Contrast Enhanced Mammography

"A Goldilocks Solution"

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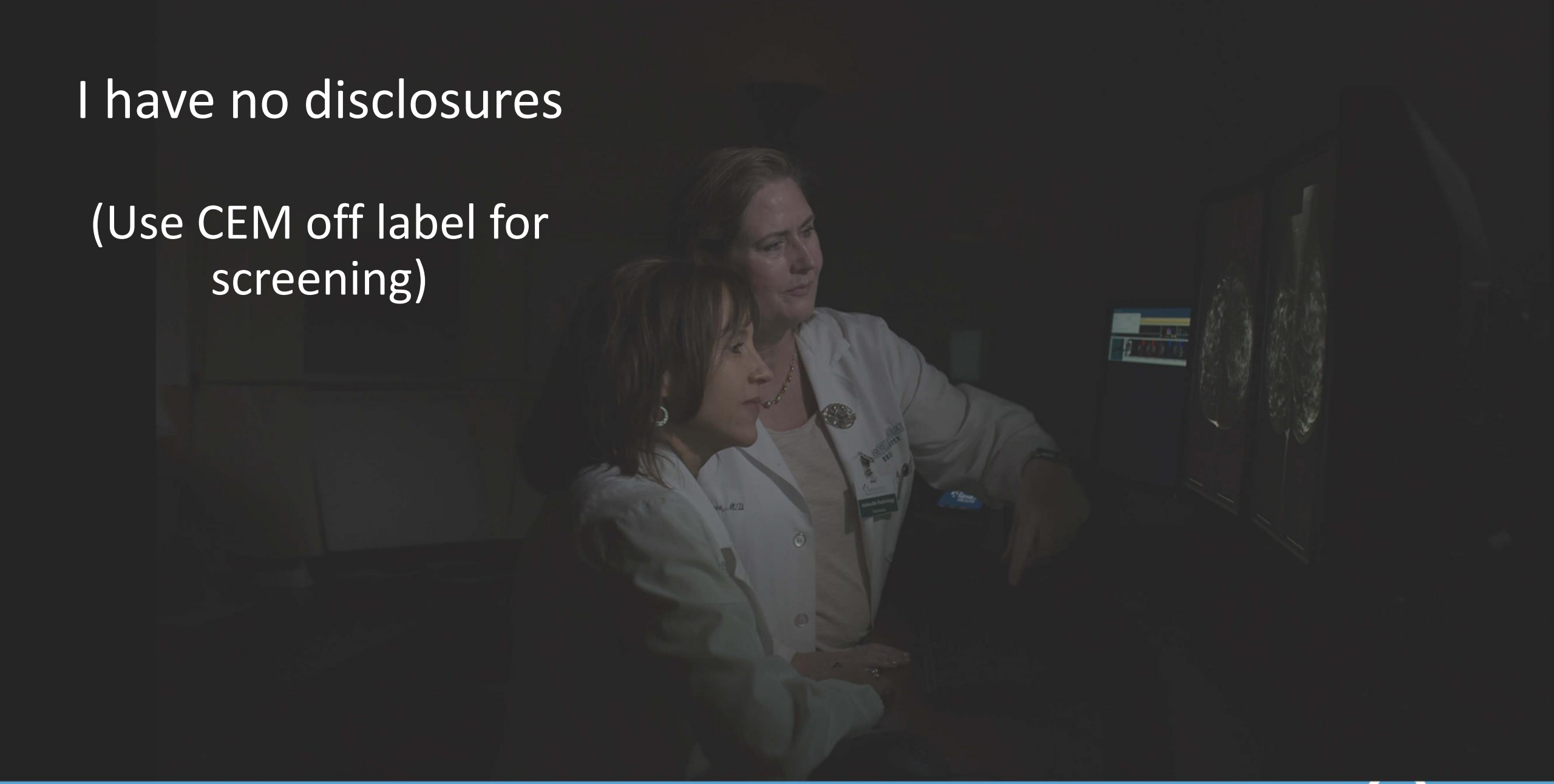
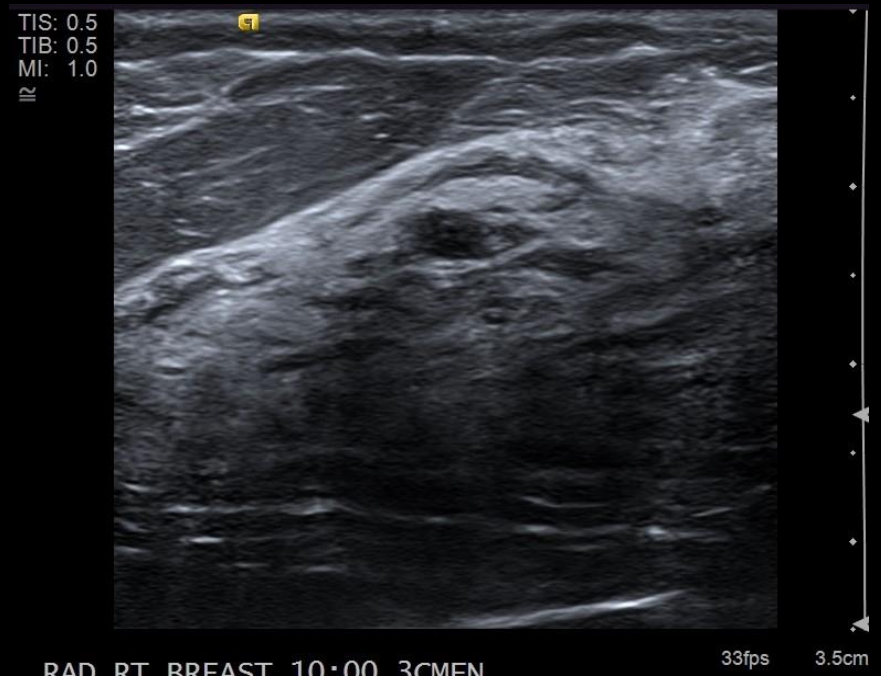
Asheville, NC

I have no disclosures

(Use CEM off label for screening)





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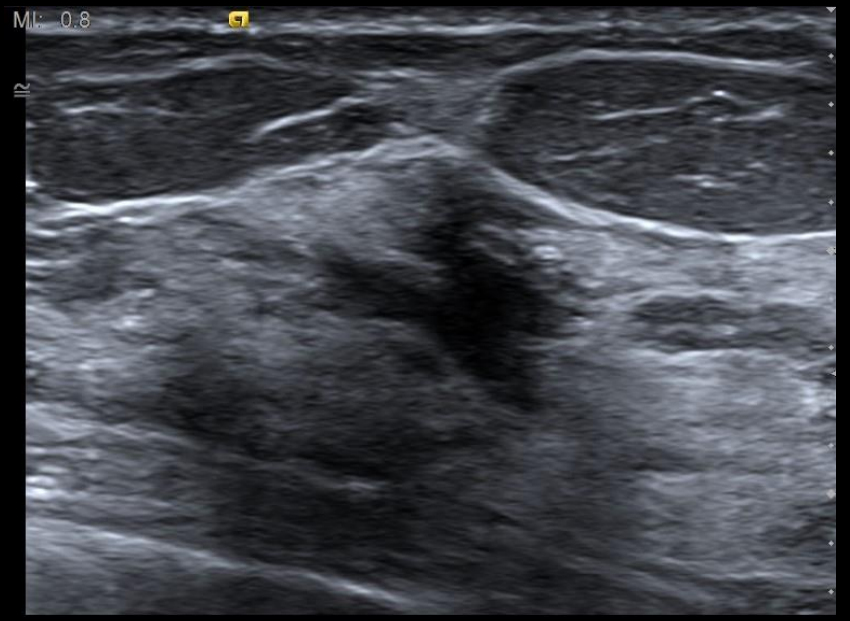
ARAD LT BREAST 8:00 3CMFN _

ARAD RT BREAST 2:00 _



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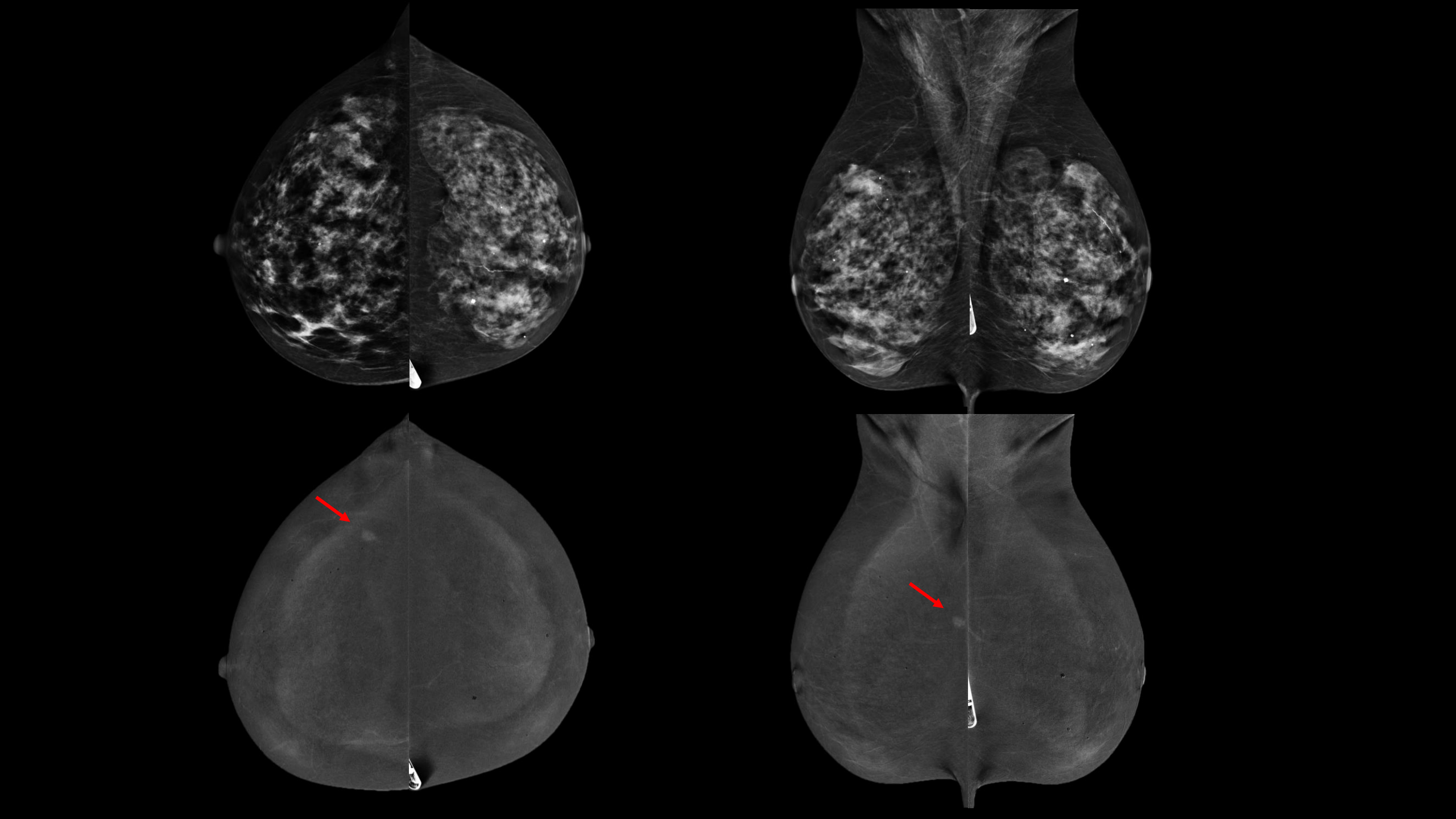
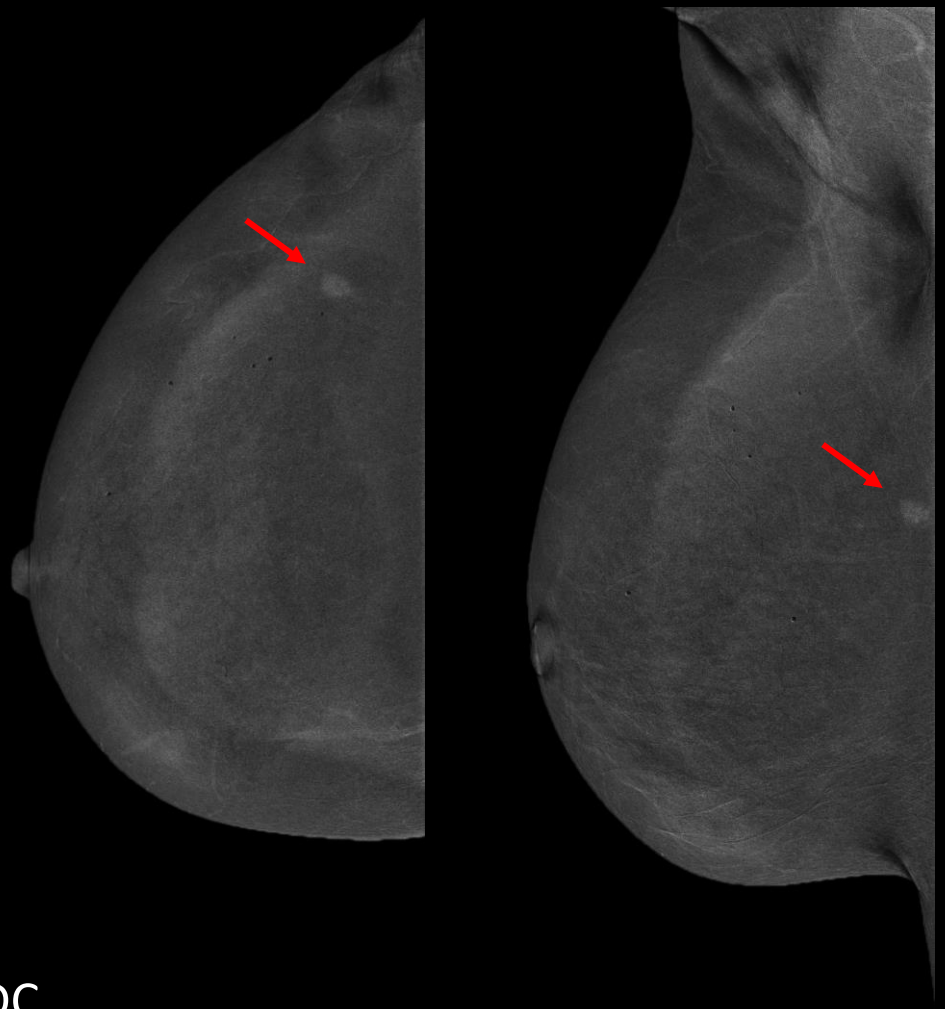
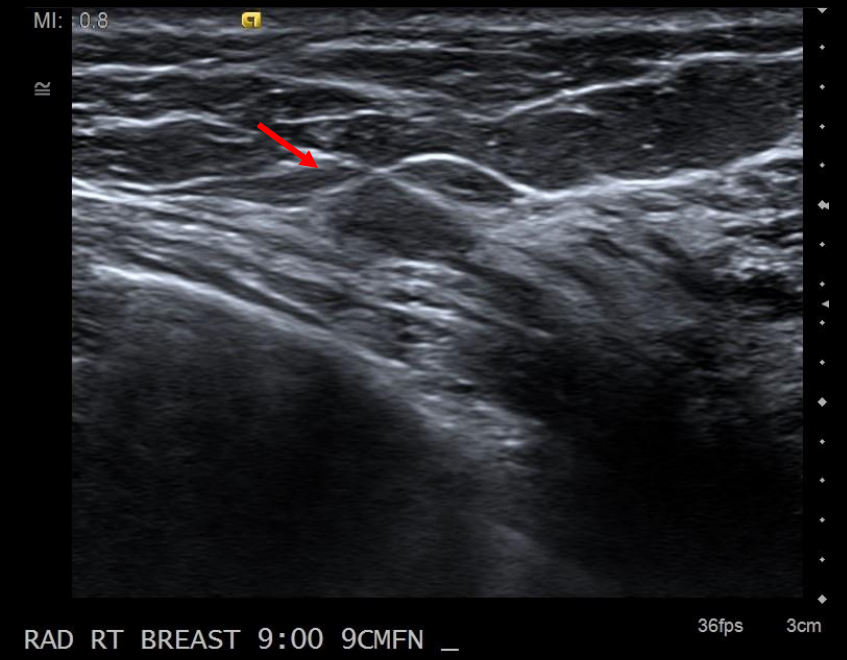




8 mm IDC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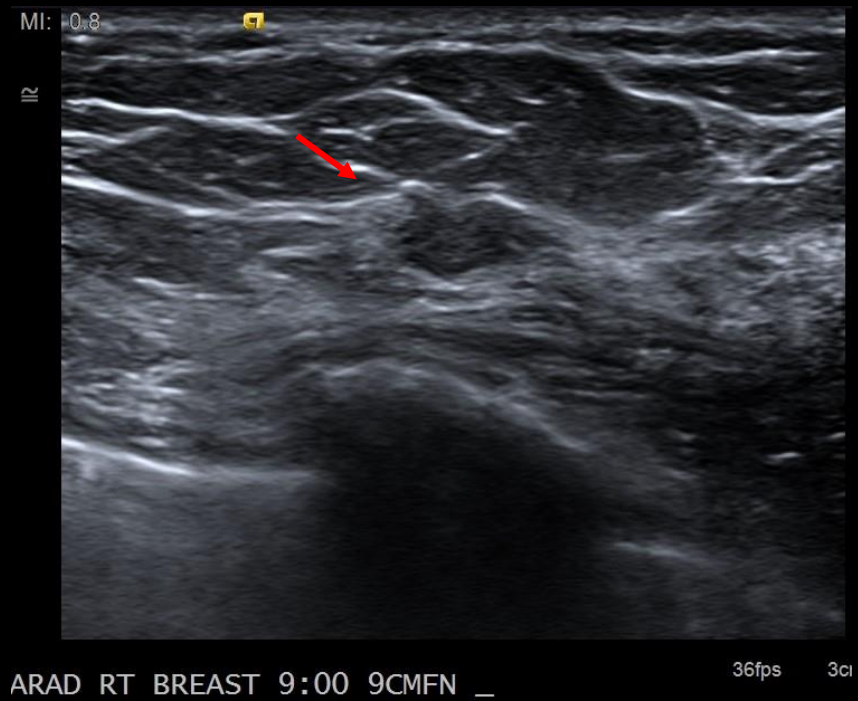
RAD RT BREAST 9:00 9CMFN _
36fps
3cm


MI: 0.8
ARAD RT BREAST 9:00 9CMFN _
36fps

Contrast Enhanced Mammography: A “Just Right” Solution

CEM Overview

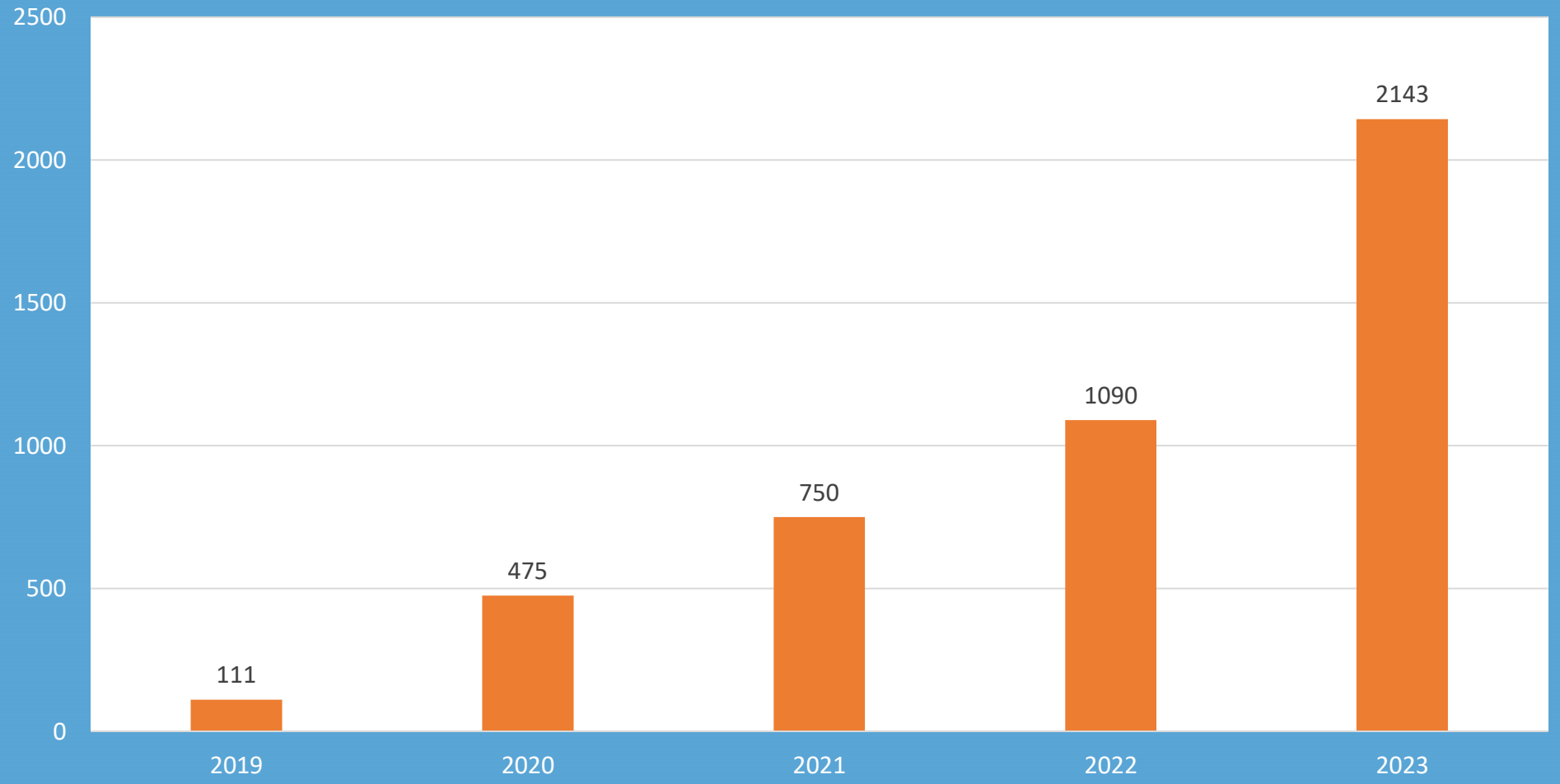
CEM use cases in screening and diagnostic setting

When anatomic imaging only is “too little,” and vascular based imaging with MR is “too much,” CEM can be “just right”

Contrast Mammography in the Mountains

- CEM approved by FDA in 2011 (aka CESM, CEDM, CEDEM)
- “Adjunct following mammography and/or ultrasound exams to localize a known or suspected lesion”
- Introduced into our community practice in 2013
- Embraced by surgeons, volume continues to grow

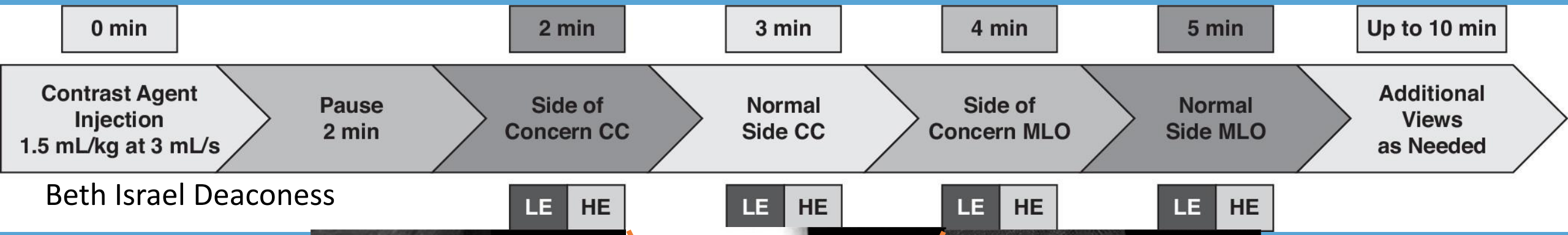
Contrast Mammography in the Mountains



Contrast Mammography Overview

- Provides physiologic information regarding perfusion in addition to anatomic morphology (vascular imaging)
- Eliminates masking effect of dense fibroglandular tissue
- Iodinated IV contrast 1.5 mL/kg at 3mL/sec
- Dual energy technique
- Images obtained starting 2 min after contrast injection, up to 10 min
- Bilateral CC and MLO views, can do added views
- Dose 20-42% higher than DBT, 20-80% higher than FFDM, but below MQSA limits

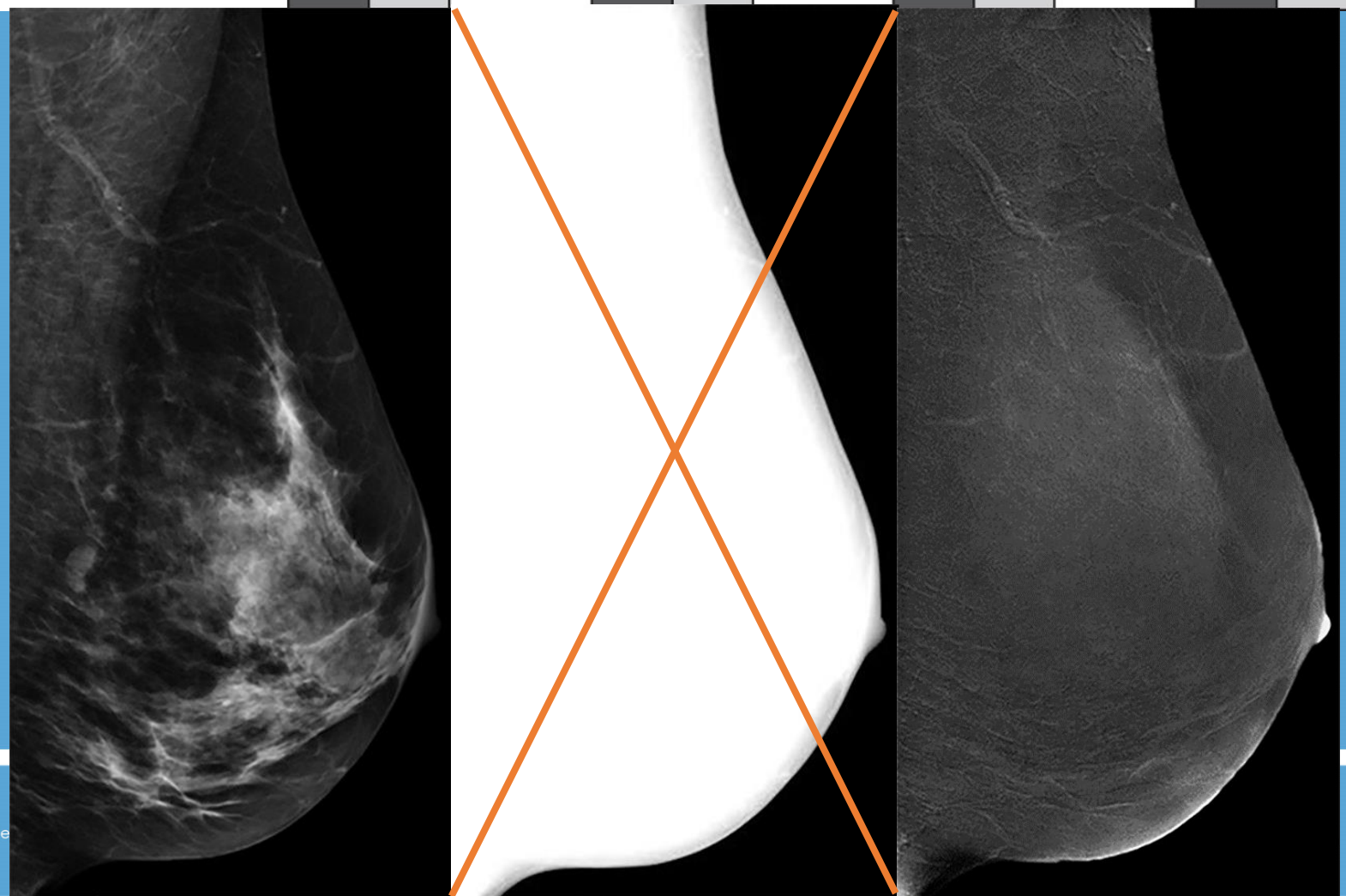
J. Sung, Contrast Enhanced Mammography Implementation into Practice
Dec. 9, 2022, ARRS Symposium Update on Breast Imaging and Multi Modality Biopsy



Beth Israel Deaconess

LE HE LE HE LE HE LE HE

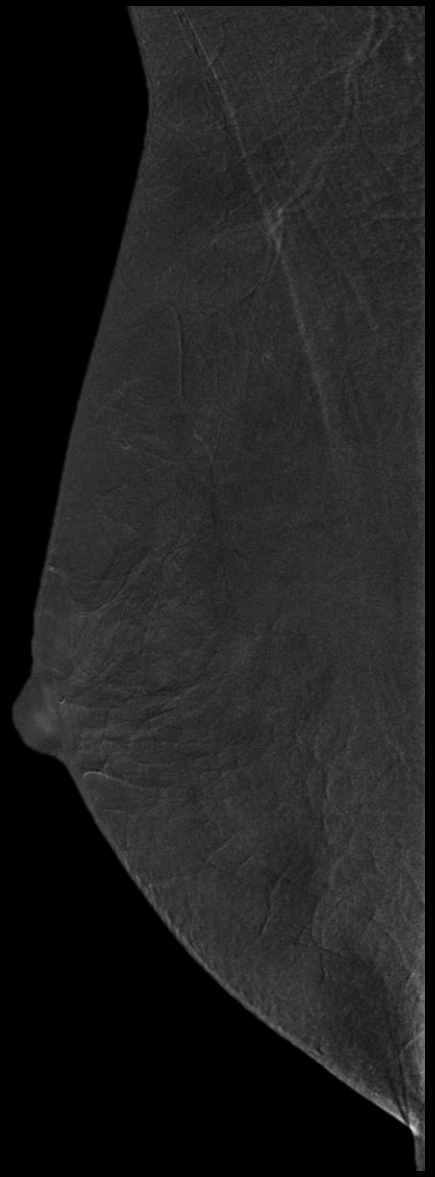
Low Energy (LE)



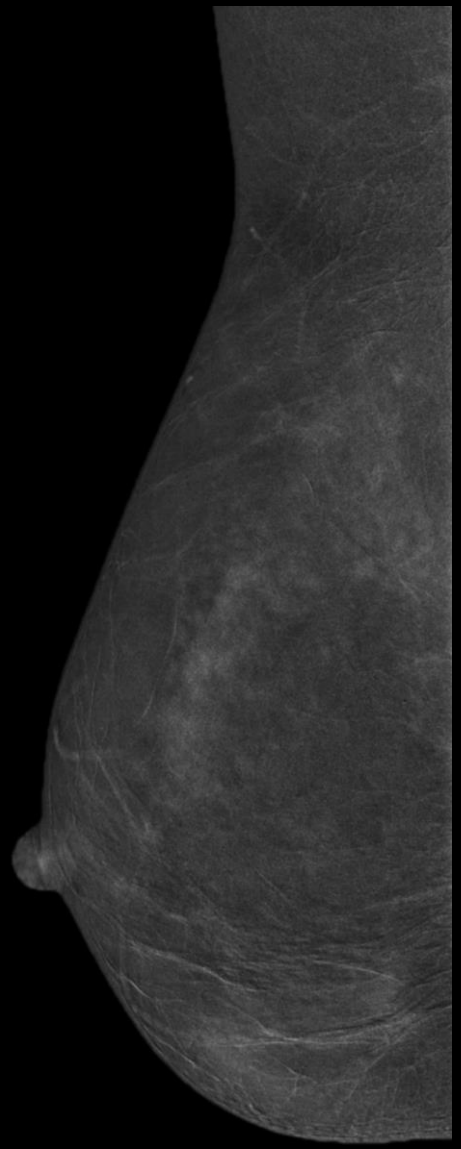
Recombined (RC)

Perry et al AJR:212, January 2019

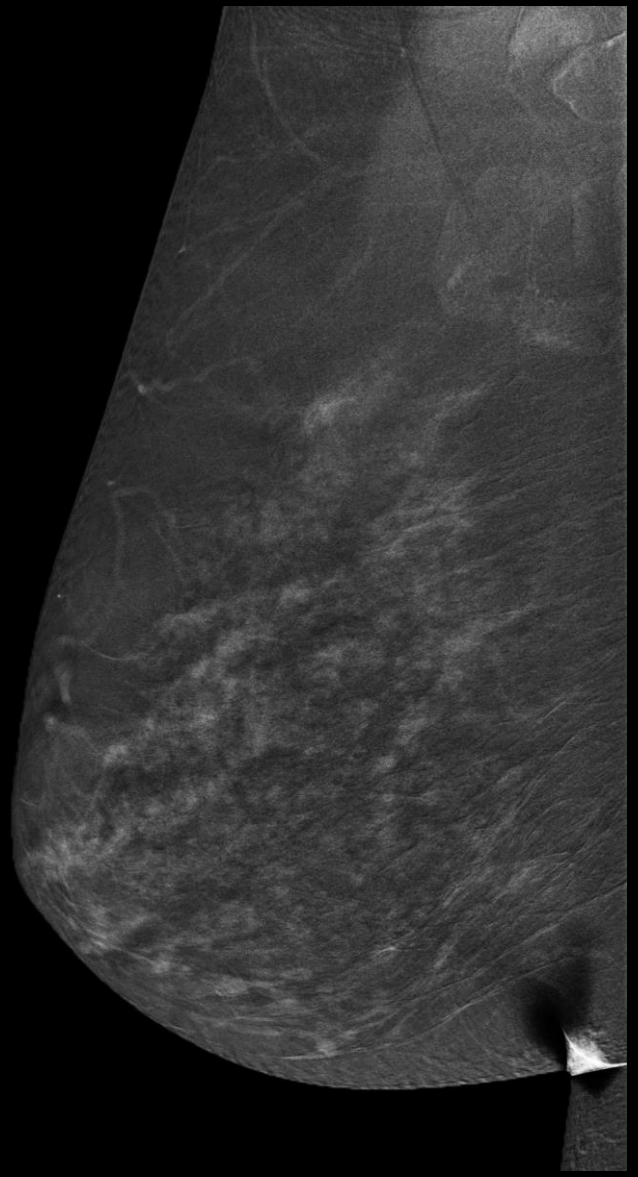
Minimal



Mild



Moderate



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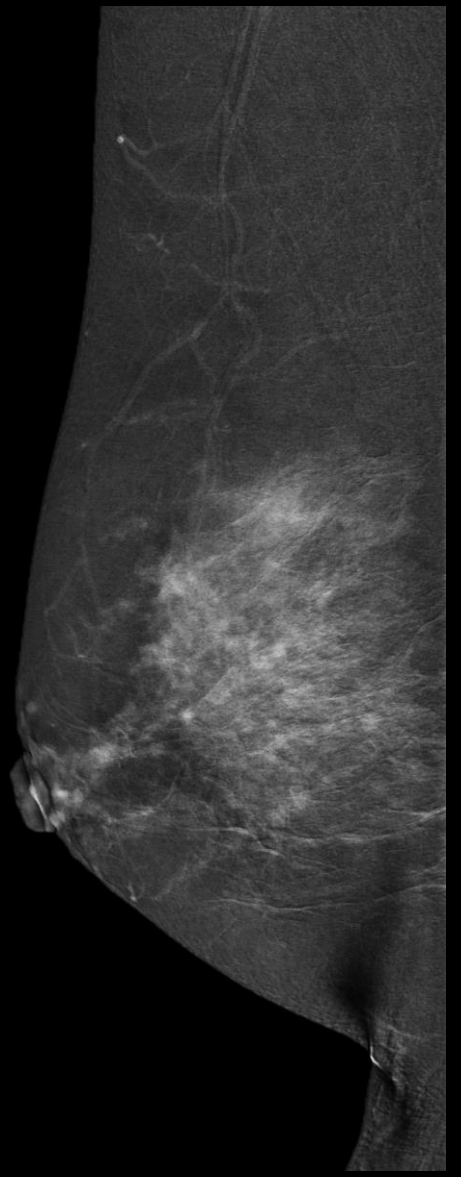


Why CEM?

- Faster, less expensive and greater access than MRI
- Well-tolerated and preferred by patients
- High sensitivity & specificity, comparable to MRI
- High negative predictive value

Clinical uses from the literature

- Recall from screening
- Symptomatic patients (lumps, discharge)
- Cancer Staging
- Monitoring neoadjuvant response
- MRI contraindicated (pacemaker, claustrophobia)
- Supplemental screening

Many subpopulations of women may benefit from vascular imaging with CEM when MRI is not feasible

Journal of the American College of Radiology
Volume 20 ■ Number 9 ■ September 2023

Breast Cancer Screening for Women at Higher-Than-Average Risk: Updated Recommendations From the ACR

CME

Debra L. Monticciolo, MD[a], Mary S. Newell, MD[b], Linda Moy, MD[c], Cindy S. Lee, MD[d], Stamatia V. Destounis, MD[e]

Journal of the American College of Radiology
Volume 15 ■ Number 3PA ■ March 2018

Breast Cancer Screening in Women at Higher-Than-Average Risk: Recommendations From the ACR

EC: Editor's Choice

SA-CME

Debra L. Monticciolo, MD[a], Mary S. Newell, MD[b], Linda Moy, MD[c], Bethany Niell, MD, PhD[d], Barbara Monsees, MD[e], Edward A. Sickles, MD[f]

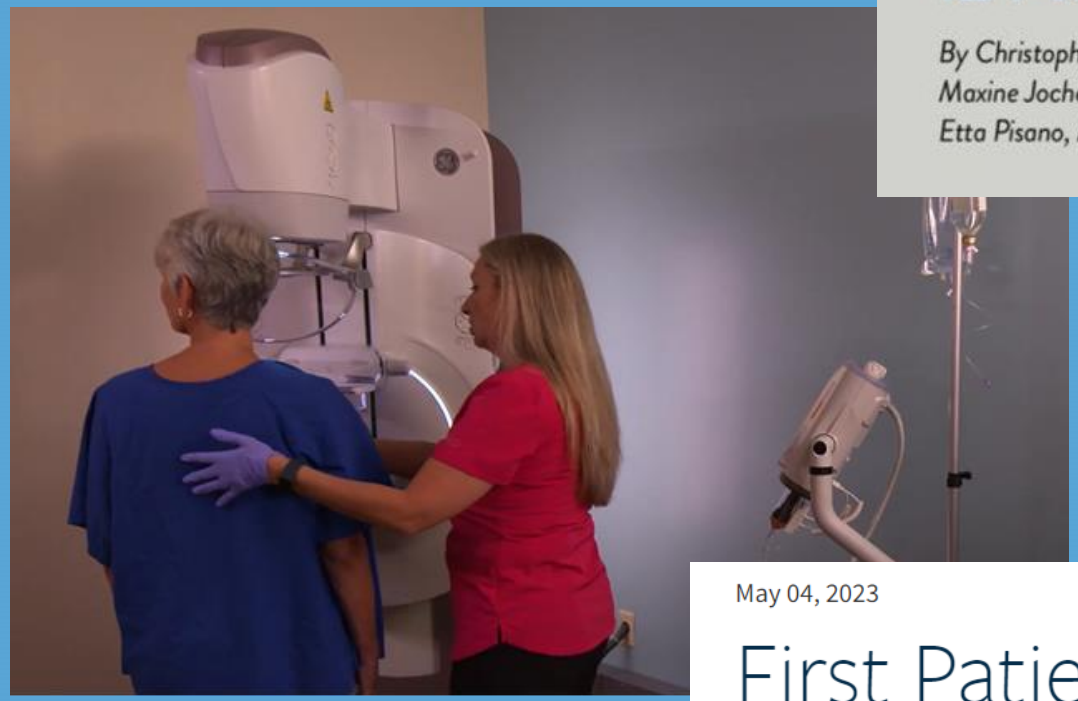
- For women with personal histories of breast cancer and dense breast tissue, or those diagnosed before age 50, annual surveillance with breast MRI is recommended.

Dense breast tissue	■ Annual DM ± DBT ■ Consider annual MRI or ultrasound (Age 40 or earlier if other risk factors)	■ Annual DM ± DBT ■ **Annual MRI** ■ **Consider CEM or ultrasound as alternative to MRI** (Age 40 or earlier if other risk factors)

Contrast Enhanced Mammography Imaging Screening Trial (CMIST) Is Now Open!

By Christopher Comstock, MD, FACR, FSBI; Janice Sung, MD, FSBI; Maxine Jochelson, MD, FACR, FSBI; Jessica Leung, MD, FACR, FSBI; Etta Pisano, MD, FACR, FSBI

Christopher Comstock, MD, FACR, FSBI



May 04, 2023

First Patients Enrolled in Contrast Enhanced Mammography Imaging Screening Trial (CMIST)

Share Recommend Bookmark

Study aims to determine whether CEM improves breast cancer detection for women with dense breasts

American College of Radiology
ACR Appropriateness Criteria®
Supplemental Breast Cancer Screening Based on Breast Density

New 2021

Variant 6: **Supplemental breast cancer screening. High-risk females with dense breasts.**

Procedure	Appropriateness Category	Relative Radiation Level
US breast	Usually Appropriate	O
Digital breast tomosynthesis screening	Usually Appropriate	☢☢
MRI breast without and with IV contrast	Usually Appropriate	O
MRI breast without and with IV contrast abbreviated	Usually Appropriate	O
Mammography with IV contrast	May Be Appropriate	☢☢
MRI breast without IV contrast	Usually Not Appropriate	O
MRI breast without IV contrast abbreviated	Usually Not Appropriate	O
Sestamibi MBI	Usually Not Appropriate	☢☢☢
FDG-PET breast dedicated	Usually Not Appropriate	☢☢☢☢

American College of Radiology
ACR Appropriateness Criteria®
Supplemental Breast Cancer Screening Based on Breast Density

New 2021

Variant 3: **Supplemental breast cancer screening. High-risk females with nondense breasts.**

Procedure	Appropriateness Category	Relative Radiation Level
Digital breast tomosynthesis screening	Usually Appropriate	☢☢
MRI breast without and with IV contrast	Usually Appropriate	O
Mammography with IV contrast	May Be Appropriate	☢☢
US breast	May Be Appropriate	O
MRI breast without and with IV contrast abbreviated	May Be Appropriate	O
MRI breast without IV contrast	Usually Not Appropriate	O
MRI breast without IV contrast abbreviated	Usually Not Appropriate	O
Sestamibi MBI	Usually Not Appropriate	☢☢☢
FDG-PET breast dedicated	Usually Not Appropriate	☢☢☢☢

American College of Radiology
ACR Appropriateness Criteria®
Supplemental Breast Cancer Screening Based on Breast Density

New 2021

Variant 5: **Supplemental breast cancer screening. Intermediate-risk females with dense breasts.**

Procedure	Appropriateness Category	Relative Radiation Level
Digital breast tomosynthesis screening	Usually Appropriate	☢☢
Mammography with IV contrast	May Be Appropriate	☢☢
US breast	May Be Appropriate	O
MRI breast without and with IV contrast	May Be Appropriate	O
MRI breast without and with IV contrast abbreviated	May Be Appropriate	O
MRI breast without IV contrast	Usually Not Appropriate	O
MRI breast without IV contrast abbreviated	Usually Not Appropriate	O
Sestamibi MBI	Usually Not Appropriate	☢☢☢
FDG-PET breast dedicated	Usually Not Appropriate	☢☢☢☢

American College of Radiology
ACR Appropriateness Criteria®
Supplemental Breast Cancer Screening Based on Breast Density

New 2021

Variant 4: **Supplemental breast cancer screening. Average-risk females with dense breasts.**

Procedure	Appropriateness Category	Relative Radiation Level
Digital breast tomosynthesis screening	Usually Appropriate	☢☢
Mammography with IV contrast	May Be Appropriate	☢☢
US breast	May Be Appropriate (Disagreement)	O
MRI breast without and with IV contrast	May Be Appropriate	O
MRI breast without and with IV contrast abbreviated	May Be Appropriate	O
MRI breast without IV contrast	Usually Not Appropriate	O
MRI breast without IV contrast abbreviated	Usually Not Appropriate	O
Sestamibi MBI	Usually Not Appropriate	☢☢☢
FDG-PET breast dedicated	Usually Not Appropriate	☢☢☢☢

NCCN Guidelines Version 1.2022
Breast Cancer Screening and Diagnosis

SCREENING OR SYMPTOM CATEGORY[a]	SCREENING/FOLLOW-UP
Increased Risk:	
Residual lifetime risk ≥20% as defined by models that are largely dependent on family history[g,h,i]	• Clinical encounter[b,d,k] every 6–12 mo ▸ To begin when identified as being at increased risk, but not prior to age 21 y ▸ Consider referral to a genetic counselor or other health professional with expertise and experience in cancer genetics, if not already done ▸ Consider referral to a breast specialist as appropriate • Annual screening[b] mammogram.[c,m] Tomosynthesis is recommended, if available[o] ▸ To begin 10 years prior to when the youngest family member was diagnosed with breast cancer, not prior to age 30 y or begin at age 40 y (whichever comes first) • Annual breast MRI[p] ▸ To begin 10 years prior to when the youngest family member was diagnosed with breast cancer, not prior to age 25 y[q] or begin at age 40 y (whichever comes first) ▸ Consider contrast-enhanced mammography[b] or whole breast ultrasound[b] for those who qualify for but cannot undergo MRI • Consider risk reduction strategies (See NCCN Guidelines for Breast Cancer Risk Reduction) • Breast awareness[l]
Thoracic RT between ages 10 and 30 y Current age <25 y	• Annual clinical encounter[b,d,k] ▸ Beginning 8 y after RT • Breast awareness[l]
Thoracic RT between ages 10 and 30 y Current age ≥25 y	• Clinical encounter[b,d,k] every 6–12 mo ▸ Begin 8 y after RT • Annual screening[b] mammogram.[c,m] Tomosynthesis is recommended, if available[o] ▸ Begin 8 y after RT but not prior to age 30 y • Annual breast MRI[p] ▸ Begin 8 y after RT but not prior to age 25 y ▸ Consider contrast-enhanced mammography[b] or whole breast ultrasound[b] for those who qualify for but cannot undergo MRI • Consider risk reduction strategies (See NCCN Guidelines for Breast Cancer Risk Reduction) • Breast awareness[l]

How we use CEM:

Diagnostic problem solving

Alternative to MR screening

Screening dense tissue (as an alternative to ABUS)

- Architectural distortion
  - *Especially prior to tomosynthesis biopsy capability*
- Asymmetries
  - *Dense tissue, intermediate or high risk*
- Complicated recalls from screening
  - *Multiple findings, ABUS recalls, no priors*
- Post lumpectomy (especially dense tissue)
- Biopsy targeting
- Increasing confidence of benign rad-path concordance

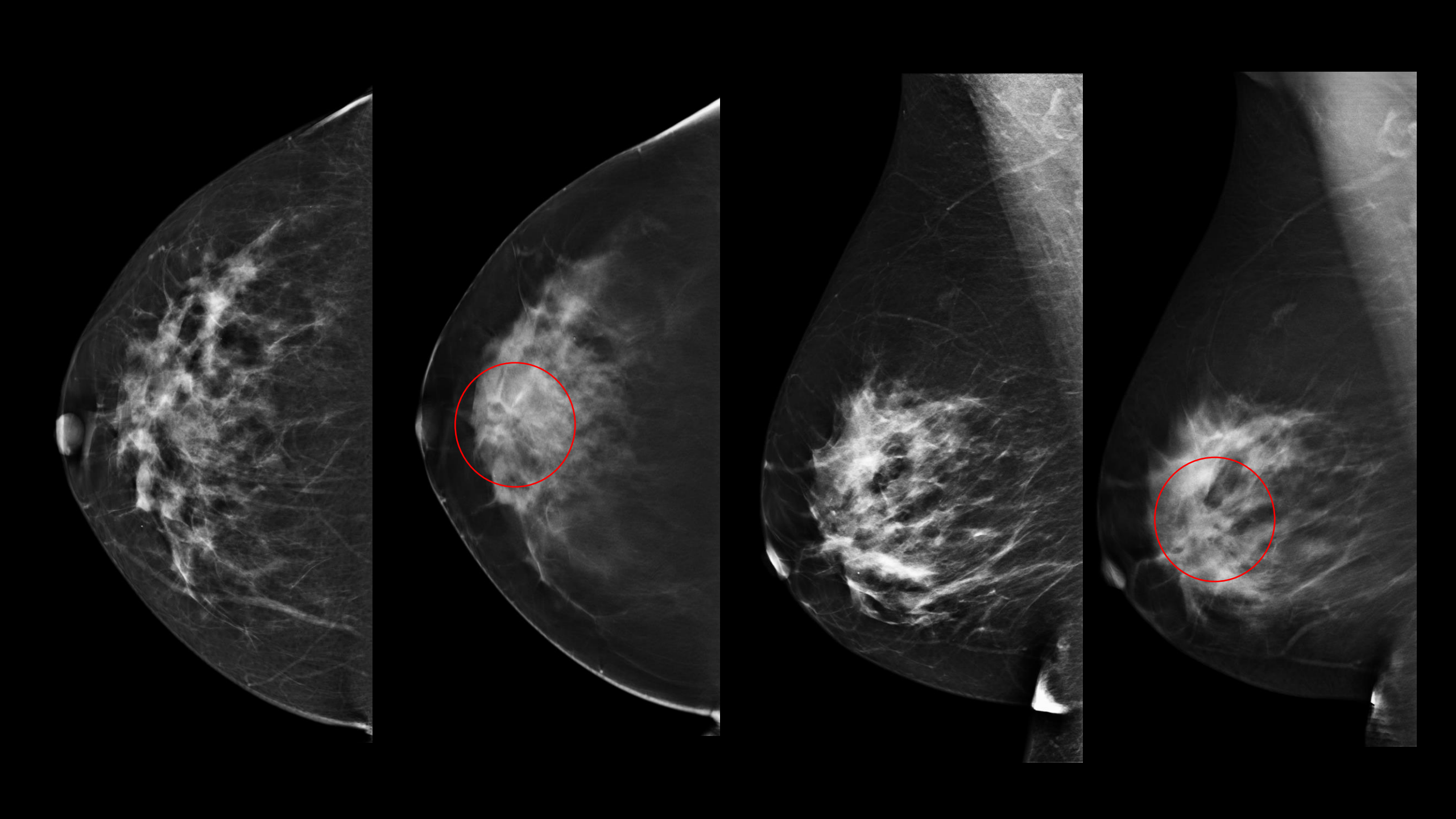
Diagnostic Problem Solving (initial workup)

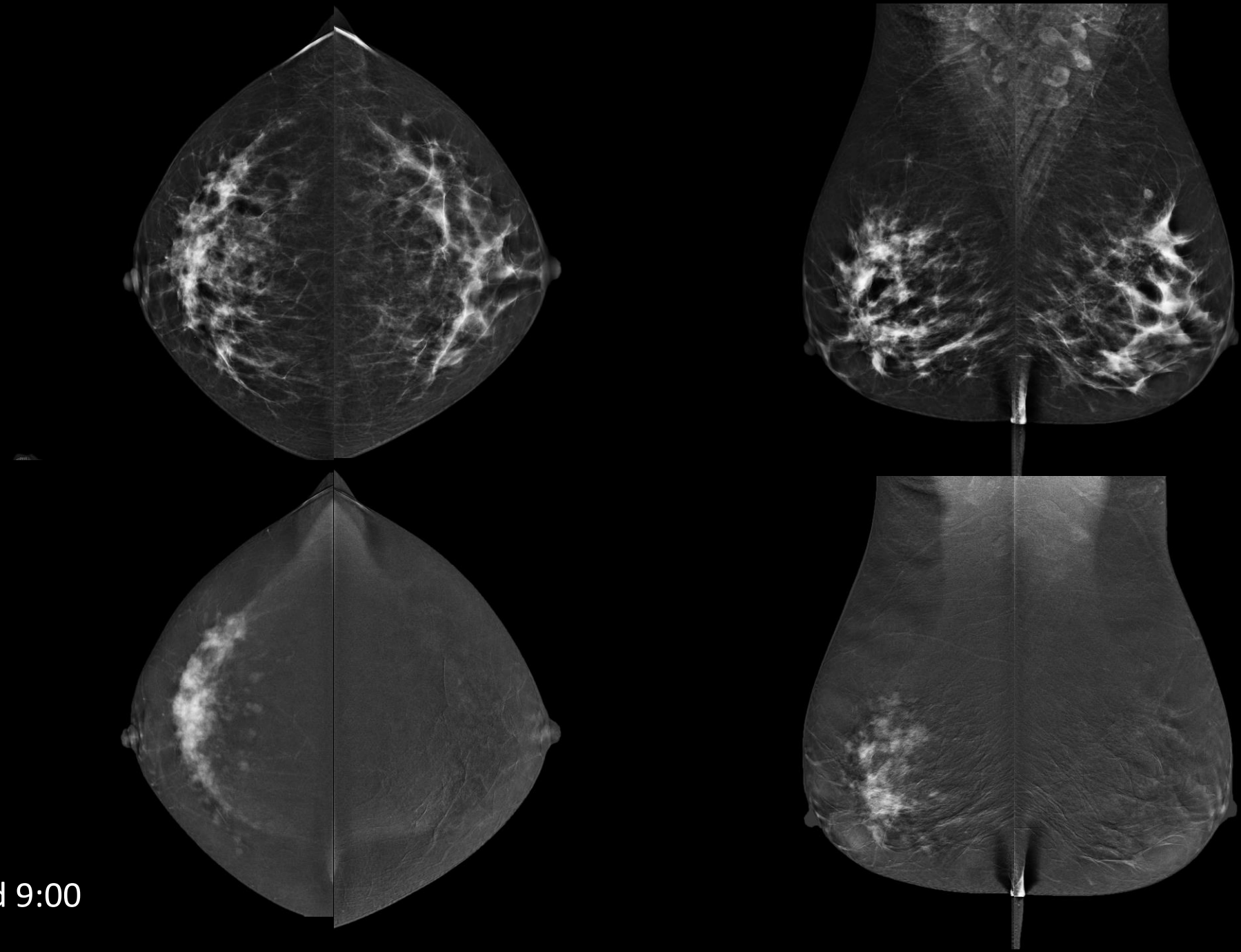
Architectural distortion

- Poorly localized for tomosynthesis guided biopsy
- "Pseudo-distortions"
- Possible post op distortion
  - *No priors, first tomo*

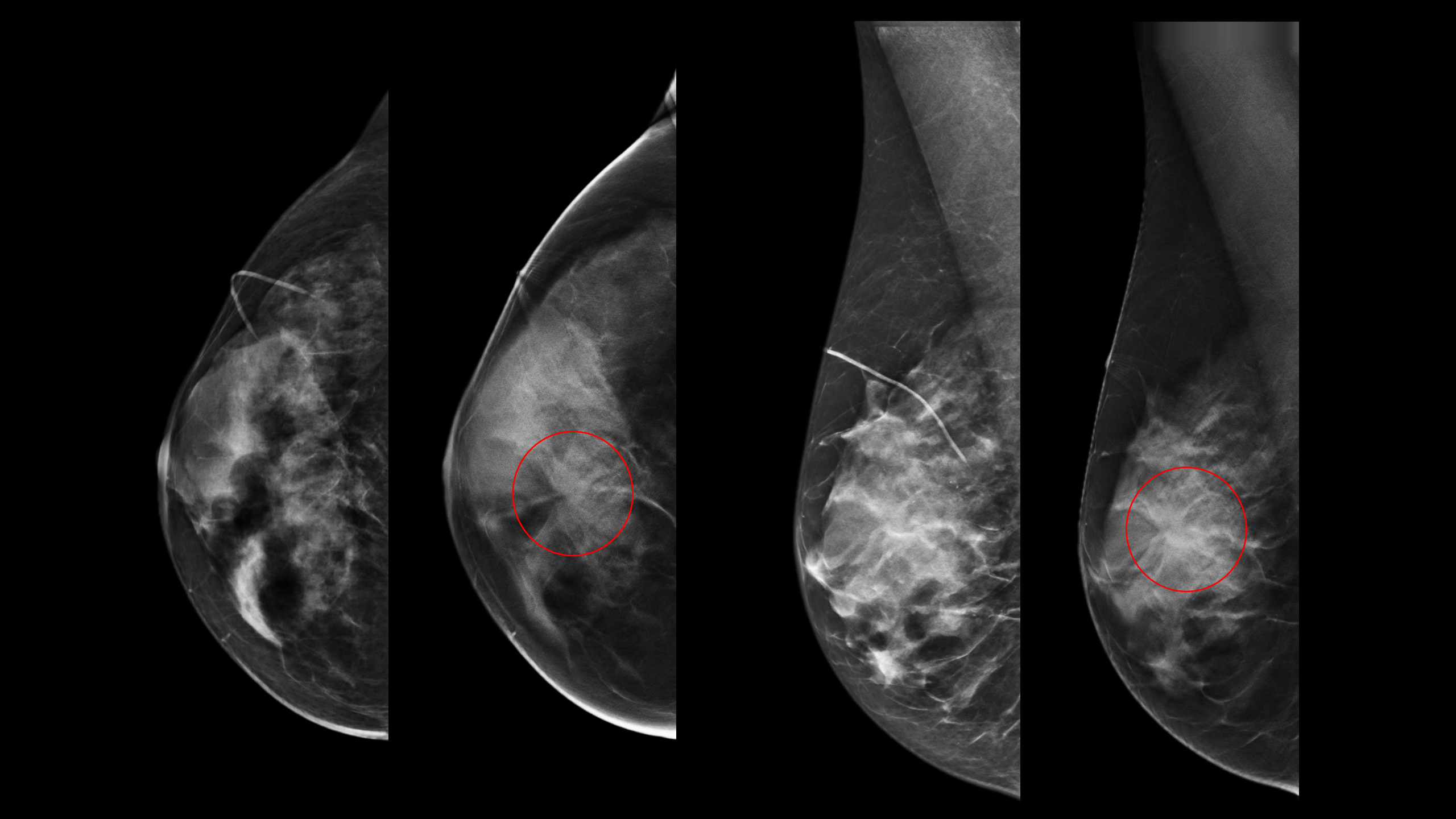
Asymmetries

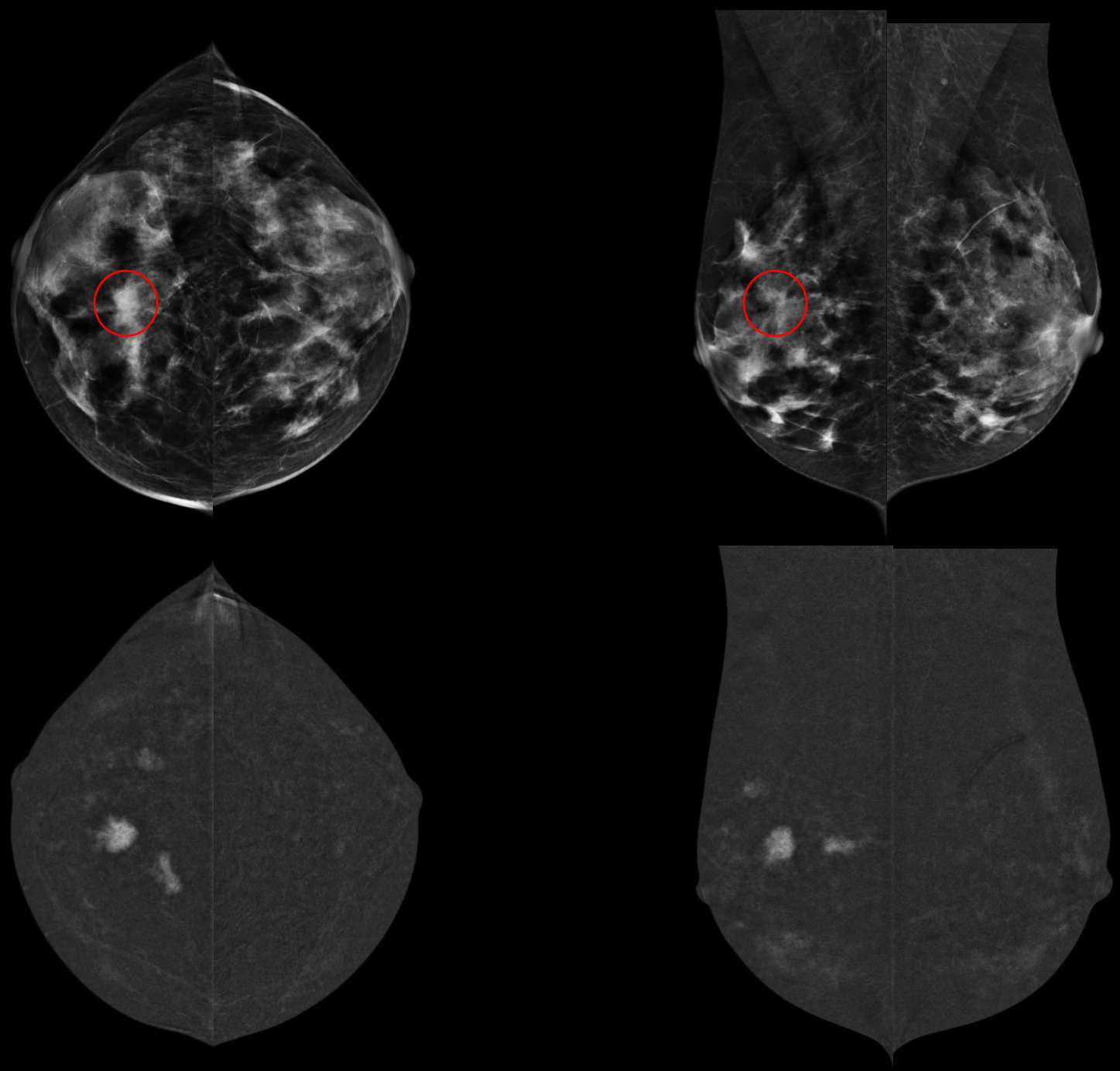
ABUS recalls (particularly non mass)



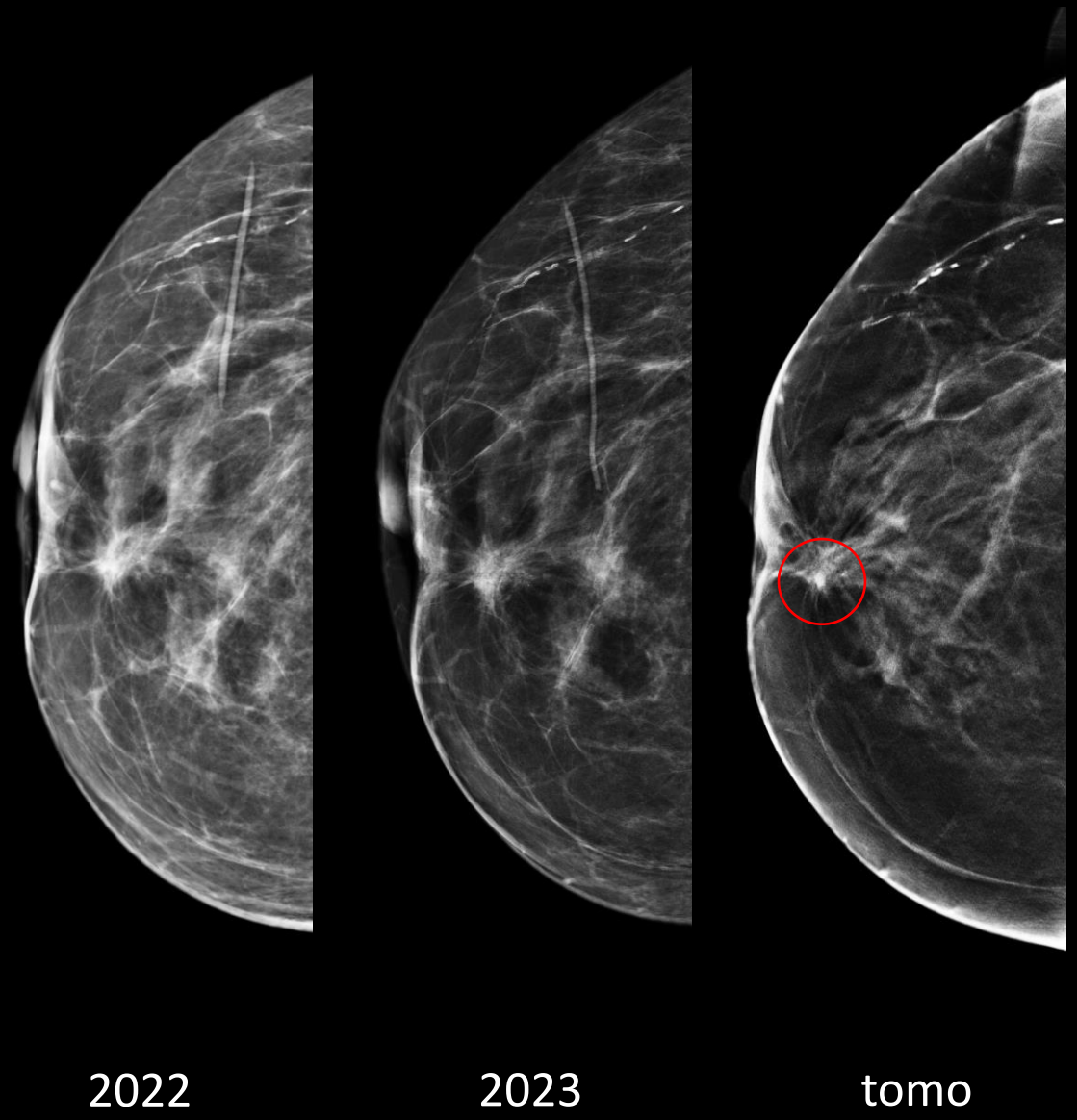


US x 2
ILC 3:00 and 9:00

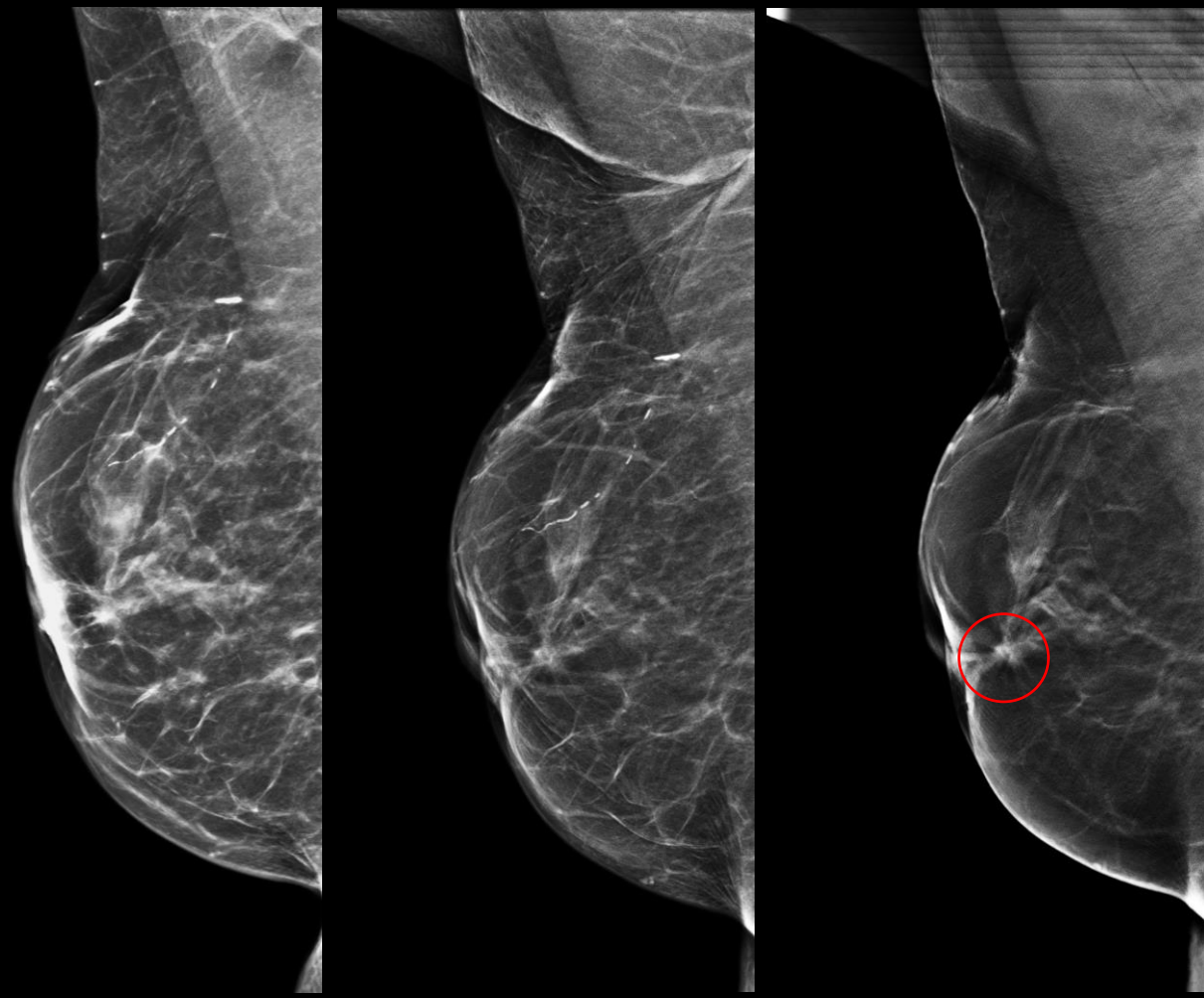




US x 2
Dominant Mass = ILC
Superior lateral LCIS

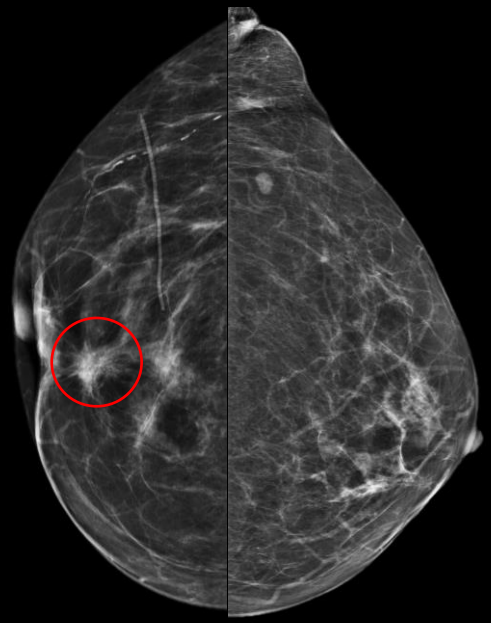


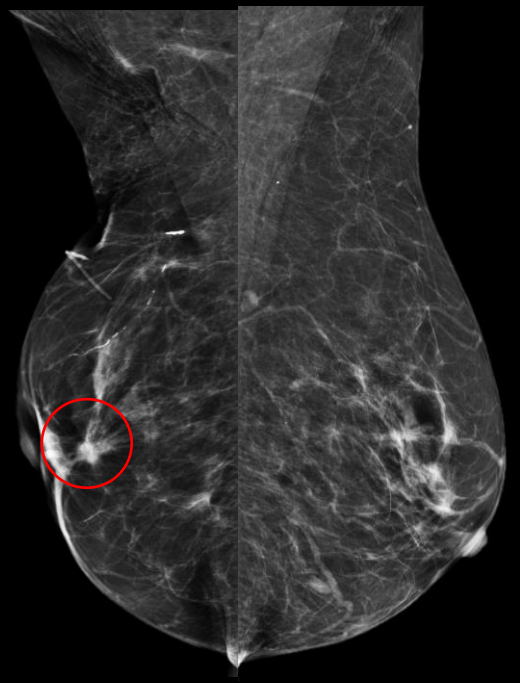
2022 2023 tomo

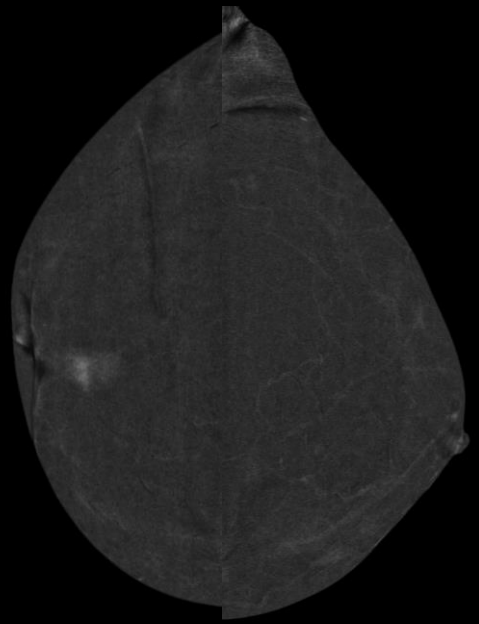


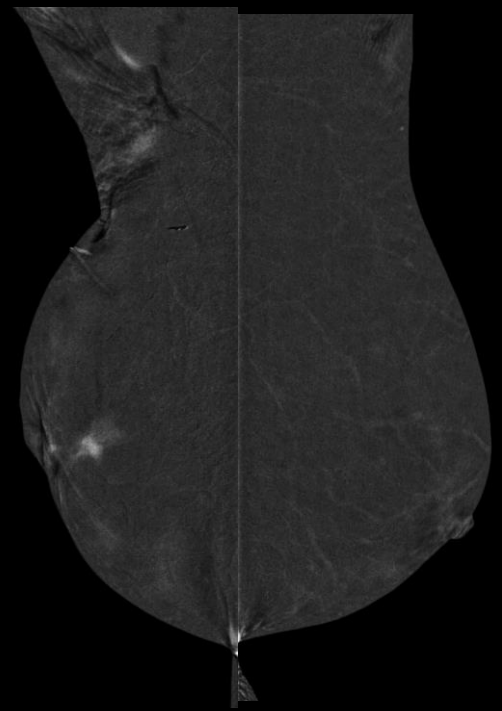
2022 2023 tomo

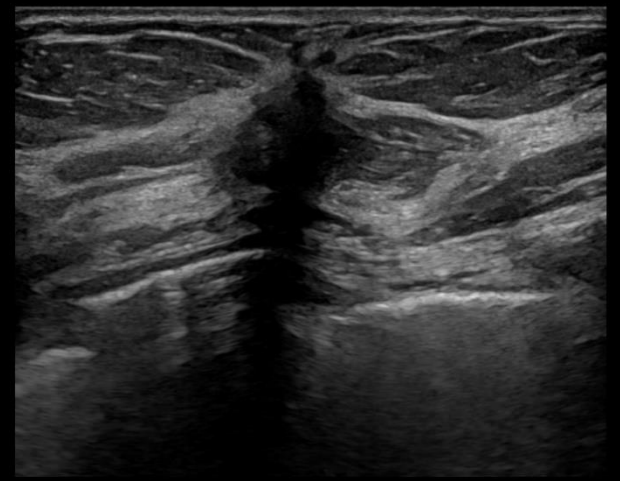
Personal hx breast ca age 43, with lumpectomy and RT
Now 79





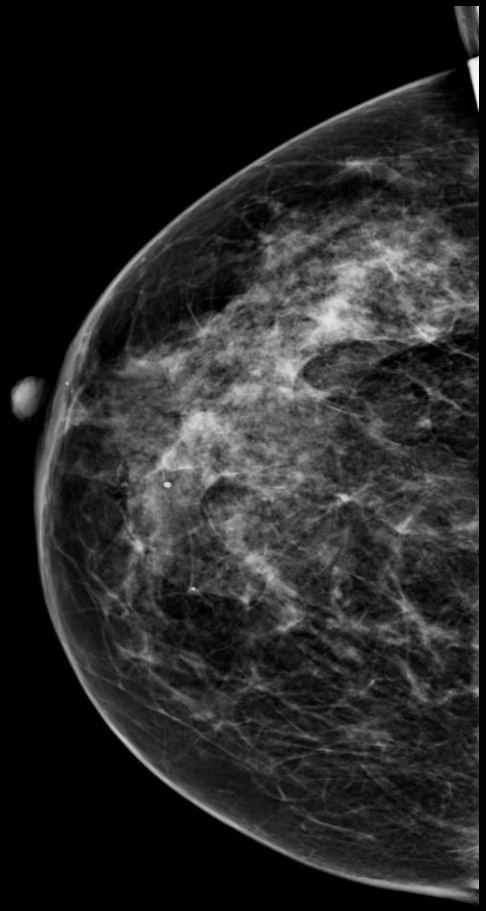




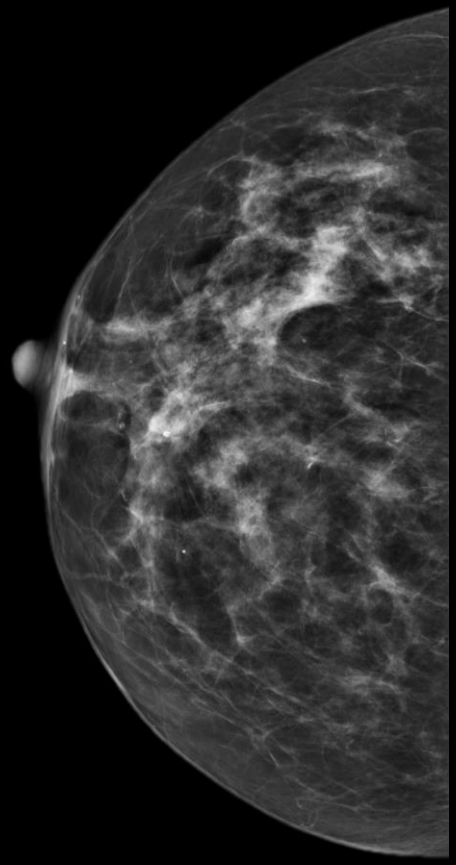


US target

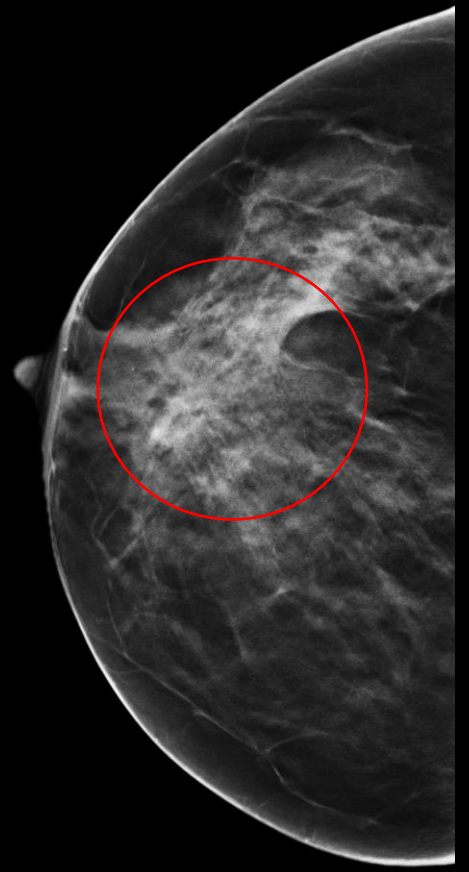
Path = IDC grade 2 and DCIS



Outside prior,
tomos unavailable



current



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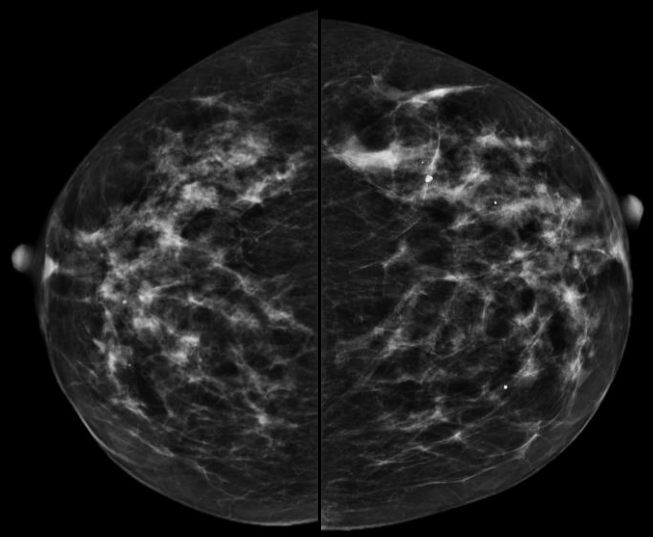
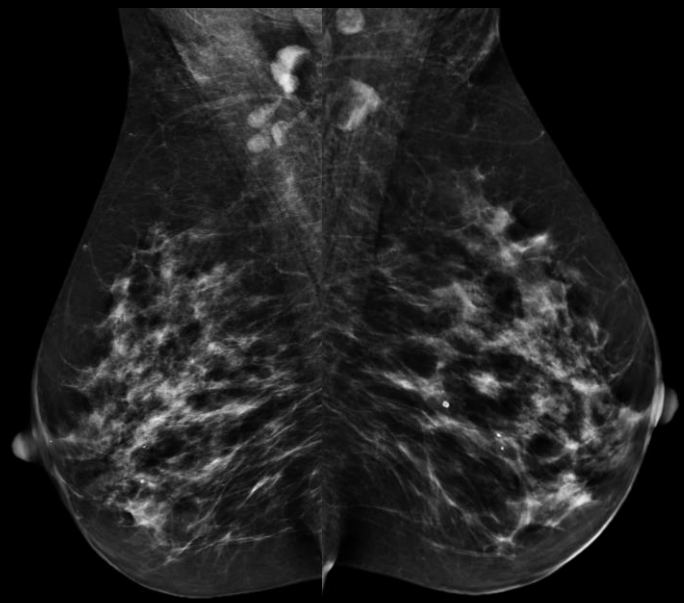
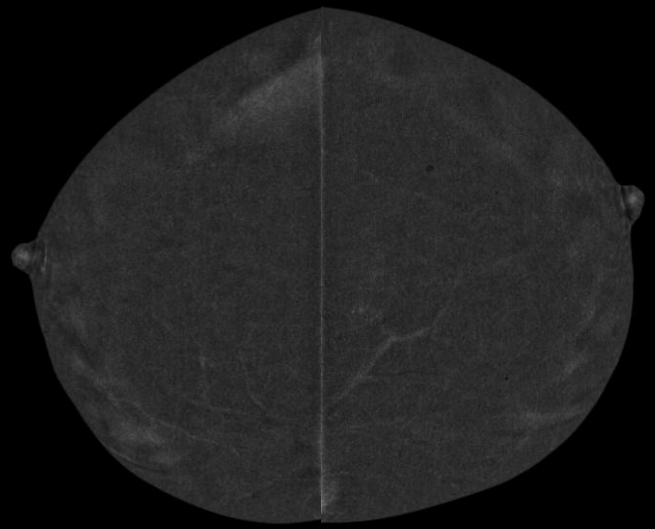
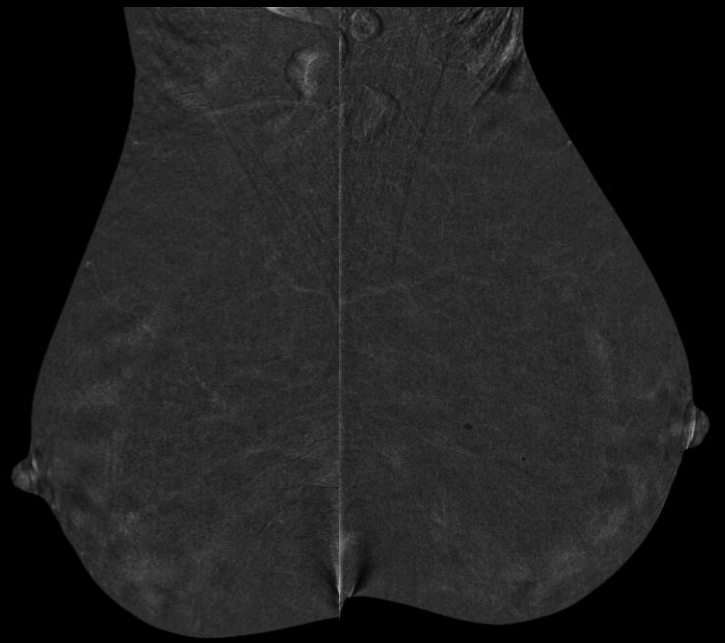
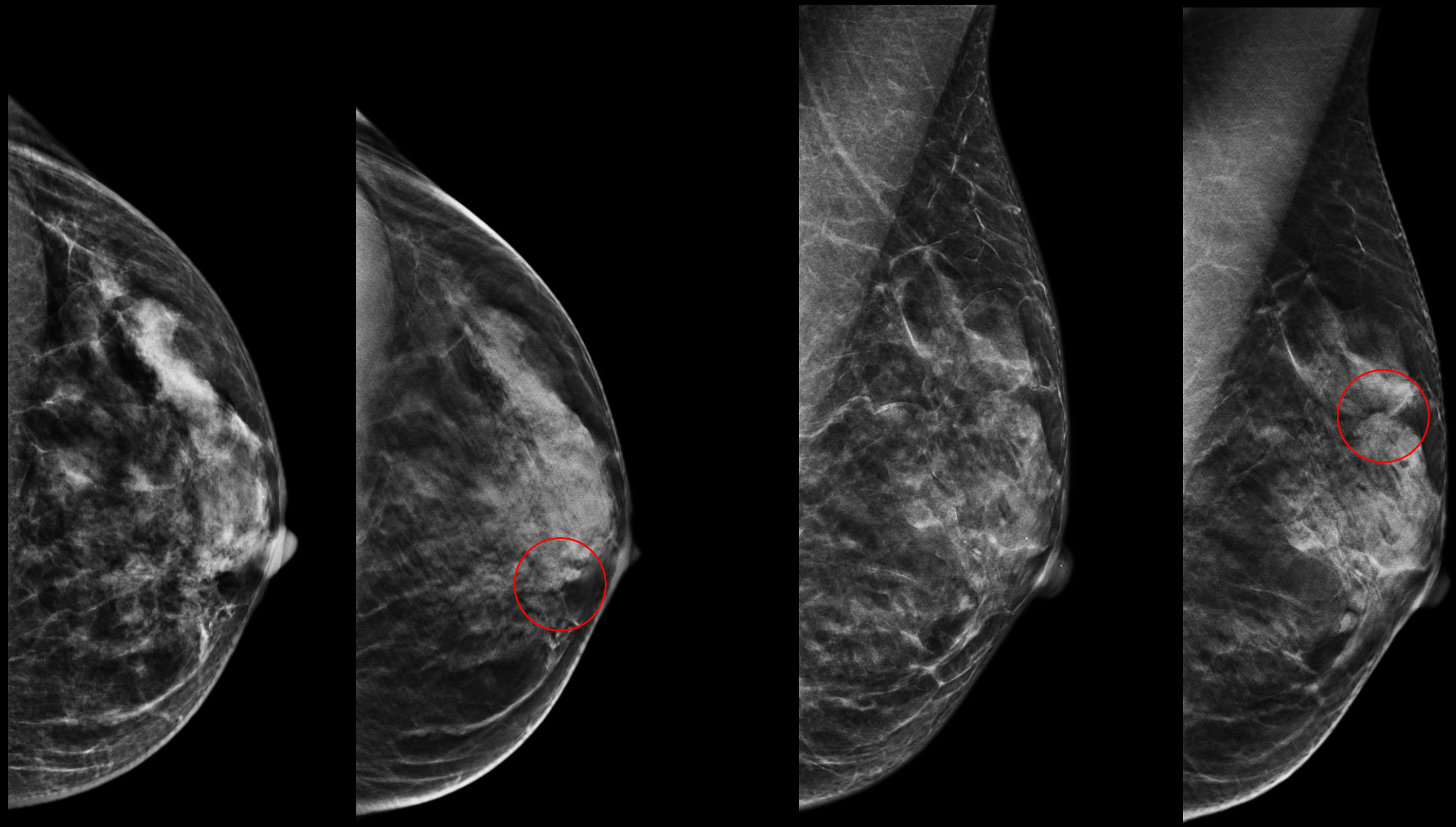
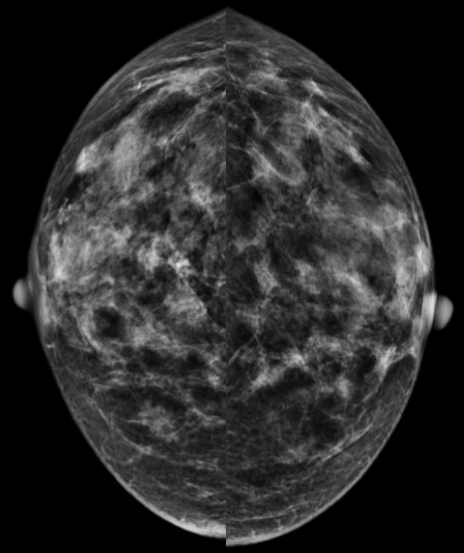


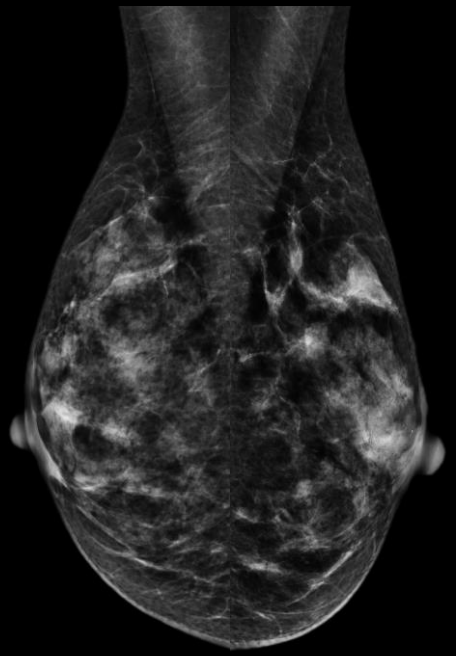


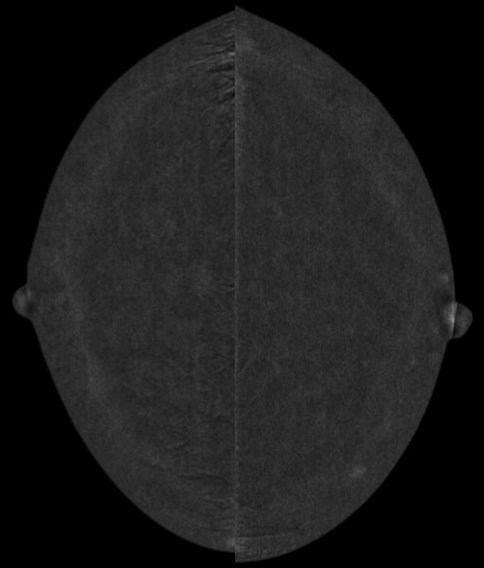












Diagnostic Problem Solving (initial workup)

Architectural distortion

Asymmetries

ABUS recalls (particularly non mass)

- Dense tissue, especially extremely dense
- Intermediate/high risk not getting vascular (CEM/MR) screening
- One view, focal, global
  - *vs. developing asymmetry → biopsy*

CEM and asymmetries

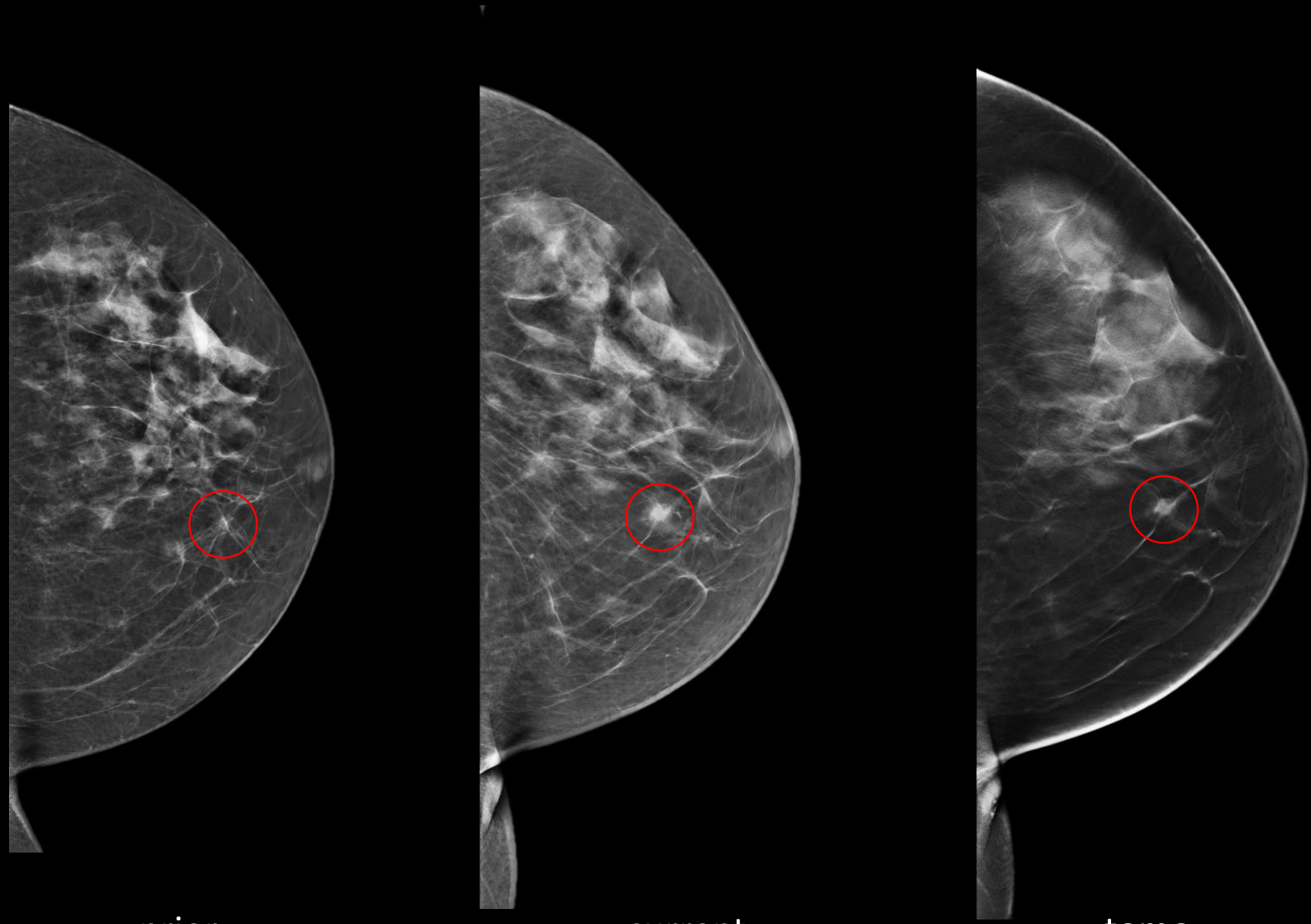
CEM has high NPV

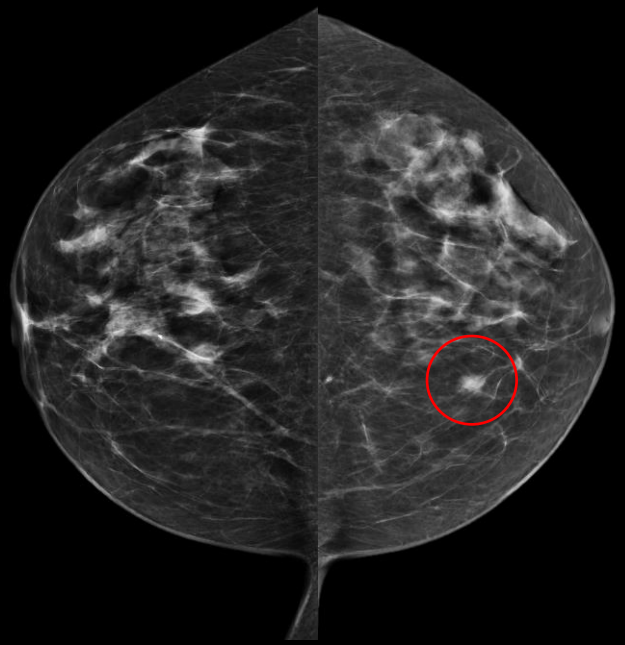
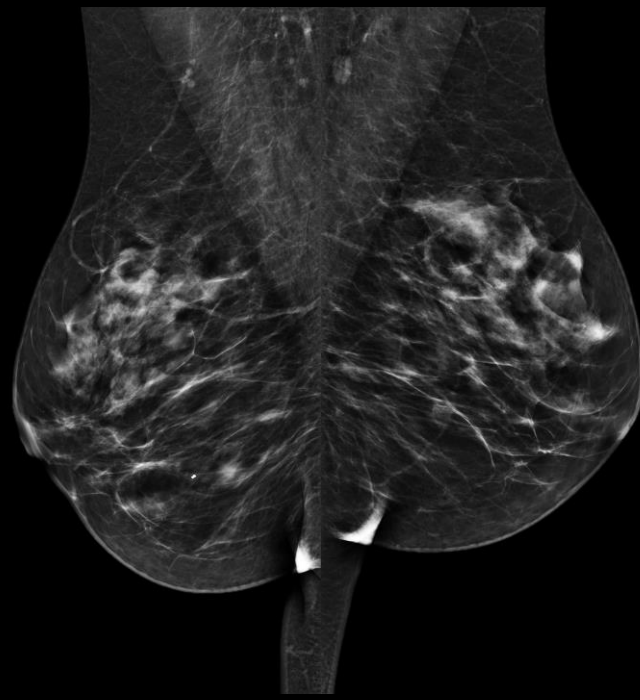
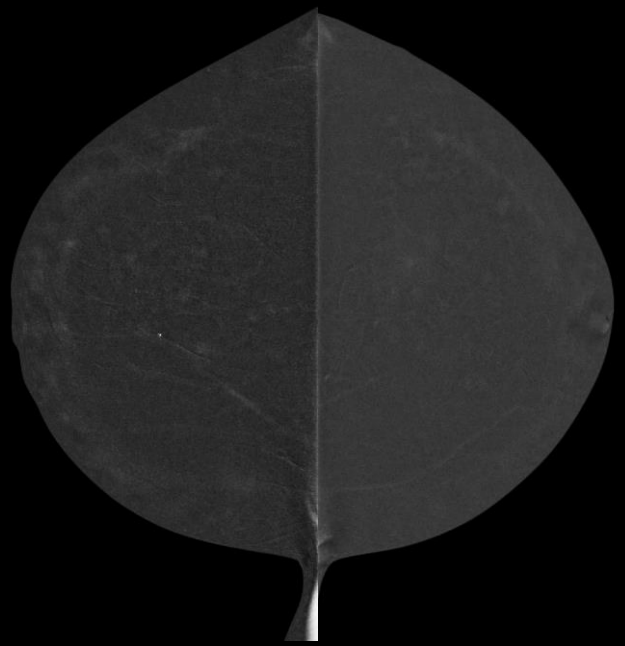
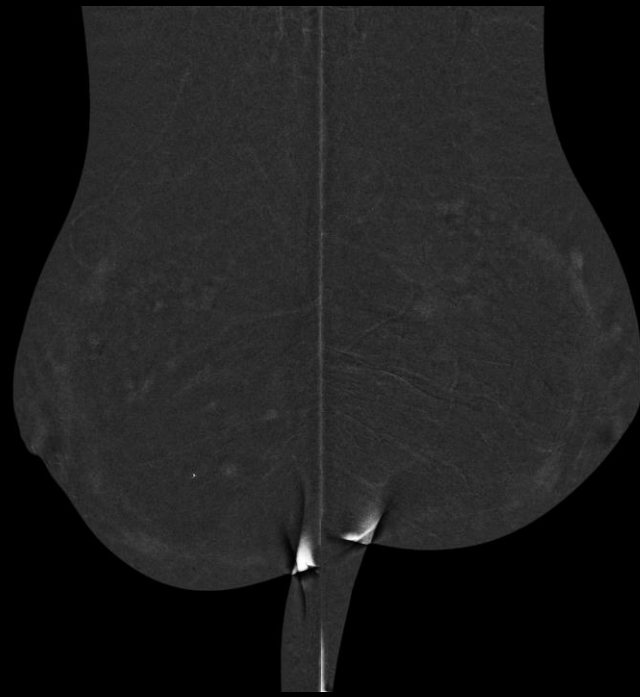
Allows return to screening

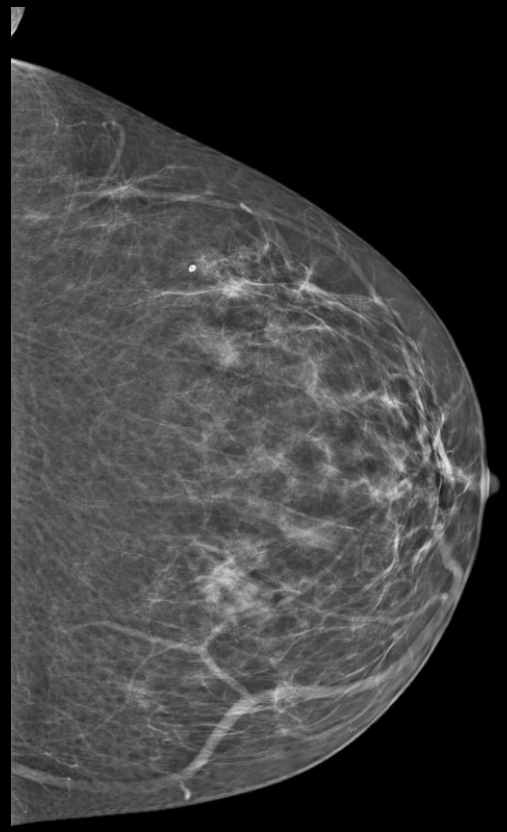
- Wessam et al, BJR, 2019
  - 125 asymmetries
  - **100% NPV**
    - 1 developing asymmetry enhanced and was malignant
- Kamal et al, Egypt J Radiol Nucl Med, 2019
  - 380 asymmetries
  - **96% NPV**
    - 14 false neg CEM (9 non enhancing, 5 “faintly enhancing”)
  - 98% NPV if include “faintly enhancing”
  - 99% NPV if add US (only 3 FN, one “faintly enhancing”)

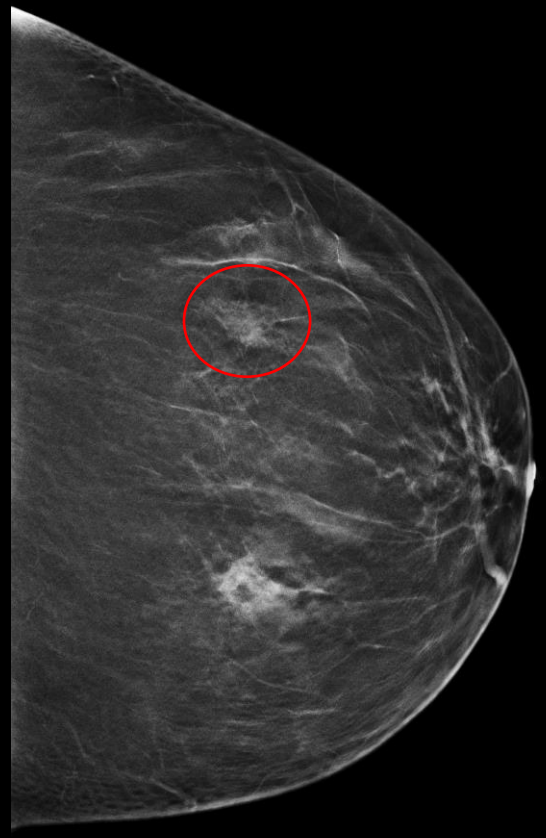
Developing Asymmetry

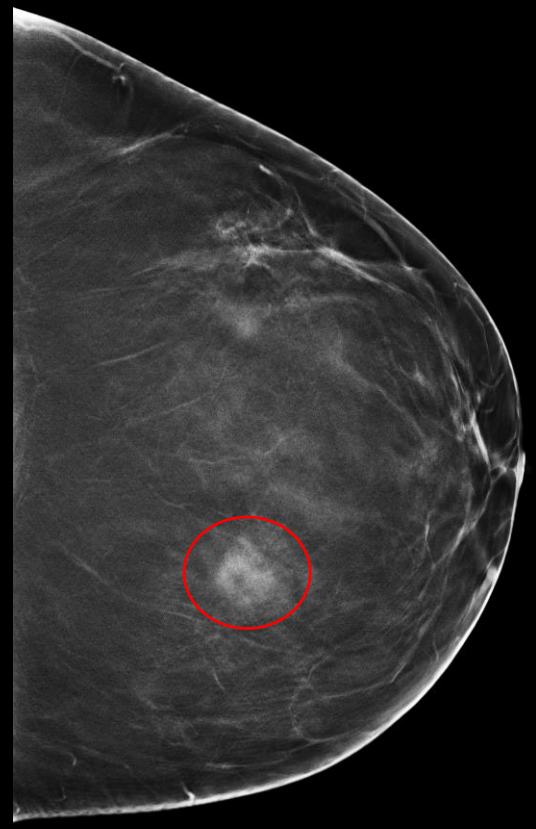
- Leung et al, AJR, 2007
  - Developing asymmetry at screening PPV 13%
  - We use CEM less here, anticipating progressing **directly to biopsy**


prior
current
tomo







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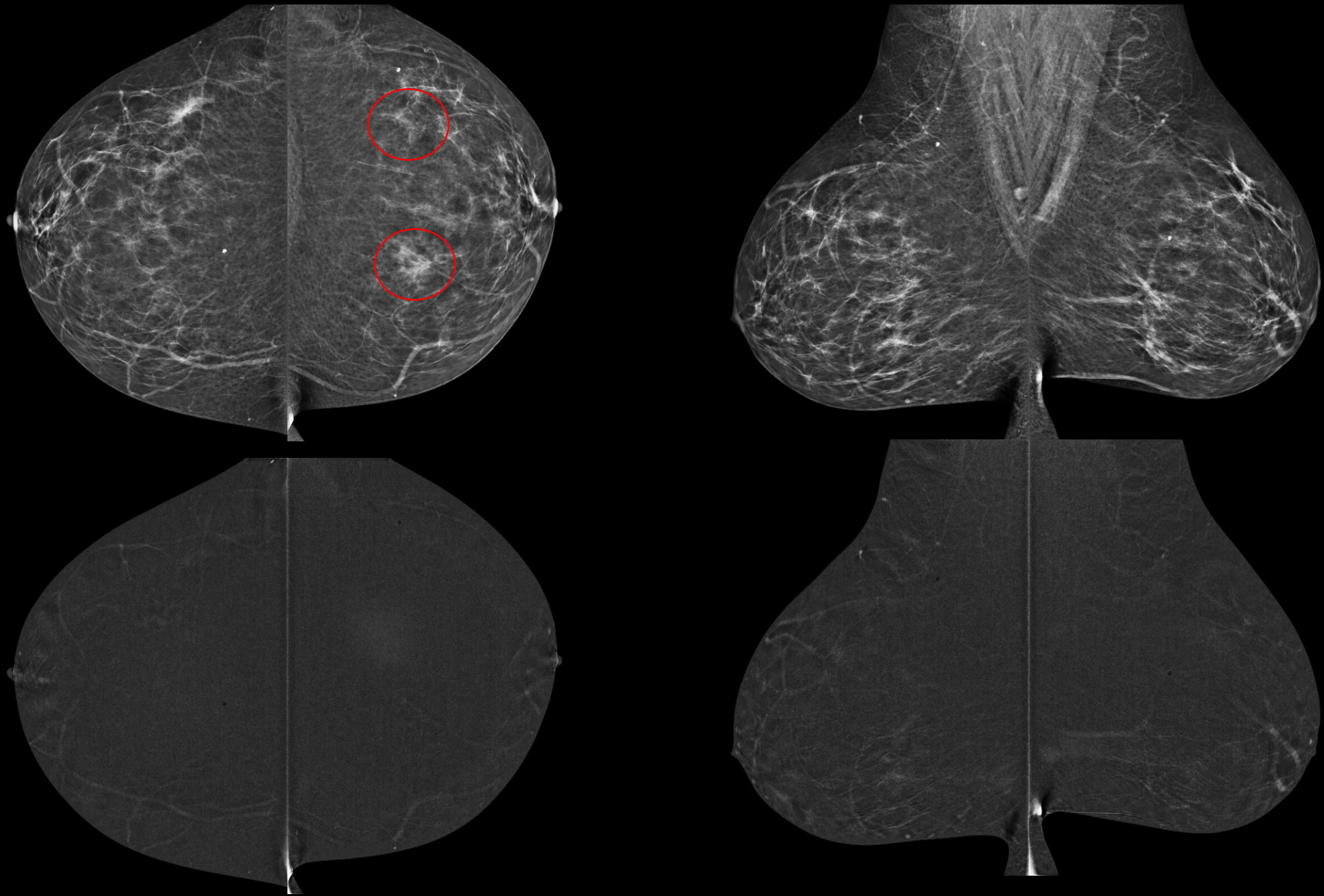


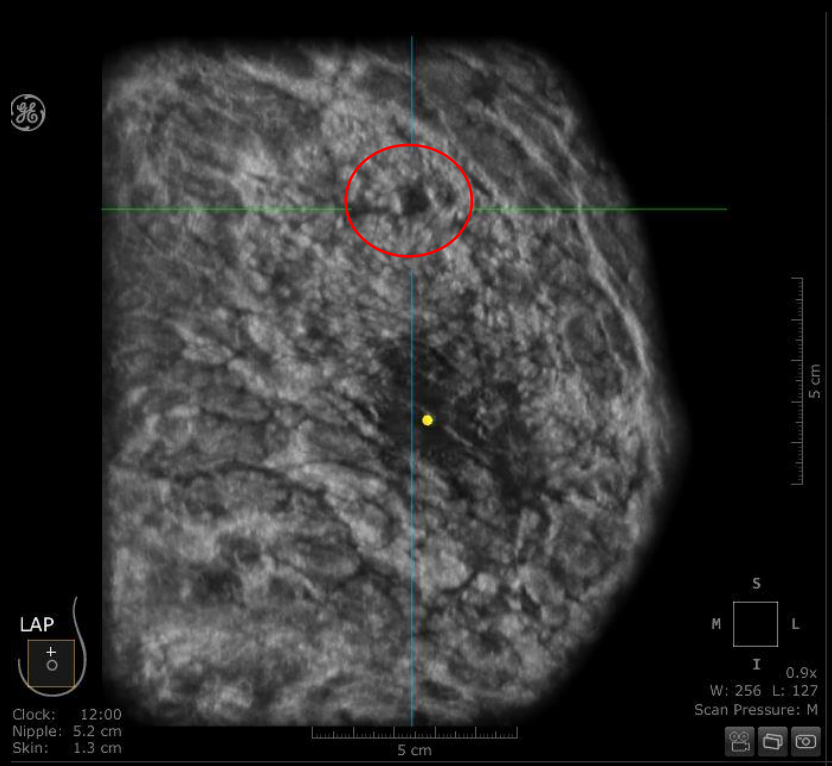
Diagnostic Problem Solving (initial workup)

Architectural distortion

Asymmetries

ABUS recalls (particularly non mass)

- Intermediate/high risk
- Multiple callbacks
- Limitations to ABUS technique
  - *Breast size*
  - *Surgical changes*
  - *Tissue heterogeneity/shadowing*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Skin: 1.3 cm
5 cm
5 cm
S
M
L
I
0.9x
W: 256 L: 127
Scan Pressure: M


LLAT
Clock: 12:00
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Skin: 1.1 cm
5 cm
5 cm
S
M
L
I
0.9x
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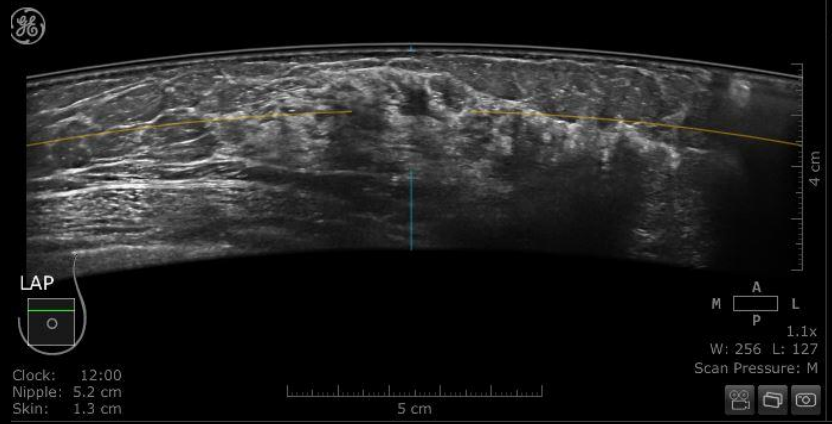
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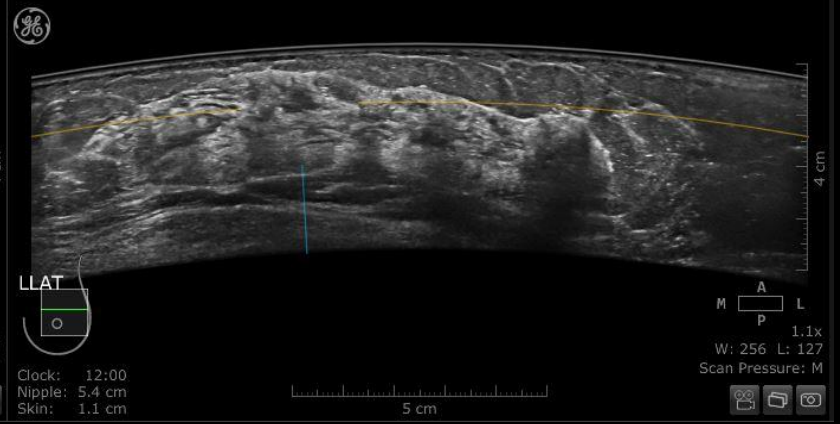
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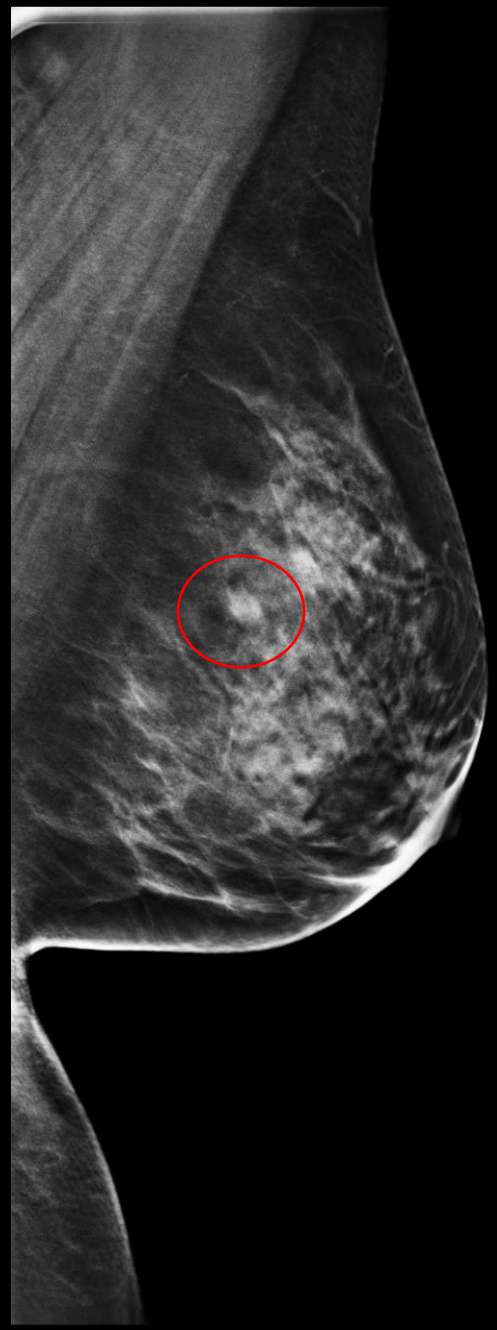
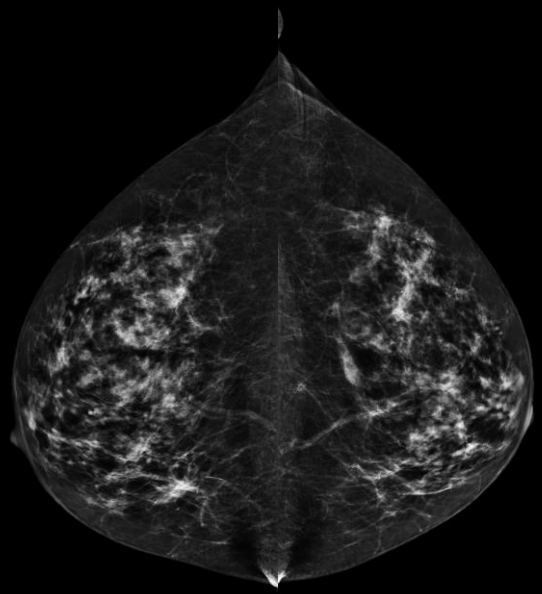
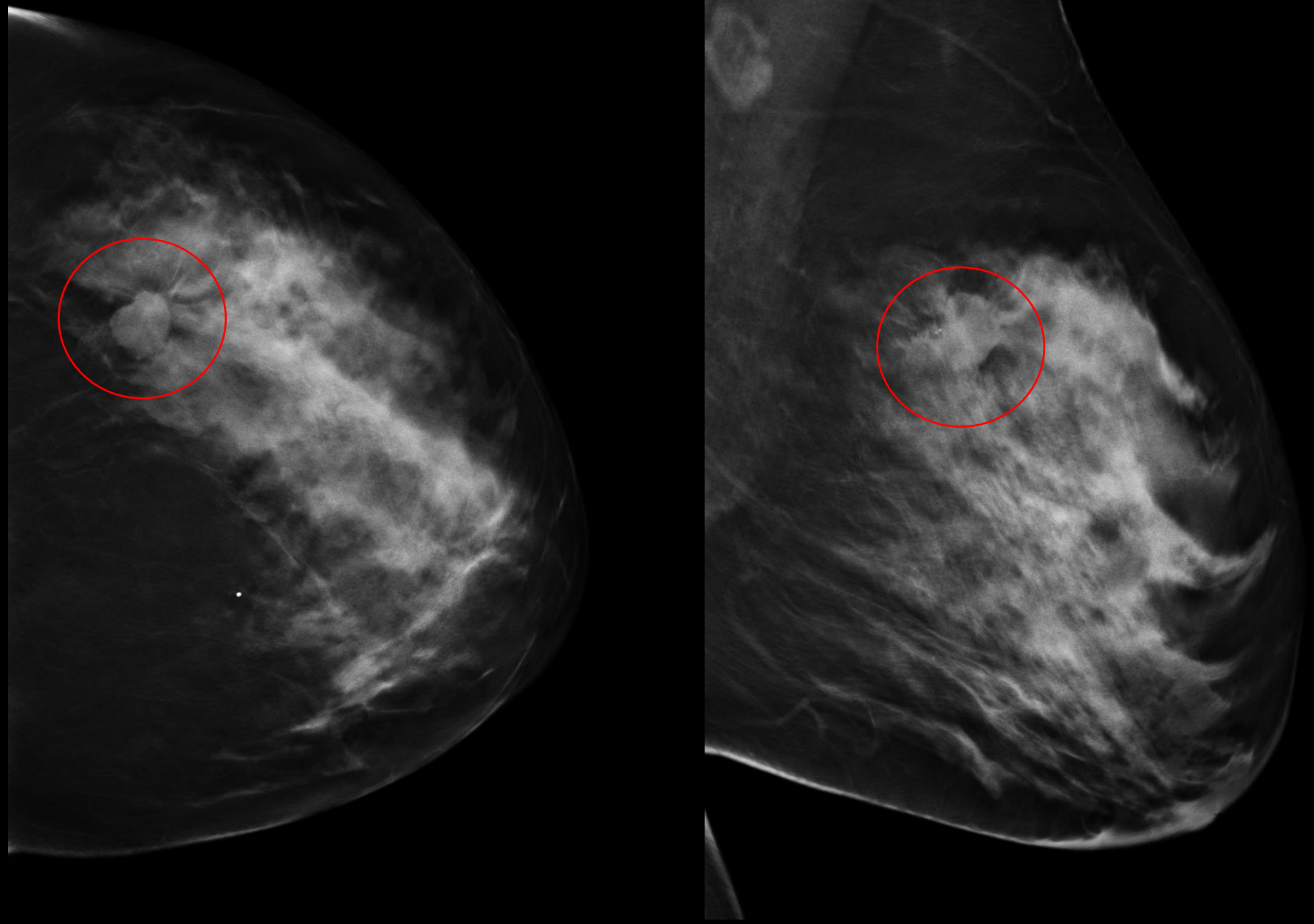
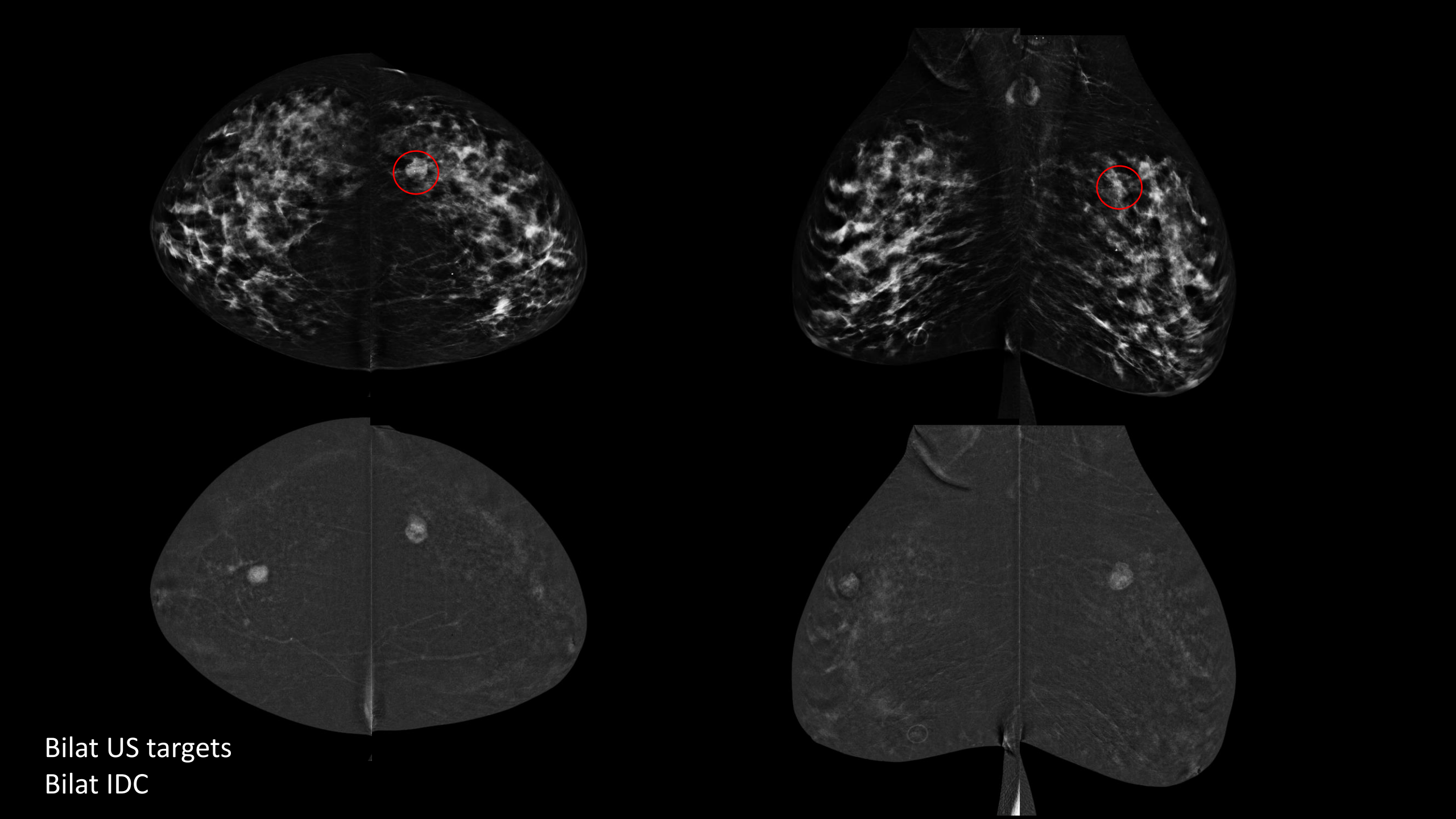





CEM rarely used for screening recalls of:

Calcifications	Magnification views remain our primary diagnostic tool
Masses	Ultrasound remains our primary diagnostic tool
BUT…	Sometimes use CEM if either are highly suspicious and/or in dense tissue • Extent of disease, targeting biopsies (multiple?) • Screen for other sites of occult malignancy (high risk, not being screened with MRI)





Bilat US targets
Bilat IDC

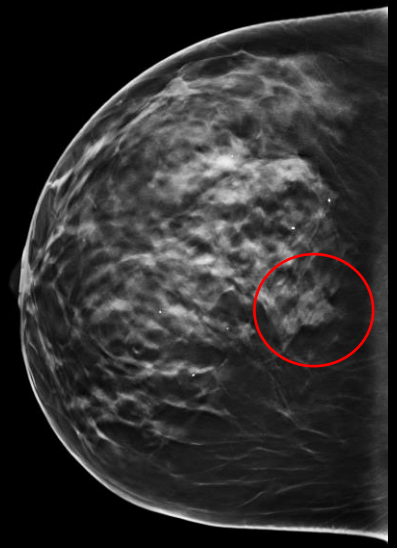
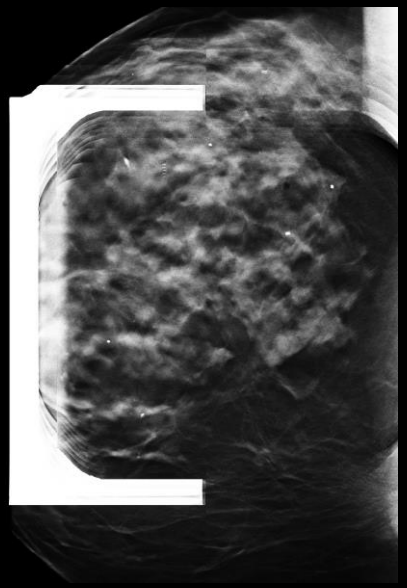
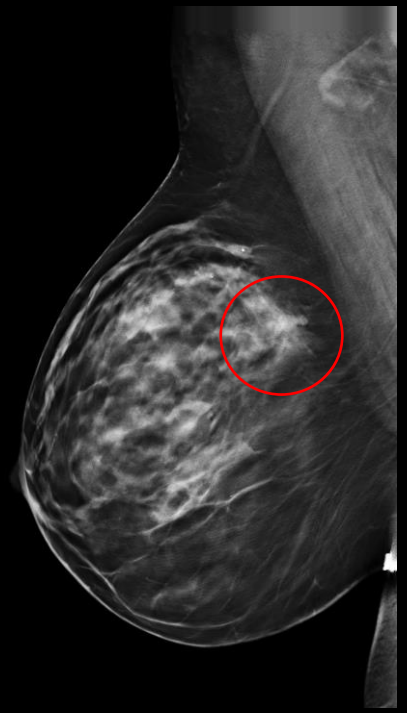
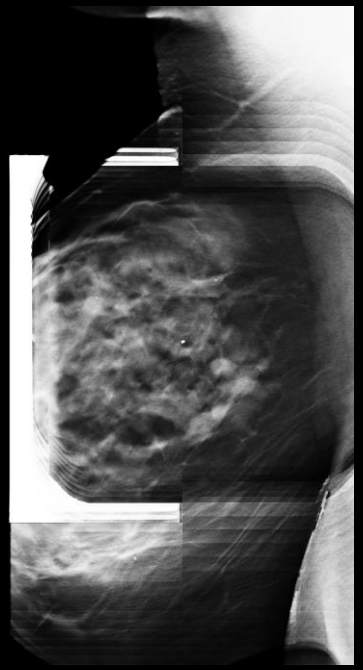
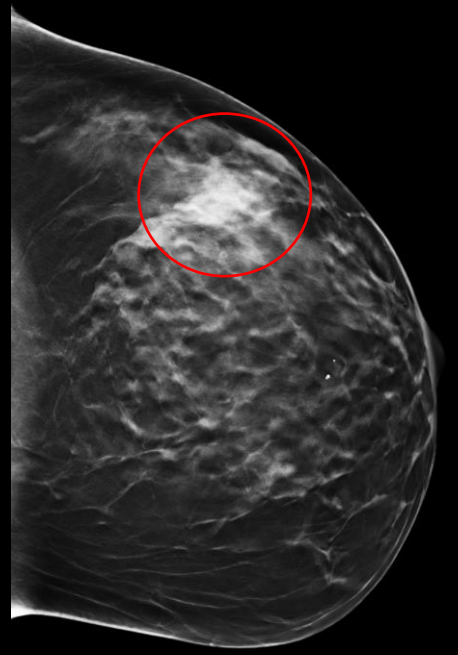
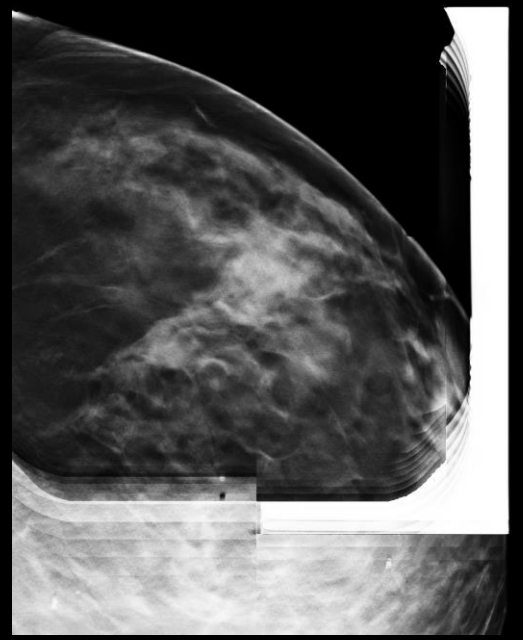
CEM after initial diagnostic work-up

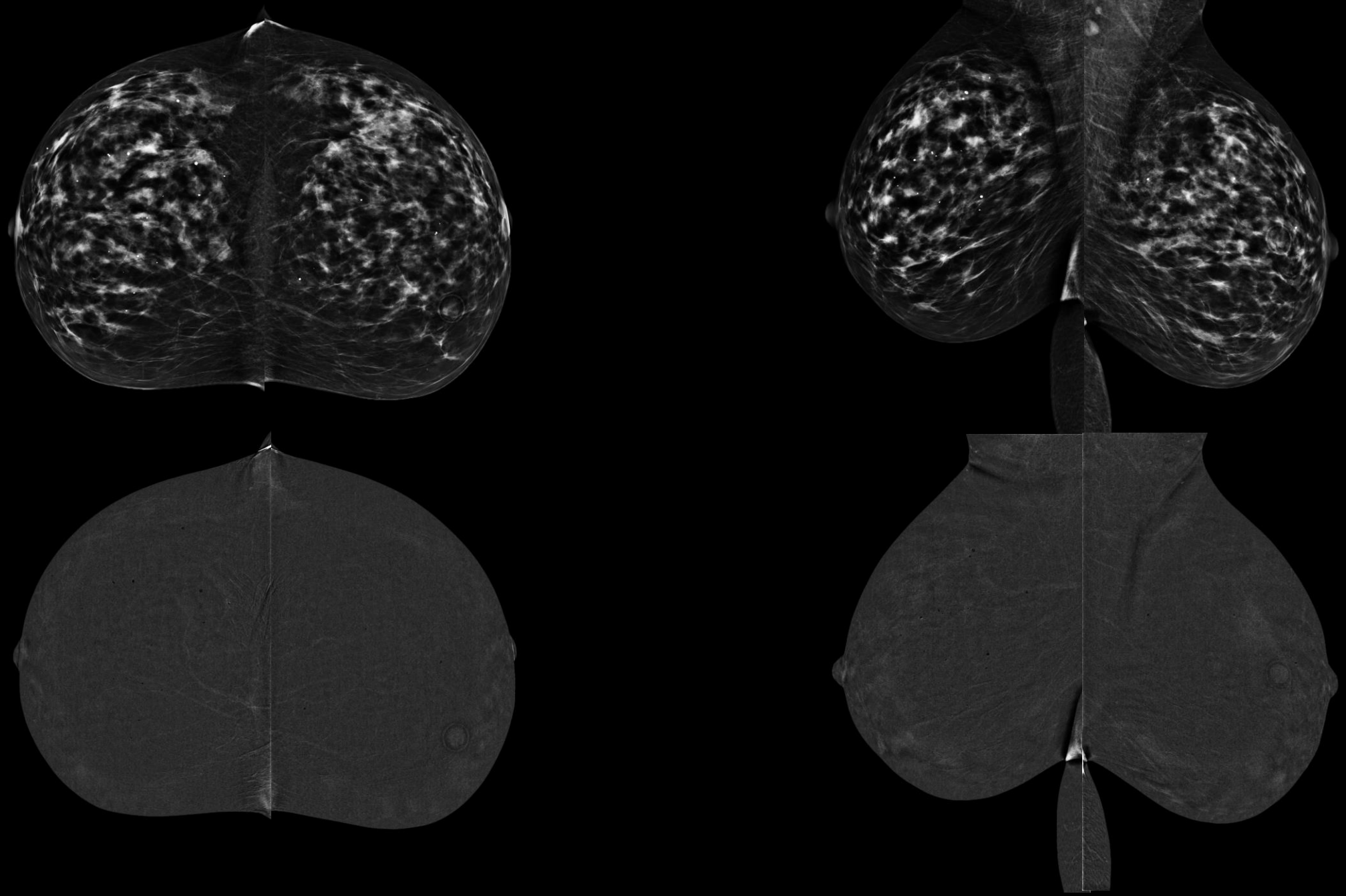
Prior to targeted US if an asymmetry resolves but dense, high risk

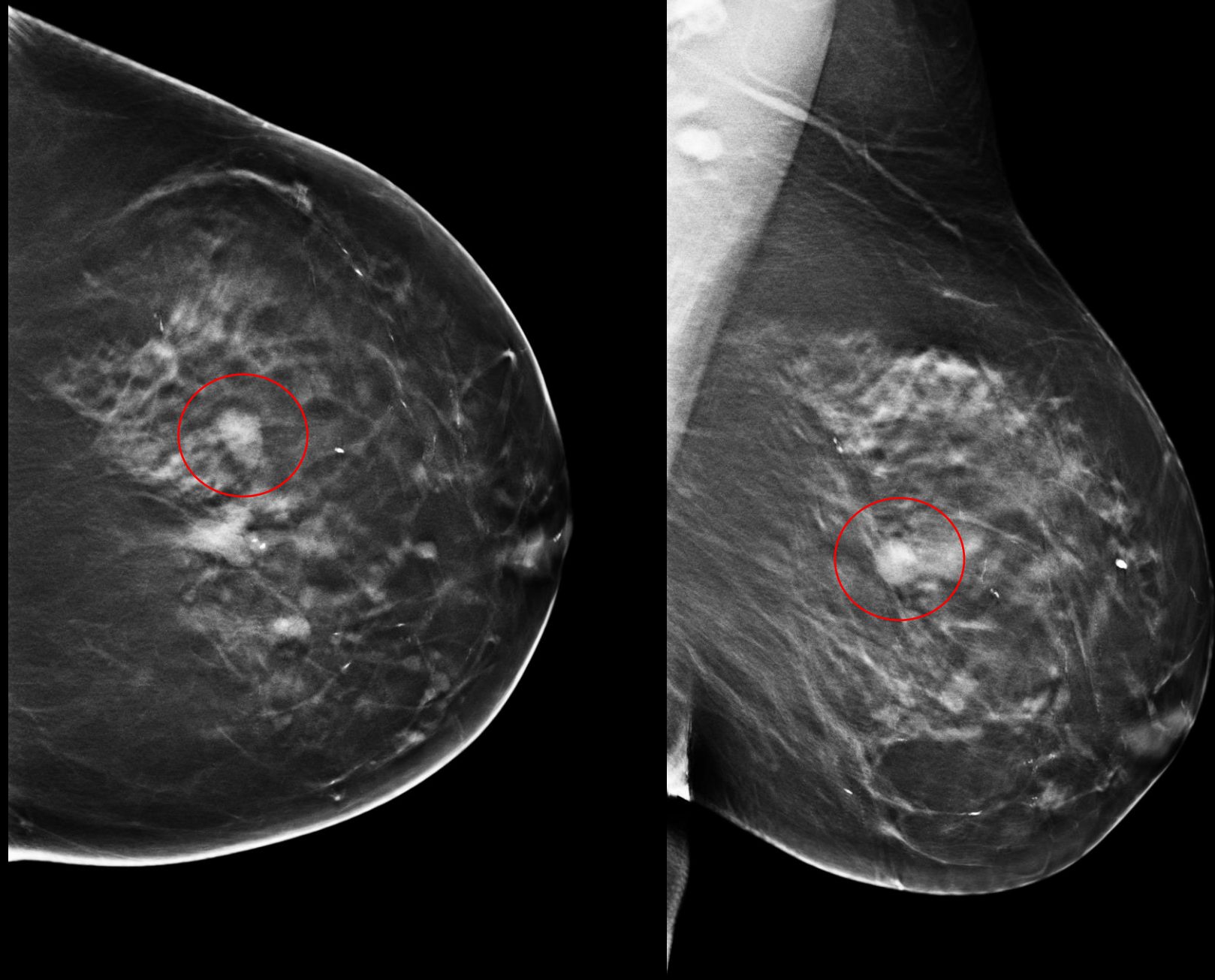
To add confidence to negative diagnostic work up (dense, high risk)

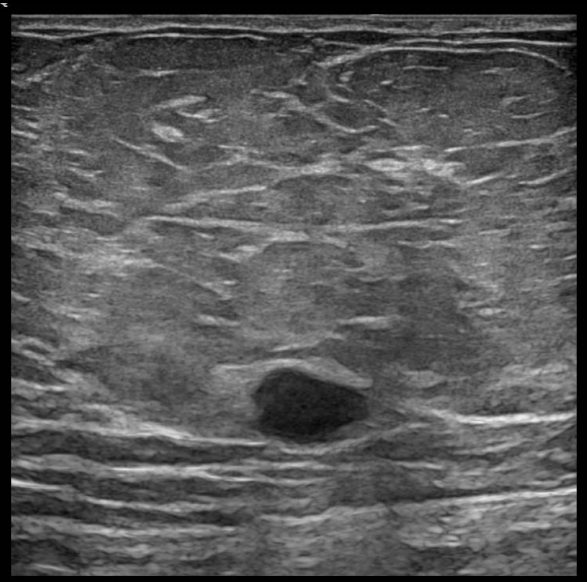
To avoid follow up of BI-RADS® Category 3 findings

To assist with biopsy planning

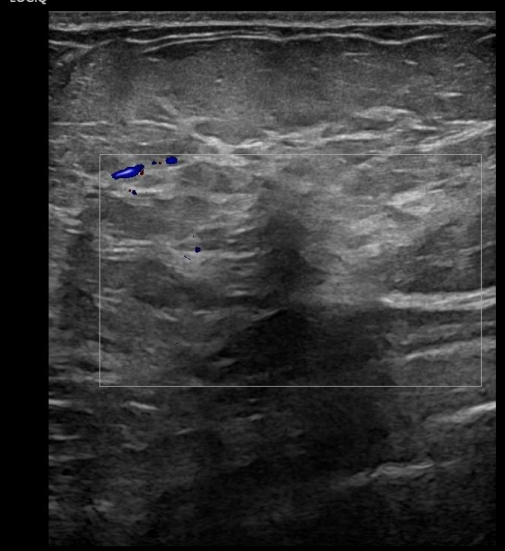









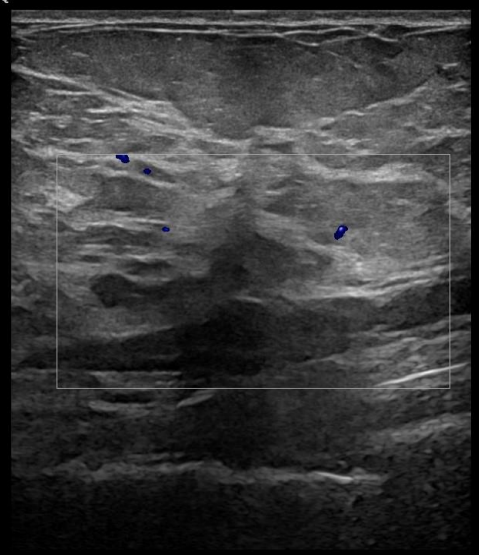




RADIAL LT BREAST 2:00 5 CMFN



ANTI-RAD LT BREAST 12:00 4 CMFN



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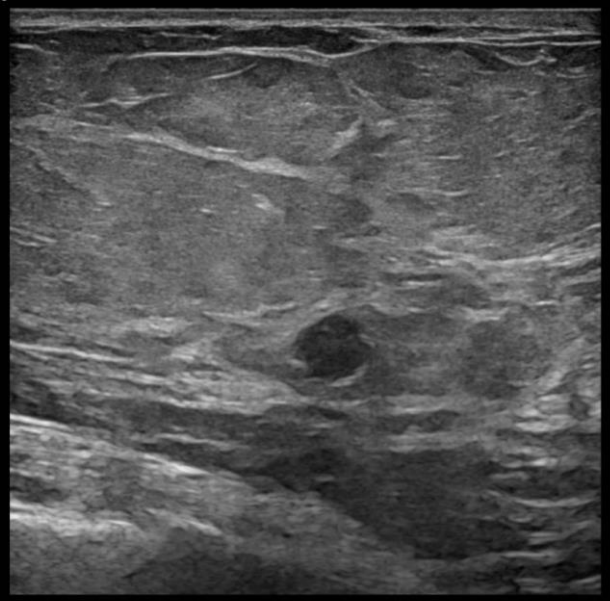
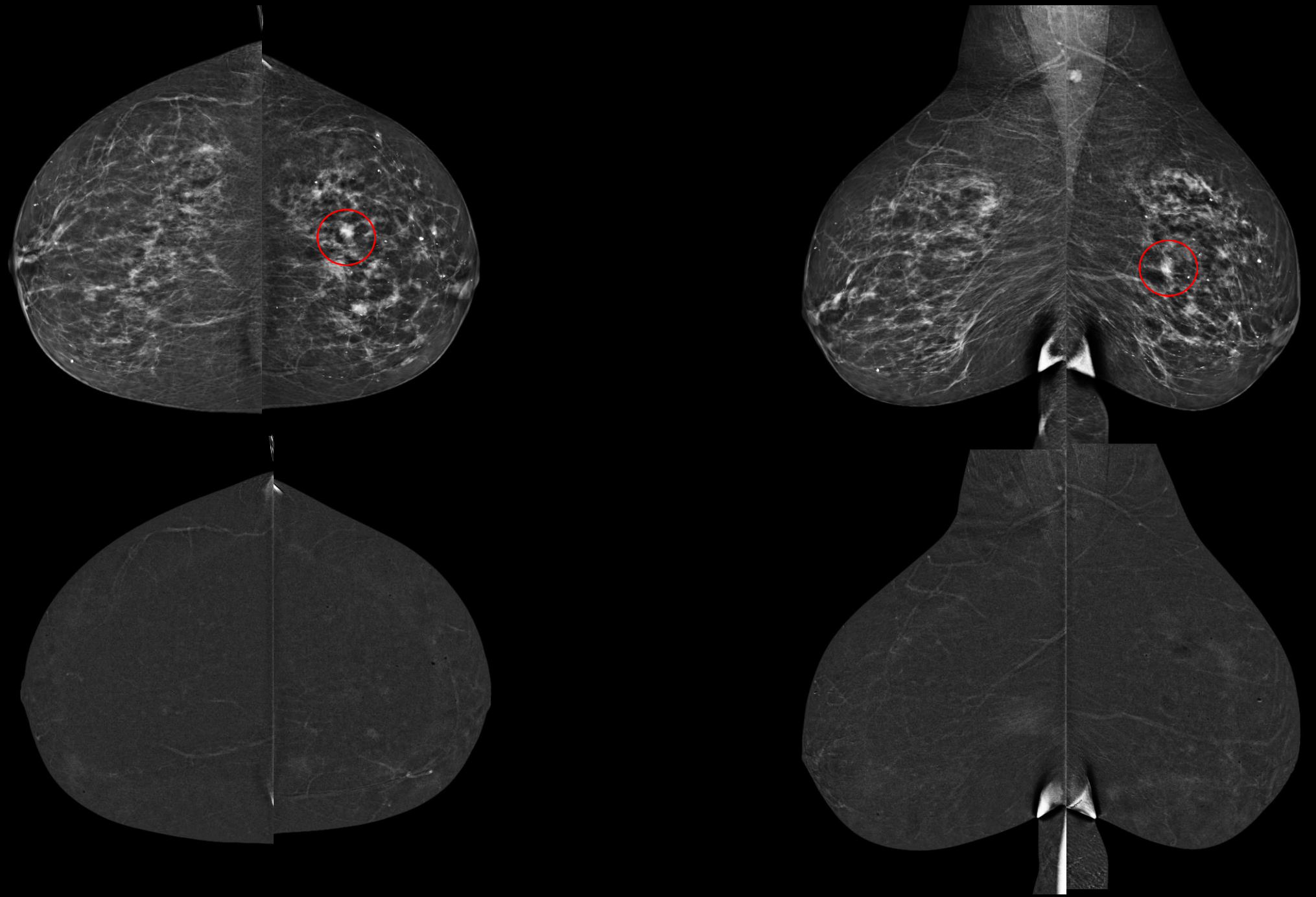
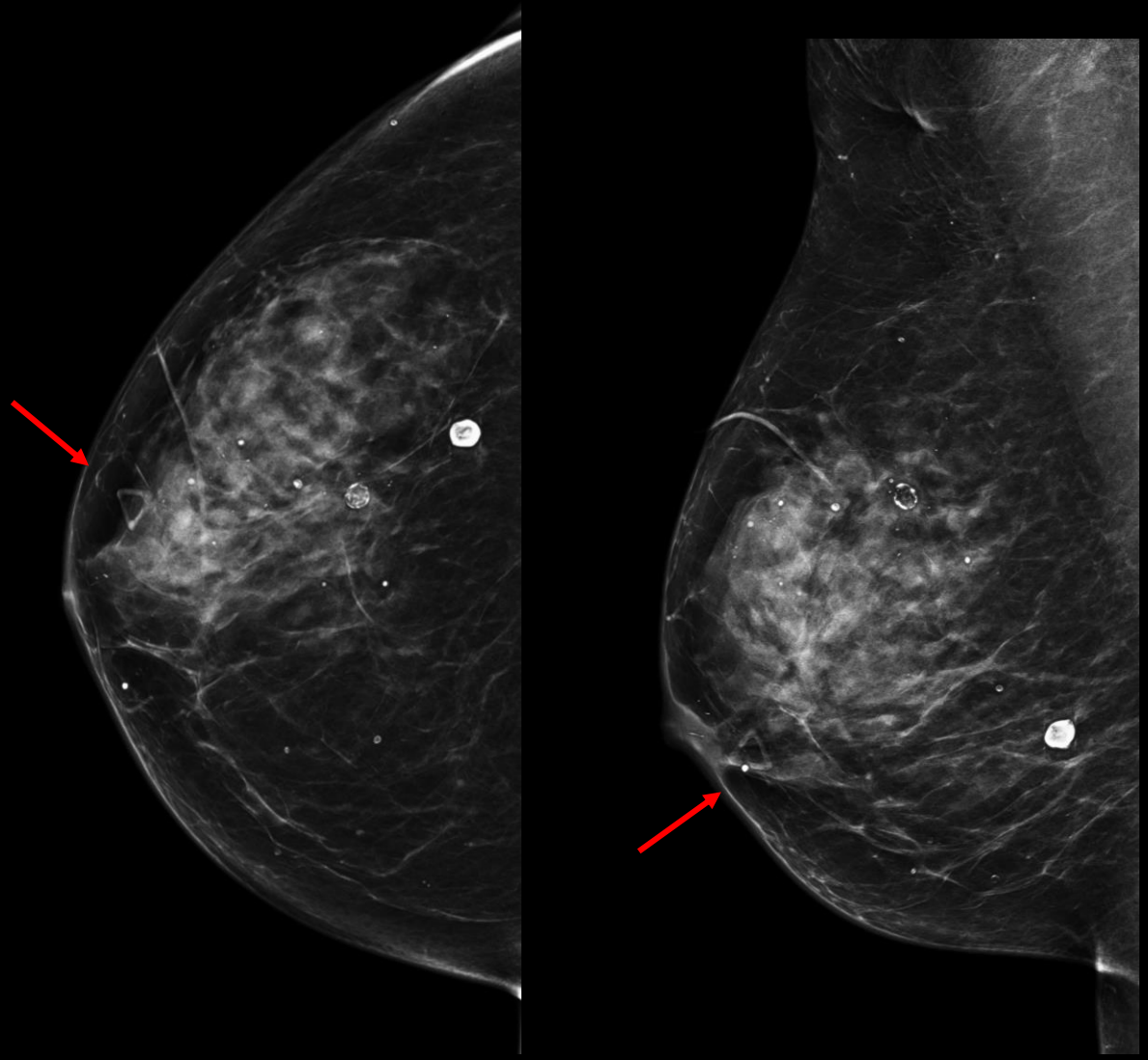
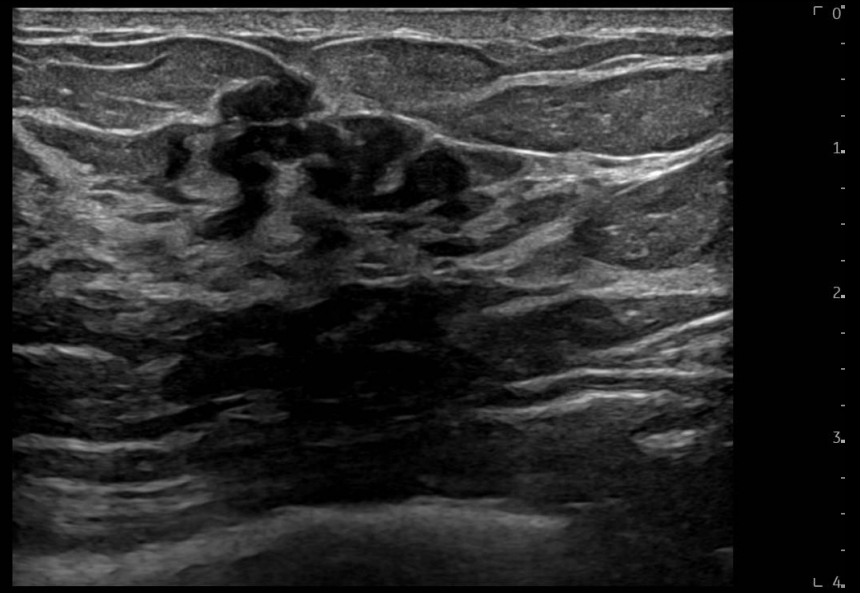


RADIAL LT BREAST 11:00 4 CMFN

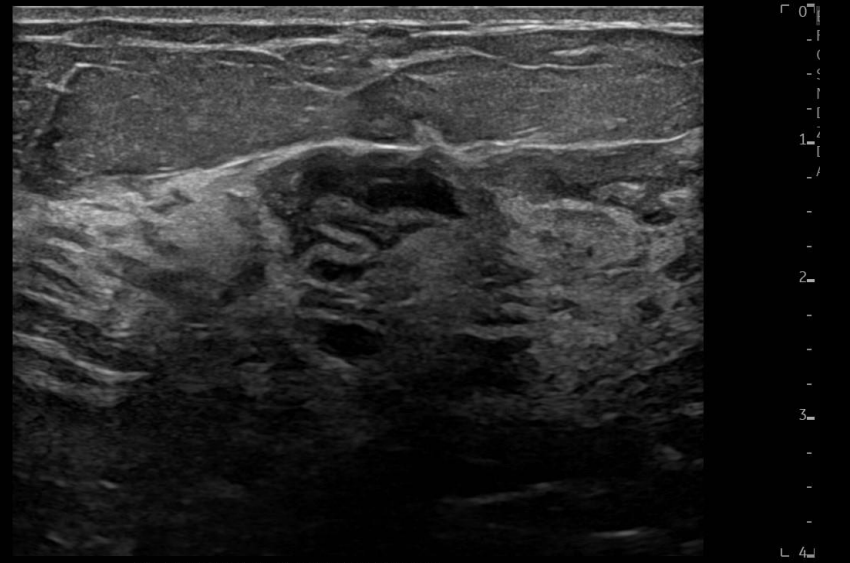
ANTI-RAD LT BREAST 12:00 4 CMFN





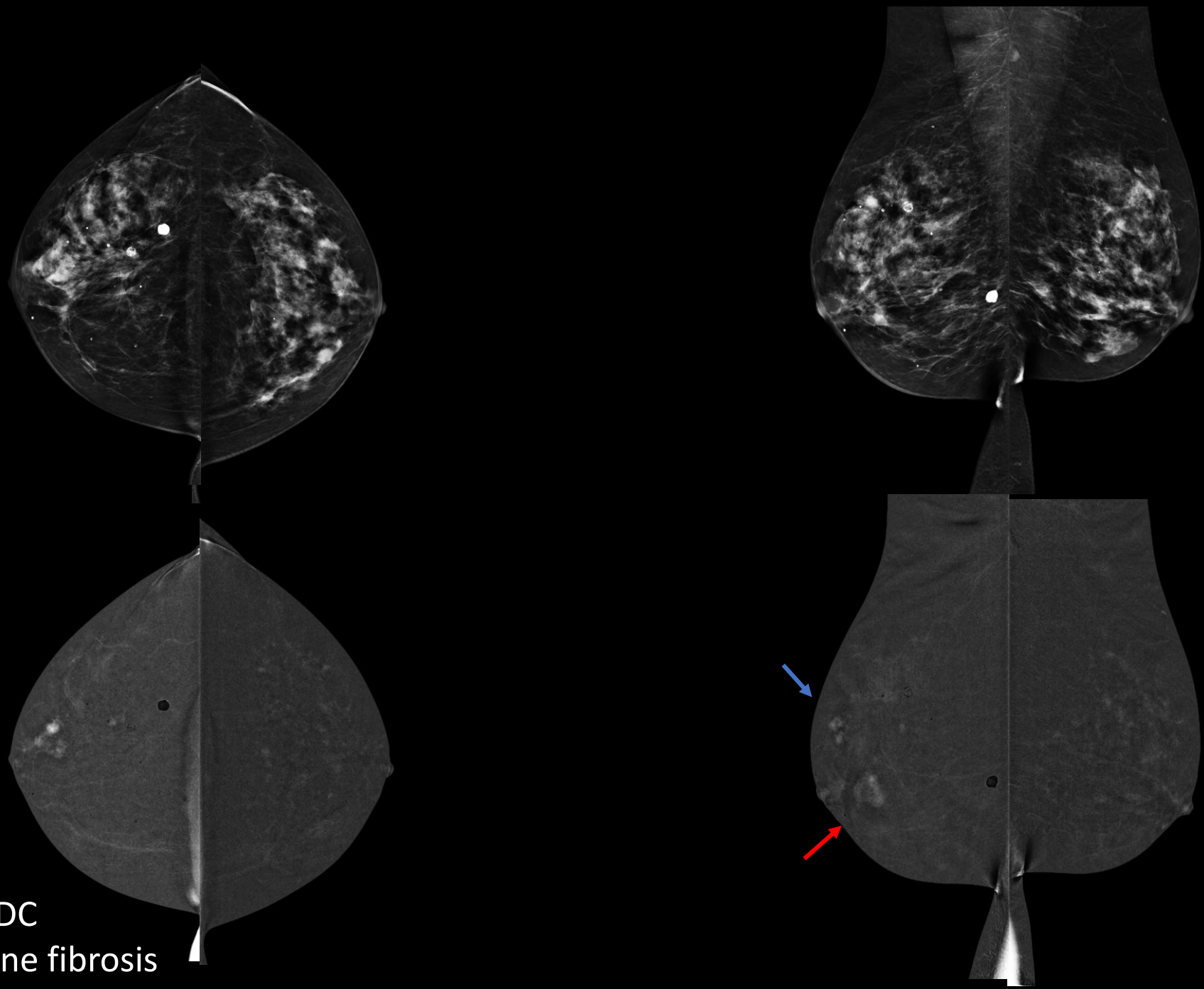


ANTI-RAD RT BREAST 8:00 RETROAREOLAR AREA OF CONCERN



RT BREAST 12:00 3CMFN RADIAL

Prior lumpectomy
New palpable at 8:00



8:00 palp = IDC
12:00 = hyaline fibrosis

Unique “Start with CEM” Diagnostic Situations

Post lumpectomy or mastectomy dense tissue/age less than 50

- Not being screened with MR

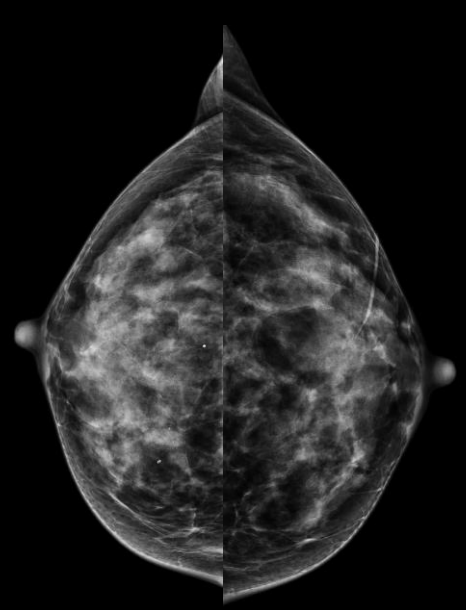
Palpable/pain/nipple discharge

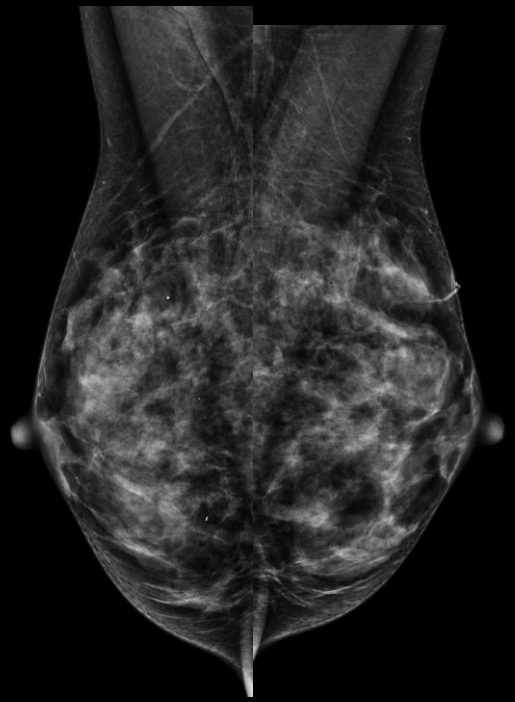
- Rarely start this way; occasionally in known high risk
- Persistent clinical concern, but negative mammo/US workup

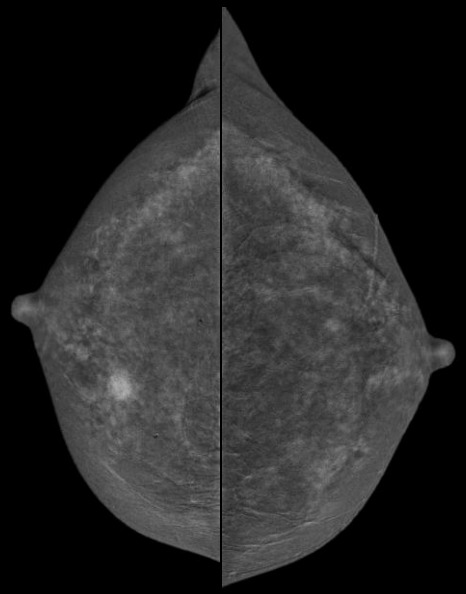
Follow up after biopsy when there is question of concordance

- Benign, concordant biopsy with clip migration or architectural distortion without typical explanatory pathology

Abnormal PET CT, enhancing finding on Chest CT

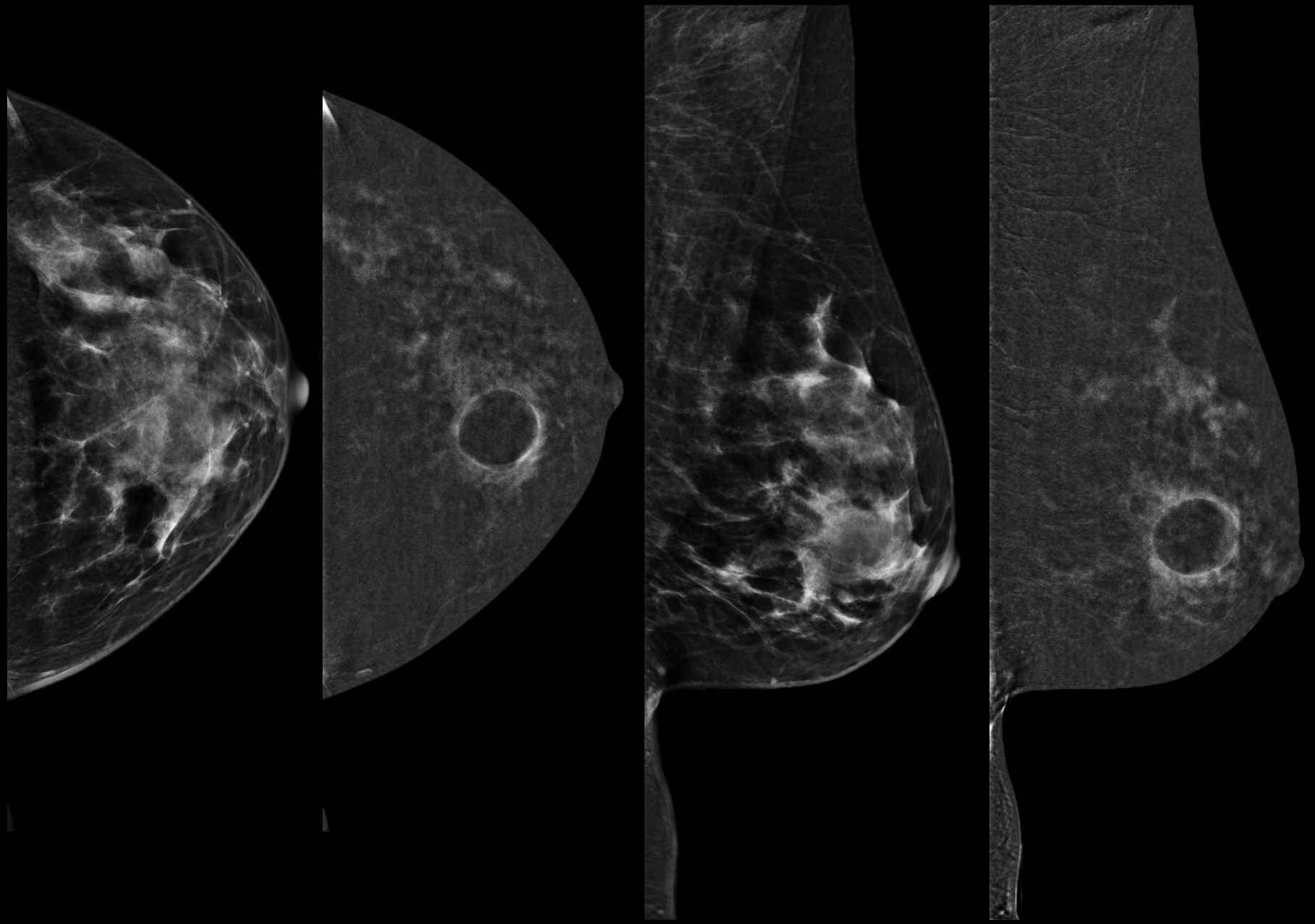






Palp 3:00

US bx = fibroadenoma

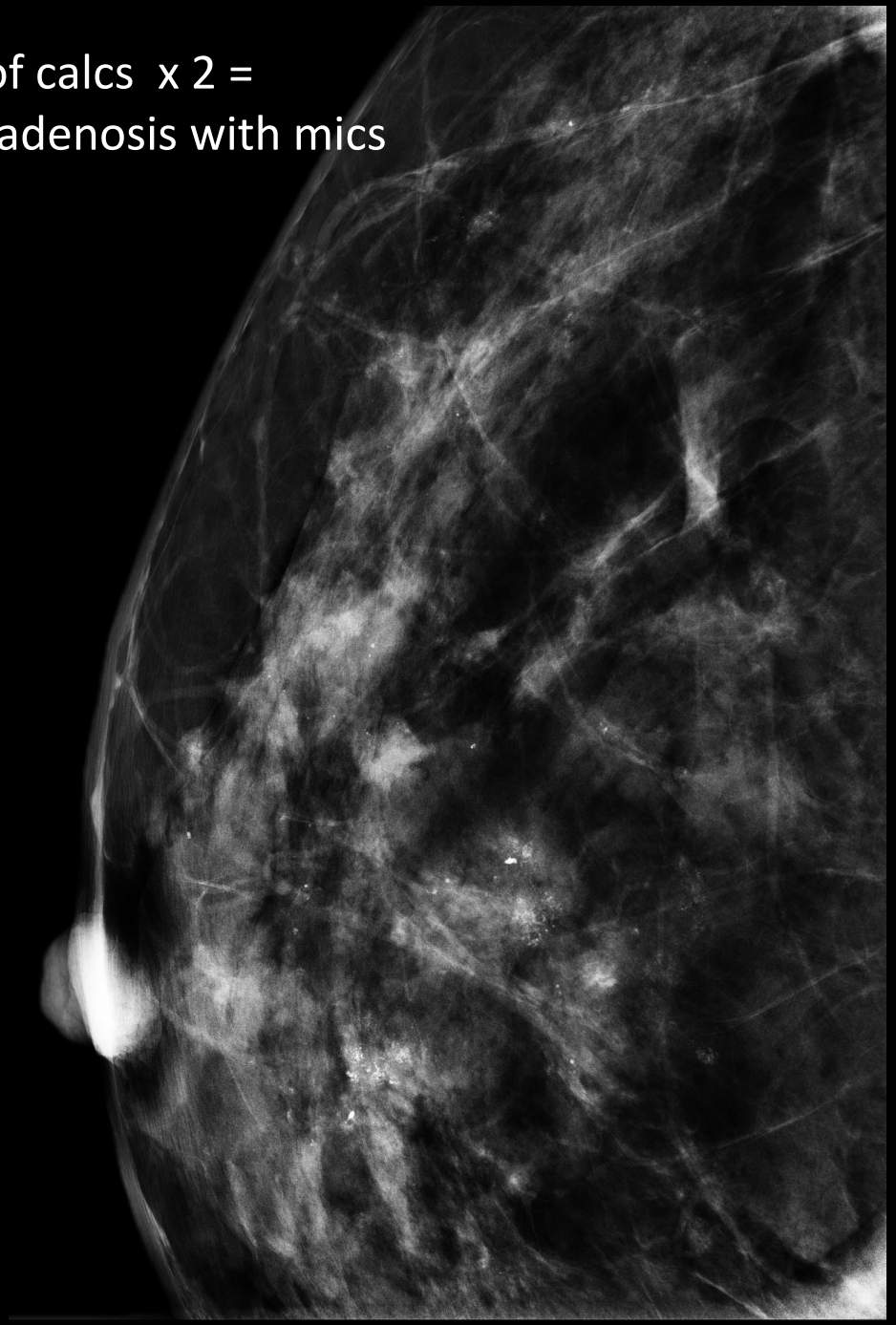


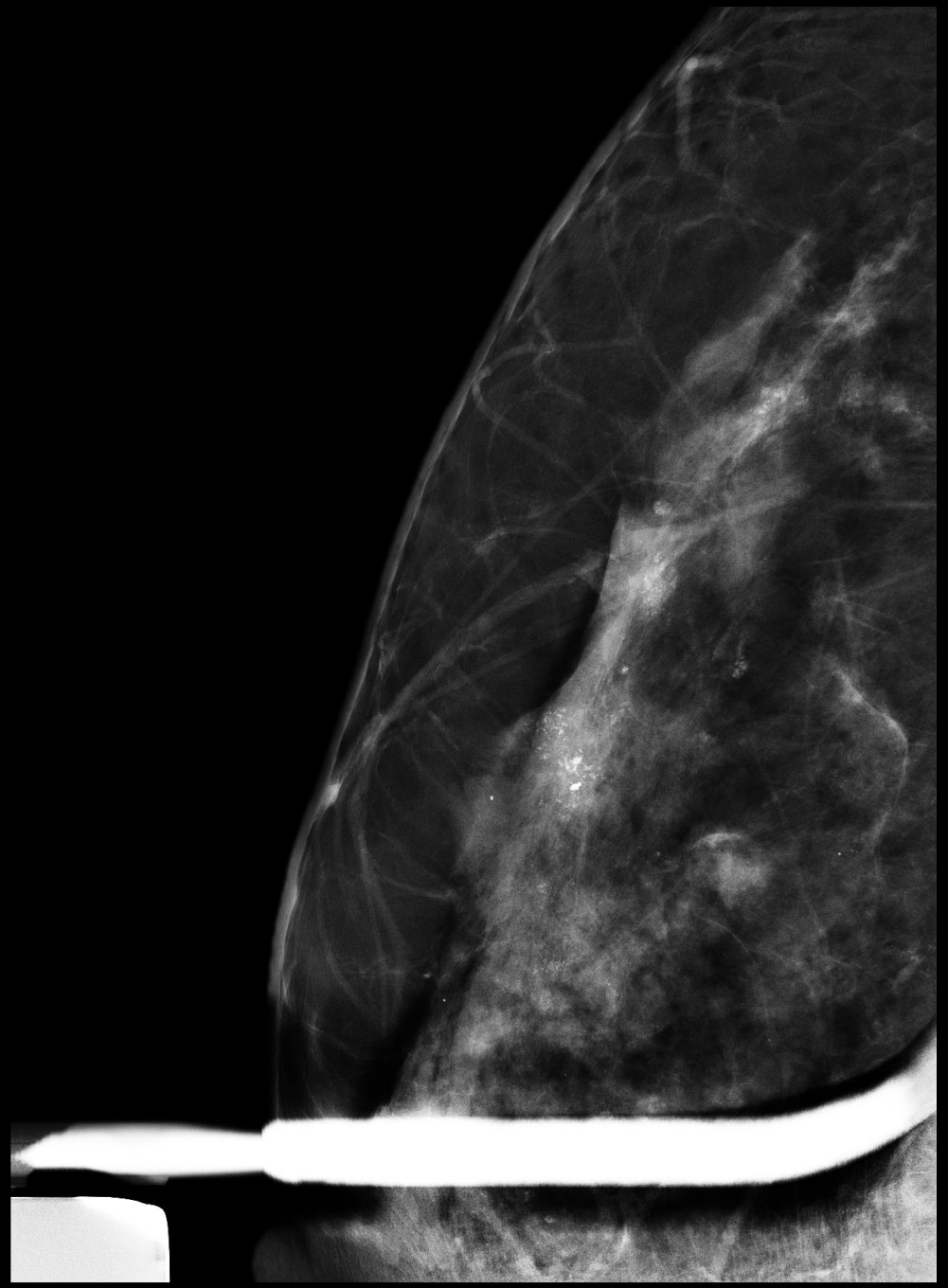
Palpable left breast mass

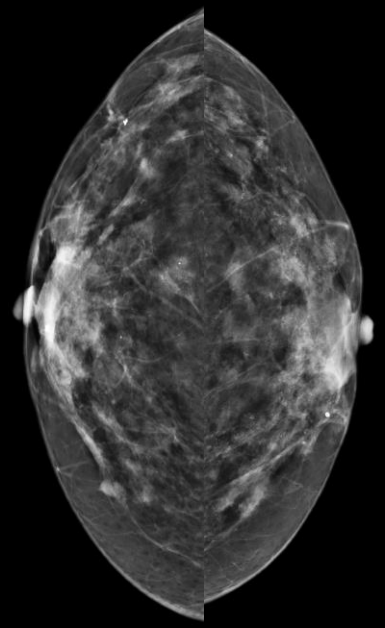
“Eclipse sign”

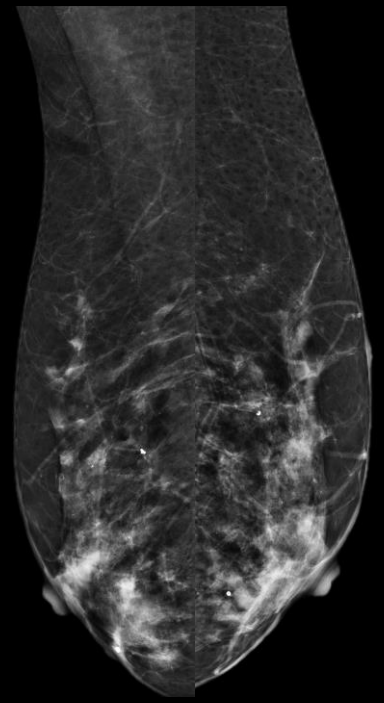
Debris filled inflammatory cyst

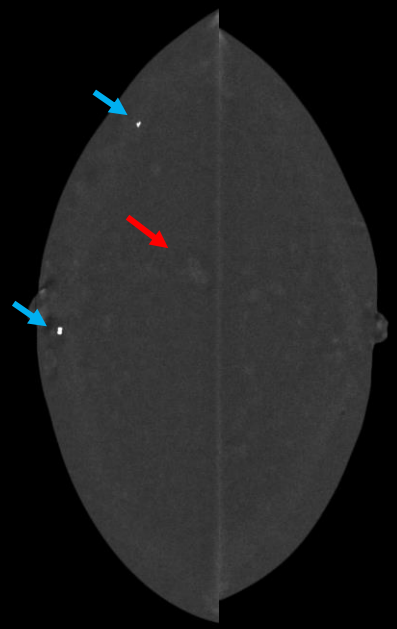
Stereo bx of calcs x 2 =
Sclerosing adenosis with mics

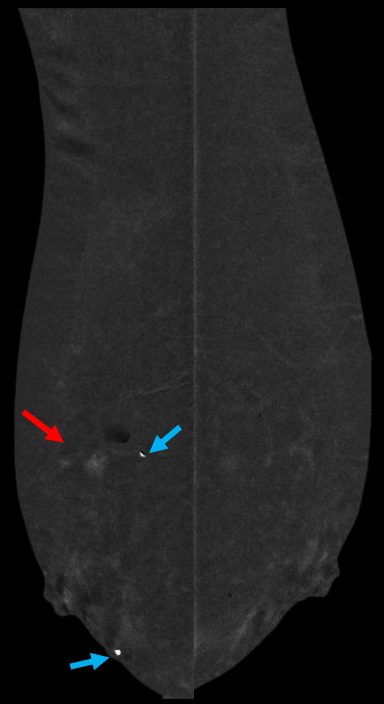




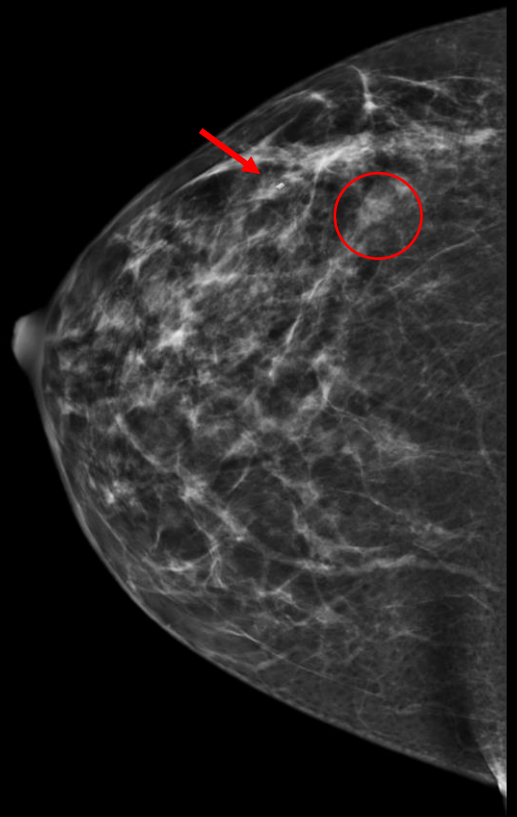


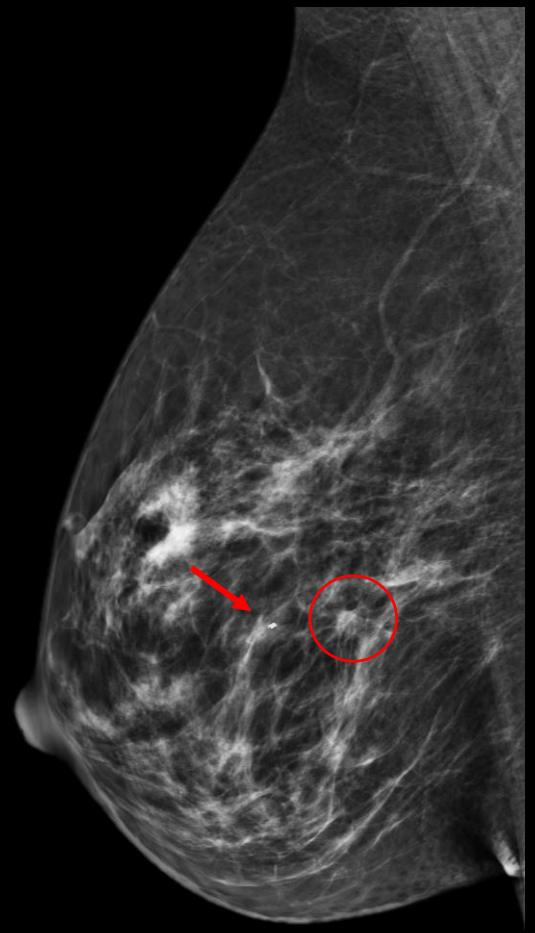


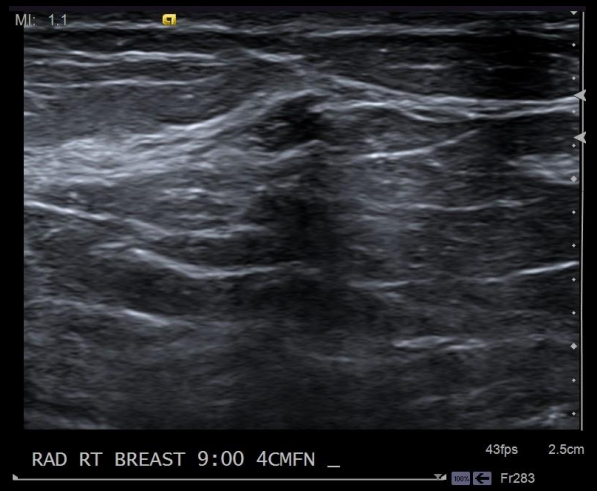




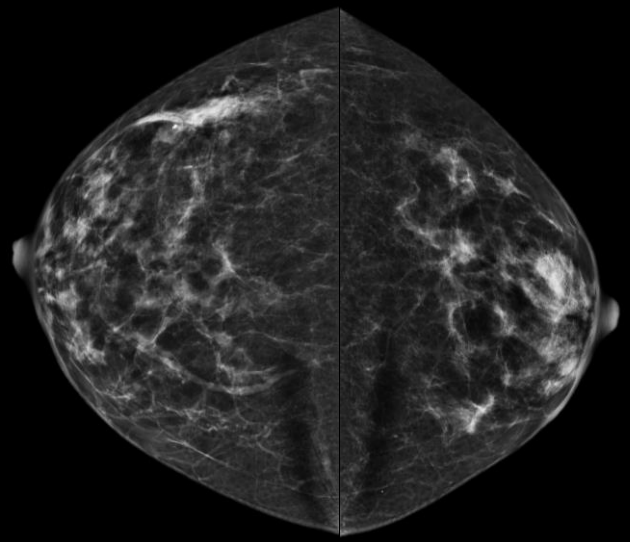
Implant displaced
Tomo bx = DCIS grade 2 with comedonecrosis

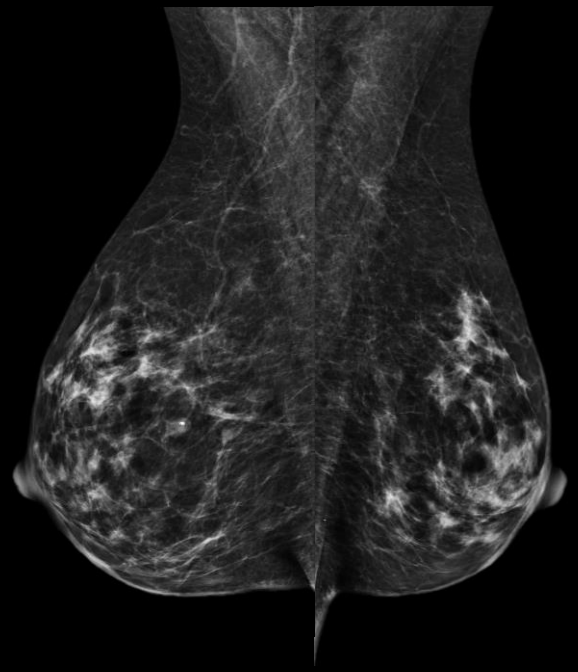


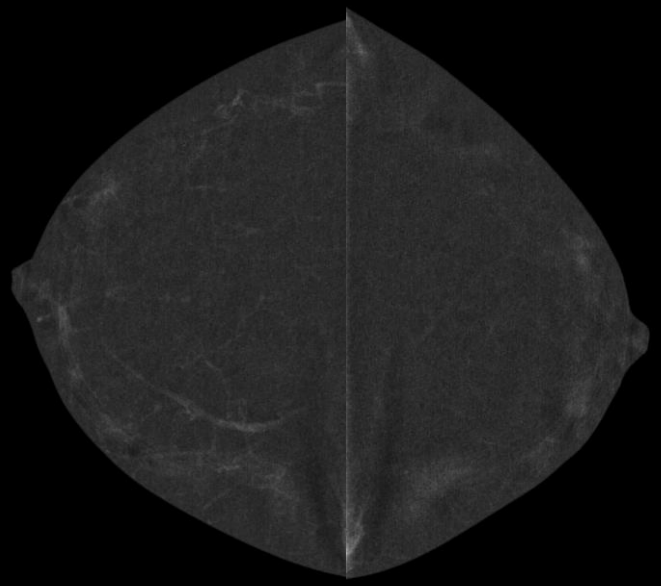


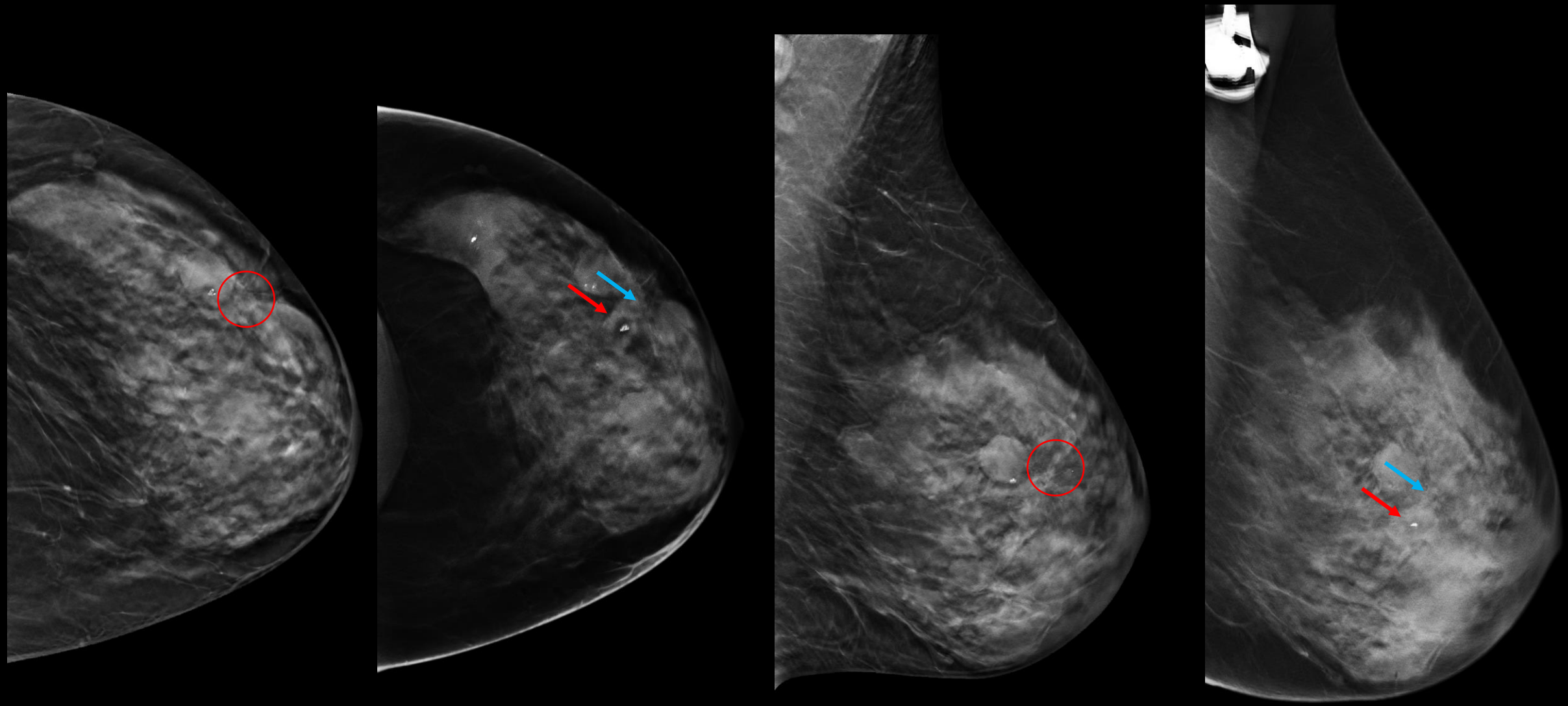


US bx = FA

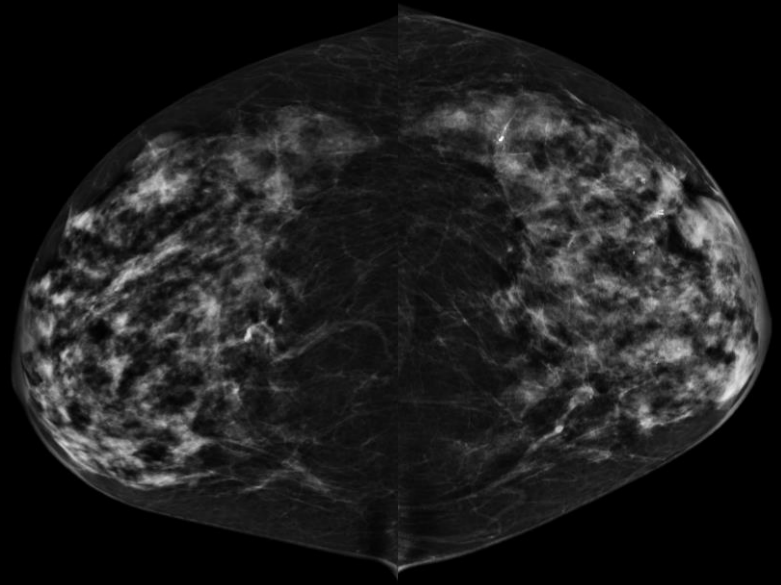


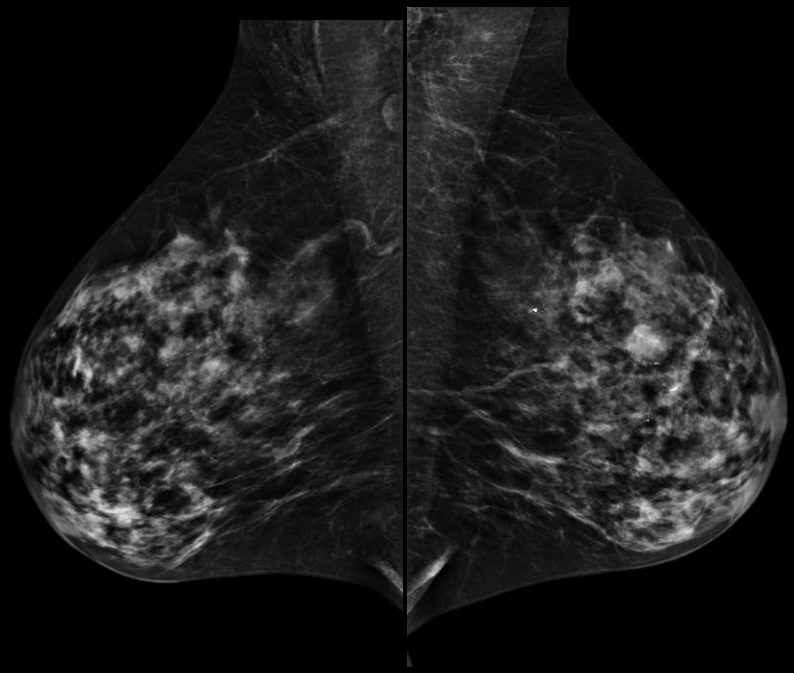


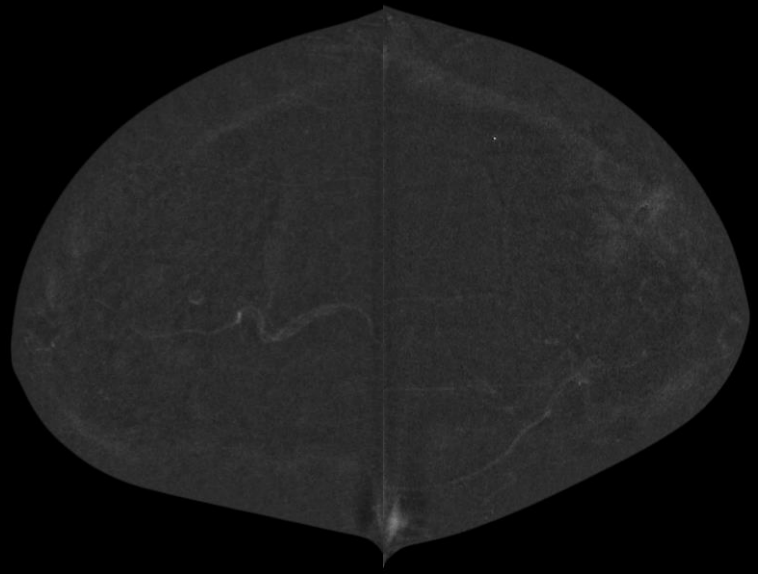


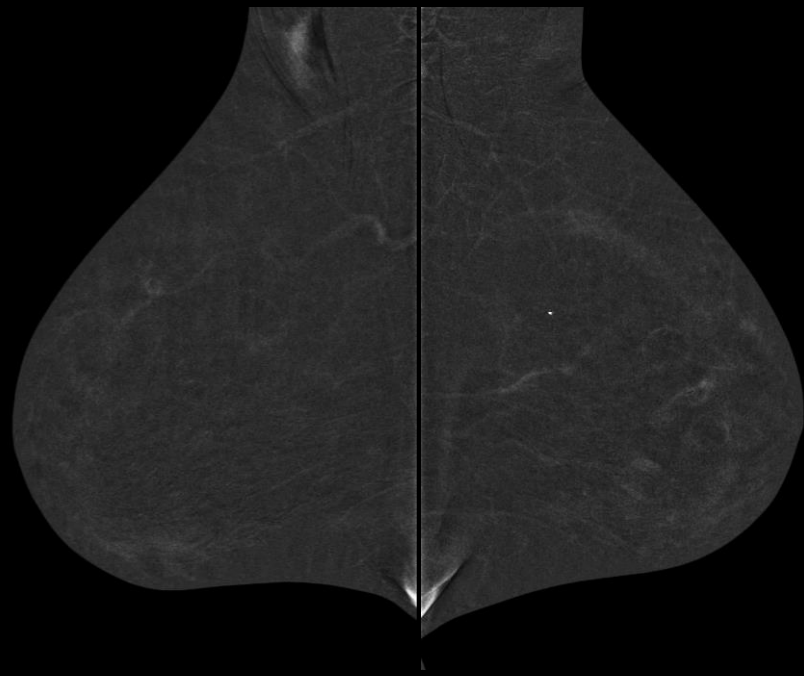


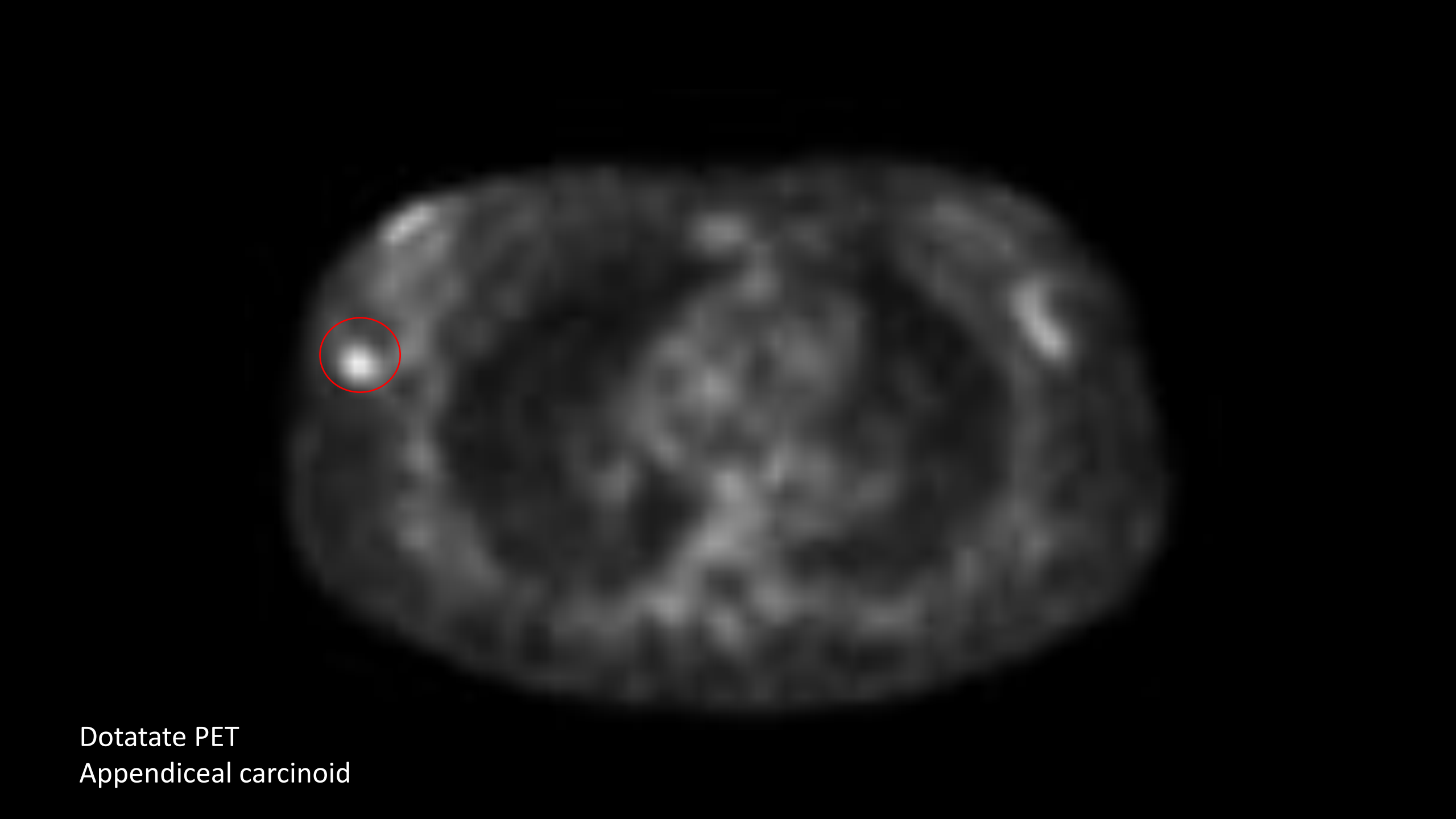
Tomo bx =
Usual ductal hyperplasia, cystic duct dilation, apocrine change



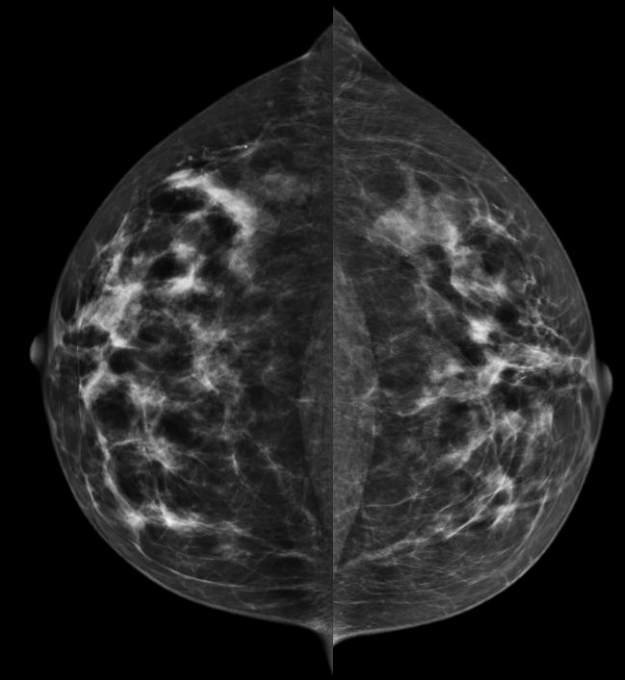


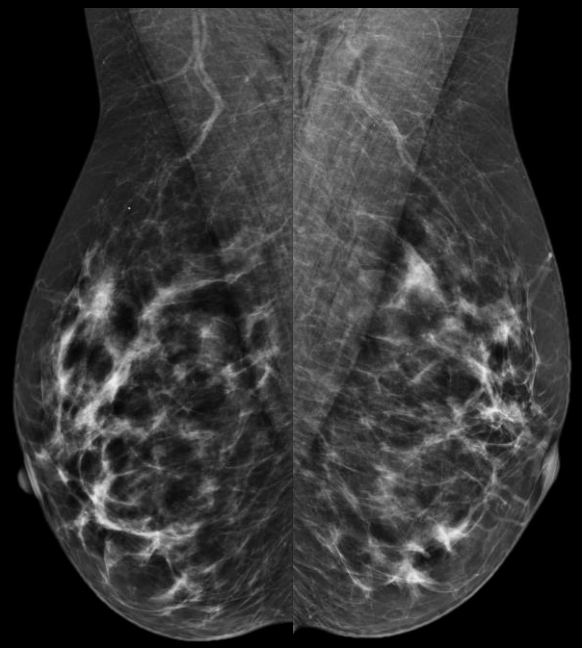


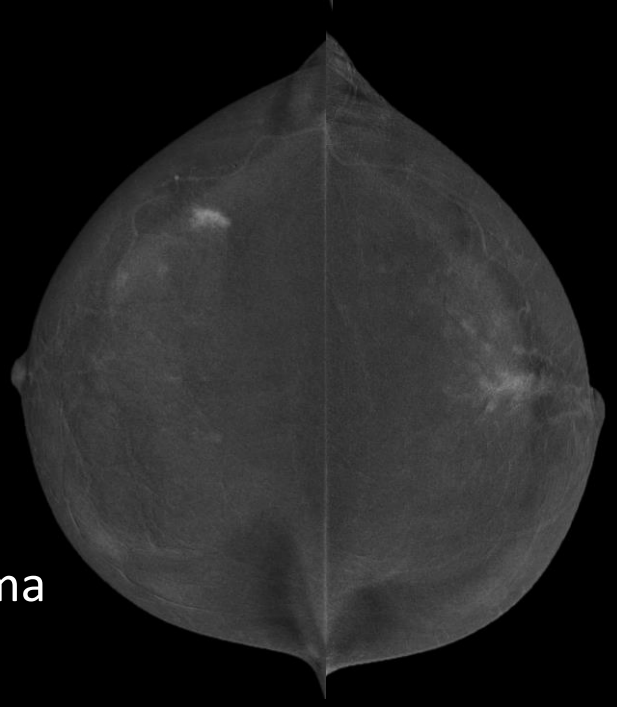




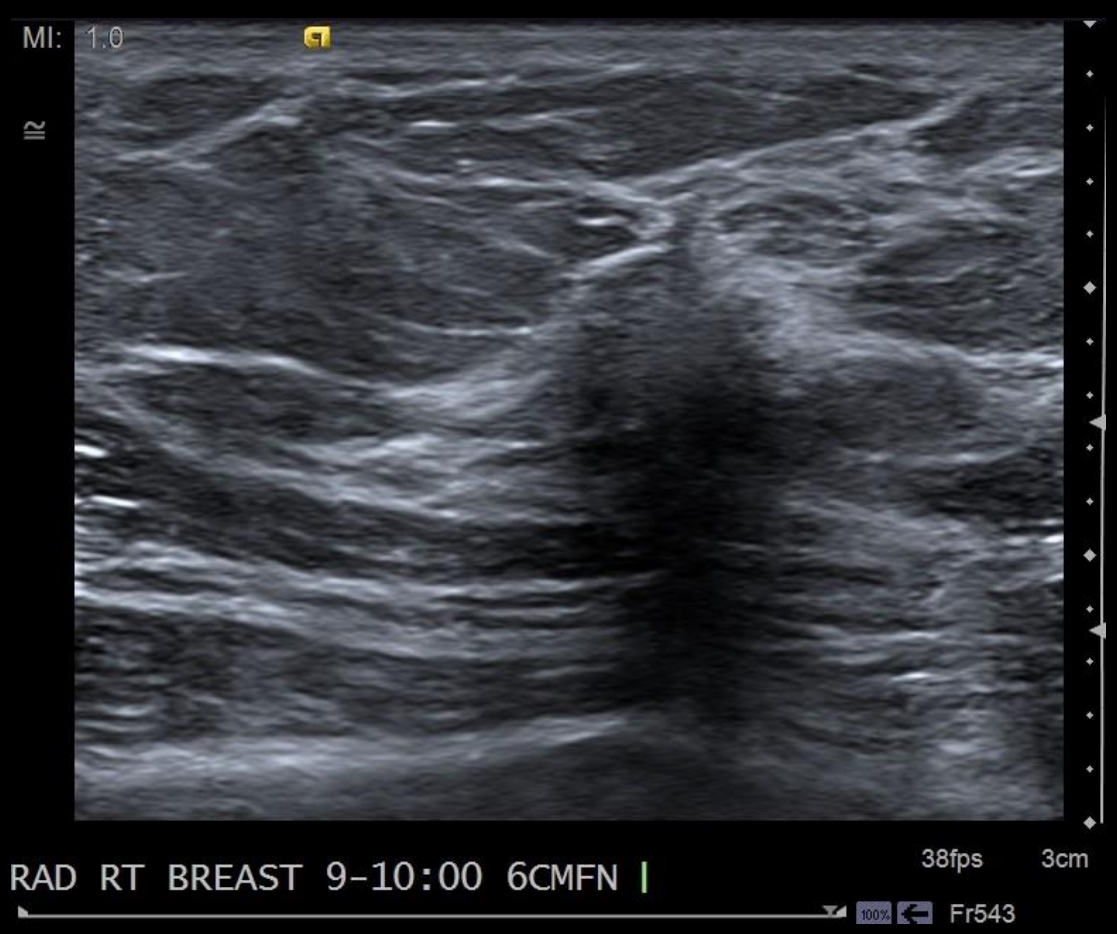
Dotatate PET
Appendiceal carcinoid

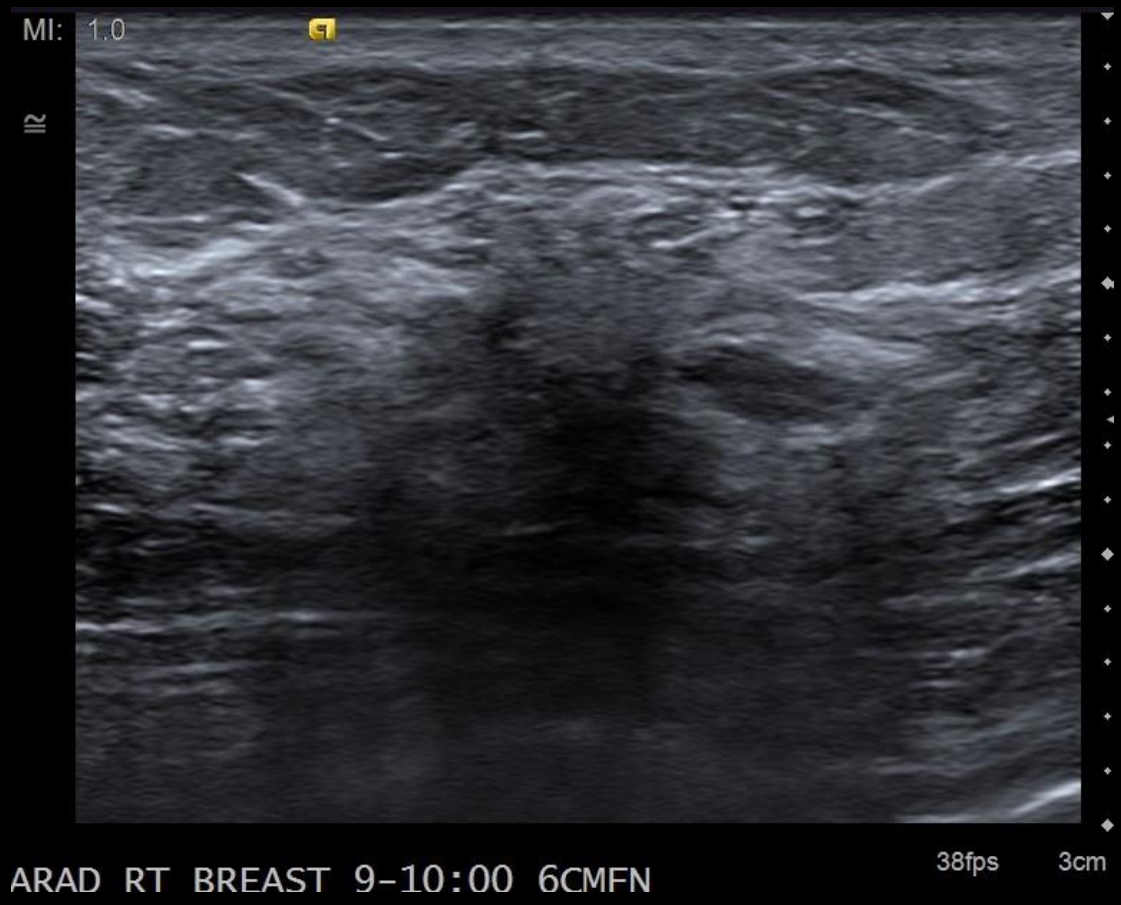




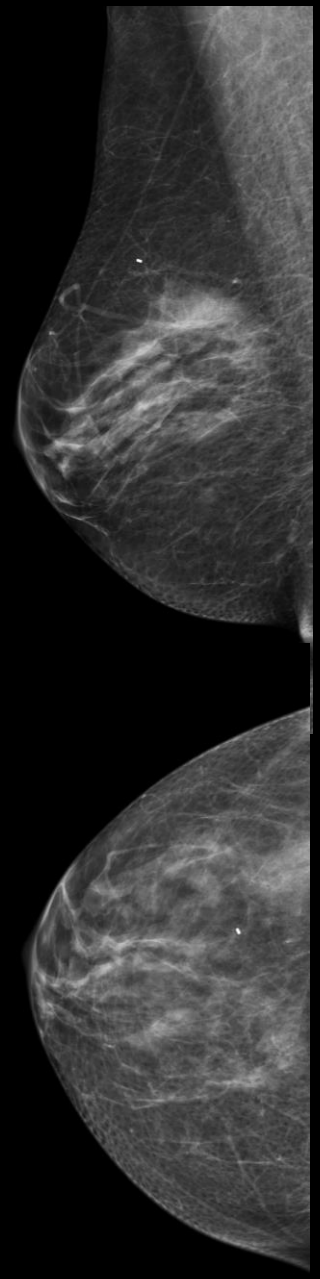


Left tomo bx =
sclerosing papilloma
and cystic dz

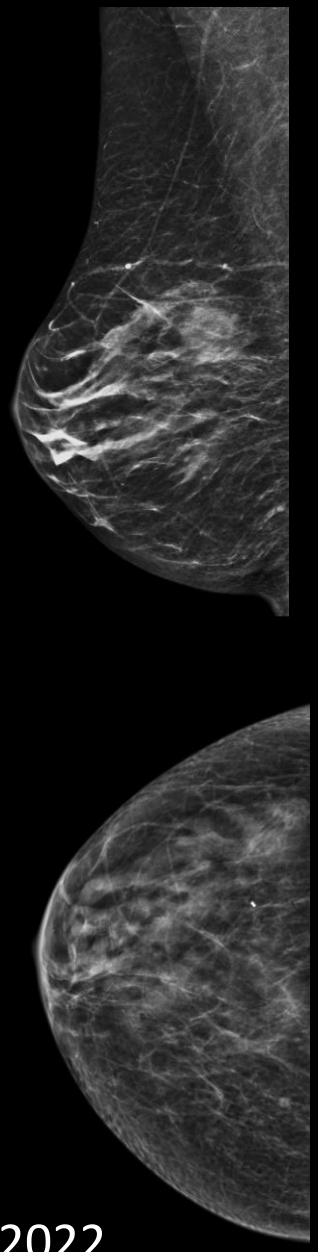




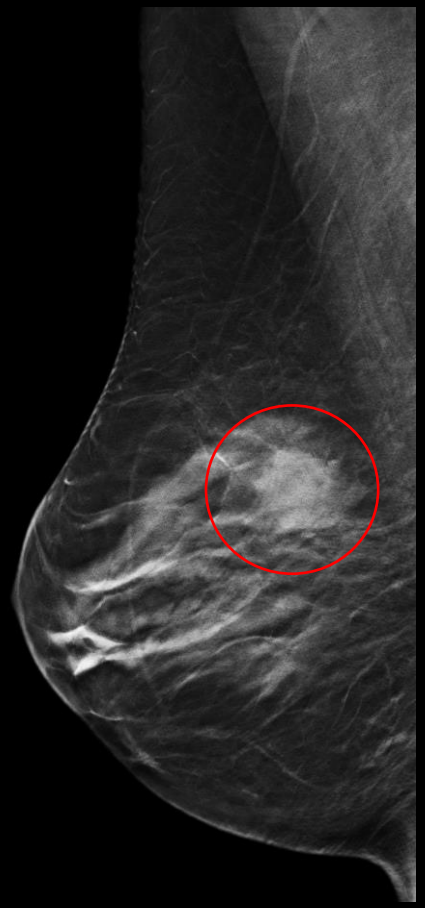
Rt US bx = invasive mixed ductal lobular



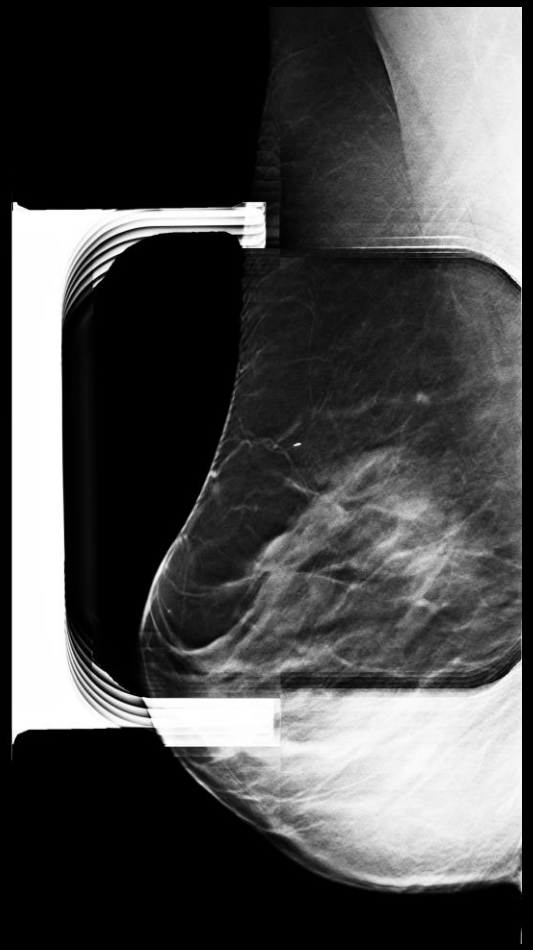
2016

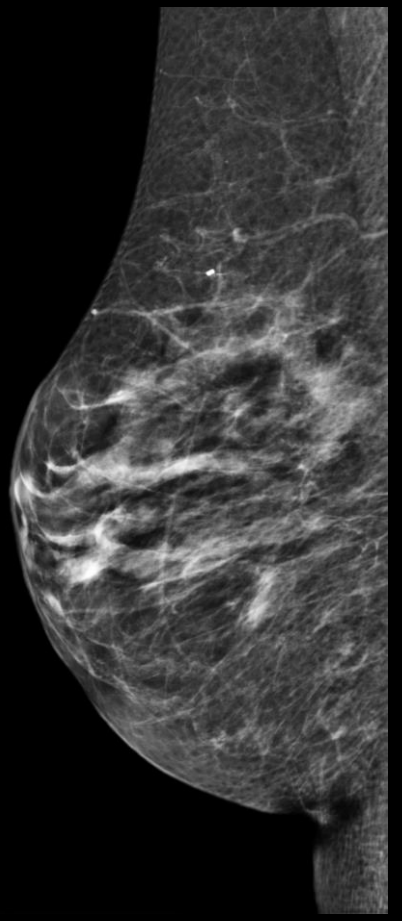


2022

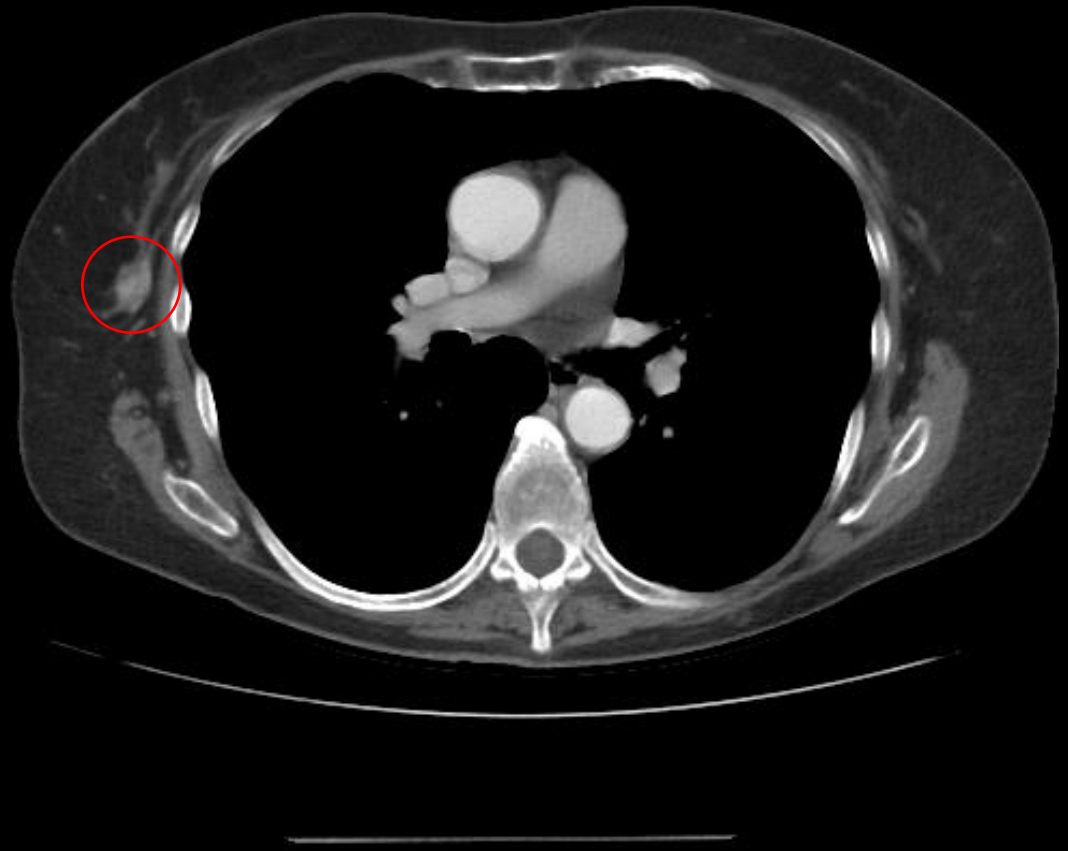


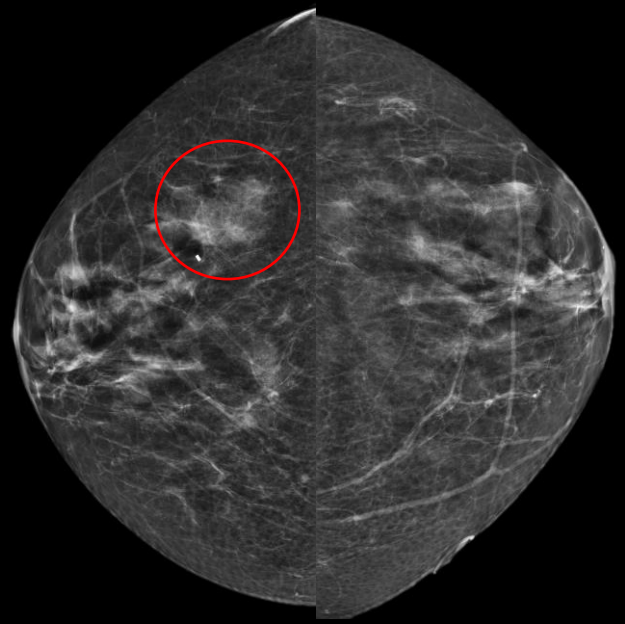
Tomo callback

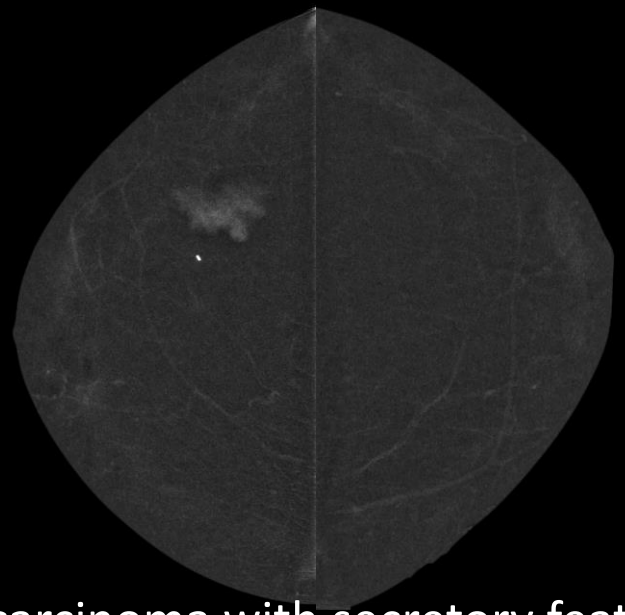




Neg US, return to screening








Tomo bx =
Inv mammary carcinoma with secretory features

How we use CEM:

Diagnostic problem solving

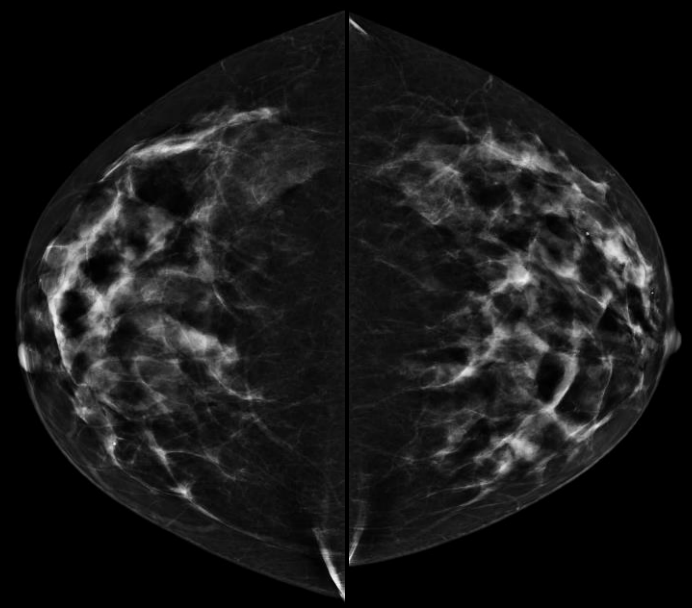
Alternative to MR

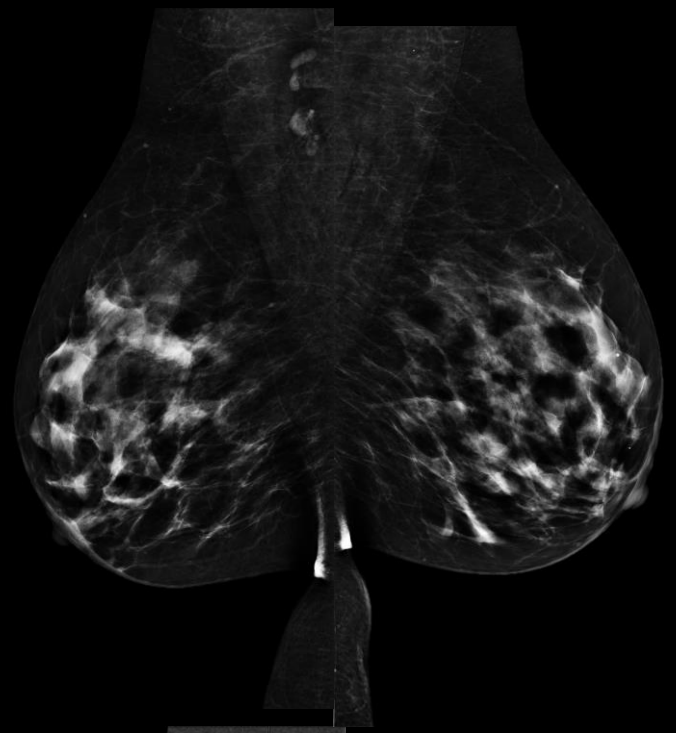
- Preop staging
- Personal hx breast cancer, dense tissue
- Personal hx breast cancer dx age < 50
- High risk patients (> 20% T-C)
- Dense tissue (2023 ACR recommendations)

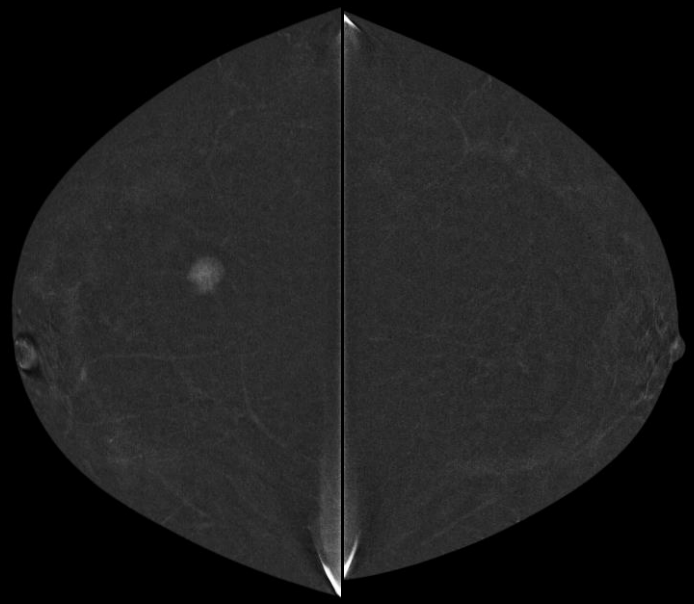
Screening dense tissue (as an alternative to ABUS)

Monticciolo et al. “Breast Cancer Screening for Women at Higher-Than-Average Risk: Updated Recommendations From the ACR.” *JACR* Sept 2023.

High risk screening





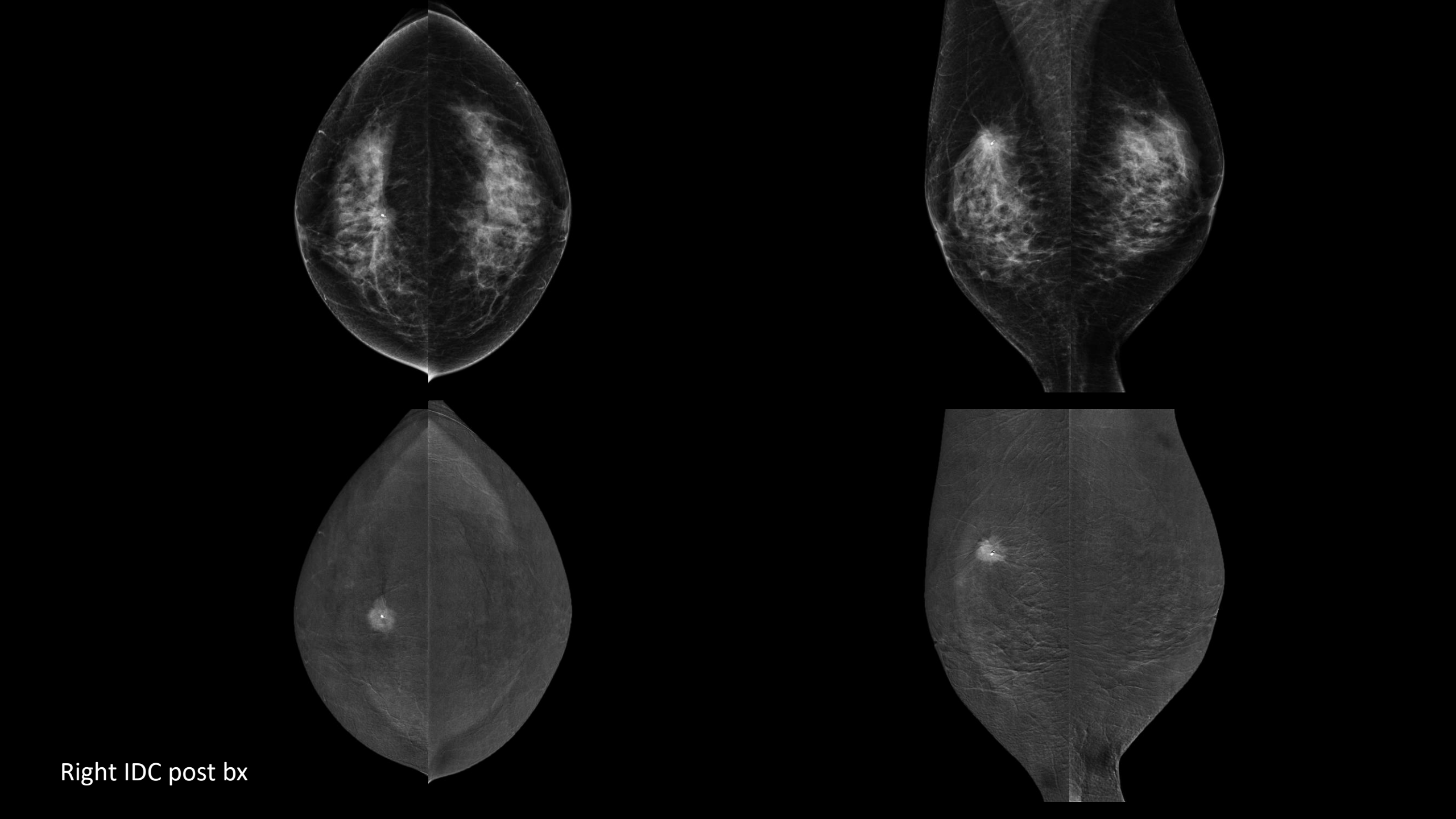


Invasive carcinoma,
mixed ductal and lobular

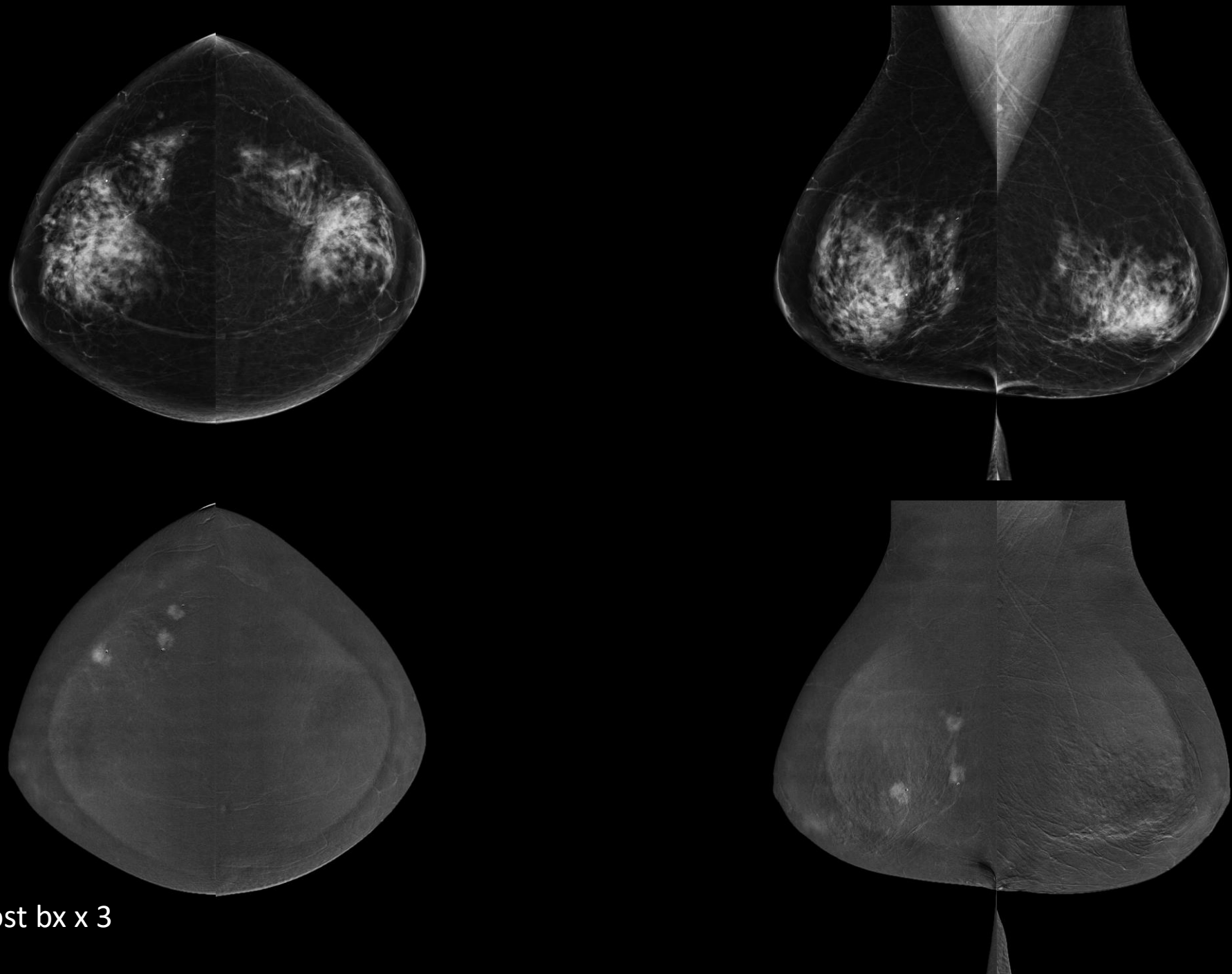
CEM for staging after cancer diagnosis:

Our surgeons love it! **When do we hesitate?**

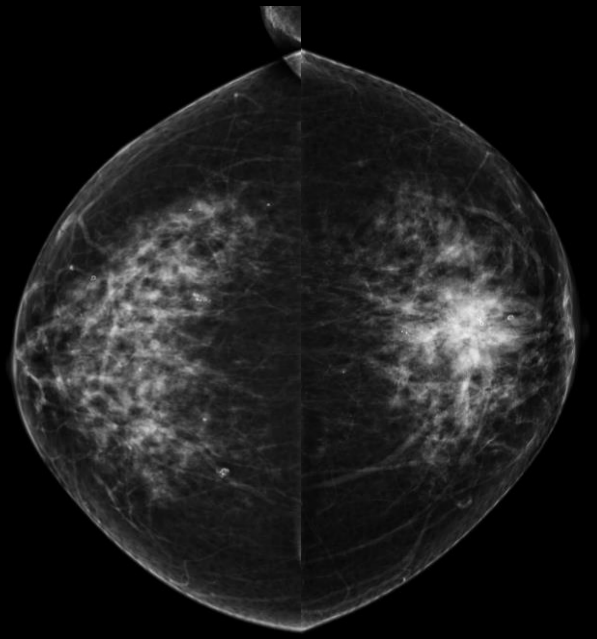
- Lobular, mucinous histology
- Cancer near chest wall
- IM nodes may be involved, need RT
- Axilla not well evaluated with US
- Implants
- Oncoplastic techniques are planned
- MRI anticipated for follow up

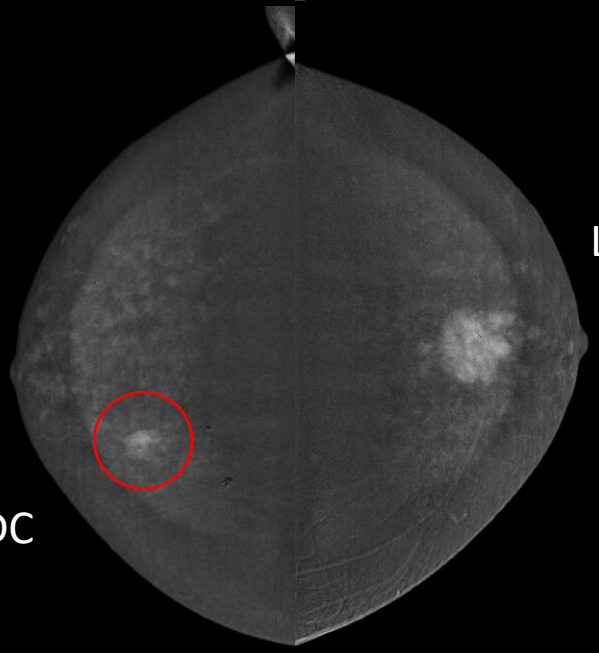


Right IDC post bx



Right IDC post bx x 3





Left IDC post bx

Rt US bx = IDC

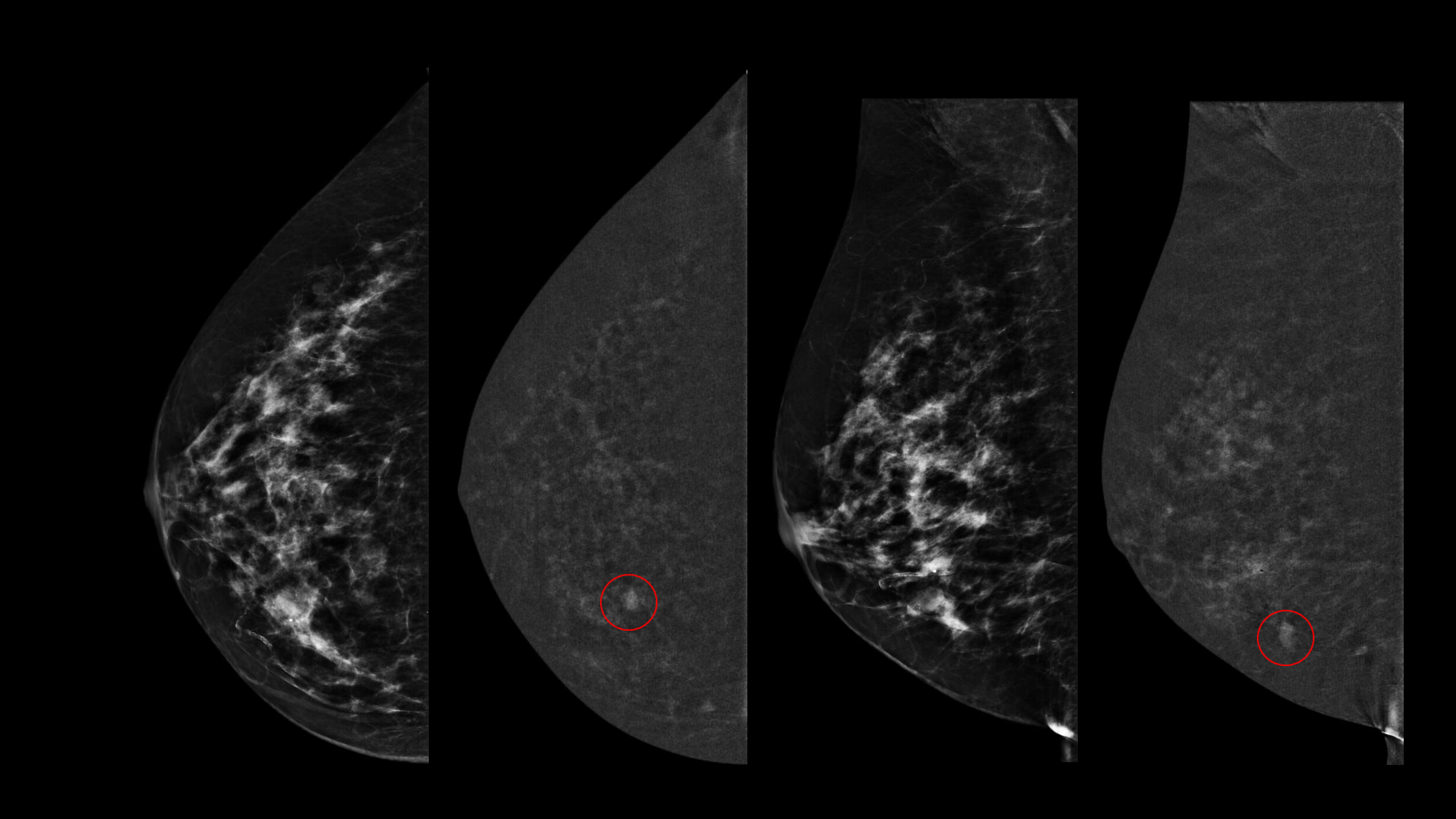
How we use CEM:

Diagnostic problem solving

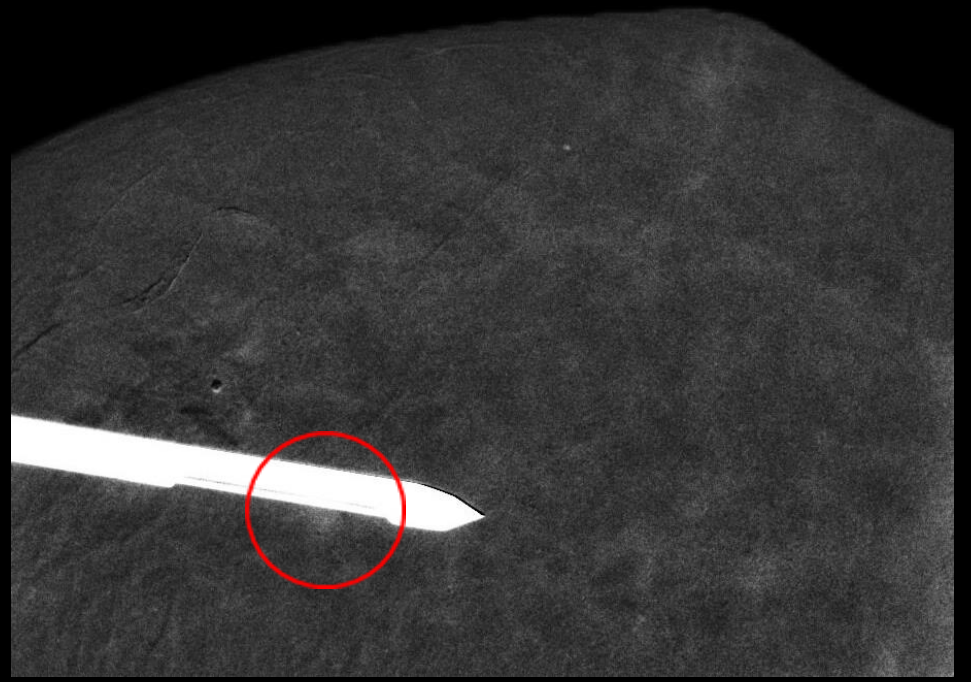
Alternative to MR screening

Screening dense tissue (as an alternative to ABUS)

- Off-label
  - *Ordered and performed as a diagnostic exam*
- Intermediate risk
- Frequent callbacks
  - *Including recalls from ABUS*
- Breast size, surgical changes, tissue heterogeneity/shadowing on US limit ABUS technique



ILC and LCIS



Contrast Enhanced Mammography: A “Just Right” Solution

CEM Overview

CEM use cases in screening and diagnostic setting

When anatomic imaging only is “too little,” and vascular based imaging with MR is “too much,” CEM can be “just right”

ARA HEALTH SPECIALISTS

Thank you!