Breast Cancer Screening and Diagnosis
Then, Now and in the Future

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History

- First Mammograms 1920s and 1930s
- First significant screening studies
- HIP study 1960s
- BCDDP 1970s
- Screening programs began then
First Mammograms

- Films and Xerox Images
Improved Mammograms

* Film          Film          Digital
Digital Mammography

2000-2008
Computer Aided Detection for Mammography 1990s

late 1990s to now
* Cyst (fluid) vs Mass (solid)

* Type of solid Mass - benign lesion vs cancer
Why is Density Important?

- Increasing density obscures findings
  - Breast tissues are heterogeneously dense which may obscure findings
  - Breast tissues are dense decreasing mammographic sensitivity
  - Breast tissues contain scattered areas of fibroglanular tissue (which can also obscure findings but this is not in lexicon)
  - Breast tissues are relatively fatty
  - Both masses and calcifications can be hidden
Why is density Important?

- Increasing density is associated with increased risk of breast cancer
  - First described in 1976 by John Wolfe MD*
  - More recent papers including one by Boyd et al** in 2007 have shown that high density, originally described as greater than 75% dense, is a strong independent risk factor for breast cancer development


Whole Breast Screening Ultrasound

- Performed by doctor or technologist - time consuming and operator dependent
- Automated breast ultrasound
MRI without and with CAD
Other Modalities for Detection

- Routine Mammography
- Contrast-Enhanced Spectral Mammography
- Film
- Scintimammogram
3D or Breast Tomosynthesis
3D or Tomo
Breast Disease Diagnosis

- Surgical biopsy or excision with or without pre-op localization
- Needle biopsy with image guidance (75% now) - a) mammography guided b) ultrasound guided c) MRI guided
- Techniques for localization a) wire b) radioactive seed c) other techniques being developed
Breast Cancer Treatment

- Surgery - less invasive techniques often used
- Radiation therapy
- Systemic treatments - often based on new understanding of tumor types based on tissue factor - to be discussed by others
Image Guided Local Treatment

- Several techniques for excision exist
- Ablation of lesion with freezing or with high frequency ultrasound have been tried
- ? Ideas to be developed yet
High risk

- Noted to be familial in some cases
- Association with ovarian cancer noted
- Eventually gene mutations associated with these patients noted (BRCA1 and BRCA2) - < 10%
- Other gene mutations also now known
- Other cancers also associated - varies with gene mutations
Screening Recommendations

- 1970s - first screening recommendations - many changes have occurred in recommendations
- Current recommendations - lots of disagreement - varies with risk factors
Screening - My recommendations

- Yearly starting at age 40 (20% of BC in 40-50 age)
- Continue until life expectancy based on medical health of woman is less than 5 years
- If higher risk - start 10 years before age of first or sometimes second degree relative diagnosed but not before 30
- May add additional screening for high risk patients - MRI or maybe Ultrasound - frequency and duration should be individualized
How to Screen for Ovarian CA

- To be discussed - still in relatively early phase compared to breast cancer screening which is really only 60 years -
- Imaging screening - Ultrasound, CT, MRI
- Based on history of breast cancer screening, many detection and treatment ideas to be developed yet
Major Issues for Future

- Will screening be available and covered by health insurance for breast, ovarian or other cancers?
- Will medical research for detection and treatment particularly for women’s diseases be funded?
Variability in Given Density

* What we evaluate when evaluating density

1. Area of dense tissue in relation to total breast on each view

2. Can we see through the dense areas

3. How much of the area of densities is dense enough to obscure findings
Remember, we can miss cancers in less dense breasts
Can we be more consistent?

- At least 2-3 computerized programs now exist for digital mammography that label breast density as one of the 4 categories.
- The basis of density determination on these is based on volume (pixels of dense versus fatty tissue).
- Can give % density (interestingly volume density numbers are much lower than area density we use now).
To Screen or Not

- Why are we here?
- Should we screen anyone? (let alone 40-50 year olds or women 65-75 or older)
- Newest study to again raise controversy was published in British Medical Journal* in February.

  (Article says survival of women 40-49 and 50-59 was no different in those screened and those not and 106 “excess “cancers were diagnosed in the mammography arm )

*BMJ 2014;348:g366
A failure analysis of invasive breast cancer: Most deaths from disease occur in women not regularly screened.

Webb ML, Cady B, Michaelson JS, Bush DM, Calvillo KZ, Kopans DB, Smith BL.

Cancer. 2013 Sep 9
Study Design

- Failure Analysis looking backward from death to discover correlations at diagnosis, rather than looking forward from the start of a study

**METHODS:**

- Invasive breast cancers diagnosed between 1990 and 1999 were followed through 2007. Data included demographics, mammography use, surgical and pathology reports, and recurrence and death dates. Mammograms were categorized as screening or diagnostic based on absence or presence of breast signs or symptoms, and were substantiated by medical records. Breast cancer deaths were defined after documentation of prior distant metastases. Absence of recurrent cancer and lethal other diseases defined death from other causes.
RESULTS

- Invasive breast cancer failure analysis defined 7301 patients between 1990 and 1999, with 1705 documented deaths from breast cancer (n = 609) or other causes (n = 905).

- Among 609 confirmed breast cancer deaths, 29% were among women who had been screened (19% screen-detected and 10% interval cancers), whereas 71% were among unscreened women, including > 2 years since last mammogram (6%), or never screened (65%).
Do we over diagnose?

Yes, we as imagers do not have a way of accurately determining the tumor grade of either in situ or invasive disease or which lesion will eventually result in patient death.

Newer techniques in genetic analysis of tumors may help predict which patients need more aggressive therapy.