



Senology Part II: MRI and Interventional MRI of the breast

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- life-time risk 9-10%
- importance for prognosis: extension of the invasive part of the tumor
- for each mm decrease in tumor diameter = decrease of mortality about 1.3 %

-> optimal diagnostics => best treatment and prognosis

- Mammography (Mx) = Goldstandard for diagnostics
- Sensitivity? Related to breast density of the breast and tumor type

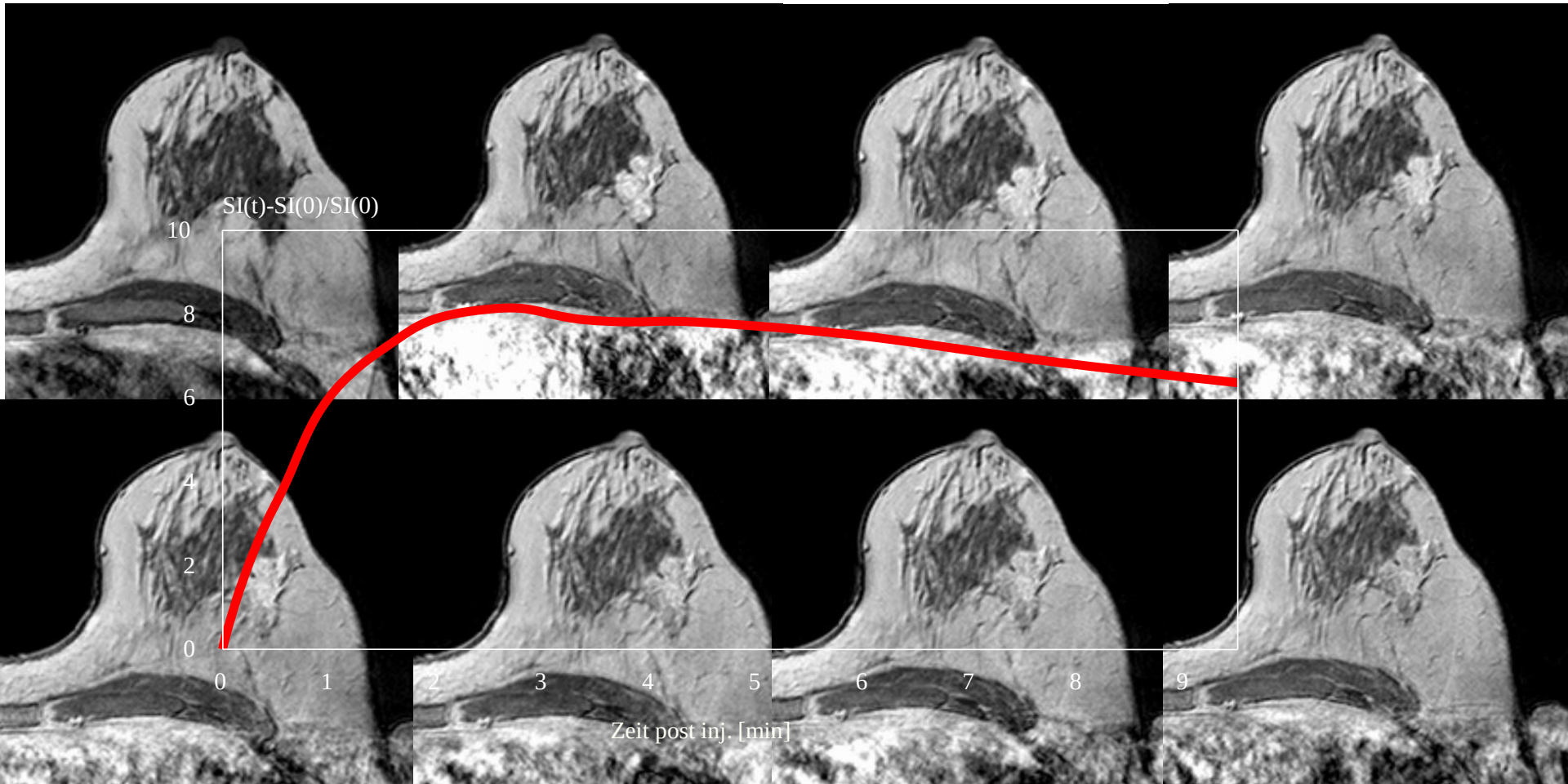
Possible solution: MRI-Mammography?

- high magnetic field strength (≥ 1.0 Tesla)
- dedicated double breast coil





- high spatial resolution
(slices thickness ≤ 4 mm, Matrix $\geq 256^2$)
- high temporal resolution
(dyn. ce T1w GE sequence > 6 min., each scan < 2.5 min.)
- image subtraction

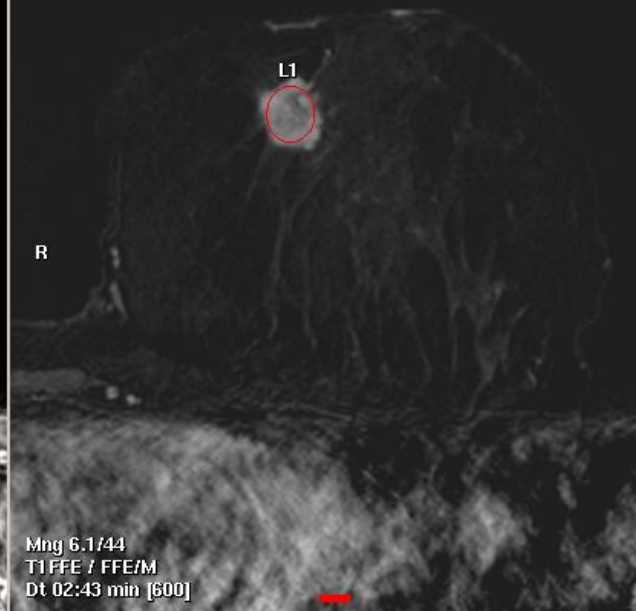


- Morphology and **kinetics** are important for the evaluation

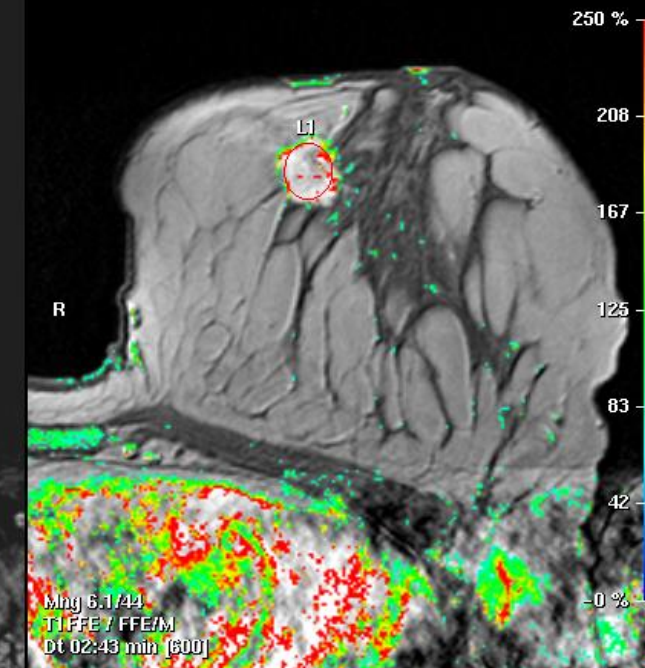
Original



Subtraktion



Relative Anhebung



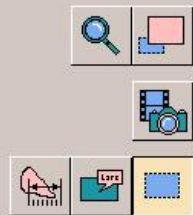
Schicht	44	-	+
'Dynamic'	3	-	+
Bezug	1	-	+

Akyurt, Emine
MR-Bildgebung der Brust
Schichtnummer: 44.

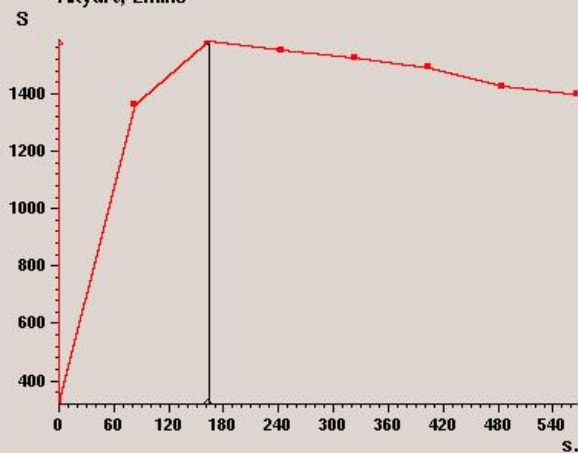
L1	
Max. Verbesserung	1259.1
Max. relative Verbesserung	388.5 %
T0	0.0 s.
Uhrzeit bis Spitze	163.8 s.
Einwasch-Rate	12.4 1/s.
Auswasch-Rate	0.79 1/s.
Kürze der Anhebung	405.1 s.
Fläche unter der Kurve	606960.3
Bereichsfläche	166.4 mm²
Pixelanzahl	302.0

Nr	Uhrzeit	Gemessen	Relativ
1	00:00.000	324.1	0.0 %
2	01:23.370	1361.5	320.1 %
3	02:43.800	1583.2	388.5 %
4	04:04.240	1551.6	378.8 %
5	05:24.670	1524.3	370.3 %
6	06:45.100	1489.1	359.5 %
7	08:05.540	1425.6	339.9 %
8	09:25.970	1397.0	331.0 %

Funktionen

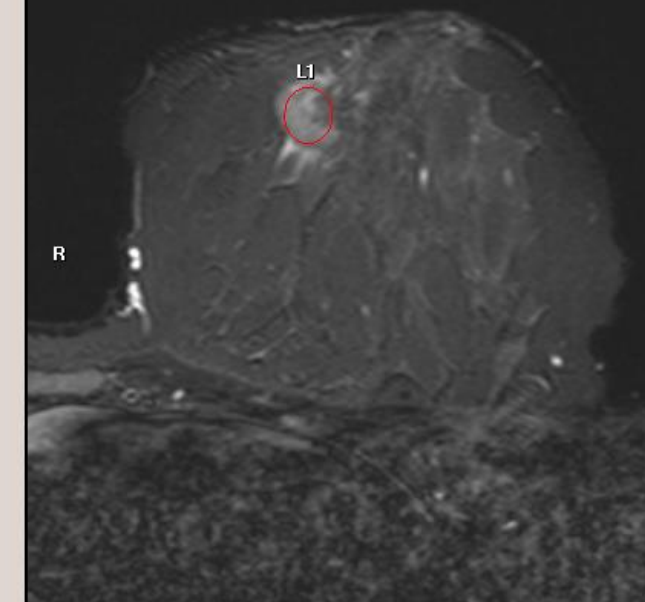


Akyurt, Emine



- ◊ Aktuelle 'dynamic'
- Bezugsdynamik
- ▲ Bezugszeit
- L1

Messung 5 s/T2/STIR SENSE TIR





Breast-MRI Score (Baum et al 2002) / BI-RADS



morphology		points	dynamic		points
shape	round	0	initial enhancement	< 50%	0
	oval	0		50-100%	1
	lobular	0		> 100%	2
	irregular	1	postinitial enhancement	continuity	0
border	well-defined	0		Plateau	1
	ill-defined	1		Wash-out	2
En- hancement	homogenous	0			
	inhomogenous	1			
	Rim	2			



Score	0 1 2	3	4 5	6 7 8
BI-RADS [®] category	1 – 2 (negative, benign finding)	3 (probably benign finding)	4 (suspicious abnormality)	5 (high suspicious of malignancy)

BIRADS 2 / 3 / 4 / 5 is corresponding to a score of 0-2 / 3 / 4-5 / 6-8 points



Differences MRI vs. Mammography/Ultrasound

- no overlapping
- functional examination
($\leftrightarrow$ Mammography (Mx): density / contrast;
Ultrasound (US): ultrasound phenomena)

- vital tissue can be identified by KM-Enhancement
(for example after ChTx / scar)
- tumors, only be visible on the MRI



MRI is more sensitive

than mammography and ultrasound in breast cancer detection (high sensitivity and negative predictive value)

But:

Suspicious enhancement of benign lesions (false positives) reduces specificity and PPV



65 patients with breast cancer

n=65	Mammography	Ultrasound	MRI- Mammography
Sensitivity	83%	70.8%	98%
False negative	37%	40%	12,5%

20 patients with multifocal or multicenter carcinoma

n=20	Mammography	Ultrasound	MRI- Mammography
Positive	35%	30%	100%
False positive	12.5%	14%	23%



- 7.-14. day of the menstrual cycle
- at least 3 month after ablation
- no hormone replacement therapy for at least 6 weeks
- 6 month post radiation
- the quality of the images and the experience of the reader!!!

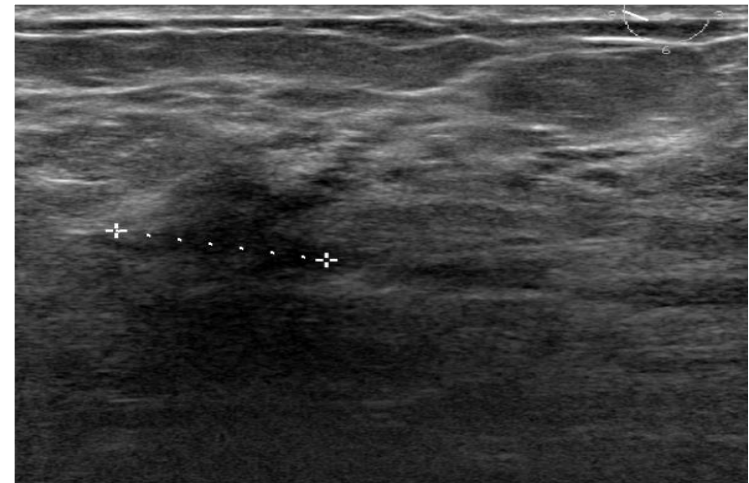
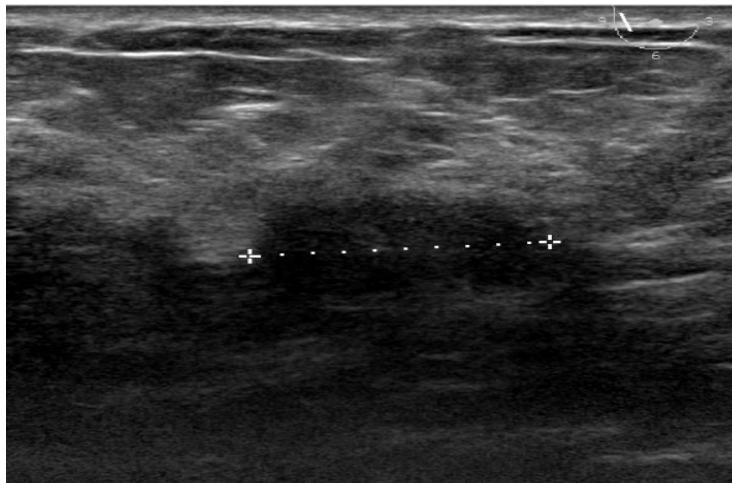


- exclusion of tumor recurrence after BCT
- tumor detection in case of CUP
- local staging of known breast cancer
- monitoring of neoadjuvant therapy
- equivocal Mx and / or US findings (palpable tumor not seen)
- tumor detection in high risk patients
- exclusion or detection of a rupture of breast implants

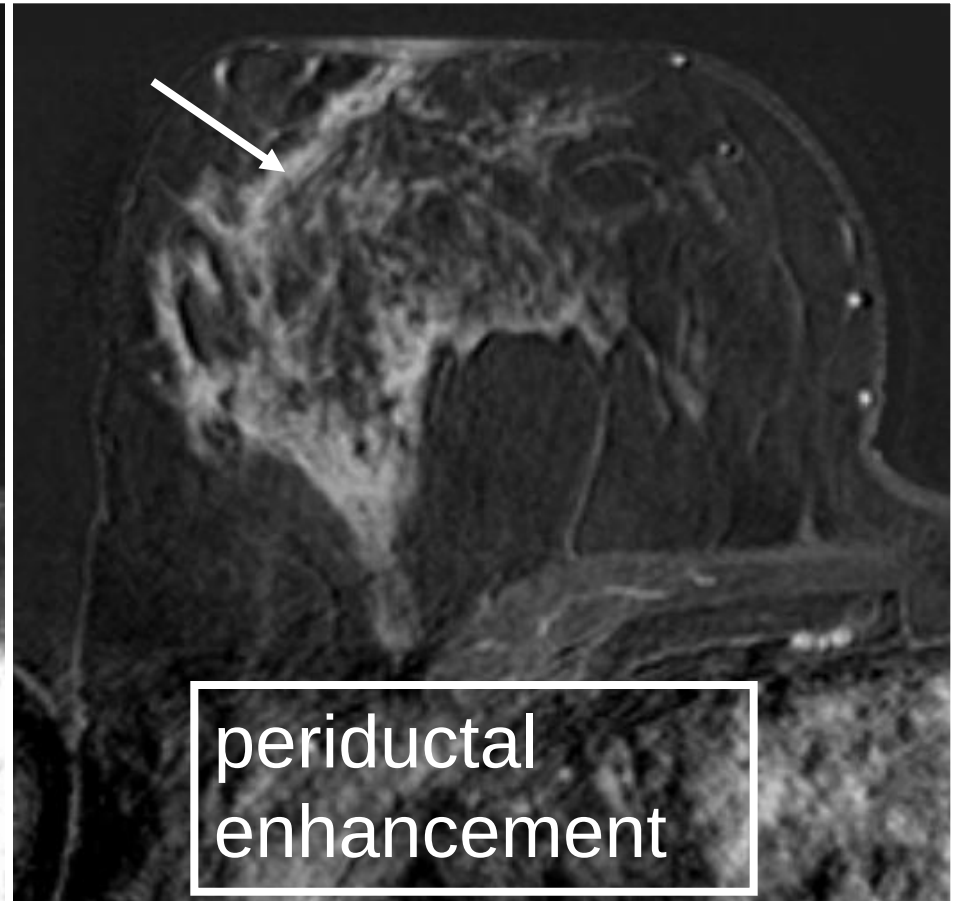
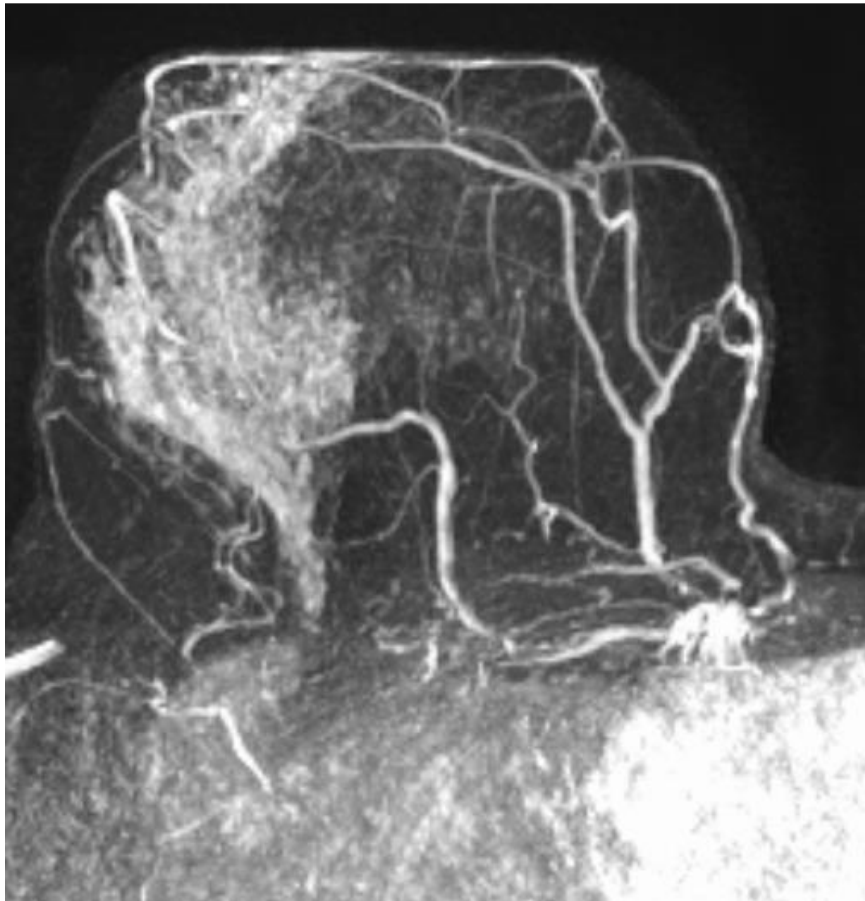


Examples of patients and some indications:

- 45 y. o. patient with palpable lump and nipple retraction of the right breast
- Mx without pathologic findings



- US 1.6 cm hypoechogenic lesion, BI-RADS[®] 5
 - ▶ Invasiv ductal carcinoma



- large (10 cm) multicentric BI-RADS 5 finding



- MRI is the most accurate tool for delineating tumor extent
(Wasif et al. Am Surg. 2009 Oct;75(10):970-5;
Takayoshi et al. Breast Cancer Res Treat 2008)
- detection of otherwise occult carcinoma (ipsilateral and contralateral)
- decrease of a recurrence (4-6.5% down to 1.2-1.7%)

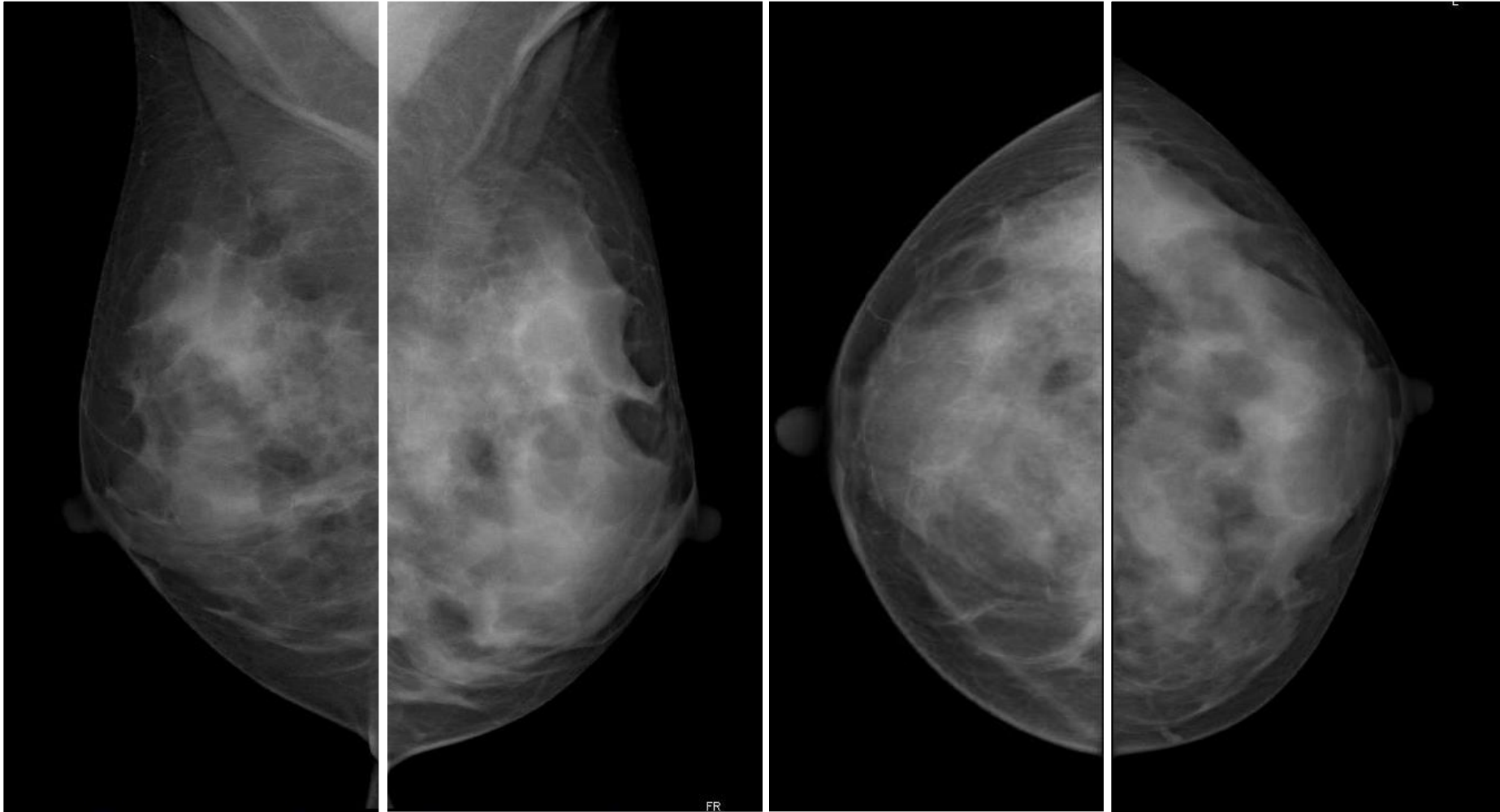


- 5% of breast cancers are associated with gene defects (BRCA 1 and 2 in 60-70%)
- these women develop breast cancer earlier (often younger than 40 years)
- proven benefit of breast MRI for early cancer detection in women with high risk (sensitivity -100%)

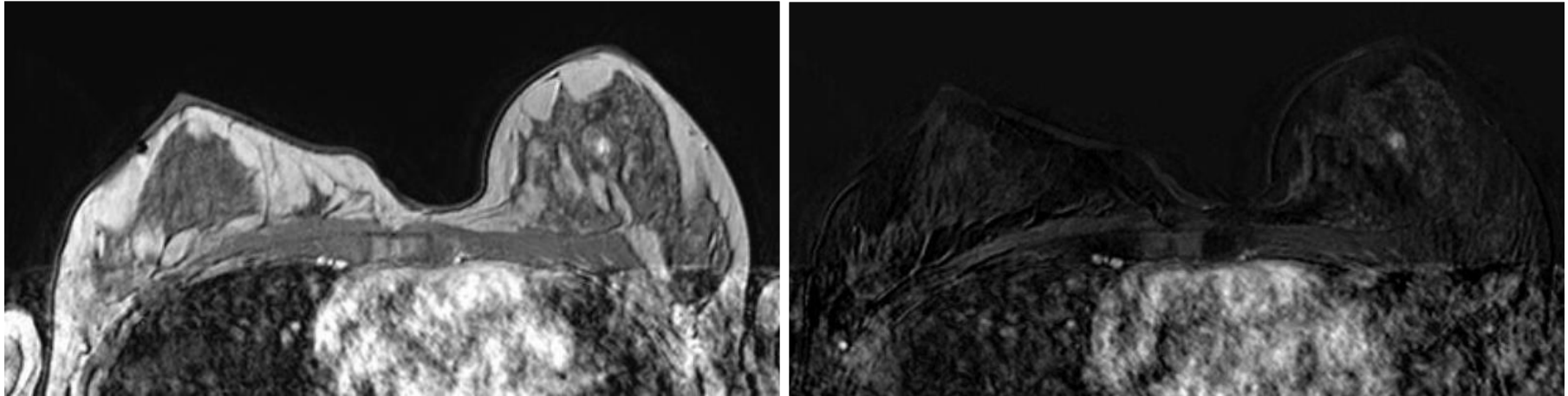
Weinstein et al. Journal of Clinical Oncology 2009. Volume 27, number 36.
Bigenwald et al. Cancer Epidemiol Biomark prev 2008
Kriege et al. N Engl J Med 2004
Kuhl et al J Exp Clin Cancer Res 2002



- 39 y. o. patient, BRCA-1 positive
- previous BCT of the right breast
- Mx / US: dense parenchyma
- MRI for early detection / follow-up

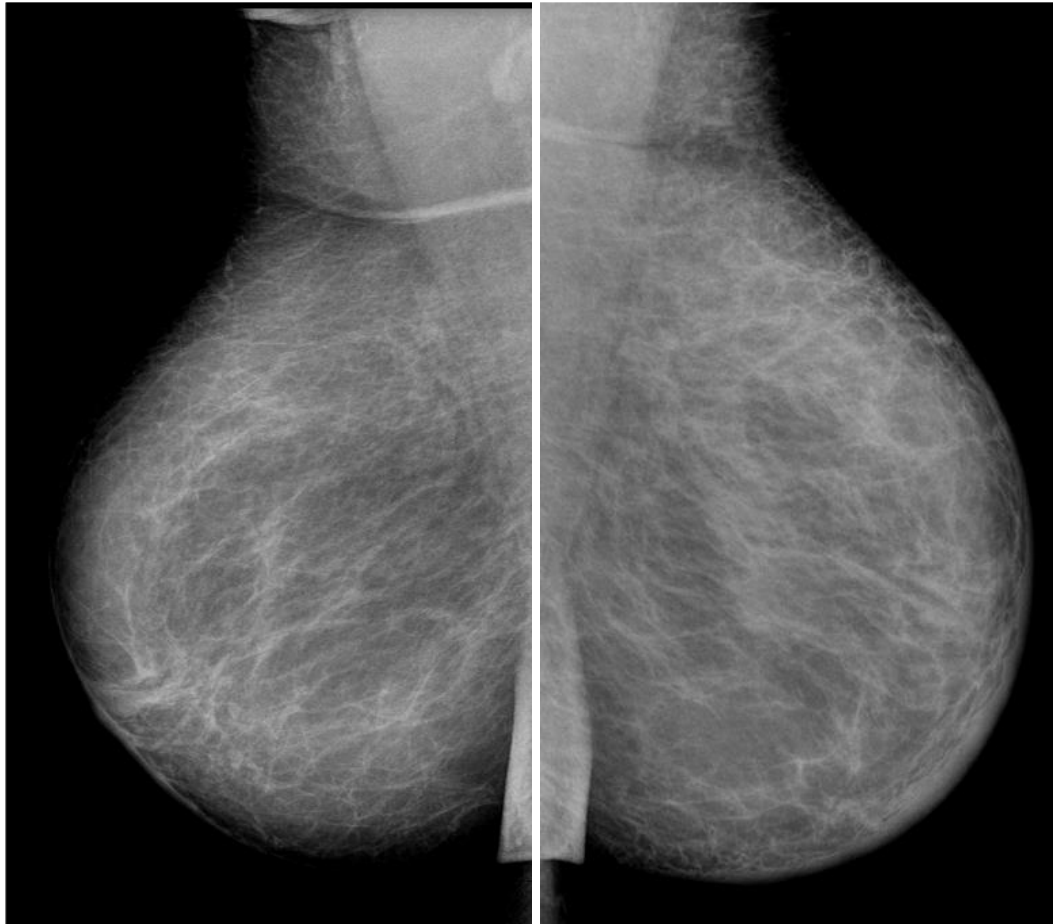


- MG: volume reduction of the right breast after BCT

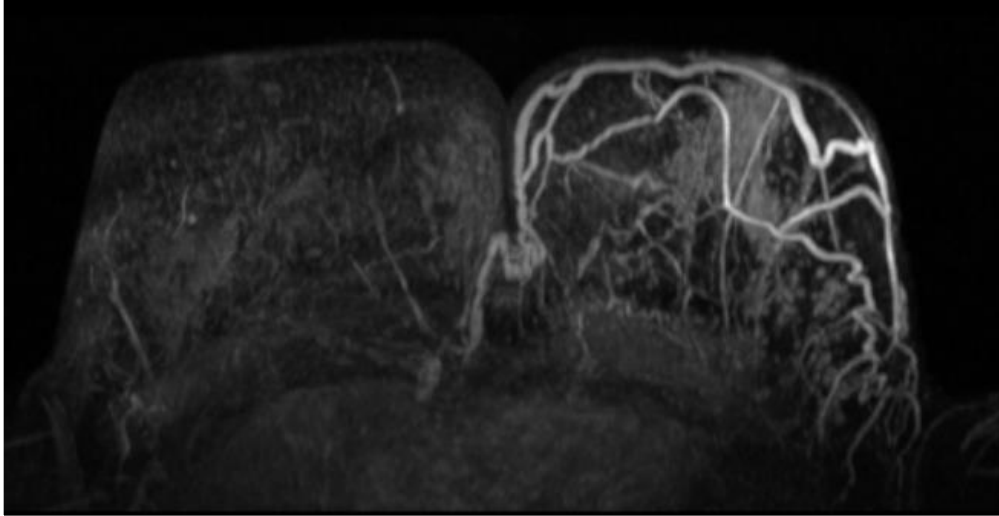


- right: unsuspected scar
- left: suspicion of contralateral cancer
 - 8 mm large BIRADS[®] 4 lesion
 - occult on Mx and US
 - MR-guided VB: invasive ductal Carcinoma

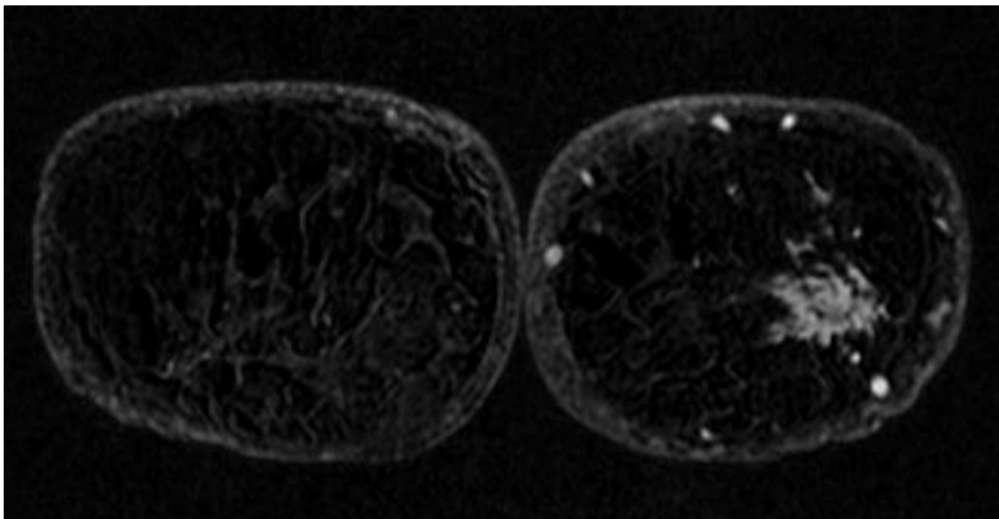
- 76 y. o. patient with axillary LN-metastases



- Mx –
edema of the
left breast



- multicentric
BI-RADS® 5 lesions
- ▶ MRI-guided
biopsy





- suspicious lesions
 - breast MRI Score 4-8 points
 - BI-RADS® 4 and 5
 - exclusively detectable on MRI
(-> „second look“ US and Mx)



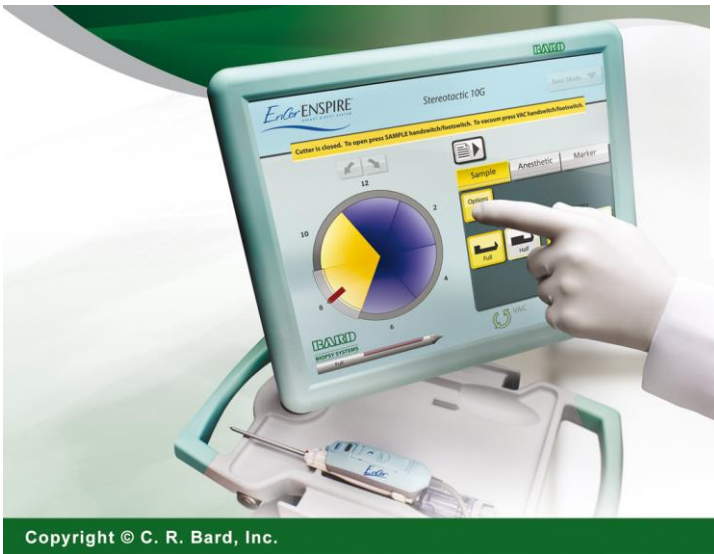
- technical requirements
 - dedicated localization set
 - surface coil
 - ce T1w GE sequence
- MRI-guided vacuum-assisted biopsy
 - biopsy system (e.g. Vacora, Mammotome, Bard)
- MRI-guided localization
 - wire (e.g. Somatex)
 - coil (e.g. Cook)

VACORA® MRI Coaxial Cannula Set

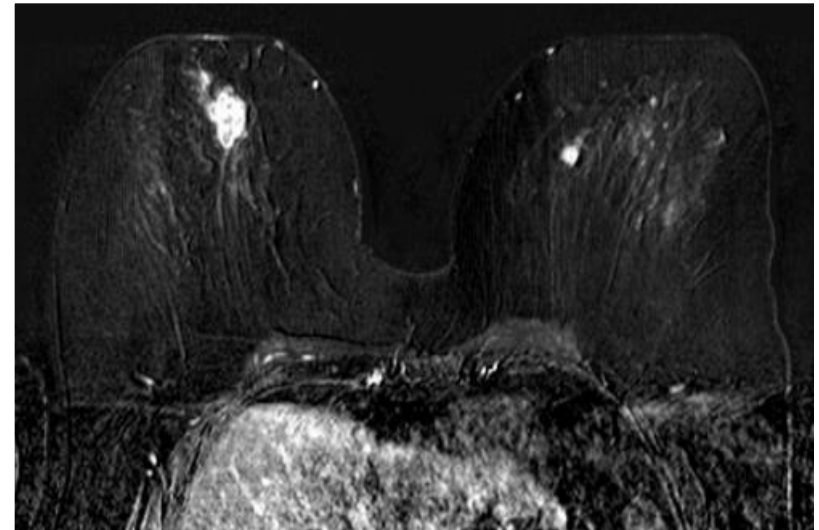
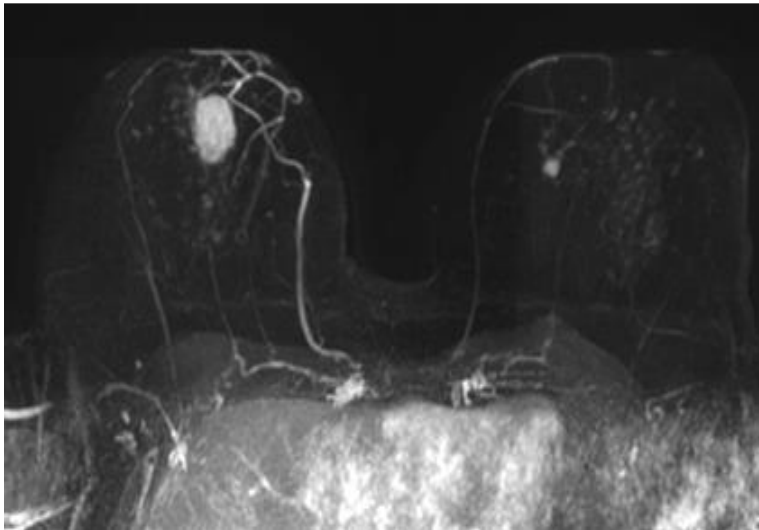
► Set includes

- White plastic coaxial cannula
 - 10 mm gradations
 - Depth stop
- Titanium stylet
- Plastic stylet

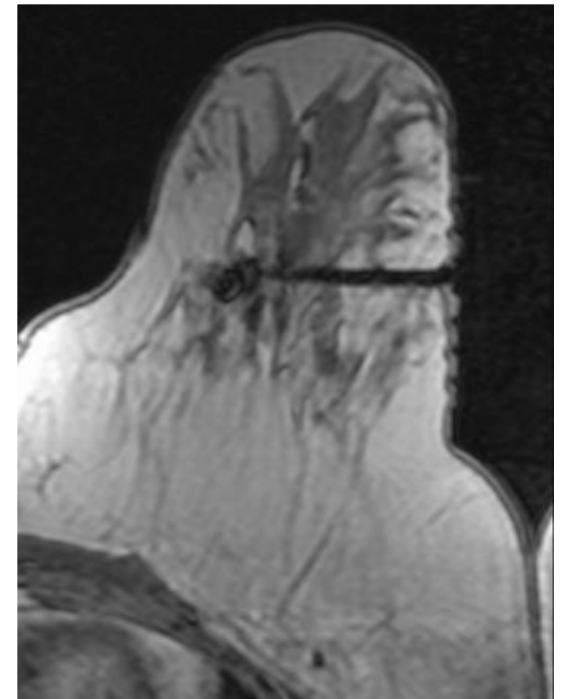
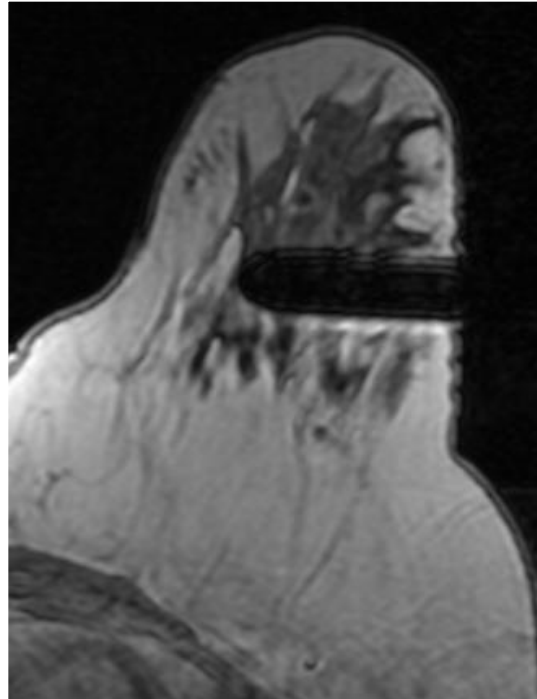
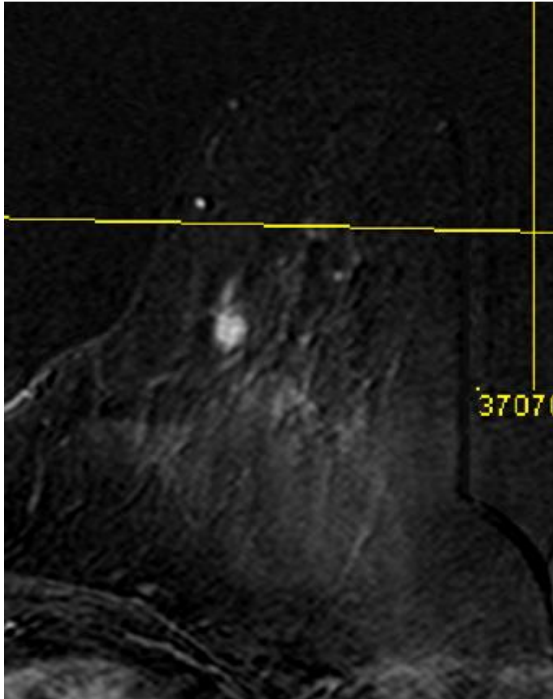




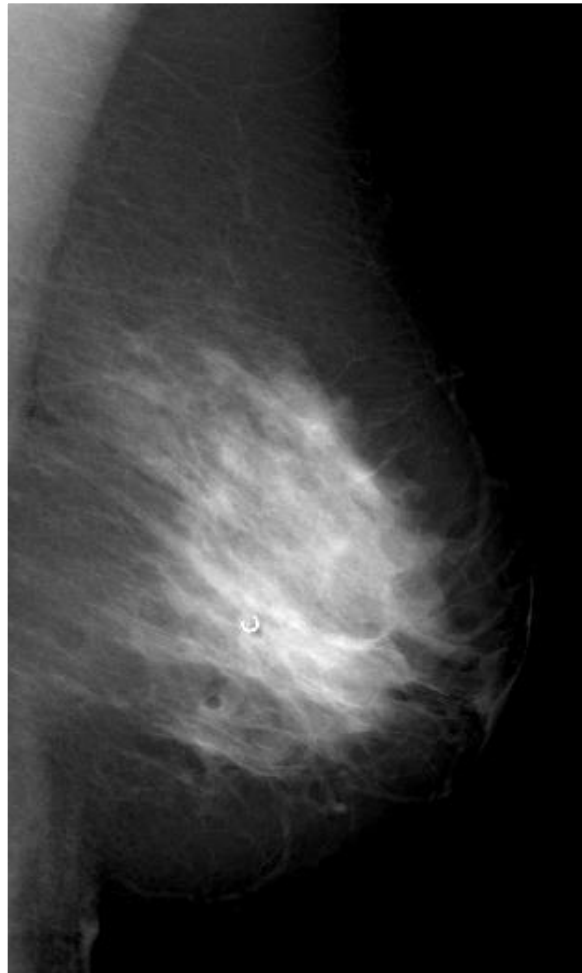
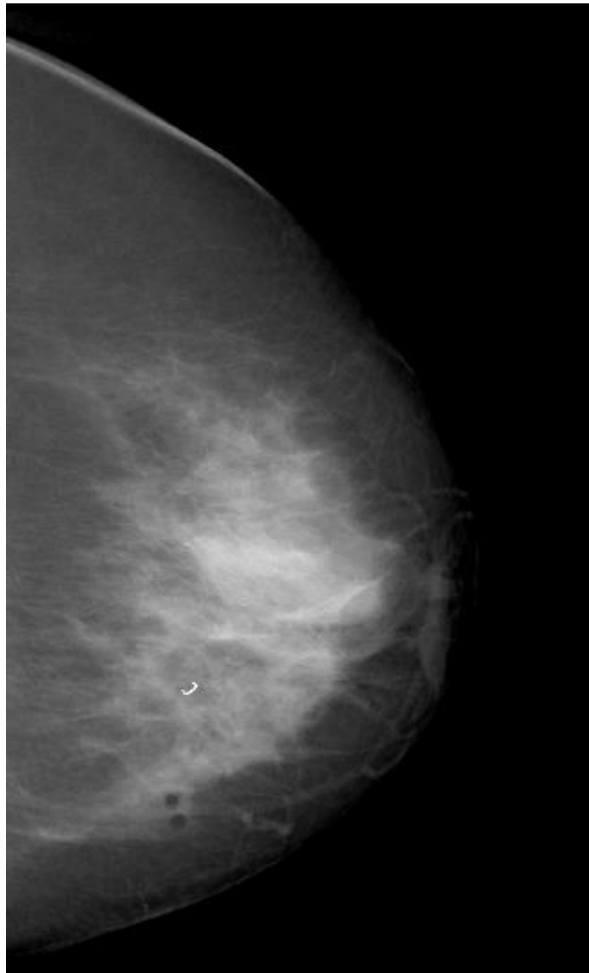
- 63 y. o. pat. with breast cancer of the right breast
- left breast: suspicious lesion with a breast score of 6 points / BI-RADS® 5



- lesion occult on second-look US and Mx
- ⇒ MR-guided vacuum biopsy performed



- clip marking of the hematoma after biopsy



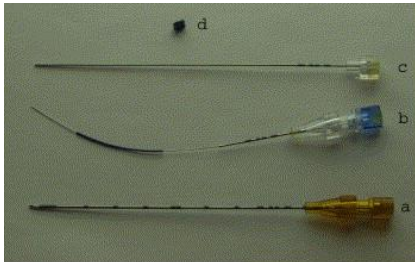
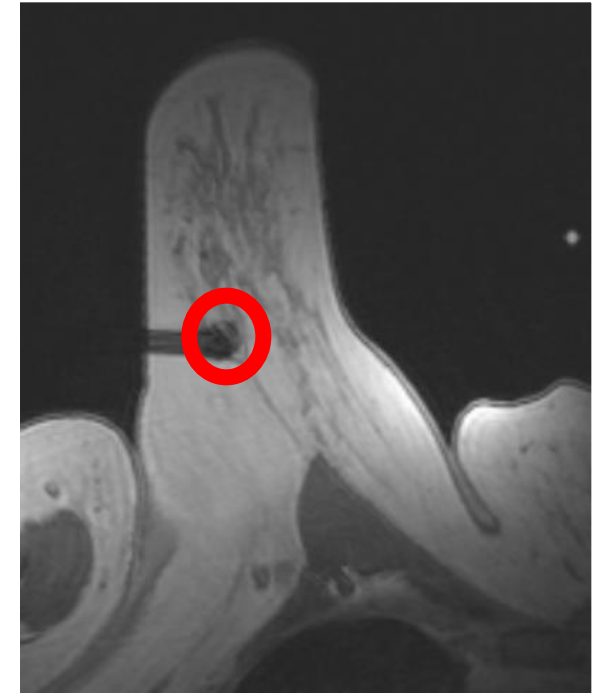
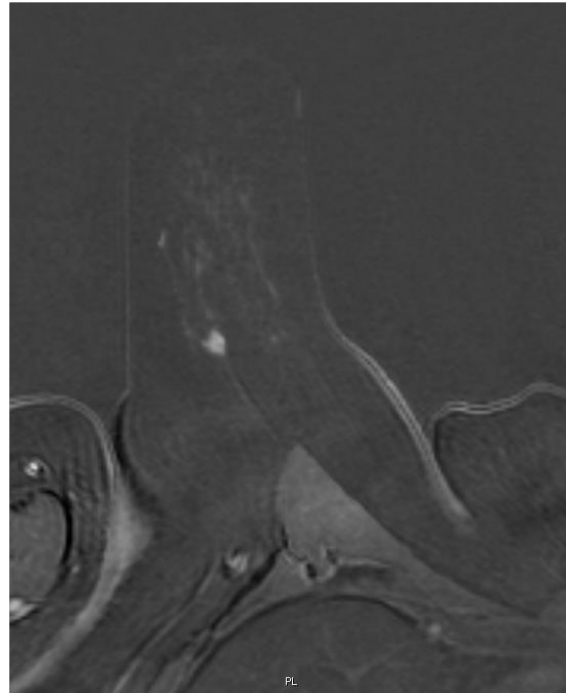
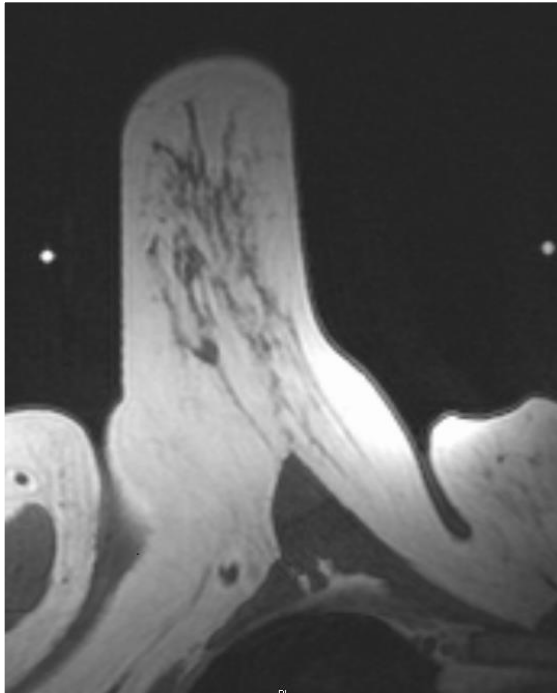
- Histology:
low grade
DCIS



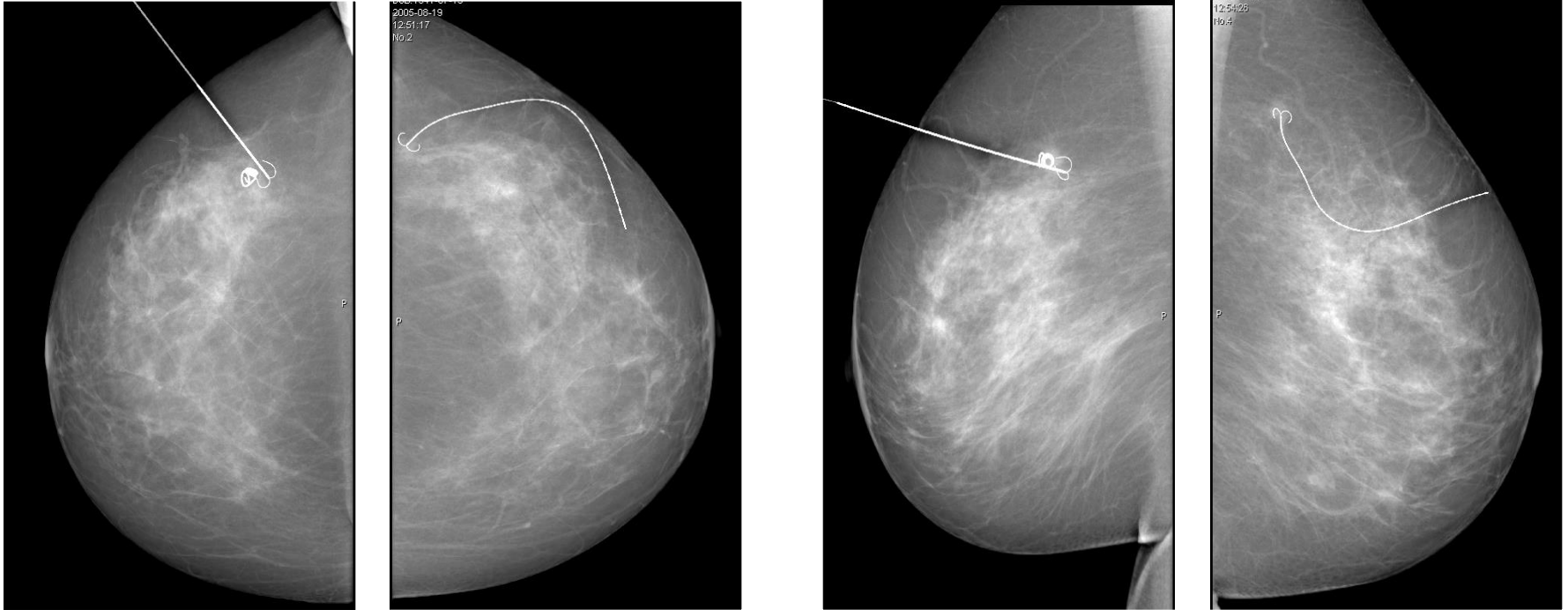
Malignancy of the lesions:

20-50%

- 64 y. old patient with MRI suspicious lesion of the right breast (had MRI for staging of known breast cancer left)



- MRI-guided Coil localization



- preoperative US-guided wire localization of the coil
- Histology: bilateral invasive ductal carcinoma



Lesions

- ▶ to near to the chest wall
- ▶ to medial
- ▶ to next to the areola
- ▶ to next to the skin



- ▶ not to see the lesion (because of compression)
- ▶ bleeding, infection
- ▶ no exact localization
- ▶ biopsy being not representative (0-15%)

Bahrs et al. 2014
Malhaire et al. 2010
Tozaki et al. 2009
Hauth et al. 2008



- Breast MRI is a valuable tool
- for breast cancer detection in case of
 - high risk patients
 - after BCT (scar / cancer recurrence)
 - equivocal Mx / US findings
- in case of breast cancer for
 - preoperative assessment
 - monitoring of neoadjuvant therapy
 - CUP

- MRI guided breast intervention should be performed for minimal invasive clarification of only MRI detectable suspicious lesions (vacuum-assisted biopsy should be preferred)

Thank you very much!

