Screening Breast Imaging

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Objectives

- To discuss screening mammography
  - Normal risk
  - High risk populations
- To discuss supplemental screening strategies
  - Ultrasound
  - Breast MRI
  - Molecular breast imaging
Breast cancer

- Most common cancer diagnosed in women
- 2nd cause of cancer death amongst women
- Lifetime risk 12%
  - 1 in 8 women
- 2019
  - 331,000 cases of invasive breast cancer
    - 268,000 invasive
  - 441,760 women expected to succumb to the disease
Goals of screening mammography

- Early detection of node negative cancer
- Decrease mortality from breast cancer
  - Since regular screening began in the U.S. in the 1980’s there has been a reduction in breast cancer mortality of 42%
  - 384,000 – 614,000 lives saved
Changing Views

The United States Preventive Services Task Force, a group of independent experts, has revised its breast cancer screening guidelines, saying most women should start having regular mammograms at age 50.

WHAT THE TASK FORCE RECOMMENDED FOR WOMEN IN THEIR 40s:

- **2009:** *Every 2 years from 50 to 74*
  - Based on new data, concludes that the potential harms of screening too often outweigh the benefits of regular mammograms.

- **2002:** *Every 1-2 years after age 40*
  - Said it was “difficult to determine the incremental benefit” but recommended mammograms for women in their forties.

- **1996:** *Every 1-2 years from 50 to 69*
  - Determined there was “insufficient evidence to recommend for or against routine mammography for women aged 40-49.”

Source: Department of Health and Human Services
Medicare Utilization 2005-2010

USPSTF 2015 Recommendations

- Screening 40-49 should be determined on a personal basis
  - C rating
- Recommend biennial screening beginning at age 50 – 74
  - B rating
- Recommendation for screening after 74
  - I rating

- B Rating
  - The USPSTF recommends this service. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial

- C Rating
  - The USPSTF recommends selectively offering this service to individual patients based on professional judgment and patient preference. There is at least a moderate certainty that the net benefit is small

- I Rating
  - The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of the service
The support data agree that mammography significantly reduces breast cancer death:
- ACS
  - Opportunity to begin annual screening 40-44
  - Recommend annual / biennial screening
- USPSTF
  - Biennial screening 50 - 74
Benefits of three Recommended Strategies
Mean 2009 CISNET

<table>
<thead>
<tr>
<th>Screening Strategy</th>
<th>Examinations per 1,000 women</th>
<th>Percentage Mortality Reduction</th>
<th>BC Deaths Averted per 1000 women screened</th>
<th>LYGs per 1000 women screened</th>
<th>NNS per Death Averted</th>
<th>NNS per LYG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual 40-84</td>
<td>36,550</td>
<td>39.6</td>
<td>11.9</td>
<td>189</td>
<td>84</td>
<td>5.3</td>
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<tr>
<td>Annual 45-54</td>
<td>19,846</td>
<td>30.8</td>
<td>9.25</td>
<td>149</td>
<td>108</td>
<td>6.7</td>
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<tr>
<td>Biennial 55-79</td>
<td>11,066</td>
<td>23.2</td>
<td>6.95</td>
<td>110</td>
<td>144</td>
<td>9.1</td>
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<tr>
<td>Biennial 50-74y</td>
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</tbody>
</table>

Adapted from Arleo et al – Comparison of recommendations for screening mammography using CISNET models. Cancer 2017
<table>
<thead>
<tr>
<th>Regimen</th>
<th>Percent Mortality reduction</th>
<th>Approximate number of mammograms</th>
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</thead>
<tbody>
<tr>
<td>ACR/SBI</td>
<td>40 %</td>
<td>36,550</td>
</tr>
<tr>
<td>ACS Annual 45 – 54 Biennial 55 -79</td>
<td>31 %</td>
<td>19,846</td>
</tr>
<tr>
<td>USPSTF Biennial 50 –74</td>
<td>23 %</td>
<td>11,066</td>
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</tbody>
</table>

Arleo et al. Cancer 2017
# Performance of Screening Mammography (BCSC)

<table>
<thead>
<tr>
<th>Age</th>
<th>Exams</th>
<th>CDR Sensitivity</th>
<th>PPV</th>
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<tbody>
<tr>
<td>50-59</td>
<td>186,944</td>
<td>3.7/1000 – 77.3%</td>
<td>22.2%</td>
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<tr>
<td>60-69</td>
<td>116,362</td>
<td>4.0/1000 – 80.1%</td>
<td>29.3%</td>
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<tr>
<td>70-79</td>
<td>75,692</td>
<td>6.2/1000 – 80.4%</td>
<td>37.6%</td>
</tr>
<tr>
<td>80-89</td>
<td>23,409</td>
<td>7.9/1000 – 83.4%</td>
<td>40.7%</td>
</tr>
<tr>
<td>90-101</td>
<td>1,041</td>
<td>14.1/1000 – 93.8%</td>
<td>55.6%</td>
</tr>
</tbody>
</table>

Sinclair et al
Accuracy of screening mammography in older women. Am J Roentgenology 2011
Screening Mammography Recommendations

- American College of Radiology / American Cancer Society
  - Annual screening mammography beginning at age 40

- American College of Obstetricians and Gynecologists
  - Screening every 1-2 years 40 – 49 years of age
  - Annually after age 50
  - Recommended CBE for all women
Screening Mammography Recommendations

Screening Interval – Recommended time between periodic screens

- **NCI** – Every 1-2 years
- **Canada** – Every two years 50-69
- **UK** – Every three years 47-73
- **USPSTF** –
  - 40 – 49 discuss with physician
  - Every two years 50-74
Screening Stats

- 1 in 6 breast cancers diagnosed in 40 -49 year old age group

- 1/3 of lives lost from breast cancer are women in their 40’s.

- 70 % of the women dying from breast cancer in their 40’s belong the 20% of patient’s not being screened.
Screened women

- 60% lower mortality at 10 years follow up
- 47% lower mortality at 20 years follow up

Tabar et al. Cancer 2018 November
Benefits of early diagnosis

- Node negative cancer
- Decreases morbidity
  - Less extensive surgery
  - Improved treatment options
- Overall decrease in healthcare costs
Harms of screening

- False positive mammogram
- Patient anxiety
- Over diagnosis
  - Treating lesion that would not have become clinically apparent
    - Three components
Harms of screening

Follow-up Testing Risks of Mammography Screening

Out of every 100 women who get a screening mammogram:

- 90 will be told that their mammograms are normal
- 10 will be asked to return for additional mammograms or ultrasounds
- 6 will be reassured that their mammograms are normal
- 2 will be asked to return in 6 months for a follow-up exam
- 2 will be recommended to have a needle biopsy

MammographySavesLives®
... one of them may be yours

To learn more about mammography benefits and risks visit MammographySavesLives.org
Harms of screening

- Patient anxiety
  - Most patient’s do not report lasting harm if they are recalled for a diagnostic examination.
  - Most patient’s agree that the benefit of being tested far outweighs testing anxiety
  - Paternalistic perspective
Harms of screening

- **Overdiagnosis 1–10%**
  - The cancer would not have caused a problem in the patient’s lifetime.
  - DCIS
    - Heterogenous
    - Non-obligate precursors to IDC
  - Breast cancer does not spontaneously involute
  - Should not outweigh the thousands of lives saved yearly
Health Care Disparity

- African American women and Caucasian women are diagnosed at similar rates with breast cancer.
- Recent ACS data confirms that non Hispanic black women have death rates 39% higher than non Hispanic white women.
  - Access to mammography
  - Health care delivery patterns
    - Delays in diagnosis
    - Delays in treatment initiation
  - Tumor biology
Health Care Disparity

- One study found that
  - Before USPSTF guidelines 56% of PCP recommended annual screening beginning at age 40
  - After USPSTF guidelines only 20% PCP gave the recommendations
Screening Mammography

All women are advised to undergo breast cancer risk assessment at the age of 30 to determine the type of screening program from which they would derive the greatest benefit.

- Average risk
- High risk > 20% Lifetime risk
Screening Mammography

- **Average Risk**
  - Shall begin at the age of 40 – no later than 45
  - Shall continue as long as the woman is in good health, chooses to be screened, intends to seek and tolerate treatment and or the life expectancy is equal to or greater than 10 years
Screening Mammography

- **Transgender men**
  - Shall begin at the age 40 without mastectomy and average risk for breast cancer

- **Transgender women**
  - On at least 5 years of hormonal therapy shall begin routine mammography at the age of 50
High Risk Populations

- Genetic predisposition – 5 – 10 % of all breast cancers
  - BRCA 1 – 50 – 80 %
  - BRCA 2 – 45 %

- Strong family history – absent known genetic mutation
  - First degree relatives; age of diagnosis
High Risk Populations

- Chest or mantle radiation young age
- Personal history of breast cancer
  - Recurrence or second breast cancer
  - 50 year old or younger - > 20% lifetime risk of a new breast cancer
- Previous biopsy
- Dense breast tissue
Screening Modalities

- Mammography 2D with or without DBT
- Ultrasound
- Breast MRI
Screening Mammography

- Sensitivity in high risk women
  - 25 – 59 %
Dense Breast Tissue – Relative risk 1.25
Digital Breast Tomosynthesis (DBT)

- Overlapping tissue is a reason for the false positive rate for screening mammography.
- Deals with the problem of structural overlap, thereby enhancing lesion detection.
Digital Breast Tomosynthesis

Benefits
- Increases CDR
- Decreases the recall rate
  - 15-40%
- Increases PPV
- Decreases the use of additional views

Limitations
- 2x interpretation time
- Large storage requirements
- Evolving reimbursement
Mammography

- X-ray Tube
- Pivot
- Breast
- Detector

3D and 2D datasets simultaneously acquired by single movement across stationary object
Screening breast ultrasound

- Greater than 10 year life expectancy
- High risk women unable to undergo MR screening
  - Pregnant
  - Lack of access to MR
  - Severe claustrophobia
- Dense breasts - > 50% of population
- Mammography should also be performed
Results

- Single screening ultrasound in addition to mammography – an additional yield of 1.1 – 7.2 cancers /1000 high risk women
- Dense breast tissue only factor
  - 3.2/1000 women
- Will also substantially increase the risk of false positives
  - Personal or family history of breast cancer increased specificity
Women whose only risk is dense breast tissue

- 3.2/1000 – incremental cancer detection rate
Maryland Density Notification Legislation

- October 1, 2013
- Requires mammography centers notify patients of their breast density
Breast MRI

- Examination requires intravenous contrast – abnormal vascularity of the tumor
- Approximately 30 – 45 minutes
- Optimally obtained during follicular phase of menstrual cycle – days 7-10
Breast MRI

- More sensitive than either MRI or US in high risk populations
  - Sensitivity
    - MRI 90%
    - Mammography 37%
    - Ultrasound 35%
Supplemental MRI eligibility

- American Cancer Society
  - Models that incorporate first and second degree family history
    - Claus
    - Tyrer-Cuzick
      - PenRad – Mammography Reporting System
    - BRCAPRO
Supplemental Screening MRI

Screening MRI
- Genetic predisposition
- Chest wall radiation prior to age 30
- Life time risk > 20 %

Clarification of MRI use
- Personal history of breast cancer
- Biopsy proven atypia and LCIS
- Intermediate risk 15 – 20 %
- Dense breast tissue
Screening Protocol

Genetic based/Strong Family History

- Screening mammography – beginning age 30
- Screening breast MRI – 25 – 30
Screening Protocol

Chest Wall Radiation – younger than 30

- Screening mammography with or without DBT annual at the age of 25 or 8 years after the cessation of chest wall therapy – whichever is later.

- Screening MRI – begin between the ages of 25 – 30.
  - Incremental detection rate 4%
Screening Protocol

- Women with personal history of breast cancer **and** dense tissue
  - Combination of factors > 20 % lifetime risk
  - Screening mammography at time of diagnosis
  - Supplemental breast MRI
Screening protocol

- Women diagnosed with breast cancer age 50 or younger
  - Supplemental breast MRI
    - Early stage biologically aggressive tumors
    - Decrease interval cancers
BSGI

- Injection of a radiopharmaceutical
  - Technetium – 99m Sestamibi
- Sensitivity > 95%
- Specificity 80%
  - Decrease in small cancers
  - DCIS
BSGI

- Multicenter trial 201 women both MRI and BSGI
  - Equal sensitivity to MRI
  - Not hampered by breast density
  - Reduces the rate of false positivity by 50%
  - Incremental detection rate - breast density primary factor
    - 7.7 – 8.8 / 1000 women
BSGI

- Less images than MRI
- All patients
- Overall decrease cost
BSGI

- Increased radiation dose – biodistribution will result in whole body exposure
BSGI/Molecular Breast Imaging

The future ...

- Screening dense breasts
- Assessing response to neoadjuvant chemotherapy
Summary

- Annual screening mammography beginning at age 40 saves the most lives.
- Screening with PCP’s beginning at the age of 30 will identify more patient’s who will benefit from additional screening.
- Supplemental Breast MRI is the most sensitive adjunct screening modality.
- Breast US should be considered more by our referring physician population.
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