

# 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

## Interdisziplinäre Früherkennung, Diagnostik, Therapie und Nachsorge des Mammakarzinoms. Leitlinie der DGGG und DKG (S3-Level, AWMF-Registernummer 032/045OL, Dezember 2017) – Teil 2 mit Empfehlungen zur Therapie des primären, rezidierten und fortgeschrittenen Mammakarzinoms



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### Key words

breast cancer, guideline, therapy, primary breast cancer,  
metastatic breast cancer

### Schlüsselwörter

Brustkrebs, Leitlinie, Therapie, primäres Mammakarzinom,  
metastasiertes Mammakarzinom

received 19.6.2018

accepted 20.6.2018

### Bibliography

DOI <https://doi.org/10.1055/a-0646-4630>

Geburtsh Frauenheilk 2018; 78: 1056–1088 © Georg Thieme  
Verlag KG Stuttgart · New York | ISSN 0016-5751

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Deutsche Version unter:

<https://doi.org/10.1055/a-0646-4630>

### ABSTRACT

**Purpose** The aim of this official guideline coordinated and published by the German Society for Gynecology and Obstetrics (DGGG) and the German Cancer Society (DKG) was to optimize the screening, diagnosis, therapy and follow-up care of breast cancer.

**Method** The process of updating the S3 guideline published in 2012 was based on the adaptation of identified source

guidelines. They were combined with reviews of evidence compiled using PICO (Patients/Interventions/Control/Outcome) questions and with the results of a systematic search of literature databases followed by the selection and evaluation of the identified literature. The interdisciplinary working groups took the identified materials as their starting point and used them to develop suggestions for recommendations and statements, which were then modified and graded in a structured consensus process procedure.

**Recommendations** Part 2 of this short version of the guideline presents recommendations for the therapy of primary, recurrent and metastatic breast cancer. Loco-regional therapies are de-escalated in the current guideline. In addition to reducing the safety margins for surgical procedures, the guideline also recommends reducing the radicality of axillary surgery. The choice and extent of systemic therapy depends on the respective tumor biology. New substances are becoming available, particularly to treat metastatic breast cancer.

### ZUSAMMENFASSUNG

**Ziele** Das Ziel dieser offiziellen Leitlinie, die von der Deutschen Gesellschaft für Gynäkologie und Geburtshilfe (DGGG) und der Deutschen Krebsgesellschaft (DKG) publiziert und koordiniert wurde, ist es, die Früherkennung, Diagnostik, Therapie und Nachsorge des Mammakarzinoms zu optimieren.

**Methode** Der Aktualisierungsprozess der S3-Leitlinie aus 2012 basierte zum einen auf der Adaptation identifizierter Quellleitlinien und zum anderen auf Evidenzübersichten, die nach Entwicklung von PICO-Fragen (PICO: Patients/Interventions/Control/Outcome), systematischer Recherche in Literaturdatenbanken sowie Selektion und Bewertung der gefundenen Literatur angefertigt wurden. In den interdisziplinären Arbeitsgruppen wurden auf dieser Grundlage Vorschläge für Empfehlungen – und Statements erarbeitet, die im Rahmen von strukturierten Konsensusverfahren modifiziert und graduiert wurden.

**Empfehlungen** Teil 2 dieser Kurzversion der Leitlinie zeigt Empfehlungen zur Therapie des primären, rezidierten und metastasierten Mammakarzinoms: Die lokoregionären Therapien erfahren in der aktuellen Leitlinie eine Deeskalation. Neben einer Verringerung des Sicherheitsabstandes bei den operativen Verfahren gibt die Leitlinie auch Empfehlungen zu einer reduzierten Radikalität bei axillären Interventionen. Die Systemtherapie richtet sich nach den tumorbiologischen Eigenschaften, neue Substanzen stehen insbesondere beim metastasierten Mammakarzinom zur Verfügung.

## I Guideline Information

### Guidelines program of the DGGG, OEGGG and SGGG

Information on the guidelines program is available at the end of the guideline.

### Citation format

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. Geburtsh Frauenheilk 2018; 78: 1056–1088

## Guideline documents

The complete long version together with a summary of the conflicts of interest of all the authors and a short version of the guideline are available in German on the AWMF homepage under: <http://www.awmf.org/leitlinien/detail/II/032-045OL.html> or [www.leitlinienprogramm-onkologie.de](http://www.leitlinienprogramm-onkologie.de)

## Guideline authors

The German Society for Gynecology and Obstetrics (DGGG), working together with the German Cancer Society (DKG), was the lead professional organization behind this guideline. The updated guideline presented here was supported by German Cancer Aid in the context of their oncology guidelines program (OL program). The working groups for this guideline consisted of members of the guideline steering group (► **Table 1**), specialists nominated by participating professional societies and organizations (► **Table 2**), and experts invited to participate by the steering committee (► **Table 3**), and they are the authors of this guideline. Only mandate holders nominated by participating professional societies and organizations were eligible to vote on a chapter-by-chapter basis during the voting process (consensus process) after they had disclosed and excluded any conflicts of interest. The guideline was compiled with the direct participation of four patient representatives.

► **Table 1** Steering committee.

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► **Table 2** Participating professional societies and organizations.

| Professional societies                                                                                                                                                 | 1st mandate holder                     | 2nd mandate holder (deputy)           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------------------------------|
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Continued next page

► **Table 2** Participating professional societies and organizations. (continued)

| Professional societies                                                                                                                                 | 1st mandate holder                                     | 2nd mandate holder (deputy)                                                                 |
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## Abbreviations of the S3 Breast Cancer Guideline

|         |                                                                   |
|---------|-------------------------------------------------------------------|
| ADH     | atypical (intra) ductal hyperplasia                               |
| AI      | aromatase inhibitor                                               |
| AML     | acute myeloid leukemia                                            |
| APBI    | accelerated partial breast irradiation                            |
| ASCO    | American Society of Clinical Oncology                             |
| ADL     | activities of daily living                                        |
| AUC     | area under the curve                                              |
| BÄK     | German Medical Association (Bundesärztekammer)                    |
| BCT     | breast-conserving therapy                                         |
| BI-RADS | breast imaging reporting and data system                          |
| BMI     | body mass index                                                   |
| BPM     | bilateral prophylactic mastectomy                                 |
| BPSO    | bilateral prophylactic salpingo-oophorectomy                      |
| BRCA1/2 | breast cancer-associated gene 1/2                                 |
| CAM     | complementary and alternative methods                             |
| CAP     | College of American Pathologists                                  |
| CD      | cognitive dysfunction                                             |
| CDLT    | complex/complete decongestive lymphatic therapy                   |
| CGA     | comprehensive geriatric assessment                                |
| CHF     | chronic heart failure                                             |
| CIPN    | chemotherapy-induced peripheral neuropathy                        |
| CISH    | chromogenic in situ hybridization                                 |
| CM      | contrast media                                                    |
| CNB     | core needle biopsy                                                |
| CNS     | central nervous system                                            |
| CT      | computed tomography                                               |
| DCIS    | ductal carcinoma in situ                                          |
| DBT     | digital breast tomosynthesis                                      |
| DFS     | disease-free survival                                             |
| DGS     | German Society for Senology (Deutsche Gesellschaft für Senologie) |
| DKG     | German Cancer Society                                             |
| DMP     | disease management program                                        |
| EC      | expert consensus                                                  |
| ECE     | extracapsular tumor extension                                     |
| EIC     | extensive intraductal component                                   |
| ER      | estrogen receptor                                                 |
| ESA     | erythropoiesis-stimulating agents                                 |
| ESAS    | Edmonton Symptom Assessment Scale                                 |
| ET      | estrogen therapy                                                  |
| FEA     | flat epithelial atypia                                            |
| FISH    | fluorescent in situ hybridization                                 |
| FN      | febrile neutropenia                                               |
| FNA     | fine needle aspiration                                            |
| FNB     | fine needle biopsy                                                |
| G-CSF   | granulocyte colony-stimulating factor                             |
| GnRHa   | gonadotropin-releasing hormone agonist                            |
| HADS    | Hospital Anxiety and Depression Scale                             |
| HER2    | human epidermal growth factor receptor 2                          |
| HT      | hormone therapy                                                   |
| IARC    | International Agency for Research on Cancer                       |
| IBC     | inflammatory breast cancer                                        |
| IHC     | immunohistochemistry                                              |
| IMRT    | intensity-modulated radiotherapy                                  |
| IORT    | intraoperative radiation therapy                                  |

|                    |                                                                                                                             |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------|
| IQWiG              | Institute for Quality and Efficiency in Healthcare<br>(Institut für Qualität und Wirtschaftlichkeit<br>im Gesundheitswesen) |
| ISH                | in situ hybridization                                                                                                       |
| ITC                | intrathecal chemotherapy                                                                                                    |
| LABC               | locally advanced breast cancer                                                                                              |
| LCIS               | lobular carcinoma in situ                                                                                                   |
| LN                 | lymph node                                                                                                                  |
| LoE                | level of evidence                                                                                                           |
| L-spine            | lumbar spine                                                                                                                |
| LVEF               | left ventricular ejection fraction                                                                                          |
| LVI                | lymphatic vessel invasion                                                                                                   |
| MDS                | myelodysplastic syndrome                                                                                                    |
| MG                 | mammography                                                                                                                 |
| MRI                | magnetic resonance imaging                                                                                                  |
| MSP                | mammography screening program                                                                                               |
| NAC                | nipple-areolar complex                                                                                                      |
| NACT               | neoadjuvant chemotherapy                                                                                                    |
| NCCN               | National Comprehensive Cancer Network                                                                                       |
| NICE               | National Institute for Health and Clinical Excellence                                                                       |
| NNT                | number needed to treat                                                                                                      |
| NZGG               | New Zealand Guidelines Group                                                                                                |
| OP                 | operation                                                                                                                   |
| OS                 | overall survival                                                                                                            |
| PBI                | partial breast irradiation                                                                                                  |
| pCR                | pathological complete remission                                                                                             |
| PET                | positron emission tomography                                                                                                |
| PFS                | progression-free survival                                                                                                   |
| PI                 | proliferation index                                                                                                         |
| PMRT               | postoperative radiotherapy                                                                                                  |
| PNP                | polyneuropathy                                                                                                              |
| POS                | Palliative Outcome Scale                                                                                                    |
| PR                 | progesterone receptor                                                                                                       |
| PST                | primary systemic therapy                                                                                                    |
| QoL                | quality of life                                                                                                             |
| RCT                | randomized controlled trial                                                                                                 |
| RFA                | radiofrequency ablation                                                                                                     |
| ROR                | risk of recurrence                                                                                                          |
| RR                 | relative risk                                                                                                               |
| RS                 | recurrence score                                                                                                            |
| SABCS              | San Antonio Breast Cancer Symposium                                                                                         |
| SBRT               | stereotactic radiotherapy                                                                                                   |
| SGB                | German Social Security Code (Sozialgesetzbuch)                                                                              |
| SIB                | simultaneous integrated boost                                                                                               |
| SIGN               | Scottish Intercollegiate Guidelines Network                                                                                 |
| SISH               | silver-enhanced in situ hybridization                                                                                       |
| SLN                | sentinel lymph node                                                                                                         |
| SLNB               | sentinel lymph node biopsy                                                                                                  |
| SLNE               | sentinel lymph node excision                                                                                                |
| s/p                | status post                                                                                                                 |
| SSM                | skin-sparing mastectomy                                                                                                     |
| TACE               | transarterial chemoembolization                                                                                             |
| TILs               | tumor-infiltrating lymphocytes                                                                                              |
| TNBC               | triple-negative breast cancer                                                                                               |
| TNM classification | tumor–node–metastasis classification                                                                                        |
| T-spine            | thoracic spine                                                                                                              |

|      |                                        |
|------|----------------------------------------|
| UICC | Union for International Cancer Control |
| US   | ultrasound                             |
| VMAT | volumetric arc therapy                 |
| WHO  | World Health Organization              |

## II Guideline Application

### Purpose and objectives

The most important reason to update this interdisciplinary guideline was the epidemiological impact of breast cancer and its associated burden of disease, both of which are still high. This is the context in which the impact of new management concepts and their implementation needed to be evaluated.

### Targeted areas of patient care

The guideline covers outpatient, inpatient and rehabilitative care.

### Target patient groups

The recommendations of the guideline are aimed at all women and men who develop breast cancer as well as their relatives.

### Target user groups/Target audience

The recommendations of the guideline are addressed to all physicians and professionals who provide screening services for women or care for patients with breast cancer (gynecologists, general practitioners, human geneticists, radiologists, pathologists, radio-oncologists, hemato-oncologists, psycho-oncologists, physiotherapists, nursing staff, etc.).

### Adoption of the guideline and period of validity

This guideline is valid from December 1, 2017 through to November 30, 2022. Because of the contents of this guideline, this period of validity is only an estimate. It may become necessary to update the guideline because of new scientific evidence and knowledge as well as new developments affecting the methodology used for these guidelines. It is also necessary to edit and revise the guideline's contents and re-evaluate and revise the key statements and recommendations of the guidelines at regular intervals.

## III Methodology

### Basic principles

The method used to prepare this guideline was determined by the class to which this guideline was assigned. The AWMF Guidance Manual (version 1.0) has set out the respective rules and regulations for the different classes of guidelines. Guidelines are differentiated into lowest (S1), intermediate (S2) and highest class (S3). The lowest class is defined as a set of recommendations for action compiled by a non-representative group of experts. In 2004, the S2 class was subdivided into two subclasses: a systematic evidence-based subclass (S2e) and a structural consensus-based subclass (S2k). The highest class (S3) combines both approaches. This guideline is classified as: S3.

### Grading of evidence

This guideline used the 2009 version of the system of the Oxford Centre for Evidence-based Medicine (levels 1–5) to classify the risk of bias in identified studies. This system classifies studies according to various clinical questions (benefit of therapy, prognostic value, diagnostic validity). For more detailed information, abbreviations and notes, see: <https://www.cebm.net/2009/06/oxford-centre-evidence-based-medicine-levels-evidence-march-2009/>

### Grading of recommendations

While the classification of the quality of the evidence (strength of evidence) serves as an indication of the robustness of the published data and therefore expresses the extent of certainty/uncertainty regarding the data, the classification of the level of recommendation reflects the results of weighing up the desirable and adverse consequences of alternative approaches. This guideline shows the level of evidence for the underlying studies as well as the strength of the recommendation (level of recommendation) for all evidence-based Statements and Recommendations. This guideline differentiates between three levels of recommendation (► **Table 4**). The levels reflect the strength of the respective recommendation and are also mirrored in the terms used to formulate the recommendation.

► **Table 4** Grading of recommendations.

| Level of recommendation | Description                           | Syntax                |
|-------------------------|---------------------------------------|-----------------------|
| A                       | strong recommendation, highly binding | must/<br>must not     |
| B                       | recommendation, moderately binding    | should/<br>should not |
| 0                       | open recommendation, not binding      | may/<br>may not       |

### Statements

Statements are expositions or explanations of specific facts, circumstances or problems with no direct recommendations for action. Statements are adopted after a formal consensus process using the same approach as that used when formulating recommendations and can be based either on trial results or expert opinions.

### Expert consensus

As the expression implies, this term refers to consensus decisions taken specifically with regard to Recommendations/Statements

without a previous systematic search of the literature (S2k) or when evidence is lacking (S2e/S3). The term “Expert Consensus” (EC) used here is synonymous with terms such as “Good Clinical Practice” (GCP) or “Clinical Consensus Point” used in other guidelines. The level of recommendation is graded as previously described in the Chapter “Grading of recommendations”, but the grading is only presented semantically (“must”/“must not” or “should”/“should not” or “may”/“may not”) without the use of symbols.

### Guideline report

To edit and update the various topic areas, an adaptation of existing guidelines was planned for around 80% of Statements and Recommendations in accordance with the AWMF Guidance Manual. To do this, a systematic search was carried out for source guidelines developed specifically for women with breast cancer and published after 2013. Findings were compared with the IQWiG guideline report No. 224 (Systematische Leitlinienrecherche und -bewertung sowie Extraktion relevanter Recommendations für das DMP Brustkrebs [Systematic guideline search and appraisal as well as extraction of relevant recommendations for a breast cancer DMP]). A further inclusion criterion was compliance with methodological standards. Guidelines were included if they complied with at least 50% of Domain 3 (Rigour of Development) of the AGREE II instrument. A corresponding search and evidence assessment was specified in accordance with AWMF guidelines (systematic search, selection, compilation of evidence tables) for those recommendations which could not be adapted or had to be newly created. For newly developed Recommendations and Statements, appropriate key questions were formulated and a systematic search was carried out using aggregated sources of evidence (meta-analyses, systematic reviews, etc.) as well as individual publications in specific cases. A suitable list of titles and abstracts up to and including the identification of the full text were selected by two independent raters. After the search and selection processes were completed, the necessary evidence tables which formed the basis for the consensus conferences were compiled by the Methods group (financial support was provided and allowed a researcher to be specifically hired for this purpose). The classification system of the Oxford Centre for Evidence-based Medicine (version 2009) was used to grade the evidence. To update this guideline, Recommendations and Statements were adopted and levels of recommendation (► **Table 4**) were determined during two structured consensus conferences which were preceded by a preliminary online ballot.

The guideline report provides an overview of the search strategies and selection processes used to select the literature and to formulate and grade the recommendations.

## IV Guideline

### 1 Treatment of primary breast cancer

#### 1.1 Surgical treatment for invasive carcinoma

##### 1.1.1 General recommendations

| No.   | Recommendations/<br>Statements                                                                                                                                                                             | EG | LoE | Sources |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 4.19. | a) The basic therapy for all non-advanced breast cancers is complete resection of the tumor (R0 status).                                                                                                   | A  | 1a  | [1, 2]  |
|       | b) The resection margin status has a prognostic effect on invasive breast cancer. There is a significant association between resection margin status (positive vs. negative) and local rate of recurrence. | A  | 1a  | [3]     |

##### 1.1.2 Breast-conserving therapy

Randomized clinical studies have shown that if certain clinical and histological parameters are taken into account, breast-conserving therapy achieves identical survival rates to those of mastectomy.

| No.   | Recommendations/<br>Statements                                                                                                                                                                                                                         | EG | LoE | Sources  |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|----------|
| 4.20. | a) The goal of surgical therapy is complete removal of the tumor. Breast-conserving therapy (BCT) followed by full breast radiotherapy is equivalent to mastectomy alone in terms of survival rates.                                                   |    | 1a  | [4 – 10] |
|       | b) All appropriate patients, whether or not they have previously had primary systemic therapy, must be informed about the possibility of breast-conserving therapy (BCT) and about mastectomy with the options of primary or secondary reconstruction. | EC |     |          |

### 1.1.3 Mastectomy

| No.   | Recommendations/<br>Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | EG | LoE | Sources   |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-----------|
| 4.21. | a) Mastectomy must be performed if any of the following indications are present: <ul style="list-style-type: none"> <li>▪ Incomplete removal of the tumor (incl. any intraductal component), even after secondary resection</li> <li>▪ Inflammatory breast cancer (generally even in cases with pathological complete remission)</li> <li>▪ When follow-up radiation of the breast after breast-conserving therapy is contraindicated but radiation is absolutely indicated</li> <li>▪ at the request of the patient who has been fully informed about her range of options</li> </ul> | A  | 2b  | [11 – 13] |
|       | b) If the resection margins are tumor-free, mastectomy may also be performed as a skin-sparing procedure with or without preservation of the NAC.                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0  | 2a  | [14 – 17] |
|       | c) Depending on the tumor location and tumor size, mastectomy may be necessary in individual cases, even if multiple cancers are present.                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0  | 2a  | [18 – 25] |
|       | d) Contralateral prophylactic mastectomy to reduce the risk of contralateral breast cancer should not be carried out in non-mutation carriers or patients with no evidence of high familial risk.                                                                                                                                                                                                                                                                                                                                                                                      | B  | 2b  | [26 – 28] |

### 1.1.4 Reconstructive plastic surgery procedures

| No.   | Recommendations/<br>Statements                                                                                                                                                                                                                                                                                             | EG | LoE | Sources      |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|--------------|
| 4.22. | Every patient scheduled for mastectomy must be informed about the options of having immediate or subsequent breast reconstruction or the option of foregoing reconstructive procedures; these patients should be offered the opportunity to contact other similarly affected people and self-help groups or organizations. | A  | 2b  | [16, 29, 30] |

### 1.1.5 Axillary surgery

| No.   | Recommendations/Statements                                                                                                                                                                                                                                              | EG | LoE | Sources  |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|----------|
| 4.23. | a) Axillary staging is an essential part of the surgical therapy of invasive breast cancer.                                                                                                                                                                             | EC |     |          |
|       | b) Staging must include sentinel lymph node biopsy (SLNB) even if the lymph node status is unremarkable on palpation and ultrasound.                                                                                                                                    | A  | 1a  | [30–32]  |
|       | c) Clinically significant lymph nodes that are negative on biopsy should also be resected during SLNB.                                                                                                                                                                  | B  | 2b  | [30, 33] |
|       | d) Patients with pT1–pT2/cN0 tumors who undergo breast-conserving surgery followed by percutaneous radiation by tangential opposing fields (tangential radiation therapy) and who have one or two positive sentinel lymph nodes should not undergo axillary dissection. | B  | 1b  | [31]     |
|       | e) Patients who have mastectomy or to whom the above-listed criteria do not apply should undergo axillary dissection or receive axillary radiotherapy.                                                                                                                  | B  | 1b  | [31, 34] |
|       | f) Targeted therapy of the lymph drainage areas (surgery, radiotherapy) must not be carried out if the patient only has micro-metastasis.                                                                                                                               | B  | 1b  | [35, 36] |
|       | g) Patients treated with primary systemic therapy (PST) and whose lymph node status on palpation and ultrasound is negative prior to treatment should have SLN after PST.                                                                                               | B  | 2b  | [37, 38] |
|       | h) Patients treated with primary systemic therapy (PST) whose nodal status on punch biopsy is positive (cN1) prior to treatment but whose nodal status after PST is clinically negative (ycN0) should undergo axillary dissection.                                      | B  | 2b  | [38, 39] |
|       | i) Patients treated with primary systemic therapy (PST) who have a positive nodal status before and after PST must undergo axillary dissection.                                                                                                                         | EC |     |          |
|       | j) Patients must not undergo axillary staging if there is evidence of distant metastasis.                                                                                                                                                                               | EC |     |          |

### 1.2 Adjuvant radiation therapy for breast cancer

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | EG  | LoE | Sources |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|---------|
| 4.36. | After breast-conserving surgery for invasive carcinoma the affected breast must be treated with radiotherapy. Provided the resection margins were tumor-free, patients with a clearly limited life expectancy (< 10 years) and a small (pT1), node-negative (pN0), hormone receptor-positive HER2-negative tumor and endocrine adjuvant therapy may avoid radiation therapy and accept the increased risk of local recurrence after receiving individual counselling.<br>Note for all Recommendations: all single positions are OR conjunctions. AND conjunctions are represented by “and”.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | A   | 1a  | [40–47] |
| 4.37. | Radiotherapy of the breast should be administered in hypofractionated doses (total dose: approx. 40 Gy in approx. 15–16 fractions over approx. 3 to 5 weeks) or may be administered as a standard fractionated regimen (total dose: approx. 50 Gy in approx. 25–28 fractions over approx. 5–6 weeks).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | B/0 | 1a  | [48–54] |
| 4.38. | Local dose escalation (boost radiotherapy) of the tumor bed reduces the local rate of recurrence in the breast without achieving a significant survival benefit.<br>Boost radiotherapy <ul style="list-style-type: none"> <li>▪ must therefore be carried out in all patients aged ≤ 50 years and</li> <li>▪ should only be carried out in patients aged &gt; 51 years if they have an increased risk of local recurrence (G3, HER2-positive, triple-negative, &gt;T1).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | A/B | 1a  | [55–58] |
| 4.39. | Partial breast irradiation alone (as an alternative to secondary whole breast irradiation) may be carried out in patients with a low risk of recurrence.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0   | 1a  | [59–64] |
| 4.40. | Postoperative radiotherapy of the thoracic wall after mastectomy reduces the risk of loco-regional recurrence and improves the survival of patients with locally advanced, node-positive breast cancer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | A   | 1a  | [65]    |
| 4.41. | Radiation of the thoracic wall after mastectomy is indicated in the following situations: <ul style="list-style-type: none"> <li>▪ pT4</li> <li>▪ pT3 pN0 R0 when additional risk factors are present (lymph node invasion (L1), G3 grading, premenopausal, age &lt; 50 years)</li> <li>▪ R1/R2 resection and no possibility of a second curative resection</li> </ul> a) Post-mastectomy radiation must be carried out as a standard procedure if more than 3 axillary lymph nodes are affected.<br>b) If 1–3 axillary lymph nodes show tumor involvement, post-mastectomy radiation must be carried out if the patient has an increased risk of recurrence (e.g. HER2-positive, triple-negative, G3, L1, Ki-67 > 30%, > 25% of excised lymph nodes show tumor involvement; age ≤ 45 years with additional risk factors such as medial tumor location or tumor size > 2 cm, or ER-negative).<br>c) PMRT should not be carried out if 1–3 axillary lymph nodes show tumor involvement and the tumor has a low risk of local recurrence (pT1, G1, ER-positive, HER2-negative, at least 3 characteristics must apply).<br>d) For all other patients with 1–3 axillary lymph nodes with tumor involvement, the individual indication for treatment must be decided on by an interdisciplinary board. | A   | 1a  | [65–79] |

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                | EG | LoE | Sources |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 4.42. | After primary (neoadjuvant) systemic therapy, the indication for post-mastectomy radiotherapy must be based on the clinical staging prior to treatment; for pCR (ypT0 and ypN0) the indication for treatment must be decided on by an interdisciplinary tumor board and depends on the patient's individual risk profile. | A  | 1a  | [80–83] |

| Pretreatment              | Post-treatment             | RT-BCT <sup>1</sup> | PMRT <sup>2</sup>                 | RT-LAW <sup>3</sup> |
|---------------------------|----------------------------|---------------------|-----------------------------------|---------------------|
| locally advanced          | pCR/no pCR                 | yes                 | Yes                               | yes                 |
| cT1/2 cN1+                | ypT1+ o. ypN1+ (no pCR)    | yes                 | yes                               | yes                 |
| cT1/2 cN1+                | ypT0/is ypN0 (SLNE ≥ 3 LN) | yes                 | cases with high risk <sup>4</sup> |                     |
| cT1/2 cN0 (US obligatory) | ypT0/is ypN0 (SLNE ≥ 3 LN) | yes                 | no                                | no                  |

<sup>1</sup> with standard tangential treatment

<sup>2</sup> if the patient underwent a mastectomy

<sup>3</sup> together with PMRT or RT because of BCT

<sup>4</sup> Criteria for a high risk of recurrence:

pN0 premenopausal, high risk: central or medial location, and (G2–3 and ER/PgR-negative)

pN1a high risk: central or medial location and (G2–3 or ER/PgR-negative) or premenopausal, lateral location and (G2–3 or ER/PgR-negative)

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                 | EG  | LoE   | Sources     |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|-------------|
| 4.43. | Adjuvant irradiation of regional lymph drainage areas improves disease-free survival and overall survival rates in a subgroup of patients.                                                                                                                                                                                                                                                 |     | 1a    | [84–88]     |
| 4.44. | a) Irradiation of the supra-/infraclavicular lymph nodes may be an option for patients with pN0 or pN1mi stage disease under the following circumstances if all of the following conditions are met: <ul style="list-style-type: none"> <li>premenopausal and central or medial tumor location and G2–3 and ER/PgR-negative.</li> </ul>                                                    | 0   | 2a/2b | [84–90]     |
|       | b) Irradiation of the supra-/infraclavicular lymph nodes should be carried out in patients with 1–3 affected lymph nodes in the following circumstances: <ul style="list-style-type: none"> <li>central or medial location and (G2–3 or ER/PgR-negative)</li> <li>premenopausal, lateral location and (G2–3 or ER/PgR-negative)</li> </ul>                                                 | B   | 2a    | [84–90]     |
|       | c) Irradiation of the supra-/infraclavicular lymph nodes must be generally carried out in all patients with > 3 affected axillary lymph nodes.                                                                                                                                                                                                                                             | A   | 2a    | [84–90]     |
| 4.45. | a) Irradiation of the internal thoracic artery lymph nodes may be carried out in patients without or with minimal axillary involvement (pN0 or pN1mi) in the following circumstances: <ul style="list-style-type: none"> <li>premenopausal and central or medial location and G2–3 and ER/PgR-negative</li> </ul>                                                                          | 0   | 2b    | [84–88]     |
|       | b) Irradiation of the internal thoracic artery lymph nodes should be carried out in patients with 1–3 affected lymph nodes in the following circumstances: <ul style="list-style-type: none"> <li>central or medial location and (G2–3 or ER/PgR-negative)</li> <li>premenopausal, lateral location and (G2–3 or ER/PgR-negative)</li> </ul>                                               | B   | 2b    | [84–88]     |
|       | c) Irradiation of the internal thoracic artery lymph nodes should be carried out in patients with > 3 affected axillary lymph nodes in the following circumstances: <ul style="list-style-type: none"> <li>G2–3 or ER/PgR-negative</li> </ul>                                                                                                                                              | B   | 2b    | [84–88]     |
|       | d) If tumor involvement of the internal thoracic artery lymph nodes is confirmed, they should be treated with radiotherapy.                                                                                                                                                                                                                                                                | B   | 2b    | [84–90]     |
|       | e) If patients have an increased cardiac risk or are receiving treatment with trastuzumab, the decision whether or not to irradiate the internal thoracic artery lymph nodes must be made on an individual basis by an interdisciplinary tumor board.                                                                                                                                      | A   | 4     | [91, 92]    |
| 4.46. | Expanded axillary radiation may be used to treat patients with 1–2 affected axillary sentinel lymph nodes if no axillary dissection is carried out or if the interdisciplinary tumor board agrees that no further local axillary therapy should be carried out (analogous to ACOSOG Z0011). The decision about the appropriate approach must be taken by an interdisciplinary tumor board. | 0/A | 2b    | [35, 93–95] |
| 4.47. | Radiotherapy of lymph drainage areas should be administered in standard fractions (5 × week 1.8 to 2.0 Gy, total dose: approx. 50 Gy over a period of approx. 5–6 weeks) or in hypofractionated doses (total dose: approx. 40 Gy in approx. 15–16 fractions over a period of approx. 3 to 5 weeks).                                                                                        | EC  |       |             |
| 4.48. | Treatment of patients with primary inoperable or inflammatory cancer must consist of primary systemic therapy followed by surgery and postoperative radiotherapy or, if the cancer continues to be inoperable, radiotherapy alone or preoperative radiotherapy.                                                                                                                            | A   | 1b    | [96, 97]    |

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                    | EG | LoE | Sources            |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|--------------------|
| 4.49. | a) Postoperative chemotherapy and radiotherapy must be administered sequentially.<br>Note: No specific sequence (chemotherapy first or radiotherapy first) has been confirmed as superior.<br>The sequence of chemotherapy followed by radiotherapy is the established sequence in clinical practice.                                         | A  | 1b  | [98 – 101]         |
|       | b) If only RT is administered, treatment with RT should commence within a period of 8 weeks postoperatively.                                                                                                                                                                                                                                  |    |     | [102, 103]         |
|       | c) Adjuvant endocrine therapy can be started independently of any radiotherapy. (1a)<br>Therapy with trastuzumab may be continued during radiotherapy. If the patient is receiving simultaneous irradiation of the internal thoracic artery lymph nodes, the appropriate approach must be decided on by an interdisciplinary tumor board. (4) |    |     | [91, 92, 104, 105] |

### 1.3 Systemic adjuvant therapy (endocrine therapy, chemotherapy, antibody therapy)

#### 1.3.1 Choice of adjuvant therapy and classification of risk

The 2009 St. Gallen Recommendations have pointed out the significance of endocrine sensitivity and the 2011 Recommendations have highlighted the importance of molecular subtypes as the decisive criteria whether adjuvant chemotherapy is indicated or not [106]. The markers ER, PgR, HER2 and Ki-67, which are identified by immunohistochemistry, are considered surrogate parameters for different molecular subtypes [106]. ER-positive and/or PgR-positive, HER2-negative tumors with low proliferation rates are classified as luminal A; if the proliferation rates are high, they are classified as luminal B. It should be noted that there is currently no validated threshold value for Ki-67 (e.g. for classifying a tumor as luminal A vs. luminal B or to confirm the decision for/against adjuvant chemotherapy).

Indications for adjuvant chemotherapy:

- simultaneous anti-HER2 therapy with trastuzumab over a period of 1 year combined with (neo-) adjuvant chemotherapy is the standard approach for HER2-positive tumors
- non-endocrine-sensitive tumors (ER- and PgR-negative)
- tumors which may not be endocrine-sensitive
- node-positive tumors (studies are currently being carried out to evaluate whether patients with low numbers of affected lymph nodes [1–3 affected LN] and favorable tumor biology [luminal A] may not need adjuvant chemotherapy)
- G III
- young age at onset (< 35 years)

Chemotherapy is always indicated if the individual expected benefit is higher than potential side effects and long-term negative effects. This requires careful, in-depth counselling and discussions with the patient, particularly if the expected benefit is minimal.

#### 1.3.2 Endocrine therapy

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                     | EG  | LoE                   | Sources               |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------|-----------------------|
| 4.50. | a) Patients with estrogen and/or progesterone receptor-positive* invasive tumors must receive endocrine therapy.                                                                                                                                                                                                                                                                                                                                               | A   | 1a                    | [30, 107 – 110]       |
|       | b) Endocrine therapy must only be started after chemotherapy has been completed but it can be administered in parallel to radiotherapy.                                                                                                                                                                                                                                                                                                                        | A   | 1a                    | [30, 45, 107 – 110]   |
| 4.51. | After 5 years of tamoxifen the decision whether or not to continue endocrine therapy must be re-evaluated in every patient with ER+ breast cancer.<br>When considering whether or not to continue endocrine therapy, the risk of recurrence and the therapy-related side effects (toxicity, decreased adherence) should be weighed up.<br>The patient's current menopausal status must be taken into account when selecting the appropriate endocrine therapy. | A/B | Adapt. from guideline | [111]                 |
| 4.52. | Premenopausal patients must receive tamoxifen therapy for at least 5 years.<br>Antiestrogen therapy with tamoxifen 20 mg per day must be administered for a period of 5–10 years depending on the risk of recurrence or until recurrence occurs.<br>Whether or not expanded therapy is indicated depends on the risk of recurrence and the patient's wishes.                                                                                                   | A   | 1a                    | [107, 108, 112 – 114] |
| 4.53. | a) High-risk patients with ER+ breast cancer who are still premenopausal after completing chemotherapy may be treated with an aromatase inhibitor after suppressing ovarian function.                                                                                                                                                                                                                                                                          | EC  |                       |                       |
|       | b) Suppression of ovarian function alone can be considered in premenopausal women with ER+ breast cancer who cannot receive tamoxifen or do not want to be treated with tamoxifen; suppression can be achieved either by administering a GnRHa or by oophorectomy.                                                                                                                                                                                             | EC  |                       |                       |
|       | c) Suppression of ovarian function (by GnRHa or bilateral oophorectomy) in addition to tamoxifen or an aromatase inhibitor must only be considered in patients with a high risk of recurrence who are premenopausal after receiving adjuvant chemotherapy. Suppression of ovarian function is mandatory when treatment consists of administering aromatase inhibitor.                                                                                          | A   | Adapt. from guideline | [115]                 |
| 4.54. | Adjuvant endocrine therapy for postmenopausal patients with ER+ breast cancer should include an aromatase inhibitor.                                                                                                                                                                                                                                                                                                                                           | B   | 1b                    | [115]                 |

\* ≥ 10% progesterone-receptor-positive tumor cell nuclei

### 1.3.3 Adjuvant chemotherapy

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                               | EG | LoE | Sources             |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------------------|
| 4.55. | a) Adjuvant chemotherapy is indicated for: <ul style="list-style-type: none"> <li>HER2-positive tumors (from pT1b, N0; pT1a, N0 if additional risks are present: e.g., G3, ER/PR-negative, high Ki67 levels)</li> <li>Triple-negative tumors (ER- and PgR-negative, HER2-negative)</li> </ul> Luminal-B tumors with a high risk of recurrence (high Ki-67 levels, G3, high-risk multigene assay, young age at onset, lymph nodes show tumor involvement) | B  | 1a  | [4, 11, 116–119]    |
|       | b) Chemotherapy must be administered in the recommended doses.<br>Under-dosing or reducing the number of cycles risks reducing the efficacy of chemotherapy.                                                                                                                                                                                                                                                                                             | A  | 1a  | [118, 120–124]      |
| 4.56. | Cytostatic agents may be administered simultaneously or sequentially (according to the evidence-based protocols).<br>Dose-dense therapies should be used to treated suitable patients with a high tumor-related risk of mortality.                                                                                                                                                                                                                       | B  | 1b. | [125–130]           |
| 4.57. | Adjuvant chemotherapy should include a taxane and an anthracycline.                                                                                                                                                                                                                                                                                                                                                                                      | B  | 1a  | [116, 126, 131–139] |
|       | 6 cycles of TC (docetaxel/cyclophosphamide) may be an alternative in patients with moderate clinical risk ( $\leq 3$ affected lymph nodes).                                                                                                                                                                                                                                                                                                              | O  | 1a  |                     |
|       | Standard adjuvant chemotherapy must take 18–24 weeks.                                                                                                                                                                                                                                                                                                                                                                                                    | A  | 1a  |                     |

### 1.3.4 Neoadjuvant therapy

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                            | EG | LoE | Sources              |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|----------------------|
| 4.58. | a) Neoadjuvant (primary, preoperative) systemic therapy is considered the standard treatment for patients with locally advanced, primary inoperable or inflammatory breast cancer in the context of a multimodal therapy concept.                                                                                                                                                                                     | EC |     |                      |
|       | b) Neoadjuvant systemic therapy should be preferred if the same postoperative adjuvant chemotherapy is indicated.                                                                                                                                                                                                                                                                                                     | EC |     |                      |
| 4.59. | a) If chemotherapy is indicated, it can be administered prior to surgery (neoadjuvant) or after surgery (adjuvant). Both approaches are equivalent with regard to overall survival.<br>Neoadjuvant therapy may lead to a higher rate of breast-conserving therapies.                                                                                                                                                  |    | 1a  | [140–142]            |
|       | b) The effect (pathohistological remission) is greatest for hormone receptor-negative cancers.                                                                                                                                                                                                                                                                                                                        |    | 1a  | [140, 141, 143, 144] |
|       | c) Resection within the new tumor margins is possible if R0 resection can be achieved.                                                                                                                                                                                                                                                                                                                                | EC |     |                      |
| 4.60. | a) Postmenopausal patients with endocrine-sensitive breast cancer, for whom surgery or chemotherapy is not possible or who do not want surgery or chemotherapy, may be treated with primary endocrine therapy.                                                                                                                                                                                                        | EC |     |                      |
|       | b) Neoadjuvant endocrine therapy is not a standard therapy; neoadjuvant endocrine therapy may be considered in special situations (inoperable cancer, multiple morbidities).                                                                                                                                                                                                                                          | EC |     |                      |
| 4.61. | a) If a neoadjuvant chemotherapy combination is used, it should include an anthracycline and a taxane.<br>Preoperative therapy should take 18–24 weeks.<br>HER2-positive tumors for which neoadjuvant chemotherapy is indicated should be treated with trastuzumab. High-risk (clinical/sonographic findings or N+ on punch biopsy, tumor size > 2 cm) HER2-positive patients should additionally receive pertuzumab. | EC |     |                      |
|       | b) Platinum salts increase the complete remission rate (pCR rate) in patients with triple-negative breast cancer (TNBC) irrespective of their BRCA status. The benefit for progression-free survival (PFS) and overall survival has not yet been conclusively confirmed. The toxicity is higher.                                                                                                                      | EC |     |                      |
| 4.62. | If anthracycline-taxane-based neoadjuvant chemotherapy is adequate, no additional adjuvant chemotherapy is recommended for tumor residues in the breast and/or lymph nodes. Post-neoadjuvant chemotherapy treatment should only be carried out in the context of clinical trials.                                                                                                                                     | EC |     |                      |

### 1.3.5 Antibody therapy

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                        | EG | LoE | Sources      |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|--------------|
| 4.63. | a) Patients with HER2-overexpressing tumors with a diameter $\geq 1$ cm (immunohistochemical score 3+ and/or ISH-positive) must receive (neo) adjuvant treatment with an anthracycline followed by a taxane in combination with trastuzumab. Trastuzumab must be administered over a total period of one year.                    | A  | 1b  | [16, 29, 30] |
|       | b) Adjuvant treatment with trastuzumab should preferably be started at the same time as the taxane phase of adjuvant chemotherapy.                                                                                                                                                                                                | B  | 2a  | [145]        |
|       | c) If chemotherapy is indicated to treat HER2+ tumors $\leq 5$ mm, trastuzumab should be additionally administered. Six cycles of TCH (docetaxel, carboplatin, trastuzumab) every 3 weeks may also be recommended as an adjuvant treatment. The cardiotoxicity of this approach is lower than after treatment with anthracyclines | EC |     |              |

### 1.3.6 Bone-targeted therapy

#### 1.3.6.1 Therapy and prevention of cancer treatment-induced bone loss

The risk of bone density loss with destruction of bone structure and the risk of therapy-related osteoporosis followed by an increased risk of fractures is significantly higher in patients with malignant disease [146]. Apart from such commonly reported changes as immobilization and changes in lifestyle (e.g. discontinuation of estrogen therapy), it is primarily drug therapies that are responsible for osseous changes. Supportive therapies (e.g. cortisone preparations) are as likely to damage bones as cytotoxic or endocrine drugs. This issue is becoming increasingly important following the high curative rates for many solid tumors, particularly for breast cancer.

In premenopausal women with hormone receptor-positive breast cancer, ovarian function suppression (e.g. using GnRH analogs) alone or in combination with tamoxifen or an aromatase inhibitor and treatment with tamoxifen alone leads to a loss of bone density and an increased incidence of osteoporosis compared to

healthy control populations [147–149]. The combination of ovarian function suppression with an aromatase inhibitor led to the greatest decrease in bone density [147].

In postmenopausal women, treatment with aromatase inhibitors also leads to a loss of bone density and an increased incidence of fractures compared to women treated with tamoxifen [150–153].

Chemotherapies can also result in a significant loss of bone density [154, 155].

The indication for preventive treatment depends on the patient's gender, age and bone density and should take the patient's history and lifestyle into account. Primary prevention of cancer therapy-induced bone loss should be considered if patients present with a special combination of risks [156, 157]. These include advanced age, low body mass index, nicotine abuse, therapy with aromatase inhibitors, familial disposition, long-term cortisone therapy, immobility, endocrine disease, medication (Confederation of German-speaking Scientific Osteology Society, <http://www.dv-osteologie.org>) [158].

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                  | EG | LoE | Sources              |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|----------------------|
| 4.64. | In patients with an increased familial or cancer therapy-related risk of bone loss, bone density measurements should be carried out prior to starting treatment.<br>Bone density measurements should be repeated at regular intervals depending on the results and the presence of additional risk factors. | EC |     |                      |
| 4.65. | Depending on the patient's individual combination of risk factors for developing osteoporosis, preventive treatment should be considered to prevent cancer therapy-induced osteoporosis ( <a href="http://www.dv-osteologie.org">http://www.dv-osteologie.org</a> ; ESMO bone health guidance).             | EC |     |                      |
| 4.66. | Osteoprotective therapy should be considered for premenopausal patients receiving GnRH and/or TAM and postmenopausal patients receiving treatment with AI.                                                                                                                                                  | B  | 1b  | [147, 150, 152, 158] |
| 4.67. | Hormone therapy with estrogens should not be used to prevent cancer therapy-related osteoporosis in breast cancer patients as an increased rate of recurrence cannot be excluded, particularly in patients with hormone receptor-positive disease.                                                          | B  | 1a  | [159]                |
| 4.68. | In addition to these general recommendations, bisphosphonates or denosumab may be used for primary prevention of cancer therapy-induced bone loss.                                                                                                                                                          | EC |     |                      |
| 4.69. | A reduced risk of fractures associated with endocrine therapy has only been clearly confirmed for denosumab but has not yet been confirmed for bisphosphonates.                                                                                                                                             | A  | 1   | [150]                |
| 4.70. | Bone-targeted therapy to prevent therapy-related osteoporosis should be carried out for the duration of endocrine therapy.                                                                                                                                                                                  | EC |     |                      |

### 1.3.6.1.1 Therapy for cancer therapy-induced osteoporosis

| No.   | Recommendations/Statements                                                                                                 | EG | LoE | Sources |
|-------|----------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 4.71. | It is important to exclude bone metastasis if a bone fracture occurs which was not caused by sufficiently powerful trauma. | EC |     |         |

### 1.3.6.2 Adjuvant therapy to improve bone metastasis-free survival and overall survival

According to the “seed and soil” hypothesis, luminal breast cancer cells are particularly prone to metastasize in bone where they are then detected in the form of disseminated tumor cells [160–162]. Bisphosphonates and probably also denosumab appear to have a therapeutic effect with regard to the persistence of these cells and thus on the incidence of secondary bone metastasis [163].

Two meta-analyses evaluated studies on the adjuvant use of different bisphosphonates. Ben-Aharon and colleagues found a positive effect on survival in postmenopausal patients with breast cancer (HR 0.81 [0.69–0.95]) [164]. In their meta-analysis, Coleman and colleagues reported a significant positive effect on bone metastasis-free survival of 34% and on overall survival of 17% for postmenopausal patients (including premenopausal patients with ovarian function suppression from GnRH analogs; ABCSG-12) [165].

The meta-analyses found no significant benefit for premenopausal patients (without ovarian function suppression from GnRH analogs) with regard to disease-free survival, bone metastasis-free survival and overall survival. No effect on prognosis was detected in an evaluation of a secondary endpoint carried out in a subpopulation of premenopausal patients (the majority of whom did not have suppression of ovarian function), despite the high therapy density at the start of treatment (AZURE trial [158]).

To date, no bisphosphonate has been approved for use in adjuvant therapy in the European Union, meaning that treatment can currently only be carried out as an off-label use.

| No.   | Recommendations/Statements                                                                                                                                                                                                 | EG | LoE | Sources         |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-----------------|
| 4.72. | Adjuvant bisphosphonate therapy prolongs bone metastasis-free survival and overall survival in postmenopausal patients with breast cancer and in premenopausal patients with ovarian function suppression (off-label use). | A  | 1   | [164, 165]      |
| 4.73. | It is currently not possible to recommend the adjuvant use of bisphosphonates or denosumab for premenopausal patients with suppression of ovarian function.                                                                | 0  | 1b  | [158, 164, 165] |

### 1.3.6.3 Bone-targeted therapy for patients with bone metastasis

The most common metastases of breast cancer occur in bone marrow. Luminal tumors have a particular affinity to the skeleton. The most common complications of bone metastases are pain, pathological fractures, vertebral compression syndrome, and hypercalcemia [166]. If the aforementioned symptoms (with the exception of pain) occur, then morbidity is significantly increased. A number of different measures can be initiated to prevent these serious complications.

The interdisciplinary AWMF S3 guideline 032-054OL “Supportive Therapy for Oncology Patients” provides a detailed discussion of the diagnosis and therapy of bone metastases [167]).

| No.   | Recommendations/Statements                                                                                                                                                            | EG | LoE | Sources |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 4.74. | Patients must go to the dentist before starting adjuvant osteoprotective therapy. The Recommendations of the S3 guideline on “Antiresorptive drug-related necrosis of the jaw” apply. | EC |     |         |

## 1.3.7 Lifestyle factors which can be influenced

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                             | EG | LoE   | Sources   |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|-----------|
| 4.75. | Patients must be motivated to carry out physical exercise and to normalize their body weight (if their BMI is high). Patients should receive support and assistance. It is particularly recommended that patients:<br>a) avoid physical inactivity and return to normal daily activities as early as possible after diagnosis (LoE 2a)<br>b) work towards achieving the goal of 150 minutes of moderate or 75 minutes of strenuous physical activity per week (LoE 1a) | A  | 2a/1a | [168–171] |
| 4.76. | Patients should be offered weight training programs, particularly when they are undergoing chemotherapy and hormone therapy.                                                                                                                                                                                                                                                                                                                                           | B  | 1b    | [172–175] |
| 4.77. | Patients should be advised and taught to do regular sports activities and physical exercise to treat breast cancer-associated fatigue.                                                                                                                                                                                                                                                                                                                                 | B  | 1a    | [176–179] |

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                         | EG | LoE                   | Sources              |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------------------|----------------------|
| 4.78. | If manifest chemotherapy-induced polyneuropathy is present, patients should have exercise therapy to improve functionality.<br>This may include: <ul style="list-style-type: none"> <li>balance exercises</li> <li>sensorimotor training</li> <li>coordination training</li> <li>vibration training</li> <li>fine motor skills training</li> </ul> | B  | 1a/2a                 | [173, 174, 180, 181] |
| 4.79. | Patients with lymphedema after surgery for breast cancer must be started on monitored, gradually progressive weight training to treat lymphedema.                                                                                                                                                                                                  | B  | 1b                    | [182 – 187]          |
| 4.80. | Patients should be counselled (a) about achieving and maintaining a healthy body weight, and (b) if they are overweight or obese, about how to limit their consumption of highly-calorific food and drinks and how to increase their physical activity to promote moderate weight loss and maintain it over the long-term.                         | A  | Adapt. From guideline | [188]                |
| 4.81. | Patients should be counselled on how to achieve and adhere to a nutritional program rich in vegetables, fruit, wholegrain and pulses which contains few saturated fats and only limited alcohol consumption.                                                                                                                                       | A  | Adapt. from guideline | [188]                |
| 4.82. | Patients must receive counselling not to smoke; if necessary, smokers must be recommended smoking cessation programs.                                                                                                                                                                                                                              | A  | 2a                    | [188]                |
| 4.83. | To prevent late recurrence (> 5 years after primary diagnosis), patients with receptor-positive disease should avoid a daily alcohol consumption of > 12 g pure alcohol.                                                                                                                                                                           | B  | 2a                    | [189]                |

## 1.4 Breast cancer during pregnancy and lactation, pregnancy after breast cancer, fertility preservation

### 1.4.1 Pregnancy after breast cancer

| No.  | Recommendations/Statements                                                                                                                                                                                                                                                                       | EG      | LoE     | Sources              |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|----------------------|
| 7.1. | Patients who have had breast cancer must not be counselled against becoming pregnant. This applies irrespective of their hormone status.                                                                                                                                                         | A       | 3a      | [190, 191]           |
| 7.2. | a) The interval until becoming pregnant after breast cancer is not correlated with a poorer prognosis.<br>b) The risk of recurrence depends on the tumor biology and the stage of disease. This must be discussed during counselling for any subsequent pregnancy.                               | A<br>EC | 3a      | [190]                |
| 7.3. | The longer the endocrine therapy, the better the chances for a cure (see Chapter 4.7.2 Endocrine therapy). If the patient wished to become pregnant before completing endocrine therapy, then endocrine therapy should be continued after the patient has given birth and stopped breastfeeding. | EC      |         |                      |
| 7.4. | a) Patients can try to become pregnant after breast cancer with the help of reproductive medical procedures.<br>b) The chances of success (i.e. an intact pregnancy or baby) are lower for breast cancer patients when autologous eggs are used compared to women without breast cancer.         | 0<br>EC | 4<br>2c | [192 – 194]<br>[195] |

### 1.4.2 Breast cancer during pregnancy

| No.  | Recommendations/Statements                                                                                                                                                                                            | EG | LoE | Sources         |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-----------------|
| 7.5. | a) Treatment (systemic therapy, surgery, RT) for breast cancer (in pregnant patients) during pregnancy must be as similar as possible to treatment administered to younger, non-pregnant patients with breast cancer. | EC |     |                 |
|      | b) Standard chemotherapy with anthracyclines and taxanes may be administered in the 2nd and 3rd trimester of pregnancy.                                                                                               | 0  | 2b  | [196 – 200]     |
|      | c) Anti-HER2 therapy must not be administered during pregnancy.                                                                                                                                                       | A  | 3a  | [196, 197, 199] |
|      | d) Endocrine therapy must not be administered during pregnancy.                                                                                                                                                       | EC |     |                 |
|      | e) Surgery may be carried out in the same way as in non-pregnant patients.                                                                                                                                            | EC |     |                 |

### 1.4.3 Fertility preservation

| No.  | Recommendations/Statements                                                                                                                                | EG | LoE | Sources     |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-------------|
| 7.6. | a) Patients of childbearing age with breast cancer must receive counselling about fertility and preserving fertility before starting cancer treatment.    | EC |     |             |
|      | b) The administration of a GnRH analog before starting chemotherapy may be considered in all women who wish to preserve their ovarian function/fertility. | 0  | 1b  | [200 – 206] |

## 1.5 Breast cancer in older patients

### 1.5.1 General comments

| No.  | Recommendations/Statements                                                                                                                                                                                                                      | EG | LoE | Sources |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 8.1. | Therapeutic decisions for older patients should be based on current standard recommendations but also take account of the patient's biological age, life-expectancy and preferences; the benefits and risks of such therapy must be weighed up. | EC |     |         |

### 1.5.2 Geriatric patients

| No.  | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                           | EG | LoE | Sources         |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-----------------|
| 8.2. | Patients who are older than 75 years should have a geriatric assessment or screening using a geriatric assessment algorithm, particularly if chemotherapy or surgery requiring a general anesthetic is planned, with the aim of improving therapy adherence, tolerance of chemotherapy and possibly survival.                                                                                        | B  | 2a  | [207 – 210]     |
| 8.3. | Geriatric assessment and management should cover therapy-relevant geriatric domains (particularly functionality-related parameters such as activities of daily living, mobility, cognition, falls, and morbidity-related parameters such as multiple medication, nutrition, fatigue, and number of comorbidities) in order to adapt the choice of therapy accordingly and start supportive measures. | B  | 2a  | [30, 211 – 214] |

### 1.5.3 Local therapy

| No.  | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                             | EG | LoE | Sources |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 8.4. | a) Surgical therapy to treat older patients is basically no different from the surgical therapy used to treat younger patients.                                                                                                                                                                                                                                                                                                                                                        | EC |     |         |
|      | b) Patients with ER/PR-positive breast cancer: primary endocrine therapy should be started if surgery is not carried out because of the patient's frailty (e.g., comorbidities and higher anesthetic risk) or because the patient rejects surgery. When deciding on the appropriate therapy, any drug-related specific side effects, particularly the risk of thrombosis/embolism (tamoxifen) and the risk of bone fractures (aromatase inhibitors), must be taken into consideration. | B  | 1b  | [215]   |
|      | c) Patients with ER- and PR-negative breast cancer: if surgery under general anesthesia is not carried out because of the patient's frailty (e.g. comorbidities and increased surgical risk) or because the patient rejects surgery, surgery under local anesthesia, primary radiotherapy or purely palliative medical treatment may be considered.                                                                                                                                    | EC |     |         |

### 1.5.4 Adjuvant endocrine therapy

| No.  | Recommendations/Statements                                                                                                                                                                                                                                                   | EG | LoE | Sources    |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|------------|
| 8.5. | Endocrine therapy is recommended for patients with hormone receptor-positive disease. Endocrine therapy may be dispensed with in individual cases (i.e., when treating patients with very low-grade tumors or very favorable tumor biology or if the patient is very frail). | 0  | 2b  | [213, 216] |

### 1.5.5 Adjuvant chemotherapy

| No.  | Recommendations/Statements                                                                                                                                                                                                  | EG | LoE | Sources     |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-------------|
| 8.6. | As patients become frailer with increasing age, their reduced physical reserves and changes in their pharmacokinetics may lower the tolerability of chemotherapy and increase the rate of side effects requiring treatment. | EC |     |             |
| 8.7. | Chemotherapy may be associated with a significant reduction in cognitive performance in older women aged > 70 years.                                                                                                        |    | 2b  | [217, 218]  |
| 8.8. | Preference should be given to anthracycline and/or taxane-based combinations or sequential regimens. The increased risk of cardiotoxicity and of MDS/AML associated with anthracyclines must be taken into consideration.   | B  | 2a  | [219 – 227] |

### 1.5.6 Anti-HER2 therapy

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                            | EG | LoE   | Sources          |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|------------------|
| 8.10. | Treatment is analogous to the treatment administered to younger patients and consists of trastuzumab combined sequential anthracycline-taxane-based chemotherapy.<br>It is important to be aware of the increased risk of cardiotoxicity associated with this approach. (EC)<br>An anthracycline-free combination consisting of carboplatin-docetaxel or docetaxel-cyclophosphamide may be used. (1b) |    | EC/1b | [214, 228 – 230] |
| 8.11. | Paclitaxel administered weekly (over 12 weeks) with trastuzumab may be used to treat T1–2 (up to 3 cm) pN0 tumors.                                                                                                                                                                                                                                                                                    | 0  | 2b    | [231, 232]       |

## 1.6 Breast cancer in men

Breast cancer in men should be diagnosed and treated by an interdisciplinary group of specialists. Because of the type of tumor biology and the similarities to breast cancer in women, specialists for gynecologic oncology must also be involved when treating breast cancer in men. An interdisciplinary cooperation between

breast centers, gynecologists, urologists and andrologists is particularly advisable when treating sexual disorders caused by therapy with tamoxifen, men with BRCA mutations [233] who have an increased associated risk of prostate cancer, and men with breast cancer who must be treated for benign prostate syndrome [234].

| No.  | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | EG | LoE | Sources |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 9.1. | a) Patients must be encouraged to ask for medical counselling early on and provided with information about disease, particularly about symptoms and changes in the breast; they must be encouraged to monitor themselves.<br>b) If there is a suspicion of malignancy, the initial investigation must include taking the patient's history, clinical examination, mammography, and ultrasound examination of the breast and of the lymphatic drainage areas. There are no data on the diagnostic use of CM-MRI.<br>c) If there are malignant findings in the breast and axilla, further examinations with staging/investigation into the extent and spread of disease must be carried out in accordance with the recommendations made for women in the same situation, although there are no data on the diagnostic use of CM-MRI. | EC |     |         |
| 9.2. | a) The aim of surgery is complete resection of the tumor. Surgery should consist of a mastectomy.<br>Breast-conserving surgery should be considered if the tumor is small enough.<br>b) If the axilla are clinically unremarkable (cN0), sentinel lymph node resection must be carried out, with the same rules applying as for women.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | EC |     |         |
| 9.3. | Irrespective of surgery, adjuvant radiotherapy of the thoracic wall and, if necessary, of the lymphatic drainage areas (the indications for this are the same as for women) must be carried out to treat large tumors ( $\geq 2$ cm) and axillary lymph node involvement if the hormone receptor status is negative.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | EC |     |         |
| 9.4. | When deciding whether adjuvant chemotherapy and antibody therapy (anti-HER2) are indicated, the same rules apply as for women and the same therapy must be carried out.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | EC |     |         |
| 9.5. | Patients with hormone receptor-positive breast cancer must receive adjuvant endocrine therapy with tamoxifen, usually over a period of 5 years. There are no data available about treatment for more than 5 years. It may be considered in individual cases in the same way it would be considered when treating women.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | EC |     |         |
| 9.6. | a) Metastatic disease should be treated according to the same rules as those used to treat women.<br>b) It is not clear whether aromatase inhibitors are sufficiently effective in men without suppression of testicular function. Aromatase inhibitors should therefore be administered together with suppression of testicular function.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | EC |     |         |

| No.   | Recommendations/Statements                                                                                                                                                                                                                                         | EG | LoE | Sources |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 9.7.  | Men with breast cancer should be offered the opportunity to participate in trials/be included in tumor registers.                                                                                                                                                  | EC |     |         |
| 9.8.  | Genetic testing must be recommended to all men with breast cancer.                                                                                                                                                                                                 | EC |     |         |
| 9.9.  | The follow-up regimen including imaging evaluations must be analogous to the approach used for women.                                                                                                                                                              | EC |     |         |
| 9.10. | The patient should be provided with qualified and relevant gender-specific information (in print and online) by the professionals who treat them, and the patient should be helped to access the targeted support and information available from self-help groups. | EC |     |         |

► **Table 5** Risk factors for men to develop breast cancer.

|                    |                                                                                                                                                                                                                                             |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Age                | Unimodal age distribution; the highest incidence is in the 71st year of life                                                                                                                                                                |
| Ethnicity          | Increased risk for men of African or Caribbean descent, who usually also have an advanced stage of disease when they are first diagnosed                                                                                                    |
| Germline mutations | If the patient's family has a positive history of germline mutations for both sexes, they have a 2.5-fold higher risk of disease; BRCA-2 mutations were confirmed in 4–40% of all cases; RAD51B gene modifications increase the risk by 50% |
| Endocrine causes   | Exposure to exogenous estrogen, e.g. hormone therapy for transsexuals, treatment of prostate cancer, professional exposure                                                                                                                  |
|                    | Increased endogenous estrogen synthesis: Klinefelter syndrome, obesity                                                                                                                                                                      |
|                    | Decreased levels of androgen: orchiectomy, undescended testicle, mumps orchitis, cirrhosis of the liver                                                                                                                                     |
| Environment        | Lifestyle: obesity, lack of exercise, excessive consumption of alcohol                                                                                                                                                                      |
|                    | Exposure to radiation: nuclear weapons, radiotherapy, diagnostic radiology                                                                                                                                                                  |
|                    | Professional exposure: high temperatures, petroleum, exhaust gases                                                                                                                                                                          |

## 2 Therapy (Recurrence/Metastasis)

### 2.1 Therapy for local/loco-regional recurrence

#### 2.1.1 Local (intramammary) recurrence

| No.  | Recommendations/Statements                                                                                                                                                                                                                                                                              | EG | LoE | Sources     |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-------------|
| 5.7. | a) If there is a suspicion of loco-regional recurrence, the first step must be histological verification including repeat determination of ER, PR and HER2/neu status and complete re-staging to exclude metastasis and make it possible to plan an interdisciplinary therapy strategy.                 | EC |     |             |
|      | b) The highest level of local tumor control in patients with intramammary recurrence (DCIS/invasive carcinoma) is achieved by secondary mastectomy.                                                                                                                                                     | EC |     |             |
|      | c) If the initial situation is favorable (e.g. DCIS or invasive carcinoma with a lengthy recurrence-free interval and no skin involvement), then breast-conserving surgery can be carried out again after careful counselling of the patient.                                                           | 0  | 4a  | [235 – 238] |
|      | d) Prior to carrying out another breast-conserving surgery, the possibility of carrying out repeat radiotherapy (partial breast irradiation) should be investigated and discussed by an interdisciplinary tumor conference; if necessary, the patient should have an appointment with a radiotherapist. | EC |     |             |
|      | e) After breast-conserving surgery, the patient must be informed about the increased risk of repeat intramammary recurrence.                                                                                                                                                                            | EC |     |             |

#### 2.1.2 Local recurrence after mastectomy

| No.  | Recommendations/Statements                                                                                                                                                                                                                                                          | EG | LoE | Sources |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.8. | Any isolated recurrence in the thoracic wall must be completely resected (R0) where possible. If the main site of recurrence is the ribs/intercostal muscles, the decision for therapy should be taken after interdisciplinary consultation with a specialist for thoracic surgery. | EC |     |         |
| 5.9. | Local therapy (surgical intervention, radiotherapy) may be considered for symptomatic local recurrence (e.g. ulceration, pain) to reduce symptoms, even if the patient has distant metastasis.                                                                                      | EC |     |         |

### 2.1.3 Axillary lymph node recurrence

| No.   | Recommendations/Statements                                                                                                                                                                                                                                  | EG | LoE | Sources |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.10. | In the event of axillary lymph node recurrence, local recurrence of disease should be controlled by repeat surgical axillary intervention, if need be with radiotherapy. Thoracic CT should be done preoperatively to identify the extent of LN metastasis. | EC |     |         |

### 2.1.4 Drug therapy

| No.   | Recommendations/Statements                                                                                                                    | EG | LoE | Sources |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.11. | Systemic therapy after R0 resection of loco-regional recurrence must be considered to prolong the disease-free interval and overall survival. | EC |     |         |

### 2.1.5 Radiotherapy

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | EG | LoE | Sources |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.12. | a) The question whether radiation is indicated after surgery for recurrence must be discussed and decided by an interdisciplinary tumor board.<br>Postoperative radiotherapy should be carried out if no radiotherapy was carried out previously or if the local recurrence was not radically resected (R1–2).                                                                                                                                                                                         | EC |     |         |
|       | b) Palliative radiotherapy, if necessary in combination with chemotherapy, may be used to treat inoperable local recurrence and control symptoms.                                                                                                                                                                                                                                                                                                                                                      | EC |     |         |
|       | c) If there is intramammary recurrence or recurrence in the thoracic wall after breast-conserving surgery (R0) or mastectomy (R0) which was not followed by radiotherapy, the decision whether adjuvant radiotherapy is indicated must follow the recommendations for primary disease.                                                                                                                                                                                                                 | EC |     |         |
|       | d) If intramammary recurrence occurs after breast-conserving surgery (R0) followed by radiotherapy, the question whether adjuvant radiotherapy is indicated must be discussed by an interdisciplinary tumor board. Radiotherapy may be indicated for patients who did not experience serious late sequelae after the 1st radiotherapy.                                                                                                                                                                 | EC |     |         |
|       | e) In the event of recurrence in the thoracic wall after mastectomy (R0) followed by radiotherapy, the question whether repeat radiotherapy is indicated for local control should be discussed by an interdisciplinary tumor board.                                                                                                                                                                                                                                                                    | EC |     |         |
|       | f) In the event of recurrence in the thoracic wall after primary mastectomy without subsequent radiotherapy, adjuvant radiotherapy should be carried out after resection of the recurrence (R0) if additional risk factors are present (very small resection margins, rpN+, G3, lymph node invasion).                                                                                                                                                                                                  | EC |     |         |
|       | g) In the event of recurrence in the thoracic wall after primary mastectomy without subsequent radiotherapy, the question whether repeat adjuvant radiotherapy is indicated after resection of the recurrence (R0) when additional risk factors are present (very small resection margins, rpN+, G3, lymph node invasion) should be discussed by an interdisciplinary tumor board. Radiotherapy may be indicated for patients who did not experience serious late sequelae after the 1st radiotherapy. | EC |     |         |
|       | h) Additional radiotherapy must be recommended if recurrence occurs in an area which was not previously irradiated, the recurrence was not completely resected (R1/R2), and the risk associated with complete surgical resection (R0) cannot be justified.                                                                                                                                                                                                                                             | EC |     |         |
|       | i) An interdisciplinary tumor board must decide whether repeat radiotherapy is indicated when recurrence occurs after prior radiotherapy, the recurrence was not completely resected (R1/R2), and the risk associated with complete surgical resection (R0) cannot be justified.<br>Radiotherapy may be indicated in patients who did not experience serious late sequelae after the 1st radiotherapy.                                                                                                 | EC |     |         |

## 2.2 Distant metastases

### 2.2.1 Systemic therapy for metastatic breast cancer

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                   | EG | LoE | Sources       |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------------|
| 5.13. | Endocrine therapy ± targeted therapy is the therapy of choice for patients with hormone receptor-positive and HER2-negative cancer. Endocrine therapy is not indicated in patients for whom rapid remission is important to avoid pronounced symptoms in the affected organ. | A  | 1b  | [30, 239–243] |

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | EG | LoE   | Sources                 |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|-------------------------|
| 5.14. | Combined chemo-endocrine therapy is not recommended. Although this approach can increase the rate of remission, it also leads to increased toxicity without prolonging the progression-free interval or improving overall survival.                                                                                                                                                                                                                                                                                                                                   | A  | 1a    | [244]                   |
| 5.15. | In premenopausal patients, suppression of ovarian function (with GnRH analogs, oophorectomy) combined with tamoxifen is the first-choice therapy if treatment with tamoxifen was not concluded less than 12 months previously. An alternative approach consisting of suppression of ovarian function followed by the same treatment as that recommended for postmenopausal women may be chosen, and endocrine therapy may be combined with CDK 4/6 inhibitors.                                                                                                        | A  | 1b    | [30, 242, 245, 246]     |
| 5.16. | Subsequently, ovarian suppression combined with an aromatase inhibitor or fulvestrant, if necessary in combination with palbociclib, can be used to treat premenopausal patients. As long as ovarian suppression is maintained, treatment may be administered in the same way as therapy for postmenopausal patients.                                                                                                                                                                                                                                                 | 0  | 2c/EC | [247, 248]              |
| 5.17. | In postmenopausal patients, the first step of endocrine treatment for metastasis should consist of an aromatase inhibitor if adjuvant therapy consisted exclusively of tamoxifen or the patient did not receive adjuvant therapy. It is not possible to give a clear recommendation whether primary endocrine treatment should consist of a steroidal or a non-steroidal aromatase inhibitor. Letrozole may be combined with a CDK 4/6 inhibitor.                                                                                                                     | A  | 1a    | [30, 239, 242, 249–252] |
| 5.18. | Treatment with fulvestrant should be carried out after pretreatment with an aromatase inhibitor, although fulvestrant may also be used as a first-line therapy, particularly for patients who have not previously received endocrine therapy.                                                                                                                                                                                                                                                                                                                         | EC |       |                         |
| 5.19. | No specific therapy sequence is recommended. A combination treatment consisting of letrozole or fulvestrant with a CDK 4/6 inhibitor represents an alternative to monotherapy.<br>Follow-up therapy with exemestane and the mTOR inhibitor everolimus may be administered after anti-hormonal pretreatment with a non-steroidal aromatase inhibitor.<br>Studies have shown that combination therapies prolonged progression-free survival but it has not yet been proven that they improve overall survival.                                                          | EC |       |                         |
| 5.20. | Depending on the patient's previous treatment, the next steps in the endocrine treatment sequence for postmenopausal patients consist of administration of antiestrogens, estrogen receptor antagonists, switching from a steroidal to a non-steroidal aromatase inhibitor or vice versa, or the use of high-dose progestogens.<br>If disease progression continues during treatment with a non-steroidal aromatase inhibitor, patients may be treated with a combination of letrozole or fulvestrant with palbociclib or a combination of exemestane and everolimus. | EC |       |                         |

## 2.2.2 Chemotherapy for metastatic breast cancer

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EG | LoE | Sources    |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|------------|
| 5.21. | Before starting chemotherapy, the patient's general condition, co-morbidities and previous therapies must be evaluated and her probable compliance with treatment must be assessed.                                                                                                                                                                                                                                                                                                                                                                                                                                                             | EC |     |            |
| 5.22. | Regular evaluations of toxicity (subjective and objective) must be carried out during therapy. Treatment doses and scheduled treatment intervals must follow generally accepted standard regimens or recently published therapy regimens. After determining suitable representative parameters (symptoms, tumor markers, imaging) prior to starting therapy, the effect of treatment must be evaluated at least every 6–12 weeks according to clinical requirements. Over time, the intervals between imaging procedures can be extended for patients with sustained remission and a good clinical and laboratory assessment of disease status. | EC |     |            |
| 5.23. | Therapy should be discontinued if the patient has clinically relevant progression or toxicity is intolerable. Patients should not change to a different chemotherapy regimen unless the patient has documented progression or toxicity is intolerable.                                                                                                                                                                                                                                                                                                                                                                                          | EC |     |            |
| 5.24. | a) If chemotherapy is indicated, patients not in need of rapid remission should receive sequential chemotherapy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | B  | 1a  | [253, 254] |
|       | b) A combination therapy consisting of chemotherapy and bevacizumab may improve progression-free survival as a first-line therapy, but this approach is associated with a higher rate of side effects and has no impact on overall survival.                                                                                                                                                                                                                                                                                                                                                                                                    | 0  | 1a  | [255–260]  |
|       | c) Polychemotherapy or chemotherapy + bevacizumab may be administered to patients with severe symptoms and rapid tumor growth or aggressive tumor behavior, i.e. to patients who urgently require remission.                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0  | 1a  | [253, 261] |

### 2.2.2.1 Bevacizumab for metastatic breast cancer (1st line)

In summary, higher rates of remission and an improved PFS (but no survival benefit) has been reported for additional therapy with bevacizumab, which seems to indicate that combination therapy is the appropriate treatment for patients in urgent need of remis-

sion and no combination of risk factors predisposing them to side effects (no previous history of uncontrolled arterial hypertension, cerebrovascular ischemia and deep vein thrombosis). See the long version for more details.

### 2.2.2.2 Regimens

Specific information on the regimens are available in the long version of this guideline (in German).

| No.   | Recommendations/<br>Statements                                                                                                                                                                                                                                                                                                                                                                                                         | EG | LoE | Sources |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.25. | Possible monotherapies can consist of the following substances: alkylating agents, anthraquinones, anthracyclines (also in liposomal form), eribulin, fluoropyrimidine, platinum complexes, taxanes, and vinorelbine. These substances can be combined with each another or with further substances for polychemotherapy. However, patients should only be treated with combinations that have previously been investigated in trials. | EC |     |         |

### 2.2.3 Metastatic HER2-positive breast cancer

| No.   | Recommendations/<br>Statements                                                                                                                | EG | LoE | Sources    |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------|----|-----|------------|
| 5.26. | Systemic therapy after R0 resection of loco-regional recurrence must be considered to prolong the disease-free interval and overall survival. | B  | 1a  | [262, 263] |
| 5.27. | First-line therapy for metastasized HER2-positive breast cancer should consist of a dual blockade with trastuzumab/pertuzumab and a taxane.   | B  | 1b  | [262]      |
| 5.28. | Second-line therapy for metastasized HER2-positive breast cancer should consist of therapy with T-DM1.                                        | B  | 1b  | [262]      |

### 2.2.4 Specific locations of metastases

#### 2.2.4.1 Basic approach for distant metastasis

| No.   | Recommendations/<br>Statements                                                                                                                                      | EG | LoE | Sources |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.29. | The decision whether distant metastases should be treated with surgery or local ablation should be made on an individual basis by an interdisciplinary tumor board. | EC |     |         |

#### 2.2.4.2 Special treatment for skeletal metastases

For the diagnosis and therapy of skeletal metastasis, please refer to the S3 guideline on Supportive Therapy for Oncology Patients (<http://leitlinienprogramm-onkologie.de/Supportive-Therapie.95.0.html>).

### 2.2.4.2.1 Indications for radiotherapy

| No.   | Recommendations/<br>Statements                                                                                                                                                                                                                                                                                                                       | EG | LoE | Sources |
|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.30. | Indications for local percutaneous radiotherapy for bone metastasis are: <ul style="list-style-type: none"> <li>local pain,</li> <li>limited mobility,</li> <li>reduced stability (danger of fractures),</li> <li>s/p surgical stabilization,</li> <li>impending or existing neurological symptoms (e.g. compression of the spinal cord).</li> </ul> | EC |     |         |

### 2.2.4.2.2 Indications for surgical therapy

| No.   | Recommendations/<br>Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | EG | LoE | Sources |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.31. | Indications for the surgical therapy of osseous manifestations may be: <ul style="list-style-type: none"> <li>myeloid compression with neurological symptoms,</li> <li>pathological fracture,</li> <li>impending fracture (risk of fracture, e.g. based on Mirels' scoring system, the Spinal Instability Neoplastic Scale [SINS]),</li> <li>solitary late metastasis,</li> <li>osteolysis which does not respond to radiotherapy,</li> <li>pain which does not respond to treatment.</li> </ul> | EC |     |         |

### 2.2.4.2.3 Osteoprotective therapy

| No.   | Recommendations/<br>Statements                                                                                                     | EG | LoE | Sources |
|-------|------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.32. | Osteoprotective therapy with bisphosphonates/denosumab should be carried out to prevent complications from osseous manifestations. | EC |     |         |

## 2.2.4.3 Treatment for brain metastasis

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | EG | LoE   | Sources     |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|-------------|
| 5.26. | <ul style="list-style-type: none"> <li>Single or solitary brain metastases should be resected if the patient has an otherwise favorable prognosis and the metastasis is in a location which permits its resection, and the risk of postoperative neurological deficits resulting from resection is low. Local fractionated radiotherapy or radiosurgery of the tumor bed should be subsequently carried out.</li> <li>Radiosurgery represents an alternative to resection for patients with single metastases if the metastases are not larger than 3 cm and there is no midline shift with symptoms of intracranial compression.</li> <li>Primary treatment of infratentorial metastasis consists of resection, which should be carried out to prevent imminent occlusive hydrocephalus.</li> <li>If the patient only has a limited number of brain metastases (between 2–4) and their total volume can be treated with targeted radiation, initial radiosurgery is preferable to whole brain radiation therapy because of the lower negative impact on neurocognition, the shorter treatment time, and the better control rates. If surgery or radiosurgery cannot be carried out because of other negative prognostic criteria, the patient must receive whole brain radiation therapy alone. Whole brain radiation therapy alone must be used to treat patients with multiple brain metastases.</li> <li>A combination of resection or radiosurgery with whole brain radiation therapy improves the brain-specific progression-free survival compared to surgery or radiosurgery alone but does not improve overall survival. However, this approach can be considered in individual cases.</li> <li>It is not necessary to combine whole brain radiation therapy with radiosensitizing drugs.</li> </ul> |    | 1b/EC | [264 – 273] |

| No.   | Recommendations/Statements                                                                                                                                                                  | EG | LoE | Sources |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.34. | If cerebral metastasis is present, the patient should also receive systemic therapy (chemotherapy/endocrine therapy/anti-HER2 therapy) in addition to local therapy (surgery/radiotherapy). | EC |     |         |

## 2.2.4.4 Treatment for liver metastases

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                    | EG | LoE | Sources     |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-------------|
| 5.35. | <p>If the patient has liver metastases, resection or another form of local therapy (RFA, TACE, SBRT, SIRT) may be indicated in individual cases; the preconditions for this are:</p> <ul style="list-style-type: none"> <li>no disseminated metastases</li> <li>controlled extrahepatic metastasis</li> </ul> | 0  | 3b  | [274 – 285] |

## 2.2.4.5 Treatment for lung metastases

| No.   | Recommendations/Statements                                                                                                                                                                                                                                                                                | EG | LoE | Sources     |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-------------|
| 5.36. | <p>Resection or another local therapy (RFA, stereotactic radiotherapy) may be indicated to treat individual patients with lung metastases; the preconditions for this are:</p> <ul style="list-style-type: none"> <li>no disseminated metastases</li> <li>controlled extrapulmonary metastasis</li> </ul> | 0  | 4   | [286 – 290] |

## 2.2.4.5.1 Malignant pleural effusion

| No.   | Recommendations/Statements                                                                      | EG | LoE | Sources |
|-------|-------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.37. | Patients with pleural carcinosis and symptomatic pleural effusions must be offered pleurodesis. | A  | 1a  | [291]   |

## 2.2.4.6 Skin and soft tissue metastasis

| No.   | Recommendations/Statements                                                                                                         | EG | LoE | Sources |
|-------|------------------------------------------------------------------------------------------------------------------------------------|----|-----|---------|
| 5.34. | Surgical excision or another form of local therapy (e.g. radiotherapy) can be considered to treat skin and soft tissue metastasis. | EC |     |         |

## Conflict of Interest

See <https://www.leitlinienprogramm-onkologie.de/leitlinien/mammakarzinom/>

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