



## Approach to Breast Masses

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## Objectives

By the end of the presentation, the audience should be able to:

- Refer for the correct radiology exam to work up a palpable breast mass
- Understand terminology used in breast imaging reports
- Be familiar with breast cancer statistics
- Be familiar with risks for breast cancer and patients considered high risk for breast cancer

## Introduction

- Breast cancer accounts for 30% of cancers in American women (1)
- It is the most common non-skin cancer among American women
  - 1 in 8 (12%) will develop breast cancer during their lifetime
- It is the second leading cause of cancer death in American women
  - Lung cancer is #1

## Breast Cancer Prevalence

- Incidence rates of breast cancer began to decline after 2002 but have stabilized in recent years.
- Death rates from breast cancer have been declining since 1989
  - Earlier detection, increased awareness, improved treatment



## Risk Factors for Breast Cancer

- Female (only 1% of breast cancers occur in men)
- Increasing age
- Personal history of breast cancer
- Family history of breast cancer/gene-mutation
- Chest radiation
- Prolonged estrogen exposure (early menarche/late menopause, obesity)

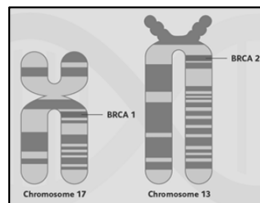
## Family History

- First degree family member = 2x the risk of the average women
- More than 1 first-degree female family member = 3-4x risk of average women
- In general, the younger the age of family member diagnosis, the higher the associated risk.
- Most women (70-75%) with breast cancer have no family history of breast cancer

## Family History

5-10% of breast cancers are hereditary

- BRCA1 or BRCA2
- ATM
- P53
- CHEK2
- PALB2

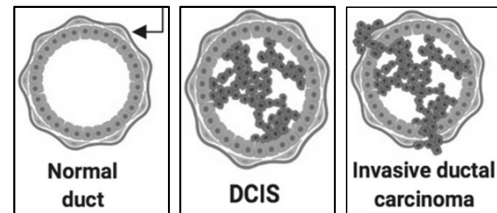
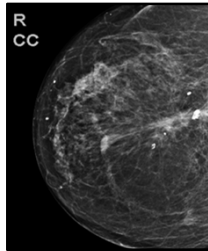


## Family History

Annual screening mammography is recommended 10 years earlier than the affected relative at the time of diagnosis but not before age 30.

## Personal History of Breast Cancer

- Incidence of local recurrence = 0.5-1%/year
- Greatest risks include:
  - Patients diagnosed younger than 35, especially younger than 30 y/o
  - Multicentric disease
  - Invasive Ductal Carcinoma with a large DCIS component



## Chest Radiation

- Radiation therapy to the chest (mantle radiation for Hodgkin's disease), particularly in patients younger than 30 years old.
- Annual mammography is recommended starting eight years after RT but not before age 25 for women who received RT from 10-30 years of age.

## CLINICAL PRESENTATION

## Clinical Examination

- Although the majority of palpable lumps are benign, a new palpable breast mass is the most common presenting symptom of breast cancer (2) .
- In general, cancers detected symptomatically tend to be more aggressive than screen-detected cancers and tend to have a poorer prognosis.

## Clinical Presentation

- Benign masses often are mobile, soft/rubbery in texture on physical exam
- DDx of benign breast masses:
  - Cysts
  - Fibroadenomas
  - Fibrocystic breast disease
  - Stromal fibrosis
  - Pseudoangiomatous Stromal Hyperplasia (PASH)
  - Atypical ductal hyperplasia

## Clinical Examination

- Cancer is firm and immobile on palpation with attachments to skin/deep fascia.
- Can have associated skin dimpling or nipple retraction
- Palpable breast thickening may be associated with cancer in ~5% of women.

## Clinical Examination

- Cysts cannot be reliably distinguished from solid breast masses by palpation.
  - In one study by Rosner et al, only 58% of 66 palpable cysts were correctly identified by physical exam (3).

## Imaging Work-Up

The imaging work-up for a palpable breast mass requires diagnostic mammography AND ultrasound in most patients.

## Imaging Work-Up

- NPV of mammography with US in the work-up of palpable mass ranges from 97.4-100% (4)
- In several series, evaluating palpable breast abnormalities (5-7), the sensitivity of mammography alone was 86-91%.
- Despite this, negative imaging should never overrule a strongly suspicious finding on physical exam.

## Screening vs Diagnostic Mammography

## Screening Mammography

### Asymptomatic women

Consists of two views of each breast:

- MLO (mediolateral oblique views): X-ray beam travels from the medial aspect of the breast to the lateral aspect at ~45 degree angle
- CC (craniocaudal view): X-ray beam travels from the cranial to caudal aspect of the breast.

## Screening Mammography



<https://greenimaging.net/wp-content/uploads/2018/02/greenimaging-screening-mammography-1.jpg>

Breast is under compression to minimize motion and blur

## Diagnostic Exams

### Indications for Diagnostic Exams:

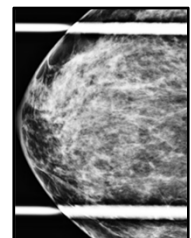
- Evaluating patients symptoms
  - Lump, nipple discharge, skin retraction, swelling, pain
- Evaluate findings seen on screening mammography
- Evaluate extent of disease/treatment response in known breast cancer

## Diagnostic Evaluation

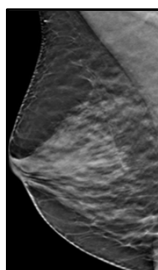
May include additional views:

- XCCL or XCCM (to include far lateral or medial tissue)
- Spot Compression
- Spot magnification views
- May also be followed with ultrasound

Spot Compression View



## Tomosynthesis



- X-ray source moves in arc over 4 seconds to make a 3-D image
- Eliminates artifact from overlapping breast tissue
- Decreases false positives from screening mammography and increases cancer detection rate

## Tomosynthesis

### Pros:

- It has consistently shown to both decrease recall rates from screening mammography AND increase cancer detection rates.
- Increased detection of clinically significant, invasive cancers
- Increases sensitivity of mammography particularly for women with dense breasts

### Cons:

- Increased radiation
- Most insurance companies cover tomosynthesis for screening mammography but NOT diagnostic

## ACR Appropriateness Criteria

- Radiologic decision making is based on ACR appropriateness criteria
- Appropriateness of imaging modalities in a given clinical scenario is rated 1-9
  - 7-9 is usually appropriate
  - 1-3 is not usually appropriate

Imaging Procedure	Rating	Comments	RBI*
Mammography diagnostic	9	See references [13-15]	99
Digital breast tomosynthesis diagnostic	9	See references [16-18, 20, 21]	99
US breast	4	If she had recent mammogram (ie, past 6 months), US may be appropriate.	0
MRI breast without and with IV contrast	2	See references [4, 49]	0
MRI breast without IV contrast	1		0
FDG-PET	1		0
Scintimamm	1		0
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

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## ACR Appropriateness Criteria



Radiation level is taken into account for each imaging modality

Imaging Procedure	Rating	Comments	RBI*
Mammography diagnostic	9	See references [13-15]	99
Digital breast tomosynthesis diagnostic	9	See references [16-18, 20, 21]	99
US breast	4	If she had recent mammogram (ie, past 6 months), US may be appropriate.	0
MRI breast without and with IV contrast	2	See references [4, 49]	0
MRI breast without IV contrast	1		0
FDG-PET	1		0
Scintimamm	1		0
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

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## ACR Appropriateness Criteria

Initial evaluation of palpable breast mass in women 40 years or older.

- Diagnostic Mammography: 9
  - 2-D or 3-D is 9
- Ultrasound: 4
- MRI with contrast: 2

Table 1: Palpable breast mass, Female, 40 years of age or older, initial evaluation. (See Appendix 1, 1a, 1b for additional steps in the workup of these patients.)

Radiologic Procedure	Rating	Comments	REL*
Mammography diagnostic	9	See references [11-15]	99
Digital breast tomosynthesis diagnostic	9	See references [16-18,20,21]	99
US breast	4	She had recent mammogram (ie, past 6 weeks). US may be appropriate.	0
MRI breast without and with IV contrast	2	See references [4,49]	0
MRI breast without IV contrast	1		0
FDG-PET	1		00000
Scintimibc MBI	1		0000
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

Rating Scale: 1-2 usually not appropriate; 3-4 May be appropriate; 5-9 usually appropriate. \*Relative Radiation Level.

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## ACR Appropriateness Criteria

Palpable breast mass in women over 40 y/o with suspicious findings on mammogram

- Ultrasound: 9
- MRI: 2

Table 2: Palpable breast mass, Female, 40 years of age or older, mammography findings suspicious for malignancy. Next examination to perform. (See Appendix 1 for additional steps in the workup of these patients.)

Radiologic Procedure	Rating	Comments	REL*
US breast	9	See reference [22]	0
MRI breast without and with IV contrast	2	See references [4,49]	0
Image-guided core biopsy breast	2		Varies
Mammography short-interval follow-up	1		00
Digital breast tomosynthesis short-interval follow-up	1		00
MRI breast without IV contrast	1		0
FDG-PET	1		00000
Scintimibc MBI	1		0000
Image-guided fine-needle aspiration breast	1		Varies

Rating Scale: 1-2 usually not appropriate; 3-4 May be appropriate; 5-9 usually appropriate. \*Relative Radiation Level.

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## ACR Appropriateness Criteria

Palpable breast mass in women over 40 y/o with negative mammographic findings.

- Ultrasound: 9
- DBT: 3
  - If prior mammogram was 2-D can consider tomosynthesis
- MRI: 1

Table 3: Palpable breast mass, Female, 40 years of age or older, mammography findings negative. Next examination to perform. (See Appendix 1b for additional steps in the workup of these patients.)

Radiologic Procedure	Rating	Comments	REL*
US breast	9	See references [10-15]	0
Digital breast tomosynthesis diagnostic	3	If prior mammogram was 2-D only, consider doing DBT as part of the diagnostic workup.	00
Mammography diagnostic	1		00
MRI breast without and with IV contrast	1	See references [4,49]	0
MRI breast without IV contrast	1		0
FDG-PET	1		00000
Scintimibc MBI	1		0000
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

Rating Scale: 1-2 usually not appropriate; 3-4 May be appropriate; 5-9 usually appropriate. \*Relative Radiation Level.

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## Point of Emphasis

- For an initial work-up of a palpable mass in a woman over 40 years old, the diagnostic mammogram and ultrasound should both be ordered.
- Ultrasound will almost always be performed following the mammogram in a palpable lump, even if no findings are seen on the mammogram.



## ACR Appropriateness Criteria

Palpable breast mass in women younger than 30 years of age, initial evaluation

- US: 9
- Diagnostic mammogram: 3
- MRI: 1

Variant 1: Palpable breast mass, Female, younger than 30 years of age, initial evaluation. (See Appendices 2.3-2.8 for additional steps in the workup of these patients.)			
Radiologic Procedure	Rating	Comments	RRL*
US breast	9	See references [25-29,62]	O
Mammography diagnostic	3		??
Digital breast tomosynthesis diagnostic	3		??
MRI breast without and with IV contrast	1	See references [4,49]	O
MRI breast without IV contrast	1		O
FDG-PET	1		????
Scintimibi MBI	1		???
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

Rating Scale: 1-2,3 usually not appropriate; 4-5 May be appropriate; 7-8 usually appropriate; \*Relative Radiation Level

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## Palpable mass in women younger than 30 years old

- Because of the radiation with mammography and low incidence of breast cancer (<1%) in younger women, the recommended imaging is US
  - Differing from women >30 y/o which is mammography
- Younger women tend to have dense breast tissue which is associated with decreased mammographic sensitivity.
- If suspicious finding on US, mammography is usually pursued.

## ACR Appropriateness Criteria

Palpable breast mass younger than 30 years of age, US findings suspicious for malignancy. Next exam to perform.

- US-guided core biopsy: 9
- Diagnostic mammography: 8
- Short term follow-up: 1
- MRI: 1

Variant 2: Palpable breast mass, Female, younger than 30 years of age, US findings suspicious for malignancy. Next examination to perform. (See Appendix 2.3 for additional steps in the workup of these patients.)			
Radiologic Procedure	Rating	Comments	RRL*
Image-guided core biopsy breast	9	Either mammography or biopsy is appropriate. It depends on the history and findings. See references [26,38]	Varies
Mammography diagnostic	8	Either mammography or biopsy is appropriate. It depends on the history and findings.	??
Digital breast tomosynthesis diagnostic	8	Either DBT or biopsy is appropriate. It depends on the history and findings.	??
US breast short-interval follow-up	1		O
MRI breast without and with IV contrast	1	See references [4,49]	O
MRI breast without IV contrast	1		O
FDG-PET	1		????
Scintimibi MBI	1		???
Image-guided fine-needle aspiration breast	1		Varies

Rating Scale: 1-2,3 usually not appropriate; 4-5 May be appropriate; 7-8 usually appropriate; \*Relative Radiation Level

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## ACR Appropriateness Criteria

Palpable breast mass in woman younger than 30 y/o, US findings negative.

- Diagnostic mammography: 3
- MRI breast: 2
- Short-term US follow-up: 1

Variant 3B: Palpable breast mass, Female, younger than 30 years of age, US findings negative. Next examination to perform.			
Radiologic Procedure	Rating	Comments	RRL*
Mammography diagnostic	3		??
Digital breast tomosynthesis diagnostic	3	If the clinical examination is highly suspicious and the breasts are dense, DBT may be helpful.	??
MRI breast without and with IV contrast	2	See references [4,49]	O
US breast short-interval follow-up	1		O
MRI breast without IV contrast	1		O
FDG-PET	1		????
Scintimibi MBI	1		???
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

Rating Scale: 1-2,3 usually not appropriate; 4-5 May be appropriate; 7-8 usually appropriate; \*Relative Radiation Level

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## ACR Appropriateness Criteria

Palpable breast mass in women 30-39 y/o, initial evaluation.

- US: 8
- Diagnostic mammography: 8
- MRI: 2

**Variant 1:** Palpable breast mass, female, 30 to 39 years of age, initial evaluation. (See Appendix 3 for additional steps in the workup of these patients.)

Radiologic Procedure	Rating	Comments	IRL <sup>a</sup>
US breast	8	If imaged initially with US, see Variant 1-5 for additional imaging.	0
Mammography diagnostic	8	If imaged initially with mammography, see Variant 2-5. See references [14,15].	***
Digital breast tomosynthesis diagnostic	8	See references [16-20].	***
MRI breast without and with IV contrast	2	See references [4,49].	0
MRI breast without IV contrast	1		0
FDG-PET	1		****
Scansite MRI	1		****
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

<sup>a</sup>Rating Scale: 1-2: Usually not appropriate; 3-6: May be appropriate; 7-8: Usually appropriate; 9-10: Usually not appropriate.

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## MRI in Palpable Breast Mass

- Should not be used in initial evaluation of palpable breast mass
- Pros: Highest sensitivity
- Cons: High cost, low specificity

## Take-Home Points

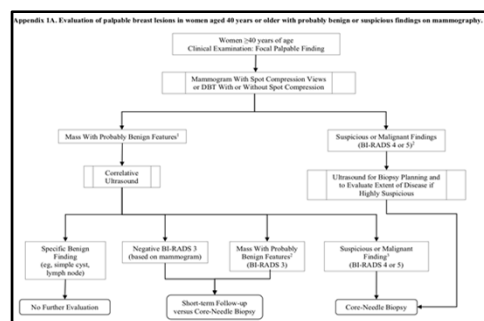
Older than 40 y/o: diagnostic mammography + US orders should be placed

<30 y/o: US is initial imaging. Mammography does not usually need to be ordered.

Women between 30-39 y/o: Initial imaging could be US with or without mammography

- Depends on risk factors/patient preference/additional symptoms

MRI is NOT a way to work-up palpable breast mass



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## Palpable mass in the pregnant/lactating patient

## Differential of new palpable mass in pregnant/lactating patient

- Fibroadenoma
- Galactocele
- Lactating adenoma
- Puerperal mastitis/abscess
- Pregnancy-associated breast cancer

## Palpable mass in pregnant patient

- Initial test to order is US
- Mammo may be appropriate if suspicious finding on US

**Variant 5:** Pregnant women with a palpable breast mass. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
US breast	Usually Appropriate	0
Digital breast tomosynthesis diagnostic	May Be Appropriate	##
Mammography diagnostic	May Be Appropriate	##
MBI breast without and with IV contrast	Usually Not Appropriate	0
MBI breast without IV contrast	Usually Not Appropriate	0
Scintib's MBI	Usually Not Appropriate	###
Image-guided core biopsy breast	Usually Not Appropriate	Varies
Image-guided fine-needle aspiration breast	Usually Not Appropriate	Varies

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## Palpable mass in the male breast

## Male Breast Mass

Clinical symptoms of gynecomastia at any age:  
No imaging is recommended

Clinical symptoms suspicious for cancer at any age:

Mammography AND US  
are usually appropriate

Variant 1: Male patient of any age with symptoms of gynecomastia and p with gynecomastia or pseudogynecomastia. Initial imaging.	
Procedure	Appropriateness Category
Mammography diagnostic	Usually Not Appropriate
Digital breast tomosynthesis diagnostic	Usually Not Appropriate
US breast	Usually Not Appropriate
MRI breast without and with IV contrast	Usually Not Appropriate
MRI breast without IV contrast	Usually Not Appropriate

Variant 2: Male of any age with physical examination suspicious for breast mass, axillary adenopathy, nipple discharge, or nipple retraction.	
Procedure	Appropriateness Category
Mammography diagnostic	Usually Appropriate
Digital breast tomosynthesis diagnostic	Usually Appropriate
US breast	Usually Appropriate
MRI breast without and with IV contrast	Usually Not Appropriate
MRI breast without IV contrast	Usually Not Appropriate

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## Male breast mass

Younger than 25 y/o with indeterminate palpable mass:

- US: usually appropriate
- Diagnostic mammo: May be appropriate
- MRI: Usually not appropriate

25 years or older:

- Diagnostic mammo: usually appropriate
- US: May be appropriate

Variant 3: Male younger than 25 years of age with indeterminate palpable mass.	
Procedure	Appropriateness Category
US breast	Usually Appropriate
Mammography diagnostic	May Be Appropriate
Digital breast tomosynthesis diagnostic	May Be Appropriate
MRI breast without and with IV contrast	Usually Not Appropriate
MRI breast without IV contrast	Usually Not Appropriate

Variant 4: Male 25 years of age or older with indeterminate palpable breast mass.	
Procedure	Appropriateness Category
Mammography diagnostic	Usually Appropriate
Digital breast tomosynthesis diagnostic	Usually Appropriate
US breast	May Be Appropriate
MRI breast without and with IV contrast	Usually Not Appropriate
MRI breast without IV contrast	Usually Not Appropriate

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## Male Breast Mass

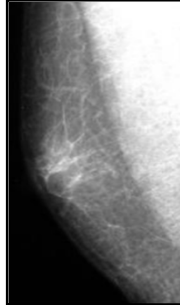
- Majority of male breast problems are benign
- Differential diagnosis for male breast mass:
  - Gynecomastia
  - Breast cancer
  - Lipoma
  - Epidermal inclusion cyst
  - Oil cysts
  - Pseudogynecomastia- Excess fatty tissue

## Gynecomastia

- Most common cause of a palpable mass, breast enlargement, or pain in men.
- Bilateral in ~50% of patients
- Common causes:
  - Side effect of many medications and recreational drugs
  - Hormonal changes
  - Chronic liver disease
- On physical exam, presents as a soft, rubbery, or firm mobile mass directly under the nipple.
- Not a risk factor for breast cancer

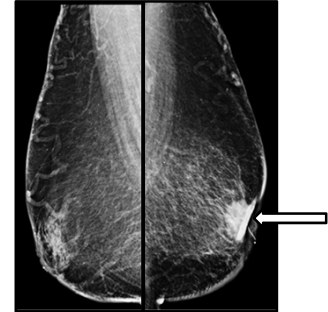
## Gynecomastia

- Diagnostic findings on mammography
  - Dendritic pattern
  - Directly behind the nipple
  - No mass-like component
- No further imaging is usually needed



## Male Breast Cancer

- 1% of all breast cancers
- Median onset is 63 years of age
- Frequently presents with symptoms- palpable lump, nipple retraction, nipple discharge.



## Take-Home Points

Younger than 25 y/o with palpable mass: US is appropriate

25 years or older: Mammography with possible US is the best imaging modality

## Clinical Cases

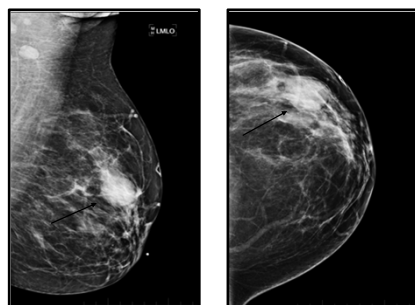
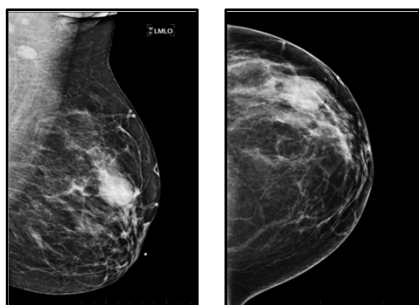
**63 year old female presents with palpable abnormality for 3 weeks**

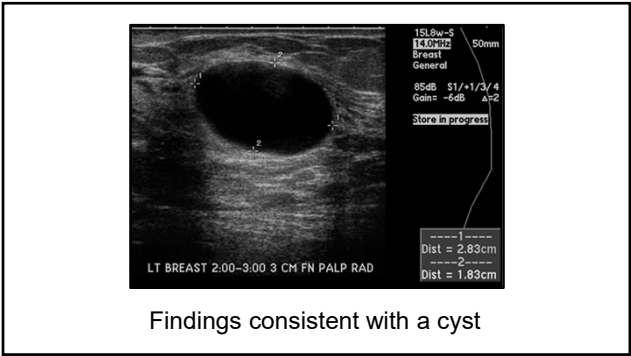
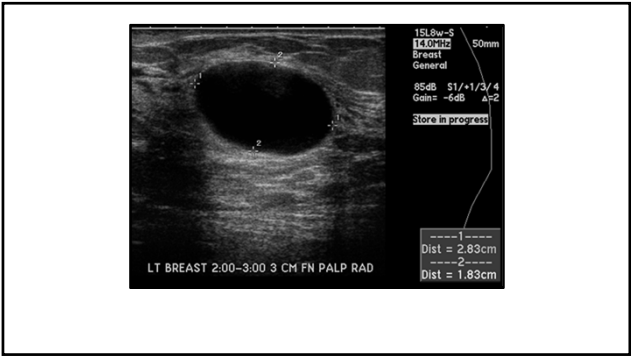
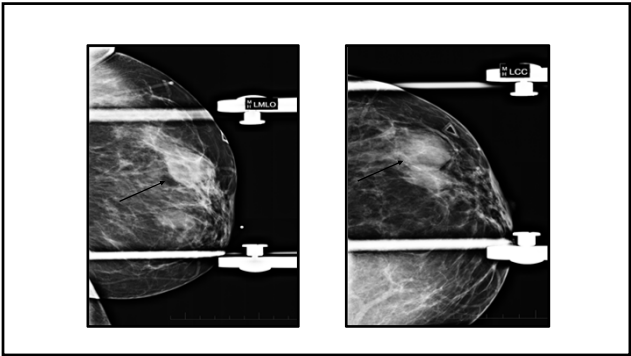
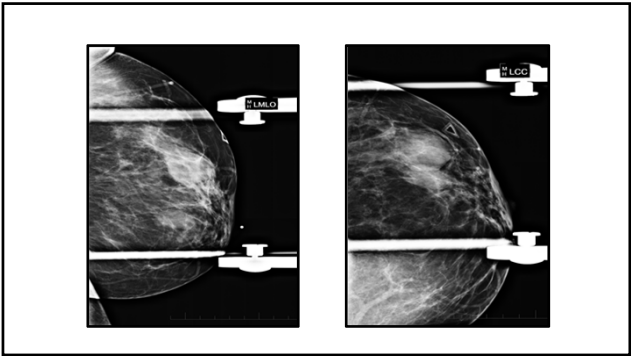
What study/studies should you order?

**63 year old female presents with palpable abnormality for 3 weeks**

What study/studies should you order?

**Mammogram and Ultrasound**





Findings consistent with a cyst

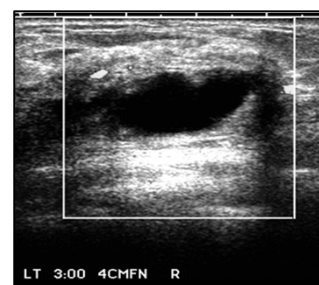
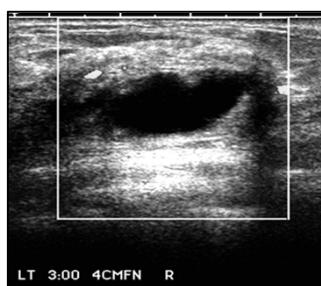
**28 year old postpartum female presents with left breast redness and mass.**

What study should be ordered?

**28 year old postpartum female presents with left breast redness and mass.**

What study should be ordered?

**Start with US only**



Findings consistent with an abscess



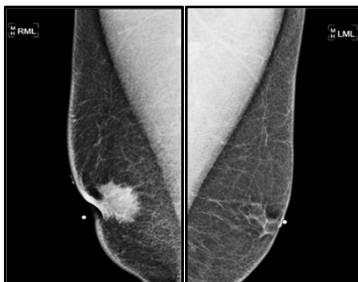
**55 year old male has a mass palpated in the subareolar right breast on physical exam.**

What studies should you order?

**55 year old male has a mass palpated in the subareolar right breast on physical exam.**

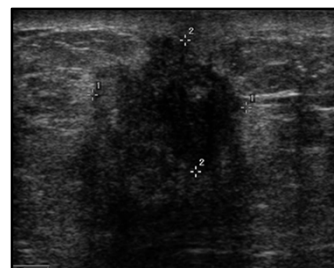
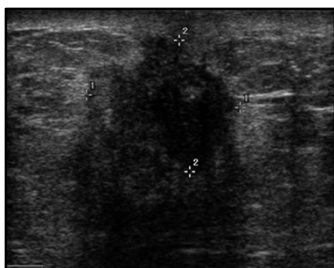
What studies should you order?

**Without physical exam findings suggestive of gynecomastia, then mammogram and US**



How should we proceed?





Findings consistent with highly suspicious mass found to be biopsy-proven IDC

## References

1. DeSantis C, Ma J, Min, Gaudet M, Newman L, Miller K, Sauer A, Jemal A, Siegel R. Breast Cancer Statistics, 2019. *A Cancer Journal for Clinicians*. October 2019. 69 (6): 438-451. <https://ascjournals.onlinelibrary.wiley.com/doi/full/10.3322/caac.21583>.
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