BRANT AND HELMS

INTRODUCTION TO BREAST IMAGING

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2018

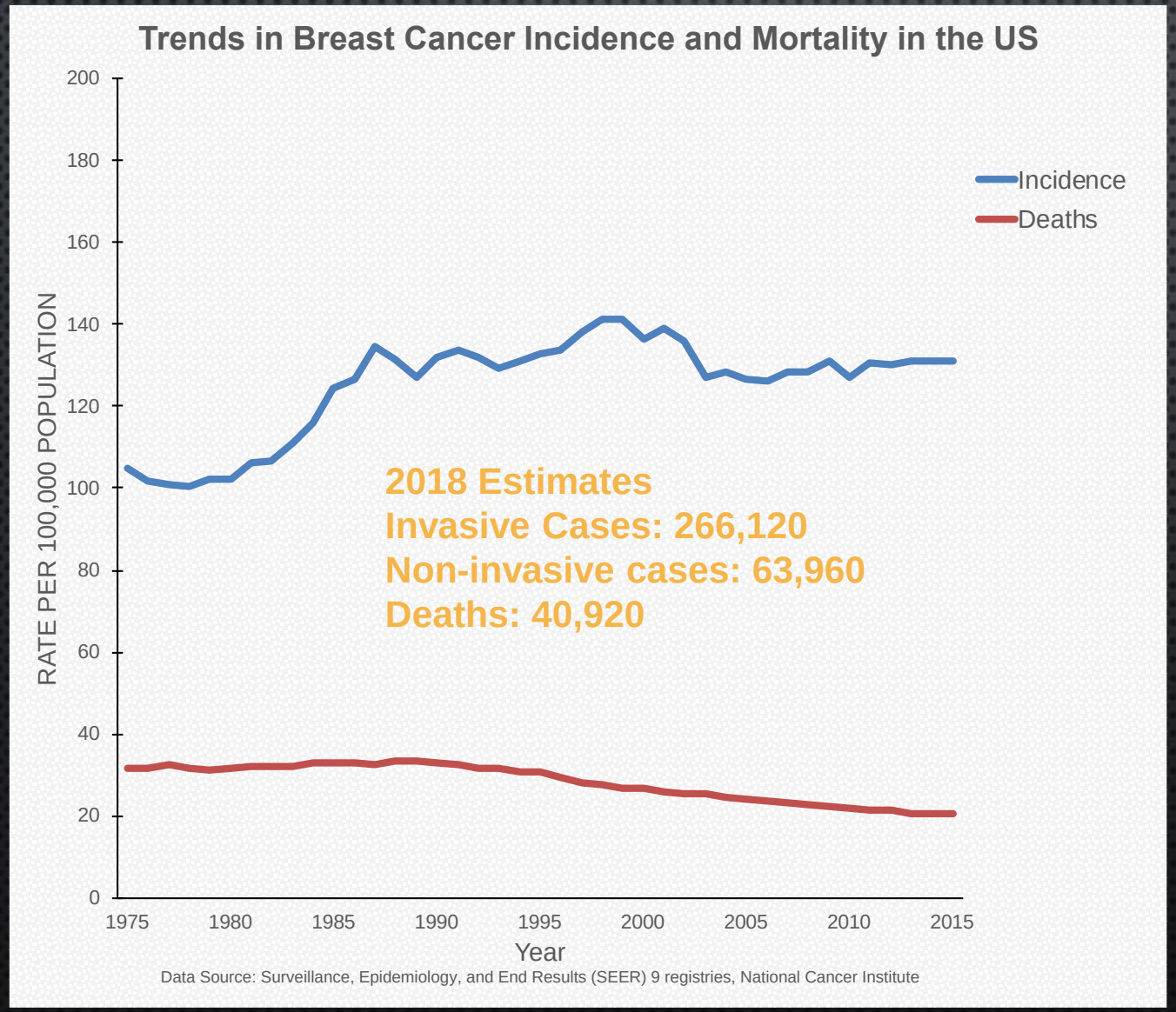
OBJECTIVES

- Breast imaging rotation
- Breast cancer figures
- Breast anatomy
- Review of BIRADS lexicon for mammography and ultrasound
- Cases – common breast lesions and imaging findings

BREAST IMAGING ROTATION

- Location:
  - Lee Bell – diagnostics, biopsies, and localizations
  - Dana Farber – diagnostics
- Resources: BIRADS Atlas, ACR Appropriateness criteria, Core Radiology
- Physics modules: Projection X-ray Imaging → "Mammographic Imaging Quality and Dose" and "Radiographic and Mammographic Systems"
- Contact: Sona Chikarmane MD

BREAST CANCER FACTS AND FIGURES



1 in 8 women will develop invasive breast cancer.

BRCA1: 55-65% lifetime risk
BRCA2: 45% lifetime risk

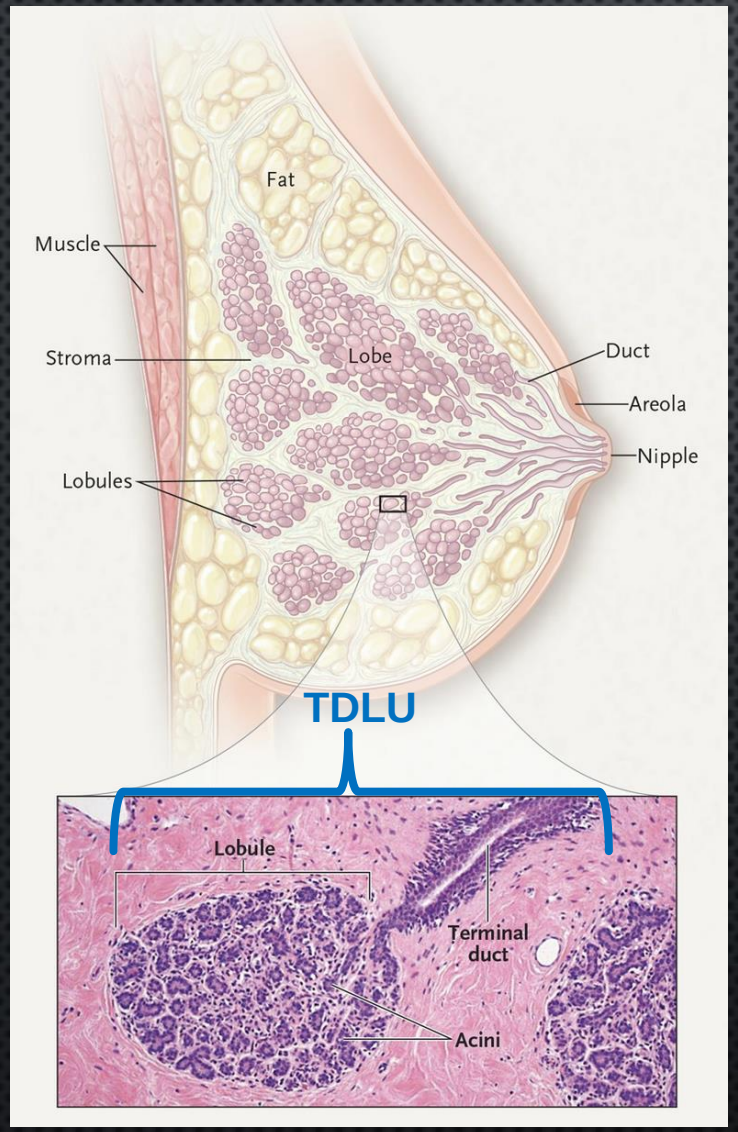
BREAST CANCER MAMMOGRAPHY SCREENING RECOMMENDATIONS

Mammography is the only method of breast cancer screening proven to decrease mortality

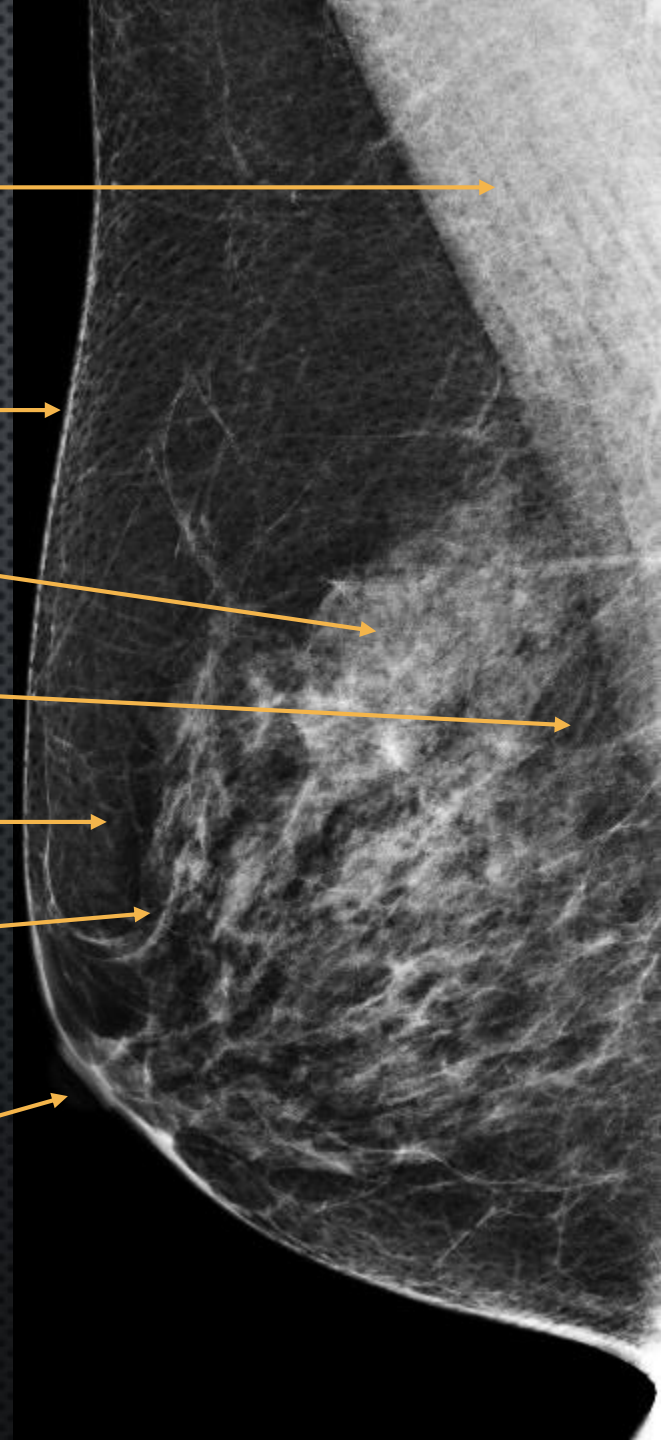
Recommended **annual screening** starting at:

- Age 40 for general population
- Age 25-30 for BRCA carriers and first degree relatives
- Age 25-30 or 10 yrs earlier than age of the affected relative at diagnosis (whichever is **later**)
  - For women with a first-degree relative with premenopausal breast cancer
- 8 yrs after radiation therapy but not before age 25
  - For those who received chest radiation between ages 10-30, usually for Hodgkins
- Any age for those with biopsy-proven breast cancer

BREAST ANATOMY

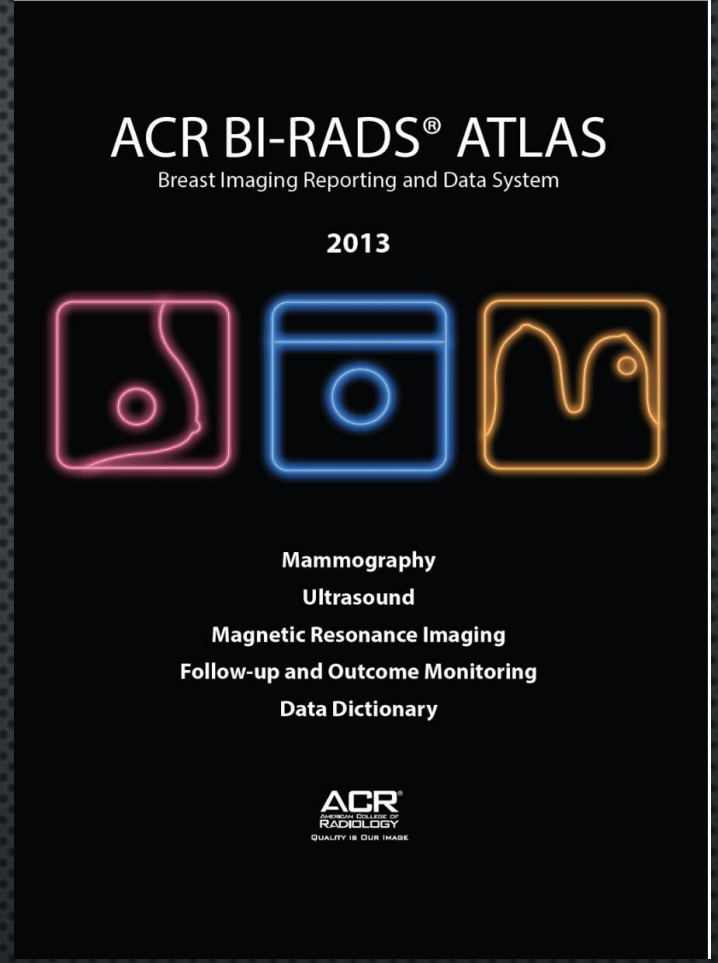


TDLU – Terminal duct lobular unit



BI-RADS

- Breast Imaging Reporting and Data System
- Published by the American College of Radiology
- Standardize reporting of mammography, breast US, and breast mri



BIRADS ASSESSMENT CATEGORIES

0 – Incomplete, need additional imaging evaluation

1 – Negative (normal breast)

2 – Benign (No follow up needed)

3 – Probably benign (0 - <2% risk of malignancy) – short term follow up

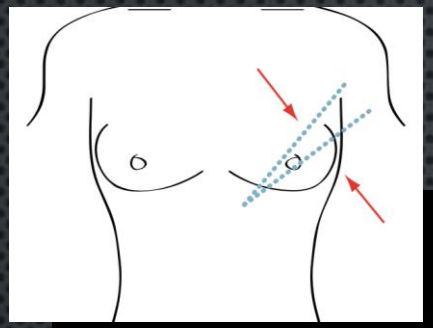
4 – Suspicious (2-95% risk)

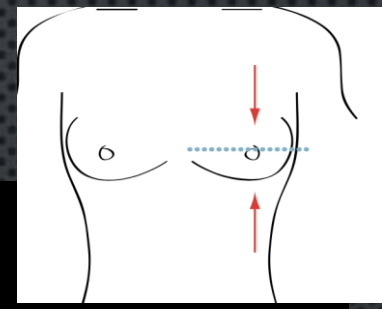
- 4A – Low suspicion (2-10%)
- 4B – Moderate suspicion (10-50%)
- 4C – High suspicion (50-95%)

5 – Highly suggestive of malignancy (>95% risk)

6 – Known biopsy-proven malignancy

STANDARD MAMMOGRAPHIC VIEWS





Mediolateral Oblique
MLO

Right breast

Left breast

Upper

Lower

Craniocaudal
CC

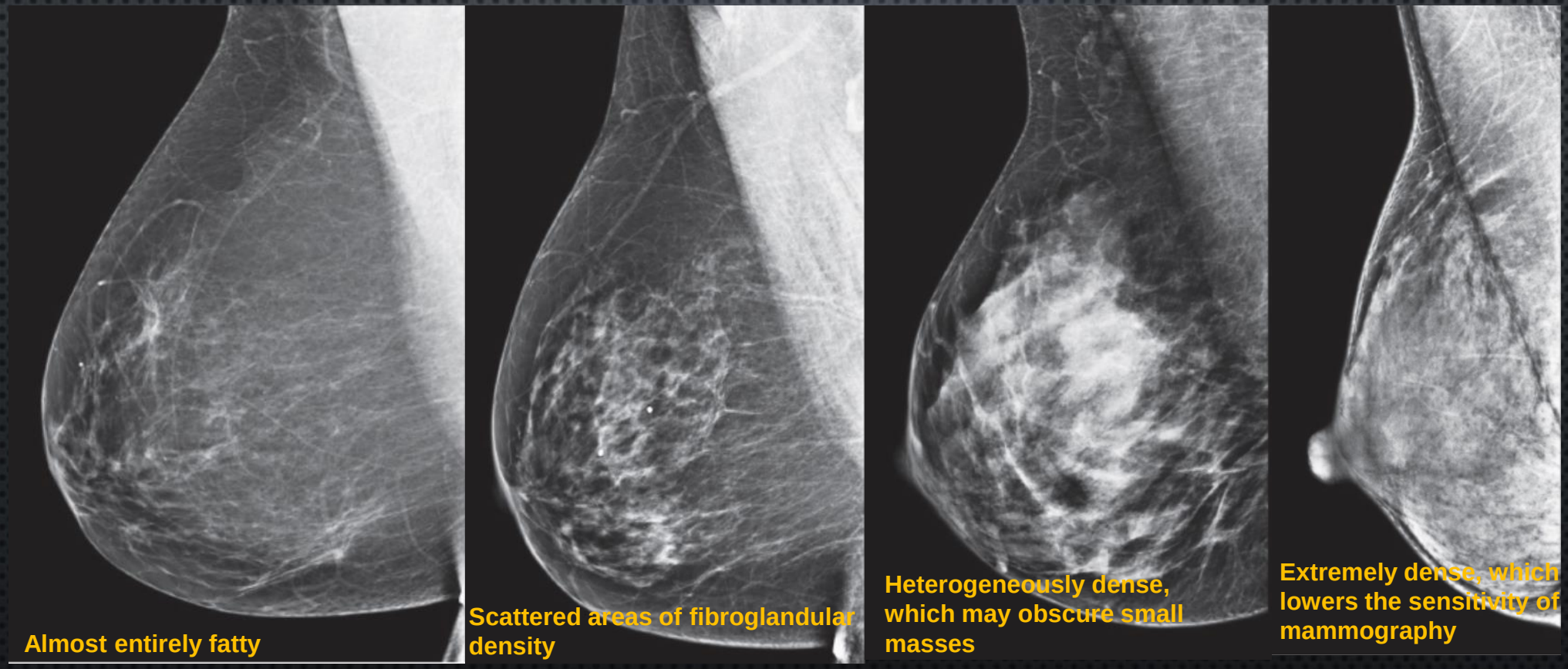
Right breast

Left breast

Outer

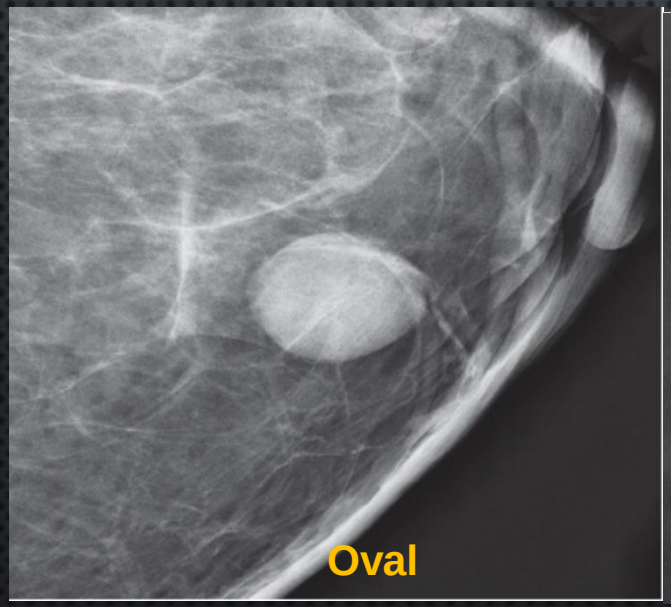
Inner

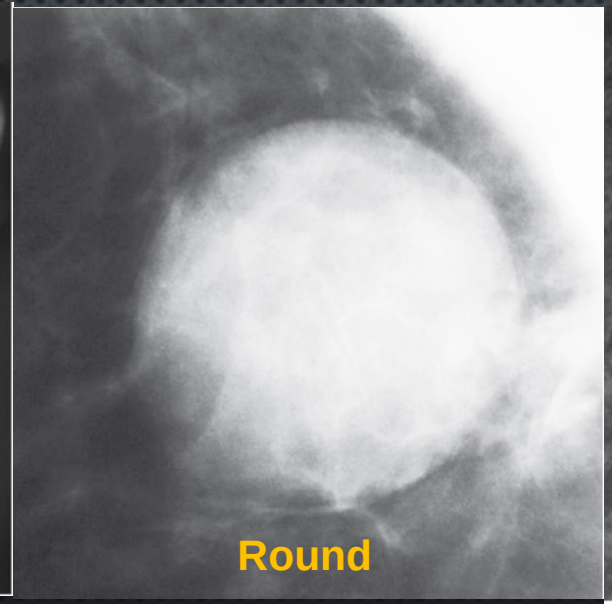
BREAST COMPOSITION

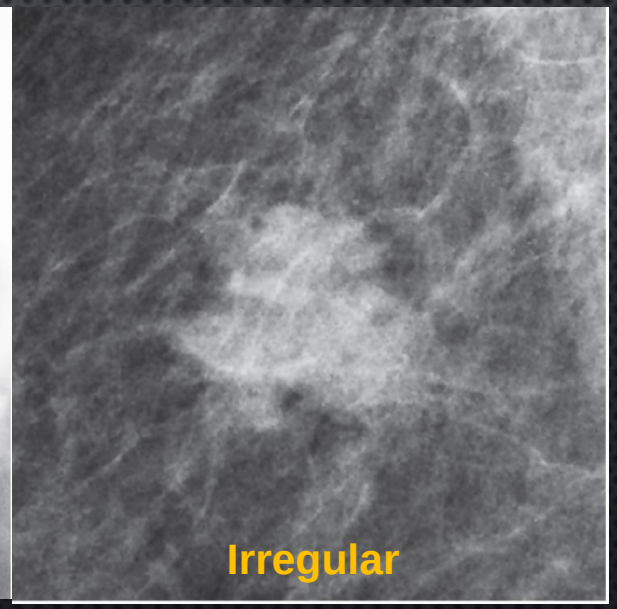


MASSES – **SHAPE** /MARGIN/DENSITY

Mass: Space occupying 3D lesion seen in two different projections

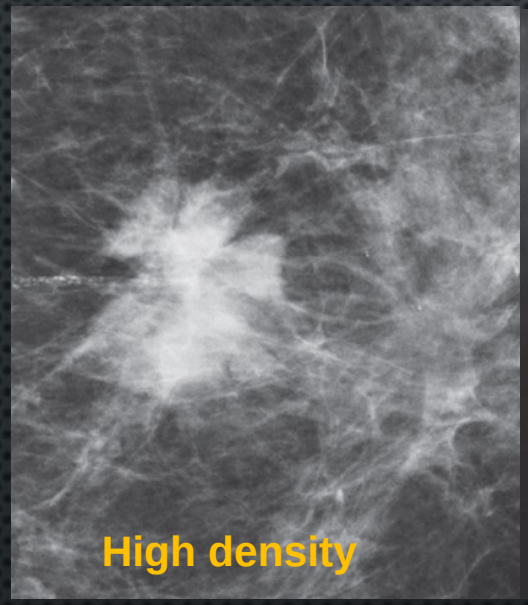




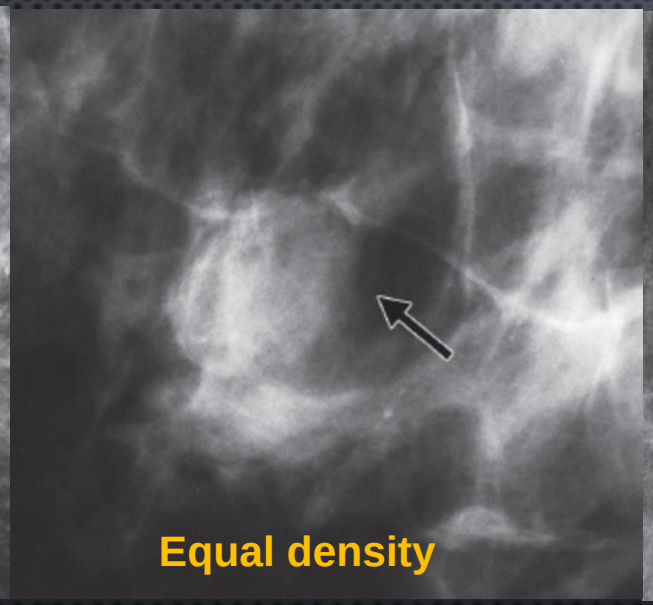


MASSES – SHAPE /**MARGIN**/DENSITY

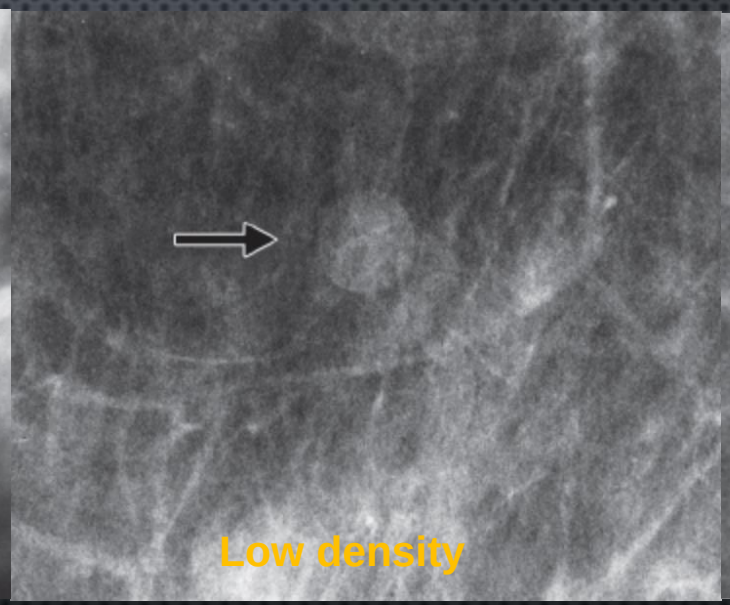
MASSES – SHAPE /MARGIN/**DENSITY**



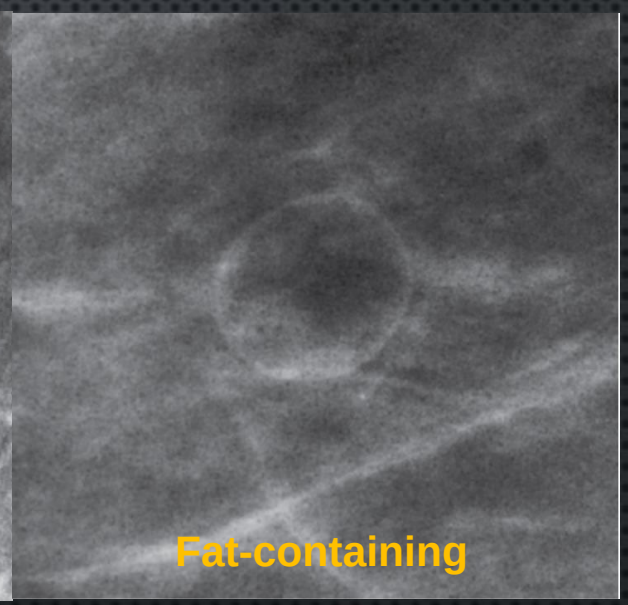
High density



Equal density

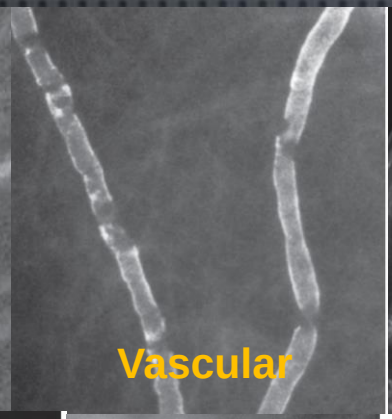


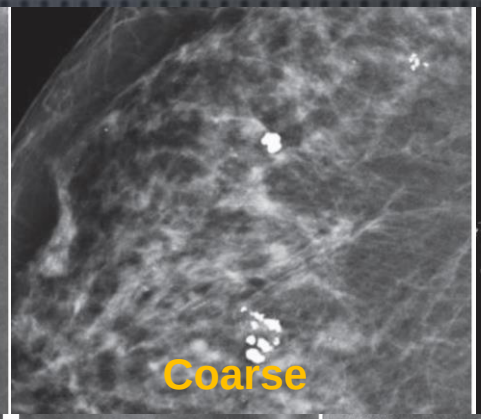
Low density

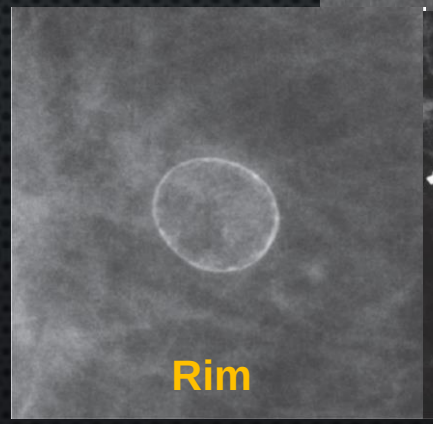


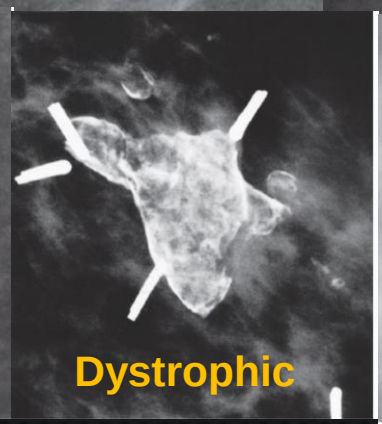
Fat-containing

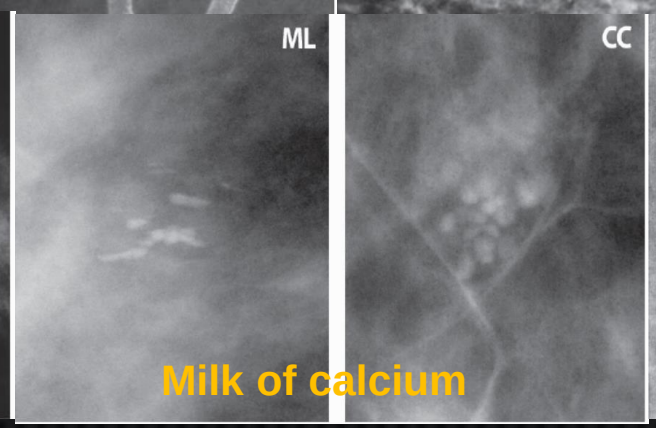
CALCIFICATIONS – TYPICALLY BENIGN

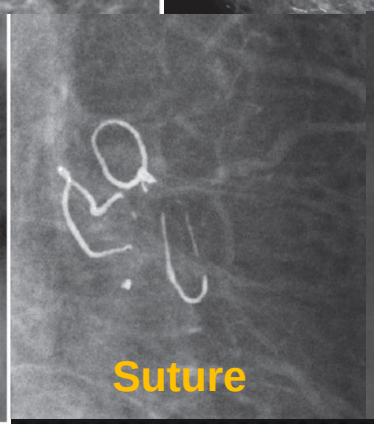


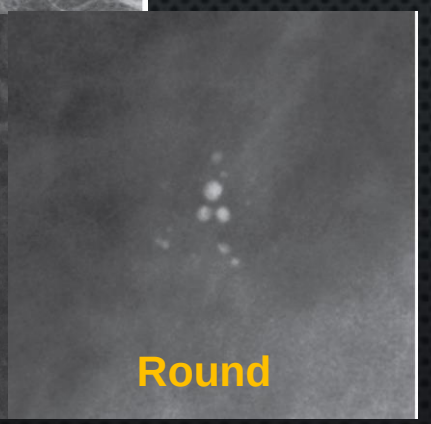




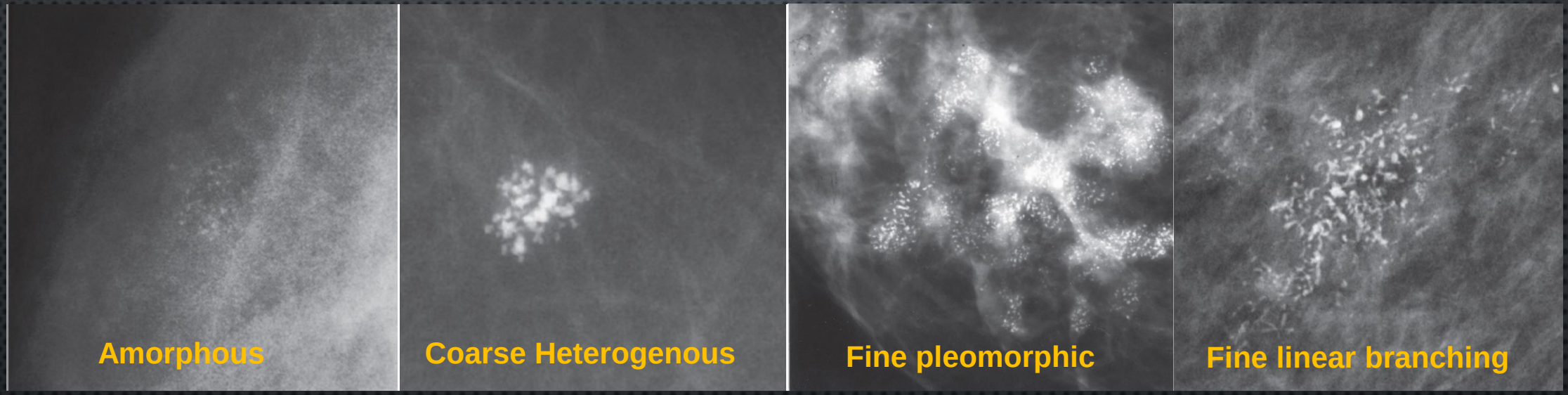






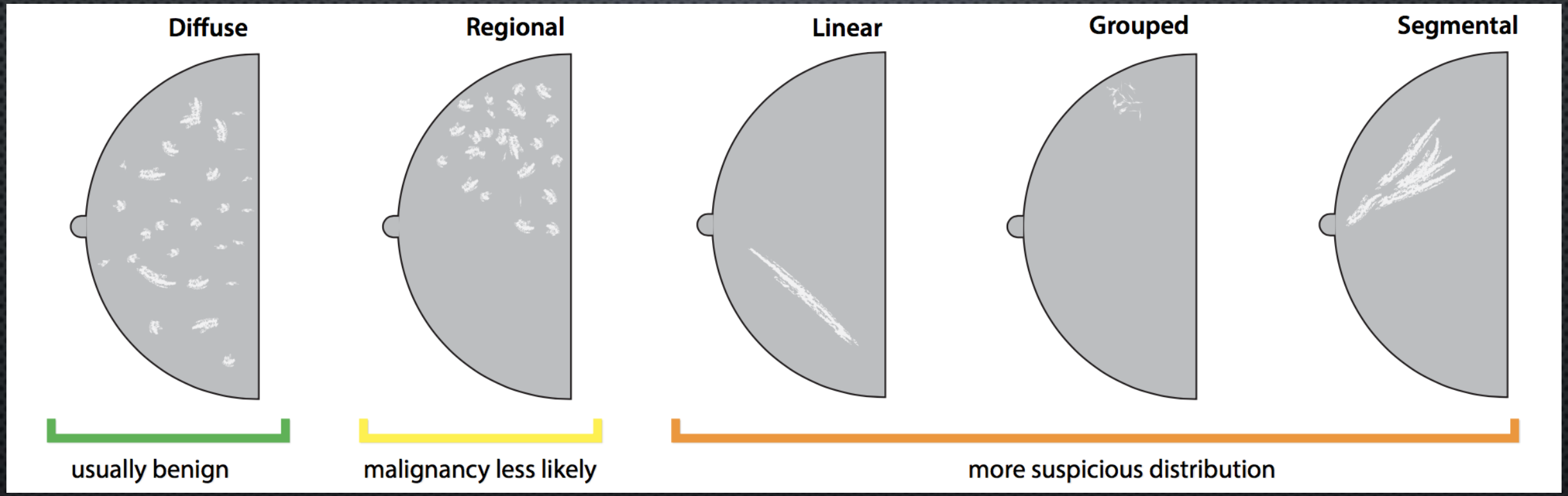


CALCIFICATIONS – SUSPICIOUS MORPHOLOGY



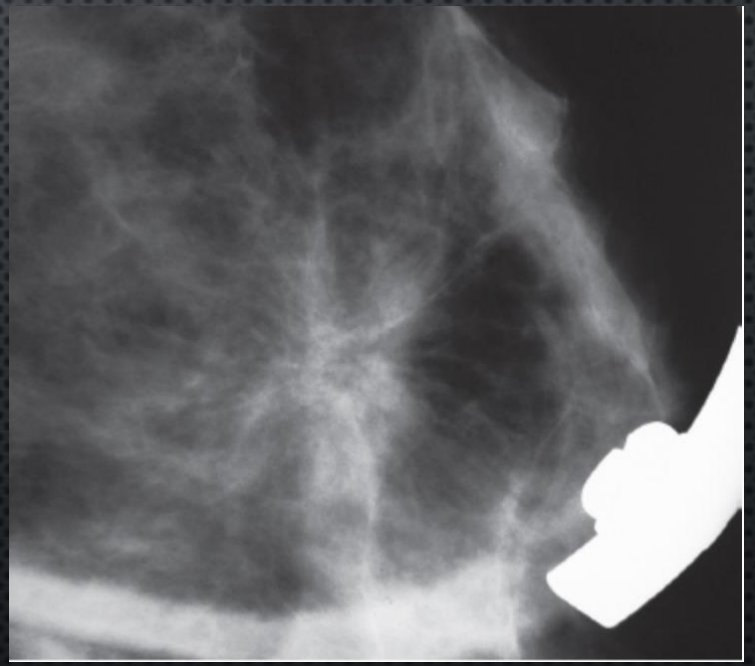
Approximately 95% of all DCIS is diagnosed because of mammographically detected microcalcifications.

CALCIFICATIONS - DISTRIBUTION



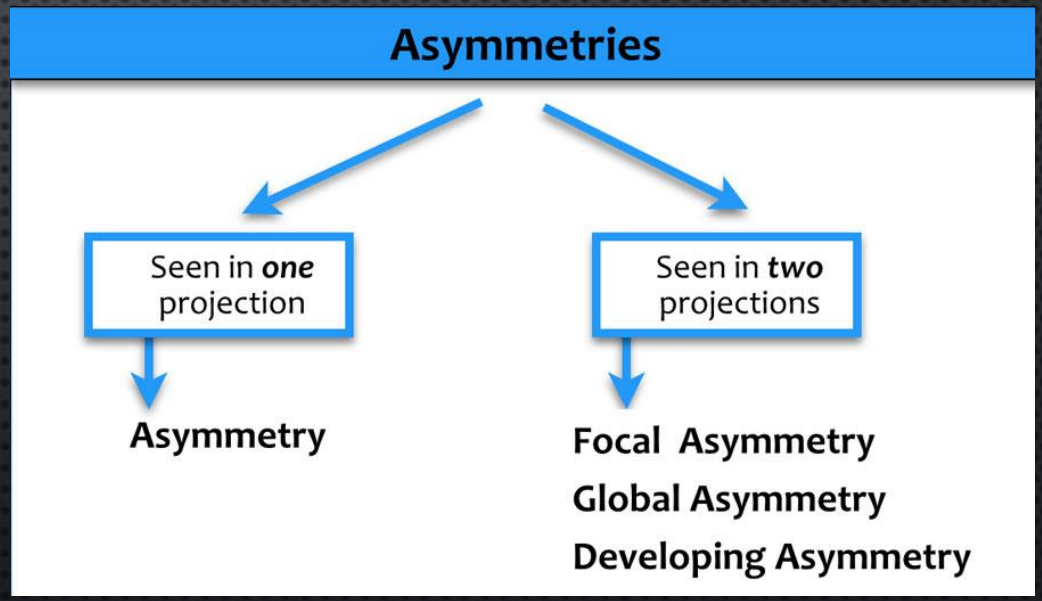
ARCHITECTURAL DISTORTION

- The parenchyma is distorted with **no definite mass visible.**
- Spiculations radiating from a point, and focal retraction, distortion, or straightening at the anterior or posterior edge of the parenchyma.
- In the absence of appropriate history of trauma or surgery, architectural distortion is suspicious for **malignancy or radial scar**, and tissue diagnosis is appropriate.



ASYMMETRIES

- Unilateral deposits of fibroglandular tissue not conforming to the definition of a radiodense mass.
- **Concave-outward borders** and usually are seen to be interspersed with fat, whereas a radiodense mass displays completely or partially convex-outward borders.



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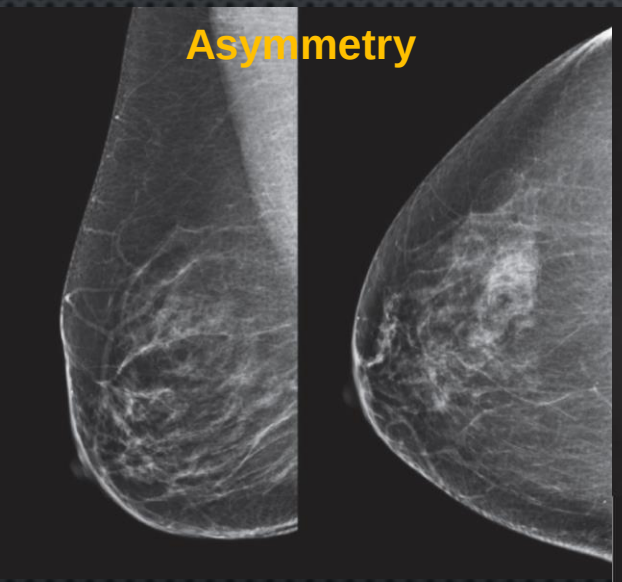
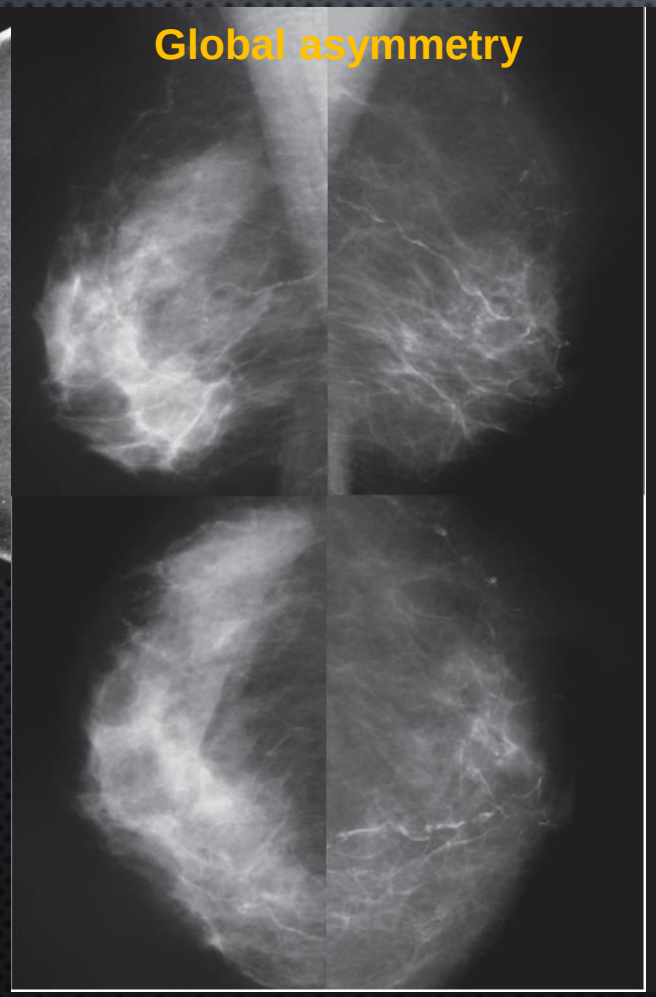
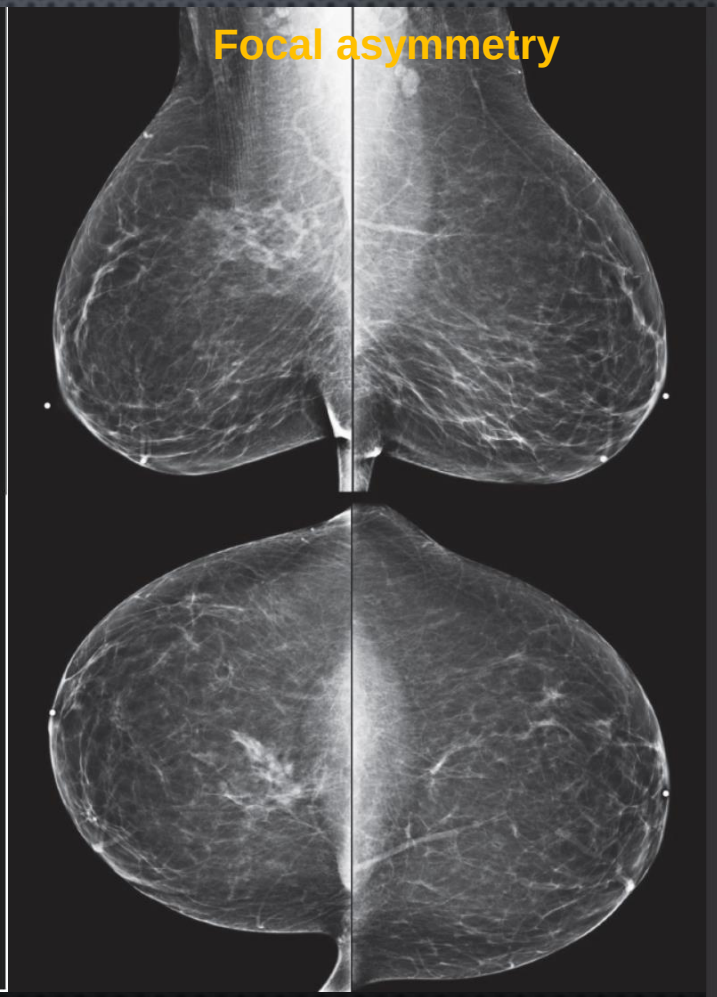
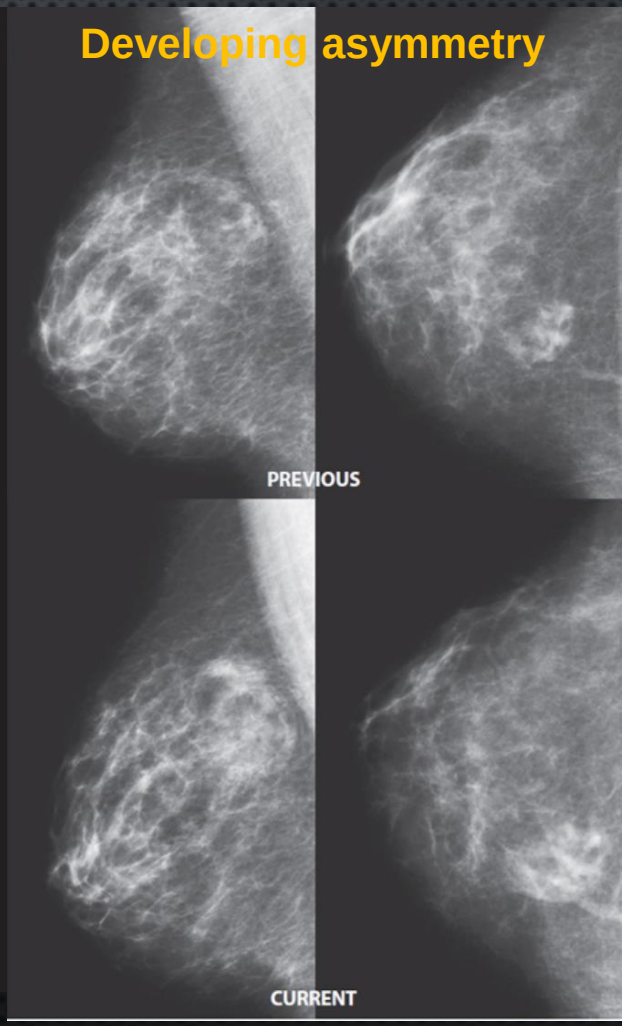
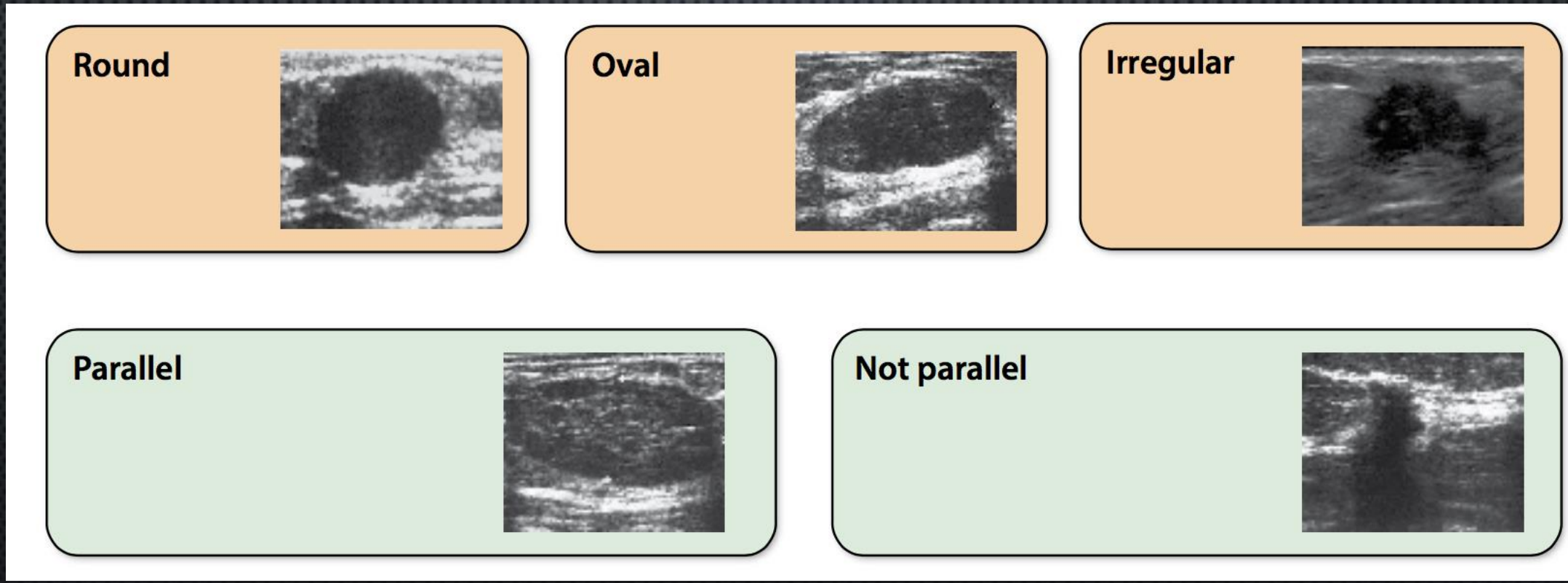








ULTRASOUND – MASSES – SHAPE/ORIENTATION/MARGINS/ ECHO PATTERN/POSTERIOR FEATURES



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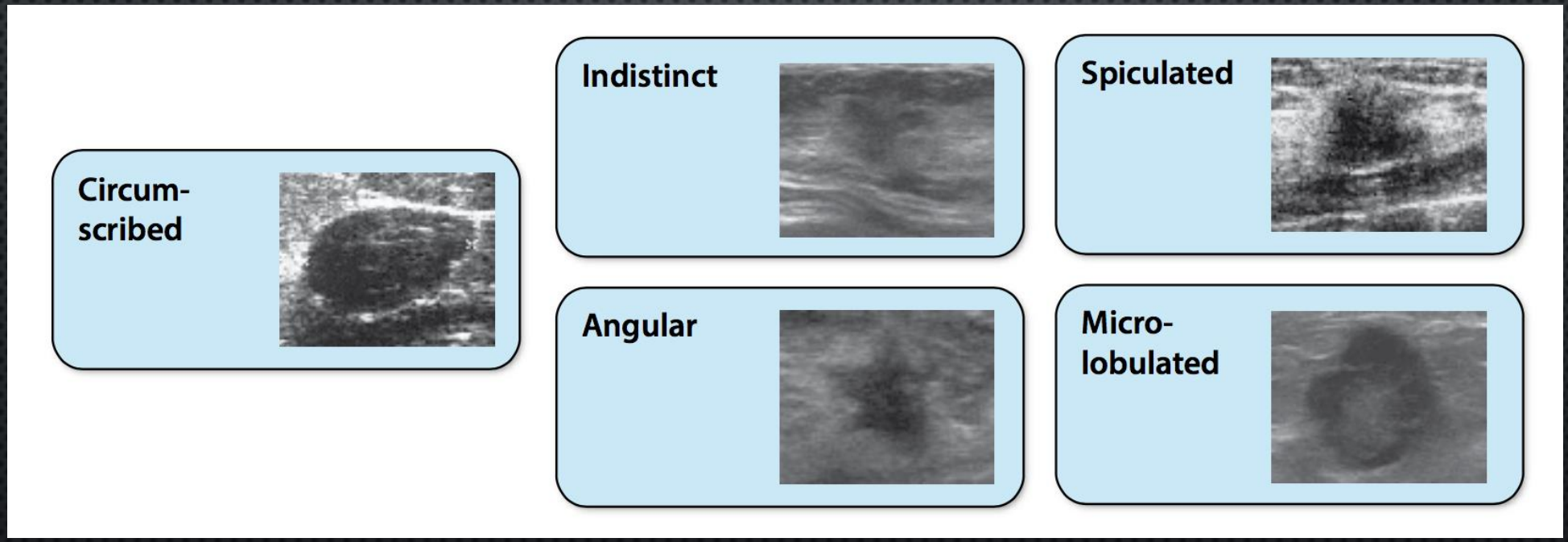

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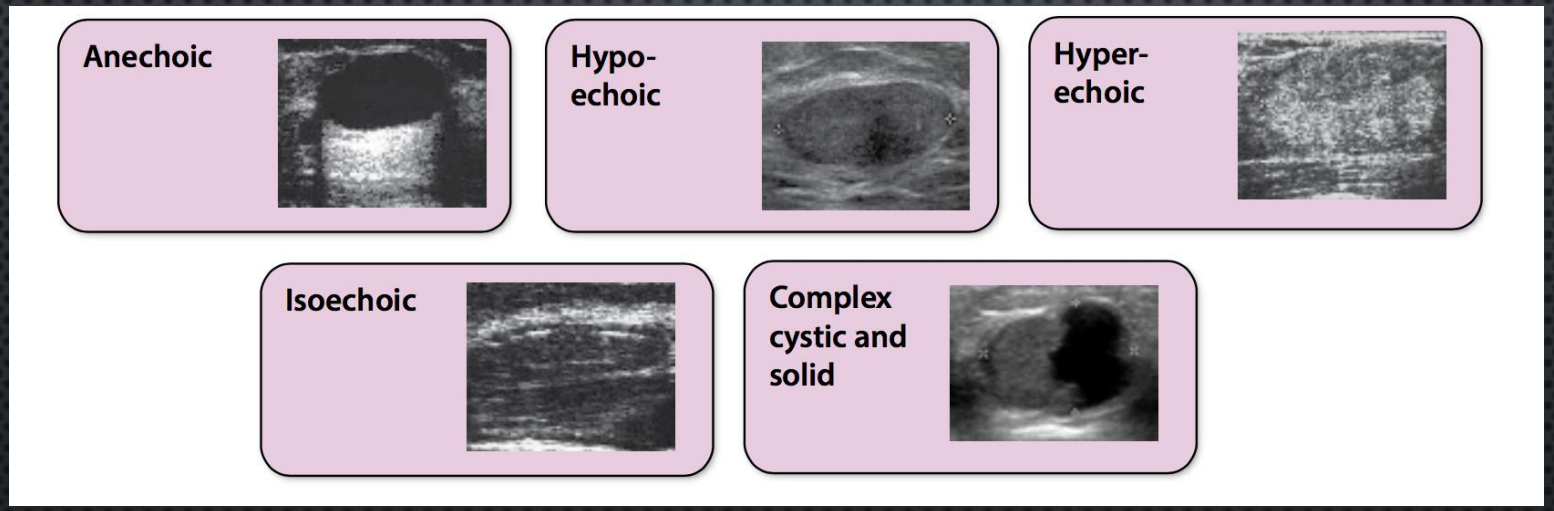

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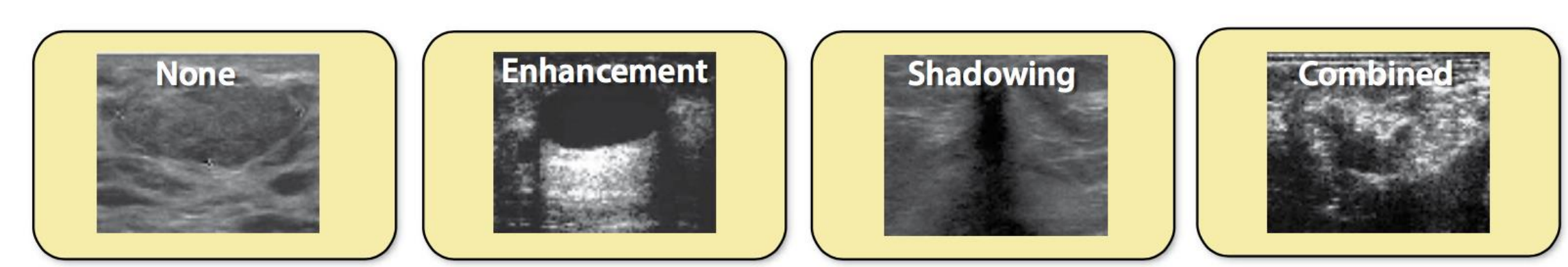
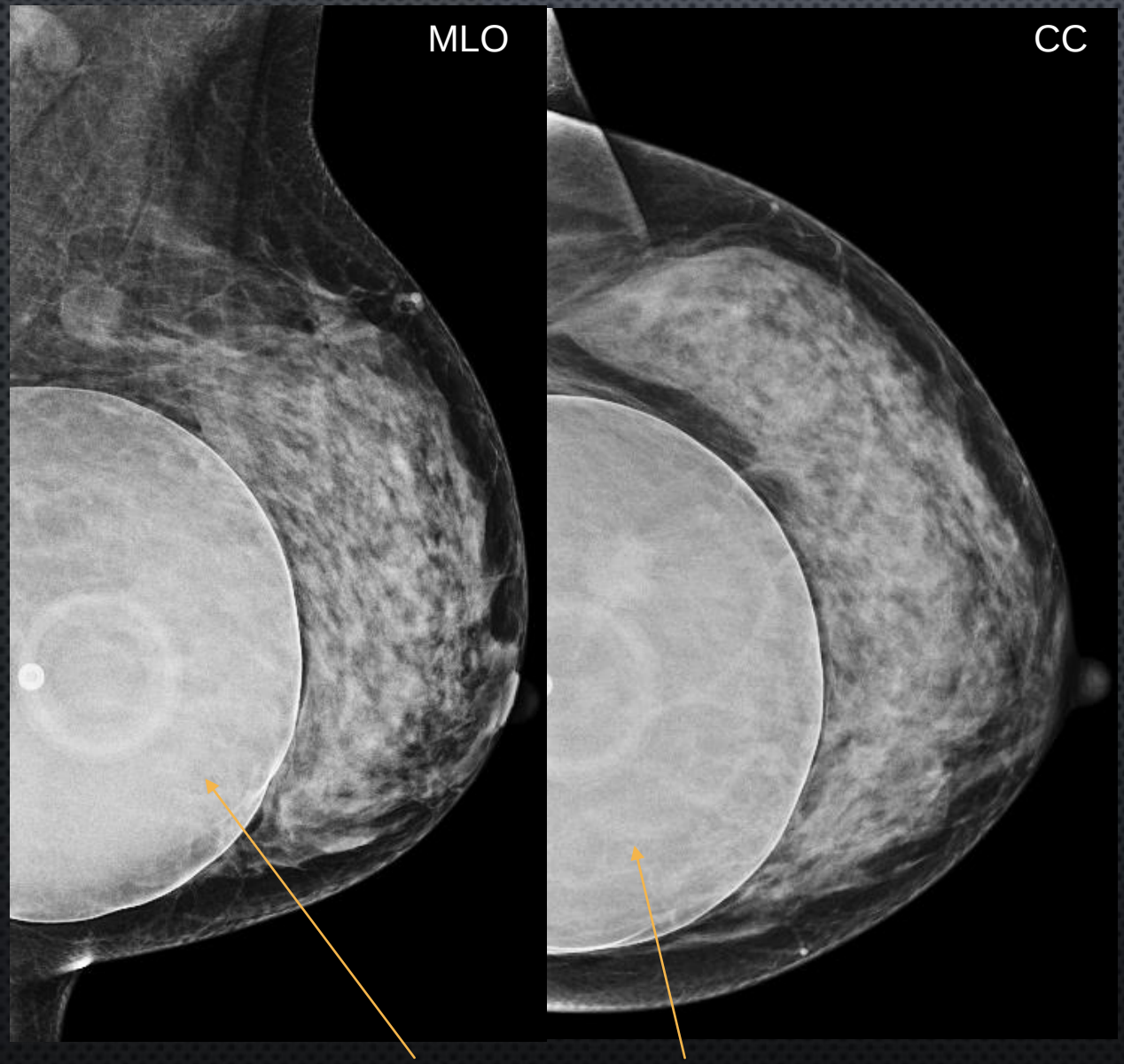


CASE 1: 42YO FEMALE PRESENTING FOR A SCREENING MAMMOGRAPHY

- No current complaints
- History of bilateral breast implants

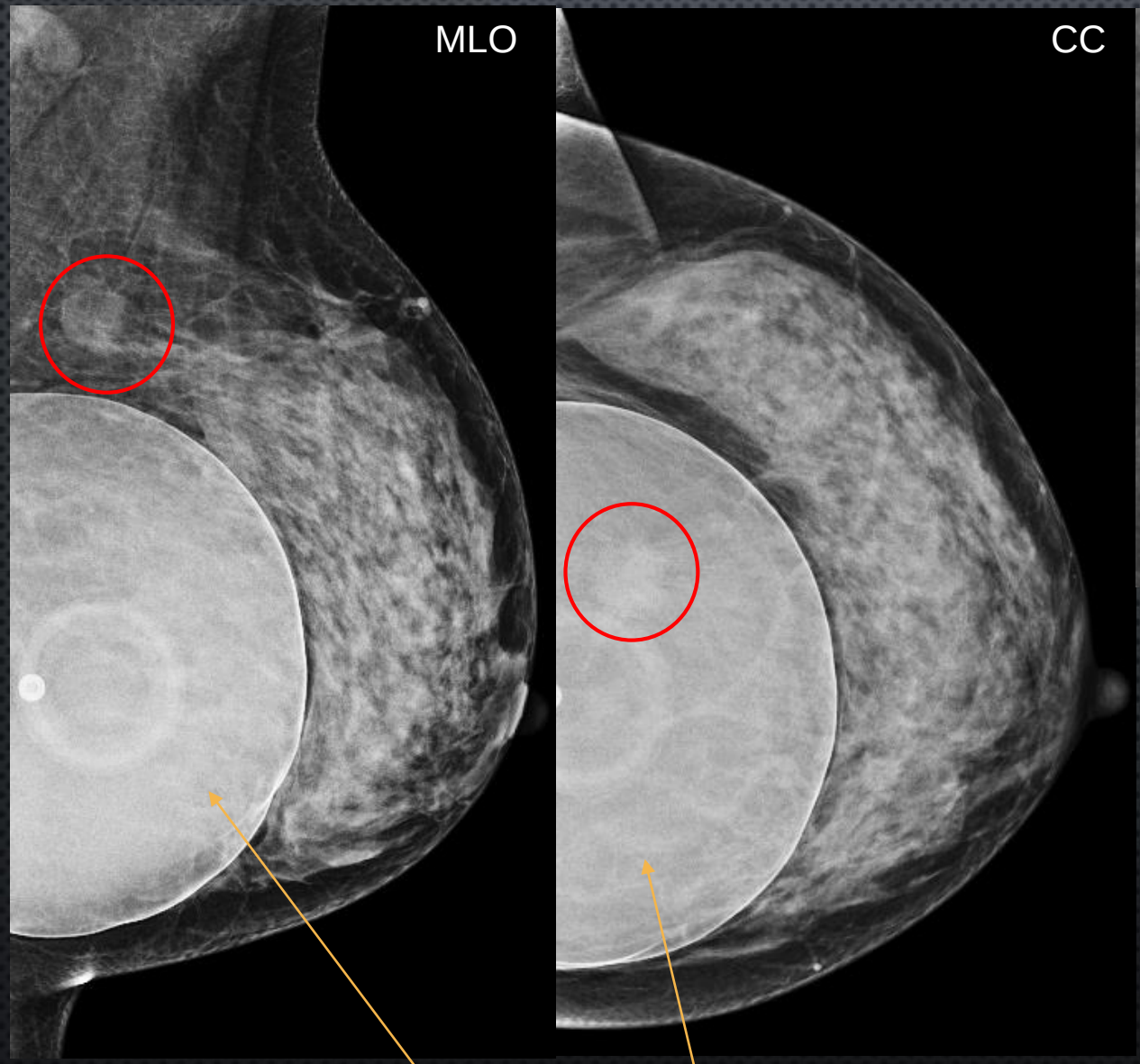
Left breast

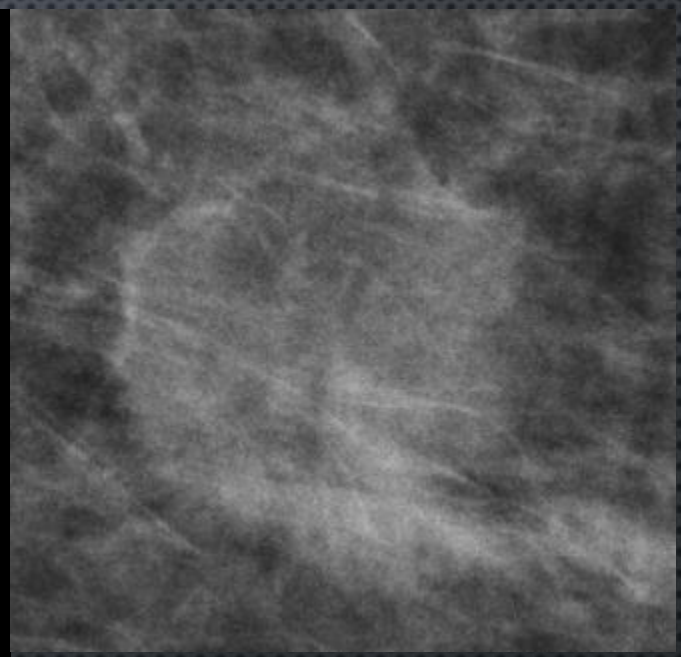


How would you describe the breast composition?

Anything else?

Left breast



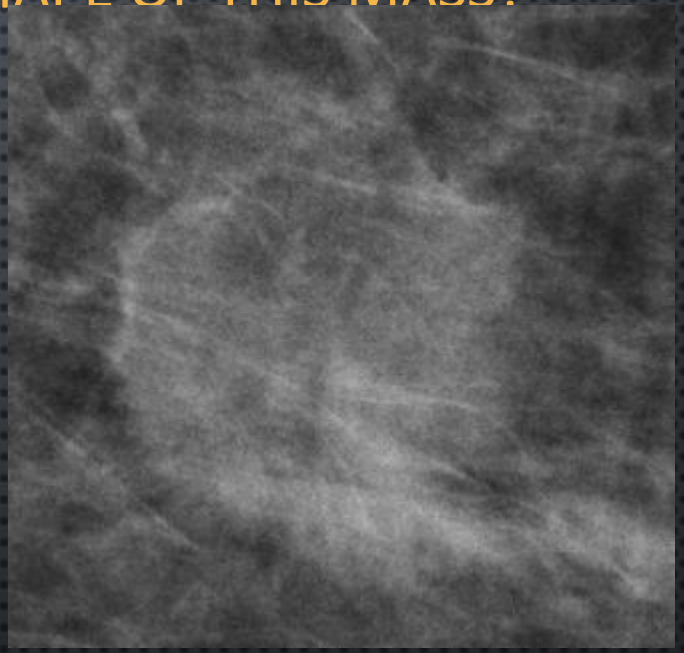


Mass in the upper outer quadrant of left breast, new since last mammo 2 yrs ago

Breast implants

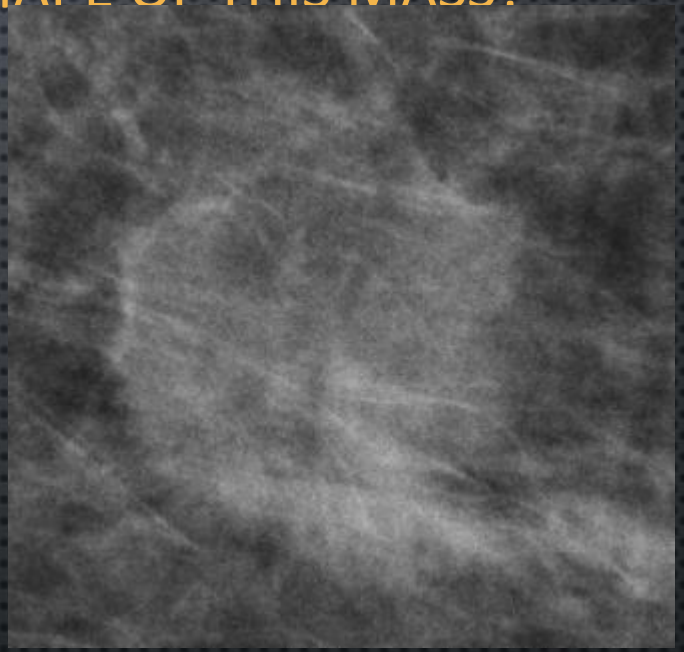
HOW WOULD YOU DESCRIBE THE MARGIN AND SHAPE OF THIS MASS?

- Round shape, circumscribed margin,
- Round shape, indistinct margin
- Irregular shape, circumscribed margin
- Irregular shape, spiculated margin



STOP
Answer on next page

HOW WOULD YOU DESCRIBE THE MARGIN AND SHAPE OF THIS MASS?



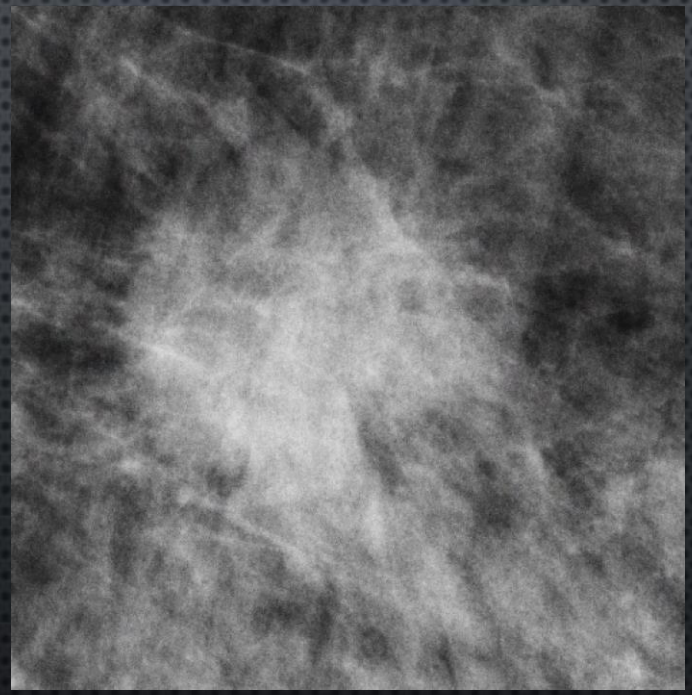
- Round shape, circumscribed margin,
- Round shape, indistinct margin
- Irregular shape, circumscribed margin
- Irregular shape, spiculated margin ★

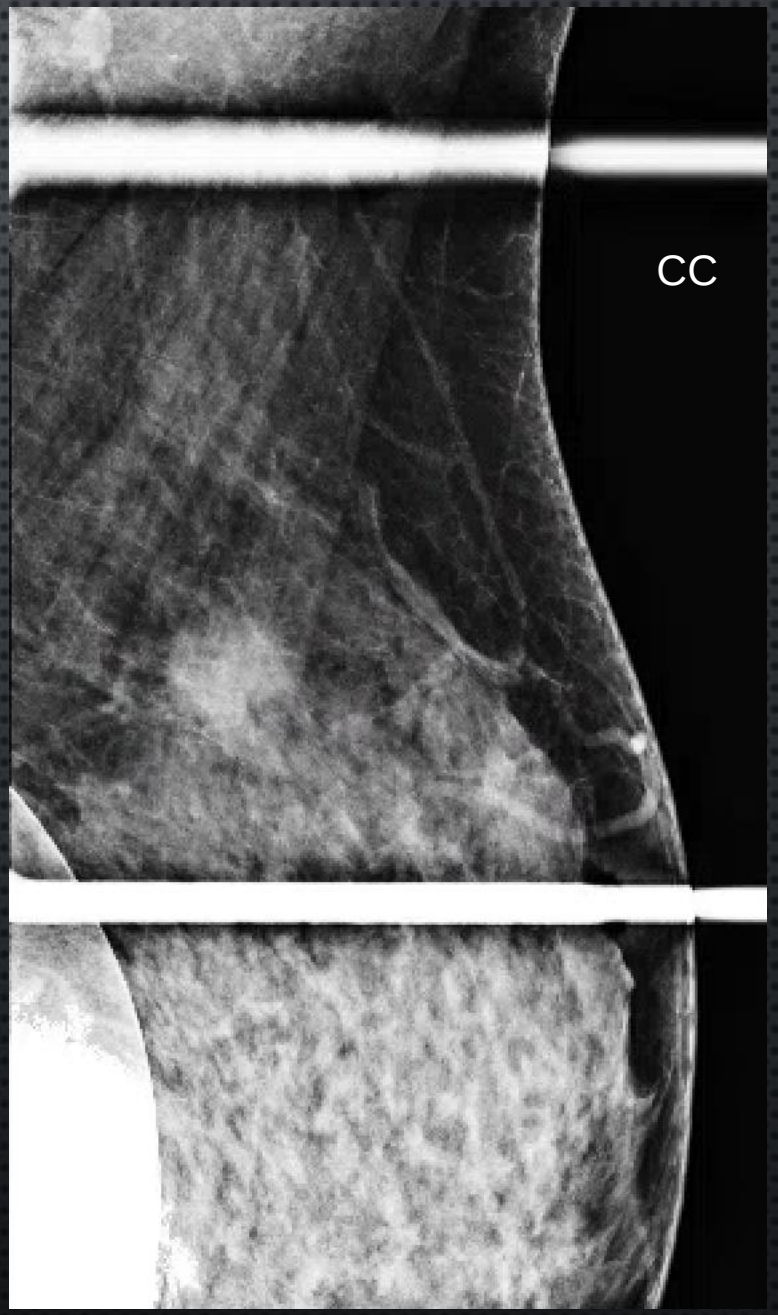
NEW SPICULATED MASS – HIGHLY SUSPICIOUS

- Patient was “called back” for a diagnostic mammography
- Spot compression

1.6 x 1.5 cm irregular, spiculated mass
BIRADS 5 – highly suggestive for malignancy

Core biopsy showed IDC



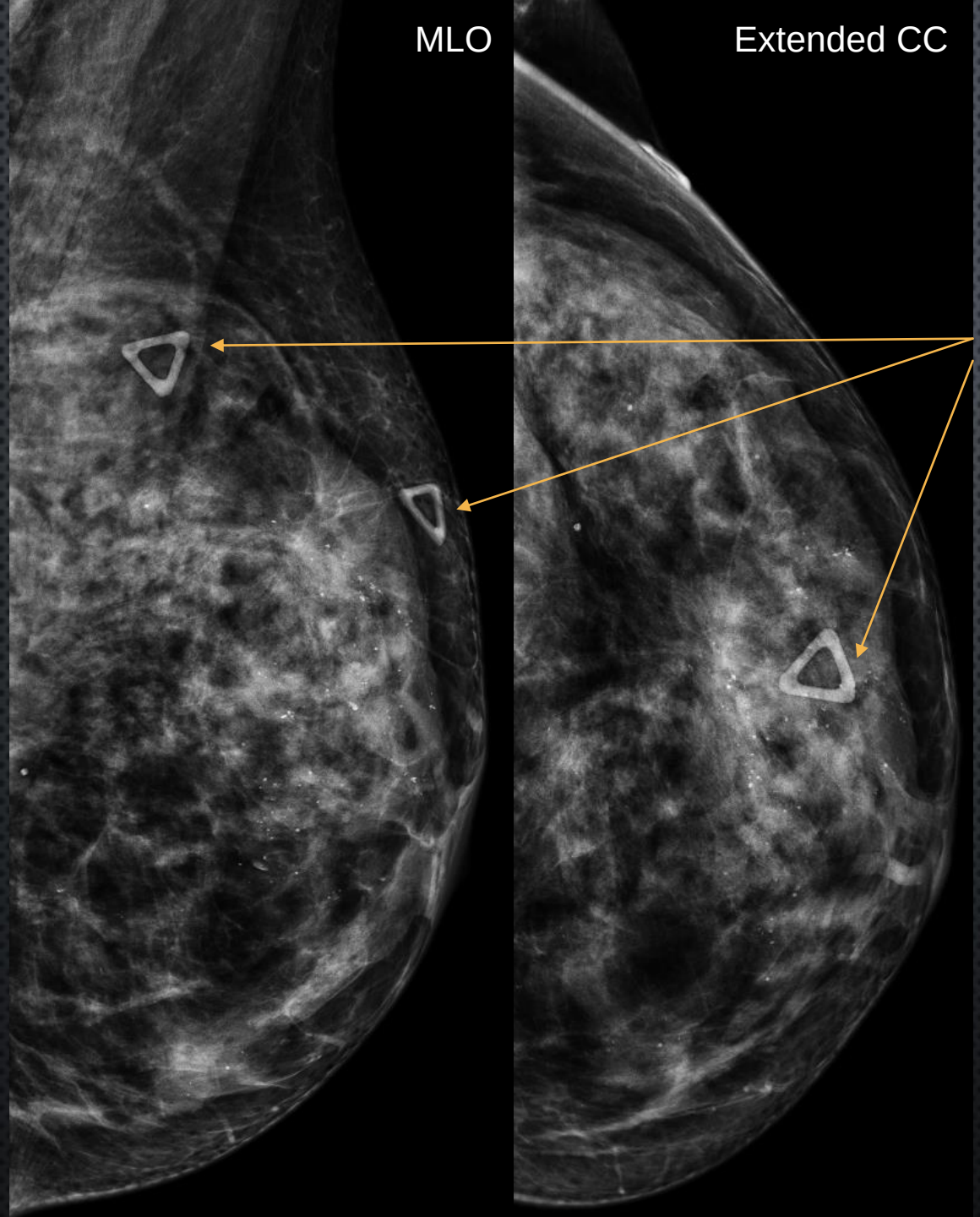


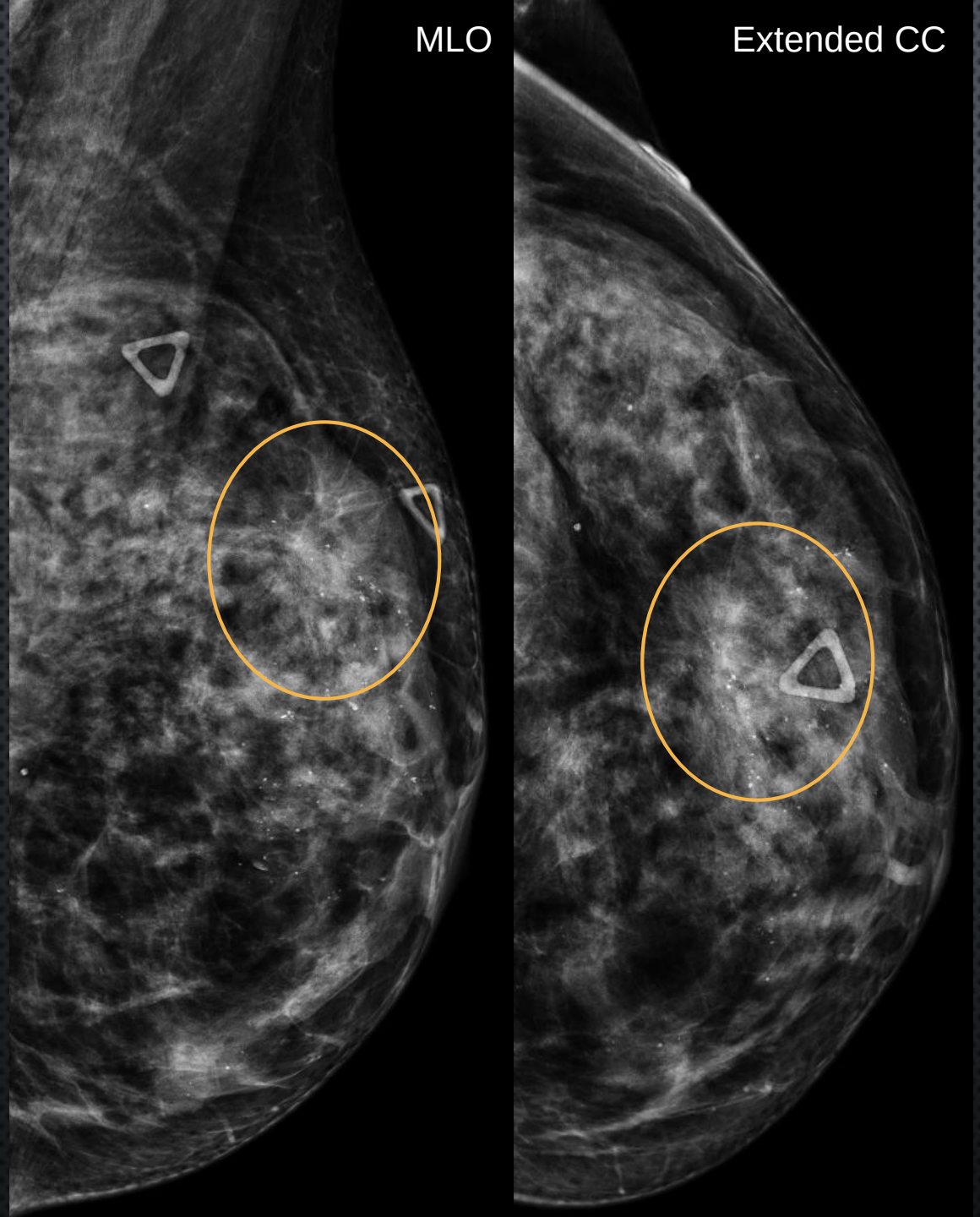
IDC: INVASIVE DUCTAL CARCINOMA

- The most common subtype of breast cancer (70-80%)
- Often presents as a palpable mass
- Classic mammographic appearance is a high density, spiculated mass
  - +/- pleomorphic or fine-linear branching calcifications
- Can have a variable mammographic appearance as
  - E.g. round mass, isolated calcifications, architectural distortion

CASE 2: 49YO FEMALE WITH PALPABLE FINDING IN LEFT BREAST

Case courtesy of Sona Chikarmane, M.D.


MLO
Extended CC
Skin marker at site of palpable finding



Irregular spiculated mass with associated architectural distortion.

Triangle skin marker at the site of palpable concern.

HOWEVER, THE MASS AND ARCHITECTURAL DISTORTION ARE VERY HARD TO SEE.

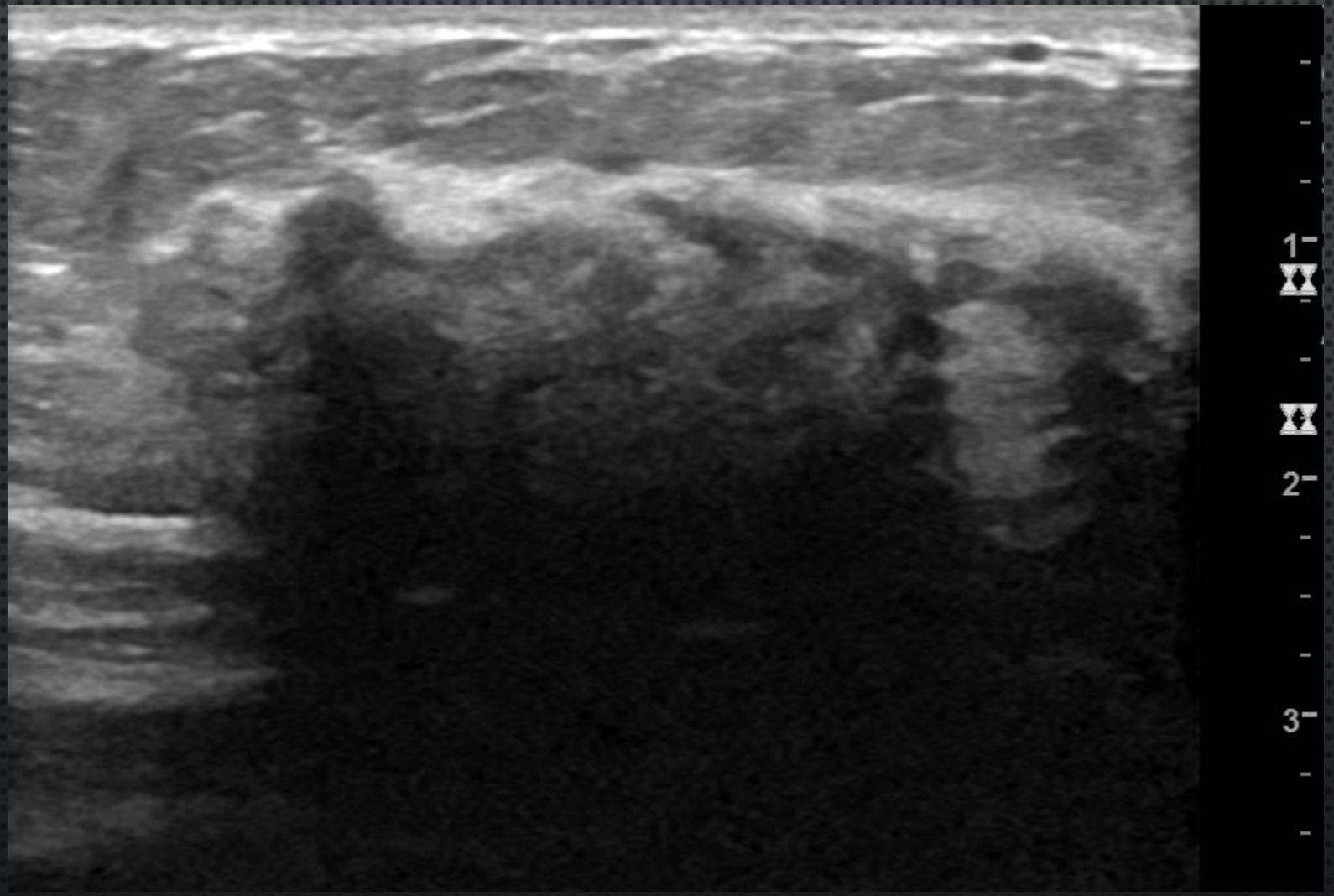
WHAT SHOULD YOU DO NEXT?

- Ultrasound
- MRI
- CT
- Biopsy

NEXT STEP TO BETTER CHARACTERIZE THIS MASS

- Ultrasound 
- MRI
- CT
- Biopsy

Targeted ultrasound in the area of the palpable lump



Ill-defined mass with irregular and indistinct margins, posterior acoustic shadowing (sound waves can’t pass through = typically bad in breast ultrasound!).

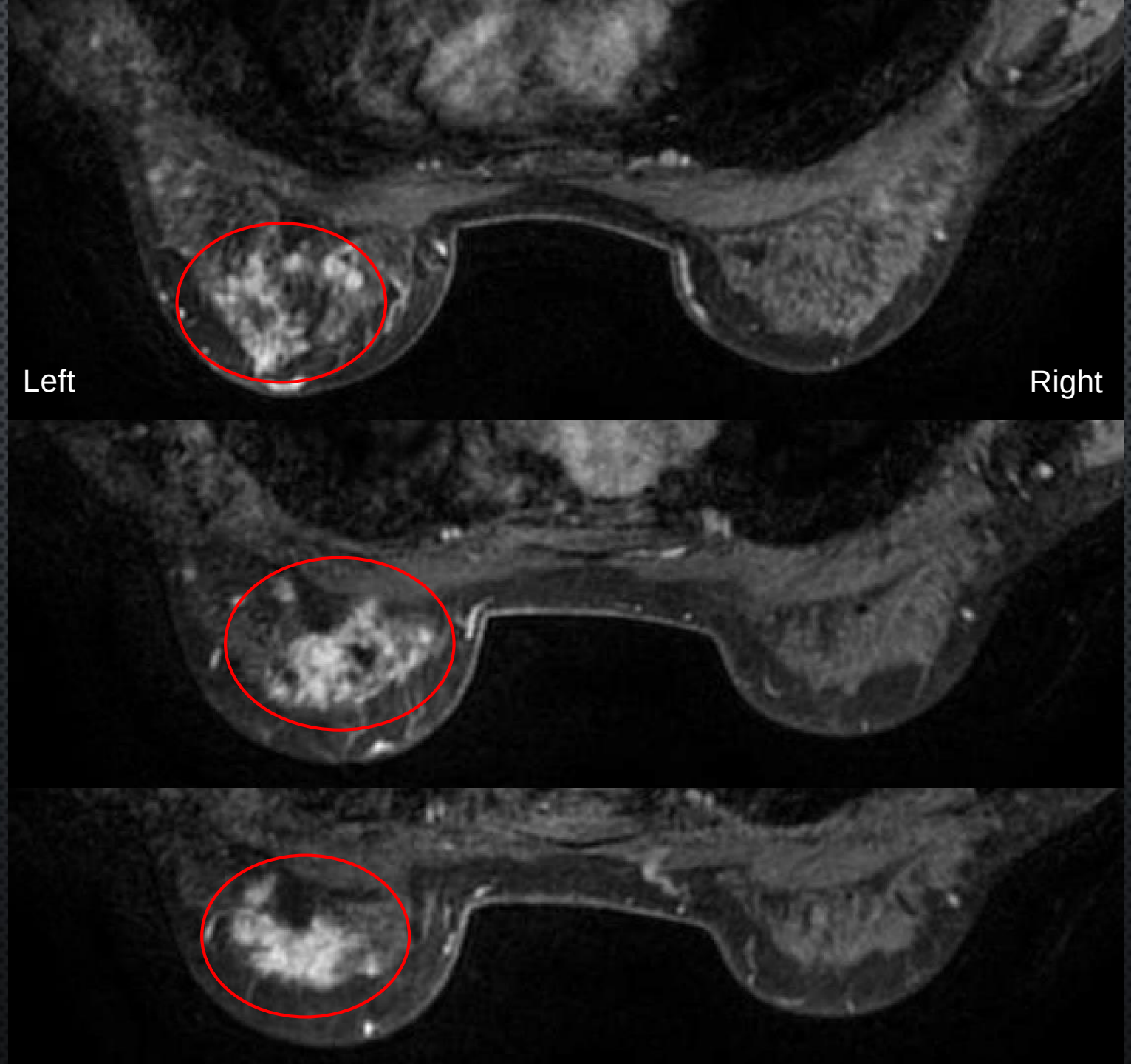
ANYTHING ELSE YOU CAN DO TO BETTER CHARACTERIZE THIS LARGE, ILL-DEFINED MASS?

- Spot compression of the area
- MRI
- CT
- Biopsy

ANYTHING ELSE YOU CAN DO TO BETTER CHARACTERIZE THIS LARGE, ILL-DEFINED MASS?

- Spot compression of the area
- MRI 
- CT
- Biopsy

MRI



Contrast-enhanced series showed extensive multicentric disease within the left breast

Biopsy showed ILC

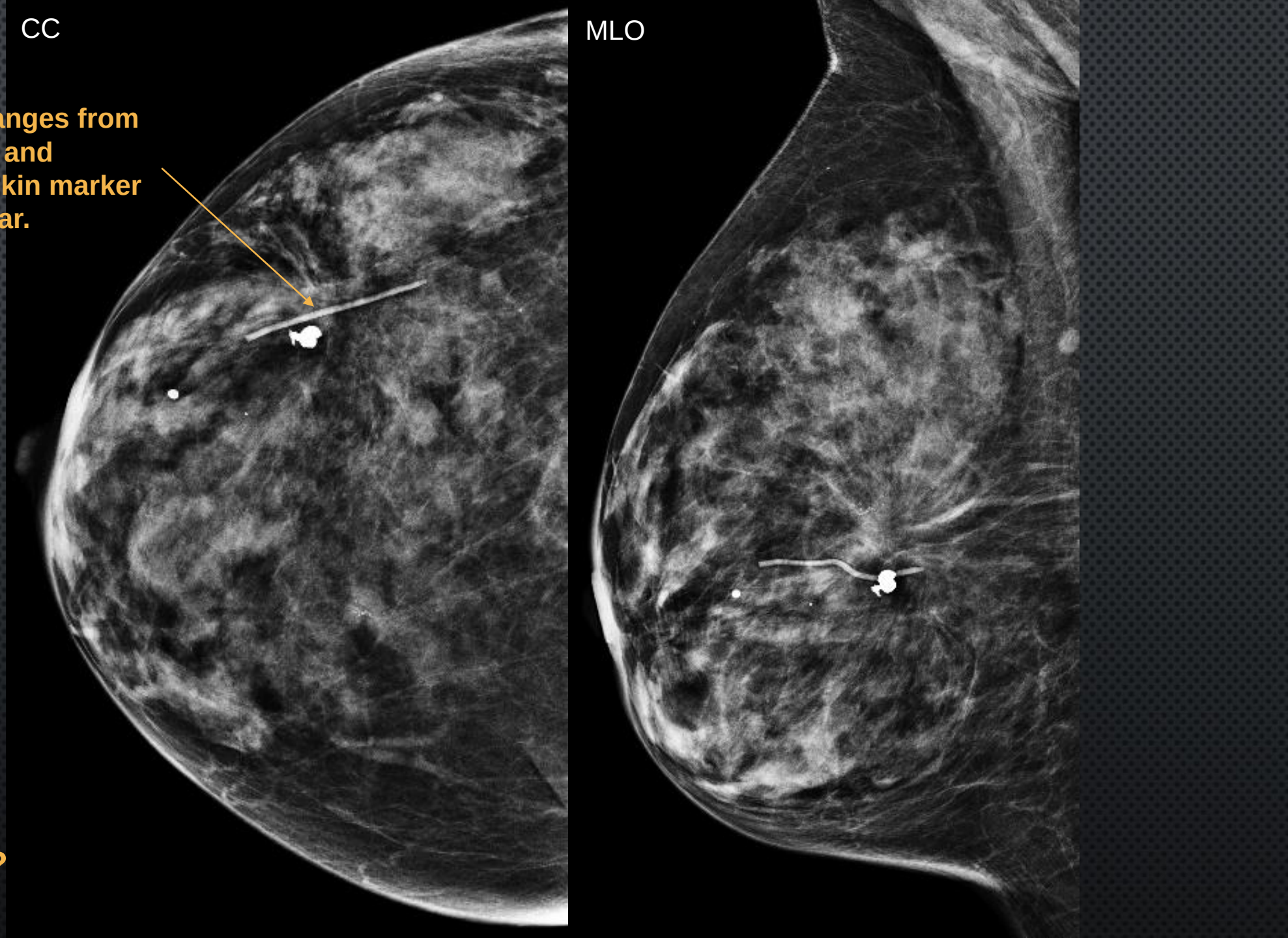
ILC: INVASIVE LOBULAR CARCINOMA

- Up to 10% of breast cancer cases
- Challenging to diagnose compared to IDC because it tends to spread through breast tissue without forming a discrete mass
- Variable imaging appearance, ranging from an asymmetry, to architectural distortion, to a mass
- Rarely contains microcalcifications
- More often multifocal or bilateral

CASE 3: 75YO FEMALE, SCREENING MAMMO

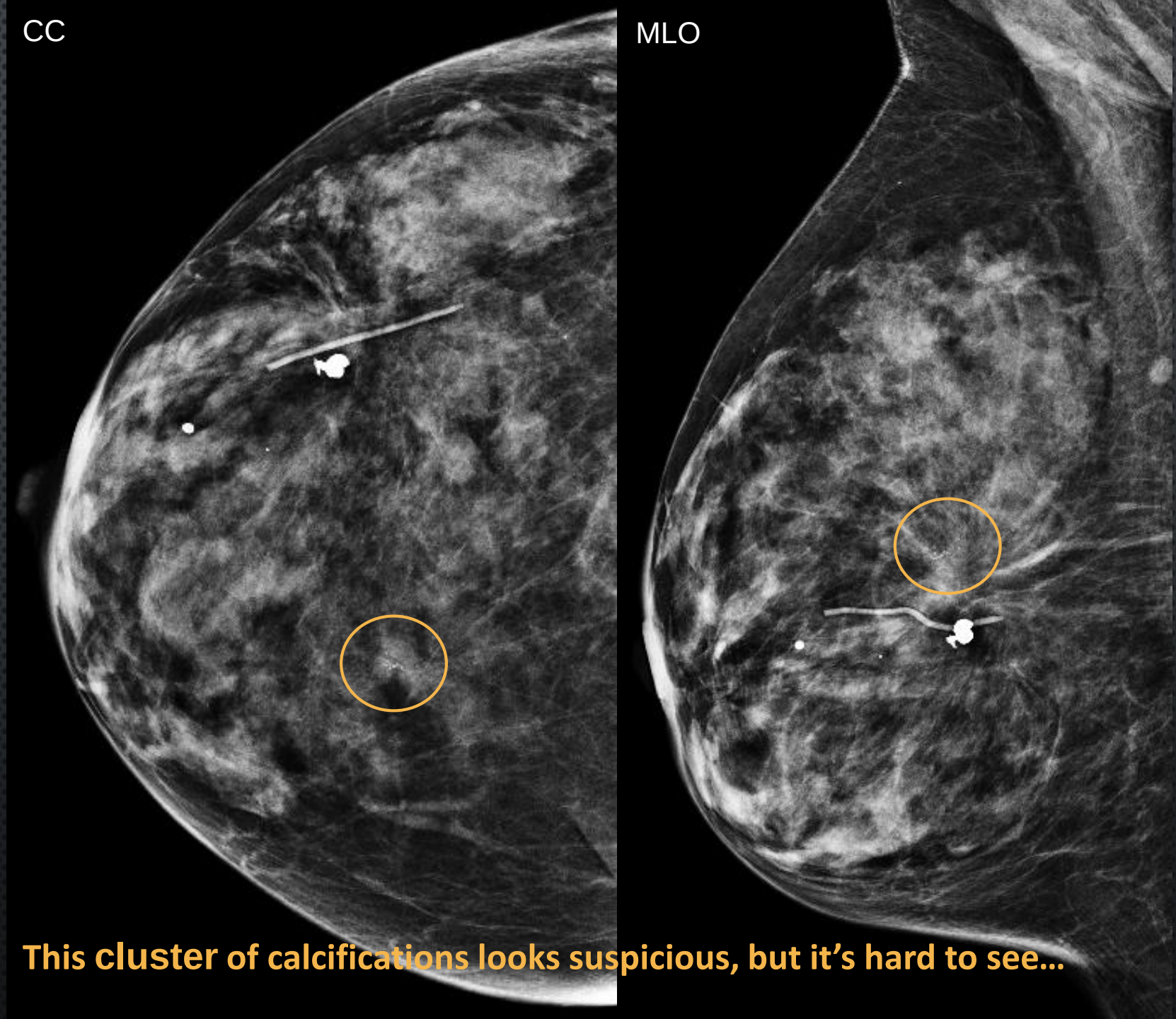
- History of right-sided breast cancer, status post lumpectomy and radiation 11 years ago

Case courtesy of Sona Chikarmane, M.D.



Post-treatment changes from prior lumpectomy and radiation. Linear skin marker over superficial scar.

Anything else?



This cluster of calcifications looks suspicious, but it's hard to see…

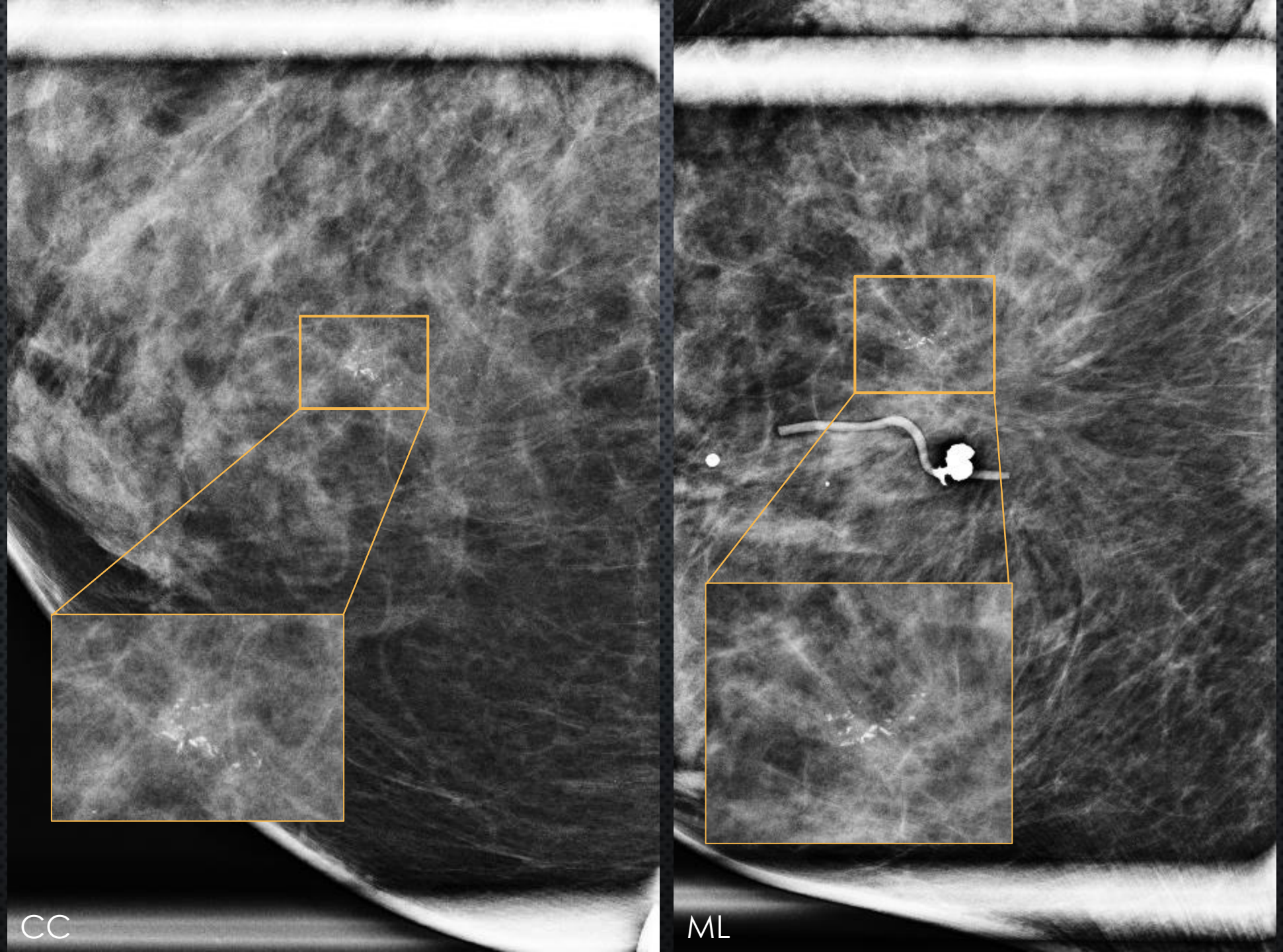
HOW CAN YOU GET A BETTER LOOK OF THE SMALL CALCIFICATIONS?

- DBT (tomosynthesis)
- Ultrasound
- Mammography with spot magnification
- MRI
- CT

HOW CAN YOU GET A BETTER LOOK OF THE SMALL CALCIFICATIONS?

- DBT (tomosynthesis)
- Ultrasound
- Mammography with spot magnification 
- MRI
- CT

Ultrasound is not as good as mammography in characterizing calcifications.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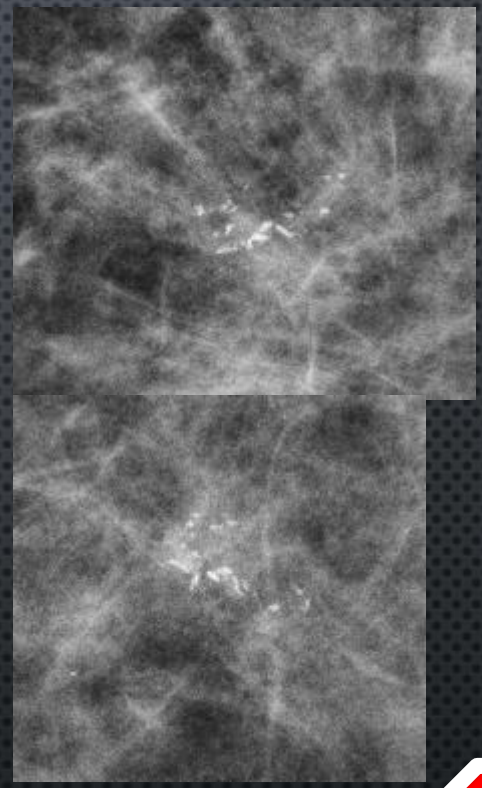
HOW WOULD YOU DESCRIBE THESE CALCIFICATIONS?

- Amorphous
- Coarse heterogeneous
- Fine linear or fine-linear branching
- Fine pleomorphic
- Dystrophic



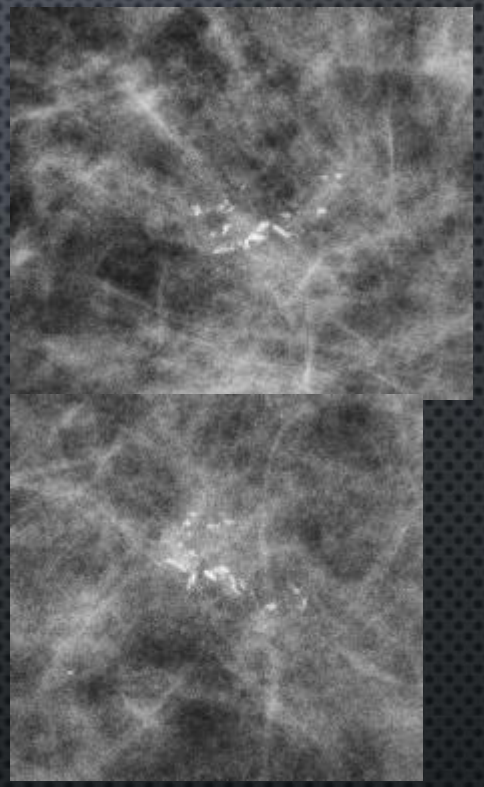
STOP
Answer on next page

HOW WOULD YOU DESCRIBE THESE CALCIFICATIONS?

- Amorphous
- Coarse heterogeneous
- Fine linear or fine-linear branching
- Fine pleomorphic ★
- Dystrophic

Fine pleomorphic
Small, < 0.5 mm
Vary in shape and size
Dot-dash appearance

Highly suspicious for malignancy, most commonly DCIS



Biopsy showed DCIS

DCIS: DUCTAL CARCINOMA IN SITUS

- Carcinoma contained within the duct, with intact basement membrane – no invasion
- Typically asymptomatic and **non-**palpable

- Classic mammographic appearance = calcifications
  - E.g. Fine linear or fine-linear branching, fine pleomorphic

- Treatment is surgical excision
  - 30-50% patients with DCIS will develop invasive carcinoma within 10 yrs
  - ~43% of DCIS diagnosed by core needle biopsy is upstaged to invasive carcinoma upon surgical excision

CASE 4: 28YO FEMALE PRESENTING WITH BILATERAL PALPABLE FINDINGS

Case courtesy of Eren Yeh, M.D.

MAMMOGRAPHY IS THE BEST INITIAL IMAGING MODALITY FOR THIS PATIENT.

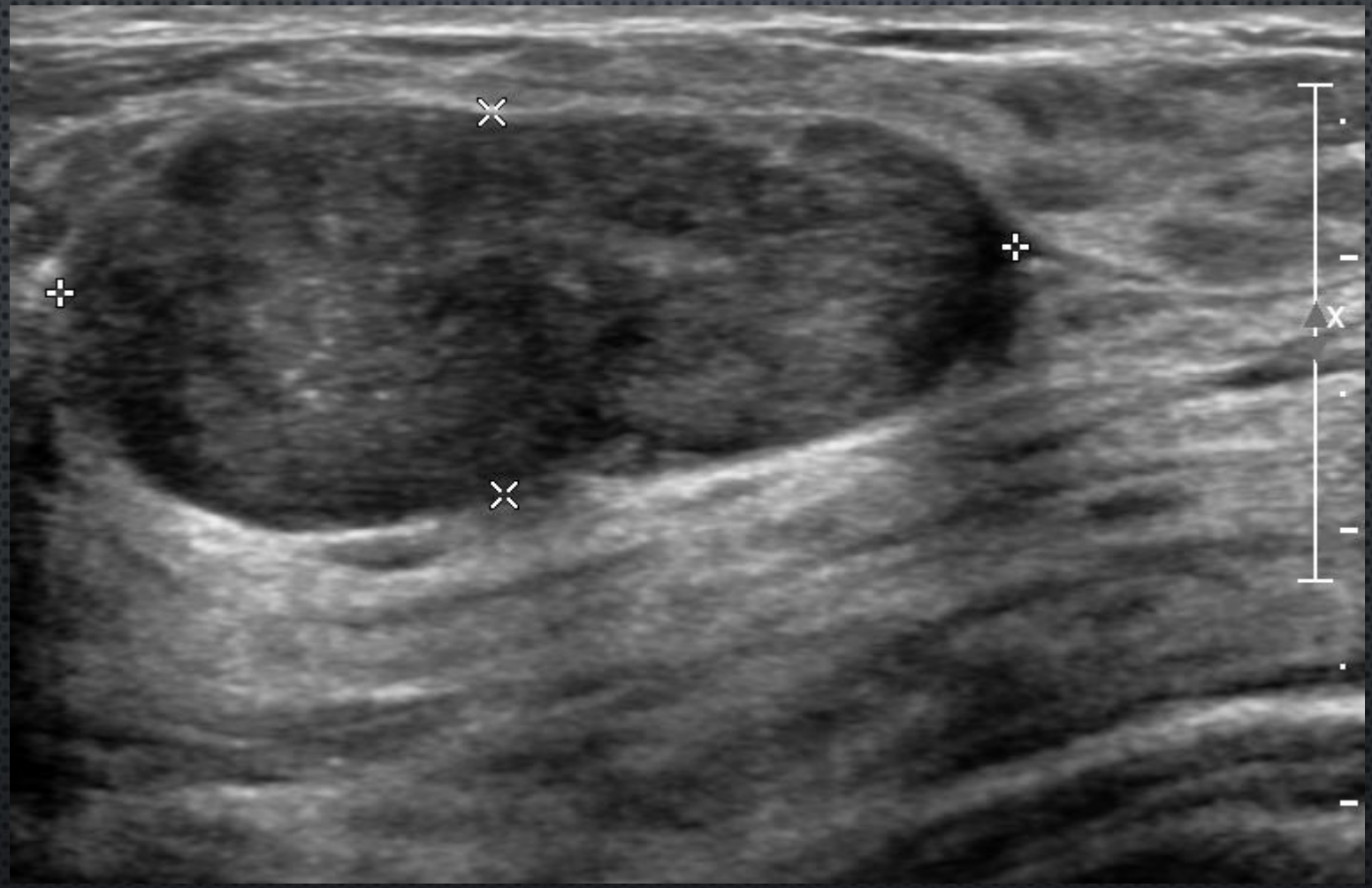
- True
- False

MAMMOGRAPHY IS THE BEST INITIAL IMAGING MODALITY FOR THIS PATIENT.

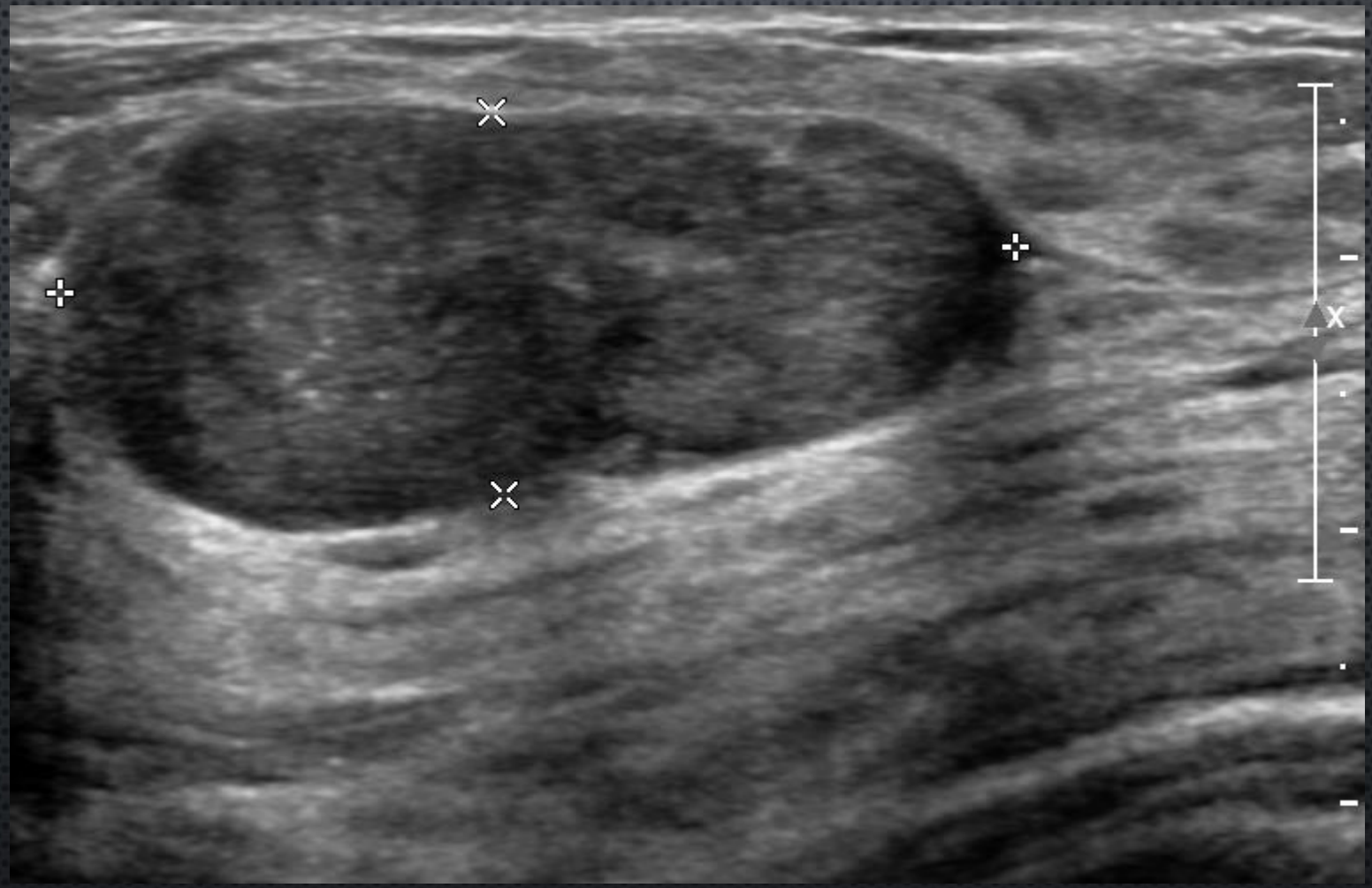
- True
- False ★

Based on the ACR Appropriateness Criteria, ultrasound is the modality of choice for women < 30 yo with palpable mass

Left breast



Left breast



★ Benign - fibroadenoma

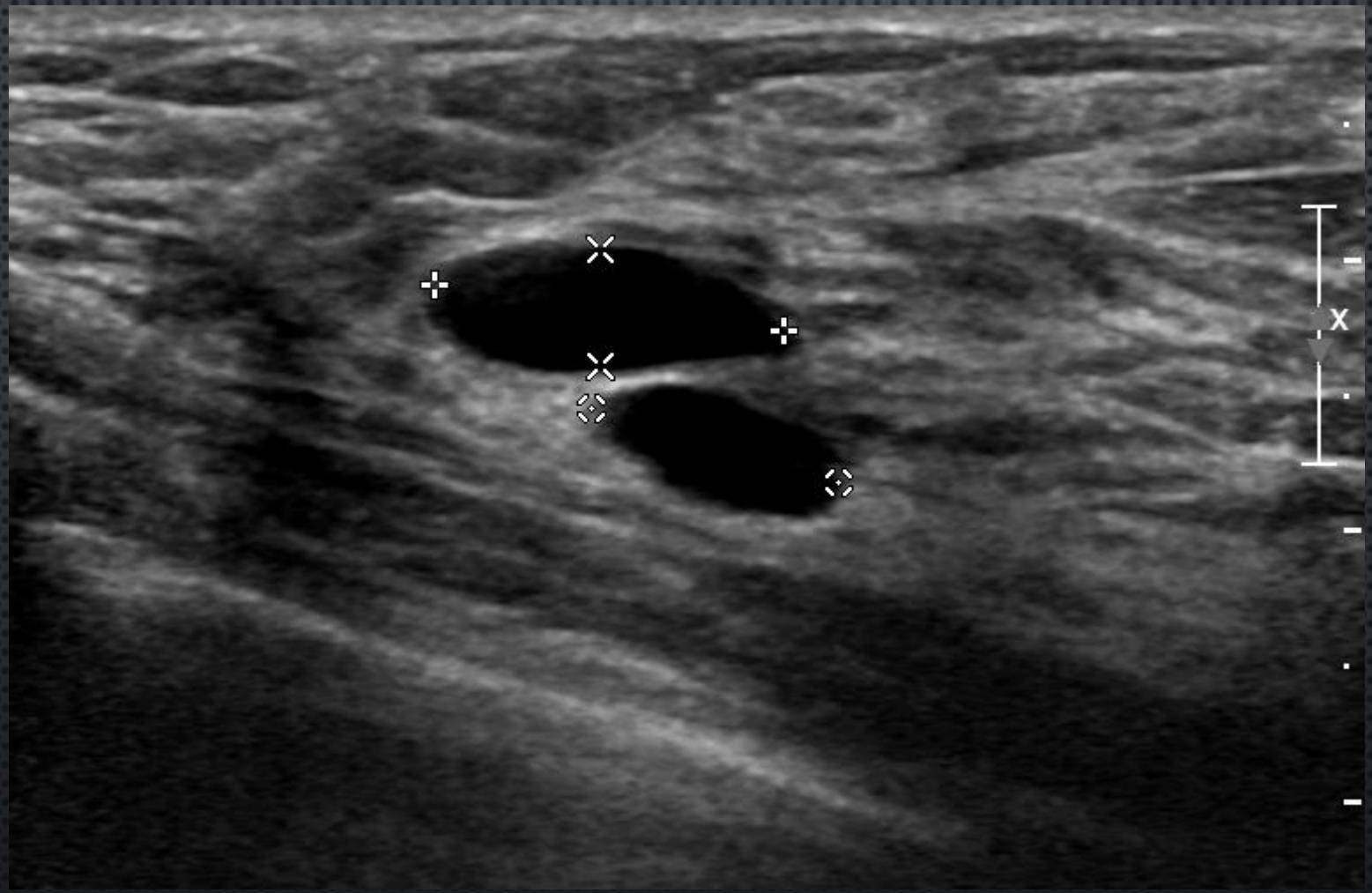
FIBROADENOMA

- Benign neoplasm
- Most common palpable breast mass in young women
- Classic mammographic appearance
  - Oval, equal density circumscribed mass
  - +/- coarse “popcorn” calcifications
- Ultrasound appearance
  - Circumscribed, homogeneous hypoechoic or isoechoic mass

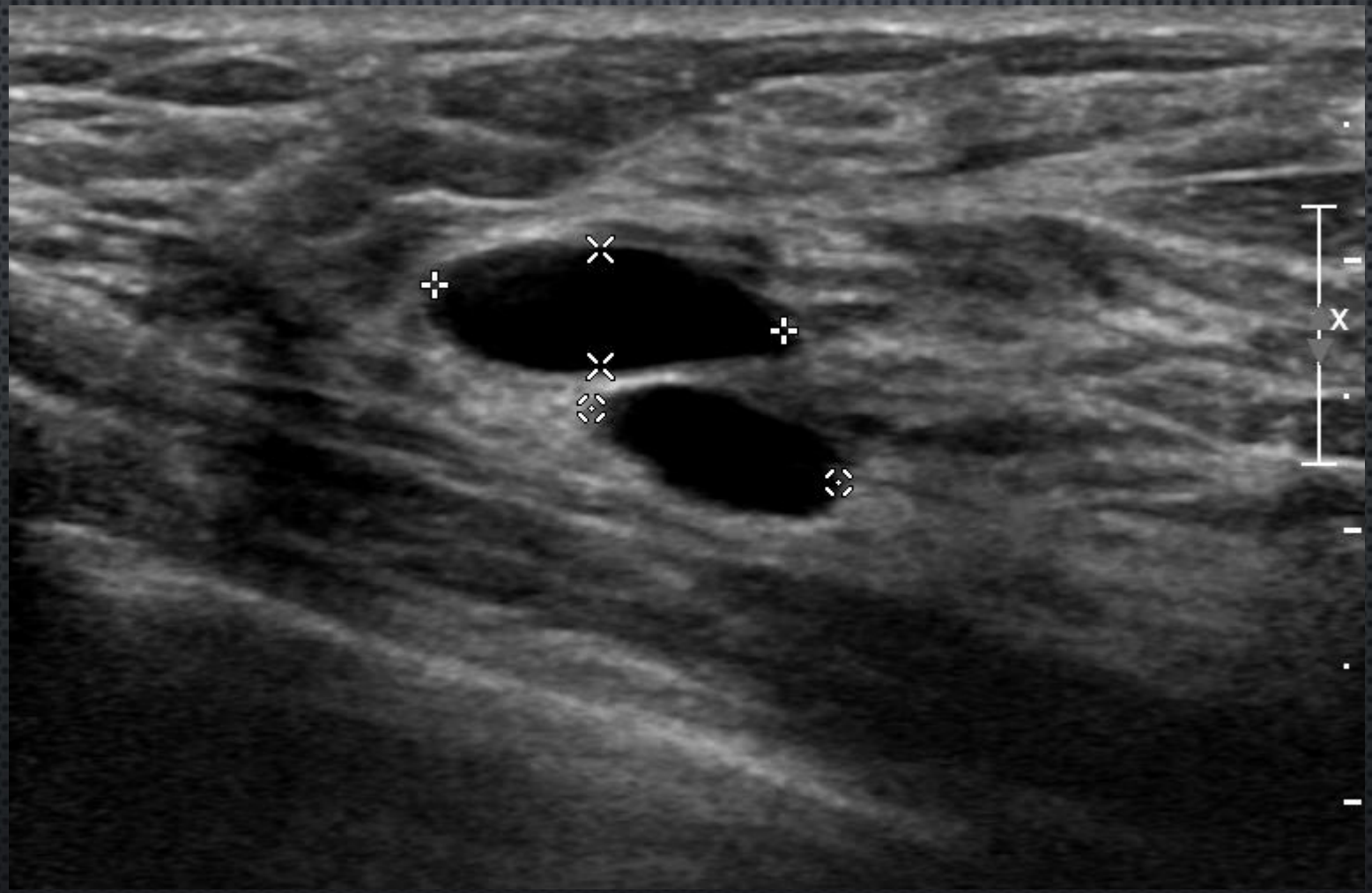
- Typically followed
- Biopsy if new, enlarging, or any suspicious features

Images from STATdx

Right breast



Right breast



★ Benign – simple cysts

SIMPLE CYSTS

- Hard to differentiate cystic versus solid mass on mammography
- Best seen on ultrasound
  - Round or oval in shape
  - Circumscribed margins and anechoic internal echo pattern
  - Thin wall and posterior through-transmission (echo looks brighter posterior/deeper to the cyst)

- No treatment needed
- If causing pain or discomfort, the cyst may be aspirated

REFERENCES

- ACR BIRADS Atlas, fifth edition
- Core Radiology by Jake Mandell, MD