Update in Breast Cancer Screening

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Disclosures

• None
Learning Objectives

• Breast cancer statistics
• Outline breast cancer screening modalities currently endorsed by ACR
• Discuss emerging techniques for breast cancer screening
• Discuss breast cancer screening recommendations for average risk women
• Outline breast cancer screening for high risk women
Breast Cancer Statistics

- Most commonly diagnosed cancer in women
- A woman living in the US has a 13.3% (1 in 8) chance of being diagnosed with breast cancer in her lifetime
- Approximately 200,000 new cases of breast cancer are diagnosed in women each year
Breast Cancer Statistics

- Breast cancer is the second leading cause of cancer death in women (lung cancer ranks first)
- Approximately 40,000 deaths are expected in women from breast cancer each year
Breast Cancer Screening Modalities

• Mammography
• MRI
• Whole Breast Ultrasound
• Molecular Breast Imaging (MBI)
Mammography
Mammography

- Mammography remains the most effective method for early detection of breast cancer and is the only proven method to decrease breast cancer death
- American College of Radiology recommends annual screening mammograms beginning at age 40
Mammography

- Swedish trials of the 1990’s found a 21% reduction in breast cancer deaths among women who underwent periodic screening mammogram.
- Later studies of 1.1 million women with 20-40 years of followup showed that mammograms were associated with a 17-37% reduction in advanced tumors in patients aged 40-69 years.

Mammography Limitations

- General population sensitivity is at best only 80-90%
- Only 25-40% of “lesions” detected at mammogram are positive at biopsy
- Rates of false positive mammograms can approach 20-56% (after 10 mammograms)

Mammography Limitations

- Heterogeneous and extremely dense breast tissue interferes with lesion detection
- Certain areas of the breast are poorly imaged on mammography (far medial aspect and along the chest wall, etc)

Mammography Limitations

- Mammographic screening has a particularly low sensitivity for detecting tumors in BRCA patients and those at highest risk.

Komenka IK, Ditkoff BA, Joseph KA et al. Cancer 2004;100(10):2079-2083
MRI

• Contrast-enhanced MRI is the single most sensitive modality for detection of breast cancer
• Multiple studies demonstrate benefit of screening MRI in high-risk populations
• MRI is more effective in screening in conjunction with mammography than alone
MRI

- 2005 UK study (MARIBS: Magnetic Resonance Imaging Breast Screening study)
  - 649 women age 35-49 with strong family history or high probability of mutation
  - 35 breast cancers: 19 MR only, 6 mammo only, 8 both and 2 interval
  - Sensitivity and specificity:
    - MR = 77/81%
    - Mammo = 40/93%
    - Both = 94/77%
  - Largest disparity seen for BRCA1 carriers (sensitivity 92% for MR vs 23% for Mammo)

MRI

- 2005 German study
- 529 asymptomatic women (risk > 20%)
- 43 cancers in 41 patients (34 IDC, 9 DCIS)
  - 31 cancers in patients with no prior hx of cancer. 12/43 (28%) were in patients with a prior history of breast cancer
  - Multifocal/multicentric cancers seen in 44%
  - 14 seen at mammo, 17 at US, 21 at mammo + US, 39 at MR and 40 found by MR + mammo
  - 19 diagnosed only at MR, 1 by mammo only

MRI

- 2005 German study
- Sensitivity and specificity:
  - Mammo = 33/96.8% (sensitivity in the mutation carrier group decreased to 25%)
  - MRI = 91/97%

42 yo with prior hx of ALH on RT breast biopsy. Strong family history. Extremely dense breast tissue. MRI performed due to high-risk.
1.2 x 1.1 x 1.0 cm solid irregular mass on US
MRI Limitations

- Specificity in MRI lower than mammography in most studies reviewed (77-97%)
- Decreased specificity often leads to multiple additional exams (8-17%)
- Number of biopsies recommended greater
- Proportion of biopsies found to be cancer same as mammography (25-40%)

Whole Breast Ultrasound
Whole Breast Ultrasound

- Technique:
  - Systematic whole breast ultrasound scan
  - May be manual vs automatic
Whole Breast Ultrasound

- 2008 ACRIN study
- 2637 patients
- Diagnostic yield:
  - 7.6/1000 for mammo
  - 11.8/1000 for mammo + US
  - 4.2/1000 supplemental yield
- PPV3:
  - 22.6% for mammo
  - 8.9% for US
  - 11.2% for mammo + US

Berg WA, Blume JD, Cormack JB et al. JAMA 2008;299(18):2151-2163
Ultrasound Limitations

- MRI is still more sensitive
- US suboptimal in larger breasts
- Increased exam and interpretation time (up to 3000 images per breast on automated machines)
- Increased false positive biopsy rates
Molecular Breast Imaging
Molecular Breast Imaging

• Technique:
  • 20 mCi Tc$^{99m}$ sestamibi administered IV
  • After ~5 minutes, image breast using breast-specific gamma cameras in CC and MLO views, 10 min per view
R MLO Mammo 2009
R MLO Mammo 2011
R MLO MBI 2011

Courtesy of Katie Jones, MD
Mayo Clinic Rochester
Molecular Breast Imaging

- In patients with suspicious findings on mammogram/US and subsequent biopsy:
  - 90% sensitivity for all lesions
  - 82% sensitivity for lesions < 1 cm
- In patients with both MRI and MBI exams, 97% concordance between studies

Hruska CB, Phillips SW, Whaley DH et al. AJR 2008;191:1805-1815
MBI Limitations

- Very small lesions may not be detected
- Benign breast lesions (i.e. fibroadenomas) demonstrate activity
- Increased radiation exposure
- Little screening data
Digital Breast Tomosynthesis

- **Technique:**
  - Multiple low dose images acquired from an x-ray tube moving in a small arc around the breast
  - 3D volumetric set of images created (each image 1 mm thick, ~70 images/breast/view)
  - Displayed as a series of images or a cine loop
  - Can be obtained in CC, MLO projections
Digital Breast Tomosynthesis

- When used with mammography, has been shown to reduce recall rate by up to 30-40% compared to mammography alone

- Compared with traditional diagnostic mammographic views, tomo has:
  - Similar or increased sensitivity for cancer
  - Lower false positive biopsy rate (74% vs 85%)

Zuley ML, Bandos AI, Ganott MA et al. Radiology 2013;266(1):89-95
Rafferty EA, Park JM, Philpotts LE et al. Radiology 2013;266(1):104-113
Tomosynthesis Limitations

- Expensive and has no reimbursement codes
- Increased interpretation time
- Increased radiation dose
- Requires large electronic data storage capability
Breast Cancer Screening - USPSTF Recommendations 2009

- <50: Individualized decision to start biennial mammograms
- Biennial mammograms 50-74
- >75: insufficient evidence to assess the benefits/harms of screening mammograms
- Recommend against BSE
- Insufficient evidence to assess benefits/harms of CBE beyond mammograms
American Cancer Society 2015

- 40-44: option to start yearly mammograms
- 45-54: annual mammograms
- ≥55: Biennial mammograms (or option to continue annual)
- No upper age limit. Continue screening as long as good health and life expectancy ≥10 years
- CBE and BSE not recommended
- Breast awareness
National Comprehensive Cancer Network 2015

• ≥25 - <40: CBE q1-3 years and breast awareness
• ≥40: yearly CBE and mammograms, breast awareness
High Risk Screening: BRCA mutations and Family History

- Breast awareness at 18
- CBE’s every 6-12 months at age 20-25
- Mammograms annually 30-75
- MRIs annually 20 (Li Fraumenii), 25 (BRCA), 30 (Cowden)

Mammography – 10 years earlier than youngest age of breast cancer in the family
High Risk Screening - MRI

- 2007 American Cancer Society:
- Annual MRI recommended (based on evidence):
  - BRCA mutation carriers
  - Untested 1\textsuperscript{st} degree relatives of BRCA carriers
  - Lifetime risk of breast cancer $\geq 20\%$
High Risk Screening - MRI

- Annual MRI recommended (based on consensus opinion):
  - Radiation to the chest between 10 and 30 years of age
  - Li Fraumeni syndrome and 1\textsuperscript{st} degree relatives
  - Cowden and Bannayan-Riley-Ruvalcaba syndromes and 1\textsuperscript{st} degree relatives
Conclusions

- Screening guidelines for breast cancer have been updated in the last 5-10 years
- Recommendations for average risk screening vary from 1 organization to another
- Screening criteria for high-risk women are well established
- Evolving breast imaging modalities may improve screening outcomes