The Future of Breast MRI
Improving Outcomes

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Harvard Medical School
Director of Breast Imaging
Massachusetts General Hospital
Opportunities

• New technology provides opportunities for challenging old paradigms
  – Reducing “harms” at the same time as we increase benefits
  – In era of shared decision making
    • Do all high risk lesions need surgical excision?
    • Can we offer more women options of follow up in place of biopsy?
      – < 2% rule?
Precision diagnostics to impact patient decision making

Prospective Multicenter Study of the Impact of the 21-Gene Recurrence Score Assay on Medical Oncologist and Patient Adjuvant Breast Cancer Treatment Selection


Conclusion The results of this study indicate that the RS assay impacts medical oncologist adjuvant treatment recommendations, patient treatment choice, and patient anxiety.
Future of Breast MRI in Era of Precision Medicine

- **Screening**
  - CE imaging replaces mammography
    - Interval defined by risk profile of patient
    - Rapid, less expensive technology for CE imaging

- **Diagnosis**
  - Apply MR imaging to avoid unnecessary surgeries and unnecessary biopsies

- **Treatment**
  - Apply MRI to reduce overtreatment and provide patients with more targeted therapy options that maintain excellent outcomes, but with associated lower morbidity
<table>
<thead>
<tr>
<th>Study</th>
<th>Sensitivity</th>
<th>Mammo</th>
<th>US</th>
<th>MRI</th>
</tr>
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<tbody>
<tr>
<td>Tilanus, 2000</td>
<td>0% (0/3)*</td>
<td>100%</td>
<td>3/3</td>
<td></td>
</tr>
<tr>
<td>Podo, 2002</td>
<td>12.5% (1/8)</td>
<td>12.5%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Morris, 2003</td>
<td>0% (0/14)*</td>
<td>--</td>
<td>100%</td>
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</tr>
<tr>
<td>Kriege, 2004</td>
<td>40.0% (18/45)</td>
<td>--</td>
<td>71.1%</td>
<td></td>
</tr>
<tr>
<td>Warner, 2004</td>
<td>36.4% (8/22)</td>
<td>33.3%</td>
<td>77.3%</td>
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<tr>
<td>Kuhl, 2005</td>
<td>32.6% (14/43)</td>
<td>39.5%</td>
<td>90.7%</td>
<td></td>
</tr>
<tr>
<td>Lehman, 2005</td>
<td>25.0% (1/4)</td>
<td>--</td>
<td>100%</td>
<td></td>
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<td>Leach, 2005</td>
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<td>77.1%</td>
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<tr>
<td>Lehman, 2007</td>
<td>33.3% (2/6)</td>
<td>16.7%</td>
<td>100%</td>
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<tr>
<td>Sardanelli, 2007</td>
<td>58.8% (10/17)</td>
<td>64.7%</td>
<td>93.8%</td>
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</tr>
<tr>
<td>Weinstein et al, 2009</td>
<td>55% (11/20)</td>
<td>15%</td>
<td>60%</td>
<td></td>
</tr>
<tr>
<td>Elmore et al, 2010</td>
<td>50% (2/4)</td>
<td>--</td>
<td>100%</td>
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</tr>
<tr>
<td>Kuhl et al, 2010</td>
<td>33.3% (9/27)</td>
<td>37%</td>
<td>92.6%</td>
<td></td>
</tr>
<tr>
<td>Sardanelli et al, 2011</td>
<td>50% (25/50)</td>
<td>52%</td>
<td>91.3%</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38.6%</strong> (115/298)</td>
<td><strong>39.6%</strong> (76/192)</td>
<td><strong>84.6%</strong> (248/293)</td>
<td></td>
</tr>
</tbody>
</table>

* To be included, subjects had to have negative mammogram.
ACRIN 6666---Single MRI performed after multiple rounds of screening ultrasound....

From: Detection of Breast Cancer With Addition of Annual Screening Ultrasound or a Single Screening MRI to Mammography in Women With Elevated (Intermediate) Breast Cancer Risk

Table 4. Screening Performance in 612 Participants Screened by Magnetic Resonance Imaging After 3 Annual Mammography and Ultrasound Screenings

<table>
<thead>
<tr>
<th></th>
<th>Combined Mammography Plus Ultrasound</th>
<th>Combined Mammography Plus Ultrasound MRI</th>
<th>Estimate (95% CI)</th>
<th>P Value</th>
<th>Mammography Alone</th>
<th>Combined Mammography Plus MRI</th>
<th>Estimate (95% CI)</th>
<th>P Value</th>
<th>MRI Alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>No./total</td>
<td>17/100</td>
<td>16/612</td>
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<td></td>
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</tr>
<tr>
<td>Yield (95% CI),</td>
<td>11.4 (4.6 to 23.4)</td>
<td>26.1 (15.0 to 42.1)</td>
<td>14.7 (3.5 to 25.9)</td>
<td>.004</td>
<td>8.2 (2.7 to 19.0)</td>
<td>26.1 (15.0 to 42.1)</td>
<td>18.0 (5.8 to 30.1)</td>
<td>&lt;.001</td>
<td>22.9 (12.6 to 38.1)</td>
</tr>
<tr>
<td>Short-term follow-up rate (95% CI), %</td>
<td>4.6 (3.1 to 6.5)</td>
<td>19.6 (16.5 to 23.0)</td>
<td>15.0 (12.0 to 18.0)</td>
<td>&lt;.001</td>
<td>0.5 (3.1 to 1.4)</td>
<td>16.3 (13.5 to 19.5)</td>
<td>15.8 (12.8 to 18.9)</td>
<td>&lt;.001</td>
<td>15.8 (13.0 to 19.0)</td>
</tr>
<tr>
<td>No./total</td>
<td>28/612</td>
<td>120/612</td>
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<td></td>
</tr>
<tr>
<td>Biopsy rate (95% CI), %</td>
<td>6.2 (4.4 to 8.6)</td>
<td>13.2 (10.7 to 16.2)</td>
<td>7.0 (4.8 to 9.2)</td>
<td>&lt;.001</td>
<td>1.6 (3.8 to 3.9)</td>
<td>9.6 (7.4 to 13.3)</td>
<td>8.0 (5.7 to 10.3)</td>
<td>&lt;.001</td>
<td>8.5 (6.4 to 11.0)</td>
</tr>
<tr>
<td>No./total</td>
<td>38/612</td>
<td>81/612</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPV2 (95% CI), %</td>
<td>16.5 (7.7 to 33.3)</td>
<td>18.5 (10.8 to 28.7)</td>
<td>0.1 (8.8 to 8.8)</td>
<td>&lt;.001</td>
<td>0.1 (18.7 to 83.1)</td>
<td>25.4 (15.0 to 38.4)</td>
<td>24.6 (8.3 to 3.7)</td>
<td>.06</td>
<td>23.1 (12.5 to 36.6)</td>
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<tr>
<td>No./total</td>
<td>7/38</td>
<td>15/612</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Abbreviation: MRI, magnetic resonance imaging; PPV, positive predictive value.

*P* value that observed difference of combined mammography plus ultrasound, and MRI vs mammography plus ultrasound occurred by chance.

*P* value that observed difference of combined mammography and MRI vs mammography alone occurred by chance.

Yield is the cancer detection rate.

Defined as the malignancy rate among women with a positive screening test (ie, assessment of BI-RADS 3 or higher and recalled from screening for further testing or short interval follow-up).

Defined as the malignancy rate among women with a positive screening test who underwent biopsy of the same lesion.
MRI Alone for Screening High Risk Populations?

Fig 1. Cancer yield of the different imaging methods, used alone or in combination. Number of true-positive diagnoses per 1,000 complete screening rounds. Mx, mammography; US, ultrasound; MRI, magnetic resonance imaging.
American Cancer Society 2007

“Based on the evidence from studies of MR screening high risk women, and the limitations of mammography and CBE alone, the American Cancer Society recommends annual MR screening in conjunction with mammography in women at significantly increased risk of breast cancer.”

• ACS, ACR (SBI), NCCN support screening MRI in high risk women
Current ACS Recommendations for MRI Screening

- Recommend annual screening for particular high risk groups*
  - *BRCA* mutation
  - First-degree relative of *BRCA* carrier, but untested
  - Lifetime risk ~20–25% or greater, as defined by BRCAPRO or other models that are largely dependent on family history

Current ACS Recommendations for MRI Screening

- Insufficient evidence to recommend *either* for or against “moderate risk”
  - Lifetime risk 15-20%
  - High risk biopsy: ADH, ALH, LCIS
  - Heterogeneously or extremely dense breasts on mammogram
  - Personal history of breast cancer

- Not recommended for average risk
Breast Cancer Surveillance Consortium (BCSC)

- Funded by the National Cancer Institute (NCI)
- Largest longitudinal collection of breast imaging data in U.S
  - 12.6 breast imaging exams, 2.9 million women
- Imaging data linked to state and regional tumor registries
- 2010: Collection was extended to include MRI data
• 2005-2009 Breast Cancer Surveillance Consortium
• 1.3 million mammograms, 9,000 breast MRIs
• 75% of all screening MRIs performed were in women with less than 20% lifetime risk
• Of women at greater than 20% lifetime risk, less than 2% had received an MRI
Rethinking Breast Cancer Screening: Ultra FAST Breast Magnetic Resonance Imaging

Elizabeth A. Morris, Memorial Sloan Kettering Cancer Center, New York, NY

Abbreviated Breast Magnetic Resonance Imaging (MRI): First Postcontrast Subtracted Images and Maximum-Intensity Projection—A Novel Approach to Breast Cancer Screening With MRI

Christiane K. Kuhl, Simone Schrading, Kevin Strobel, Hans H. Schild, Ralf-Dieter Hilgers and Heribert B. Bieling

Conclusion An MRI acquisition time of 3 minutes and an expert radiologist MIP image reading time of 3 seconds are sufficient to establish the absence of breast cancer, with an NPV of 99.8%. With a reading time < 30 seconds for the complete AP, diagnostic accuracy was equivalent to that of the FDP and resulted in an additional cancer yield of 18.2 per 1,000.
Abbreviated MRI

Kuhl et al. JCO 2014

– Intermediate to slightly increased risk women
– 18.3/1000 additional cancers
– All were Tis or T1, N0, M0
– Median tumor size was 8.4mm
Comparison of Abbreviated Breast MRI and Digital Breast Tomosynthesis in Breast Cancer Screening in Women with Dense Breasts

ECOG-ACRIN AB-MR Working Group

Christopher Comstock M.D.
Christiane Kuhl M.D.
Gillian Newstead M.D.
Where we started:
GE 1.5 HDX  Breast Protocol
8 channel coil
Total Scan Time 40-45 minutes
4 mm thick T2 and 2 mm thick T1 Vibrant

<table>
<thead>
<tr>
<th>Series #</th>
<th>Name</th>
<th>Pulse Seq.</th>
<th>TE</th>
<th>TR</th>
<th>Flip Angle</th>
<th>FOV</th>
<th>Thick</th>
<th>Skip</th>
<th>NEX</th>
<th>Freq Dir.</th>
<th>Phase Encode</th>
<th>Freq Encode</th>
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<tbody>
<tr>
<td>1</td>
<td>Sag_3-Plane_Loc</td>
<td>GradientEcho</td>
<td>32</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Unswap</td>
<td>128</td>
<td>A/P</td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>Calibration_Scan</td>
<td>GradientEcho</td>
<td>48</td>
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<tr>
<td>3</td>
<td>PRE_AX_SPGR_3D_ax</td>
<td>SPGR</td>
<td>10</td>
<td>32</td>
<td>3</td>
<td>2</td>
<td>A/P</td>
<td></td>
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<tr>
<td>4</td>
<td>Ax_FastSTIR_T2</td>
<td>IR</td>
<td>60</td>
<td>6600</td>
<td>35</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>A/P</td>
<td></td>
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<td>5</td>
<td>PRE_Sag_Vibrant_</td>
<td>VIBRANT</td>
<td>10</td>
<td>20</td>
<td>3</td>
<td>1</td>
<td>A/P</td>
<td></td>
<td></td>
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<tr>
<td>6</td>
<td>Ax_Vibrant_MultiPhase</td>
<td>VIBRANT</td>
<td>10</td>
<td>32</td>
<td>2</td>
<td></td>
<td></td>
<td>A/P</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Post_Sag_Vibrant_</td>
<td>VIBRANT</td>
<td>10</td>
<td>20</td>
<td>3</td>
<td>1</td>
<td>A/P</td>
<td></td>
<td></td>
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</table>
Where we are now:
New MGH Main GE 3T Discovery 750 scanner Breast Protocol
Total Scan Time 9 minutes 48 seconds
Isotropic resolution 0.8 mm

<table>
<thead>
<tr>
<th>Series</th>
<th>Pulse</th>
<th>FOV</th>
<th>Matrix</th>
<th>Resolution</th>
<th>Slice</th>
<th>Nex</th>
<th>Phase</th>
<th>Time</th>
<th>TR/TE</th>
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<tr>
<td>Localizer</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>20sec</td>
<td></td>
</tr>
<tr>
<td>Non FS Vibrant</td>
<td>3D SPGR</td>
<td>330</td>
<td>400/400</td>
<td>0.8X0.8X0.8</td>
<td>0.8</td>
<td>1</td>
<td>AP</td>
<td>1.19</td>
<td>5/2.3</td>
</tr>
<tr>
<td>FS CUBE T2 (ASPIR)</td>
<td>3D FSE</td>
<td>330</td>
<td>352/352</td>
<td>0.9X0.9X0.8 (interpolated—1.6 thick overlapping)</td>
<td>0.8</td>
<td>1</td>
<td>AP</td>
<td>1.54</td>
<td>2500/90</td>
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<tr>
<td>FS Vibrant (ASPIR)</td>
<td>3D SPGR</td>
<td>330</td>
<td>400/400</td>
<td>0.8X0.8X0.8</td>
<td>0.8</td>
<td>1</td>
<td>AP</td>
<td>2.04 per phase (1 pre, 2 post)</td>
<td>6.4/2.4</td>
</tr>
</tbody>
</table>
Summary of Process

Sample times are defined for center of scan (halfway through scan). 2 minutes per phase (pre, initial post, delayed post contrast)

- Pre: 60-75 sec
- Initial Post: 60-75 sec (with 15 secs for contrast and flush)
- Delayed Post: 180-205 sec
Less than 10 min scan

Non FS Vibrant

Cube T2
Future of Breast MRI in Era of Precision Medicine

• **Screening**
  - CE imaging increases
    • Interval defined by risk profile of patient
    • Rapid, less expensive technology for CE imaging

• **Diagnosis**
  - To avoid unnecessary surgeries and unnecessary biopsies

• **Treatment**
  - To reduce overtreatment and provide patients with targeted therapy options
Can breast MRI provide patients with safe alternatives to surgery?

- Excision of benign lesions
- Excision of high risk lesions
- Duct “exploration”/excision
- Multiple re-excisions for clear margins in breast cancer patient
Clinical Indications for Breast MRI

1.6 million breast biopsies are performed annually in the U.S.
30% of biopsies 2003-2008 are surgical (recommendation is less than 10%)
300,000 women have unnecessary breast surgery every year in the United States, hundreds of millions of dollars
$5,000 for a needle biopsy, $10,000 for surgical biopsy
• $1000 for a breast MRI?
Minimally invasive surgical management of benign breast lesions

Anna Lakoma and Eugene S. Kim

Abstract

Benign breast disease is common among women, and when symptomatic, definitive surgical management is preferred by both clinicians and patients. Given the nonmalignant nature of these lesions, an important factor in treatment is cosmesis. Novel minimally invasive techniques for breast lesions are rapidly emerging and demonstrate good efficacy, safety and cosmesis. This review will describe minimally invasive techniques of breast lesions via surgical and percutaneous approaches and discuss the outcomes, advantages and limitations for each. Based on promising initial results, the future standard of care for benign breast lesions may focus on one or more of these minimally invasive techniques.
Future of Breast MRI in Era of Precision Medicine

• Screening
  – CE imaging increases
    • Interval defined by risk profile of patient
    • Rapid, less expensive technology for CE imaging

• Diagnosis
  – To avoid unnecessary surgeries and unnecessary biopsies

• Treatment
  – To reduce overtreatment and provide patients with targeted therapy options
## Ipsilateral Breast CA by MRI

<table>
<thead>
<tr>
<th>Author, Year</th>
<th># Women</th>
<th># (%) Additional Unsuspected Ipsilateral MRI Malignancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harms, 1993</td>
<td>29 (breasts)</td>
<td>10 (34.5%)</td>
</tr>
<tr>
<td>Orel, 1995</td>
<td>64</td>
<td>13 (20.3%)</td>
</tr>
<tr>
<td>Mumtaz, 1997</td>
<td>92 (breasts)</td>
<td>11 (12.0%)</td>
</tr>
<tr>
<td>Fischer, 1999</td>
<td>336</td>
<td>54 (16.1%)</td>
</tr>
<tr>
<td>Bedrosian, 2003</td>
<td>267</td>
<td>49 (18.4%)</td>
</tr>
<tr>
<td>Liberman, 2003</td>
<td>70</td>
<td>19 (27.1%)</td>
</tr>
<tr>
<td>Schelfout, 2004</td>
<td>170</td>
<td>33 (19.4%)</td>
</tr>
<tr>
<td>Schnall, 2005</td>
<td>423</td>
<td>41 (9.7%)</td>
</tr>
<tr>
<td>Tan, 1999</td>
<td>83</td>
<td>5 (6.0%)</td>
</tr>
<tr>
<td>Kim do, 2007</td>
<td>72</td>
<td>8 (11.1%)</td>
</tr>
<tr>
<td>Tillman, 2002</td>
<td>207</td>
<td>18 (8.7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>4500</strong></td>
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<tr>
<td></td>
<td></td>
<td><strong>617 (13.7%)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Author, Year</th>
<th># Women</th>
<th># (%) Additional Unsuspected Ipsilateral MRI Malignancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sardanelli, 2004</td>
<td>90</td>
<td>31 (34.4%)</td>
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<tr>
<td>Hlawatsch, 2002</td>
<td>101</td>
<td>6 (5.9%)</td>
</tr>
<tr>
<td>Bagley, 2004</td>
<td>27</td>
<td>6 (22.2%)</td>
</tr>
<tr>
<td>Hollingsworth, 2008</td>
<td>603</td>
<td>43 (7.1%)</td>
</tr>
<tr>
<td>Godinez, 2008</td>
<td>79</td>
<td>30 (38%)</td>
</tr>
<tr>
<td>Crowe, 2008</td>
<td>327</td>
<td>30 (9.2%)</td>
</tr>
<tr>
<td>Tendulkar, 2009</td>
<td>260</td>
<td>11 (4.2%)</td>
</tr>
<tr>
<td>Schell, 2009</td>
<td>199</td>
<td>32 (16.1%)</td>
</tr>
<tr>
<td>Adkisson, 2011</td>
<td>710</td>
<td>140 (19.7%)</td>
</tr>
<tr>
<td>Girardi, 2011</td>
<td>291</td>
<td>27 (9.3%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4500</strong></td>
<td><strong>617 (13.7%)</strong></td>
</tr>
<tr>
<td>Author, Year</td>
<td># Patients</td>
<td># (%) Contralateral MRI Malignancy</td>
</tr>
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<td>------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Rieber, 1997</td>
<td>34</td>
<td>3 (8.8%)</td>
</tr>
<tr>
<td>Fischer, 1999</td>
<td>463</td>
<td>15 (3.2%)</td>
</tr>
<tr>
<td>Slanetz, 2002</td>
<td>17</td>
<td>4 (23.5%)</td>
</tr>
<tr>
<td>Liberman, 2003</td>
<td>223</td>
<td>12 (5.4%)</td>
</tr>
<tr>
<td>Lee, 2003</td>
<td>182</td>
<td>7 (3.9%)</td>
</tr>
<tr>
<td>Viehweg, 2004</td>
<td>119</td>
<td>4 (3.4%)</td>
</tr>
<tr>
<td>Berg, 2004</td>
<td>111</td>
<td>3 (2.7%)</td>
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<tr>
<td>Lehman (IBMC), 2005</td>
<td>103</td>
<td>4 (3.9%)</td>
</tr>
<tr>
<td>Pediconi, 2007</td>
<td>118</td>
<td>22 (18.6%)</td>
</tr>
<tr>
<td>Lehman (ACRIN), 2007</td>
<td>969</td>
<td>30 (3.1%)</td>
</tr>
<tr>
<td>Hlawatsch, 2002</td>
<td>101</td>
<td>2 (2.0%)</td>
</tr>
<tr>
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<td>1 (3.7%)</td>
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<tr>
<td>Schell, 2009</td>
<td>199</td>
<td>8 (4.0%)</td>
</tr>
<tr>
<td>Girardi, 2011</td>
<td>291</td>
<td>2 (0.7%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4147</strong></td>
<td><strong>161 (3.9%)</strong></td>
</tr>
</tbody>
</table>
# Guidelines for MRI in Newly Diagnosed Breast Cancer Patients

| **ACR** | Support use of breast MRI in pre-operative setting  
Acknowledgement of sparse quality data on long term outcomes |
|---|---|
| **SBI** | Support use of breast MRI in pre-operative setting  
Acknowledgement of sparse quality data on long term outcomes |
| **EUSOBI** | Support use of breast MRI in pre-operative setting  
Acknowledgement of sparse quality data on long term outcomes |
| **NCCN** | Support *consideration* of breast MRI in pre-operative setting  
Acknowledgement of sparse quality data on long term outcomes |
| **SSMO** | Imaging including mammography and MR as pre treatment work up |
| **SIGN** | Imaging including MR where indicated to diagnose. Use for surveillance to detect relapse. |
Precision Diagnostics/Sloppy Therapeutics

• Positive margins/Re-excision rates vary widely
  • 10% to 80% without MRI
  • Multiple other factors impact re-excision rates
    – Selection of patients by size and location of tumor
    – Surgical technique used

• Mastectomy rates vary widely
  • Multiple factors impact physician-patient decision
    (age, family history, extent of disease, patient desire, interest in reconstruction, anxiety regarding continued surveillance)
• Can MRI support a future of more targeted, less aggressive, treatment paradigms in select patients?
  
  • Surgical oncology
    – Decrease mastectomies
      » Offer reassurance of unifocal disease in patient with dense breast tissue
      » Offer lumpectomies to patients with small tumors in more than one quadrant
• Can MRI support a future of more targeted, less aggressive, treatment paradigms in select patients?

• Radiation oncology
  – Decrease need for full breast radiation
  – Support success of partial breast radiation treatments
ECOG-ACRIN DCIS 4112: MRI and OncoType in BrCa Treatment Decision Making

Constance Lehman, M.D., Ph.D.
Study Chair
University of Washington
Background

Primary question remains and must focus on identifying subset of women with DCIS who may be managed less aggressively without sacrificing excellent outcomes.
Double Mastectomy Rates Rise Among Women With Early-Stage Breast Cancer

From 1998 Through 2011, Proportion Opting to Have Both Breasts Removed Increased From 2% to 11%, Vanderbilt Study Finds

‘We don’t have a good sense of what drives this decision on the part of patients or providers.’

—Kristy Kummerow, lead author of the study
NCI Recommendations

- Investigate and validate combinations of new and existing clinical, radiological, pathological, and molecular factors to improve risk stratification of DCIS patients and thus to identify the optimal therapy for each individual.
- Investigate patient preferences and decision making concerning the diagnosis and treatment of DCIS.
- Investigate the impact the diagnosis and treatment of DCIS has on the quality of life.
Goals of E4112

1. **Breast MRI as It Impacts Treatment Decisions:**
   To determine how often the results of breast MRI change the recommended surgery for the treatment of DCIS from lumpectomy to mastectomy.

2. **OncoType DCIS Score as It Impacts Treatment Decisions:**
   In women undergoing lumpectomy, can radiation therapy be avoided in a subset of women based on a low OncoType DCIS Score (a test on tumor tissue)?
Study Schema

Eligibility (Section 3.0)
- DCIS on core biopsy
- No invasive or micro-invasive carcinoma
- Bilateral mammogram within 6 months of registration
- No prior breast MRI within 6 months of registration
- Candidate for wide local excision

Arm A (Section 5.1):
Bilateral Breast MRI within 30 days of registration
Perform additional imaging and/or biopsies if indicated based on MRI
Proceed to Step 2 (Section 4.2) and surgery after MRI and additional imaging and biopsies if indicated

At final surgical procedure:
- WLE is final procedure
- Final margin ≥ 2mm after WLE
- No Invasive/micro-invasive carcinoma

Study procedures and treatment:
- Send Oncotype DCIS Score to Genomic Health (1) (see Section 9.1)
- Register to Step 3 (Section 4.3) after DCIS Score available (Section 9.2)

Arm A (Section 5.1):
Bilateral Breast MRI within 30 days of registration
Perform additional imaging and/or biopsies if indicated based on MRI
Proceed to Step 2 (Section 4.2) and surgery after MRI and additional imaging and biopsies if indicated

Arm B:
Mastectomy (Section 5.2)

Cross over to arm B if mastectomy indicated

At final surgical procedure:
- Mastectomy is final procedure, or
- Margin < 2mm after WLE, or
- Invasive or micro-invasive carcinoma present irrespective of procedure

Study procedures and treatment:
- Do not register on Step 3 but follow for clinical outcomes
- Treatment as per NCCN guidelines
- Send tissue to ECOG PCO-RL (2)

Arm C:
Wide local excision (WLE) +/- re-excision (Section 5.2)

At final surgical procedure:
- WLE is final procedure
- Final margin ≥ 2mm after WLE
- No Invasive/micro-invasive carcinoma

Study procedures and treatment:
- Send Oncotype DCIS Score to Genomic Health (1) (see Section 9.1)
- Register to Step 3 (Section 4.3) after DCIS Score available (Section 9.2)

Arm D: Low DCIS score < 39
No Radiation Therapy
Endocrine Therapy (Section 5.4)
Send additional specimens to ECOG POC-RL (Section 9.3)

Arm E: Intermediate–High DCIS score ≥ 39
Radiation Therapy (Section 5.3)
Endocrine Therapy (Section 5.4)
Send additional specimens to ECOG POC-RL (Section 9.3)

STEP 1

STEP 2

STEP 3

Group Meeting • Nov 13-15, 2014
What are the most pressing needs of our patients with cancer?

Clinical Validity and Utility

Our tests.

Studies have shown that Recurrence Score results reduce chemotherapy use, spare patients the negative health and quality of life impact of unnecessary chemotherapy, and reduce the costs to society and the healthcare system.3-6

Future of Breast MRI in Era of Precision Medicine

- Screening
  - CE imaging replaces mammography
    - Interval defined by risk profile of patient
    - Rapid, less expensive technology for CE imaging

- Diagnosis
  - Apply MRI to avoid unnecessary surgeries and unnecessary biopsies

- Treatment
  - Apply MRI to reduce overtreatment and provide patients with more targeted therapy options that maintain excellent outcomes, but with associated lower morbidity
• Can MRI support a future of more targeted, less aggressive, treatment paradigms in select patients?

• Medical oncology
  – Enhance information re risk for recurrence
  – Reduce need for chemotherapy
  – Guide targeted treatments
Interval Cessation of Tamoxifen

Comparison 1
year prior

Current

With permission UWMC
BPE as Risk Predictor

36 yo woman with strong family history, BRCA negative. Marked BPE on index MRI; IDC diagnosed 4 years after presentation.

Age, BRCA, and history matched control. Minimal BPE on index MRI; no breast cancer diagnosed at 4 years of follow-up.

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Thank you!