Missed Breast Cancers: What can we do?

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Objectives

- Review cases of missed breast cancers
- Identify factors leading to missed breast cancers
- Understand radiologist and technologist role in reducing missed breast cancers

Factors Leading to Misses

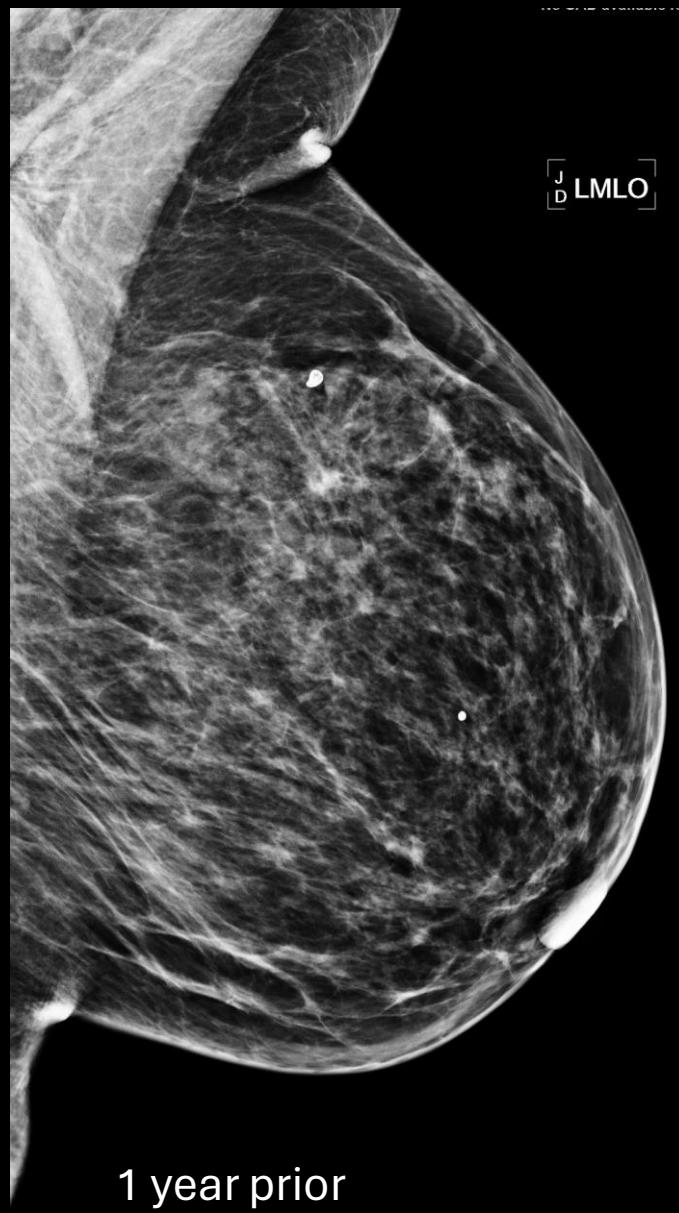
- Patient Related Factors
  - Breast density
- Tumour Characteristics
  - Location
  - Breast cancer subtypes
- Technical Factors
  - Motion blur
  - Suboptimal positioning
- Radiologist Factors
  - Perceptual error
  - Cognitive error
  - Rad Path discordance

Common Cognitive Biases in Breast Imaging

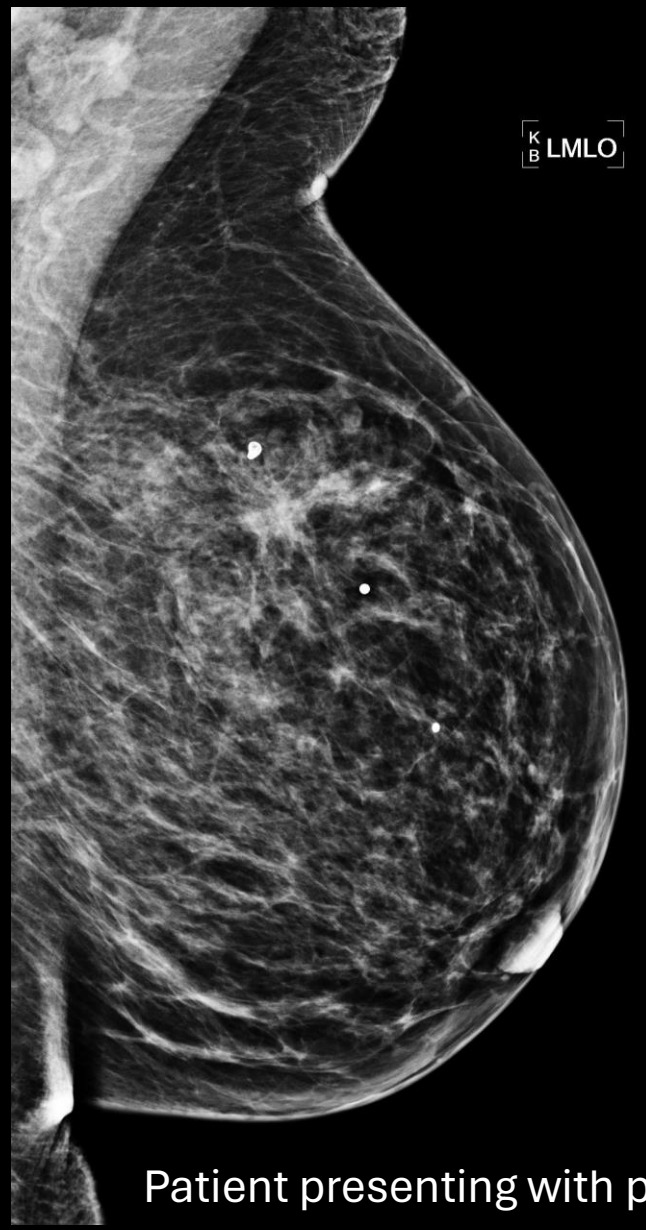
Cognitive Bias	Definition	Strategies to Counteract Bias
Anchoring bias	Failing to adjust an initial impression, despite receiving additional information	Gather all available clinical data before making a diagnosis, seek to disprove one's initial diagnosis, and seek a second opinion
Confirmation bias	Searching for data to reaffirm an existing hypothesis	Reexamine and seek new evidence, particularly that which supports alternate hypotheses Be conscious of the psychologic impact of retracting an initial diagnosis
Availability bias	Judging the probability of an event by the ease with which it comes to mind	Use objective data on the base rates of disease to correlate with one's own rates of diagnosis, and create a differential diagnosis
Satisfaction of report	Perpetuating an impression from a prior report	Review the examination and generate an impression before reviewing the prior report, and consider a second opinion
Framing bias	Drawing different conclusions from the same information, depending on how the information is presented	Consider other organ systems or causes Read an image first while the clinical history and the side of concern are masked, and then review the history Review the patient's chart if the provided history substantially impacts the diagnosis
Attribution bias	Attributing findings to patient characteristics or stereotypes	Be aware of this bias Read an image first while the clinical history is masked, and then review the history Review the patient's chart if the demographic information impacts how the diagnosis is formulated
Satisfaction of search	Decreasing vigilance and/or awareness for additional abnormalities after differentiating the first abnormality	Use a systematic or checklist approach, particularly for common and commonly missed diagnoses Initiate a secondary search after differentiating the first finding Remain aware of related diagnoses and common diagnostic combinations
Premature closure	Accepting a preliminary diagnosis as final	Keep an open mind when formulating a working diagnosis, and generate a differential diagnosis
Inattentional bias	Missing findings hiding in plain sight due to unexpected location or nature	Know one's own blind spots, and always step back to look at the big picture
Hindsight bias	Retrospectively de-emphasizing the difficulty in making the initial diagnosis	Do not lose confidence or become overconfident as a result of retrospective analysis, and try to understand a colleague's perspective

Lamb et al. Radiographics 2020 Jul-Aug 40(4): 941-960

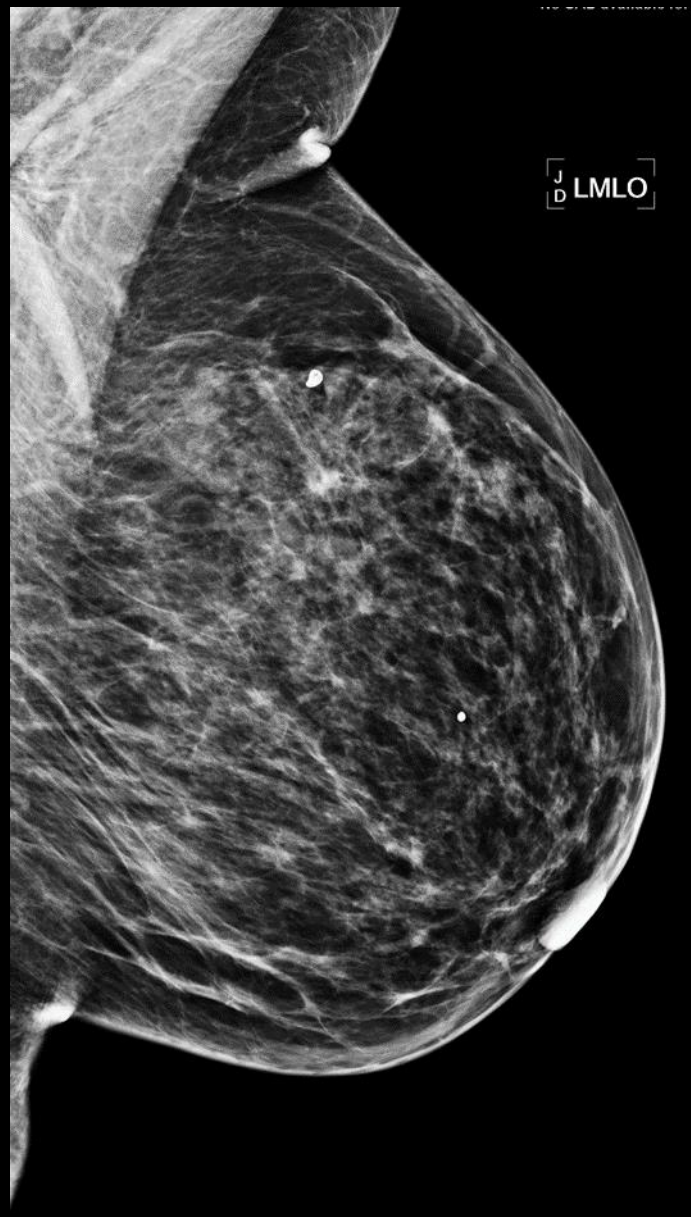
Case 1-Screening Mammogram

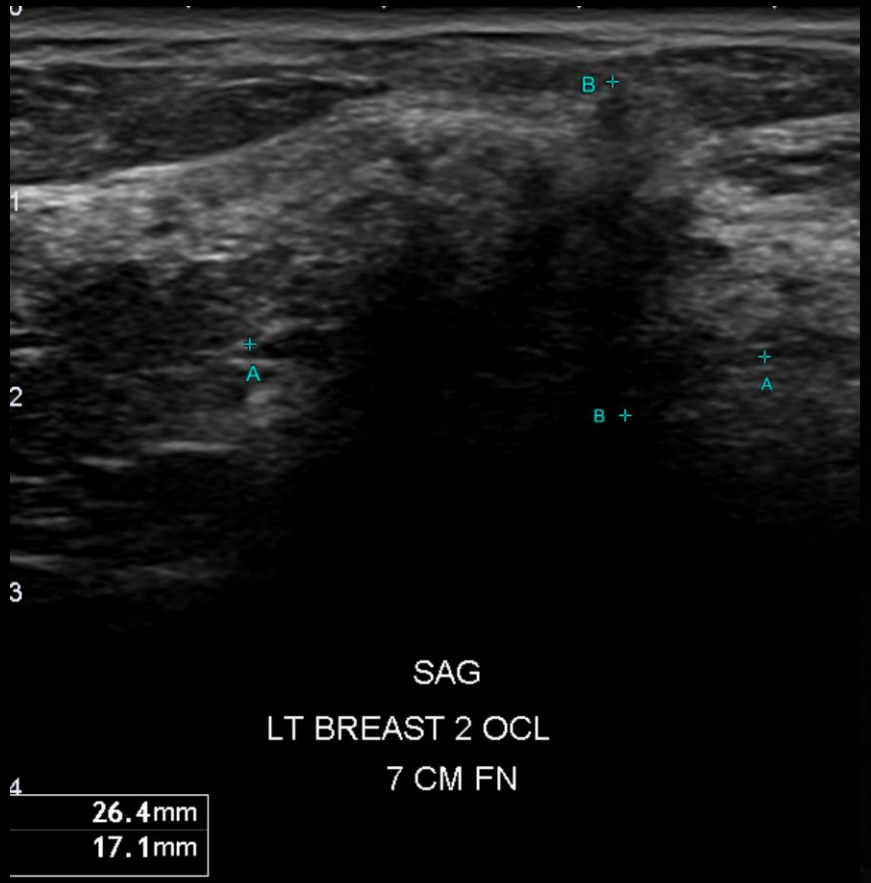


1 year prior



Patient presenting with palpable

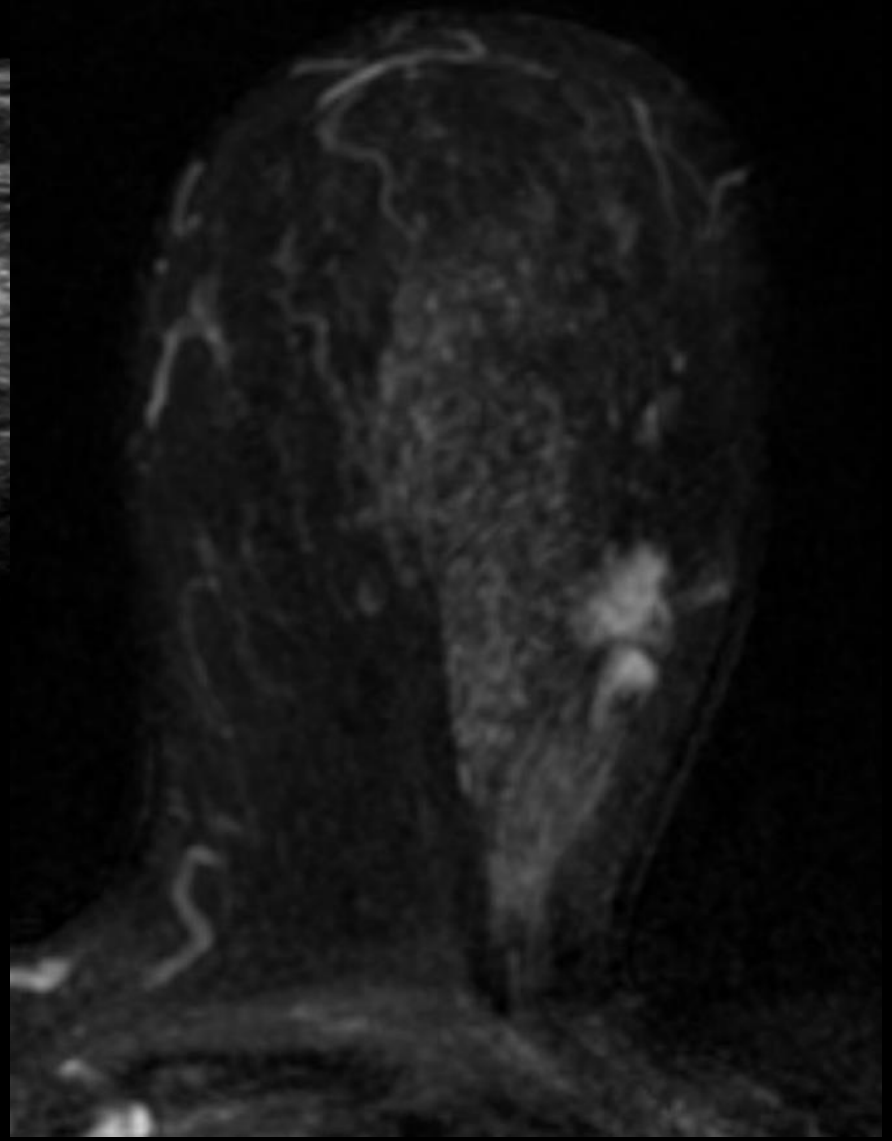




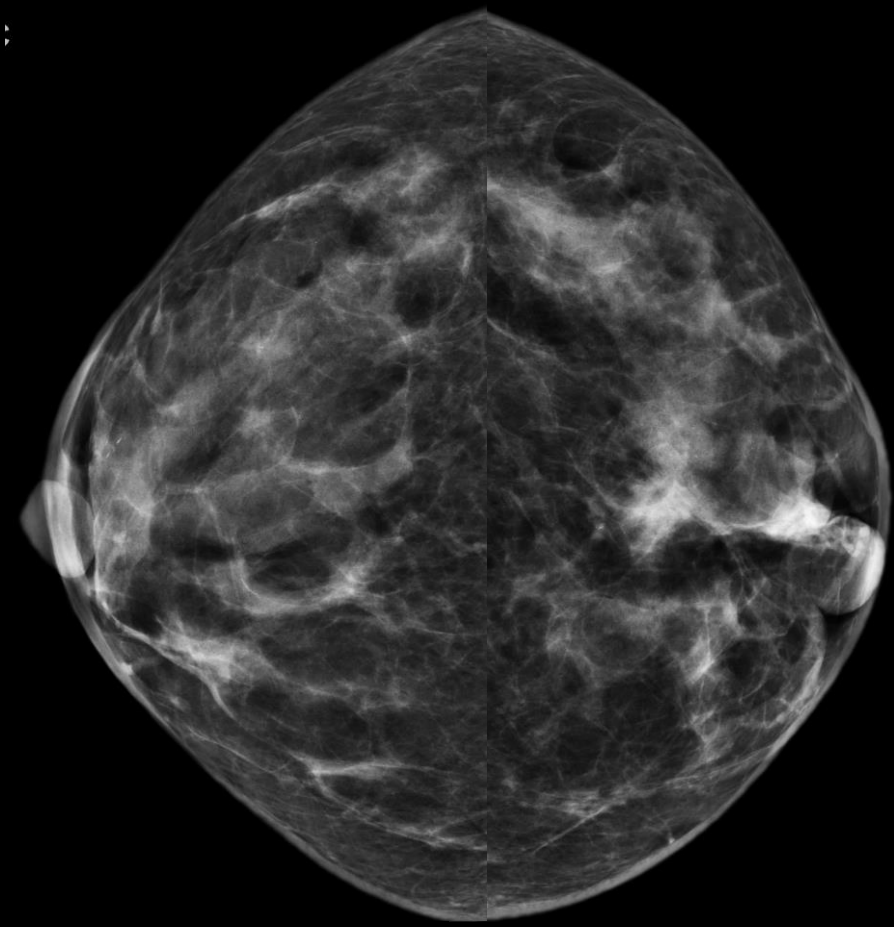
SAG

LT BREAST 2 OCL

7 CM FN



Companion Case



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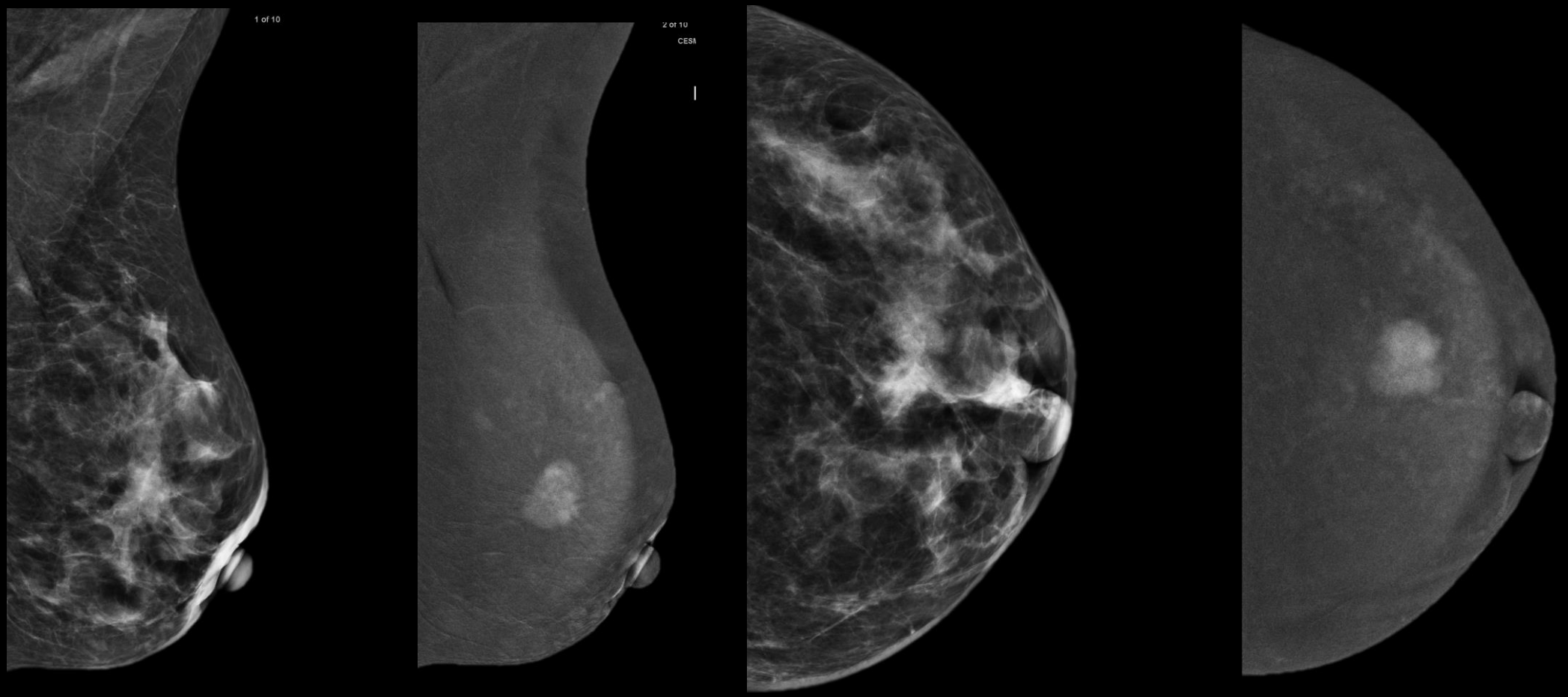
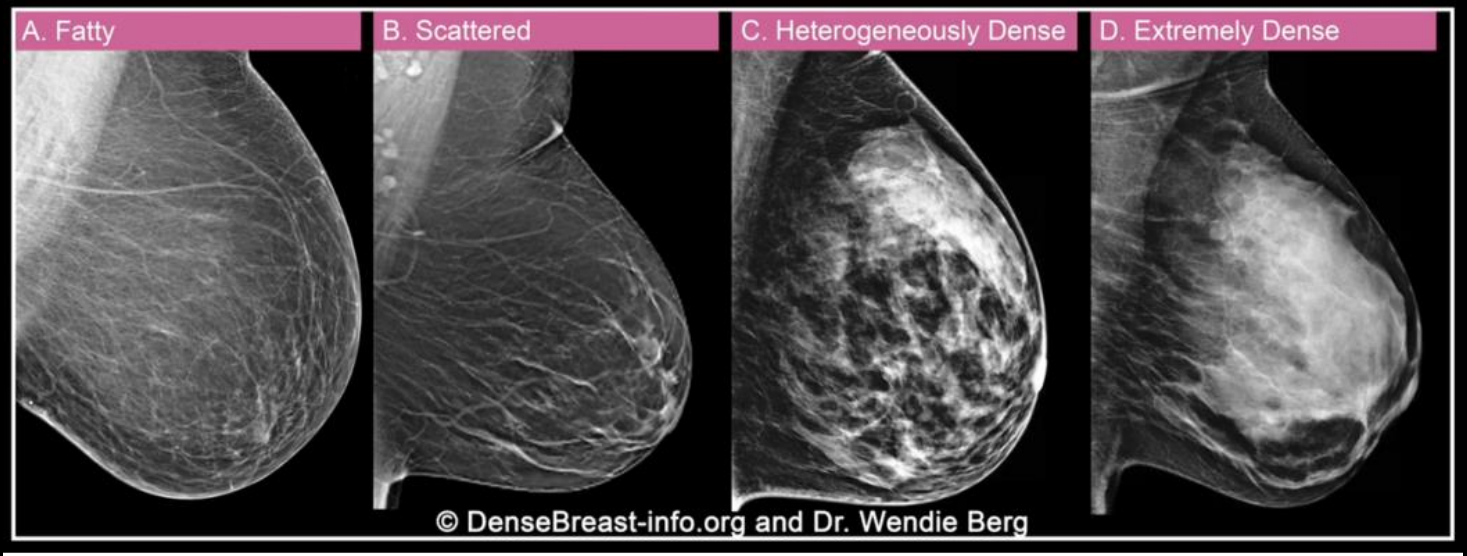


Mammogram and Breast Density



- Screening mammogram gold standard for screening
- Breast density limits sensitivity AND increases risk for breast cancer

Supplemental screening and breast density

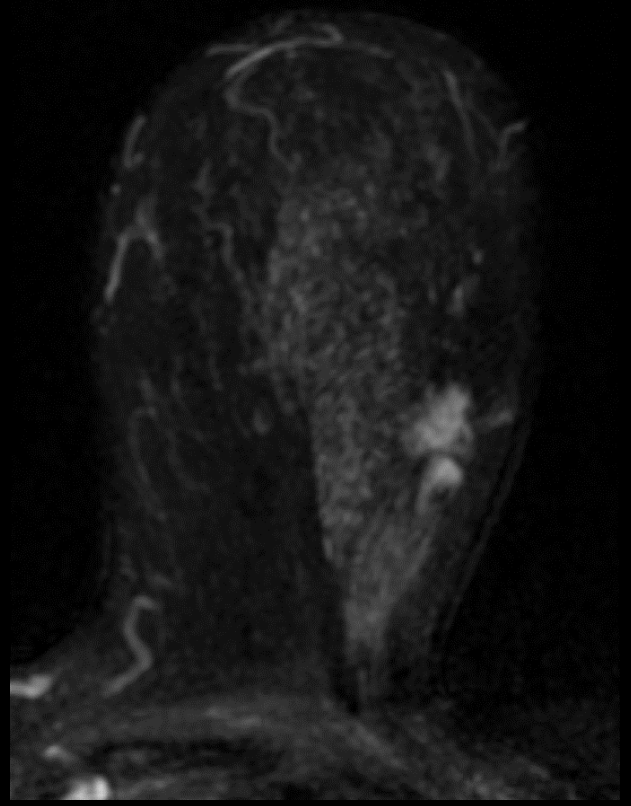


Table 3.

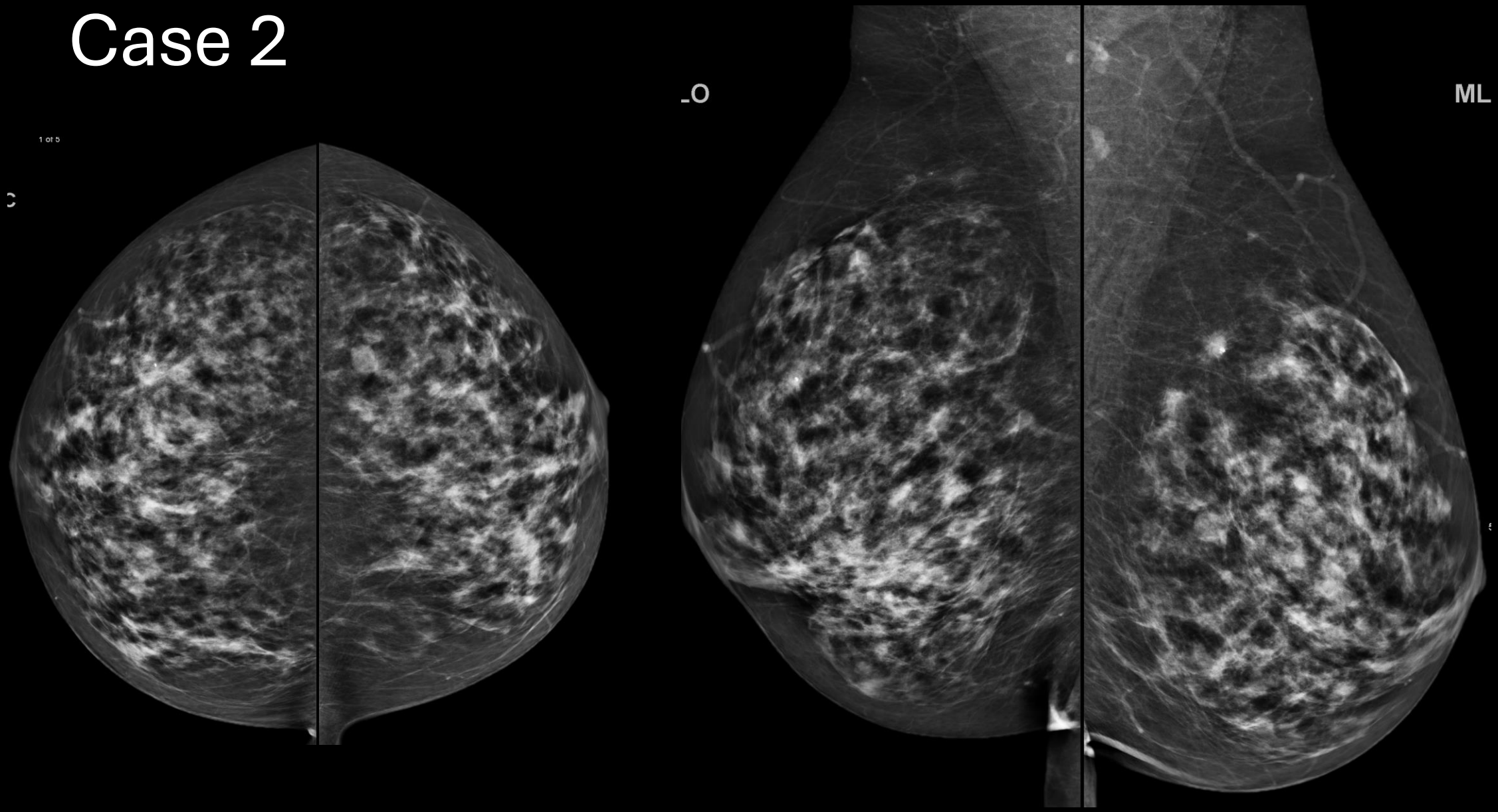
Outcomes from Supplemental Screening After Standard 2D Mammography in Women With Dense Breasts (or All Densities for MRI)

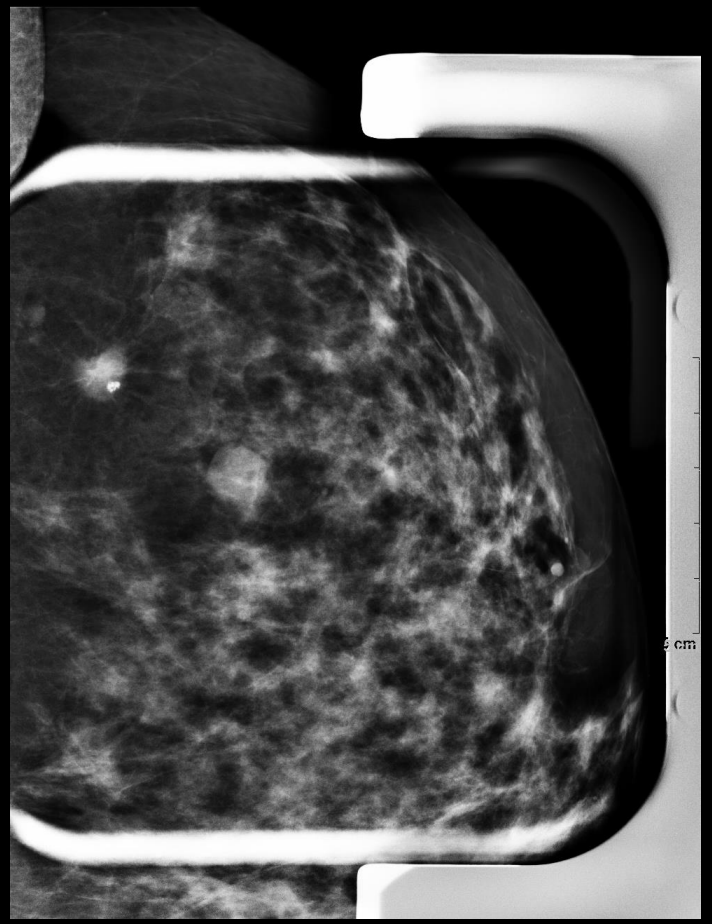
Method	Incremental cancer detection rate per 1000	Additional false positive rate	Interval cancers reduced
US (first round)[a]	2–3 (73)	8%–12% (73, 81, 82)	Yes
US (subsequent rounds)[b]	1–3 (71,81,82)	2%–5% (71,81,82)	Yes
Contrast-enhanced mammography[c]	7–13 (66,67,83,84)	6.5% (66,67,83,84)	Unknown
MRI or abbreviated MRI (first round)	10–20 (55,57,64,82,85)	9% (55,57,64,82,85)	Yes
MRI (subsequent rounds)	6–7 (58,85)	2% (58,85)	Yes

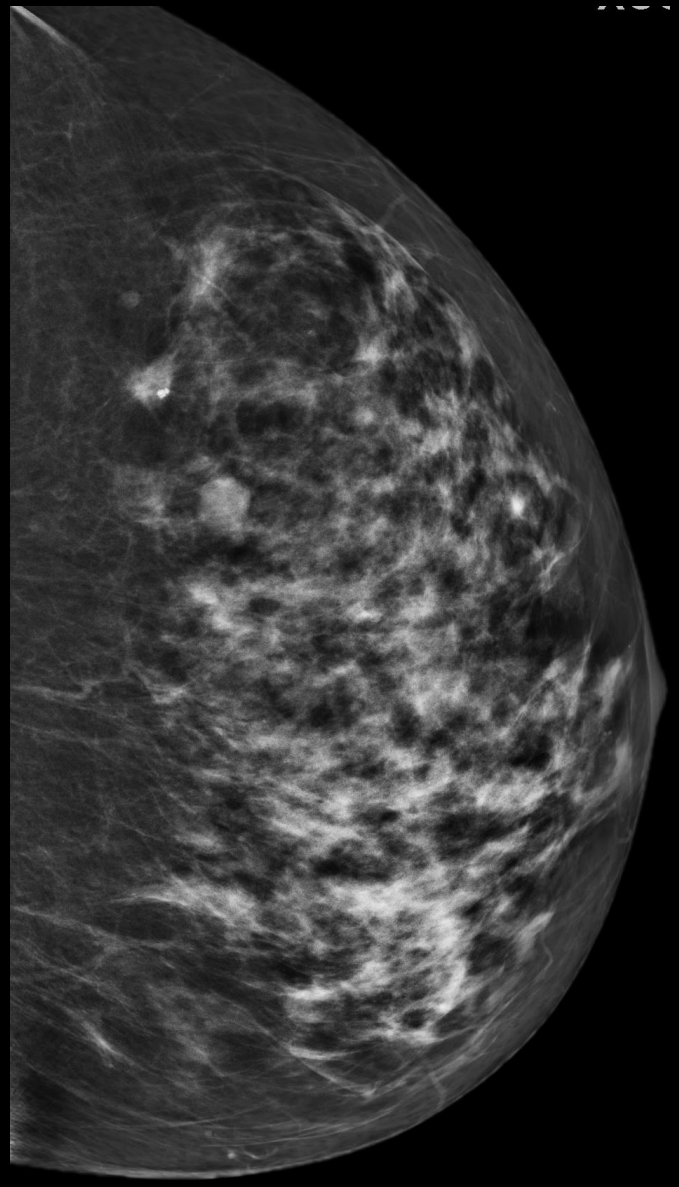
[a] Performance characteristics of screening US are similar with handheld US, automated US, and semiautomated US.
[b] Includes results from screening US after tomosynthesis (71).
[c] Results reflect a mix of prevalence (first) and incidence (subsequent) screens.

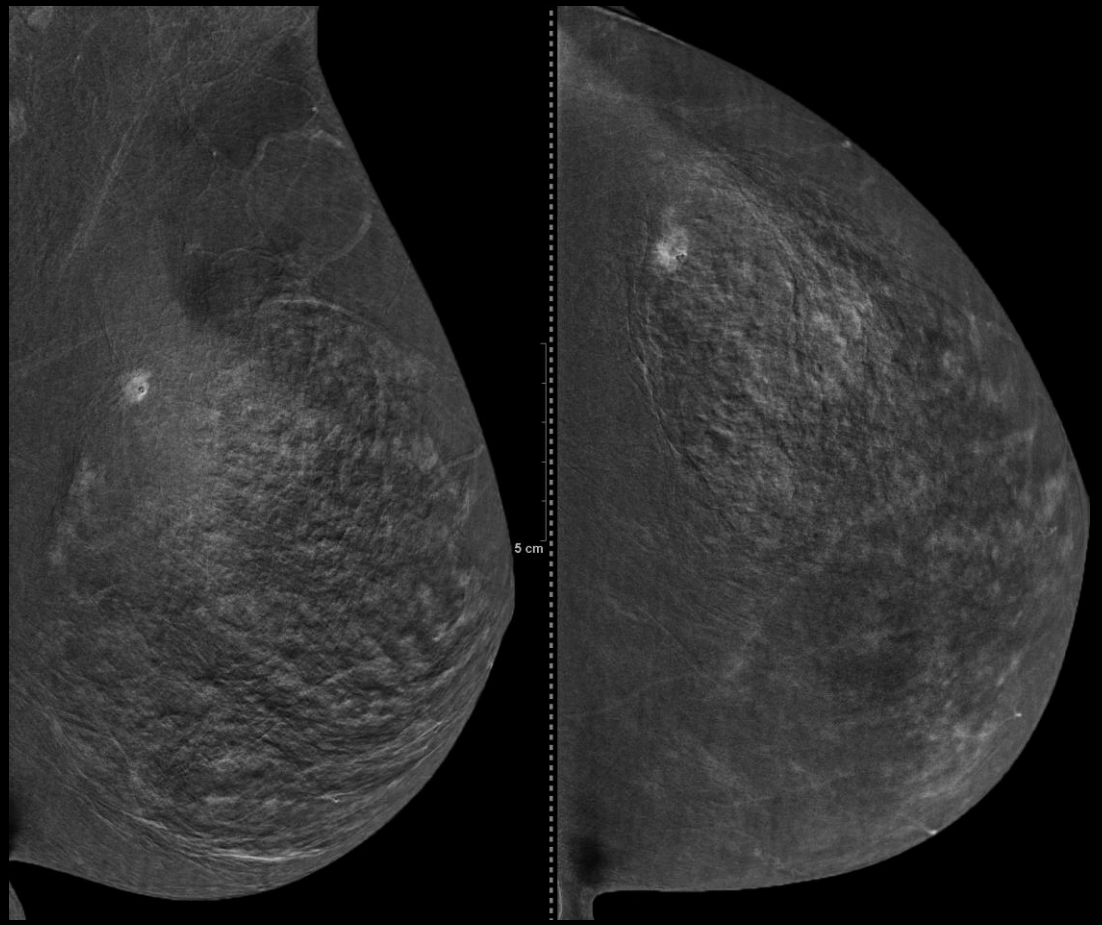
Berg WA J Breast Imaging 2023 5 (6): 712-723

Case 2



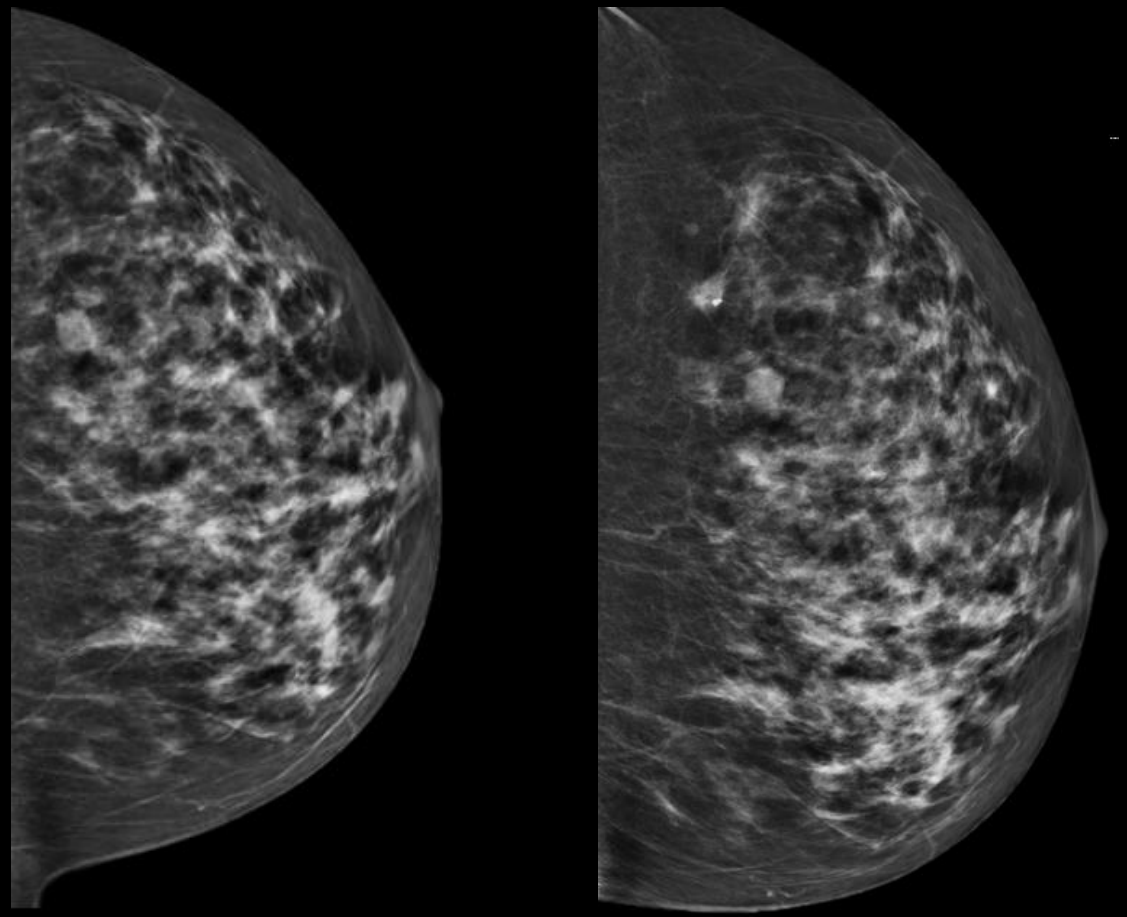





5 cm

Mammographic positioning

- Poor positioning decreases sensitivity
- Increases risk of interval cancer
- Cancers detected at later stage



Taplin et al. Screening Mammography. Clinical image quality and risk of interval breast cancer Raushcer et al BMC Cancer 2013; 13: 208

- MLO
  - Pectoralis within 1 cm nipple line
  - Convex or straight muscle
  - Open intramammary fold
  - Nipple in profile
- CC
  - Retroglandular fat
  - Ideally pec muscle
  - Depth at PNL within 1 cm of MLO
  - Nipple in profile
  -

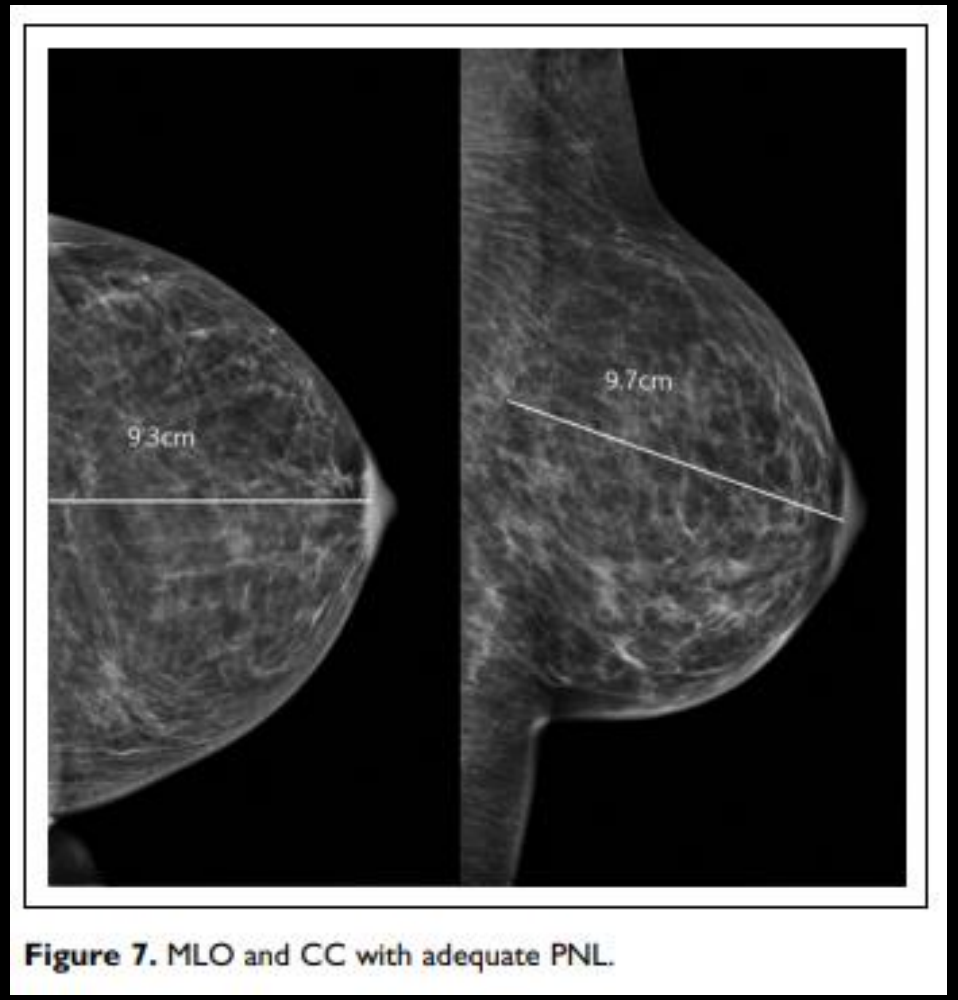


Figure 7. MLO and CC with adequate PNL.

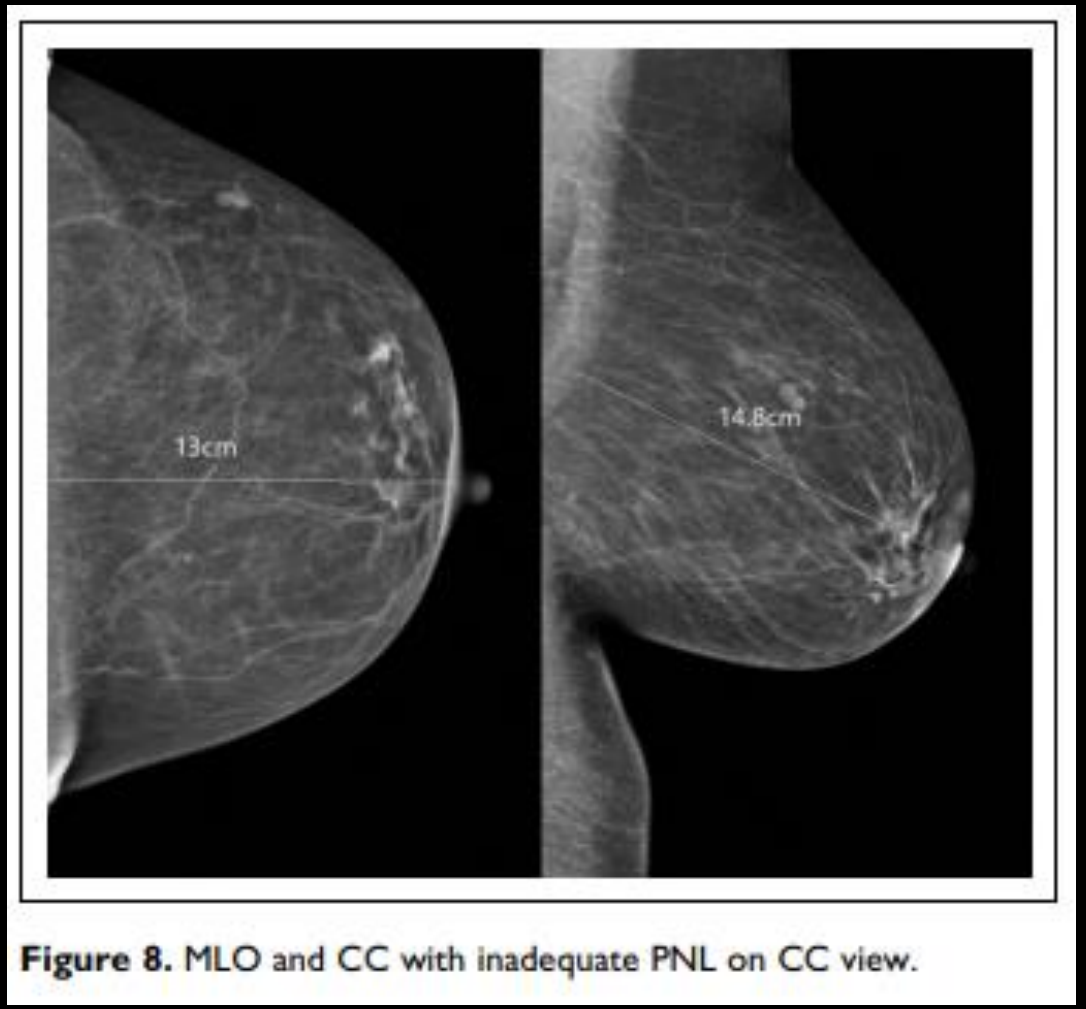
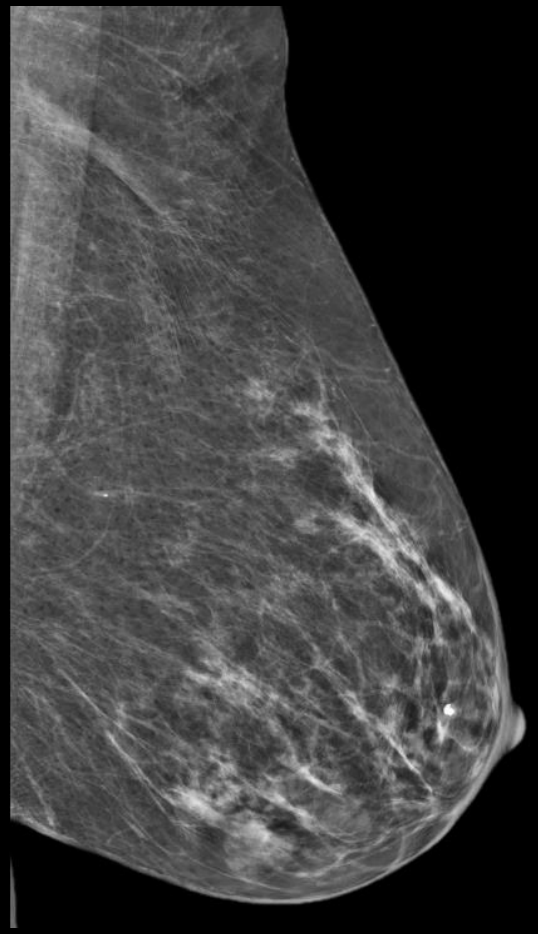
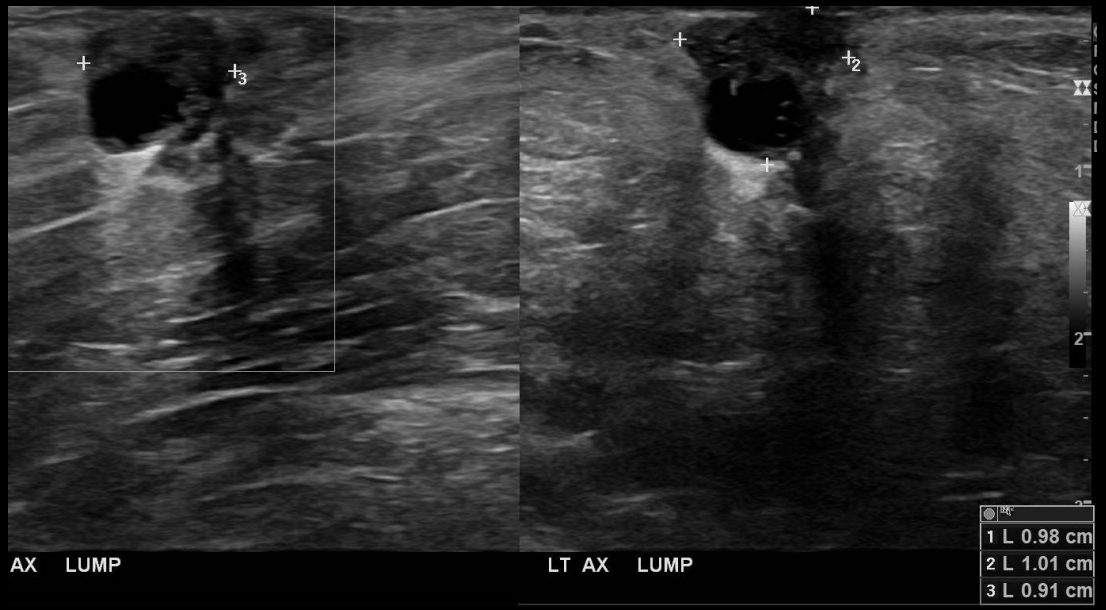


Figure 8. MLO and CC with inadequate PNL on CC view.

Wadden N and Hapgood C. Canadian Association of Radiologists Accreditation Program – Clinical Image Assessment

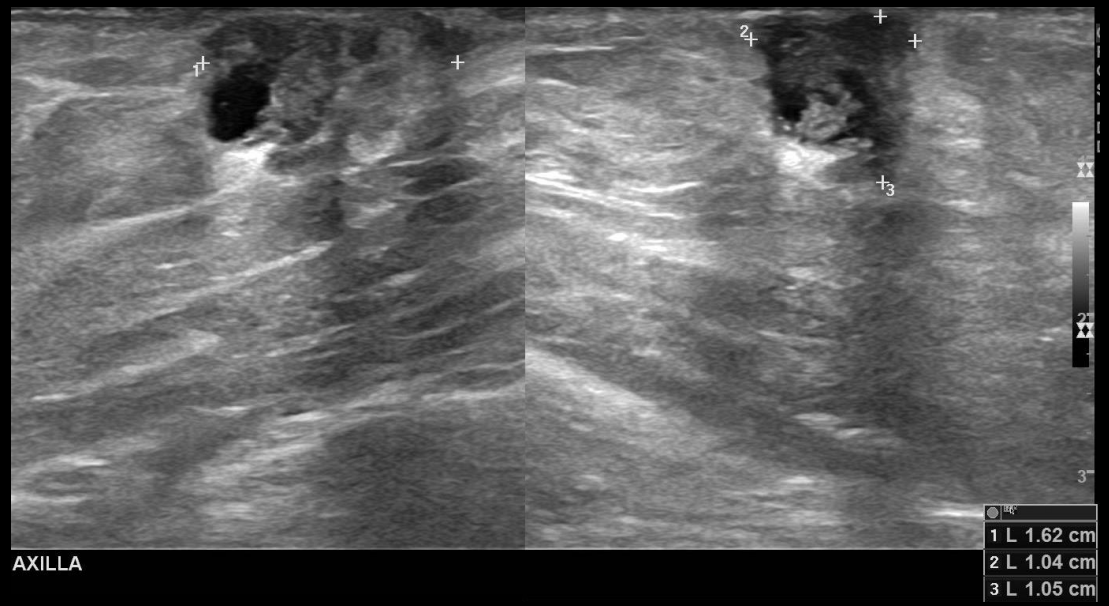
Case 3

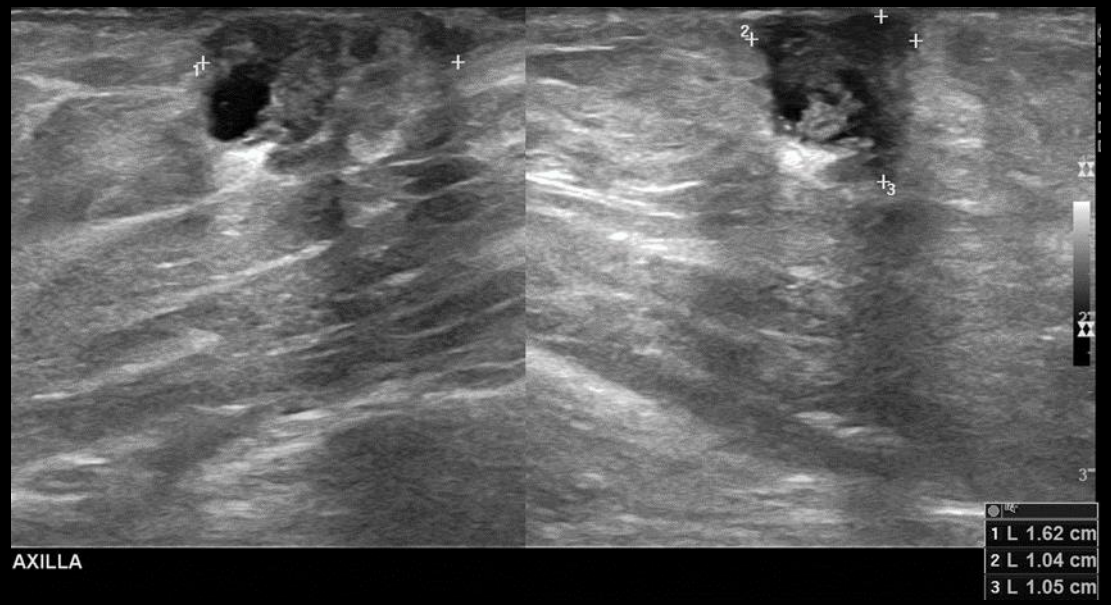




Nov 2019

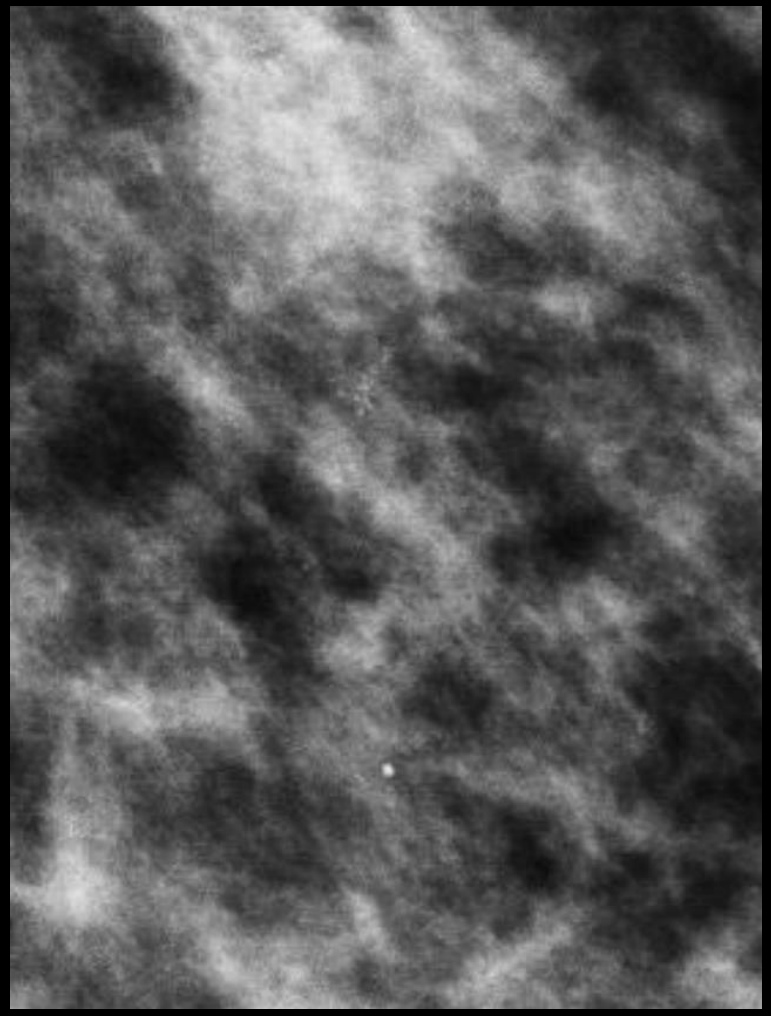
March 2020

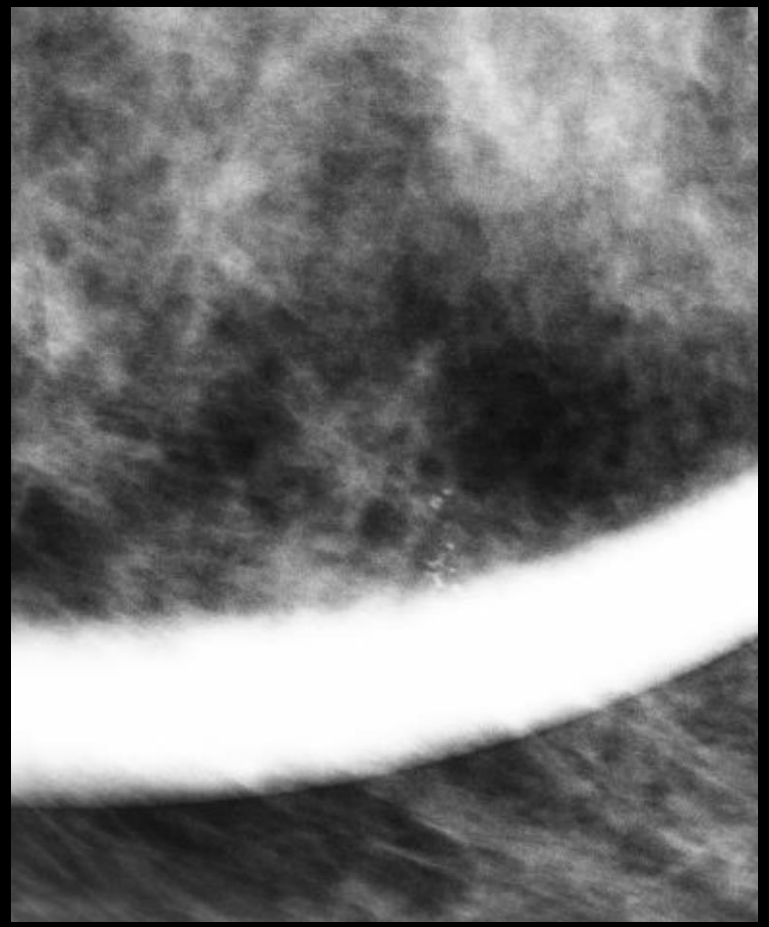


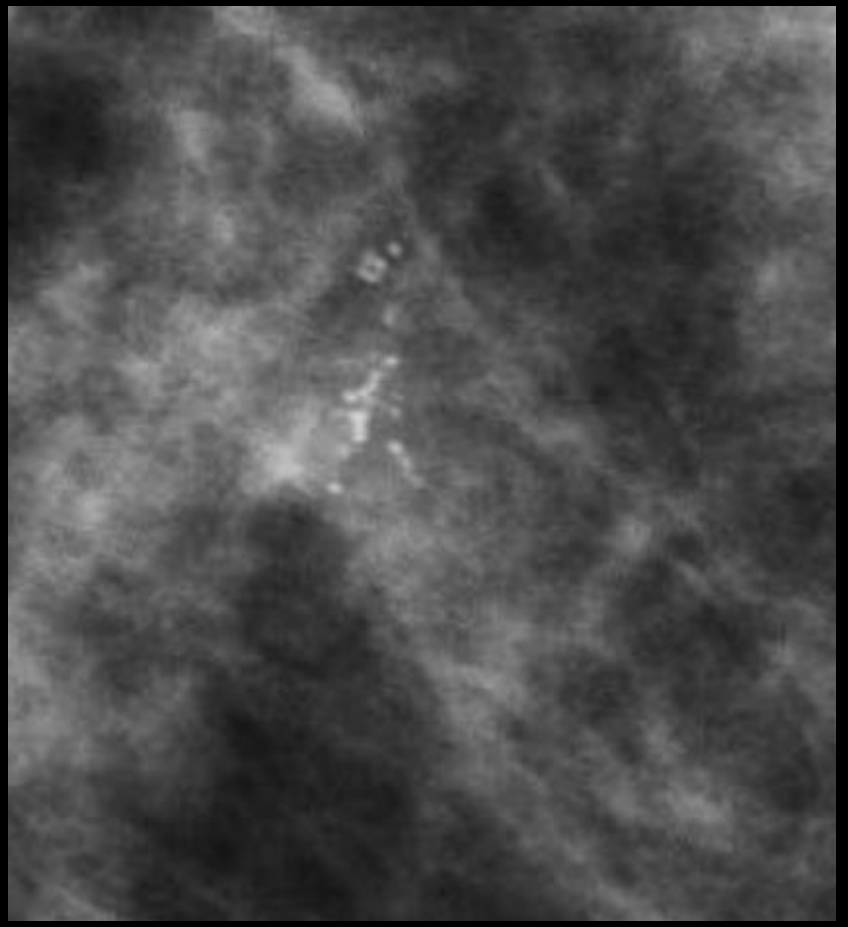


- Not all cancers visible mammographically
- Technologist history stated patient had palpable left axilla
- Patient recalled for focused ultrasound

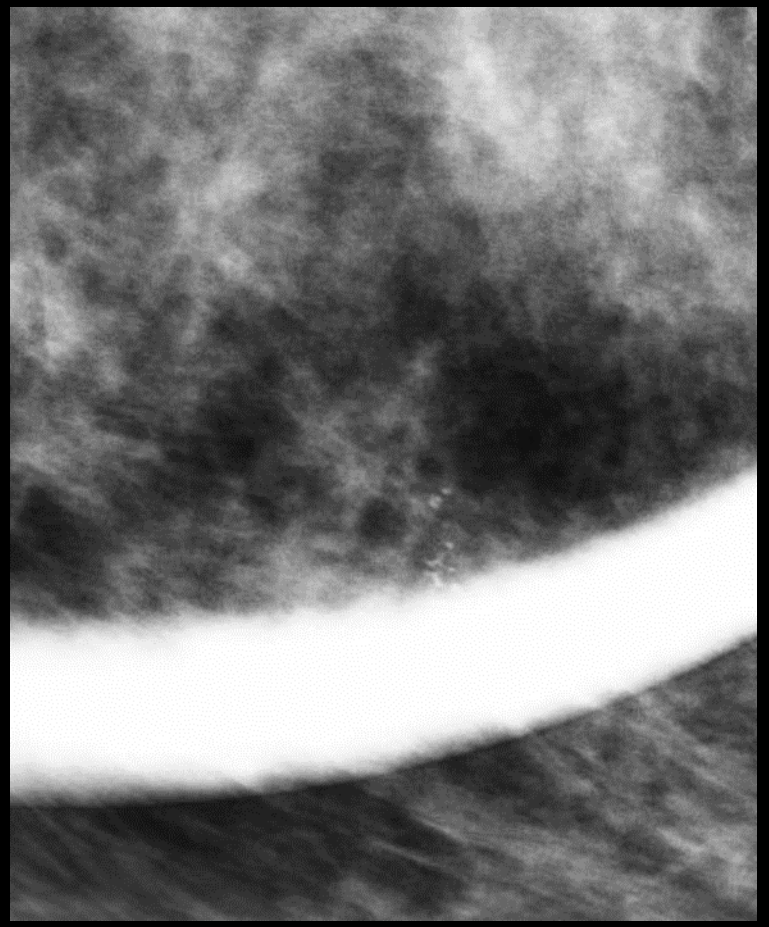
Case 4

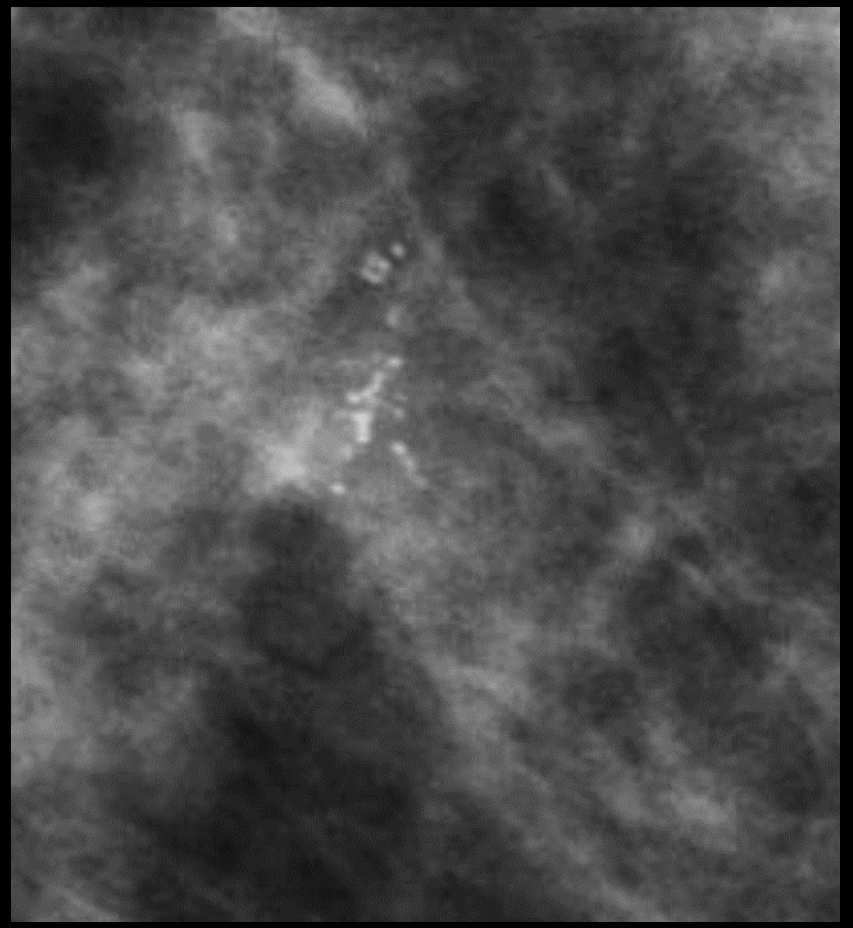






Motion Blur Obscures Calcifications

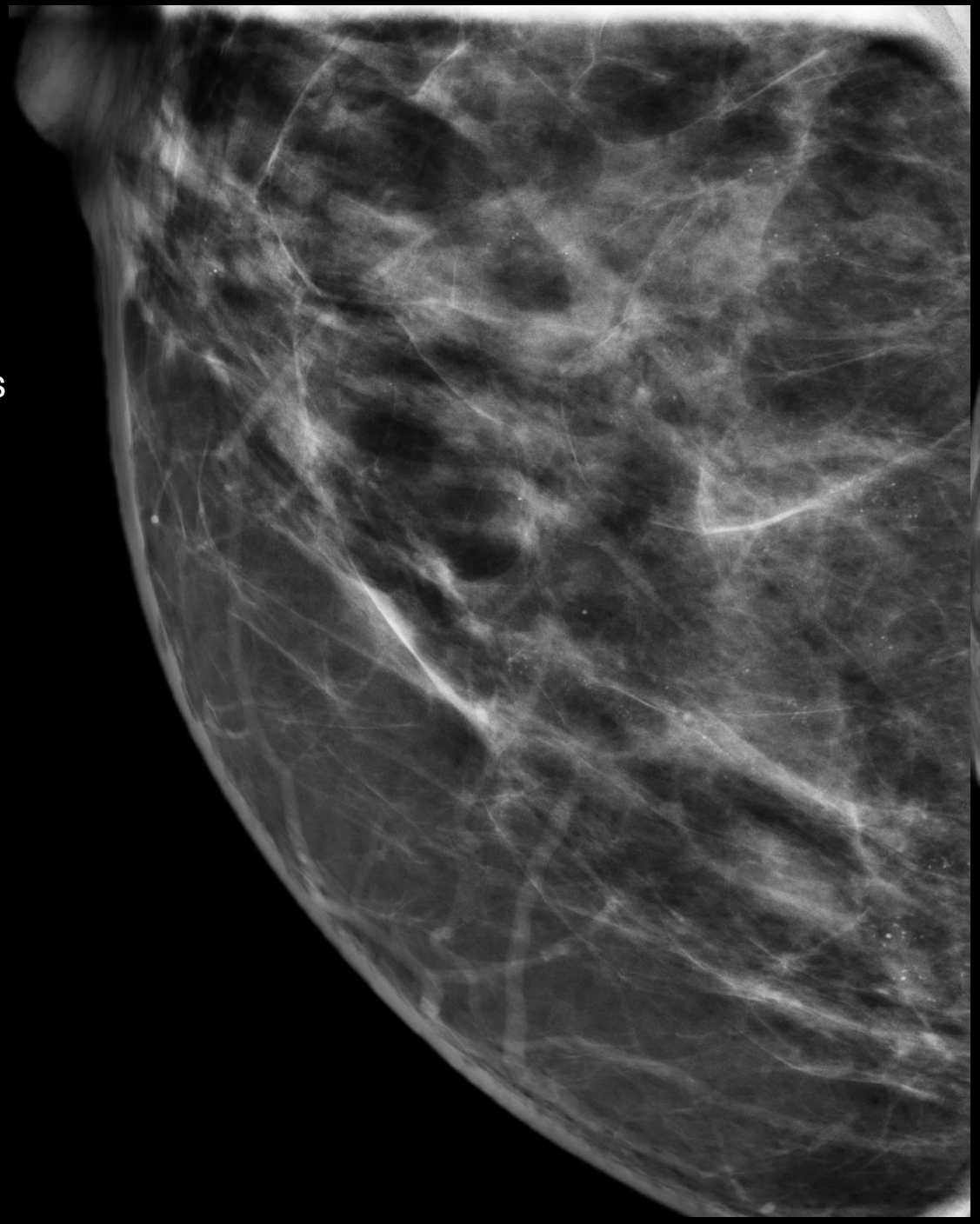


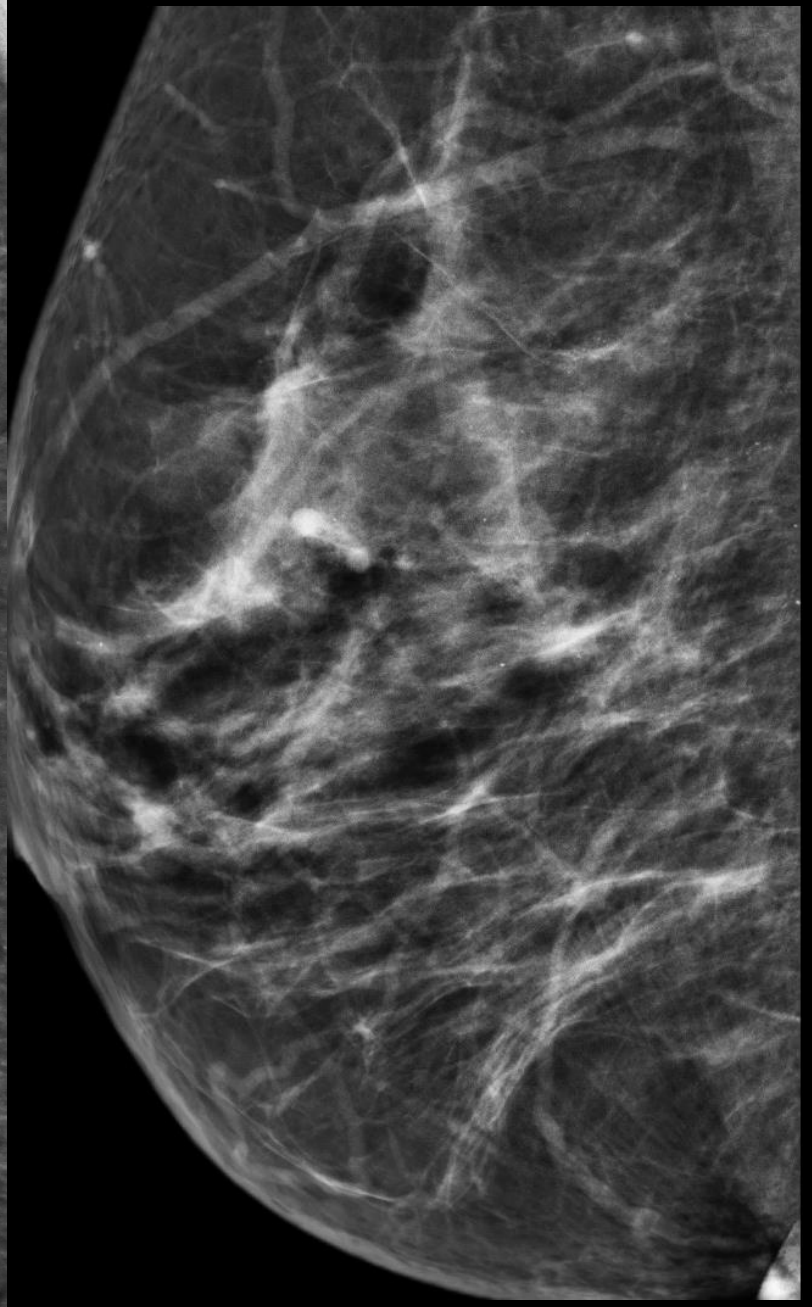


Motion blur obscures calcifications

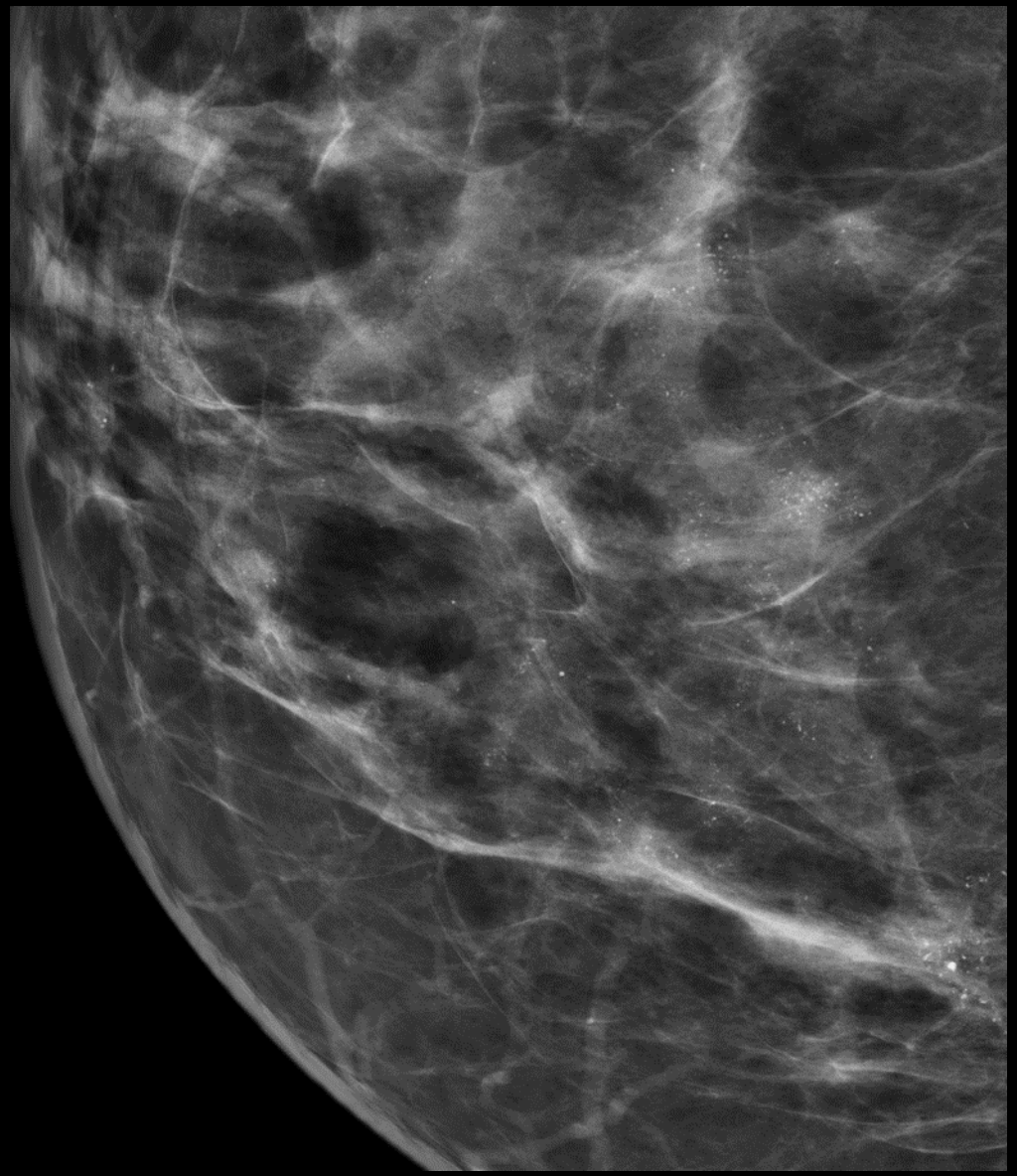
Case 5

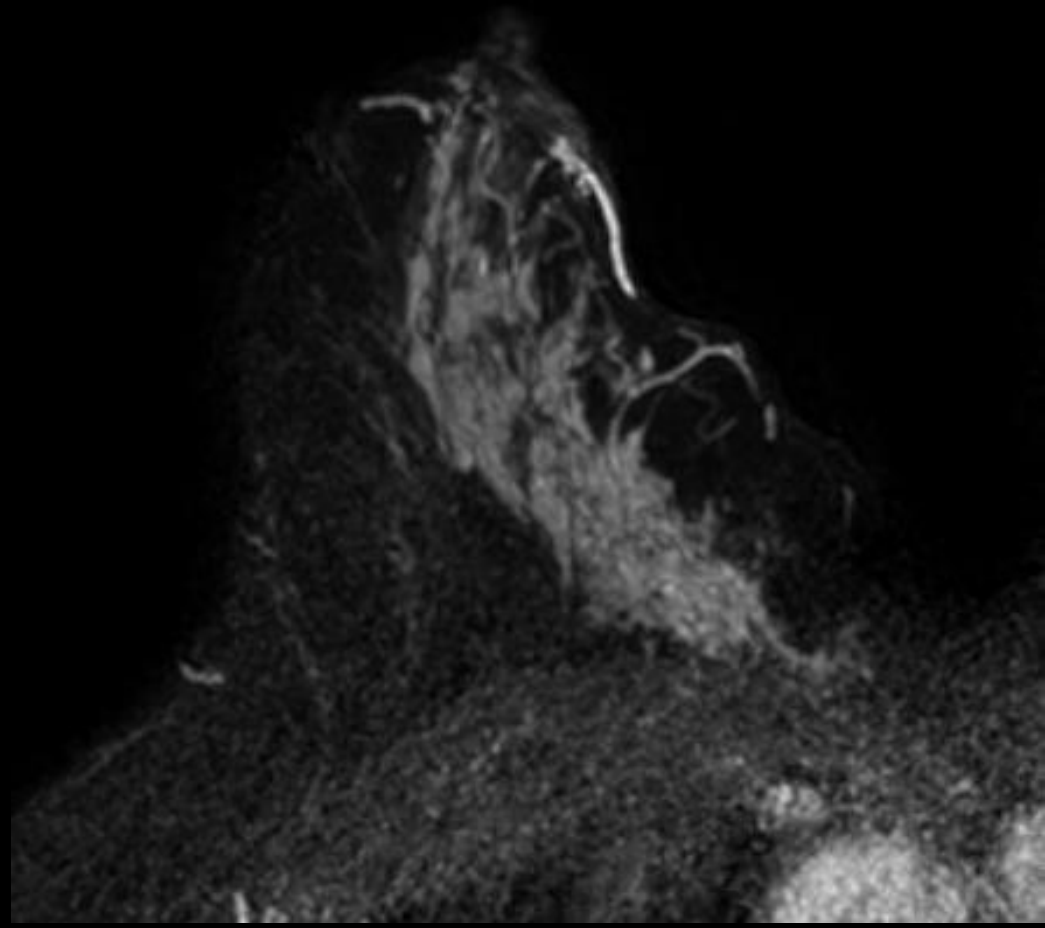
*Amorphous calcifications seen on screening mammogram
*No ultrasound correlate
*Reported as likely fibrocystic ‘BI-RADS 3’

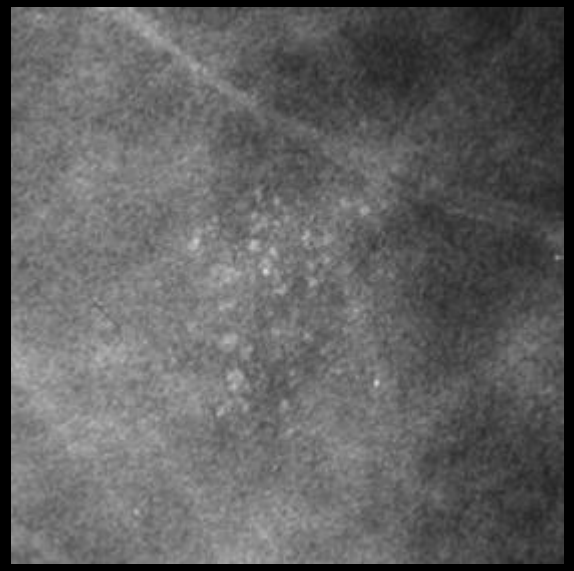


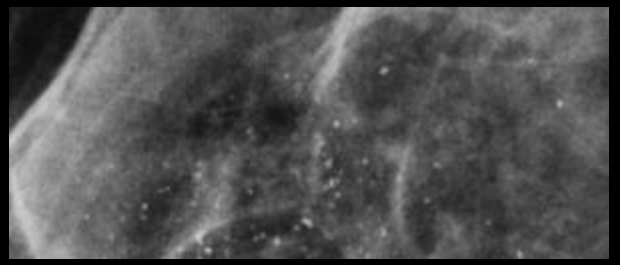


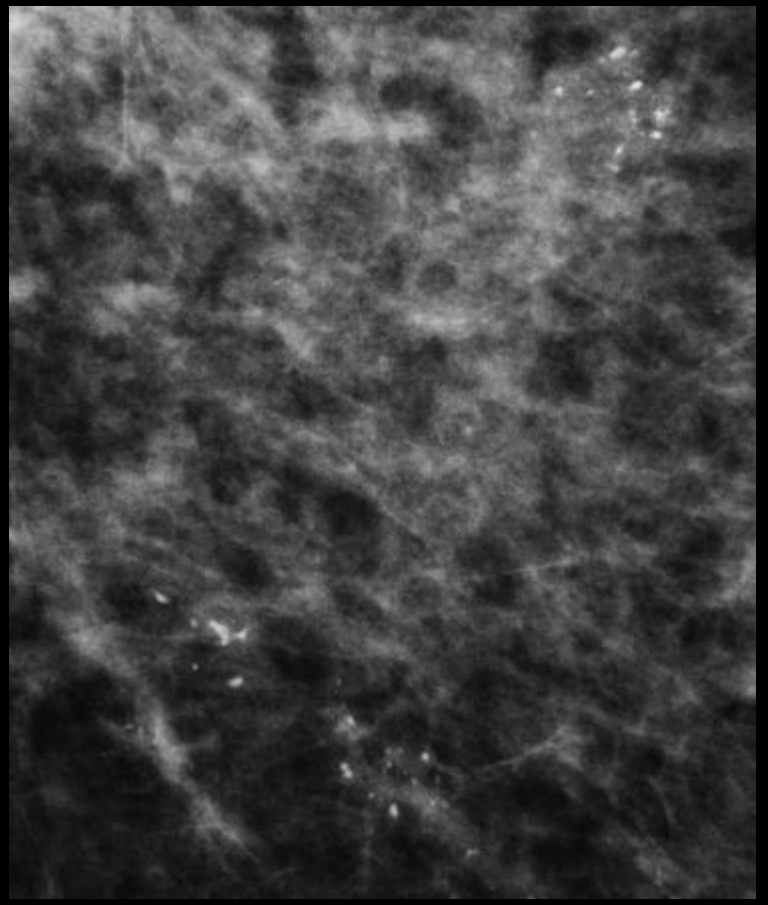
Patient eventually recalled for stereotactic biopsy. High grade DCIS and IDC. Subsequent MRI revealed extensive NME extending to nipple

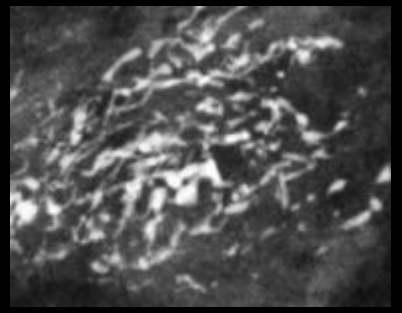






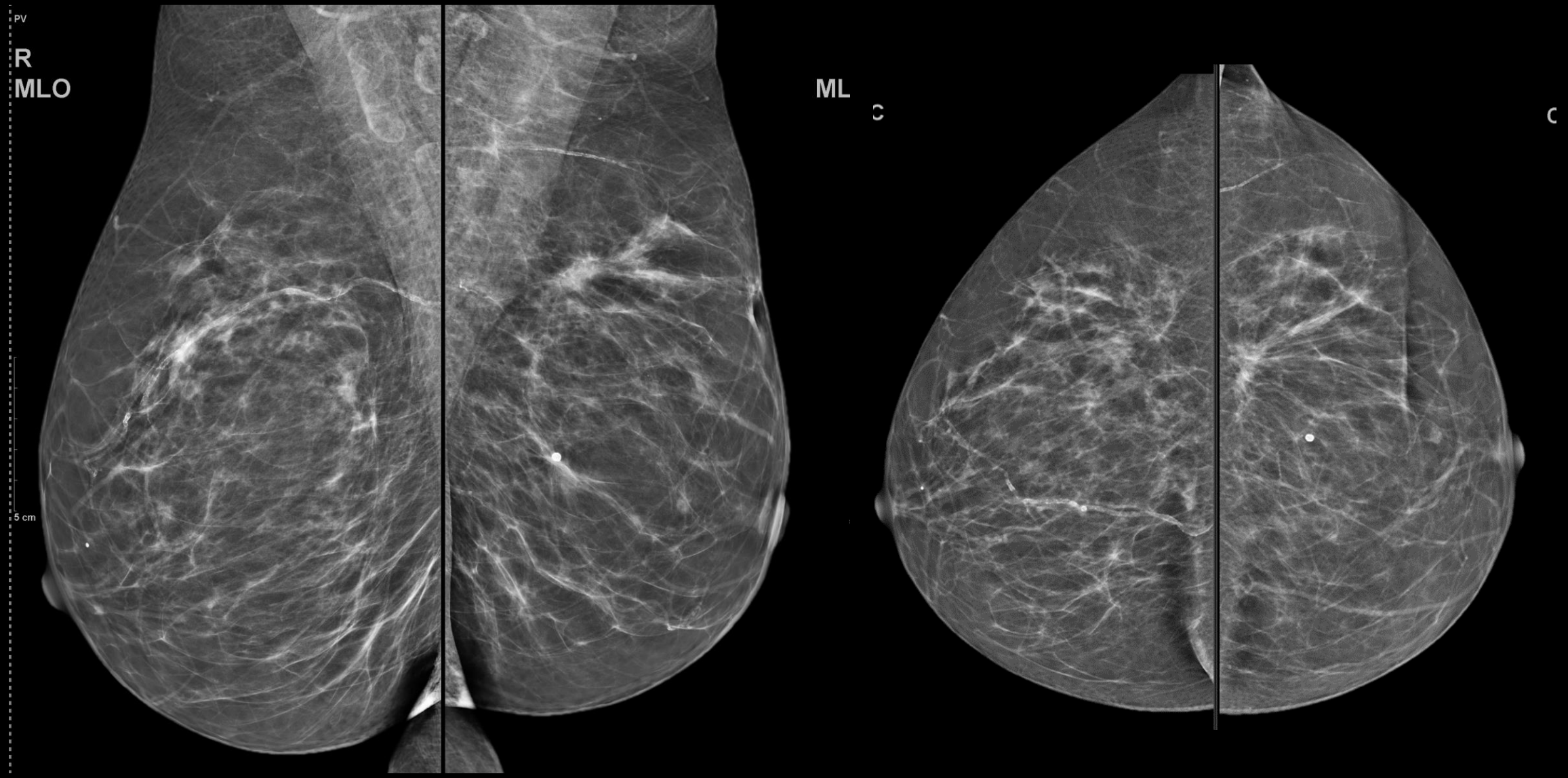


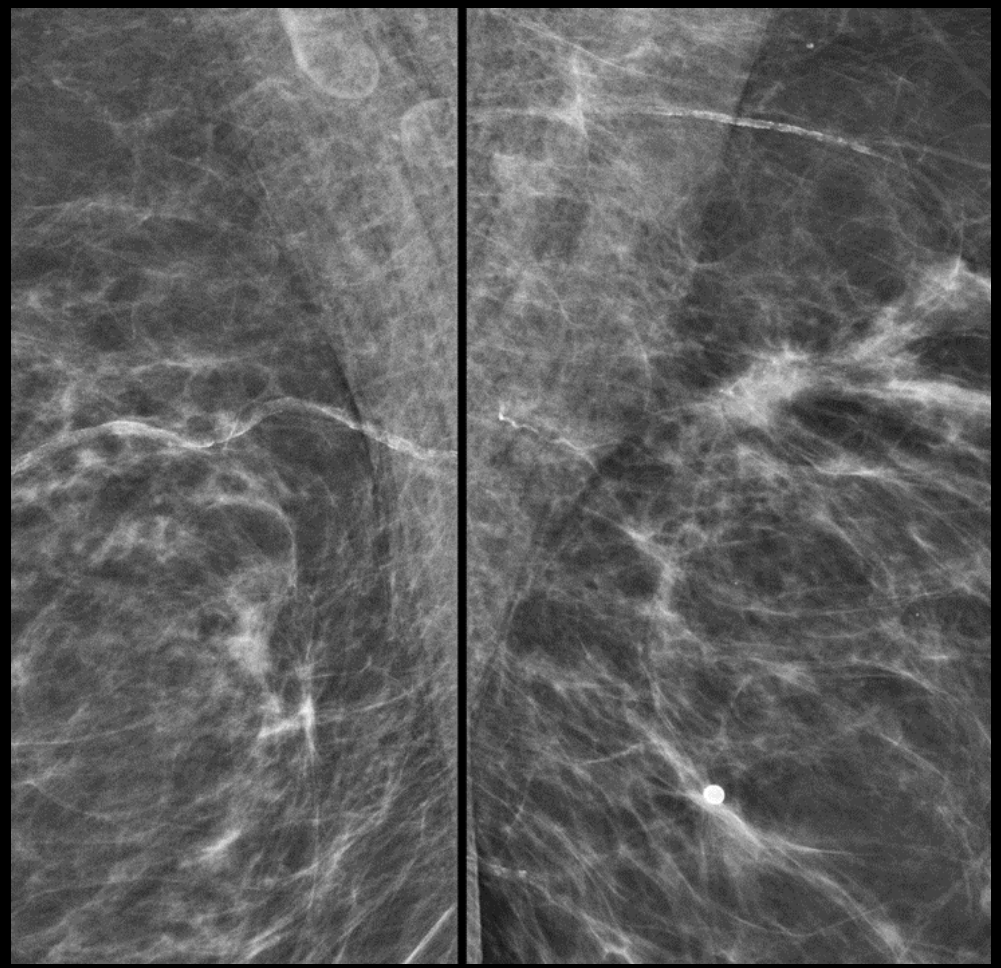


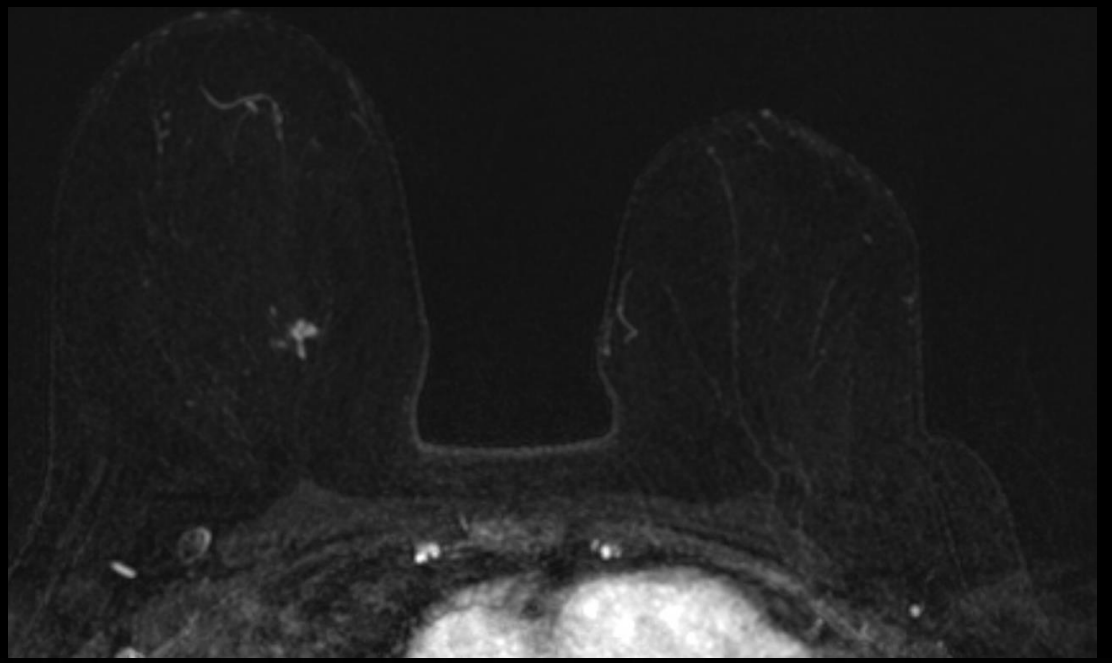


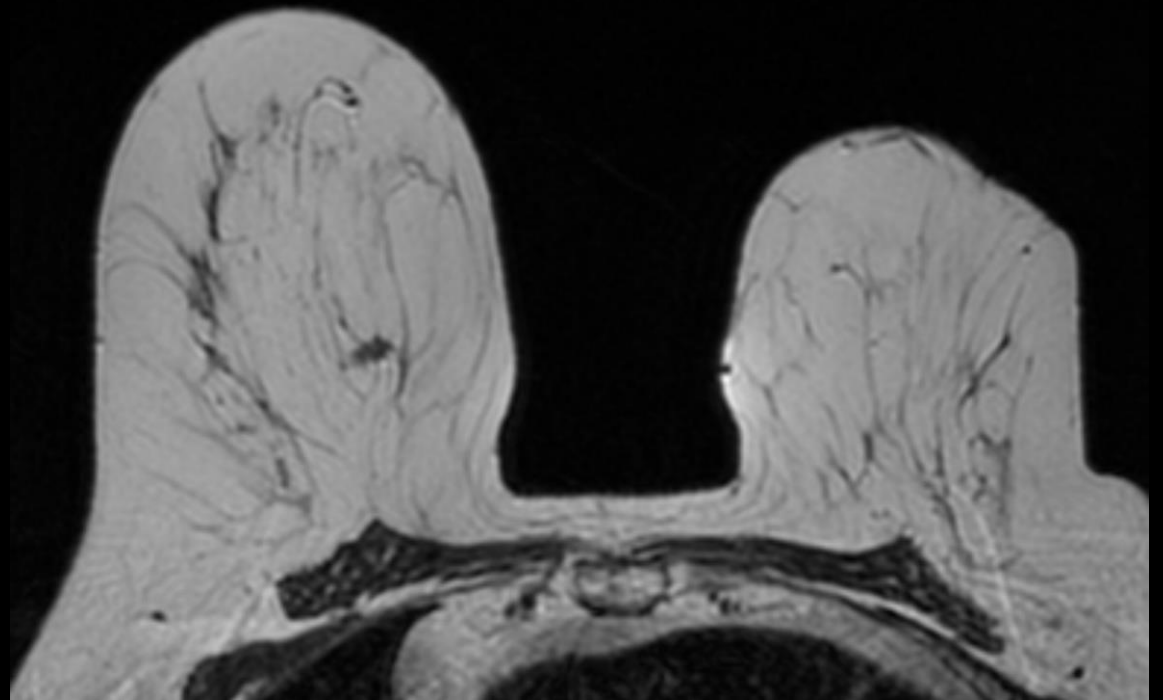
- Calcifications PPV
  - Coarse heterogeneous PPV 15%
  - Amorphous PPV 20% (benign, high risk lesion, DCIS)
  - Fine pleomorphic PPV 29% BIRADS 4b
  - Fine linear/linear branching PPV 70% BIRADS 4c

Case 6

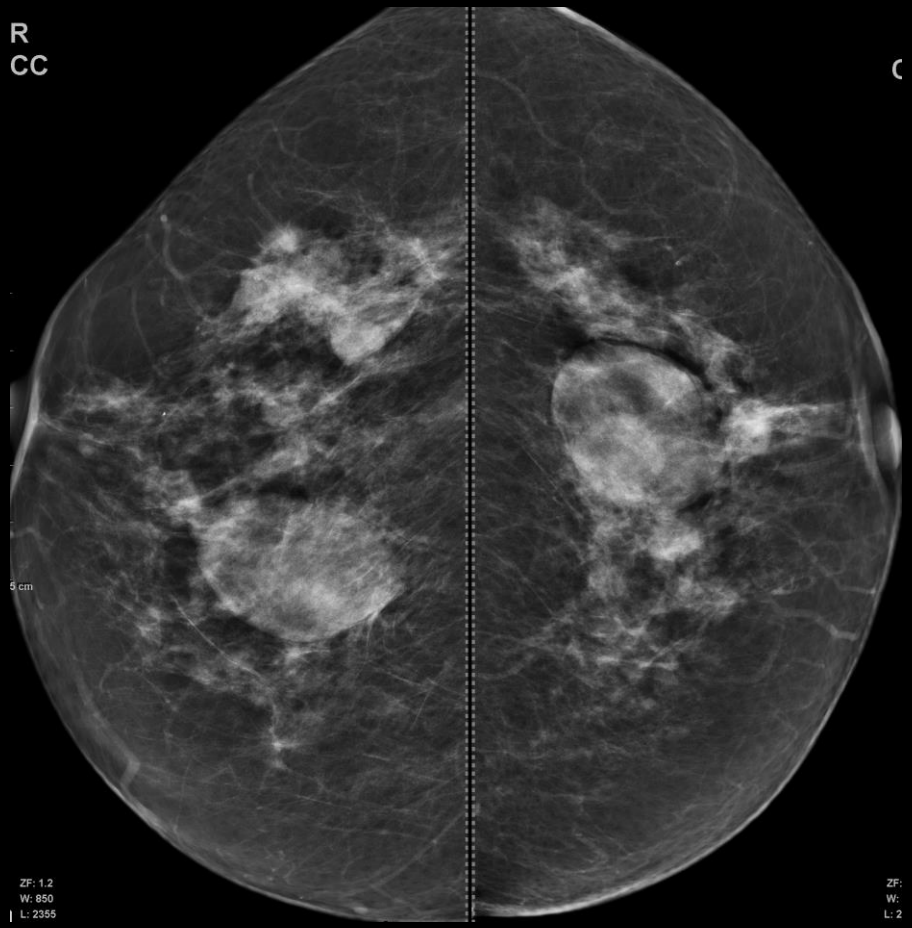


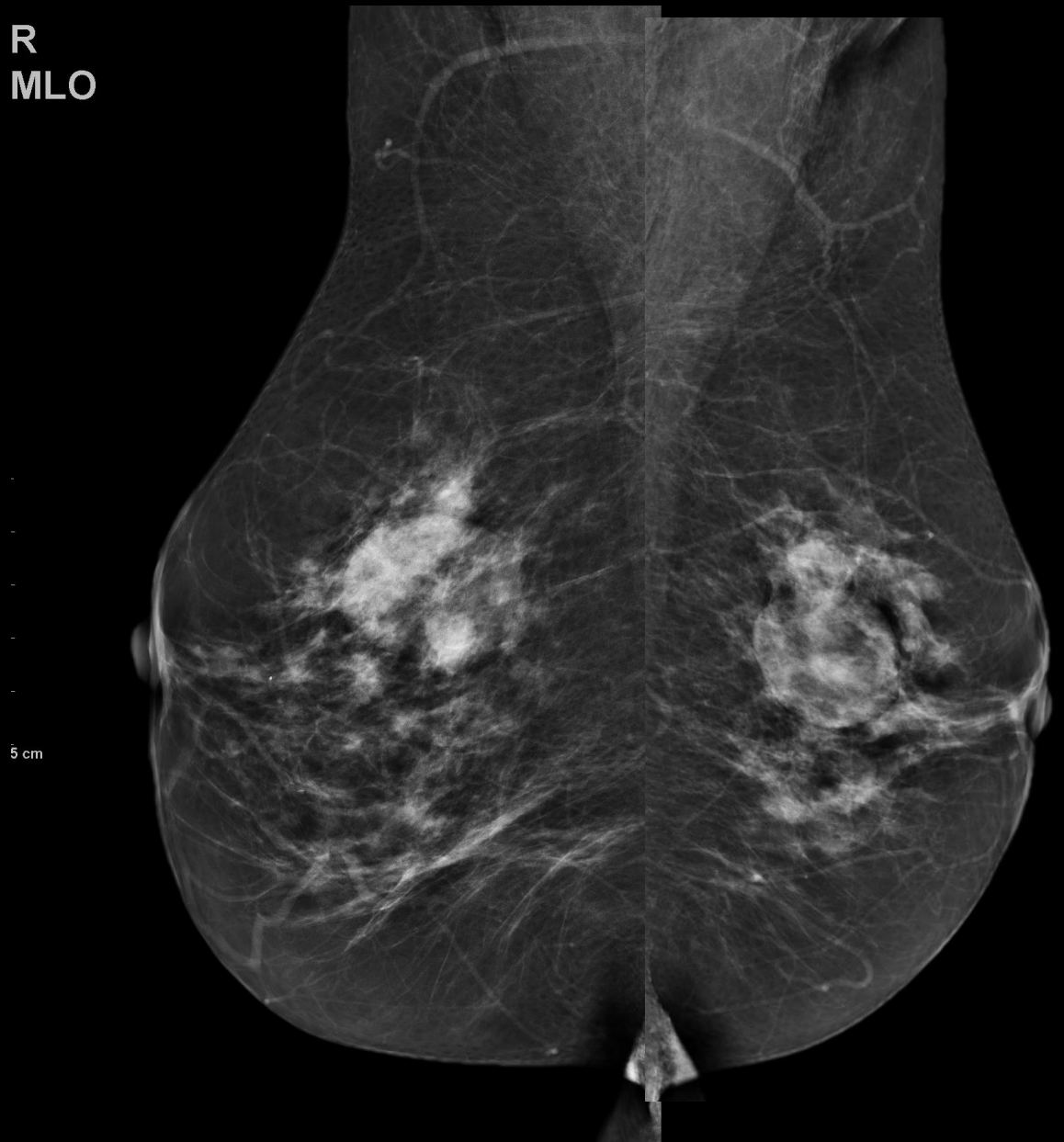


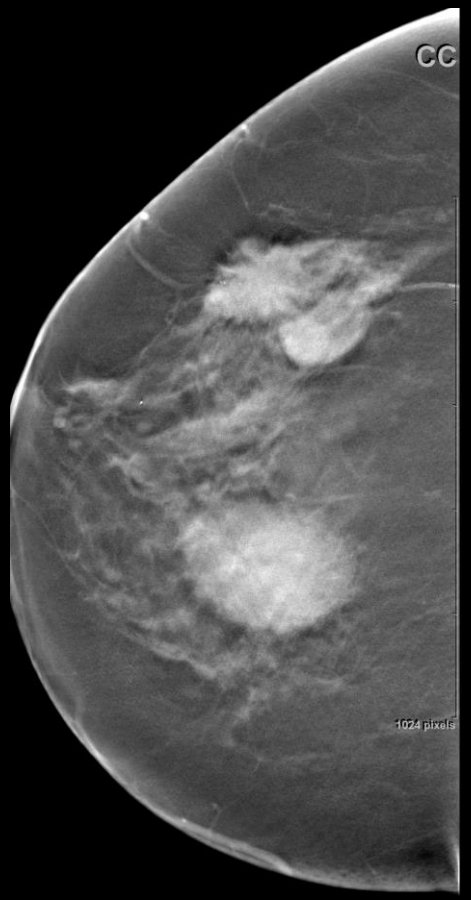




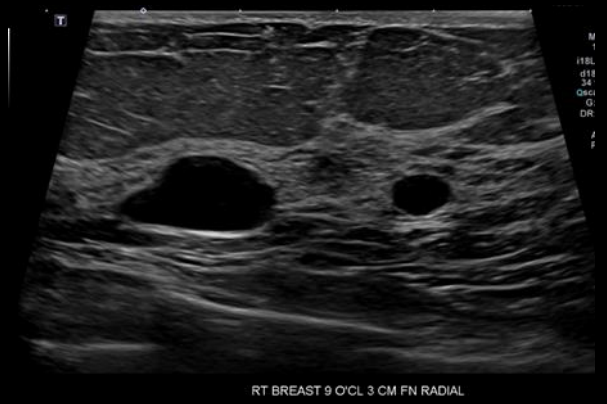
Case 6

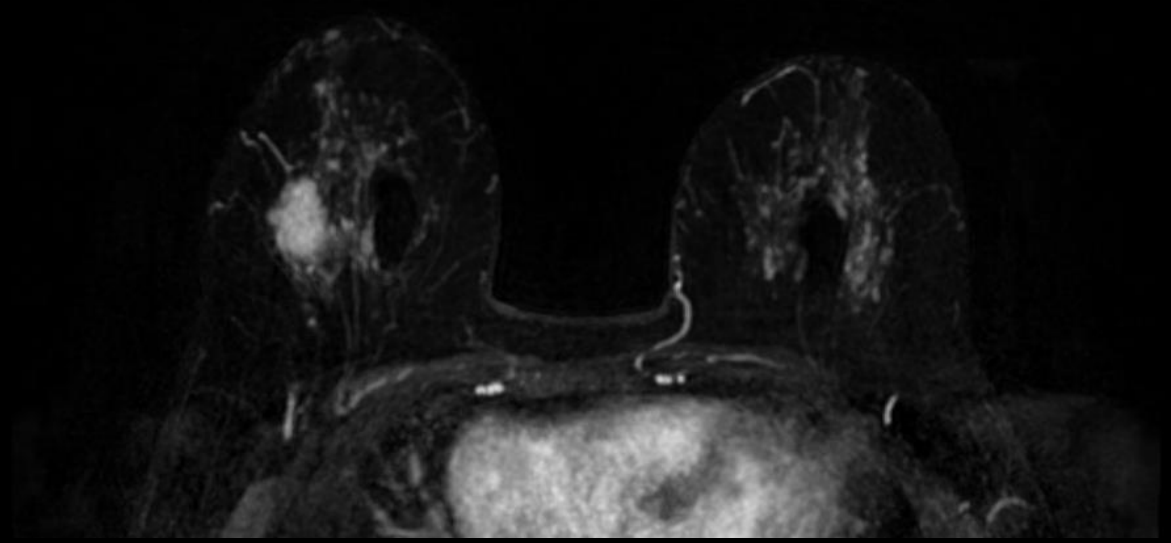


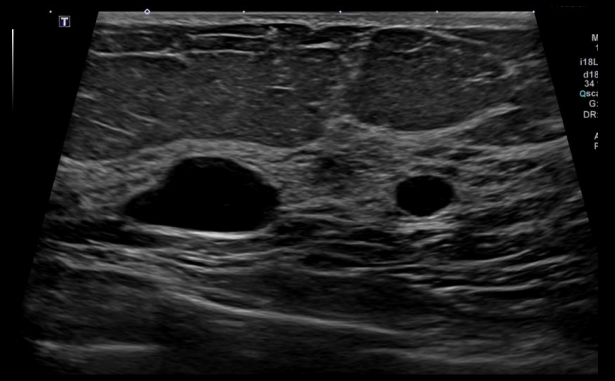




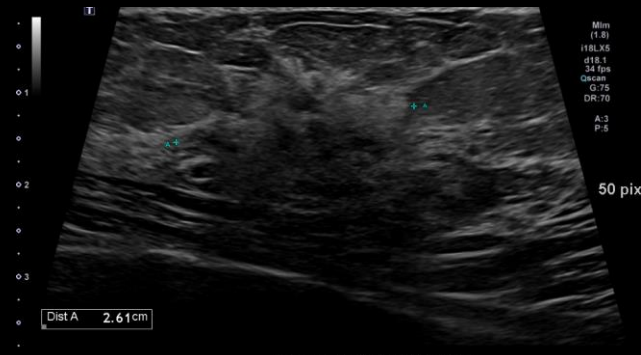
- Any additional abnormalities?





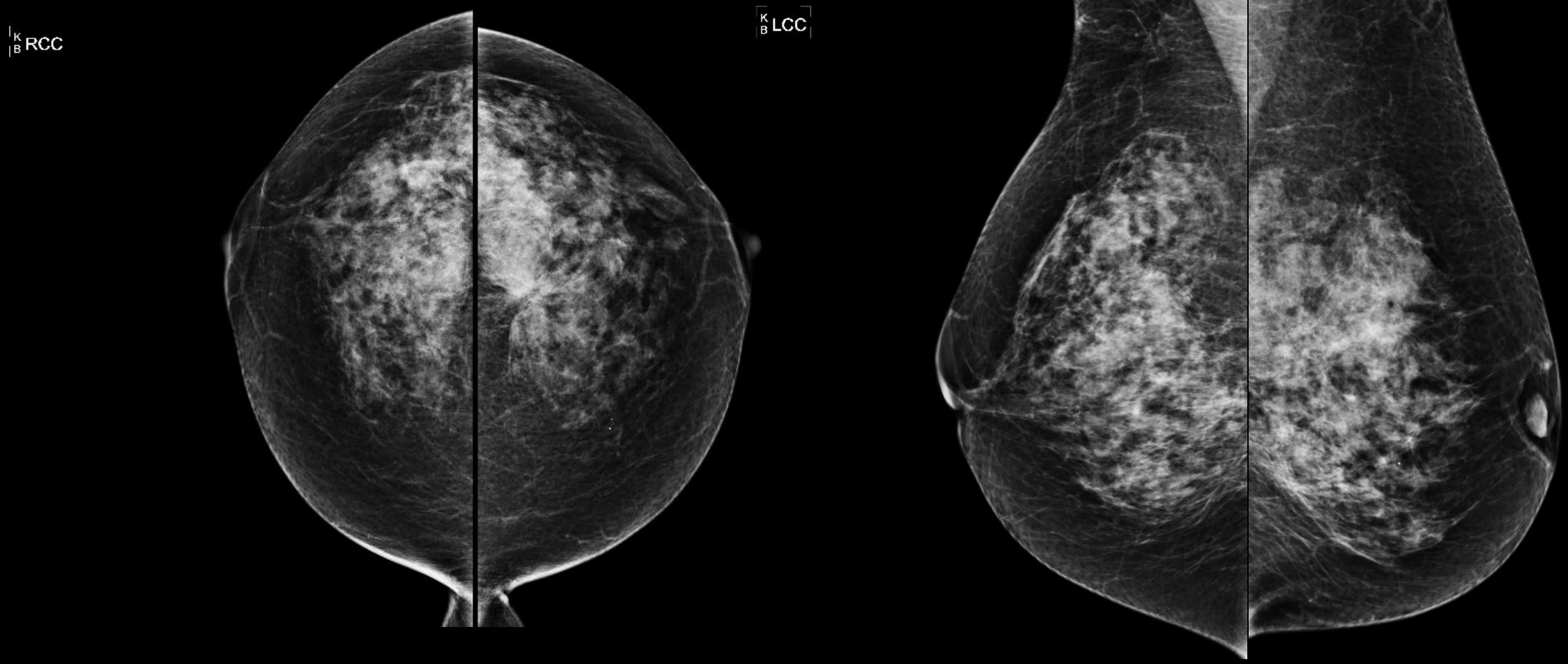


RT BREAST 9 O'CL 3 CM FN RADIAL

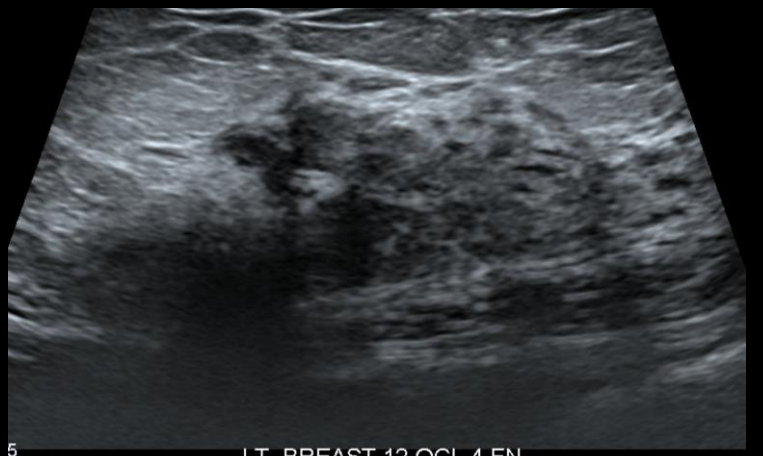


RT BREAST 9 O'CL 4 CM FN ANTI-R

Case 7




TRV
RT BREAST 9 OCL 2 CM FN


LT BREAST 12 OCL 4 FN

Satisfaction of search

- Don’t stop at first abnormality
- Systematic approaches for study review
- Checklists/standardized reporting
- Check blind spots

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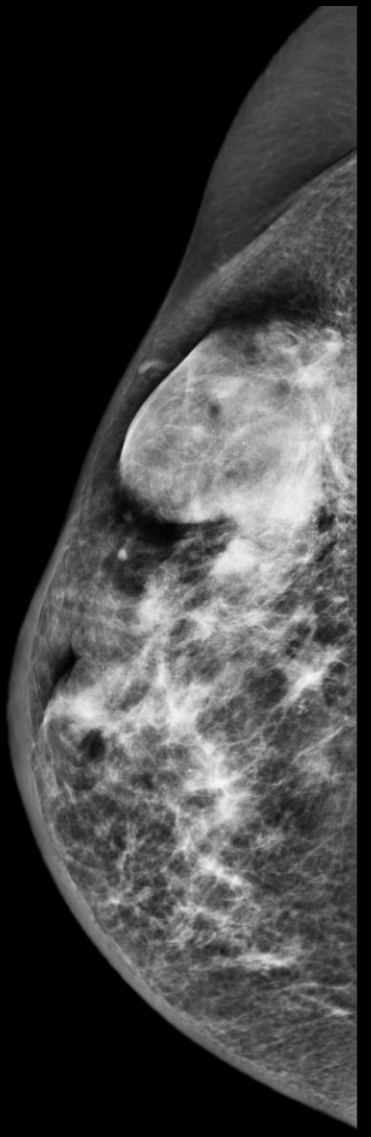
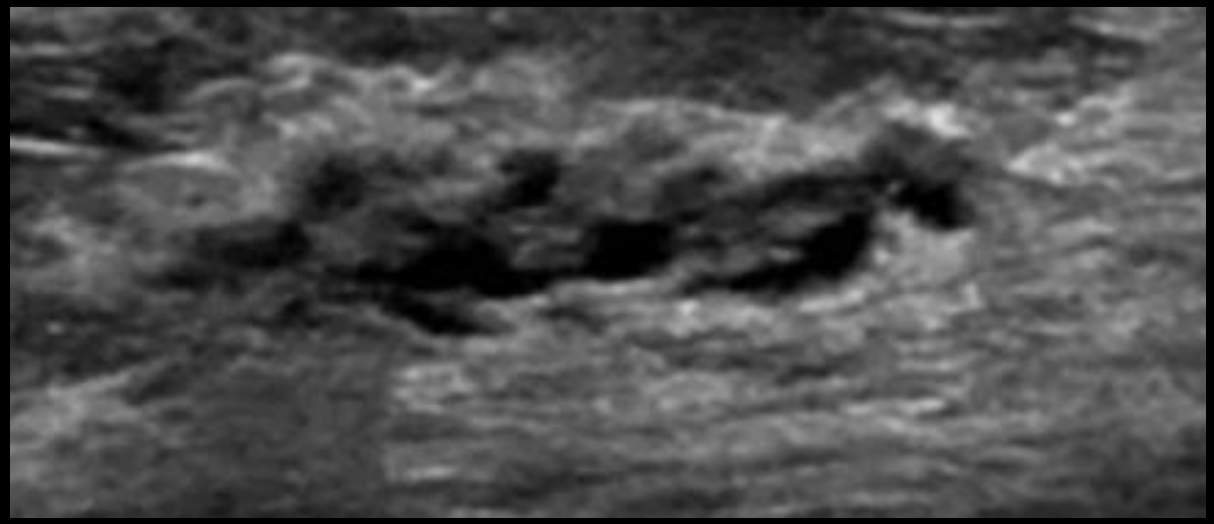
Case 8



Appropriate Use BIRADS 3

- Circumscribed mass
- Focal asymmetry with no correlate (on baseline)
- Solitary group round calcifications



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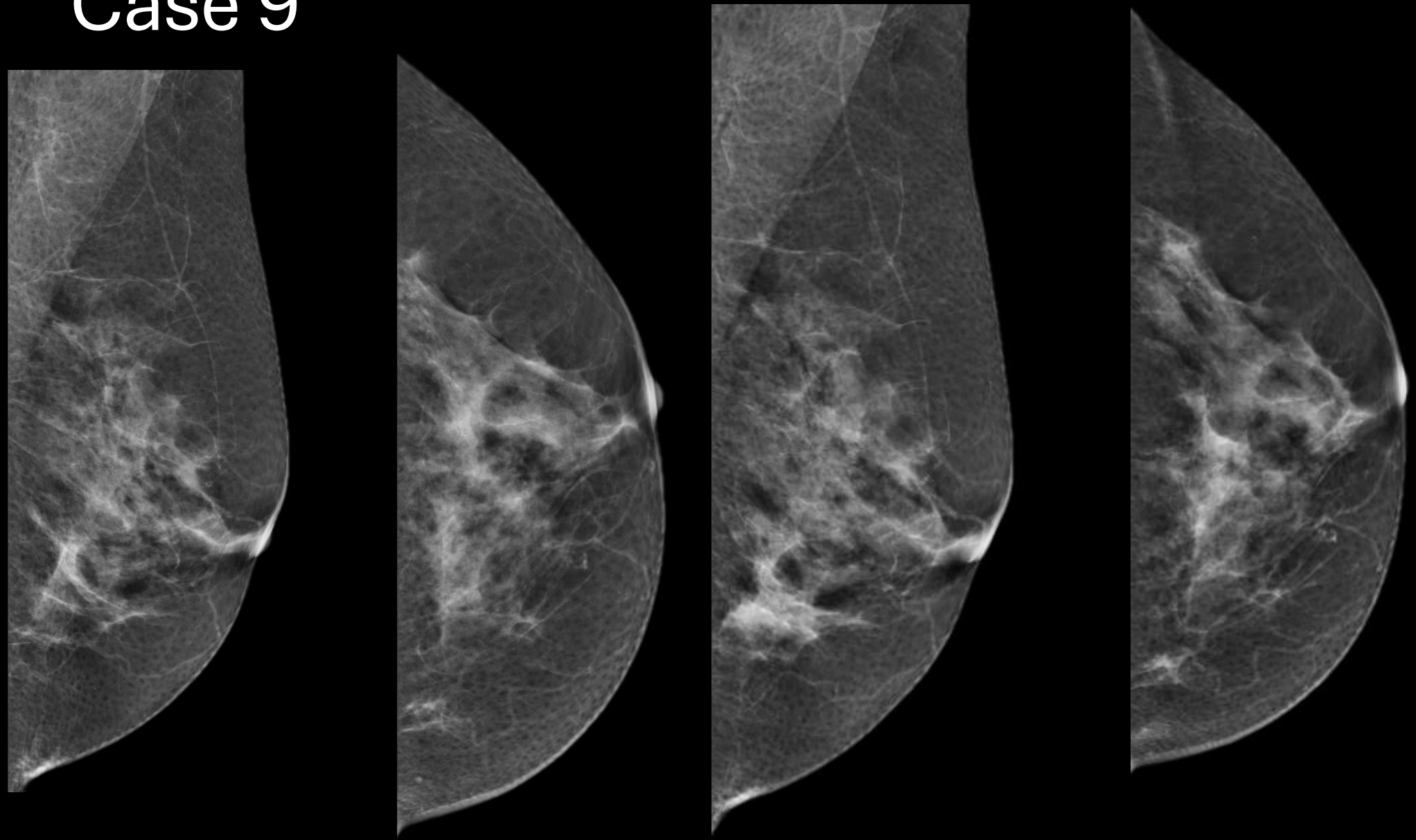
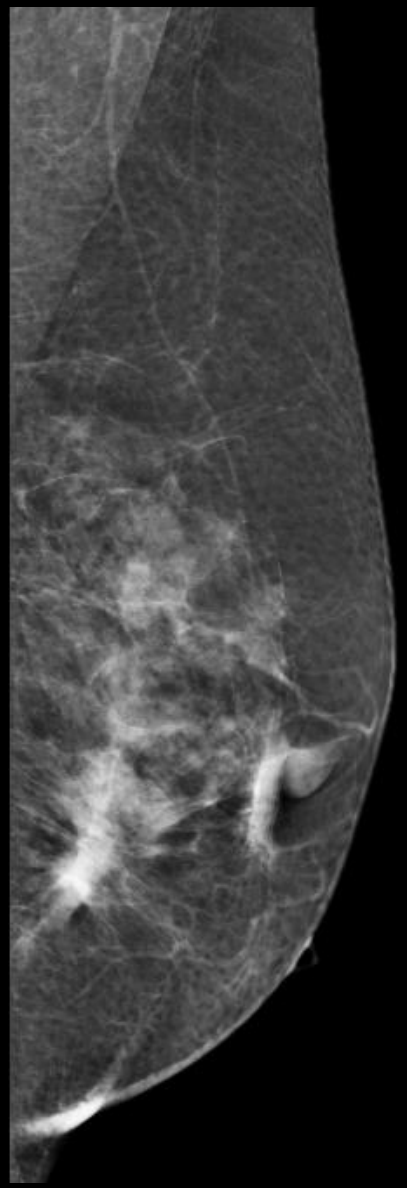
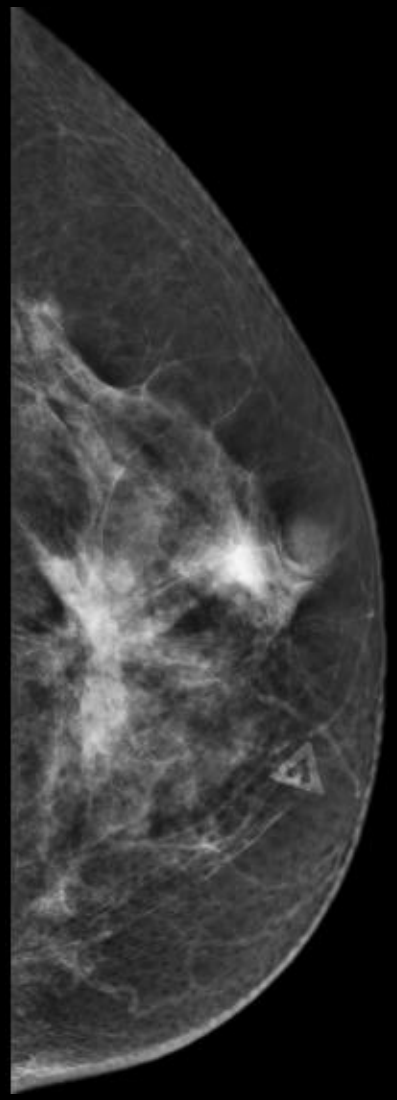
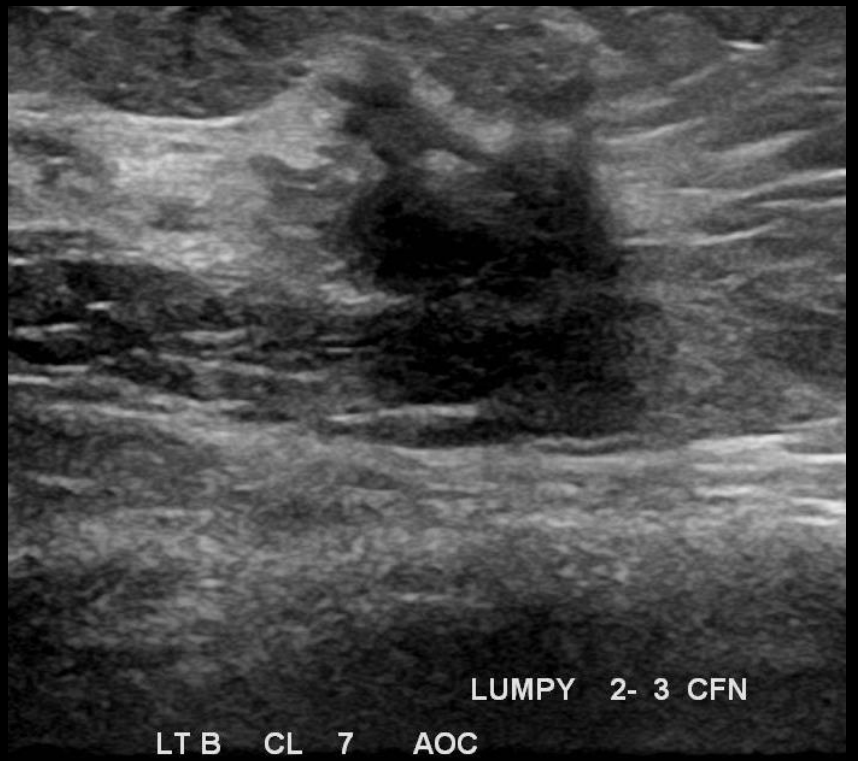
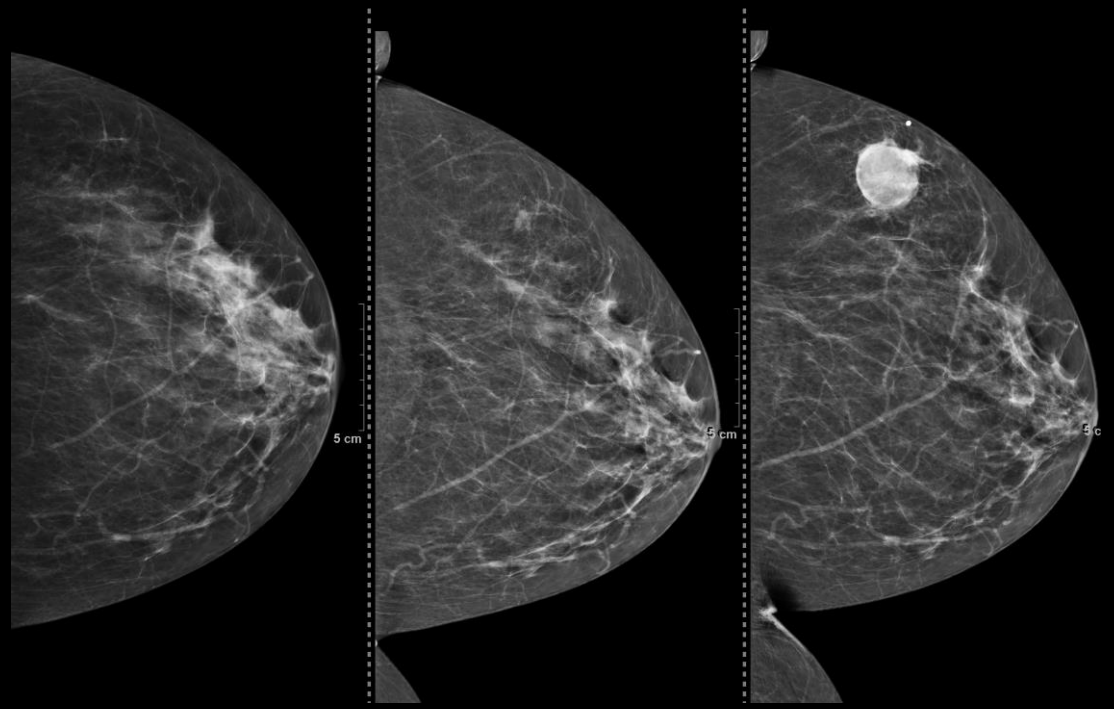
Case 9

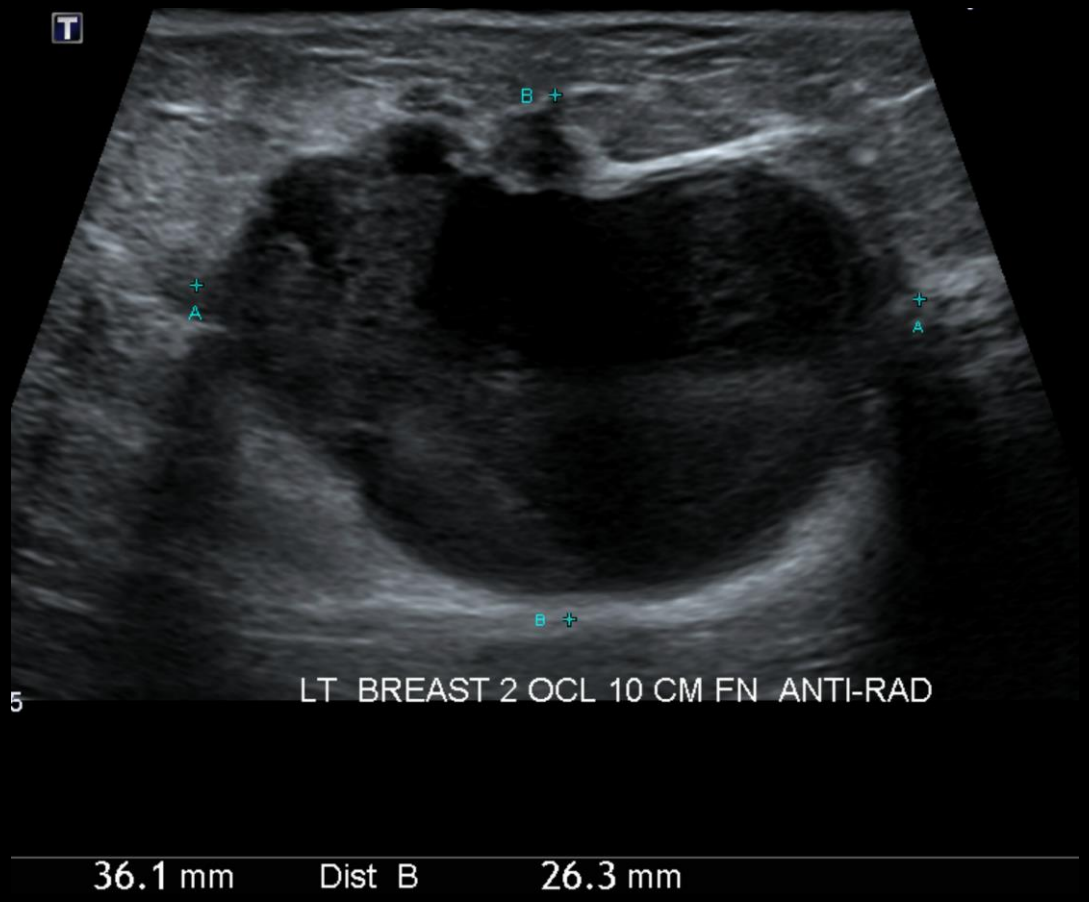







LUMPY 2- 3 CFN
LT B CL 7 AOC


5 cm
5 cm


T
B
A
A
B
LT BREAST 2 OCL 10 CM FN ANTI-RAD
36.1 mm
Dist B
26.3 mm

Developing asymmetries

Type of asymmetry	Description	Likehood of malignancy
Asymmetry	Single view	1.8%
Global asymmetry	At least one quadrant	Non palpable 0% Palpable 7.5%
Focal asymmetry	Less than one quadrant	0.67%
Developing asymmetry	New, increasing or more dense	12.8%

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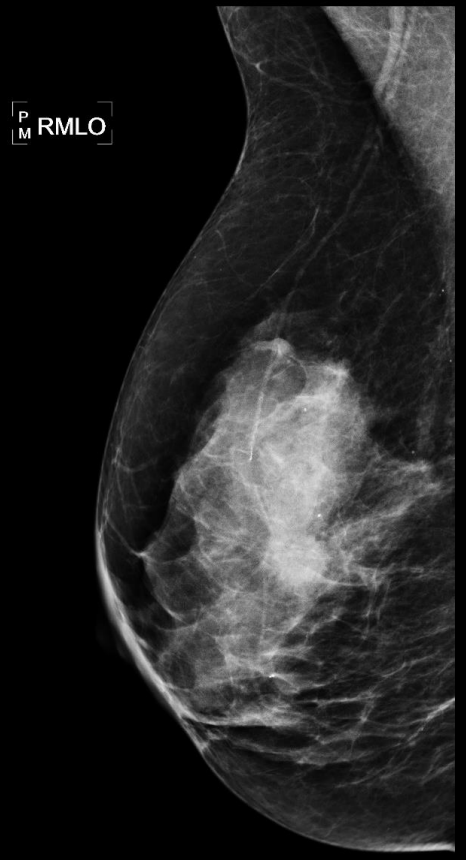
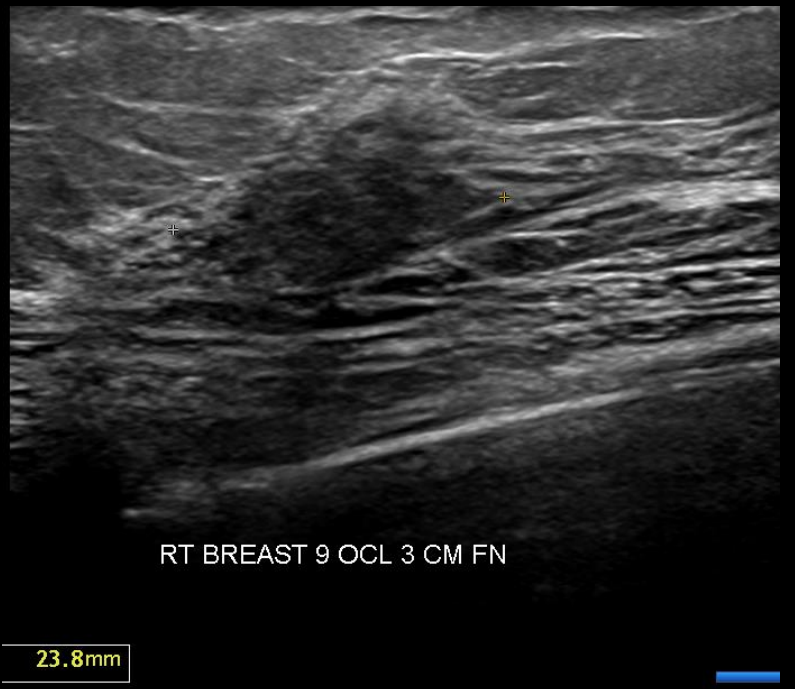
Developing asymmetries

- Compare with priors
- Attention to appropriate coverage and technical factors
- Beware of satisfaction of search or seduction of stability

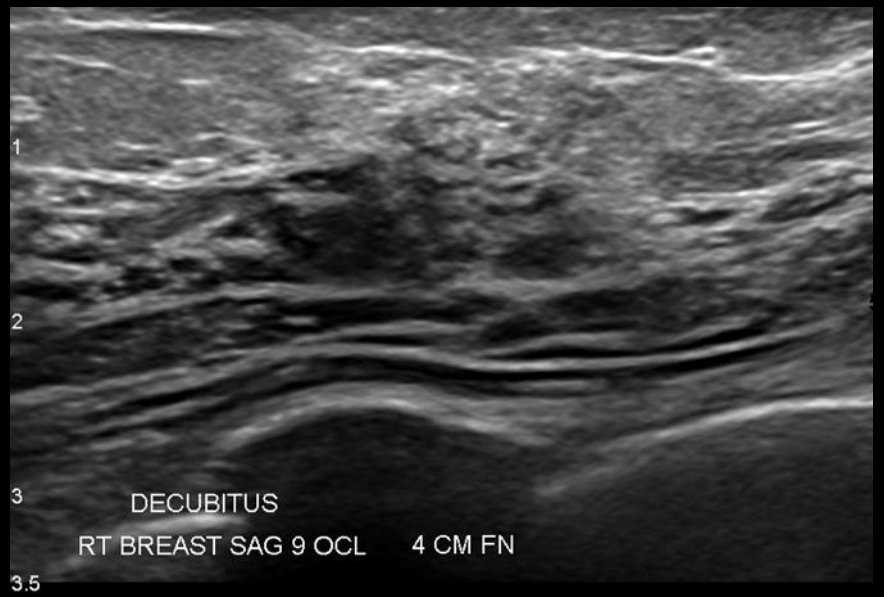
Case 10



July 2019



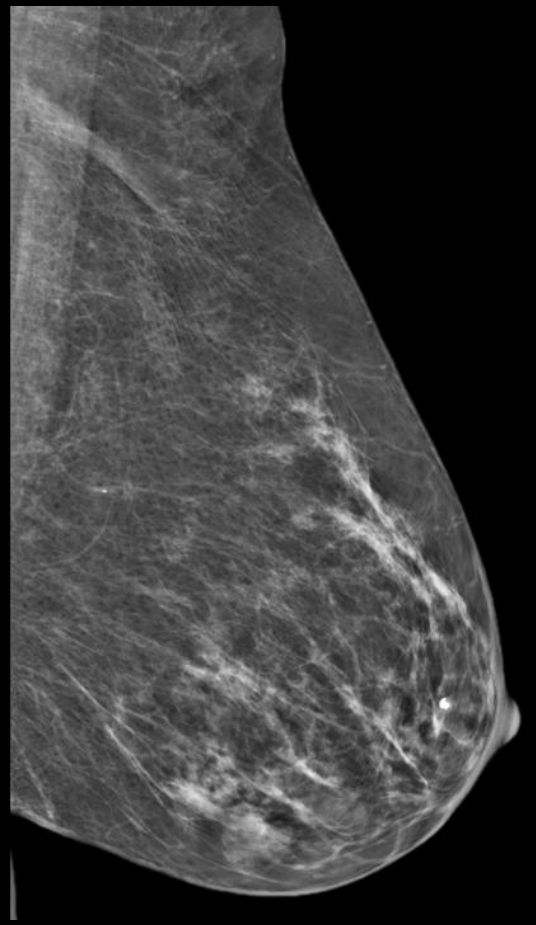
Feb 2020



- 6th edition BIRADS to include non-mass lesions for ultrasound
- Findings unique from adjacent normal tissue, lacking discreet margination of mass
- No definitive shape
- Must correlate with other imaging to not confuse with heterogeneous tissue

Conclusion

- Was it a miss?
  - Not all cancers detectable on standard mammographic views
  - Dense breast tissue may obscure breast cancers
  - Certain cancer subtypes may be mammographically occult
  - Tomosynthesis and supplemental screening detect additional cancers



Conclusion – What can we do?

Technologists-

- Proper positioning
- Compression
- Obtaining prior exams and patient history

Radiologists-

- Be aware of technical factors
- Be aware of cognitive biases
- Proper use of BIRADS 3
- Review missed cancers
- Peer review/double reads

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THANK YOU!