Breast Cancer Screening and Risk

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Objectives

1. Review current scope of breast cancer

2. Breast cancer screening recommendations
   - Discuss conflicting recommendations
   - Average risk women
   - High risk women

3. Supplemental screening modality: Fast MRI

Current Scope of Breast Cancer

- 1 in 8 women will develop breast cancer
- Average lifetime risk 12.4%

- 2018 → 266,120 women diagnosed with breast cancer (#1 – 30%)
  - 63,960 cases of DCIS

  → 40,920 deaths (2nd leading cause of cancer death in women)

  - leading cause of cancer death in women ages 20 – 59 yr

Cancer Statistics, 2018. CA Cancer J Clin 2018; 68: 7-30.

Current Scope of Breast Cancer

- Exact cause is not fully understood
- Acquired gene mutations account for majority of cases
- Inherited gene mutations account for a small portion (5-10%)
- Likely environmental causes

- Several known risk factors for breast cancer
  - many women with multiple risk factors never develop breast cancer
  - many women without risk factors do develop breast cancer

Incidence

- Invasive breast cancer incidence increased ~1-2% every year from 1940 – 1980.
- Large increase in 1980's – result of increase in screen detected cancers (DCIS).

- The institution of widespread screening mammography in the US caused a change in national statistics.

Cancer Statistics, 2018. CA Cancer J Clin 2018; 68: 7-30.

Mortality

- Unchanged death rate from 1940 – 1990.
- Steadily declined by at least 38% through 2014.
- Mammography largely responsible for this drop

Cancer Statistics, 2018. CA Cancer J Clin 2018; 68: 7-30.

Five-Year Relative Survival Rates by Race and Stage at Diagnosis, United States, 2007 to 2013.

- Prognosis is related to extent of disease

Cancer Statistics, 2018. CA Cancer J Clin 2018; 68: 7-30.

Stage Distribution by Race, United States, 2007 to 2013.

Cancer Statistics, 2018. CA Cancer J Clin 2018; 68: 7-30.

Early detection saves lives!

Current Breast Screening Recommendations

Mammography is the only screening exam proven to reduce breast cancer mortality

“ Breast Cancer Mortality in Participant of the Norwegian Breast Cancer Screening Program ”

Solveig Hofvind, PhD, Giske Ursin, MD, PhD, Steinar Tretli, PhD, Sofie Sebuedegard, BSc, and Bjorn Meller, PhD. Cancer Sept 1, 2013.

- Norwegian Breast Cancer Screening Program (NBCSP) is administered by the Cancer Registry of Norway
  - Targets women ages 50-69yr old

- Each woman in the target group received a personal letter inviting her to undergo a 2D screening mammogram every other year.
- Cancer reporting is mandatory by law in Norway
- Database is 99% complete for solid tumors

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- Women were defined as screened or unscreened based on the date of their first attendance in the program.

- 699,628 women ages 50-69 without dx of breast cancer were invited into a screening program between 1996-2009.

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- Crude breast cancer mortality rate:
  - Screened group – 20.7 / 100,000
  - Unscreened group – 39.7 / 100,000

- The difference in crude mortality rate increased with time and reached a statistically significant difference after 2 years

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- Adjusted for calendar period, attained age, years after inclusion in the cohort and self-selection bias
- 15 years after the start of the program
- Mortality reduction associated with patients screened was

43%

Breast Cancer Screening Guidelines

- Several different groups with varying screening recommendations

- United States Preventative Services Task Force - USPSTF
- American Cancer Society - ACS
- American College of Radiology - ACR

- Which guidelines should we follow??

United States Preventative Services Task Force 2009

United States Preventative Services Task Force Update 1/2016

Breast Cancer: Screening. U.S. Preventive Services Task Force. May 2019.

Women aged 40 to 49 years	The decision to start screening mammography in women prior to age 50 years should be an individual one. Women who place a higher value on the potential benefit than the potential harms may choose to begin biennial screening between the ages of 40 and 49 years. • For women who are at average risk for breast cancer, most of the benefit of mammography results from biennial screening during ages 50 to 74 years. Of all of the age groups, women aged 60 to 69 years are most likely to avoid breast cancer death through mammography screening. While screening mammography in women aged 40 to 49 years may reduce the risk for breast cancer death, the number of deaths averted is smaller than that in older women and the number of false-positive results and unnecessary biopsies is larger. The balance of benefits and harms is likely to improve as women move from their early to late 40s. • In addition to false-positive results and unnecessary biopsies, all women undergoing regular screening mammography are at risk for the diagnosis and treatment of noninvasive and invasive breast cancer that would otherwise not have become a threat to their health, or even apparent, during their lifetime (known as "overdiagnosis"). Beginning mammography screening at a younger age and screening more frequently may increase the risk for overdiagnosis and subsequent overtreatment. • Women with a parent, sibling, or child with breast cancer are at higher risk for breast cancer and thus may benefit more than average-risk women from beginning screening in their 40s.	C

Breast Cancer: Screening. U.S. Preventive Services Task Force. May 2019.

United States Preventative Services Task Force Update 1/2016

Population	Recommendation
Women aged 50 to 74 years	The USPSTF recommends biennial screening mammography for women aged 50 to 74 years.

Breast Cancer: Screening. U.S. Preventive Services Task Force. May 2019.

United States Preventative Services Task Force Update 1/2016

Women aged 75 years or older	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening mammography in women aged 75 years or older.

Breast Cancer: Screening. U.S. Preventive Services Task Force. May 2019.

United States Preventative Services Task Force Update 1/2016

All women	The USPSTF concludes that the current evidence is insufficient to assess the benefits and harms of digital breast tomosynthesis (DBT) as a primary screening method for breast cancer.
Women with dense breasts	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of adjunctive screening for breast cancer using breast ultrasonography, magnetic resonance imaging, DBT, or other methods in women identified to have dense breasts on an otherwise negative screening mammogram.

Breast Cancer: Screening. U.S. Preventive Services Task Force. May 2019.

United States Preventative Services Task Force, 1/2016

- Federally funded committee that does not include a radiologist, oncologist, breast surgeon or any breast cancer specialist.

- Cost-cutting measure

Breast Cancer: Screening. U.S. Preventive Services Task Force. May 2019.


USPSTF

Breast Cancer Screening for Women at Average Risk
2015 Guideline Update From the American Cancer Society

JAMA October 20, 2015 Volume 314, Number 15

Breast Cancer Screening for Women at Average Risk
2015 Guideline Update From the American Cancer Society

Table 5. Comparison of Current and Previous American Cancer Society (ACS) Guidelines for Breast Cancer Screening in Women at Average Risk[a]

	Recommendations for Breast Cancer Screening[b]	
Population	ACS, 2015	ACS, 2003[5]
Women aged 40-44 y	Women should have the opportunity to begin annual screening between the ages of 40 and 44 years. (*Qualified Recommendation*)	Begin annual mammography screening at age 40 years.
Women aged 45-54 y	Women should undergo regular screening mammography beginning at age 45 years. (*Strong Recommendation*) Women aged 45 to 54 years should be screened annually. (*Qualified Recommendation*)	Women should have annual screening mammography.

JAMA October 20, 2015 Volume 314, Number 15

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2015 Guideline Update From the American Cancer Society

Table 5. Comparison of Current and Previous American Cancer Society (ACS) Guidelines for Breast Cancer Screening in Women at Average Risk[a]

	Recommendations for Breast Cancer Screening[b]	
Population	ACS, 2015	ACS, 2003[5]
Women aged ≥55 y	Women 55 years and older should transition to biennial screening or have the opportunity to continue screening annually. (*Qualified Recommendation*)	Women should have annual screening mammography.
	Women should continue screening mammography as long as their overall health is good and they have a life expectancy of 10 years or longer. (*Qualified Recommendation*)	As long as a woman is in reasonably good health and would be a candidate for treatment, she should continue to be screened with mammography.

JAMA October 20, 2015 Volume 314, Number 15

Breast Cancer Screening for Women at Average Risk
2015 Guideline Update From the American Cancer Society

Table 5. Comparison of Current and Previous American Cancer Society (ACS) Guidelines for Breast Cancer Screening in Women at Average Risk[a]

	Recommendations for Breast Cancer Screening[b]	
Population	ACS, 2015	ACS, 2003[5]
All women	Clinical breast examination is not recommended for breast cancer screening among average-risk women at any age. (*Qualified Recommendation*)	For women in their 20s and 30s, it is recommended that clinical breast examination be part of a periodic health examination, preferably at least every 3 years. Asymptomatic women 40 years and older should continue to receive a clinical breast examination as part of a periodic health examination, preferably annually.

JAMA October 20, 2015 Volume 314, Number 15

Breast Cancer Screening for Women at Average Risk
2015 Guideline Update From the American Cancer Society

"These recommendations are made with the intent of maximizing reductions in breast cancer mortality while being attentive to the need to minimize harms associated with screening."

- Harms include false-positive results causing potential psychological trauma, unnecessary follow-up and treatments

JAMA October 20, 2015 Volume 314, Number 15


ACS

? Women aged 40-49 ?

Cancer. 2014 Sep 15;120(18):2839-46. doi: 10.1002/cncr.28199. Epub 2013 Sep 9.

A failure analysis of invasive breast cancer: most deaths from disease occur in women not regularly screened.

Webb ML[1], Cady B, Michaelson JS, Bush DM, Calvillo KZ, Kopans DB, Smith BL.

Author information

1 Department of Surgery, Massachusetts General Hospital, Boston, Massachusetts; Gillette Center for Breast Cancer, Massachusetts General Hospital, Boston, Massachusetts.

- Set out to determine cause of death and history of mammography in women who died following a diagnosis of breast cancer
- 7301 pts, followed over 10 years (1990-1999) – MGH/Harvard
- Deaths not from breast cancer were documented if the patient never had a recurrence or metastasis.

Cancer. 2014 Sep 15;120(18):2839-46. doi: 10.1002/cncr.28199. Epub 2013 Sep 9.

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1 Department of Surgery, Massachusetts General Hospital, Boston, Massachusetts; Gillette Center for Breast Cancer, Massachusetts General Hospital, Boston, Massachusetts.

- 1705 confirmed deaths overall; 681 (40%) from breast ca
  - 71% deaths from breast ca in unscreened women
  - 395 women who died of breast cancer never had a mammogram before dx
- Median age at dx for fatal CA = 49yr
- Of all breast cancer deaths, 13% occurred >70 and 50% occurred < 50yr
  - 31% occurred 40-49yr

- At all age decades, the predominance of women who died from breast cancer were unscreened at the time of diagnosis (light blue).

Cancer 2014 Sep 15;120(18):2839-46

- Women who died of breast cancer (orange/red) were diagnosed at a median age of 49.

- Women who died of other causes (blue/green) were diagnosed at a median age of 72.

Cancer 2014 Sep 15;120(18):2839-46

Cancer. 2014 Sep 15;120(18):2839-46. doi: 10.1002/cncr.28199. Epub 2013 Sep 9.

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- Conclusions:
- Majority of deaths from breast cancer now occur in the minority of women not regularly screened

- Annual screening increases likelihood of detecting nonpalpable cancers
  - among the patients who died of breast cancer, 80.6% presented with palpable or symptomatic breast cancers

American College of Radiology
ACR

Average Risk

Breast Cancer Screening for Average-Risk Women: Recommendations From the ACR Commission on Breast Imaging

EC: Editor's Choice

Debra L. Monticciolo, MD[a], Mary S. Newell, MD[b], R. Edward Hendrick, PhD[c], Mark A. Helvie, MD[d], Linda Moy, MD[e], Barbara Monsees, MD[f], Daniel B. Kopans, MD[g], Peter R. Eby, MD[h], Edward A. Sickles, MD[i]

- Annual screening mammography starting at age 40.
  - maximizing proven benefits including a substantial reduction in breast cancer mortality

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Benefits

Breast Cancer Screening for Average-Risk Women: Recommendations From the ACR Commission on Breast Imaging

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Table 1. Benefits of three recommended screening strategies in terms of percentage mortality reduction, breast cancer deaths averted, LYGs, and NNS to avert one breast cancer death and to gain 1 life year based on mean 2009 Cancer Intervention and Surveillance Modeling Network

Screening Strategy	Examinations per 1,000 Women	Percentage Mortality Reduction	BC Deaths Averted per 1,000 Women	LYGs per 1,000 Women Screened	NNS per Death Averted	NNS per LYG
Annual 40-84 y	36,550	39.6	11.9	189	84	5.3
Annual 45-54 y, biennial 55-79 y	19,846	30.8	9.25	149	108	6.7
Biennial 50-74 y	11,066	23.2	6.95	110	144	9.1

Note: Adapted from Arleo et al [46]. BC = breast cancer; LYG = life year gained; NNS = number needed to screen.

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ACS

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Benefits:

- The number of interval cancers increases markedly with biennial screening
  - Twice the # of interval cancers in the 2nd yr vs the 1st
  - Interval cancers carry a worse prognosis and more advanced stage at diagnosis

Breast Cancer Screening for Average-Risk Women: Recommendations From the ACR Commission on Breast Imaging

EC: Editor's Choice

Risks

Breast Cancer Screening for Average-Risk Women: Recommendations From the ACR Commission on Breast Imaging

EC: Editor's Choice

Table 2. Risks of three recommended screening strategies in terms of negative recalls and benign biopsies performed per 1,000 women screened based on mean 2009 Cancer Intervention and Surveillance Modeling Network

Screening Strategy	Examinations per 1,000 Women	Negative Recalls per 1,000 Women	Benign Biopsies per 1,000 Women	LYGs per Benign Biopsy
Annual 40-84 y	36,550	2,780	195	1.0
Annual 45-54 y, biennial 55-79 y	19,846	1,680	116	1.3
Biennial 50-74 y	11,066	940	96	1.7

Note: The last column shows the estimated ratio of life years gained (LYG) per benign biopsy performed. Adapted from Arleo et al [46].

ACR

ACS

USPSTF

Breast Cancer Screening for Average-Risk Women: Recommendations From the ACR Commission on Breast Imaging

EC: Editor's Choice

Risks:

- On average, a woman undergoing annual screening 40-49yr will experience a recall once every 12 years
- Recommendation for biopsy occurs for <2% of screened women

- Recalls and negative biopsies can cause short term anxiety
- No long-term health effects

Breast Cancer Screening for Average-Risk Women: Recommendations From the ACR Commission on Breast Imaging

EC: Editor's Choice

Risks:

- Overdiagnosis: the detection of a cancer at screening that would not have become clinically evident in a woman's lifetime absent screening
  - Estimated to be <10%
  - ACR considers proven screening benefits to greatly outweigh this risk

Breast Cancer Screening for Average-Risk Women: Recommendations From the ACR Commission on Breast Imaging

EC: Editor's Choice

Take Home Points:

- Start annual mammography at age 40

- Age to stop screening is based on health status
  - Tailored to life expectancy, comorbidities and intention to seek treatment if a cancer is detected

- Overdiagnosis should not be a factor in deciding when to start screening or what screening interval to choose
  - It will exist regardless

American College of Radiology
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High Risk

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]

- Women with risk factors placing them at high risk for breast cancer need consideration for earlier and/or more intensive screening

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RISK FACTORS

- Known genetic predisposition (5-10%)
- Strong family history
- History of chest or mantle XRT
- Personal history of breast cancer
- Atypical hyperplasia on previous bx (ADH, ALH, LCIS)
- Dense breast tissue
- Race (African American higher risk)

→ Refer to high risk clinic (216) 844 - BRST

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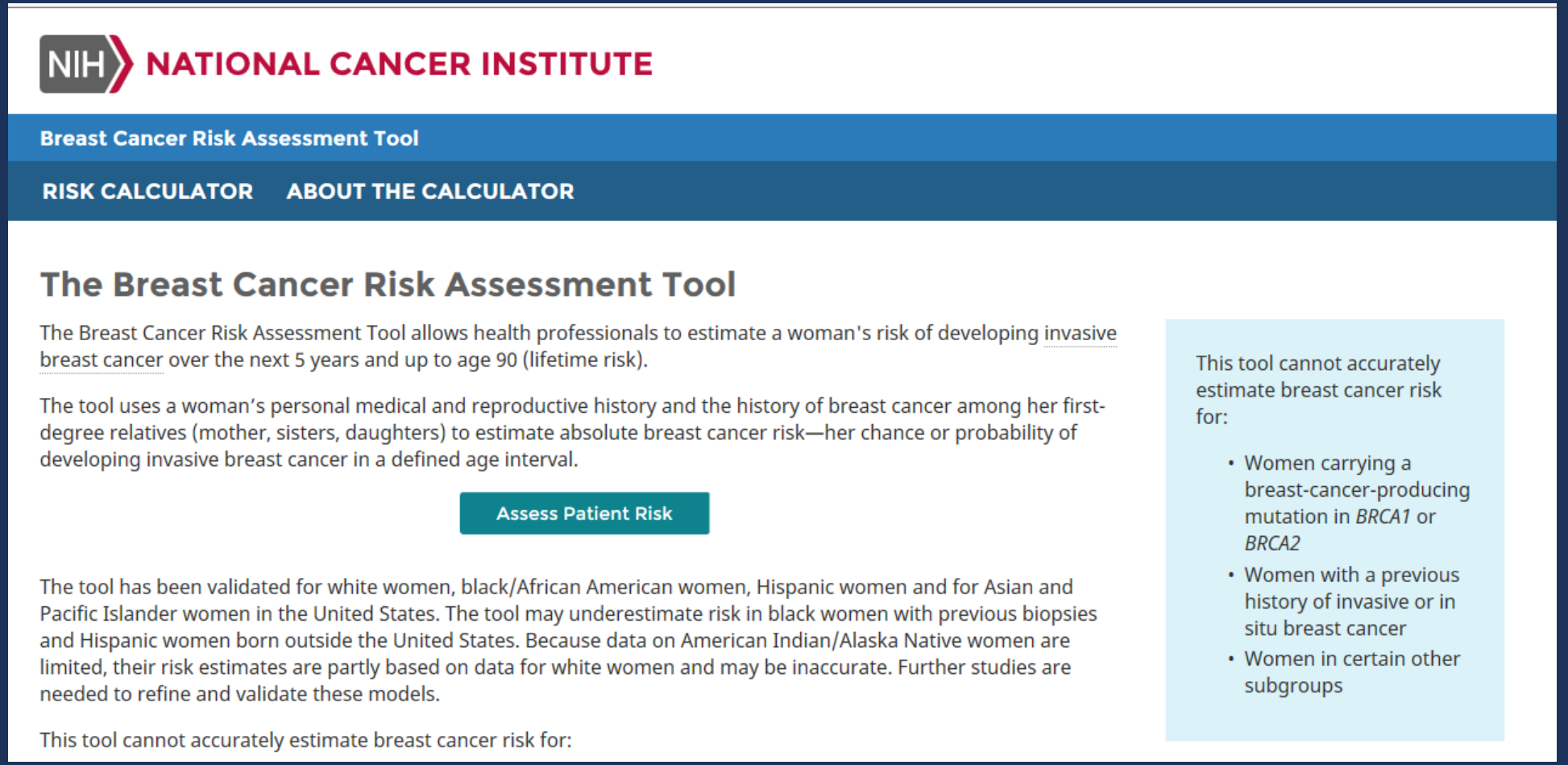
RISK MODELS

- GAIL model
  - https://bcrisktool.cancer.gov/
- Tyrer Cuzick
  - http://www.ems-trials.org/riskevaluator/

Gail Model Risk Assessment

http://www.cancer.gov/bcrisktool



Patient Eligibility

Does the w... lobular ca... of Hodgkir...

- Yes
- No

Demographics

What is the patient's age?

Patient & Family History

Has the woman ever had a breast biopsy?

- Yes
- No
- Unknown

How many breast biopsies (positive or negative) has the woman had?

- 1
- 2 or more

Has the woman ever had a breast biopsy with atypical hyperplasia?

- Yes
- No
- Unknown

What was the woman's age at the time of her first menstrual period?

- 7 to 11
- 12 to 13
- 14 or older

What was the woman's age when she gave birth to her first child?

30 or older

How many of the woman's first-degree relatives (mother, sisters, daughters) have had breast cancer?

- None
- One
- More than one
- Unknown

Calculate Risk

Reset

5–Year Risk of Developing Breast Cancer

Patient Risk

3.1%

Average Risk

0.9%

Based on the information provided, the patient's estimated risk for developing invasive breast cancer over the next 5 years is 3.1%, presented in red since hers is higher than the average risk of 0.9% (presented in blue) for women of the same age and race/ethnicity in the general U.S. population.

Lifetime Risk of Developing Breast Cancer

Patient Risk

26.2%

Average Risk

9.5%

Based on the information provided, the woman's estimated risk for developing invasive breast cancer over her lifetime (to age 90) is 26.2%, presented in red since hers is higher than the average risk of 9.5% (presented in blue) for women of the same age and race/ethnicity in the general U.S. population.

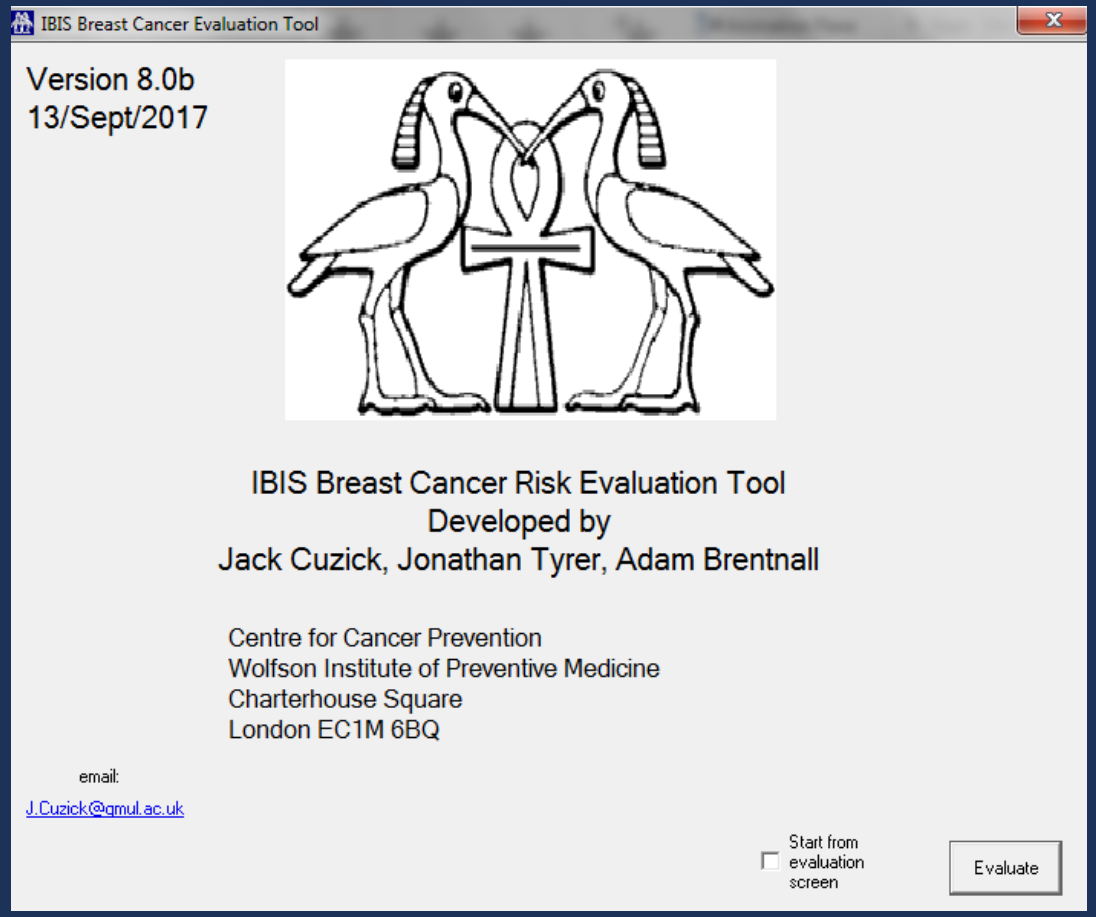
Gail Model Risk Assessment

5 yr risk > 1.7% → eligible for risk reducing medications

Lifetime risk >20% → eligible for enhanced screening (MRI)

Tyrer Cuzick Risk Calculator 8.0

www.ems-trials.org/riskevaluator



Untitled - IBIS Risk Evaluator

File Edit View Tools Help

Add Del Risk Sort Find

Personal factors

Woman's age: 45 | Menarche: 13 | Height: ft: 5 in: 5 | Weight: stone: ? lb: 140

Measurements: Metric: ○ Imperial: ●

Nulliparous: ○ Parous: ● Unknown: ○

Age First Child: 30

No prior biopsy / no proliferative disease: ●
Prior biopsy, result unknown: ○
Hyperplasia (not atypia): ○
Atypical hyperplasia: ☐
Lobular Carcinoma in Situ (LCIS): ☐

Premenopausal: ●
Perimenopausal: ○
Postmenopausal: ○
No information: ○
Age at Menopause: ?

Ovarian cancer: ☐

Patient id:
no.: 1

Calculate Risk

Competing mortality ☐

Risk Options

HRT use

Never: ●
5 or more years ago: ○
Less than 5 years ago: ○
Current user: ○
Length of use (years): 0

Mammographic density (age 40+)

c. Heterogeneously dense

○ % Volpara® Volumetric Density*
○ % VAS Percentage Density*
● BI-RADS® ATLAS Density*

Ashkenazi inheritance: ☐

Show start up screen

Mother: Ovarian: ☐ Bilateral: ☐ Breast cancer: ☑ Age: 60

Sisters: Number: 2 | Ovarian: ☐ ☐ ☐ | Bilateral: ☐ ☐ ☐ | Breast cancer: ☐ ☐ ☐ | Age: ? ? ?

Paternal Gran: Ovarian: ☐ Breast cancer: ☐ Age: ?

Maternal Gran: Ovarian: ☐ Breast cancer: ☑ Age: 70

Paternal aunts: Number: 0 | Ovarian: ☐ ☐ | Breast cancer: ☐ ☐ | Age: ? ?

Maternal aunts: Number: 0 | Ovarian: ☐ ☐ | Breast cancer: ☐ ☐ | Age: ? ?

Daughters: Number: 0 | Ovarian: ☐ ☐ | Breast cancer: ☐ ☐ | Age: ? ?

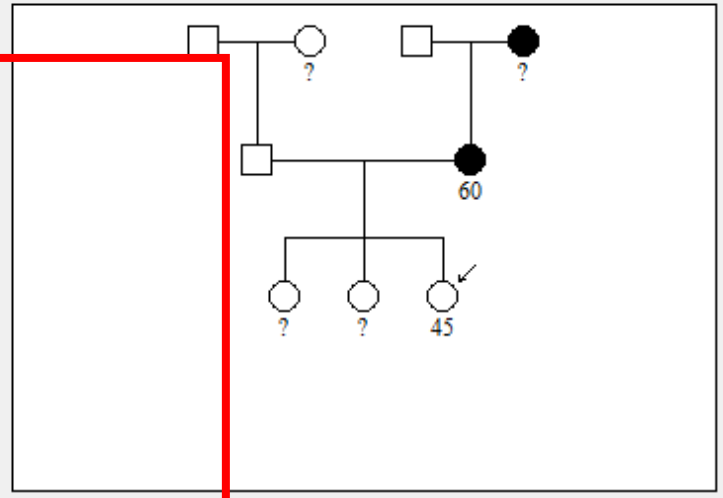
Genetic Testing

Male relatives

Half Sisters

Affected cousins

Affected Nieces



View Family History

IBIS Risk Evaluator v8.0b

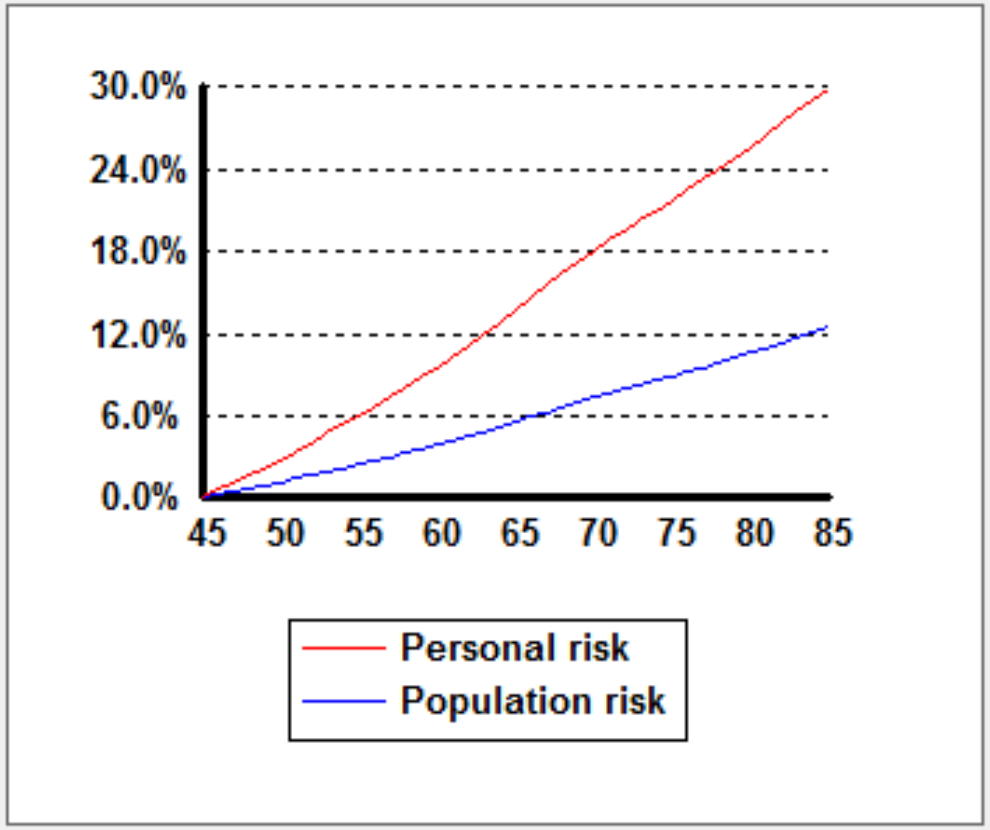
Ready NUM

Risks

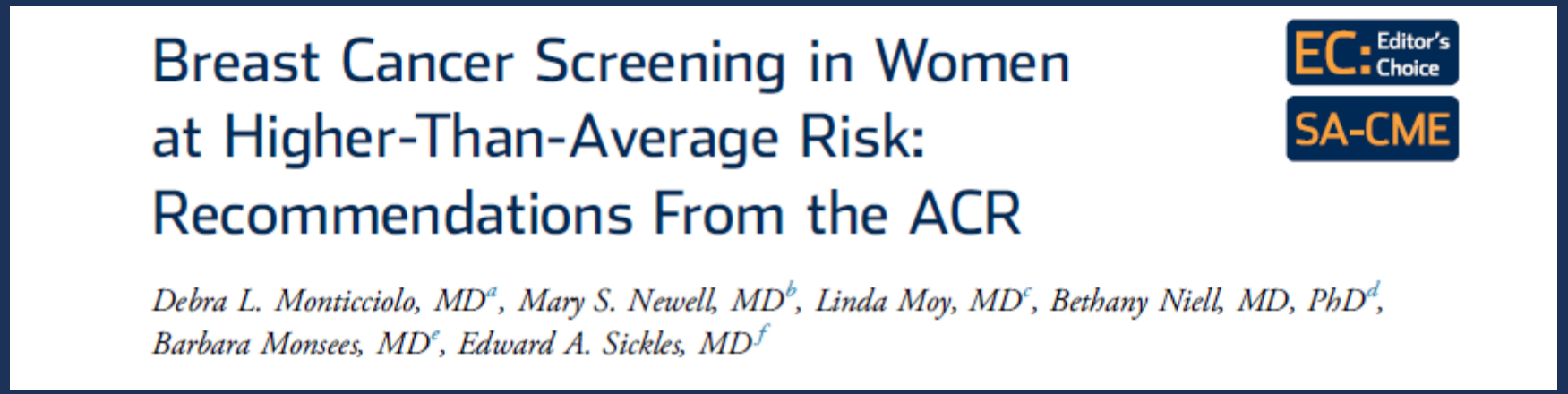
	Personal	Population
5-yr risk	2.6%	1.0%
Lifetime risk	29.7%	12.3%

OK

Print Preview



	Personal	Population
No BRCA	99.22%	99.68%
BRCA1	0.16%	0.12%
BRCA2	0.62%	0.20%



Imaging for Higher Risk Women

- Digital Breast Tomosynthesis (DBT) vs standard Digital Mammography (DM)
  - Increases cancer detection by 40%
  - reduces callbacks by 15%
  - largest improvement seen in women <50yr and those with dense breast tissue

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

EC: Editor's Choice

SA-CME

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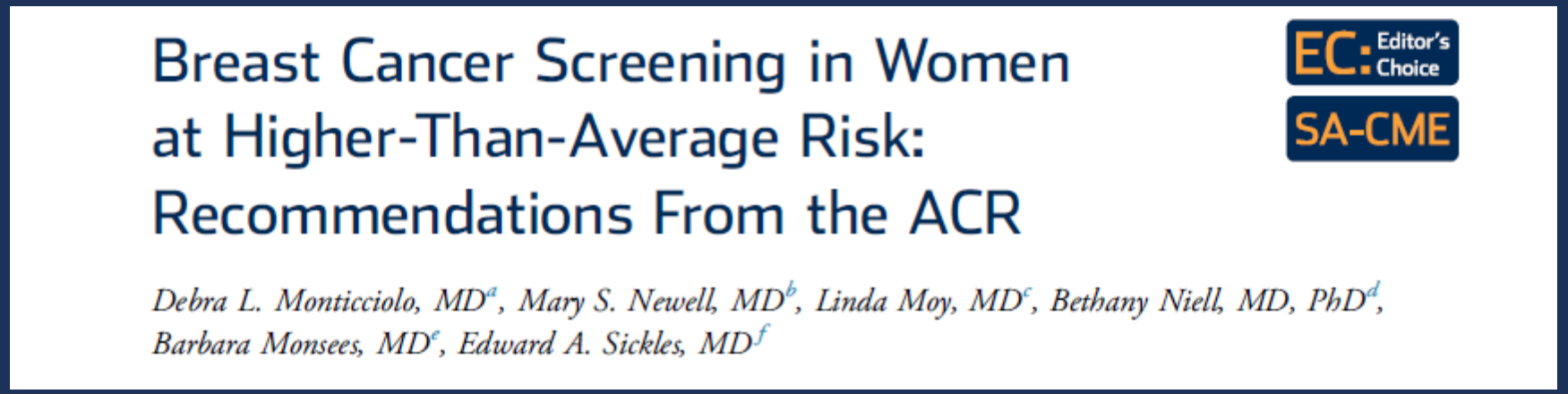
- MRI
  - increases cancer detection and is more sensitive than mammography or US.

- Patients eligible for MRI:
  - Gene carriers and their untested first degree relatives
  - Hx chest radiation <30yr
  - Calculated lifetime risk >20%



- Ultrasound
  - Available as screening tool but has drawbacks
    - High false positive rate
    - High short term follow-up rate
    - Operator dependent
    - Labor-intensive

  - Use of DBT reduces added benefit of US
  - If patient is able to have MRI screening, US adds little to no benefit

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]

* All women should be evaluated for breast cancer risk no later than age 30, so those at high risk can be identified and benefit from supplemental screening *

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MAMMOGRAPHY:

- Gene carriers, lifetime risk >20% - annual mammography at age 30
- Hx mantle XRT before age 30 – annual mammography 8 yrs after XRT, or age 25 (no sooner)
- Hx breast cancer, atypical hyperplasia before 40 – annual mammography at time of diagnosis

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

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MRI:

- Gene carriers, lifetime risk >20%, hx mantle XRT before age 30
  - annual MRI at age 25 - 30

- Hx breast ca diagnosed before 50yr – annual MRI

- Hx breast ca and dense breast tissue – annual MRI

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ULTRASOUND:

- Women with elevated risk who would qualify for but cannot undergo breast MRI, screening US should be considered

J Clin Oncol. 2010 Mar 20;28(9):1450-7. doi: 10.1200/JCO.2009.23.0839. Epub 2010 Feb 22.

Prospective multicenter cohort study to refine management recommendations for women at elevated familial risk of breast cancer: the EVA trial.

Kuhl C[1], Weigel S, Schrading S, Arand B, Bieling H, König R, Tombach B, Leutner C, Rieber-Brambs A, Nordhoff D, Heindel W, Reiser M, Schild HH.

Prospective screening study set out to investigate cancer yield and accuracy of different imaging methods for high risk women

- 687 asymptomatic women with lifetime risk >20%
- All women the same annual screening protocol
  → CBE, mammography, US and MRI

- Median follow-up 29.18 mos

J Clin Oncol. 2010 Mar 20;28(9):1450-7. doi: 10.1200/JCO.2009.23.0839. Epub 2010 Feb 22.

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- 27 women were diagnosed with breast cancer
- Mean age at diagnosis was 43.1yr

PPV:
MMG – 39.1%
US – 35.7%
MRI – 48.0%

Cancer yield with MRI alone was significantly higher than MMG/US.

Did not increase significantly when read with MMG or US.

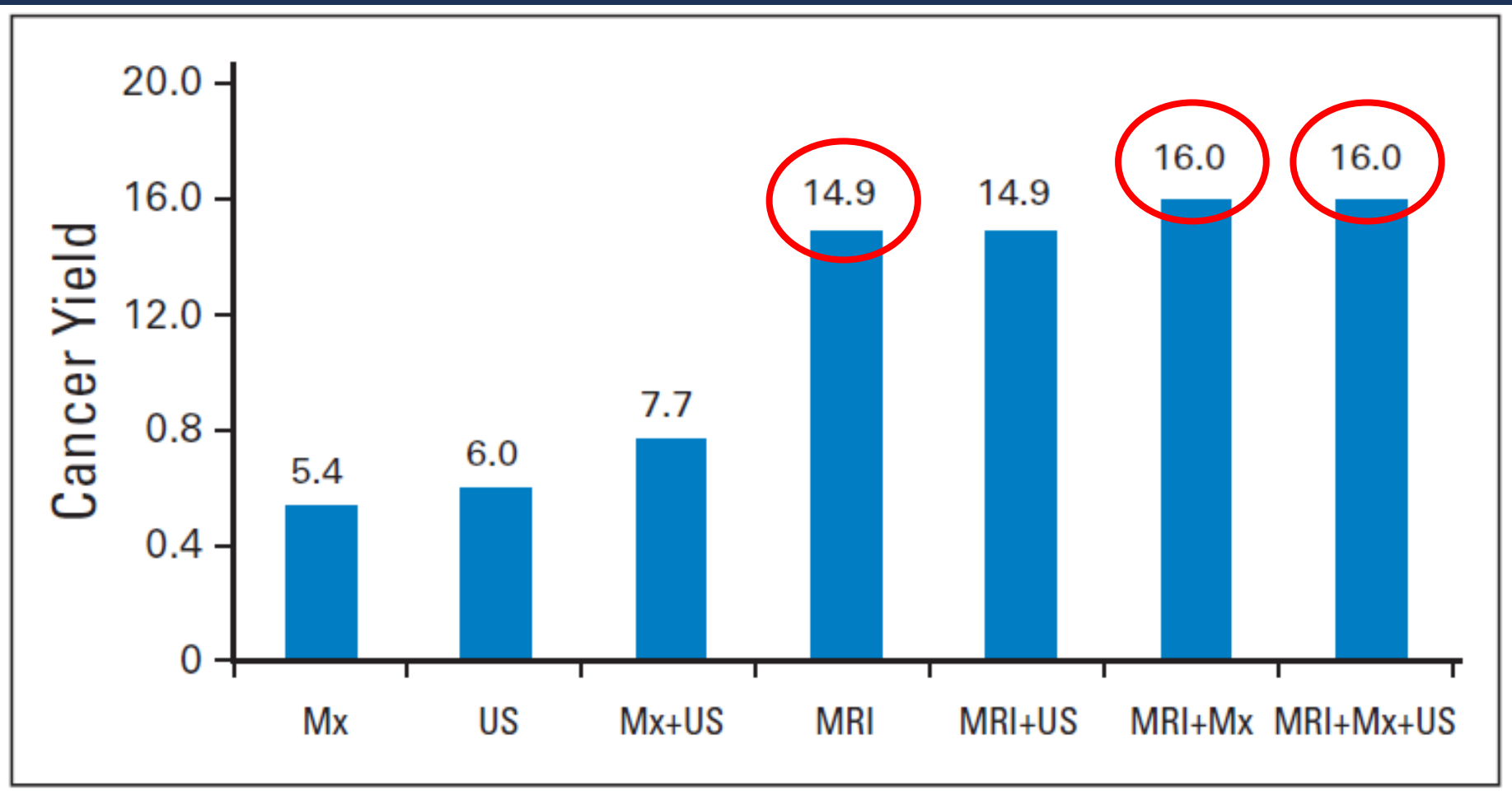

Fig 1. Cancer yield of the different imaging methods, used alone or in combination. Number of true-positive diagnoses per 1,000 complete screening rounds. Mx, mammography; US, ultrasound; MRI, magnetic resonance imaging.

Interval Cancer Rate = 0

J Clin Oncol 2010 Mar 20;28(9): 1450-7

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Conclusions:

- MRI is most sensitive tool for finding breast cancer
- MRI shifts distribution of screen detected cancer toward pre-invasive stage (finding intermediate and high grade DCIS)
- Is it conceivable to screen young women with MRI rather than MMG???

MRI Screening

Barriers:

- Only recommended for certain subset of patients
- Cost
- Access
- Time to scan
- Time to interpret

FAST MRI

Fast MRI

- Abbreviated MRI protocol
- Rationale:
  - Reduce cost
  - Reduce image acquisition time
  - Reduce image interpretation time
  - Improve acceptance of MRI screening

- Women with intermediate lifetime risk (15-20%) or those with dense breast tissue as their only risk factor.

J Clin Oncol. 2014 Aug 1;32(22):2304-10. doi: 10.1200/JCO.2013.52.5386. Epub 2014 Jun 23.

Abbreviated breast magnetic resonance imaging (MRI): first postcontrast subtracted images and maximum-intensity projection-a novel approach to breast cancer screening with MRI.

Kuhl CK[1], Schrading S[2], Strobel K[2], Schild HH[2], Hilgers RD[2], Bieling HB[2].

- To investigate whether an abbreviated MRI protocol (AP) was suitable for screening

Setup:

- All women had a full diagnostic protocol (FDP) MRI
- Initially, only images from the first 2 sequences were made available for interpretation (AP)
- Then the remaining images were made available for interpretation (FDP)

J Clin Oncol. 2014 Aug 1;32(22):2304-10. doi: 10.1200/JCO.2013.52.5386. Epub 2014 Jun 23.

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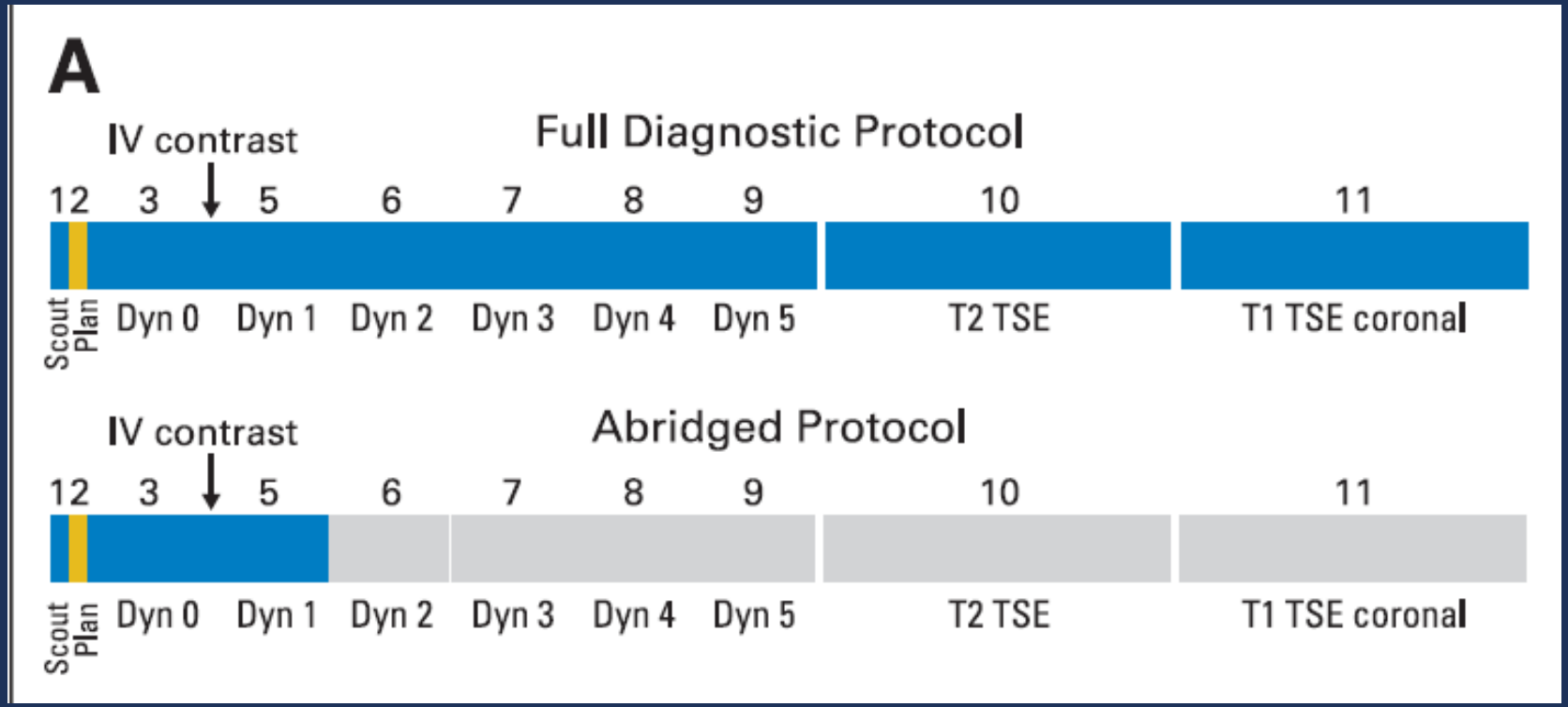
Kuhl CK[1], Schrading S[2], Strobel K[2], Schild HH[2], Hilgers RD[2], Bieling HB[2].

- 443 women (mild to intermediate risk; dense breast tissue)
- All women had neg MMG; dense breasts had neg US
- 606 total screening MRIs



- FDP: All AP images, plus the nonsubtracted and subtracted images of the remaining four postcontrast phases
  - 17 min
- AP: one pre- and one post-contrast image, then fused into a single summation image – the MIP (maximum intensity projection)
  - 3 min

J Clin Oncol. 2014 Aug 1;32(22):2304-10. doi: 10.1200/JCO.2013.52.5386. Epub 2014 Jun 23.

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Kuhl CK[1], Schrading S[2], Strobel K[2], Schild HH[2], Hilgers RD[2], Bieling HB[2].

Interpretation of AP and FDP:

1. Interpretation of MIP (positive or negative) – avg time 2.8s
2. Source images interpreted, BI-RADS given – avg time 28s
3. Remaining FDP images interpretation, final BI-RADS given.

Table 3. Diagnostic Indices

Index	MIP Images*		FAST Images		FDP	
	%	95% CI	%	95% CI	%	95% CI
First screening round (n = 443)						
Sensitivity	90.9	58.7 to 99.7	100.0	71.5 to 100.0	100.0	71.5 to 100.0
Specificity	NA	NA	94.4	91.8 to 96.4	94.9	92.4 to 96.8
PPV	NA	NA	31.4	16.9 to 49.3	33.3	18.0 to 51.8
NPV	99.7	98.2 to 100.0	100.0	99.1 to 100.0	100.0	99.1 to 100.0
Entire screening period (n = 606)						
Sensitivity	90.9	58.7 to 99.7	100.0	71.5 to 100.0	100.0	71.5 to 100.0
Specificity	NA	NA	94.3	92.1 to 96.0	93.9	91.7 to 95.7
PPV	NA	NA	24.4	12.9 to 39.5	23.4	12.3 to 38.0
NPV	99.8	98.7 to 100.0	100.0	99.3 to 100.0	100.0	99.3 to 100.0

Abbreviations: FAST, first postcontrast subtracted; FDP, full diagnostic protocol; MIP, maximum-intensity projection; NA, not applicable; NPV, negative predictive value; PPV, positive predictive value.

*MIP images were read as positive or negative depending on whether significant enhancement was observed; no actual differential diagnosis was attempted based on MIP images.

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Kuhl CK[1], Schrading S[2], Strobel K[2], Schild HH[2], Hilgers RD[2], Bieling HB[2].

11 cancers diagnosed (4 DCIS, 7 invasive (T1N0) – median size 8mm)

- All asymptomatic at time of MRI with negative mammogram

- Additional cancer yield of 18.2/1000
- Interval cancer rate 0%

- FDP did improve classification of BIRADS 3 lesions (downgrading 38% to BIRADS 2)

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Abbreviated breast magnetic resonance imaging (MRI): first postcontrast subtracted images and maximum-intensity projection-a novel approach to breast cancer screening with MRI.

Kuhl CK[1], Schrading S[2], Strobel K[2], Schild HH[2], Hilgers RD[2], Bieling HB[2].

Conclusions:

- Abbreviated MRI screening is feasible without compromising sensitivity or specificity compared to full protocol MRI.

- Could increase access and decrease cost of MRI screening.

Radiology. 2017 May;283(2):361-370. doi: 10.1148/radiol.2016161444. Epub 2017 Feb 21.

Supplemental Breast MR Imaging Screening of Women with Average Risk of Breast Cancer.

Kuhl CK[1], Strobel K[1], Bieling H[1], Leutner C[1], Schild HH[1], Schrading S[1].

- To investigate diagnostic accuracy and cancer yield of MRI screening in average risk women

- Prospective observational study at 2 academic breast centers
- 2120 patients underwent 3861 screening MRIs
- Pts had neg MMG, 64.8% had neg US
- Lifetime risk <15%

- AP time <10min
- MRIs read independent of other studies, then in conjunction for final clinical management

Radiology. 2017 May;283(2):361-370. doi: 10.1148/radiol.2016161444. Epub 2017 Feb 21.

Supplemental Breast MR Imaging Screening of Women with Average Risk of Breast Cancer.

Kuhl CK[1], Strobel K[1], Bieling H[1], Leutner C[1], Schild HH[1], Schrading S[1].

- Breast cancer was diagnosed in 61 women
- 60/61 cancers were detected by MRI only

  → supplemental CDR of 15.5/1000 screened

  (sCDR for tomo 1.2/1000; US 3.5/1000)

- Cancers found on MRI:
  - Small (median 8mm)
  - 93.4% node negative
  - Poorly differentiated high grade lesions nearly 50%

Abbreviated MRI Protocol

Implications for Patient Care

- MRI is a useful adjunct screening tool in women at average risk for breast cancer.
- Cancers detected with MRI were prognostically relevant
- MRI can be used to detect cancers that would have progressed to clinically detectable disease

INTERVAL CANCER RATE 0%

Beneficial for all breast densities

What are we waiting for??

Fast MRI

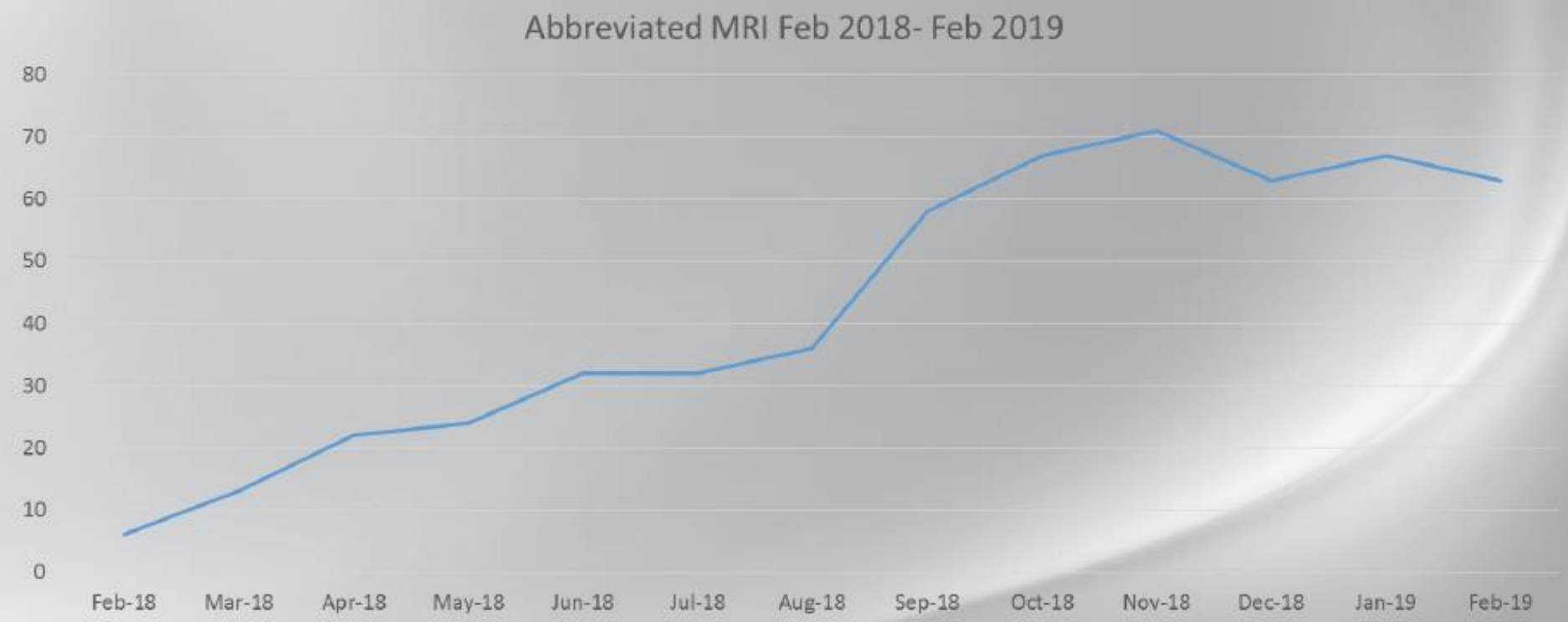
- Implemented at UHCMC 2/1/2018
- Protocol <10min
- Does not replace mammogram (preferred after negative MMG)

My Favorites | OFF | Record w/o Ordering

- CT Abdomen and Pelvis w/wo Contrast
- CT Abdomen and Pelvis with Contrast
- CT Abdomen and Pelvis without Contrast
- CT Abdomen w/wo Contrast
- CT Biopsy Bone Trocar/Needle Deep
- CT Chest with Contrast
- CT Chest without Contrast
- Mamm - Diagnostic Mammogram Bilateral
- Mamm - Digital Diagnostic Mammogram Bilateral w/ Tomosynth...
- Mamm - Ductogram
- Mamm - Screening Mammogram
- Mamm - Screening Mammogram w/ Tomosynthesis
- Mamm - Stereotactic Breast
- Mamm - Ultrasound Guided Breast Biopsy
- Mamm - Ultrasound Guided Cyst Aspiration
- Mamm - Ultrasound Guided Fine Needle Aspiration
- Mamm - Ultrasound Guided Lymph Node Biopsy
- Mamm - Ultrasound Guided Needle (or other device) Localizati...
- Mamm - Ultrasound of Breast
- Mamm - Ultrasound of Chest
- Mamm Consult Outside Films
- MRI Brain w/wo Contrast
- MRI Breast Bilateral with contrast fast screening (SELF PAY)
- MRI Breast Bilateral with contrast full protocol
- MRI Breast Bilateral without contrast for implant integrity
- MRI Breast Vacuum Assisted Biopsy
- MRI Liver w/wo Contrast
- NM Bone Scan Whole Body
- NM Injection Only For Sentinal Node Bx
- PET/CT Breast Initial
- PET/CT Breast Staging
- PET/CT Head And Neck Initial
- PET/CT Lung Ca Staging
- PET/CT Lung Scan SPN
- Ultrasound Breast Screening
- Ultrasound Neck

* K V
A L W
B M X
C N Y
D O Z
E P
F Q
G R
H S
I T
J U

Volume of Abbreviated MRI



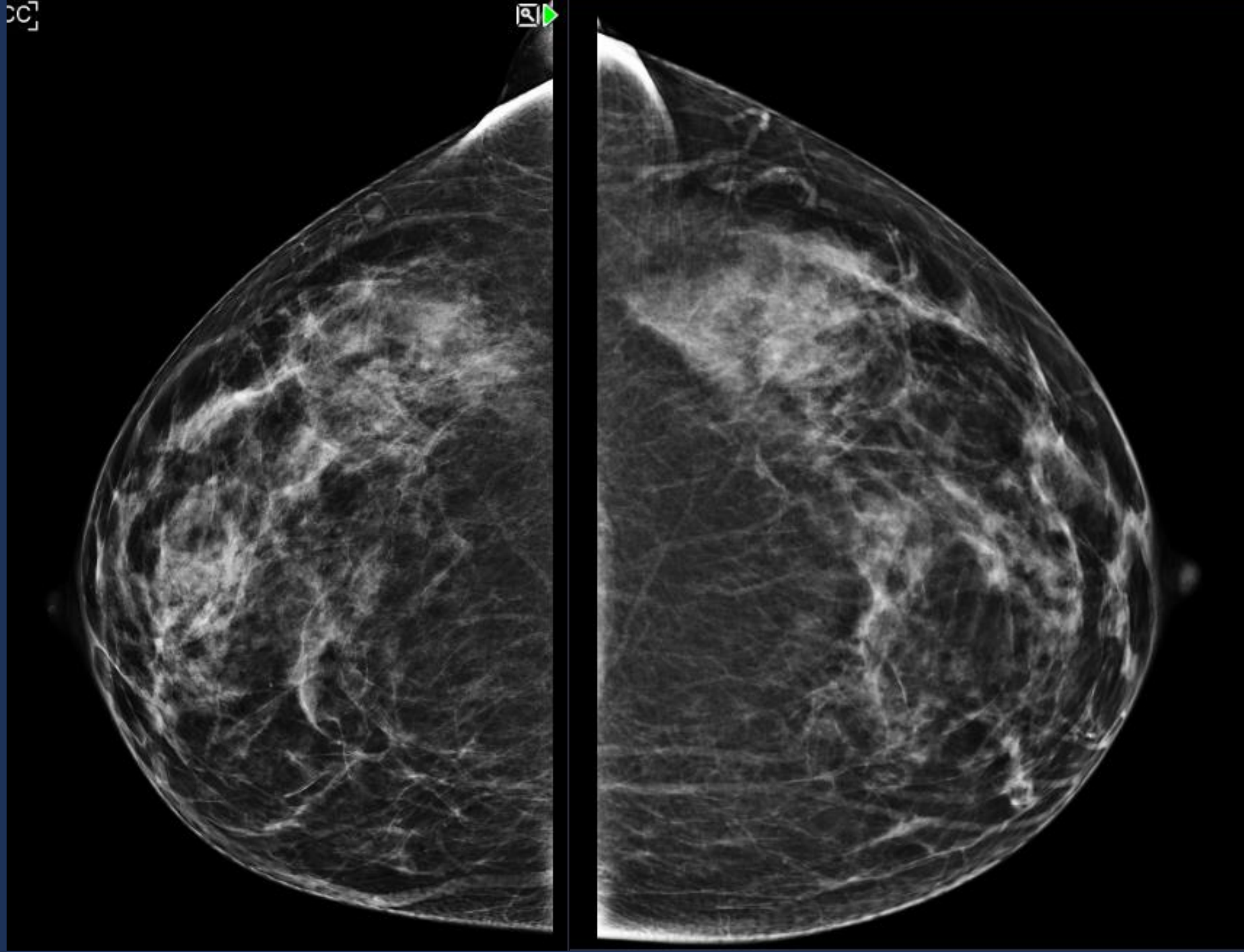
Total Volume 526

Patient Examples

Case #1

48 yr old F
Screening MMG
6/18/2018

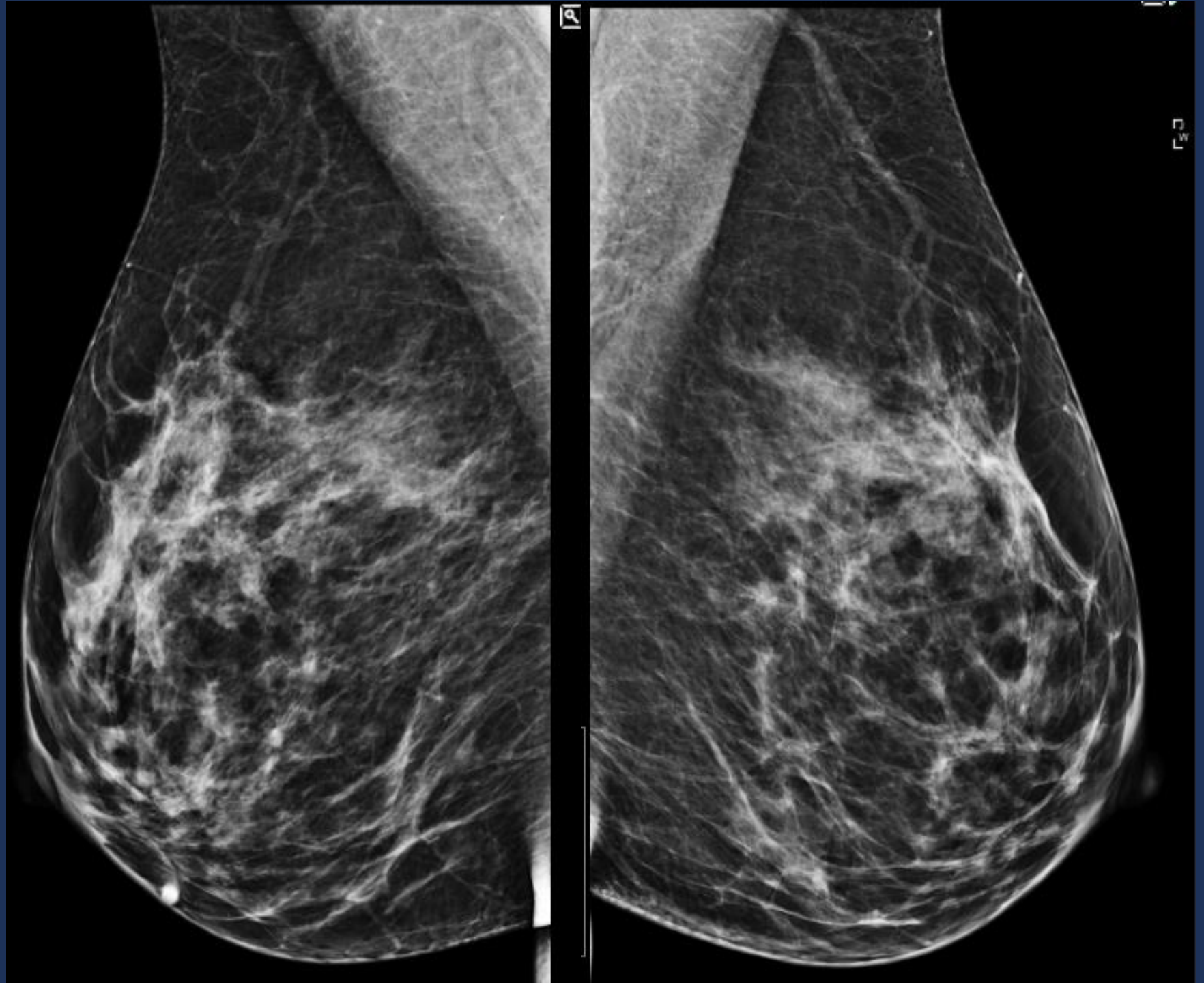
Heterogeneously dense



48 yr old F
Screening MMG
6/18/2018

Heterogeneously dense

BIRADS 1 - Negative

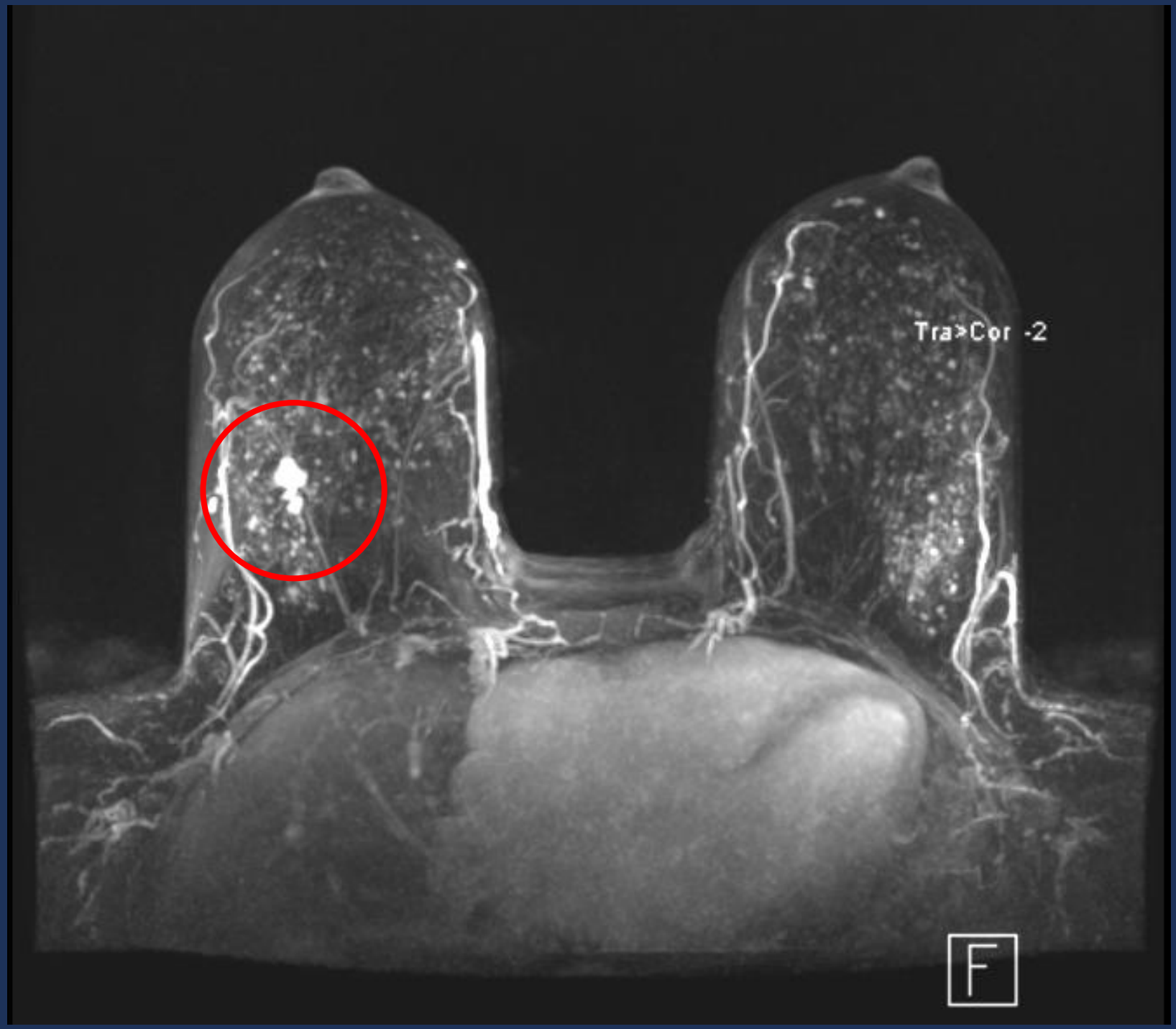


48 yr old F
Screening MMG
6/18/2018 - Neg

FAST MRI 7/12/2018

- irregular enhancing mass Right UOQ 1.6 x 1.8 x 1.9cm

- US guided bx → gr3 IDC ER/PR+ HER2-

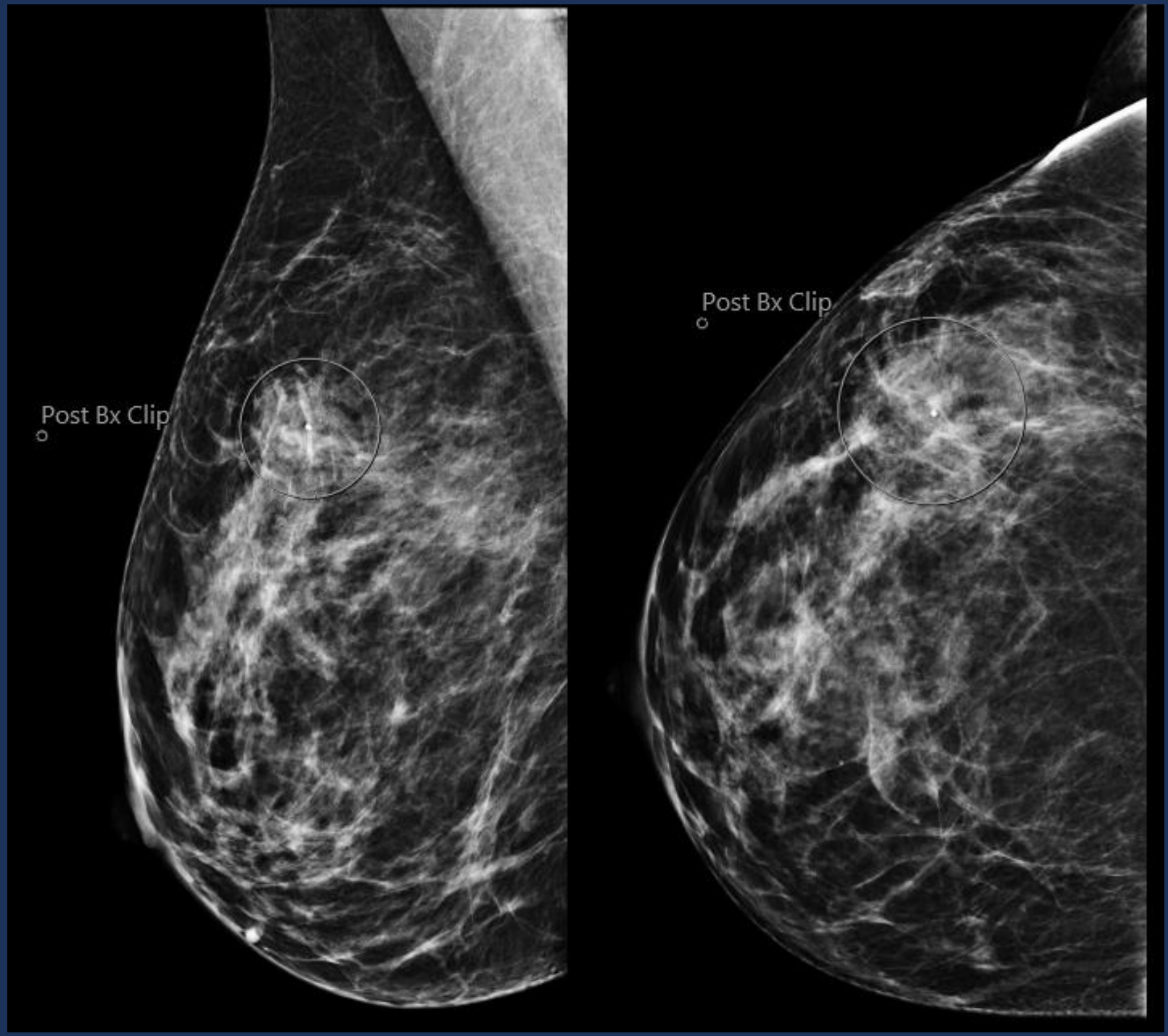


48 yr old F
Screening MMG
6/18/2018 - Neg

FAST MRI 7/12/2018
- irregular enhancing mass Right UOQ 1.6 x 1.8 x 1.9cm

- US guided bx → gr3 IDC ER/PR+ HER2-

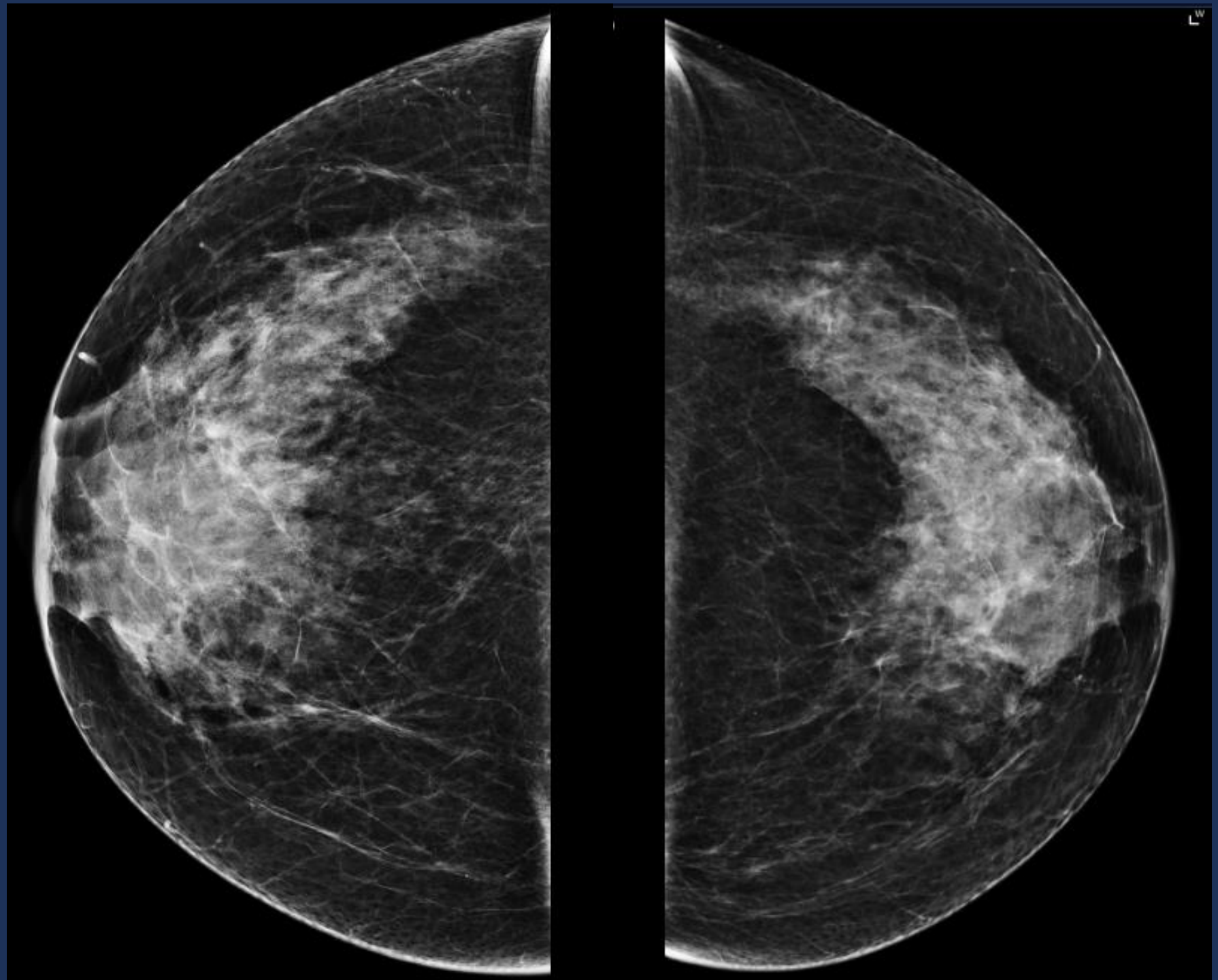
- Sx: 1.2cm IDC 0/3LN pT1cN0



Case #2

55 yr old F
Screening MMG
3/29/2018

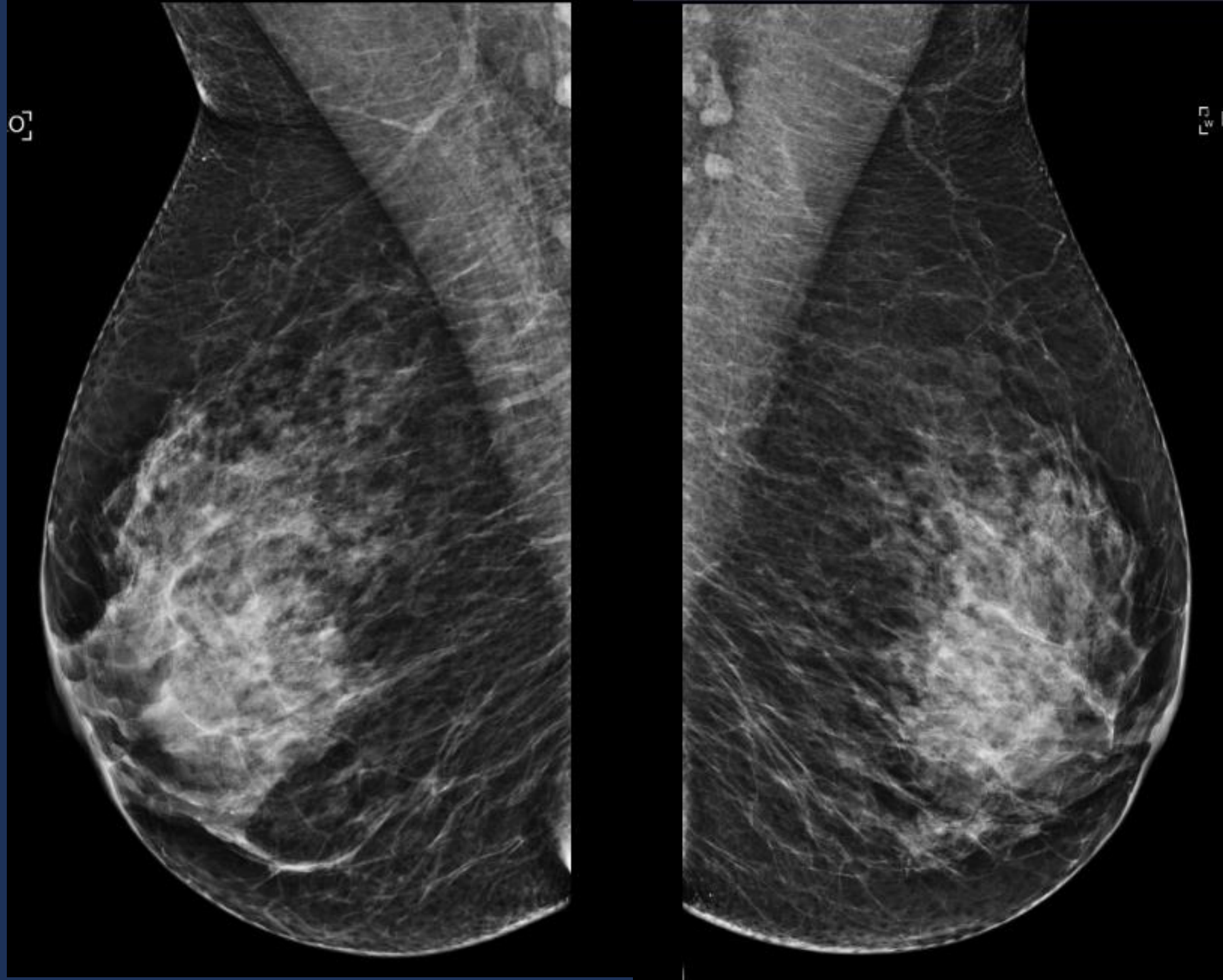
Extremely dense



55 yr old F
Screening MMG
3/29/2018

Extremely dense

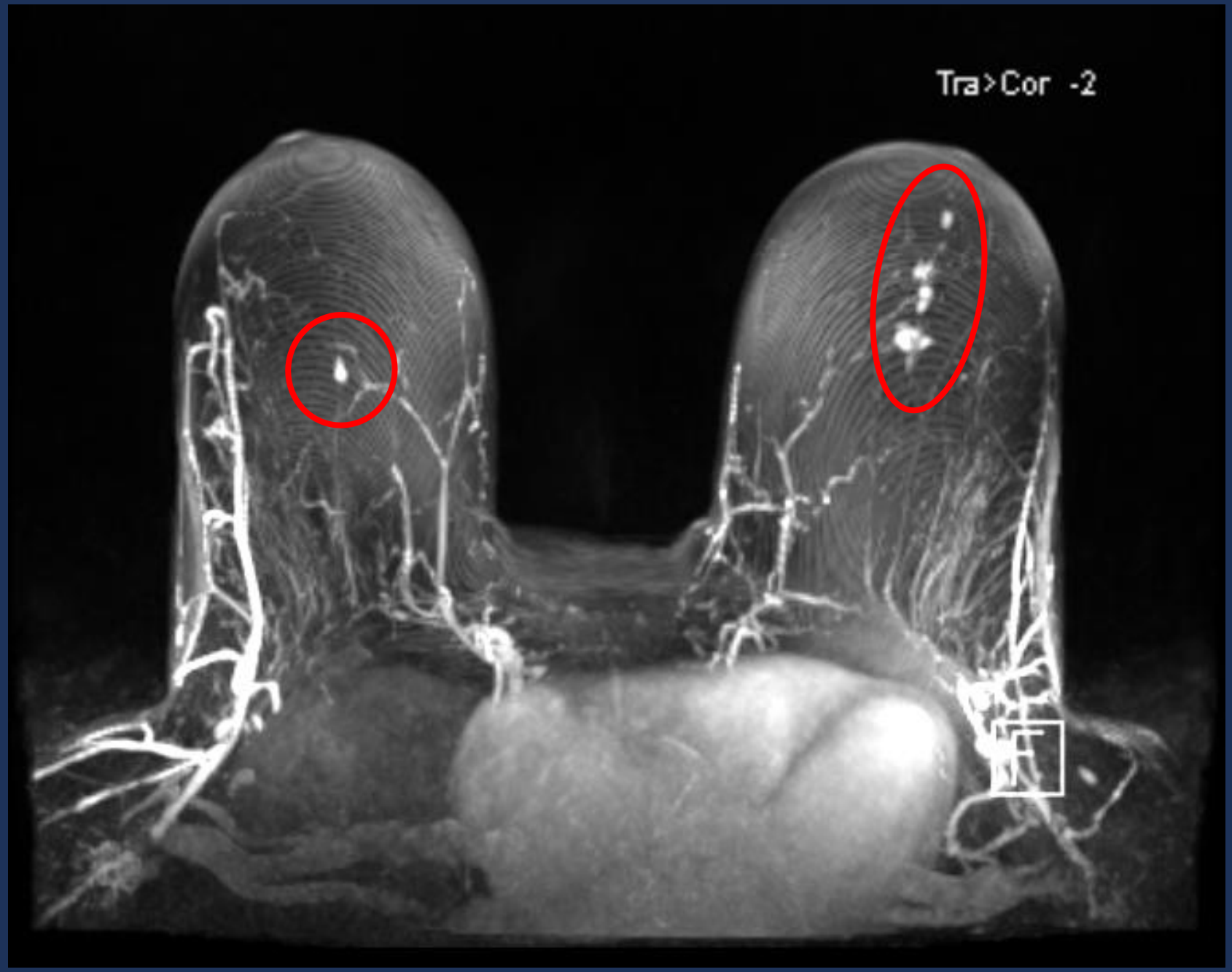
BIRADS 1 - Negative



55 yr old F
Screening MMG
3/29/2018 - Neg

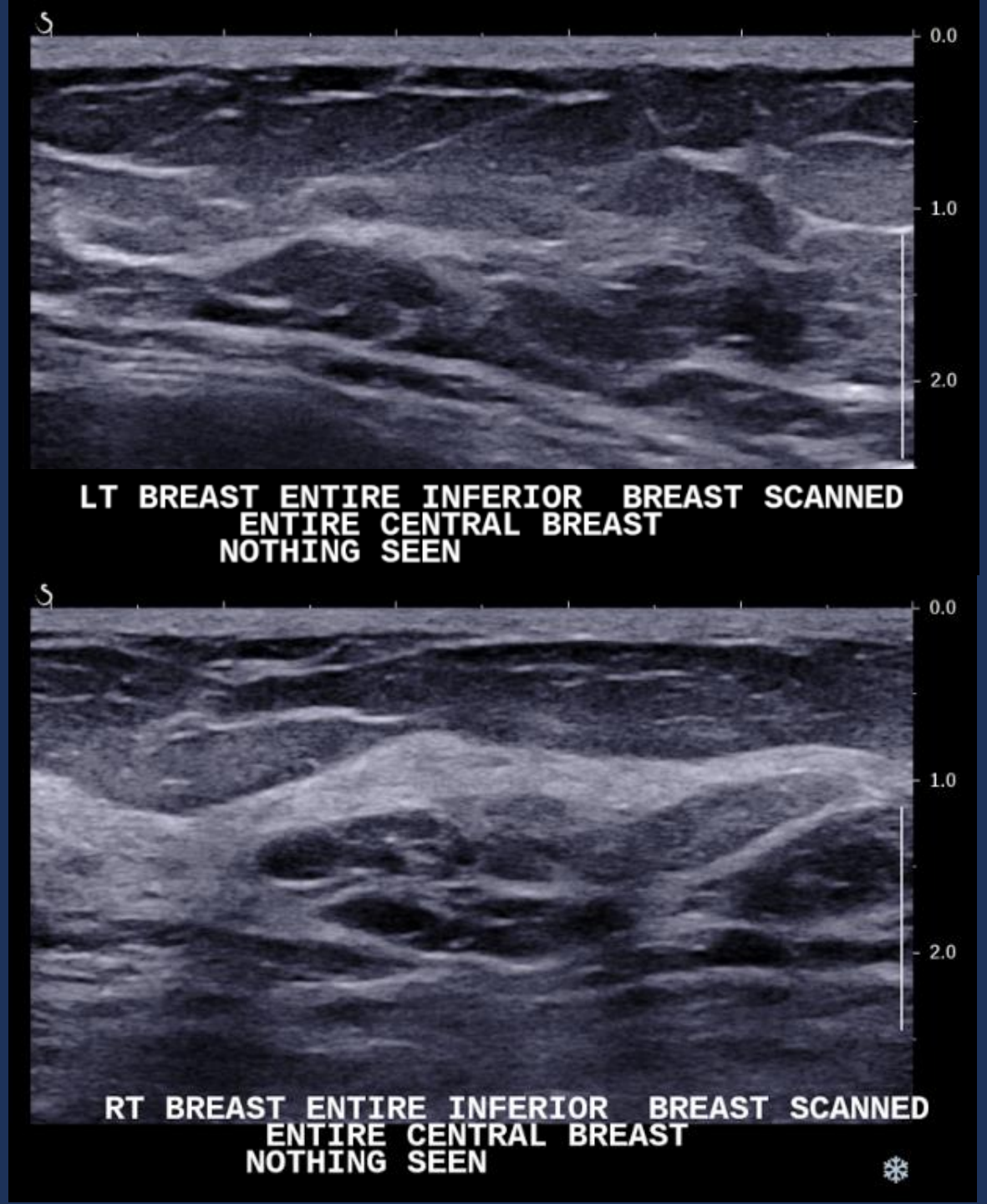
FAST MRI 4/5/2018

- Irregular enhancing mass R. central br 8x5x4mm
- Irregular enhancing mass L. central br 1.4x1x0.9cm and 2 adjacent masses



55 yr old F
Screening MMG
3/29/2018 - Neg

2nd look US 4/17/2018
- Negative



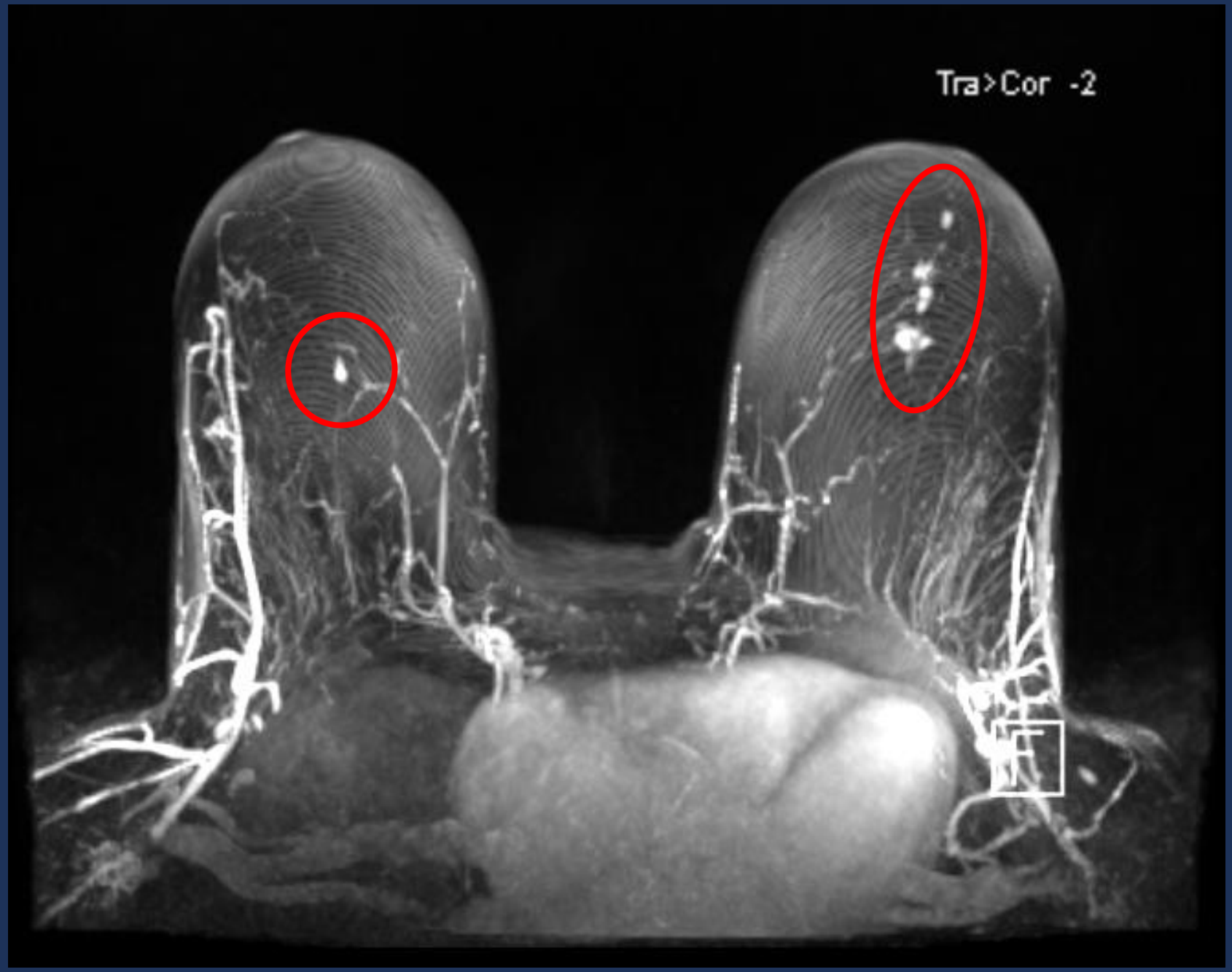
55 yr old F
Screening MMG
3/29/2018 - Neg

BL MRI guided bx →

- R. benign hemangioma (conc.)

- L. gr2 IDC ER/PR+ HER2-

- add'l L.bx anterior mass – gr2 IDC ER/PR+ HER2-

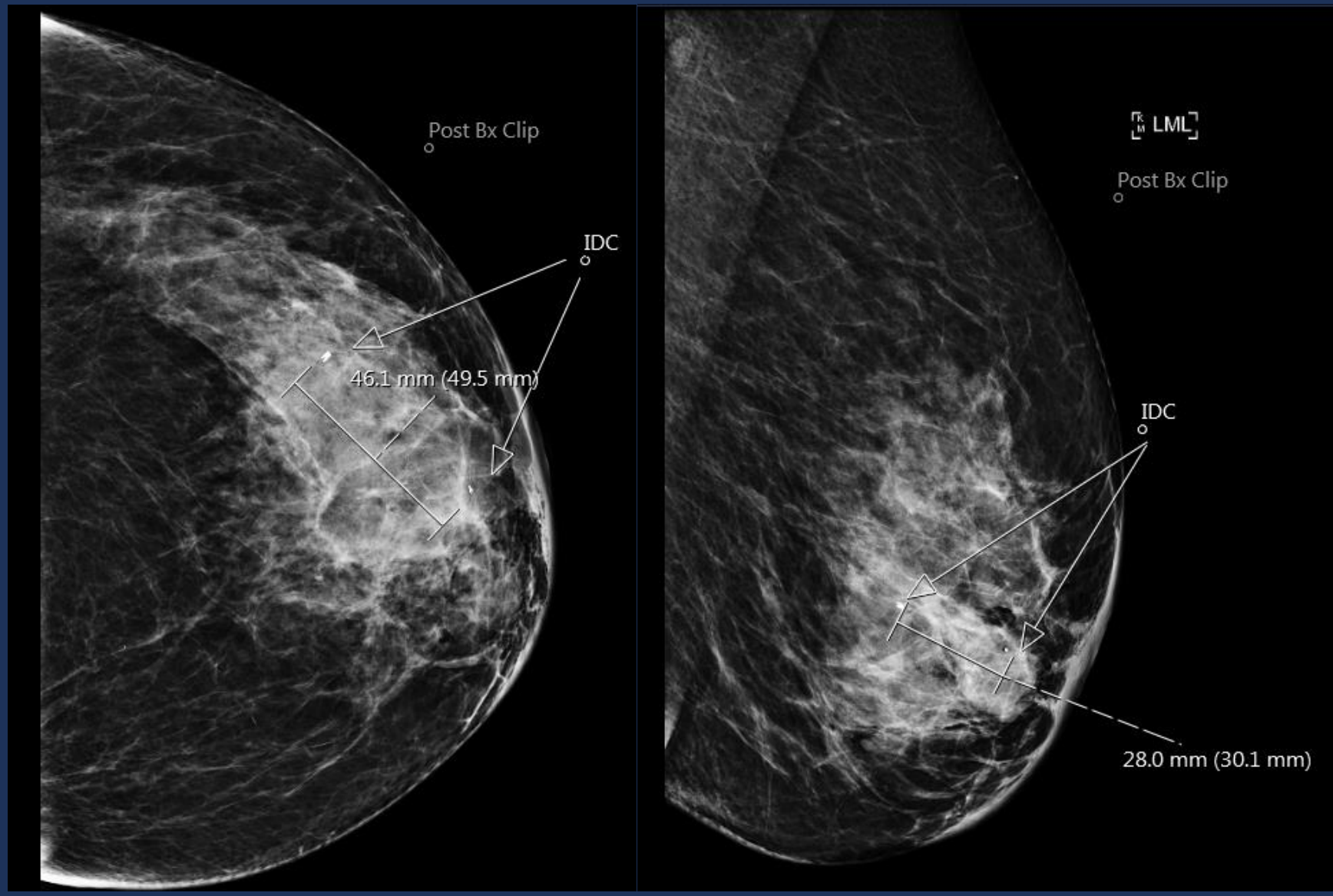


55 yr old F
Screening MMG
3/29/2018 - Neg

FAST MRI 4/5/2018
- BL findings

2nd look US 4/17/2018
- Negative

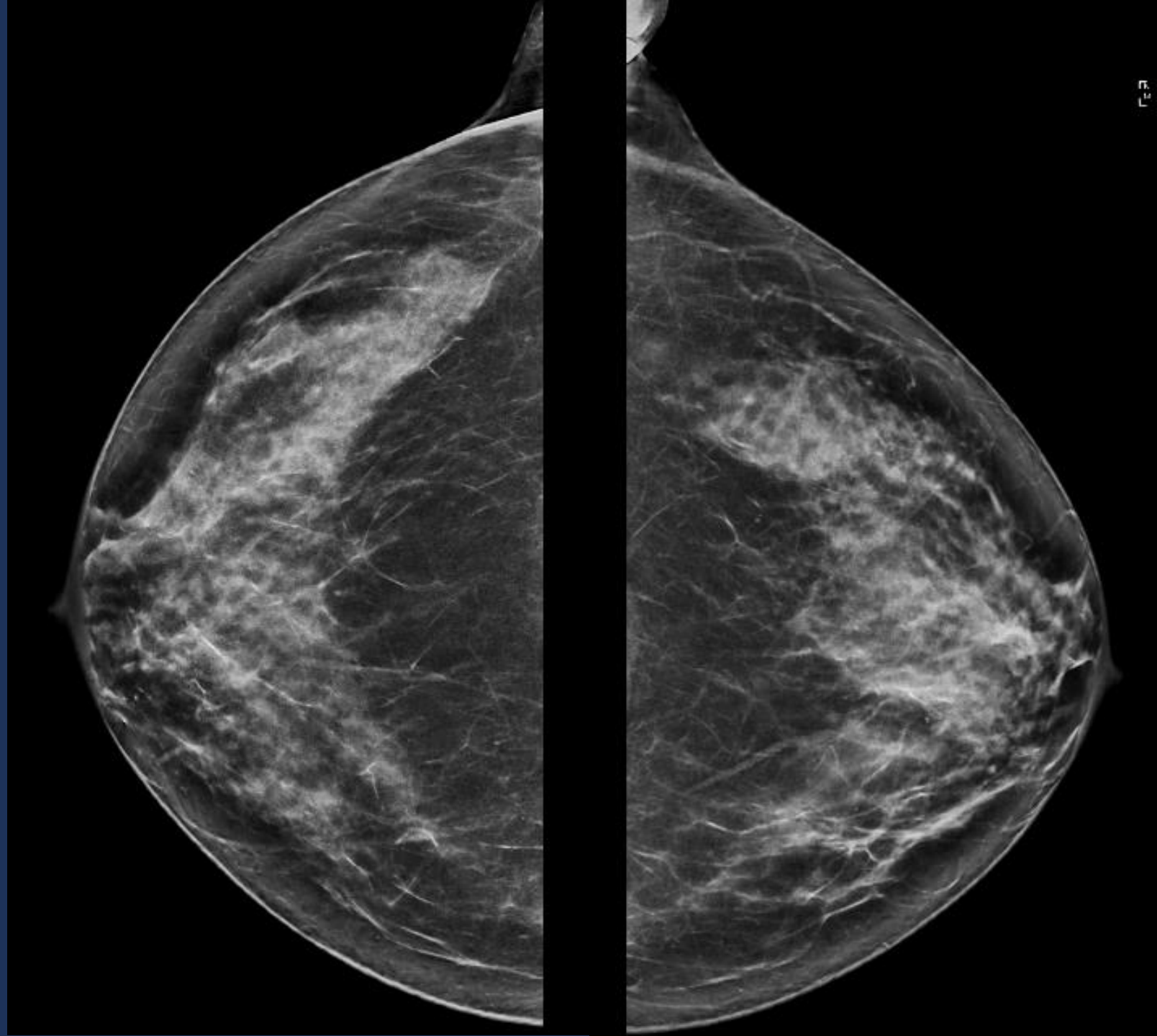
- Sx: 2.8cm gr2 IDC
  0/6LN
    pT2N0



Case #3

50 yr old F
Screening MMG
7/13/2018

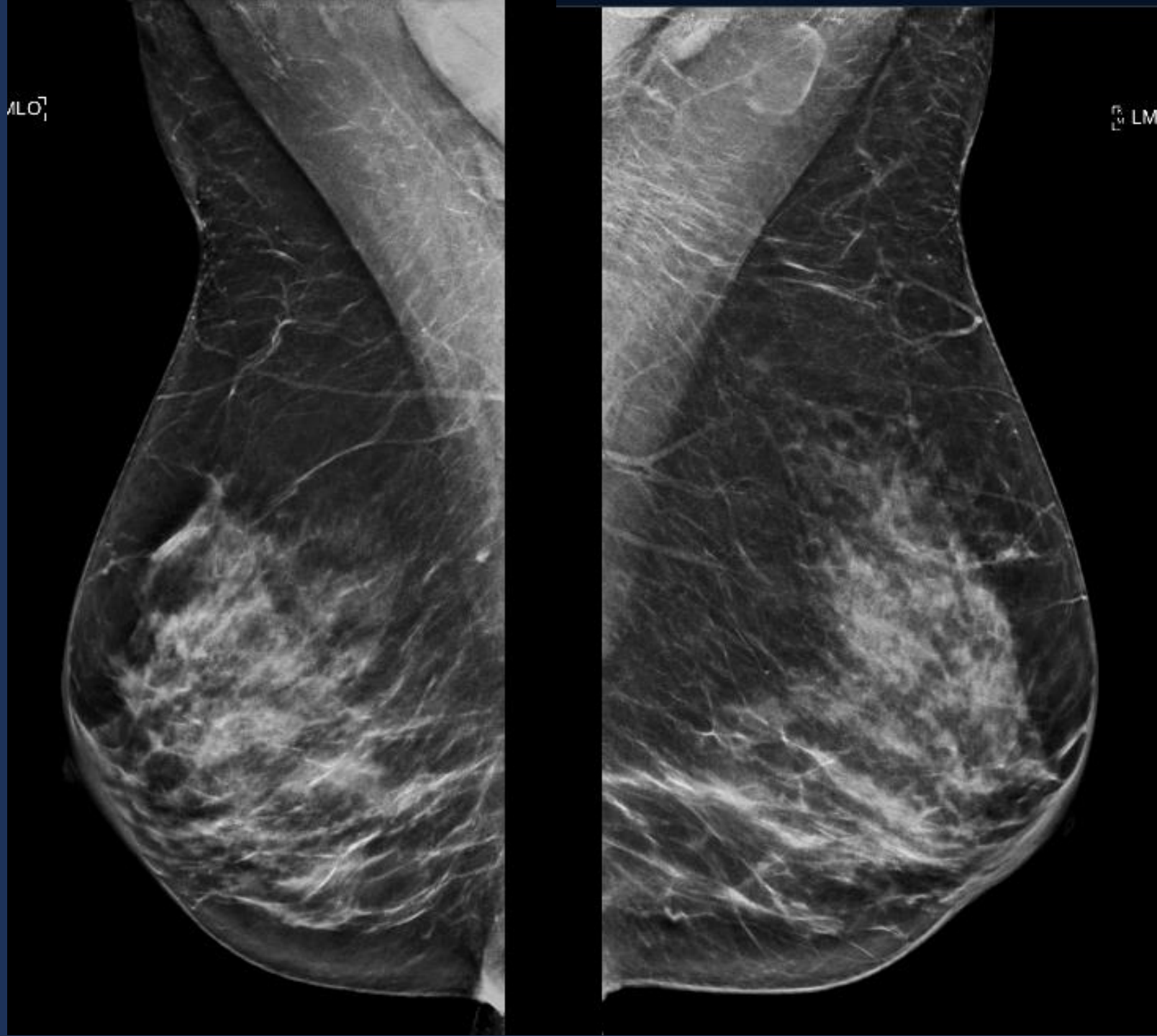
Heterogeneously dense



50 yr old F
Screening MMG
7/13/2018

Heterogeneously dense

BIRADS 1 - Negative



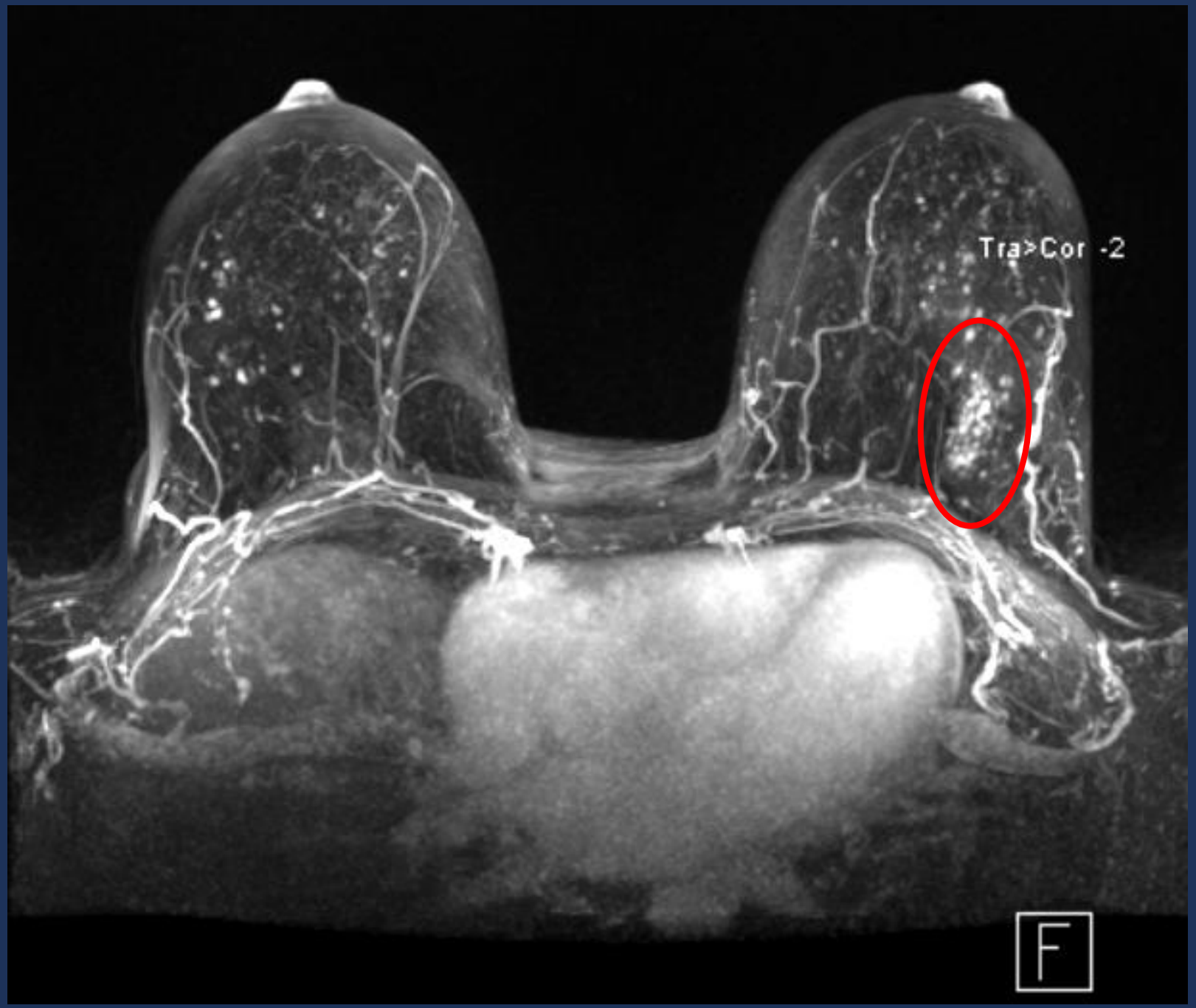
50 yr old F
Screening MMG
7/13/2018 - Neg

FAST MRI 8/9/2018

- Focal clumped NME
  R. central br.
  2.3x0.8x1.8cm

- MRI bx → LCIS

- Sx excision → LCIS

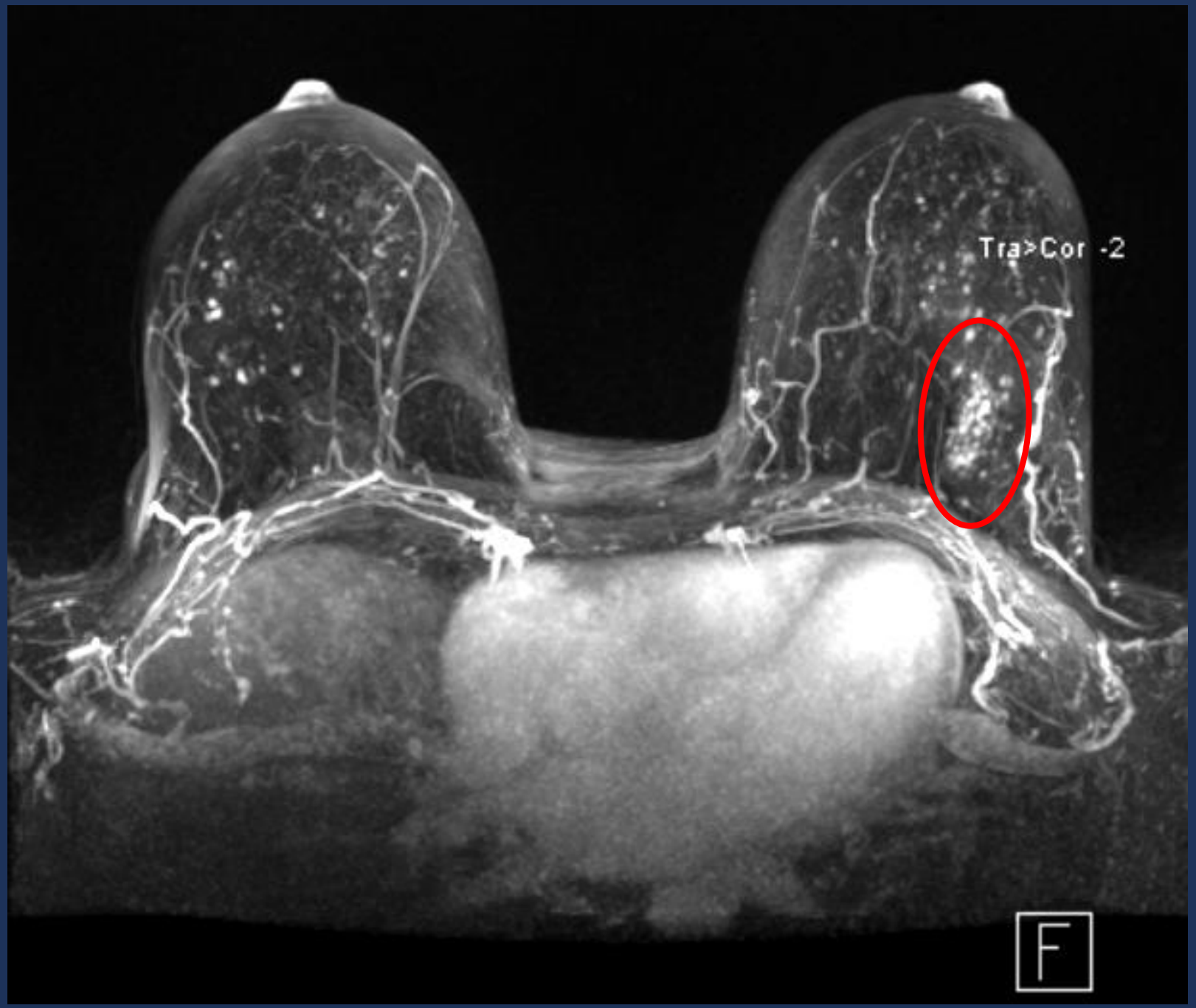


50 yr old F
Screening MMG
7/13/2018 - Neg

Risk assessment:

Tyrer Cuzick Risk:
5 yr: 11.8% vs 1.3%
Lifetime: 68.2% vs 11.4%

→ Chemoprevention and MRI screening



Abbreviated ‘Fast’ MRI

- Detects 15.5 – 18/1000 additional cancers after negative MMG and US
- Detects biologically aggressive invasive cancers that are small and node negative
- Low interval cancer rates
- High positive predictive value
- Self pay low cost option ($250)

Supplemental Breast Cancer Screening for Women with Dense Breasts

University Hospitals Cleveland Medical Center is now offering a new low-cost option for women who are interested in a supplemental screening for breast cancer. A self-pay option for a Fast Breast MRI is available for $250 at all University Hospitals sites that perform breast MRI. MRI is the most sensitive tool for detecting breast cancer, even after a negative mammogram.

Cancer Detection Rates/1,000 Women Screened	
Modality	CDR/1,000
Digital Mammography	2-7
DBT	+0.5-2.7
Screening Ultrasound	+1.8-4.6
Fast MRI	+15.5-18.1
"+" indicates additional cancers detected compared to digital mammography	

What is a "Fast Breast MRI" Study?

The Fast Breast MRI is a supplemental screening study for women with dense breast tissue. Because increased breast density both lowers the sensitivity of mammography and increases the risk of developing breast cancer, dense-breasted women may benefit from supplemental screenings to detect cancers that may not be visible on their mammogram. While the conventional breast MRI study (45 minutes) is tailored for women with a very high risk for developing breast cancer (such as BRCA1/2 genetic mutations), the Fast Breast MRI (10 minutes) is a supplemental screening for women with dense breast tissue who do not meet the lifetime breast cancer risk level for a full MRI study. The Fast Breast MRI takes about 10 minutes, requires an IV injection of contrast and will be read by fellowship-trained breast imaging radiologists. Fast Breast MRI is not currently covered by insurance providers and is only available on a "self-pay" basis.

Although studies have demonstrated that the Fast Breast MRI is effective in detecting invasive breast cancers, it is not designed to detect the spectrum of diseases that can be found by a full breast MRI exam [1]. And, as with any screening exam, additional noncancerous lesions that could require biopsy or additional follow up may also be detected by the Fast Breast MRI. Mammography is still recommended and the Fast Breast MRI study is not meant to replace annual, routine mammograms.

If you have questions about breast cancer screenings including mammograms, screening ultrasound, Fast Breast MRI or full Breast MRI exams, please contact Donna Plecha, MD at donna.plecha@uhhospitals.org.

University Hospitals

To obtain more information or schedule an appointment, call 855-995-0972 or visit UHHospitals.org/FASTMRI

Take Home Points

- Recommend yearly mammogram starting at age 40 (average risk)
- All women should have a risk evaluation by age 30
  - Ask high risk questions during evaluation and refer accordingly
- Be aware of additional screening options for patients with dense breast tissue

FAST MRI

Thank you

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