Contrast enhanced mammography (CEM) and risk assessment

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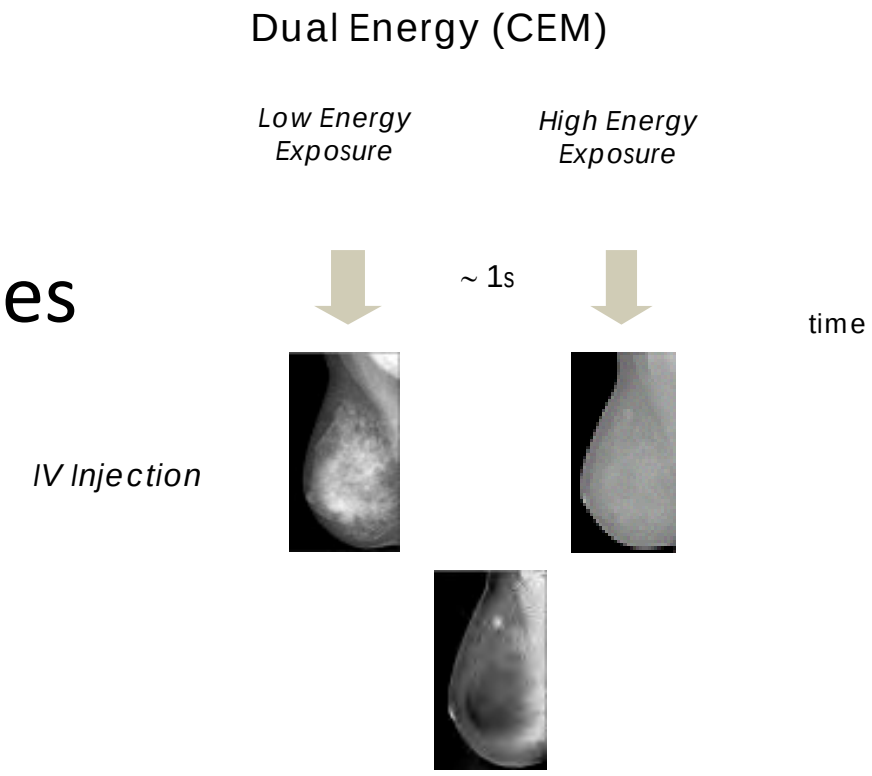
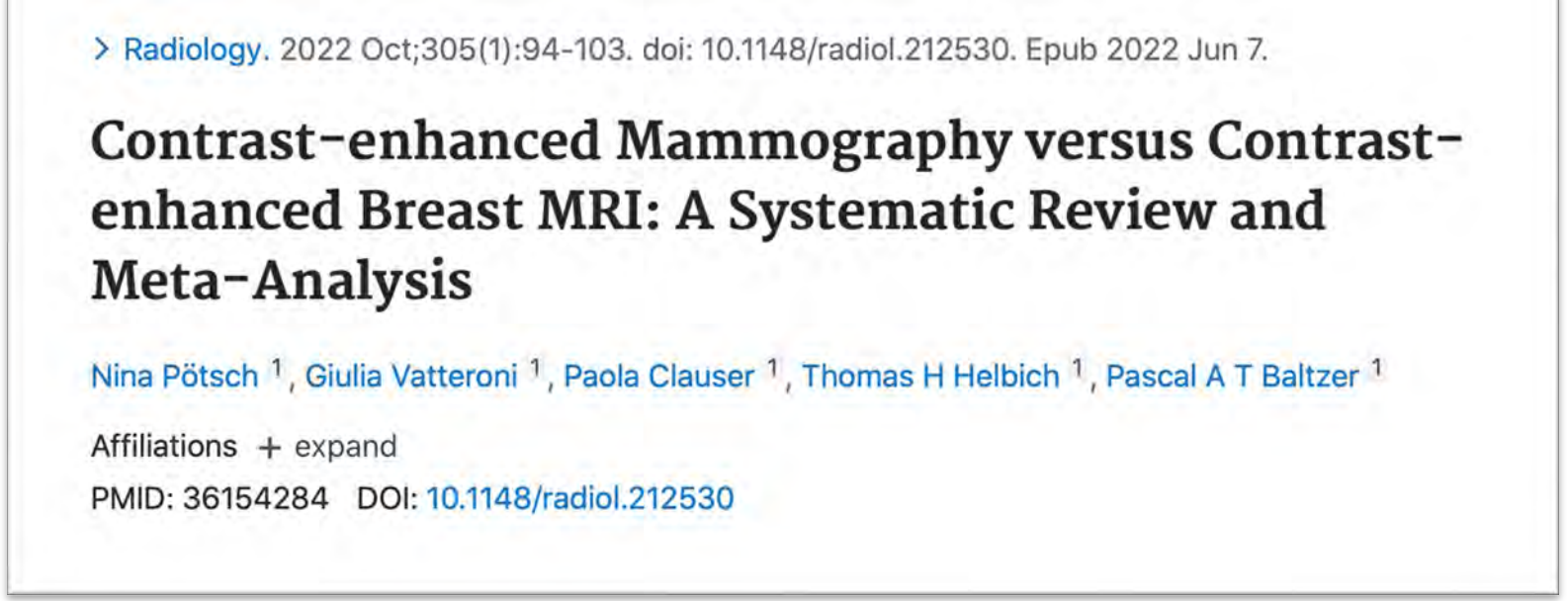
Contrast enhanced mammography

- Simple, dual-energy method
- I.v. iodine contrast
- High sens/spec in intitial, smaller studies





› Radiology. 2022 Oct;305(1):94-103. doi: 10.1148/radiol.212530. Epub 2022 Jun 7.

Contrast-enhanced Mammography versus Contrast-enhanced Breast MRI: A Systematic Review and Meta-Analysis

Nina Pötsch [1], Giulia Vatteroni [1], Paola Clauser [1], Thomas H Helbich [1], Pascal A T Baltzer [1]

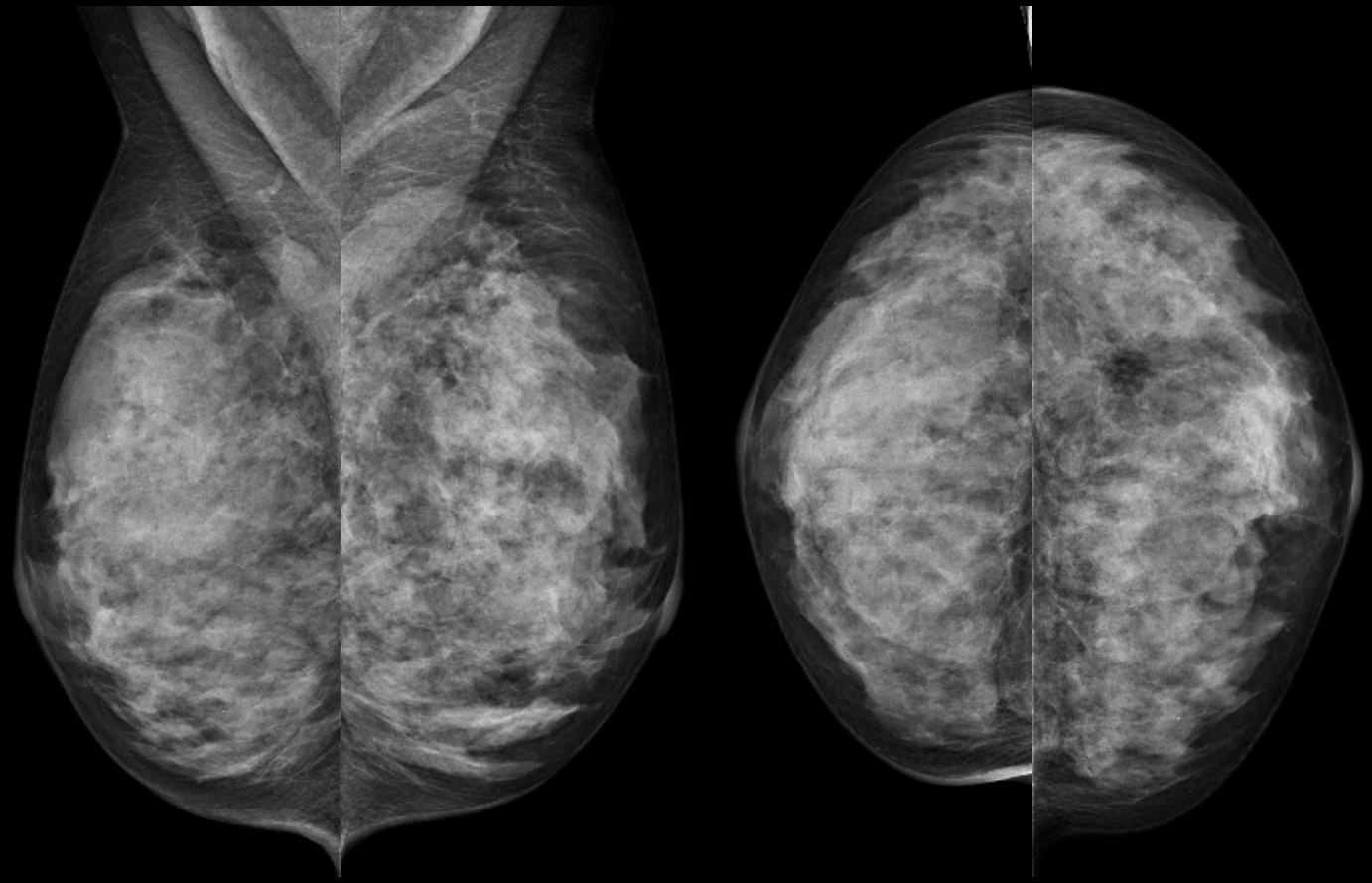
Affiliations + expand

PMID: 36154284 DOI: 10.1148/radiol.212530

- 7 studies investigating 1137 lesions (654 malignant, 483 benign) with an average cancer prevalence of 65.3%
- CE-MRI had higher sensitivity for breast cancer than CEM (97% [95% CI: 86, 99] vs 91% [95% CI: 77, 97], respectively; *P* < .001)
- CEM had lower specificity (69% [95% CI: 46, 85] vs 74% [95% CI: 52, 89]; *P* = .09).
- Conclusion: Contrast-enhanced MRI had superior sensitivity and negative likelihood ratios with higher pretest probabilities to rule out malignancy compared with contrast-enhanced mammography

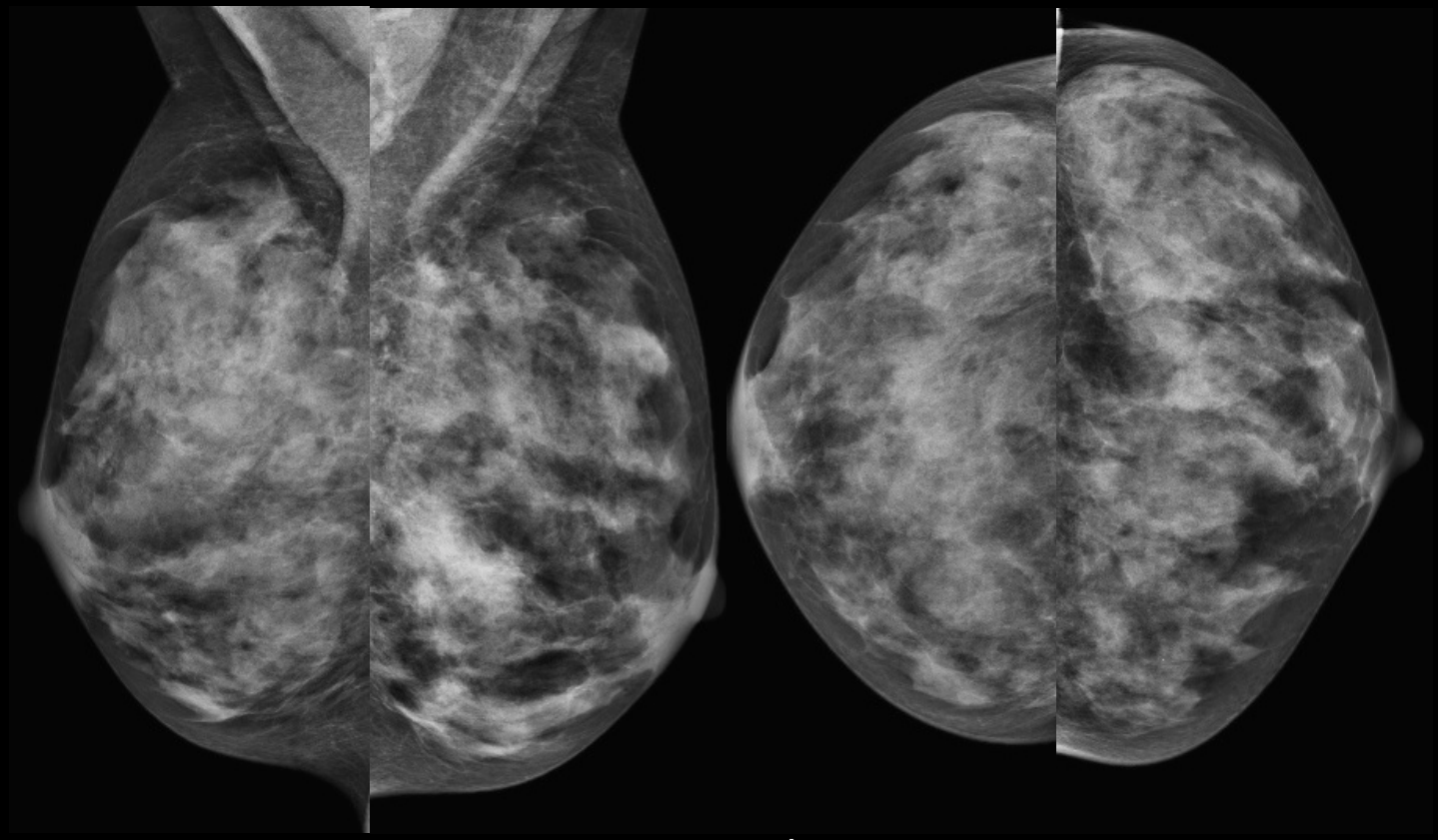
- Standardised reporting
- Many ongoing trials

Tumor not visible on MX

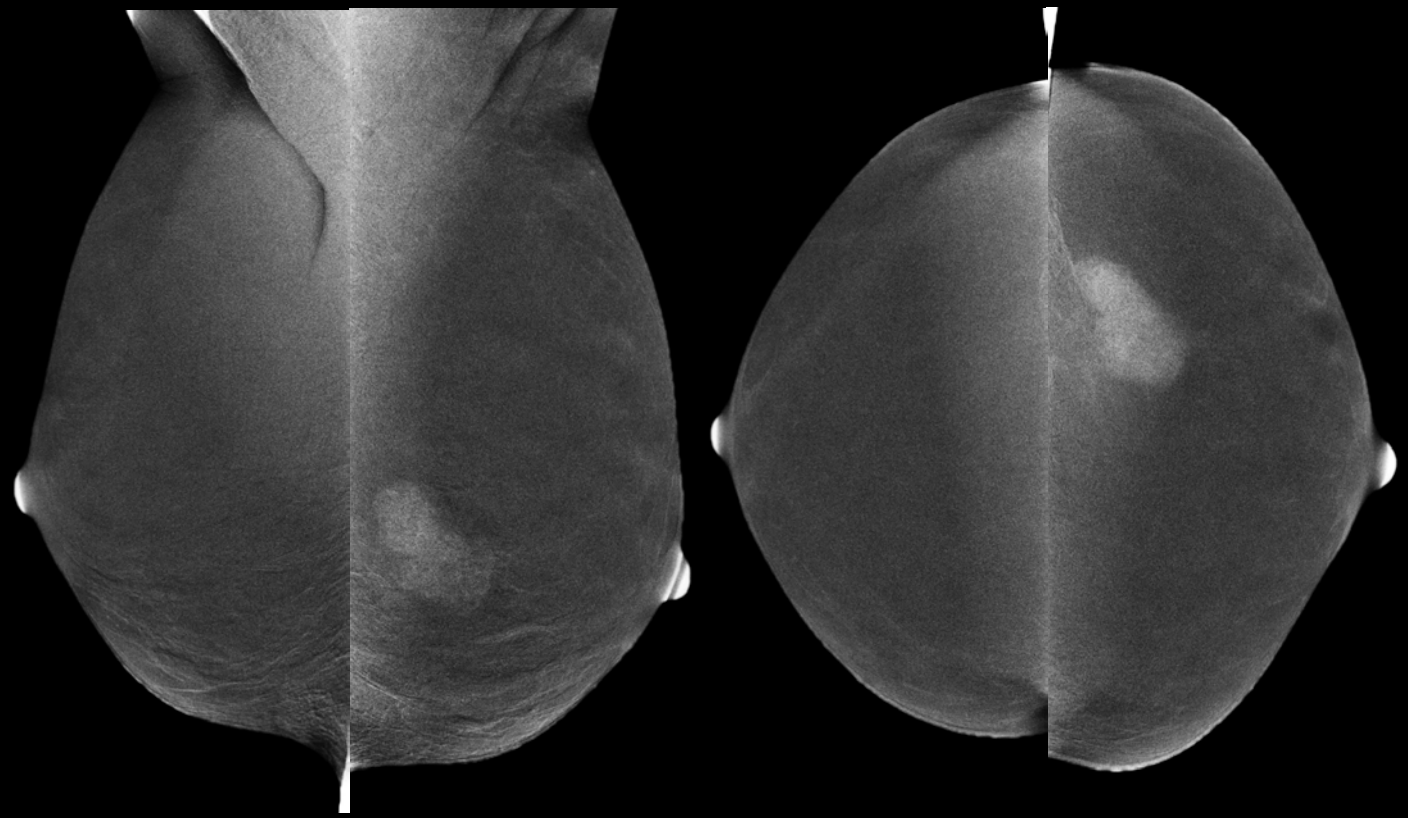


58 yrs, 3 cm palpable mass left breast

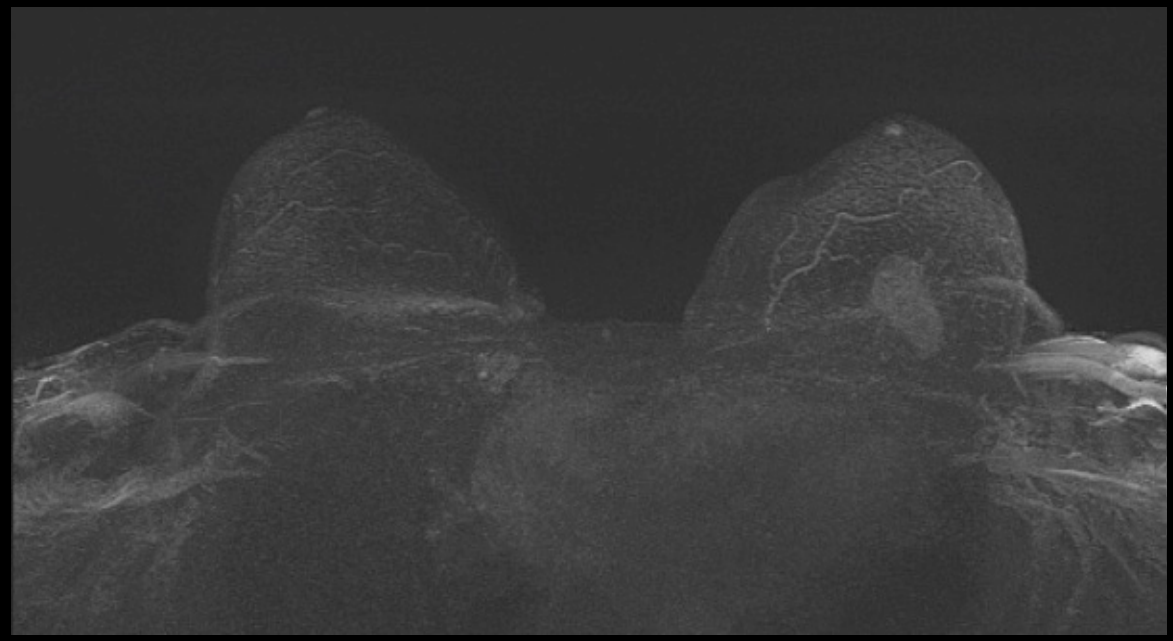
Standard mammography images



Low energy images



Subtraction images



Dynamic MRI MIP
images

	MRI	CEM
Radiation	No	Yes (+20-80% compared to DM)
Contrast media reactions	Less (0.001-0.01%)	More (0.2-0.4%)
Examination time	Longer (20-30 min)	Shorter (5-10 min)
Reading time	3-10 min	1-2 min
Cost	Higher	Lower
Availability	Limited	Good
Includes axilla and other local nodal stations	Yes	No
Timing menstrual cycle	Preferred?	No
		Women with contraindications to MRI
Biopsy possible	Yes (longer time)	Yes (shorter time, US or CM guided bx)

Jochelson and Lobbes. CEM – State of the art. Radiology 2021
Patel et al. AJR 2017
Fallenberg et al. Eur Radiol 2017

MRI versus CEM – cost (US)

TABLE 2: Summary of Cost Comparison of Mammography, MRI, and Contrast-Enhanced Digital Mammography (CEDM)

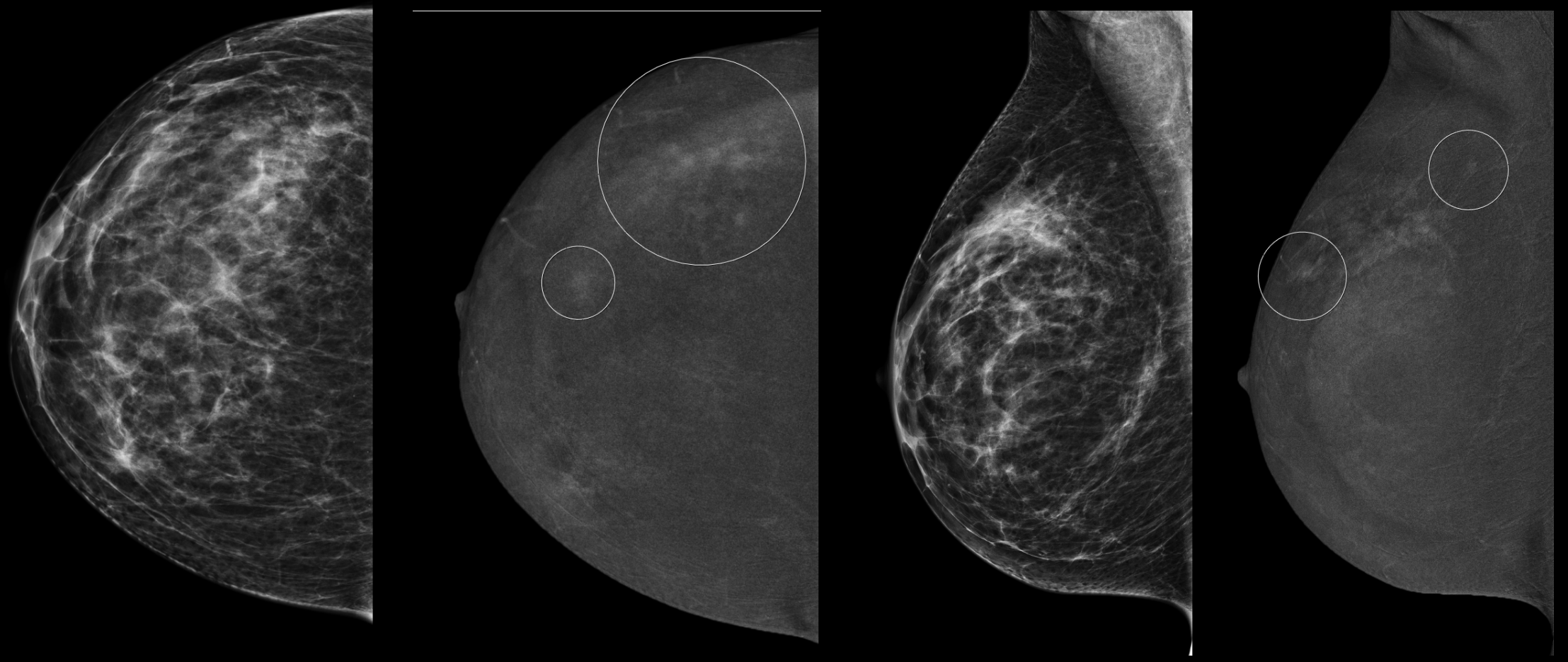
Charge	Screening			Diagnostic		
	FFDM	FFDM + MRI	CEDM	FFDM	MRI	CEDM
Screening FFDM	179.10	179.10				
Diagnostic FFDM			179.01	179.01		179.01
Breast MRI		586.10			586.10	
Breast MRI computer-assisted detection		150.00			150.00	
Gadolinium contrast agent		39.00			39.00	
Iodinated contrast agent			17.00			17.00
Total	179.10	954.20	196.01	179.01	775.10	196.01

Note—Values are U.S. dollars. FFDM = full-field digital mammography.

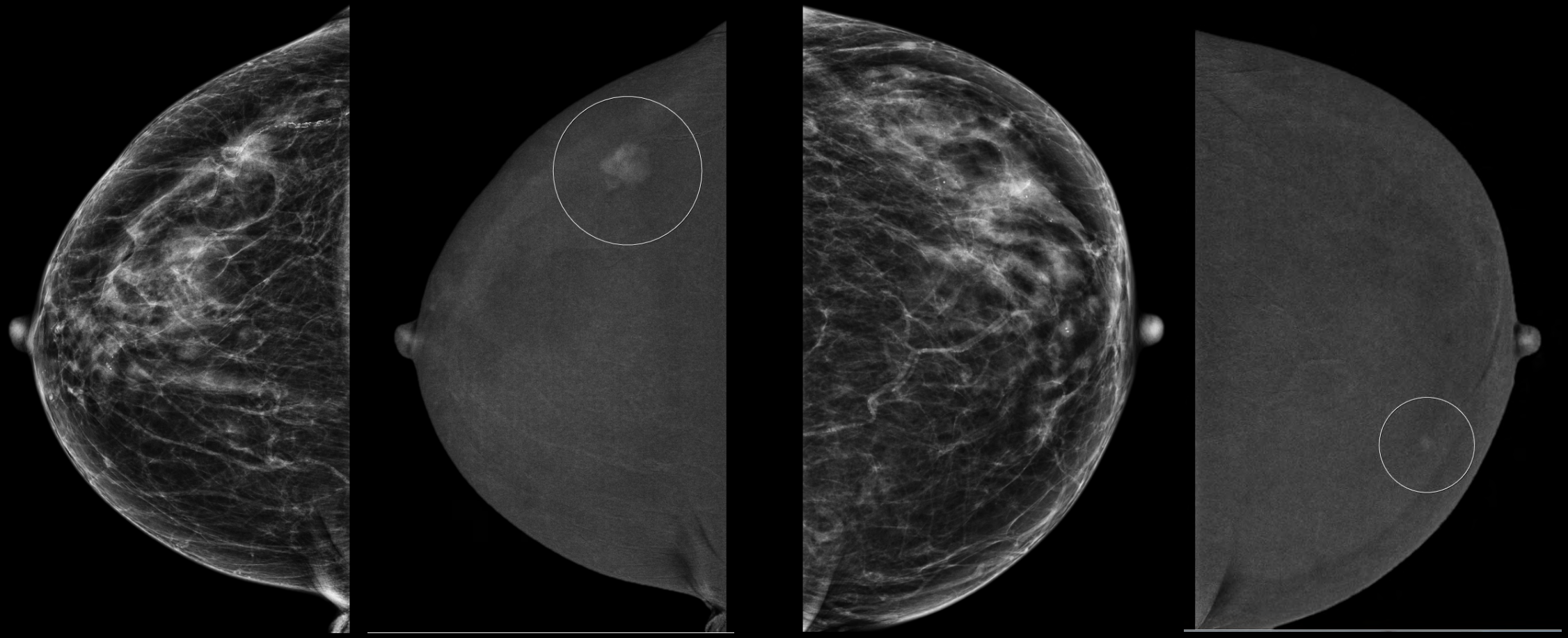
x 4

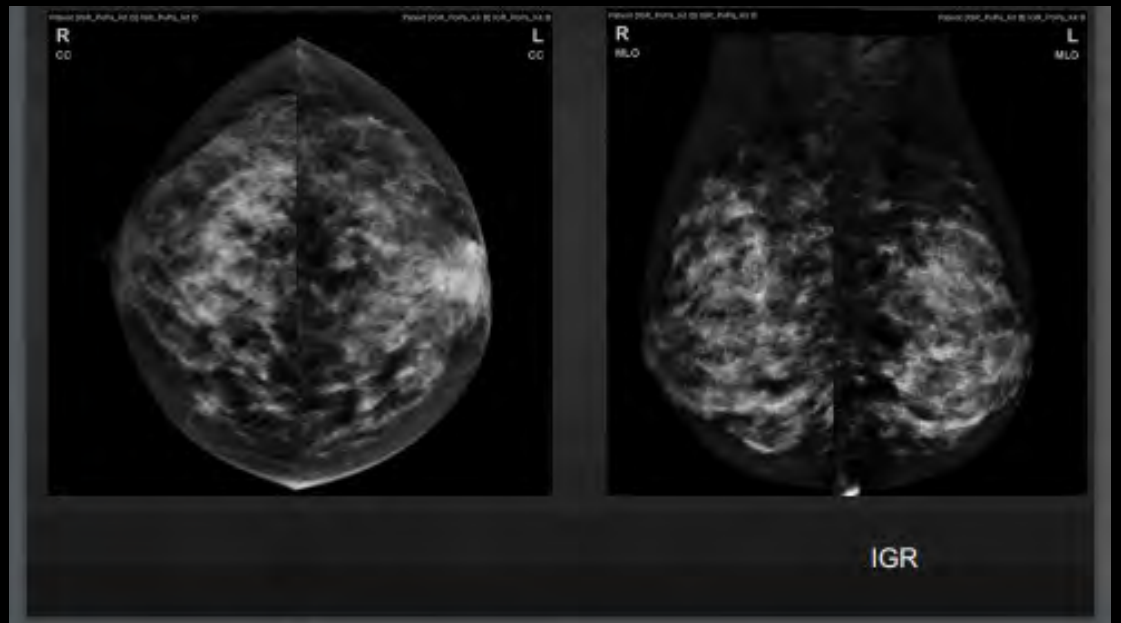
Patel et al. Potential Cost Savings of Contrast-Enhanced Digital Mammography. AJR 2017

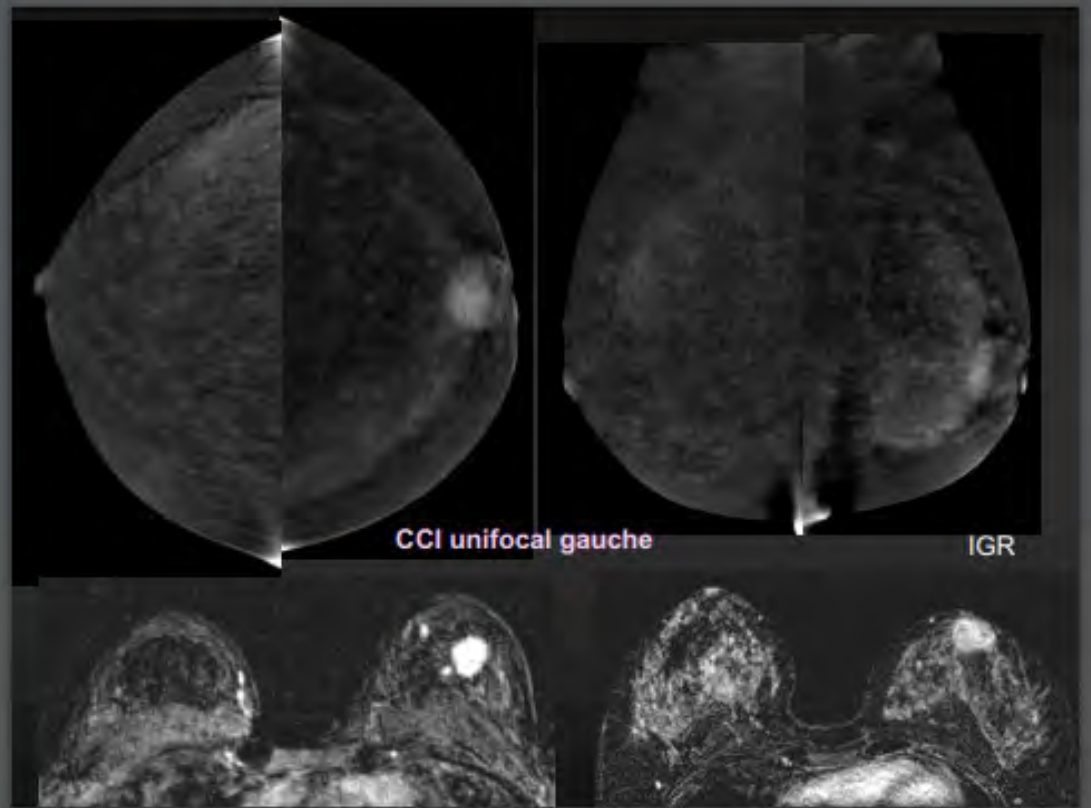
CEM –ipsilateral multifocal cancer



Confirmed breast cancer in right breast. Contralateral cancer detected with CEM







Specificity better with CEM?

- Unifocal retroareolar fibroadenoma left breast

- Small enhancing foci on MRI in the same breast, NOT enhanced in CEM. Benign!

Case courtesy: Dr A Athanasiou and Institut Gustave Roussy, Paris

CEM in risk populations?

- High risk

- Currently no evidence to support CEM

➢Radiation exposure, screening starts at younger age

➢Alternative for women who cannot do MRI

- Supplemental screening for women with high breast density or intermediate risk?
- Ongoing trials

Breast Screening – Risk Adaptive Imaging for Density Trial (BRAID, NCT04097366)
Contrast Enhanced Mammography Screening Trial (CMIST, NCT05625659)

van Nijnatten *et al*. Contrast-enhanced breast imaging: Current status and future challenges. EJR 2024

What’s on in Sweden?

Åhsberg *et al. World Journal of Surgical Oncology* (2020) 18:100
https://doi.org/10.1186/s12957-020-01865-0

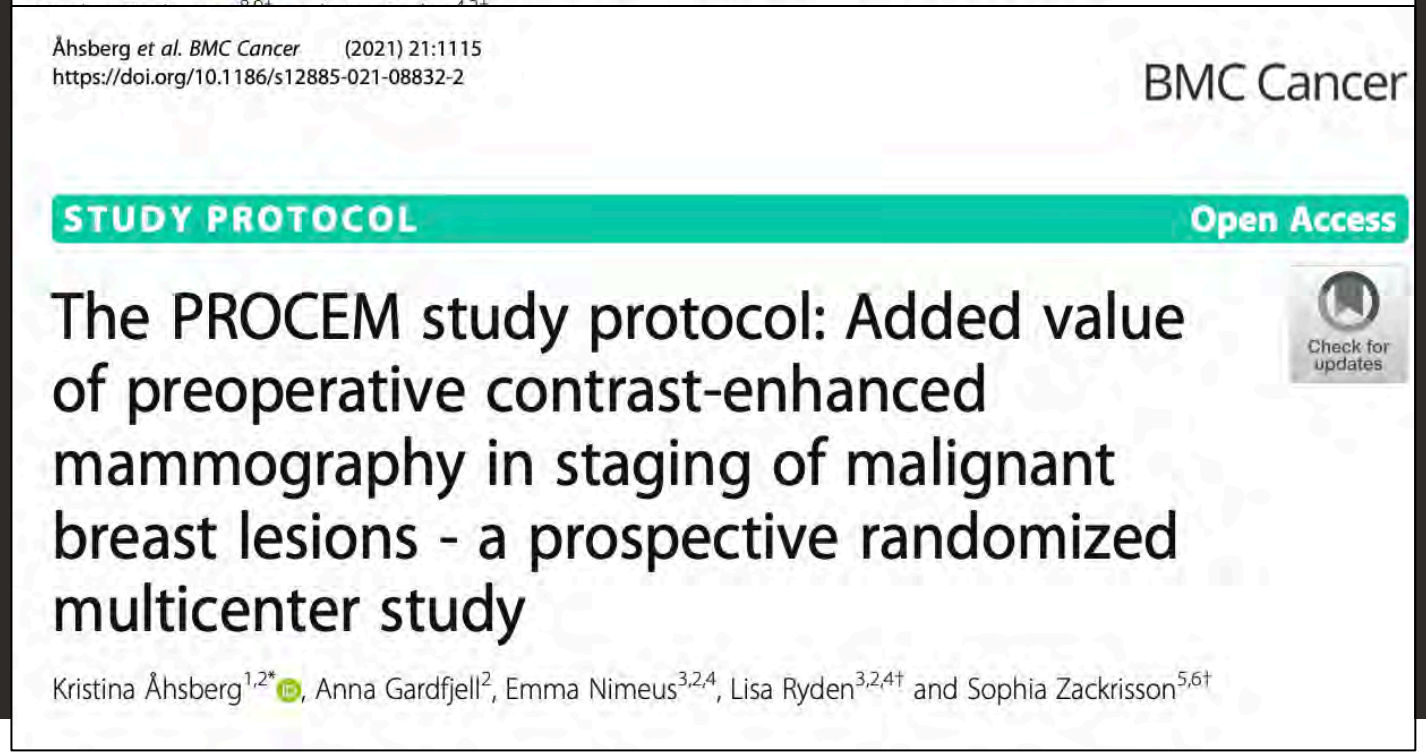
World Journal of Surgical Oncology

RESEARCH Open Access

Added value of contrast-enhanced mammography (CEM) in staging of malignant breast lesions—a feasibility study

Kristina Åhsberg[1,2*], Anna Gardfjell[3], Emma Nimeus[4,2,5], Rogvi Rasmussen[6], Catharina Behmer[7],

Pilot study, 50 patients



Åhsberg *et al. BMC Cancer* (2021) 21:1115
https://doi.org/10.1186/s12885-021-08832-2

BMC Cancer

STUDY PROTOCOL Open Access

The PROCEM study protocol: Added value of preoperative contrast-enhanced mammography in staging of malignant breast lesions - a prospective randomized multicenter study

Kristina Åhsberg[1,2*], Anna Gardfjell[2], Emma Nimeus[3,2,4], Lisa Ryden[3,2,4†] and Sophia Zackrisson[5,6†]

RCT 440 patients,
estimated completion Q2 2024

REGIONAL
CANCER CENTRE
STOCKHOLM GOTLAND

Karma Kontrast

- Women, either recalled after a screening mammography, or referred by a medical doctor, are invited to participate *if having a strong suspicion of a cancer*

- Women that consent are offered a contrast enhanced mammography (CEM)

- The overall aim is to study the added value of CEM when it comes to multifocality, ipsi- or contralateral breast cancers and *to prepare for SMART*

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STOCKHOLM MAMMOGRAPHY RISK

STRATIFIED TRIAL

YOUR BREAST CANCER RISK

YOUR SCREENING

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REGIONAL CANCER CENTRE STOCKHOLM GOTLAND

SMART
Din bröstcancerrisk
Din screening

Overall aim of **SMART**

- *Test if individualized breast cancer screening is better than current age based screening practice in reducing mortality from breast cancer*

- *Proxy response variables*
  - *Interval cancer*
  - *Stage distribution*

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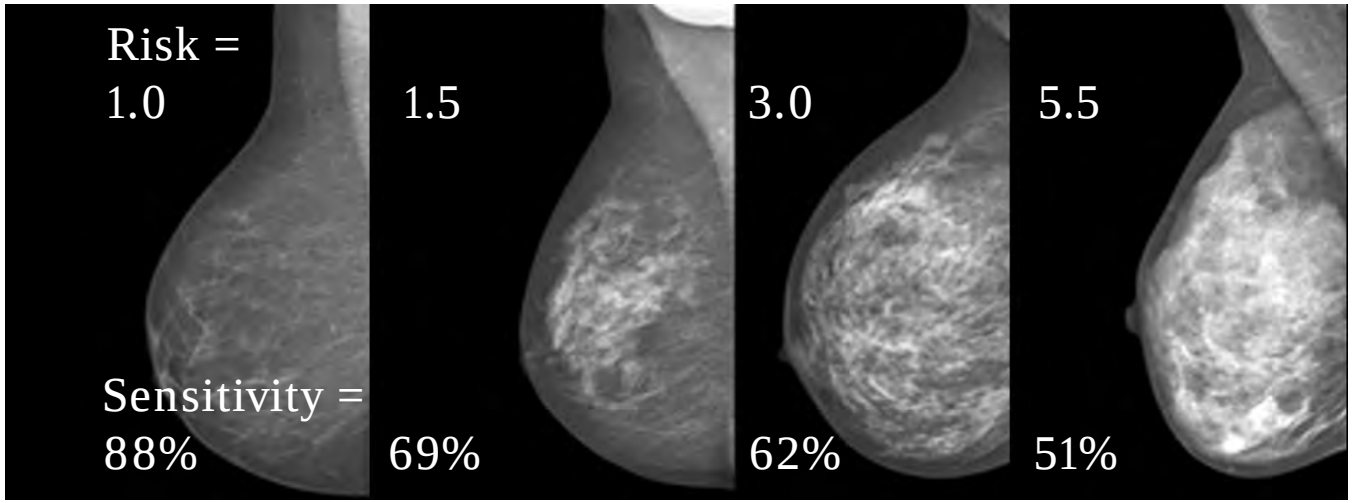
REGIONAL CANCER CENTRE STOCKHOLM GOTLAND

SMART
Din bröstcancerrisk
Din screening

Breast cancer screening in Sweden

- All women between 40 and 74 years of age are invited for screening every second year



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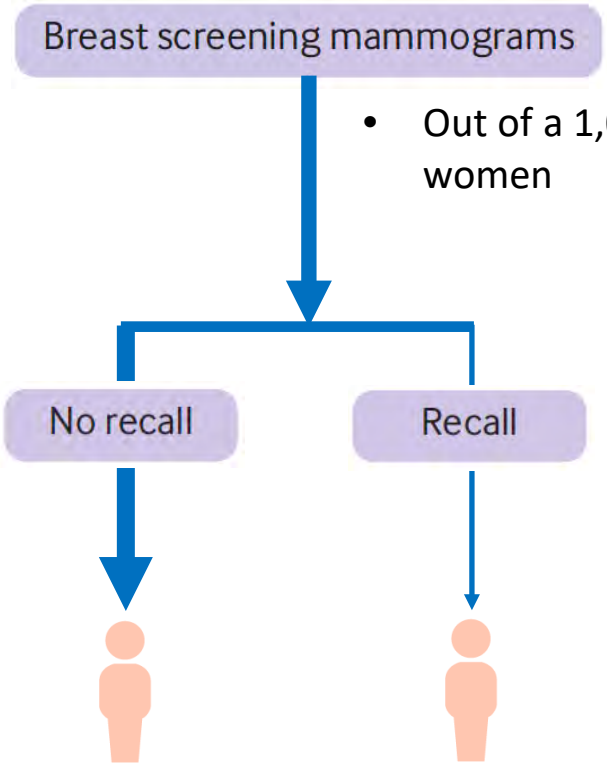
Breast cancer screening in Sweden

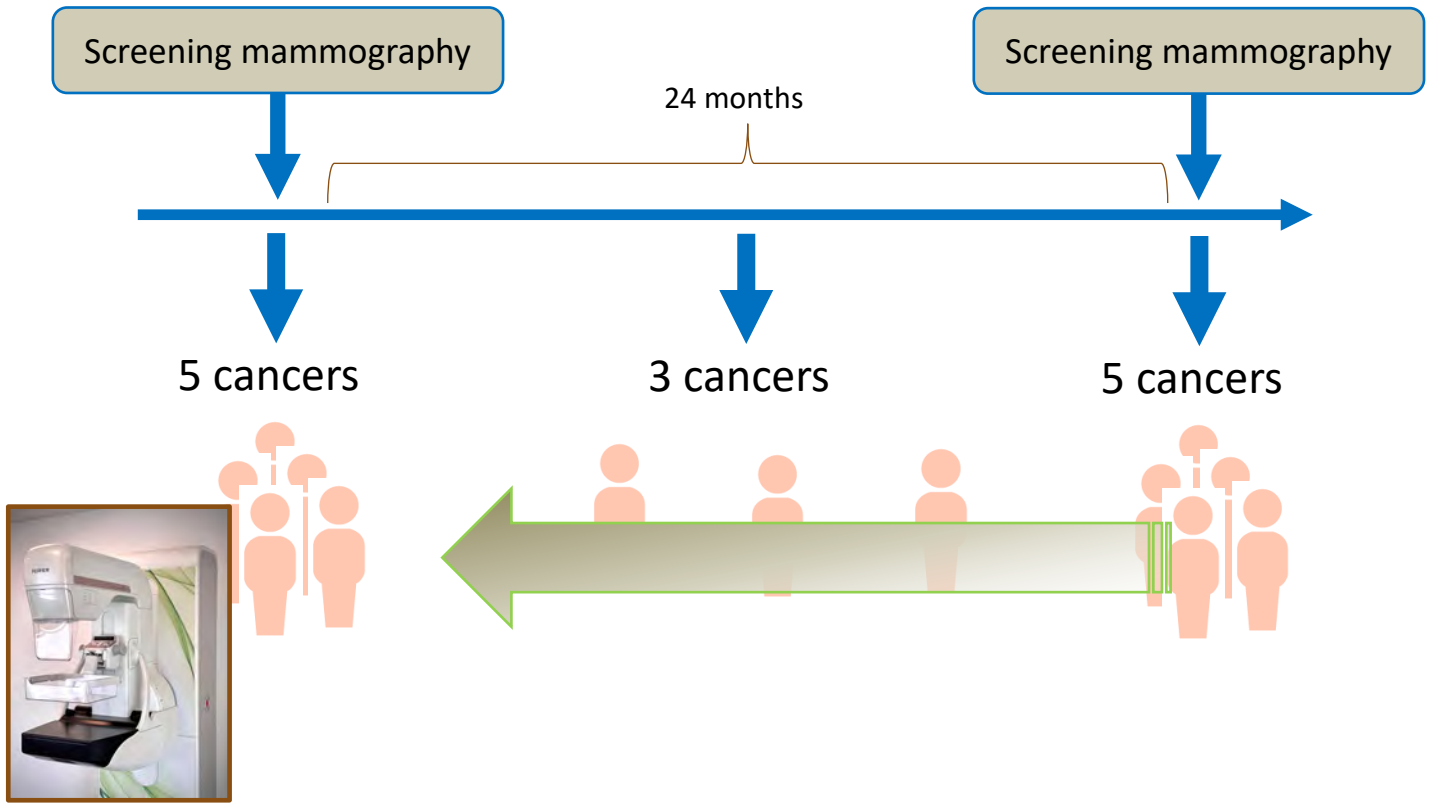


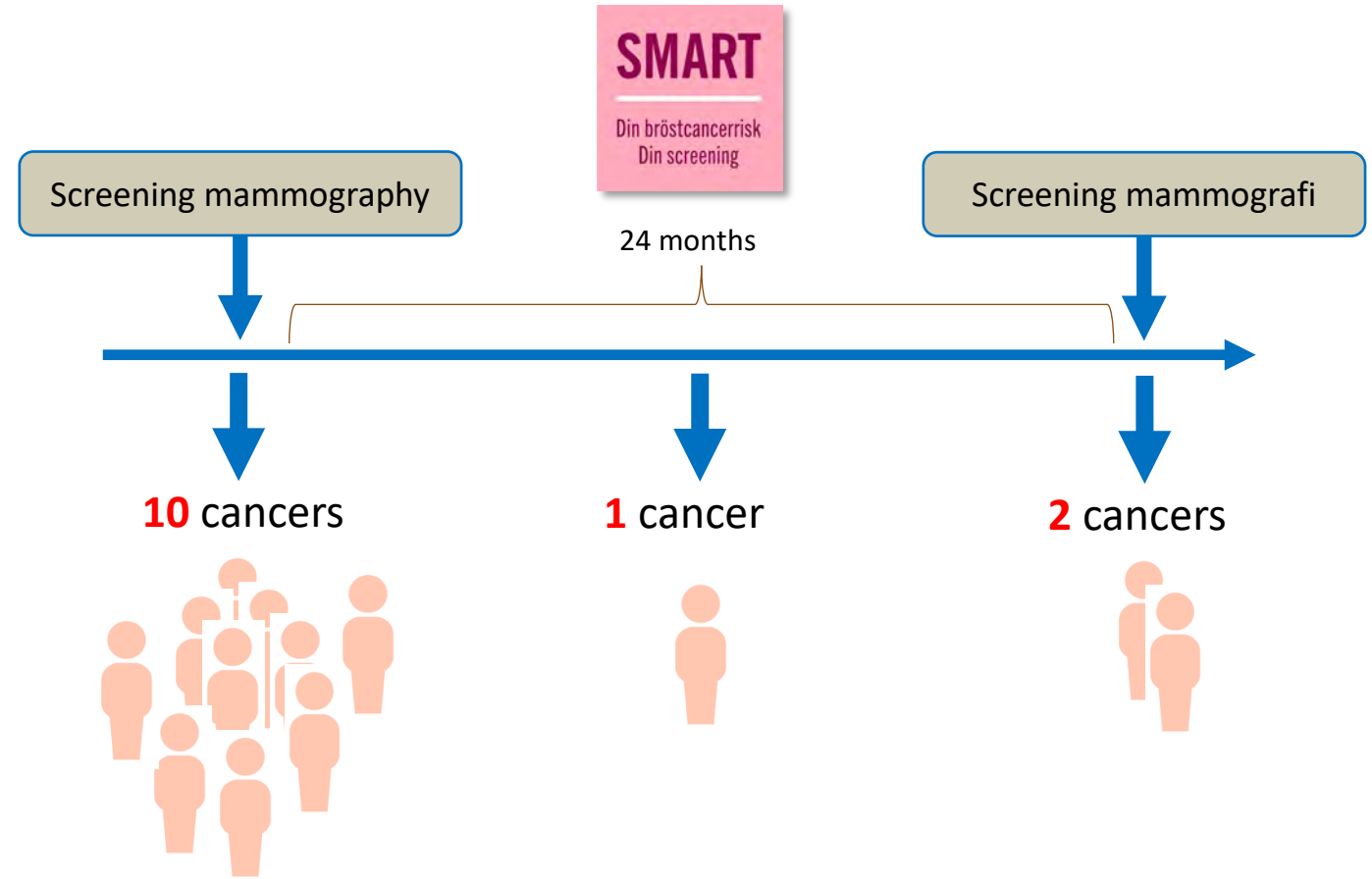
- Out of a 1,000 women

- ≈ 970 women are sent home with a negative mammogram
- **≈ 8 women are diagnosed with breast cancer before or at next screen**

- ≈ 30 women are recalled
- ≈ 15 women are biopsied
- ≈ 5 women are diagnosed with cancer

TODAY


Screening mammography
Screening mammography
24 months
5 cancers
3 cancers
5 cancers



More cancers detected in an earlier curable state

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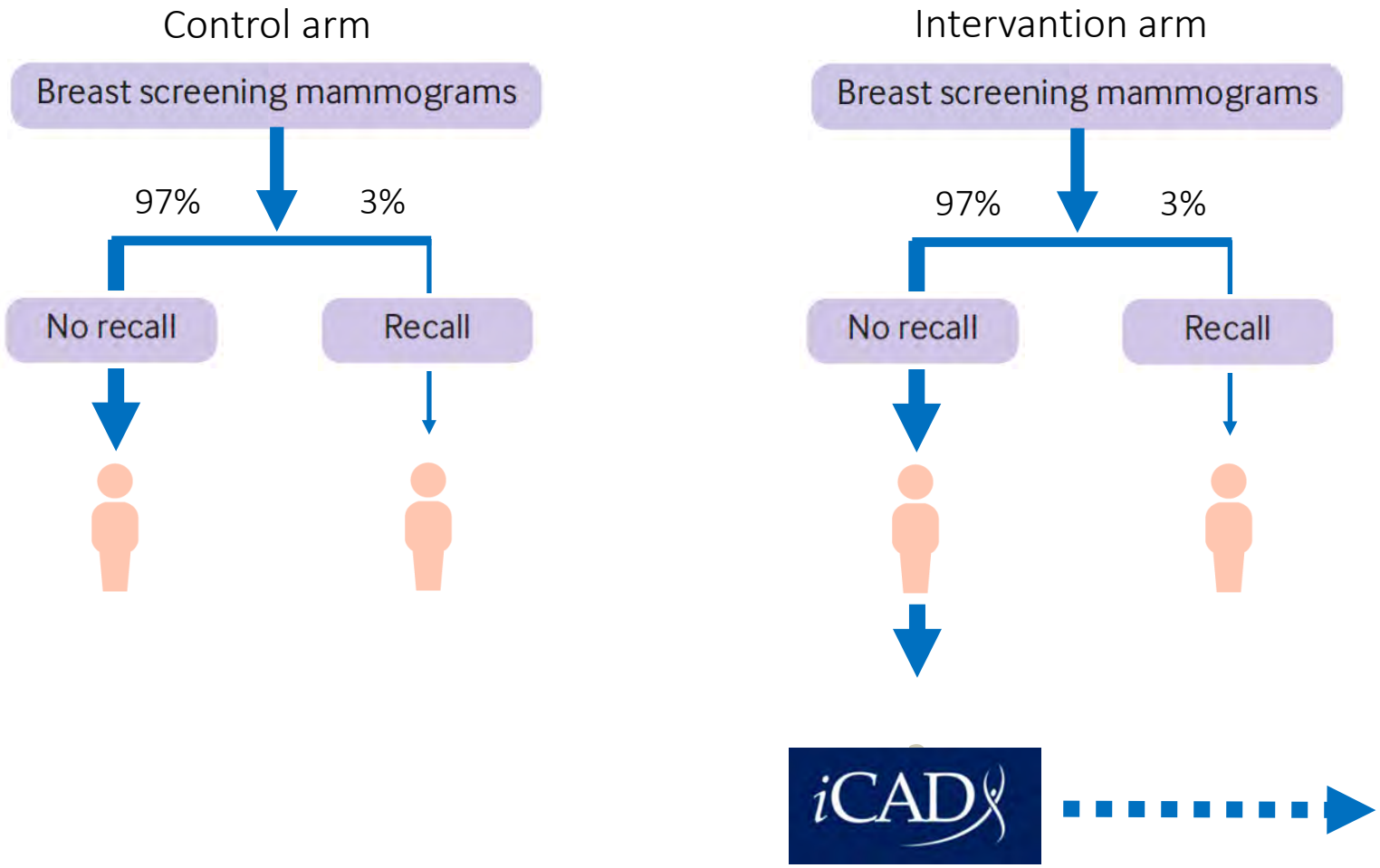
SMART – Stockholm Mammography Risk stratified Trial



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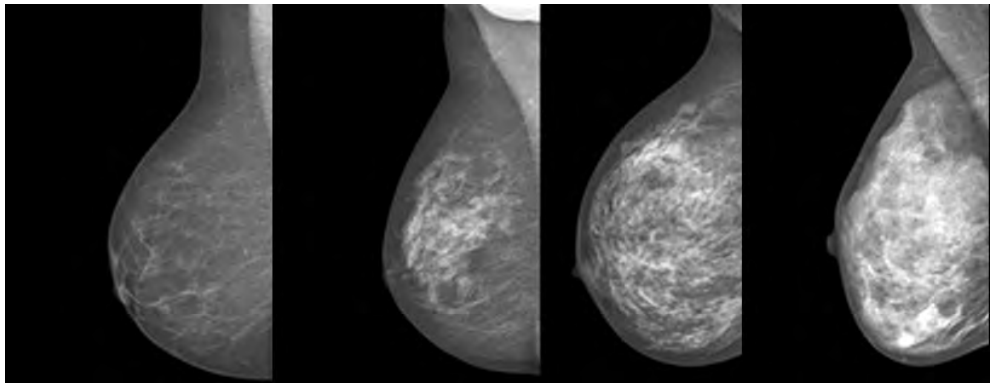
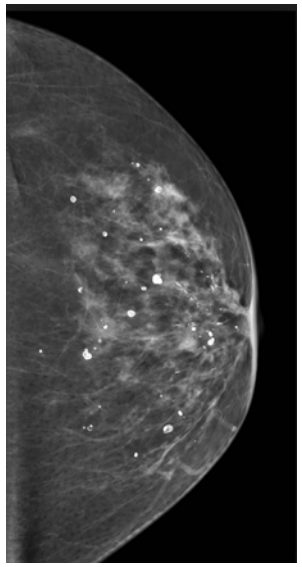
The Karma Risk Model – Profound AI Risk

2-year risk model that predicts the likelihood of being diagnosed with a cancer before or at next screen

Mammographic density, left – right asymmetry



Microcalcifications, masses, left – right asymmetry



Additional variables: BMI, age, family history, hormone replacement therapy, alcohol, tobacco

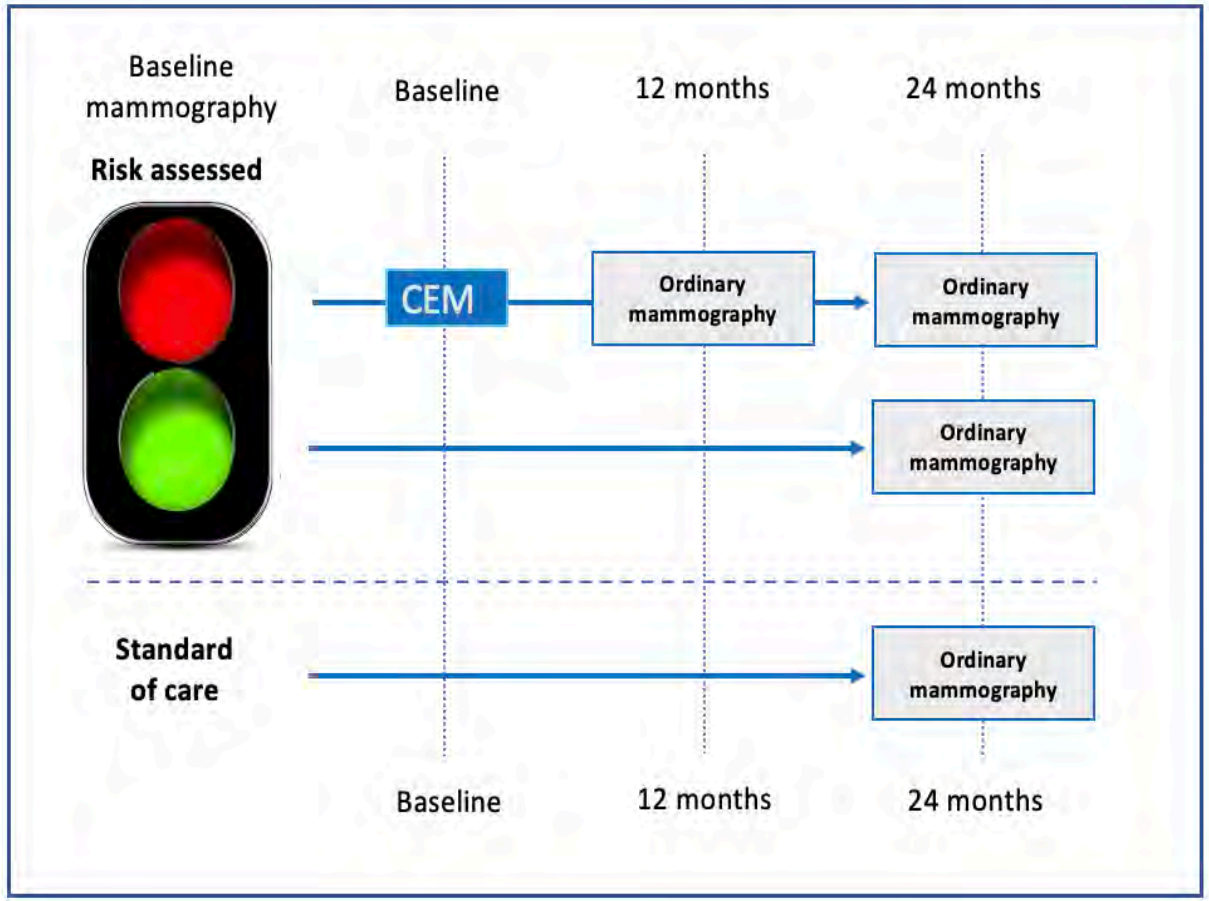
ProFound AI Risk, 2-year risk model

Risk Stratification

Risk groups	Model 3	Absolute 2-year risk (%)	Relative risk
0 - 0.15 (low)	27	0.09	0.3
0.15 - 0.6 (general)	48	0.29	1.0 (ref)
0.6 - 1.6 (moderate)	17	0.87	3.0
≥1.6 (high)	8	2.70	9.4

SMART

Din bröstcancerrisk
Din screening



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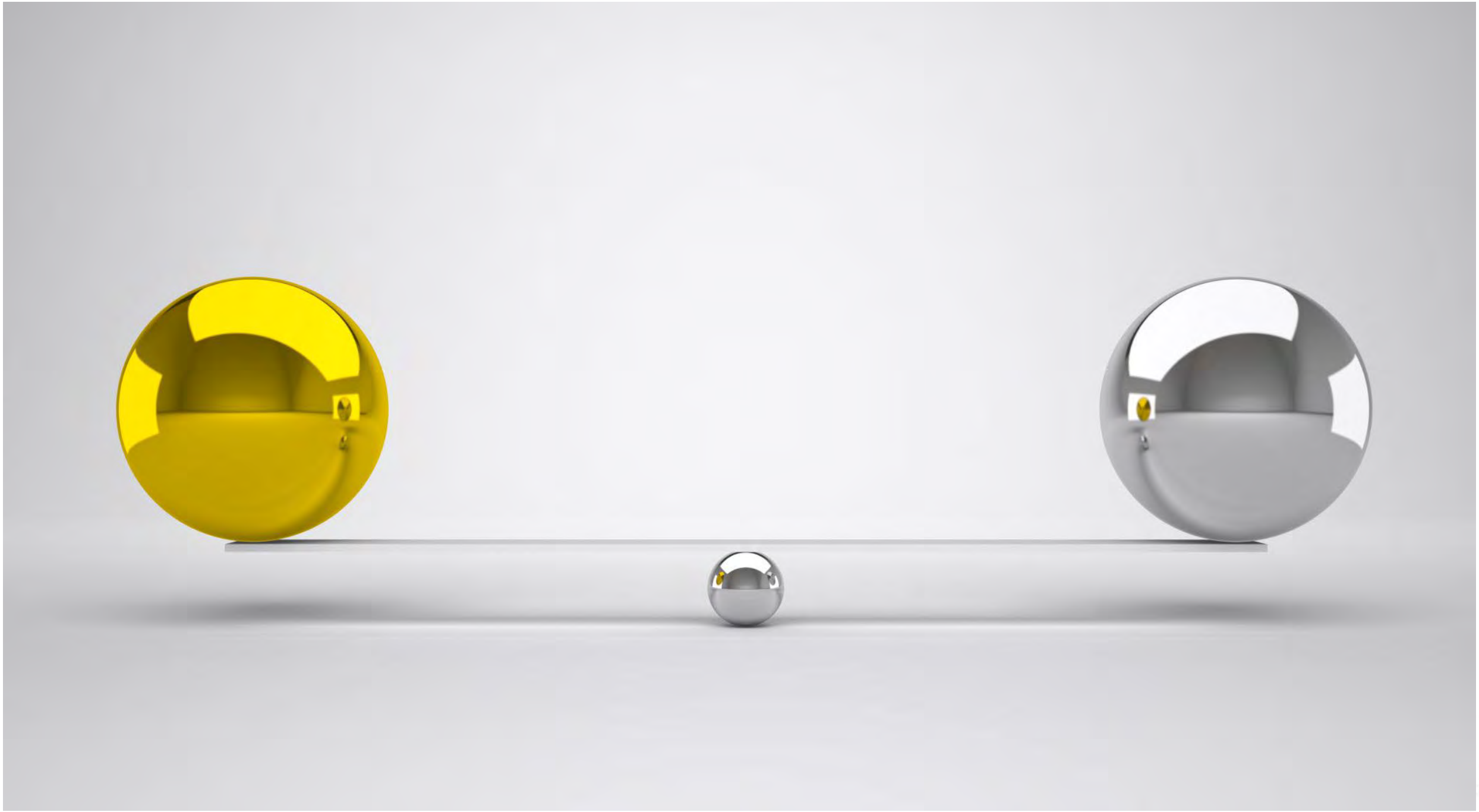

Take-home messages

- CEM is a promising alternative to CE-MRI in certain situations
- Problem solving tool
- Women with contra-indications for MRI
- Intermediate risk screening in a future personalized screening scenario?
- Evaluation of pre-operative treatemnt effects
- No evidence for high-risk screening

- Professor Per Hall, Karolinska institutet, Stockholm, Sweden
- Dr Paola Clauser, Medical University of Vienna, Austria


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