

# Breast MRI and it's role in breast screening

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# Format

- Screening mammography and breast ultrasound
- Breast MRI- what does it involve ?
- Recommendations - Screening Breast MRI
- Summary

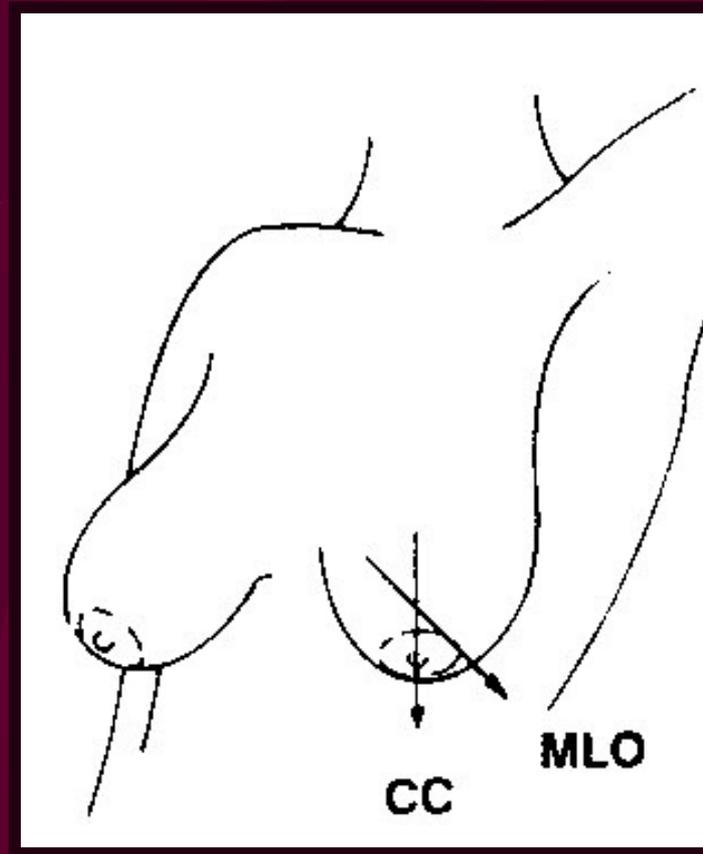


# Screening Mammography

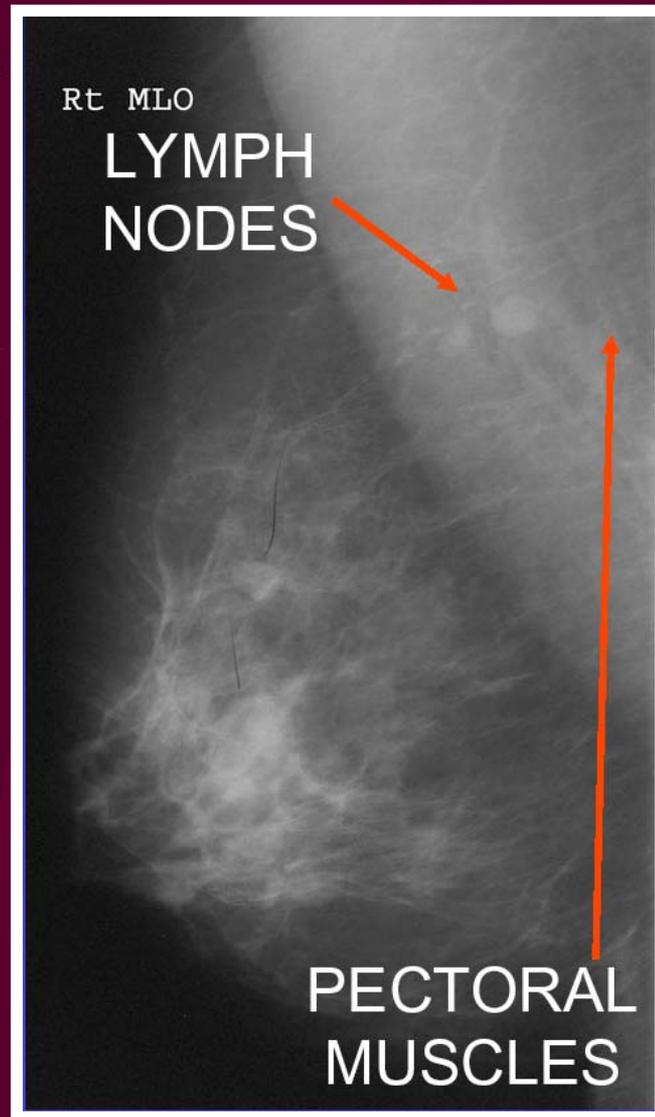
# Routine Mammography

- Screening mammography
- 2 views per breast - 4 images total
- Medio- lateral oblique & Cranio-caudal
- X- ray of the breast
- Masses, calcifications, architectural distortion
- 10-15 minutes (film versus digital)

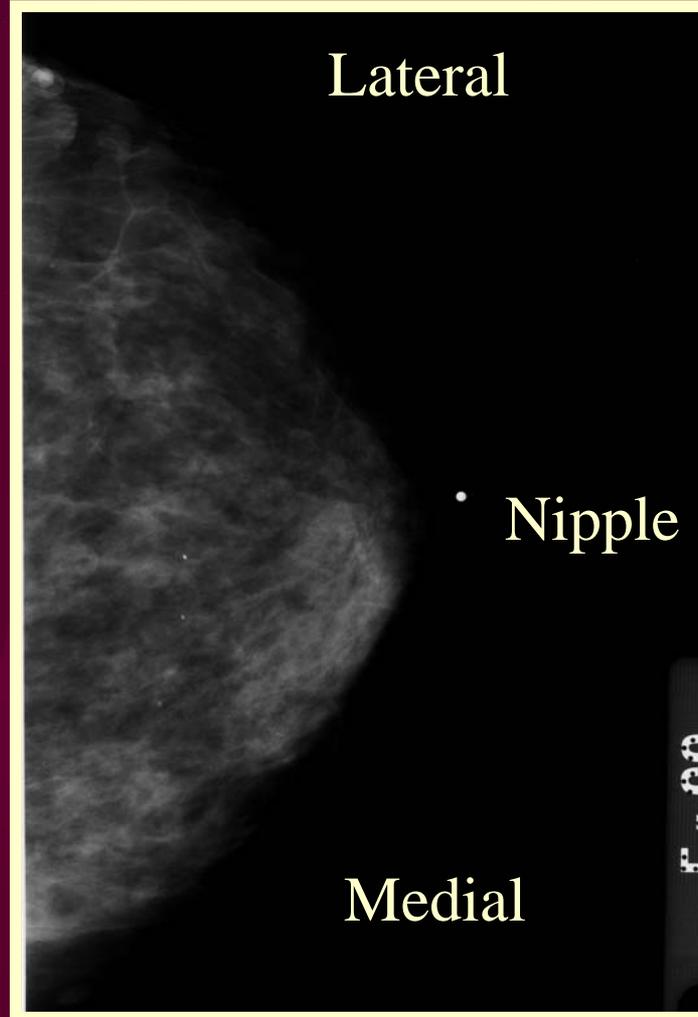
# Screening mammography - 2 views



# Mediolateral oblique



# Craniocaudal



# Problems

- False negative rate -- 15-20%
- Difficulty mainly lies in women with dense breasts
- Younger women  $< 50$ , hormone replacement therapy
- 25-40% of women have dense breasts

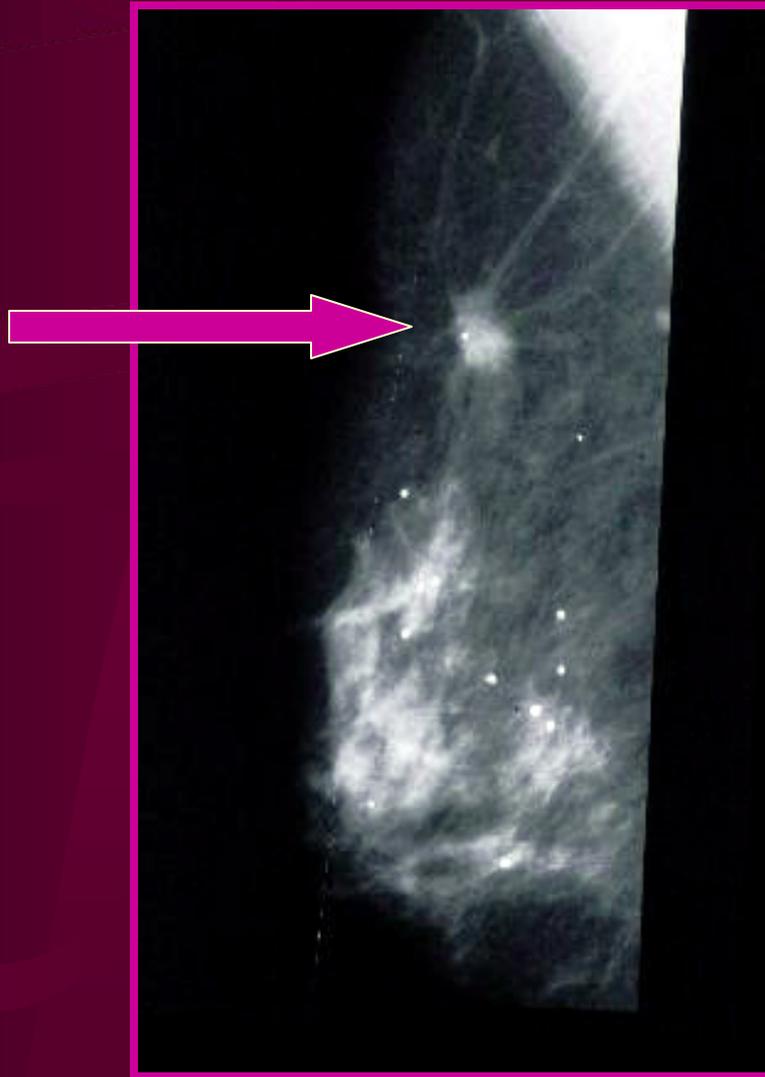
Dense



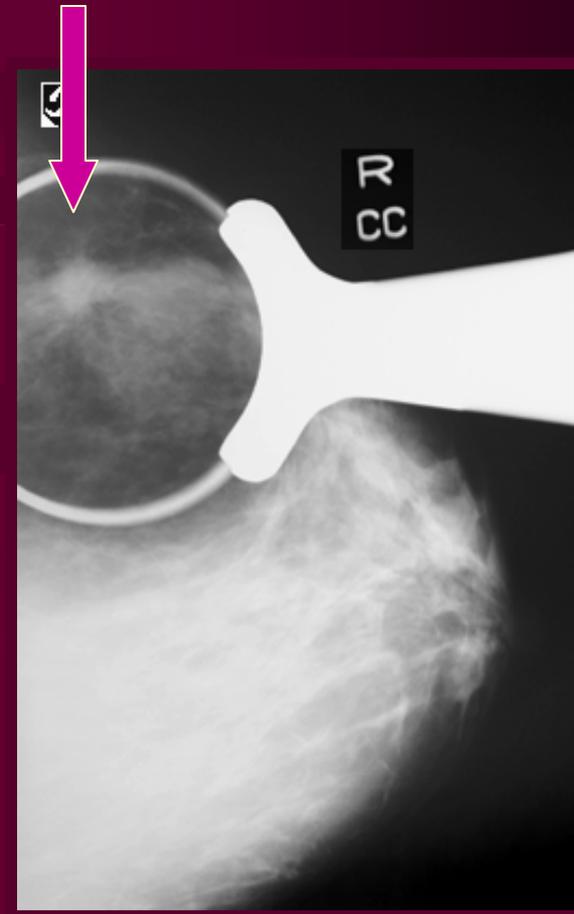
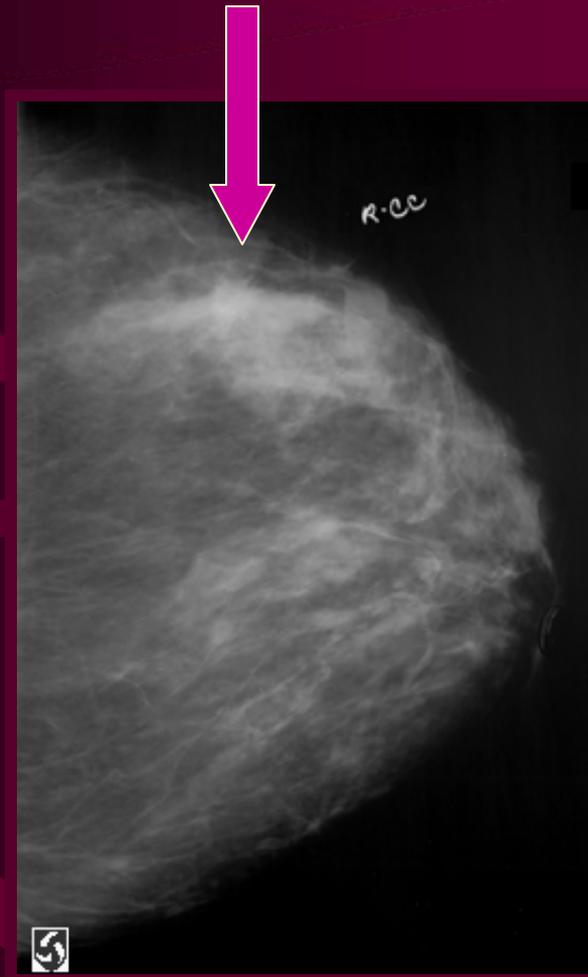
Fatty



# Breast cancer - Mammo



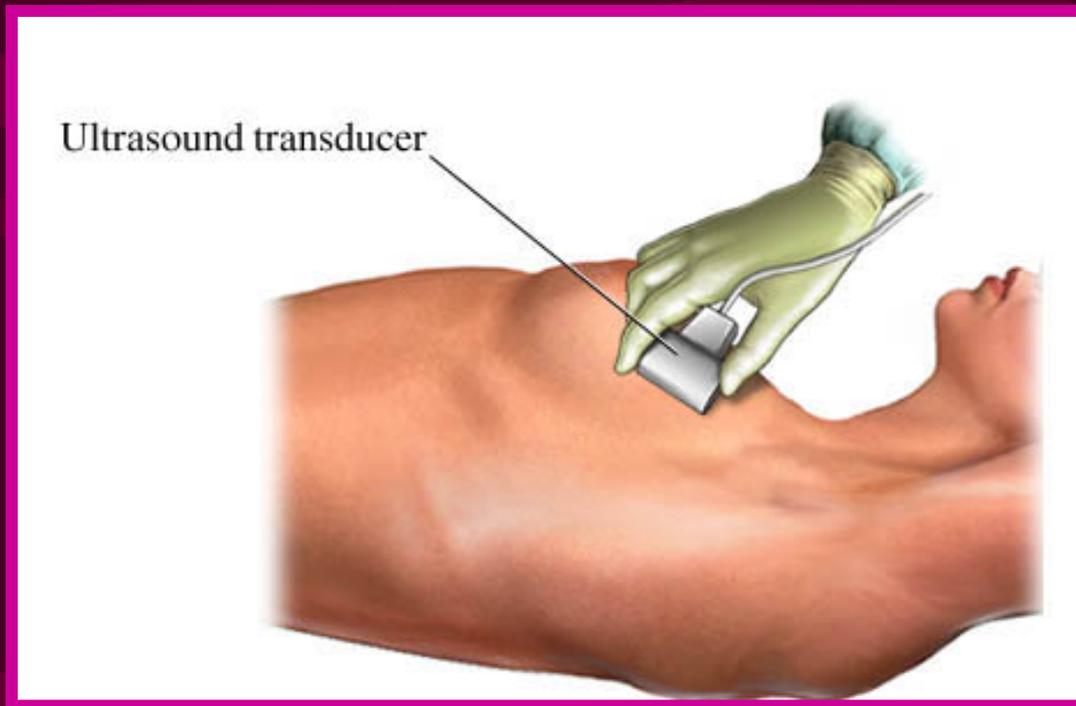
# Breast cancer - mammography



# Mammography - Summary

- Established as gold standard for screening
- Extensively studied
- Shown to decrease mortality from breast cancer
- Quick and available to most patients
- Charge - \$100-150

# Breast Ultrasound



# Screening breast ultrasound

- Not reimbursable
- Several single center studies - bilateral screening breast ultrasound
- Depict small non palpable breast cancers not seen on mammography
- Particularly in women with dense breasts

*Semin Ultrasound CT MR 2000 ;21:325–336*

*Radiology 2001 ;221:641–649*

*Radiology 2002 ;225:165–175*

# Screening breast ultrasound

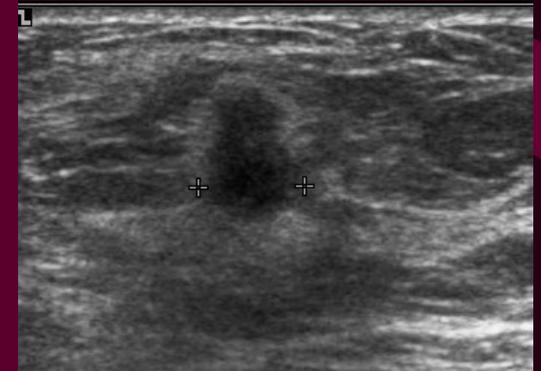
- No published randomized controlled trials have been conducted to evaluate the impact of screening sonography on breast cancer mortality rates.
- Presume that this early detection is of benefit, this benefit has not been proven.

# Screening breast ultrasound

- Any screening test must be held to a high standard of proof
- Otherwise healthy women will undergo additional testing and possibly treatment for conditions that may never become clinically significant.
- Studies to date only look at sono after reading mammo - bias

# Screening breast ultrasound

- Patients will be asked to sign a waiver acknowledging that she will assume financial responsibility for the screening sonogram
- ACRIN 666 study - multicenter protocol to assess the efficacy of screening breast sonography



# ACRIN 6666 study

- 2800 women - high risk patients
- Increases detection of cancers BUT substantial risk of false positives
- Mammography - biopsies 2.6%, 29% positive
- Sonography - biopsies 5%, 8% positive
- Only 35% of facilities in US offer breast ultrasound

# Screening ultrasound

- Operator dependant
- Not billable at present
- Await further analysis of ACRIN 6666
- Only looked at high risk women
- Currently supplement to and not a replacement for mammography

# Breast MRI

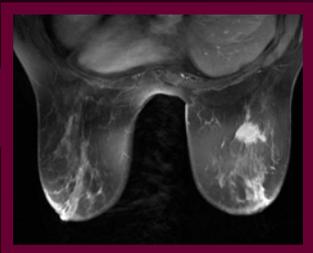


# Patient information

- Exam will take 30-45 minutes
- Normal contraindications for MRI
- Weight limits check if over 300lbs, MRI bore diameter 60cm
- Renal failure (NSF)

# How does it work?

- Patient lies prone -- face down
- Breasts are in specific “breast coil”
- Multiple slices through the breast
- Can image in axial, coronal or sagittal plane
- 1-3mm slices
- Can have up to 1000 images per study



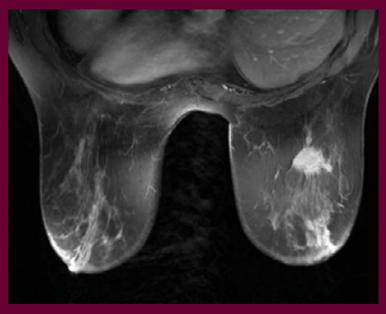
## How does it work?

- Magnetic resonance imaging - no radiation
- All patients will need an iv injection
- Development of a breast tumor - accompanied by development of new, abnormal vessels (angiogenesis)
- Cancers enhance earlier and brighter than adjacent normal tissue

# Referring a patient for a MRI

- Read in conjunction with mammography & ultrasound ( supplement Not stand alone test)
- Day 7-14 of menstrual cycle
- Reading time ?





# Breast MRI

- Refer to a specialist
- Refer to a place who will follow up and do the MRI guided biopsy and localization as necessary
- Cost - \$1000- \$2000
- Not appropriate as a screening modality except in a certain target population.

# Screening Breast MRI

Who should have it?

# Breast Screening

- **American Cancer Society Guidelines for Breast Screening with MRI as an Adjunct to Mammography**
- *CA Cancer J Clin* 2007;57;75-89 (3/07)
- <http://caonline.amcancersoc.org/cgi/content/full/57/2/75>



# Annual Screening Breast MRI: Evidence based

- BRCA mutation
- First degree relative of BRCA carrier but untested
- 20-25% lifetime risk or greater of breast cancer ( BRCAPRO or other models)



# Models to estimate breast cancer risk

- Models assist clinicians to estimate breast cancer risk
- Gail, Claus, Tyrer- Cusick models
- Look at risk factors, family, reproductive etc
- Two decision models developed to estimate likelihood of BRCA being present  
BRCAPRO, BOADICEA



Who is high risk for BRCA?

# Who is high risk for BRCA?

- Prevalence - 1/500 and 1/1000 general pop
- Jewish ethnicity - 1/50
- Increased risk of both breast and ovarian cancer
- BRCA 1 - 65% risk by age 70
- BRCA 2 - 45% risk by age 70
- Calculate with decision models -  
BRCAPRO, BOADICEA

# Genetic testing for BRCA gene

- US Preventive Services Task Force
- Recommendations for genetic testing
- Eastern European Jewish heritage - referred if
- A first degree relative with breast or ovarian cancer at any age or
- Two second degree relatives on the same side of the family with breast or ovarian cancer at any age.

# Genetic testing for BRCA gene

- Women who are not of Eastern European Jewish Heritage referred if
- Two first-degree relatives with breast cancer, one of whom was diagnosed when they were younger than 50, or
- Three or more first or second degree relatives diagnosed with breast cancer at any age, or
- A first degree relative diagnosed with cancer in both breasts, or
- Two or more first or second degree relatives diagnosed at any age, or
- A male relative with breast cancer

# Annual Screening Breast MRI

## (2) Expert consensus

- Radiation to chest wall between age 10 and 30 years
- Li-Fraumeni syndrome and first degree relatives
- Cowden & Bannayan-Riley-Ruvalcaba syndromes and first degree relatives





# Insufficient evidence

- Life risk 15-20%
- LCIS, ALH (15-20% . 6-7 fold increased risk)
- ADH ( 4-5 fold increased risk)
- Dense breasts (75% or more- 4-5 fold)
- Personal history of breast cancer including DCIS (risk of contralateral cancer, 0.5 -1% per year during 10 years following diagnosis)

How good is screening MRI?

High risk  
patients  
( $>25\%$ )

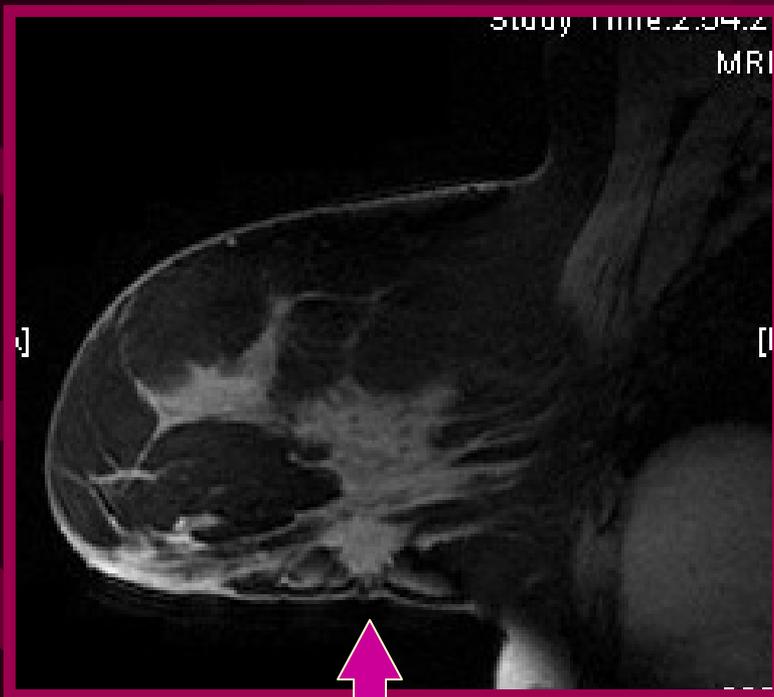
# High Risk 40 yr old female- mammography normal



# Pre and post contrast



# 55 year old - known carcinoma extent of disease evaluation



# Known left breast carcinoma - scan ordered to evaluate extent of disease



# Clinical Trials - high risk patients

<u>Site</u>	<u>Investigators</u>	<u>Number Patients</u>	<u>Sensitivity Mammo</u>	<u>Sensitivity US</u>	<u>Sensitivity MRI</u>
Bonn	Kuhl et al, 2000	192	33%	33%	100%
Dutch	Tilanus-Linthorst et al, 2000	109	0%	--	100%
Dutch	Stoutjesdijk Boetes et al, 2001	179	46%	--	100%
U Penn	Rosen et al, 2001	147	12%	--	75%
MSK	Morris, Lieberman, et al	367			100%

# **Efficacy of MRI and Mammography for Breast Cancer Screening in Women With a Familial or Genetic Predisposition**

- Prospective Study of 1909 Women - Mean age 40 years**
- Lifetime risk of 15% or more**
- Comparison of the sensitivity, specificity & PPV of**
- Physical examination, Mammography & MRI**

*N Engl J Med.* 2004;351:427-437.

# Efficacy of MRI and Mammography for Breast Cancer Screening in Women With a Familial or Genetic Predisposition

Screening Modality	Sensitivity	Specificity	PPV
CBE	17.9%	98%	9.6%
Mammography	33.3%	95%	8.0%
MRI	79.5%	90%	7.1%

# Earlier Detection With MRI

- **The proportion of invasive tumors that were 10 mm or less in diameter was significantly greater in the surveillance group (43.2%) than in either control group (14%;  $P < .001$ ) and (12.5%;  $P = .04$ )**
- **Combined incidence of positive axillary nodes and micrometastases in invasive cancers was 21.4% vs 52.4% ( $P < .001$ ) and 56.4% ( $P = .001$ ) in the 2 control groups**

# Efficacy of screening MRI for high risk patients

- Is there a benefit to adding annual MRI to film-screen?
- Since 2000, 8 prospective non-randomized studies published peer reviewed literature
- Patients BRCA mutation, v strong family history, prior history of breast cancer
- All showed significantly higher sensitivity for MRI compared with mammography & mammo/sono combined.

# Efficacy of screening MRI for high risk patients

- Sensitivity of MRI : 71-100%
- Sensitivity of mammo: 13-40%
- Increased sensitivity when MRI added to program: 31-100%
- Additional cancer yield: (number of additional cancers detected per 1000 high risk women screened) 8-67

# Breast MRI: Advantages for screening high risk women

- Tumors detected when smaller
- Women outside the screening programs carried over twice the risk of node positive disease
- Added benefit - greatest in high risk women

# What about women 15-20% lifetime risk?

- Currently evidence does not support routine screening with MRI
- Insurance often will not cover
- Pre-approval often required
- This is an expensive test
- Cash payment only other option

# Limitations of Breast MRI

# Screening MRI



# **False-Positive Enhancement**

**Specificity of MRI limited by enhancement of benign processes:**

- Fibrocystic change**
- FA**
- Fat necrosis**
- Atypia, lobular neoplasia**
- “Normal” breast tissue (hormonal)**

# Problems

- High risk women - detect cancer in 3%
- Normal women - detect cancer in 0.3%
- High risk woman having screening MRI-  
chance of abnormal exam - 10%
- Risk of benign biopsy - 5%

# Problems

- Sensitivity high across all studies
- Specificity is not as high
- False positives - mean additional imaging and unnecessary biopsies
- Ranged from 2.9% to 15%
- Call back for additional imaging 8-17%

# Remember !



- Screening Breast MRI is NOT recommended for average risk women
- All women in studies we reviewed were at least  $> 15\%$ , most  $>25\%$
- Expertise needed for reading
- Access to MRI biopsy needed
- Women & referring physicians need be educated about appropriateness criteria

# Take Home Points



- Mammography - gold standard for screening
- Cost, availability
- Ultrasound not proven effective for screening
- MRI currently only appropriate for screening high risk women

Thank you for your attention

