Breast MRI and it’s role in breast screening

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Format

• Screening mammography and breast ultrasound
• Breast MRI- what does it involve?
• Recommendations - Screening Breast MRI
• Summary
Screening Mammography
Routine Mammography

- Screening mammography
- 2 views per breast - 4 images total
- Medio-lateral oblique & Cranio-caudal
- X-ray of the breast
- Masses, calcifications, architectural distortion
- 10-15 minutes (film versus digital)
Screening mammography - 2 views

www.Imaginis.com
Mediolateral oblique

RT ML0
LYMPH NODES
PECTORAL MUSCLES
Craniocaudal

Nipple

Lateral

Medial
Problems

• False negative rate -- 15-20%
• Difficulty mainly lies in women with dense breasts
• Younger women < 50, hormone replacement therapy
• 25-40% of women have dense breasts
Breast cancer - Mammo
Breast cancer - mammography
Mammography - Summary

- Established as gold standard for screening
- Extensively studied
- Shown to decrease mortality from breast cancer
- Quick and available to most patients
- Charge - $100-150
Breast Ultrasound
Screening breast ultrasound

- Not reimbursable
- Several single center studies - bilateral screening breast ultrasound
- Depict small non palpable breast cancers not seen on mammography
- Particularly in women with dense breasts

Radiology 2001;221:641–649
Radiology 2002;225:165–175
Screening breast ultrasound

- No published randomized controlled trials have been conducted to evaluate the impact of screening sonography on breast cancer mortality rates.
- Presume that this early detection is of benefit, this benefit has not been proven.
Screening breast ultrasound

- Any screening test must be held to a high standard of proof
- Otherwise healthy women will undergo additional testing and possibly treatment for conditions that may never become clinically significant.
- Studies to date only look at sono after reading mammo - bias
Screening breast ultrasound

- Patients will be asked to sign a waiver acknowledging that she will assume financial responsibility for the screening sonogram
- ACRIN 666 study - multicenter protocol to assess the efficacy of screening breast sonography
ACRIN 6666 study

• 2800 women - high risk patients
• Increases detection of cancers BUT substantial risk of false positives
• Mammography - biopsies 2.6%, 29% positive
• Sonography - biopsies 5%, 8% positive
• Only 35% of facilities in US offer breast ultrasound
Screening ultrasound

- Operator dependant
- Not billable at present
- Await further analysis of ACRIN 6666
- Only looked at high risk women
- Currently supplement to and not a replacement for mammography
Breast MRI
Patient information

- Exam will take 30-45 minutes
- Normal contraindications for MRI
- Weight limits check if over 300lbs, MRI bore diameter 60cm
- Renal failure (NSF)
How does it work?

- Patient lies prone -- face down
- Breasts are in specific “breast coil”
- Multiple slices through the breast
- Can image in axial, coronal or sagittal plane
- 1-3mm slices
- Can have up to 1000 images per study
How does it work?

- Magnetic resonance imaging - no radiation
- All patients will need an iv injection
- Development of a breast tumor - accompanied by development of new, abnormal vessels (angiogenesis)
- Cancers enhance earlier and brighter than adjacent normal tissue
Referring a patient for a MRI

- Read in conjunction with mammography & ultrasound (supplement Not stand alone test)
- Day 7-14 of menstrual cycle
- Reading time?
Breast MRI

- Refer to a specialist
- Refer to a place who will follow up and do the MRI guided biopsy and localization as necessary
- Cost - $1000- $2000
- Not appropriate as a screening modality except in a certain target population.
Screening Breast MRI

Who should have it?
Breast Screening

- American Cancer Society Guidelines for Breast Screening with MRI as an Adjunct to Mammography

- *CA Cancer J Clin* 2007;57;75-89 (3/07)
- [http://caonline.amcancersoc.org/cgi/content/full/57/2/75](http://caonline.amcancersoc.org/cgi/content/full/57/2/75)
Annual Screening Breast MRI: Evidence based

- BRCA mutation
- First degree relative of BRCA carrier but untested
- 20-25% lifetime risk or greater of breast cancer (BRCAPRO or other models)
Models to estimate breast cancer risk

- Models assist clinicians to estimate breast cancer risk
- Gail, Claus, Tyrer- Cusick models
- Look at risk factors, family, reproductive etc
- Two decision models developed to estimate likelihood of BRCA being present BRCAPRO, BOADICEA
Who is high risk for BRCA?
Who is high risk for BRCA?

- Prevalence - 1/500 and 1/1000 general pop
- Jewish ethnicity - 1/50
- Increased risk of both breast and ovarian cancer
- BRCA 1 - 65% risk by age 70
- BRCA 2 - 45% risk by age 70
- Calculate with decision models - BRCAPRO, BOADICEA
Genetic testing for BRCA gene

- US Preventive Services Task Force
- Recommendations for genetic testing
- Eastern European Jewish heritage - referred if
- A first degree relative with breast or ovarian cancer at any age or
- Two second degree relatives on the same side of the family with breast or ovarian cancer at any age.
Genetic testing for BRCA gene

- Women who are not of Eastern European Jewish Heritage referred if
- Two first-degree relatives with breast cancer, one of whom was diagnosed when they were younger than 50, or
- Three or more first or second degree relatives diagnosed with breast cancer at any age, or
- A first degree relative diagnosed with cancer in both breasts, or
- Two or more first or second degree relatives diagnosed at any age, or
- A male relative with breast cancer
Annual Screening Breast MRI
(2) Expert consensus

• Radiation to chest wall between age 10 and 30 years
• Li-Fraumeni syndrome and first degree relatives
• Cowden & Bannayan-Riley-Ruvalcaba syndromes and first degree relatives
Insufficient evidence

- Life risk 15-20%
- LCIS, ALH (15-20%. 6-7 fold increased risk)
- ADH (4-5 fold increased risk)
- Dense breasts (75% or more- 4-5 fold)
- Personal history of breast cancer including DCIS (risk of contralateral cancer, 0.5 -1% per year during 10 years following diagnosis)
How good is screening MRI?

High risk patients
(>25%)
High Risk 40 yr old female - mammography normal
Pre and post contrast
55 year old - known carcinoma extent of disease evaluation
Known left breast carcinoma - scan ordered to evaluate extent of disease.
## Clinical Trials - high risk patients

<table>
<thead>
<tr>
<th>Site</th>
<th>Investigators</th>
<th>Number Patients</th>
<th>Sensitivity Mammo</th>
<th>Sensitivity US</th>
<th>Sensitivity MRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonn</td>
<td>Kuhl et al, 2000</td>
<td>192</td>
<td>33%</td>
<td>33%</td>
<td>100%</td>
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<tr>
<td>Dutch</td>
<td>Tilanus-Linthorst et al, 2000</td>
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<td>Dutch</td>
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<tr>
<td>U Penn</td>
<td>Rosen et al, 2001</td>
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<td>--</td>
<td>75%</td>
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<tr>
<td>MSK</td>
<td>Morris, Lieberman, et al</td>
<td>367</td>
<td></td>
<td></td>
<td>100%</td>
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</tbody>
</table>
Efficacy of MRI and Mammography for Breast Cancer Screening in Women With a Familial or Genetic Predisposition

- Prospective Study of 1909 Women - Mean age 40 years
- Lifetime risk of 15% or more
- Comparison of the sensitivity, specificity & PPV of
- Physical examination, Mammography & MRI

Efficacy of MRI and Mammography for Breast Cancer Screening in Women With a Familial or Genetic Predisposition

<table>
<thead>
<tr>
<th>Screening Modality</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBE</td>
<td>17.9%</td>
<td>98%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Mammography</td>
<td>33.3%</td>
<td>95%</td>
<td>8.0%</td>
</tr>
<tr>
<td>MRI</td>
<td>79.5%</td>
<td>90%</td>
<td>7.1%</td>
</tr>
</tbody>
</table>
Earlier Detection With MRI

- The proportion of invasive tumors that were 10 mm or less in diameter was significantly greater in the surveillance group (43.2%) than in either control group (14%; \( P < .001 \)) and (12.5%; \( P = .04 \))

- Combined incidence of positive axillary nodes and micrometastases in invasive cancers was 21.4% vs 52.4% (\( P < .001 \)) and 56.4% (\( P = .001 \)) in the 2 control groups
Efficacy of screening MRI for high risk patients

- Is there a benefit to adding annual MRI to film-screen?
- Since 2000, 8 prospective non-randomized studies published peer reviewed literature
- Patients BRCA mutation, v strong family history, prior history of breast cancer
- All showed significantly higher sensitivity for MRI compared with mammography & mammo/sono combined.
Efficacy of screening MRI for high risk patients

- Sensitivity of MRI: 71-100%
- Sensitivity of mammo: 13-40%
- Increased sensitivity when MRI added to program: 31-100%
- Additional cancer yield: (number of additional cancers detected per 1000 high risk women screened) 8-67
Breast MRI: Advantages for screening high risk women

- Tumors detected when smaller
- Women outside the screening programs carried over twice the risk of node positive disease
- Added benefit - greatest in high risk women
What about women 15-20% lifetime risk?

• Currently evidence does not support routine screening with MRI
• Insurance often will not cover
• Pre-approval often required
• This is an expensive test
• Cash payment only other option
Limitations of Breast MRI
Screening MRI
False-Positive Enhancement

Specificity of MRI limited by enhancement of benign processes:
- Fibrocystic change
- FA
- Fat necrosis
- Atypia, lobular neoplasia
- “Normal” breast tissue (hormonal)
Problems

- High risk women - detect cancer in 3%
- Normal women - detect cancer in 0.3%
- High risk woman having screening MRI - chance of abnormal exam - 10%
- Risk of benign biopsy - 5%
Problems

- Sensitivity high across all studies
- Specificity is not as high
- False positives - mean additional imaging and unnecessary biopsies
- Ranged from 2.9% to 15%
- Call back for additional imaging 8-17%
Remember!

- Screening Breast MRI is NOT recommended for average risk women
- All women in studies we reviewed were at least > 15%, most >25%
- Expertise needed for reading
- Access to MRI biopsy needed
- Women & referring physicians need be educated about appropriateness criteria
Take Home Points

- Mammography - gold standard for screening
- Cost, availability
- Ultrasound not proven effective for screening
- MRI currently only appropriate for screening high risk women
Thank you for your attention