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
Case imaging

Right breast 6:00 mass with axillary lymphadenopathy
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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Breast Anatomy

Progression of breast cancer

1. Normal
2. Atypical hyperplasia
   - Normal cells
   - Abnormal cells
3. In situ
   - Cancer cells inside duct wall
4. Invasive
   - Cancer cells break through duct wall
5. Metastatic
   - Cancer cells travel to other parts of body through blood and lymph vessels
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

<table>
<thead>
<tr>
<th>Category</th>
<th>Management</th>
<th>Likelihood of cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Need additional imaging or</td>
<td>Recall for additional imaging and/or await prior</td>
<td>n/a</td>
</tr>
<tr>
<td>prior examinations</td>
<td>examinations</td>
<td></td>
</tr>
<tr>
<td>1 Negative</td>
<td>Routine screening</td>
<td>Essentially 0%</td>
</tr>
<tr>
<td>2 Benign</td>
<td>Routine screening</td>
<td>Essentially 0%</td>
</tr>
<tr>
<td>3 Probably Benign</td>
<td>Short interval-follow-up (6 months) or continued</td>
<td>&gt;0% but ≤ 2%</td>
</tr>
<tr>
<td>4 Suspicious</td>
<td>Tissue diagnosis</td>
<td>4a. low suspicion for malignancy (&gt;2% to ≤ 10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4b. moderate suspicion for malignancy (&gt;10% to ≤ 50%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4c. high suspicion for malignancy (&gt;50% to &lt;95%)</td>
</tr>
<tr>
<td>5 Highly suggestive of</td>
<td>Tissue diagnosis</td>
<td>≥95%</td>
</tr>
<tr>
<td>malignancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Known biopsy-proven</td>
<td>Surgical excision when clinical appropriate</td>
<td>n/a</td>
</tr>
</tbody>
</table>
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.
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).
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).
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).
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.
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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V. https://www.uptodate.com/contents/image/print?imageKey=PI%2F53453&topicKey=PI%2F858&search=breast%20cancer%20treatment&rank=1~45&source=see_link