Imaging the Breast Before Preoperative Therapy

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Objectives

• Review recommendations for imaging the breast prior to preoperative therapy
• Clarify goals of pre-therapy imaging
• Understand benefits and limitations of current imaging tools
  – Mammography, Ultrasound, MRI
• Clarify issues regarding placing markers at tumor site before initiating preoperative therapy
Recommendations for Women with Current Breast Cancer Diagnosis

- Complete mammographic evaluation
  - (diagnostic mammography for all lesions)
- Complete sonographic evaluation
  - (diagnostic US for all palpable lesions, all masses, AD, FAD)
- Core needle biopsy of all suspicious lesions depending on clinical impact
- MRI for evaluation of extent of disease in known breast and unsuspected disease in contralateral breast, regardless of breast density, depending on clinical impact
Evolving Paradigms: 20th Century

1900  Radical Mastectomy

1970  Breast conserving surgery followed by radiation, chemorx

1990  Chemotherapy prior to surgery
Goal of Imaging Prior to Preoperative Therapy: *Accurate Staging*

- Within the breast(s)
  - T stage
    - Tumor histology and size
- Outside of the breast
  - N stage
    - Nodal involvement
- Outside the breast and nodes
  - M stage
    - Liver, lungs, bones
Staging: determining extent of disease within the breast(s)

- **T stage**
  - *In situ* or invasive
  - Size
  - Extension to chest wall or skin
- **Multi-focal**
  - Multiple lesions within a quadrant
- **Multi-centric**
  - Multiple lesions in more than one quadrant or the equivalent
- **Bilateral**
Rationale for Determining Accurate Extent of Disease Within the Breast(s)

• In patient considered for preoperative therapy
  – To determine if patient is candidate for breast conservation post therapy
  – To establish accurate baseline prior to initiating therapy
  – To accurately diagnose the specific types of cancers in the breast (mixed histologies can occur)
Limitations of Mammography and Ultrasound for Extent of Disease

- Mammography: limited sensitivity for women with dense breast tissue, young women, certain cancer types (ILC, DCIS)
- Ultrasound: limited sensitivity for women with fatty breast tissue, certain cancer types (ILC, DCIS), operator dependent
49 year old woman with palpable thickening left breast
Central mass and 2 o’clock mass, multifocal bordering on multicentric
MRI demonstrates confluent large mass spanning over 6 cm and involving more than one quadrant
57 yo female presents for screening mammography
Same patient ......right breast
### Additional Ipsilateral Malignancy on Diagnostic MR:

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Number of Malignant Cases</th>
<th>Number (%) Additional Malignancy</th>
<th>Number (%) Multi-focal</th>
<th>Number (%) Multi-centric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harms, 1993</td>
<td>29 breasts</td>
<td>10 (34)</td>
<td>3 (10)</td>
<td>7 (24)</td>
</tr>
<tr>
<td>Orel, 1995</td>
<td>64 women</td>
<td>13 (20)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Mumtaz, 1997</td>
<td>92 breasts</td>
<td>11 (12)</td>
<td>1 (1)</td>
<td>10 (11)</td>
</tr>
<tr>
<td>Fischer, 1999</td>
<td>336 women</td>
<td>54 (16)</td>
<td>30 (9)</td>
<td>24 (7)</td>
</tr>
<tr>
<td>Bedrosian, 2003</td>
<td>267 women</td>
<td>49 (18)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Liberman, 2003</td>
<td>70 women</td>
<td>19 (27)</td>
<td>14 (20)</td>
<td>5 (7)</td>
</tr>
<tr>
<td>Schelfout, 2004</td>
<td>170 women</td>
<td>33 (19)</td>
<td>12 (7)</td>
<td>17 (10)</td>
</tr>
<tr>
<td>Schnall, 2005</td>
<td>423 women</td>
<td>41 (10)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1451</strong></td>
<td><strong>230/1451 (16)</strong></td>
<td><strong>60/697 (9)</strong></td>
<td><strong>63/697 (9)</strong></td>
</tr>
</tbody>
</table>
### Extent of disease: Comparative Sensitivities

<table>
<thead>
<tr>
<th>Histology</th>
<th>Mammo</th>
<th>US</th>
<th>MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDC</td>
<td>81%</td>
<td>94%</td>
<td>95%</td>
</tr>
<tr>
<td>ILC</td>
<td>34%</td>
<td>86%</td>
<td>96%</td>
</tr>
<tr>
<td>DCIS</td>
<td>55%</td>
<td>47%</td>
<td>89%</td>
</tr>
</tbody>
</table>

Berg, Radiology. 2004 Dec;233(3):830-49
## Contralateral Occult Cancer Diagnosed by MRI Alone

<table>
<thead>
<tr>
<th>Study</th>
<th>Cancer yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rieber, 1997</td>
<td>9% (3/34)</td>
</tr>
<tr>
<td>Fischer, 1999</td>
<td>3% (15/463)</td>
</tr>
<tr>
<td>Liberman, 2003</td>
<td>5% (12/223)</td>
</tr>
<tr>
<td>Lee, 2003</td>
<td>4% (7/182)</td>
</tr>
<tr>
<td>Viehweg, 2004</td>
<td>3% (4/119)</td>
</tr>
<tr>
<td>Berg, 2004</td>
<td>3% (3/111)</td>
</tr>
<tr>
<td>Lehman, 2005</td>
<td>4% (4/103)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4% (48/1235)</strong></td>
</tr>
</tbody>
</table>
MRI Evaluation of the Contralateral Breast in Women with a Recent Diagnosis of Breast Cancer: ACRIN 6667

- 25 sites from the US, Canada, Germany
- Mixture of academic and community practices
- 969 women  
  - 58% IDC  20% DCIS

American College of Radiology Imaging Network (NCI/NIH)  
Connie Lehman (PI) and Constantine Gatsonis (Statistician)
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Rationale for Marking the Tumor Prior to Preoperative Therapy

• Identify the location of the tumor for surgeon and/or pathologist in the event the tumor is no longer visible after therapy
  – Particularly relevant if breast conservation planned
Tumor Marking Prior to Therapy

- Current approaches are not standardized
- Collaborative decision (multidisciplinary approach of surgeon, medical oncologist, radiologist) but clear driver needed
- Caution with “wait and see” approach with risk that tumor is no longer visible after treatment initiated
Considerations for Marker Placement: Who, What, When, How?

• **Who requests**
  – surgeon or medical oncologist or radiologist

• **Which lesions**
  – all lesions biopsied
  – all cancers
  – only cancers planned for BCT
  – only cancers planned for preoperative therapy followed by BCT

• **When placed**
  – time of initial biopsy prior to known diagnosis of cancer
  – post initial biopsy and cancer diagnosis/prior to treatment
  – post therapy initiation

• **How**
  – single marker central to tumor
  – multiple markers bracketing tumor
Possible “Standard” Protocol

• Radiologist places marker at the time of initial diagnostic biopsy centrally in all large (> 2 cm), highly suspicious lesions

• For biopsy proven cancers that have not had a marker placed, surgeon/medical oncologist requests marker placement for all candidates for preoperative therapy
  – Marker placed prior to therapy initiated
  – Single central or multiple peripheral markers based on surgeon preference
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Preoperative Therapy in Invasive Breast Cancer

Reviewing the State of the Science and Exploring New Research Directions

Thank you!