Breast Imaging in Young Women

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Outline

1. Statistics of breast cancer in young women
2. Clinical presentation of a patient with benign breast lesions on ultrasound and mammography
3. Discussion of the recommended use of different breast imaging modalities in young patients
4. Clinical presentation and imaging findings of a patient with a malignant breast mass
5. Review of benign and malignant features of breast lesions on ultrasound and mammography
Breast Cancer Incidence

- Overall lifetime incidence: 1 in 8 women
- 207,090 new diagnoses annually in the U.S.
- 12.4% of breast cancers are diagnosed in women under 45.
- 1.9% are in women ages 20-34.

National Cancer Institute. SEER Fact Sheets. 2010.
Breast Cancer Mortality

- Breast cancer (not lung) is the leading cause of death from cancer in the U.S. in women ages 20-59.
- U.S. deaths from breast cancer per year: 40,599
- 1094 (2.7%) are in women under age 40.

2007 data from Jemal et al. ACS. 2010.
Breast Cancer in Young Women: Poorer Prognosis

- Higher grade tumor (less well-differentiated)
- Larger tumor size at time of diagnosis
- More likely to involve lymph nodes at time of diagnosis
- Poorer prognosis (shorter disease-free survival, higher mortality)
- More likely to have a delayed diagnosis after seeking medical attention

From Anders CK et al. JCO 2008.

Breast Masses in Young Women

- We have seen that breast cancers do occur and can be aggressive in young women.

- However, 99.5% of palpable breast masses in women under 30 are benign.

- It is important to use appropriate imaging techniques to differentiate between these.

Loving VA et al. AJR 2010.
Patient #1: Clinical Presentation

- Healthy 29-year-old woman on oral contraceptives with no family history of breast or ovarian cancer.

- Presented with left breast pain and a separate area of palpable thickening in the left breast on clinical exam.

How should these findings be evaluated?
Breast Imaging Options

- Ultrasound
- Mammogram
- MRI

Our patient was first evaluated with a targeted ultrasound of the regions of interest on her left breast.
Patient #1: Breast Cyst on Ultrasound

Ultrasound, anti-radial view, of the left breast, 3:00 position, 2 cm from the nipple, in the area of tenderness.

**Round, well-circumscribed, anechoic lesion, 0.6 x 0.6 x 0.5 cm,** with good through transmission and **backwall enhancement.** Consistent with a benign Simple Cyst.
Patient #1: Solid Mass with Atypical Features on Ultrasound

Ultrasound, radial view, of the left breast, 12:00 position, 1-2 cm from the nipple, in the area of palpable thickening. Hypoechoic solid mass, 1.4 x 1.6 x 0.8 cm, with microlobulations (scalloped appearance).
Patient #1: Solid Mass with Atypical Features on Ultrasound (2)

Ultrasound, Anti-radial view, of the left breast, 12:00 position, 1-2 cm from the nipple, in the area of palpable thickening. Hypoechoic lesion with branching, concerning for ductal extension of the lesion.
Patient 1: Additional Imaging

- This patient’s solid breast mass was felt to be likely consistent with a fibroadenoma on ultrasound.
- However, because of the atypical features, she required a biopsy to definitively characterize this lesion.
- Before the biopsy, she had a bilateral diagnostic mammogram.
Patient #1: Dense Breast Tissue on Mammogram

Digital mammography, craniocaudal view, of the right and left breasts, with a BB indicating the site of the ultrasound abnormality.

Breasts are dense bilaterally, which obscures any possible finding in the area of interest. No calcifications seen.
Patient #1: Diagnostic Work-up

- With no additional areas of concern seen on mammography (limited by breast density), this patient then proceeded to have ultrasound-guided tissue sampling for definitive diagnosis.
Patient #1: Aspiration of Simple Cyst

Pre- and post-aspiration images from the ultrasound-guided fine needle aspiration of the cyst seen in the left breast at the 3:00 position.

Aspiration of the simple cyst, with removal of 0.5 mL clear fluid, which was subsequently discarded due to its benign appearance. Post-aspiration image shows complete collapse of the cyst.
Patient #1: Biopsy of Atypical Solid Mass

Five core biopsies of the solid mass were taken.

Pathology revealed benign Fibroadenoma.

Imaging findings were concordant with pathology.

Follow-up ultrasound was recommended in 6 months to document stability.

Ultrasound-guided core needle biopsy of the solid lesion in the left breast.
Considerations for Breast Imaging Modalities in Young Women

- **Radiation:**

  Typical mean glandular dose from bilateral two-view mammography = 3.7-4.7 milligray, which is equivalent to about 2 months of natural background radiation.

  Exposure to ionizing radiation at a younger age (higher cell proliferation rates) has a higher risk of inducing cancer.

  Lifetime attributable risk of breast cancer due to a single mammogram, by age at exposure:

<table>
<thead>
<tr>
<th>Age</th>
<th>Incidence (per 100,000)</th>
<th>Mortality (per 100,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>18</td>
<td>4.5</td>
</tr>
<tr>
<td>40</td>
<td>6</td>
<td>1.5</td>
</tr>
<tr>
<td>80</td>
<td>0.15</td>
<td>&lt;0.1</td>
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Considerations for Breast Imaging
Modalities in Young Women: Density

- **Breast Density**

Younger women are more likely than older women to have denser breasts.

Mammography has significantly lower sensitivity in breast tissue that is dense or heterogeneously dense, especially in younger women. Ultrasound is not significantly affected by breast density.

Breast Density on Mammography

Figure 1  Representations of the 4 Breast Imaging Reporting and Data System (BI-RADS) breast density qualitative and quantitative assessments. A) BI-RADS 1: almost entirely fat; B) BI-RADS 2: scattered fibroglandular densities; C) BI-RADS 3: heterogenously dense; and D) BI-RADS 4: extremely dense.

From Pinsky RW, Helvie MA. JNCCN. 2010.
Patient #1:
Dense Breast Tissue on Mammogram

Comparing our patient’s breasts to these classifications, we see that her breasts are dense, consistent with BI-RADS density 3-4.
Breast Density Lowers Sensitivity of Mammography

With increasing BI-RADS density classification, sensitivity of mammogram decreases from 100% to 47%. Sensitivity of ultrasound remains in the 80-88% range at all densities.

## Comparing Sensitivities of Imaging Modalities in Young Women

<table>
<thead>
<tr>
<th>Mammography (%)</th>
<th>Ultrasound (%)</th>
<th>Age</th>
<th>Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>58.0</td>
<td>78.6</td>
<td>&lt;50</td>
<td>(Kolb 2002)</td>
</tr>
<tr>
<td>71.7</td>
<td>84.9</td>
<td>&lt;45</td>
<td>(Houssami 2003)</td>
</tr>
<tr>
<td>70.8</td>
<td>92.2</td>
<td>&lt;40</td>
<td>(Foxcroft 2004)</td>
</tr>
<tr>
<td>85</td>
<td>95</td>
<td>30-39</td>
<td>(Osako 2007)</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>&lt;30</td>
<td>(Loving 2010)</td>
</tr>
</tbody>
</table>

In each study in younger women, the sensitivity of ultrasound is significantly (10-23%) greater than that of mammography. The sensitivity of ultrasound is very high (>92%) in women under age 40. Specificity of ultrasound in women less than 30 is 80.5%.
Summary of Recommended Breast Imaging Modalities

- **Mammography**: Routine screening in women over age 40. Diagnostic imaging in symptomatic women age 30 and older.
- **Ultrasound**: Diagnostic imaging in symptomatic women under age 30.
- **MRI**: Recommended for routine screening in high-risk women (e.g. BRCA mutation). Highest sensitivity, lower specificity. Used in pre-surgical planning.

Consistent with these ACR guidelines, ultrasound was the correct first imaging modality for this young patient.

As we have seen, ultrasound has the benefits of higher sensitivity in dense breasts and no radiation, compared with mammography.

However, there is still a role for mammography in younger women.
Role for mammography in women under age 30

- When malignancy is suspected on ultrasound or confirmed on core biopsy pathology, we can use mammography or MRI to look for additional lesions in the ipsilateral or contralateral breast.

- Ultrasound is the better diagnostic test for a targeted area of clinical abnormality.

- Mammography and MRI are better for screening of the whole breast, as these are less operator-dependent than ultrasound.

Sentis M. Breast Cancer Res Treat. 2010
Patient #2: Clinical Presentation

- Healthy 26-year-old woman with no family history of breast or ovarian cancer.

- Presented with self-detected right breast mass. Her primary care physician confirmed the presence of a mass on clinical exam, and appropriately referred the patient for a diagnostic ultrasound.
Ultrasound of the right breast, antiradial view, 11:00 position, 6 cm from the nipple.

**Irregular, hypoechoic mass**, 1.6 x 2.3 cm, with **angular margins** and **spiculation** along the anterior aspect.
Patient #2: Solid Mass with Calcifications on Ultrasound

Ultrasound of right breast, antiradial view, 11:00 position, 6 cm from the nipple. Multiple punctate, hyperechoic foci (likely calcifications), which are highly concerning for malignancy. There is also concern for invasion into the chest wall, given the proximity to and ill-defined margin along the pectoralis major muscle.
Patient #2: Additional Imaging

- As with our first patient, because of the concerning features seen on ultrasound, this patient then had a bilateral diagnostic mammogram to evaluate for any additional lesions.

- Her mammogram was performed at an outside hospital and the actual images are not available.

- We will use the mammographic images from a companion patient to demonstrate some of the findings described on Patient #2’s mammogram report.
Patient #2’s Mammography Report: “An area of increased density in the upper outer quadrant of the right breast associated with numerous pleomorphic calcifications spanning an area of approximately 3cm.” -- OMR, BIDMC
Patient #2:
Additional Findings on Mammogram

- Patient #2’s mammogram also revealed heterogeneously dense (BI-RADS 3) breasts, which somewhat limits the sensitivity of mammography, as we have previously examined. Other than the pleomorphic calcifications noted in the area of the ultrasound abnormality, there were no additional calcifications in either breast.

- A right mediolateral-oblique view also demonstrated a suspicious enlarged lymph node (1.5 cm) in the right axilla.
Patient #2: Biopsy Results

- This patient had an ultrasound-guided core biopsy of the right breast mass and right axillary lymph node.

- Pathology: **Invasive ductal carcinoma, grade 3** of 3, with associated calcifications.

  Lymph node with **metastatic poorly differentiated ductal carcinoma**.

  ER/PR and HER-2 immunostains were positive.
Patient #2:

Additional Imaging for Cancer Staging

- With biopsy-proven invasive breast cancer involving lymph nodes, this patient then underwent additional imaging to evaluate her disease stage, in order to determine her prognosis and treatment options.

- Her imaging included a CT torso and a radionuclide bone scan to evaluate for distant metastases. We will view these studies briefly.
Abnormally enlarged lymph node in the right axilla, status post biopsy with clip placement. No evidence of metastases to the lungs or abdominal organs.
Patient #2: Normal Radionuclide Bone Scan

There is normal radiotracer uptake in the axial skeleton and normal visualization of the bilateral kidneys and bladder. There are no abnormal foci of tracer uptake that would be concerning for bony metastases.

Whole body bone scan with Tc-99m radiotracer, anterior and posterior projections.
Patient #2: Cancer Stage

- Our patient underwent a wide excision (partial mastectomy) of her right breast invasive ductal carcinoma with axillary lymph node dissection.

- Staging using TNM system:
  - Tumor: 3.3 cm = T2 (2-5 cm)
  - Nodes: 5 axillary nodes = N2 (4-9 nodes)
  - Metastases: No distant mets = M0

- \textbf{T2N2M0} = Stage IIIA

Patient #2: Disease Course

- This patient underwent a wide surgical excision with acceptable margins and axillary lymph node dissection, as mentioned previously.
- She then underwent adjuvant chemotherapy (Taxol/Herceptin/trial drug).
- Genetic testing revealed no BRCA 1 or 2 mutation.
- She has annual screening mammograms to monitor for recurrence of disease. Continue to view her one-year post-op mammogram.
**Patient #2: One-year Post-op Mammogram with no Calcifications**

One-year post-operative follow-up screening mammogram. Heterogeneously dense breasts bilaterally. **Architectural distortion** in right upper outer quadrant consistent with post-surgical changes. No residual calcifications seen. No evidence of residual or recurrent cancer.

Mammogram of the right and left breasts, mediolateral-oblique views.
Review of Patients #1 and #2

- We have reviewed the use of different breast imaging modalities in patients under the age of 30 who present with a palpable breast mass.
- We saw ultrasound features of a benign simple cyst and an atypical benign fibroadenoma in Patient #1.
- We saw ultrasound and mammographic features of an invasive ductal carcinoma in Patient #2.
Summary of Benign vs. Malignant Imaging Findings

Ultrasound and Mammographic features:

- Benign simple cyst – anechoic, well-circumscribed
- Benign fibroadenoma – round/oval shape, orientation parallel to the skin, up to 2-3 gentle macrolobulations
- Malignancy – hypoechoic, irregular shape, poorly circumscribed, angulated or spiculated margins, microlobulations, taller than wide, calcifications (pleomorphic/fine linear/branching), ductal extension, invasion into surroundings, hypervascularity at edges

Learning Objectives

- Breast cancer can occur and be aggressive in young women, so it is important to evaluate any new palpable mass.
- Ultrasound is the first-line imaging modality in symptomatic women under age 30 (higher sensitivity in dense breasts than mammography and no radiation exposure).
- Be familiar with benign and worrisome features of breast lesions on ultrasound and mammography.
References


References (continued)


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