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Review Article

AGO Breast Commission recommendations for the surgical therapy of breast cancer: Working Group on Gynecologic Cancers (AGO) update 2025

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ABSTRACT

The German Guideline Commission (AGO: Working Group on Gynecologic Cancers) updated its recommendations on the diagnosis and treatment of breast cancer in March 2025. Chapters on oncological and oncoplastic-reconstructive surgery are coordinated with the Working Group for Plastic, Aesthetic, and Reconstructive Surgery in Gynecology (AWOgyn). The most important changes include the incorporation of INSEMA and SOUND trial results into the guidelines. In patients with low-risk characteristics, defined as age ≥50 years, postmenopausal status, hormone receptor-positive/HER2-negative subtype, tumor grading G1-2 with a maximum preoperative size of 2 cm, and unsuspicious axillary ultrasound and clinical examination, the sentinel lymph node biopsy (SLNB) can be omitted if breast-conserving surgery and whole-breast irradiation are planned. In patients with 1–2 macrometastatic sentinel lymph nodes (SLNs) undergoing a mastectomy and postoperative irradiation, completion axillary lymph node dissection (ALND) is no longer recommended. After neoadjuvant systemic therapy (NST), ALND is recommended if the targeted axillary dissection (TAD) shows macrometastases in the sentinel and/or in the target lymph node (the node that was marked and had a macrometastasis in the biopsy before NST). Patients with isolated tumor cells in the sentinel and/or target lymph node should not receive ALND after NST. In case of ypN1mi status, the decision to perform a completion ALND should be made on a case-by-case basis. Oncoplastic surgery is safe and may replace a mastectomy in select cases.

1. Introduction

The German Guideline Commission (AGO Breast: Breast Committee of the Working Group for Gynecologic Cancers) updated the recommendations for the diagnosis and treatment of breast cancer in March 2025 [1]. Two of the 26 chapters focus on surgical treatment and are consistent with the AWOgyn (Working Group for Plastic, Aesthetic and Reconstructive Surgery in Gynecology):

- Breast cancer surgery - Oncological aspects
- Oncoplastic and reconstructive surgery

The AGO Breast Commission recommendations are updated yearly and are available in English and German at: https://www.ago-breast.com. The last detailed update on surgical therapy, which includes explanations of the AGO recommendation levels used (Table 1), was published in 2022 [2]. This year, the surgery-related chapter focused on the de-escalation of axillary surgery in the adjuvant and neoadjuvant settings. Before the voting, the current evidence was thoroughly discussed within the commission. Since surgical therapy is a part of the multidisciplinary locoregional treatment of breast cancer, preoperative interdisciplinary tumor boards involving both radiation and medical oncologists are essential. The following article presents the recommendations and current evidence for surgical and oncoplastic-reconstructive therapy of the breast.

2. Surgical therapy of early breast cancer

2.1. Upfront breast-conserving therapy in clinically node-negative patients

The de-escalation of axillary surgery was the primary focus of the widely discussed changes. Five prospective randomized trials (SOUND [3], INSEMA [4], BOOG 2013-08 [5], NAUTILUS [6], and VENUS [7]) investigate the avoidance of axillary sentinel lymph node biopsy (SLNB) in clinically node-negative (cN0) patients and upfront breast-conserving surgery (BCS). In September 2023, primary results for the SOUND trial were published, showing that omitting axillary surgery was non-inferior to SLNB in patients with small breast cancers up to 2 cm [8]. The primary endpoint of the SOUND trial was distant disease-free survival at 5 years, analyzed in the intention-to-treat population (N = 1405) after a median follow-up of 5.7 years. Apart from the AGO Breast Commission in March 2024, most national breast cancer guideline groups (e.g., NCCN, NICE) have not revised their recommendations on axillary staging in primary surgery following the release of the SOUND data.

In December 2024, the primary results of the German-Austrian

Table 1
Recommendation levels of the AGO Breast Commission.

++	This investigation or therapeutic intervention is highly beneficial for patients and can be recommended without restriction; therefore, it should be performed.
+	This investigation or therapeutic intervention offers limited benefits to patients and can be performed.
+/−	This investigation or therapeutic intervention has not shown benefit for patients and may be performed only in individual cases. According to current knowledge, a general recommendation cannot be given.
-	This investigation or therapeutic intervention can be of disadvantage to patients and might not be performed.
–	This investigation or therapeutic intervention is of clear disadvantage for patients and should be avoided or omitted in any case.

[1] contributed equally to the paper.

INSEMA study were published after a median follow-up of 6.1 years [9]. This prospective trial involved 5154 patients with preoperative T1 or T2 breast carcinomas who showed no lymph node involvement either clinically or sonographically (iN0). Patients were randomized to undergo BCS with or without axillary SLNB. The primary endpoint of the study was the 5-year invasive disease-free survival (iDFS) for the per-protocol population. Secondary endpoints included overall survival, recurrence patterns, long-term complications, quality of life, and analyses of radiotherapy.

The primary outcome demonstrated that omitting axillary surgery did not negatively affect oncological outcomes. The estimated 5-year iDFS was 91.9 % in the group without axillary surgery, compared to 91.7 % in the control group (hazard ratio [HR], 0.95; 95 % confidence interval [CI], 0.77–1.17). Since the upper bound of the 95 % CI was below the predefined non-inferiority margin of 1.271, the study was considered positive for the primary hypothesis. Likewise, overall survival rates were similar (98.2 % versus 96.9 %; HR 0.69; 95 % CI 0.46–1.02).

The main features and outcomes of the SOUND and INSEMA trials are summarized on a background slide of the current AGO recommendations (Fig. 1). INSEMA provides essential information regarding patient selection for omitting SLNB. Approximately 90 % of INSEMA participants were aged 50 years or older, and 95 % had a luminal intrinsic subtype (hormone receptor-positive/HER2-negative), making these two subgroups eligible for SLNB omission. For the first time, INSEMA results provide evidence to omit SLNB for patients with tumors measuring between 2.1 and 5.0 cm. Subgroup analyses suggest that patients with T2 tumors are not harmed by the omission of SLNB (HR 0.71; 95 % CI 0.39–1.32). However, the median tumor size in this subgroup was 2.5 cm, so the significance is limited to smaller T2 stages (up to 3 cm). As expected for a study arm without axillary surgery, a slightly higher risk of axillary recurrence (1.0 % versus 0.4 %) was observed in the INSEMA subgroup without SLNB.

Despite these convincing data, axillary SLNB remains a standard procedure for primary breast surgery in cN0 patients with an unsuspicious axillary ultrasound (AUS): AGO++ recommendation for tumor stage T1-T2; AGO+ recommendation for tumor stage T3-T4c. Additionally, detailed criteria for the omission of SLNB (AGO+) were defined in a low-risk subgroup (all factors have to be present), similar to the treated patients within the INSEMA study (Fig. 2):

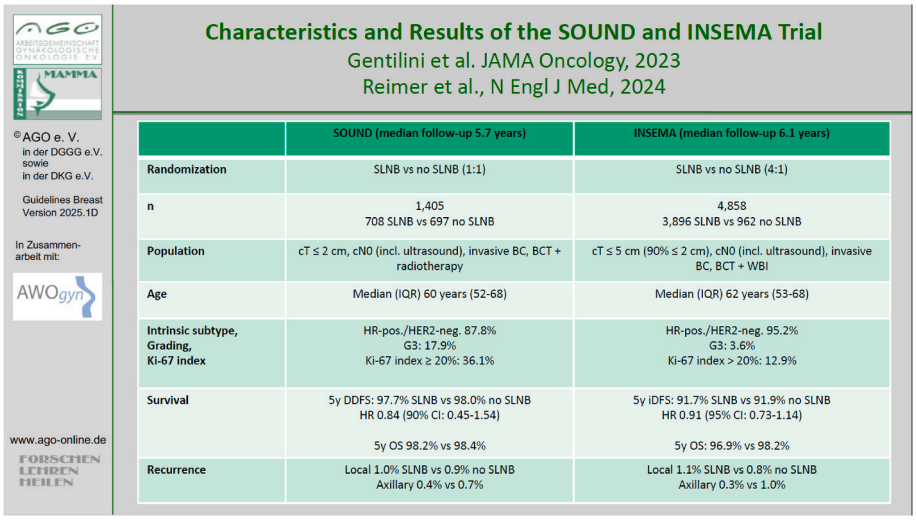
- postmenopausal women (age ≥50 years)
- Hormone receptor-positive/HER2-negative subtype
- Preoperative tumor size up to 2 cm, tumor grading G1/G2
- indication for BCS with postoperative whole-breast irradiation in cN0 patients.

This expands on the previous criteria following the 2021 ASCO recommendations (age ≥70 years, preoperative tumor size up to 2 cm, hormone receptor-positive/HER2-negative subtype) [10]. The criteria based on the INSEMA publication were fully incorporated into the updated ASCO guideline for SLNB: Clinicians should not recommend routine SLNB in select patients who are postmenopausal, aged 50 or older, with negative preoperative AUS results for grade 1–2, small (≤2 cm), hormone receptor-positive, HER2-negative breast cancer, and undergoing breast-conserving therapy [11]. Using these criteria, the rate of sentinel node macrometastases is exactly 10.0 % in the SLNB arm of the INSEMA trial. This indicates that 10 SLNB procedures are needed to identify one SLNB-positive patient (number needed to diagnose: 1:10).

In particular, patients from the mammography screening population (age ≥50 years, small tumor size, often with a hormone receptor-positive/HER2-negative subtype) appear to qualify for this de-escalation of axillary surgery. The benefit of omitting the SLNB for these patients is evident in fewer long-term complications (e.g., lymphedema) and enhanced quality of life, consistent with the published INSEMA analyses [9,12].

After the AGO State of the Art Meeting in March 2025, the question often emerged on the level of recommendation (the majority voted AGO+) for omitting SLNB, despite two positive prospective randomized trials. Even if SLNB itself does not provide a survival benefit, postoperative therapy might vary according to the axillary nodal status. Examples include adjusting radiotherapy strategies - such as partial breast irradiation alone, omitting irradiation after BCS, or indicating regional nodal irradiation - or the recommendation of the CDK4/6-inhibitor ribociclib in the adjuvant setting, depending on nodal status. Similarly, the updated ASCO guidelines state that SLNB can be omitted for select patients for whom the detection of metastatic SLN(s) would not change postoperative treatment recommendations [11].

Two tumor parameters were discussed in detail, which were controversial among the members of the AGO Breast Commission. First, the value of clinical examination and AUS in diagnosing nodal involvement is limited for the subtype of invasive lobular carcinoma (ILC). Accordingly, almost two-thirds of St. Gallen Breast Cancer Conference 2025 panelists would not use the listed criteria of the INSEMA trial to omit SLNB for patients with ILC (majority vote: 59.7 %). The German experts disagreed with this [13]. The current AGO recommendation for omitting SLNB does not differentiate between invasive ductal and ILC. This approach is supported by the forest plot analysis carried



Characteristics and Results of the SOUND and INSEMA Trial

Gentilini et al. JAMA Oncology, 2023
Reimer et al., N Engl J Med, 2024

	SOUND (median follow-up 5.7 years)	INSEMA (median follow-up 6.1 years)
Randomization	SLNB vs no SLNB (1:1)	SLNB vs no SLNB (4:1)
n	1,405 708 SLNB vs 697 no SLNB	4,858 3,896 SLNB vs 962 no SLNB
Population	cT ≤ 2 cm, cN0 (incl. ultrasound), invasive BC, BCT + radiotherapy	cT ≤ 5 cm (90% ≤ 2 cm), cN0 (incl. ultrasound), invasive BC, BCT + WBI
Age	Median (IQR) 60 years (52-68)	Median (IQR) 62 years (53-68)
Intrinsic subtype, Grading, Ki-67 index	HR-pos./HER2-neg. 87.8% G3: 17.9% Ki-67 index ≥ 20%: 36.1%	HR-pos./HER2-neg. 95.2% G3: 3.6% Ki-67 index > 20%: 12.9%
Survival	5y DDFS: 97.7% SLNB vs 98.0% no SLNB HR 0.84 (90% CI: 0.45-1.54) 5y OS 98.2% vs 98.4%	5y iDFS: 91.7% SLNB vs 91.9% no SLNB HR 0.91 (95% CI: 0.73-1.14) 5y OS: 96.9% vs 98.2%
Recurrence	Local 1.0% SLNB vs 0.9% no SLNB Axillary 0.4% vs 0.7%	Local 1.1% SLNB vs 0.8% no SLNB Axillary 0.3% vs 1.0%

Fig. 1. Main characteristics and results of the SOUND and INSEMA trials (AGO background slide).

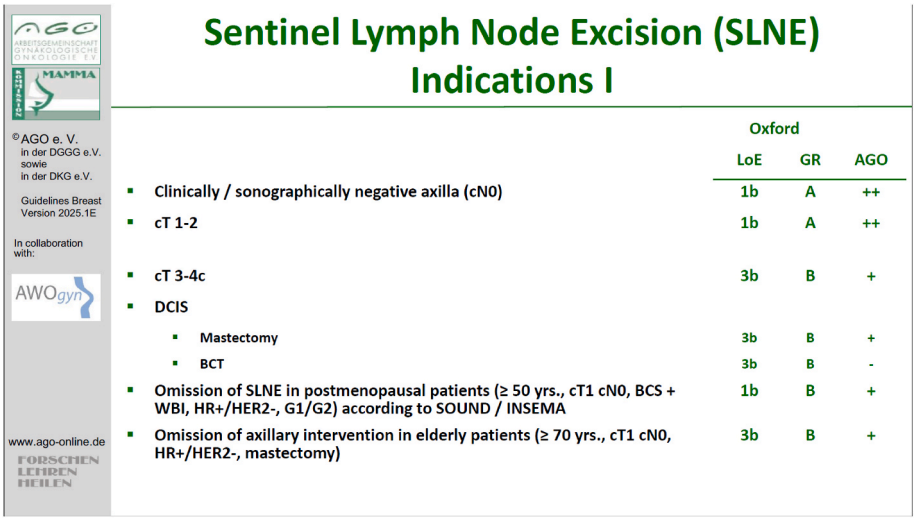


Fig. 2. Recommendation of the AGO Breast Commission on primary surgical treatment of the axilla regarding indications for axillary SLNB.

out in the INSEMA trial. More than 600 patients in the INSEMA trial had ILC or mixed ductal-lobular breast cancer [9]. It is worth noting, however, that the updated ASCO guidelines restrict the population in whom the SLNB may be omitted to patients with unifocal ductal carcinoma, thus excluding patients with lobular disease [11].

Second, a minority of AGO Breast Commission members suggested using a high Ki-67 index as an additional exclusion criterion for SLNB omission because higher values might affect postoperative systemic treatment. Fewer than 5 % of the INSEMA patients had G3 tumors, but 13 % of the trial population had a high Ki-67 index (Ki-67 > 20 %). The INSEMA investigators presented a not previously published forest plot analysis (Fig. 3), indicating that the omission of SLNB has no impact on the 5-year iDFS depending on Ki-67 subgroups (Ki-67 ≤ 20 %: no SLNB versus SLNB with an HR of 0.87 [95 % CI 0.67–1.12]; Ki-67 > 20 %: no SLNB versus SLNB with an HR of 0.97 [95 % CI 0.58–1.65]).

Importantly, preoperative AUS was performed for nodal evaluation in the INSEMA and SOUND trials, and the false-negative rate of AUS is reported to be approximately 10 % for both trials in the SLNB arm (INSEMA: 11.5 %, SOUND: 8.7 %). No clear criteria are defined for simple, yet reproducible and validated, sonographic methods to categorize patients as iN0 in the preoperative setting accurately. Recently, a review by van Nijnatten et al. offers an overview of four de-escalation trials, comparing differences in AUS protocols and AUS-guided biopsy techniques [14]. In particular, no consensus has been reached on the optimal cut-off value for cortical thickness in AUS.

Primary outcome results of the BOOG 2013-08 trial (N = 1644) will be presented at the San Antonio Breast Cancer Symposium 2025. Subsequently, data from the NAUTILUS and VENUS trials are anticipated. A planned meta-analysis of the SOUND, INSEMA, and BOOG 2013-08 trials may offer additional insights into smaller subgroups (age <50 years, tumor size > 2 cm, ILC, or high tumor grading) concerning the potential omission of SLNB. For patients with HER2-positive or triple-negative breast cancer, it is agreed that, even in the cN0 setting, SLNB omission cannot be recommended [13].

2.2. *Upfront axillary surgery in sentinel node-positive or clinically node-positive patients*

Given the published secondary study results of the SENOMAC trial [15], the AGO Breast Commission revised its recommendation regarding the indication for completion axillary lymph node dissection (cALND) in the upfront surgery setting with one or two macrometastases in the SLNB (Fig. 4). As in previous years, cALND is not recommended for patients who have undergone BCS. However, the statement was amended to

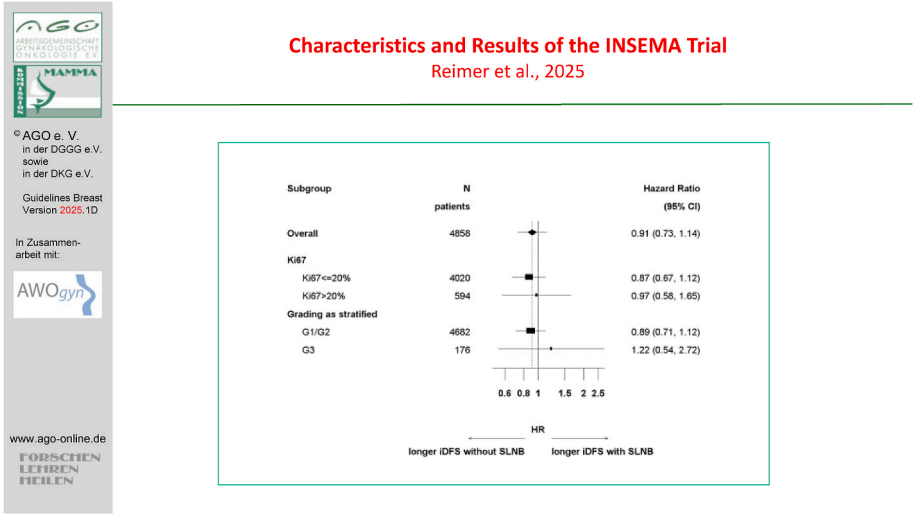


Fig. 3. Additional INSEMA trial analysis regarding the impact of axillary SLNB on 5-year iDFS depending on Ki-67 subgroups (not included in the finally released AGO Breast slides).

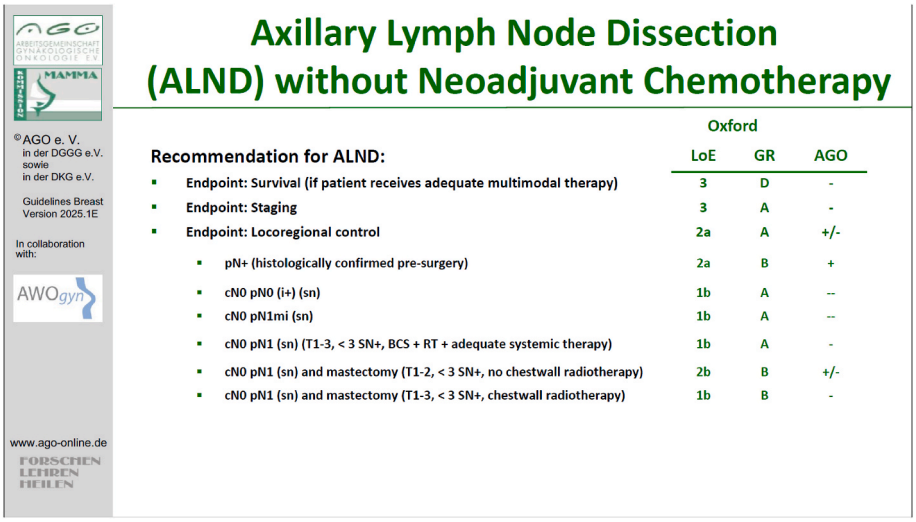


Fig. 4. Recommendation of the AGO Breast Commission regarding indications for cALND after positive SLNB or primary ALND.

include T3 carcinomas, provided that postoperative irradiation and systemic therapy are administered according to current guidelines. Extracapsular extension in axillary lymph node metastasis will no longer be considered an indication for cALND. Based on recent study data, the recommendation for cALND in case of a mastectomy has also been downgraded. If post-mastectomy radiotherapy (PMRT) is performed, cALND is discouraged (AGO-, in line with the SENOMAC study [15]); for patients without PMRT, cALND should be discussed on a case-by-case basis (AGO+/−, based on the SINODAR-ONE study [16,17] and a retrospective meta-analysis [18]). Complete axillary lymph node dissection (ALND) should only be performed in the upfront surgery setting if preoperative minimally invasive biopsy confirms lymph node metastasis.

3. Surgery after neoadjuvant systemic therapy

Neoadjuvant systemic therapy (NST), initially introduced as the treatment of choice for women with inoperable tumors, currently serves two main goals. First, it provides a unique opportunity to assess tumor sensitivity to therapy in vivo, thereby identifying patients who require additional post-neoadjuvant treatment strategies. Second, it allows a de-escalation of surgical approach in patients with extensive disease and/or nodal involvement. However, a recent analysis of the EUSOMA database showed that many patients undergo mastectomy despite achieving complete response of the primary tumor through NST, and this proportion seems to have risen in recent years [19,20].

3.1. Surgical therapy of the breast

Patients scheduled for NST should be discussed in an interdisciplinary tumor board before starting treatment. Early marking of the tumor with one or more markers, depending on the extent of disease and the planned surgical target volume, is recommended. During NST, the tumor's response to therapy is assessed using clinical examination and imaging (ultrasound and mammography are graded as AGO++, while contrast-enhanced mammography and MRI are graded as AGO+). Importantly, magnetic and paramagnetic markers, as well as radiofrequency identification devices, are not suitable for MRI-based response assessment due to the generation of significant artifacts [21]. Surgery should be performed 4–8 weeks after the last dose of NST. During surgery, resection of the tumor within new borders is recommended to achieve clear margins (i.e., no ink on the tumor) on the removed specimen [22]. In cases of inflammatory breast cancer responding well to NST, multicentric disease, and cT4 stage disease, the decision to perform BCS should be made on a case-by-case basis (AGO+/−).

3.2. Surgical therapy of the axilla

Over the last decades, we have seen an unprecedented reduction in axillary surgery. As a result, arm morbidity has decreased significantly without risking the outcome [23]. In patients with cN0 disease, SLNB after completing NST has become standard care (Fig. 5) to accurately evaluate the response to systemic therapy. The SLNB offers a high detection rate and excellent accuracy in predicting nodal status in the neoadjuvant setting. Whether axillary staging can be skipped in some patients with pathological complete response (pCR) in the breast is currently being investigated in the EUBREAST-01 trial, which focuses on patients with HER2-positive and triple-negative disease receiving NST [24]. In these tumor subtypes, pCR in the breast strongly correlates with axillary response to treatment [25]. This international prospective single-arm trial enrolled patients with a radiological complete response. Patients underwent BCS without axillary procedures, and - in cases where breast pCR was confirmed (defined as ypT0 or ypTis) - they moved on to postoperative therapy and follow-up. In cases of non-pCR, a secondary SLNB was performed outside of the trial protocol. The primary endpoint is the 3-year axillary recurrence-free survival. The study is expected to present its first results in 2028.

In patients with biopsy-proven lymph node involvement before NST, SLNB is linked to a relatively high false-negative rate (FNR) of over 10 % (SENTINA, ACOSOG Z1071). Although increasing the number of removed sentinel lymph nodes (SLNs) can improve SLNB accuracy, the AGO Breast Commission recommends marking the most prominent metastatic lymph node and combining its removal (target lymph node biopsy) with the SLNB, a procedure referred to as targeted axillary dissection (TAD) [23,26]. TAD has demonstrated an FNR of less than 5 % in a prospective multicenter study [27], whereas most SLNB trials report a median of fewer than three SLNs. Data from mostly retrospective studies and one prospective multicenter trial indicate low regional recurrence rates across all axillary staging techniques, with comparable oncologic outcomes among SLNB, TAD, and ALND [28–31]. While awaiting results from the prospective multicenter AXSANA study (NCT04373655), which includes a predefined statistical analysis plan and closely monitored datasets unlike previous data, the AGO Breast Commission recommends ALND and TAD for surgical staging of the axilla in patients with one to three clinically involved nodes at the time of diagnosis. For patients with more than three suspicious nodes, TAD is not recommended as a standard procedure (Fig. 6).

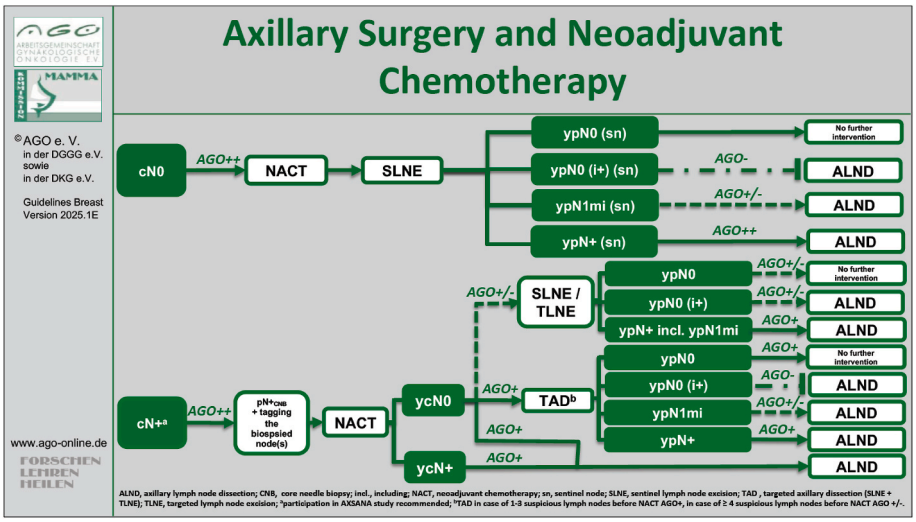


Fig. 5. Recommendation of the AGO Breast Commission on surgical treatment of the axilla after neoadjuvant therapy.

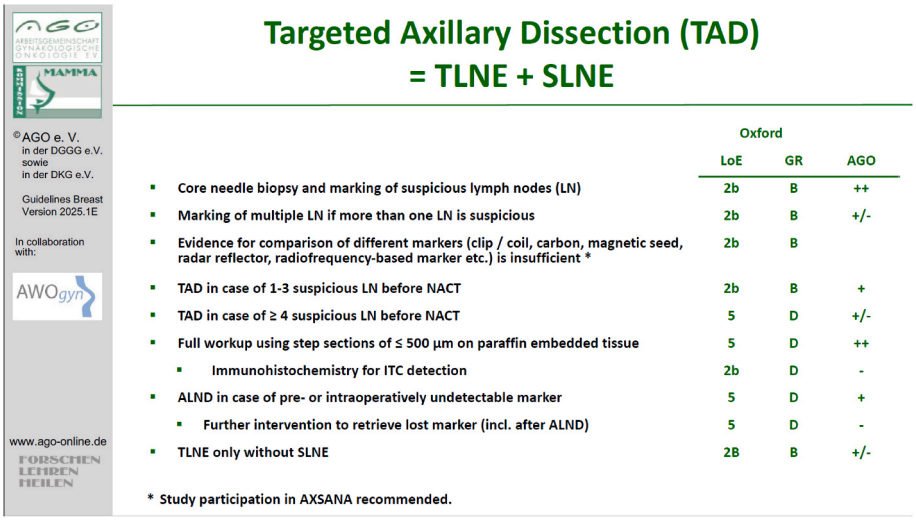


Fig. 6. Recommendation of the AGO Breast Commission regarding targeted axillary dissection in the neoadjuvant setting.

For patients with macrometastatic sentinel and/or target lymph node involvement (≥ypN1a) after NST, cALND remains the standard of care. Although data from the National Cancer Database involving more than 6000 patients showed that omitting ALND does not affect overall survival [30], the AGO recommends waiting for the results of the randomized Alliance A011202 study, which compares cALND and axillary radiotherapy in cases of positive SLNB after NACT.

For patients with micrometastatic sentinel and/or target lymph node involvement, routine cALND is no longer recommended as a standard procedure. Although patients with a ypN1mi (sn/tad) status have a higher residual tumor burden compared to patients in the upfront surgery setting, cALND rarely upgrades the final ypN-stage and does not provide relevant diagnostic information that impacts adjuvant treatment decisions, as has been shown in the AXSANA study (Kuehn T et al., Poster Discussion at the SABCS 2024).

For patients with isolated tumor cells in the sentinel and/or target lymph node (ypN0 (i+) [sn/tad]), the AGO panel advises against cALND for all patients. Although additional lymph node involvement can be detected in 30 % of patients (with only 5 % having macrometastases) [32], this information did not lead to changes in post-neoadjuvant treatment. Patients with a ypN0 (i+) status are not included in the Alliance A011202 and are therefore not considered candidates for cALND or axillary radiotherapy. It is worth noting that more than 80 % of patients included in prospective or retrospective cohort registry trials of ALND omission after NST received regional nodal irradiation [28,31,32].

4. Oncoplastic surgery and breast reconstruction

4.1. Oncoplastic surgery

Oncoplastic surgery (OPS) is defined in the AGO recommendations 2025 as “the use of plastic surgical techniques at the time of tumor removal to enhance aesthetic and quality of life outcomes without compromising oncological safety.” The focus should be on “favorable scar placement, adequate soft tissue formation, selection of an appropriate reconstructive technique (considering radiation therapy), and contralateral symmetrization.”

OPS is oncologically safe, and when compared to BCS, the complication rates are similar [33]. Therefore, OPS can replace mastectomy in several indications, including cases of multicentric or multifocal tumors. A recent meta-analysis [34] found that tumor-adapted reduction mammaplasty performed before radiation therapy was associated with fewer complications than secondary reduction after radiation. However, even

in cases of major complications, secondary reduction remains a viable option.

4.2. Breast reconstruction after mastectomy: techniques and current developments

Breast reconstruction after mastectomy can be performed using various methods and techniques [35]. Options include implant-based reconstruction, autologous reconstruction, or a combination of both. In addition to pedicled or free flaps, autologous fat transfer (AFT) is increasingly gaining prominence. The AGO Commission recommends AFT (AGO+) for the following indications:

1. After mastectomy and after reconstruction,
2. After BCS (not earlier than 2 years post-surgery),
3. After autologous reconstruction,
4. As the sole technique for breast reconstruction.

For example, the multicenter, randomized clinical BREAST trial demonstrated that quality of life was significantly better in the AFT group compared to the standard group, which underwent expander-implant reconstruction. Additionally, there was no difference in oncological outcomes between the groups [36].

Regarding flap-based autologous reconstruction, a recent systematic review on the omental flap has led to its inclusion in guidelines as a safe technique for unilateral breast reconstruction. This flap can be used in selected cases as a safe option with acceptable donor-site morbidity, mainly when harvested laparoscopically [37].

4.3. Direct-to-implant reconstruction

In recent years, direct-to-implant (DTI) reconstruction combined with nipple-sparing or skin-sparing mastectomy has become very popular. Two recent meta-analyses have shown that sub- or prepectoral implant placement does not significantly differ in complication rates [38,39]. However, in the context of PMRT, prepectoral implant placement is associated with a lower rate of capsular contracture compared to subpectoral placement (OR 0.57; 95 % CI 0.41 to 0.79) [39].

A current and ongoing question, which cannot yet be definitively answered with the latest data, concerns the added benefit of using acellular dermal matrices (ADMs) or synthetic meshes in implant-based reconstruction. Unfortunately, there are no head-to-head comparisons between ADM, mesh, or no reinforcement, so the AGO Breast Commission cannot make a clear recommendation for or against their use. While evidence suggests that ADM-based reconstructions may have higher complication rates, the studies have significant limitations. For instance, a meta-analysis by Clark et al. observed higher re-operation rates following ADM use, regardless of whether the implant was placed prepectorally or subpectorally [40]. Similarly, Zhang et al. reported increased rates of seroma, implant loss, and wound dehiscence with ADM compared to titanium-coated meshes [41]. These studies involved both sub- and prepectoral implant positions.

4.4. Implant-associated diseases

Beyond the well-known breast implant-associated anaplastic large cell lymphoma (BIA-ALCL) and capsule-associated squamous cell carcinoma, with approximately 30 cases reported to date [42], other implant-related conditions are increasingly discussed. Recently, the so-called Breast Implant Illness (BII) or autoimmune syndrome induced by adjuvants (ASIA) has gained attention. These symptom complexes encompass a variety of reported symptoms that occur following implant reconstruction or augmentation, regardless of the implant type, filling material, or surface.

Most frequent systemic symptoms reported in the FDA MDR database (sorted from most to least common) are: 40 % fatigue, >30 % joint pain, >20 % brain fog, autoimmune diseases, hair loss, and 10–20 % depression, rash, headache, and weight changes. Interestingly, significantly more patients reporting BII symptoms have received implants for aesthetic reasons rather than for reconstruction (cosmetic: 3864/4109 [94.0 %] versus reconstructive: 245/4109 [5.96 %]; $P < 0.001$) [43].

A systematic review of 15 studies summarized that 72.4 % of women had their implants removed due to BII, with 53.7 % also removing the capsule. In 83.5 % of cases, patients reported an improvement in their symptoms. Currently, BII is not recognized as an official medical diagnosis but remains a diagnosis of exclusion, lacking specific tests or defined criteria to characterize the condition [43].

4.5. Complication management

Seromas have long been associated with higher complication rates; therefore, reducing seroma formation is a key goal. One approach to decrease seroma rates is the use of tranexamic acid (TXA). Two notable studies have addressed this:

- The retrospective study by Guggenheim et al. [44] investigated systemic TXA use, administering 1g intravenously at the start of surgery, followed by 1g IV every 8 h for the first 24 h, and then 1g orally every 8 h for the next 24 h.
- The prospective, randomized study by Safran et al. [45] examined topical TXA, applying 3g in 100 mL sodium chloride to irrigate the implant pocket once after nipple-sparing mastectomy and once before implant placement.

In the study by Safran, patients with bilateral nipple-sparing mastectomy were treated with TXA on one side and without on the other. The TXA group experienced significantly fewer complications (5.67 %) compared to the control group (28.3 %) (OR 0.192; $P = 0.0129$).

Beyond reducing seroma formation, TXA also significantly decreases postoperative hematoma rates [46]. Of course, any contraindications to TXA should be carefully considered. The SERMA study, conducted by the EUBREAST network (NCT05899387), aims to elucidate the causes of seromas and their management.

4.6. Infection prevention

In addition to preventing seromas, reducing infection rates is crucial. Flushing the implant pocket with antibiotics and/or antiseptics before implant placement has been recommended for years [47]. The current AGO guideline suggests that perioperative intravenous antibiotics should not be administered for longer than 24 h (AGO+ with level of evidence 1a).

However, a recent meta-analysis involving 19,301 patients suggested that extended prophylactic antibiotics may be more effective than intraoperative antibiotics or antibiotics administered for only up to 24 h [48]. Due to significant limitations and potential biases in some studies, the use of intravenous antibiotics for longer than 24 h is only recommended as an alternative of equivalent efficacy.

4.7. Surgical complications

The most common complication in skin- or nipple-sparing mastectomy is skin flap necrosis, and with concurrent skin tightening, necrosis of the nipple-areola complex can also occur. To mitigate these risks, the AGO Breast Commission has identified several preventive measures, including the use of topical nitroglycerin. In 2025, another method was added (AGO+/−): the intravenous administration of prostaglandin E1 (PGE1).

In a retrospective analysis of 259 patients, it was observed that daily intravenous administration of PGE1 (10 μg/2 mL) resulted in a significantly lower complication rate in reconstructed breasts compared to the control group (21.6 % versus 34.3 %; $P = 0.022$) [49]. Within the group

of nipple-sparing mastectomies, the rate of nipple necrosis was also significantly lower in the PGE1 group (15.5 % versus 29.4 %; P = 0.027). The treatment was started intraoperatively and continued until the sixth postoperative day.

It remains to be seen whether, in addition to established reconstructive procedures such as implants and autologous tissue, implant-free reconstruction methods using resorbable scaffolds will also become available on the market in the future. Currently, promising initial data are available. Until then, the only alternative, which is also increasingly in demand, is AFT.

5. Summary

In the 2025 update of the AGO Breast Commission recommendations, the focus of the surgery-related chapters was on reducing axillary surgery in the adjuvant and neoadjuvant settings. Omitting SLNB is an option for patients with low-risk breast cancer undergoing upfront BCS with whole-breast irradiation. The recommendation for cALND in case of a mastectomy with one or two macrometastases in the SLNB has been downgraded depending on the use of PMRT. The guidance for patients with low-volume residual disease after NACT in the SLN has been revised: because the chance of finding additional metastatic non-sentinel nodes during cALND is low, patients with isolated tumor cells in the SLN (ypN0 [i+]) should not undergo cALND (AGO-). In patients with a micrometastatic SLN (ypN1mi), performing cALND remains a decision based on individual circumstances (AGO+/−). However, cALND is recommended in cases of macrometastatic involvement in the SLN (ypN1; AGO+). Oncoplastic breast surgery is oncologically safe, and when compared to BCS, complication rates are similar.

Author contributions

TR, TK, MBP, MT: Conceptualization; Writing - original draft.
All authors: Conceptualization; Writing - review & editing.

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Appendix A. Supplementary data

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