Early Detection and Diagnosis
Early Detection and Diagnosis

- **Versions 2005–2015:**
  Albert / Blohmer / Fersis / Junkermann / Maass / Scharl / Schreer

- **Version 2016:**
  Schreer / Albert
# Early Detection Mammography

<table>
<thead>
<tr>
<th>Age</th>
<th>Interval</th>
<th>LOE / GR</th>
<th>Oxford</th>
<th>AGO</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 40</td>
<td>na</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>40–50</td>
<td>12–18</td>
<td>1b</td>
<td>B</td>
<td>+</td>
</tr>
<tr>
<td>50–70*</td>
<td>24</td>
<td>1a</td>
<td>A</td>
<td>++</td>
</tr>
<tr>
<td>&gt;70</td>
<td>24</td>
<td>4</td>
<td>C</td>
<td>+</td>
</tr>
</tbody>
</table>

* National Mammography-Screening-Program
## Meta-Analyses

<table>
<thead>
<tr>
<th>Study</th>
<th>RR 95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent UK Panel, 2012</strong></td>
<td></td>
</tr>
<tr>
<td>13-year metaanalysis</td>
<td>0.80 (0.73–0.89)</td>
</tr>
<tr>
<td><strong>Cochrane Review, 2011</strong></td>
<td></td>
</tr>
<tr>
<td>Fixed-effect metaanalysis of 9 RCT-trials</td>
<td>0.81 (0.74–0.87)</td>
</tr>
<tr>
<td>As above, but excluding women &lt;50 years</td>
<td>0.77 (0.69–0.86)</td>
</tr>
<tr>
<td><strong>US Task Force, 2009</strong></td>
<td></td>
</tr>
<tr>
<td>Women 50–59 years</td>
<td>0.86 (0.75–0.99)</td>
</tr>
<tr>
<td>Women 60–69 years</td>
<td>0.68 (0.54–0.87)</td>
</tr>
<tr>
<td>Estimates weighted average</td>
<td>0.81</td>
</tr>
<tr>
<td><strong>Canadian Task Force, 2011</strong></td>
<td></td>
</tr>
<tr>
<td>Women aged 50–69 years</td>
<td>0.79 (0.68–0.90)</td>
</tr>
<tr>
<td><strong>Duffy et al., 2012</strong></td>
<td></td>
</tr>
<tr>
<td>Review of all trials and age groups</td>
<td>0.79 (0.73–0.86)</td>
</tr>
</tbody>
</table>
# Breast Cancer Mortality Reduction

## Meta-Analyses

### Case-Control Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>RR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broeders et al</td>
<td>Screening Mx</td>
<td>0.46 (0.4 – 0.54)</td>
</tr>
<tr>
<td></td>
<td>Corr. for self selection</td>
<td>0.52 (0.42-0.65)</td>
</tr>
<tr>
<td></td>
<td>Invited for screening</td>
<td>0.69 (0.57-0.83)</td>
</tr>
</tbody>
</table>

### Incidence-based Mortality Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>RR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broeders et al</td>
<td>Screening Mx</td>
<td>0.62 (0.56-0.69)</td>
</tr>
<tr>
<td></td>
<td>Invited to screening</td>
<td>0.75 (0.69-0.81)</td>
</tr>
</tbody>
</table>

### Randomized Clinical Trials

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>RR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gotsche and Jorgenson</td>
<td>Screening Mx</td>
<td>0.81 (0.74-0.87)</td>
</tr>
</tbody>
</table>
## Breast Cancer Mortality Reduction

<table>
<thead>
<tr>
<th>Age Group (yrs)</th>
<th>NNS</th>
<th>Mortality Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20%</td>
</tr>
<tr>
<td>40 - 49</td>
<td>1770</td>
<td>753</td>
</tr>
<tr>
<td>50 - 59</td>
<td>1087</td>
<td>462</td>
</tr>
<tr>
<td>60 - 69</td>
<td>835</td>
<td>355</td>
</tr>
</tbody>
</table>

4 systematic reviews of 8 RCTs, 1 systematic review of 7 cohort studies and metaanalysis of case-control studies

Oeffinger KC et al  JAMA 2015;314
American Cancer Society Guideline for Breast Cancer Screening, 2015

These recommendations represent guidance from the American Cancer Society (ACS) for women at average risk of breast cancer: women without a personal history of breast cancer, a suspected or confirmed genetic mutation known to increase risk of breast cancer (eg, BRCA), or a history of previous radiotherapy to the chest at a young age.

The ACS recommends that all women should become familiar with the potential benefits, limitations, and harms associated with breast cancer screening.

Recommendations

1. Women with an average risk of breast cancer should undergo regular screening mammography starting at age 45 years. *(Strong Recommendation)*
   1a. Women aged 45 to 54 years should be screened annually. *(Qualified Recommendation)*
   1b. Women 55 years and older should transition to biennial screening or have the opportunity to continue screening annually. *(Qualified Recommendation)*
   1c. Women should have the opportunity to begin annual screening between the ages of 40 and 44 years. *(Qualified Recommendation)*

2. Women should continue screening mammography as long as their overall health is good and they have a life expectancy of 10 years or longer. *(Qualified Recommendation)*

3. The ACS does not recommend clinical breast examination for breast cancer screening among average-risk women at any age. *(Qualified Recommendation)*

*A strong recommendation conveys the consensus that the benefits of adherence to that intervention outweigh the undesirable effects that may result from screening. Qualified recommendations indicate there is clear evidence of benefit of screening but less certainty about the balance of benefits and harms, or about patients’ values and preferences, which could lead to different decisions about screening.*
### Breast-Cancer Screening - Viewpoint of the IARC Working Group

<table>
<thead>
<tr>
<th>Method</th>
<th>Strength of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduces breast-cancer mortality in women 50-69 yr of age</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Reduces breast-cancer mortality in women 70-74 yr of age</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Reduces breast-cancer mortality in women 40-44 yr of age</td>
<td>Limited</td>
</tr>
<tr>
<td>Reduces breast-cancer mortality in women 45-49 yr of age</td>
<td>Limited</td>
</tr>
<tr>
<td>Detects breast cancer that would never have been diagnosed or never have caused harm if women had not been screened (overdiagnosis)</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Reduces breast-cancer mortality in women 50-74 yr of age to an extent that its benefits substantially outweigh the risk of radiation-induced cancer</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Produces short-term negative psychological consequences when the result is false positive</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Has a net benefit for women 50-69 yr of age who are invited to attend organized mammographic screening programs</td>
<td>Sufficient</td>
</tr>
</tbody>
</table>
# Mammography-Screening

## Women 40–49 Years

<table>
<thead>
<tr>
<th>Age Group</th>
<th>RR (invited women)</th>
<th>NNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>40–44 J</td>
<td>0.74 (95% CI 0.66-0.83)</td>
<td>1252 (95% CI 958-1915)</td>
</tr>
<tr>
<td>45–49 J</td>
<td>0.68 (95% CI 0.59-0.78)</td>
<td></td>
</tr>
</tbody>
</table>

Participants 0.71 (95% CI 0.62-0.80)

(1 live saved / 10 years screening)

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Hellquist BN et al. Cancer 2011; 117(4) : 714-722
## Early Detection Sonography

<table>
<thead>
<tr>
<th><strong>Oxford / AGO LOE / GR</strong></th>
<th><strong>Screening-Breast Sonography</strong></th>
<th><strong>As an adjunct:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5 D</td>
<td>2b B</td>
</tr>
<tr>
<td></td>
<td>3b C</td>
<td>1b C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2b B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2b C</td>
</tr>
</tbody>
</table>

- **Screening-Breast Sonography**
  - Automated 3D-Sonography

- **As an adjunct:**
  - Dense mammogram (ACR 3–4)
  - Elevated risk
  - Mammographic lesion
  - Second-look US (MRI-only detected lesions)
Early Detection
Clinical Examination

As stand alone procedure

- Self-examination
- Clinical breast examination (CBE) by health professionals
- CBE because of mammo/sonographic lesion

CBE in combination with imaging

Oxford / AGO
LOE / GR

1a  A  -*
3b  C  -*
5   D  ++
BCP  ++

* May increase breast awareness
## Assessment of Breast Symptoms or Lesions

- **Clinical examination**: 3b, B, ++
- **Mammography**
  - Additional Tomosynthesis (vs spot compression): 2b, B, +
- **Sonography**: 2b, B, ++
  - Elastography (shear-wave): 2a, B, +
  - Automated 3D-sonography: 3b, B, +/-
- **MRI***: 2b, B, +/-
- **Minimally invasive biopsy**: 1c, A, ++

---

* If clinical examination, mammography and sonography do not allow a definite diagnosis
Pretherapeutic Assessment and Staging

- Clinical examination
  - Mammography
  - Mammography + Tomosyntheses + Sonography added MRI
  - Sonography
    - Axilla + FNP/CNB
  - MRI *
  - Minimally invasive biopsy**

<table>
<thead>
<tr>
<th>Oxford / LOE / GR</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGO</td>
</tr>
<tr>
<td>5 D ++</td>
</tr>
<tr>
<td>2b B ++</td>
</tr>
<tr>
<td>3b B +</td>
</tr>
<tr>
<td>3b B -</td>
</tr>
<tr>
<td>2b B +</td>
</tr>
<tr>
<td>2b B ++</td>
</tr>
<tr>
<td>2b B ++</td>
</tr>
<tr>
<td>1b B +/-</td>
</tr>
<tr>
<td>1b A ++</td>
</tr>
</tbody>
</table>

* Weak reduction in reexcision rate in lobular invasive cancer but sign. higher rate of initial mastectomy. Lobular invasive tumors, suspicion of multilocular disease, high-risk patients. MRI-guided vacuum biopsy mandatory in case of MRI-detected additional lesions.

** If clinical examination, mammography and sonography (e.g. plus MRI) do not allow assessment of lesion extension
MRI: Preoperative Staging

- 9 eligible studies (2 randomized trials; 7 comparative cohorts)
- 3112 patients with BC
- MRI versus no-MRI:
  - Initial mastectomy 16.4% versus 8.1% [OR, 2.22 (P < 0.001); adjusted OR, 3.06 (P < 0.001)]
  - Re-excision after initial breast conservation 11.6% versus 11.4% [OR, 1.02 (P = 0.87); adjusted OR, 0.95 (P = 0.71)]
  - Overall mastectomy 25.5% versus 18.2% [OR, 1.54 (P < 0.001); adjusted OR, 1.51 (P < 0.001)]

MRI: Preoperative Staging in Lobular Invasive Breast Cancer

- 766 patients with invasive lobular cancer (ILC)
  - Initial mastectomy: 31.1% versus 24.9% [OR, 1.36 (P = 0.056); adjusted OR, 2.12 (P = 0.008)]
  - Re-excision after initial breast conservation 10.9% versus 18.0% [OR, 0.56 (P = 0.031); adjusted OR, 0.56 (P = 0.09)]
  - Overall mastectomy 43.0% versus 40.2% [OR, 1.12 (P = 0.45); adjusted OR, 1.64 (P = 0.034)]

MRI Screening (High-risk)

Benefit

- Early detection of cancer cases additionally to conventional imaging
- Improved patient prognosis? (Mortality reduction? Reduction of interval cancers?)
# MRI Screening in Women with High Familiar Risk

<table>
<thead>
<tr>
<th>Autor</th>
<th>Hochrisiko / Mutation</th>
<th>Anzahl Frauen</th>
<th>Anzahl Karzinome</th>
<th>Sensitivität (%)</th>
<th>Spezifität (%)</th>
<th>Sensitivität (%)</th>
<th>Spezifität (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kriege 2004</td>
<td>M</td>
<td>1909</td>
<td>50</td>
<td>80</td>
<td>90</td>
<td>33</td>
<td>95</td>
</tr>
<tr>
<td>Warner 2004</td>
<td>M</td>
<td>236</td>
<td>22</td>
<td>77</td>
<td>95</td>
<td>36</td>
<td>99</td>
</tr>
<tr>
<td>Hagen 2004</td>
<td>M</td>
<td>491</td>
<td>25</td>
<td>86</td>
<td>-</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>Leach 2005</td>
<td>H / M</td>
<td>649</td>
<td>35</td>
<td>94</td>
<td>77</td>
<td>40</td>
<td>93</td>
</tr>
<tr>
<td>Riedl 2007</td>
<td>H / M</td>
<td>327</td>
<td>28</td>
<td>50</td>
<td>98</td>
<td>85,7</td>
<td>92</td>
</tr>
<tr>
<td>Kuhl 2010</td>
<td>H / M</td>
<td>687</td>
<td>27</td>
<td>93</td>
<td>98,4</td>
<td>33</td>
<td>99,1</td>
</tr>
<tr>
<td>Rijnsburger 2010</td>
<td>M</td>
<td>594</td>
<td>97</td>
<td>77,4</td>
<td>89,7</td>
<td>41</td>
<td>-</td>
</tr>
<tr>
<td>Sardanelli 2011</td>
<td>H / M</td>
<td>501</td>
<td>52</td>
<td>91</td>
<td>97</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>Passaperuma 2012</td>
<td>M</td>
<td>496</td>
<td>57</td>
<td>90</td>
<td>97</td>
<td>19</td>
<td>97</td>
</tr>
<tr>
<td>Gareth 2014</td>
<td>H / M</td>
<td>649</td>
<td>139</td>
<td>93</td>
<td>63</td>
<td>60</td>
<td>-</td>
</tr>
</tbody>
</table>

Prospective study results for MRI screening in women with high familiar risk (H) and mutation carriers (M)
## MRI Screening (High-risk) Problems

<table>
<thead>
<tr>
<th>MRI in addition to mammography</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>False-positive MRI</td>
<td>3.43–4.86</td>
</tr>
<tr>
<td>Benign biopsies</td>
<td>1.22–9.50</td>
</tr>
<tr>
<td>Benign surgical biopsies</td>
<td>2</td>
</tr>
<tr>
<td>False-negative MRI (MRISC)</td>
<td>22%</td>
</tr>
</tbody>
</table>
### MRI and DCIS

<table>
<thead>
<tr>
<th>Study</th>
<th>No. Cases</th>
<th>Overall accuracy (%)</th>
<th>Sens. (%)</th>
<th>Spec. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gilles et al 1995</td>
<td>172</td>
<td>70</td>
<td>95</td>
<td>51</td>
</tr>
<tr>
<td>Westerhof et al 1998</td>
<td>63</td>
<td>56</td>
<td>45</td>
<td>72</td>
</tr>
<tr>
<td>Bazzocchi et al 2006</td>
<td>112</td>
<td>80</td>
<td>79</td>
<td>68</td>
</tr>
<tr>
<td>Kuhl et al 2007</td>
<td>75</td>
<td>-</td>
<td>88</td>
<td>-</td>
</tr>
<tr>
<td>Baur et al 2013</td>
<td>58</td>
<td>-</td>
<td>79.3</td>
<td>-</td>
</tr>
</tbody>
</table>

„Negative breast MRI findings should not be considered a sure marker of benignancy.“
Early Detection and diagnosis (2/19)

Further information and references:

Screened data bases:
- Pubmed 2013 - 2015
- Medline 2013 – 2015
- Cochrane 2013 - 2015

Guidelines:
- S3 Brustkrebsfrüherkennung
- S3 Diagnostik, Therapie, Nachsorge
- 2015 ACS Update Breast Cancer Screening for women at average risk
- IARC Handbook 2016

Screened: Metaanalyses/ Systematic reviews / RCT / Cohort studies
**Early Detection – Mammography (3/19)**

*Further information:*

The aim of early detection and screening of breast cancer is to reduce the risk of dying from the disease. Detecting invasive breast cancer at an early stage (Stage I-IIA) offers the chance of survival with less treatment impairment and better quality of life. Professionals and women need to be informed about the benefits and harms of cancer screening tests before making medical decisions. This includes clear and understandable information in absolute terms about false positives, false negatives, overdiagnosis and overtreatment.

Meta-analysis and reviews from randomised trials:
Conclusion of the meta-analysis of the Independent UK Panel on Breast Cancer Screening: “Considering the internal bias in the trials, which were done a long time ago, the relative risk reduction in breast cancer mortality from invitation to mammography screening is estimated to be 20%.”

Data from observational studies and registries:
The EUROSCREEN Working Group has published their report about the impact of population-based screening with mammography on breast cancer in Europe. They conclude: 1. “the best “European” estimate of of breast cancer reduction is 25-31% for women invited for screening, and 38-48% for women actually screened. The estimate of overdiagnosis range from 1-10%. The chance for saving a woman’s life by population-based mammographic screening of appropriate quality is greater than that of over-diagnosis”.
The population-based data from the United States (SEER-Cancer Statistics 1976 - 2009) showed an marked increase in early-stage breast cancer (DCIS and localised breast cancer) and a reduction of late-stage cancer of 37% compared with the prescreen trends.
Since 2006 mammography screening is offered to women age 50-69 in Germany within a population-based organised quality assured program in accordance with the European Guidelines for Quality Assurance in Mammography Screening.
References:


40. Walter LC, Schonberg MA Screening mammography in older women: a review. JAMA 2014;311(13):1336-1347
References:

Breast Cancer Mortality Reduction (5/19)

No further information

References:

Breast Cancer Mortality Reduction (6/19)

No further information

References:

2015 Guideline Update From The American Cancer Society (7/19)

No further information

No further references
Breast cancer screening – Viewpoint of the IARC Working Group (8/19)

No further information

References:

**Mammography Screening Women 40–49 years (9/19)**

*Further information:*

On the basis of randomized controlled trials there is evidence of a 26% mortality reduction. The only one especially designed for this age group (“Age-Trial”) achieved a mortality reduction of 17% for those invited and 24% for those participating. These results were not yet statistically significant (95% CI, 0.66-1.04)), because the follow-up time was too short for this young age group. Recently a significant reduction in breast cancer mortality in the first 10 years after diagnosis as noted in the intervention group compared with the control group (RR 0.75, CI 0.58-0.97), but not thereafter. The data have been underlined by study results of several service screening studies.

To estimate overdiagnosis within the “Age-Trial” Markov-modelling was performed and yielded the following results (Gunsoy N, 2012): “The sensitivity of mammography for invasive and in-situ breast cancers was 90% (95% CI, 72-99) and 82% (43-99), respectively. The screen-detectable mean sojourn time of preclinical non-progressive and progressive in-situ cancers was 1.3 (0.4-3.4) and 0.11 (0.05-0.19) years, respectively, and 0.8 years (0.6-1.2) for preclinical invasive breast cancer. The proportion of screen-detected in-situ cancers that were non-progressive was 55% (25-77) for the first and 40% (22-60) for subsequent screens. In our main analysis, overdiagnosis was estimated as 0.7% of screen-detected cancers. A sensitivity analysis, covering a wide range of alternative scenarios, yielded a range of 0.5% to 2.9%.” The authors conclude: “The extent of overdiagnosis due to screening in women aged 40-49 was small. Results also suggest annual screening is most suitable for women aged 40-49 in the United Kingdom due to short cancer sojourn times.”

*References:*

3. FH01 Collaborative Teams Mammographic surveillance in women younger than 50 years who have a family history of breast cancer: tumour characteristics and projected effect on mortality in the prospective, single-arm, FH01 study. Lancet Oncol 2010;11:1127-1134
**Early Detection Sonography (10/19)**

*Further information:*

The arguments against ultrasound use as stand alone screening modality are reproducibility, high false-positive rate, low ppv for biopsy, inability to detect most DCIS cases, operator dependency and lack of quality assurance.

Supplemental breast ultrasound in the population of women with mammographically dense breast tissue (ACR 3 and 4) permits detection of small, otherwise occult, breast cancers. Potential adverse impacts for women in this intermediate risk group are associated with an increased recall and biopsy rate. Supplemental ultrasound is associated with increasing costs. Modeling suggests for women between the ages of 50 and 74 years with heterogeneously or extremely dense breast tissue may avert only 0.4 breast cancer deaths but result in 354 additional biopsy recommendations per 1000 women screened compared with biennial screening mammography alone, with a cost-effectiveness ratio of $325 000 per quality-adjusted life-year gained (Sprague BL, et al 2015).

Automated ultrasound (ABUS/AVUS) might overcome the time-consuming and costly nature of hand-held, physician-performed whole-breast ultrasound but data are immature (accuracy cohort studies only).

The IARC Working Group statement on ultrasound as an adjunct to mammography in women with dense breasts and negative results on mammography are: Inadequate evidence concerning breast cancer mortality reduction, limited evidence for breast cancer detection rate, inadequate evidence for a reduction of the interval cancer rate and sufficient evidence for an increase of FPs. This is in line with the recommendations of the U.S. Preventive Services Task Force (Siu A 2016).

*References:*


Further information:

In a large well performed randomized study no difference in breast cancer mortality emerged after 11 years of follow-up. The only difference was that women in the self-examination arm had nearly twice as many biopsies for benign lesions than women in the control arm. Therefore based on current evidence breast self-examination cannot be recommended anymore. No randomized studies have been performed, where screening-examination by health professionals is compared to no screening. One Japanese case-control study suggests that examination by health professionals might reduce mortality from breast cancer. A randomized trial in Canada showed no difference in breast cancer mortality between a group of women offered clinical breast examination or mammography combined with clinical breast examination. Nevertheless in asymptomatic women participating in mammography screening programs there is the risk of interval cancer development. This is the reason why in the US mammography screening is recommended in close connection with clinical examination. Recent data (Haakinson and coauthors 2010) underscore this strategy. The ACS updated Guideline 2015 does not recommend clinical breast examination for breast cancer screening among average-risk women at any age. The IARC Working Group states that there is inadequate evidence for a reduction of breast cancer mortality.

References:

Assessment of Breast Symptoms or Lesions (12/19)

Further information:

If clinical examination, mammography and ultrasound are not conclusive, morphological diagnosis based on biopsy material is warranted. MRI has a high sensitivity but a low specificity to allow definitive diagnosis. Digital breast tomosynthesis (DBT) in the diagnostic setting (specifically, evaluation of mammographic abnormalities) has been shown to be at least as effective as spot compression views for workup of noncalcified abnormalities, including asymmetries and distortions. For DBT combined with 2-view full-field digital mammography (FFDM) radiation doses are elevated, at a maximum by a factor ~2 ¼ of that for FFDM alone. A replacement of FFDM with synthetic 2D-views reduces the breast dose approximately by half. Problems to be solved concern additional reading time, IT storage, overdiagnosis and cost effectiveness (Gilbert FJ, et al 2015).

Shear wave elastography (SWE) is a promising adjunct to greyscale ultrasound in differentiating benign from malignant breast masses adding improved specificity of breast US mass assessment without loss of sensitivity thus reducing the need for core biopsy by downstaging US-BIRADS III and IVa lesions. A systematic review and metaanalysis using shear-wave elastography combined with conventional ultrasound resulted in a sensitivity of 0.971 (95% CI 0.941-0.986) and specificity of 0.801 (95% CI 0.733-0.856) (Liu B, 2015).

Accuracy studies demonstrate that automated ultrasound (ABUS/AVUS) is a potentially feasible way to overcome limitations of hand-held breast ultrasound such as operator dependence and non-reproducibility.

Minimally invasive biopsy allows definitive diagnosis in most cases at reduced expenditure. In case of suspicious microcalcifications extensively distributed in mammography several percutaneous biopsies should be performed before deciding upon mastectomy.
References:


**Tomosynthese**


**Elastography**


Automated Breast Ultrasound (ABUS)


Pretherapeutic Assessment of Lesion Extension and Staging (13/19)

Further information:

Sonography corresponds better than mammography with the pathological tumour size of the invasive component of breast tumours. Mammography delineates the in situ component better if microcalcifications are present. In these cases magnification mammography is warranted. MRI is the most sensitive method for both invasive and non-invasive tumours, but lacks specificity. Thus MRI findings should be verified by percutaneous biopsy before definite treatment.

A recent prospective study examined the accuracy of digital breast tomosynthesis (DBT) and magnetic resonance imaging (MRI) added to digital mammography (DM) and ultrasound (US) in the preoperative assessment of breast cancer. DBT had higher sensitivity than DM (90.7% vs. 85.2%). Combined DM and DBT with US yielded a 97.7% sensitivity; despite high sensitivity of MRI (98.8%), the addition of MRI to combined DM with DBT and US did not significantly improve sensitivity. Overall accuracy did not significantly differ between MRI and DM with DBT and US (92.3% vs. 93.7%). Breast density affected sensitivity of DM and DBT (statistically significant difference for DM), not MRI. The authors concluded that there is little gain in sensitivity and no gain in overall accuracy, by performing MRI for patients who have been evaluated with DM with DBT and US (Mariscotti G et al 2014).

Axillary ultrasound is recommended for pretherapeutic assessment to guide axillary surgery (Feng Y et al 2015). Elastography of lymph nodes might add prognostic information additional to that provided by conventional preoperative tumor assessment and staging. A general recommendation for the use of lymph node elastography cannot be given as data on quality assurance is lacking.

MRI for preoperative staging may be helpful in individual cases (high-risk women, multifocality/multicentricity demonstrated at conventional imaging and pathologically proven, invasive lobular cancer with inconclusive findings at conventional imaging), but considering the present evidence no general recommendation can be given for preoperative MRI in patients before breast conservation in both invasive and non-invasive cancer.

In case of large areas of highly suspicious microcalcifications on mammography several percutaneous biopsies to define tumour size should be performed before deciding upon mastectomy.
References:

11. Houssami N, Hayes DF Review of preoperative magnetic resonance imaging (MRI) in breast cancer: Should MRI be performed on all women with newly diagnosed early stage breast cancer. CA Cancer J Clin 2009; 59:290-302
13. Lourenco AP, Mainiero MB Incorporating imaging into the locoregional management of breast cancer. Semin Radiat Oncol 2016;26(1)
MRI: Preoperative Staging (14/19)

No further information

References:

5. Sardanelli F Overview of the role of preoperative breast MRI in the absence of evidence on patient outcomes. Breast 2010; 19: 3-6
years on breast cancer mortality a 10 years follow-up: a randomised controlled trial. The Lancet 2006; 368: 2053 – 2060


MRI Preoperative Staging in Lobular Invasive Breast Cancer (15/19)

No further information

References:

MRI Screening (High-risk) – Benefit (16/19)

*No further information*

*No references*
**MRI Screening in Women with High Familial Risk (17/19)**

*Further information:*

Six prospective multicentre studies and further systematic reviews showed that additional use of MRI increased the sensitivity significantly and that cancers could be detected at a better stage. Overall sensitivity levels ranged from 77% - 100%. About 33% of malignancies were detected by MRI alone, about 11% by mammography alone and only 3% by ultrasound alone. Therefore MRI should be the first imaging method used for intensified screening in high-risk women. It is still unclear whether early detection by MRI will translate into improved disease-free and overall survival.

*References:*


14. Saadatmand S, Obdeijn IM, Rutgers EJ, Oosterwijk JC, Tollenaar et al. Survival benefit in women with BRCA1 mutation or familial risk in the MRI screening study (MRISC) Int J Cancer 2015;137(7)1729-1738


MRI Screening (High Risk) Problems (18/19)

No further information

No references
**MRI and DCIS (19/19)**

*No further information*

**References:**