Breast Imaging

Judy Champaign, MD, Radiology
Community Medical Imaging
TOPICS OF DISCUSSION

- History
- Mammography
  - Diagnostic
  - Screening
- Guidelines and Controversies
- Other Modalities
- Legislation
EVOLUTION OF BREAST IMAGING MAMMOGRAPHY

1960's
1963 First RCT and first recorded preoperative needle localization

1980's-90's Film screen MMG
1987 ACR voluntary accredited
1992 regulation
1998 CAD

2002
Mammography Quality Standards Act
BIRADS

2005
DMIST Trial and expansion of Digital Mammography

2011 Digital Breast Tomosynthesis
2013 synthetic
2016 TMIST trial
**Complementary Examination**

### Ultrasound

- **1952**: US develops from WW2 technology
- **1960s**: First dedicated scanner, B mode of breast developed
- **1980’s to present**: Digital advancements, Color Doppler, Automated whole breast Ultrasound
- **2000**: elastography

### Other Developments

- **1990**: Stereotactic Percutaneous Breast Biopsy
- **1990’s**: Ultrasound guided breast biopsy
- **1977**: First human MRI, 1990’s earliest breast MRI
• Imaging in the setting of **problem solving** for symptomatic patients (masses, thickening, skin or nipple changes, discharge and identifiable facial pain)
• Follow up of previously abnormal imaging
• Follow up of breast cancer – pre and post treatment

**Tailored examination to answer question/patient interaction with radiologist.**
SCREENING: WOMEN WITHOUT SIGNS/SYMPTOMS OF BREAST CANCER

4 Mammographic Views

Batch Reading by Radiologist

- Call back for additional diagnostic tests
- No problem

10% 90%
EVIDENCE SUPPORTING SCREENING MAMMOGRAPHY

- Randomized controlled trials—8
- Case-control studies
- Incidence-based mortality studies
- Trend studies
- Expert opinion
- Anecdotal reports
The condition sought should be an important health problem.

There should be an accepted treatment for patients with recognized disease.

Facilities for diagnosis and treatment should be available.

There should be a recognizable latent or early symptomatic stage.

There should be a suitable test or examination.

The test should be acceptable to the population.

The natural history of the condition, including development from latent to declared disease, should be adequately understood.

There should be an agreed policy on whom to treat as patients.

The cost of case-finding (including diagnosis and treatment of patients diagnosed) should be economically balanced in relation to possible expenditure on medical care as a whole.

Case-finding should be a continuing process and not a “once and for all” project.
<table>
<thead>
<tr>
<th>ADVICE</th>
<th>ACR/SBI</th>
<th>ACS</th>
<th>ACOG</th>
<th>AMA</th>
<th>NCCN</th>
<th>USPSTF (AAFP, ACP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE TO START</td>
<td>40</td>
<td>45Choice 40-45</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>LIFE EXPECTANCY &gt; 5-7 YRS</td>
<td>LIFE EXPECTANCY &lt; 10 YRS</td>
<td>ANNUAL AS LONG AS IN GOOD HEALTH</td>
<td>LIFE EXPECTANCY &lt; 10 YRS</td>
<td>UPPER AGE LIMIT NOT ESTABLISHED</td>
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<tr>
<td>AGE TO STOP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>74</td>
</tr>
<tr>
<td>INTERVAL</td>
<td>ANNUAL</td>
<td>ANNUAL 45-54 55+ 1-2YRS</td>
<td>ANNUAL</td>
<td>ANNUAL</td>
<td>ANNUAL</td>
<td>2 YEARS</td>
</tr>
<tr>
<td>EXTRAS</td>
<td>DBT NO LONGER CONSIDERED INVESTIGATIONAL</td>
<td>DBT IMPROVEMENT IN DETECTION, LOWER CHANCE OF RECALL</td>
<td>CONSIDERING DBT</td>
<td>CONSIDERING DBT</td>
<td>DBT INSUFFICIENT EVIDENCE</td>
<td></td>
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</table>
SPECIAL CIRCUMSTANCES

• BEGIN ANNUAL SCREENING FOR WOMEN WITH FAMILY HISTORY OF PREMENOPAUSAL BREAST CANCER IN FIRST DEGREE RELATIVE (MOTHER, SISTER, DAUGHTER) 10 YEARS BEFORE YOUNGEST AFFECTED RELATIVE IF OVER AGE 30

• National Comprehensive Cancer Network (NCCN) guidelines recommend BRCA 1 and 2 carriers begin mammography at age 25. Some experts favor starting age 30 when the risks of radiation induced cancer is lower.

• WOMEN WHO HAVE RECEIVED THORACIC RADIATION AT YOUNG AGE – age 25 or >8 yrs from radiation (whichever occurs first). Annual.

• TRANSGENDER
**Why did the ACS Change Recommendations? 2015**

- **Review of data on the burden of disease** – ACS in 5 yr increments, UPSTF 10 yrs
- ACS and UPSTF looked at same data with different weighting
- More emphasis on observational studies and less on modeling
- Emphasis on individual absolute benefit
- Less concerned with “harms” than UPSTF
“Created in 1984, the U.S. Preventive Services Task Force is an independent, volunteer panel of national experts in prevention and evidence-based medicine. The Task Force works to improve the health of all Americans by making evidence-based recommendations about clinical preventive services such as screenings, counseling services, and preventive medications.”

The Task Force assigns each recommendation a letter grade (an A, B, C, or D grade or an I statement) ACA requires insurers to cover exams and procedures given “A” or “B” ranking.

PRIOR TO 2009, SCREENING MAMMOGRAPHY RECOMMENDED. NO NEW DATA SO IS THIS “TRIAL BALLOON” FOR RATIONING CARE?
SCREENING ADVOCATES

- REDUCTION IN BREAST CANCER MORTALITY, average 35%
- EARLIER STAGE BREAST CANCER ALLOWS MORE TREATMENT OPTIONS AND PERHAPS LESS TREATMENT
- LESS ADVANCED. METASTATIC DISEASE
- REASSURANCE
OVERDIAGNOSIS OF NON LETHAL CANCERS THAT MAY NEVER HAVE BECOME CLINICALLY APPARENT

OVERTREATMENT

HARMS OF EXTRA TESTING, BIOPSIES, AND ANXIETY

$4 BILLION IN EXTRA COST TO SYSTEM

BREAST CANCER MORTALITY DECREASE DUE TO BETTER THERAPY
Four out of five doctors agree...
UPDATE IN BREAST CANCER CARE

Delaying breast cancer screening to age 50 won't save nearly as much money as delaying it to age 60.

H.H.S.

We didn't think recommending women not have mammograms until fifty would pose a health risk...

Fed. Medical Panel

I just discovered a lump.

Breast cancer research

Mike Luckovich

...to us...

Yes, regular mammograms and early detection would have saved your life.

But aren't you glad you were spared all that anxiety?
UPDATE IN BREAST CANCER CARE

THEN
EARLY DETECTION SAVES LIVES.

NOW
WAITING TEN YEARS SAVES MONEY.

PREVENTIVE SVCS.
TASK FORCE

PREVENTIVE SVCS.
TASK FORCE

WE RECOMMEND AGAINST ROUTINE MAMMOGRAMS EVEN THOUGH BREAST CANCER HAS DECLINED 30%.

U.S. PREVENTIVE SERVICES TASK FORCE

NEW GUIDELINES
UNDER 50 YEARS OLD DO NOT NEED MAMMOGRAMS.

I THINK THIS BOOB IS MALIGNANT.
Historical Trends (1975-2013)

Mortality, Breast
All Races (incl Hisp), Female
All Ages

Deaths per 100,000 resident population

Year of Death

Notes:
Created by statecancerprofiles.cancer.gov on 11/01/2016 4:29 pm.
Regression lines calculated using the Joinpoint Regression Program (Version 4.3.0.0).

Source: Death data provided by the National Vital Statistics System public use data file. Death rates calculated by the National Cancer Institute using SEER*Stat. Death rates (deaths per 100,000 population per year) are age-adjusted to the 2000 US standard population (19 age groups: <1, 1-4, 5-9, …, 80-84, 85+). Population counts for denominators are based on Census populations as modified by NCI. The US populations included with the data release have been adjusted for the population shifts due to hurricanes Katrina and Rita for 62 counties and parishes in Alabama, Mississippi, Louisiana, and Texas. 1969-2014 US Population Data File is used with mortality data.
DIGITAL BREAST TOMOSYNTHESIS (DBT) 3D MAMMOGRAPHY

• DESIGNED TO ACQUIRE MAMMOGRAM AT MULTIPLE POINTS ON AN ARC AND RECONSTRUCT THE IMAGE INTO MULTIPLE SLICES THAT ARE VIEWED AS CINE LOOP. 2D ACQUISITION ALSO OBTAINED WHICH CAN DECREASE THE PROBLEM OF OVERLAPPING STRUCTURES.

• NOT MUCH LONGER ACQUISITION TIME THAN 2D, BUT RADIATION DOSE HIGHER.

• REIMBURSEMENT SPOTTY

2D MAMMOGRAPHY REMAINS THE STANDARD OF CARE
TOMOSYNTHESIS
MLO VIEWS
UPDATE IN BREAST CANCER CARE
UPDATE IN BREAST CANCER CARE

2D Mammogram

3D Mammogram

CANCER
BREAST ULTRASOUND

- TRADITIONAL USE IN DIAGNOSTIC SETTING
- READILY AVAILABLE
- NO RADIATION
- RELATIVELY LOWER COST
- OPERATOR DEPENDANT
• NO RCT
• HANDHELD: Shifts sonographers role
• READILY AVAILABLE
• NO RADIATION
• RELATIVELY LOWER COST
• OPERATOR DEPENDANT
• EVALUATES STIFFNESS OF A LESION
• COLOR MAP ASSIGNED
• HOPE FOR HELPING SEPARATE BENIGN FROM MALIGNANT LESIONS
• MAY BE HELPFUL TO DETERMINE MULTIFOCALITY
BREAST MRI

- Highly sensitive for invasive malignancy
- Longer exam time than mammography. IV contrast
- Expensive. Insurance coverage spotty
- Abbreviated protocols under investigation which could reduce cost and time in scanner
- Supplemental screening high risk patients
BREAST SPECIFIC GAMMA IMAGING (BSG)/MOLECULAR BREAST IMAGING (MBI)

• Sensitivity similar to MRI without limitations of hormone effects. Additional 7 – 8 cancers/1000
• Injection of radiotracer (Tc99mSestamibi)
• Higher radiation dose which affects entire body.
• Acquisition time about 10 minutes/image
• Not as widely available as MRI
• Reimbursement?
PET MAMMOGRAPHY (PEM)

- Functional rather than anatomical
- Higher resolution than FDG-PET
- Higher radiation dose than mammography and affects entire body. Not recommended for screening.
DUAL ENERGY CONTRAST MAMMOGRAPHY

- SOFTWARE UPGRADE TO EXISTING MAMMOGRAPHY MACHINE
- REQUIRES IV CONTRAST
- HIGHER RADIATION. 2 IMAGES ACQUIRED AT DIFFERENT ENERGY WHICH ALLOWS RECONSTRUCTION OF SUBTRACTED IMAGE

![Images of mammography](image-1)

GE Senobright
• THERMOGRAPHY

• DUCTAL LAVAGE

• “Despite widely publicized claims to the contrary, thermography should not be used in place of mammography for breast cancer screening or diagnosis.”

  FDA website
**MUST HAVE BIOPSY CAPABILITY FOR ANY MODALITY**

- MAMMOGRAPHY – STEREOTACTIC
- MAMMOGRAPHIC - TOMOSYNTHESIS
- ULTRASOUND
- MRI
UPDATE IN BREAST CANCER CARE

- PREGNANCY
- LACTATION
- SPECIAL CIRCUMSTANCES
- IMPLANTS
- MEN
• ULTRASOUND PREFERRED AS FIRST TEST, MAMMOGRAPHY IF SHIELDED

• SENSITIVITY OF MAMMOGRAPHY DECREASED DUE TO HIGH BREAST DENSITY WITH LACTATIONAL CHANGES

• DEFER SCREENING MAMMOGRAPHY UNTIL AT LEAST 3 MONTHS POST WEANING
• SCREENING/DIAGNOSTIC CAN BE PERFORMED SAFELY WITH MINIMAL RISK TO IMPLANT INTEGRITY, PARTICULARLY IF SUBPECTORAL PLACEMENT, OLDER, ENCAPSULATED IMPLANTS DISPLACE LESS.

• MRI PREFERRED METHOD OF DETECTING SILICONE IMPLANT RUPTURE

• MAMMOGRAPHY ADEQUATE FOR CONFIRMING SALINE IMPLANT RUPTURE
• MAMMOGRAM BEST FOR CONFIRMING GYNECOMASTIA IF AN IMAGING TEST IS REQUIRED.

• ULTRASOUND MAY BE APPROPRIATE FOR CLINICAL FINDINGS THAT ARE NOT CENTERED UNDER THE NIPPLE.
LEGISLATION

MQSA
- LEXICON
- ASSESSMENT

BREAST DENSITY
- STATEMENT
- PATIENT LETTER
MAMMOGRAPHY REPORTING BIRADS – FALLS UNDER FDA (MQSA)

- COMPLETE LEXICON OF DESCRIPTIVE TERMS FOR MAMMOGRAPHY, ULTRASOUND AND MRI

- ALL INCLUDE DESCRIPTIONS OF BREAST DENSITY (DIFFERENT TERMINOLOGY FOR SCREENING US)

- BIRADS ASSESSMENT FOR ALL
**BREAST DENSITY**

- All the breasts are almost entirely fatty
- There are scattered areas of fibroglandular density
- The breasts are heterogeneously dense, which may obscure small masses
- The breasts are extremely dense, which lowers the sensitivity of mammography

**EXAMPLE**

Density categorizations can vary by radiologist. New BIRADS Atlas may result in more women categorized with dense breasts.
## Final Assessment Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Management</th>
<th>Likelihood of cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Need additional imaging or prior examinations</td>
<td>Recall for additional imaging and/or await prior examinations</td>
<td>n/a</td>
</tr>
<tr>
<td>1 Negative</td>
<td>Routine screening</td>
<td>Essentially 0%</td>
</tr>
<tr>
<td>2 Benign</td>
<td>Routine screening</td>
<td>Essentially 0%</td>
</tr>
<tr>
<td>3 Probably Benign</td>
<td>Short interval-follow-up (6 month) or continued</td>
<td>&gt;0 % but ≤ 2%</td>
</tr>
<tr>
<td>4 Suspicious</td>
<td>Tissue diagnosis</td>
<td>4a. low suspicion for malignancy (≥2% to ≤ 10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4b. moderate suspicion for malignancy (≥10% to ≤ 50%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4c. high suspicion for malignancy (≥50% to &lt;95%)</td>
</tr>
<tr>
<td>5 Highly suggestive of malignancy</td>
<td>Tissue diagnosis</td>
<td>≥ 95%</td>
</tr>
<tr>
<td>6 Known biopsy-proven</td>
<td>Surgical excision when clinical appropriate</td>
<td>n/a</td>
</tr>
</tbody>
</table>
27 states have notification laws, but not all have mandates for additional screening. 8 states have legislation pending.

- California law effective Apr. 1, 2013
- MASKING EFFECT
- MAY BE INDEPENDENT RISK FACTOR FOR BREAST CANCER

50-60% of women
• The most lives are saved with annual mammography beginning at age 40. Women in their 40’s account for about 40% of the years of life lost to breast cancer.

• Screening saves more years of life for women who get screened every year rather than every other year.

• The reduction in breast cancer mortality from mammography is significant and has been proven in multiple studies involving millions of women, yet is routinely understated in the press (ACRSpreadingTheWord)

Control studies | Service studies
---|---
31-49% | 38-40%
• PAST DECADE OF TECHNOLOGICAL ADVANCES SHOW PROMISE TO SIGNIFICANTLY IMPROVE ABILITY TO DETECT AND CHARACTERIZE BREAST CANCERS

• SPECIALTY CARE/MULTIDISCIPLINARY IMPROVEMENTS

• BREAST CANCER “OVERDIAGNOSIS” IS MISCONCEPTION THAT CAN BE OVERCOME AS WE DEVELOP BETTER PREDICTORS OF LETHALITY OF TUMORS AND ADJUST THERAPIES ACCORDINGLY
BUT ... it's about the MONEY$$
“There seems to be a wave of health professionals making a name for themselves via nihilism regarding screening. We have gone from over-promotion of screening ("a mammogram will find cancer the size of a pinhead") to throwing out the whole enterprise. Screens such as colonoscopy and mammography have clearly benefited many more people than they have harmed. Maybe we should stop checking blood pressures, the meds have lots of bad side effects.”

Comment from Dr. Donald Bachman on Mediscope website Jan. 25, 2016 in response to article, Cancer Screening Has Not Been Shown to “Save Lives.”
FORM AN OPINION. YOUR PATIENT WANTS TO KNOW

ANYBODY WANT MY OPINION?

GOV'T TASK FORCE ON BREAST CANCER

(Underline text and emphasis added for clarity)
Thank you ..........

It takes 1900 mammograms of women in their 40s to save one life, but only 1300 of women in their 50s! It's more cost-effective! So just wait 'til you're 50! And stop calling us the "death panel."
RESOURCES FOR DENSE BREAST INFORMATION

• AMERICAN COLLEGE OF RADIOLOGY
• AMERICAN CANCER SOCIETY
• BREASTCANCER.ORG
• ARE YOU DENSE
• BREAST DENSITY INFO
• MAYO CLINIC
• MEMORIAL SLOAN KETTERING
RESOURCES FOR SCREENING INFORMATION

• AMERICAN COLLEGE OF RADIOLOGY
• AMERICAN CANCER SOCIETY
• NATIONAL COMPREHENSIVE CANCER NETWORK
• NATIONAL CANCER INSTITUTE WEBSITE
• UNITED STATES PREVENTIVE SERVICES TASK FORCE (USPSTF)
• AMERICAN COLLEGE OF PHYSICIANS/AMERICAN SOCIETY OF INTERNAL MEDICINE/AMERICAN ACADEMY OF FAMILY PHYSICIANS
• AMERICAN COLLEGE OF PREVENTIVE MEDICINE
• AMERICAN GERIATRICS SOCIETY