The Use of MRI in the Evaluation of Breast Cancer

Techksell McKnight Washington, MD, MPH
Assistant Professor
University of Texas Medical Branch
August 17, 2011
Outline

- Introduction
- Recent data
- Study Aims
- Material and Methods
- Discussion

"She must be very sick. She didn't even tell me to wipe my feet before entering the room."

*Age-adjusted to the 2000 US standard population and adjusted for delays in reporting.
### The Lifetime Probability of Developing Cancer for Women, 2005-2007*

<table>
<thead>
<tr>
<th>Site</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>All sites†</td>
<td>1 in 3</td>
</tr>
<tr>
<td>Breast</td>
<td>1 in 8</td>
</tr>
<tr>
<td>Lung &amp; bronchus</td>
<td>1 in 16</td>
</tr>
<tr>
<td>Colon &amp; rectum</td>
<td>1 in 20</td>
</tr>
<tr>
<td>Uterine corpus</td>
<td>1 in 39</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>1 in 52</td>
</tr>
<tr>
<td>Urinary bladder‡</td>
<td>1 in 87</td>
</tr>
<tr>
<td>Melanoma§</td>
<td>1 in 55</td>
</tr>
<tr>
<td>Ovary</td>
<td>1 in 72</td>
</tr>
<tr>
<td>Pancreas</td>
<td>1 in 71</td>
</tr>
<tr>
<td>Uterine cervix</td>
<td>1 in 147</td>
</tr>
</tbody>
</table>

* For those free of cancer at beginning of age interval.
† All Sites exclude basal and squamous cell skin cancers and in situ cancers except urinary bladder.
‡ Includes invasive and in situ cancer cases
§ Statistic for white women.

2011 Estimated US Cancer Deaths

Women 271,520

- 26% Lung & bronchus
- 15% Breast
- 9% Colon & rectum
- 7% Pancreas
- 6% Ovary
- 4% Non-Hodgkin lymphoma
- 3% Leukemia
- 3% Uterine corpus
- 2% Liver & intrahepatic bile duct
- 2% Brain/Other nervous system
- 23% All other sites
First Mammogram Machine
Introduction

- Screening with mammogram was introduced in 1976
- Ultra Sound (US) has been used to better characterized lesions and masses in dense breast
The United States Preventive Services Task Force (USPSTF)

- Biennial screening mammography for women aged 50 to 74
- Before the age of 50 years screening should be individualized if the patient is at high risk (family history or genetics)
- Evidence is insufficient to assess the additional benefits and harms of screening mammography in women 75 years or older.
- Recommends against teaching breast self-examination (BSE)
- Evidence is insufficient to assess the additional benefits and
Yearly mammograms are recommended starting at age 40 and continuing for as long as a woman is in good health.

Clinical breast exam (CBE) about every 3 years for women in their 20s and 30s and every year for women 40 and over.
Introduction

- MRI was introduced in the early 1990s
- MRI use in the general population continues to increase as the technology becomes available
- Utilization of MRI in the general population
  - Not well understood
  - Its benefit is uncertain
Breast MRI, when combined with mammography and clinical breast exam, has been shown to provide sensitivity of 99% for the preoperative assessment of the local extent of disease in patients with newly diagnosed breast cancer.

Sensitivities of 50% for clinical breast exam, 60% for mammography and 83% for ultrasound alone.

Breast MRI was significantly better than the combination of mammography, clinical examination, and US, which depicted 93.2%
Common Reasons for MRI

- Staging biopsy-proven primary breast carcinoma
- Detecting an occult primary breast cancer in a patient with proven axillary node involvement but negative results on mammography and ultrasonography
- Ascertaining the extent of disease after lumpectomy with positive margins or close margins
- Investigating suspected pectoralis muscle invasion
- Assessing response to chemotherapy, including preoperative chemotherapy
Common Reasons for MRI

- Looking for suspected recurrent disease, such as in a postsurgical scar
- A compelling clinical presentation with negative or equivocal imaging results
- Needle localization and guided biopsy
- Known or suspected rupture of breast implants
- Screening patients with certain well-defined risk factors for breast cancer.
7/12/12 – Clip radiographs after 3 US guided core biopsies completed
Known mass 10 o’clock retroareolar

New finding centrally 2 cm from skin

New finding 10 o’clock 5

New finding 8 o’clock 5

Known mass 10 o’clock 6

Known mass 9 o’clock 7
The USPSTF concludes that the current evidence is insufficient to assess the additional benefits and harms of either digital mammography or (MRI) instead of film mammography as screening modalities for breast cancer.

ACS
- BRCA1 or 2 gene mutation
- Li-Fraumeni syndrome, Cowden syndrome or Bannayan-Riley-Ruvalcaba syndrome
- People with a ≥20% lifetime risk of breast cancer
  - Gail Model
  - Tyrer-Cuzick
  - Claus model
Outline

- Introduction
- **Recent data**
- Study Aims
- Material and Methods
- Discussion
Recent Data

- Comparative effectiveness of MRI in breast cancer (COMICE) trial: a randomized controlled trial
- Breast MRI Utilization with Newly Diagnosed Breast Cancer (SEER-Medicare Linked Data)
The UK COMICE Trial

COMICE study is the first large prospective, Randomized control, multicenter trial to investigate the effectiveness of MRI for detection of small breast lesions that are suitable for wide local excision.

Lancet 2010;563-71
The UK COMICE Trial

- Potential benefits of MRI in newly diagnosed breast cancer:
  - Reduce re-excision rates/ conversion to mastectomy
  - Screen for contra-lateral cancer
  - Decrease local recurrence

- Methods:
  - 1623 pts, candidates for BCT based on mammogram/US/PE
  - Multicenter randomization:
    - MRI: Results of MRI used to in surgical planning
    - No MRI: Proceed to BCT

- Primary endpoint:
  - Re-operation rate: further excision or mastectomy within 6 mo or pathologically avoidable mastectomy at initial surgery (Unifocal, <3cm)
The UK COMICE Trial

5496 assessed for eligibility
3871 excluded
- 1360 did not meet inclusion criteria
- 1173 refused to participate
- 1338 excluded for other reasons

1625 randomised

817 assigned to receive triple assessment plus MRI (MRI)
- 1 confirmation of consent not received

816 in intention-to-treat population
- 761 received MRI
- 53 no MRI interpreted
  - 11 MRI technical failures
  - 10 cases of MRI not available before surgery
  - 9 refused MRI
  - 5 did not attend MRI appointment
  - 5 patients had MRI but results not used
  - 5 not suitable for MRI
  - 3 MRI scans abandoned, patients claustrophobia
  - 2 MRI results uninterpretable
  - 2 randomised after surgery
  - 1 staffing issues
  - 2 unable to identify whether MRI received (data unavailable at time of analysis)

4 lost to follow-up
- 1 patient withdrew from follow-up before surgery
- 3 primary endpoint (data unavailable at time of analysis)

816 analysed (primary endpoint)*

808 assigned to triple assessment alone (no MRI)
- 1 confirmation of consent not received

807 in intention-to-treat population
- 798 did not receive MRI
- 9 received MRI
  - 6 on patient request
  - 3 on clinician request

6 lost to follow-up
- 2 patients moved away
- 4 primary endpoint (data unavailable at time of analysis)

807 analysed (primary endpoint)*
The UK COMICE Trial Results

- Demographics:
  - 70% post-menopausal; med age 57
  - 50% dx by screening mammography
  - Median tumor size ~ 1.5cm

- Primary: Re-operation rates equivalent (19%)*
  - Both arms: ~ 10% of re-operations were mastectomies
  - Re-op ↑ if age <50 (OR 0.64) or lobular cancer (OR 0.52)

*Controlled for age, breast density and surgeon
The UK COMICE Trial Results

- **Secondary**
  - Change in management with MRI: 7%
    - Initial Mastectomy: 7% (MRI) vs 1% No MRI
    - Pathologically avoidable in 2% (MRI group)
  - Additional malignant lesions identified by MRI = 4.8%
  - Contra-lateral findings 7.6% (data on % malignant is not available)
  - QOL and cost equal
The addition of MRI to conventional triple assessment had no benefit on reduction of reoperation rate.

No difference in health-related quality of life between groups 12 months after initial surgery.

There was a slight increase in cost associated with getting the MRI but there was no statistical difference.
Breast MRI Utilization with Newly Diagnosed Breast Cancer (SEER-Medicare Linked Data)

- Queried Medicare Claims
- 2003-2005
- 46,824 women
- Mean age was 76.4 (65-107)
- Multivariate logistic regression analyses
- Demographic, Clinical characteristic and Region

J Surg Res 2011 Sept;77-83
Inclusion/Exclusion Criteria

- **Included:**
  - Stage 0–IV breast cancer diagnosed between 1/1/03 and 12/31/05
  - Women enrolled in both Medicare both Parts A and B for 3 mo prior to and 12 mo after diagnosis
  - Not enrolled in a “Medicare Advantage” plan during this same time period

- **Excluded:**
  - Male breast cancer patients
  - If their diagnosis occurred at the time of death or autopsy
  - <65- y/o at diagnosis.
Patient Flow

87,433 Diagnosed 1.1.03-12.31.05

50,360 Excluded those enrolled in Medical Advantage or did not meet continuous enrollment criteria

46,826 Excluded those <65 at diagnosis

46,824 Included Cases

3,241 (6.9%) patients received MRI
Analysis

- Outpatient Medicare Claims
- American Medical Association Current Procedural Terminology (CPT) or HCPCS codes
  - 76093-94, 77058-59, C8903-C8908
- Excluded MRIs performed in the inpatient setting.
- Definitive surgical management was obtained from SEER records, with additional surgical information obtained from Medicare claims when possible.
Analysis

- Sociodemographic
  - age
  - race
  - year of diagnosis
  - SEER region
  - poverty level
  - urban/rural residence
  - level of education

- Clinical
  - stage
  - surgery type
  - tumor size
## Subject Demographics and Percent of Patients Receiving Breast MRI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total n = 46,824</th>
<th>Received MRI n = 3241 (% of total)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (mean)</strong></td>
<td>76.4</td>
<td>73.1 (6.9)</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>39,672</td>
<td>2832 (7.1)</td>
</tr>
<tr>
<td>Black</td>
<td>3383</td>
<td>133 (3.9)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1836</td>
<td>152 (8.3)</td>
</tr>
<tr>
<td>Asian/Pacific Isl.</td>
<td>1589</td>
<td>92 (5.8)</td>
</tr>
<tr>
<td>Other/unknown</td>
<td>344</td>
<td>32 (9.3)</td>
</tr>
<tr>
<td><strong>SEER urban/rural</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big metro</td>
<td>26,835</td>
<td>2289 (8.5)</td>
</tr>
<tr>
<td>Metro</td>
<td>13,320</td>
<td>732 (5.5)</td>
</tr>
<tr>
<td>Urban</td>
<td>2744</td>
<td>109 (4.0)</td>
</tr>
<tr>
<td>Less urban</td>
<td>3259</td>
<td>95 (2.9)</td>
</tr>
<tr>
<td>Rural</td>
<td>666</td>
<td>16 (2.4)</td>
</tr>
</tbody>
</table>
## Subject Demographics and Percent of Patients Receiving Breast MRI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Received MRI (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Poverty level† (n = 43,958)</strong></td>
<td></td>
</tr>
<tr>
<td>1st Quartile ($$$)</td>
<td>10,973</td>
</tr>
<tr>
<td></td>
<td>1048 (9.6)</td>
</tr>
<tr>
<td>2nd Quartile</td>
<td>11,002</td>
</tr>
<tr>
<td></td>
<td>856 (7.8)</td>
</tr>
<tr>
<td>3rd Quartile</td>
<td>10,985</td>
</tr>
<tr>
<td></td>
<td>712 (6.5)</td>
</tr>
<tr>
<td>4th Quartile ($)</td>
<td>10,998</td>
</tr>
<tr>
<td></td>
<td>436 (4.0)</td>
</tr>
<tr>
<td><strong>Education level† (43,962)</strong></td>
<td></td>
</tr>
<tr>
<td>1st Quartile (highest)</td>
<td>10,876</td>
</tr>
<tr>
<td></td>
<td>1182 (10.9)</td>
</tr>
<tr>
<td>2nd Quartile</td>
<td>11,043</td>
</tr>
<tr>
<td></td>
<td>798 (7.2)</td>
</tr>
<tr>
<td>3rd Quartile</td>
<td>11,070</td>
</tr>
<tr>
<td></td>
<td>655 (5.9)</td>
</tr>
<tr>
<td>4th Quartile (lowest)</td>
<td>10,973</td>
</tr>
<tr>
<td></td>
<td>418 (3.8)</td>
</tr>
</tbody>
</table>

†Grouped in quartiles
Clinical Characteristics and Percent of Patients Receiving Breast MRI

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total n=46,824</th>
<th>Received MRI n=3241 (%of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0/in situ</td>
<td>7,694</td>
<td>496 (6.5)</td>
</tr>
<tr>
<td>I</td>
<td>19,019</td>
<td>1318 (6.9)</td>
</tr>
<tr>
<td>II</td>
<td>11,556</td>
<td>887 (7.7)</td>
</tr>
<tr>
<td>III</td>
<td>3361</td>
<td>295 (7.2)</td>
</tr>
<tr>
<td>IV</td>
<td>2137</td>
<td>82 (3.8)</td>
</tr>
<tr>
<td>Unknown</td>
<td>3057</td>
<td>163 (6.9)</td>
</tr>
<tr>
<td><strong>Surgery type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>4,036</td>
<td>184 (4.6)</td>
</tr>
<tr>
<td>Breast conservation</td>
<td>26,005</td>
<td>1901 (7.3)</td>
</tr>
<tr>
<td>Mastectomy</td>
<td>16,444</td>
<td>1139 (6.9)</td>
</tr>
<tr>
<td>Unknown/missing</td>
<td>339</td>
<td>17 (5.0)</td>
</tr>
<tr>
<td><strong>Tumor size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0/micro</td>
<td>3133</td>
<td>151 (4.8)</td>
</tr>
<tr>
<td>0–2</td>
<td>26,495</td>
<td>1886 (7.1)</td>
</tr>
<tr>
<td>2–5</td>
<td>11,173</td>
<td>775 (6.9)</td>
</tr>
<tr>
<td>&gt;5</td>
<td>2724</td>
<td>221 (8.1)</td>
</tr>
<tr>
<td>Unknown</td>
<td>3299</td>
<td>208 (7.1)</td>
</tr>
</tbody>
</table>
Percent of incident breast cancer cases receiving MRI by year.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3166796/figure/F1/
Percent of incident breast cancer cases receiving breast MRI by SEER Region

- Hawaii: 0.1%
- Kentucky: 1.2%
- Louisiana: 1.4%
- Iowa: 1.7%
- Rural Georgia: 1.9%
- Utah: 2.8%
- San Jose: 3.8%
- Atlanta: 4.2%
- Detroit: 4.4%
- San Francisco: 4.9%
- Greater California: 8.7%
- Connecticut: 8.8%
- New Jersey: 9.0%
- Los Angeles: 10.0%
- Seattle: 14.8%
- New Mexico: 18.0%
Young, Hispanic, high income, higher education and living in a metropolitan was associated with an increase in MRI use.

Use was associated with earlier staging and larger breast lesions

Variation in utilization across each region

Utilization had increased every year from 2003-2005
Outline

- Introduction
- Recent data
- **Study Aims**
- Material and Methods
- Discussion
Study Aims

- To assess the frequency utilization of MRI use in patients with newly diagnosed breast cancer in Texas
- To evaluate the clinical factors associated with MRI use
- To examine sociodemographic factors associated with the use of breast MRI in newly diagnosed breast cancer
Material and Methods

- To use the Texas Cancer Registry Medicare linked data to identify breast cancer incidence between 1/1/2003-12/30/2007
- Breast MRI
  - American Medical Association Current Procedural Terminal (CPT)
  - HCPCS codes
Table 1: Diagnostic Breast MRI CPT/HCPCS codes

<table>
<thead>
<tr>
<th>CPT/HCPCS Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT 77058</td>
<td>Magnetic resonance imaging breast, without and/or with contrast material(s); unilateral</td>
</tr>
<tr>
<td>CPT 77059</td>
<td>Magnetic resonance imaging breast, without and/or with contrast material(s); bilateral</td>
</tr>
<tr>
<td>HCPCS C8903</td>
<td>Magnetic resonance imaging with contrast, breast; unilateral</td>
</tr>
<tr>
<td>HCPCS C8904</td>
<td>Magnetic resonance imaging without contrast, breast; unilateral</td>
</tr>
<tr>
<td>HCPCS C8905</td>
<td>Magnetic resonance imaging without contrast followed by with contrast, breast; unilateral</td>
</tr>
<tr>
<td>HCPCS C8906</td>
<td>Magnetic resonance imaging with contrast, breast; bilateral</td>
</tr>
<tr>
<td>HCPCS C8907</td>
<td>Magnetic resonance imaging without contrast, breast; bilateral</td>
</tr>
<tr>
<td>HCPCS C8908</td>
<td>Magnetic resonance imaging without contrast followed by with contrast, breast; bilateral</td>
</tr>
</tbody>
</table>
Outline

- Introduction
- Recent data
- Study Aims
- Material and Methods
- Discussion
Thank you!

Discussion