

BREAST ULTRASOUND 101

Back to the Basics

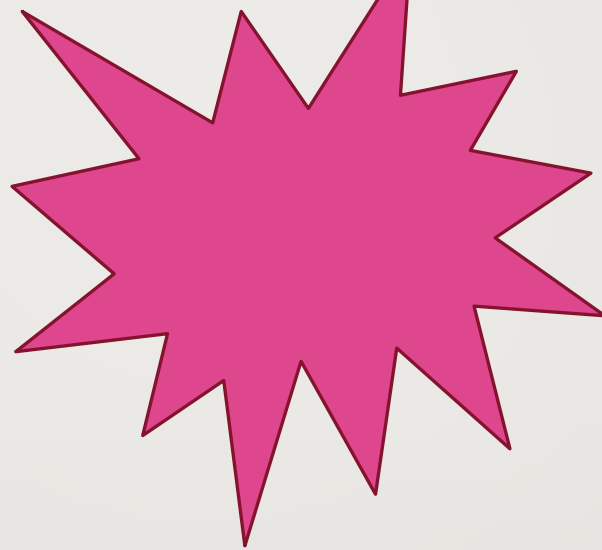


THEORY:

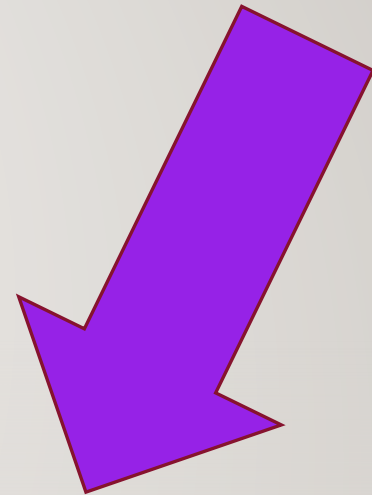
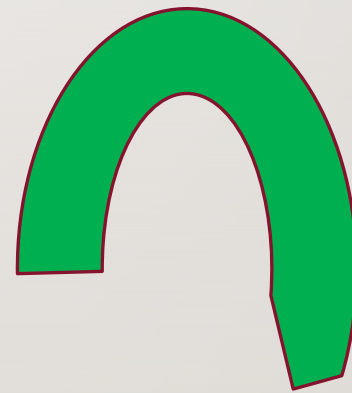
- To ensure all breast tissue has been interrogated in a **standardized method, that can be replicated**
- Screening method
- Diagnostic Method



- Reality



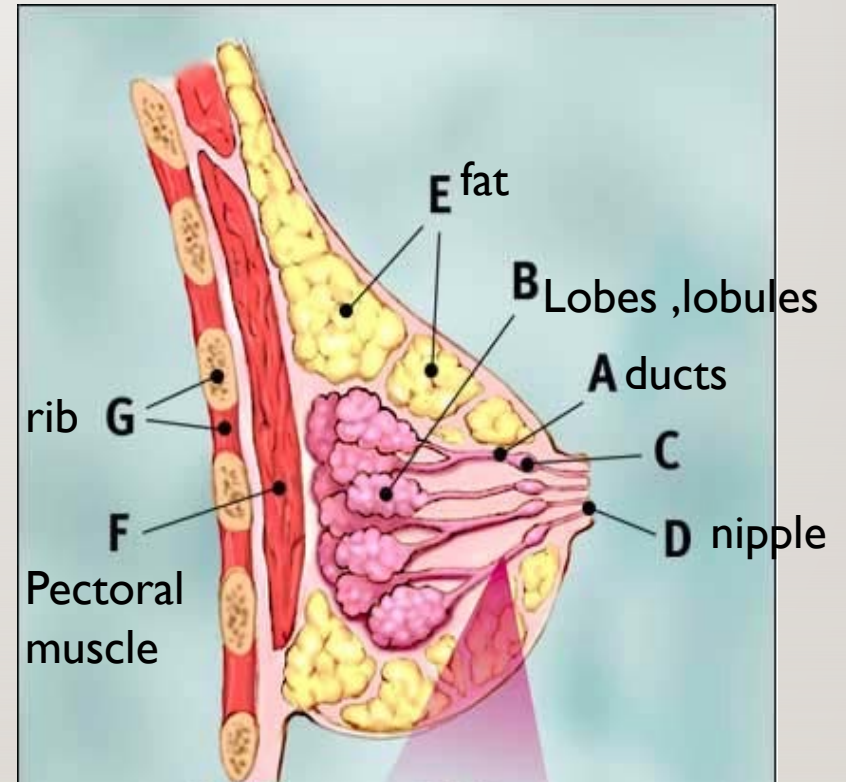
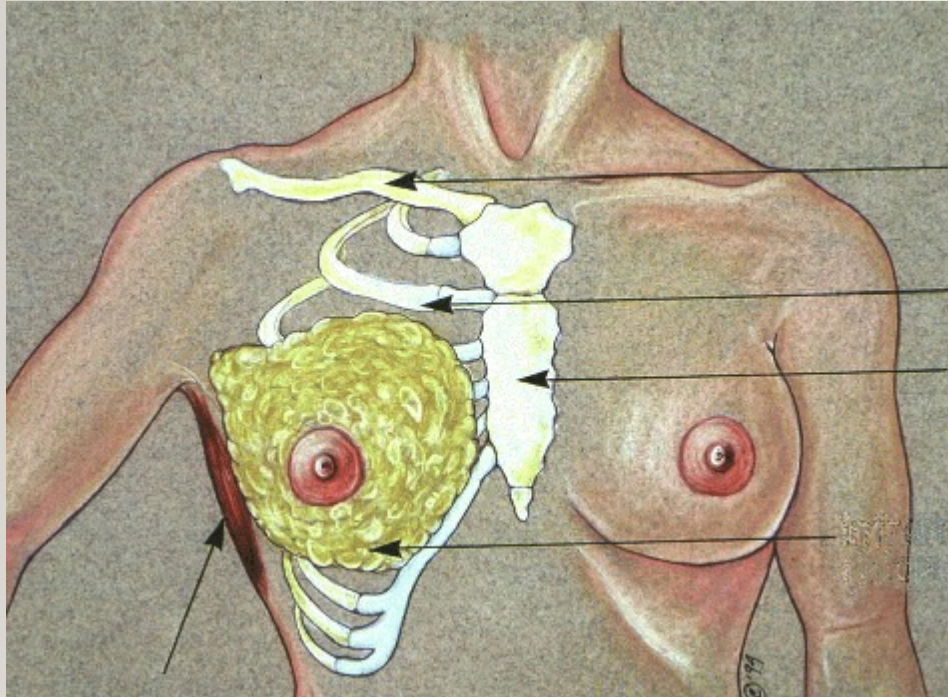
- ??????????



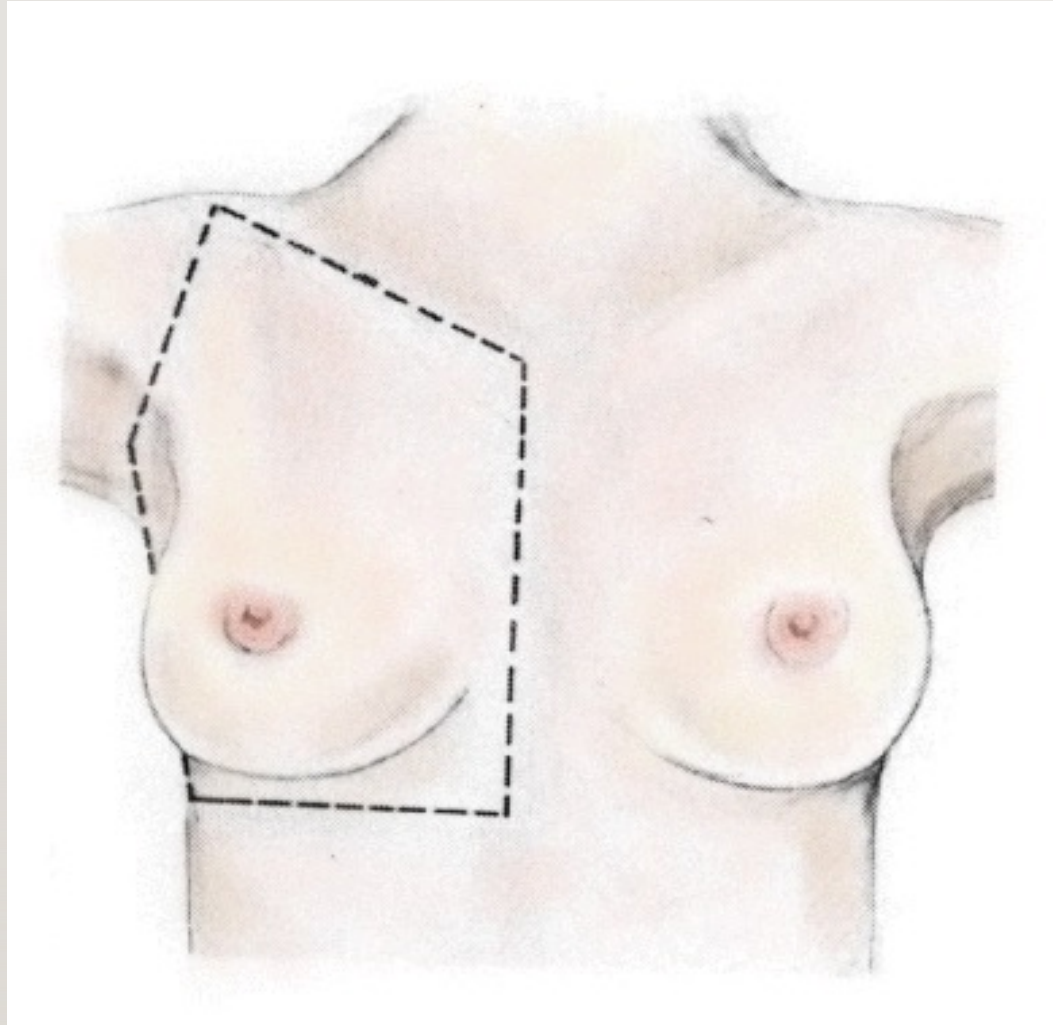
Imaging is not consistent, not standardized and is user dependent...WHY????



ANATOMY



Perimeter



Ultrasound Breast Anatomy

Nipple

Skin

Subcutaneous fat

Coopers ligaments

Breast parenchyma

Retromammary fat

Pectoralis muscle

Ribs

Pleura



Breast Ultrasound Anatomy

SKIN- Hyperechoic

FAT,SUBQFAT-Hypoechoic(Reference Tissue) Appears lobulated with a surrounding thin echogenic rim

FIBROGLANDULAR PARENCHYMA(most variable)

Can appear homogeneous or heterogeneous (uniformly) or a combination of both.

Can appear **I**soechoic in lactation

TDLU's can sometimes be identified,

Ducts when collapsed appear as thin echogenic line(hypoechoic zone)

Conspicuity changes with age, and can accumulate and appear as dilated tube up to 5mm



Reference Tissue

FAT

Fat in the breast appears dark gray, unlike in other areas of the body

FAT is **Isoechoic**

Darker than ***FAT*** is **Hypoechoic**-usually lesion of concern

Brighter than ***FAT*** is **Hyperechoic** or echogenic-usually lesion is benign

Intramammary Lymph nodes with a fatty hilum will still appear echogenic





HETEROGENEOUS

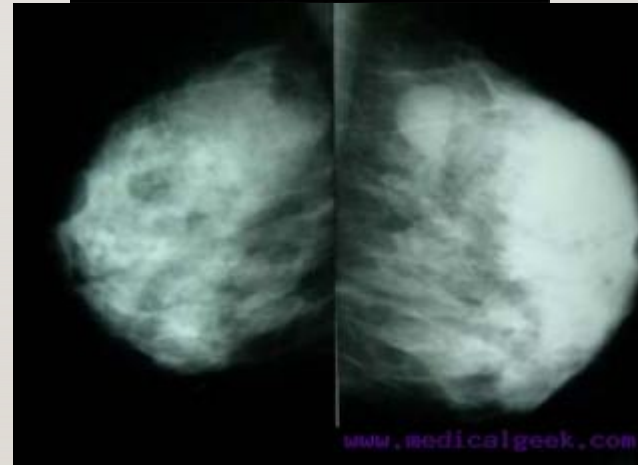
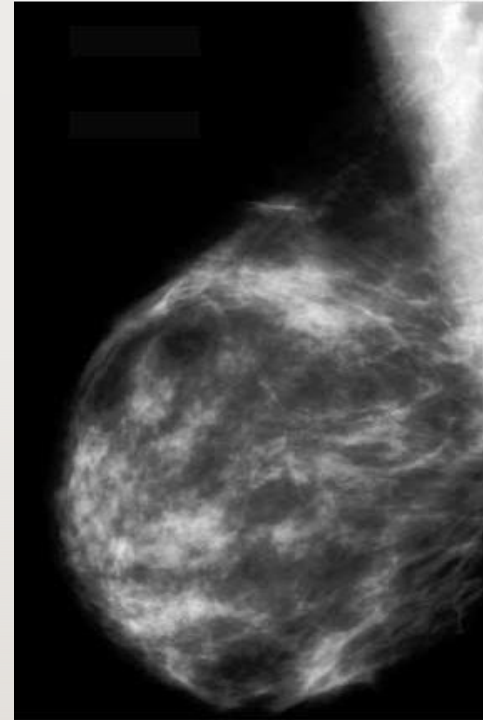


Hypoechoic



BREAST COMPOSITION

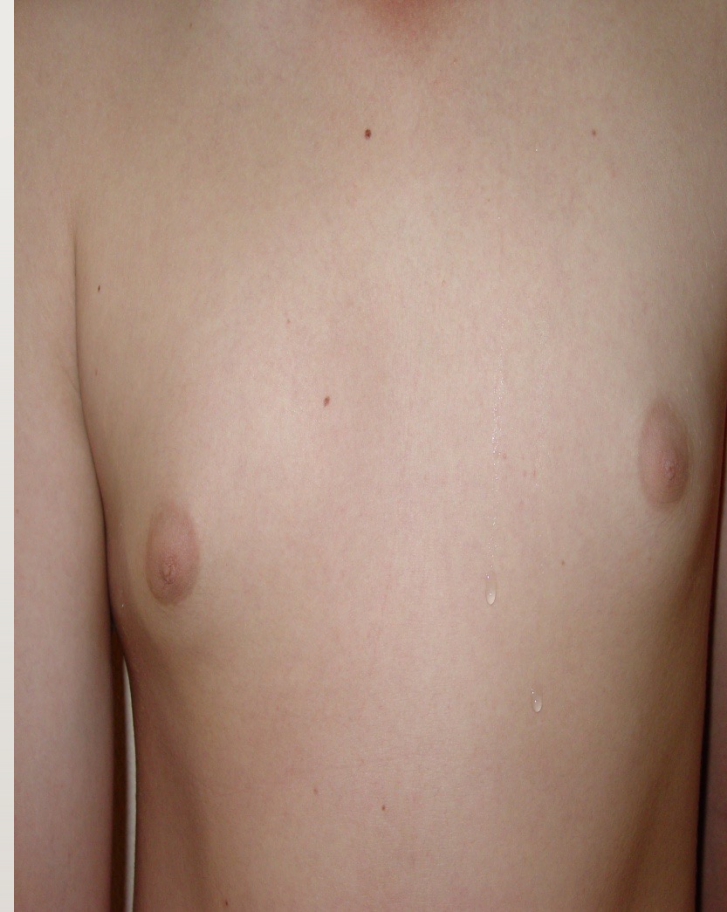
There is four different types of breast tissue.



Look at your patient's breast







- Physics Of Ultrasound..
- To understand the relationship of the speed of sound, the frequency of the sound wave and the wavelength in image acquisition
- Frequency affects the resolution of the image- use 12.5mHz or higher
- Resolution and Frequency are equally proportional but can affect depth penetration.
- Axial resolution is best with higher frequency transducers
- Lateral resolution is determined by the width and focus of the beam
- Focal zones should be at the level of the lesion or at most 1 cm superficial or deep to the anterior or posterior margins of the area of interest

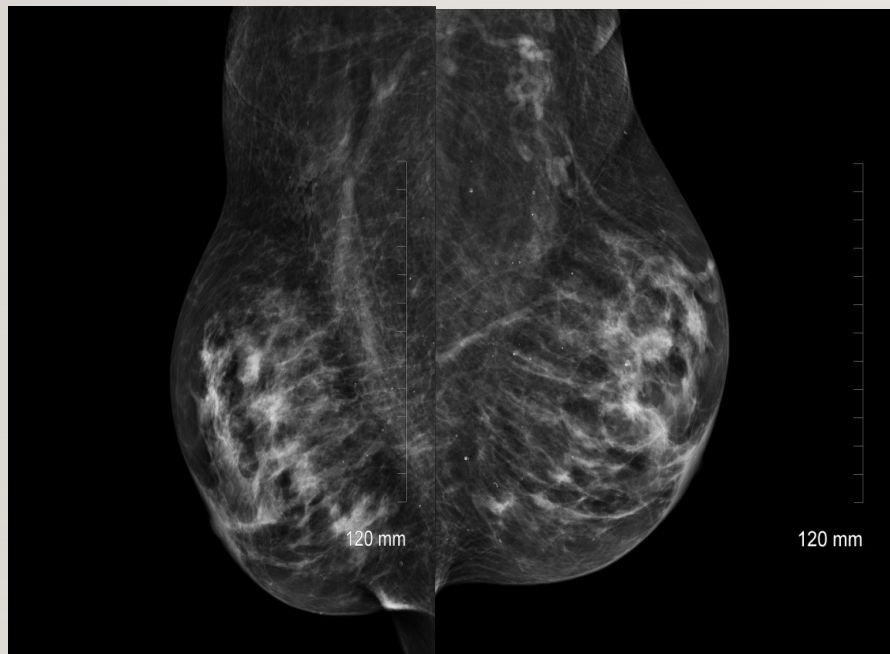
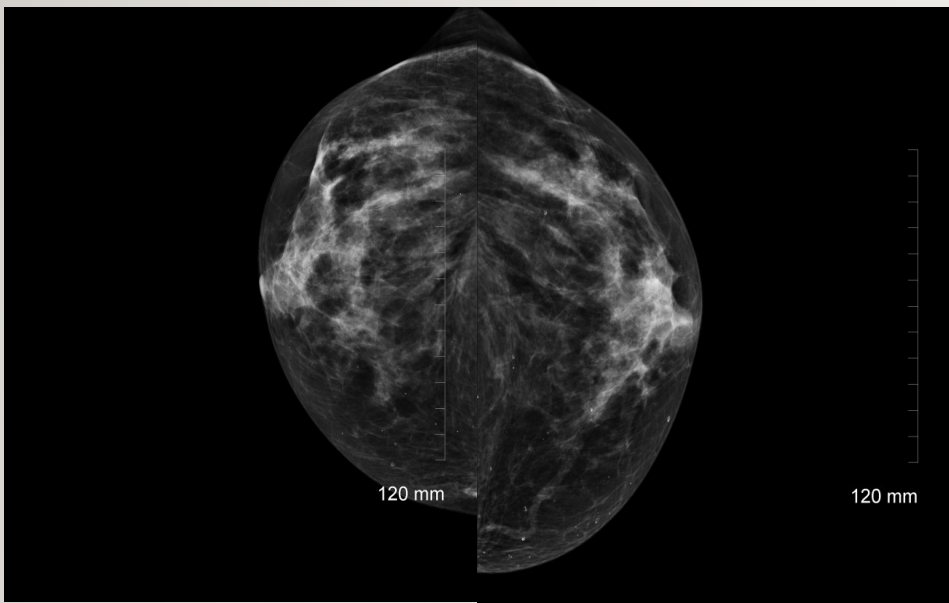


- Common Mistakes



- Inaccurate Imaging
 - Reading only the report, not reviewing images
 - OR
 - Looking at the images and not reading the report
- Review images, Review the report, a must!!!!





Scanning with the lights on???

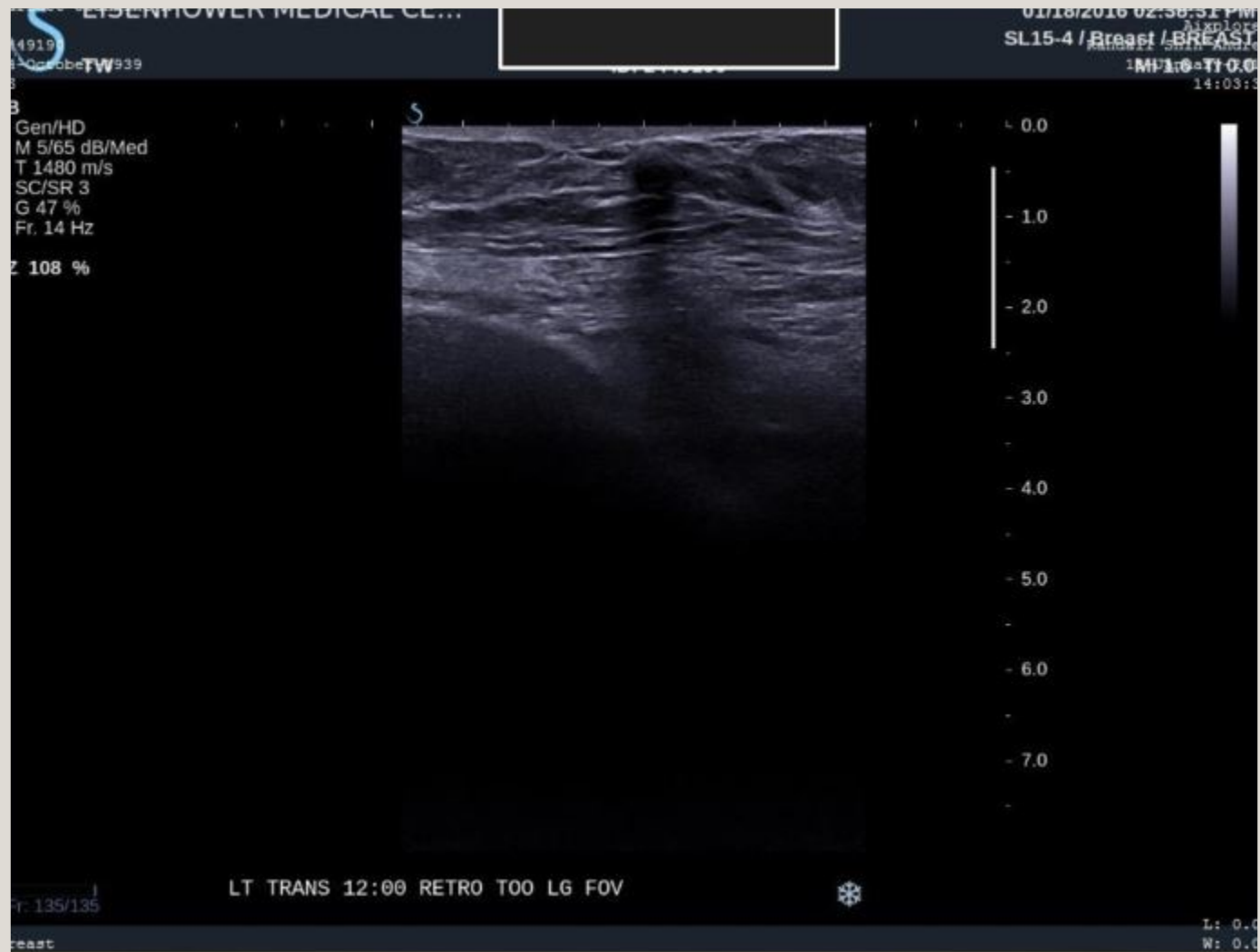
Our best work is done in the dark.



• If the field of view is too large,

information can be compressed or stacked at the top of the image.





- If the field of view is too small, important information deep to your image will be not seen.



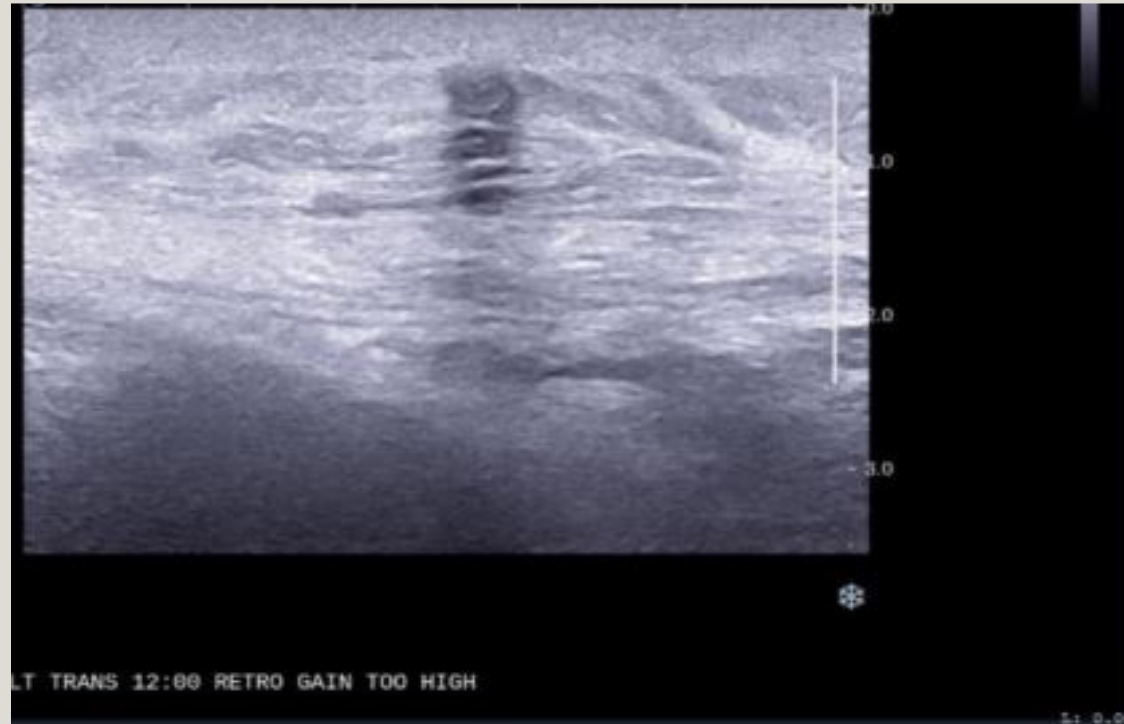
Field of View=Correct Depth



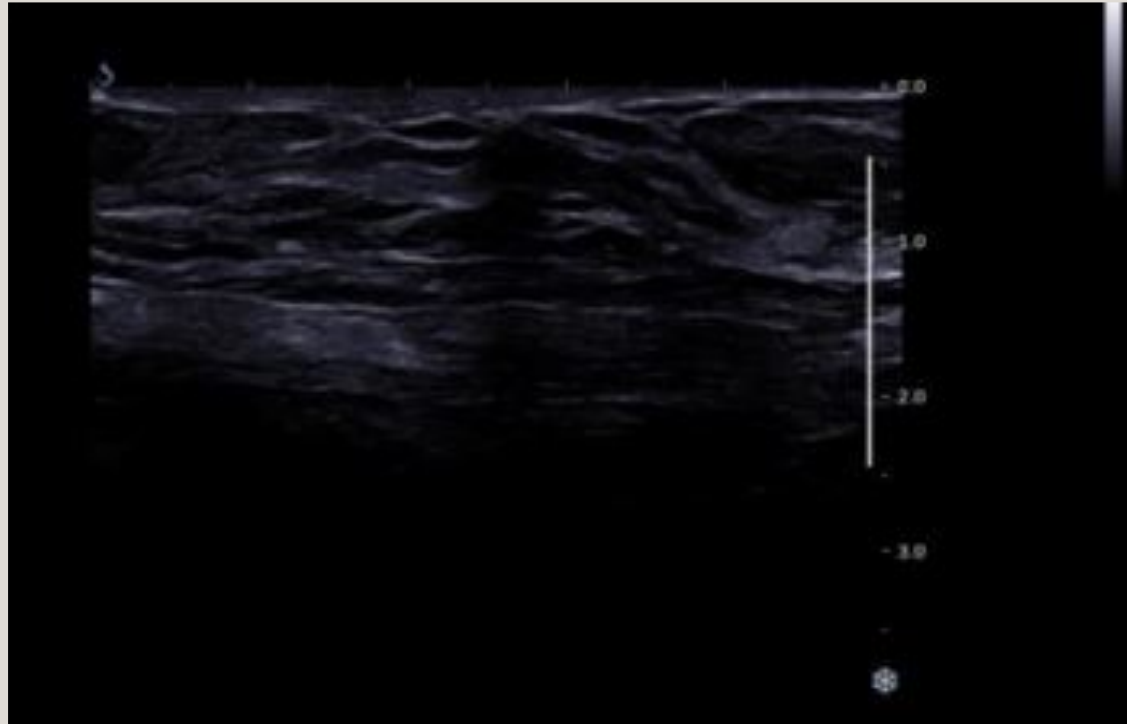
Scan the Breast with a larger field of view,
then decrease the field of view when
characterizing the lesion.



Too high of gain, causing the image to be too bright, which creates artifactual noise that affects the contrast resolution



Too low of gain, the image is too dark
and real echoes can be missed



Contrast, Gray Scale, Dynamic Range

The goal is to display the maximum levels of grays, which creates a wide or high dynamic range



Field of View=Correct Depth

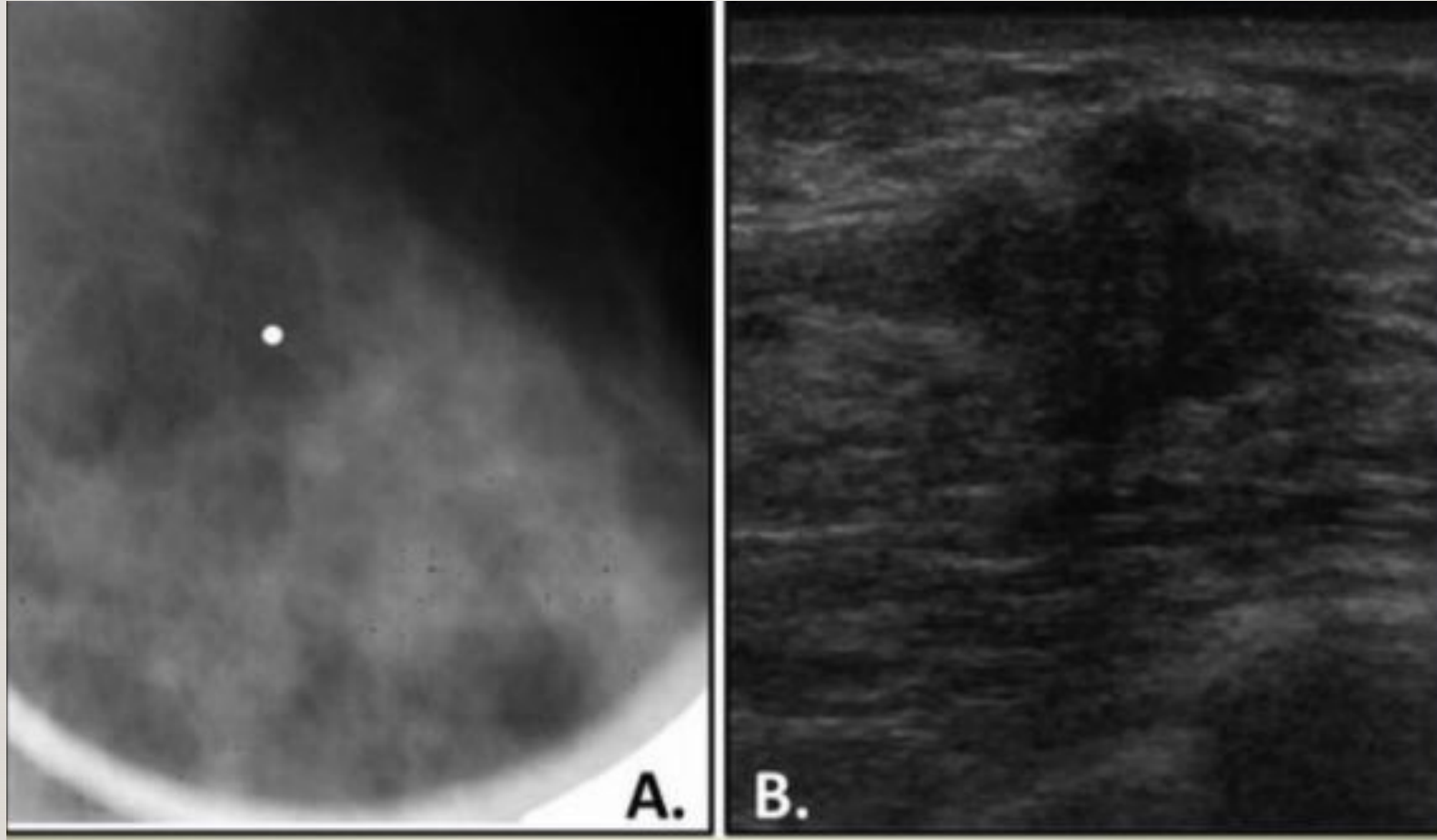


skin

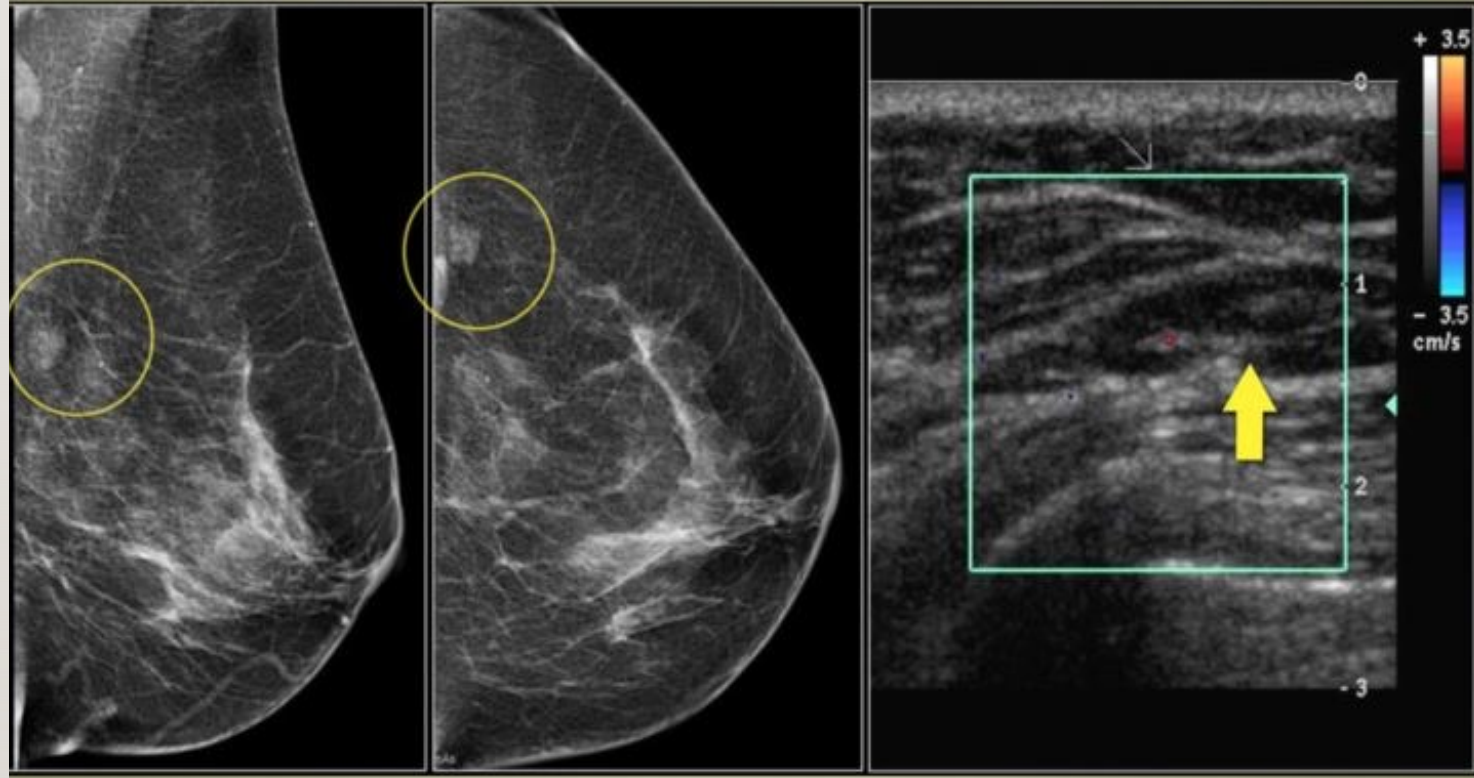
prepectoral fascia



A dense breast will present echogenic on ultrasound.
This provides more contrast for hypoechoic lesions.



But... On fatty breast, the opposite holds true...

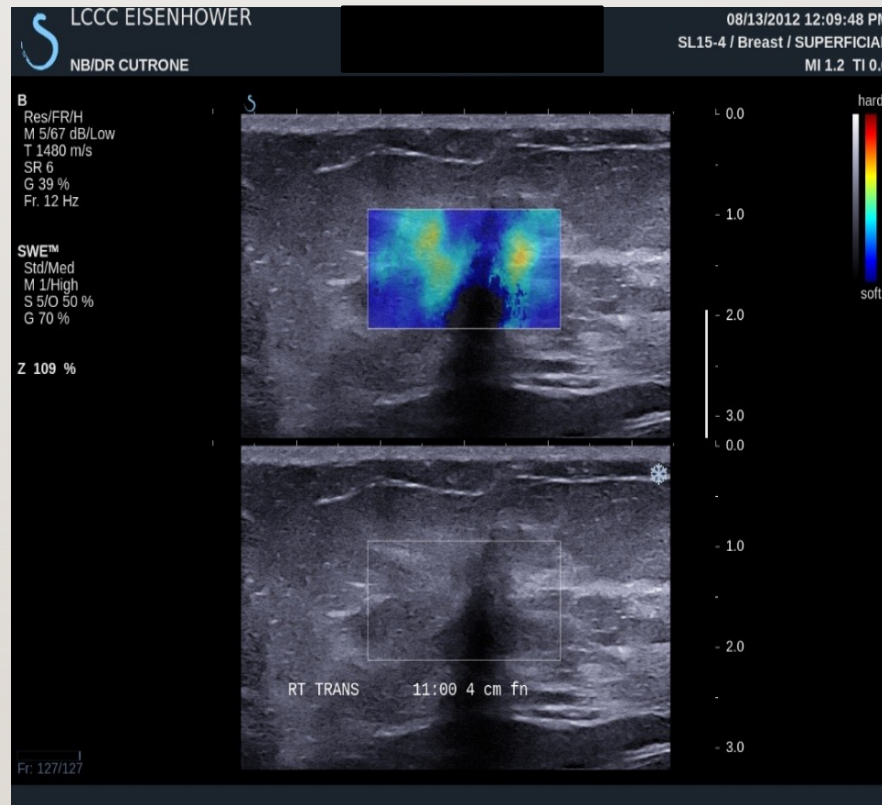




Doppler- to check vascularity

Harmonics- to optimize contrast ,lesion conspicuity

Elastography-tissue stiffness



Transducer Angle

It should be parallel to the sub Q fat/,glandular tissue and the chest wall

This improves visualization of acoustic interfaces and keeps the beam perpendicular

*The plane which most lesions grow



Rock it, Roll it... side to side, back and forth

On curved surfaces, it aids in keeping the perpendicular interface of the transducer.

Aids in ultrasound guided biopsies, to help keep the needle perpendicular to transducer (visualize it) while keeping the needle parallel to the chest wall, (to avoid pneumothorax and implant rupture).



Knobology

Recommendation:

Agree to Agree

Set it and leave it alone

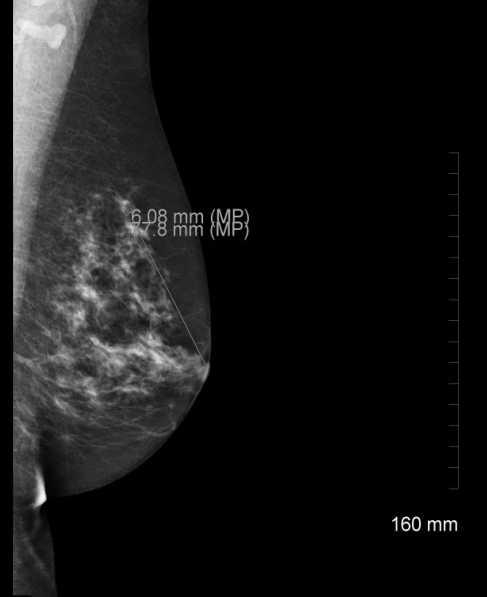
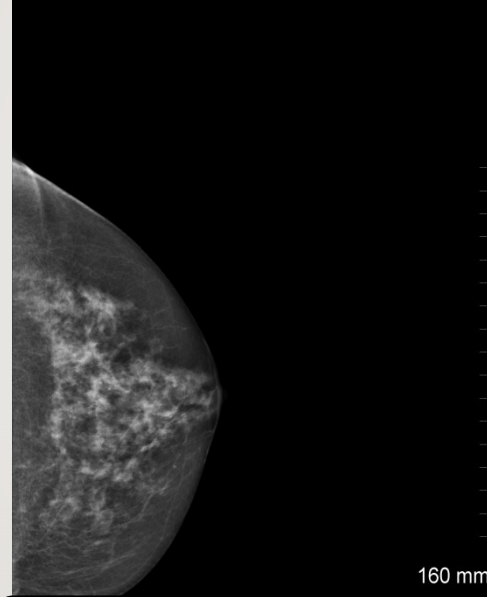
All machines have same settings



UNDERSTANDING PRESENTATION, ORIENTATION AND TRIANGULATION

- Mammography- Upright
- MRI-Prone
- Ultrasound-Supine



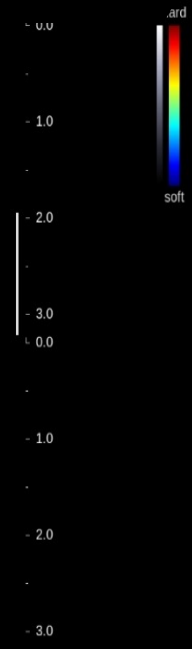
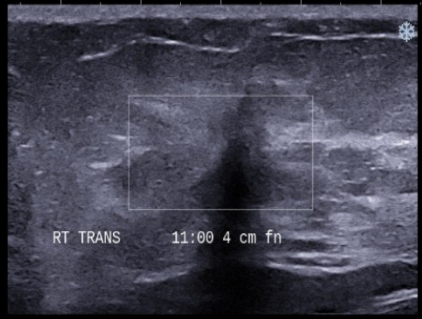
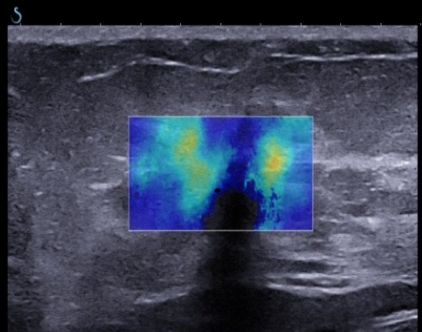


LCCC EISENHOWER
NB/DR CUTRONE

B
Res/FR/H
M 5/67 dB/Low
T 1480 m/s
SR 6
G 39 %
Fr. 12 Hz

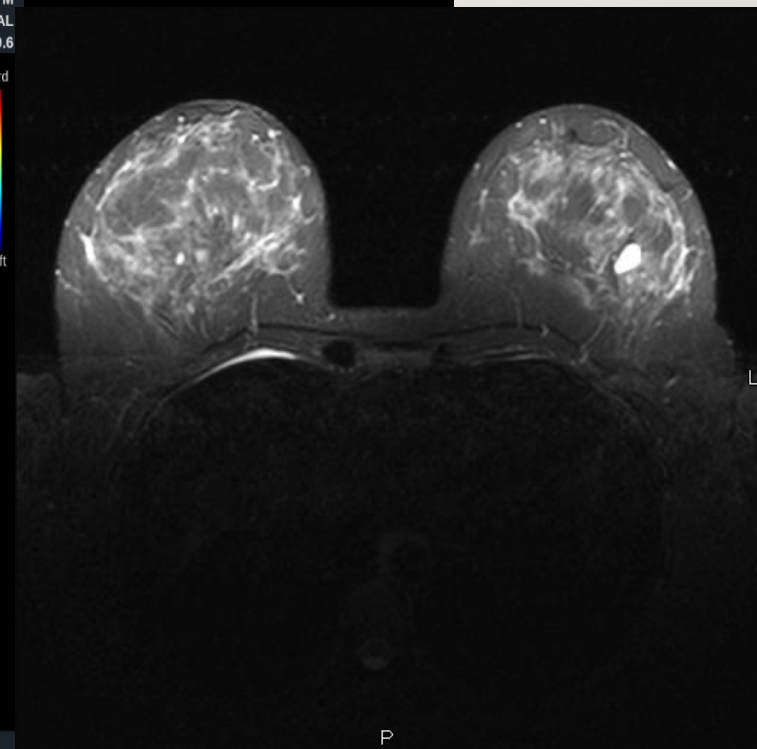
SWE™
Std/Med
M 1/High
S 5/O 50 %
G 70 %

Z 109 %

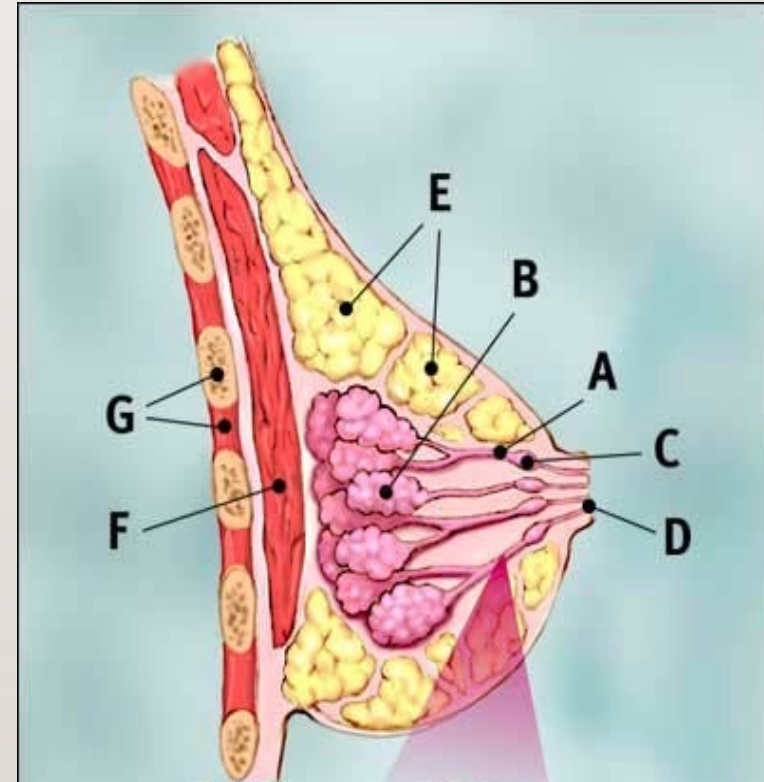
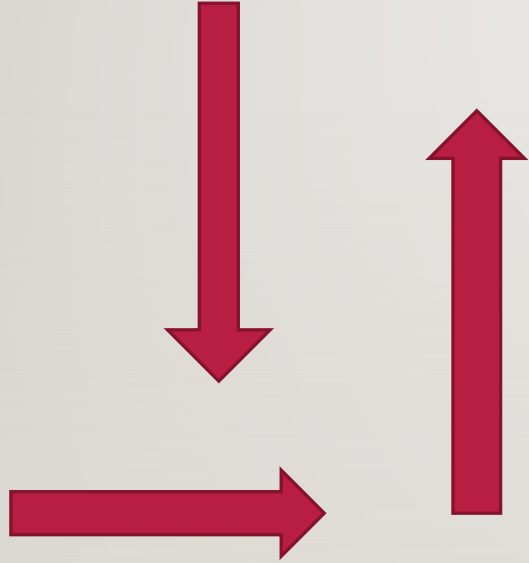


PM
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ard
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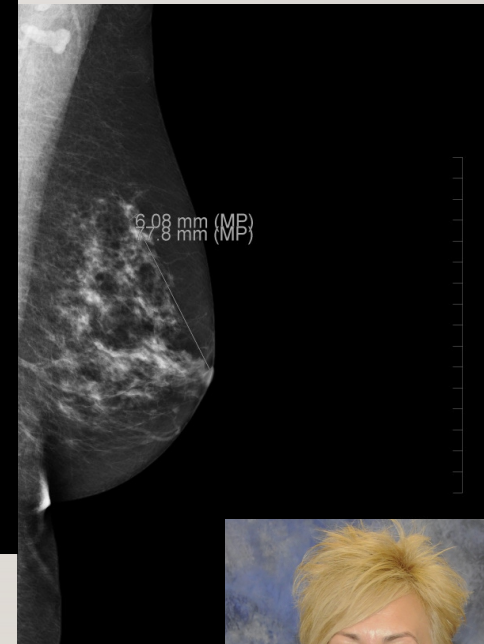
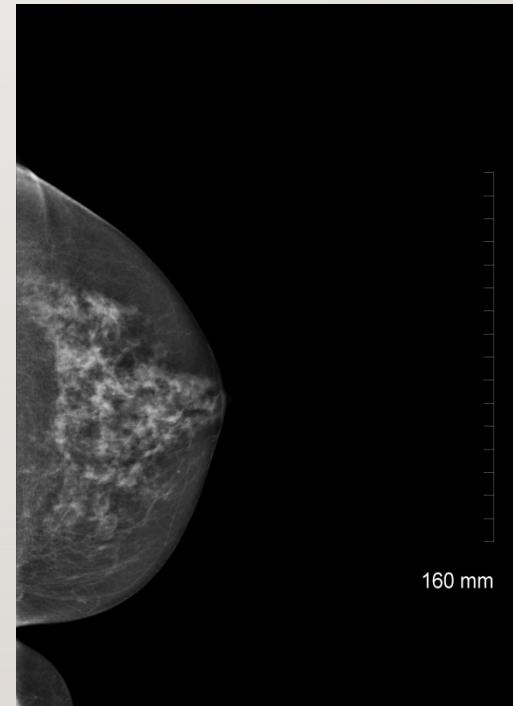
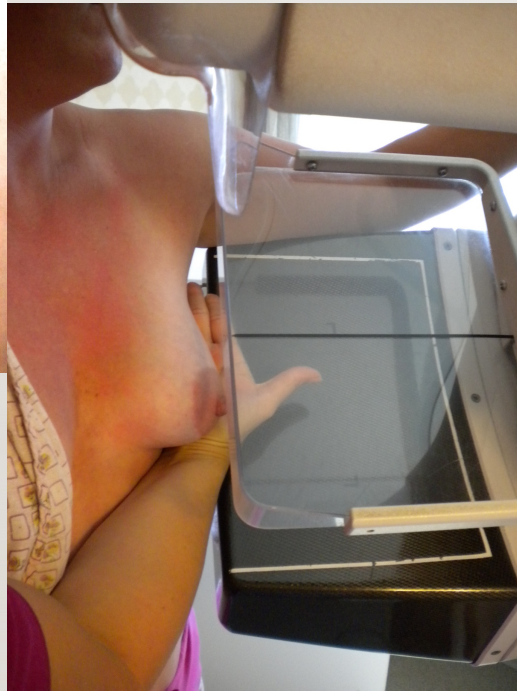
- How we view the anatomy is always changing, but the anatomy itself always presents the same



Mammography

Cranial caudad view – 0 degrees

Medio-Lateral view- 45 degrees



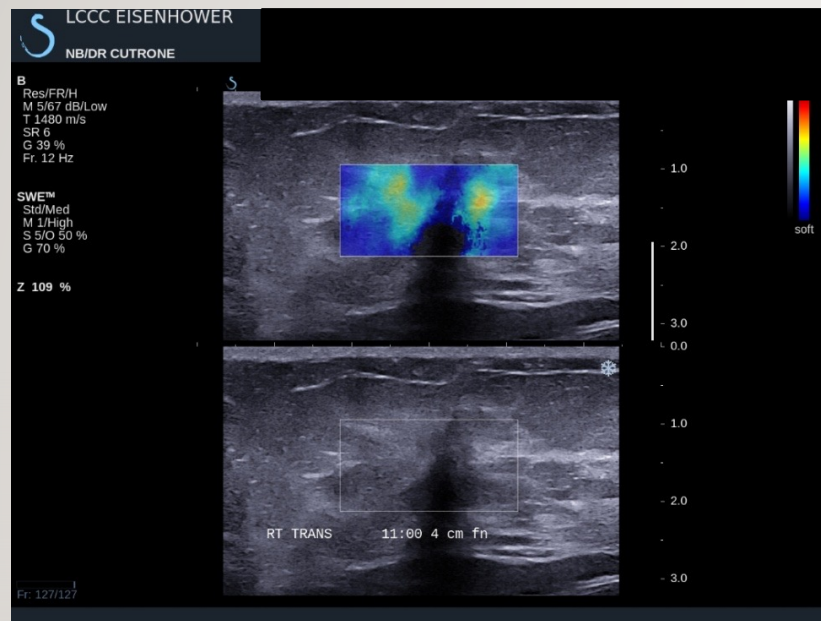


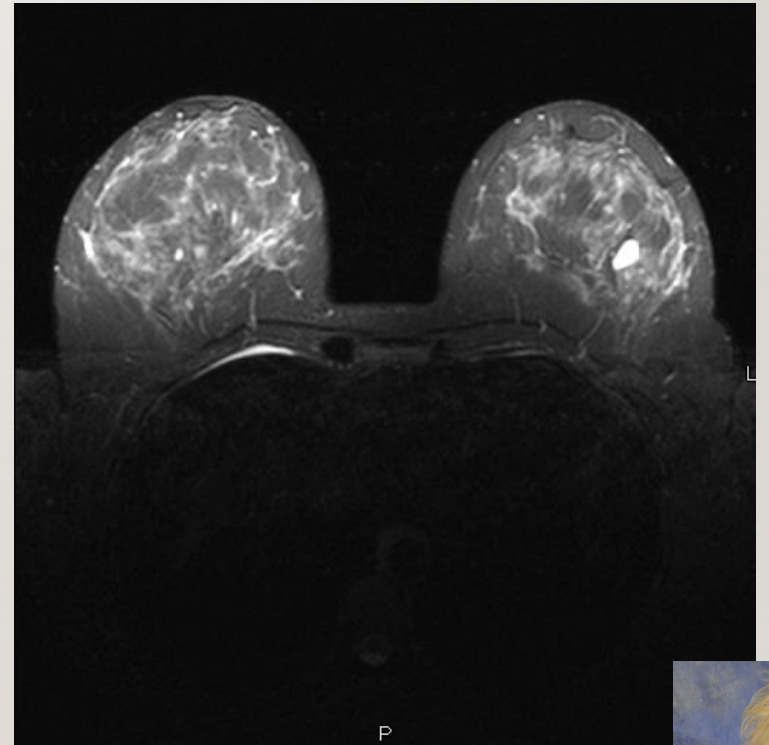
Image courtesy of GE



Breast MRI

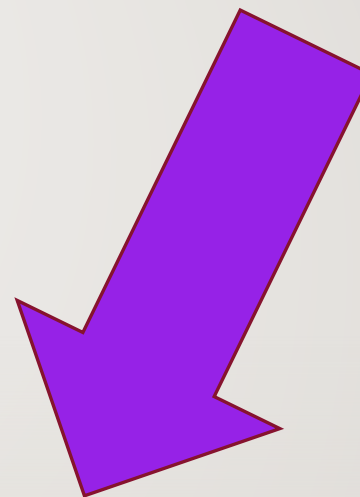


Photo Courtesy of GE Healthcare





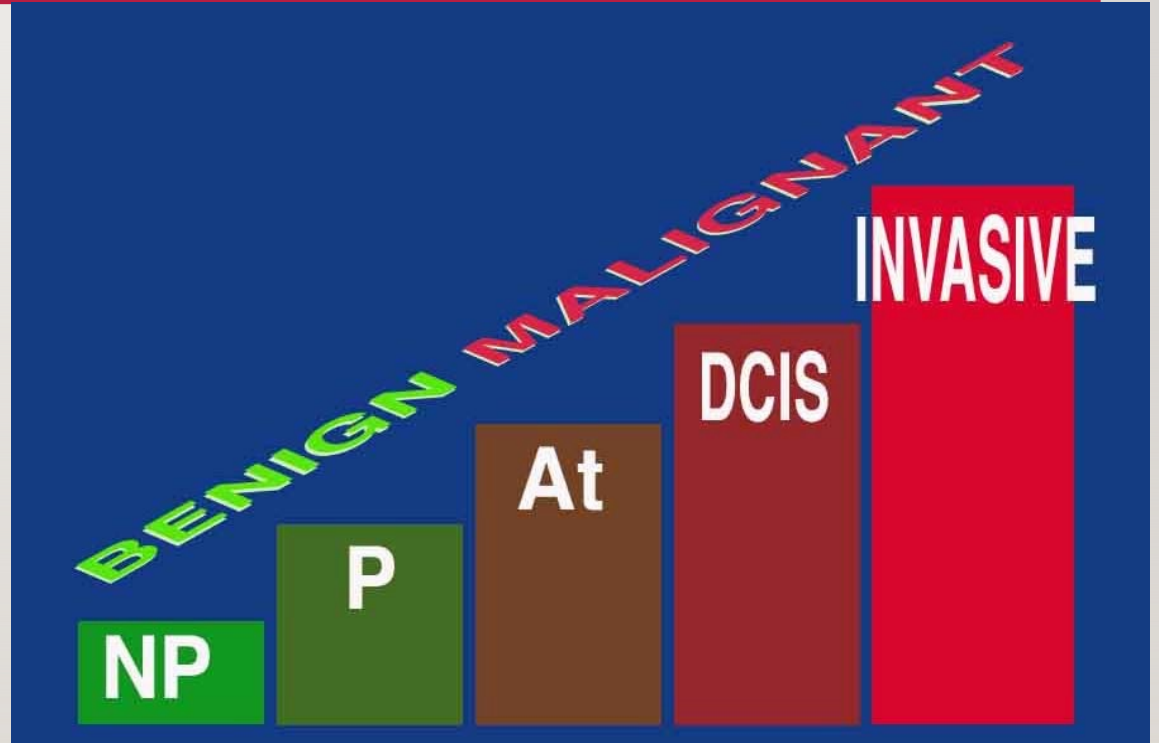
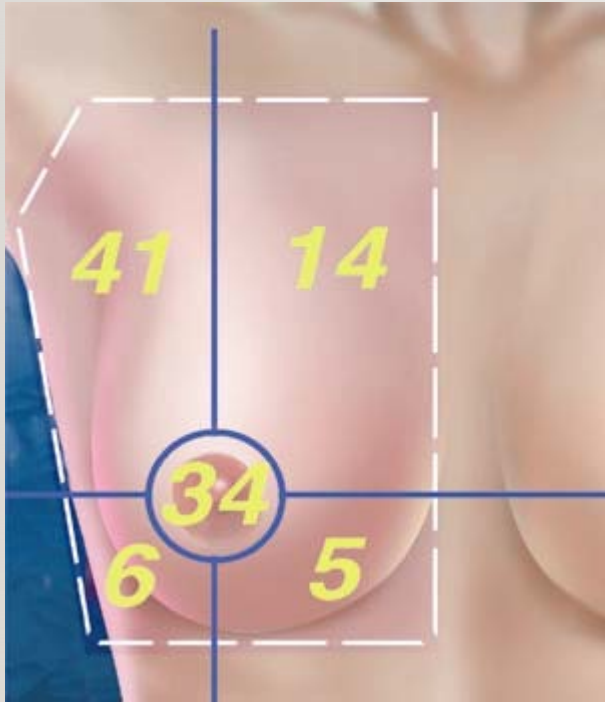
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PATHOLOGY

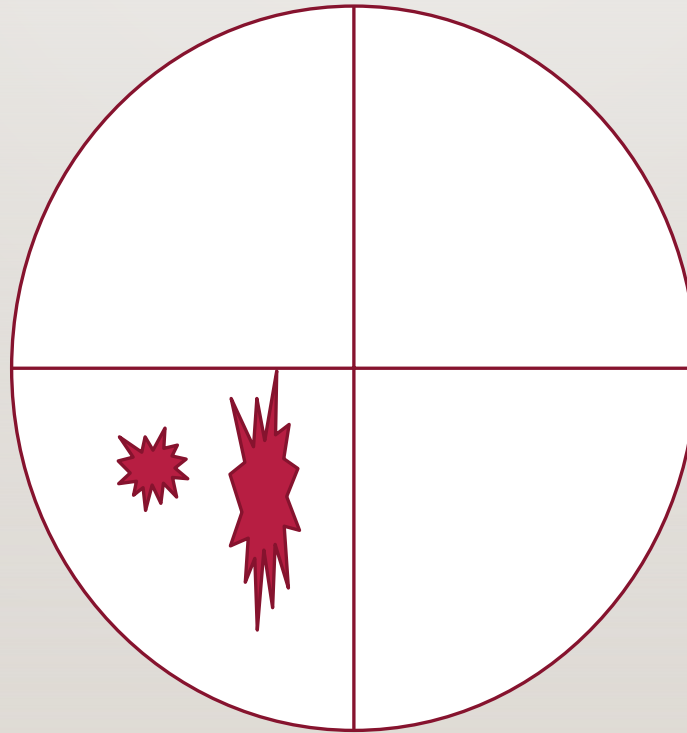
- It is important to be familiar with breast pathology because:
-
- It indicates the relative risk of developing an invasive breast cancer
-
- Helps to determine the plan of care
-
- Assists in the tumor characteristics to determine neoadjuvant treatment



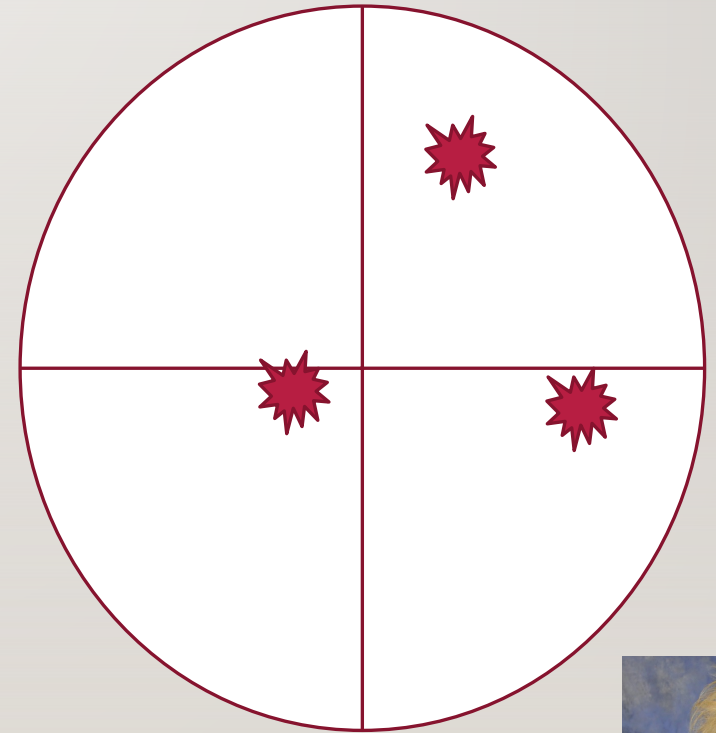


BREAST CANCER CAN BE MULTI FOCAL AND MULTI CENTRIC

Multifocal



Multi centric



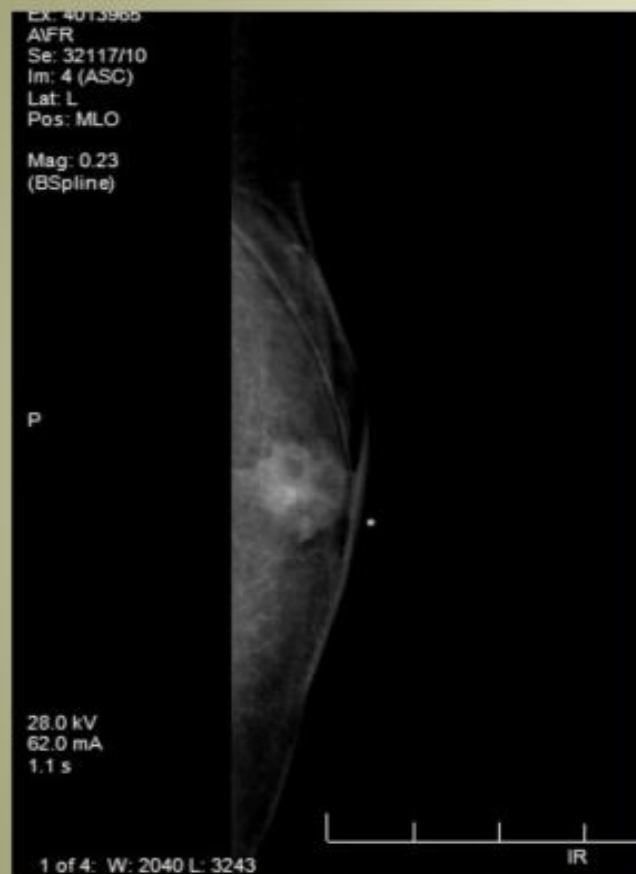


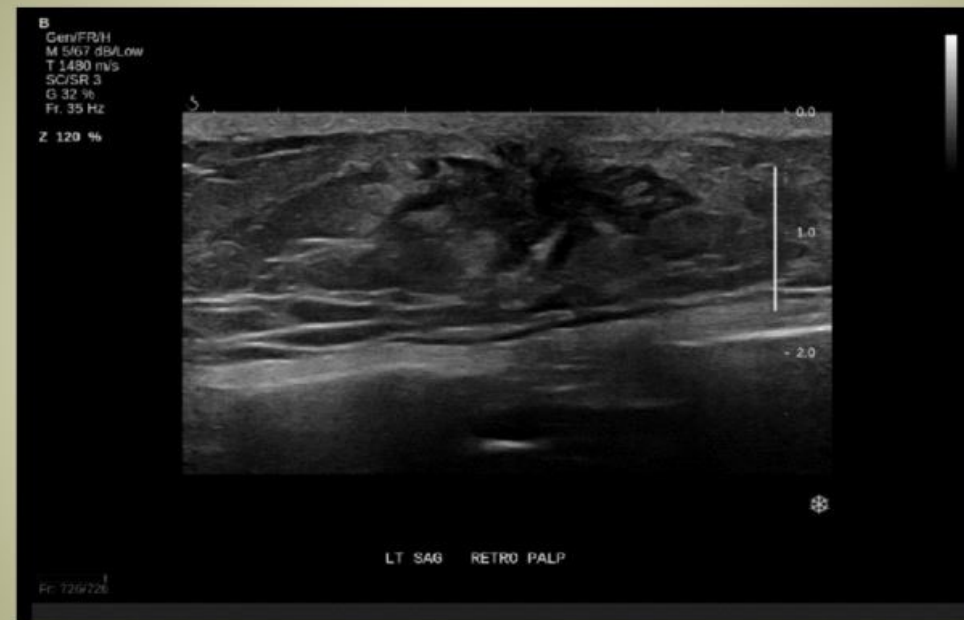


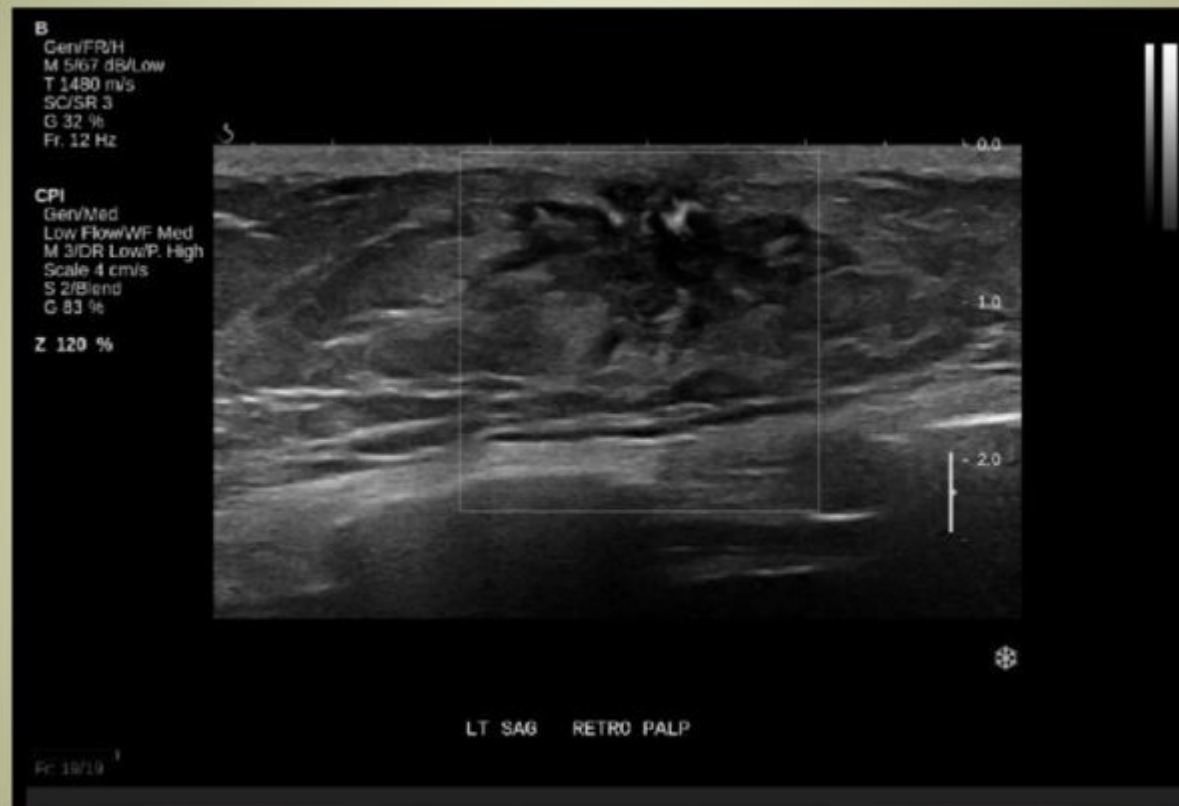
- Case I





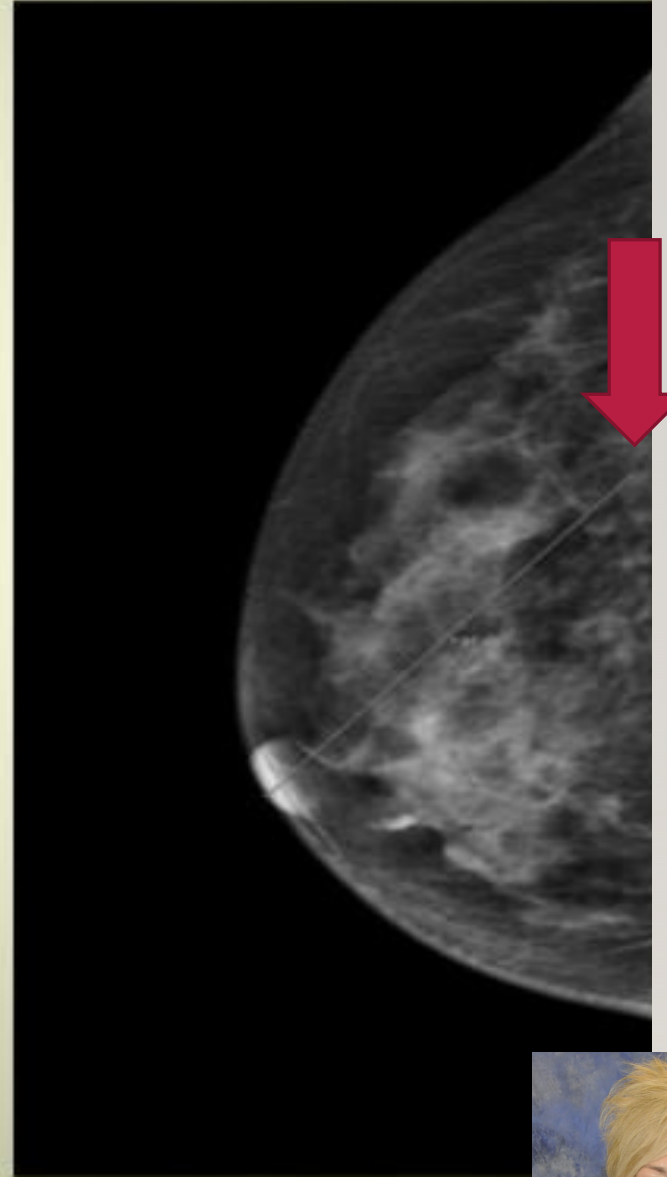
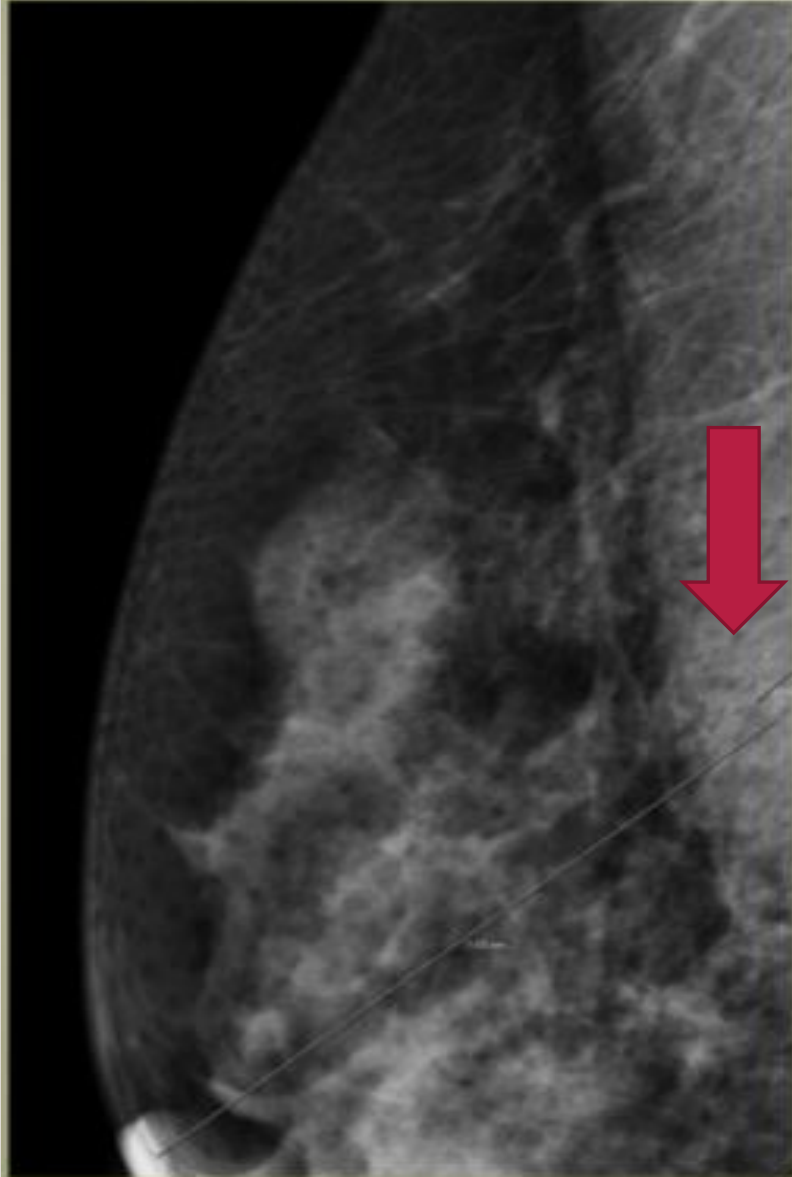


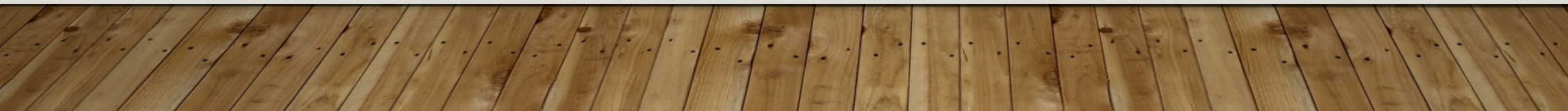
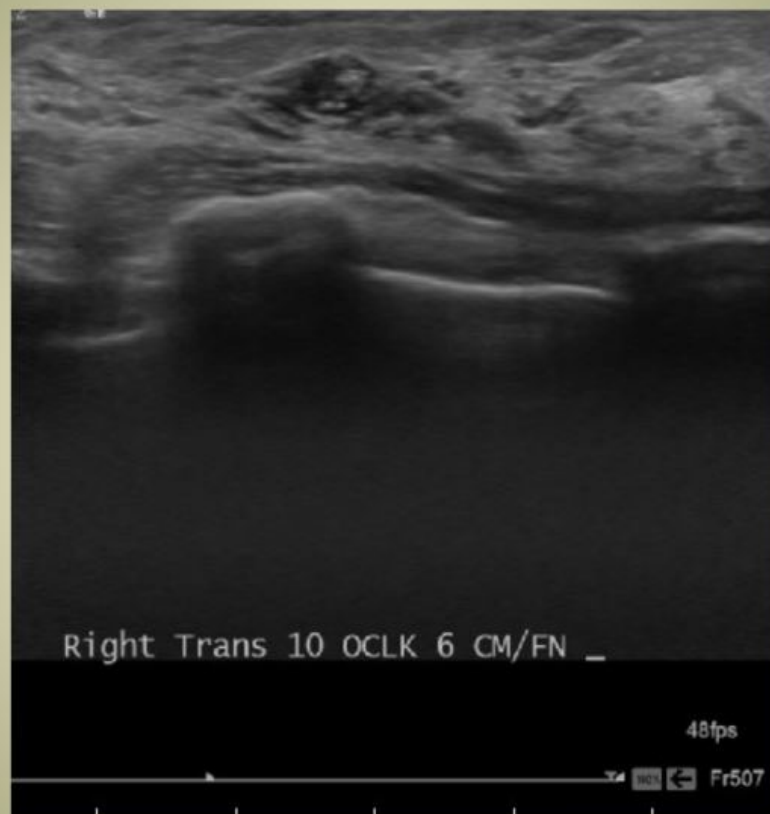


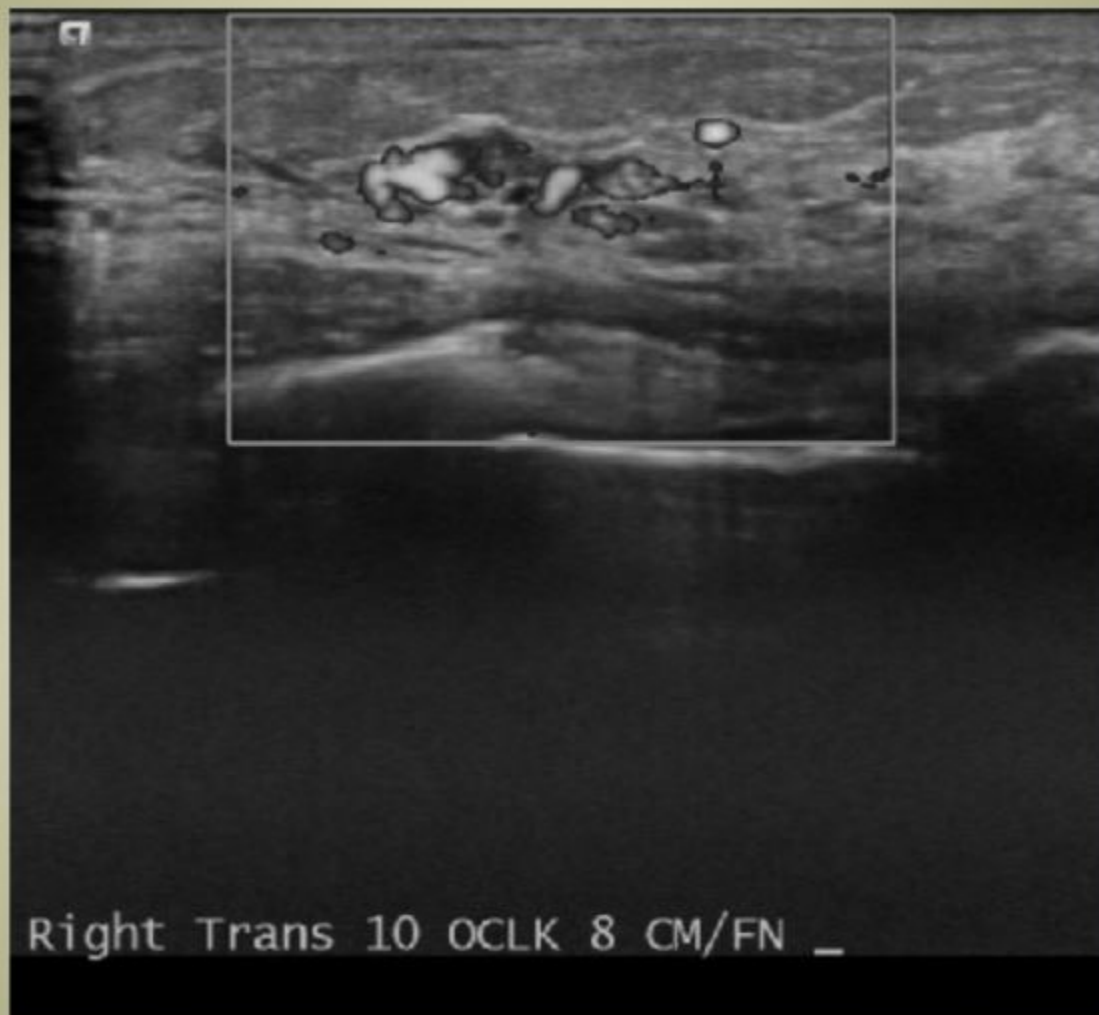


•Case 2









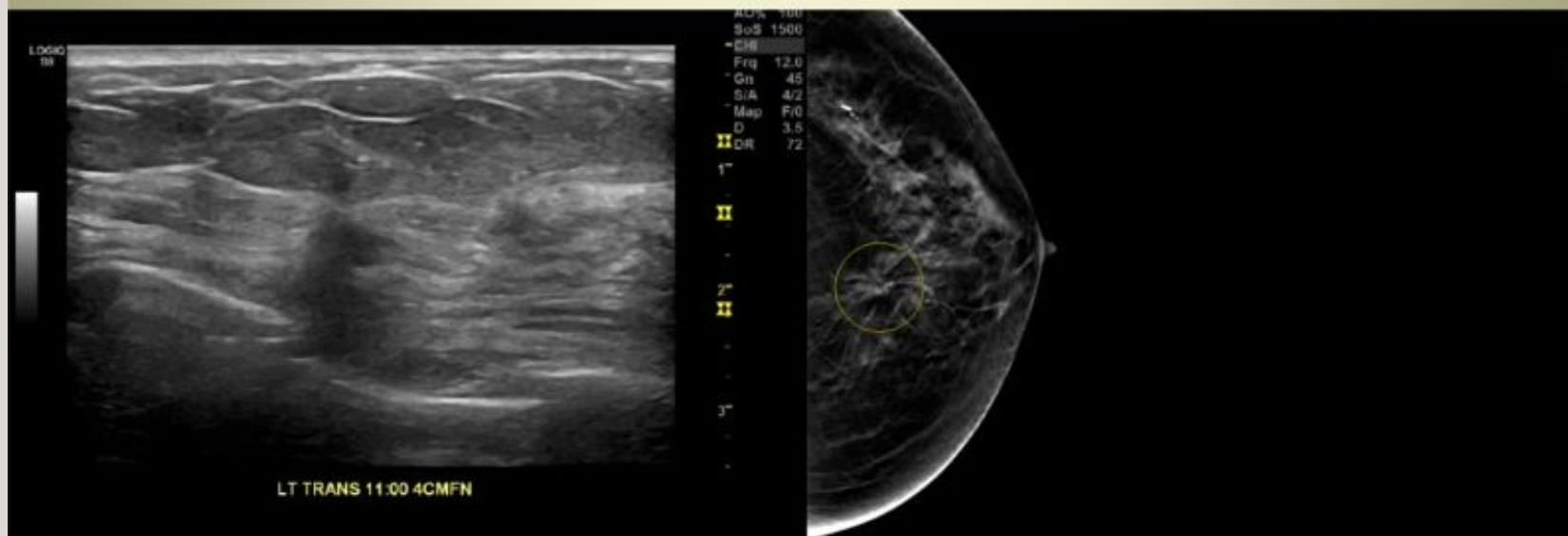
- # Calcifications

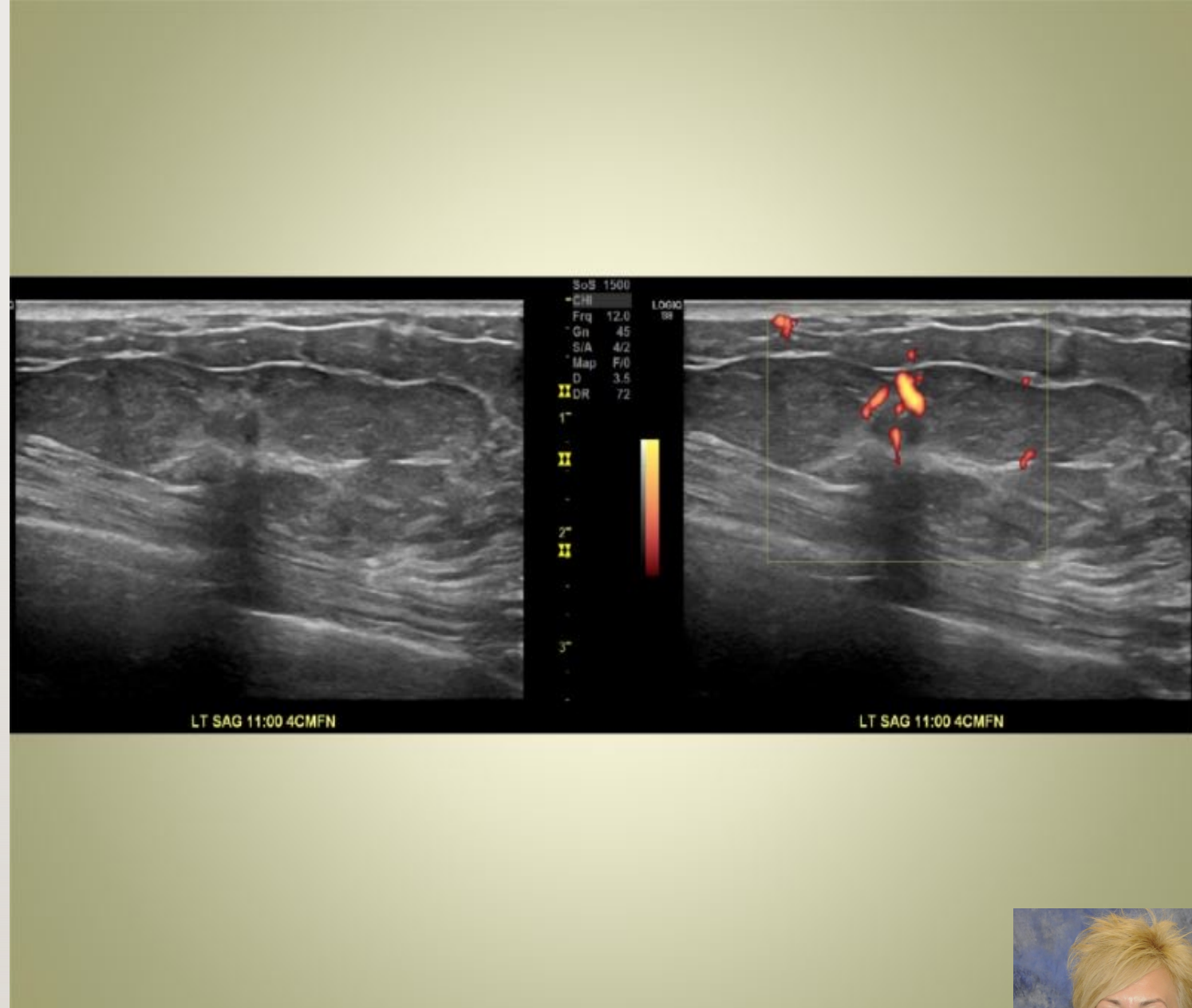
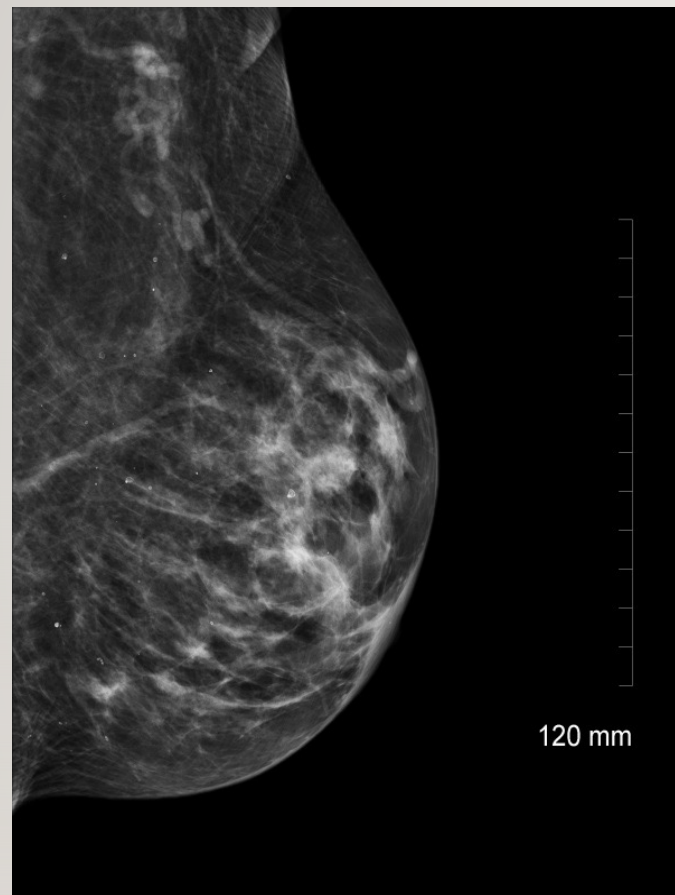
- *Makes easier to bx vs stereo for the patient*



Case 3

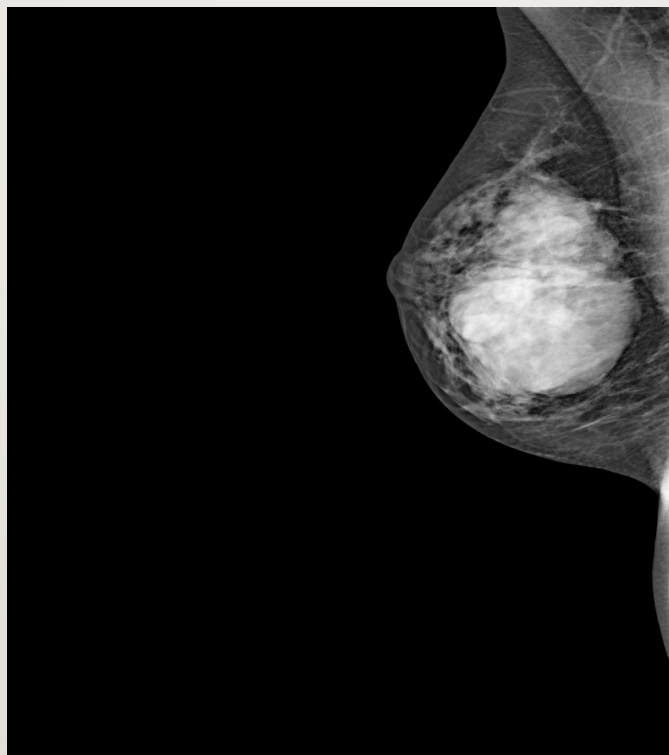
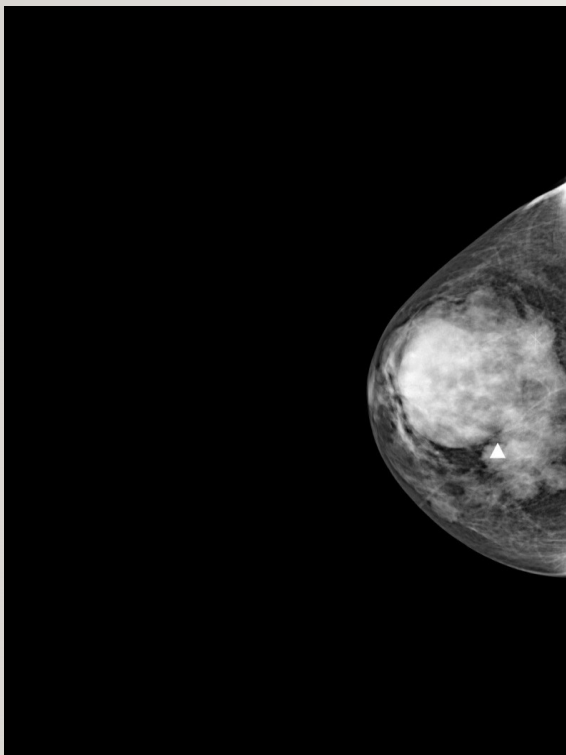






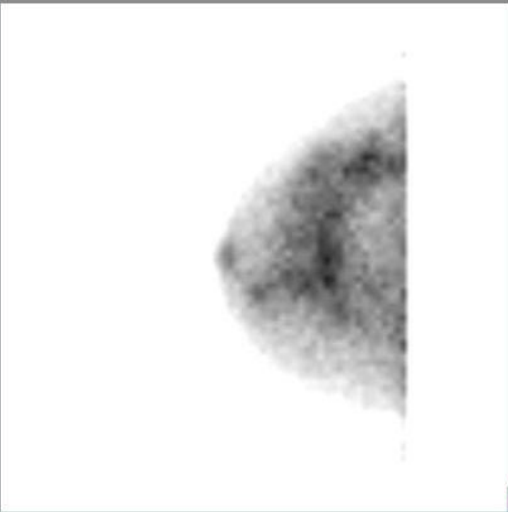
•Case 4





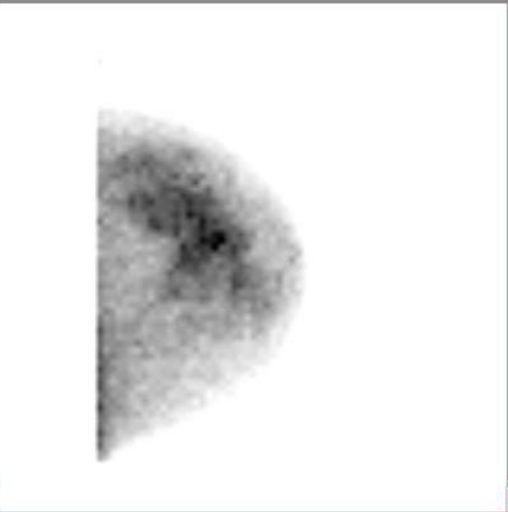
Static Image Report

CC - RCC



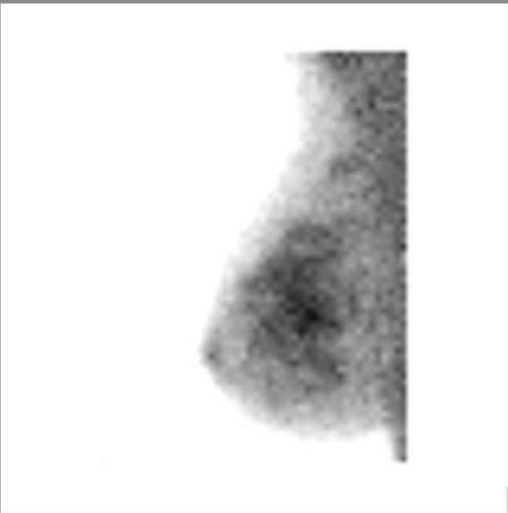
196

CC - LCC



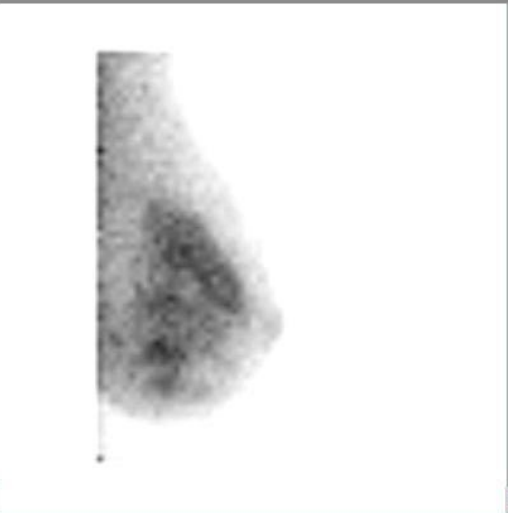
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MLO - RMLO



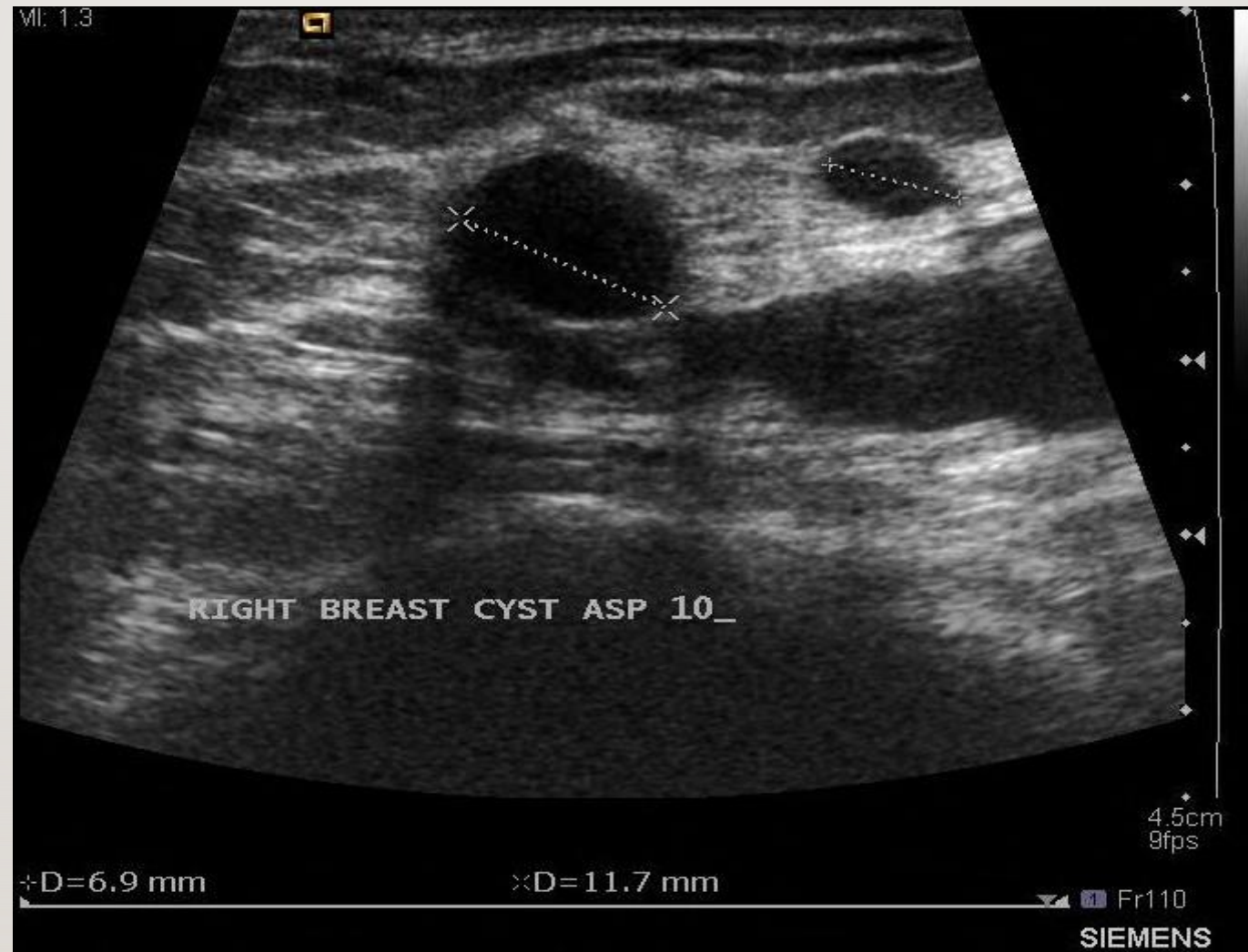
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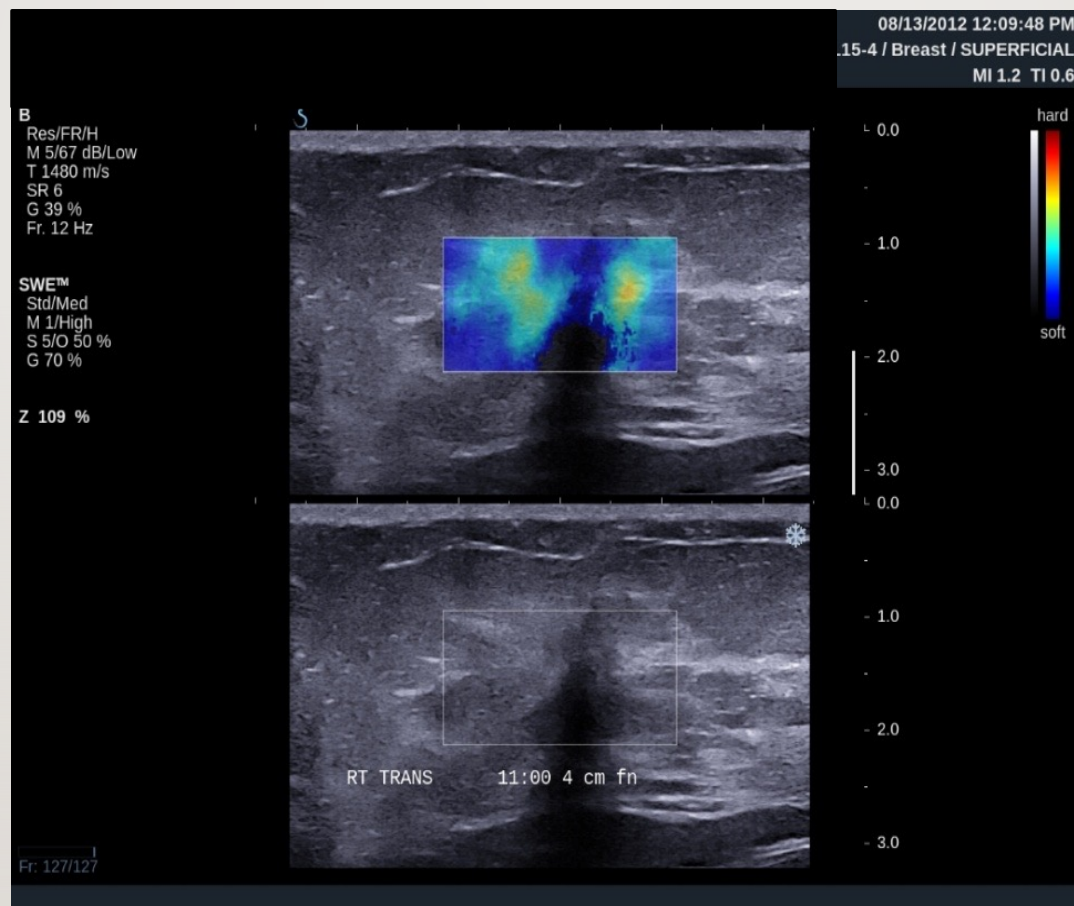
MLO - LMLO



198



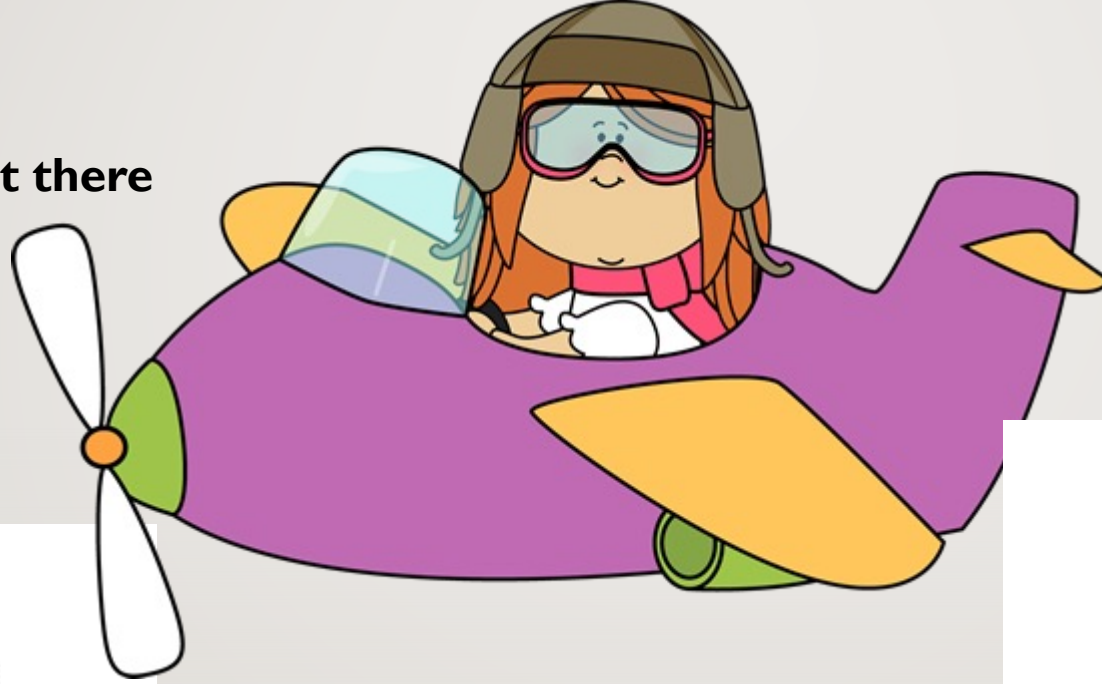




Why is Breast Ultrasound so complicated????



We know how to get there



But not the same route



...PROTOCOLS... IMPLEMENTATION

- Scanning Protocols- Screening vs Diagnostic Protocols
- Standardized Scanning Technique
- Creates consistency, continuity of care and accountability



HAND HELD **SCREENING**



Patient is in the **Cahan position**

Scan the outer quadrant, axillary tail, documenting in transverse and sagittal.

The patient should be rolled supine when at the 12 O'clock position to scan inner breast, arm should still be raised, (but can be brought down if needed), continue scanning, to 6 o'clock documenting in transverse and sagittal.

Scan the nipple documenting in transverse and sagittal.
If scan is suspicious, then document the axilla





Image courtesy of
GE



HAND HELD DIAGNOSTIC

- **Protocol Options:**
- **(A)** Start at affected area first, scan above and scan below
- **(B)** Start at affected area first, then complete scanning that breast
- **(C)** Start at affected area first, then complete scanning that breast, then scan the other breast



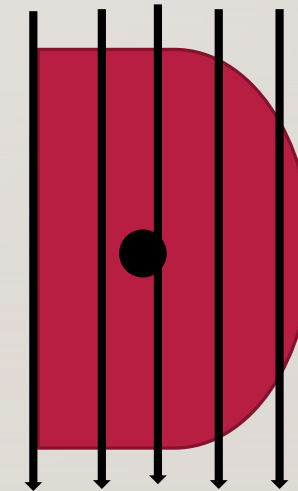
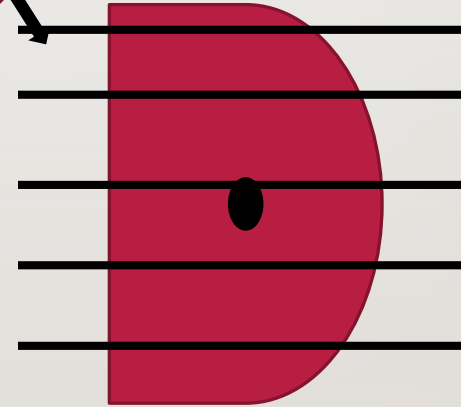
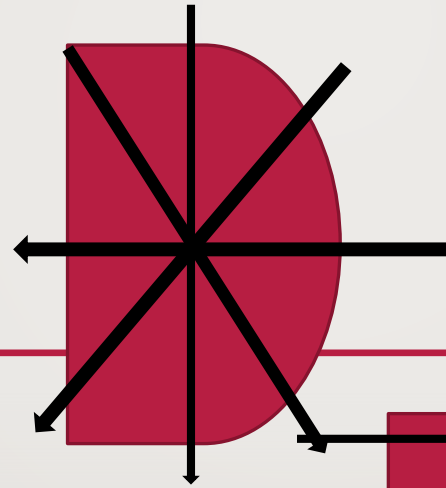
Scan in three directions

Radial/Antiradial

Applying firm even pressure

Transverse

Sagittal



DOCUMENTATION OF IMAGES

Laterality

Clockface, O'clock, orientation

12

3

6

9

Nipple

Axillary tail

Axilla

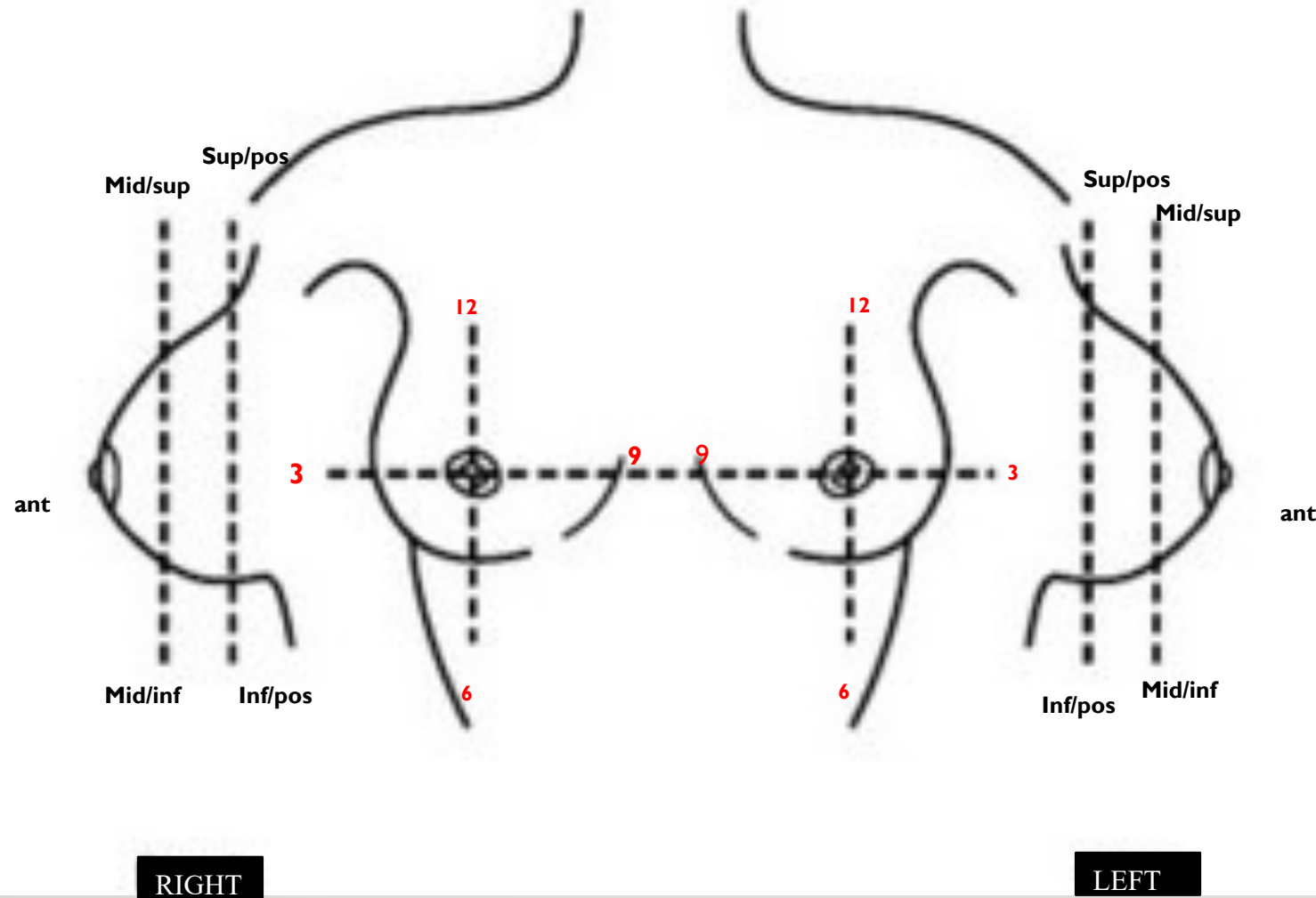
Measure lesions in orthogonal planes, using longest axis

Measure distance from nipple



Documentation

allows for reproducible images



Nipple-solid dot ●

•Mole: Circle-



•Palpable Lumps: Triangle



•Scars: Broken line-



•Pain or Concern: Square



AUTOMATED WHOLE BREAST ULTRASOUND



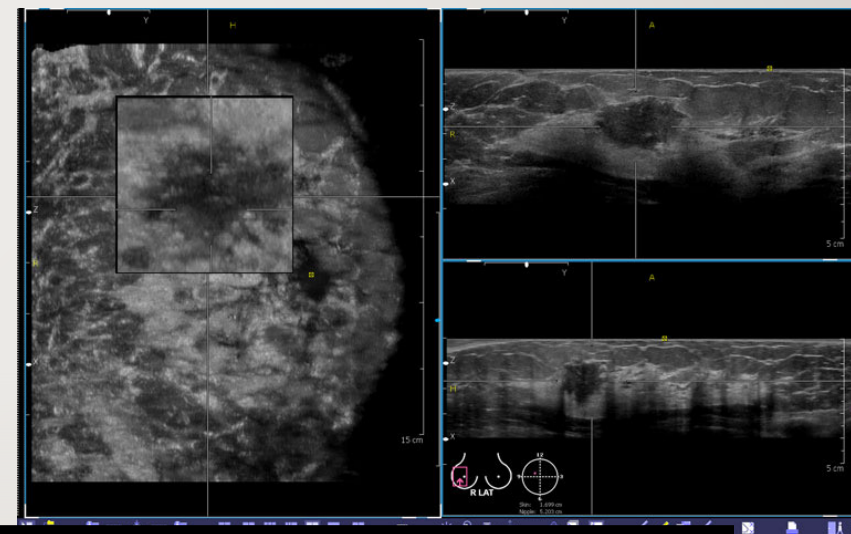
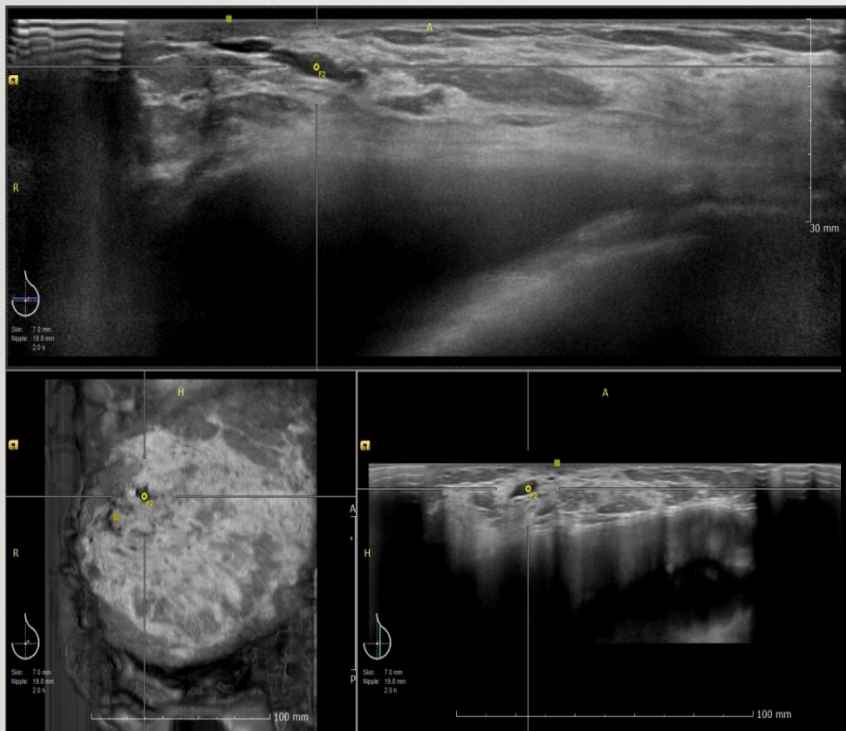
Images courtesy of GE,
Siemens, U systems,
Hitachi



- Scan according to manufacturers protocol
- Patient can be supine or prone
- Automated Breast US can be used as a Screening or Diagnostic (Ideally screening)
- **Protocol options:**
- Do hand held work up at appointment time
- OR
- Patient can be called back for further work up



3D Ultrasound



Courtesy of Siemens



THE KEY TO CONSISTENCY....

- Set protocol
- Demand standardization
- Document Laterality, Mode, O'clock and DFN
- Scan follow up on the same machine
- Have settings the same on all machines



- Ergonomics

Roughly 80 % sonographers have musculoskeletal related injuries

1 in 5 have a career ending injury

5 years before experiencing pain on average





(A)







(A)



(B)



- Chair or stool adjusted to you
- Monitor at eye level
- Machine within proper reach
- Feet flat or supported
- Move the patient close to you
- Adjust height of bed if possible
- Flip the patient



- You are the commodity
- Take care of **yourself** to
provide care to **others**



THANK YOU

