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# Ultrasound in Screening?

## Screening for breast cancer

- 1973 HIP (Health Insurance Plan) study prove the reduction of the mortality in women screened with mammography
- Breast Cancer Detection Demonstration Project prove a significant reduction of mortality in different age groups
  - 40-49 years, 50-59 years, 60-69 years

Strax, P., et al. (1973). "Value of mammography in reduction of mortality from breast cancer in mass screening." Am J Roentgenol Radium Ther Nucl Med 117(3): 686-689.
Smart, C. R., et al. (1997). "Twenty-year follow-up of the breast cancers diagnosed during the Breast Cancer Detection Demonstration Project." CA Cancer J Clin 47(3): 134-149.

## Mammography

- Reliable
- Reproducible
- Rapid
- Reasonable price

## Mammography, US, MRI

| | Sensibility | Specificity | PPV | NPV |
|---|---|---|---|---|
| Mammo | 55 - 89 | 70 - 77 | 53 – 94 | 47 – 81 |
| US | 65 - 71 | 80 - 98 | 90 | 72 |
| MRI | 89 - 99 | 37 – 96 | 61 - 95 | 80 - 100 |

Schlossbauer T, Hellerhoff K, Reiser M. [Value of breast MRI as supplement to mammography and sonography for high risk breast cancer patients]. Radiologe 2008; 48:351-357.
Uematsu T, Yuen S, Kasami M, Uchida Y. Comparison of magnetic resonance imaging, multidetector row computed tomography, ultrasonography, and mammography for tumor extension of breast cancer. Breast Cancer Res Treat 2008; 112:461-474.
Van Goethem M, Schelfout K, Kersschot E, et al. Comparison of MRI features of different grades of DCIS and invasive carcinoma of the breast. JBR-BTR 2005; 88:225-232.

## Breast Ultrasound

- Depends on the operator's level of skill and experience
- Sensitivity depends on breast type
- Trained personal
- Requires time
- Low reproducibility

Bozzini A, Renne G, Meneghetti L, et al. Sensitivity of imaging for multifocal-multicentric breast carcinoma. BMC Cancer 2008; 8:275.
Berg WA, Blume JD, Cormack JB, et al. Combined screening with ultrasound and mammography vs mammography alone in women at elevated risk of breast cancer. JAMA 2008; 299:2151-2163.
Corsetti V, Houssami N, Ferrari A, et al. Breast screening with ultrasound in women with mammography-negative dense breasts: evidence on incremental cancer detection and false positives, and associated cost. Eur J Cancer 2008; 44:539-544.

## Indications to Breast Ultrasound

- Initial assessment of a lump in women ≤ 30 years old
- Identification and additional characterization of palpables and non-palpables anomalies
- Guiding of interventions
- Evaluation of problems associated to breast implants

- Not appropriate for screening

ACR Standards for the Performance of Breast Ultrasound Examination. ACR Standards. 2000
Teh W, Wilson AR: The role of ultrasound in breast cancer screening. A consensus statement by the European Group for Breast Cancer Screening. Eur J Cancer 34 (4): 449-50, 1998.

# Importance of breast density

- Breast density strongly associated with reduced mammographic sensitivity
  - Overall 72%
  - Fatty breast 80%
  - Extremely dense 30%
- Dense breast sixfold greater risk of interval cancer
- 1.2-2.2 increased risk

Boyd, N. F., H. Guo, et al. (2007). "Mammographic density and the risk and detection of breast cancer." N Engl J Med 356(3): 227-236.
van Dijck, J. A., A. L. Verbeek, et al. (1993). "The current detectability of breast cancer in a mammographic screening program. A review of the previous mammograms of interval and screen-detected cancers." Cancer 72(6): 1933-1938.
Sickles, E. A. (2010). "The use of breast imaging to screen women at high risk for cancer." Radiol Clin North Am 48(5): 859-878.

# Hand-held Ultrasound

- At least heterogeneously dense breast
- Women at elevated risk
- Adding screening sonography to mammography yield an additional of 1.1 to 7.2 cancers for 1000 high-risk women
- Substantial increase of false positive rate
- PPV of biopsy falls from 22.6 to 8.9%

Freer, P. E. (2015). "Mammographic breast density: impact on breast cancer risk and implications for screening." Radiographics 35(2): 302-315.
Berg, W. A., et al. (2008). "Combined screening with ultrasound and mammography vs mammography alone in women at elevated risk of breast cancer." JAMA 299(18): 2151-2163.

# Whole-Breast Ultrasound

- Automated sweeping of the probe
- 3D image of the compressed breast
- Reduction of operator dependence
- Supplemental screening


- High false positive rate
- PPV 6-7%

Freer, P. E. (2015). "Mammographic breast density: impact on breast cancer risk and implications for screening." Radiographics 35(2): 302-315.

# Whole-Breast Ultrasound

Table 3: Incremental Cancer Detection Rate and PPV of Whole-Breast US in Asymptomatic Women with Dense Breasts in 15 Large Screening Studies

| Study | PPV, (%) | Incremental Cancer Detection Rate (per 1000) | No. of Women | Comments | Country and Year |
|---|---|---|---|---|---|
| United States | | | | | |
| Parris et al* (45) | 5.5 | 1.8 | 5519 | . . . | U.S., 2013 |
| Weigert and Sussbargen* (46) | 6.7 | 3.2 | 4647 | . . . | U.S., 2012 |
| Hooley et al* (47) | 6.5 | 3.2 | 935 | 20% of patients were placed in short-term follow-up; 9% of those opted for biopsy instead | U.S., 2012 |
| Kolb et al (48) | 10.3 | 2.5 | 4897; total of 12,193 examinations | Included breasts with scattered fibroglandular tissue | U.S., 2002 |
| Kaplan (49) | 11.8 | 2.7 | 1862 | 10.2% underwent follow-up imaging or biopsy | U.S., 2001 |
| International | | | | | |
| Girardi et al (50) | Unable to be calculated from data given | 2.2 | 9960 | Incremental cancer detection rate did not differ significantly for dense vs fatty breasts or breasts with scattered fibroglandular tissue | Italy, 2013 |
| Leong et al (51) | 12.5 | 14.2 | 141 | . . . | Singapore, 2012 |
| Corsetti et al (52) | 7.5 | 4.4 | 3556; total of 7224 examinations | . . . | Italy, 2011 |
| Corsetti et al (53) | 5.7 | 4.0 | 9157 | 24% of cancers were detected at mammography in a retrospective blind review of the quality of the initial mammographic interpretations | Italy, 2008 |
| De Felice et al (54) | 6.4 | 6.8 | 1754 | Demonstrated increased costs | Italy, 2007 |
| Brancato et al (55) | 3.2 | 0.4 | 5227 | Demonstrated increased costs | Italy, 2007 |
| Leconte et al (56) | Unable to be calculated from data given | 3.8 | 4236 (included diagnostic examinations but excluded palpable lesions) | Included breasts with scattered fibroglandular tissue | Belgium, 2003 |
| Crystal et al (57) | 18.4 | 4.6 (in women with dense breasts and normal risk, the cancer detection rate fell to 2.7) | 1517 | Included breasts with scattered fibroglandular tissue | Israel, 2003 |
| Buchberger et al (58) | 8.8 | 3.9 | 8103 | Included breasts with scattered fibroglandular tissue | Austria, 2000 |
| Maestro et al (59) | 13.3 | 5.7 | 350 | 14% of patients had an incidentally detected solid mass | France, 1998 |

Source.—Reference 43.
*Published studies of the Connecticut experience with supplemental screening whole-breast US after implementation of breast density notification legislation.

Freer, P. E. (2015). "Mammographic breast density: impact on breast cancer risk and implications for screening." Radiographics 35(2): 302-315.

# Breast Ultrasound and Screening

- Supplemental screening
  - High risk: MRI
  - Intermediate risk: US as option
  - Average or low risk and dense breast: not recommended
- No replacement of screening mammography
- No additional value of US in women who undergo mammography and MRI

Freer, P. E. (2015). "Mammographic breast density: impact on breast cancer risk and implications for screening." Radiographics 35(2): 302-315.
NCCN guidelines: breast cancer screening and diagnosis. National Comprehensive Cancer Network web site. hhhp://www.nccn.org/professionals/physician_gls/pdf/breast-screening.pdf

# Thank you for your attention