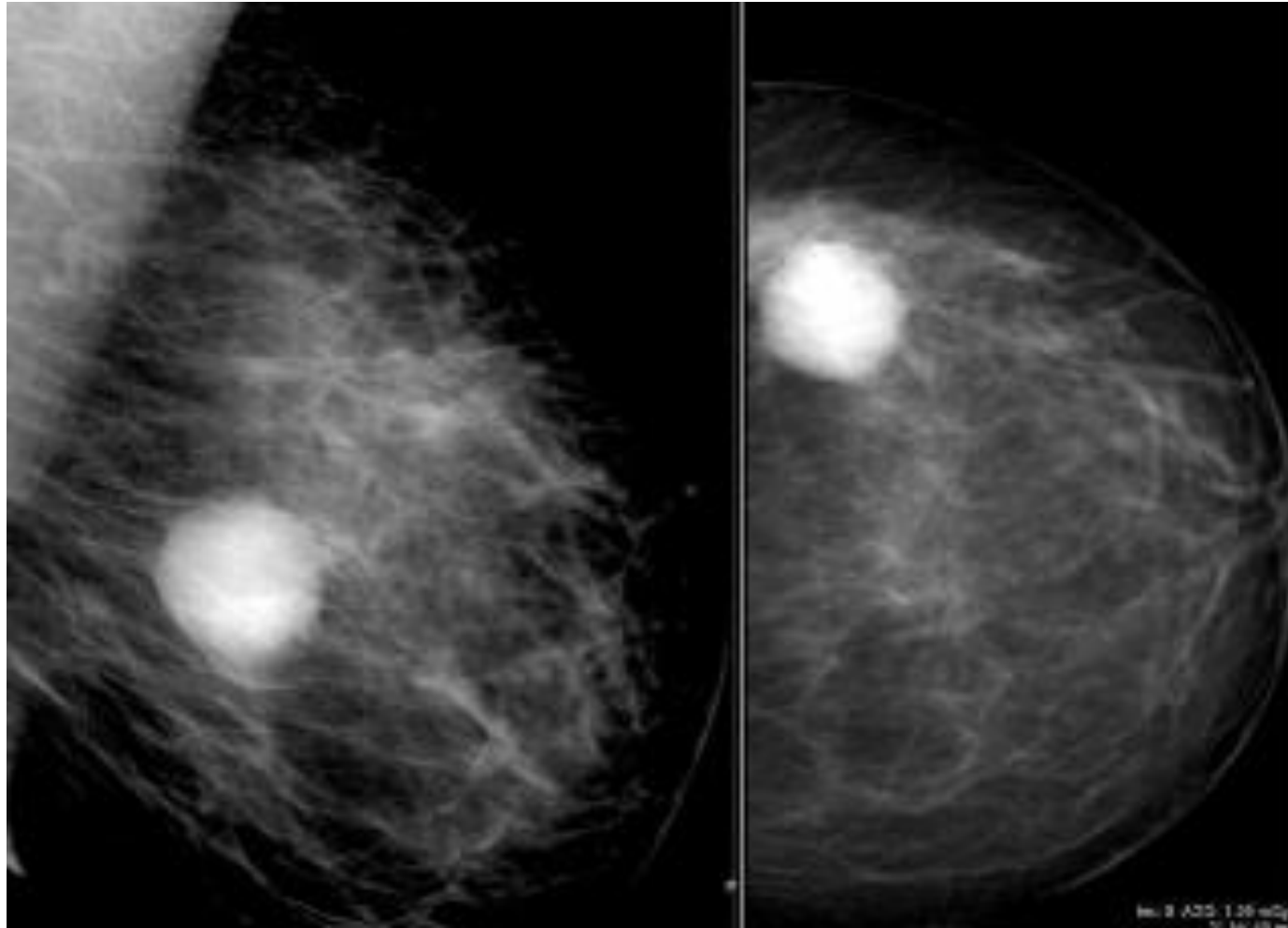
INDISTINCT



Spiculated



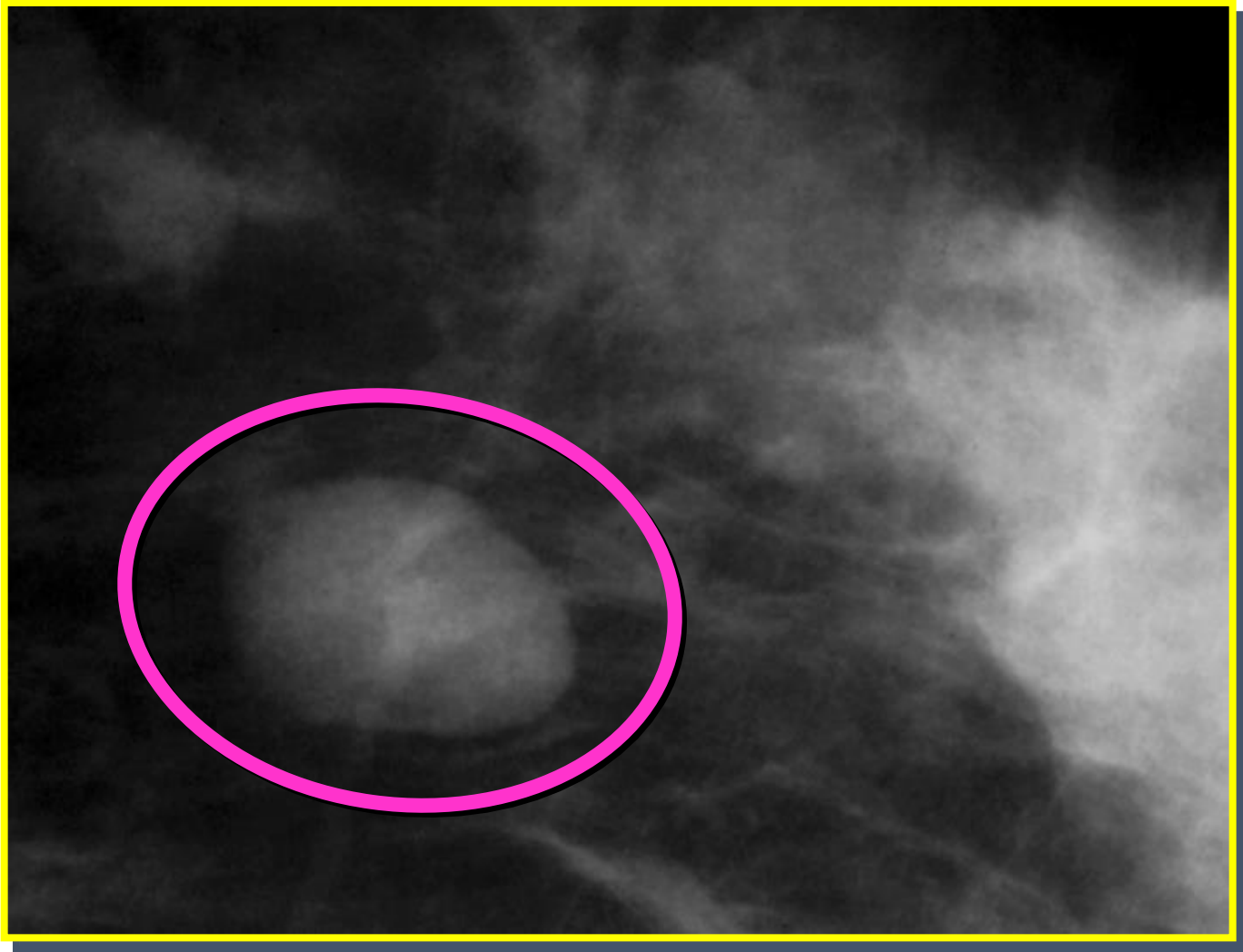
HIGH DENSITY



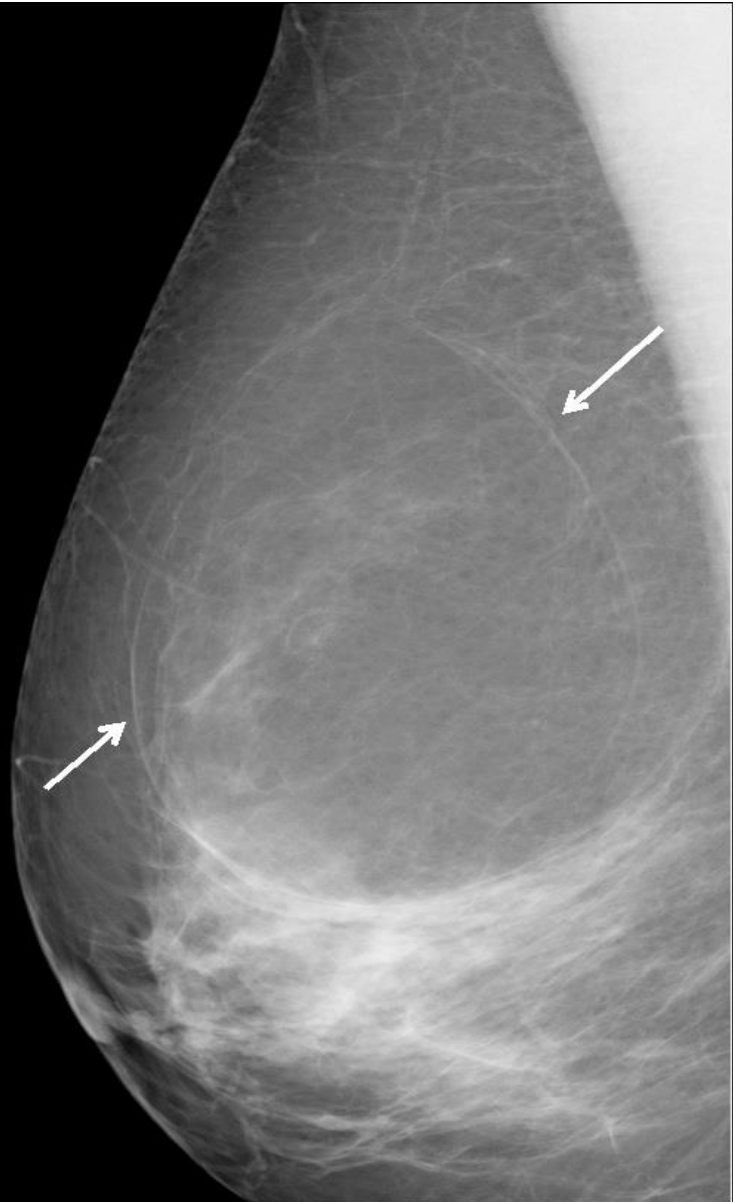
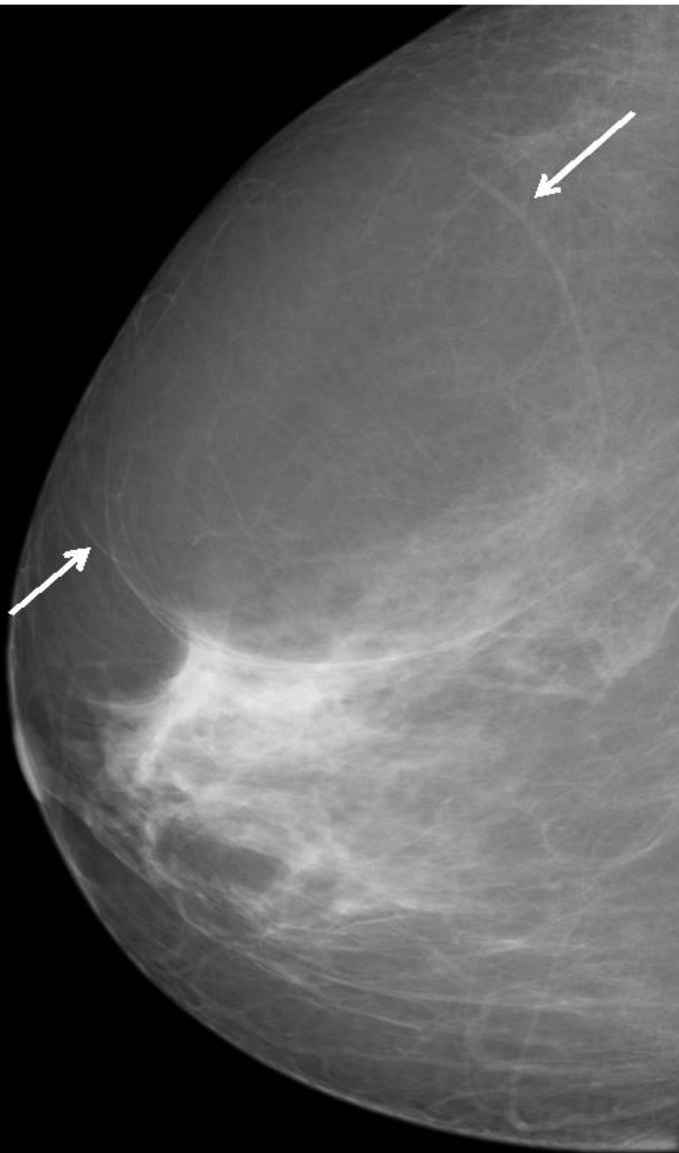
EQUAL DENSITY



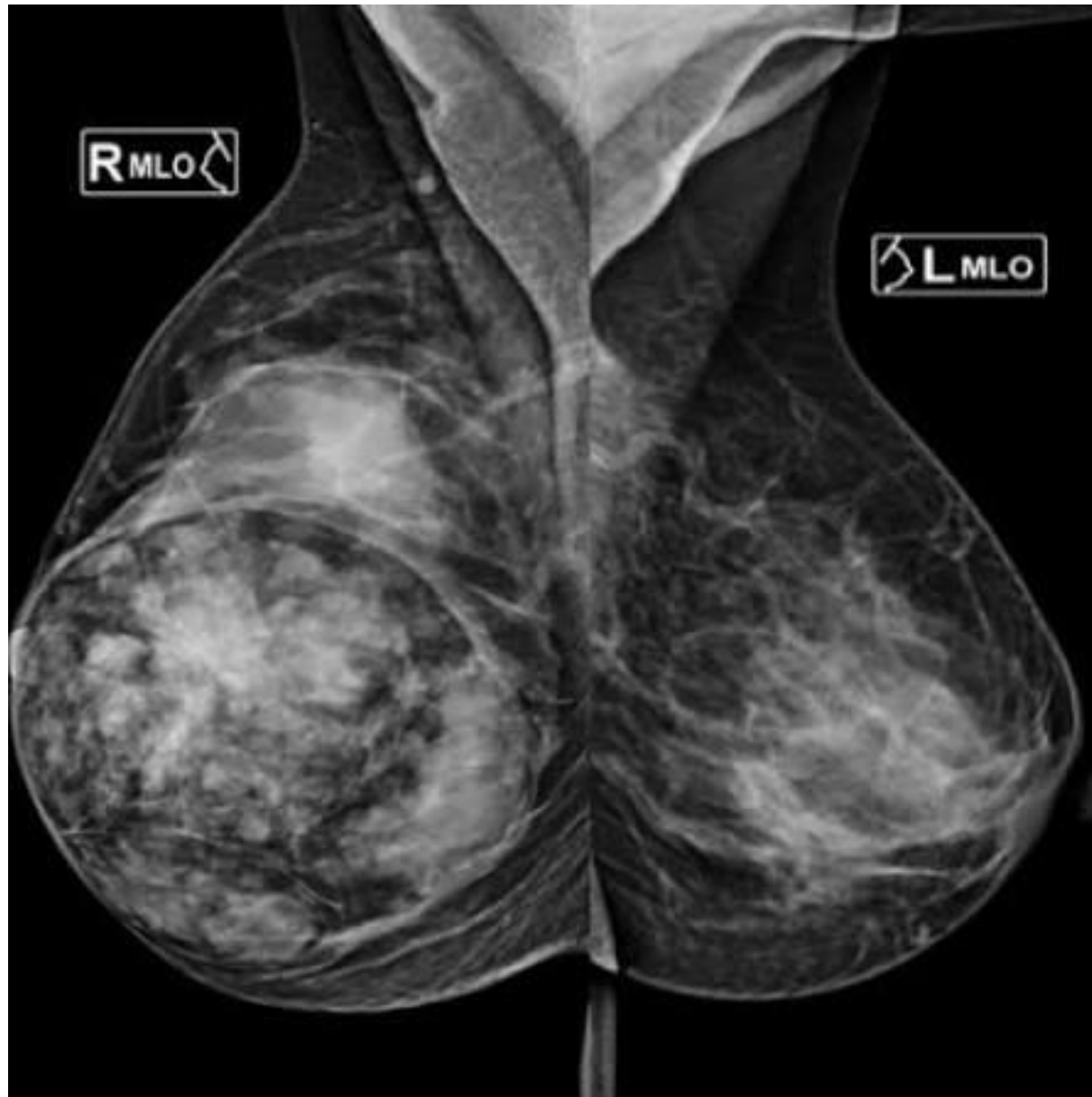
LOW DENSITY



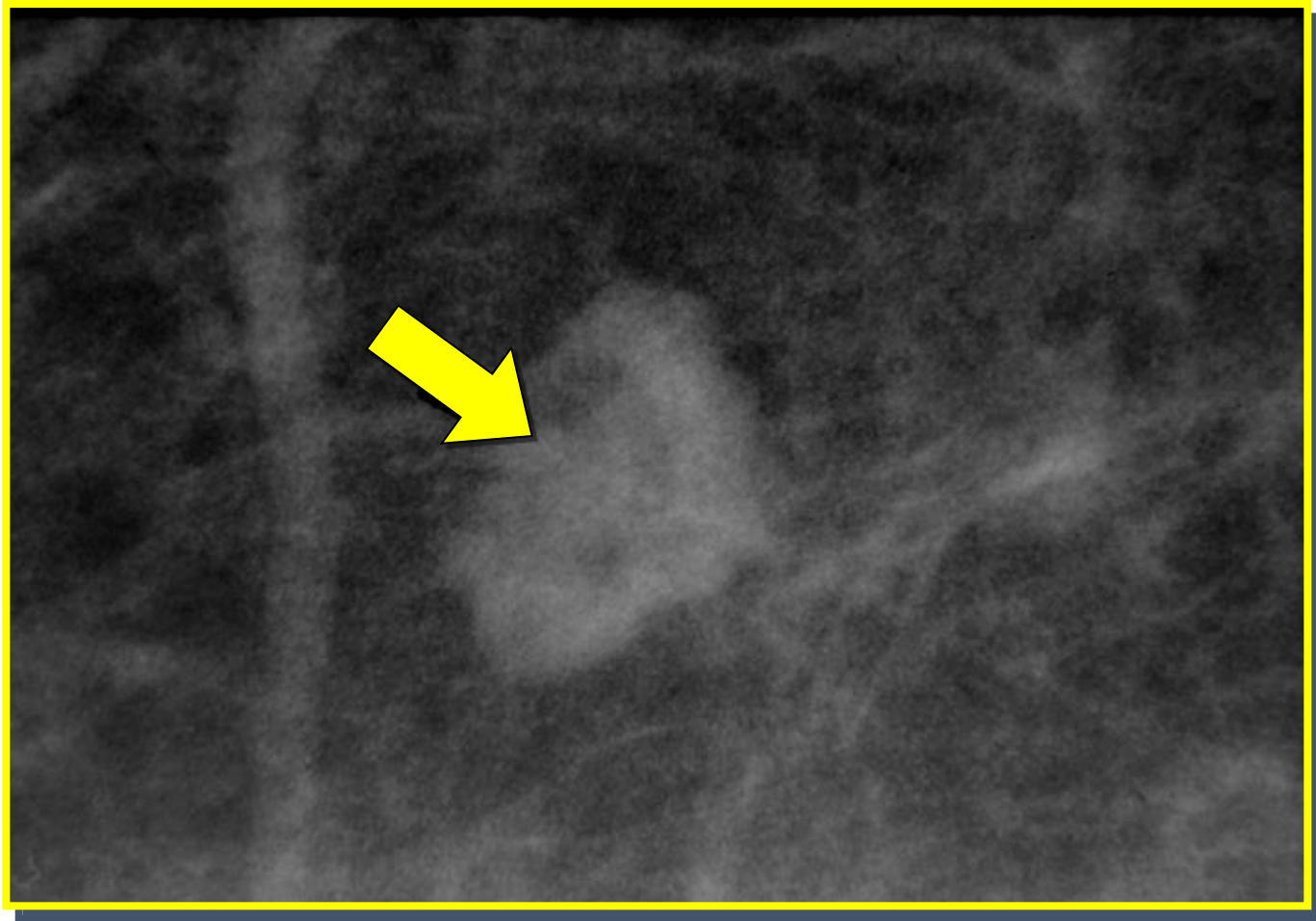
Fat containing



Hamartoma



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

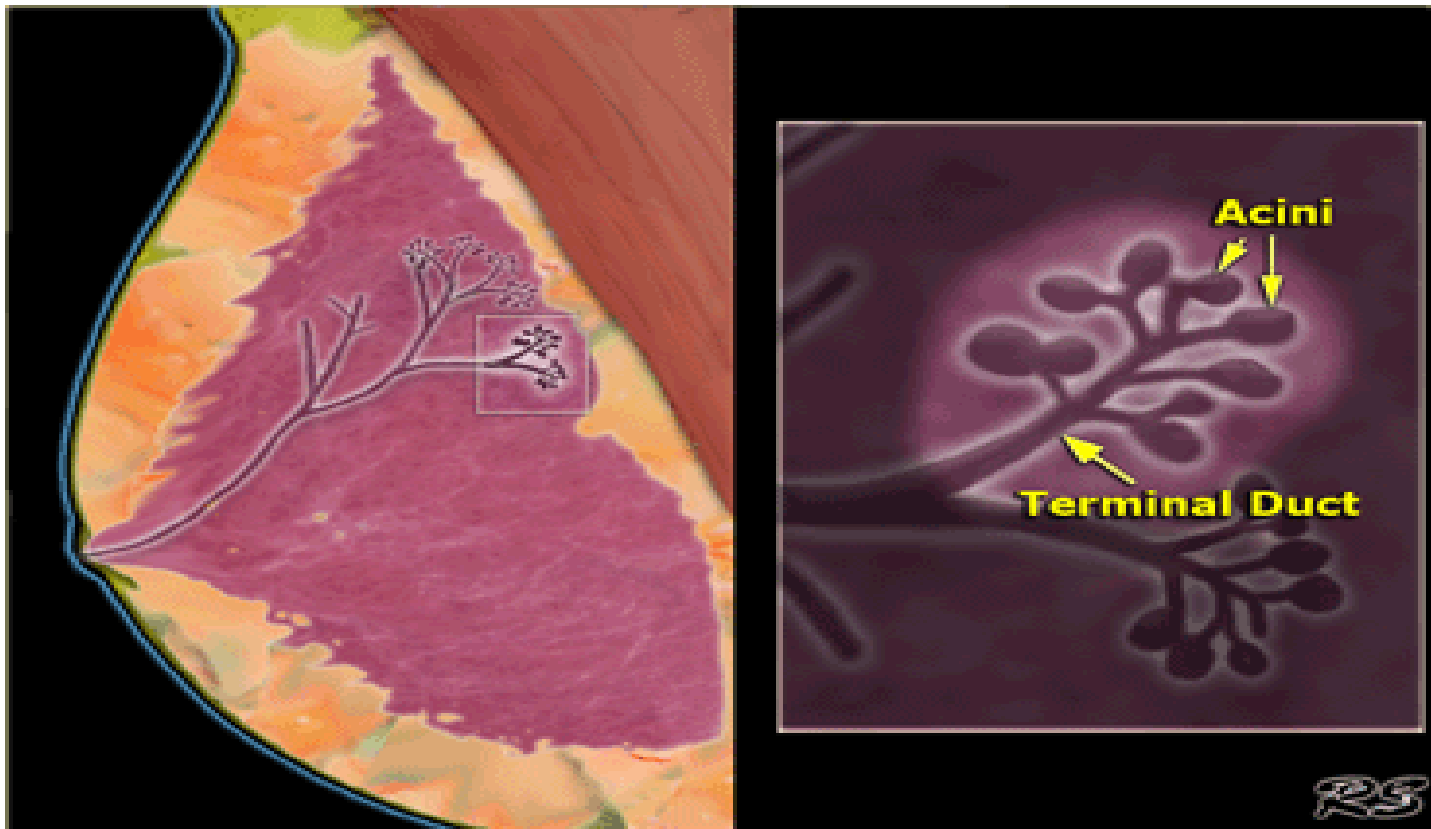
BI-RADS LEXICON: MASSES

- 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**

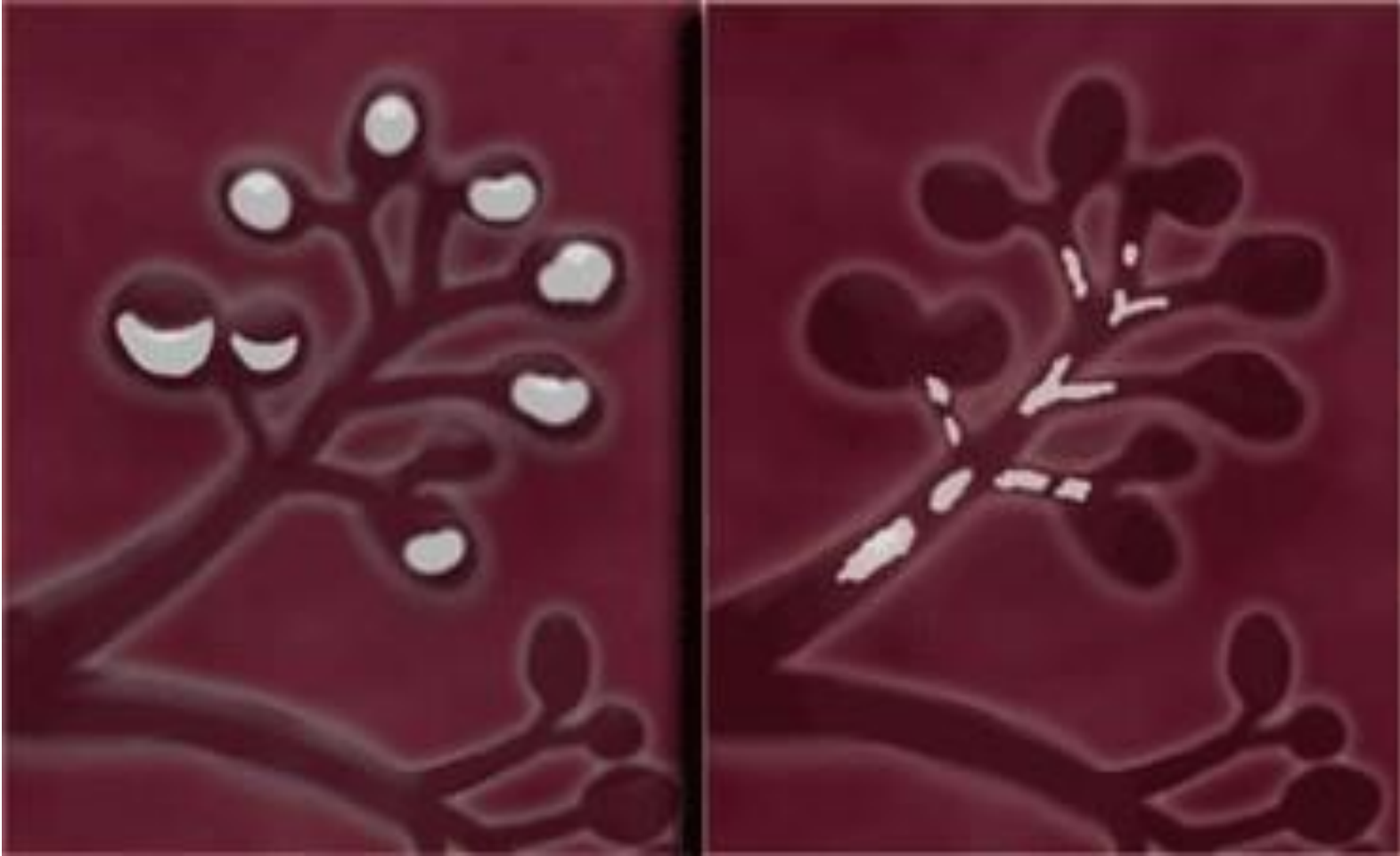
CALCIFICATIONS

Terminal ductal lobular unit

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



Calcifications may be intralobular or intraductal



LEFT: Lobular calcifications: punctate, round or 'milk of calcium'

RIGHT: Intraductal calcifications: pleomorph and form casts in a linear or branching pattern

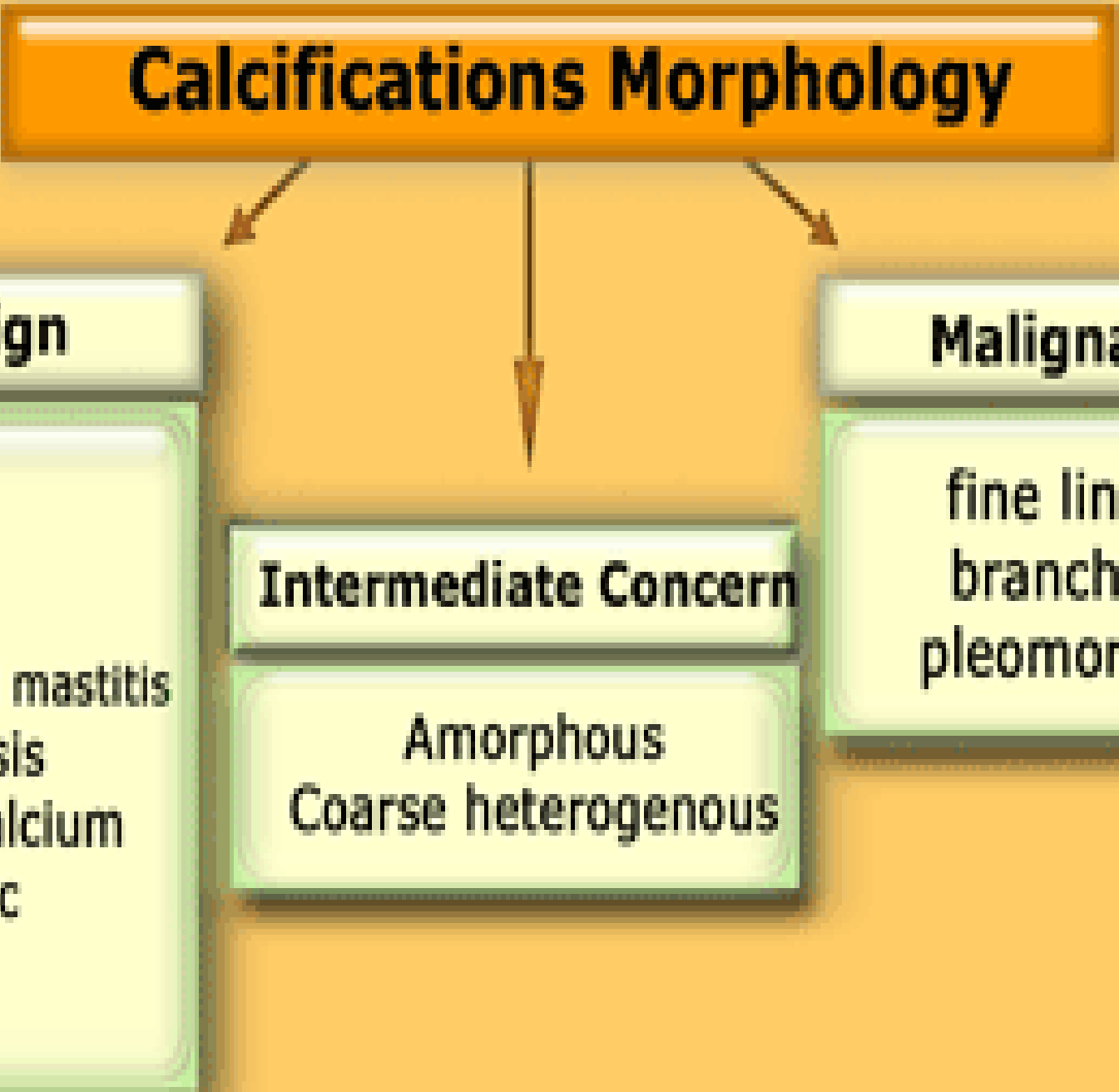
DIAGNOSTIC APPROACH OF CALCIFICATIONS

It is based on Morphology of calcifications
and their Distribution

1-Morphology

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

Calcifications Morphology



```
graph TD; A[Calcifications Morphology] --> B[Benign]; A --> C[Intermediate Concern]; A --> D[Malignant]; B --> B1[Skin]; B --> B2[Vascular]; B --> B3[popcorn]; B --> B4[plasmacell mastitis]; B --> B5[fat necrosis]; B --> B6[milk of calcium]; B --> B7[dystrophic]; B --> B8[eggshell]; B --> B9[suture]; C --> C1[Amorphous]; C --> C2[Coarse heterogenous]; D --> D1[\"fine linear  
branching  
pleomorphic\"]
```

Benign

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

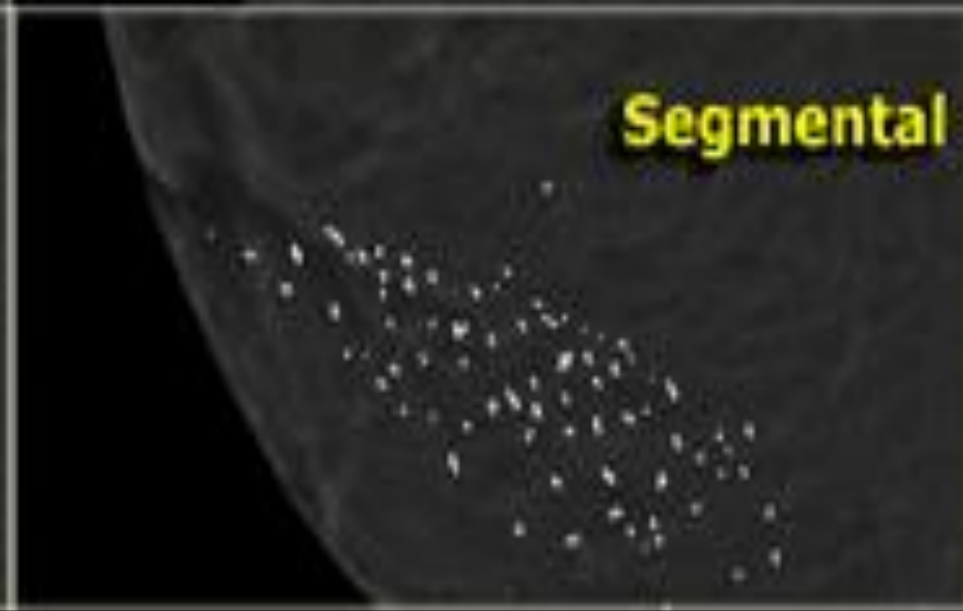
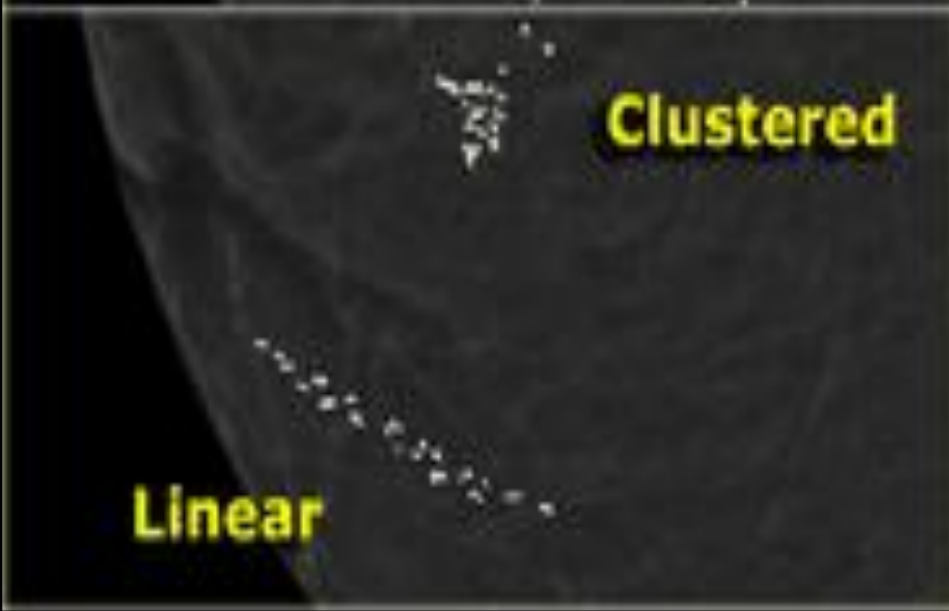
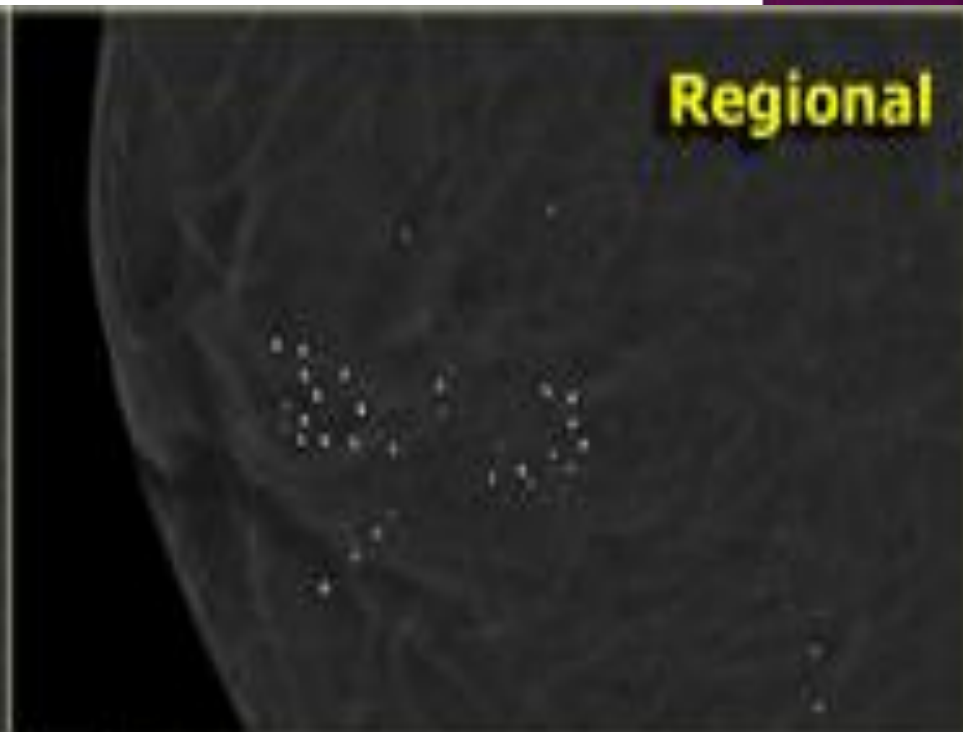
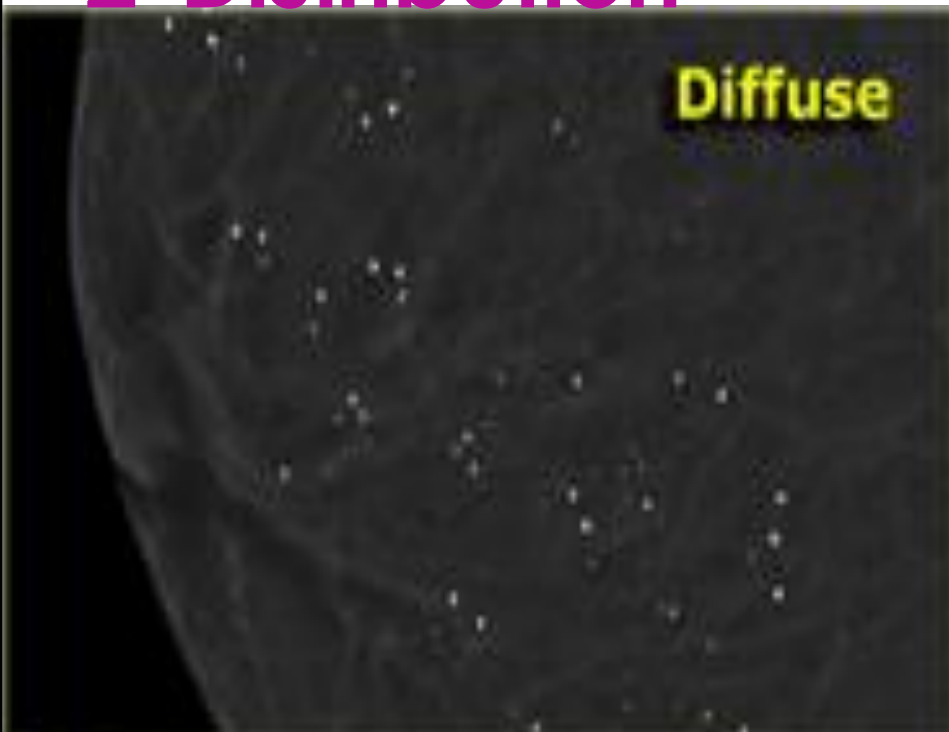
Intermediate Concern

Amorphous
Coarse heterogenous

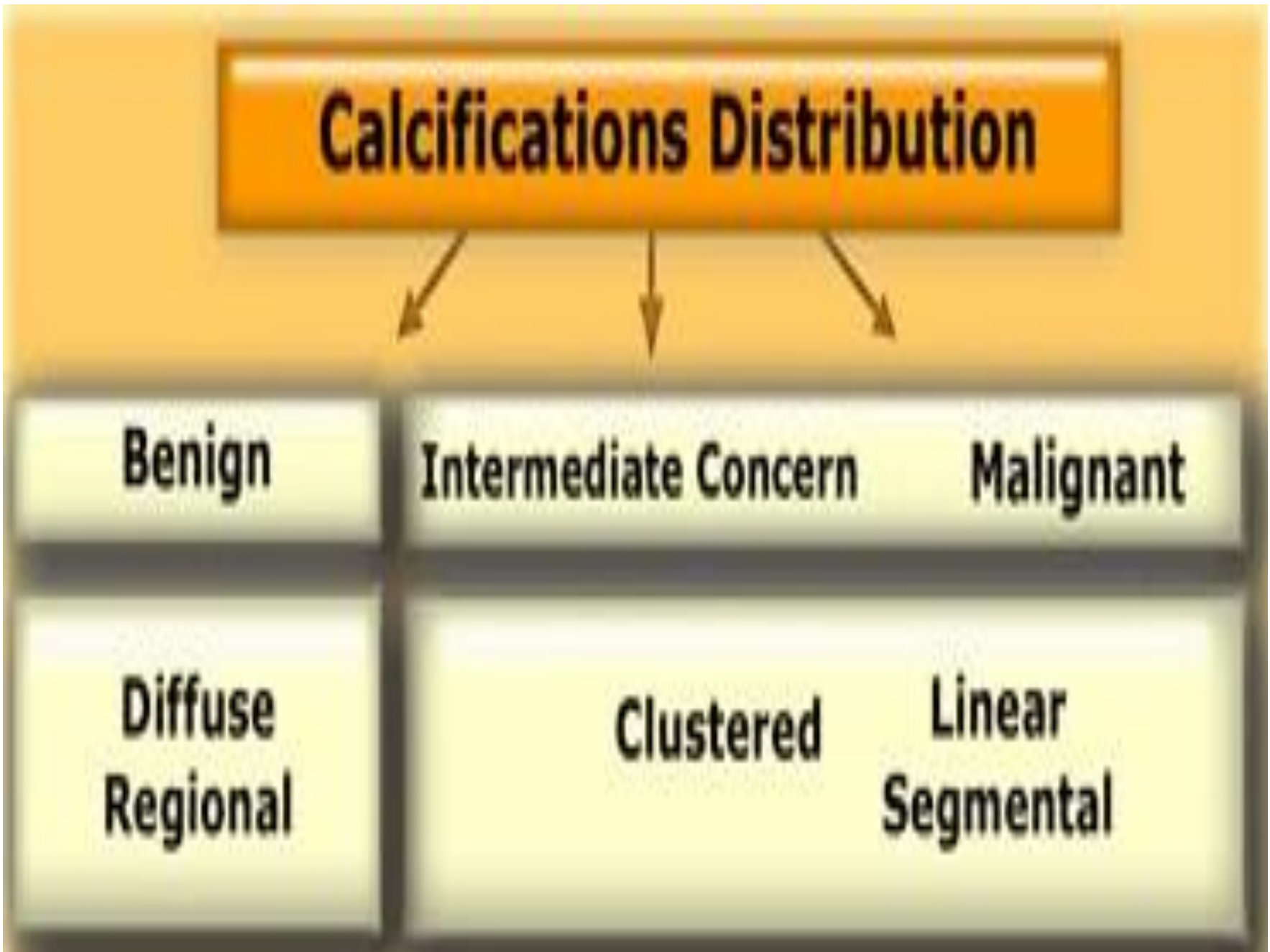
Malignant

fine linear
branching
pleomorphic

2-Distribution



Calcifications Distribution



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

Benign

Intermediate Concern

Malignant

**Diffuse
Regional**

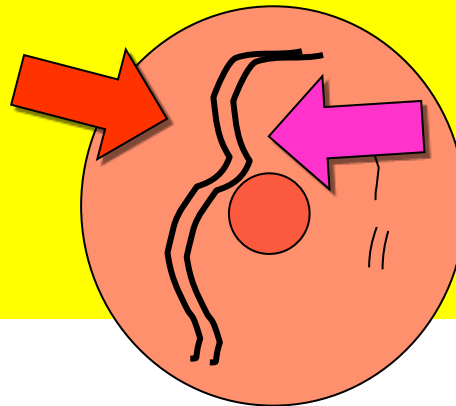
Clustered

**Linear
Segmental**

EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

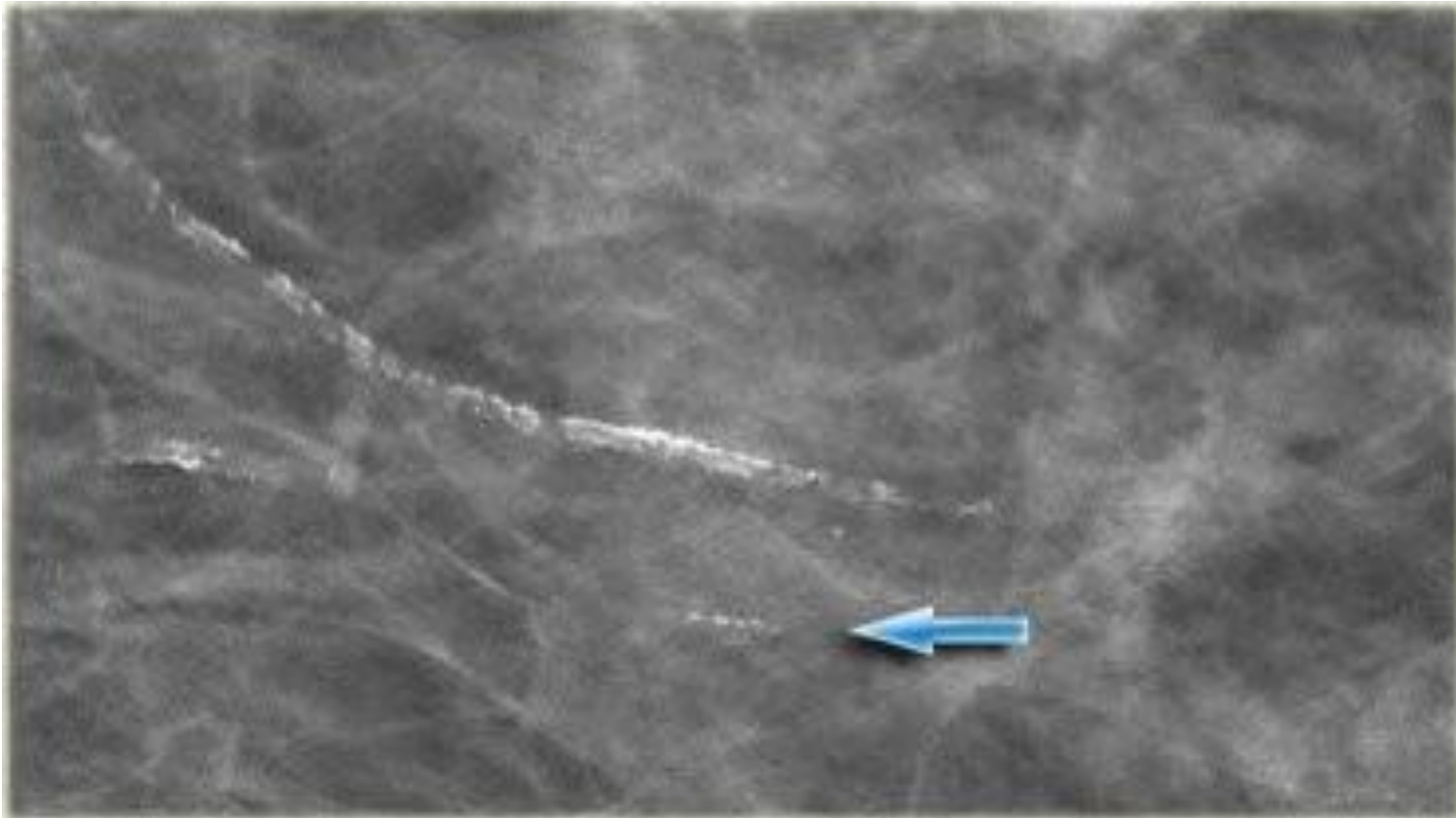
vascular



- ➡ Usually “railroad track” appearance
- ➡ Can be fragmented

BENIGN CALCIFICATIONS

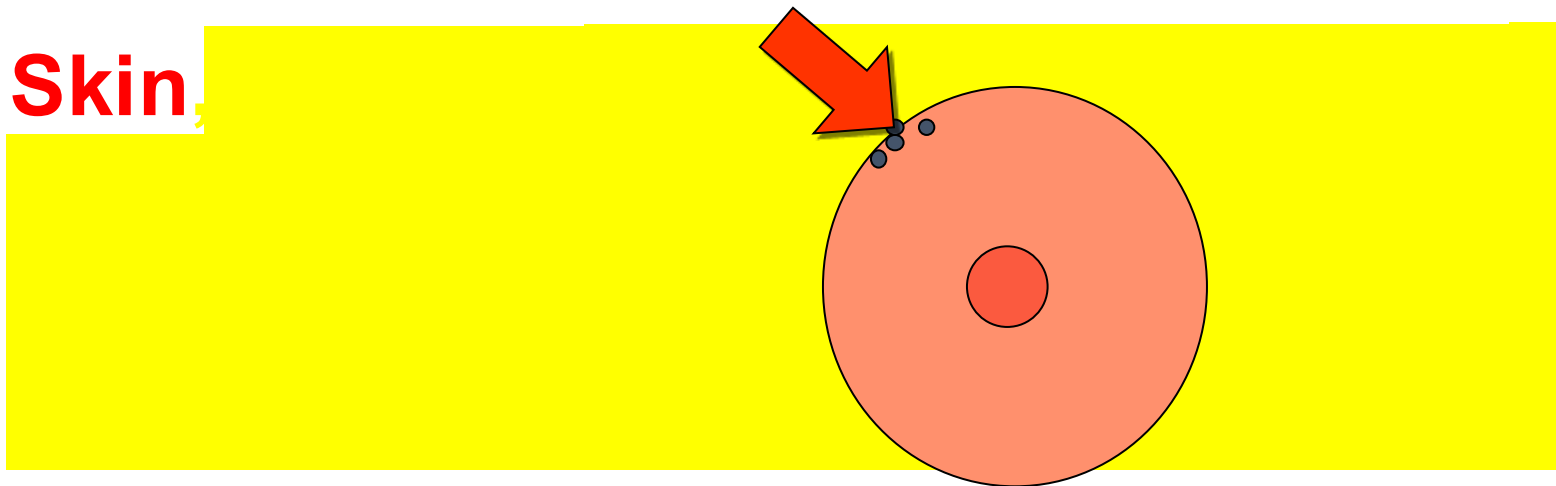
Vascular Calcifications



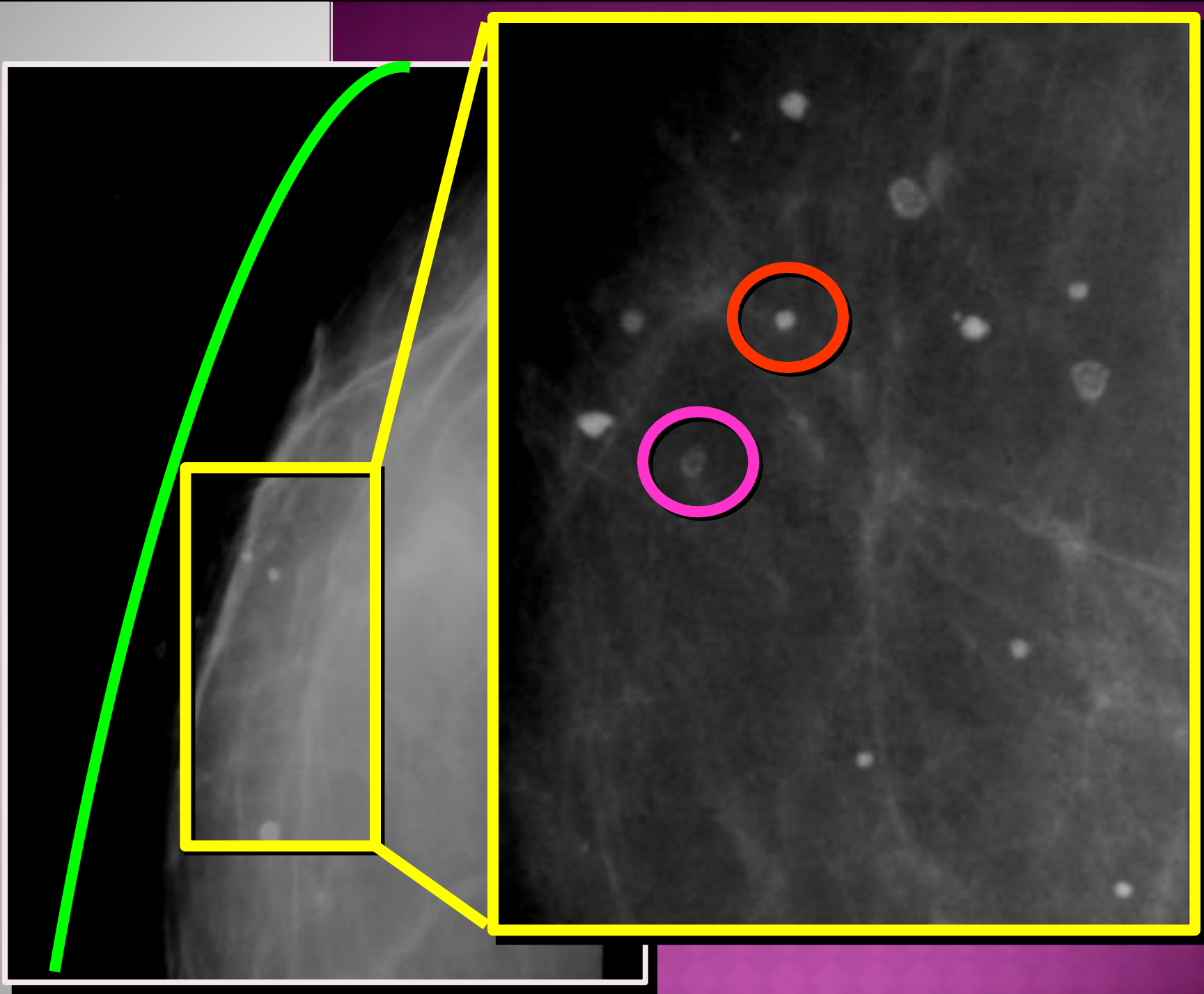
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

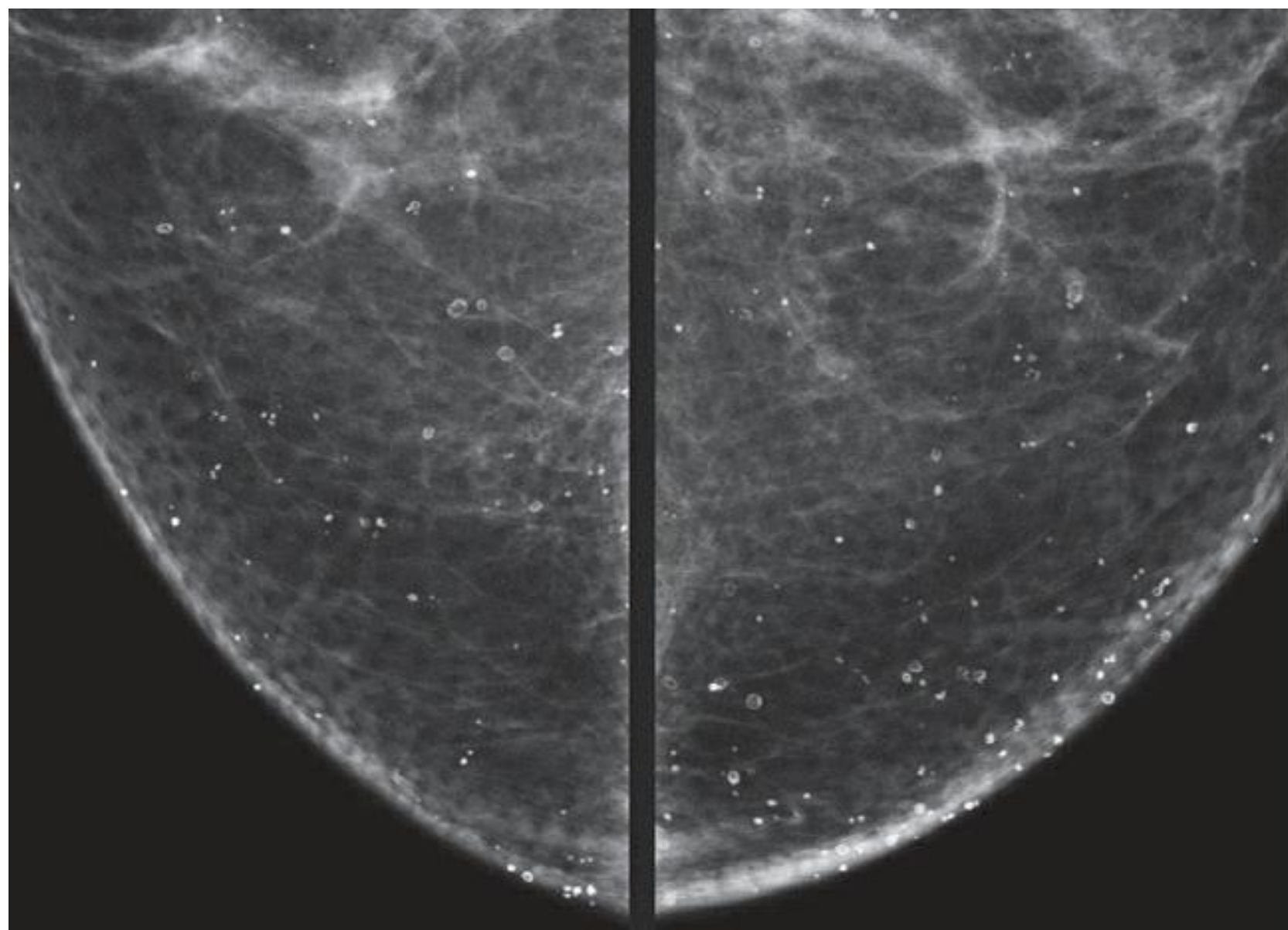
TYPICALLY BENIGN:

Skin,



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

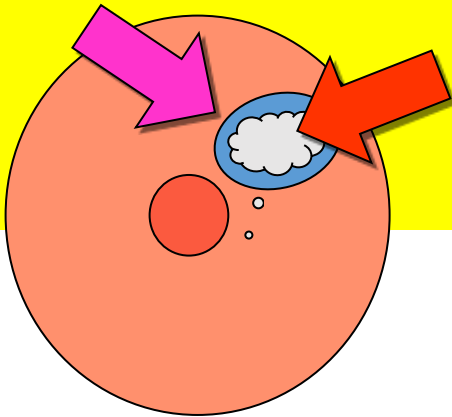




EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

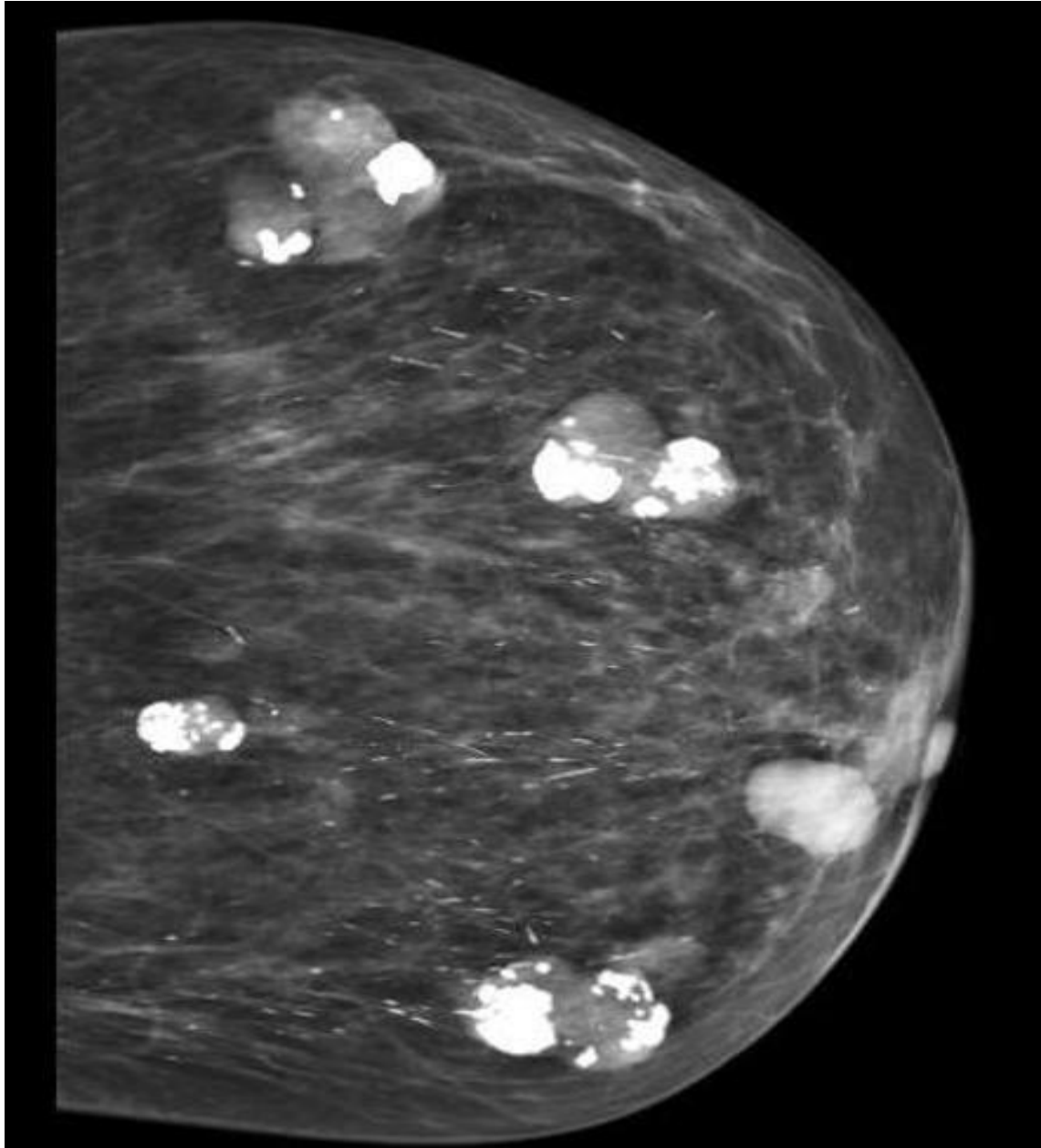
coarse (popcorn-like) ,

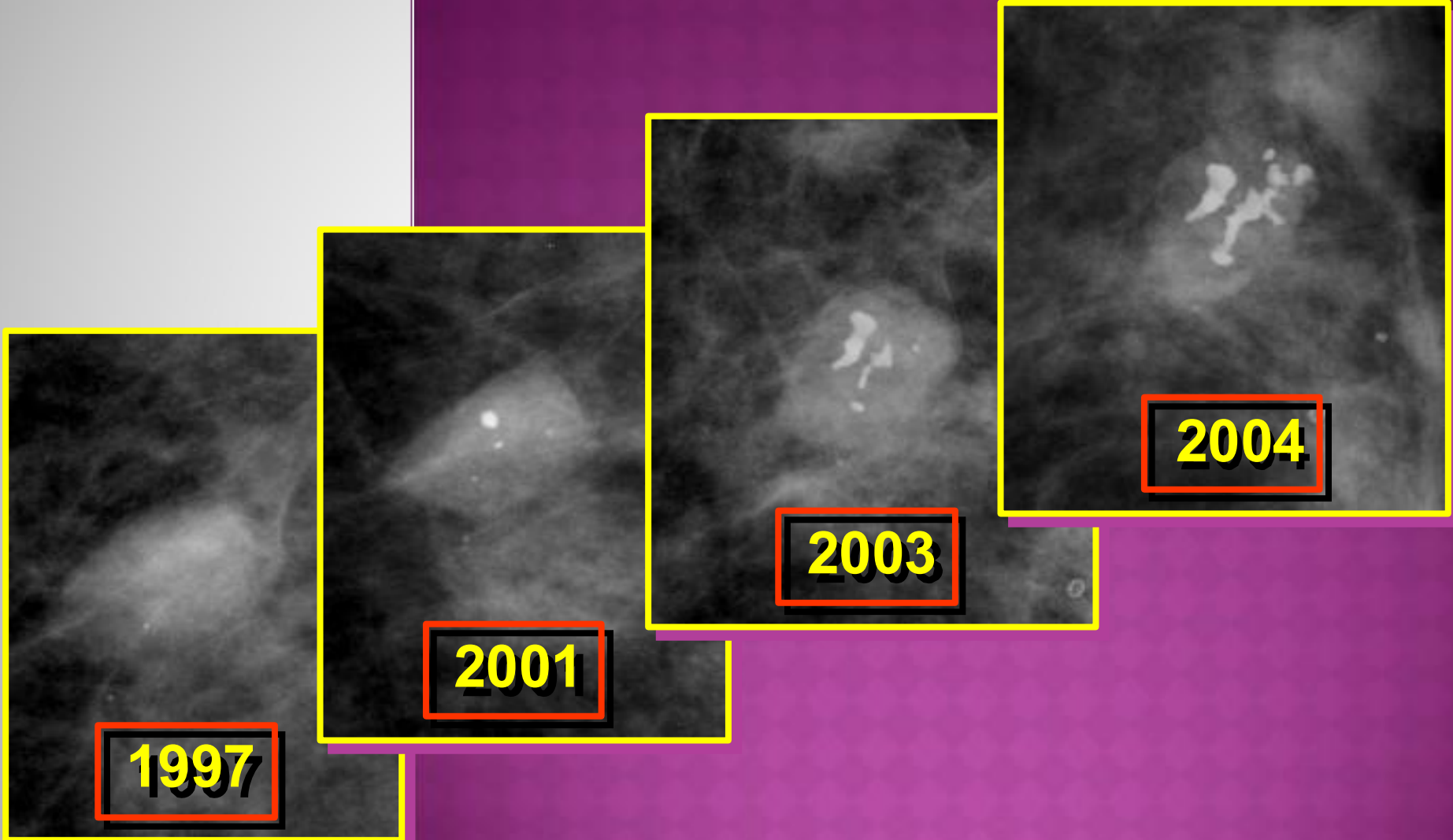


➡ Created by involuting fibroadenoma

➡ May see smooth soft tissue mass

COARSE OR 'POPCORN LIKE'





1997

2001

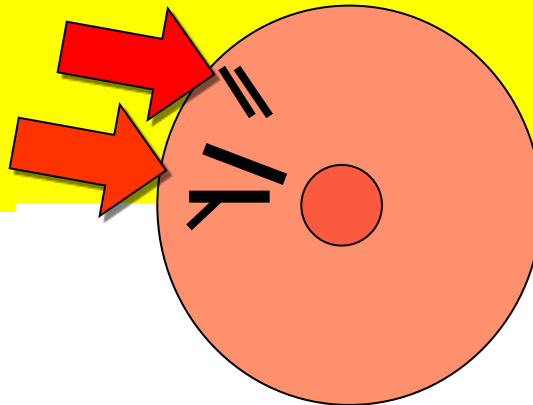
2003

2004

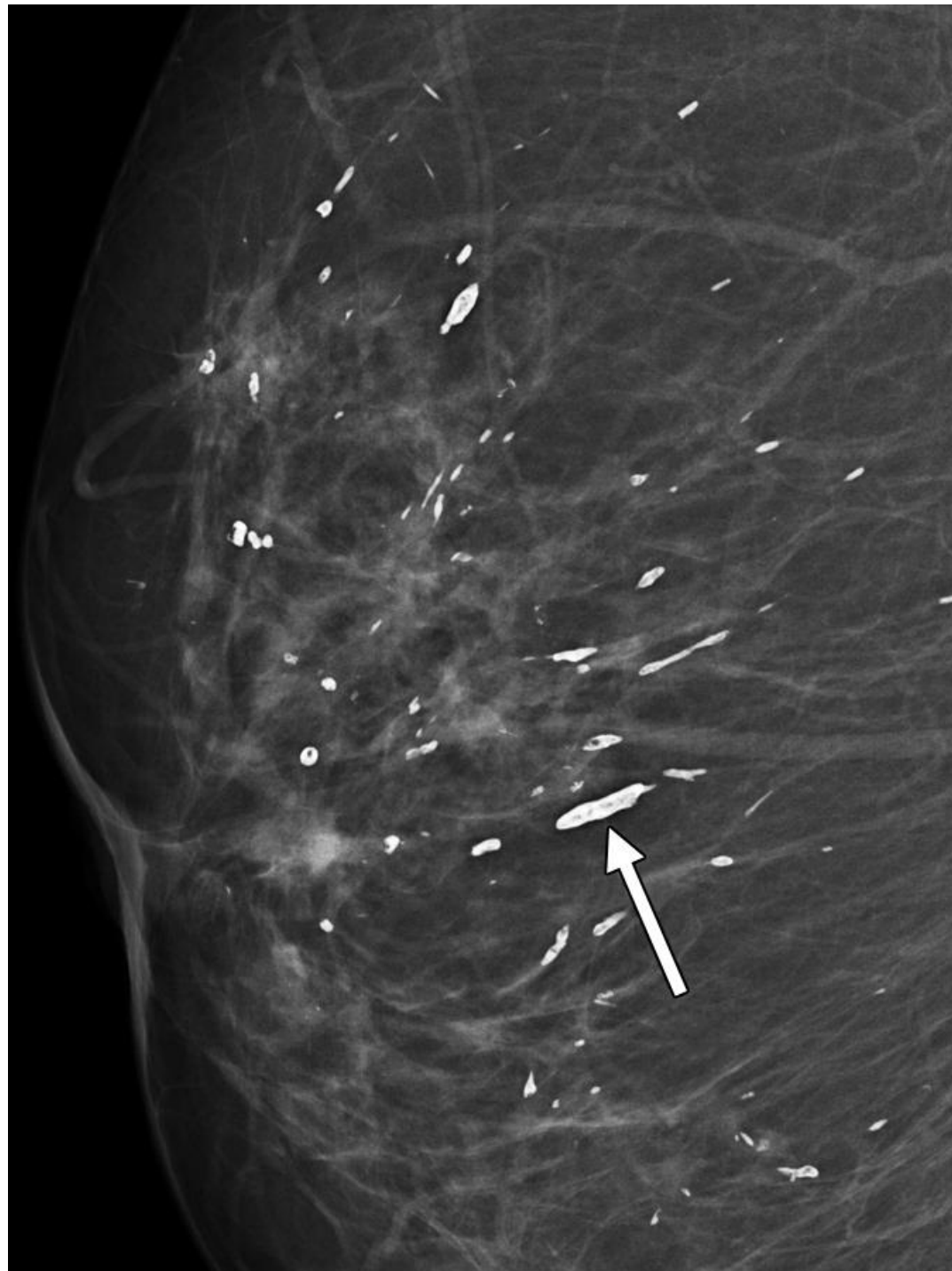
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

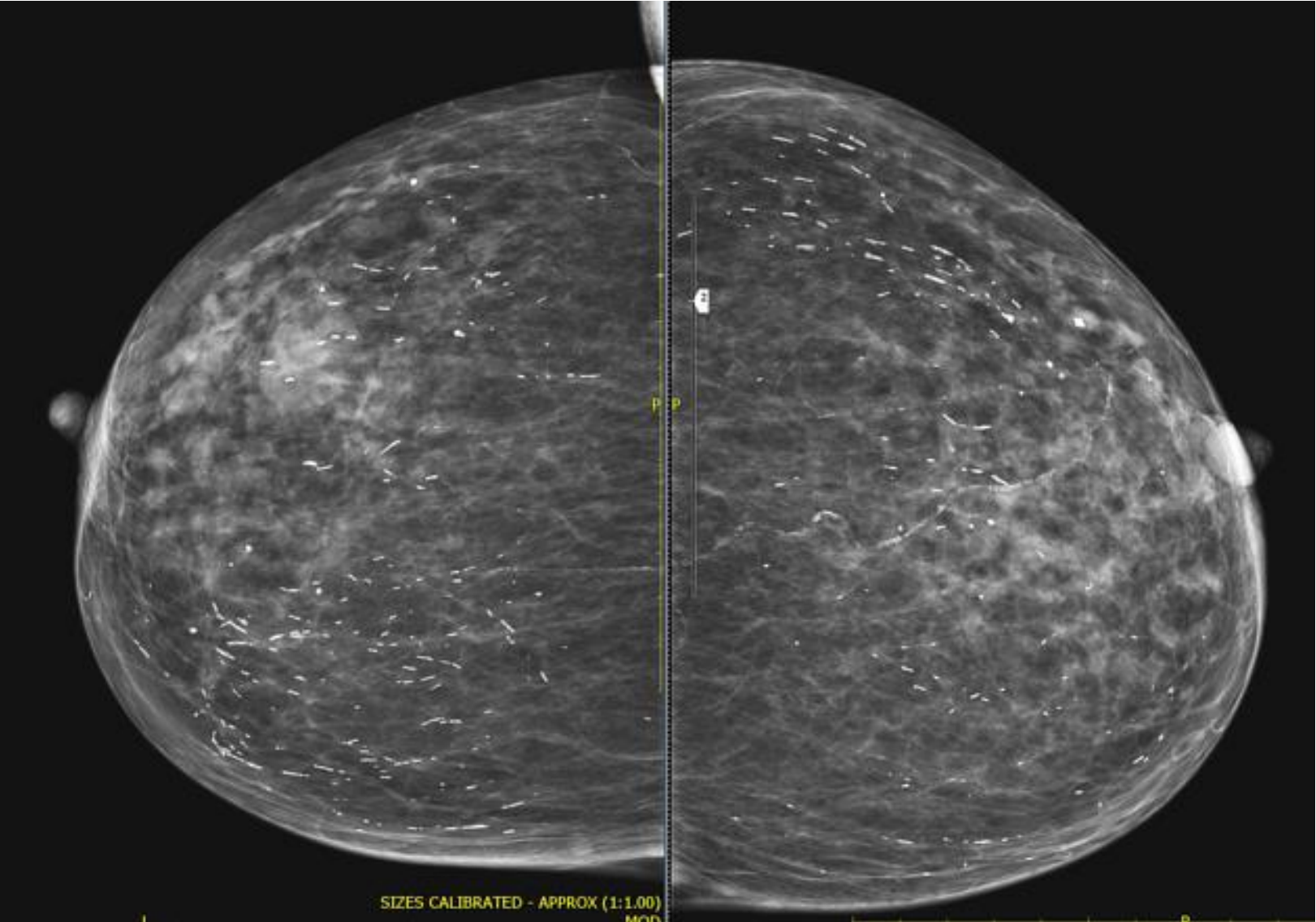
TYPICALLY BENIGN:

large rods,



- ➡ Secretory calcs., due to Plasma Cell Mastitis
- ➡ Segmental, bilateral, & intraductal or periductal (Broken needle like)

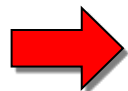
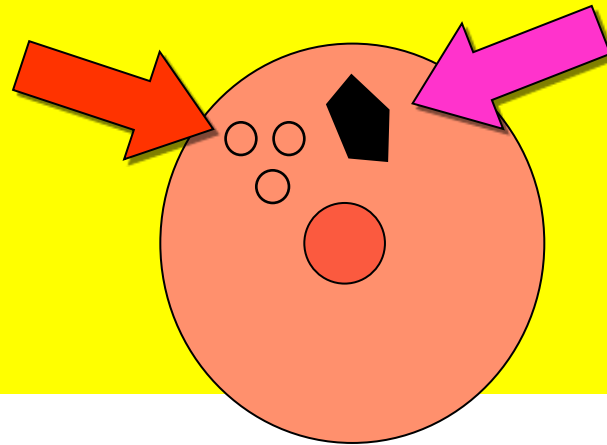




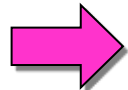
EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

TYPICALLY BENIGN:

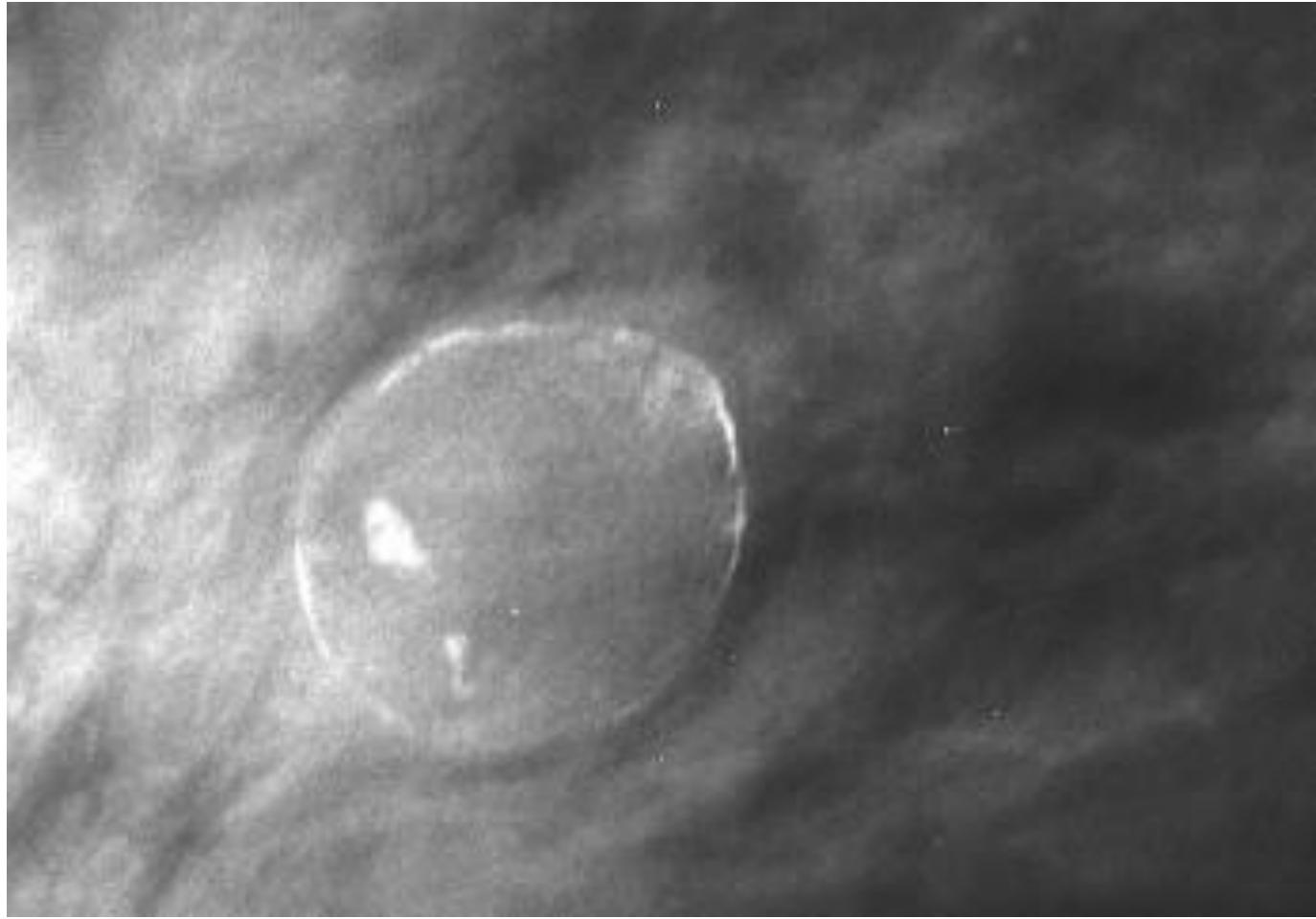
“eggshell” or “rim”



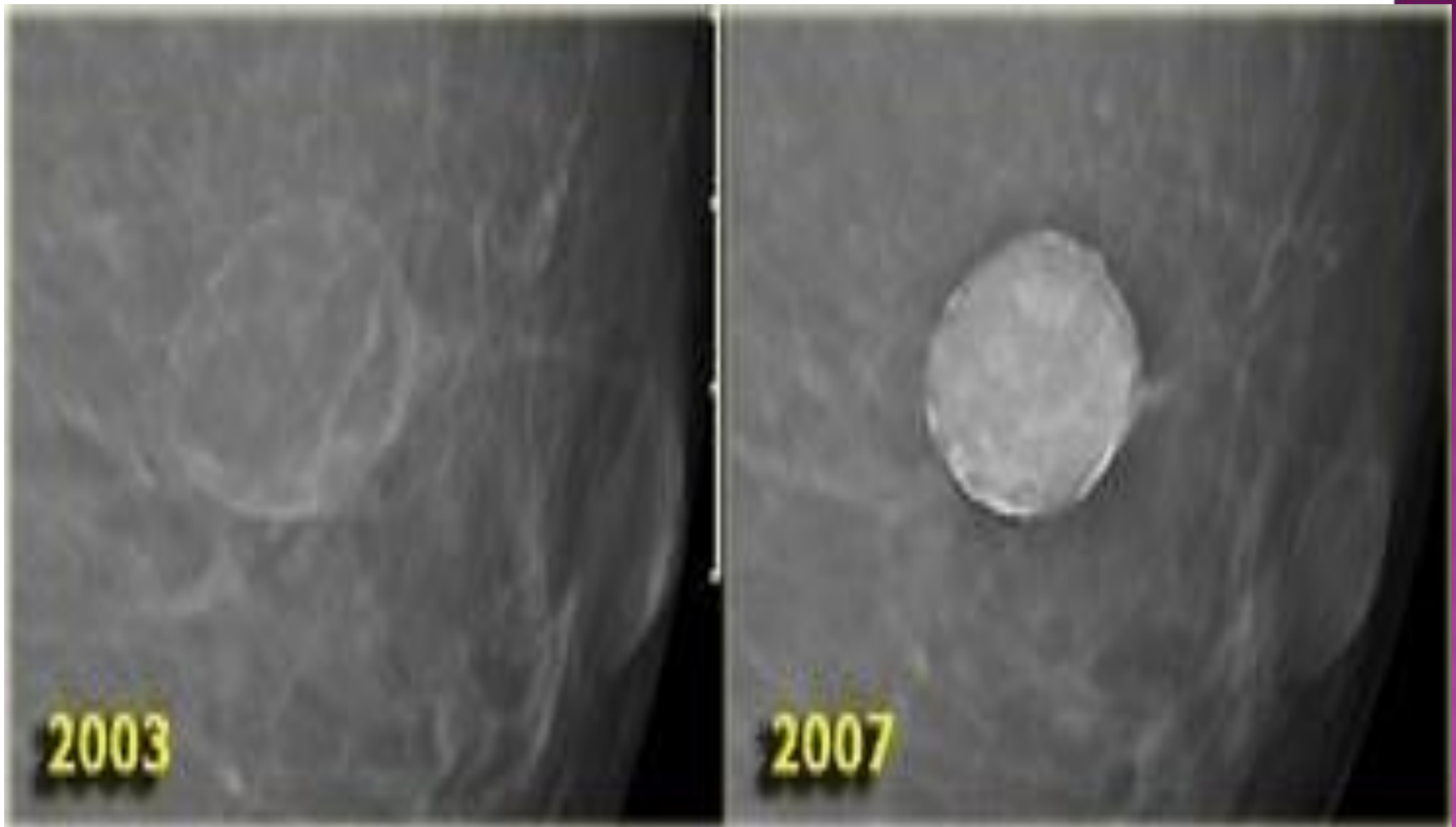
Due to calcified oil cyst or sebaceous gland



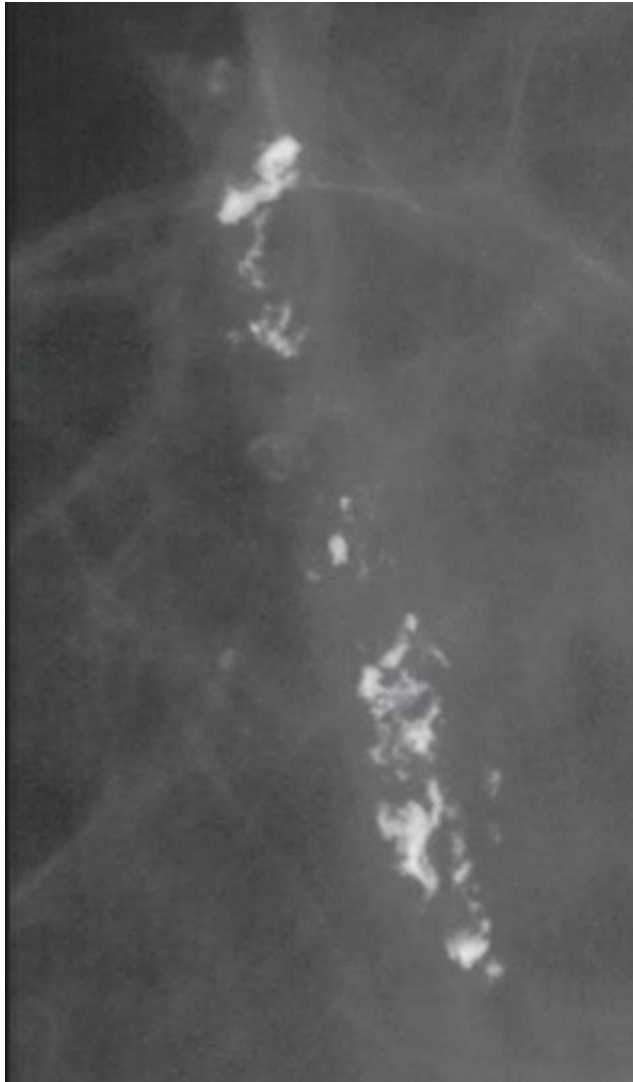
May be associated with dystrophic calcification (bizarre morphology)



Eggshell or Rim Calcifications

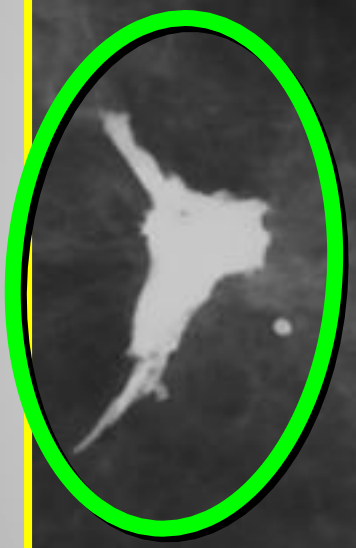


Dystrophic calcifications (bizarre forms)



CC

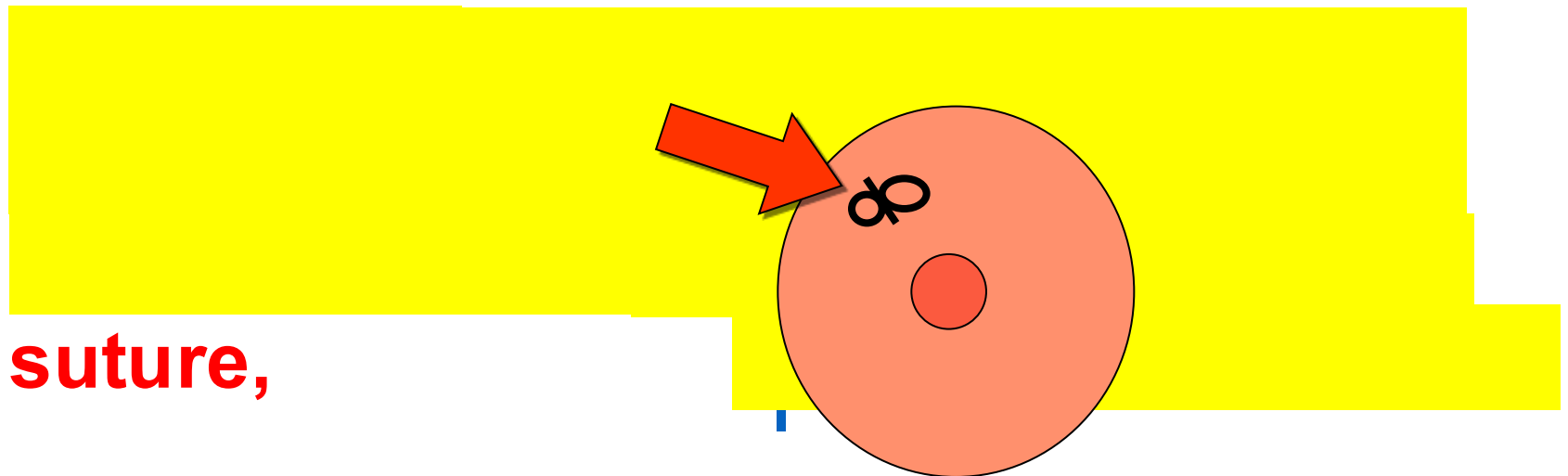
MLO



MANY YEARS POST-SURGERY

EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

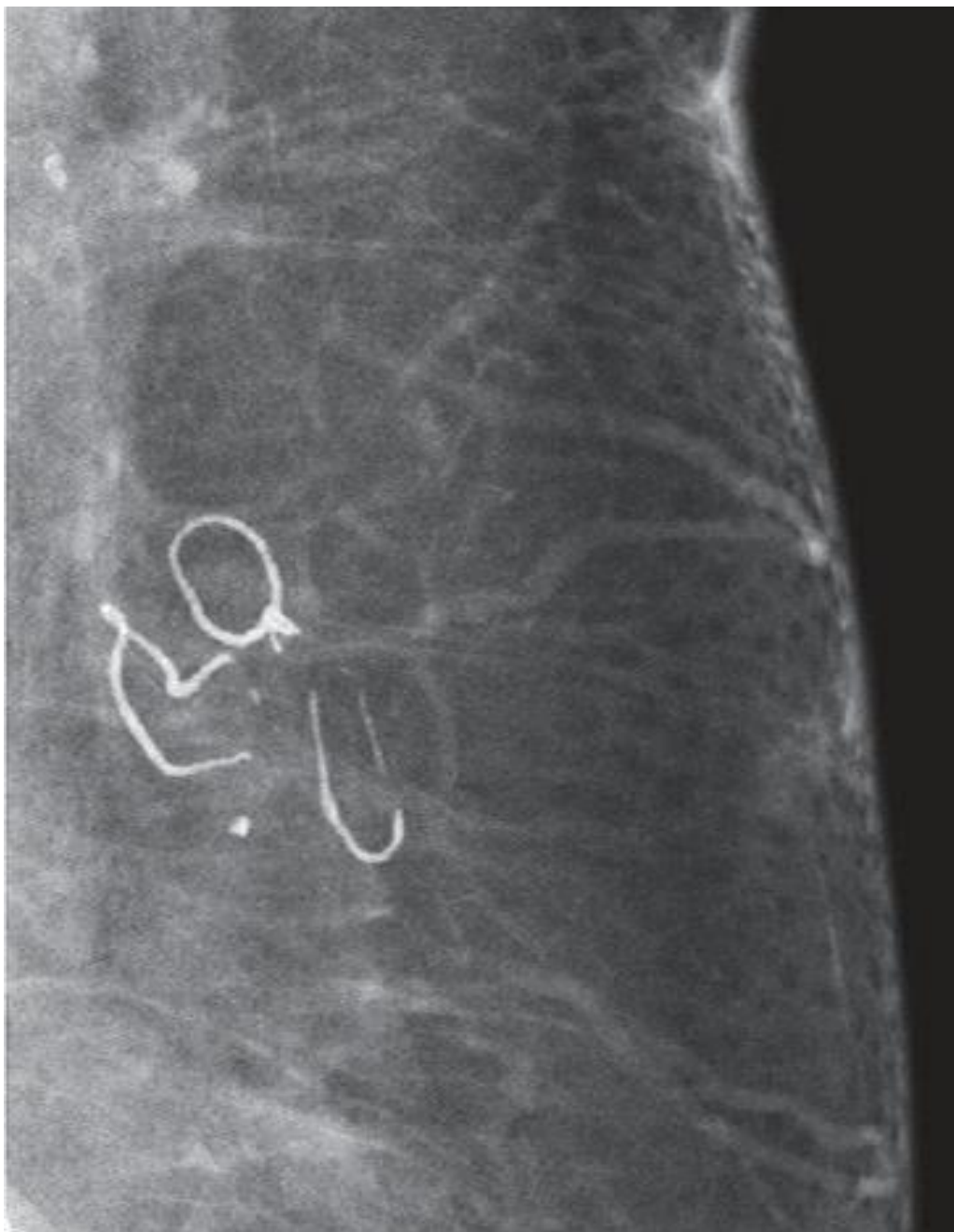
TYPICALLY BENIGN:



suture,

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

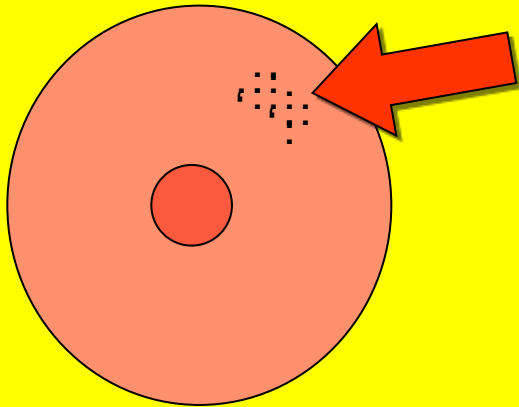




EVALUATING MICROCALCIFICATIONS: THE BI-RADS LEXICON

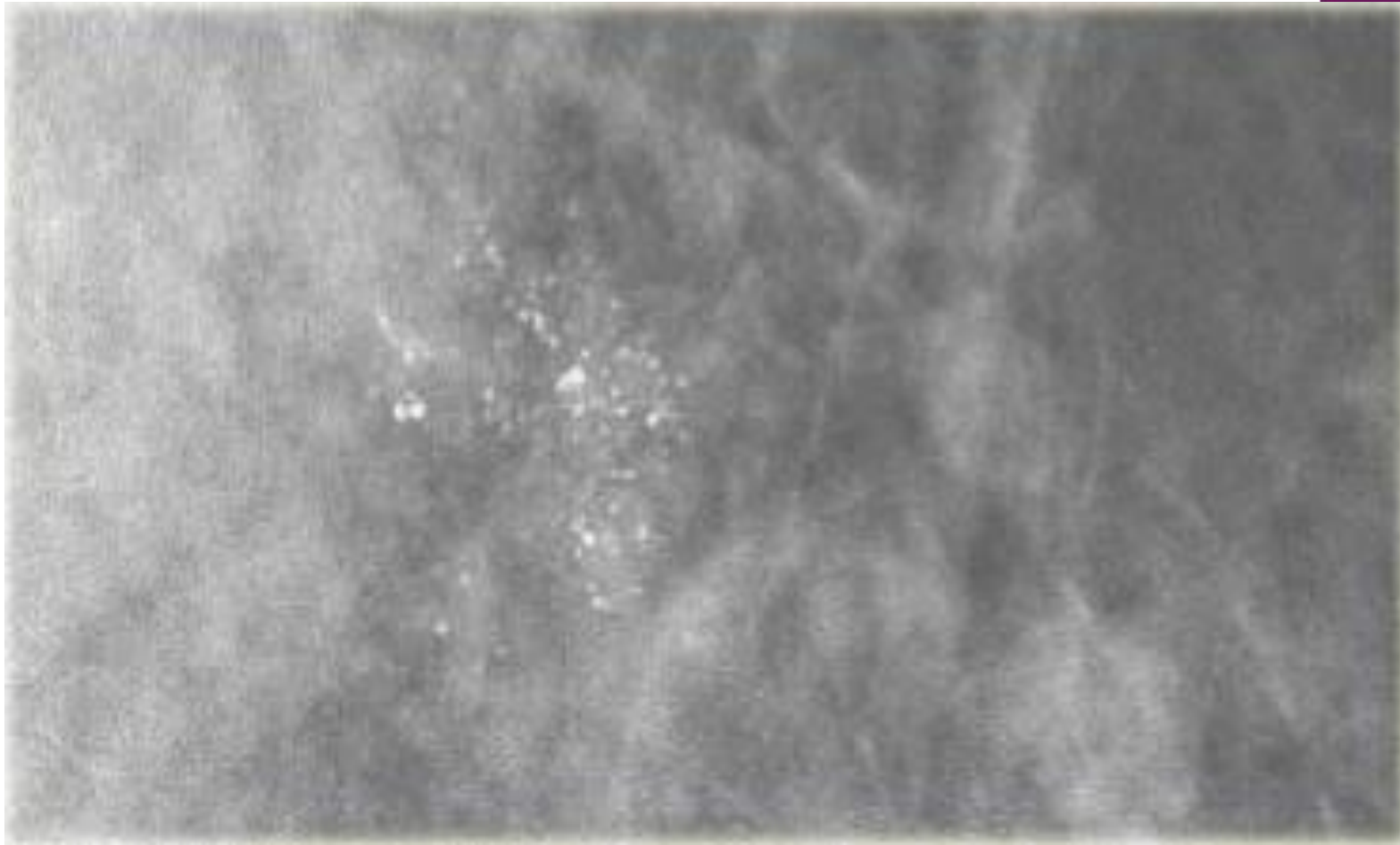
INTERMEDIATE CONCERN:

1-Amorphous or indistinct

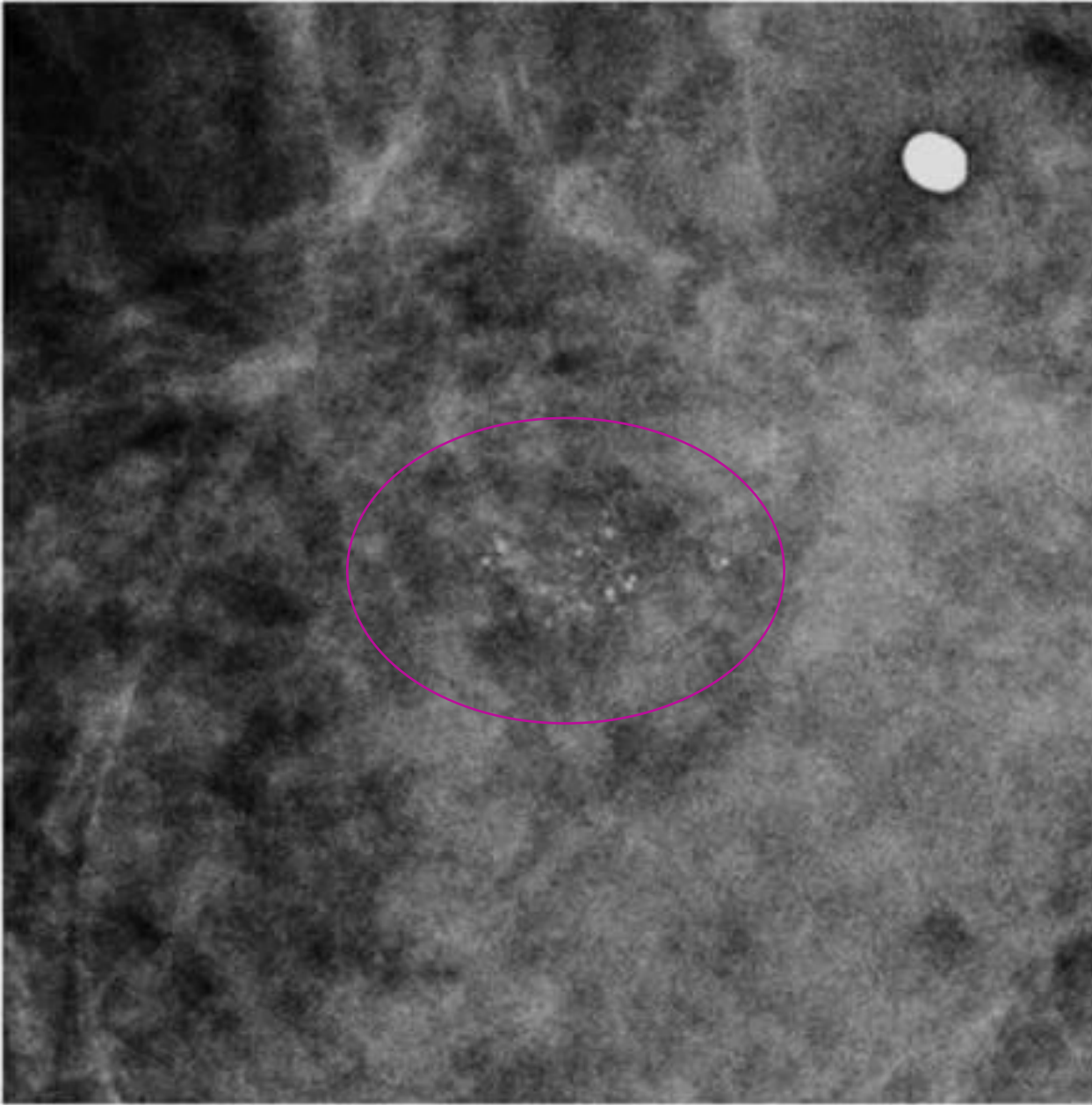


- Powdery, tight clusters
- Low-grade DCIS
- Hard to distinguish from sclerosing adenosis and fibrocystic changes

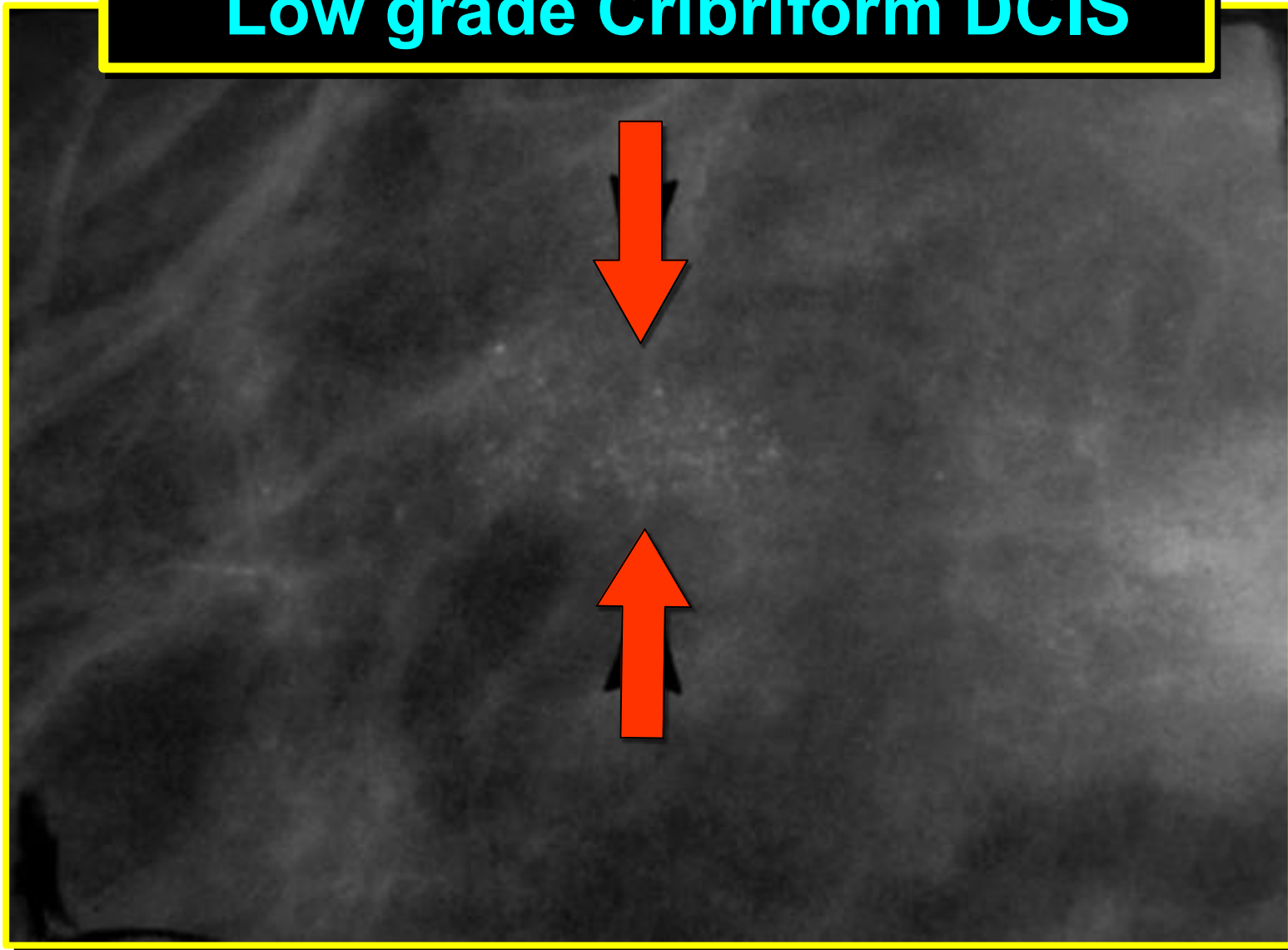
Amorphous calcifications (BI-RADS 4) Biopsy: fibrocystic changes



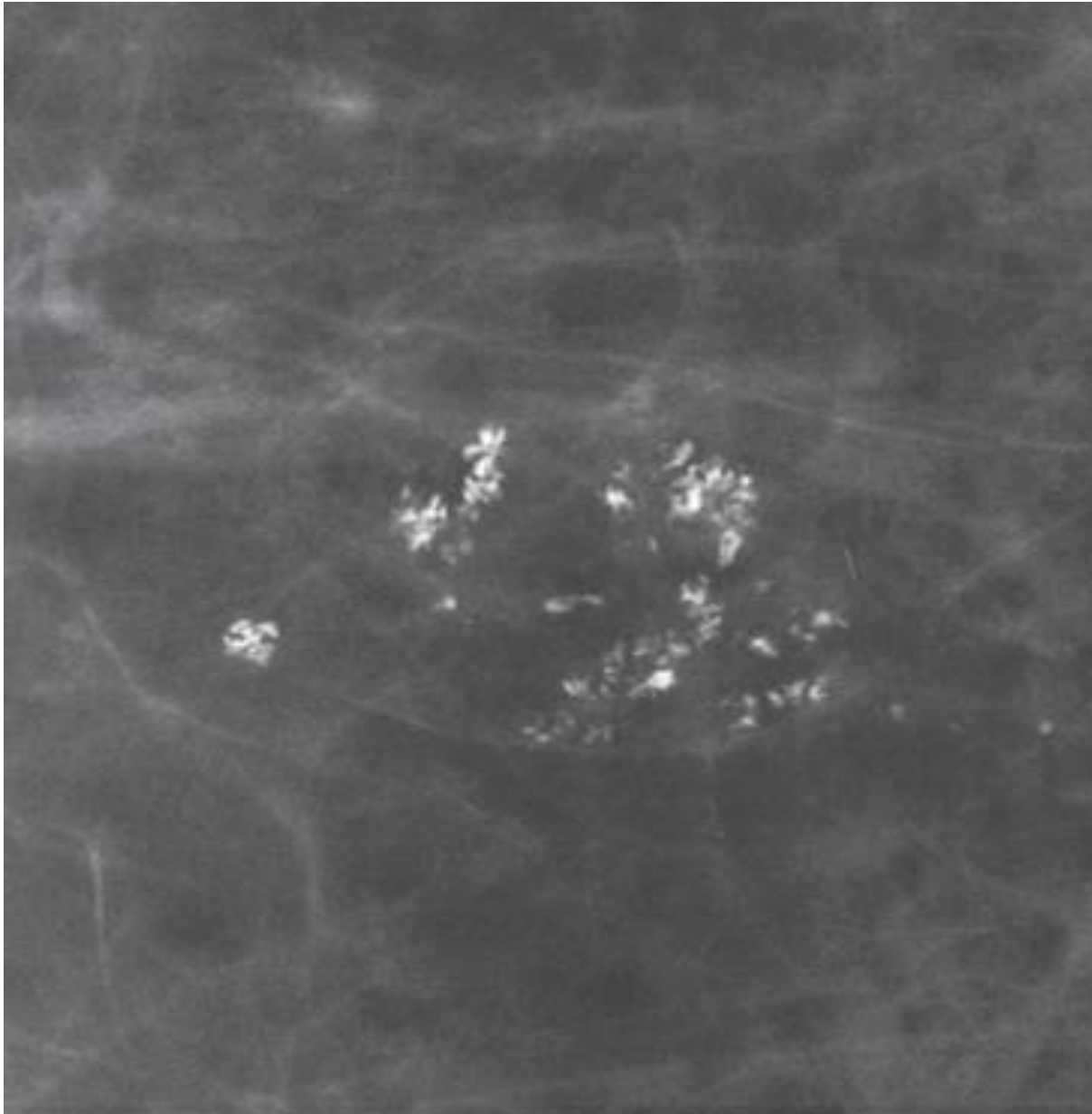
Cluster of amorphous microcalcifications Bx: DCIS



Low grade Cribriform DCIS

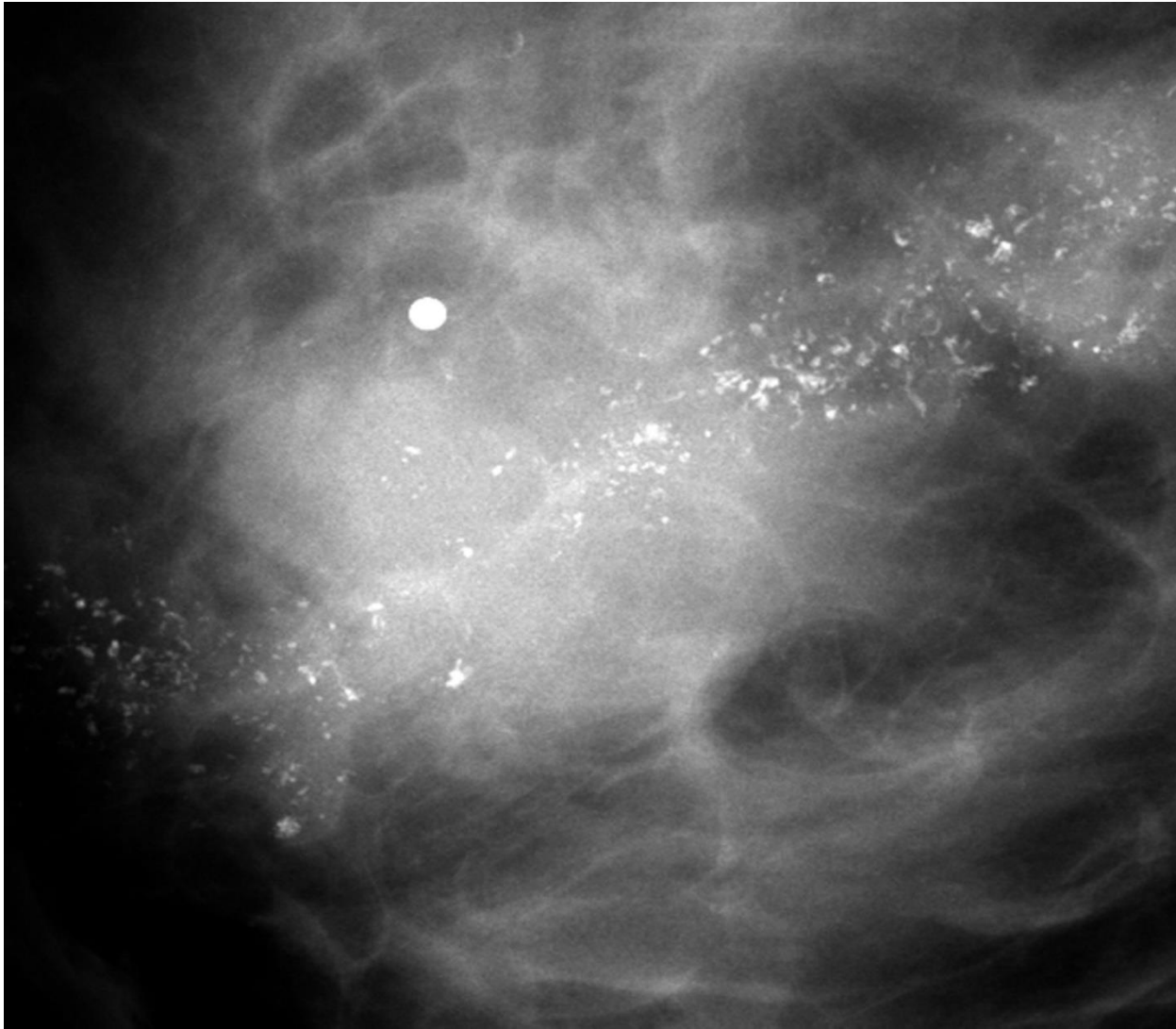


2- Coarse heterogenous calc. Dx:Fibroadenoma

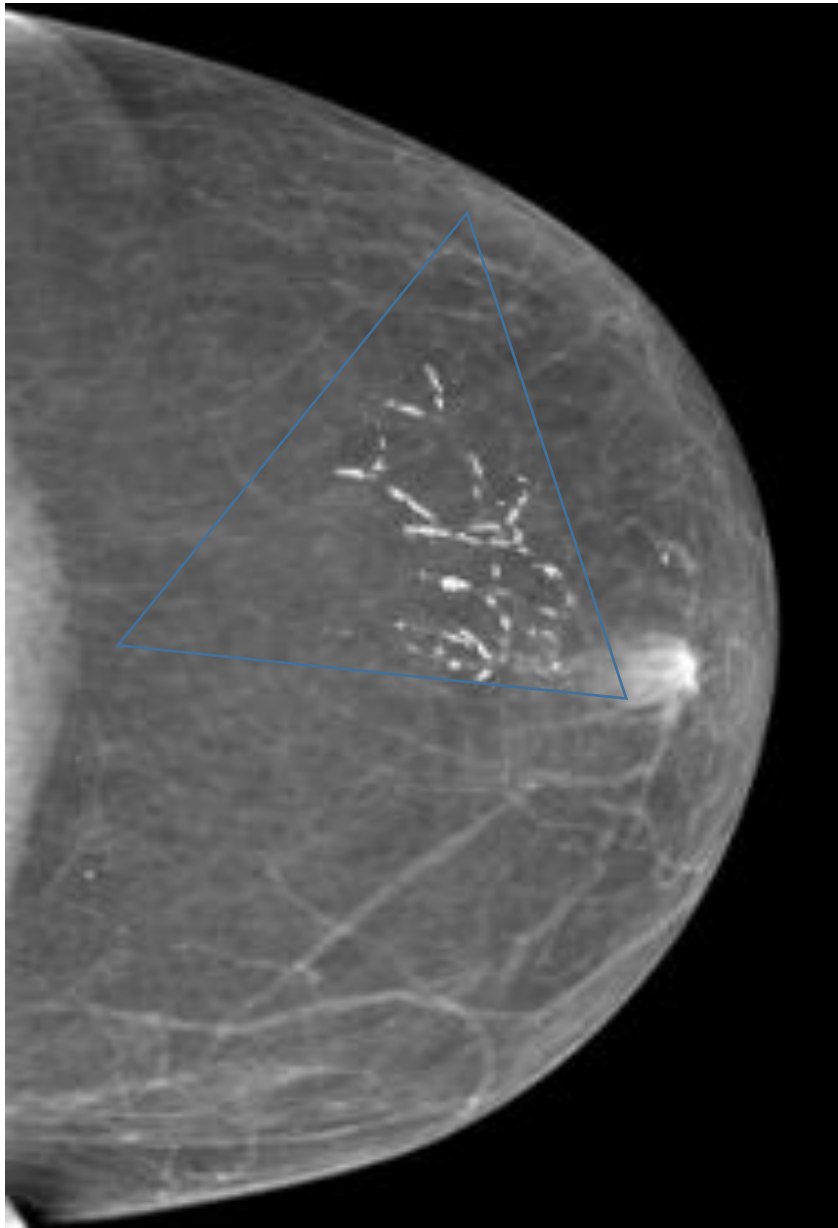


Malignant calcifications

1- Fine pleomorphic microcalcifications <1 mm : different shapes, sizes and densities



2- Fine Linear or Fine Linear Branching



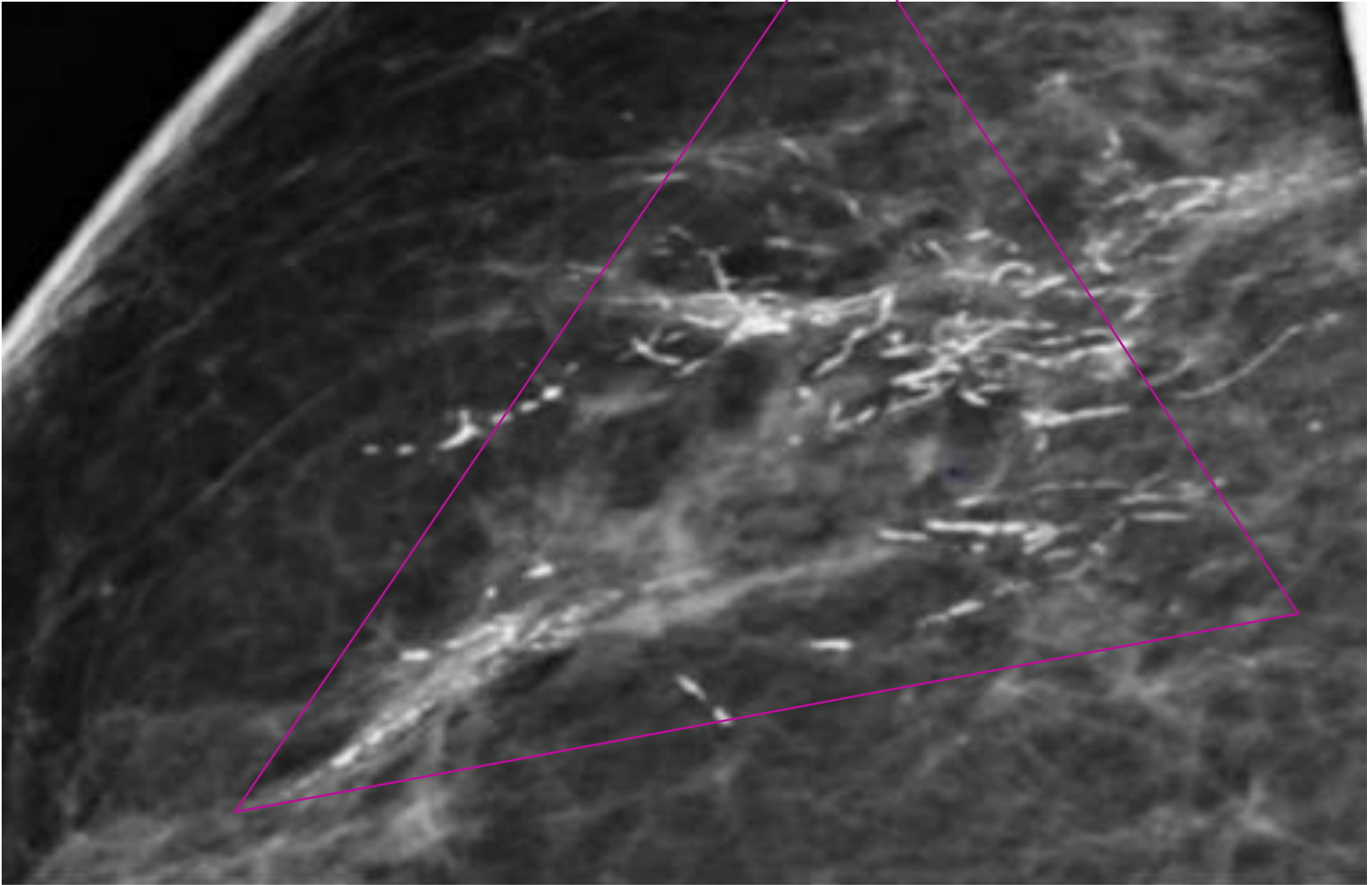
calcifications in a segmental distribution.

Some have a linear shape and some have a branching morphology.

This is highly suggestive of malignancy (BI-RADS 5).

MALIGNANT CALCIFICATIONS

Linear and linear branching in segmental distribution
BI-RADS 5



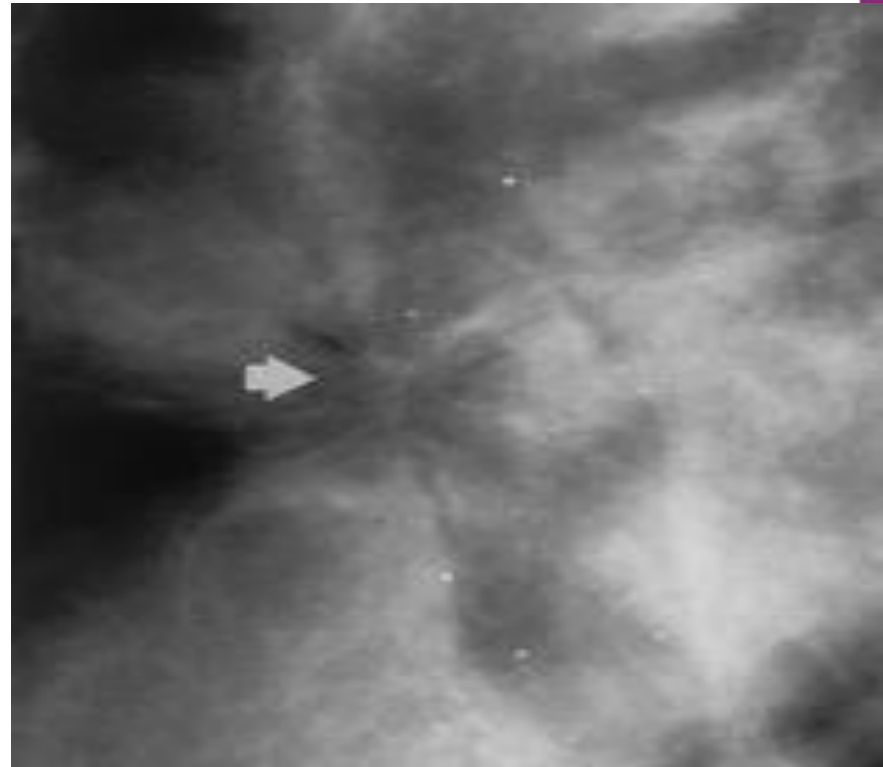
SECONDARY SIGNS OF CANCER ON MAMMOGRAPHY

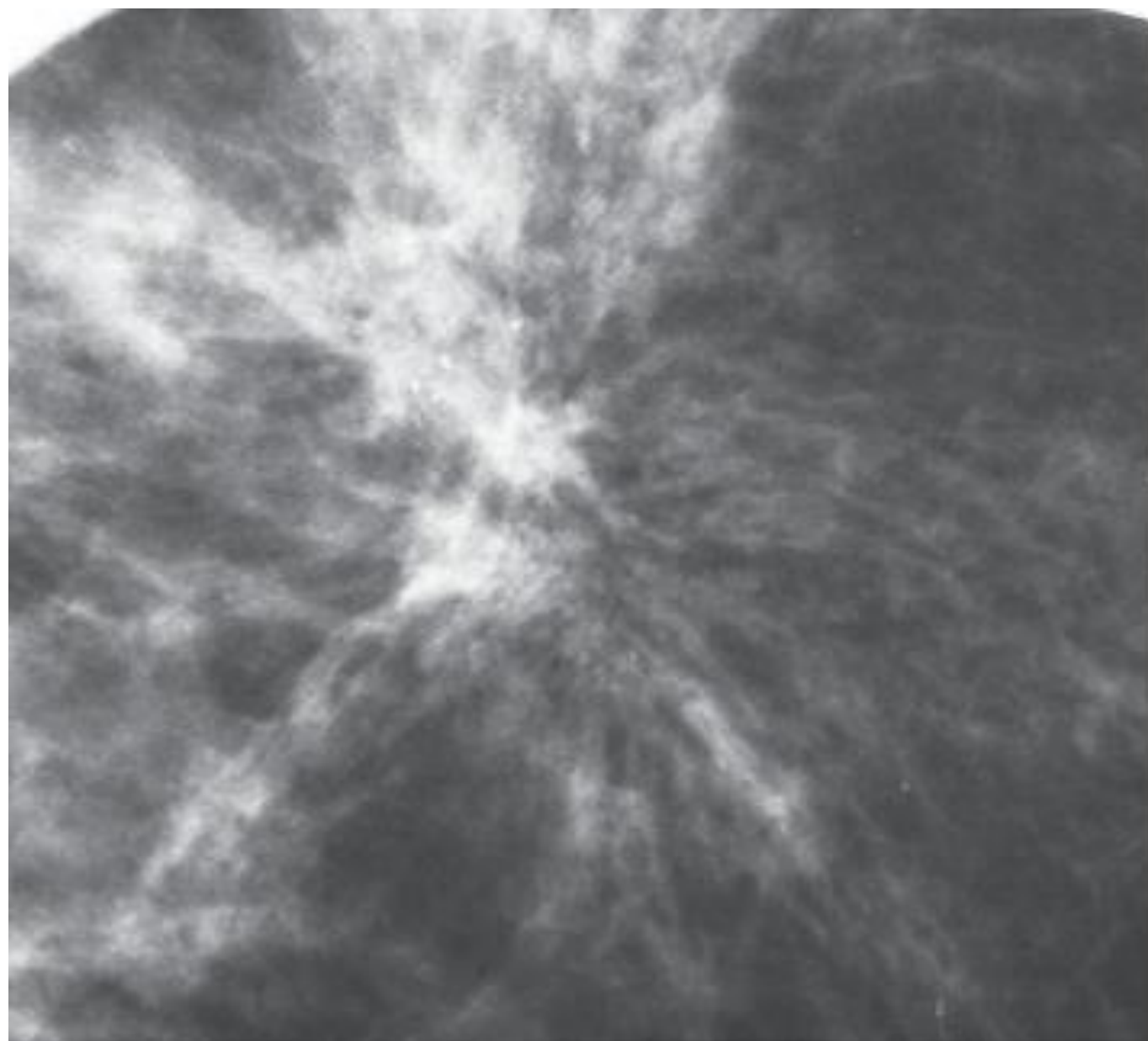
- ◉ Nipple Inversion
- ◉ Architectural Distortion
- ◉ Skin Thickening
- ◉ Axillary Adenopathy
- ◉ Skin Retraction
- ◉ Tissue Asymmetry
- ◉ Developing “Neodensity”

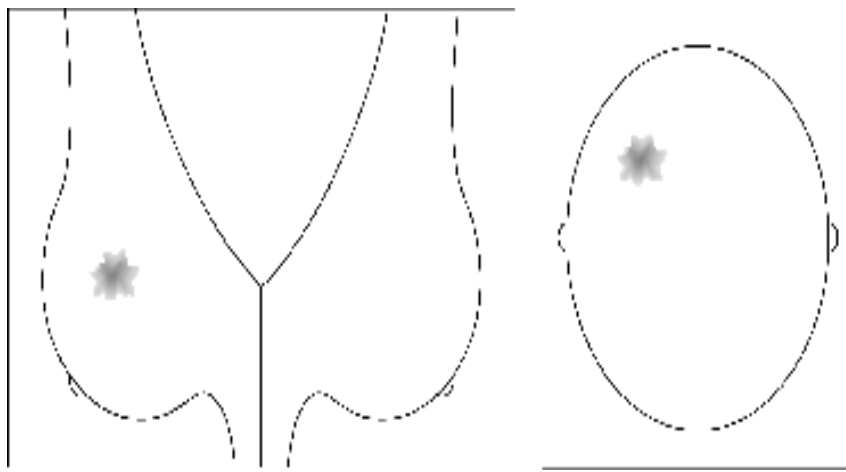
ARCHITECTURAL DISTORSION

ML view

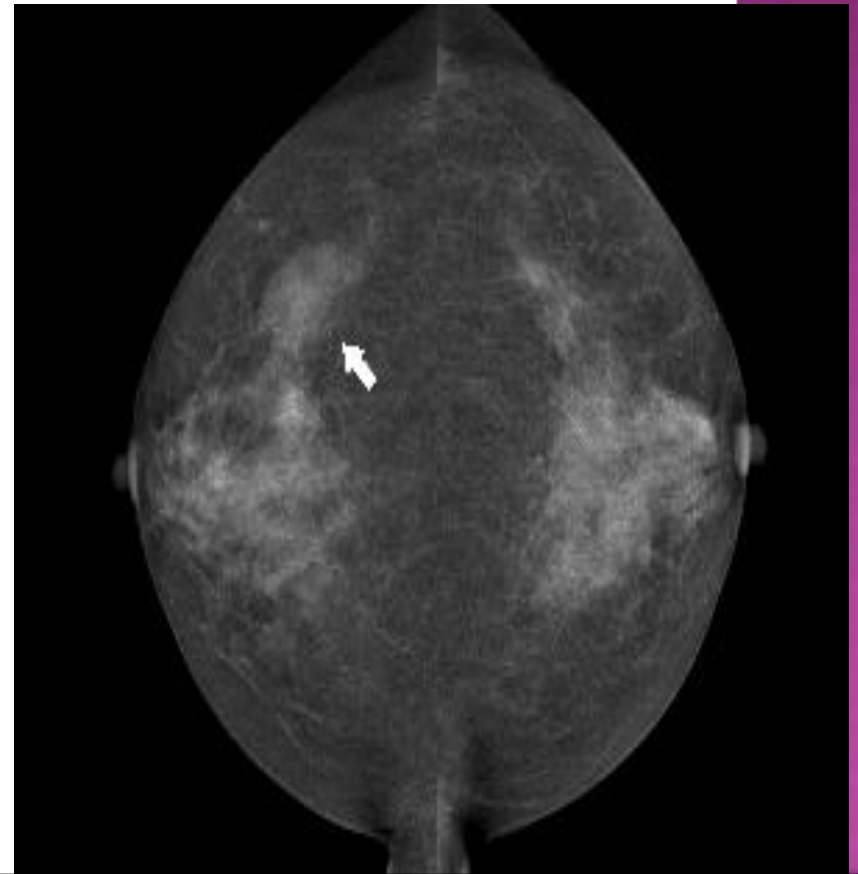
CC view





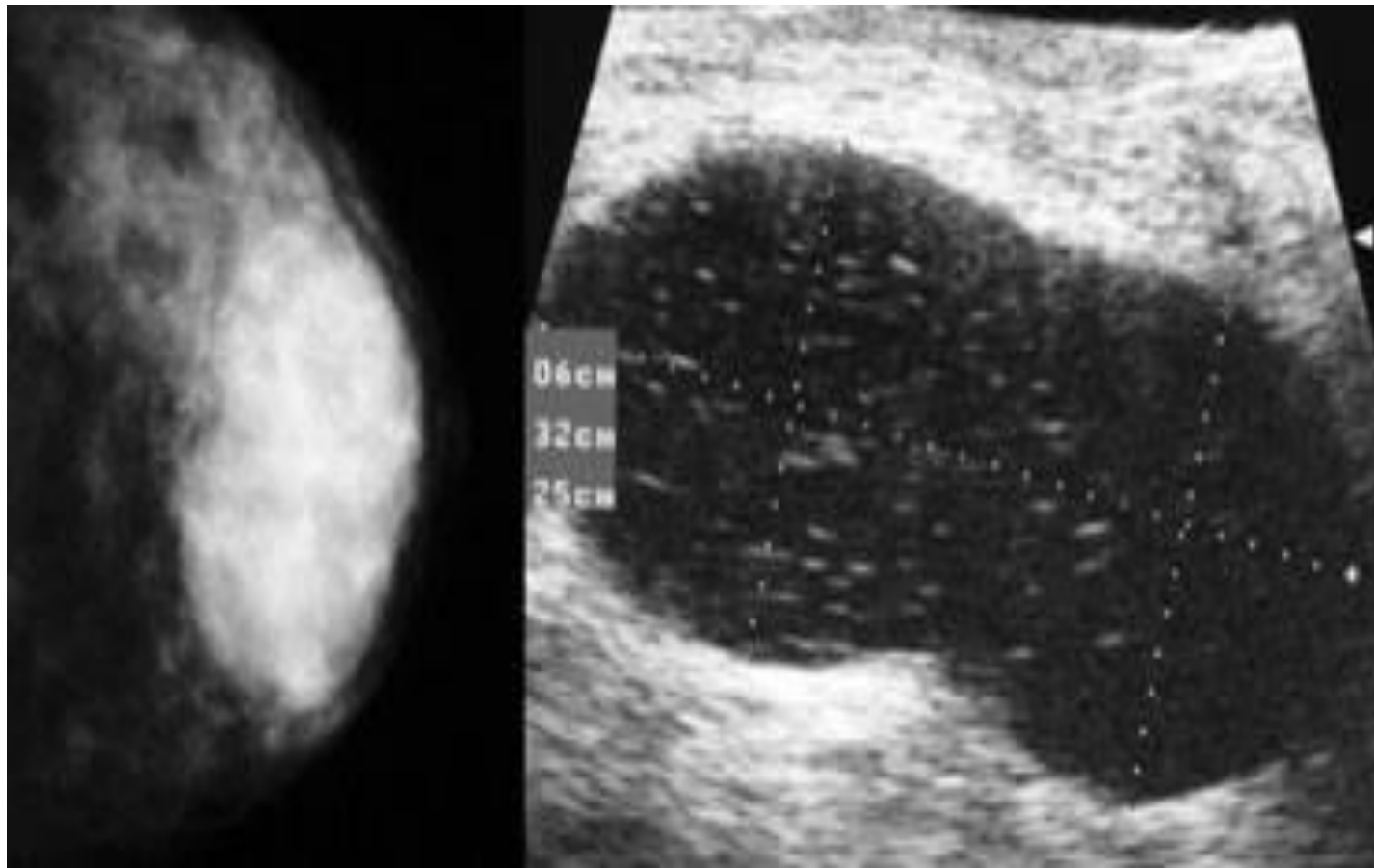


Focal asymmetry

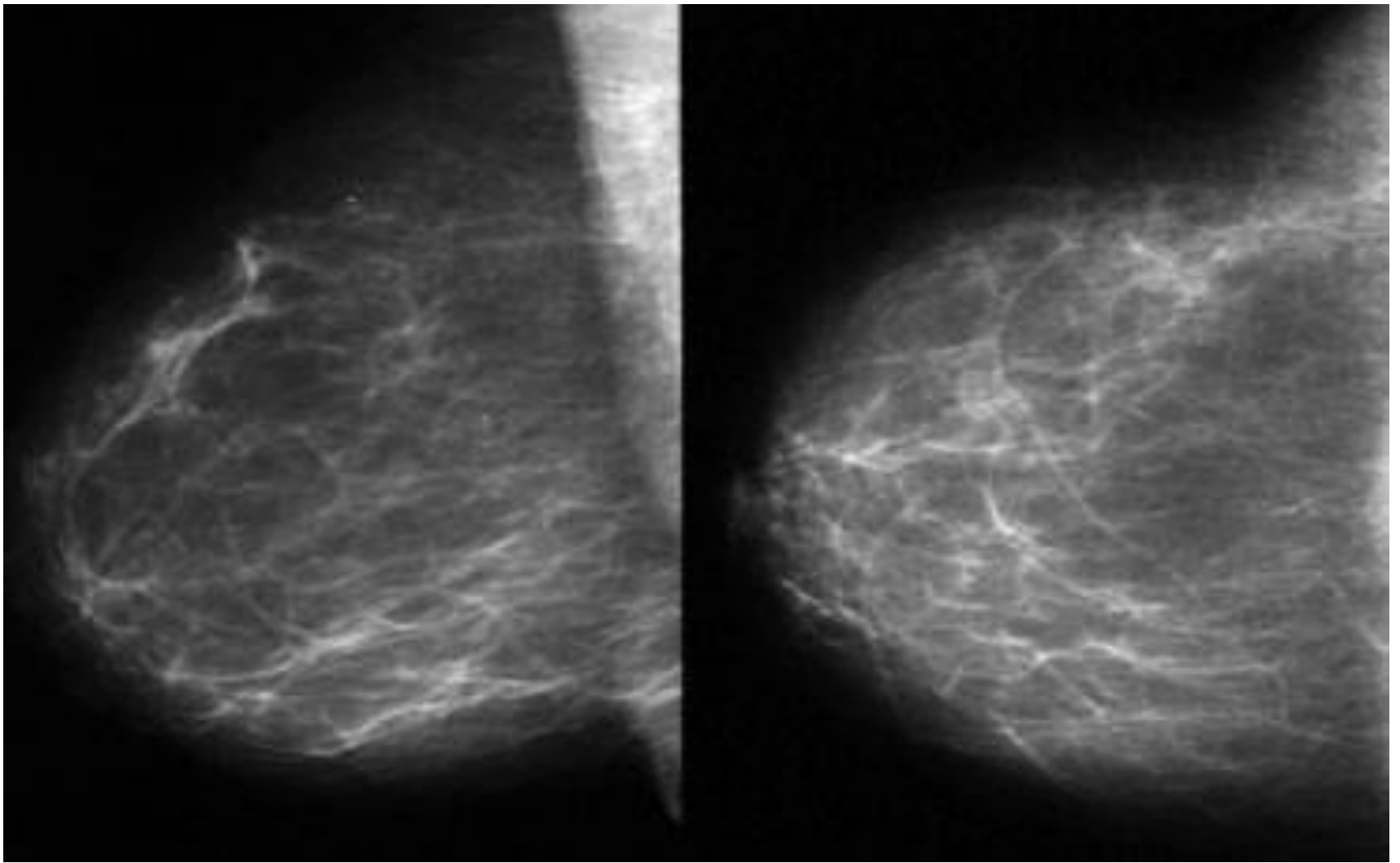


Final Assessment Categories

- 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**



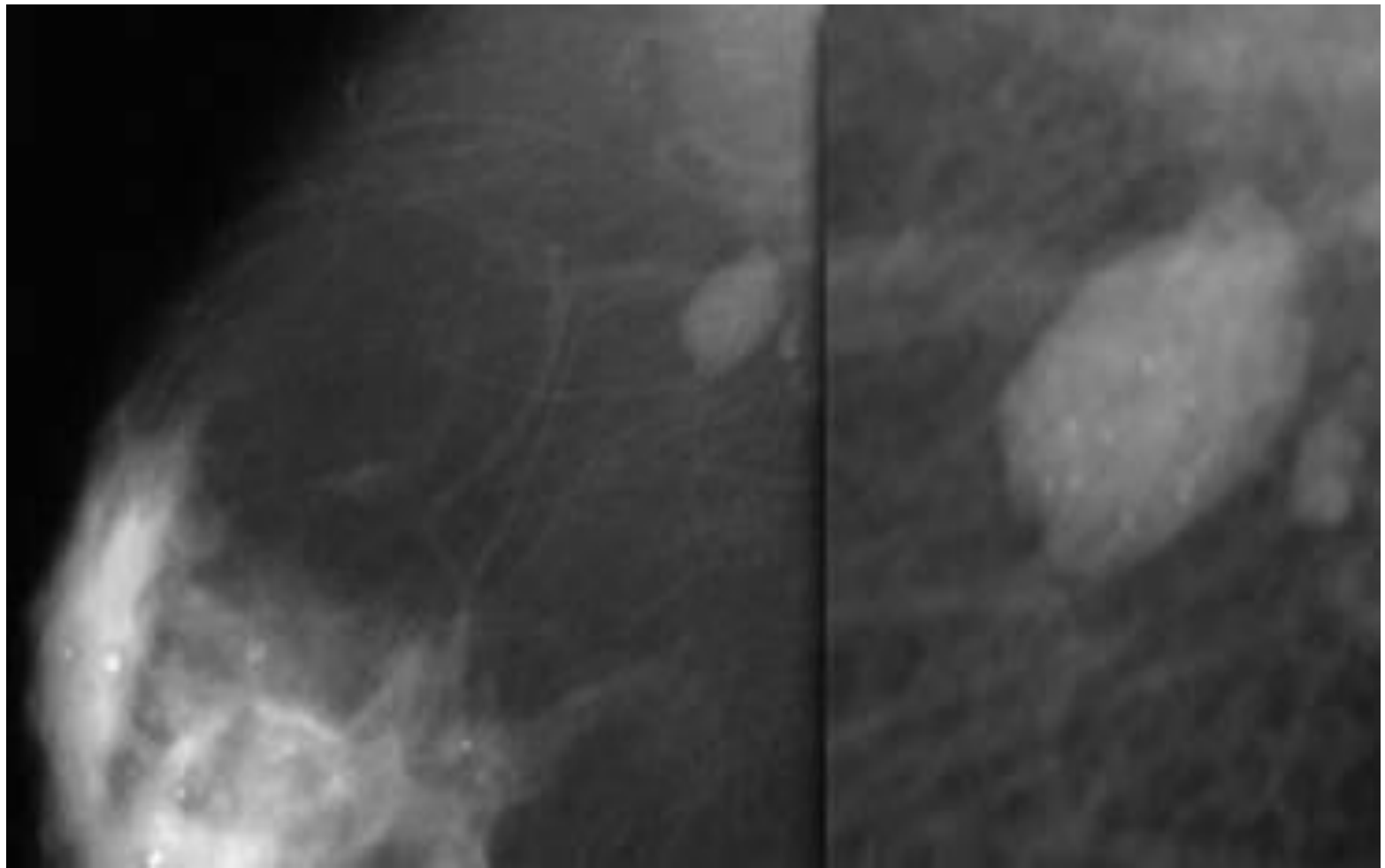
BI-RADS 0 at screening.
Additional ultrasound after referral was
performed allowing final assessment. (BI-
RADS 2)



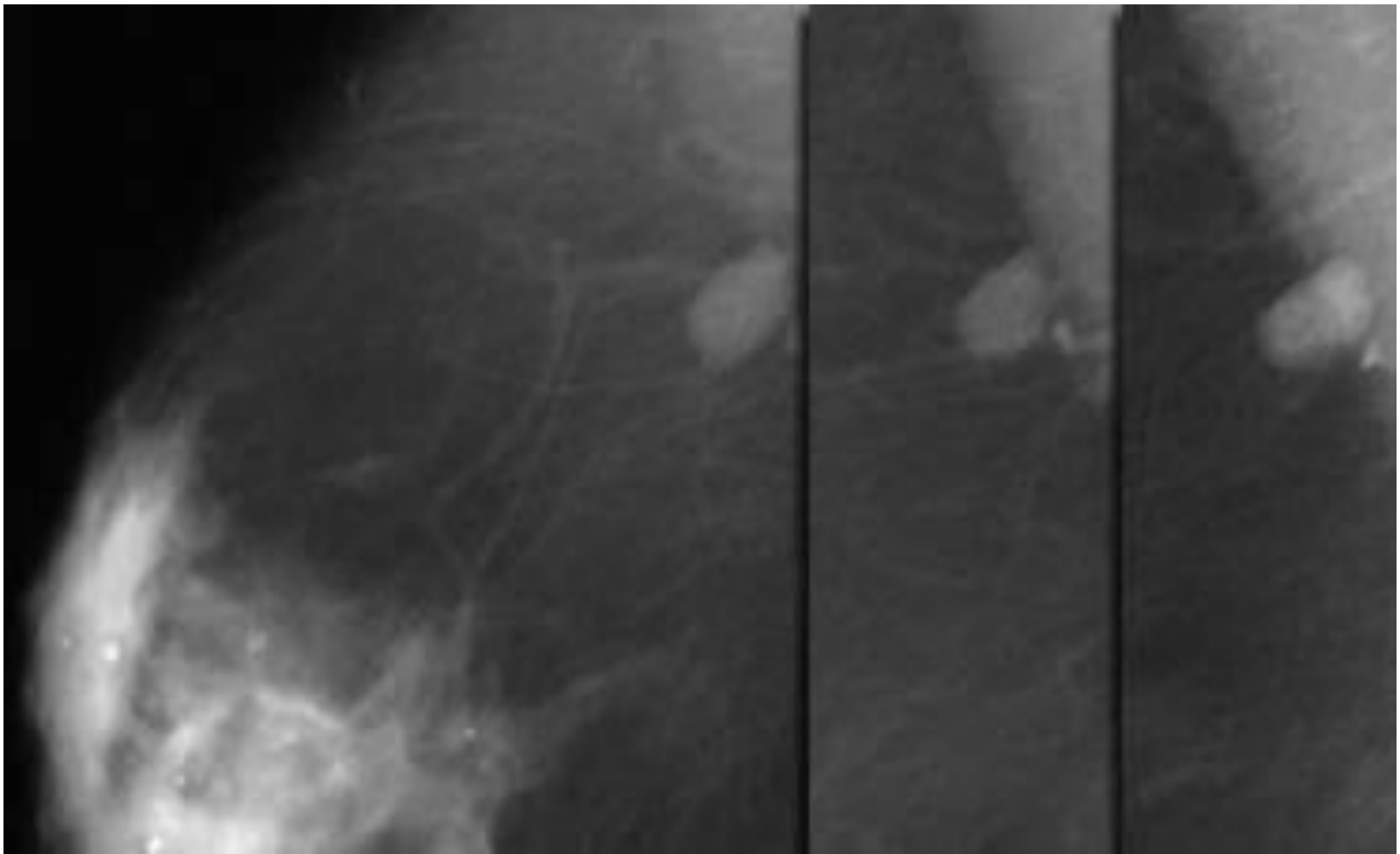
BI-RADS Category 1



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

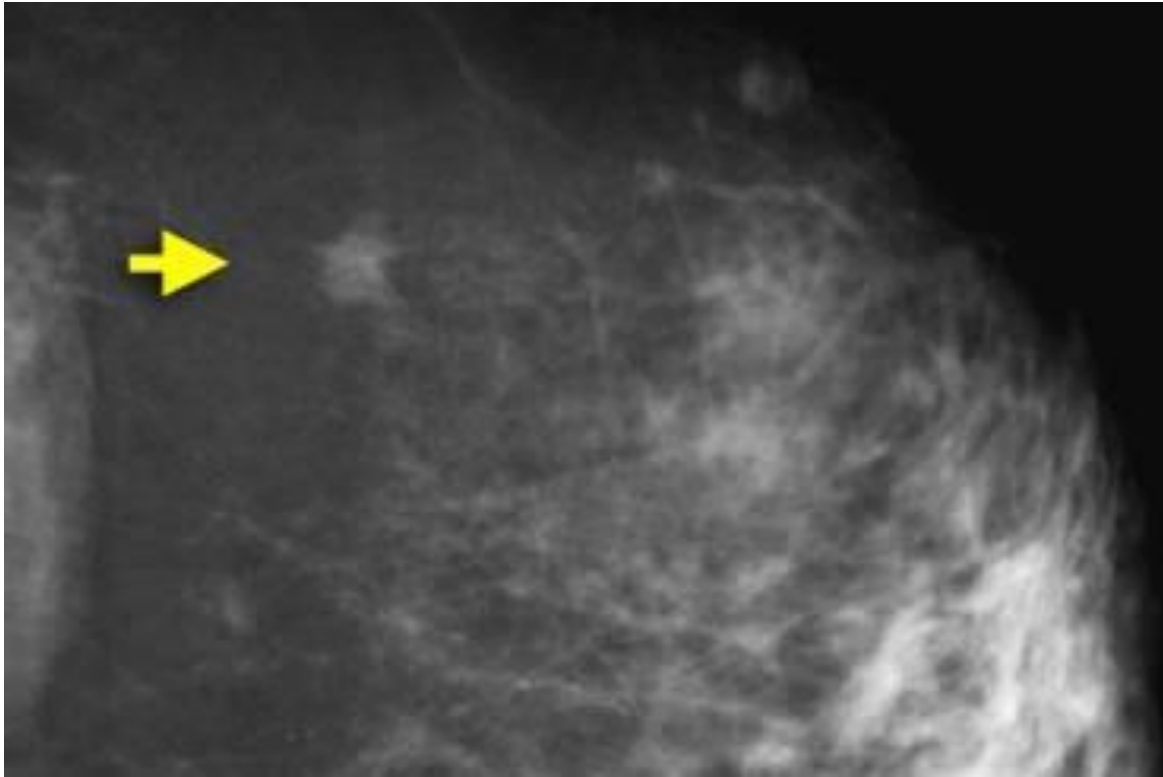


BI-RADS 3. Non-palpable sharply defined lesion with a cluster of punctate calcifications.

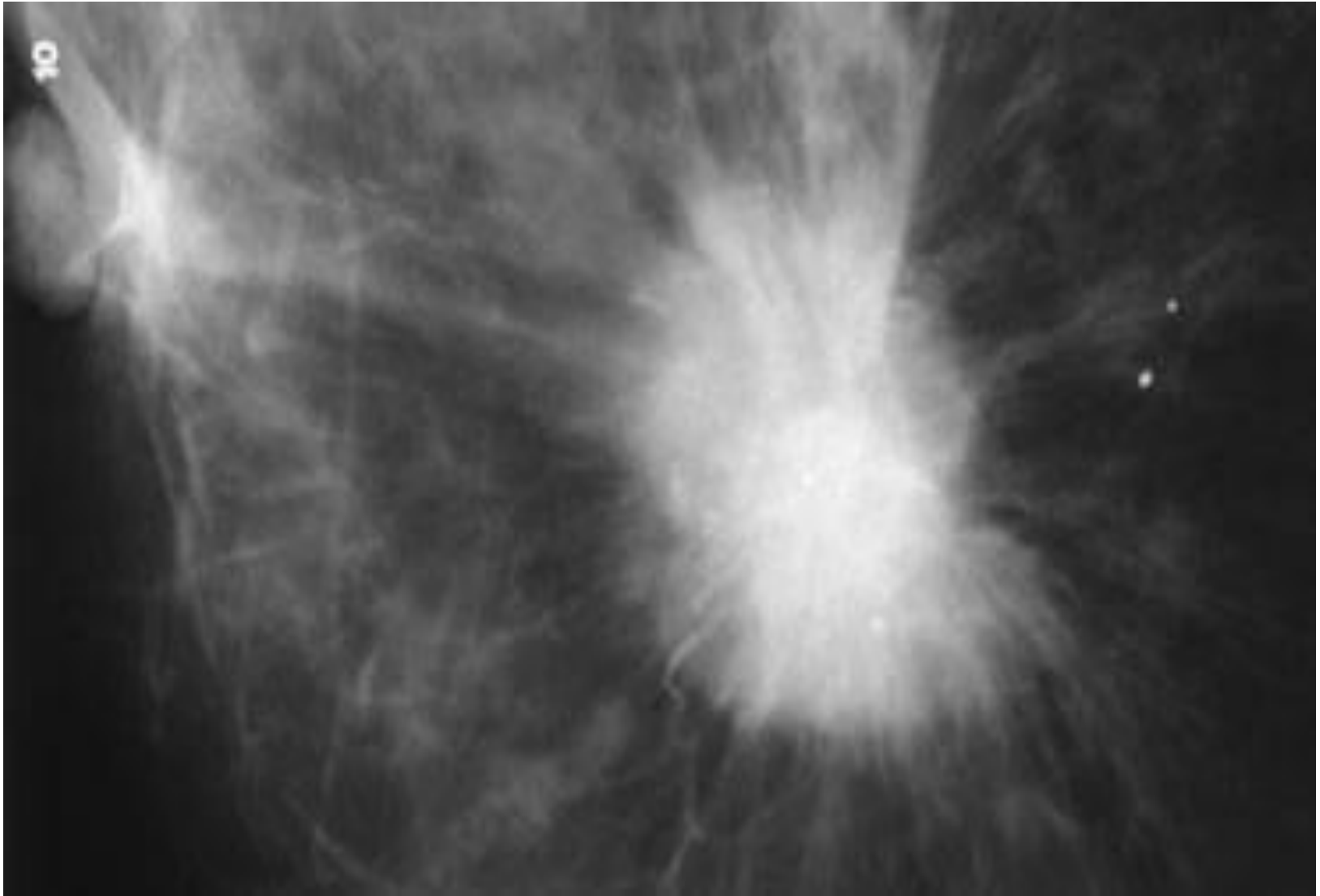


Follow up at 6, 12 and 24 months showed no change. Final assessment was changed to a Category 2.

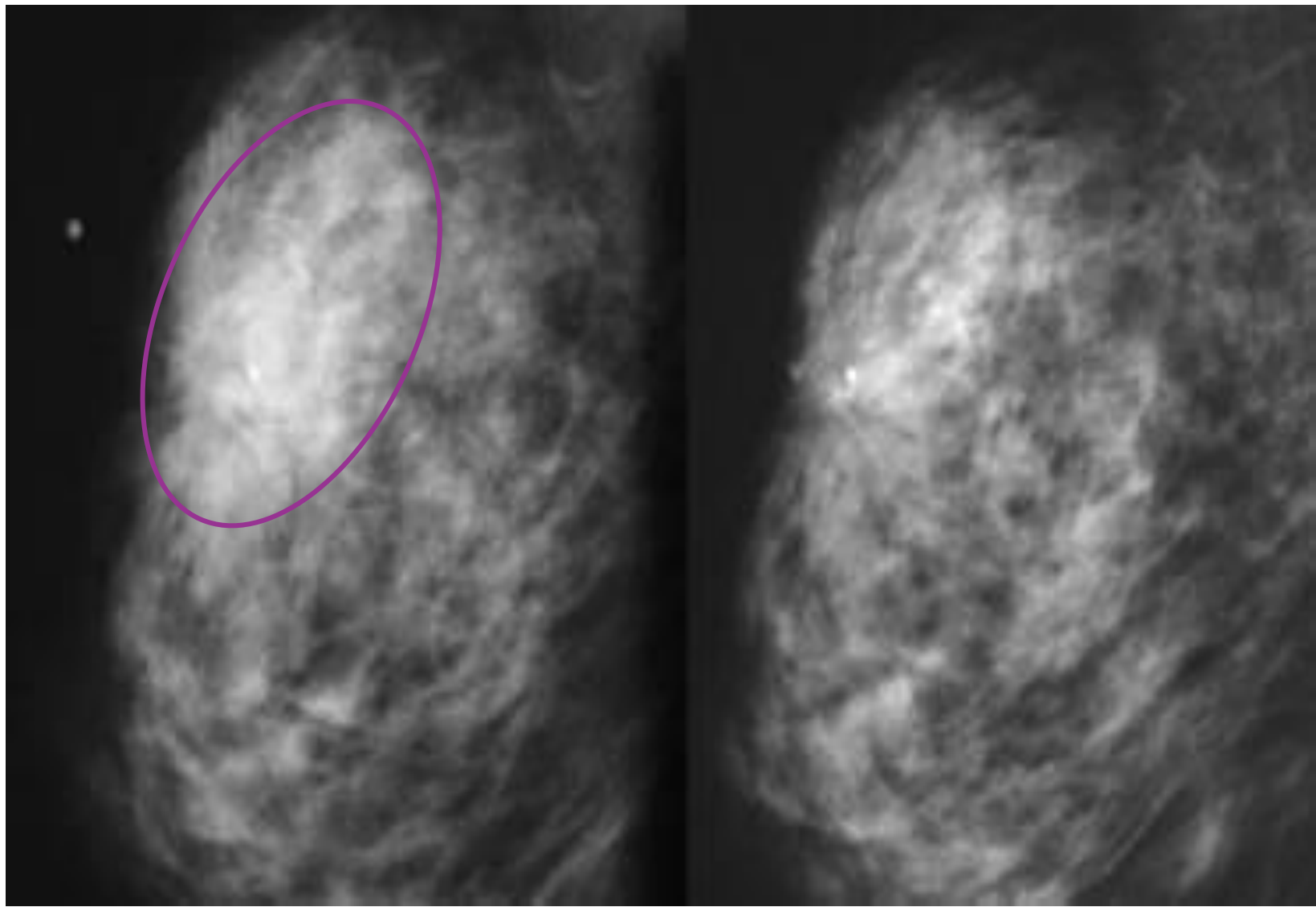
BI-RADS 4 is reserved for findings that do not have the classic appearance of malignancy but have a wide range of probability of malignancy (2 - 95%).



Category 4: There is an abnormality suspicious for malignancy, but a benign lesion, although unlikely, is a possibility (for instance a sclerotic or aged fibroadenoma).



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

1. *Journal of the American Medical Association*, 2000; 283: 2689-2693.

