



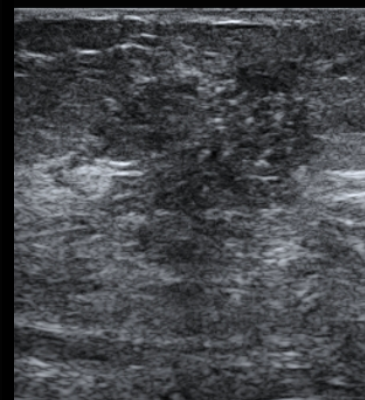
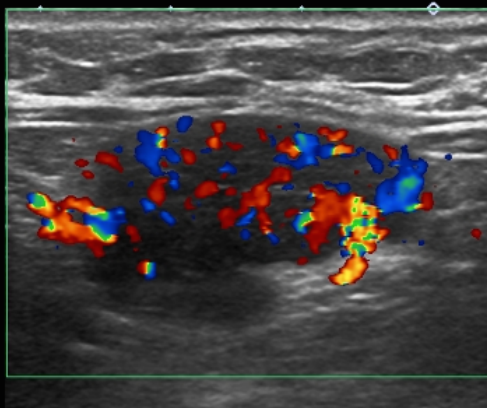
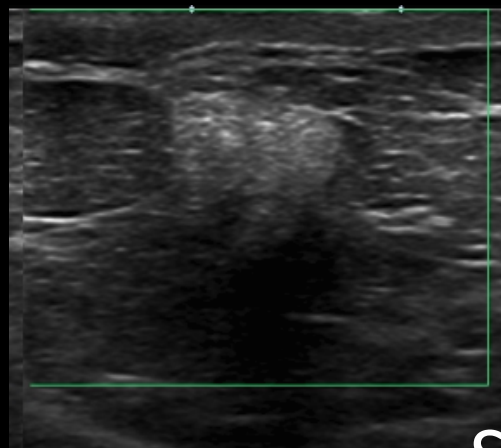
# 2015 CME SONOGRAPHER DAY



## Breast Ultrasound: Protocols, Pearls & Pitfalls – PART 2

*(Please see CME Day 2014 Lecture on TNI Intranet Portal for Part 1)*

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20 18L7  
Sharon Shin, M.D.

April 12, 2015

# Overview

- Breast Ultrasound Protocol Review
- Area of Concern (AOC) clinically
  - *Obtain minimum 3-5 images in each plane*
- Breast Cancer features on US
- TNI Cases – pathology-proven

- Much of the concepts covered in this presentation are similar to:

Apr 2014 Part I of this Lecture series on  
Breast Ultrasound – Protocol, Pearls & Pitfalls

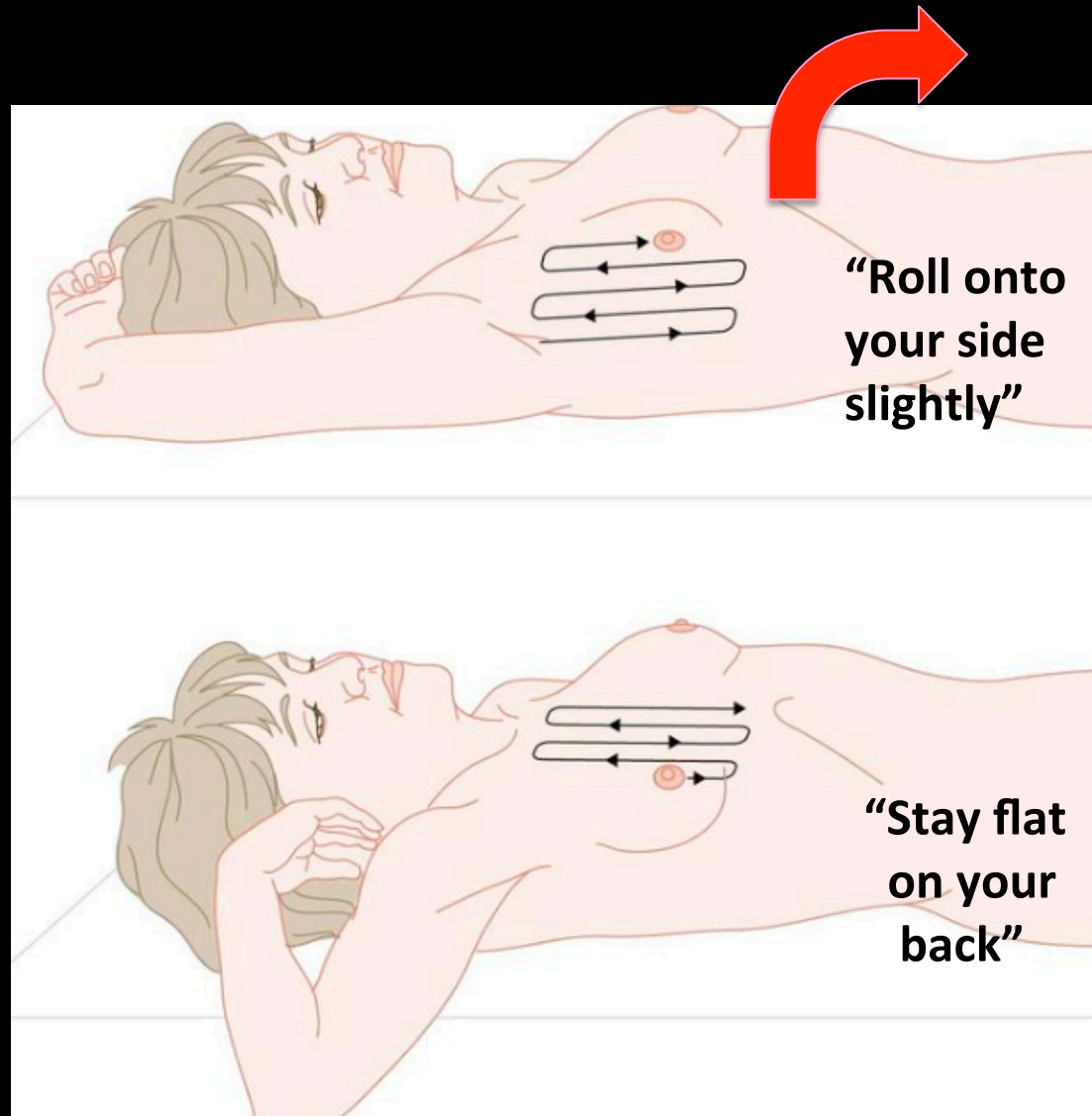
Why?

Because of paramount importance of reinforcing these basic principles to be applied every time you perform a breast ultrasound

# Ultrasound Protocol/Technique

## Patient Positioning

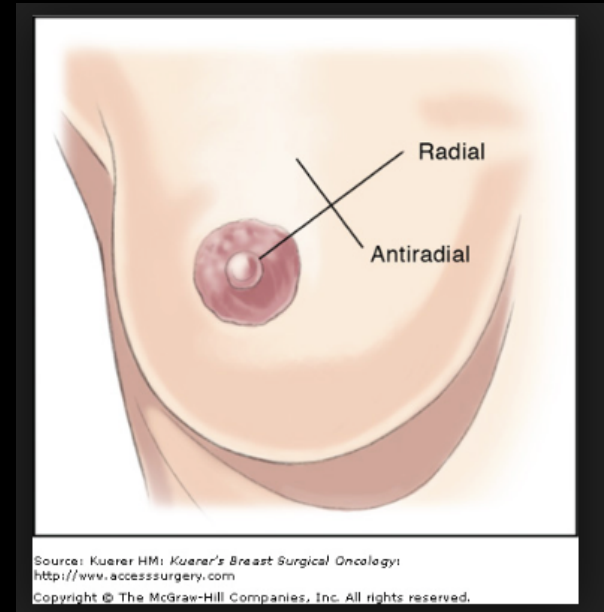
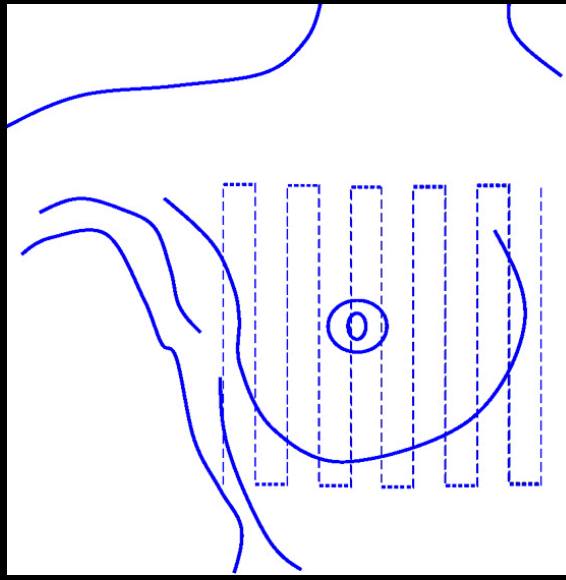
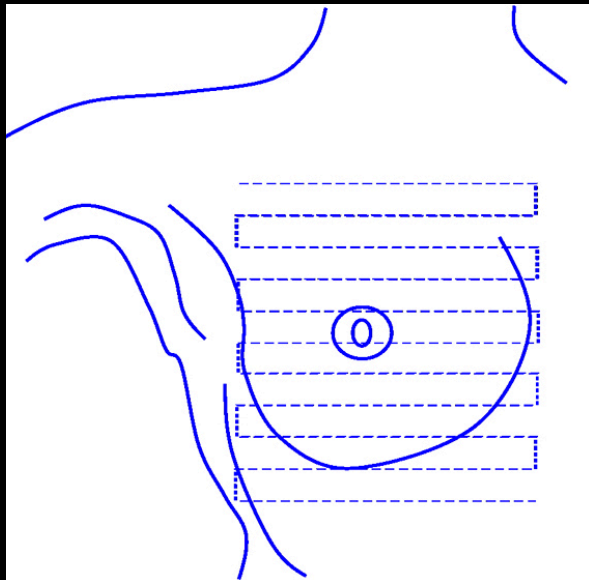
- Ipsilateral arm raised
- Supine Oblique for outer breast
- Supine for inner breast





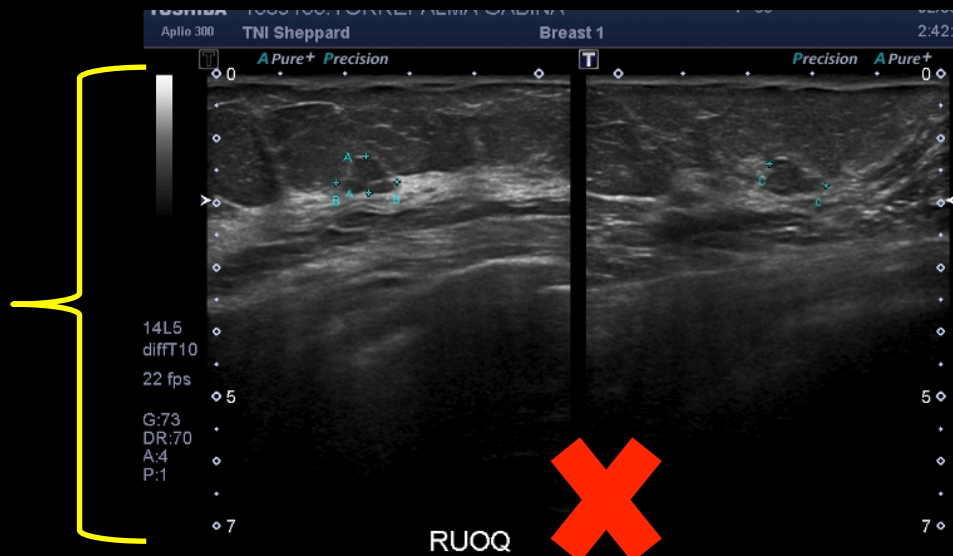
# Ultrasound Protocol/Technique

- Systematic Survey Scanning (DETECTION)
  - Survey In Transverse & Sagittal
  - Once you find a lesion,  
can characterize lesion in radial & antiradial

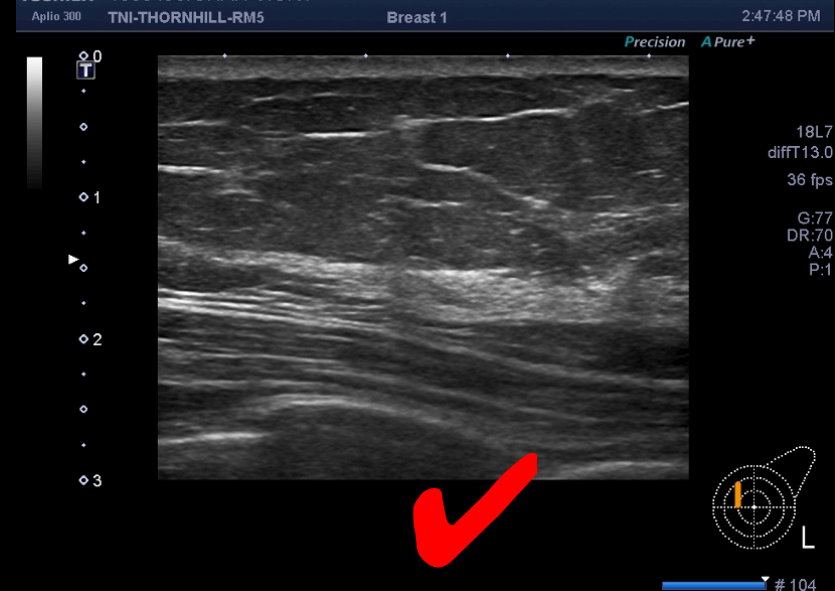


# Ultrasound Protocol/Technique

- Adjust Focal Zone
  - Pectoralis at deep aspect of image
    - i.e. **do not include much lung!**



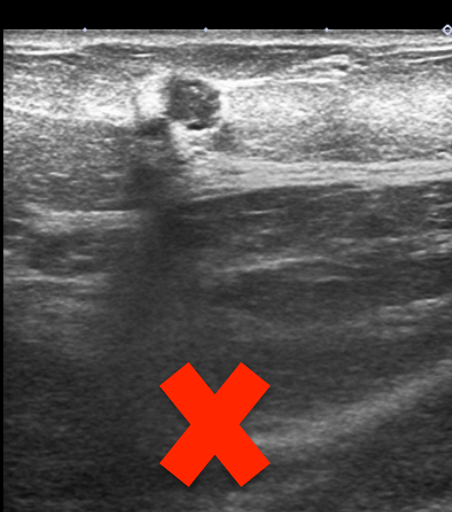
Half of this \*7 cm\*  
focal zone depth is LUNG



Better Focal Zone

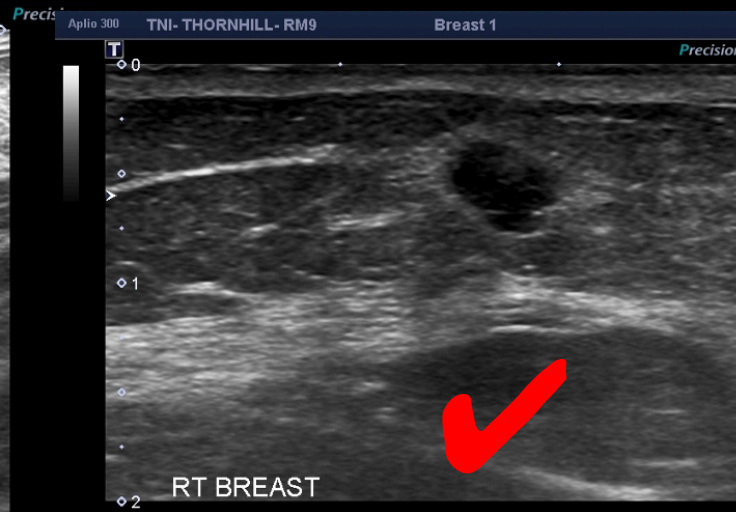
# Ultrasound Protocol/Technique

- Adjust Gain
  - Premammary fat = “medium grey”



10 OCL 4 FN

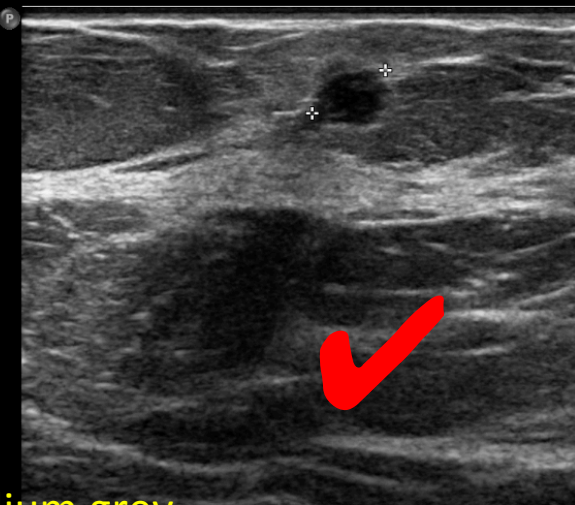
Fat is too echogenic



RT BREAST

10 OCL 4 FN

Fat is medium grey

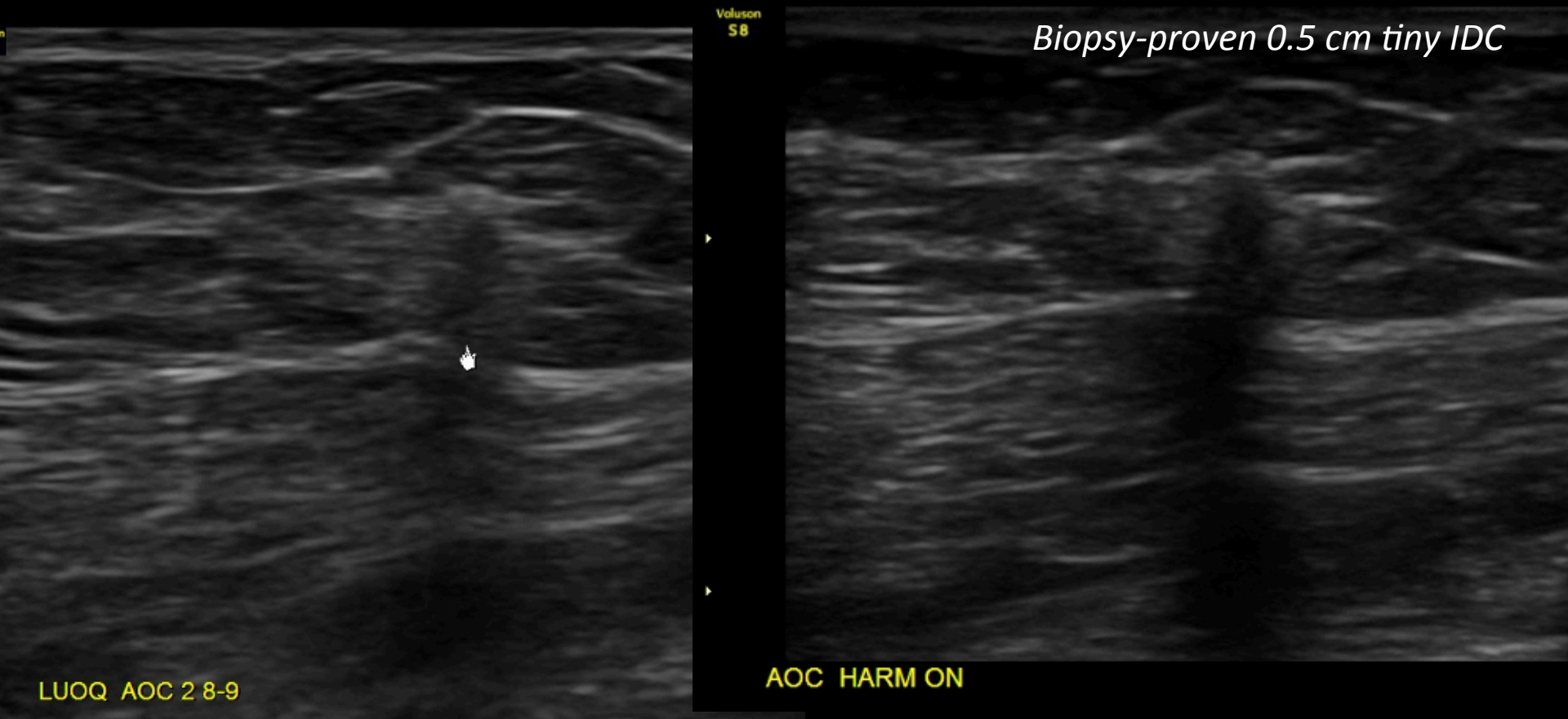


10 OCL 4 FN

*This is the same Indistinct hypoechoic lesion on all 3 images, by 3 different sonographers  
→ Papillary Carcinoma*

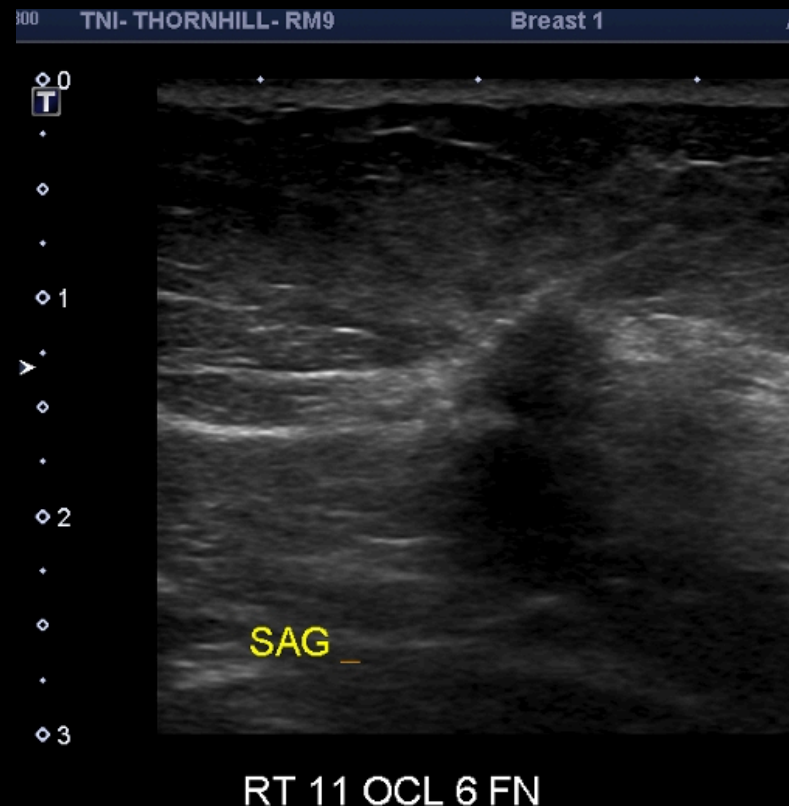
# Ultrasound Protocol/Technique

- Scan Breasts with **Harmonics on**



# Ultrasound Protocol/Technique

- Image Labelling
  - Clock face location
  - Distance (cm) from nipple
  - Transducer orientation
    - TR vs. SAG/ RAD vs. ANTIRAD



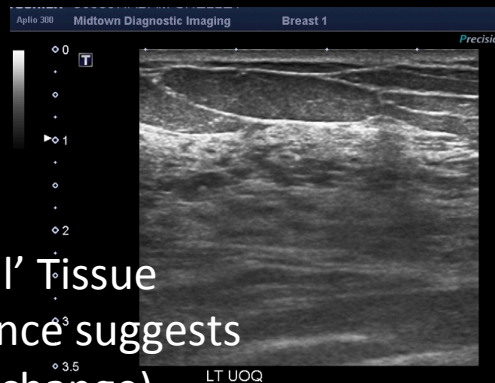
*Biopsy-proven IDC*

# Ultrasound Protocol/Technique

- If completely **Normal US**:

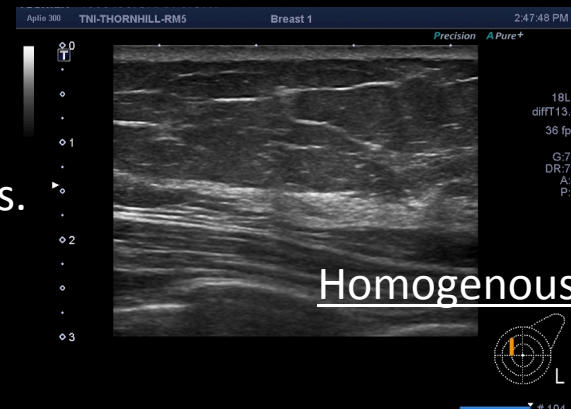
- Document representative image of
  - each quadrant
  - behind nipple
  - axilla (i.e. **minimum 12 images total for a negative US**)

- Shows radiologist **background breast parenchyma echotexture**



Heterogenous 'Normal' Tissue  
(cobblestone appearance<sup>3</sup> suggests  
underlying fibrocystic change)

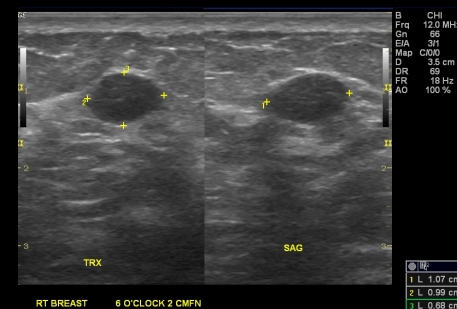
vs.



Homogenous Normal Tissue

# Ultrasound Protocol/Technique

- ANY findings?
- MEASURE:
- Obtain image WITHOUT and WITH calipers
- SIMPLE cyst – measure largest in each quadrant in 1 dimension
- Everything else:
  - measure in TWO ORTHOGONAL dimensions
  - Transverse & Sagittal / Radial & Antiradial
    - eg. Complicated cysts, Clustered microcysts, Solid masses, Solid & cystic masses, vague focal shadowing or distortion area

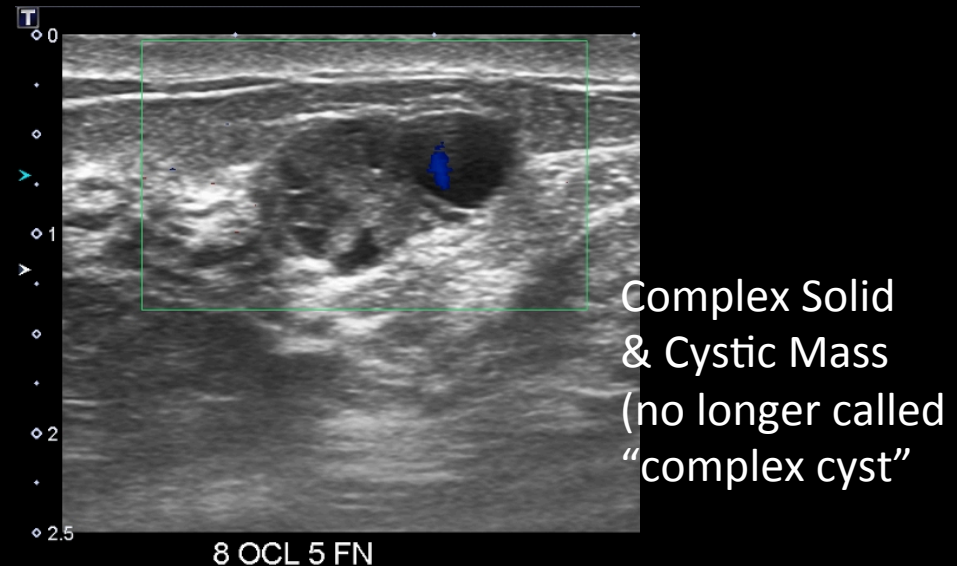
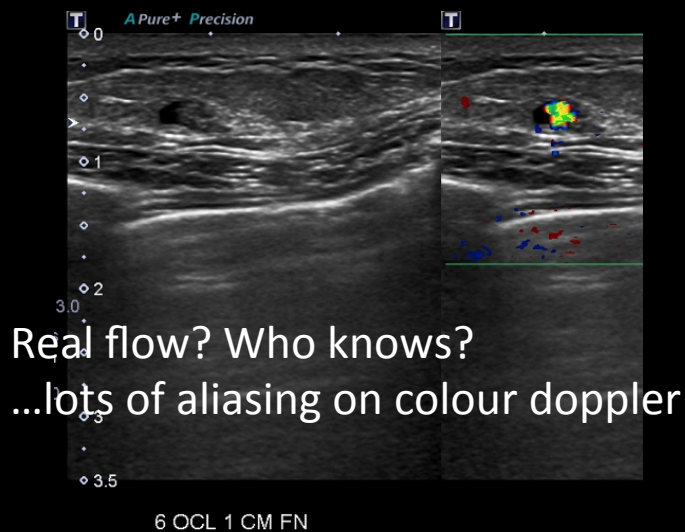




# Ultrasound Protocol/Technique

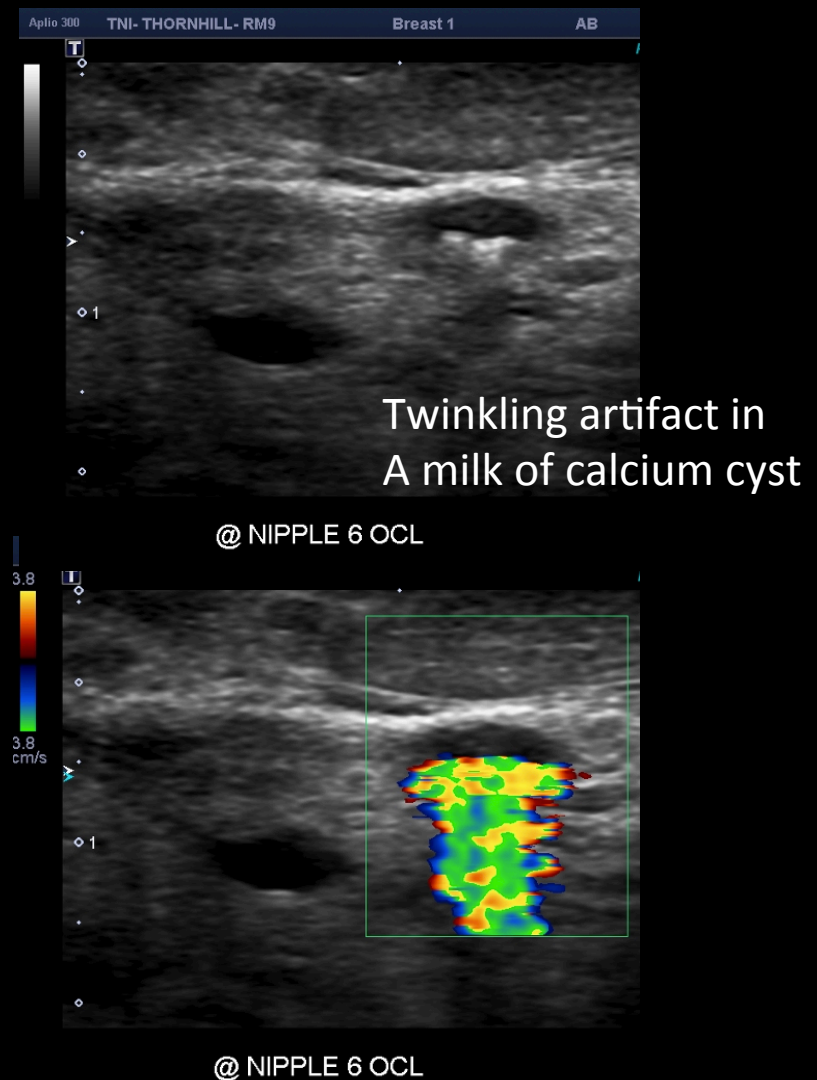
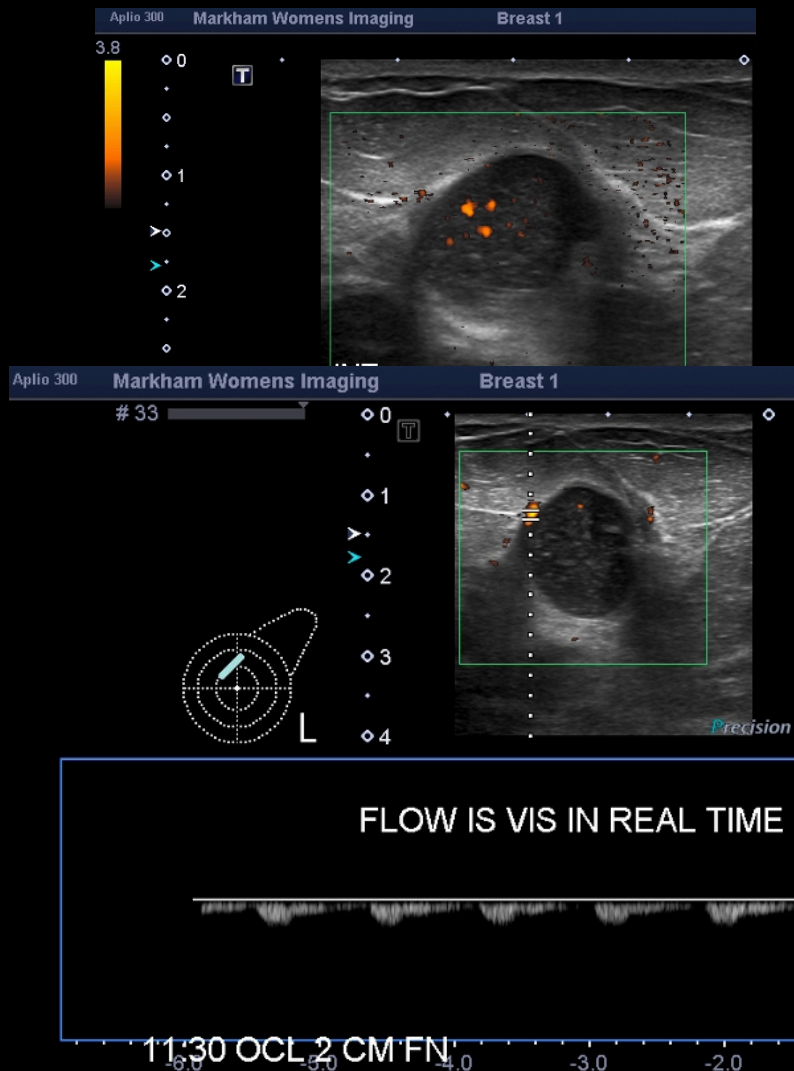
- Doppler

- Any finding besides a simple cyst
- If ANY Power or Colour Doppler signal,
  - OBTAIN A WAVEFORM/TRACING with pulse wave doppler to confirm true vascularity





# Colour Doppler Signal True Vascularity or Artifact?



# AOC: “Area of Clinical Concern”

- This is the **single most important thing** to demonstrate to the radiologist:

## –Lump?

- New vs longstanding?
- **Bloody** or **Clear** Nipple discharge?
- New Nipple inversion?
- New skin dimpling?



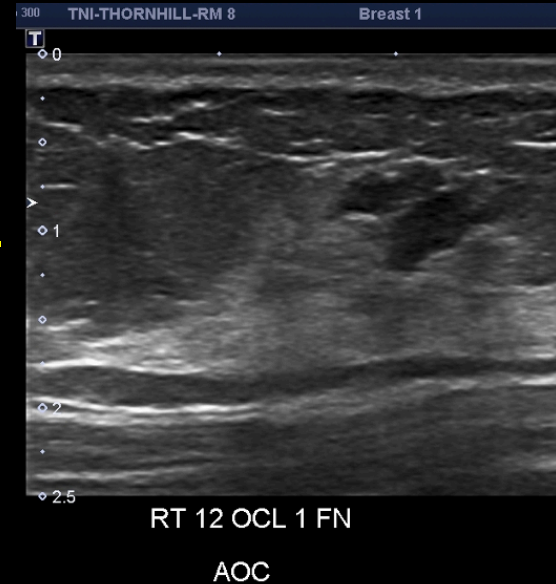
# AOC /Lump

- Obtain minimum 3-5 images in EACH plane of AOC

- Eg. 3-5 images in trans (or radial)
- 3-5 images in sagittal (or antiradial)
- If concern is nipple discharge obtain  
> 3-5 images of periareolar region

... **EVEN** if you don't notice anything abnormal

- Label as AOC or Lump on your images  
— (not just on tech sheet)



*Angular  
hypoechoic  
lesion  
correlating  
w/ lump =  
Fibroadenoma*

# BI-RADS US features

Shape:

Margins:

Orientation:

Posterior Features:

Other:

Clinical Features:

## Benign

- Oval, Round
- **Circumscribed**
- Parallel  
(aka wider-than-tall)
- Enhancement
- mobile, soft,  
longstanding lump  
or nipple inversion

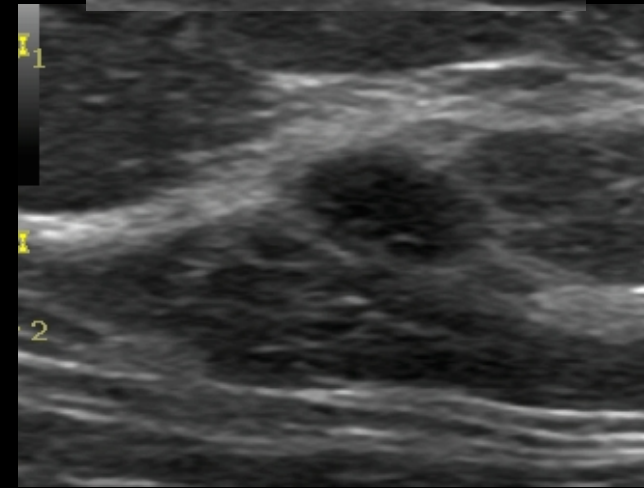
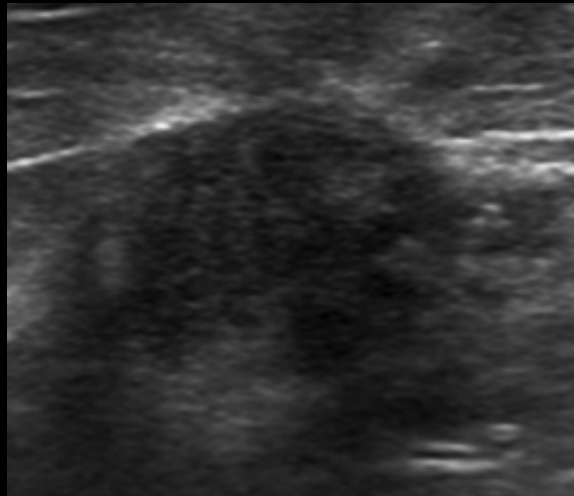
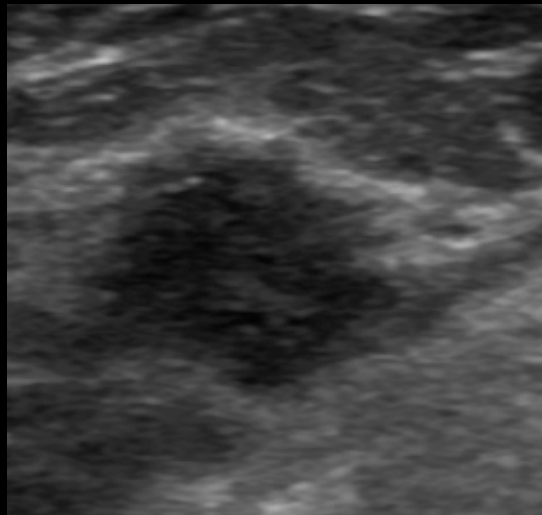
## Suspicious

- Irregular, Round
- **Noncircumscribed**
- Antiparallel  
(aka **Taller-than-wide**)
- **Shadowing**
- **Echog Halo, Microcalcs**  
Architectural Distortion
- **Firm, fixed, New lump,**  
**Skin tethering**

# Suspicious- Margins

- **Noncircumscribed** includes
  - Spiculated
  - Microlobulated
  - Angular
  - Indistinct

*IDCs in 4 different pts*

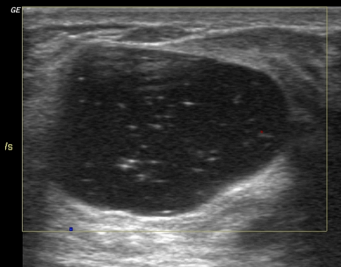


# Suspicious- Margins

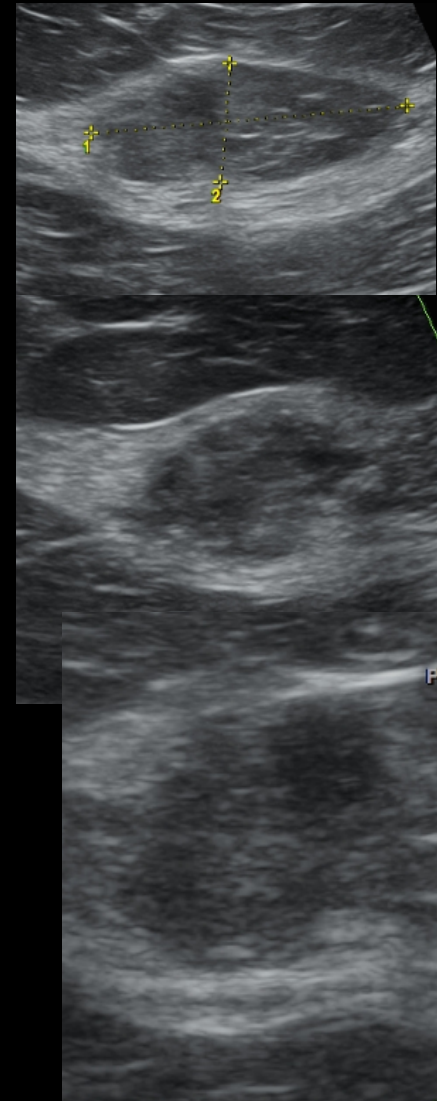
Therefore, take at least 3 - 5 images in both trans & sag if SOLID-appearing lesion to demonstrate margins adequately

...unless lesion is COMPLETELY oval & circumscribed on real-time imaging

eg. oval circumscribed fibroadenoma or obvious complicated cyst



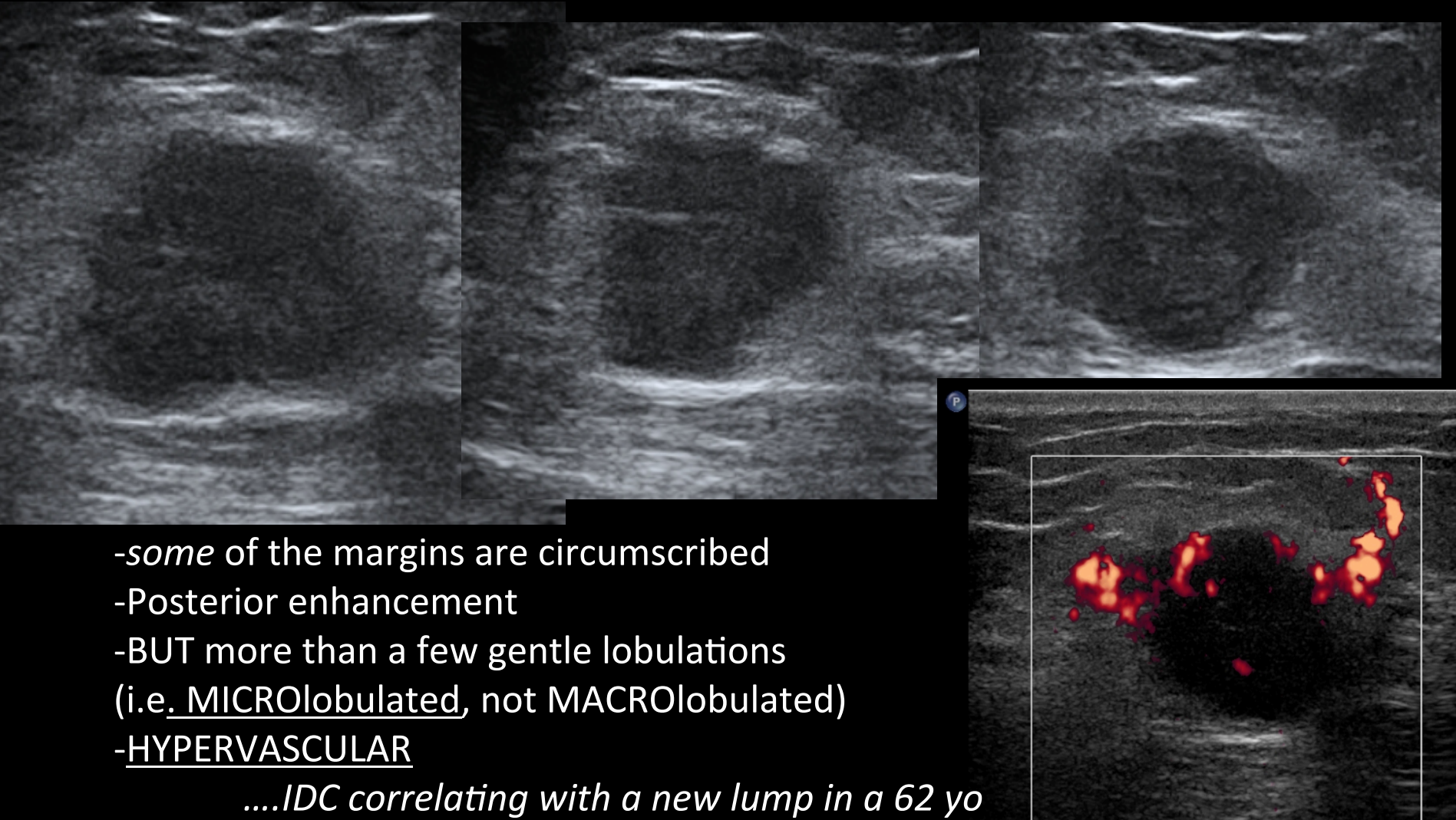
*Complicated cyst  
w circumscribed margins*



*These 3 images are  
all of the same lesion  
= Fibroadenoma*



- Use the SINGLE MOST SUSPICIOUS FEATURE allow you to make the correct diagnosis



# Cases

- All of the following are True North Imaging breast ultrasound examples

*[more to follow on [TNI intranet portal-Training](#)]*

- Unless obviously benign, all of the following are pathology-proven



# LEGEND:

IDC = Invasive ductal carcinoma

ILC = Invasive lobular carcinoma

DCIS = Ductal carcinoma in-situ

IDC NOS = IDC Not Otherwise Specified (the most common subtype of IDC)

LABC = Locally Advanced Breast Cancer (eg. >5 cm, Axillary lymph node matted/fixed metastases, skin or chest wall involvement, inflamm ca)

CBE = Clinical Breast Exam

BI-RADS –Breast Imaging Reporting and Data System – ACR standard for reporting breast imaging studies

BI-RADS0 (need additional imaging), BI-RADS1 (Normal),

BI-RADS2 (Benign), BI-RADS3 (Probably Benign), BI-RADS4a (low suspicion), BI-RADS 4b (moderate suspicion), BI-RADS 4c (moderate-to-high suspicion),

BI-RADS5 (highly suspicious >95% chance of cancer)

# Ready?

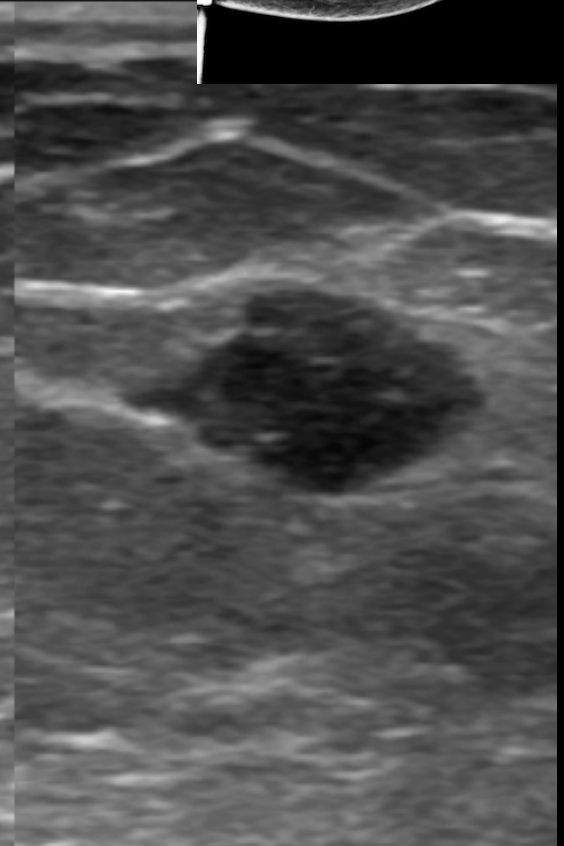
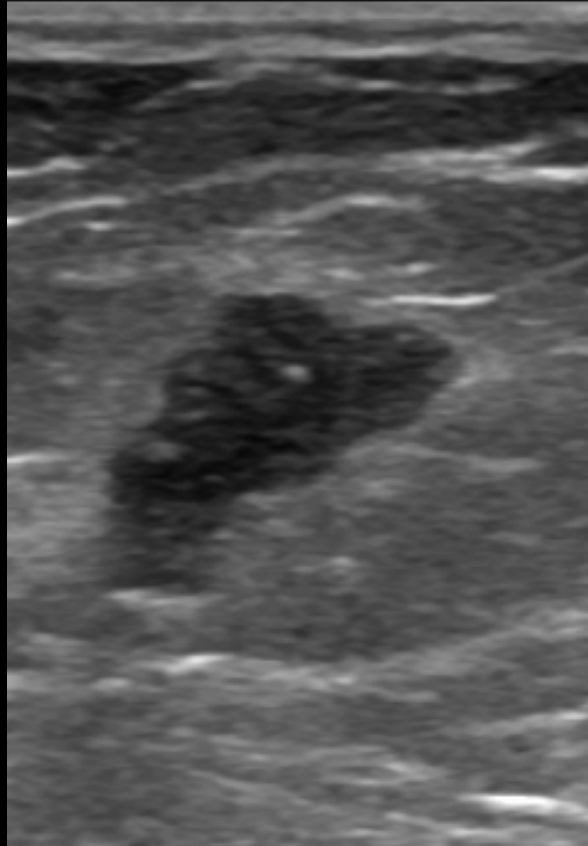
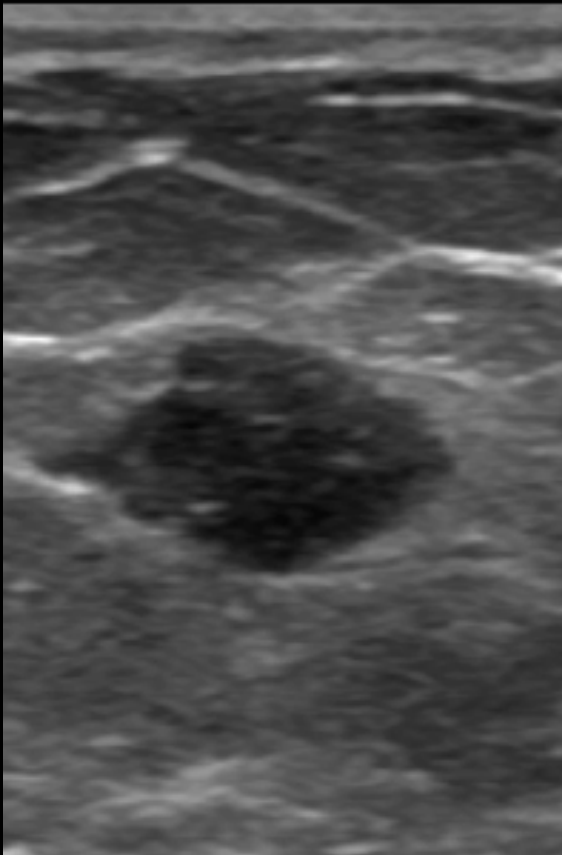
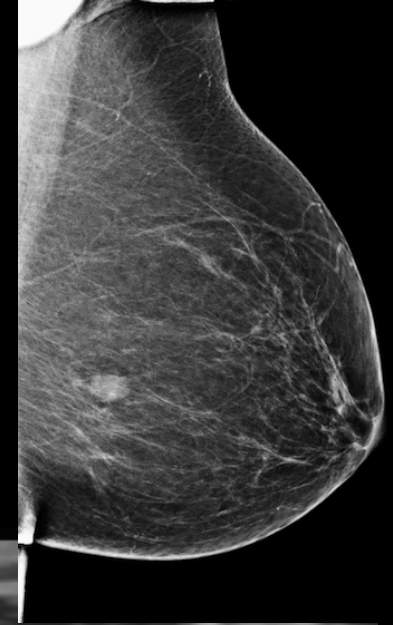
...Then Let's  
Diagnose some  
Breast Cancers!

...and try to avoid  
biopsying benign entities!



# CASE 1:

CLINICAL HISTORY: 72 yo F,  
recall from OBSP screening mammogram  
for new mass



# CASE 1:

## ULTRASOUND FEATURES:

*Margins:* Microlobulated

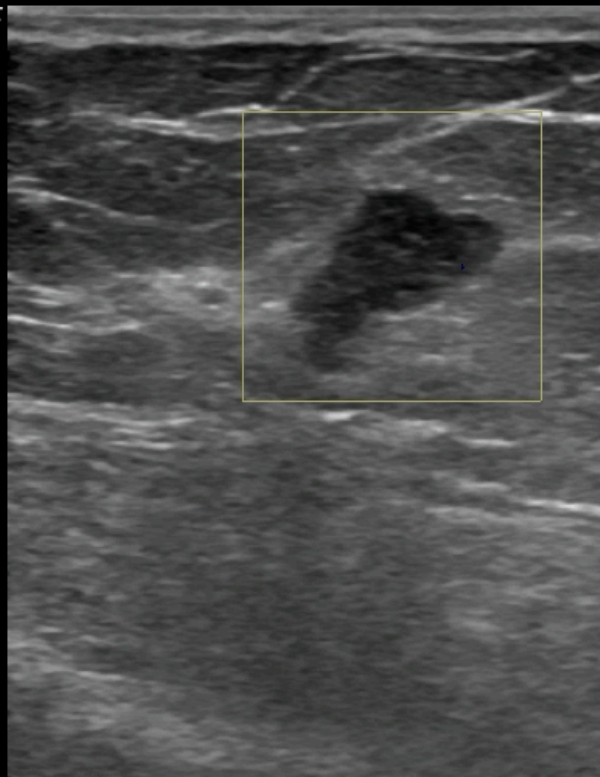
*Shape:* Oval, slightly Irregular

*Orientation:* Taller-than-Wide in 1 portion

*Echogenicity:* Hypoechoic

*Posterior Features:* No shadowing or enhancement

*US Final Assessment:* BI-RADS4b or c



9 O'CLOCK

5 CMFN

## INTERPRETATION:

New microlobulated taller-than-wide solid mass in a 72 yo raises level of suspicion to BI-RADS5

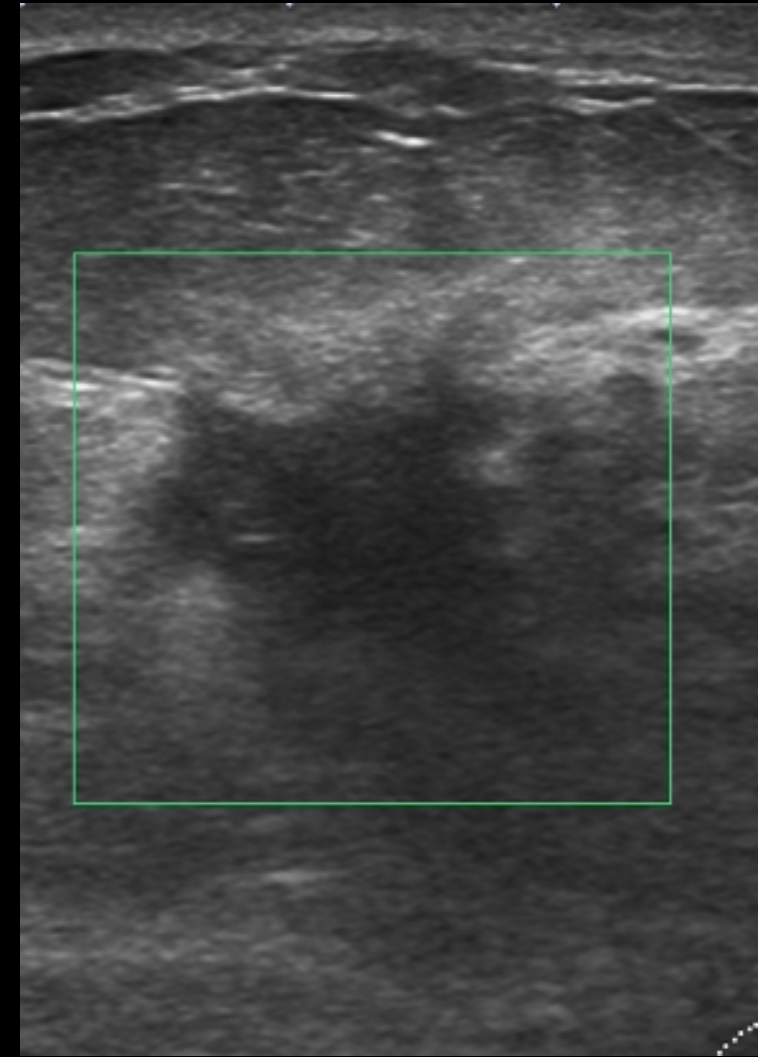
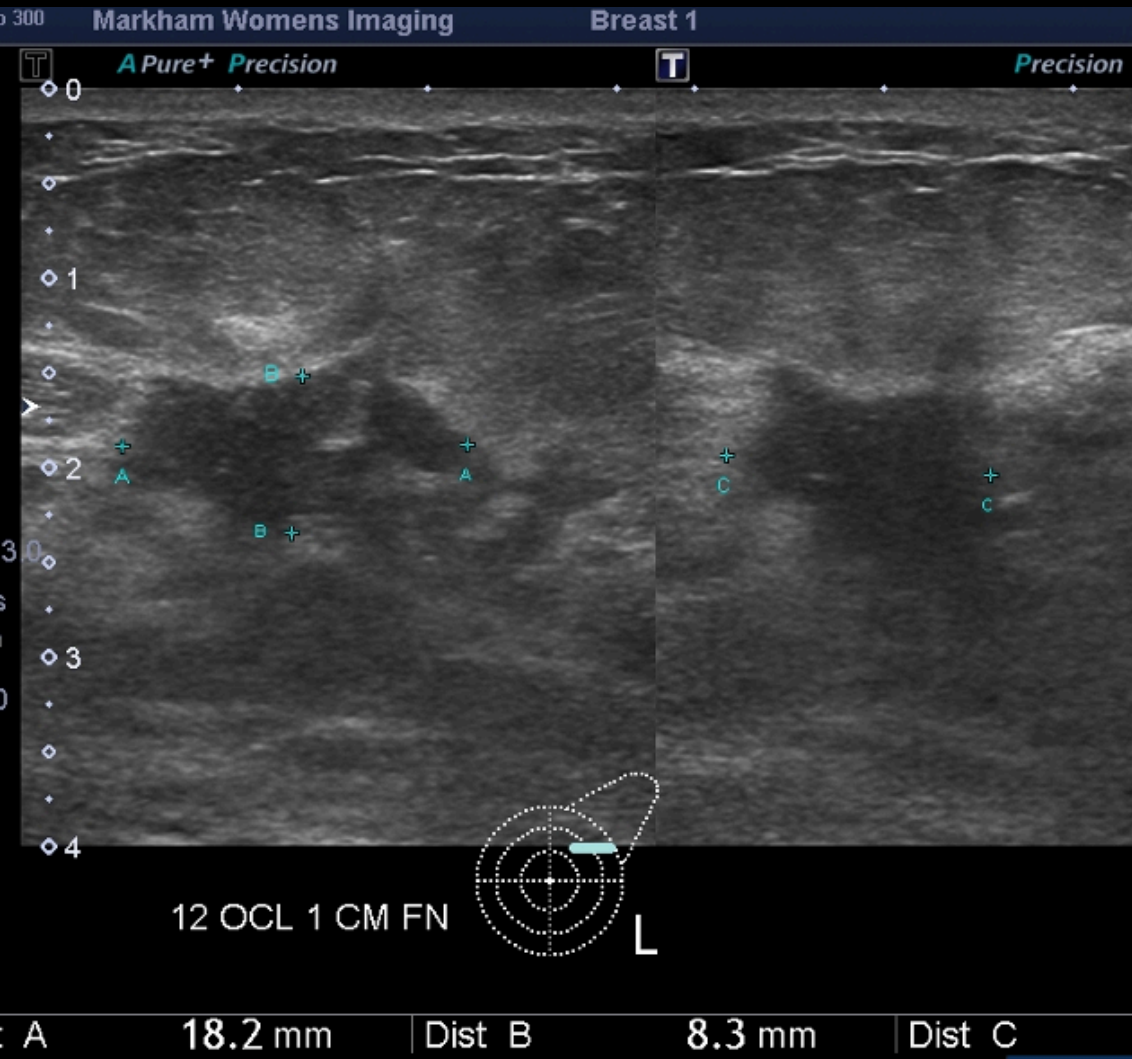
**PATHOLOGY:** Papillary Carcinoma

**LEARNING POINT:** Beware New solid masses in pts >50yo

-Go with Single most suspicious feature (taller-than-wide)

# CASE 2:

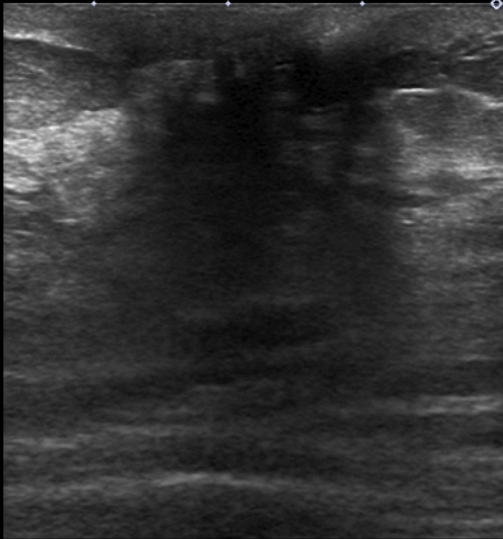
CLINICAL HISTORY: 46 yo F, clinical req: 'breast engorgement & fullness'.  
Pt tells you she has noticed a R breast lump x 1 mo, partial nipple inversion  
& sensation of her "breast shrinking"



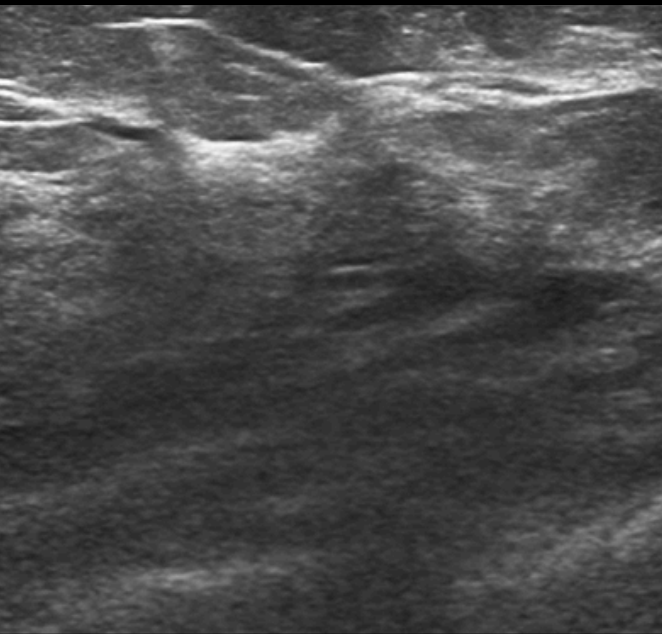


T

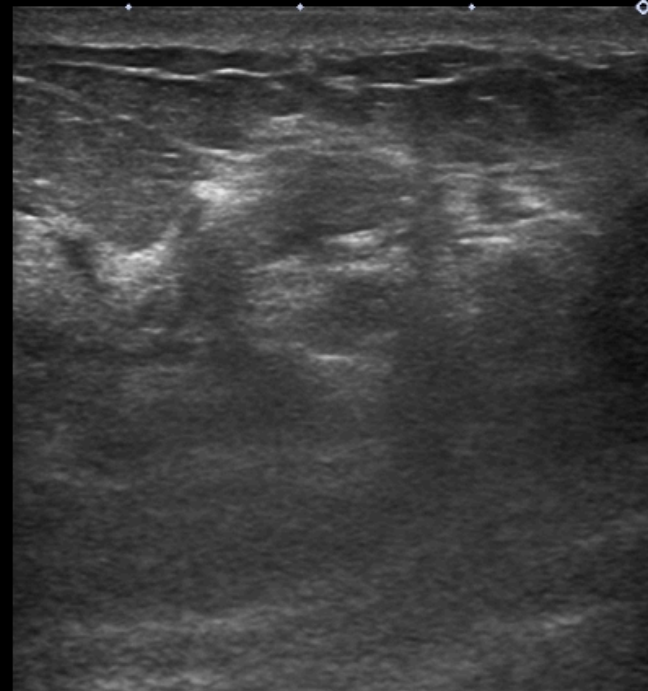
Precision A Pure+



These are images of behind the ipsilateral R nipple  
and randomly of quadrants elsewhere throughout  
Both breasts



d

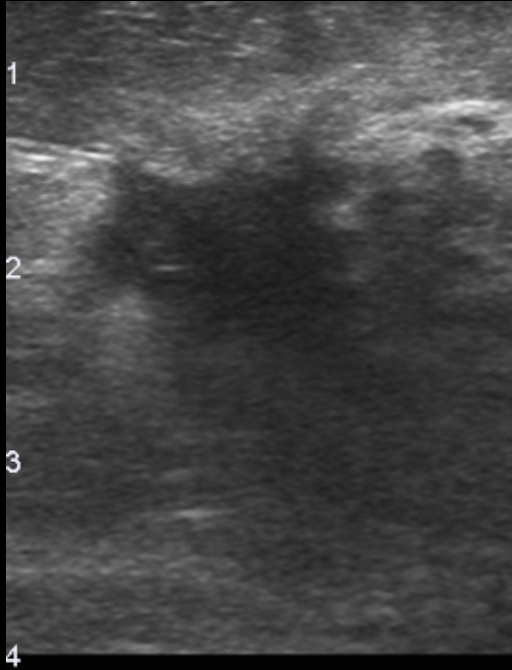


Precision A Pure+

di



## CASE 2:



12 OCL 1 CM FN

- ULTRASOUND FEATURES:
- *Margins:* Spiculated
- *Shape:* Irregular
- *Orientation:* Mostly Wider-than-Tall
- *Echogenicity:* Hypoechoic,
  - w/ internal calcs (echogenic foci)
- *Posterior Features:* Shadowing
- *Other:* Architectural Distortion
- *US Final Assessment:* BI-RADS5

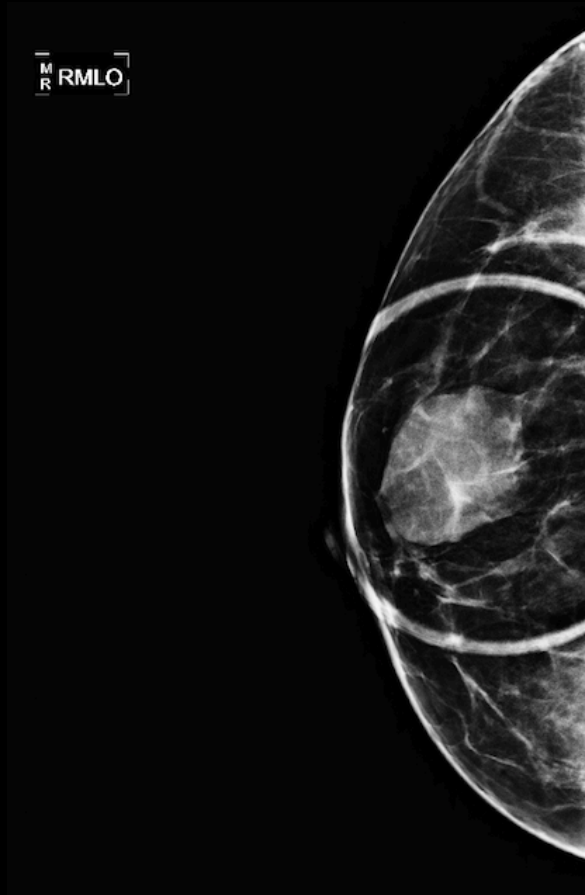
INTERPRETATION: 46 yo w/ spiculated shadowing solid mass correlating with a new breast lump → BI-RADS5, Rec Biopsy

PATHOLOGY: L IDC w/ lobular features & multiple periareolar enhancing nodules on MRI

LEARNING POINT: Many classic malignancy features

## CASE 3:

CLINICAL HISTORY: 41 yo F, baseline routine screening,  
clin req: “palpable areas of dense tissue clinically”

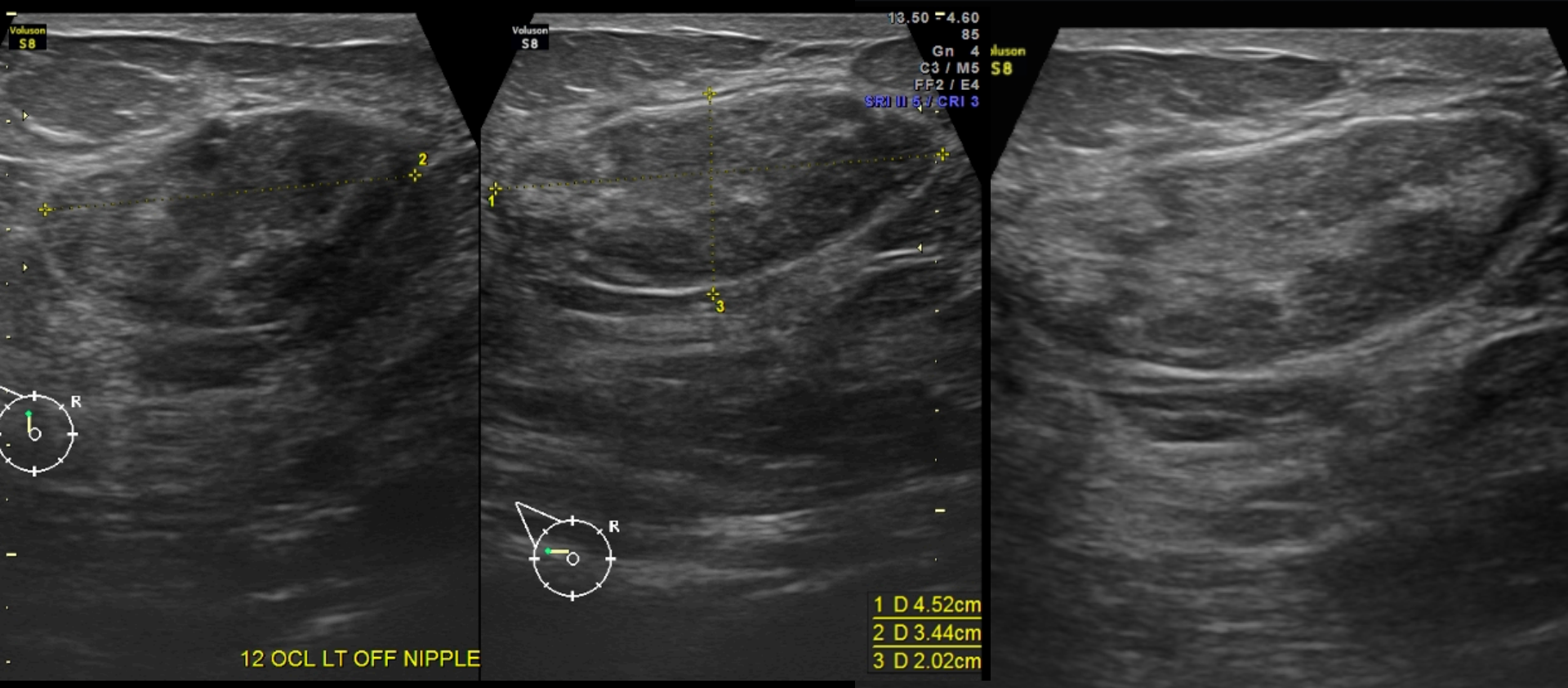


Mammo – 4.7 cm  
R retroareolar mass

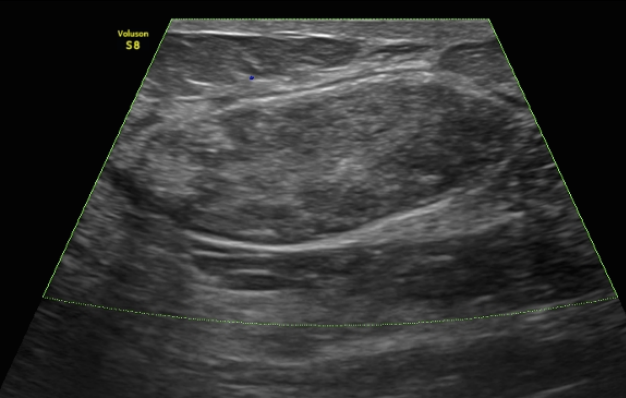
Initial TNI US tech sheet:  
“Negative Bilat US”



We recall the patient for spot compression views & targeted R periareolar second-look ultrasound



# CASE 3:



- ULTRASOUND FEATURES:
- *Margins:*       **Circumscribed**
- *Shape:*         **Oval**
- *Orientation:*   **Parallel**
- *Echogenicity:* **Mixed Echogenicity**
- *Posterior Features:* **None**
- *US Final Assessment:*   **BI-RADS2**

INTERPRETATION: 41 yo w/ circumscribed oval solid partially echogenic-partially isoechoic mass w/ internal fat demonstrated on mammo → BI-RADS2

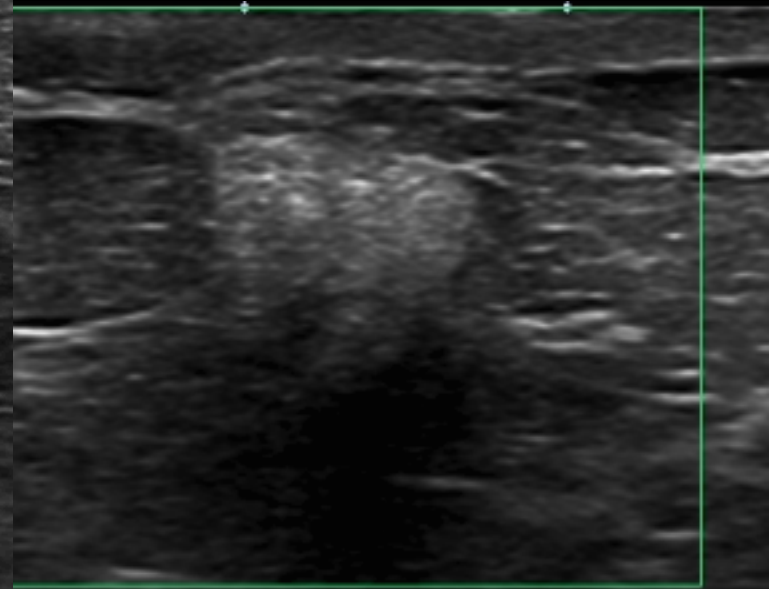
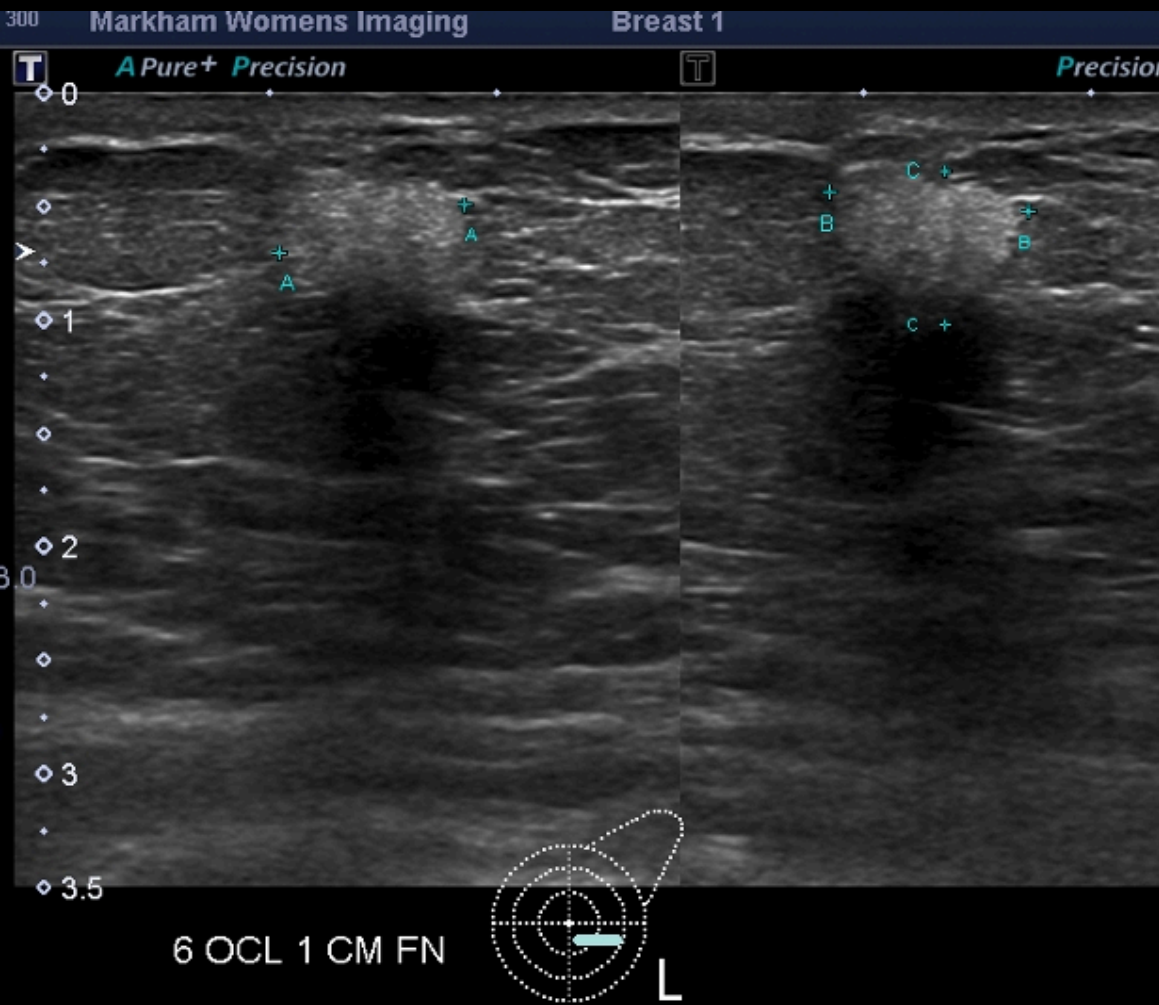
PATHOLOGY: **Hamartoma (benign)**

LEARNING POINT:

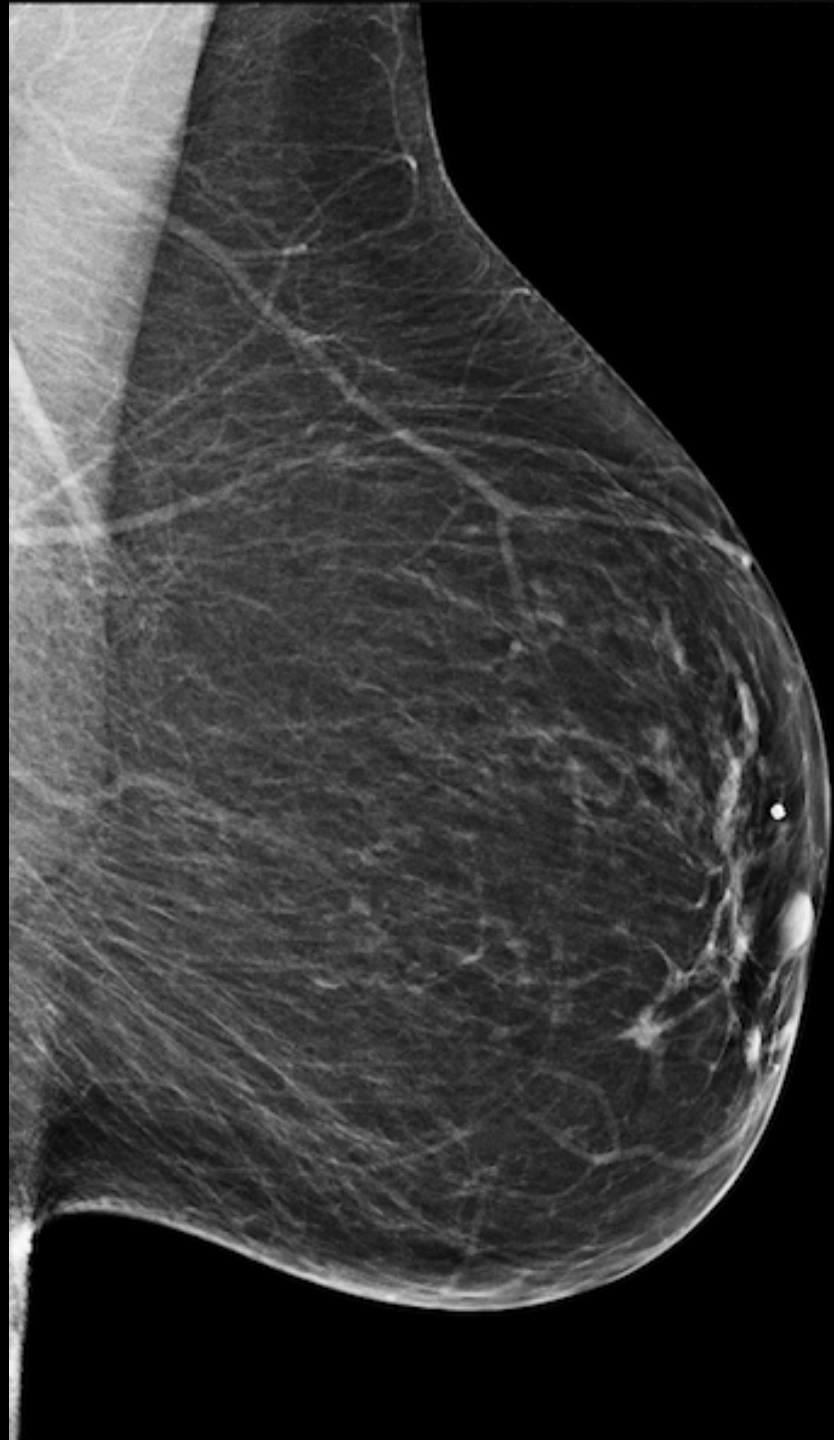
**Note the Mass Effect/Architectural distortion from this 4.5 cm mass**

# CASE 4:

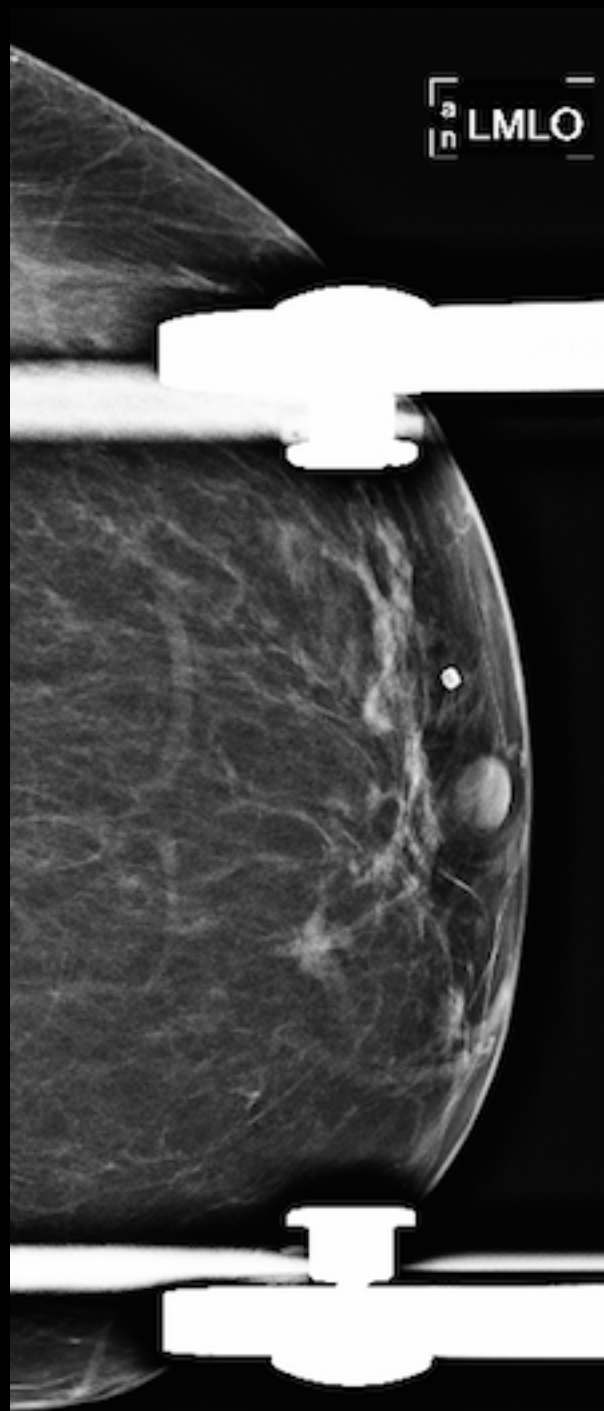
CLINICAL HISTORY: 61 yo F, recall from OBSP,  
no clinical breast concerns



A	8.5 mm	Dist B	8.8 mm	Dist C
---	--------	--------	--------	--------

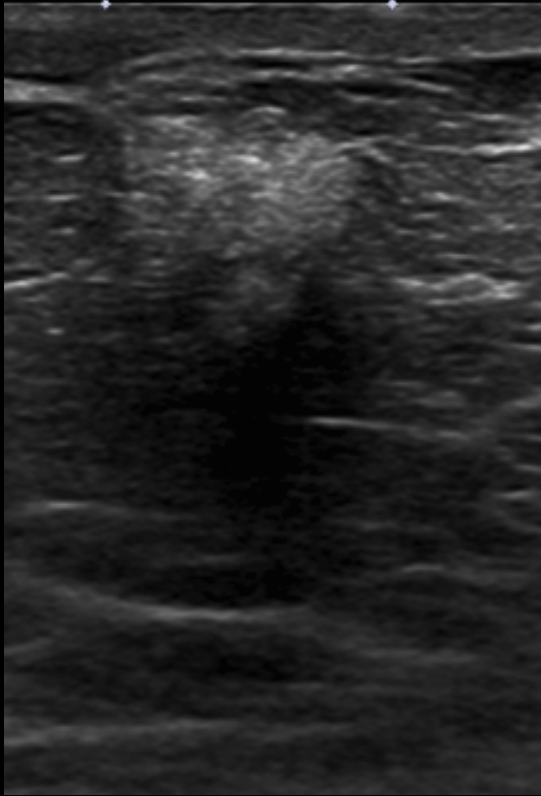


b  
LMLO



a  
LMLO

# CASE 4:



- ULTRASOUND FEATURES:
- *Margins:*       **Microlobulated**
- *Shape:*         **Oval, slighty Irregular**
- *Orientation:*   **Parallel**
- *Echogenicity:*   **Echogenic**
- *Posterior Features:* **Shadowing**
- *US Final Assessment:*   **BI-RADS4b**

INTERPRETATION: Microlobulated Echogenic Solid Mass w/ Prominent shadowing, since newly seen as a spiculated mass w/ architectural distortion on mammo in a 61 yo → BI-RADS5 (DDX=fat necrosis if appropriate hx eg. trauma, surgery)

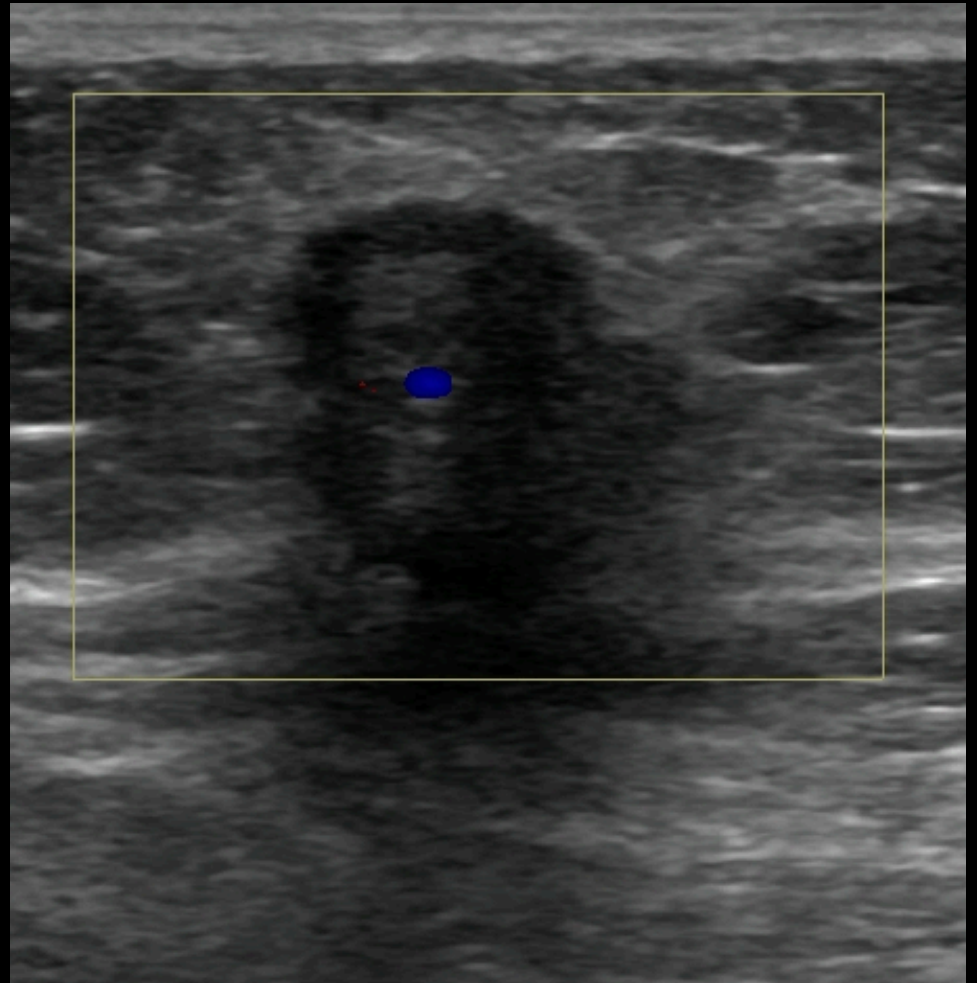
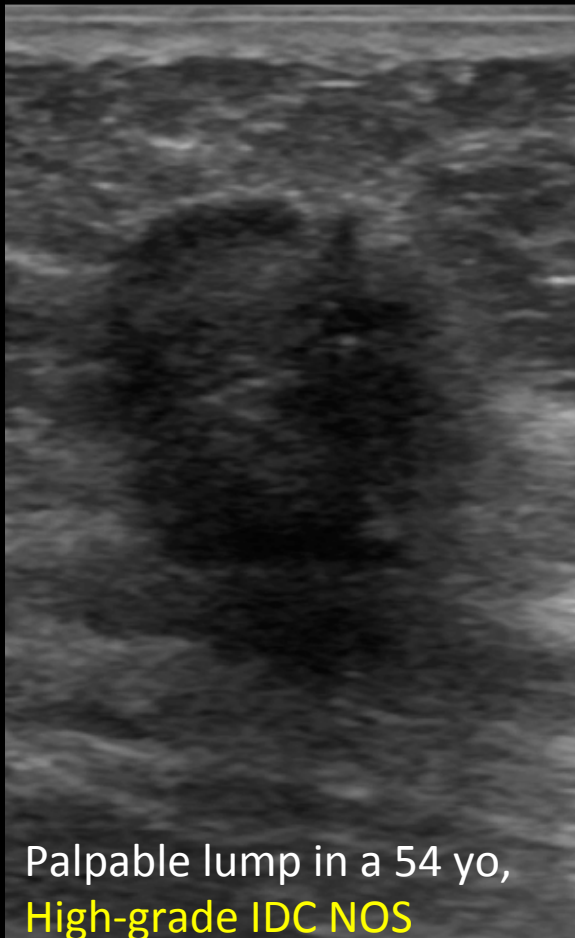
PATHOLOGY: **IDC + DCIS**

LEARNING POINT: **Beware New solid Lesions in pts >50yo**

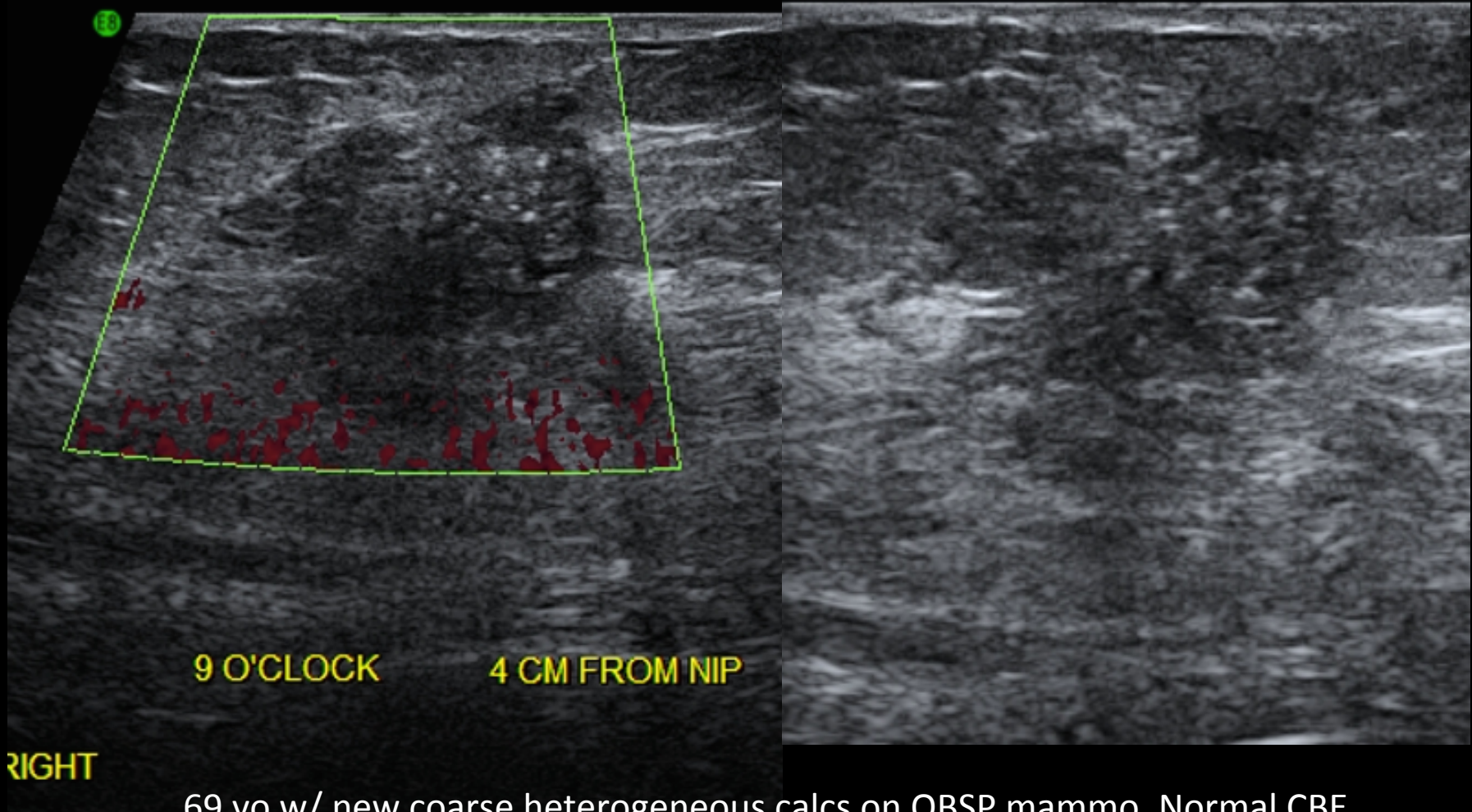
-Go with **Single most suspicious feature** (shadowing, microlob margins)



# More eggs of Cancers w/ echogenic internal areas

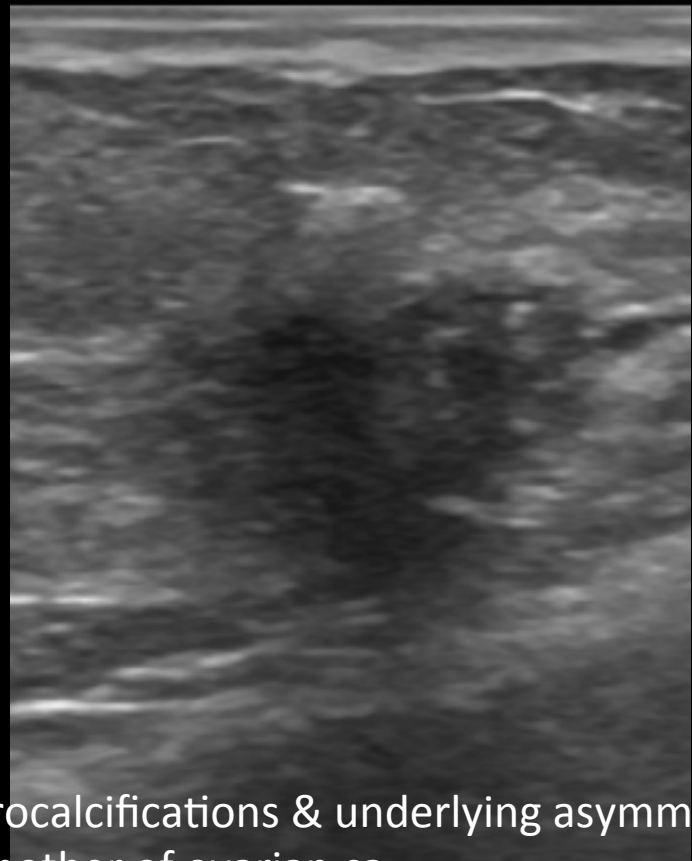
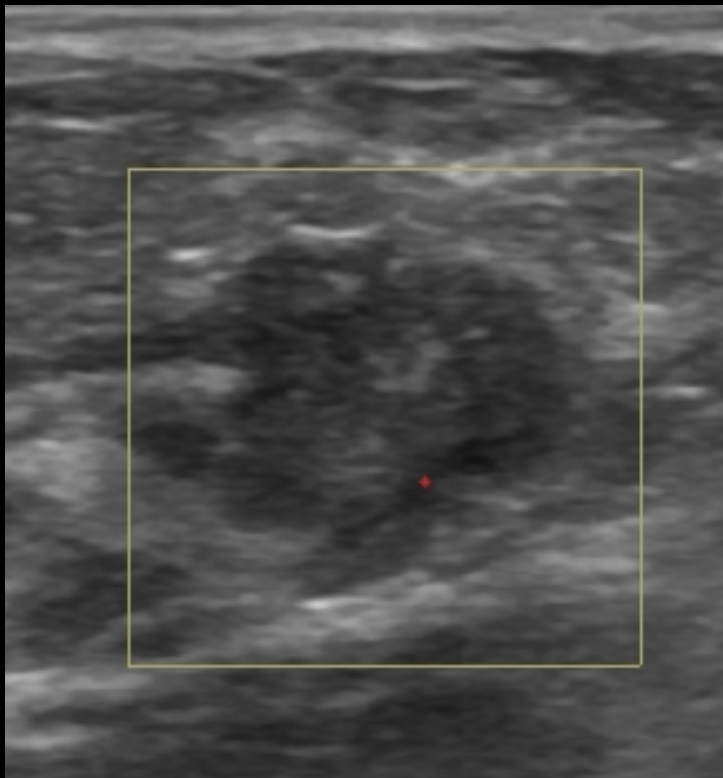


# More eggs of Cancers w/ echogenic internal areas



69 yo w/ new coarse heterogeneous calcs on OBSP mammo, Normal CBE,  
→ 2.2 cm DCIS Gr3 2 foci microinvasion <1 mm

# More eggs of Cancers w/ echogenic internal areas



45 yo, recall from screening mammo for microcalcifications & underlying asymmetry,  
Family Hx in paternal aunt of breast ca & in mother of ovarian ca

→ IDC



# More eggs of Cancers w/ echogenic internal areas

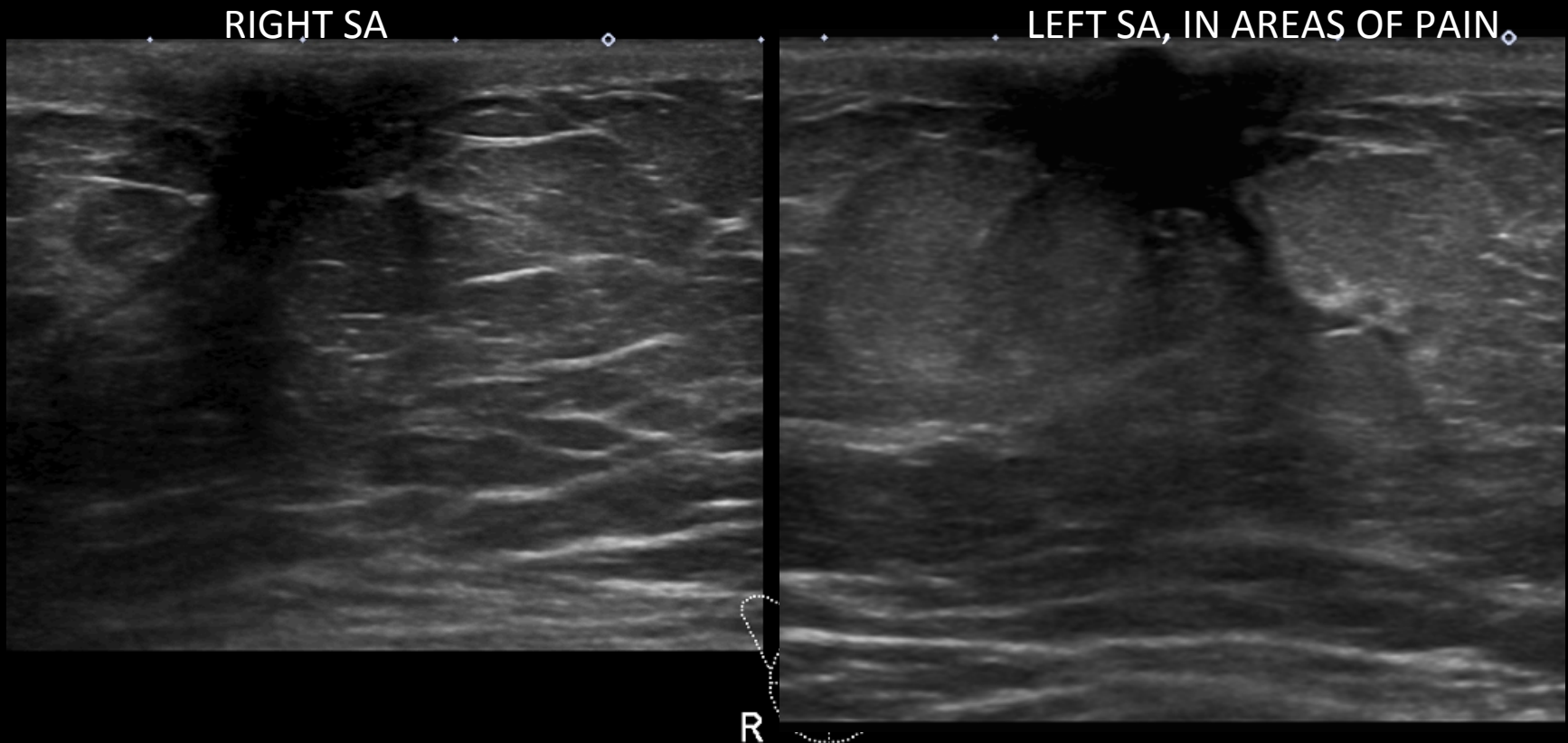


33 yo F breastfeeding, lump,  
1.7 cm microlobulated hypoechoic solid mass w/ internal echogenic foci  
→ Gr 2 IDC + DCIS w/ lymphovascular invasion & 3/5 sentinel LN mets

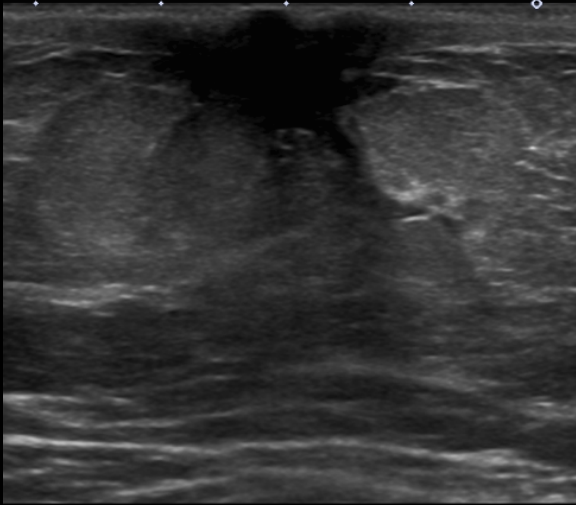


## CASE 5:

CLINICAL HISTORY: 35 yo M, clin req: "bil breast tenderness, ?cyst",  
pt report bil L > R periareolar pain x 2 mo, Fhx of Breast ca in Mother



# CASE 5:



- ULTRASOUND FEATURES:
- *Margins:* Noncircumscribed
- *Shape:* Irregular, “Flame-shaped”
- *Orientation:* Parallel
- *Echogenicity:* Hypoechoic
- *Posterior Features:* Some shadowing
- *US Final Assessment:* BI-RADS2

INTERPRETATION: Bilateral Left > Right flame-shaped hypoechoic solid tissue extending directly posteriorly from both nipples c/w Gynecomastia → BI-RADS2.

A mammogram could be performed for confirmation (if older)

PATHOLOGY: Gynecomastia

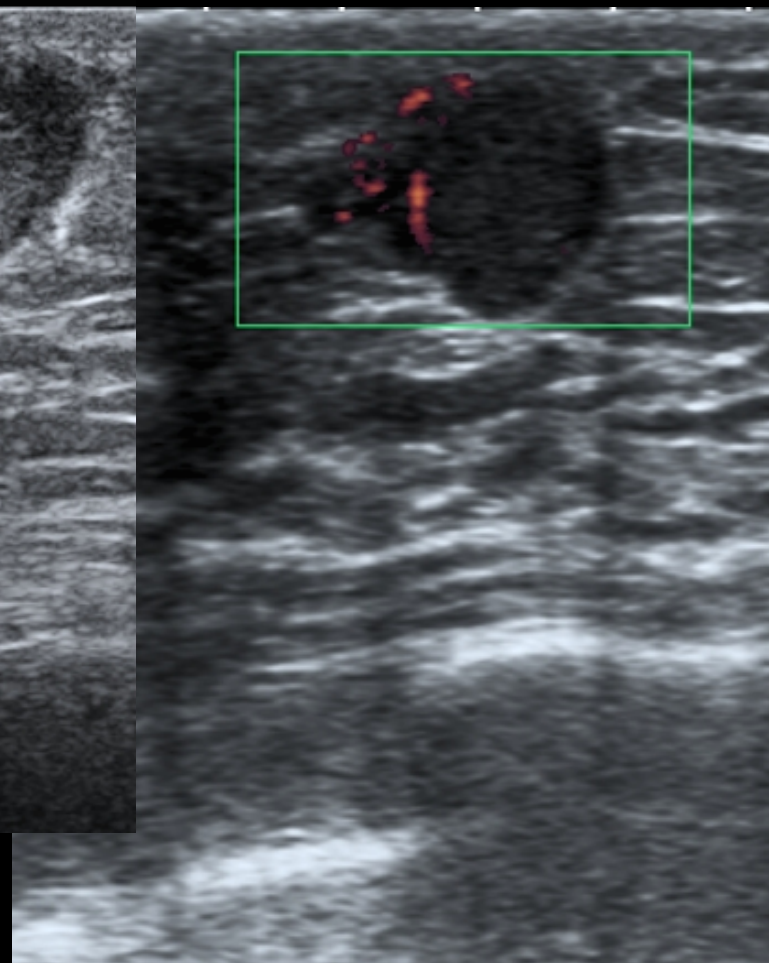
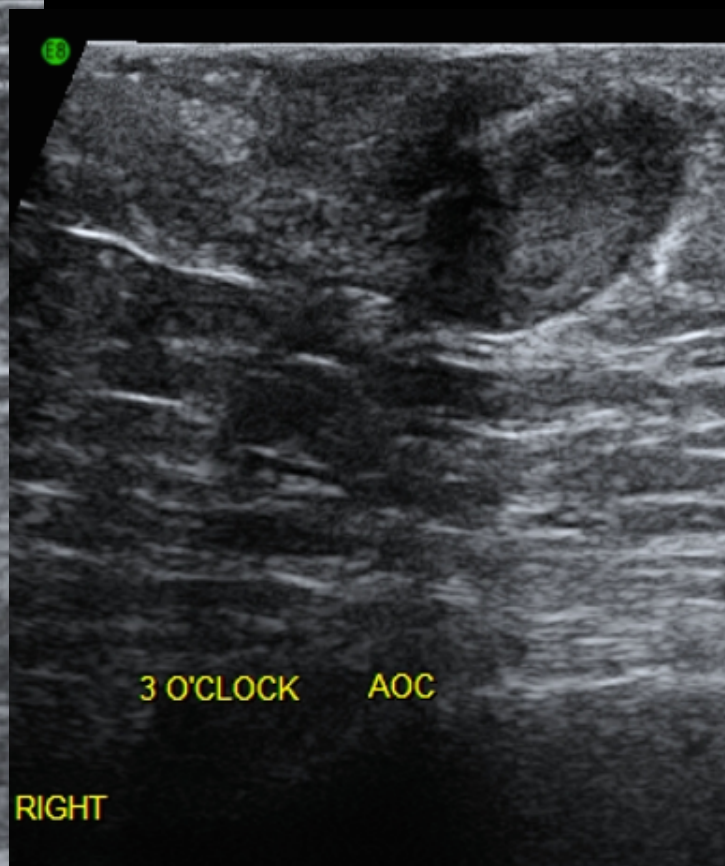
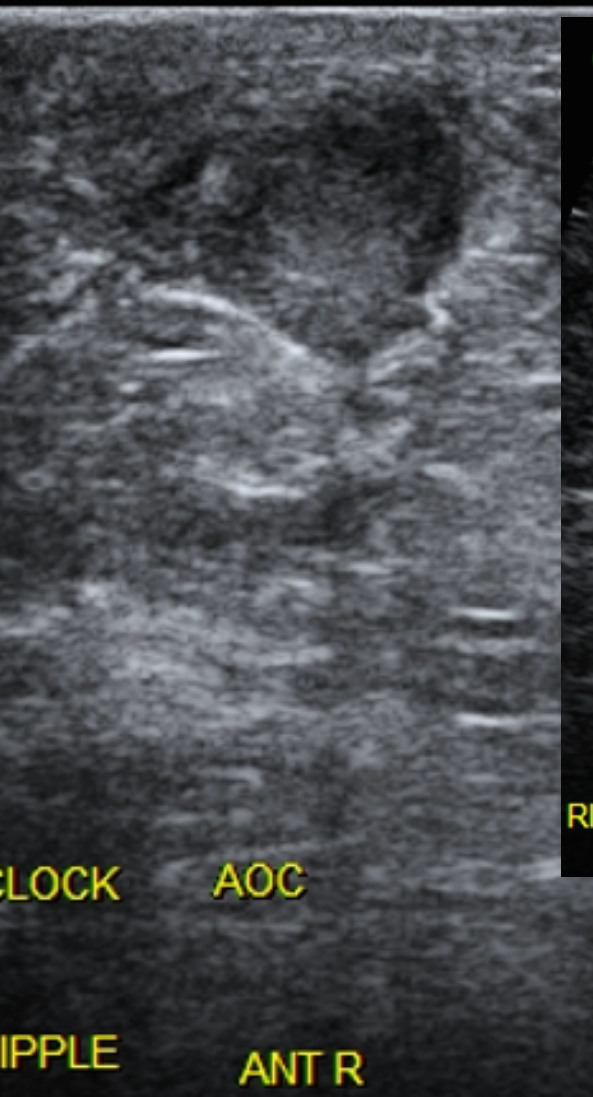
LEARNING POINT: Hypoechoic tissue **MUST** extend **DIRECTLY** from the nipple, without any eccentric mass

7/1940      SP10-16-D/SM I  
3.3cm / 1.1 / 521

## CASE 6:

### CLINICAL HISTORY:

74 yo M, R periareolar mass x 1 mo without pain

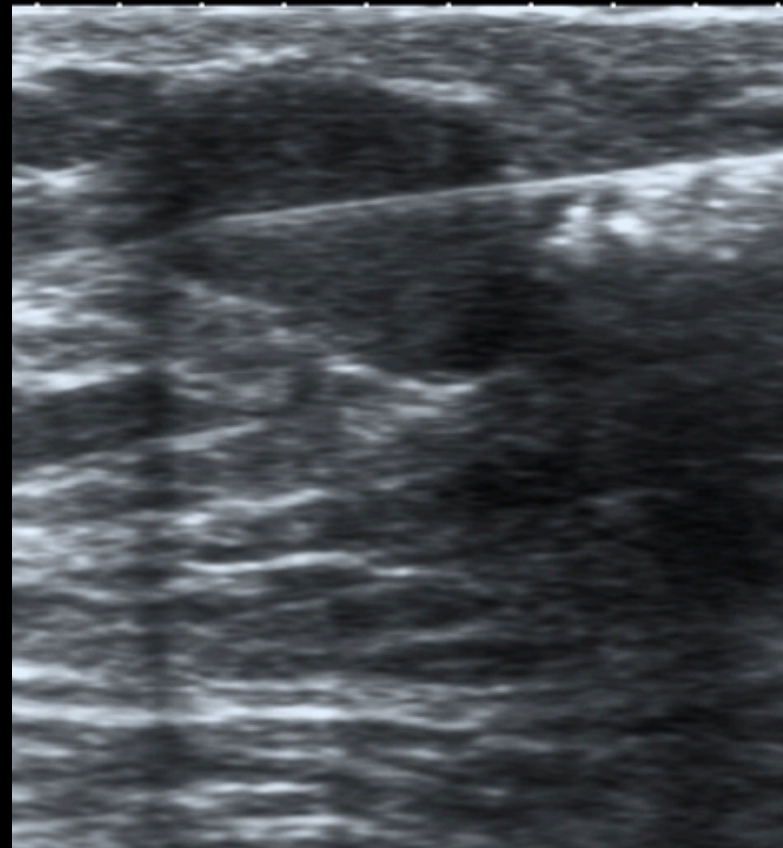
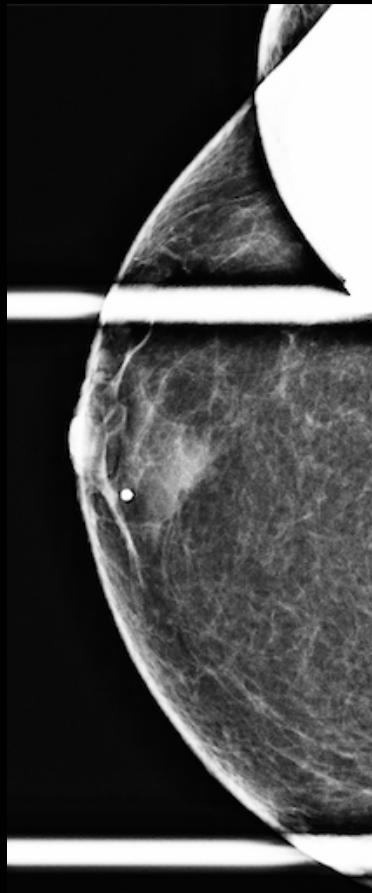
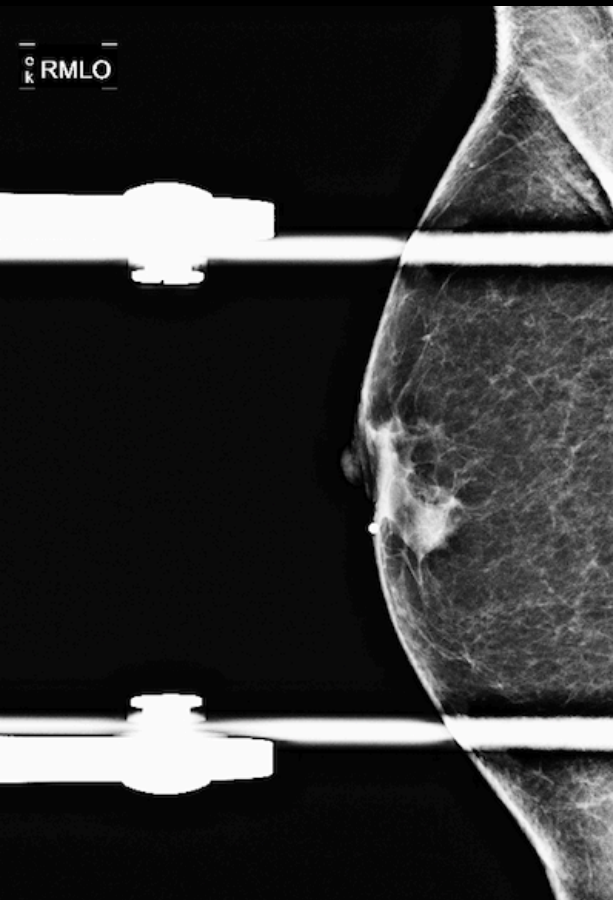




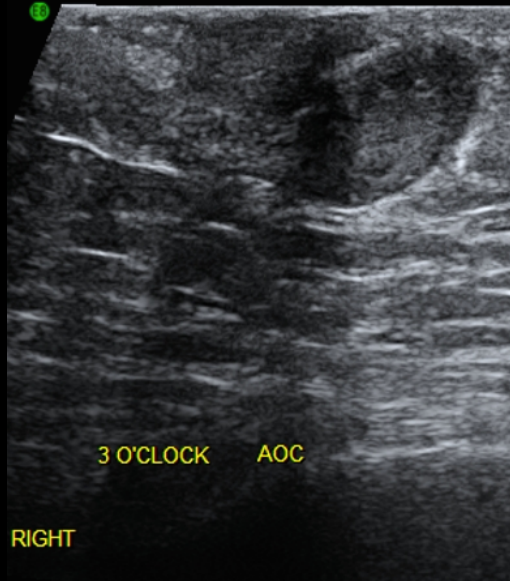
# CASE 6:

## CLINICAL HISTORY:

74 yo M, R periareolar mass x 1 mo without pain



# CASE 6:



- ULTRASOUND FEATURES:
- *Margins:*       Circumscribed
- *Shape:*         Oval
- *Orientation:*   Parallel
- *Echogenicity:*   Hypoechoic
- *Posterior Features:* No shadowing or enhancement
- *US Final Assessment:*   BI-RAD4C

INTERPRETATION: 74 yo M w/ hypoechoic solid mass eccentrically located periareolar → BI-RADS4C

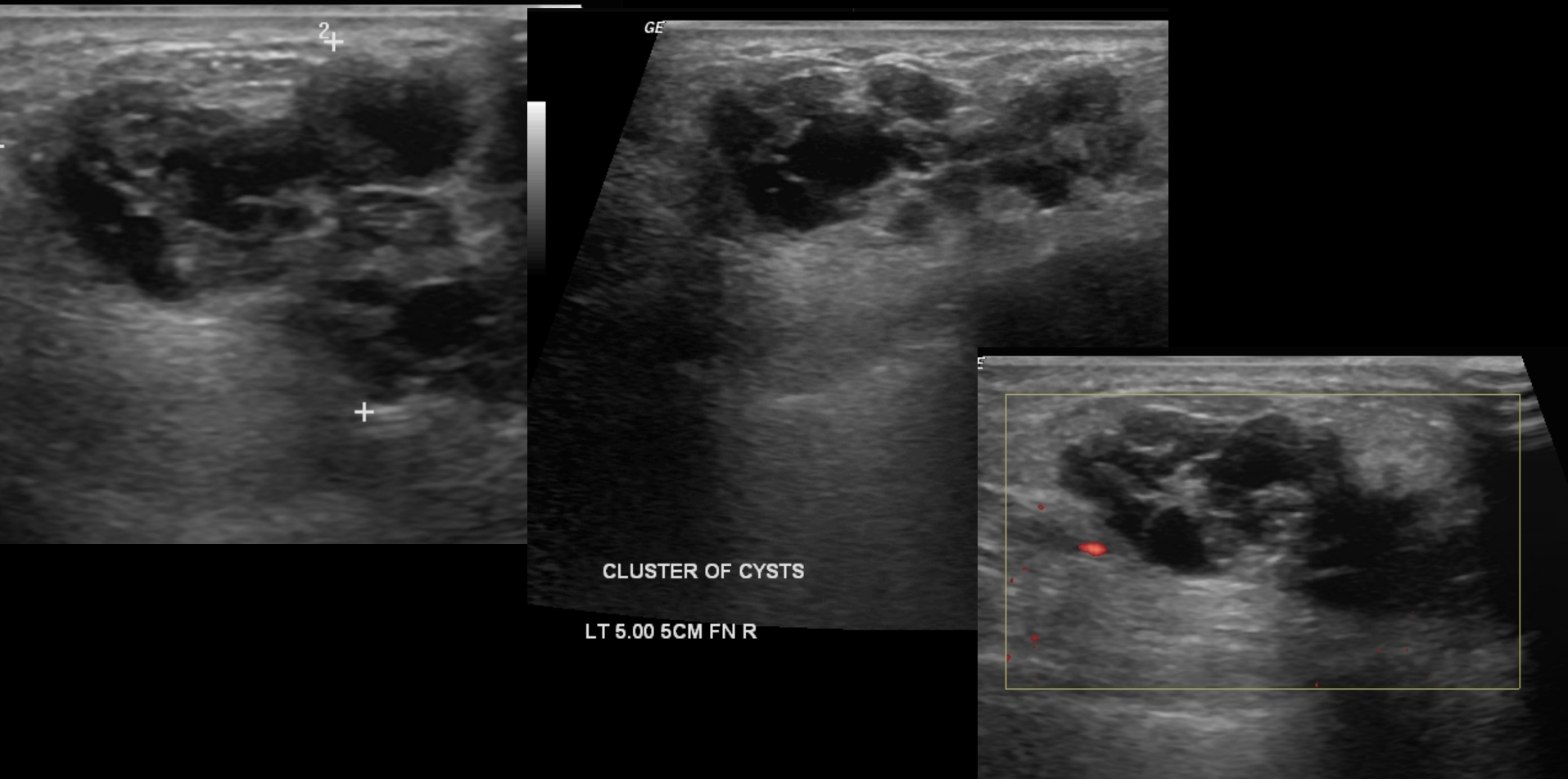
PATHOLOGY: Gr 2 IDC NOS

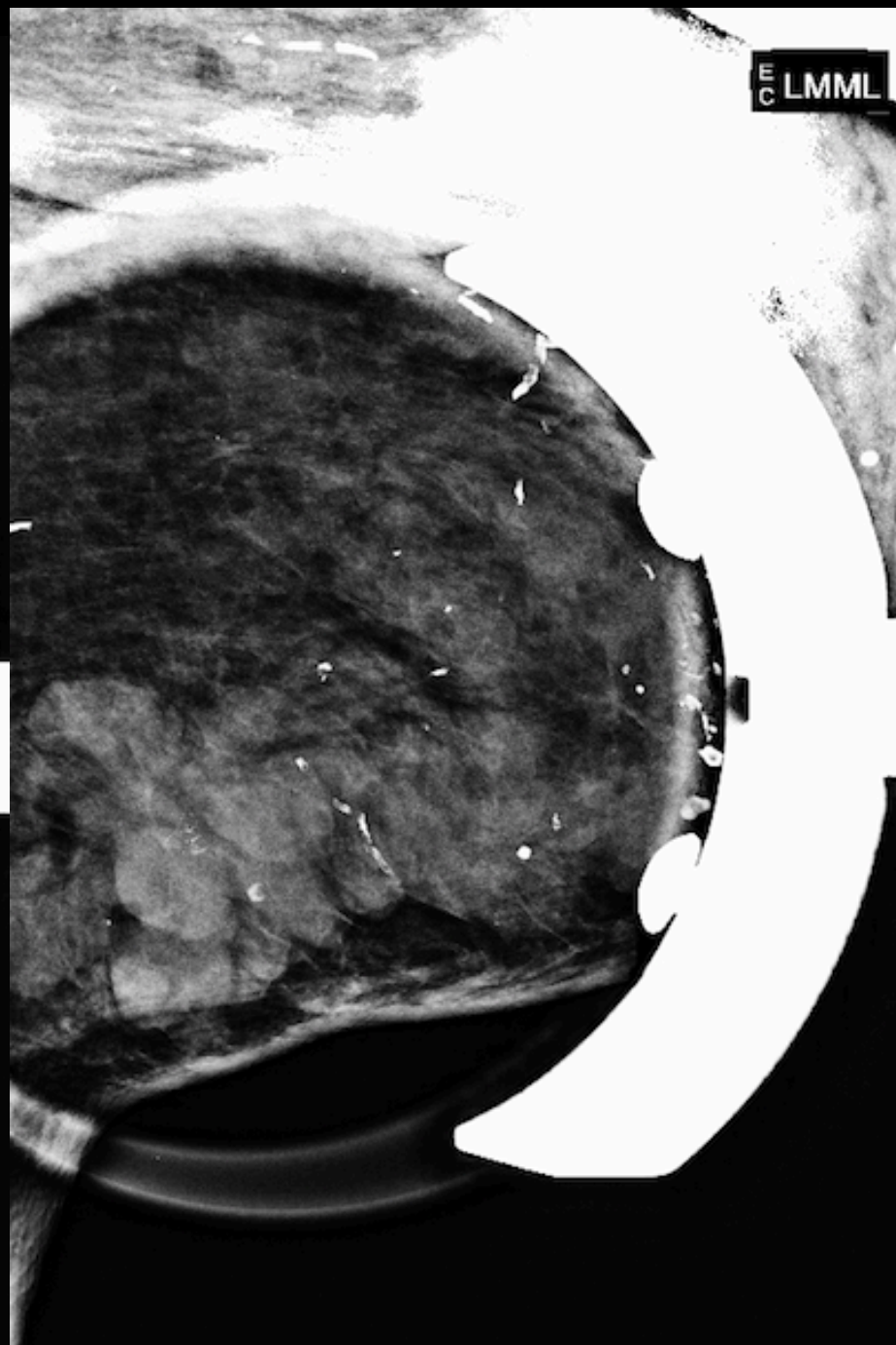
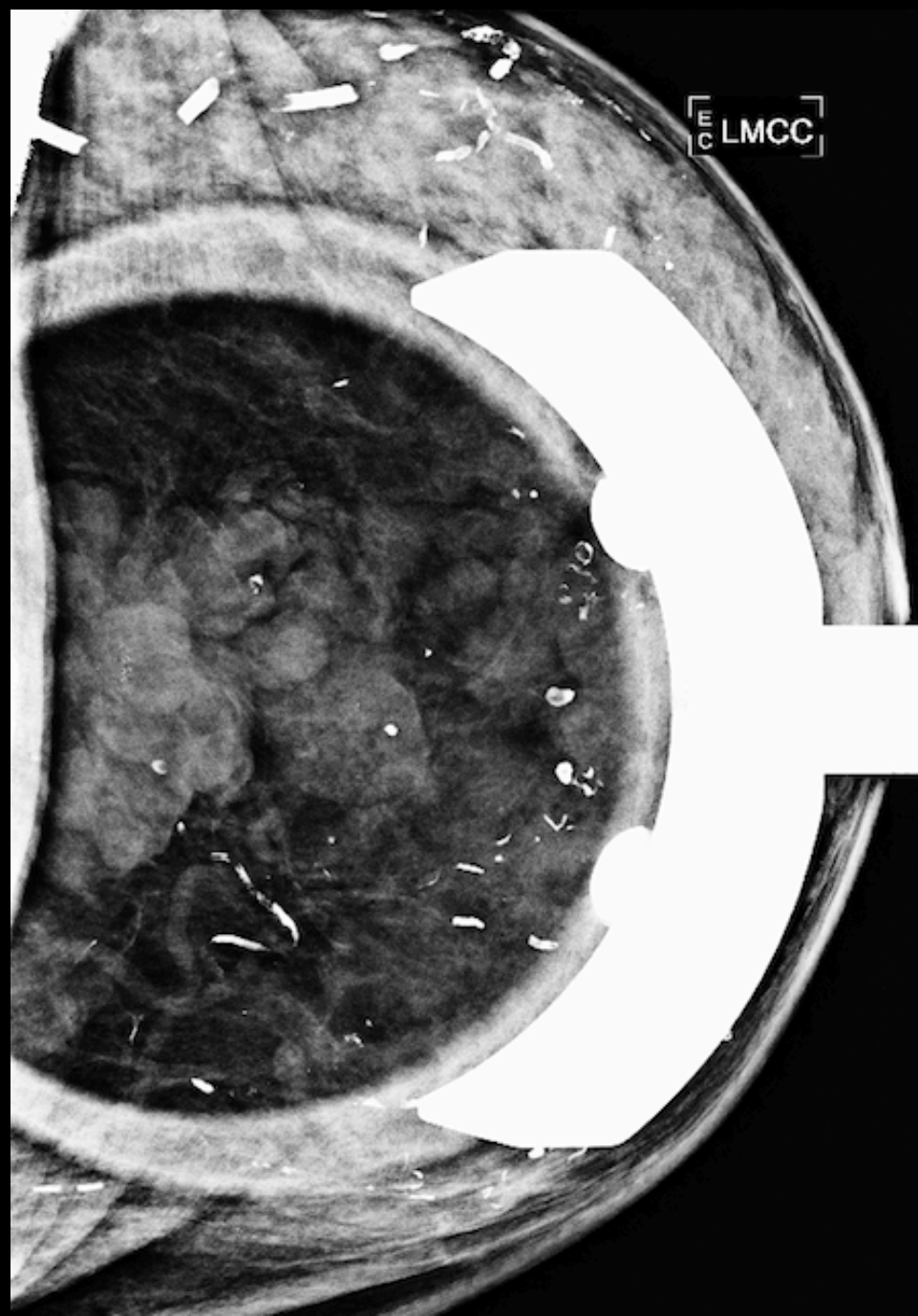
LEARNING POINT: Gynecomastia typically does not have mass-like appearance & should fan out symmetrically directly posterior to the nipple



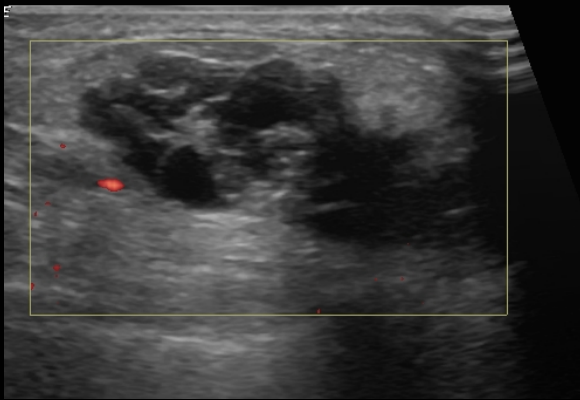
# CASE 7:

CLINICAL HISTORY: 81 yo w/ R breast lump.  
On mammo, a LLIQ lobulated mass correlating w/ a “cluster of cysts”  
is stable x 2 y in size, but with  
new associated architectural distortion & coarse heterogenous calcs



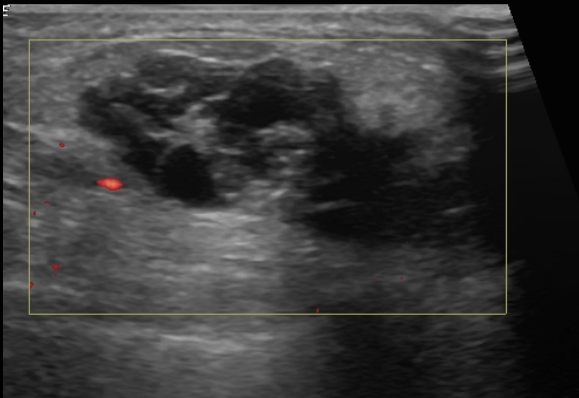


# CASE 7:



- ULTRASOUND FEATURES:
- *Margins:*       **Microlobulated**
- *Shape:*       **Irregular**
- *Orientation:*   **Parallel**
- *Echogenicity:*   **Complex Cystic & Solid Mass**
- *Posterior Features:* **Enhancement**
- *US Final Assessment:*   **BI-RADS4b**

## CASE 7:



INTERPRETATION: New distortion & suspicious calcifications associated with this Complex Solid & Cystic Mass raises the level of suspicion in this 81 yo F → BI-RADS 5

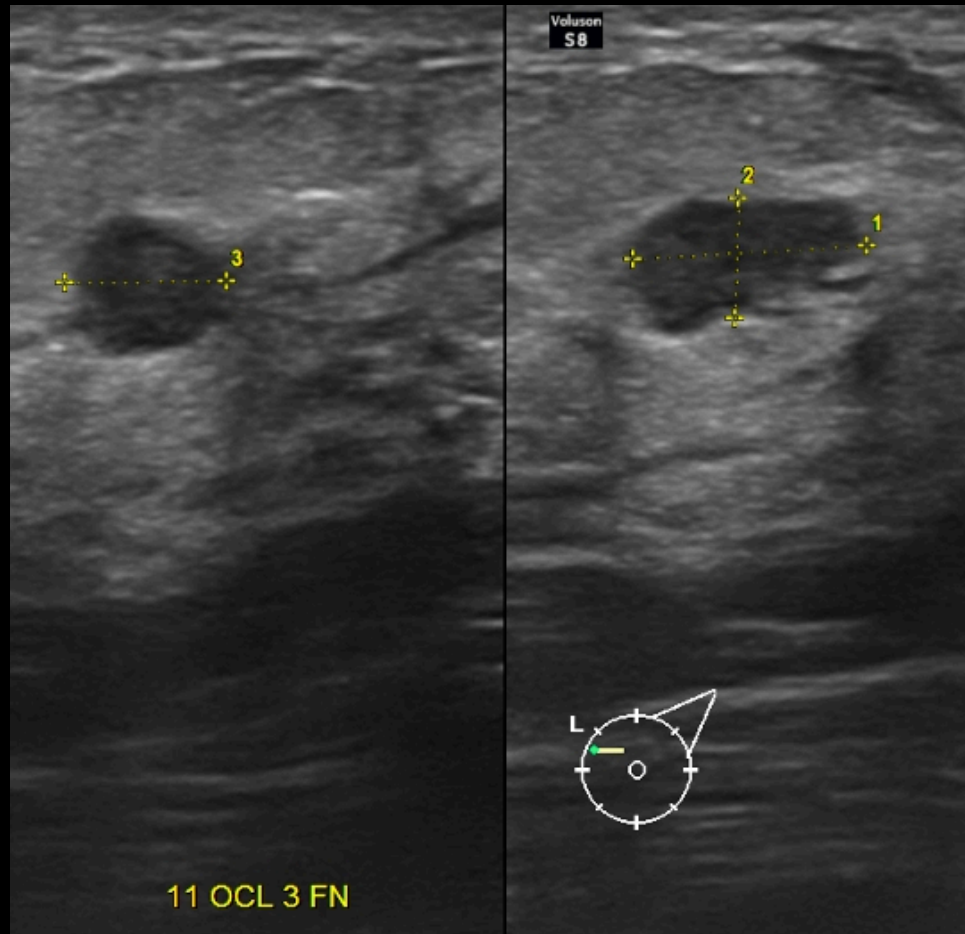
PATHOLOGY: 4.5 cm & 1.6 cm foci of IDC (at least 2 separate foci) gr 1 w/ micropapillary & cribriform DCIS & 1/2 micromets in SLNs

LEARNING POINTS: Pay attention to thick septations/wall, mural nodularity, intracystic solid mass → Complex Solid & Cystic Mass → Biopsy

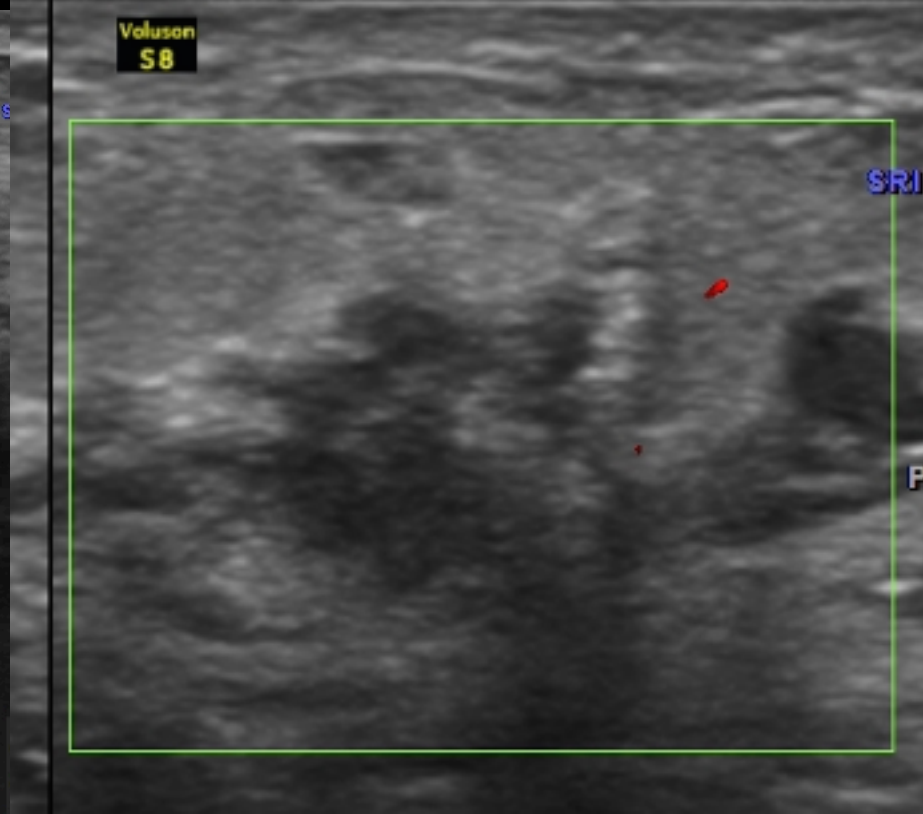
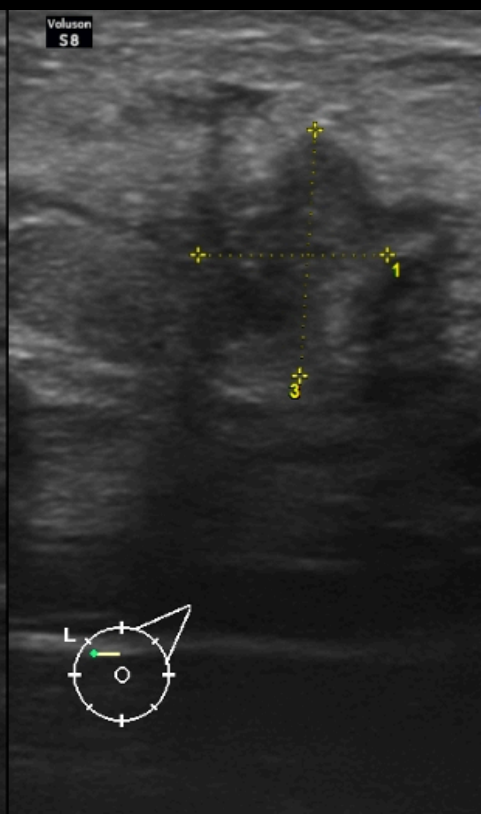
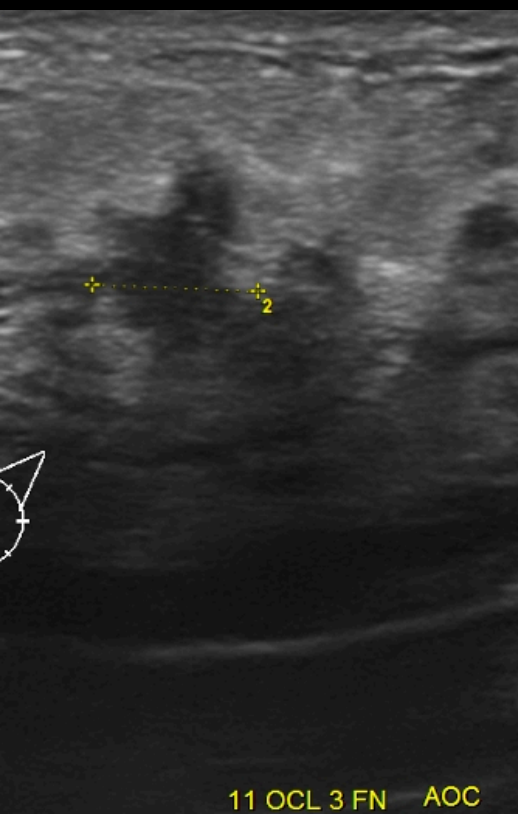
"Seduction of stability" – just because a lesion is 'stable', doesn't mean it's benign...go by suspicious features

# CASE 8:

CLINICAL HISTORY: 29 yo F, 39 wks pregnant, L breast lump x 2 d,  
clin req from OB: "11:00 nodule "?fibroadenoma"





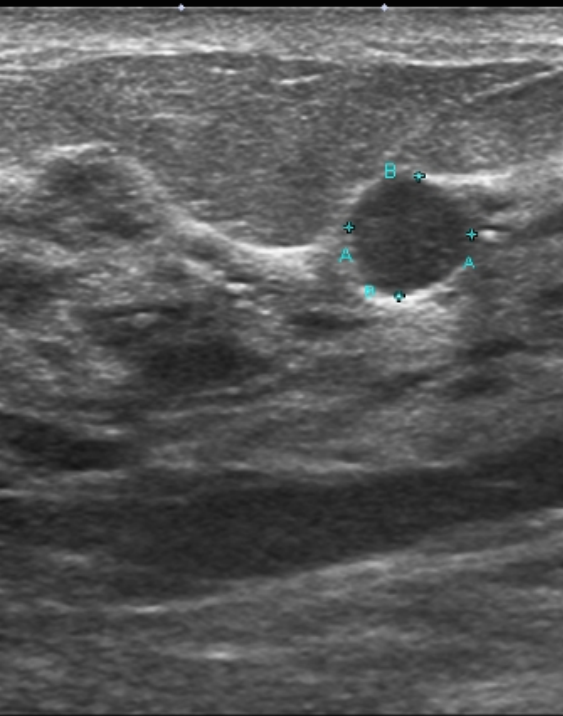




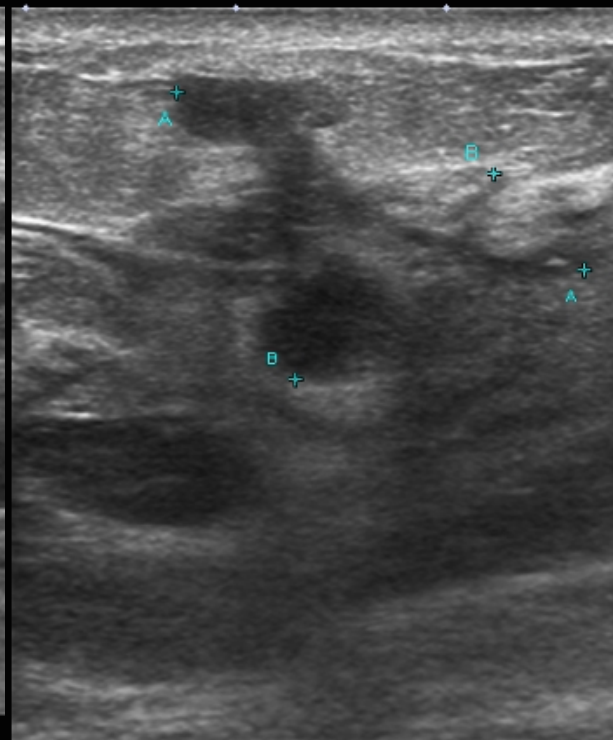
## Technologist Sheet:

- “1.0 x 0.7 x 0.5 cm cyst with echoes  
?focally dilated duct
  - 1.2 x 0.9 x 0.8 next to above corresponds to AOC”
  - No axillary lymph nodes demonstrated
- No phone call to radiologist to check or inquire whether more images necessary. Pt sent home & exam completed as ‘non-stat’ study

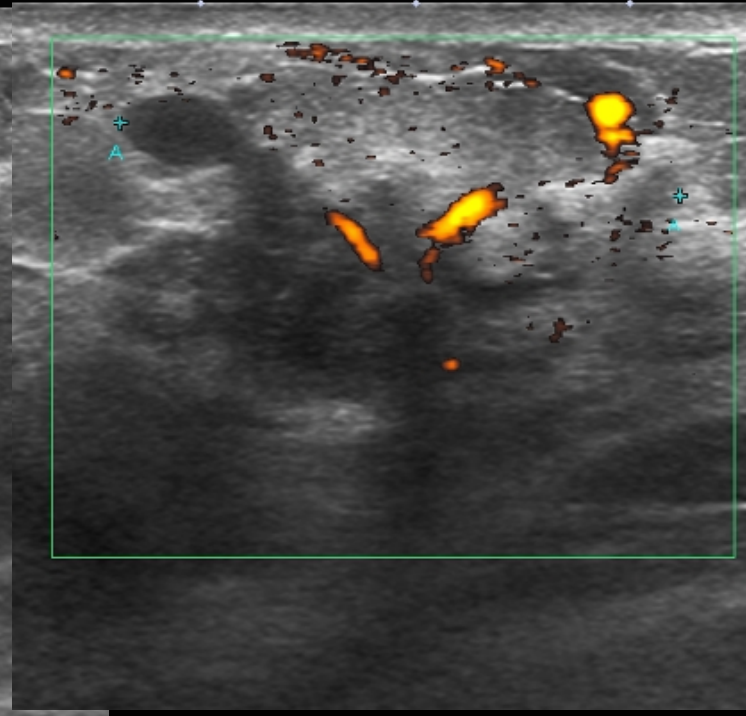
So we brought back pt for physician-supervised targeted US of AOC



11 OCL 5 FN AOC



11 OCL 5 FN AOC

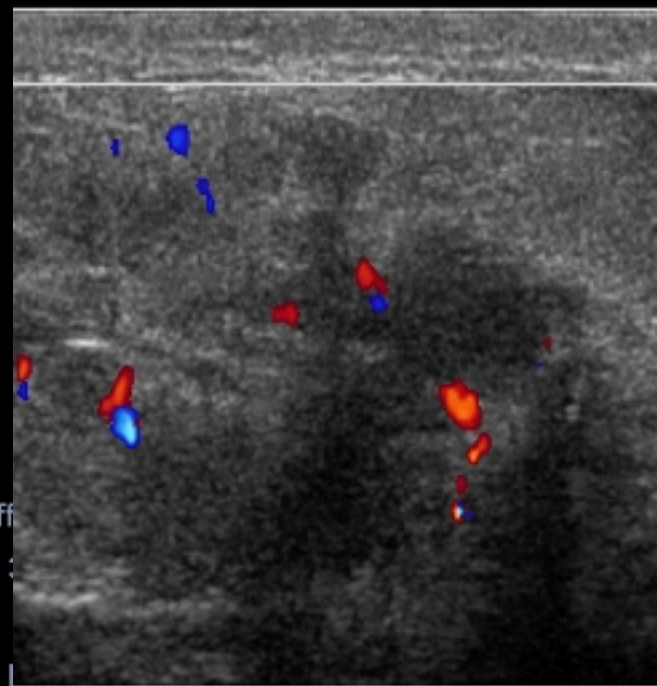
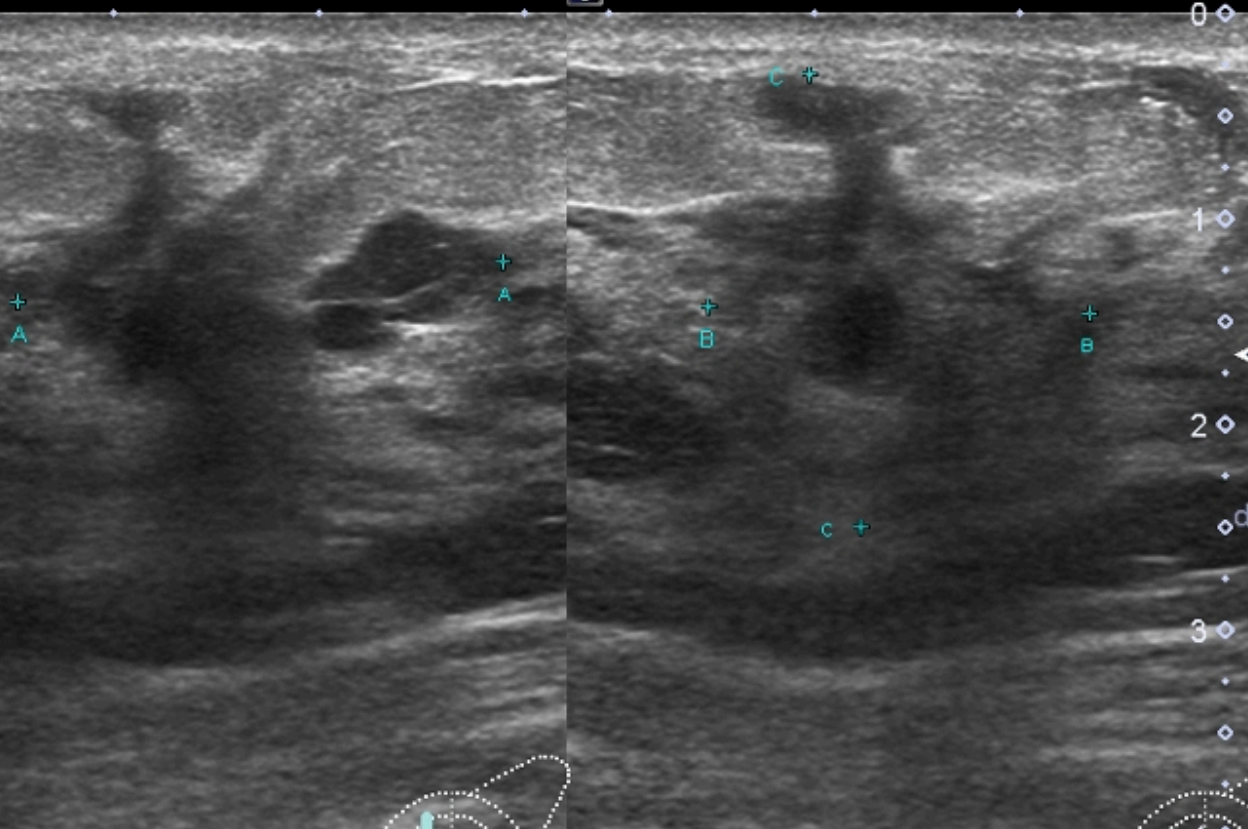


2.6 cm irregular heterogeneously hypoechoic solid area w/ architectural distortion, satellite nodules, and prominent vascularity, c/w new lump

Pure+ Precision

T

Precision A Pure+



11 OCL 3 FN L

PALPABLE LUMP

23.7 mm

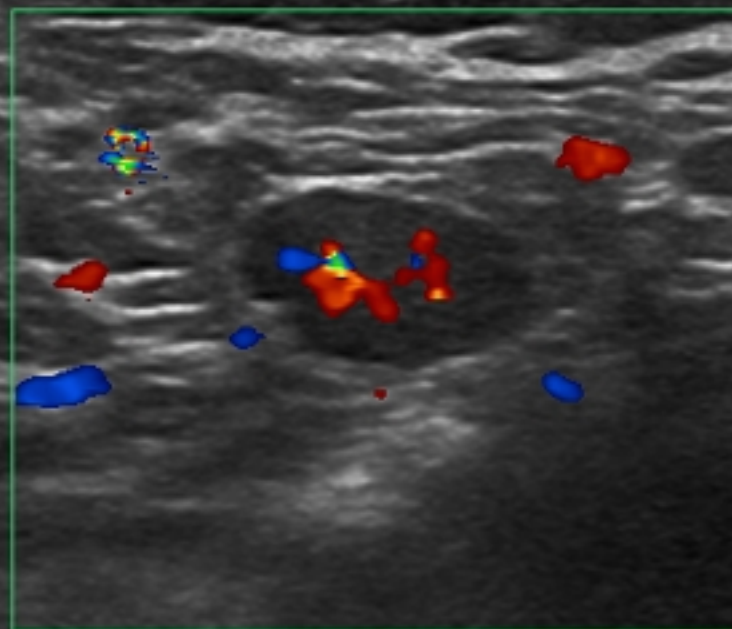
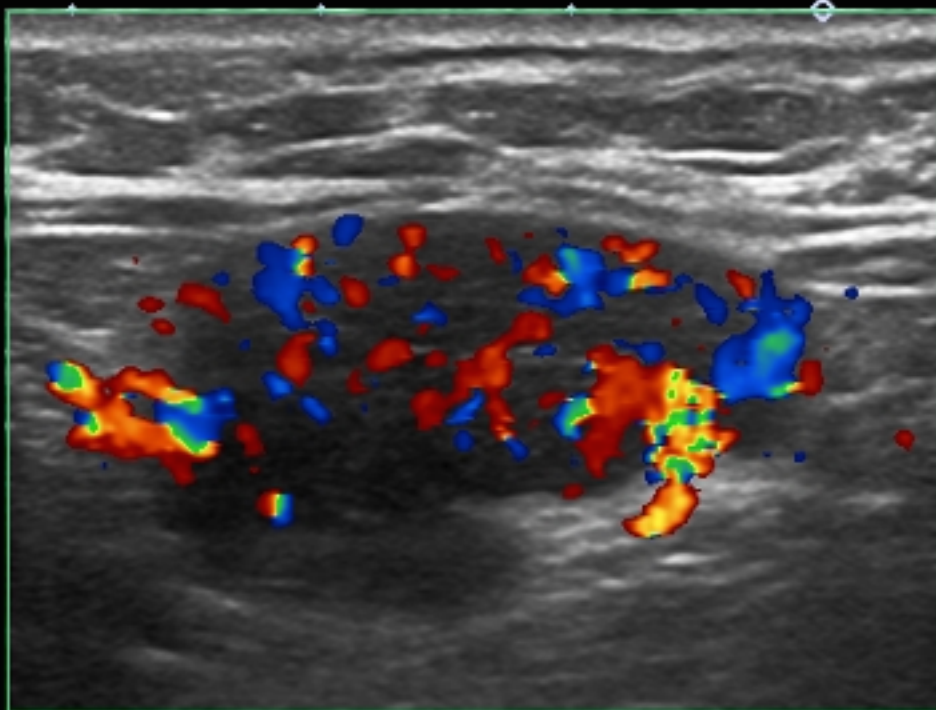
Dist B

18.6 mm

Dist C

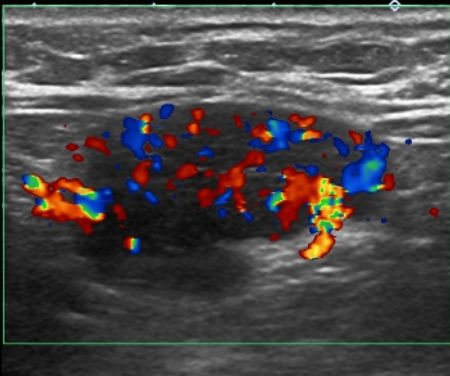
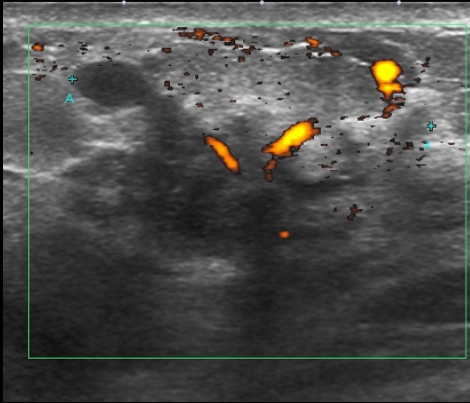
22.2 mm

L11 N3 TV



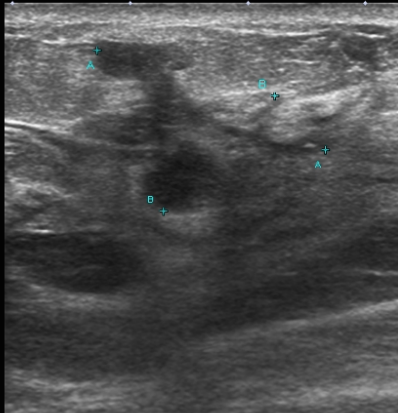


# CASE 8:

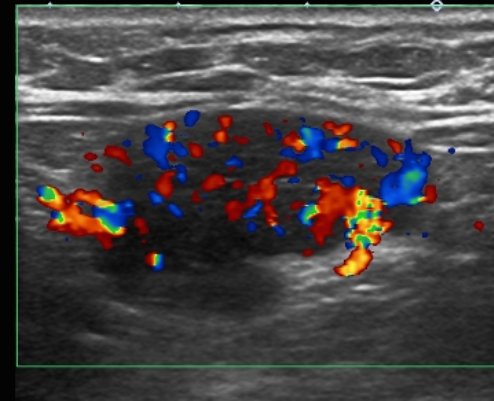
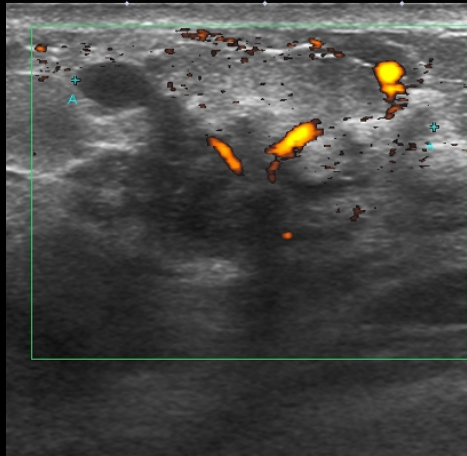


- ULTRASOUND FEATURES:
- *Margins:* Spiculated
- Shape: Irregular
- Orientation: Parallel
- Echogenicity: Hypoechoic, w/ satellite nodules
- Posterior Features: Areas of shadowing
- Other: hypervascular
- US Final Assessment: BI-RADS5

# CASE 8:



11 OCL 5 FN AOC



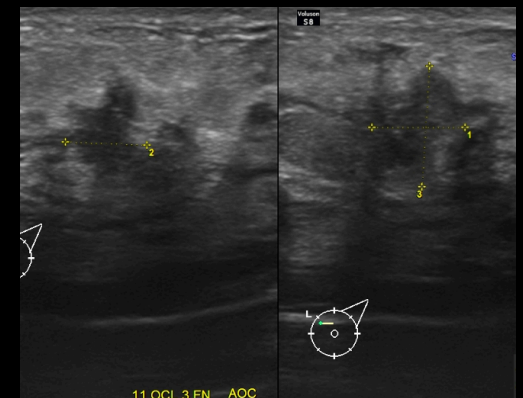
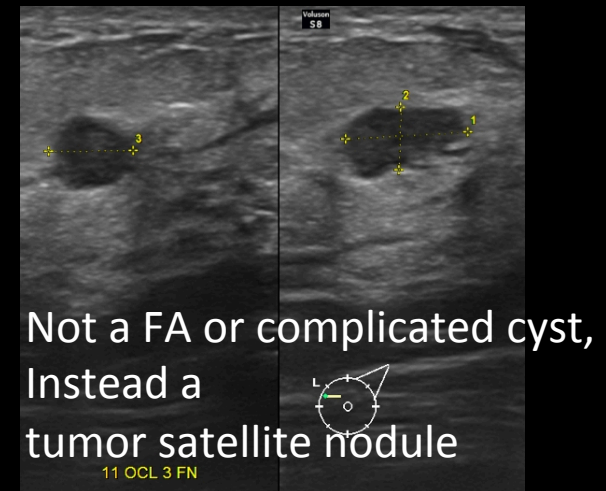
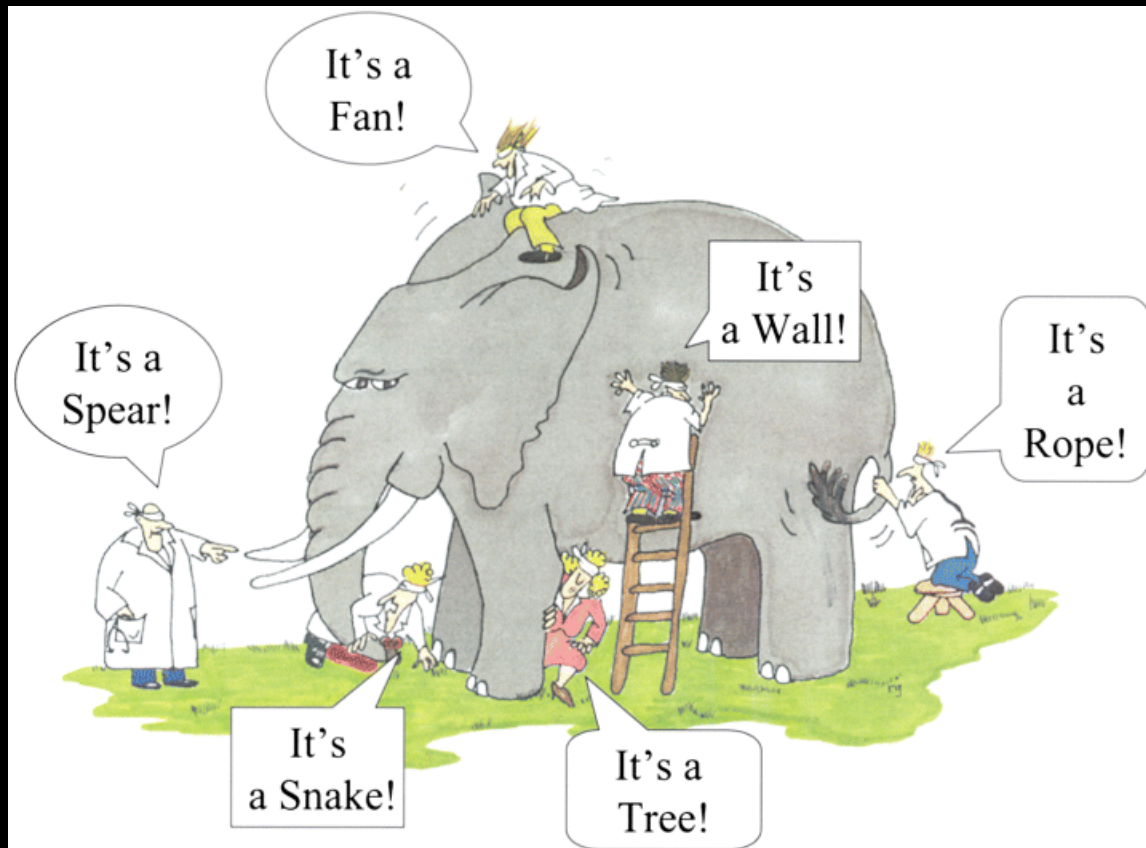
INTERPRETATION: Spiculated 2.6 cm solid area w/ 3.0 cm L axillary markedly abnormal hypervascular LNs, c/w Locally Advanced Breast Cancer in a 29 yo pregnant pt → BI-RADS5

PATHOLOGY: Gr 2 LABC IDC, w/ axillary metastases,  
no lung/liver/bone distant mets

LEARNING POINT: Take LOTS of images of the AOC

- Call radiologist if you are not sure what you are looking at
- Always scan the axillae, ESPECIALLY in pts w/ lumps clinically and/or abnormal US findings in the breasts



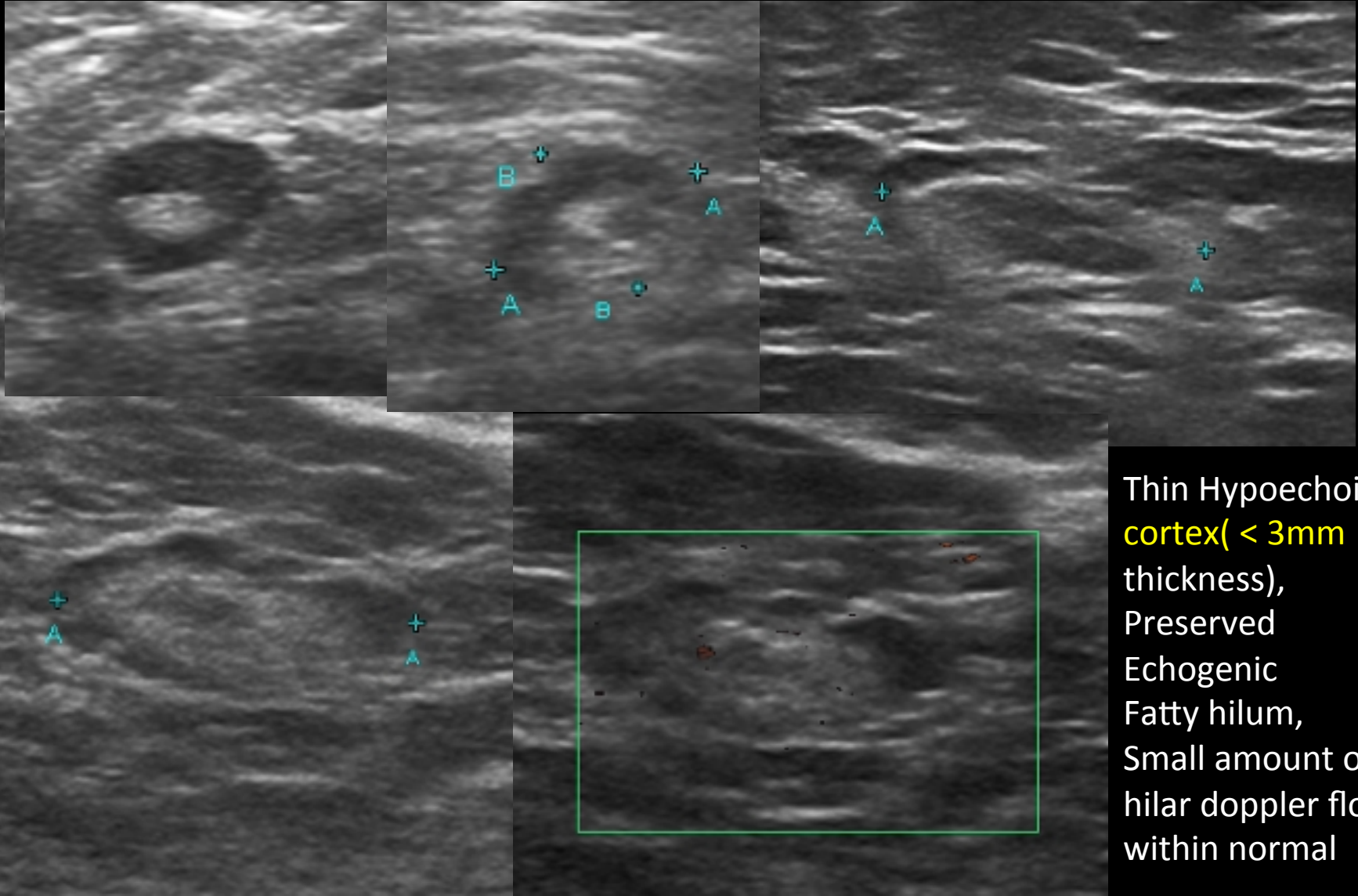


Step back, Pause, and look at the BIG PICTURE (the entire Breast):

*Is the AOC different than the rest of the breast?*

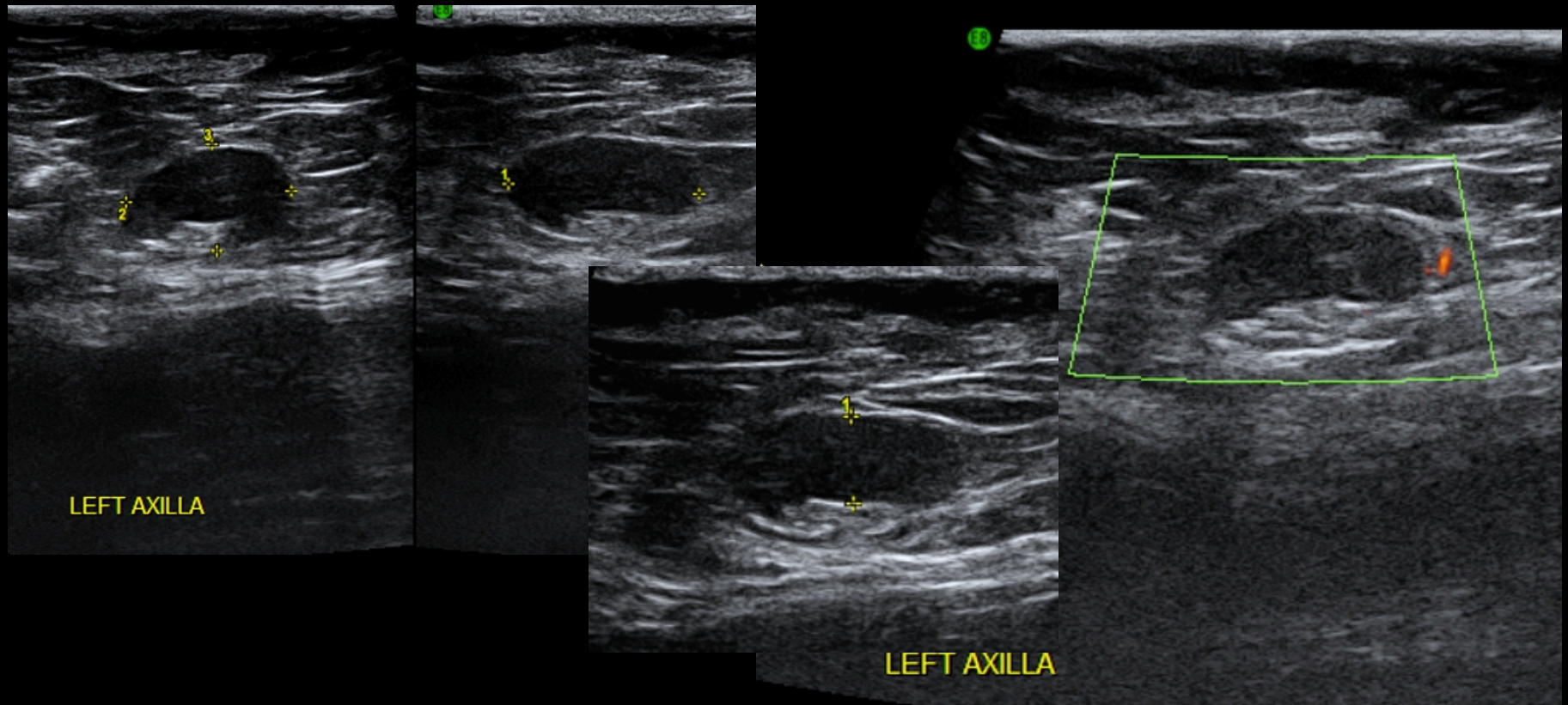
*Am I looking at / demonstrating the entire entity?*

# Normal Axillary Lymph Nodes



Thin Hypoechoic  
cortex( < 3mm  
thickness),  
Preserved  
Echogenic  
Fatty hilum,  
Small amount of  
hilar doppler flow  
within normal

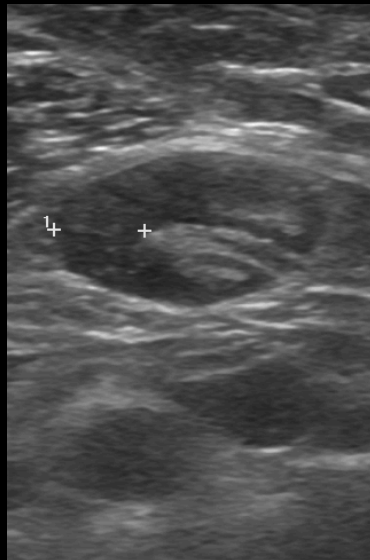
# Abnormal Axillary Lymph Nodes



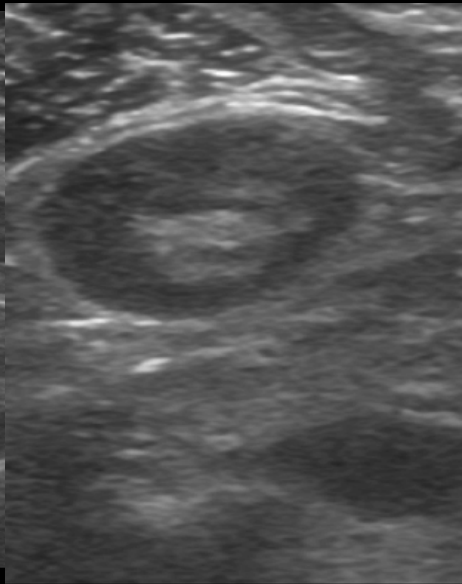
**Unilateral** Left Mildly Morphologically Abnormal Axill LNs, smooth diffuse cortical thickening to 5 mm, No finding in either breast on mammo or US  
- Multicompartiment hyperplasia on surgical excusion,  
Benign/reactive nature, neg for malignancy or lymphoma



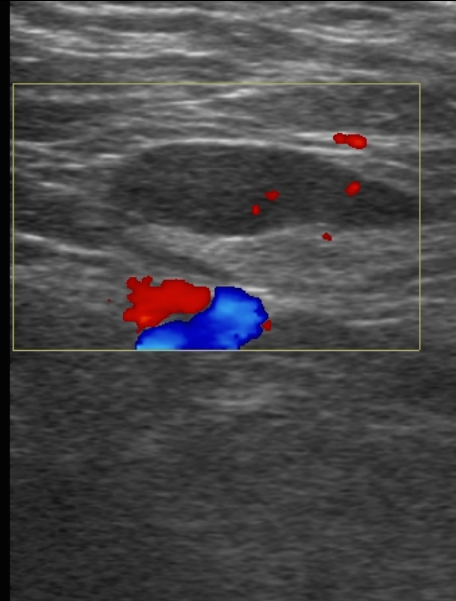
# Abnormal Axillary Lymph Nodes



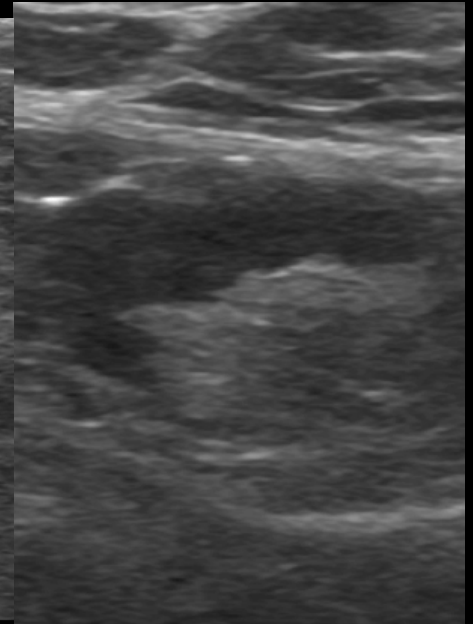
LT BREAST AXILLA



LT BREAST AXILLA



LT BREAST AXILLA

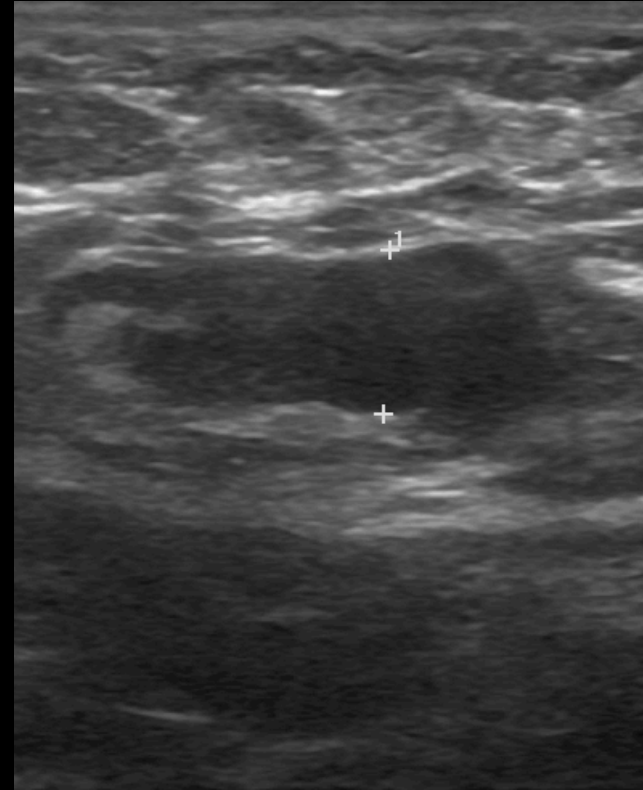
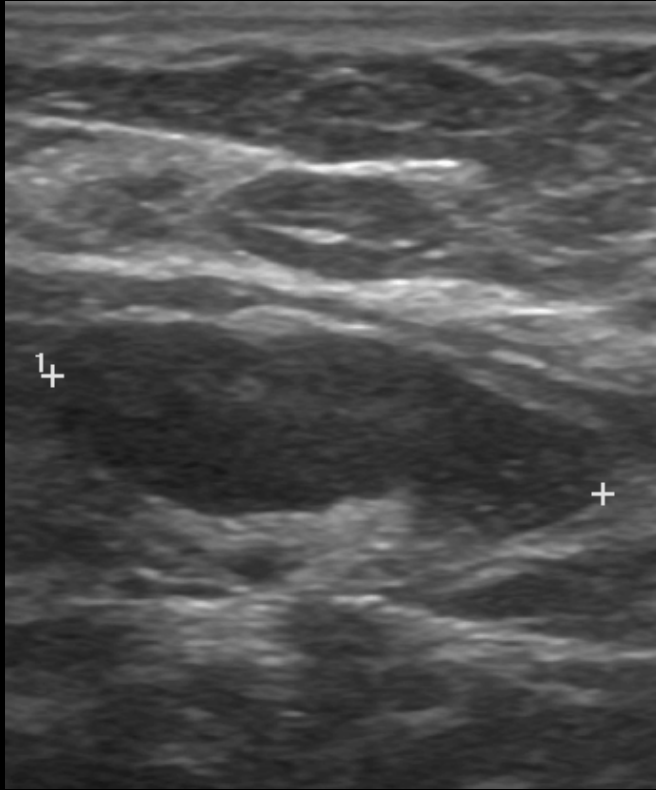


RT BREAST AXILLA

Bilateral Mildly Morphologically Abnormal Axill LNs (smooth cortical thickening to 5 mm w/ cortical heterogeneity), not seen on prior US', No finding in either breast on mammo or US

--Mantle Cell lymphoma in a 66 yo F

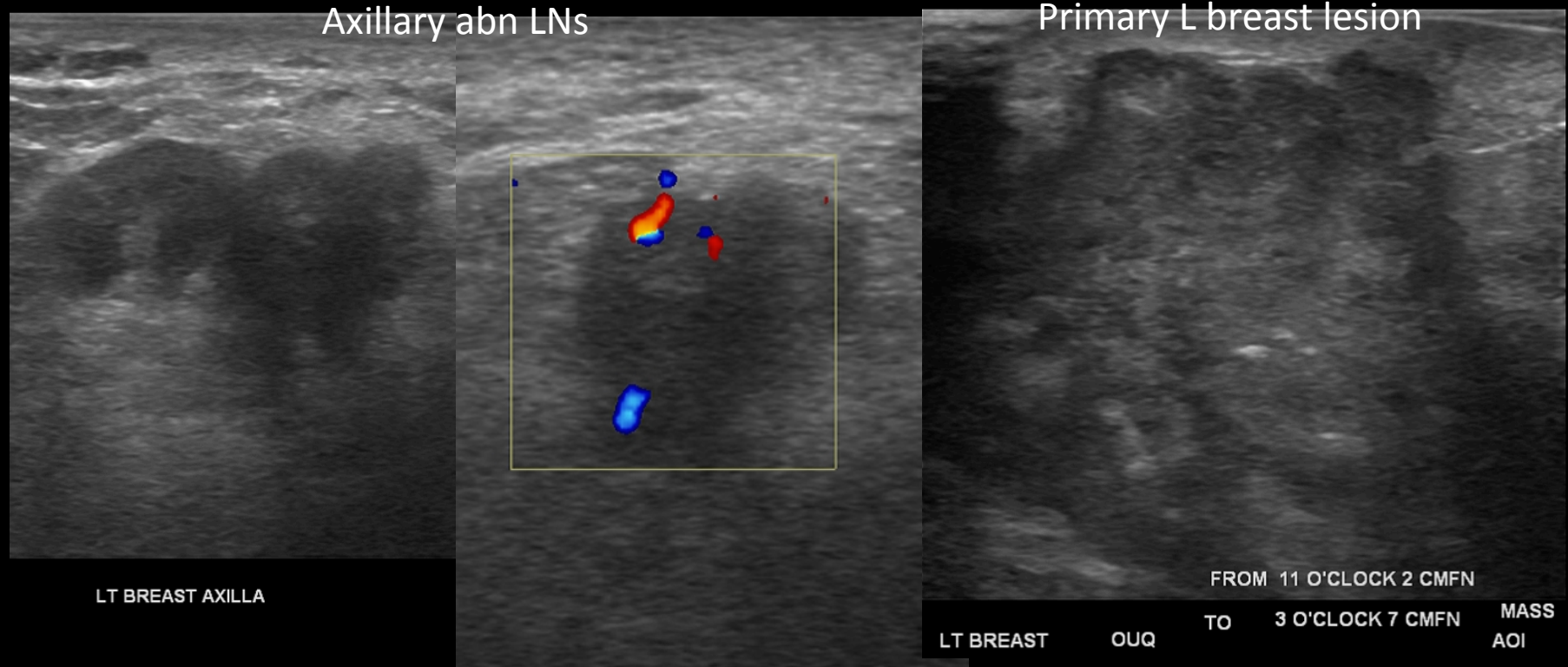
# Abnormal Axillary Lymph Nodes



LT BREAST AXILLA

Unilateral Left Moderately Morphologically Abnormal Axill LNs, irregular cortical thickening, Likely related to still-to-be-diagnosed breast cancer (no pathology results back yet)

# Abnormal Axillary Lymph Nodes



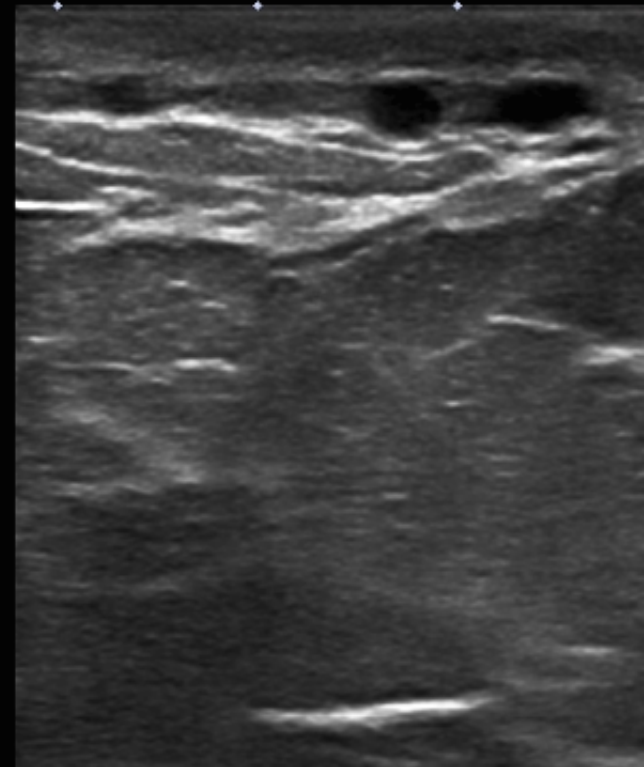
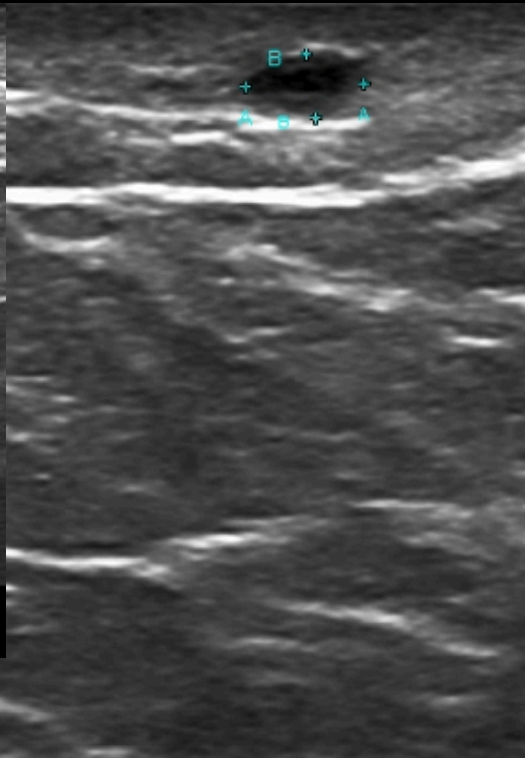
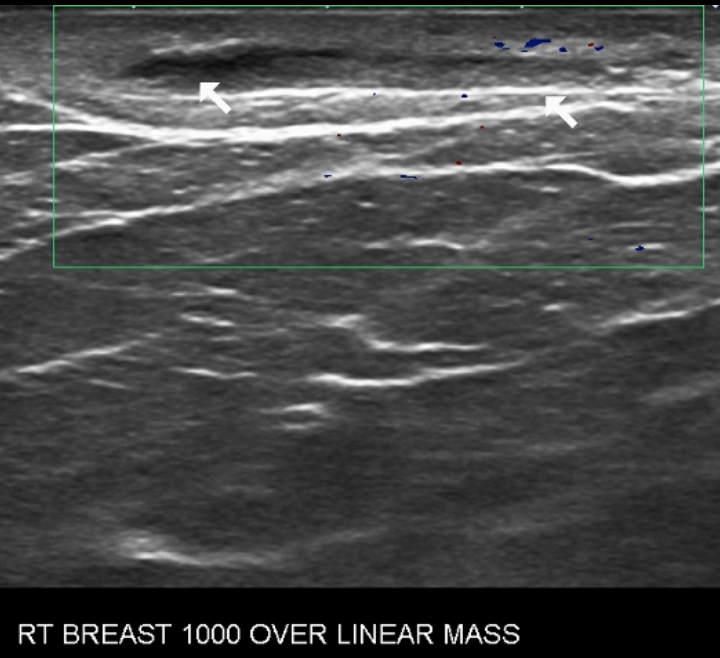
**Unilateral** Left markedly Morphologically Abnormal Axill LNs, with a primary breast mass w/ skin retraction, distortion & nipple inversion, in 49 yo F w/ lump x 2 mo

--LABC IDC w/ "no normal lymphoid tissue, completely replaced by adenocarcinoma" on pathology of the axillary LNs, plus liver mets



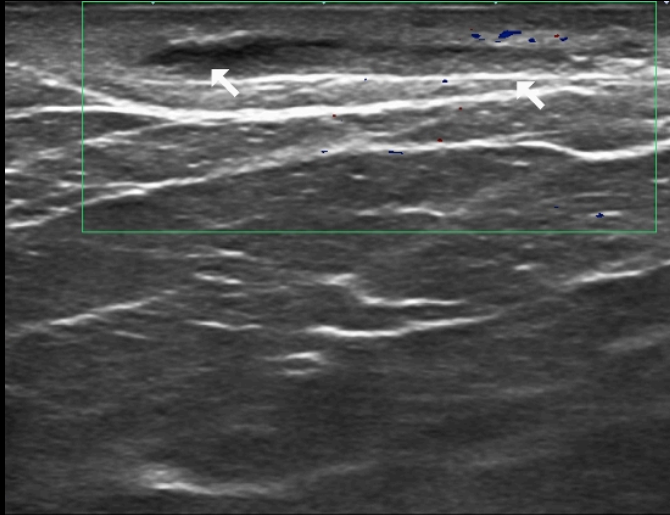
# CASE 9:

CLINICAL HISTORY: 35 yo, R breast lump,  
stopped breastfeeding 5 mo ago, no hx of infection



...called by sonographer: "Is this a dilated duct?"

# CASE 8:



RT BREAST 1000 OVER LINEAR MASS

- ULTRASOUND FEATURES:
- *Special Case:*

*Entirely intradermal tubular structure without internal doppler flow nor compressible, correlating w/ a 'linear'/ropey lump clinically [clinical req: "?SVT"]*

INTERPRETATION: Mondor's Disease (superficial thrombophlebitis of the breast)

LEARNING POINT:

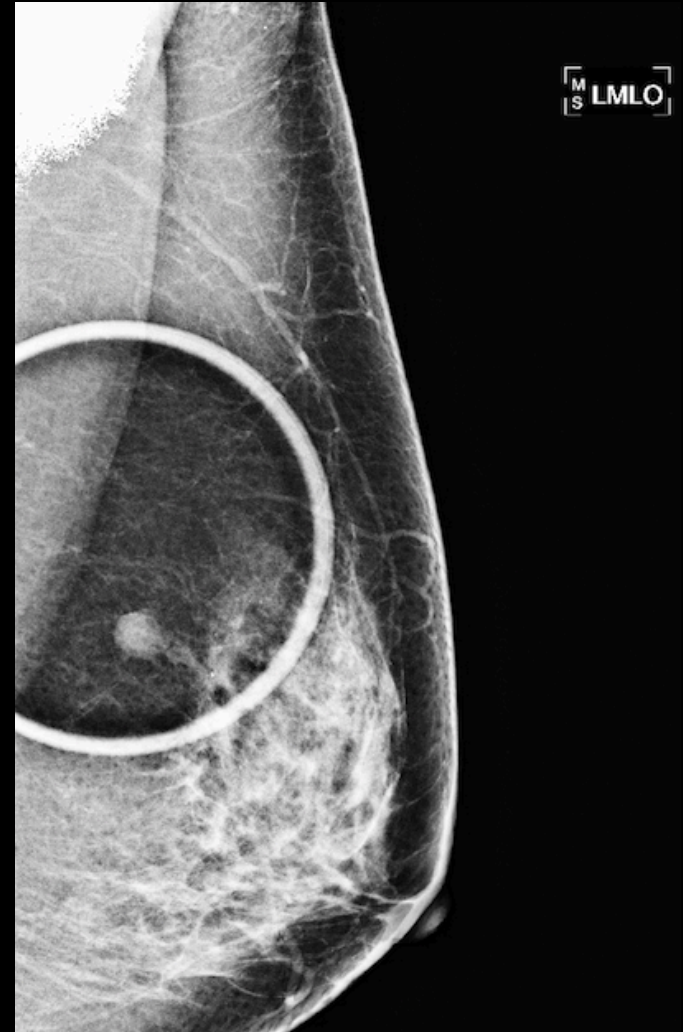
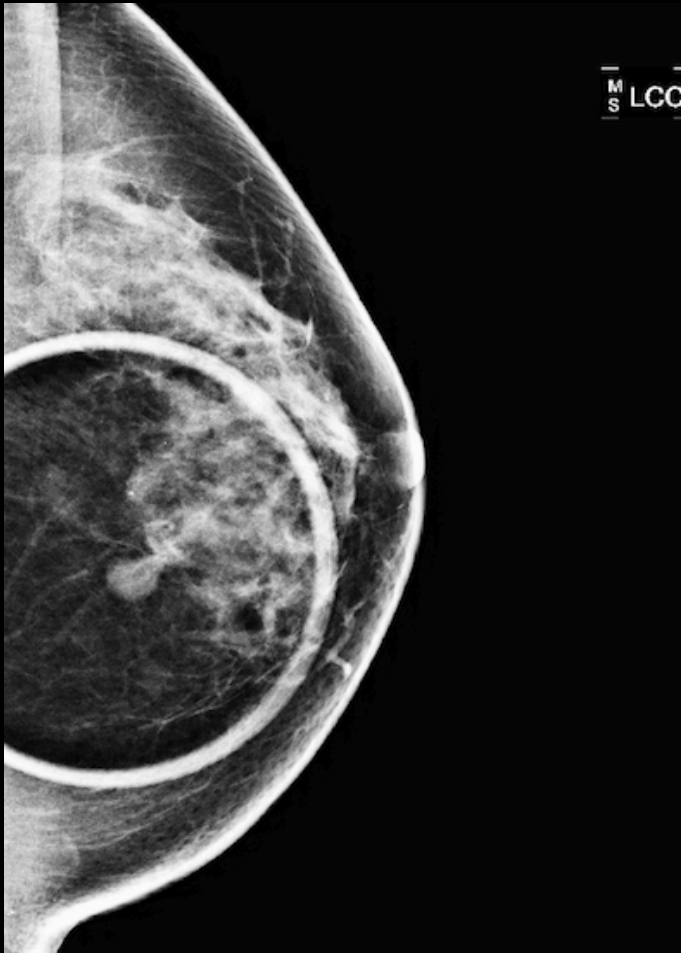
If in doubt, call the radiologist for an opinion before letting pt go

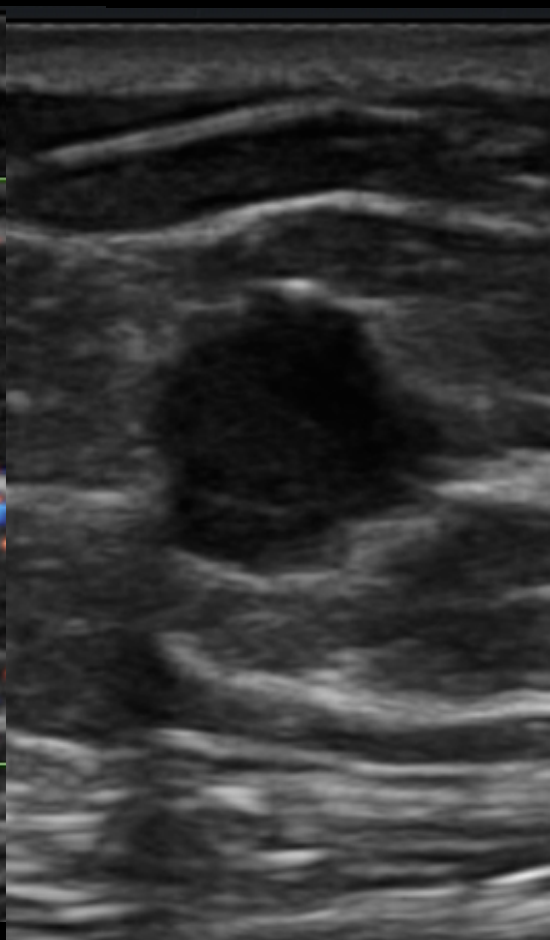
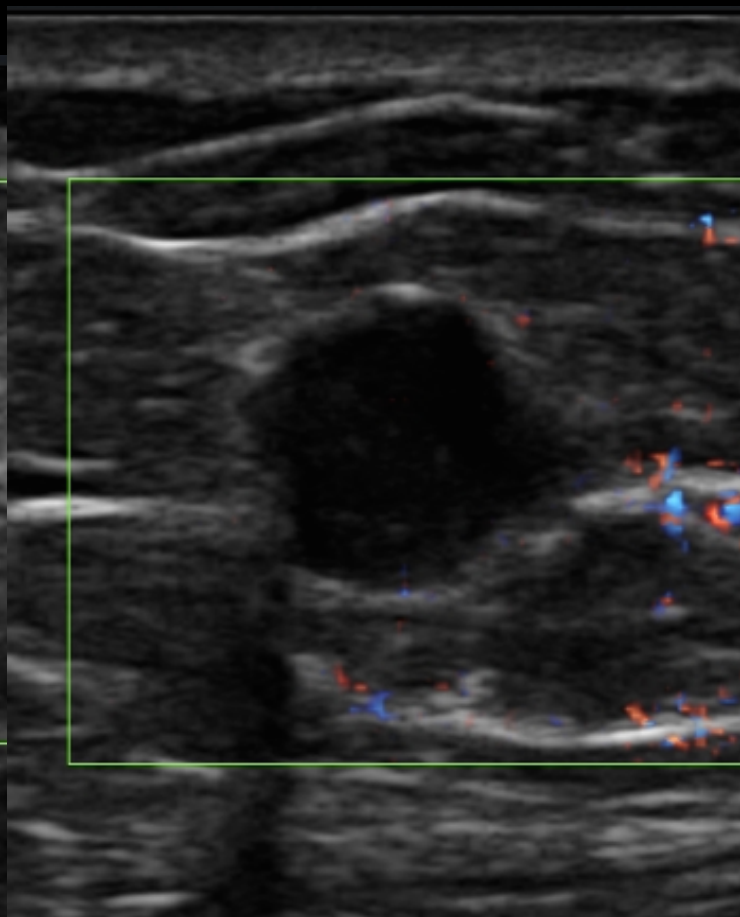
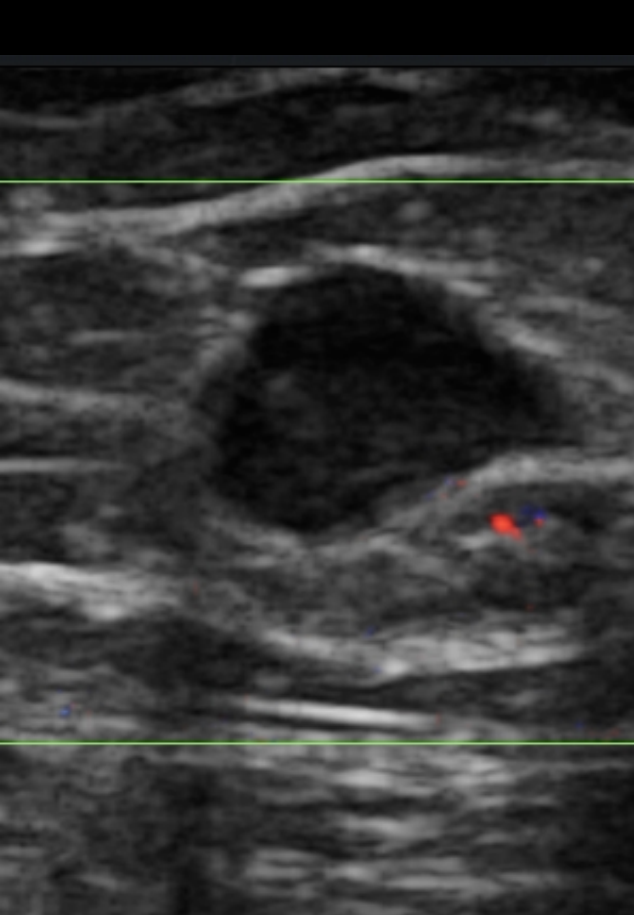


Phone a friend

# CASE 10:

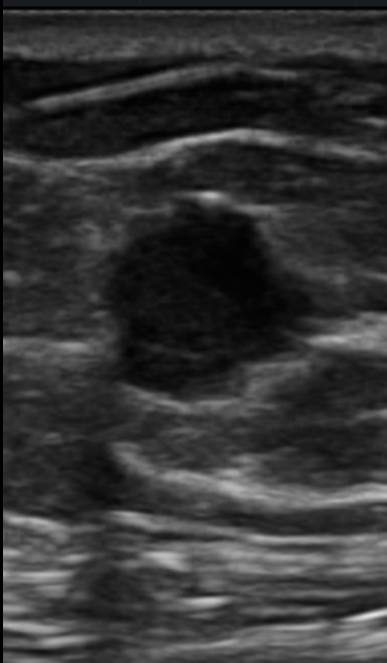
CLINICAL HISTORY: 56 yo baseline screening,  
posterior L upper mass on mammo







# CASE 10:



- ULTRASOUND FEATURES:
- *Margins:* Indistinct
- *Shape:* Round
- *Echogenicity:* Anechoic-to-hypoechoic, w/ suggestion of a fluid-debris level vs v. faint intracystic mass?
- *Posterior Features:* Enhancement
- *US Final Assessment:* BI-RADS4a

- **INTERPRETATION:** 1.0 cm indistinct complex cystic & solid mass w/ faint intracystic echoes which appeared also w/ instinct margins ON REAL-time scanning in a 54 yo → BI-RADS 4A
- **PATHOLOGY:** IDC w/ encysted papillary lesion  
(Papillary Carcinoma)

**LEARNING POINT:** Go with most suspicious feature (indistinct margins)

# Cysts

- 47.1% of 2662 women in the ACRIN6666 screening US trial/study had breast cysts
- 39% of post-menopausal pts had cysts at one point (66% for those on HRT)
- 14.1% had complicated cysts
  - Overall 2/475 (0.42%) proved to be malignant

# Multiple Bilateral Circumscribed Masses

- 6% of 2172 ACRIN6666 trial participants had multiple bilateral circumscribed findings ( $\geq 3$  M-B-C lesions):
  - Complicated cysts containing debris
  - Clustered microcysts
  - Solid mass either oval, circumscribed, and/or with 2-3 gentle lobulations
- Over the 3-yr of annual screening US followup, No malignancies detected in this M-B-C mass group
- Therefore, can consider lengthening f/u to 12 months instead of 6 months (depending on features), assuming not palpable

# Take Home Points

- **Show the AOC well**, EVEN if 'normal'
  - Obtain minimum 3-5 images in each orientation/plane
  - Label the AOC on your images
  - Mention any pertinent clinical info on your tech sheet
    - *New mass? Hard, fixed?*
    - *Biopsied before? Colour of nipple discharge?*
- **Go with the SINGLE most suspicious feature**
  - Demonstrate Margins well in your images
- **When in doubt,  
feel free to call the radiologist**



Will I get a discount if I don't need the top?

Dressing Room

SWIMSUIT  
BOUTIQUE

