

SPECIAL SERIES: LOCOREGIONAL MANAGEMENT OF BREAST CANCER

Imaging in Locoregional Management of Breast Cancer

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Learning objectives

By the end of this journal club, participants will be able to:

- Have an understanding of basic anatomy of the female breast
- Have an understanding of breast cancer presentation, risk factors, radiologic findings, and diagnostic evaluation
- Have an understanding of BIRADS categories
- Have an understanding of indications for imaging when guiding in-breast surgery, neoadjuvant chemotherapy, and management of the axilla

Module Outline

- I. Case
- II. Background
- III. Article Overview
- IV. Key Points

Case presentation

A 42-year-old female referred to Radiology for a left breast mass

- Noticed on self breast exam about 1.5 months ago
- Left breast has increased dramatically in size and “hardness”
- No personal history of breast cancer; has never undergone breast biopsy

Surgical History:

- S/p breast cyst aspiration

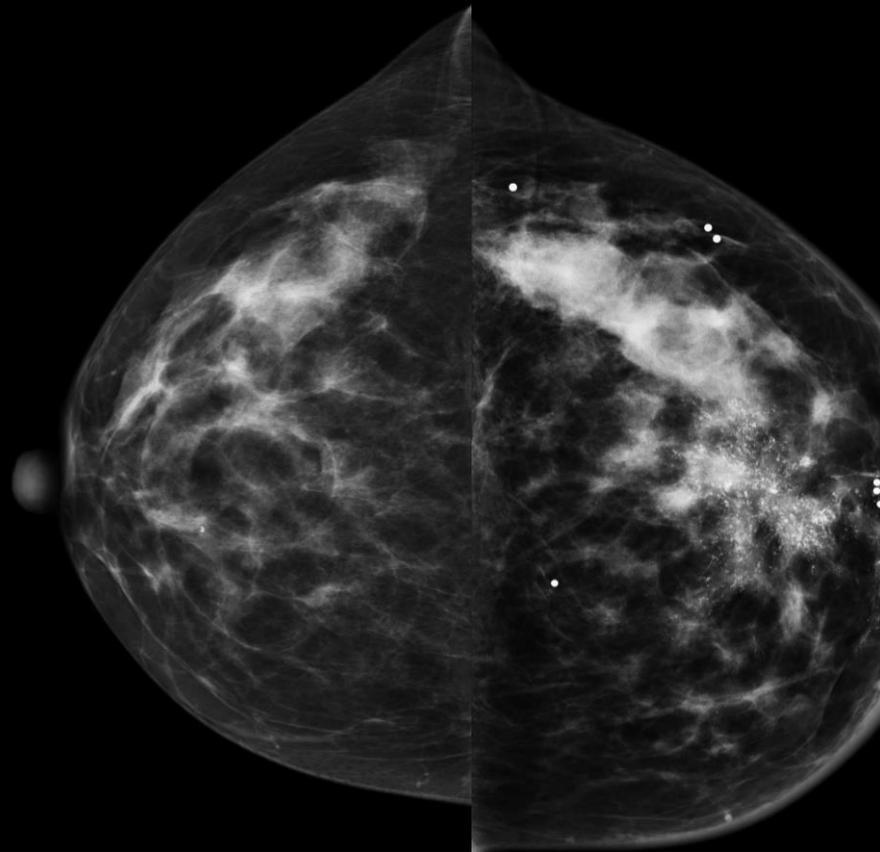
Reproductive History:

- Premenopausal G5P2
- First pregnancy at age 28

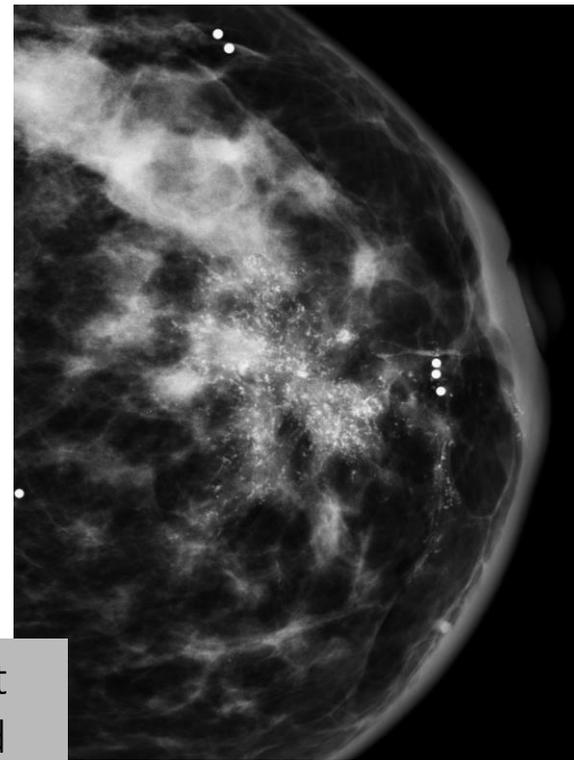
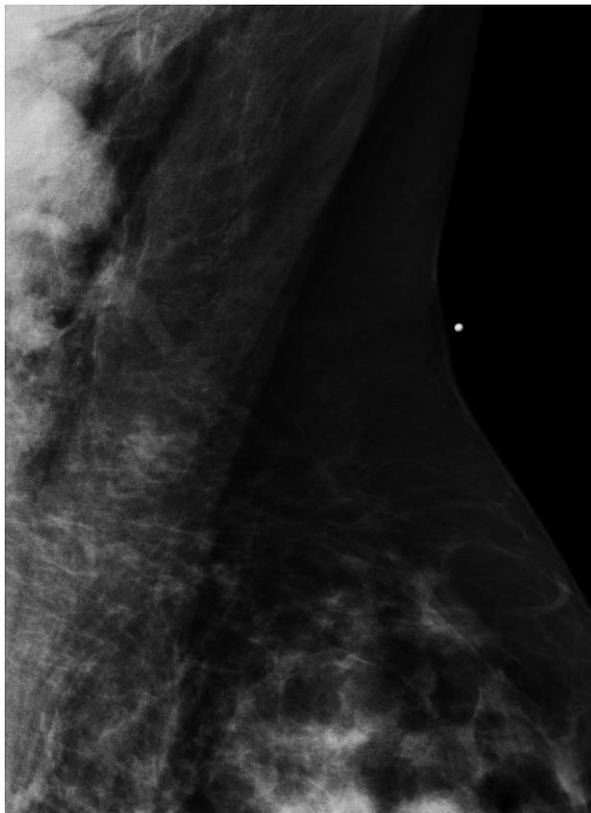
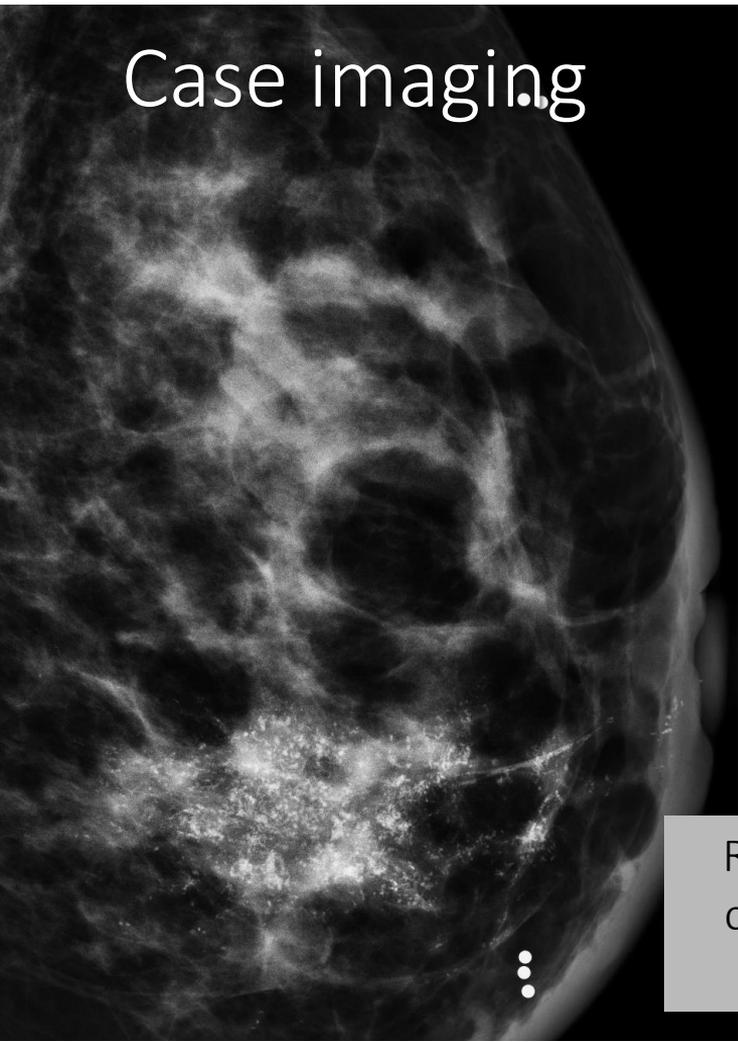
Case questions

- What imaging studies would you perform for this patient?
- What role(s) does imaging play in the management of breast cancer in this patient?

Case imaging



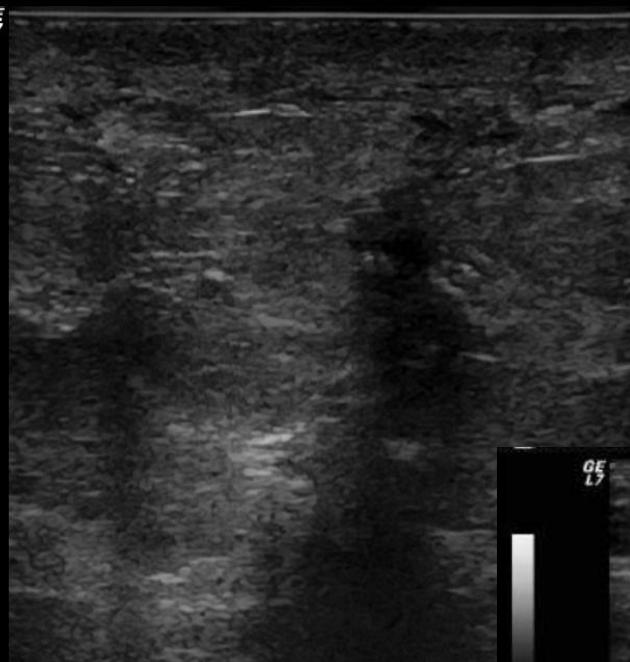
Case imaging



Right breast mass with malignant calcifications, skin thickening and axillary lymphadenopathy

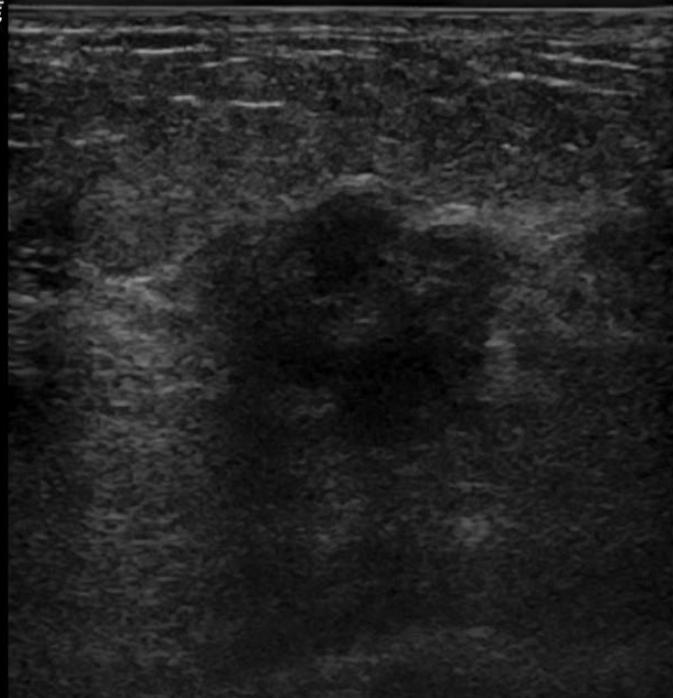
Case imaging

GE
L7



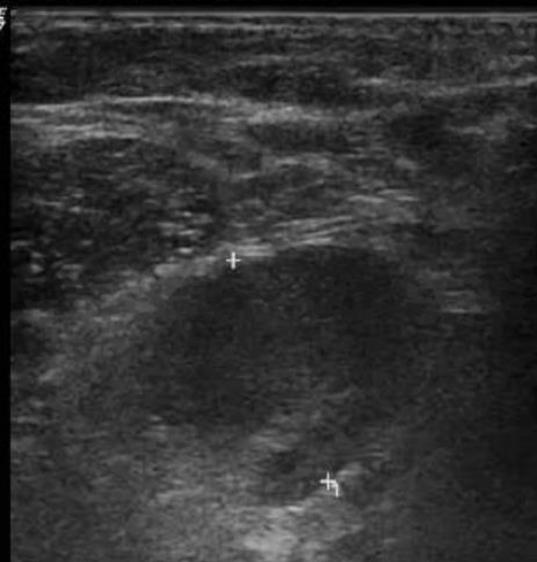
BREAST 6 O'CLOCK 3 CM FN TRANS

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WB LT BREAST 2 O'CLOCK 6 CM FN TRANS

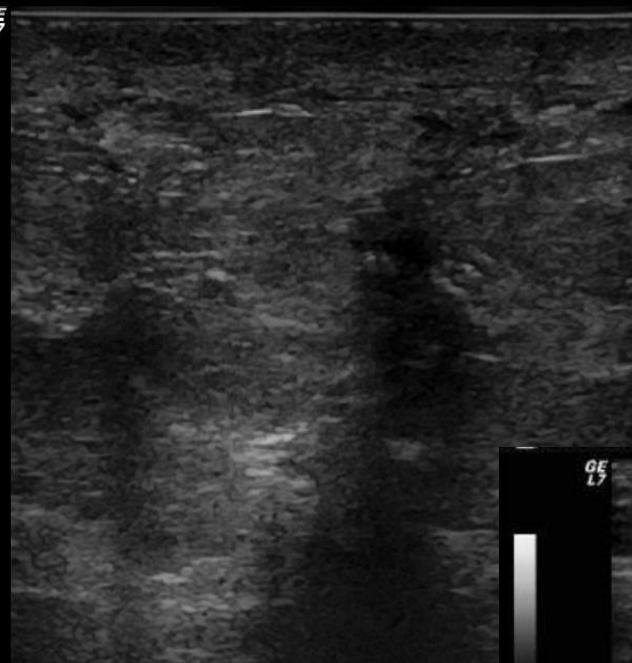
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WB LT AXILLA TRANS

Case imaging

GE
L7



3 BREAST 6 O'CLOCK 3 CM FN TRANS

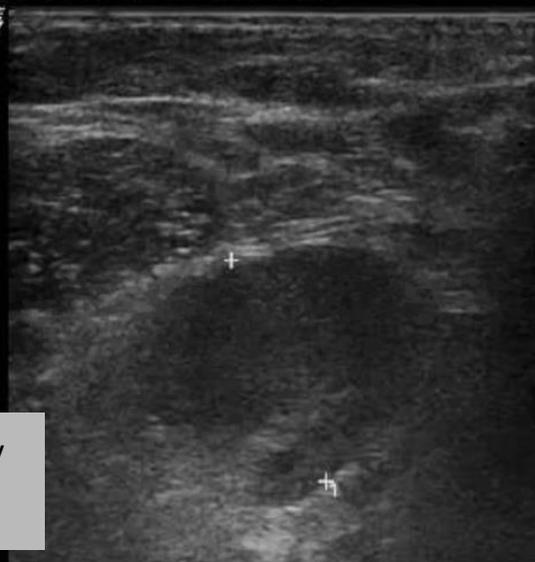
Right breast 6:00 mass with axillary lymphadenopathy

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WB LT BREAST 2 O'CLOCK 6 CM FN TRANS

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WB LT AXILLA TRANS

Case Pathology Report

Procedure: Ultrasound-guided core needle biopsy

Diagnosis: Invasive Ductal Carcinoma, histologic grade 3

ER positive 90%

PR negative

HER2 positive 95%

Case questions

- What imaging studies would you perform for this patient?
- What role(s) does imaging play in the management of breast cancer in this patient?

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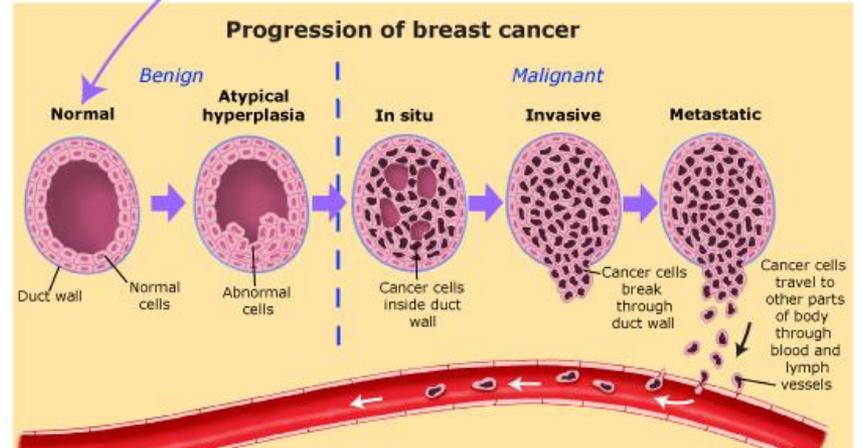
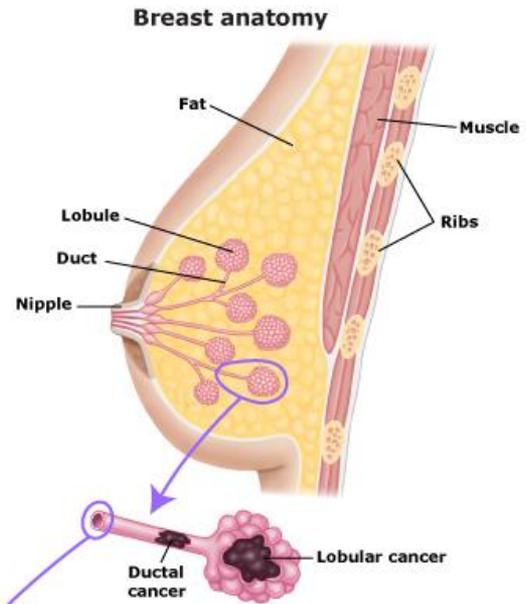
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Breast Anatomy



Breast Cancer

- Second most common type of cancer in women in the U.S.
- 1/8 women will be diagnosed with breast cancer in their lifetimes

Risk Factors (most significant):

- Sex and Age
- Genetic mutations
- Personal and/or Family history

Breast Cancer

Presentation: Presents either on screening mammography in asymptomatic women or by the palpation of the mass by the patient and/or physician

- Usually painless
- Usually hard to touch on physical exam and can present with skin changes and nipple retraction

Pathology: Invasive ductal carcinomas comprise about 80% of breast cancers; invasive lobular ~11%, inflammatory breast cancer ~3%, Paget disease ~1%

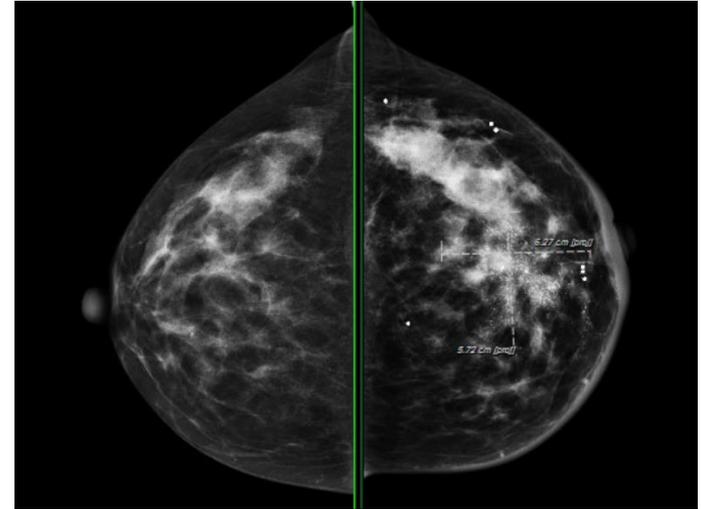
Diagnostic Evaluation: Mammography, US, MRI, biopsies: Will discuss in much detail in the latter half of this presentation!

BI-RADS Classification System

Final Assessment Categories			
	Category	Management	Likelihood of cancer
0	Need additional imaging or prior examinations	Recall for additional imaging and/or await prior examinations	n/a
1	Negative	Routine screening	Essentially 0%
2	Benign	Routine screening	Essentially 0%
3	Probably Benign	Short interval-follow-up (6 month) or continued	>0 % but ≤ 2%
4	Suspicious	Tissue diagnosis	4a. low suspicion for malignancy (>2% to ≤ 10%) 4b. moderate suspicion for malignancy (>10% to ≤ 50%) 4c. high suspicion for malignancy (>50% to <95%)
5	Highly suggestive of malignancy	Tissue diagnosis	≥95%
6	Known biopsy-proven	Surgical excision when clinical appropriate	n/a

Invasive Ductal Cancer

- “Ductal” means it is growing from the milk duct, and “invasive “ means that the cancer has invaded the surrounding fat or fibrous tissue
- Presents in older women as a firm, “rock-hard” mass
- Subtypes include tubular and mucinous



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Article Specifics

- **Purpose:** To summarize current evidence in regards to the use of imaging in patients with newly diagnosed breast cancer; to facilitate decision-making by patients and providers from multiple disciplines including surgery, radiology, and oncology.
- **Journal:** Journal of Clinical Oncology, Volume 38, Issue 20, May 2020
- **Study Type:** Review article highlighting various research studies (meta-analyses, clinical trials, retrospective studies, etc.)
- **Data:** Various

Article Overview

- 1) Imaging to Guide In-Breast Surgery
- 2) Imaging to Guide Neoadjuvant Chemotherapy
- 3) Imaging to Guide Management of the Axilla

Imaging to Guide In-Breast Surgery

In regards to in-breast surgery, imaging is used to:

- Delineate the Size of the Known Cancer
- Identify Additional Ipsilateral Disease
- Identify Additional Breast Cancer in the Opposite Breast

In-Breast Surgery: Delineating the Size of the Known Cancer

- Imaging can help identify borders between healthy tissue and cancerous areas of the breast
- UK study of >55,000 women who underwent lumpectomy: lack of accurate imaging beforehand leads to higher rates of unnecessary additional surgeries
- Mammography and US can tend to underestimate the true size of the breast tumor.
- Bosch et al found that mammography has a correlation coefficient of 0.44 while US has a correlation coefficient of 0.68.

In-Breast Surgery: Delineating the Size of the Known Cancer

MRI imaging of the breast improves the size assessments of breast cancers in general, including those categorized as DCIS or DCIS with invasive components (our patient).

This idea also translates into overall improved surgical outcomes as demonstrated by Mann et al. (showed a 3.7x lower re-excision rates and lower mastectomy rates for women who underwent prior MRI versus women who did not).

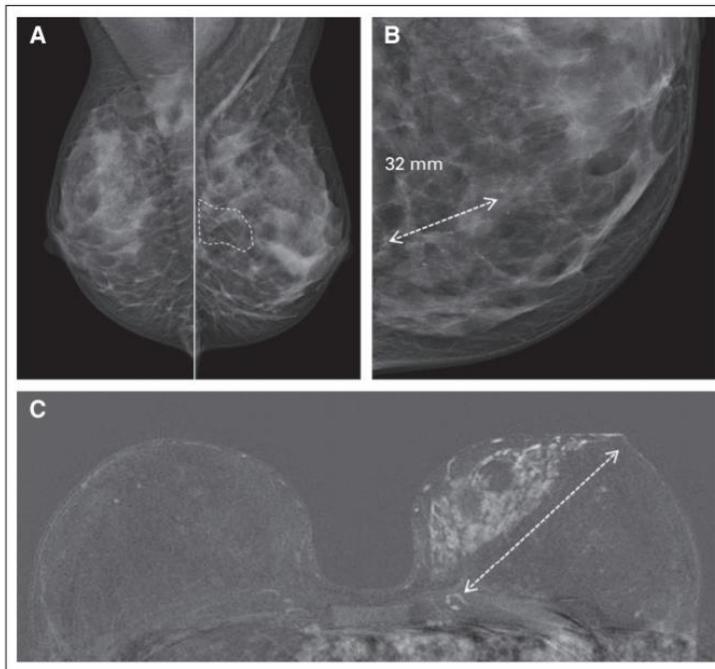
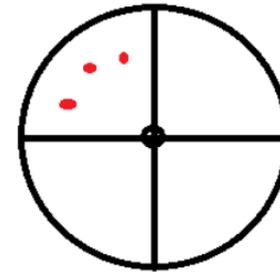


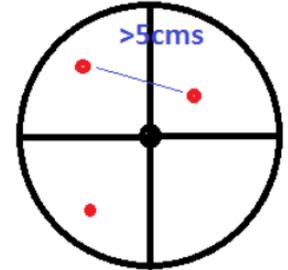
FIG 1. Depicting extent of pure ductal carcinoma in situ (DCIS). A 52-year-old patient had screening-detected calcification-associated DCIS in the posterior part of upper inner quadrant on mammography. Size on mammography was 32 mm in longest diameter. High-resolution ultrasound (12.5 MHz probe; not shown) was negative. Vacuum-assisted biopsy revealed high-grade DCIS. Magnetic resonance imaging (MRI) depicted the large DCIS that affected the entire upper inner quadrant and involved the nipple. Size on MRI was 82 mm. The patient underwent mastectomy that confirmed nipple involvement. Pathologic assessment of the size of the DCIS was 65 mm. Formal analysis would thus indicate MRI had overestimated the size of the DCIS. More likely is that pathology underestimated the size.

In-Breast Surgery: Imaging to Identify Additional Ipsilateral Disease

- Can use mammography, US, tomosynthesis to identify additional cancer in the same breast.
- Prospective study of 166 patients showed that tomosynthesis with mammography had a slightly higher sensitivity for ipsilateral disease (52%) than did mammogram alone (44%).
- MRI has a higher sensitivity than both US and mammography, according to Hollingsworth et al.
- Positron-emission mammography (PEM) is also emerging as an imaging method to detect other cancers in the same breast (Berg et al).



Multifocal



Multicentric

In-Breast Surgery: Imaging to Identify Additional Breast Cancer in the Opposite Breast

- 1-4 % of breast cancer patients are found to have contralateral breast cancer on mammography
- One retrospective study (Leblond et al) found that US may be used to find additional contralateral breast cancers. US was positive in the opposite breast in 76 of 360 patients who had all been mammographically negative in the opposite breast.
- When these 76 patients were biopsied, 11 of them were positive.
- However, retrospective studies reveal conflicting data as to whether there is a reduced overall incidence of contralateral breast cancers with MRI versus mammography (Solin et al).

Guidelines on the Use of Imaging for Breast Surgery

COMICE and POMB trials both explored reoperation rates in patients who underwent preoperative MRI versus patients who did not.

There are limited studies with impact of other methods (i.e. mammography, CT, US) on surgical or oncological outcomes. It is difficult to draw true conclusions about these imaging techniques because of the presence of confounders.

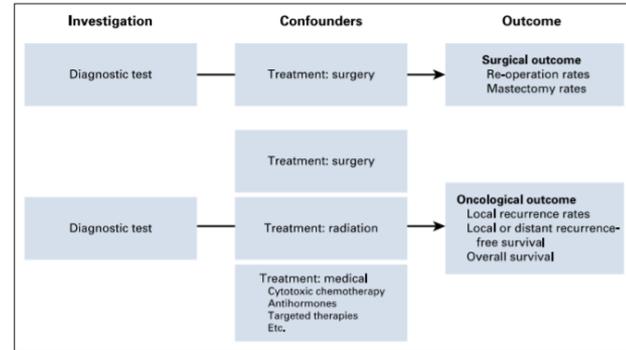


FIG 4. Confounders for diagnostic test.

Imaging to Guide Neoadjuvant Chemotherapy

- Neoadjuvant Chemotherapy (NACT) is a useful surrogate for tumor responsiveness
- Retrospective study of 200 patients who had undergone NACT with doxorubicin: preoperative mammography and US had poor correlations with residual tumor size (correlation coefficients of 0.42 and 0.41, respectively).
- Ideally, combined imaging and image-directed biopsy of the tumor may best predict pCR.

Guidelines to Guide Management of the Axilla

- Imaging methods to stage axilla include US, MRI, FDG-PET/CT
- Overall preferred method is high-resolution axillary US (AUS) combined with AUS-guided biopsy (**two meta-analyses: AUS with AUS-guided biopsy could correctly identify half of patients with positive axillary nodes**).
- Breast MRI includes parasternal and axillary LN's in field of view for evaluation (**similar NPV's for breast MRI and AUS in van Nijnatten study**).
- PET/CT recommended only for whole-body staging
- To detect residual disease in the regional nodes, US is the most accurate imaging method (Hieken et al), but it has too low of a sensitivity to avoid axillary surgery completely.

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Key points

I. Invasive Ductal Carcinoma makes up about 80% of all breast cancers and can appear on imaging as an ill-defined/irregular mass with or without calcifications.

II. Before breast surgery, imaging is used to delineate the size of the known cancer, identify additional ipsilateral disease, and identify additional breast cancer in the opposite breast

III. MRI imaging of the breast can more accurately determine tumor size when compared to US and mammography

Key points

IV. Ultrasound is an easy and noninvasive test which can detect additional tumors in the contralateral breast in patients with negative mammograms.

V. Pathologic complete response is ideally predicted using combined imaging and image-directed biopsy of the tumor

VI. US is the preferred imaging modality to detect residual tumor in the LN after chemotherapy, but surgery is still necessary.

References

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