How to Approach Breast Ultrasound

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Indications

Patients present for breast ultrasound for either screening or diagnostic purposes

Screening:

- Asymptomatic patients with high risk for breast cancer and contraindication to screening MRI
- Asymptomatic patients with dense breast (ACR categories C or D) +/- ↑ risk of breast cancer

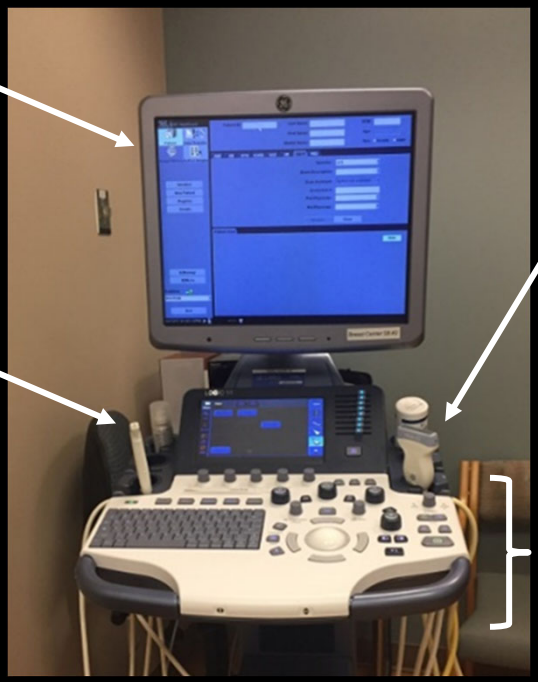
Diagnostic-Problem Solving for the evaluation of:

- Breast symptoms: lump, pain, nipple discharge, skin retraction
  - Patients < 30 years, US first, otherwise start with MG
- Mammographic abnormality
- MRI abnormality

Equipment

Monitor

Hockey stick transducer



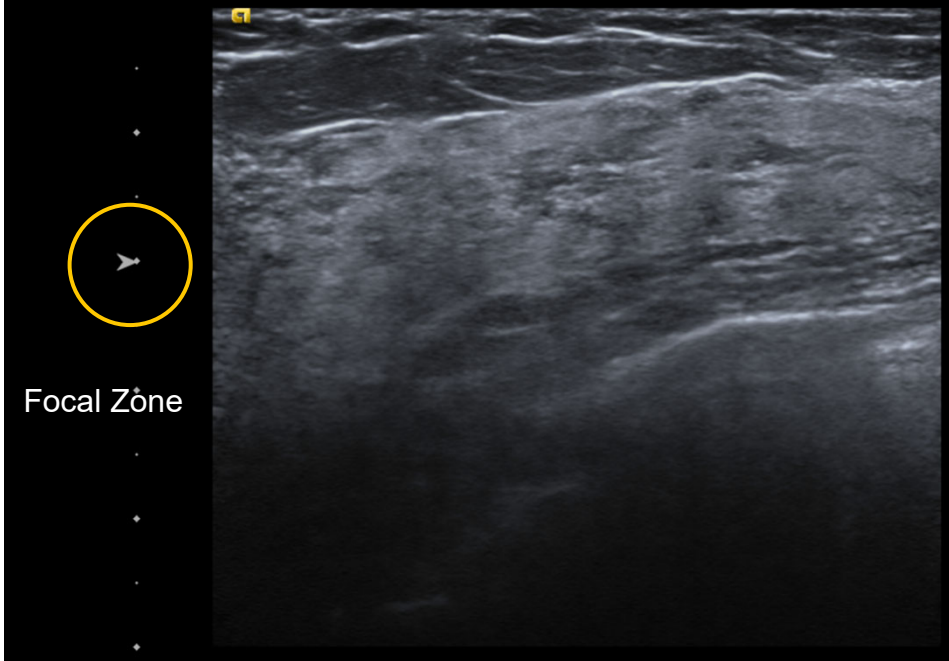
Linear Transducer

Keyboard to control imaging settings and label images

Standard US Equipment:

- Monitor - displays images
- Keyboard - houses controls to optimize images - focal zone, depth, spatial compounding, gain, harmonics, etc. to clarify images
- Measurement tools and doppler imaging to provide additional details.
- Transducers - come in various frequencies
  - lower frequency transducers having deeper penetration of tissue.

Technique: Optimize Imaging



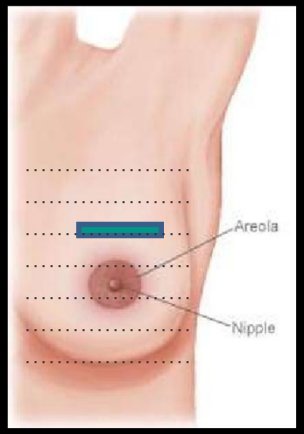
- High frequency, linear array transducer
  - with center of frequency of at least 10MHz
  - with maximum frequency 12-18 MHz
- Field of view - reach chest wall but not beyond
- Overall gain - set so that fat is gray
- TGC - increase with increasing depth
- Focal zone - set at lesion
  - Most transducers allow for multiple focal zones
  - Increase resolution of lesion with one focal zone

Technique: Patient Positioning

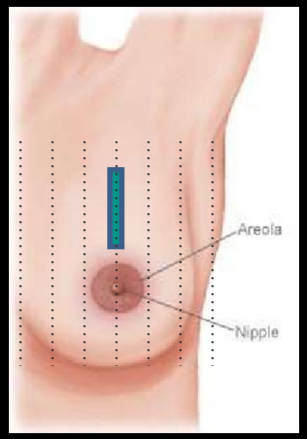
- Positioning is key to immobilize breast tissue and aid with scanning
- Good positioning includes:
  - Arm above the head - helps thin and spread breast tissue for improved penetration
  - Lying supine to evaluate medial tissue
  - Lying supine oblique for lateral breast and axilla evaluation
  - Wedges can be used to provide additional support

Approach: Scanning planes

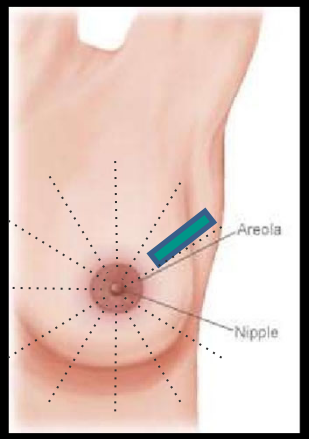
Document findings in two planes (transverse/longitudinal or radial/antiradial). Images below demonstrate orientation of the transducer (blue rectangle) in relation to the breast



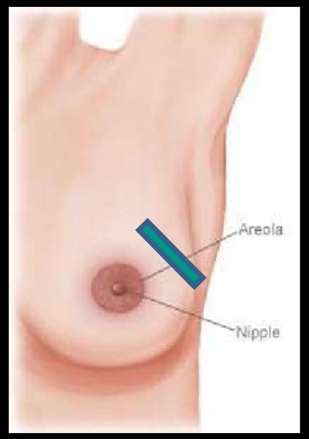
Transverse



Longitudinal



Radial- spokes on wheel



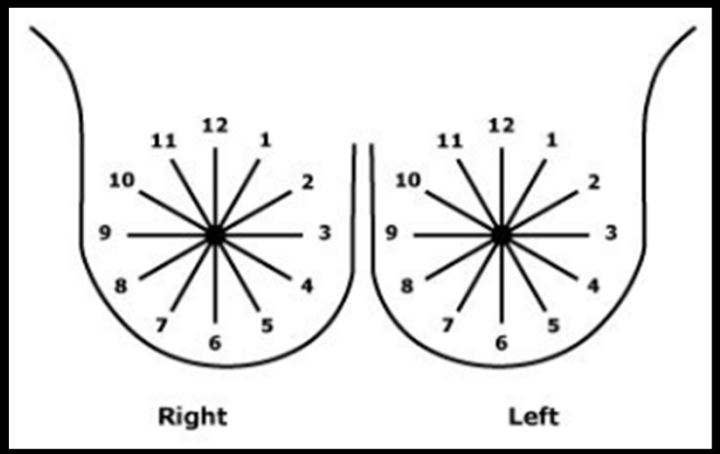
Anti-radial - perpendicular to radial spokes

Lesion Location:

Findings in ultrasound are given two location identifiers:

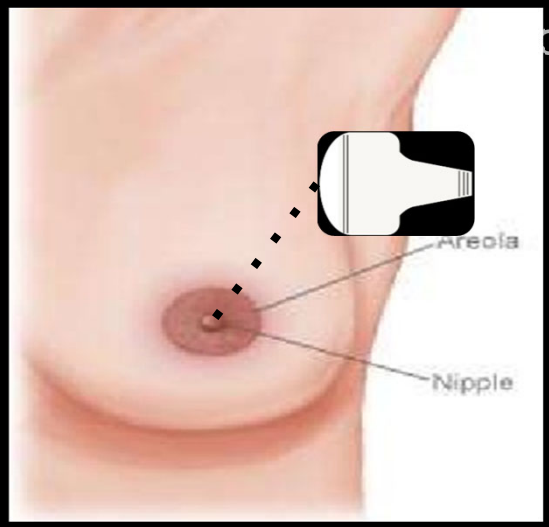
1) Clock face position

Distance (cm) from the nipple



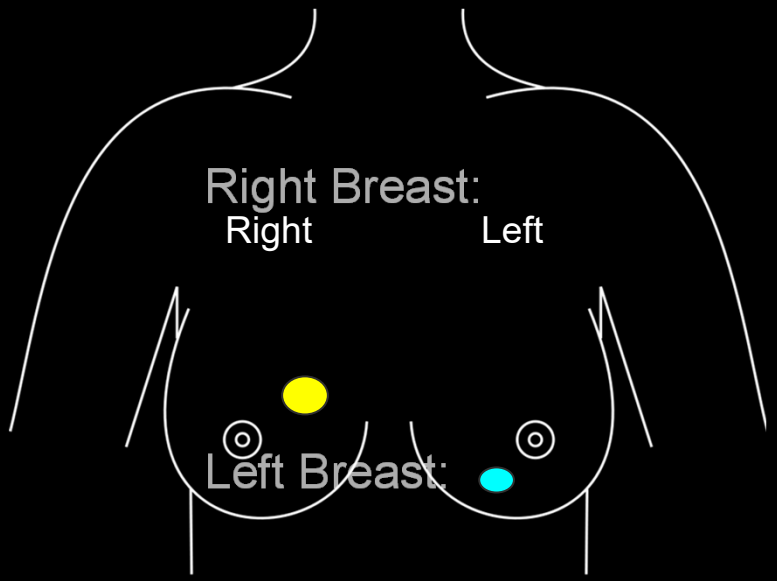
2)

o nipple)



Lesion Location:

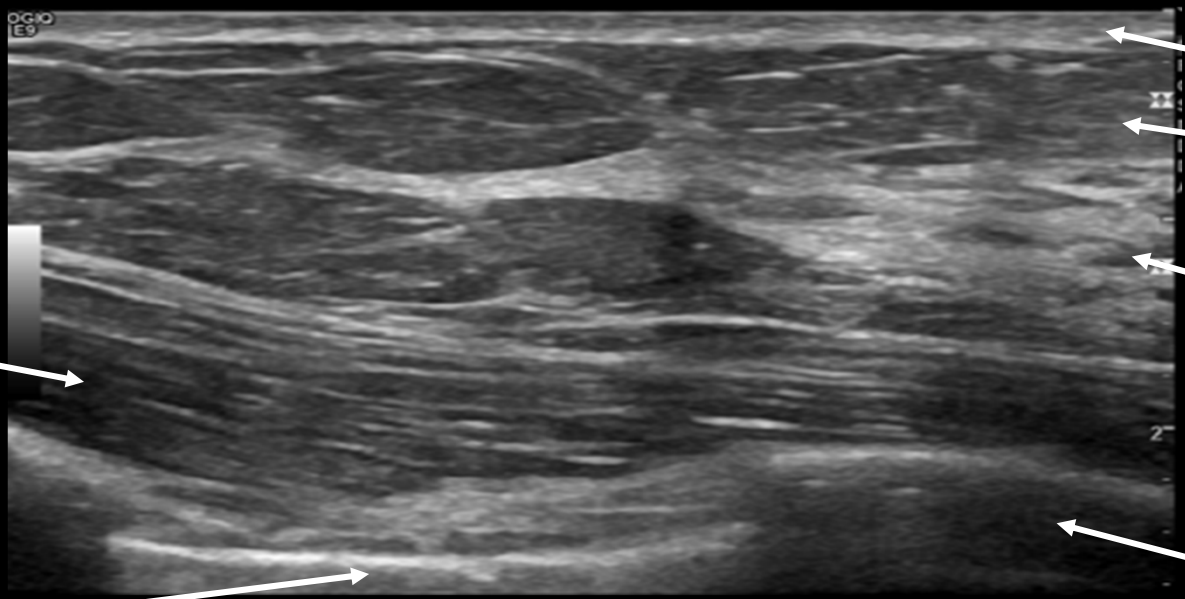
Now let's practice. What is the clock face position of the following findings?



2:00

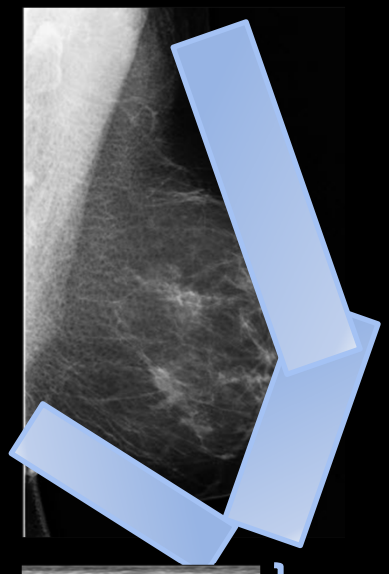
7:00

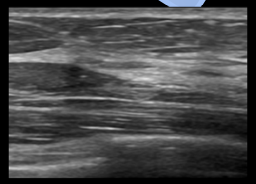
Normal Anatomy



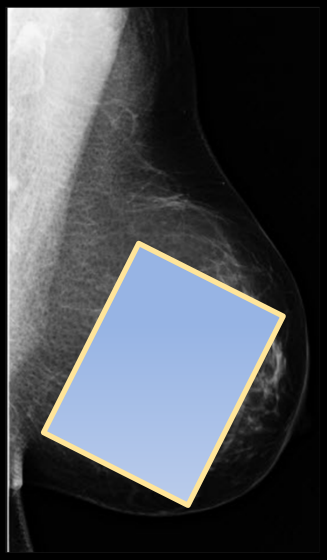
Important to note that echogenicity of ultrasound findings are described relative to echogenicity of breast fat.

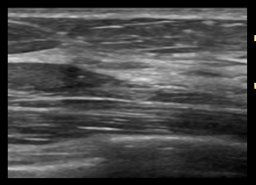
Relationship of tissue depth on MG and US



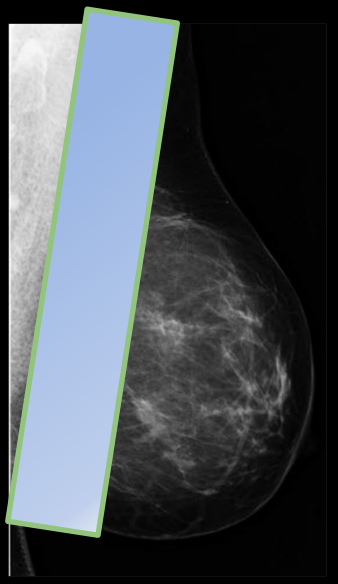


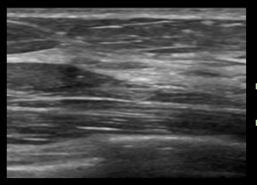
} Closer to skin





} Within Glandular tissue





} Closer to pectoralis muscle

Ultrasound Reporting: BIRADS

ULTRASOUND		
Tissue composition *(screening only)*	a. Homogeneous background echotexture – fat b. Homogeneous background echotexture – fibroglandular c. Heterogeneous background echotexture	
Masses	Shape	Oval Round Irregular
	Orientation	Parallel Not parallel
	Margin	Circumscribed Not circumscribed - Indistinct - Angular - Microlobulated - Spiculated
	Echo pattern	Anechoic Hyperechoic Complex cystic and solid Hypoechoic Isoechoic Heterogeneous
	Posterior features	No posterior features Enhancement Shadowing Combined pattern

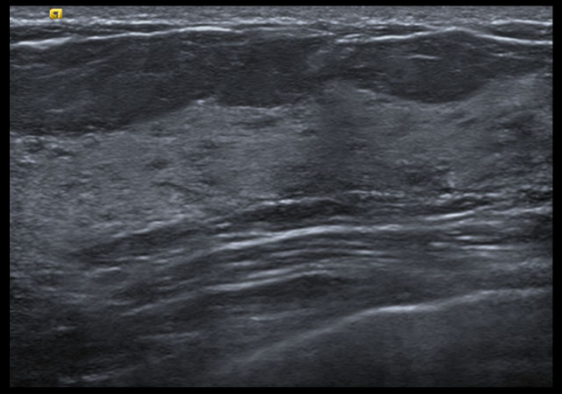
Calcifications	Calcifications in a mass	
	Calcifications outside of a mass	
	Intraductal calcifications	
Associated features	Architectural distortion	
	Duct changes	
	Skin changes	Skin thickening Skin retraction
	Edema	
	Vascularity	Absent Internal vascularity Vessels in rim
	Elasticity assessment	Soft Intermediate Hard
Special cases	Simple cyst	
	Clustered microcysts	
	Complicated cyst	
	Mass in or on skin	
	Foreign body including implants	
	Lymph nodes – intramammary	
	Lymph nodes – axillary	
	Vascular abnormalities	AVMs (arteriovenous malformations/ pseudoaneurysms) Mondor disease
	Postsurgical fluid collection	
	Fat necrosis	

https://www.acr.org/~/media/ACR/Documents/PDF/QualitySafety/Resources/BIRADS/Posters/BIRADS-Poster_36x24in_F.pdf?la=en

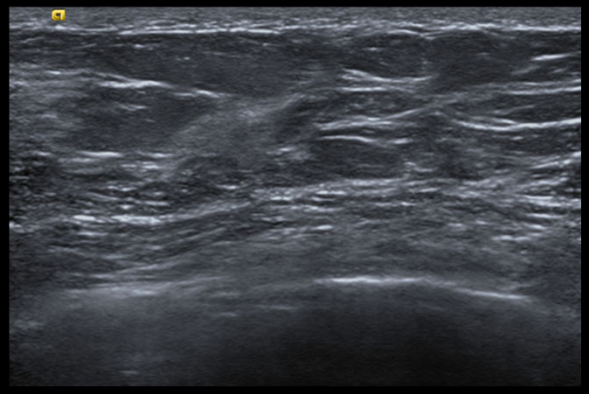
Tissue Composition
(Screening Ultrasound)

On screening ultrasound exams, documentation of the patient's tissue background echotexture is a standard component of report.

Homogeneous background echotexture - fat



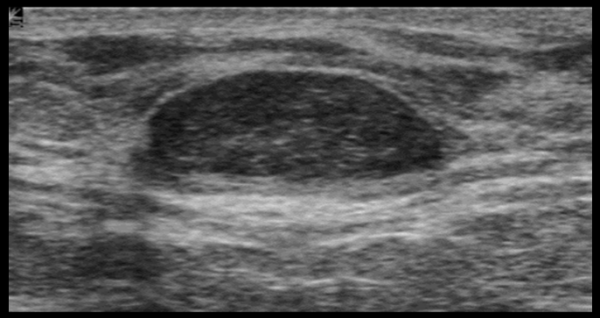
Homogeneous background echotexture - fibroglandular



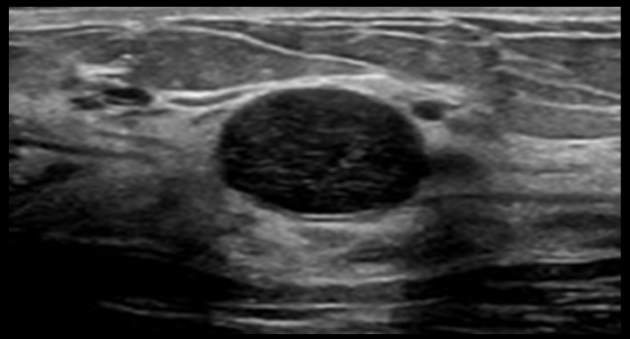
Heterogeneous background echotexture

Ultrasound Findings

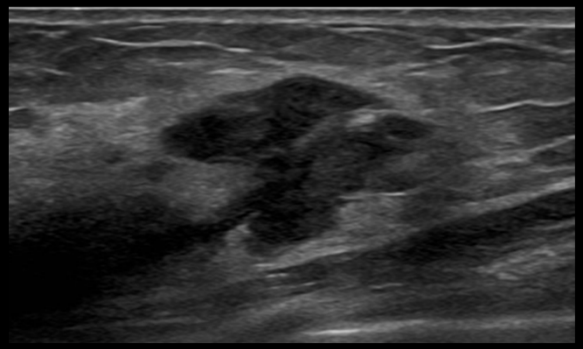
Mass - Shape



Oval



Round

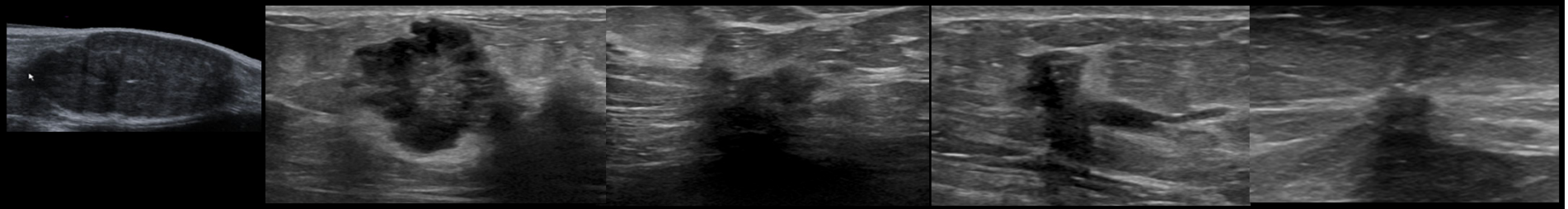


Irregular

Lower likelihood of malignancy (LOM) → Higher LOM

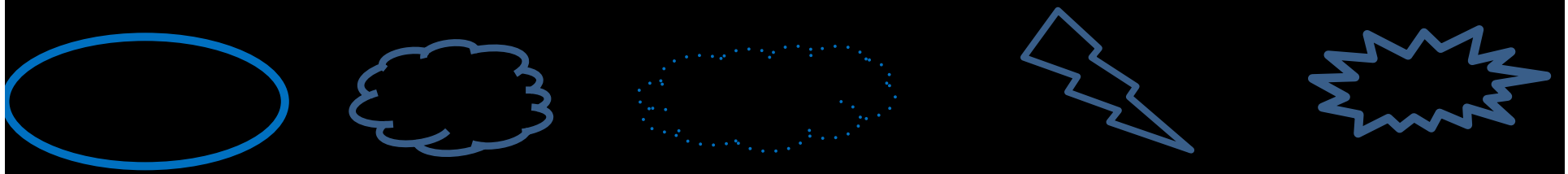
Ultrasound Findings

Mass - Margin

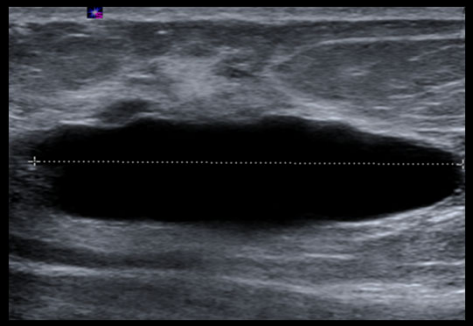


Circumscribed | Microlobulated | Indistinct | Angular | Spiculated

More suspicious

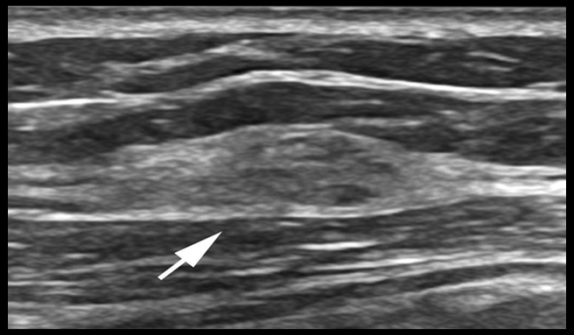


Ultrasound Findings
Mass - Echogenicity



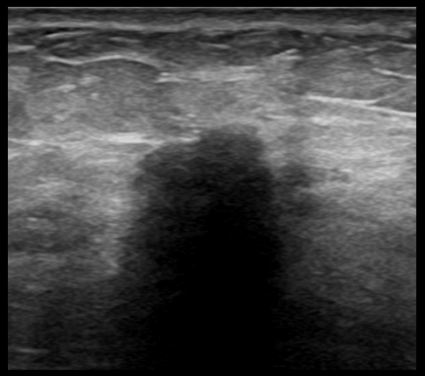
Anechoic

- No internal echoes (black)
- Mostly indicates simple cyst



Hyperechoic

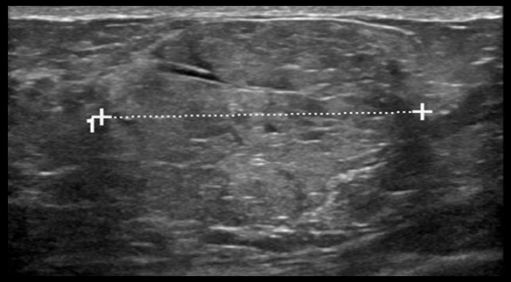
- Brighter than FAT (light gray-white)
- Usually benign



Hypoechoic

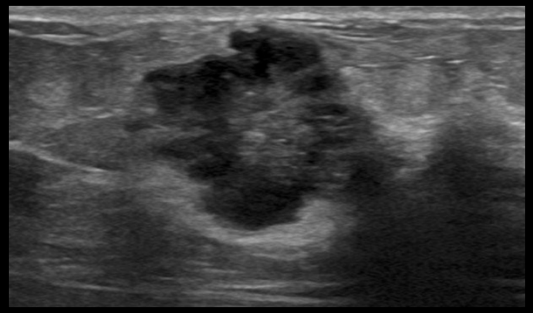
- Darker than FAT
- Most of masses

Ultrasound Findings
Mass - Echogenicity

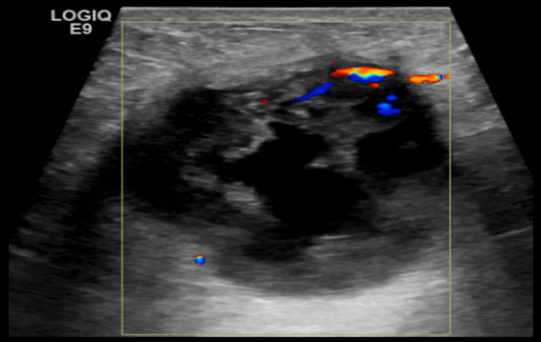


Isoechoic

- Similar to FAT
- Typically benign



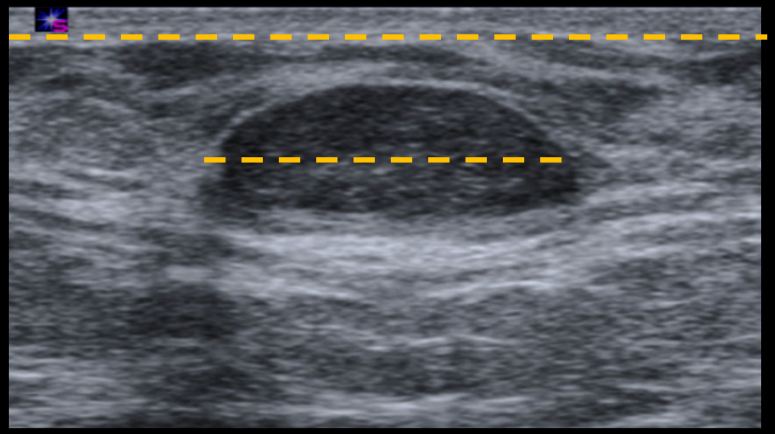
Heterogeneous



Complex Solid and cystic

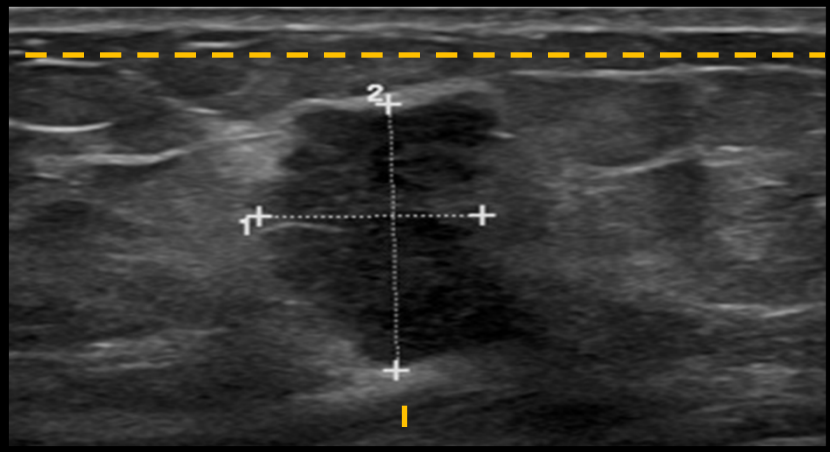
- Highly suspicious for malignancy

Ultrasound Findings
Mass - Orientation



wider than tall

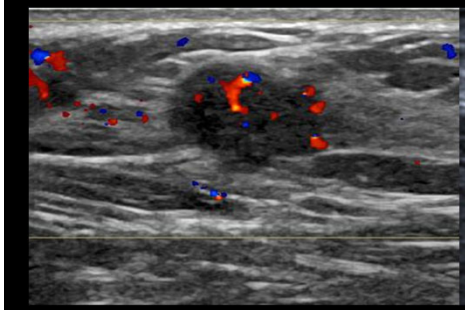
More common with benign masses



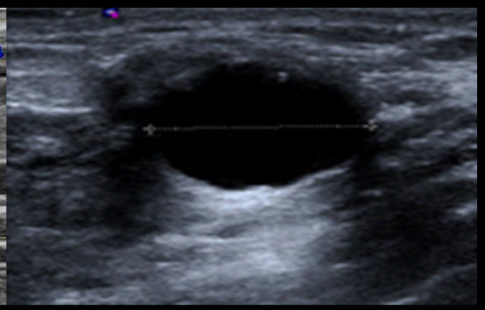
Taller than wide

More common with malignant masses

Ultrasound Findings
Mass - Posterior Features

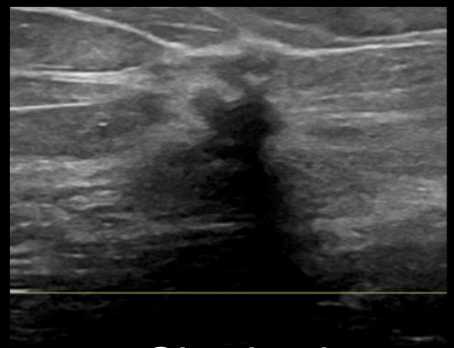


None



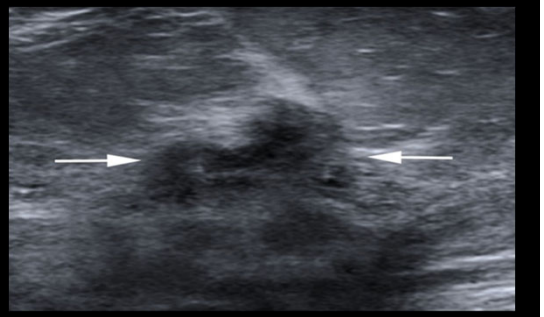
Enhancement

Tissue posterior to mass is brighter



Shadowing

Tissue posterior to mass is darker



Combined

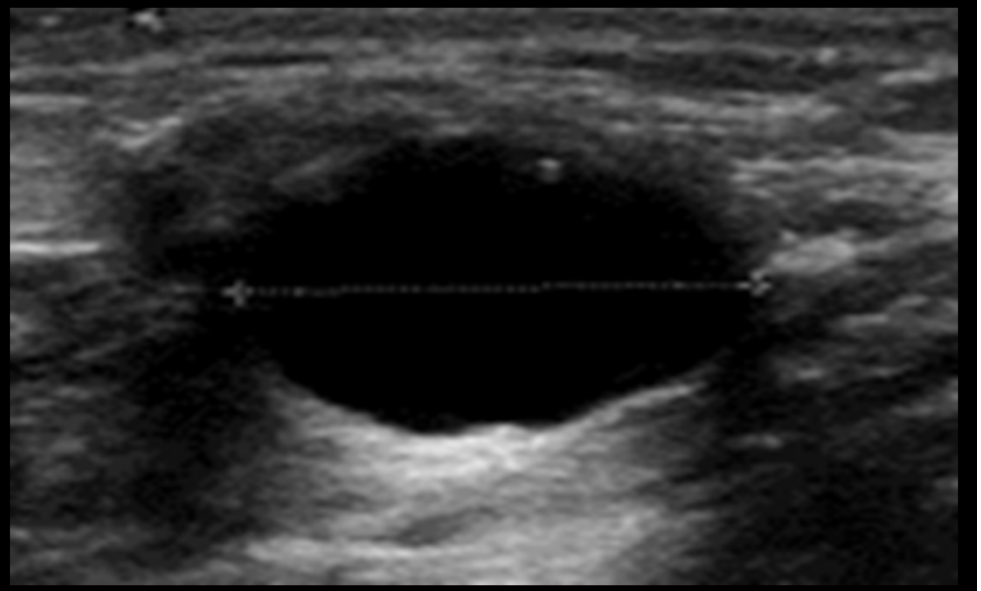
MASS SUMMARY

More common with Benign	More common with Malignant
• Oval	• Round/irregular
• Circumscribed	• Not circumscribed (indistinct, microlobulated, angular, spiculated)
• Posterior enhancement	• Posterior shadowing
• Hyperechoic/isoechoic	• Hypoechoic
• Parallel	• Not-parallel

CYSTS

Simple Cyst

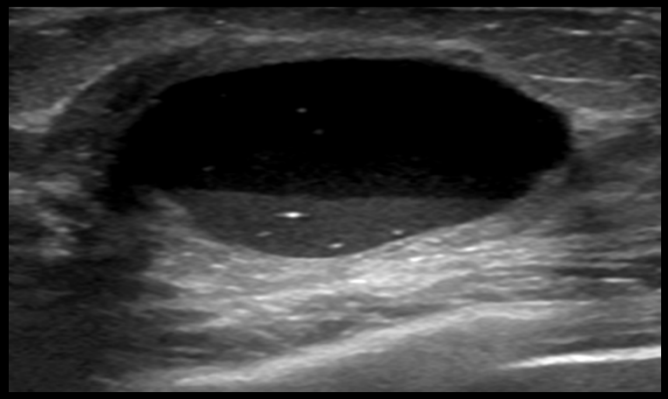
- Anechoic
- Smooth internal wall
- Posterior enhancement
- No internal vascularity
- Benign-No follow up needed

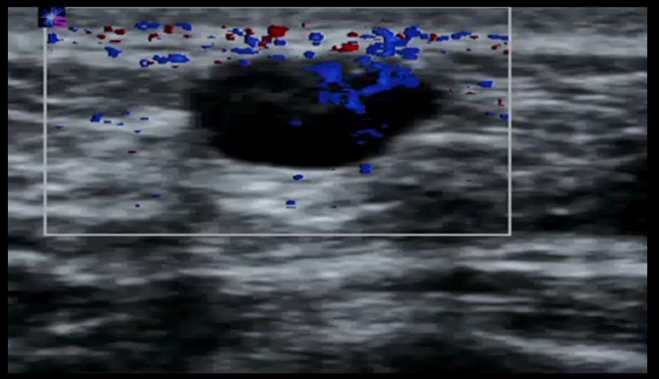


CYSTS

Complicated Cyst

- Mixed echogenicity
- Fluid/fluid level
- Floating debris
- Posterior enhancement
- No internal vascularity
- Benign-No follow up needed

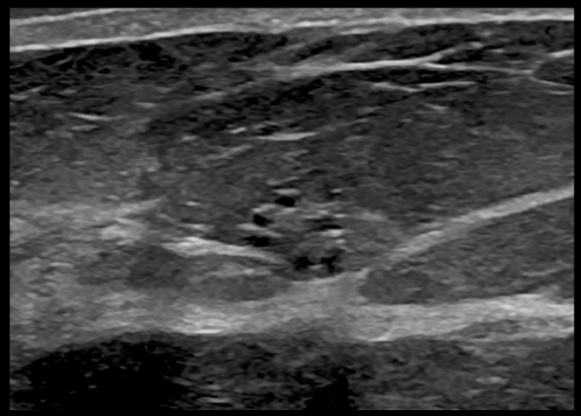




CYSTS

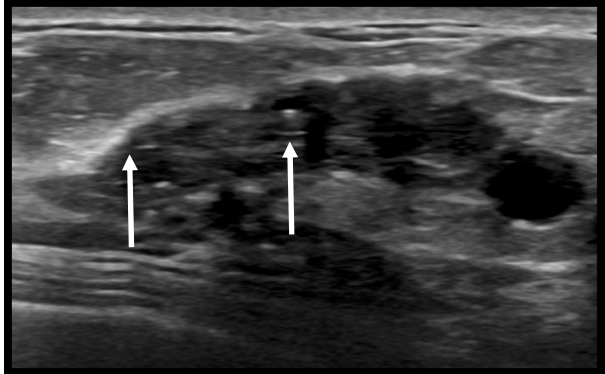
Clustered Microcysts

- Multiple small cysts (< 2-3mm)
- Imperceptible wall
- No internal vascularity
- Benign - No follow up needed
- If solid component→ biopsy

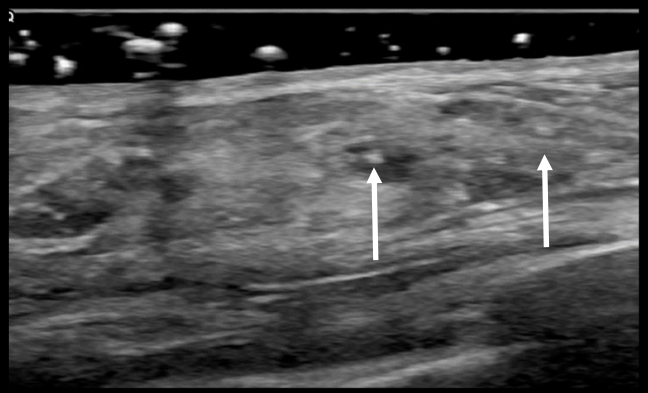


CALCIFICATIONS

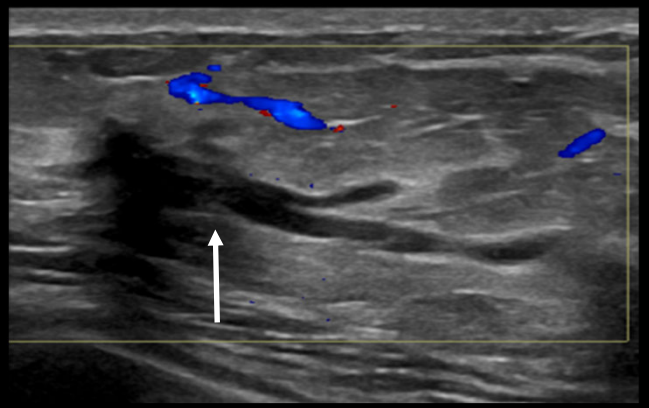
Calcifications appear as small echogenic foci on ultrasound.



In a mass



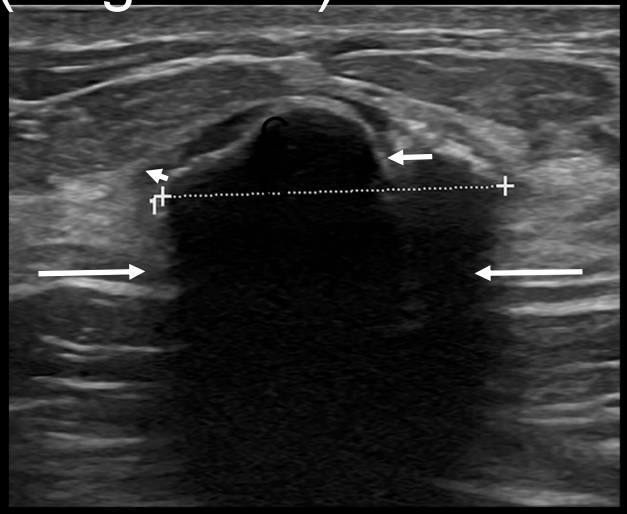
Outside a mass



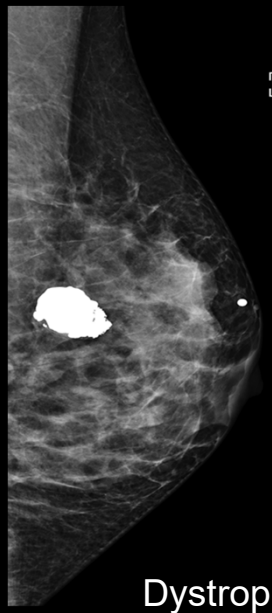
Intraductal

CALCIFICATIONS

Large dystrophic calcifications may appear echogenic superficially (arrow head), with marked posterior shadowing (long arrow).



Dystrophic calcification on US

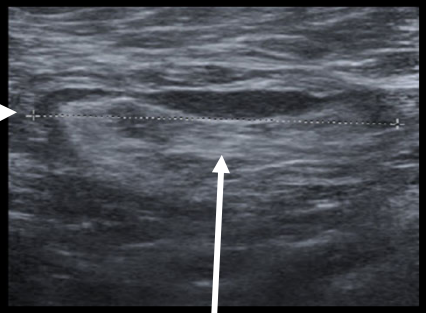


Dystrophic calcification on MG

LYMPH NODES

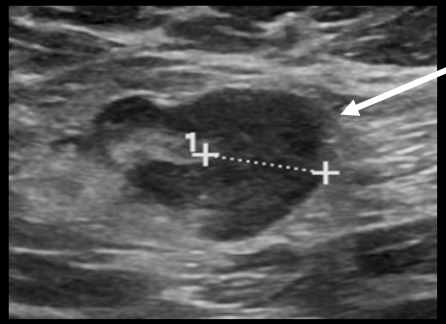
Normal

Thin uniform cortex

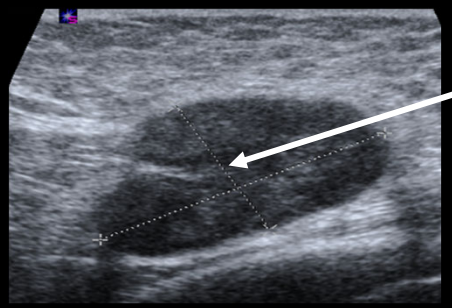


Maintain fatty hilum

Abnormal



Eccentric cortical thickening ≥ 3mm



Attenuated to complete loss of fatty hilum