Guidelines Breast
Version 2025.1D

FORSCHEN
LEHREN
HEILEN

Früherkennung und Diagnostik

Früherkennung und Diagnostik

- **Versionen 2005 - 2024:**

  Albert / Blohmer / Fallenberg / Fersis / Gerber / Heil / Junkermann / Kühn / Maass / Müller-Schimpfle / Scharl / Schreer / Wöckel

- **Version 2025:**

  Fallenberg / Thomssen

Screened data bases

Pubmed	2018 - 2024
Medline	2018 - 2024
Cochrane	2018 - 2024

Guidelines

S3 Diagnostik, Therapie und Nachsorge des Mammakarzinoms:

1. Wöckel A, Festl J, Stüber T et al. Interdisciplinary Screening, Diagnosis, Therapy and Follow-up of Breast Cancer. Guideline of the DGGG and the DKG (S3-Level, AWMF Registry Number 032/045OL, December 2017) - Part 1 with Recommendations for the Screening, Diagnosis and Therapy of Breast Cancer. Geburtshilfe Frauenheilkd. 2018 Oct;78(10):927-948. doi: 10.1055/a-0646-4522. Epub 2018 Oct 19.
2. Wöckel A, Festl J, Stüber T et al.Interdisciplinary Screening, Diagnosis, Therapy and Follow-up of Breast Cancer. Guideline of the DGGG and the DKG (S3-Level, AWMF Registry Number 032/045OL, December 2017) - Part 2 with Recommendations for the Therapy of Primary, Recurrent and Advanced Breast Cancer. Geburtshilfe Frauenheilkd. 2018 Nov;78(11):1056-1088. doi: 10.1055/a-0646-4630. Epub 2018 Nov 26.

European Commission Initiative on Breast Cancer (ECIBC)

European guidelines on breast cancer screening and diagnosis
https://healthcare-quality.jrc.ec.europa.eu/european-breast-cancer-guidelines
2015 ACS Update Breast Cancer Screening for women at average risk
IARC Handbook 2016
European Commission 2016
(http://ecibc.jrc.ec.europa.eu/recommendations/list/3;Update 24.11.2016, Abruf 20122016)
Screened: Metaanalyses/ Systematic reviews / RCT / Cohort studies

Früherkennung bei asymptomatischen Frauen durch Mammographie

Alter	Intervall (Monate)	Oxford LOE	Oxford GR	AGO
• < 40	na	-	-	--
• 40-44				
• normales Risiko	na	1b	B	-
• moderat erhöhtes Risiko oder Eigenanamnese*	na	1b	B	+/-
• 45-49#	24-36	1a	A	+#
• 50-75**	24	1a	A	++
• > 75***	24	4	C	+/-

* Siehe Empfehlungen der Strahlenschutzkommission, außer INFP (intensiviertes Früherkennungsprogramm) siehe Kapitel 02.
** Nationales Mammographie-Screening-Programm.
***Abhängig von Gesundheitszustand + Lebenserwartung (> 10 Jahre).
Rechtfertigende Indikation ist notwendig, solange Bundesmantelvertrag (Screening) nicht angepasst.

1. Bennett A, Shaver N, Vyas N et al. Screening for breast cancer: a systematic review update to inform the Canadian Task Force on Preventive Health Care guideline. Syst Rev. 2024 Dec 19;13(1):304.
2. European Commission Initiative on Breast Cancer (ECIBC): European guidelines on breast cancer screening and diagnosis (https://cancer-screening-and-care.jrc.ec.europa.eu/en/ecibc/european-breast-cancer-guidelines) Download 15.01.2025
3. Spear G, Lee K, DePersia A et al. Updates in Breast Cancer Screening and Diagnosis. Curr Treat Options Oncol. 2024 Nov;25(11):1451-1460.
4. Thomassin-Naggara I, Kilburn-Toppin F, Athanasiou A et al; EUSOBI Board. Misdiagnosis in breast imaging: a statement paper from European Society Breast Imaging (EUSOBI)-Part 1: The role of common errors in radiology in missed breast cancer and implications of misdiagnosis. Eur Radiol. 2024 Nov 15.
5. Thomassin-Naggara I, Kilburn-Toppin F, Athanasiou A et al; EUSOBI Board. Misdiagnosis in breast imaging: a statement paper from European Society Breast Imaging (EUSOBI)-Part 2: Main causes of errors in breast imaging and recommendations from European Society of Breast Imaging to limit misdiagnosis. Eur Radiol. 2024 Nov 15.
6. Trentham-Dietz A, Chapman CH, Jayasekera J et al. Breast Cancer Screening With Mammography: An Updated Decision Analysis for the U.S. Preventive Services Task Force [Internet]. Rockville (MD): Agency for Healthcare Research and Quality (US); 2024 Apr.

Report No.: 23-05303-EF-2.

7. Jayasekera J, Stein S, Wilson OWA et al. Benefits and Harms of Mammography Screening in 75 + Women to Inform Shared Decision-making: a Simulation Modeling Study. J Gen Intern Med. 2024 Feb;39(3):428-439.
8. Expert Panel on Breast Imaging; Brown A, Lourenco AP, Niell BL et al. ACR Appropriateness Criteria® Transgender Breast Cancer Screening. J Am Coll Radiol. 2021 Nov;18(11S):S502-S515.
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10. Oeffinger KC, Fontham ET, Etzioni R et al.; American Cancer Society. Breast Cancer Screening for Women at Average Risk: 2015 Guideline Update From the American Cancer Society. JAMA. 2015 Oct 20;314(15):1599-614. doi: 10.1001/jama.2015.12783. Erratum in: JAMA. 2016 Apr 5;315(13):1406.
11. Schünemann HJ, Lerda D, Quinn C et al. Breast Cancer Screening and Diagnosis: A Synopsis of the European Breast Guidelines. Annals of Internal Medicine. 2020;172(1):46-56.
12. Zielonke N, Kregting LM, Heijnsdijk EAM et al. The potential of breast cancer screening in Europe. International journal of cancer Journal international du cancer. 2021;148(2):406-18.
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14. Mao Z, Nystrom L, Jonsson H. Breast cancer screening with mammography in women aged 40-49 years: Impact of length of screening interval on effectiveness of the program. Journal of medical screening. 2020:969141320918283.
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19. Dibden A, Offman J, Duffy SW, et al. Worldwide Review and Meta-Analysis of Cohort Studies Measuring the Effect of Mammography Screening Programmes on Incidence-Based Breast Cancer Mortality. Cancers (Basel). 2020;12(4).
20. de Munck L, Siesling S, Fracheboud J, et al. Impact of mammographic screening and advanced cancer definition on the percentage of advanced-stage cancers in a steady-state breast screening programme in the Netherlands. Br J Cancer. 2020;123(7):1191-7.

Breast Cancer: Age Specific New Cancer Cases

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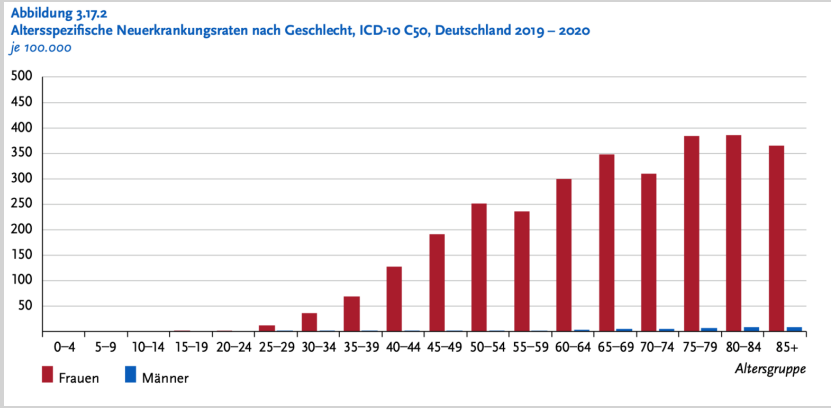
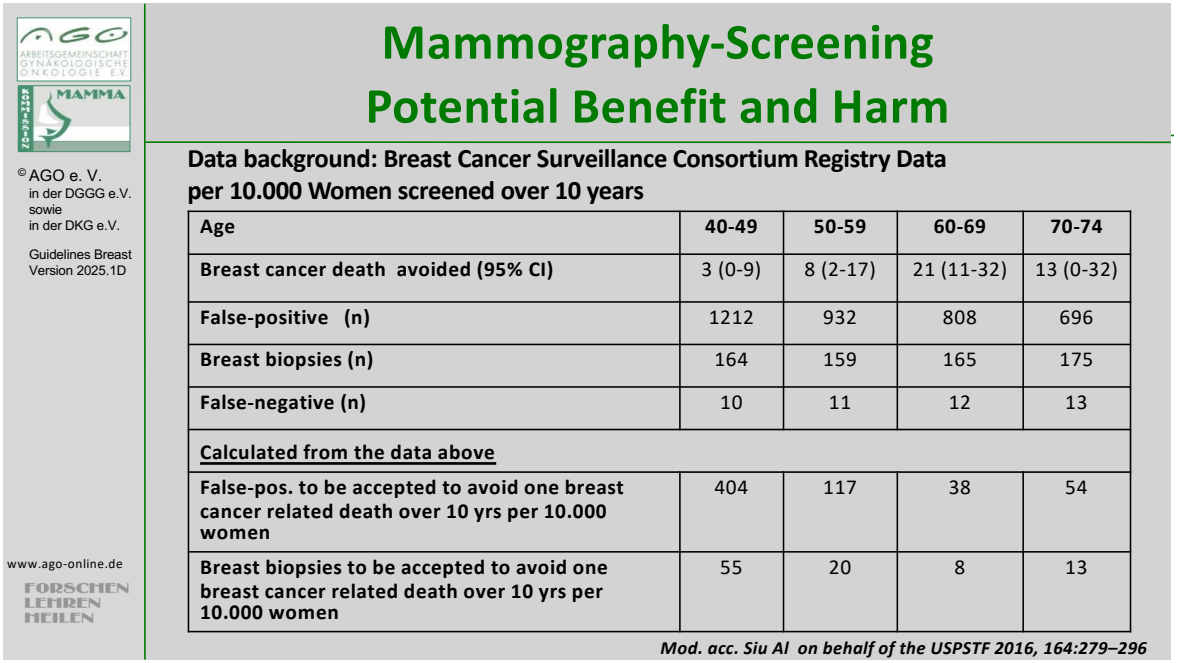


From:https://www.krebsdaten.de/Krebs/DE/Content/Publikationen/Krebs_in_Deutschland/kid_2023/kid_2023_c50_brust.pdf?__blob=publicationFile; download Dec 13, 2024



Mammography-Screening
Potential Benefit and Harm

Data background: Breast Cancer Surveillance Consortium Registry Data
per 10.000 Women screened over 10 years

Age	40-49	50-59	60-69	70-74
Breast cancer death avoided (95% CI)	3 (0-9)	8 (2-17)	21 (11-32)	13 (0-32)
False-positive (n)	1212	932	808	696
Breast biopsies (n)	164	159	165	175
False-negative (n)	10	11	12	13
Calculated from the data above				
False-pos. to be accepted to avoid one breast cancer related death over 10 yrs per 10.000 women	404	117	38	54
Breast biopsies to be accepted to avoid one breast cancer related death over 10 yrs per 10.000 women	55	20	8	13

Mod. acc. Siu Al on behalf of the USPSTF 2016, 164:279–296

1. Siu AL, on behalf of the U.S. Preventive Services Task Force. Screening for Breast Cancer: U.S. Preventive Services Task Force Recommendation Statement. Ann Internal Med 2016 vol 164: 279-296.
2. Sicsic J, Pelletier-Fleury N, Moumjid N. Women's Benefits and Harms Trade-Offs in Breast Cancer Screening: Results from a Discrete-Choice Experiment. Value Health. 2018 Jan;21(1):78-88.

SSK Recommendation Moderate Risk

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Women with moderate risk increase from the age of 40: Moderate risk defined as a personal risk of disease of 15% to 29% (depending, for example, on the number and age of diseased family members, histologically proven risk lesions)

Imaging modality	Grade of recommondation	Comment
Mammography	Primary examination	Individually adapted approach (depending on individual risk analysis, taking into account the woman's preferences and objections); in the age group of 50-69 years: Consider participation in the early detection program (mammography screening) and complementary procedures after benefit-risk analysis
US	Primary examination	Consider annually (especially in the case of high breast density)
Breast MRI	Special procedures	Only consider if a malignant finding is not sufficiently to exclude with mammography and sonography. There is insufficient data available for the use of MRI as a primary early detection method in the intermediate risk group

Moderates Risiko berechnet nach Tyrer-Cuzick (QR-code)

Einfluß auf das Risiko haben auch z. B.: Alter, BMI, Brustdichte, frühere Brustbiopsien (Histologie), Vorerkrankungen (Ovarialkarzinom), Hormontherapie, Vorfahren (Ashkenazi Jewish), Alter bei Menarche, Alter bei erster Geburt.

www.ssk.de/SharedDocs/Beratungsergebnisse/DE/2019/2019-06-27Orientie.html
Download 02. Januar 2025

Früherkennung bei asymptomatischen Frauen
Tomosynthese, Endpunkt: Cancer Detection Rate

	Oxford		
	LOE	GR	AGO
▪ Digitale Tomosynthese (DBT ± SM)*	1a	A	+
▪ Ersatz der DM durch synthetische MG + DBT**	1a	A	++

Es muss immer auch der komplette Datensatz der Tomosyntheseschichten zur Beurteilung zur Verfügung stehen, die alleinige synthetische Mammographie ist nicht ausreichend.

* **Bisher keine signifikante Reduktion der Intervallkarzinome.**
Signifikant höhere Sensitivität, heterogene Spezifität und höhere Kosten [Gerät, Befunder, Archivierung] der digitalen Brust-Tomosynthese (DBT) im Vgl. zur digitalen Mammographie (DM).
** **Dosisreduktion durch Berechnung einer synthetischen Mammographie (SM) aus den Daten der DBT statt additiver DM.**

1. Expert Panel on Breast Imaging; Niell BL, Jochelson MS et al. ACR Appropriateness Criteria® Female Breast Cancer Screening: 2023 Update. J Am Coll Radiol. 2024 Jun;21(6S):S126-S143.
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6. Hofvind S, Hovda T, Holen ÅS et al. Digital Breast Tomosynthesis and Synthetic 2D Mammography versus Digital Mammography: Evaluation in a Population-based Screening Program. Radiology. 2018 Jun;287(3):787-794. doi: 10.1148/radiol.2018171361. Epub 2018 Mar 1.
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and mammography screening]. Radiologe. 2019 Jan;59(1):13-18. doi: 10.1007/s00117-018-0473-6. Review. German.
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9. Phi X-A, Tagliafico A, Houssami N et al. Digital breast tomosynthesis for breast cancer screening and diagnosis in women with dense breasts – a systematic review and meta-analysis. BMC Cancer201818:380; https://doi.org/10.1186/s12885-018-4263-3
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11. Caumo F, Montemezzi S, Romanucci G, et al. Repeat Screening Outcomes with Digital Breast Tomosynthesis Plus Synthetic Mammography for Breast Cancer Detection: Results from the Prospective Verona Pilot Study. Radiology. 2021;298(1):49-57.
12. Kleinknecht JH, Ciurea AI, Ciortea CA. Pros and cons for breast cancer screening with tomosynthesis - a review of the literature. Med Pharm Rep. 2020;93(4):335-41.
13. Giampietro RR, Cabral MVG, Lima SAM, et al. Accuracy and Effectiveness of Mammography versus Mammography and Tomosynthesis for Population-Based Breast Cancer Screening: A Systematic Review and Meta-Analysis. Sci Rep. 2020;10(1):7991.
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15. Alabousi M, Wadera A, Kashif Al-Ghita M, et al. Performance of Digital Breast Tomosynthesis, Synthetic Mammography and Digital Mammography in Breast Cancer Screening: A Systematic Review and Meta-Analysis. Journal of the National Cancer Institute. 2020.
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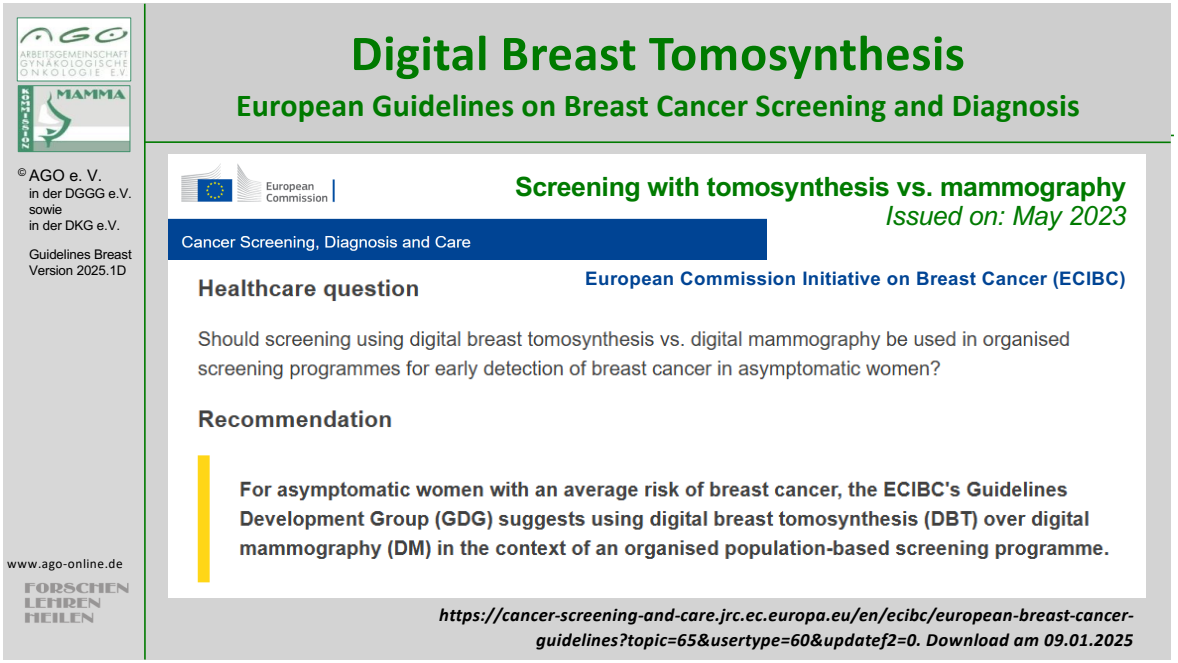

1. https://cancer-screening-and-care.jrc.ec.europa.eu/en/ecibc/european-breast-cancer-guidelines?topic=65&usertype=60&updatef2=0. Download am 09.01.2025

KI zur Detektion in der Mammadiagnostik

	Oxford		
	LOE	GR	AGO
KI im Screening			
Als Second Reader in der Mammographie	1b	B	+/-
Zur Workload-Reduktion (AI alleine)	2b	B	-
Stand alone oder als Second Reader in der Tomosynthese	2a	B	-

Einsatz von KI noch zu früh, Überlegenheit und Übertragbarkeit in die klinische Routine nicht bewiesen, Standardisierung fehlt. [Uwimana A et al. 2025, Al-Karawi D et al. 2024]

1. Uwimana A, Gnecco G, Riccaboni M. (2025) Artificial intelligence for breast cancer detection and its health technology assessment: A scoping review. Comput Biol Med. 2025 Jan;184:109391.
2. Al-Karawi D, Al-Zaidi S, Helael KA et al. Review of Artificial Intelligence in Breast Imaging. Tomography. 2024 May 9;10(5):705-726.
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Digital Breast Tomosynthesis: A Systematic Review and Meta-Analysis." Radiology 307(5): e222639.
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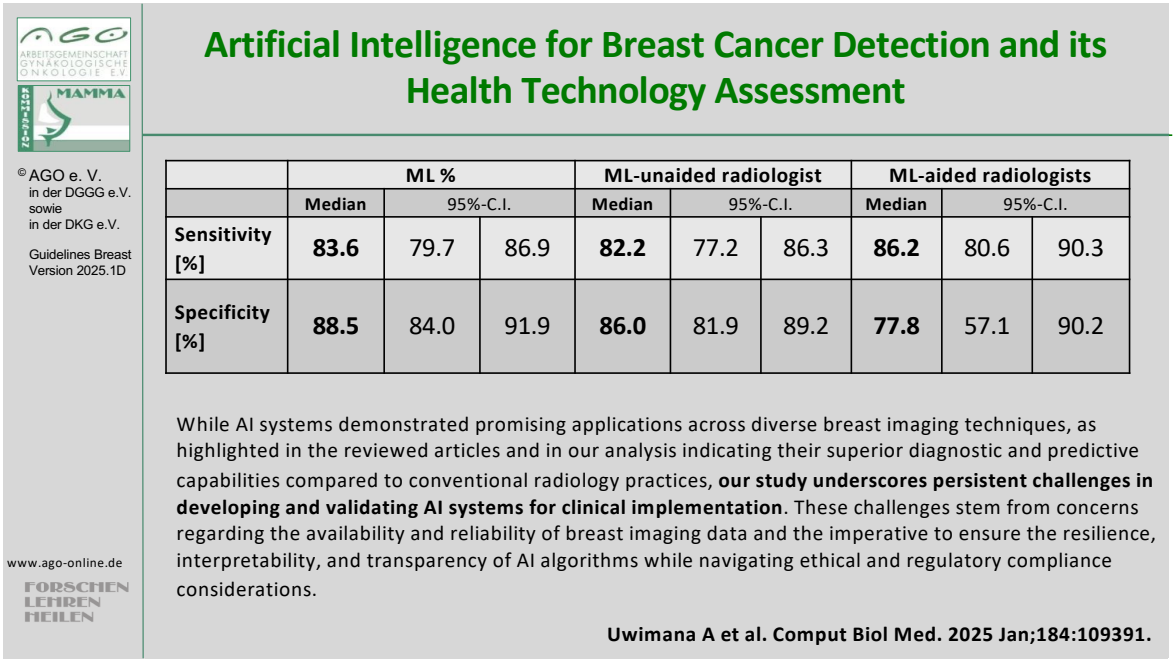
Workload-Reduction:

1. Raya-Povedano, J. L., S. Romero-Martín, E. Elías-Cabot, et al (2021). "AI-based Strategies to Reduce Workload in Breast Cancer Screening with Mammography and Tomosynthesis: A Retrospective Evaluation." Radiology 300(1): 57-65.
2. Lång, K., S. Hofvind, A. Rodríguez-Ruiz and I. Andersson (2021). "Can artificial intelligence reduce the interval cancer rate in mammography screening?" Eur Radiol 31(8): 5940-5947.



	ML %			ML-unaided radiologist			ML-aided radiologists		
	Median	95%-C.I.		Median	95%-C.I.		Median	95%-C.I.	
Sensitivity [%]	**83.6**	79.7	86.9	**82.2**	77.2	86.3	**86.2**	80.6	90.3
Specificity [%]	**88.5**	84.0	91.9	**86.0**	81.9	89.2	**77.8**	57.1	90.2

1. Uwimana A, Gnecco G, Riccaboni M. (2025) Artificial intelligence for breast cancer detection and its health technology assessment: A scoping review. Comput Biol Med. 2025 Jan;184:109391.

Früherkennung (normales oder moderates Risiko*) – Sonographie / MRT

	Oxford		
	LoE	GR	AGO
▪ **Screening-Mammasonographie alleine**	5	D	--
▪ Autom. 3D-Sonographie	3a	C	-
▪ **Mammasonographie als Ergänzung zur MG bei:**			
• Dichtem Parenchym (inhomogen dicht, extrem dicht)	2a	B	++
• Erhöhtem Risiko	1b	C	++
▪ **MRT bei neg. MG und extrem dichter Brust** 45-75 LJ**	1b	B	+

* Außer INFP (intensiviertes Früherkennungsprogramm).
** Definition von extrem dicht entspricht BIRADS-Dichtekategorie D, inhomogen dicht entspricht Kategorie C nach ACR BI-RADS Atlas 5. ed. 2013.

ACR Expert Panel

1. Expert Panel on Breast Imaging; Niell BL, Jochelson MS et al. ACR Appropriateness Criteria® Female Breast Cancer Screening: 2023 Update. J Am Coll Radiol. 2024 Jun;21(6S):S126-S143.

Ultrasound / Sonography

1. Ito T, Manabe H, Kubota M et al. Current status and future perspectives of contrast-enhanced ultrasound diagnosis of breast lesions. J Med Ultrason (2001). 2024 Oct;51(4):611-625.
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Recommendations International

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Früherkennung
Klinische Untersuchung (Clinical Breast Examination; CBE)

	Oxford		
	LoE	GR	AGO
Als alleinige Untersuchung			
▪ **Selbstuntersuchung (BSE)**	1a	B	-*
▪ **Klinische Brust-Untersuchung (CBE) außerhalb der Krebs-früherkennungsuntersuchung (KFU)**	1a	C	-*
▪ **Klinische Brust-Untersuchung (CBE) (im Rahmen der KFU)****	1a	B	++
▪ **Medizinisch-taktile Untersuchung durch Blinde / Sehbehinderte**	3b	C	-
CBE wegen klinisch- / mammo- / sonographischer Läsion	5	D	++
CBE in Kombination mit Bildgebung	1a	A	++

* Kann Brust-Bewusstsein erhöhen.
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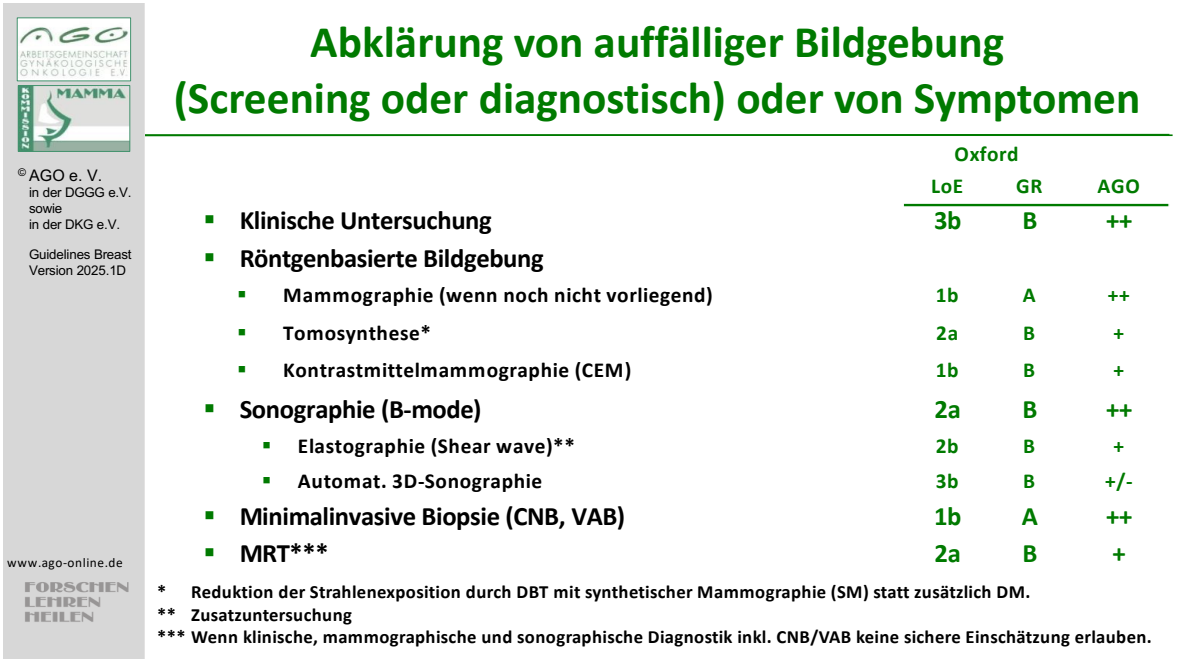

Abklärung von auffälliger Bildgebung (Screening oder diagnostisch) oder von Symptomen

	Oxford LoE	Oxford GR	AGO
▪ **Klinische Untersuchung**	**3b**	**B**	**++**
▪ **Röntgenbasierte Bildgebung**			
▪ Mammographie (wenn noch nicht vorliegend)	1b	A	++
▪ Tomosynthese*	2a	B	+
▪ Kontrastmittelmammographie (CEM)	1b	B	+
▪ **Sonographie (B-mode)**	**2a**	**B**	**++**
▪ Elastographie (Shear wave)**	2b	B	+
▪ Automat. 3D-Sonographie	3b	B	+/-
▪ **Minimalinvasive Biopsie (CNB, VAB)**	**1b**	**A**	**++**
▪ **MRT*** **	**2a**	**B**	**+**

* Reduktion der Strahlenexposition durch DBT mit synthetischer Mammographie (SM) statt zusätzlich DM.
** Zusatzuntersuchung
*** Wenn klinische, mammographische und sonographische Diagnostik inkl. CNB/VAB keine sichere Einschätzung erlauben.

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DM, DBT , US, MRI, CEM

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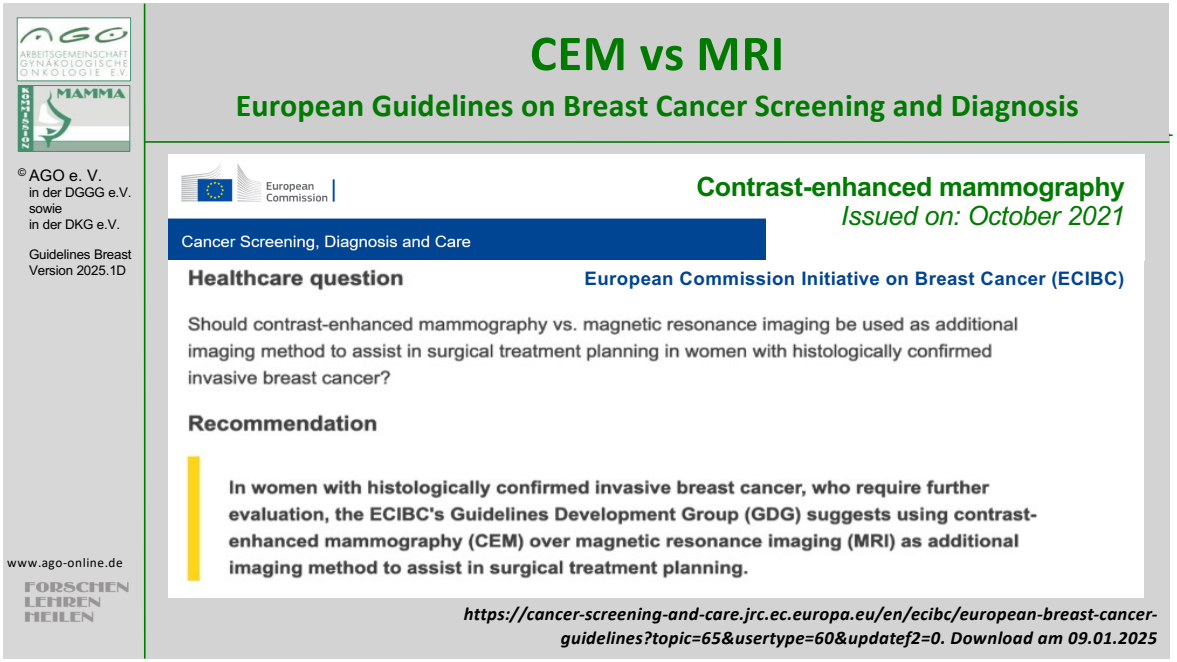

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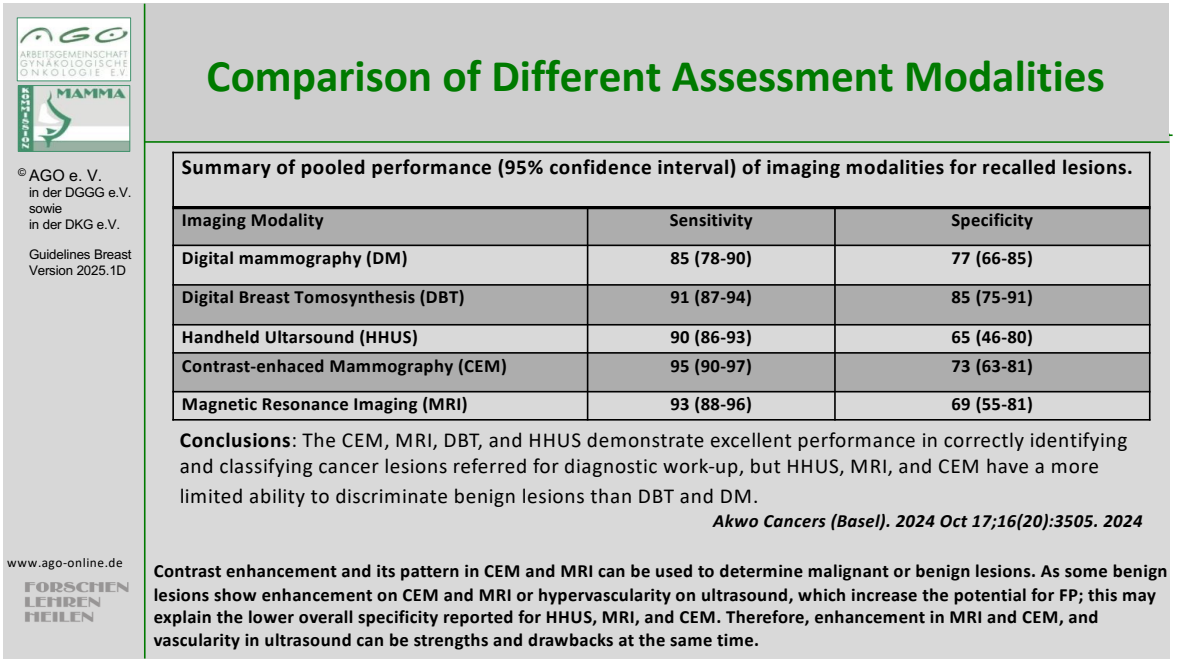

Comparison of Different Assessment Modalities

Summary of pooled performance (95% confidence interval) of imaging modalities for recalled lesions.

Imaging Modality	Sensitivity	Specificity
Digital mammography (DM)	85 (78-90)	77 (66-85)
Digital Breast Tomosynthesis (DBT)	91 (87-94)	85 (75-91)
Handheld Ultarsound (HHUS)	90 (86-93)	65 (46-80)
Contrast-enhaced Mammography (CEM)	95 (90-97)	73 (63-81)
Magnetic Resonance Imaging (MRI)	93 (88-96)	69 (55-81)

Conclusions: The CEM, MRI, DBT, and HHUS demonstrate excellent performance in correctly identifying and classifying cancer lesions referred for diagnostic work-up, but HHUS, MRI, and CEM have a more limited ability to discriminate benign lesions than DBT and DM.

Akwo Cancers (Basel). 2024 Oct 17;16(20):3505. 2024

Contrast enhancement and its pattern in CEM and MRI can be used to determine malignant or benign lesions. As some benign lesions show enhancement on CEM and MRI or hypervascularity on ultrasound, which increase the potential for FP; this may explain the lower overall specificity reported for HHUS, MRI, and CEM. Therefore, enhancement in MRI and CEM, and vascularity in ultrasound can be strengths and drawbacks at the same time.

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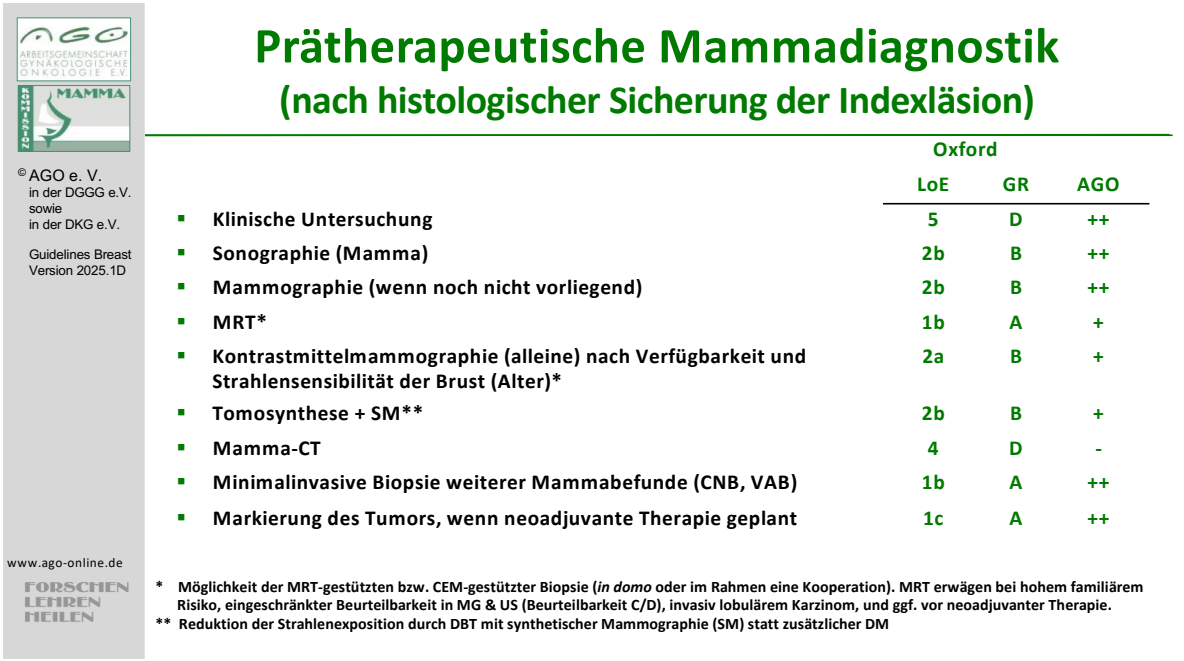

Prätherapeutische Mammadiagnostik

(nach histologischer Sicherung der Indexläsion)

	Oxford		
	LoE	GR	AGO
▪ Klinische Untersuchung	5	D	++
▪ Sonographie (Mamma)	2b	B	++
▪ Mammographie (wenn noch nicht vorliegend)	2b	B	++
▪ MRT*	1b	A	+
▪ Kontrastmittelmammographie (alleine) nach Verfügbarkeit und Strahlensensibilität der Brust (Alter)*	2a	B	+
▪ Tomosynthese + SM**	2b	B	+
▪ Mamma-CT	4	D	-
▪ Minimalinvasive Biopsie weiterer Mammabefunde (CNB, VAB)	1b	A	++
▪ Markierung des Tumors, wenn neoadjuvante Therapie geplant	1c	A	++

* Möglichkeit der MRT-gestützten bzw. CEM-gestützter Biopsie (*in domo* oder im Rahmen eine Kooperation). MRT erwägen bei hohem familiärem Risiko, eingeschränkter Beurteilbarkeit in MG & US (Beurteilbarkeit C/D), invasiv lobulärem Karzinom, und ggf. vor neoadjuvanter Therapie.

** Reduktion der Strahlenexposition durch DBT mit synthetischer Mammographie (SM) statt zusätzlicher DM

DM, DBT, US, MRI

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decreases them for lobular cancers. Breast Cancer Res Treat. 2017;162:353-364.
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Prätherapeutische Axilladiagnostik

	Oxford		
	LoE	GR	AGO
▪ Klinische Untersuchung	5	D	++
▪ Sonographie	2a	B	++
▪ CNB Axilla, wenn auffälliger LK-Befund und Markierung des LK wenn TAD geplant/≤ 3 susp. LK*	2b	B	++
▪ MRT	1b	A	+
▪ Mammographie (DM)	2b	B	-
▪ Tomosynthese (DBT)	2b	B	-
▪ Kontrastmittelmammographie (CEM, alleine)	2a	B	-
▪ PET für die Axilla (PET-CT, PET-MRT)	2b	B	-
▪ Mamma-CT	4	D	-

* Studienteilnahme empfohlen (AXSANA/EuBreast 3-Studie).

US-Axilla +FNA/CNB

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CEUS for Sentinel

Diagnosis of malignant lymph node infiltration

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Identification and tagging of the SLN (e.g carbon nanoparticle or wire guided)

1. Luo Y, Chen J, Feng L et al. Study on Sentinel Lymph Node and Its Lymphatic Drainage Pattern of Breast Cancer by Contrast-Enhanced Ultrasound. J Ultrasound Med. 2022 Nov;41(11):2727-2737.
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MRT

1. Panico C, Ferrara F, Woitek R et al. Staging Breast Cancer with MRI, the T. A Key Role in the Neoadjuvant Setting. Cancers (Basel). 2022 Nov 24;14(23):5786.

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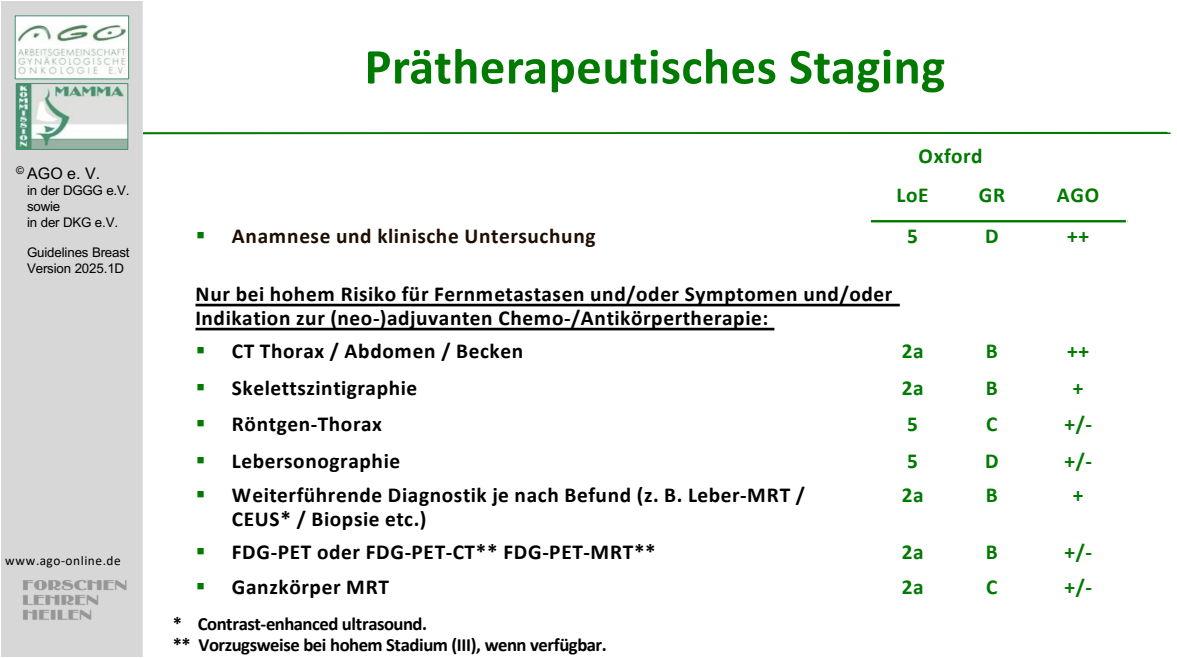

Prätherapeutisches Staging

	Oxford LoE	GR	AGO
▪ Anamnese und klinische Untersuchung	5	D	++
Nur bei hohem Risiko für Fernmetastasen und/oder Symptomen und/oder Indikation zur (neo-)adjuvanten Chemo-/Antikörpertherapie:			
▪ CT Thorax / Abdomen / Becken	2a	B	++
▪ Skelettszintigraphie	2a	B	+
▪ Röntgen-Thorax	5	C	+/-
▪ Lebersonographie	5	D	+/-
▪ Weiterführende Diagnostik je nach Befund (z. B. Leber-MRT / CEUS* / Biopsie etc.)	2a	B	+
▪ FDG-PET oder FDG-PET-CT** FDG-PET-MRT**	2a	B	+/-
▪ Ganzkörper MRT	2a	C	+/-

* Contrast-enhanced ultrasound.
** Vorzugsweise bei hohem Stadium (III), wenn verfügbar.

Statement: history and physical examination

1. GCP

Statement: high metastatic potential / symptoms

1. Gerke O, Naghavi-Behzad M, Nygaard ST et al.. Diagnosing Bone Metastases in Breast Cancer: A Systematic Review and Network Meta-Analysis on Diagnostic Test Accuracy Studies of 2-[^{18}F]FDG-PET/CT, ^{18}F-NaF-PET/CT, MRI, Contrast-Enhanced CT, and Bone Scintigraphy. Semin Nucl Med. 2025 Jan;55(1):137-151.
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4. Schneider C, Fehr MK, Steiner RA et al: Frequency and distribution pattern of distant metastases in breast cancer patients at the time of primary presentation Arch Gynecol Obstet. 2003 Nov;269(1):9-12.
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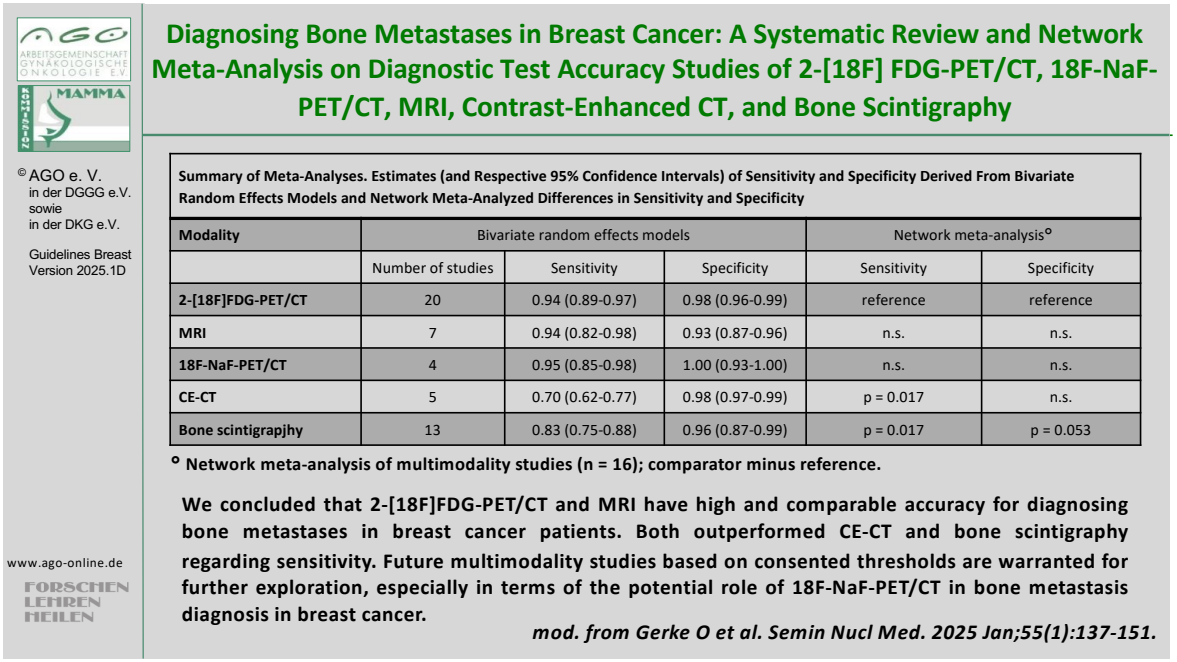

Diagnosing Bone Metastases in Breast Cancer: A Systematic Review and Network Meta-Analysis on Diagnostic Test Accuracy Studies of 2-[18F] FDG-PET/CT, 18F-NaF-PET/CT, MRI, Contrast-Enhanced CT, and Bone Scintigraphy

Guidelines Breast
Version 2025.1D

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FORSCHEN
LEHREN
HEILEN

Summary of Meta-Analyses. Estimates (and Respective 95% Confidence Intervals) of Sensitivity and Specificity Derived From Bivariate Random Effects Models and Network Meta-Analyzed Differences in Sensitivity and Specificity

Modality	Bivariate random effects models			Network meta-analysis°	
	Number of studies	Sensitivity	Specificity	Sensitivity	Specificity
2-[18F]FDG-PET/CT	20	0.94 (0.89-0.97)	0.98 (0.96-0.99)	reference	reference
MRI	7	0.94 (0.82-0.98)	0.93 (0.87-0.96)	n.s.	n.s.
18F-NaF-PET/CT	4	0.95 (0.85-0.98)	1.00 (0.93-1.00)	n.s.	n.s.
CE-CT	5	0.70 (0.62-0.77)	0.98 (0.97-0.99)	p = 0.017	n.s.
Bone scintigrapjhy	13	0.83 (0.75-0.88)	0.96 (0.87-0.99)	p = 0.017	p = 0.053

° Network meta-analysis of multimodality studies (n = 16); comparator minus reference.

We concluded that 2-[18F]FDG-PET/CT and MRI have high and comparable accuracy for diagnosing bone metastases in breast cancer patients. Both outperformed CE-CT and bone scintigraphy regarding sensitivity. Future multimodality studies based on consented thresholds are warranted for further exploration, especially in terms of the potential role of 18F-NaF-PET/CT in bone metastasis diagnosis in breast cancer.

mod. from Gerke O et al. Semin Nucl Med. 2025 Jan;55(1):137-151.

1. Gerke O, Naghavi-Behzad M, Nygaard ST et al.. Diagnosing Bone Metastases in Breast Cancer: A Systematic Review and Network Meta-Analysis on Diagnostic Test Accuracy Studies of 2-[^{18}F]FDG-PET/CT, ^{18}F-NaF-PET/CT, MRI, Contrast-Enhanced CT, and Bone Scintigraphy. Semin Nucl Med. 2025 Jan;55(1):137-151.

Neoadjuvante systemische Therapie Methoden zur Überprüfung des Ansprechens

	Oxford		
	LoE	GR	AGO
▪ **Mammasonographie**	2b	B	++
▪ **Palpation**	2b	B	++
▪ **Mammographie**	2b	B	++
▪ **CEM (Kontrastmittel-verstärkte Mammographie)**	2a	B	+
▪ **MRT**	2a	B	+
▪ **DBT (Tomosynthese)**	2b	B	+/-
▪ **PET(-CT)**	2b	B	+/-

Zur Kontrolle des Ansprechens sollte die gleiche Modalität prä- und posttherapeutisch gewählt werden.

Breast ultrasound

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Palpation

1. Kaufmann M, et al. Recommendations from an international consensus conference on the current status and future of neoadjuvant systemic therapy in primary breast cancer. Ann Surg Oncol 2012: 19; 1508

Mammography
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MRI
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PET(-CT)
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Clip pN+
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2. Hartmann et al. Wire localization of clip-marked axillary lymph nodes in breast cancer patients treated with primary systemic therapy. Eur J Surg Oncol. 2018 ;44:1307-1311

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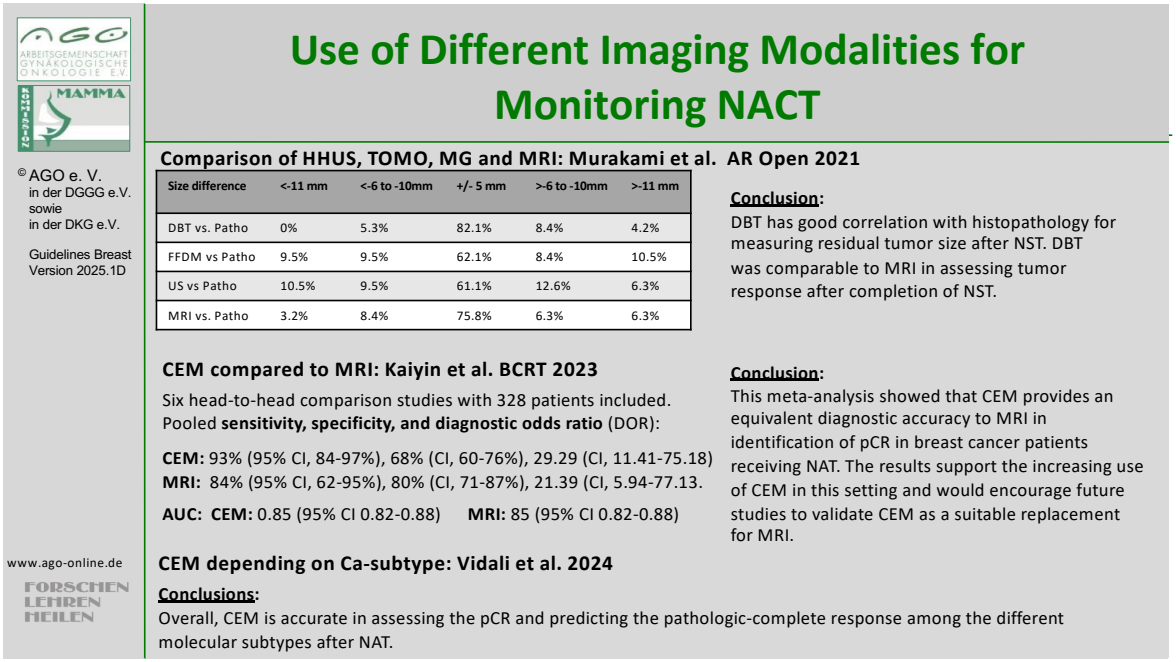

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