BreastScreen Aotearoa Mortality Evaluation 1999-2011

Presentation BSOS

August 10 2016

Background on breast screening

- Randomised controlled trials 1960-80s – mammography screening a population at 70% coverage reduced mortality from breast cancer by around 30% for women screened compared to those who are not.
- reduces deaths from breast cancer by detecting cancers at an earlier stage.
- also reduces morbidity from breast cancer

Breast screening does not prevent breast cancer.

RCTs

Study	Age	Year began	Interval (m)
HIP	40-64	1963	12
Malmö I	45-70	1976	18-24
Malmö II	43-49	1978	18-24
Swedish Two County	38-74	1977	24-33
Edinburgh	45-64	1978	24
Canadian I	40-49	1980	12
Canadian II	50-59	1980	12
Stockholm	40-64	1981	24-28
Gothenburg	39-59	1982	18

What the RCTs can't tell us

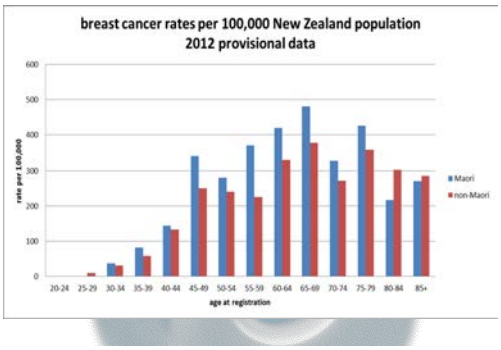
- The effect of service screening in the real world
- Whether the results translate to other populations

What the RCTs can't tell us

The effect of screening Māori women

2013 New Zealand breast cancer registrations and deaths per 100,000

	breast cancer registrations	breast cancer deaths
Non-Maori	91.3	16.3
Maori	125.4	30.9



What the RCTs can't tell us

- The effect of screening Pacific women

Teng *et al.BMC Cancer (2016) 16:755*
Pacific women 20% higher incidence than other NZ women

Maori and Pacific women significantly more likely to die from their breast cancer

Will screening Maori and Pacific women be as effective?

Breast Screening in New Zealand

- 1998 BSA commenced screening women age 50-64
- Two view double read mammography
- 2004 The programme is extended to include women age 45-69 .
- Fully digital 2013
- Coverage over 70% since 2011 for all women and Pacific
- Coverage for Maori currently 64%

Programme evaluation

- Surrogate markers of mortality reduction used including
  - small cancer detection rate
  - node negativity
  - interval cancer rate
- Results suggested outcomes improved for Maori, Pacific and other women

BreastScreen Aotearoa Mortality Evaluation 1999-2011

The study

- Commissioned by BSA
- Published 2015
- Followed all women eligible for breast screening between 1999 to 2011
- necessary to undertake this type of study after screening a population for at least ten years

Research questions

Are there fewer deaths from breast cancer in women

-who have **ever screened** than in those **never screened**?

-who **screen regularly** than in those who don't?

-whose cancer was **detected by BSA**?

Research questions

- Do **Māori and Pacific women** receive similar benefit (morbidity and mortality reductions) from screening?
- Do BSA-detected breast cancers have **better prognostic** features than those in women never screened?

Methods – Data sets

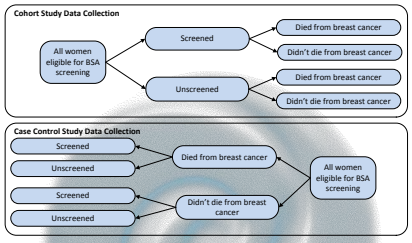
- **Mortality collection** used to identify women who died.
- **Cancer Registry** used to confirm if they died from breast cancer.
- **BSA data** used to identify if and when women were screened.
- **Population estimates from Statistics NZ** was used to determine the number of women who never screened.

Methods - study design

The overall study is made up of two separate studies.

- A retrospective inception cohort study.
- A case-control study.

Cohort vs case control studies



Methods - analysis

- Breast cancer mortality was compared between
  - **ever and never screened** women
  - **regularly screened** women vs **not regularly screened**
- Adjusted for age and **screening selection bias**
  - a formula using coverage, and the Duffy ratio of 1.17 from Swedish RCT

Methods - analysis

- Prognostic indicators compared between
  - **screened and non-screened** women
  - **grade 3** cancers to address length-time bias
  - **screen-detected** and **non-screen-detected** cancers

The Key Findings

Lower mortality – all women

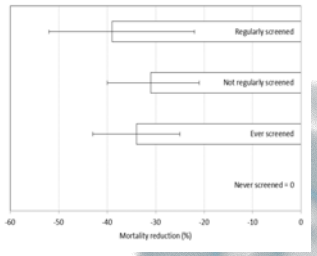
- For all women, **ever screened** compared to **never screened** women
  - 29% lower breast cancer mortality at average coverage of 66% (adjusted for age and screening selection bias)
  - **33% lower breast cancer mortality** at current coverage 72%

Lower mortality – Māori women

- For **Māori women, ever screened** compared to **never screened**
  - **17%** lower breast cancer mortality at average coverage of 48%
  - **28%** lower breast cancer mortality at current coverage 65%

32% lower breast cancer mortality if 70% coverage achieved

Greater benefit from regular screening



Shows dose response

- 31% reduction irregular screen
- 39% reduction regular screen

Prognostic indicators

- **More favourable in ever screened women vs never screened**
- More likely to have low grade tumours
- More likely to have localised disease
- Smaller median maximum size
- Less likely to have multiple tumours

Study Strengths

- Avoids lead time bias (examining mortality cf survival)
- Major treatment improvements introduced prior to BSA
- Unprecedented evaluation of screening in a real-world population setting because of national data linkage
- Uniquely able to evaluate the impact of screening on an indigenous population due to good quality ethnicity data

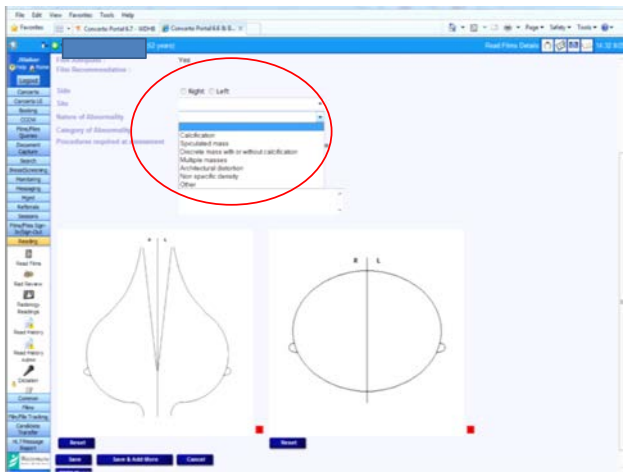
In summary

- For women screened in BSA breast cancer mortality is reduced by 33% at current coverage.
- For women who are regularly screened the reduction in breast cancer mortality is 39%
- Māori and Pacific women will achieve similar benefit to non-Māori women with the same coverage

Māori women have significantly higher breast cancer incidence and mortality, so even more critical to achieve equitable coverage for Māori.

Recall to Assessment: Does the lesion descriptor matter?

Jenny Walker 2017



BreastScreen Aotearoa lesion descriptors

- BSA set up in 1999 following earlier pilot.
- Descriptors taken from Nottingham and South Australia.
- UK now nationally use a version similar to BI-RADs (Breast Imaging Reporting and Data system) lexicon.
- NBCC (National Breast cancer Centre) and RANZCR now also recommends a version similar to BI-RADs.

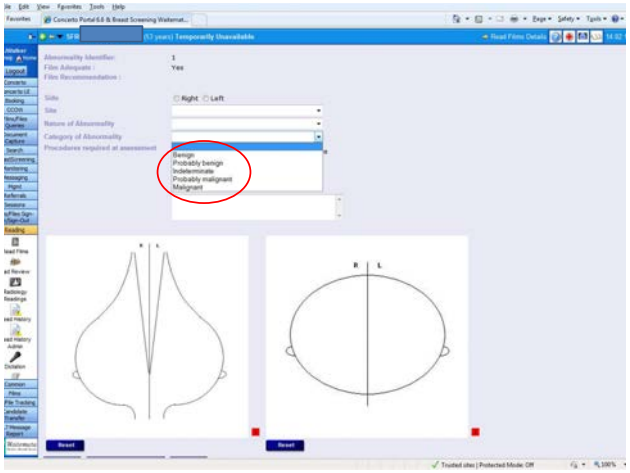
NZ	Australia	UK	USA BI-RADs (Breast Imaging Reporting and Data system)
Discrete mass with or without calcification	Mass: Shape Margin: Sharply defined or Poorly defined Assoc calcs	Mass: Well defined Ill defined	Mass: Shape Margin: circumscribed, obscured, microlobulated, indistinct Density
Spiculate mass	Mass: Shape Margin: Spiculate Assoc calcs	Mass: Spiculate	Mass: Shape Margin: Spiculate Density
Calcification	Significant calcification (Distribution, shape, associated density)	Calcification (Casting, granular, punctate, benign)	Calcification: Morphology Distribution
Architectural Distortion	Architectural Distortion	Attributes: Architectural deformity	Architectural Distortion
Non-specific density	Asymmetric density	Attributes: Asymmetry	Asymmetry: Focal, global, developing
Multiple masses		Focus: single, multiple	
Other (skin thickening, nipple inversion)	Other findings	Lymph node Attributes: (lymphoedema, skin thickening)	Associated features

WHY DESCRIBE THE LESION?

- Identify side and area of the breast which is causing the radiologist concern (No descriptor needed).

WHY DESCRIBE THE LESION?

- Direct third reader or assessment radiologist to a lesion they might not otherwise perceive.
- Direct additional views required at assessment (Eg Magnification for calcifications).
- Research or audit purposes.
- Assist in Lesion categorisation?



CATEGORY	NZ	AUSTRALIA	UK	USA BI-RADS
0				Incomplete
1	Normal or Benign	No sig abnormality	Normal/No sig abnormality	Negative
2	Probably benign (May need assessment to confirm)	Benign findings	Benign findings	Benign
3	Indeterminate (assessment required)	Indeterminate/ equivocal findings (assessment required)	Indeterminate/ probably benign (Further investigation required)	Probably benign <2% malignant (6 month FU)
4	Probably malignant	Suspicious findings of malignancy	Findings suspicious of malignancy	Suspicious: 4a 2-10%, 4b 10-50%, 4c 50-95% malignant
5	Malignant	Malignant findings	Findings highly suspicious of malignancy	Highly suggestive of malignancy (95% +)

WHY DEFINE THE LESION?

- Or should we just divide into Recall vs No Recall based on lesion category and mark area of interest?

CANCER DETECTION ANALYSIS 2011 TO 2016

5 years of digital screening at BreastScreen Waitemata Northland

Women aged 45-69 first and subsequent screens

1/6/2011 to 1/6/2016	CALCS	NSD	SPIC MASS	ARCH DIST'N	D MASS	M MASSES	TOTAL screens 202188
Number recalls (Recall rate %)							
Number of Cancers (DCIS+Inv)							
Cancer detection rate/10K							
PPV %							

1/6/2011 to 1/6/2016	CALCS	NSD	SPIC MASS	ARCH DIST'N	D MASS	M MASSES	TOTAL screens 202188
Number recalls							9861 (4.8%)
Number of Cancers (DCIS+Inv)							1170
Cancer detection rate/10K							57.9
PPV %							11.9

1/6/2011 to 1/6/2016	CALCS	NSD	SPIC MASS	ARCH DIST'N	D MASS	M MASSES	TOTAL screens 202188
Number recalls	2454 25%	3295 33%	263 3%	742 8%	2986 30%	98 1%	9861
Number of Cancers (DCIS+Inv)							1170
Cancer detection rate/10K							57.9
PPV %							11.9

1/6/2011 to 1/6/2016	CALCS	NSD	SPIC MASS	ARCH DIST'N	D MASS	M MASSES	TOTAL screens 202188
Number recalls	2454 25%	3295 33%	263 3%	742 8%	2986 30%	**98** **1%**	9861
Number of Cancers (DCIS+Inv)	445 38%	245 21%	191 16%	142 12%	137 12%	9 1%	1170
Cancer detection rate/10K							57.9
PPV %							11.9

1/6/2011 to 1/6/2016	CALCS	NSD	SPIC MASS	ARCH DIST'N	D MASS	M MASSES	TOTAL screens 202188
Number recalls (Recall rate %)	2454	3295	263	742	2986	98	9861
Number of Cancers (DCIS+Inv)	445	245	191	142	137	9	1170
Cancer detection rate/10K							57.9
PPV %	18.1	7.4	72.6	19.1	4.6	9.2	11.9

1/6/2011 to 1/6/2016	CALCS	NSD	SPIC MASS	ARCH DIST'N	D MASS	M 9.2MASSES	TOTAL screens 202188
Number recalls	2454	3295	263	742	2986	98	9861
Number of Cancers (DCIS+Inv)	445	245	191	142	137	9	1170
Cancer detection rate/10K	22	12.1	9.4	7.0	6.8	0.4	57.9
PPV %	18.1	7.4	72.6	19.1	4.6	9.2	11.9

But all those cancers from calcifications are DCIS, right?

INVASIVE CANCERS FROM A CALCIFICATION RECALL
2 year period 183 total cancers

June 2014 to June 2016	Number	Percent all cancers
GRADE 3	19	10%
GRADE 2	38	21%
GRADE 1	11	6%
Micro-invasive	6	3%
Total	74	40%

DCIS FROM A CALCIFICATION RECALL
2 year period 183 total cancers

June 2014 to June 2016	Number	Percent all cancers
HG DCIS	57	31%
IG DCIS	39	21%
LG DCIS	13	7%
TOTAL	109	60%

FROM A CALCIFICATION RECALL
2 year period 183 total cancers

June 2014 to June 2016	NUMBER	PERCENT OF ALL CANCERS
Grade 1	19	10%
Grade 2	38	21%
Grade 3	11	6%
Microinvasion	6	3%
HG DCIS	57	31%
TOTAL	131	71%

1/6/2011 to 1/6/2016	CALCS	NSD	SPIC MASS	ARCH DIST'N	D MASS	M MASSES	TOTAL 202188 reads
Number recalls	2454 (25%)	3295 (33%)	263 (3%)	742 (8%)	2986 (30%)	98 (1%)	9861
Number of Cancers	445	245	191	142	137	9	1170
Cancer detection rate/10K	22	12.1	9.4	7.0	6.8	0.4	57.9
PPV %	18.1	7.4	72.6	19.1	4.6	9.2	11.9

Mammographic Feature Analysis

- ACR BI-RADS lexicon 1993.
- Descriptors selected on basis of ability to discriminate between benign and malignant findings.

Breast imaging reporting and data system standardized mammographic lexicon: observer variability in lesion description
Baker et al AJR 1996 Apr;166 (4):773-8

"BI-RADS is moderately successful in providing a standardized language for physicians to describe lesion morphology"

Descriptive terms for mammographic Abnormalities: Variation in Application

Simpson et al Clinical Radiology (1996)51,709-713

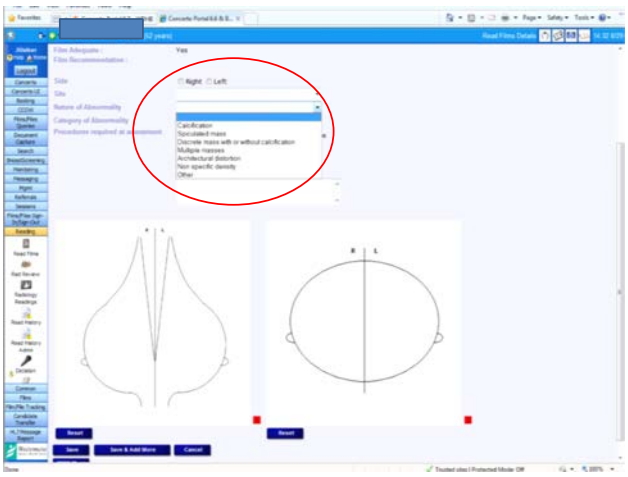
"There is no set of descriptive terms for mammographic appearances which this group of radiologists can guarantee to use consistently…..

We have given up any attempt to standardise a set of descriptive terms"

Reader variability in reporting breast imaging according to BI-RADS assessment categories

Ciatto et al Breast 2005

We found insufficient intra- and inter-observer consistency of breast radiologists in reporting BI-Rads categories. .. Simpler methods…. should be explored.



Cancers last 6/12 2016 BSWN

100 Total cancers:

- 27 had third read (so benefit of double reading is 13.5% for us).
- 21 were for calcifications.
- 52 for investigation.

- NB: Scrolling errors!

Cancers last 6/12 2016 BSWN (not calcification, 2 reads only)

Recall descriptor	Number
Same both readers	26
Distortion and Spic mass	12
Distortion and nsd	2
Spic mass and nsd	8
Discrete mass and nsd	3
D mass and spic mass	1
Total (100 total cancers this period)	52

Lesion Descriptors

- Mammographic Feature analysis. Orsi and Kopans, Semin Roentgenol. 1993 Jul;28(3):204-30

Lesion Descriptors

Mass

- Space-occupying lesion persisting in 2 projections
- A possible mass seen in 1 projection should be called a density (now asymmetry in BIRADs lexicon!)
- Margins are the major determinant of benign or malignant status
- Circumscribed/obscured/microlobulated/ indistinct/spiculated

Lesion Descriptors

Asymmetry (our NSD, Oz asymmetric density)

- Focal or global.
- Focal aysmmetry may be seen on 2 views with a similar shape but not as conspicuous as a mass and lacking the margins of a mass.

  (but what about an ill-defined mass?)

Lesion Descriptors

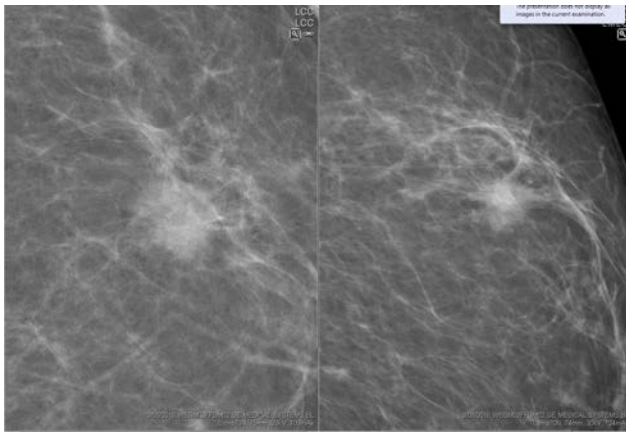
Architectural distortion

- Spiculation radiating from a point with no definite mass visible.
- Can include focal or retraction of the edge of the parenchyma.
- May be associated with a mass!

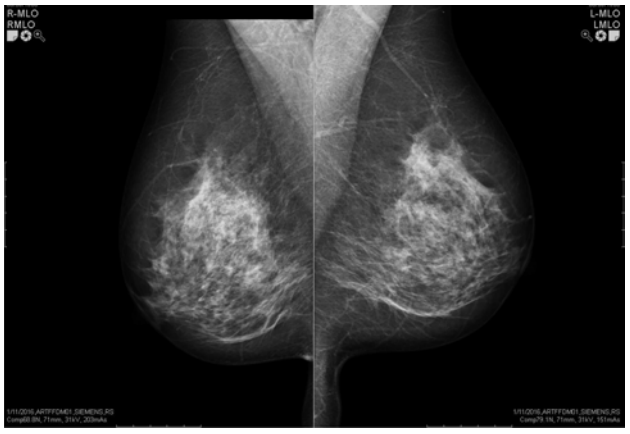
NSD or spiculate mass?

NSD or spiculate mass?

NSD or spiculate mass?



Architectural Distortion or NSD (or really a spiculate mass?)



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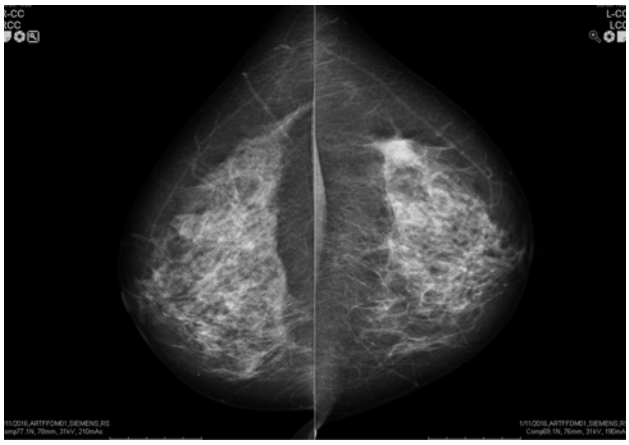

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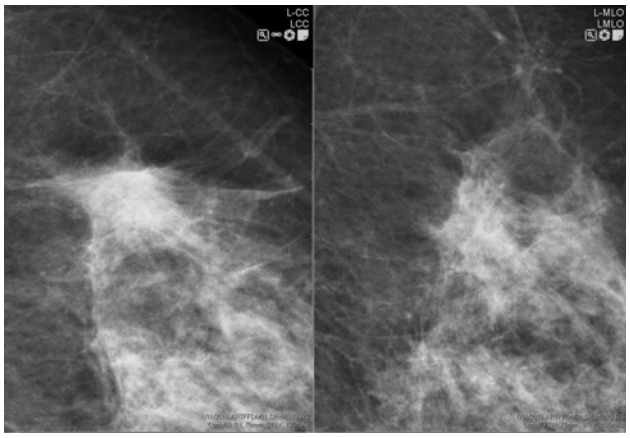
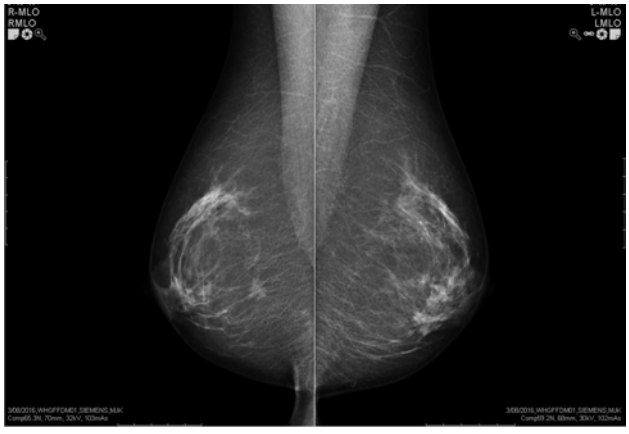
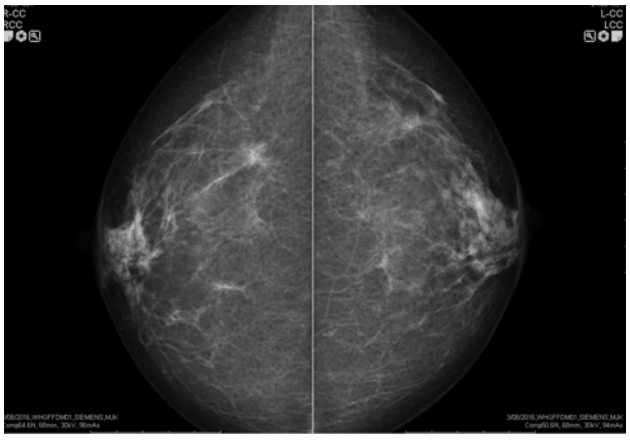


Spic mass or NSD?



Spic mass or NSD?



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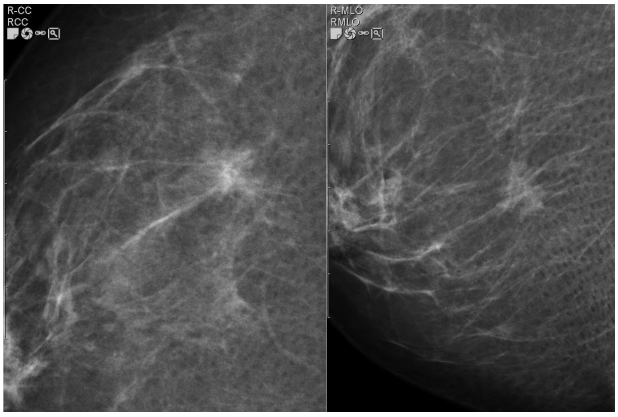
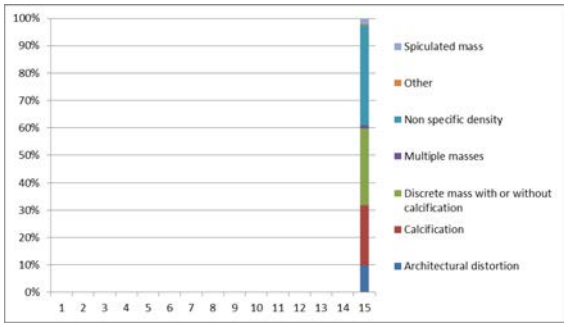
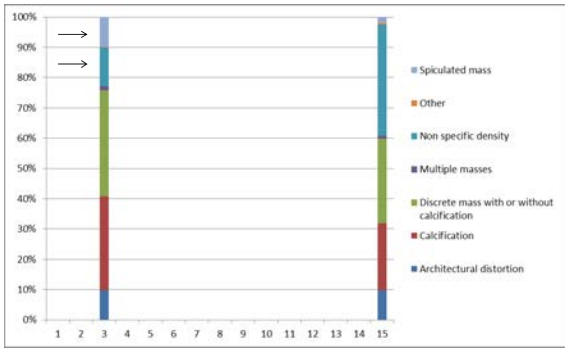
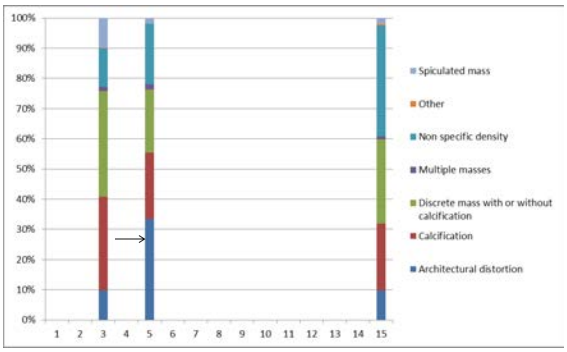


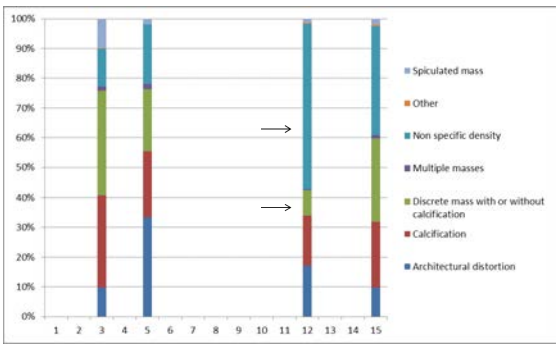
READER PROFILES

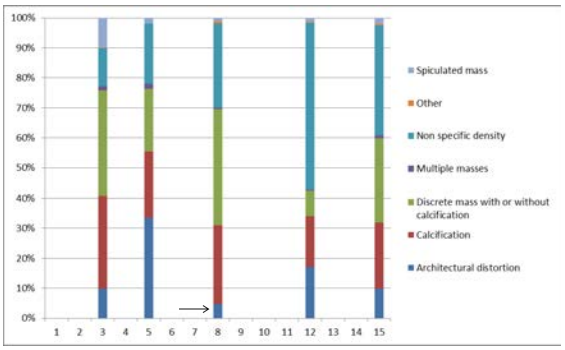
Note: All readers met the BSA targets for cancer detection in the time period.

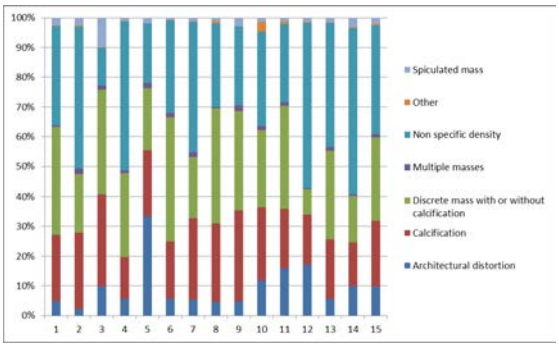












PPV recall- Spiculate mass

	Total	Cancer	PPV (%)
1	43	36	84
2	21	19	90
3	**161**	**59**	**37**
4	21	20	95
5	38	34	89
6	16	9	56
8	19	16	84
9	45	40	89
10	26	22	85
12	23	17	74
13	39	31	79
14	59	42	71

PPV recall- Architectural distortion

	Total	Cancer	PPV (%)
1	83	18	22
2	19	5	26
3	158	11	7
4	111	16	14
5	**644**	**36**	**6**
6	126	31	25
8	70	11	16
9	78	32	41
10	224	22	10
12	283	33	12
13	134	20	15
14	188	21	11

PPV recall- Non-specific densities

	Total	Cancer	PPV (%)
1	562	34	6
2	397	34	9
3	**207**	**6**	**3**
4	998	48	5
5	**385**	**17**	**4**
6	685	33	5
8	419	28	7
9	417	46	11
10	599	23	4
12	924	60	6
13	1013	69	7
14	1053	65	6

Does it matter?

"Internal audit .. has shown little variation in sensitivity, specificity or areas under ROC curves between individual radiologists when it comes to detecting cancer. Yet the same radiologists show considerable variation in their choice of descriptive terms"

So, does it matter?

- Probably not in terms of overall cancer detection.
- BUT……..

So, does it matter…..?

Psychology of third read:

- For some radiologists it is hard not to recall something called a distortion or spic mass even if they do not perceive it, leading to more false positive recalls.
- “Crying wolf” might make regular third readers fail to take seriously what turns out to be cancer.

Does it matter?

False Negative Interval cancers

- If returned at third read and yet the one recall was for distortion or spic mass might there be medico-legal implications for the readers who returned it?

Does it matter?

Research and Audit

- Yes!
- Where is the money: getting recall rates down.

Lessons?

- Calcifications do matter.
- Try to get a degree of local consensus on lesion descriptors to reduce third reader angst.
- Should NZ align descriptors and categories with the rest of the world?

THANK YOU

11th B.I.G. of R.A.N.Z.C.R. Meeting

April 05-08, 2017

Queenstown/New Zealand

MR-guided intervention

Federica Pediconi

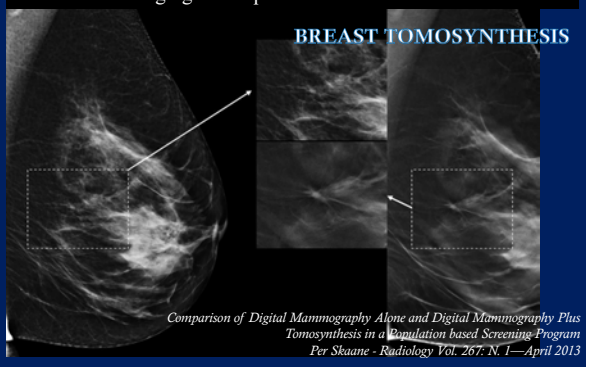
Department of Radiological, Oncological and Pathological Sciences

"Sapienza" University of Rome

SAPIENZA
UNIVERSITÀ DI ROMA

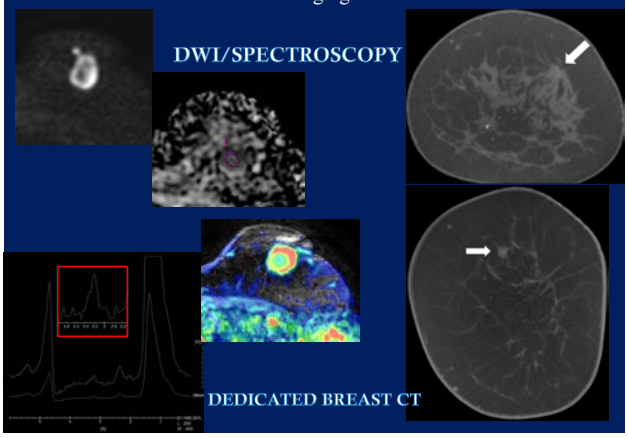
BACKGROUND

Early diagnosis of breast cancer thanks to technical advances of conventional imaging techniques...



Comparison of Digital Mammography Alone and Digital Mammography Plus Tomosynthesis in a Population based Screening Program
Per Skaane - Radiology Vol. 267: N. 1—April 2013

…and the introduction of new imaging methods.



Magnetic Resonance Imaging

Despite in majority of cases MX and US are able to provide the correct diagnosis…

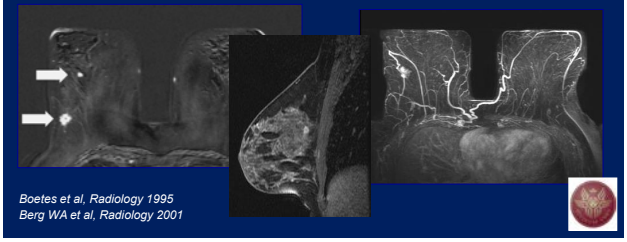
…sometime a lesion can remain hidden until a more accurate examination is performed

Very small lesion
Dense Mx
Inconclusive US scan /second look

Magnetic Resonance Imaging

Breast MR imaging is a highly sensitive technique (94%-100%) for detection of breast cancer.

It can commonly find lesions that are occult on mammograms and US scans



Boetes et al, Radiology 1995
Berg WA et al, Radiology 2001

Radiology

Linda R. LaTrenta, MD
Jennifer H. Menell, MD
Elizabeth A. Morris, MD
Andrea F. Abramson, MD
D. David Dershaw, MD
Laura Liberman, MD

Breast Lesions Detected with MR Imaging: Utility and Histopathologic Importance of Identification with US[1]

Retrospective study on 64 pts and 93 suspicious lesions at MRI (0.9 mm)

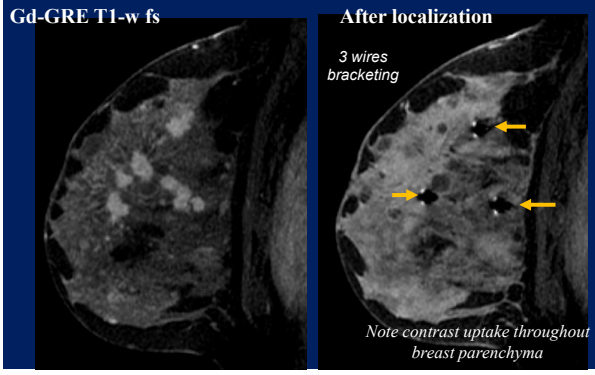
TABLE 1
Presence of US Correlate versus Lesion Type and Histologic Category in (21) of 93 Lesions

Lesion Characteristics	No. with US Correlate	*P* Value	Median Size (cm)
Type			
Mass	19/76 (25)	.34	0.8
Nonmass	2/17 (12)		2.9
Histologic type			
Benign	12/74 (16)	.01	0.9
Malignant	9/19 (47)	.35	1.0
DCIS	2/7 (29)		0.9
Invasive	7/12 (58)		1.3

Note.—Numbers in parentheses are percentages.

MR-guided Biopsy

Wire localization of occult multifocal carcinoma



ACR PRACTICE PARAMETER FOR THE PERFORMANCE OF MAGNETICRESONANCE IMAGING-GUIDED BREAST INTERVENTIONAL PROCEDURES

INDICATIONS FOR MRI-GUIDED BREAST BIOPSY

1. Lesions not seen on MX or US or only seen with certainty on breast MRI
   a. highly suggestive of malignancy (BI-RADS 5)
   b. suspicious abnormalities (BI-RADS 4)
   c. probably benign (BI-RADS 3) only when there are valid clinical indications or when short term interval imaging follow-up would be difficult or unreasonable.

ACR PRACTICE PARAMETER FOR THE PERFORMANCE OF MAGNETICRESONANCE IMAGING-GUIDED BREAST INTERVENTIONAL PROCEDURES

INDICATIONS FOR MRI-GUIDED BREAST BIOPSY

2. Repeat biopsy

Repeat MRI-guided percutaneous sampling is an alternative to surgical biopsy in cases when the initial biopsy results are non-diagnostic or are discordant with the imaging findings.

ACR PRACTICE PARAMETER FOR THE PERFORMANCE OF MAGNETICRESONANCE IMAGING-GUIDED BREAST INTERVENTIONAL PROCEDURES

INDICATIONS FOR MRI-GUIDED BREAST BIOPSY

3. MRI-guided pre-surgical needle localization

a. To guide excision of malignant lesions seen only on MRI or with discordant or non-diagnostic findings on MRI-guided core biopsy.

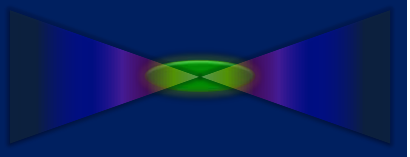
b. For lesions that are not technically amenable to MRI-guided core biopsy due to their location in the breast or the size of the breast.

c. To allow complete excision of an MRI-demonstrated malignancy or high risk lesion when its extent is larger than outlined on mammography or ultrasound, or by previous clip placement.

MR-guided Intervention

From diagnosis…

…To treatment



NON-INVASIVE ABLATION

Several publications focusing on new non-invasive approaches for breast cancer treatment

DIFFERENT WAYS TO ABLATE TISSUE

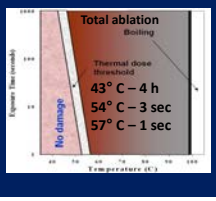
- ✓ **Interstitial Laser Therapy (ILT)**
- ✓ **RadioFrequency Ablation (RFA)**
- ✓ **High Focused Ultrasound (HIFU)**
- ✓ **Cryotherapy**

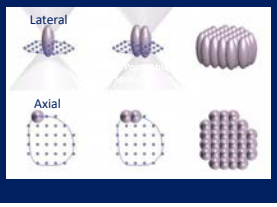
cause tissue necrosis by increasing the temperature

causes tissue necrosis by a rapid temperature decrease

HIGH-INTENSITY FOCUSED ULTRASOUND

A high-energy focused ultrasound beam rapidly generate a substantial increase in local tissue temperatures (>60°) by converting acoustic energy into heat. Consequences are protein denaturation and coagulation necrosis of target tissue with no damage to surrounding structures.

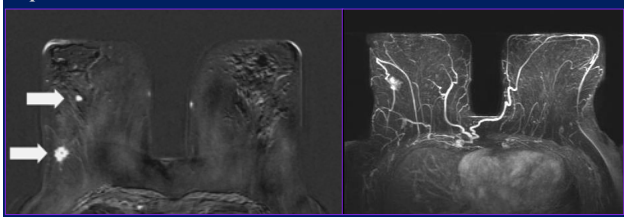




MAGNETIC RESONANCE

Technique of choice for breast cancer imaging

- ***Higher accuracy compared to mammography and US***
- ***Better evaluation of tumor shape and dimensions***
- ***Depiction of synchronus lesions***
- ***Details on neo-angiogenesis***
- ***Best imaging technique for the evaluation response of non-invasive procedures***



MRgFUS

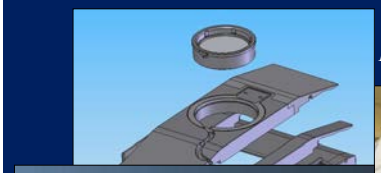
- MRI-guided focused ultrasound (MRgFUS) is a noninvasive thermal ablation method that uses magnetic resonance imaging (MRI) for target definition, treatment planning, and control of energy deposition.
- Integrating FUS and MRI as a therapy delivery system allows to localize, target, and monitor in real time, and thus to ablate targeted tissue without damaging normal structures .

MR guided Focused Ultrasound

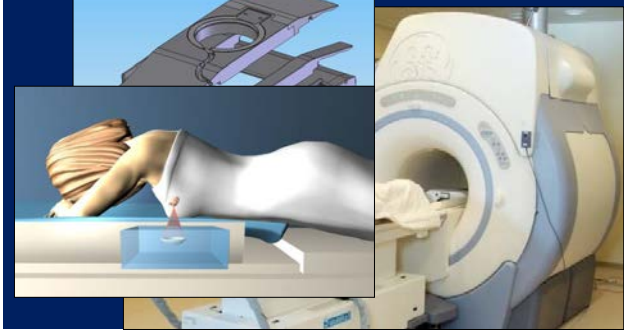
Technical aspects and patient positioning

MR-GUIDANCE ADVANTAGES

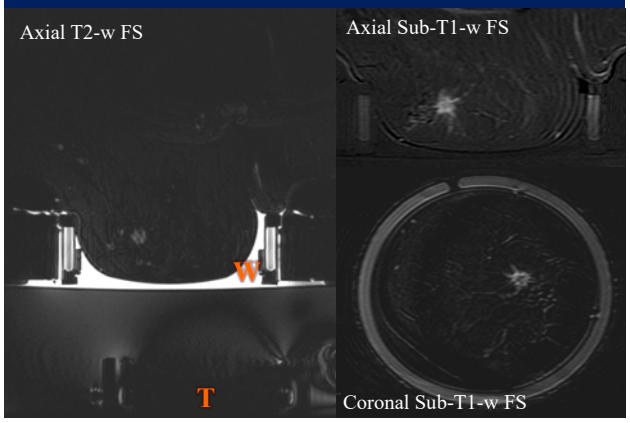
Patient positioning



Discovery 3T (GE)
ExAblate 2100 (InSightec)



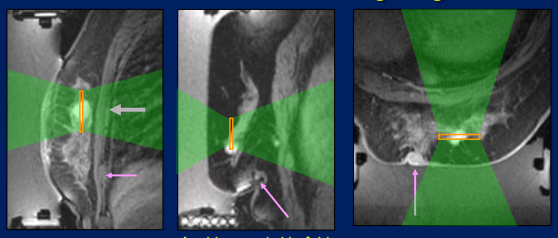
PATIENT POSITIONING



MRgFUS for *Breast* Cancer

3D anatomic views for planning treatment region

Make sure the treatment window is big enough

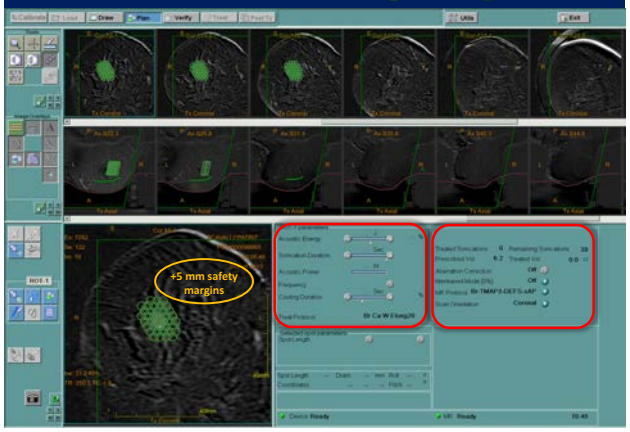


Avoid far field bone

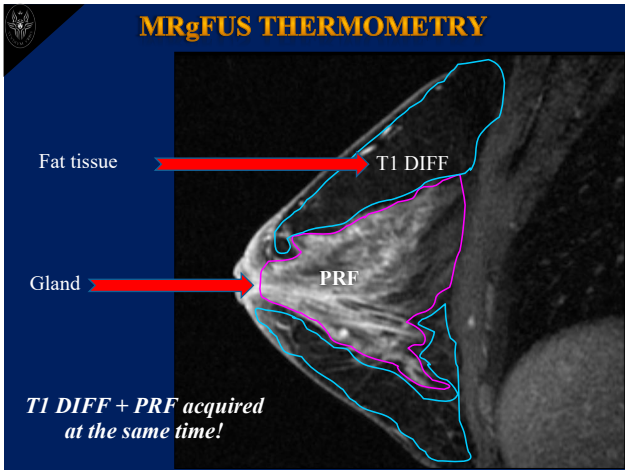
Avoid scars / skin folds and surgical clips

Avoid nipple

Automatic treatment planning



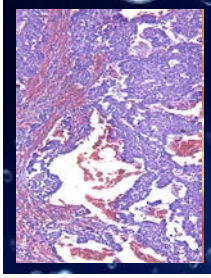
MRgFUS THERMOMETRY



T1 DIFF + PRF acquired at the same time!

CAVITATION

Development of vapor cavity in a tissue that is the consequence of high energy levels. forces acting upon the liquid.



When subjected to high pressure, the bubble can implode and generate an intense and unpredictable shockwave.

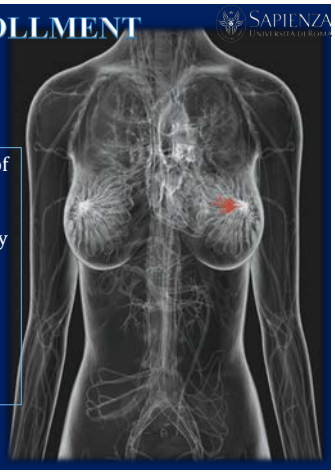
Then it should be avoided in breast cancer MRgFUS treatments

Acoustic Power < 100 W

MR guided Focused Ultrasound

Personal Experience

Pt ENROLLMENT

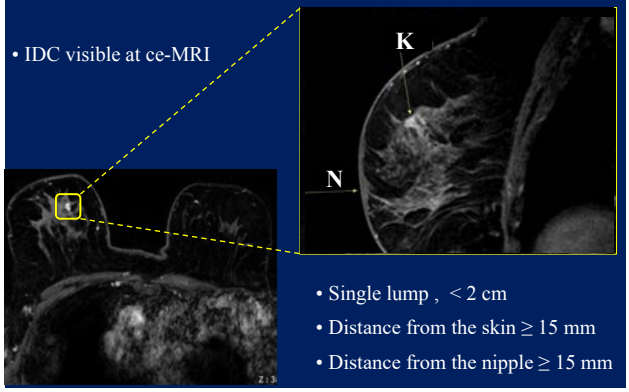


12 patients

- Biopsy-proven single focus of Invasive Ductal Carcinoma.
- No personal or family history suggesting BRCA1/2 gene mutation.
- No evidence of suspicious axillary lymph nodes at imaging.

MRGFUS TECHNIQUE
- *INCLUSION CRITERIA*-

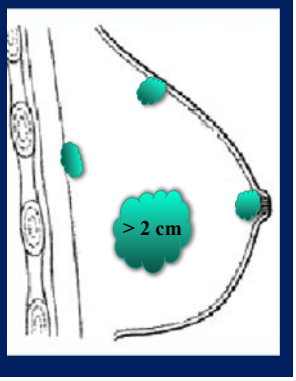
- IDC visible at ce-MRI



- Single lump , < 2 cm
- Distance from the skin ≥ 15 mm
- Distance from the nipple ≥ 15 mm

MRGFUS TECHNIQUE
- *EXCLUSION CRITERIA*-

- **Invasive lobular carcinoma, in situ ductal carcinoma (microcalcifications)**
- **Non-accessible lesions**
- **Breast implants**
- **Ca intolerance**
- **MR non-compatible devices**
- **Claustrophobia and position**



STUDY PROTOCOL

Fat-sat Ax T2-weighted TSE
Fat-sat T1 3D GRE at least on 2 planes
↓
Gd injection
↓
Fat-sat T1 3D GRE on the same planes
→ subtracted images

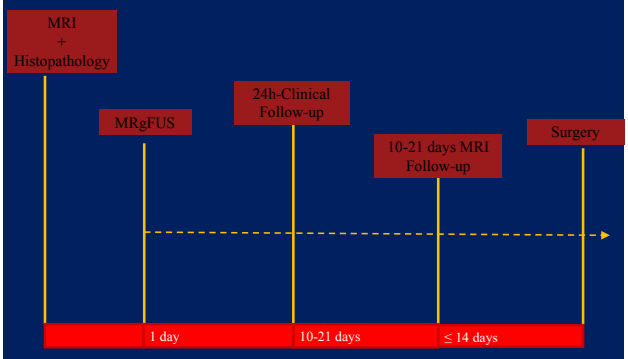
DEPICTION OF LESION DIMENSIONS AND BORDERS

FUS Treatment

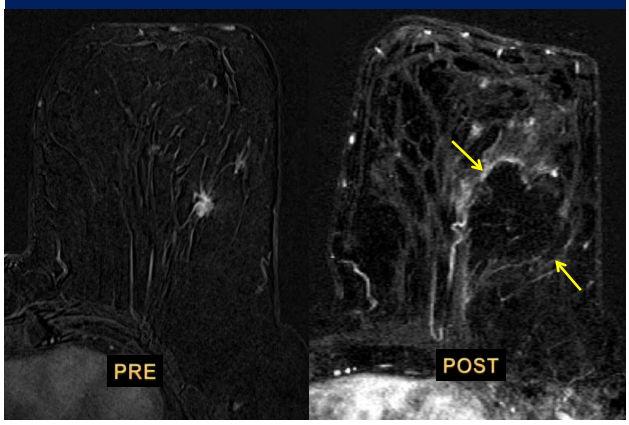
EVALUATION OF TREATMENT EFFICACY

Fat-sat Ax T2-weighted TSE
Fat-sat T1 3D GRE at least on 2 planes
↓
Gd injection
↓
Fat-sat T1 3D GRE on the same planes
→ subtracted images

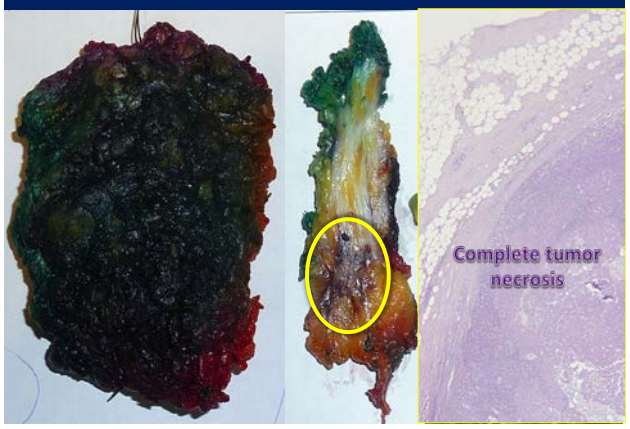
STUDY PROTOCOL



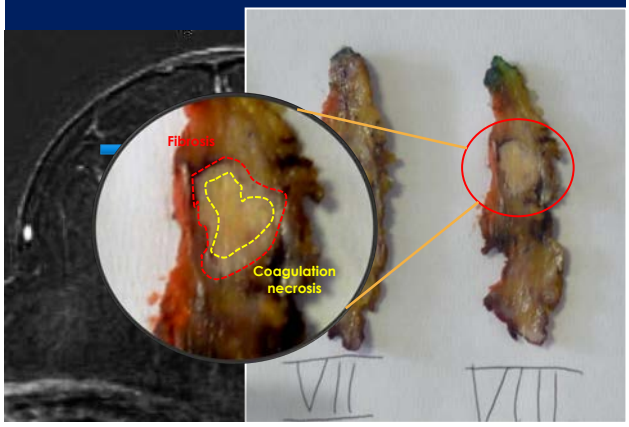
F, 53 yo, left breast IDC



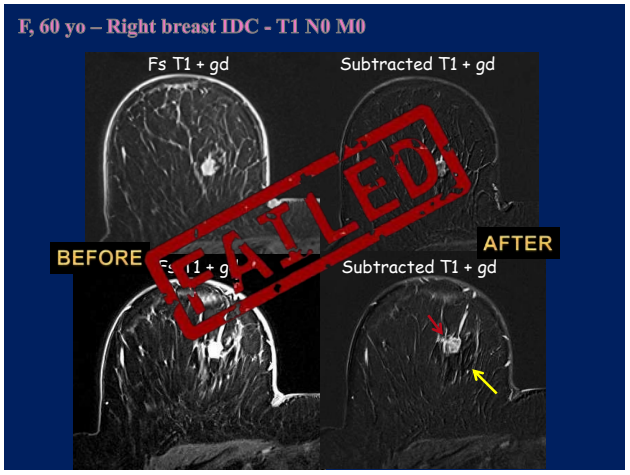
F, 48 yo, left breast IDC



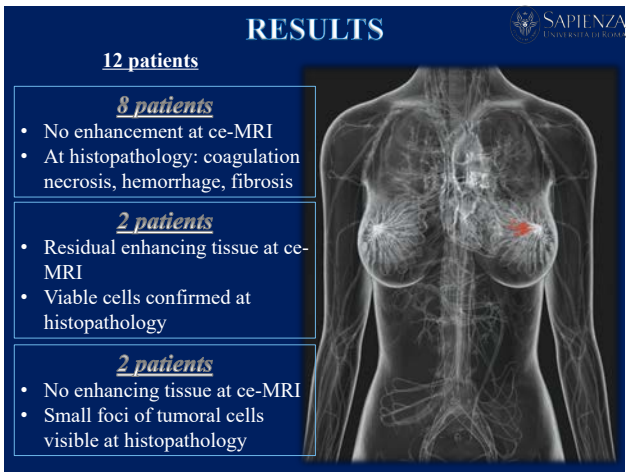
F, 52 yo, left breast IDC



F, 60 yo – Right breast IDC - T1 N0 M0



RESULTS



12 patients

8 patients

- No enhancement at ce-MRI
- At histopathology: coagulation necrosis, hemorrhage, fibrosis

2 patients

- Residual enhancing tissue at ce-MRI
- Viable cells confirmed at histopathology

2 patients

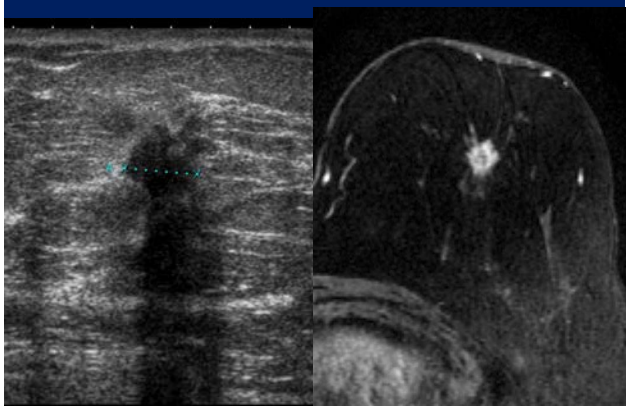
- No enhancing tissue at ce-MRI
- Small foci of tumoral cells visible at histopathology

PATIENT MANAGEMENT

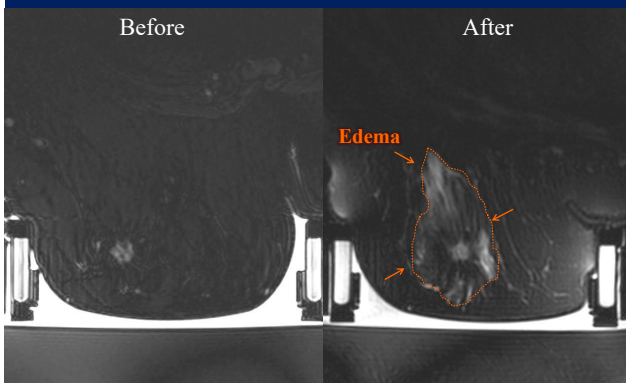
Patient may feel:

- ✓ Skin heat
- ✓ Heat during sonication
- ✓ Rib discomfort/pain
- ✓ Discomfort due to prone position

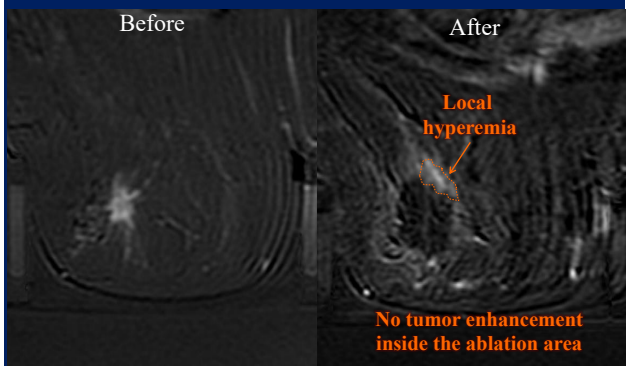
F, 56 yo - 9 mm IDC on the left breast



MRI EVALUATION AFTER TREATMENT
Axial T2-w FS



MRI EVALUATION AFTER TREATMENT
Post-GD FS T1 GRE



RESULTS FROM THE LITERATURE

J Vasc Interv Radiol. 2003 Oct;14(10):1275-82.

Feasibility of magnetic resonance imaging-guided focused ultrasound surgery as an adjunct to tamoxifen therapy in high-risk surgical patients with breast carcinoma.

Gianfelice D[1], Khiat A, Boulanger Y, Amara M, Belblidia A.

- 24 patients
- NO SURGERY (high risk or refused)
- Possibility of 2° treatment
- FU with imaging and biopsy

- Absence of MR enhancement
- 1 minor complication
- 19/24 negative biopsy
- 3/5 residual tumor

RESULTS FROM THE LITERATURE

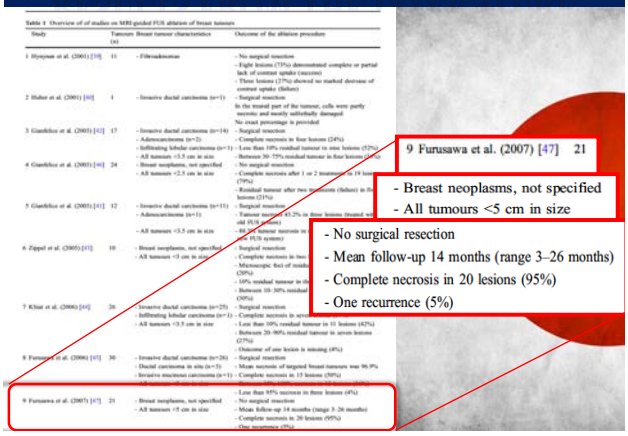
2006

Furusawa et al.

- 30 patients (IDC, DCIS, others)
- Mean necrosis ± SD: 96.9 ± 4%
- 15/28: 100% necrosis
- 3 patients < 95% necrosis

Magnetic Resonance–Guided Focused Ultrasound Surgery of Breast Cancer: Reliability and Effectiveness

RESULTS FROM THE LITERATURE

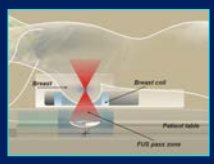


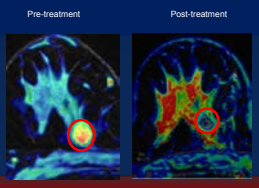
9 Furusawa et al. (2007) [47] 21

- Breast neoplasms, not specified
- All tumours <5 cm in size
- No surgical resection
- Mean follow-up 14 months (range 3–26 months)
- Complete necrosis in 20 lesions (95%)
- One recurrence (5%)

RESULTS *Breast*

- Non-invasive alternative to surgical "lumpectomy"
- Ambulatory, single session procedure
- Over 300 patients treated in Phase I/II trials, up to 48 months follow-up
- Patients treated with MRgFUS, followed by adjuvant therapy
- No recurrences; no severe adverse events





SAPIENZA UNIVERSITÀ DI ROMA

SOME CONSIDERATIONS…

ORIGINAL ARTICLE

Breast Focused Ultrasound Surgery With Magnetic Resonance Guidance

Eva C. Gombos, MD, Daniel F. Kacher, MS,* Hidemi Furusawa, MD,† and Kiyoshi Namba, MD†*

1) Need for pre-treatment biopsy with immunochemestry

enhanced MRI must replace histopathology. As no additional tissue is obtained, the histological diagnosis and tumor markers (estrogen and progesterone receptor status and HER2-Neu status) must be determined from the pretreatment core biopsy. Additional tissue can be taken at core biopsy for

Magnetic resonance thermal monitoring may be challenging in a breast that is of predominantly fatty composition.[33] Proton resonance frequency shift techniques work in aqueous tissue, but not in fatty tissue. Moreover, subtraction-

2) Difficult thermometry in fatty breasts.

3) Possibility of incomplete ablation.

There is a possibility of residual viable cancer cells with MRgFUS; however, residual tumor is a frequent finding with surgical removal and reexcision: in 50% or more of lumpectomies, the margins are inadequate, involved, or close. Histopathologic studies also demonstrated that histologically negative or close biopsy margins do not guarantee complete excision.[39,40]

SOME CONSIDERATIONS…

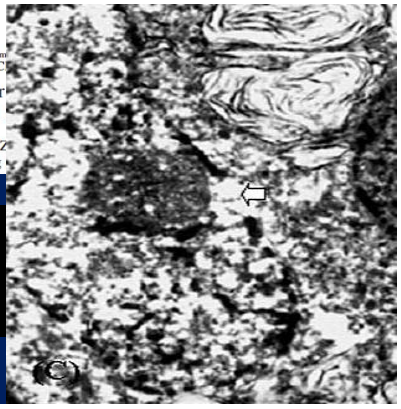
Excerpta Medica

The Am
Cl

Heat fixation of cancer ultrasound

Feng Wu, M.D., Ph.D.[a,*], Z
Zhong-Lin Xu, M.D.[b], Qiang

The use of electronic microscopy and NADH-diaphorase demonstrated no viability in those cells.



A RECENT REVIEW OF LITERATURE…

European Radiology
pp 1–12

Technical success, technique efficacy and complications of minimally-invasive imaging-guided percutaneous ablation procedures of breast cancer: A systematic review and meta-analysis

Authors

Giovanni Mauri, Luca Maria Sconfienza, Lorenzo Carlo Pescatori, Maria Paola Fedeli, Marco Ali, Giovanni Di Leo, Francesco Sardanelli

Forty-five studies were analysed, including 1,156 patients and 1,168 lesions.

Radiofrequency, microwaves, laser, cryoablation and high-intensity focused ultrasound were used.

Mauri, G., Sconfienza, L.M., Pescatori, L.C. et al. Eur Radiol (2017).

A RECENT REVIEW OF LITERATURE…

Results:

- **Pooled technical success was 96%** (95%CI 94–97%) [laser=98% (95–99%); HIFU=96% (90–98%); radiofrequency=96% (93–97%); cryoablation=95% (90–98%); microwave=93% (81–98%)].
- **Pooled technique efficacy was 75%** (67–81%) [radiofrequency=82% (74–88); cryoablation=75% (51–90); laser=59% (35–79); HIFU=49% (26–74)].
- **Major complications pooled rate was 6%** (4–8).
- **Minor complications pooled rate was 8%** (5–13%).

Mauri, G., Sconfienza, L.M., Pescatori, L.C. et al. Eur Radiol (2017).

A RECENT REVIEW OF LITERATURE…

Conclusions:

Imaging-guided percutaneous ablation techniques of breast cancer have a high rate of technical success, while technique efficacy remains suboptimal.

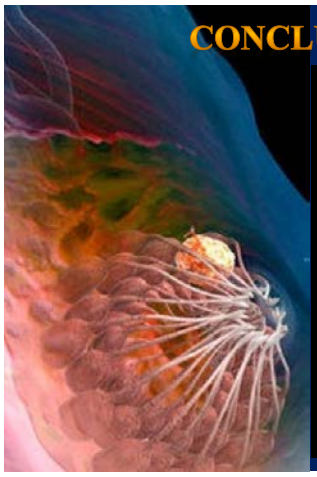
Key Points:

• Imaging-guided ablation techniques for breast cancer are 96% technically successful.

• Overall technique efficacy rate is 75% but largely inhomogeneous among studies.

• Overall major and minor complication rates are low (6–8%).

Mauri, G., Sconfienza, L.M., Pescatori, L.C. et al. Eur Radiol (2017).



CONCLUSIONS

- ✓ **Valid alternative to conservative surgery**
- ✓ **Non-invasive, incisioneless, safe**
- ✓ **Conscious sedation, no hospitalization nor general anesthesia**
- ✓ **No ionizing radiations**
- ✓ **Well tolerated, rapid return to normal daily activities for the patient**
- ✓ **Improvement in quality of life**