National Comprehensive Cancer Network®

NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Poland

Breast Cancer

Version 2.2026 — April 22, 2026

NCCN recognizes the importance of clinical trials and encourages participation when applicable and available. Trials should be designed to maximize inclusiveness and broad representative enrollment.

NCCN Guidelines for Patients® available at www.nccn.org/patients

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Breast Cancer

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Ÿ Reconstructive surgery
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NCCN Guidelines for Poland Definitions (DEF-1)
Principles of Breast Cancer Care (POLAND-INTRO)

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NCCN Categories of Evidence and Consensus: All recommendations are category 2A unless otherwise indicated.

See NCCN Categories of Evidence and Consensus.

NCCN Categories of Preference: All recommendations are considered appropriate.

See NCCN Categories of Preference.

See International Adaptations Table of Contents for other NCCN Guidelines for Poland.

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* Recommendations that are considered clinically appropriate by national/regional experts but are not currently available due to lack of reimbursement by the national/regional healthcare financing system.
**Recommendations that are considered as inconsistent with national/regional medical practice.

Note: Drugs and biologics included in the NCCN Guidelines® are approved by the United States Food and Drug Administration (FDA). Alternate agents based on the local regulations and availability may be substituted provided evidence supports their efficacy and safety. Generic drugs should be used only when studies have proven bioequivalence and the drugs have met the same standards for identity, strength, purity, and quality as the innovator drugs. The WHO Model Lists of Essential Medicines can be found here: http://www.who.int/medicines/publications/essentialmedicines/en/.

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PRINCIPLES OF CANCER CARE

- ***Patients should be referred to centers that provide the highest level of competence – Breast Units.***
- ***Standards of care are based on best achievable outcomes reported in the literature. Multidisciplinary care is always recommended.***
- ***Delays in treatment reduce the effectiveness of treatment, so efforts should be made to expedite investigations and referrals to reduce time to treatment initiation.***

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Ductal Carcinoma In Situ (DCIS)

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DIAGNOSIS

DCIS Tis,N0,M0, Encapsulated or solid papillary carcinoma (SPC)[a]

WORKUP

- History and physical exam
- Diagnostic bilateral mammogram *and ultrasound of breasts and axillae are necessary; routine MRI is not needed*
- Pathology review[b]
- Determination of tumor estrogen receptor (ER) status
- Genetic counseling for patients at risk[c] of hereditary breast cancer
- Breast MRI[d,e] as indicated
  - *CEM (contrast-enhanced spectral mammography) when MRI is contraindicated*
- Assess for distress[f]

PRIMARY TREATMENT

Breast-conserving surgery[g] (BCS) without lymph node surgery *or with SLNB*[h] →

Whole breast radiation therapy (RT) (category 1) with or without boost to tumor bed[k,l,m,n]
or
Accelerated partial breast irradiation/partial breast radiation (APBI/PBI)[k,l,m]
or
No RT[k,l,n] (category 2B) → **Postsurgical Treatment (DCIS-2)**

Total mastectomy with sentinel lymph node biopsy (SLNB)[i] ± reconstruction[j] → **Postsurgical Treatment (DCIS-2)**

[a] Encapsulated papillary carcinoma (EPC) without associated conventional invasion is staged as pTis because behavior is similar to DCIS (per AJCC). SPC should be specified as in situ or invasive based on WHO criteria but both forms have favorable outcomes.
[b] The Panel endorses the College of American Pathologists Protocol for pathology reporting for all invasive and noninvasive carcinomas of the breast. http://www.cap.org.
[c] For risk criteria, see NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate.
[d] Principles of Dedicated Breast MRI Testing (BINV-B).
[e] The use of MRI has not been shown to increase likelihood of negative margins or decrease conversion to mastectomy. Data to support improved long-term outcomes are lacking.
[f] Refer to the NCCN Guidelines for Distress Management (DIS-A) for the NCCN Distress Thermometer and Problem List, which includes social determinants of health.
[g] Re-resection(s) may be performed in an effort to obtain negative margins in patients desiring breast-conservation therapy. Patients in whom adequate surgical margins cannot be achieved with BCS should undergo a total mastectomy. For definition of adequate surgical margins, see Margin Status Recommendations After BCS for Invasive Cancers and DCIS (BINV-F).
[h] Surgical axillary staging should not be performed for preoperative (biopsy-determined) pure DCIS unless there is some clinical-radiographic-pathologic suggestion of invasion or axillary metastasis. SLNB may be considered for 1) concern of persistently positive margins 2) excision in an anatomic location compromising the performance of a future SLNB procedure; or 3) oncoplastic breast-conserving surgery*; 4) Suspicion of microinvasion within DCIS (on core needle biopsy); 5) DCIS with "risk factors": clinically palpable tumor, microcalcifications over 50 mm, DCIS diagnosed on biopsy without microcalcifications in imaging* (see BINV-D for considerations for SLNB). *Newer lymphatic tracers, such as superparamagnetic iron oxide that can stay in the SLNs for 30 days. Offer an opportunity for delayed SLNB, even in the setting of mastectomy (Cui RBJ et al: ANZ J Surg 2024;94:1090-1095; Karakatsanis A et al: Ann Surg Oncol 2023;30:4064-4072; Samaha M et al. Breast Cancer Res. Treat 2025;209(1):161-166).*
[i] Omission of SLNB in the setting of mastectomy may be considered in patients >50 years with non-palpable low-grade ER-positive DCIS with no abnormal axillary findings and in patients in whom the primary reason for mastectomy is patient preference.
[j] Principles of Breast Reconstruction Following Surgery (BINV-H).
[k] Invasive disease at total mastectomy or re-excision should be managed as clinical stage I or stage II disease (BINV-1).
[l] Principles of Radiation Therapy (BINV-I).
[m] Contraindications to Breast-Conserving Approaches Requiring RT (BINV-G).
[n] Whole breast RT following BCS reduces ipsilateral breast tumor recurrence (IBTR) rates for all DCIS by 50%–70%. Approximately half of the recurrences are invasive and half are DCIS. The risk of local relapse increases with larger DCIS, palpable mass, grade III disease, margins ≤2 mm, ER-negative tumors, and age <50. Omission of RT and treatment with endocrine therapy alone may be considered if all RTOG 9804 criteria are met (screen-detected, grade 1–2, size ≤2.5 cm, margins ≥3 mm).

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DCIS POSTSURGICAL TREATMENT

Risk reduction therapy for ipsilateral breast:
- **Consider endocrine therapy for 5 years for patients with ER-positive DCIS, if:**
  - **Treated with BCS and RT[o] (category 1)**
  - **Treated with excision alone[p]**
- **Endocrine therapy[q]:**
  - **Tamoxifen[o,r] for premenopausal patients**
  - **Tamoxifen[o,r] or aromatase inhibitor for postmenopausal patients with some advantage for aromatase inhibitor therapy in patients <60 years or with concerns for thromboembolism**

Risk reduction therapy for contralateral breast:
- **Counseling regarding risk reduction**

→

SURVEILLANCE/FOLLOW-UP

- **Interval history and physical exam every 6–12 mo for 5 y, then annually**
- **First mammogram 6–12 mo, after end of RT, if given, or after BCS (category 2B) if no RT is given and annually thereafter**

[o] *CYP2D6* genotype testing is not recommended for patients considering tamoxifen.

[p] Available data suggest endocrine therapy provides risk reduction in the ipsilateral breast treated with breast conservation and in the contralateral breast in patients with mastectomy or breast conservation with ER-positive primary tumors. Since a survival advantage has not been demonstrated, individual consideration of risks and benefits is important.

[q] The use of a bisphosphonate (PO/IV) or denosumab is acceptable to maintain or improve bone mineral density (BMD) and reduce risk of fractures in postmenopausal (natural or induced) patients receiving adjuvant aromatase inhibitor therapy. Optimal duration of either therapy has not been established. Benefits from duration beyond 3 years or optimal duration beyond 3 years is not known. Factors to consider for duration of anti-osteoporosis therapy include BMD, response to therapy, and risk factors for continued bone loss or fracture. There are case reports of spontaneous fractures after denosumab discontinuation. Patients treated with a bisphosphonate or denosumab should undergo a dental examination with preventive dentistry prior to the initiation of therapy, and should take supplemental calcium and vitamin D.

[r] Low-dose tamoxifen (5 mg per day or 10 mg every other day for 3–5 years) is an option if patient is symptomatic on the 20-mg dose or if patient is unwilling or unable to take standard-dose 20 mg per day tamoxifen [10 mg every other day since 5-mg dose is not available in the United States]. This low dosage needs further investigation in premenopausal individuals (DeCensi A, et al. J Clin Oncol 2019;37:1629-1637).

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Invasive Breast Cancer

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DIAGNOSIS (CLINICAL)

Localized breast cancer: Invasive, non-inflammatory, non-metastatic (M0)

WORKUP[a]

- History and physical exam
- Imaging:
  - Diagnostic bilateral mammogram
  - Breast ultrasound as necessary
    - ◊ Axillary ultrasound if considering omission of surgical nodal staging[b]
  - Breast MRI[c] (optional), with special consideration for mammographically occult tumors
  - *CEM (contrast-enhanced spectral mammography) when MRI is contraindicated*
- Pathology review[d]
- *Testing for Ki-67, unless the clinician deems it unnecessary*
- Estrogen/progesterone receptor (ER/PR) status and HER2 status[e]
- Genetic counseling and testing if patient is at risk[f] for hereditary breast cancer, has triple-negative breast cancer (TNBC) (at any age), or is a candidate for adjuvant olaparib
- *In the high-risk patients, consider referral to the Family Care Program for high hereditary cancer risk*
- Address fertility and sexual health concerns as appropriate[g]
- Pregnancy test in all patients of childbearing potential[g] (if pregnant, see PREG-1)
- Assess for distress[h]
- Consider additional imaging studies only in the presence of signs and symptoms of metastatic disease ~~and for patients who are clinically high risk~~ (BINV-18)[i]
- Consider baseline lymphedema screening, as per NCCN Guidelines for Survivorship

CLINICAL STAGE

cT0,cN+,M0 → See NCCN Guidelines for Occult Primary

cT1–T4, ≥cN0,M0 → Criteria for preoperative systemic therapy (BINV-L)

- Not considering preoperative systemic therapy → Locoregional treatment[j]
  - BCS ± surgical axillary staging ± RT (BINV-2)*
  - or
  - Mastectomy + surgical axillary staging ± post-mastectomy RT (PMRT) (BINV-3)
- Considering preoperative systemic therapy → Additional Workup Prior to Preoperative Systemic Therapy (BINV-12)

Inflammatory breast cancer (IBC) → Workup for IBC (IBC-1)

Metastatic (M1) invasive breast cancer → Stage IV (M1) or Recurrent disease → Workup for Recurrent or Stage IV (M1) Disease (BINV-18)

** Criteria for RT see BINV-2.*

[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.

[b] Based on SOUND and INSEMA trials, patients >50 years and postmenopausal with cT1N0 (node negative by axillary ultrasound), with HR+/HER2-negative, grade 1–2 tumors who are agreeable to receiving whole breast RT and endocrine therapy may be considered for omission of SLNB. Caution should be used in those with lobular histology.

[c] Breast MRI may be useful for characterizing axillary and/or internal mammary nodal disease. See Principles of Dedicated Breast MRI Testing (BINV-B) and NCCN Guidelines for Breast Cancer Screening and Diagnosis.

[d] The Panel endorses the College of American Pathologists Protocol for pathology reporting for all invasive and noninvasive carcinomas of the breast. http://www.cap.org.

[e] Principles of Biomarker Testing (BINV-A).

[f] For risk criteria, see NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate.

[g] For Fertility, Birth Control, and Sexual Health, see BINV-C. The general considerations for fertility and sexual health/function outlined for specific populations in NCCN Guidelines for Adolescent and Young Adult (AYA) Oncology and NCCN Guidelines for Survivorship are applicable to all patients diagnosed with breast cancer.

[h] Refer to the NCCN Guidelines for Distress Management (DIS-A) for the NCCN Distress Thermometer and Problem List, which includes social determinants of health.

[i] Routine systemic staging is not indicated for non-metastatic (M0) cancer in the absence of systemic symptoms. If metastatic disease is suspected, see Workup on BINV-18.

[j] Patients with a known genetic predisposition to breast cancer may have an increased risk of contralateral or ipsilateral breast cancers after breast-conservation therapy. Risk reduction strategies including prophylactic mastectomies should be discussed. See NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate.

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LOCOREGIONAL TREATMENT OF cT1–3, cN0 or cN+, M0 DISEASE[a,k]: BREAST-CONSERVING SURGERY (BCS) ± RT

SURGERY

BCS[b,j,l] ± surgical axillary staging (category 1)[m,n,o] ± oncoplastic reconstruction[p]

ADJUVANT SYSTEMIC THERAPY

See BINV-4 to determine whether adjuvant systemic therapy is indicated. RT is typically given after systemic therapy. See BINV-I for sequencing of systemic therapy and RT.

PATHOLOGIC NODAL STATUS

pN0 or cN0[b,q] → **RT**

Whole breast RT ± boost[t] to tumor bed, ~~and consider comprehensive regional nodal irradiation (RNI) in patients with central/medial tumors, pT3 tumors, or pT2 tumors and one of the following high-risk features: grade 3, extensive lymphovascular invasion (LVI), or hormone-receptor (HR)-negative.[u]~~
or
Consider APBI/PBI for appropriately selected patients who are low risk (category 1)[t,v]
or
Consider omitting breast irradiation if adjuvant endocrine therapy is planned and the following criteria are met (category 1):*
1) ≥70 y, HR+, HER2-negative, cN0, pT1 (≤2 cm)[r,u]
~~2) ≥65 y, HR+, HER2-negative, pN0, pT ≤3 cm[u]~~

pN1a (1–3 positive axillary nodes) →

~~Meets ALL of the following criteria:~~
- ~~cT1–T3, cN0~~
- ~~No preoperative chemotherapy~~
- ~~1–2 positive sentinel lymph nodes (SLNs)~~
- ~~Whole breast RT planned~~

~~Yes to all~~ → ~~Whole breast RT ± boost (use of comprehensive RNI with or without intentional inclusion of axilla at the discretion of the radiation oncologist) (category 1)~~

~~No~~ → Whole breast RT with inclusion of any portion of the undissected axilla at risk ± boost[t] to tumor bed (category 1). Strongly consider comprehensive RNI.

pN2–3[s] (≥4 positive axillary nodes) → Whole breast RT ± boost[t] to tumor bed (category 1) + comprehensive RNI, including any portion of the undissected axilla at risk (category 1)

** Breast irradiation may also be foregone if adjuvant endocrine therapy is planned and following criteria are met: 1) 50-69 years, pT1N0, unifocal disease, ER-positive, PR-positive, HER2-negative, surgical margins ≥2 mm, and 21-gene Recurrence Score (Oncotype DX) ≤18 (Jagsi, R., et al., J Clin Oncol 2024;42,390–398); 2) >65 years, pT1, ER-positive (≥1%), PR-positive (>20%), HER2-negative, surgical margins >1 mm, histological grade 1–2, Ki67 <13–25%, excluding invasive lobular carcinoma, no clinical or pathological evidence of direct extension to the chest wall or skin, multifocal or multicentric disease, extensive intraductal component, or lymphovascular invasion.*

[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.
[b] Based on SOUND and INSEMA trials, patients >50 years and postmenopausal with cT1N0 (node negative by axillary ultrasound), with HR+/HER2-negative, grade 1–2 tumors who are agreeable to receiving whole breast RT and endocrine therapy may be considered for omission of SLNB. Caution should be used in those with lobular histology.
[j] Patients with a known genetic predisposition to breast cancer may have an increased risk of contralateral or ipsilateral breast cancers after breast-conservation therapy. Risk reduction strategies including prophylactic mastectomies should be discussed. See NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate.
[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[l] For patients >40 years of age with 2 biopsy-proven cTis–cT2 lesions (with at least one invasive site) after MRI evaluation, intending on adjuvant whole breast radiation + boost, breast-conservation therapy may be considered (Boughey JC, et al. J Clin Oncol 2023;41:3184-3193). See BINV-G.
[m] Considerations for Surgical Axillary Staging (BINV-D).
[n] See Axillary Lymph Node Staging (BINV-E) and Margin Status Recommendations After BCS for Invasive Cancers and DCIS (BINV-F).
[o] Contraindications to Breast-Conserving Approaches Requiring RT (BINV-G).
[p] Includes techniques such as local tissue rearrangement, local flaps, regional flaps, breast reduction, and mastopexy to allow for greater volumes of resection while optimizing aesthetic outcomes in patients undergoing BCS.
[q] Determined by surgery, clinical findings, or radiographic imaging.
[r] ~~Based on data from the Europa trial (Meattini I, et al. Lancet 2025;26;37-50), older patients eligible for omission of RT may choose to receive RT alone instead of endocrine therapy with no adverse effects on early breast cancer outcomes.~~ *Not included due to short follow-up in the study of Meattini et al.*
[s] Consider imaging for systemic staging, including chest/abdomen ± pelvis diagnostic CT with contrast, bone scan, and optional FDG-PET/CT.
[t] Principles of Radiation Therapy (BINV-I).
[u] For definition of HR-positive, see Principles of Endocrine Therapy (BINV-K).
[v] APBI/PBI may be administered prior to chemotherapy.

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LOCOREGIONAL TREATMENT OF cT1–3, cN0 or cN+, M0 DISEASE[a,k]: MASTECTOMY ± PMRT

SURGERY	ADJUVANT SYSTEMIC THERAPY	PATHOLOGIC NODAL STATUS	RT
Nipple-sparing, skin-sparing, or total mastectomy with *or without* surgical axillary staging[m,n,*] (category 1) ± reconstruction[w]	See BINV-4 to determine whether adjuvant systemic therapy is indicated. RT is typically given after systemic therapy. See BINV-I for sequencing of systemic therapy and RT.	Negative axillary nodes (pN0/pN0[i+]) and ≤pT2 (≤5 cm) and negative margins	No RT[y]
		Negative axillary nodes and pT3 (>5 cm)	Consider PMRT[t] to chest wall ± comprehensive RNI (including any portion of the undissected axilla at risk).[z]
		1–3 positive axillary nodes[x]	Strongly consider PMRT[t] to chest wall + comprehensive RNI (including any portion of the undissected axilla at risk).
		≥4 positive axillary nodes[s]	PMRT[t] to chest wall + comprehensive RNI (including any portion of the undissected axilla at risk) (category 1).
		Any pT/pN with positive margins	Re-excision to negative margins is preferred. If not feasible, then strongly consider PMRT[t] to chest wall ± comprehensive RNI (including any portion of the undissected axilla at risk).

** In select patients, surgical axillary staging may be foregone.*

[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.

[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).

[m] Considerations for Surgical Axillary Staging (BINV-D).

[n] See Axillary Lymph Node Staging (BINV-E) and Margin Status Recommendations After BCS for Invasive Cancers and DCIS (BINV-F).

[s] Consider imaging for systemic staging, including chest/abdomen ± pelvis diagnostic CT with contrast, bone scan, and optional FDG-PET/CT.

[t] Principles of Radiation Therapy (BINV-I).

[w] Principles of Breast Reconstruction Following Surgery (BINV-H).

[x] In the case of pN1mi (a micrometastasis [>0.2 to ≤2.0 mm]), and no axillary dissection, evaluate other patient risk factors when considering RT.

[y] PMRT may be considered for patients with multiple high-risk recurrence factors, including central/medial tumors or tumors ≥2 cm and at least one of the following: grade 3, ER-negative, young age/longevity, or LVI.

[z] In the case of pT3N0, high-risk features for considering PMRT include, but are not limited to, young age/longevity and/or LVI.

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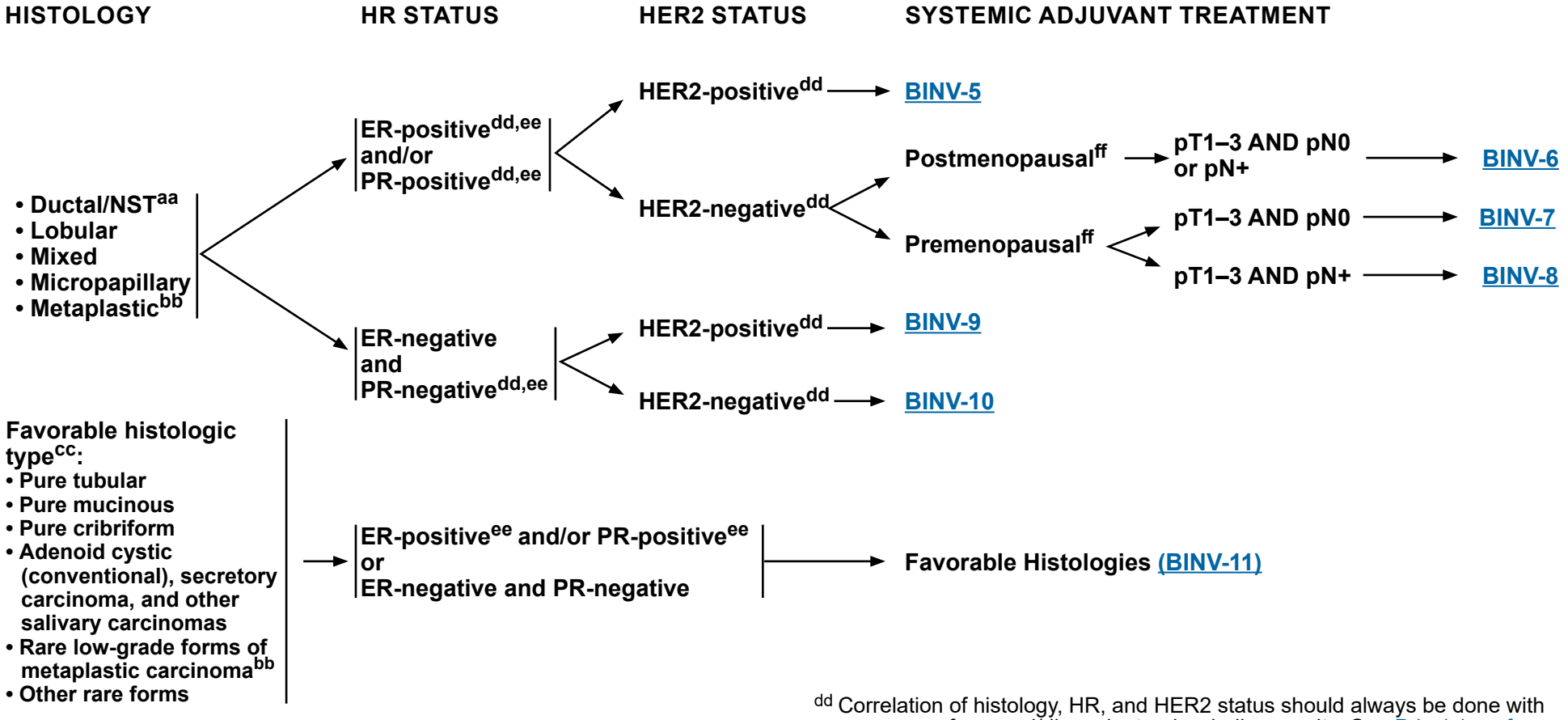
ADJUVANT SYSTEMIC THERAPY CONSIDERATIONS BASED ON HISTOLOGY AND RECEPTOR STATUS AFTER UPFRONT SURGERY



[aa] According to WHO, carcinoma of no special type (NST) encompasses multiple patterns including medullary pattern, cancers with neuroendocrine expression, and other rare patterns.

[bb] There are rare subtypes of metaplastic carcinoma (low-grade adenosquamous and low-grade fibromatosis-like carcinoma) that are considered to have a favorable prognosis without adjuvant systemic therapies.

[cc] To be associated with favorable prognosis, the favorable histologic type should not be high grade, should be pure (>90% as classified on the surgical excision, not core biopsy alone), and should be HER2 negative. If atypical pathologic or clinical features are present, consider treating as ductal/NST.

[dd] Correlation of histology, HR, and HER2 status should always be done with awareness of unusual/discordant or borderline results. See Principles of Biomarker Testing (BINV-A).

[ee] Although patients with cancers with 1%–100% ER immunohistochemistry (IHC) staining are considered ER-positive and eligible for endocrine therapies, there are more limited data on the subgroup of cancers with ER-low–positive (1%–10%) results. The ER-low–positive group is heterogeneous with reported biologic behavior often similar to ER-negative cancers; thus, individualized consideration of risks versus benefits of endocrine therapy and additional adjuvant therapies should be incorporated into decision-making. See Principles of Biomarker Testing (BINV-A).

[ff] Definition of Menopause (BINV-O).

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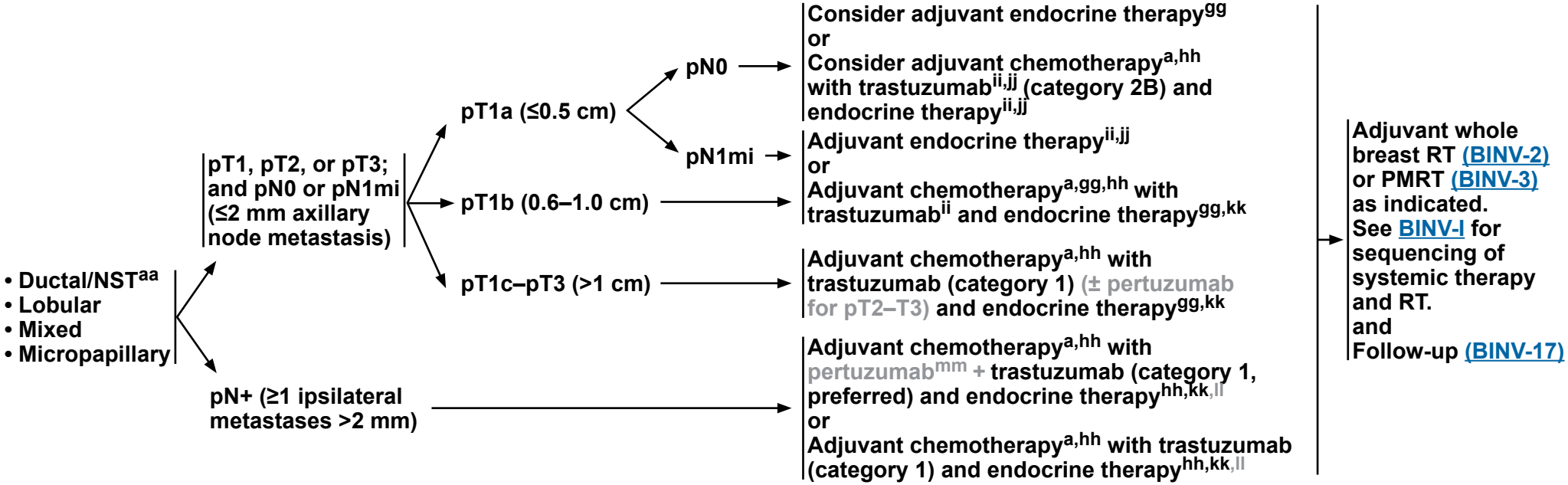
SYSTEMIC ADJUVANT TREATMENT: HR-POSITIVE – HER2-POSITIVE DISEASE[e,k,ee]



[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.
[e] Principles of Biomarker Testing (BINV-A).
[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[aa] According to WHO, carcinoma of NST encompasses multiple patterns including medullary pattern, cancers with neuroendocrine expression, and other rare patterns.
[ee] Although patients with cancers with 1%–100% ER IHC staining are considered ER-positive and eligible for endocrine therapies, there are more limited data on the subgroup of cancers with ER-low–positive (1%–10%) results. The ER-low–positive group is heterogeneous with reported biologic behavior often similar to ER-negative cancers; thus, individualized consideration of risks versus benefits of endocrine therapy and additional adjuvant therapies should be incorporated into decision-making. See Principles of Biomarker Testing (BINV-A).
[gg] Adjuvant Endocrine ± CDK/4/6 Inhibitor Therapy and Principles of Adjuvant Endocrine Therapy (BINV-K).
[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).
[ii] The benefit of HER2-targeted therapy is uncertain in HER2-positive breast cancer with pT1a–b, N0 tumors, a population not studied in randomized trials. The decision for use of trastuzumab therapy in this cohort must balance with the known toxicities.
[jj] The absolute benefit of HER2-targeted systemic therapy is negligible in patients with HR-positive cancers and tumor size bordering on T1mic (<1 mm), and endocrine therapy remains a viable option for systemic treatment.
[kk] Consider adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in postmenopausal patients (natural or induced) with high-risk node-negative or node-positive tumors.
[ll] Consider extended adjuvant neratinib following adjuvant trastuzumab-containing therapy for patients with HR-positive, HER2-positive disease with a perceived high risk of recurrence. The benefit or toxicities associated with extended neratinib in patients who have received pertuzumab or ado-trastuzumab emtansine is unknown.
[mm] Updated results from the adjuvant APHINITY trial in HER2-positive early breast cancer, with a median follow-up of 11.3 years, have confirmed the benefit of adding pertuzumab to trastuzumab plus chemotherapy in preventing recurrences.

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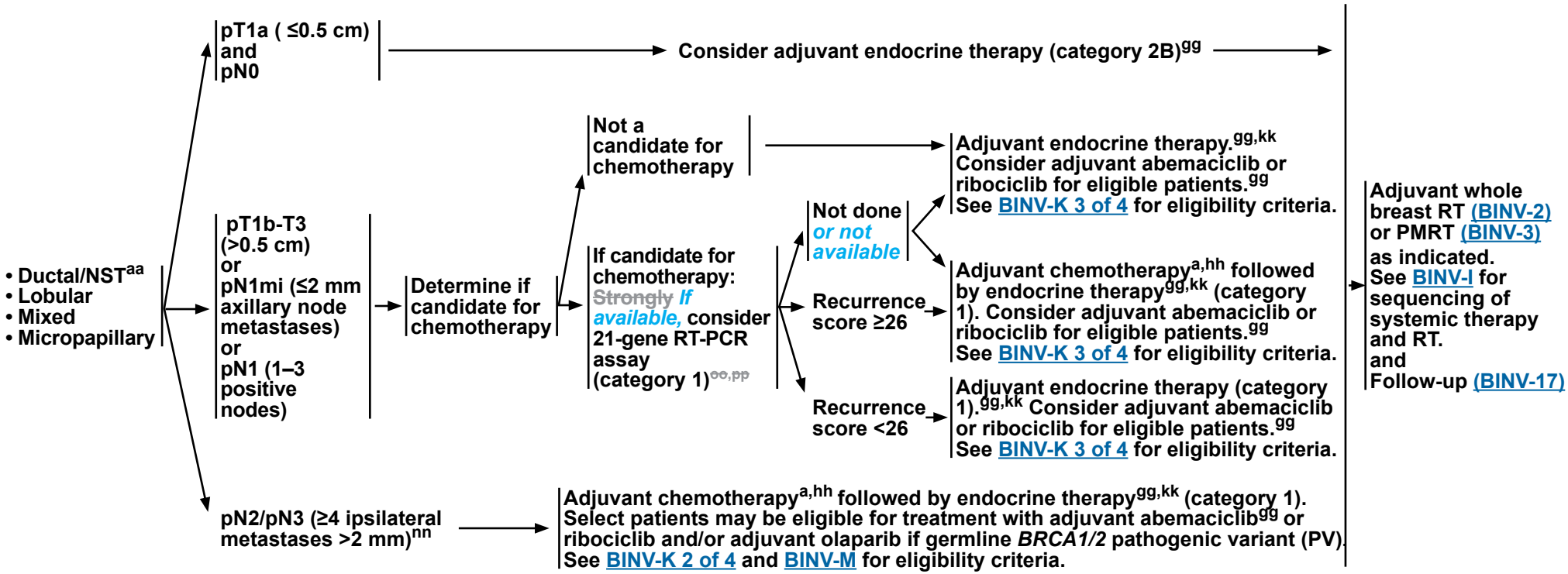
SYSTEMIC ADJUVANT TREATMENT: HR-POSITIVE – HER2-NEGATIVE DISEASE[e,k,ee] POSTMENOPAUSAL[ff] PATIENTS with pT1–3 AND pN0 or pN+ TUMORS



[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.
[e] Principles of Biomarker Testing (BINV-A).
[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[aa] According to WHO, carcinoma of NST encompasses multiple patterns including medullary pattern, cancers with neuroendocrine expression, and other rare patterns.
[ee] Although patients with cancers with 1%–100% ER IHC staining are considered ER-positive and eligible for endocrine therapies, there are more limited data on the subgroup of cancers with ER-low–positive (1%–10%) results. The ER-low–positive group is heterogeneous with reported biologic behavior often similar to ER-negative cancers; thus, individualized consideration of risks versus benefits of endocrine therapy and additional adjuvant therapies should be incorporated into decision-making. See Principles of Biomarker Testing (BINV-A).
[ff] Definition of Menopause (BINV-O).
[gg] Adjuvant Endocrine ± CDK/4/6 Inhibitor Therapy and Principles of Adjuvant Endocrine Therapy (BINV-K).
[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).
[kk] Consider adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in postmenopausal patients (natural or induced) with high-risk node-negative or node-positive tumors.
[nn] There are few data regarding the role of gene expression assays in those with ≥4 ipsilateral axillary lymph nodes. Decisions to administer adjuvant chemotherapy for this group should be based on clinical factors.
[oo] ~~Other prognostic gene expression assays may be considered to help assess risk of recurrence but have not been validated to predict response to chemotherapy. See Gene Expression Assays for Consideration of Adjuvant Systemic Therapy (BINV-N).~~
[pp] ~~Patients with T1b tumors with low-grade histology and no LVI should be treated with endocrine monotherapy as the TAILORx trial did not include patients with such tumors.~~

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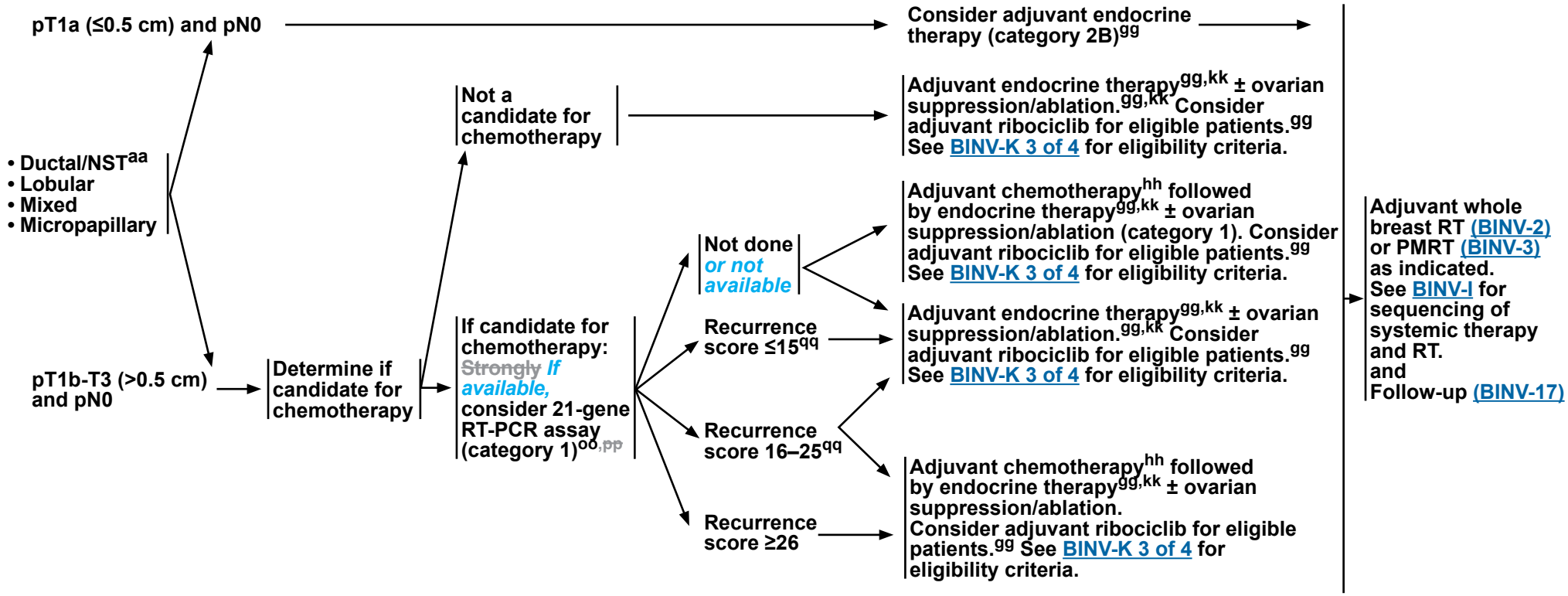
SYSTEMIC ADJUVANT TREATMENT: HR-POSITIVE – HER2-NEGATIVE DISEASE[e,k,ee] PREMENOPAUSAL[ff] PATIENTS with pT1–3 AND pN0 TUMORS



[e] Principles of Biomarker Testing (BINV-A).
[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[aa] According to WHO, carcinoma of NST encompasses multiple patterns including medullary pattern, cancers with neuroendocrine expression, and other rare patterns.
[ee] Although patients with cancers with 1%–100% ER IHC staining are considered ER-positive and eligible for endocrine therapies, there are more limited data on the subgroup of cancers with ER-low–positive (1%–10%) results. The ER-low–positive group is heterogeneous with reported biologic behavior often similar to ER-negative cancers; thus individualized consideration of risks versus benefits of endocrine therapy and additional adjuvant therapies should be incorporated into decision-making. See Principles of Biomarker Testing (BINV-A).
[ff] Definition of Menopause (BINV-O).
[gg] Adjuvant Endocrine ± CDK/4/6 Inhibitor Therapy and Principles of Adjuvant Endocrine Therapy (BINV-K).
[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).
[kk] Consider adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in postmenopausal patients (natural or induced) with high-risk node-negative or node-positive tumors.
[oo] Other prognostic gene expression assays may be considered to help assess risk of recurrence but have not been validated to predict response to chemotherapy. See Gene Expression Assays for Consideration of Adjuvant Systemic Therapy (BINV-N).
[pp] ~~Patients with T1b tumors with low-grade histology and no LVI should be treated with endocrine monotherapy as the TAILORx trial did not include patients with such tumors.~~
[qq] In premenopausal patients with recurrence score <26, the addition of chemotherapy to endocrine therapy was associated with a lower rate of distant recurrence compared with endocrine monotherapy, but it is unclear if the benefit was due to the ovarian suppression effects promoted by chemotherapy.

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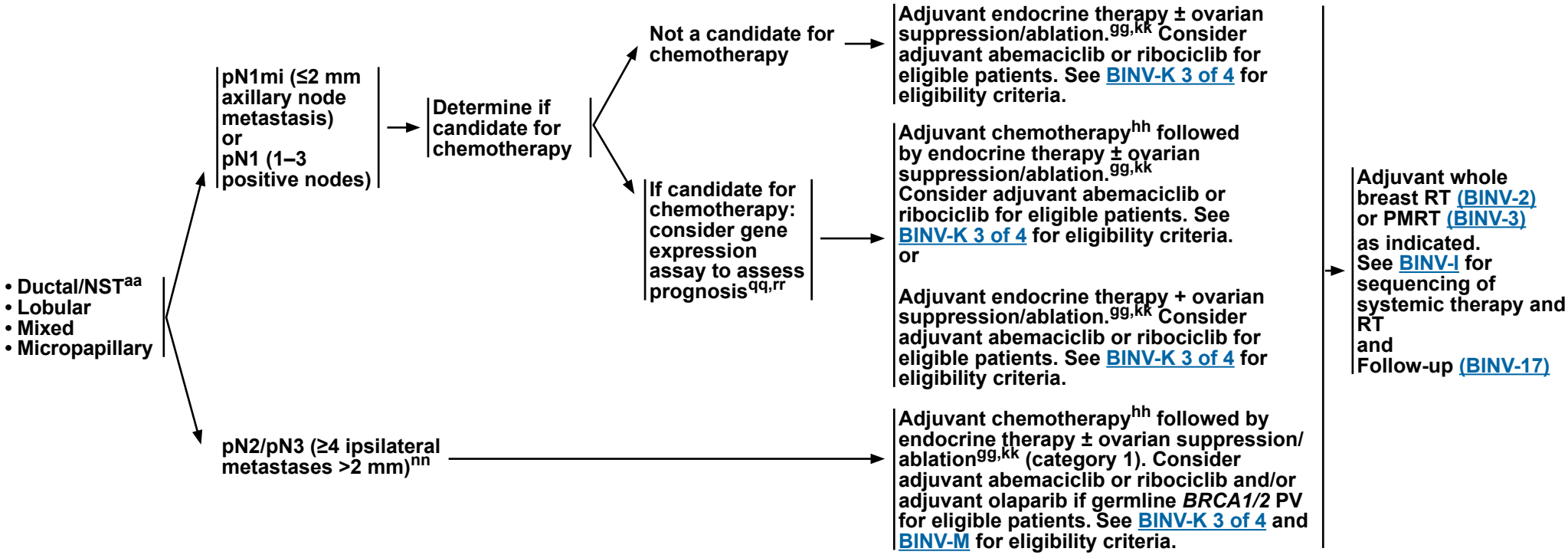
SYSTEMIC ADJUVANT TREATMENT: HR-POSITIVE – HER2-NEGATIVE DISEASE[e,k,ee] PREMENOPAUSAL[ff] PATIENTS with pT1–3 AND pN+ TUMORS



[e] Principles of Biomarker Testing (BINV-A).
[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[aa] According to WHO, carcinoma of NST encompasses multiple patterns including medullary pattern, cancers with neuroendocrine expression, and other rare patterns.
[ee] Although patients with cancers with 1%–100% ER IHC staining are considered ER-positive and eligible for endocrine therapies, there are more limited data on the subgroup of cancers with ER-low–positive (1%–10%) results. The ER-low–positive group is heterogeneous with reported biologic behavior often similar to ER-negative cancers; thus individualized consideration of risks versus benefits of endocrine therapy and additional adjuvant therapies should be incorporated into decision-making. See Principles of Biomarker Testing (BINV-A).
[ff] Definition of Menopause (BINV-O).
[gg] Adjuvant Endocrine ± CDK/4/6 Inhibitor Therapy and Principles of Adjuvant Endocrine Therapy (BINV-K).
[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).
[kk] Consider adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in postmenopausal patients (natural or induced) with high-risk node-negative or node-positive tumors.
[nn] There are few data regarding the role of gene expression assays in those with ≥4 ipsilateral axillary lymph nodes. Decisions to administer adjuvant chemotherapy for this group should be based on clinical factors.
[qq] In premenopausal patients with recurrence score <26, the addition of chemotherapy to endocrine therapy was associated with a lower rate of distant recurrence compared with endocrine monotherapy, but it is unclear if the benefit was due to the ovarian suppression effects promoted by chemotherapy.
[rr] Gene Expression Assays for Consideration of Adjuvant Systemic Therapy (BINV-N).

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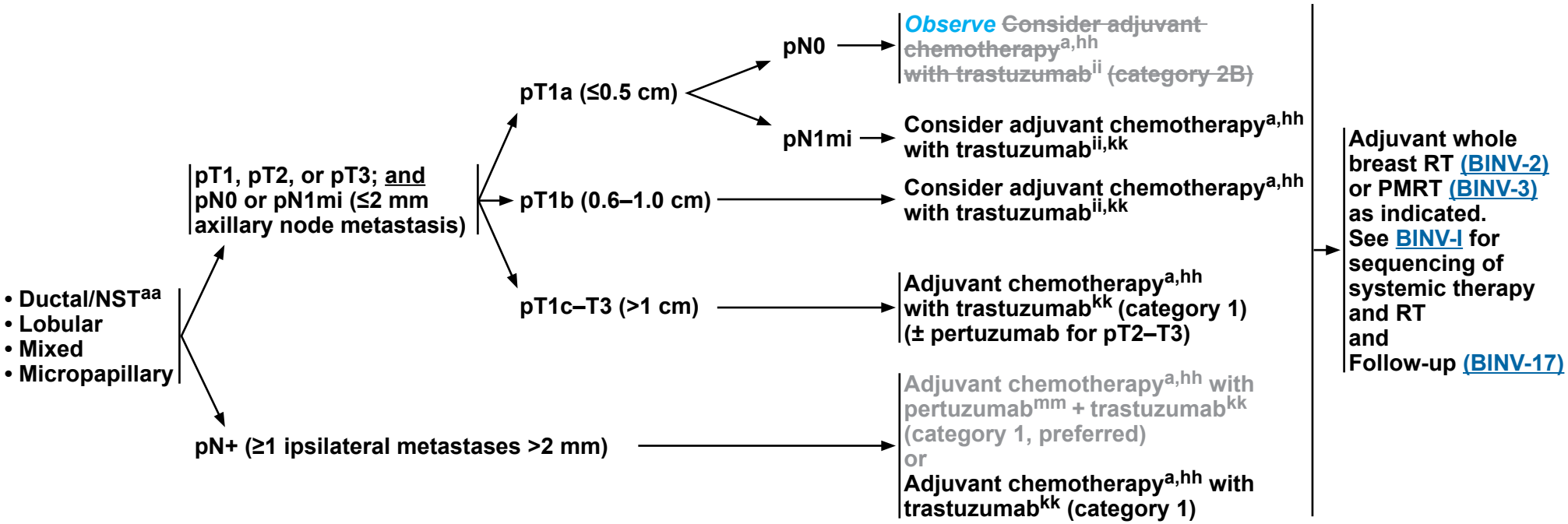
SYSTEMIC ADJUVANT TREATMENT: HR-NEGATIVE – HER2-POSITIVE DISEASE[e,k]



[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.
[e] Principles of Biomarker Testing (BINV-A).
[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[aa] According to WHO, carcinoma of NST encompasses multiple patterns including medullary pattern, cancers with neuroendocrine expression, and other rare patterns.
[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).
[ii] The benefit of HER2-targeted therapy is uncertain in HER2-positive breast cancer with pT1a-b, N0 tumors, a population not studied in randomized trials. The decision for use of trastuzumab therapy in this cohort must balance with the known toxicities.
[kk] Consider adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in postmenopausal patients (natural or induced) with high-risk node-negative or node-positive tumors.
[mm] Updated results from the adjuvant APHINITY trial in HER2-positive early breast cancer, with a median follow-up of 11.3 years, have confirmed the benefit of adding pertuzumab to trastuzumab plus chemotherapy in preventing recurrences. *Pertuzumab is unavailable in Poland.*

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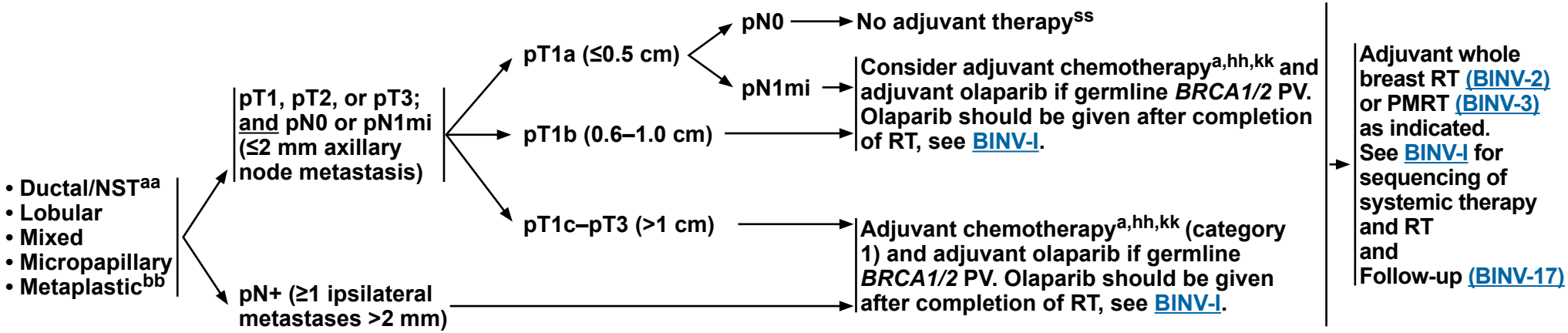
SYSTEMIC ADJUVANT TREATMENT: HR-NEGATIVE – HER2-NEGATIVE DISEASE[e,k]



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[aa] According to WHO, carcinoma of NST encompasses multiple patterns including medullary pattern, cancers with neuroendocrine expression, and other rare patterns.
[bb] There are rare subtypes of metaplastic carcinoma (eg, low-grade adenosquamous and low-grade fibromatosis-like carcinoma) that are considered to have a favorable prognosis without adjuvant systemic therapies.
[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).
[kk] Consider adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in postmenopausal patients (natural or induced) with high-risk node-negative or node-positive tumors.
[ss] In select patients with high-risk features (eg, young patients with high-grade histology), adjuvant chemotherapy may be considered (category 2B). See BINV-L.

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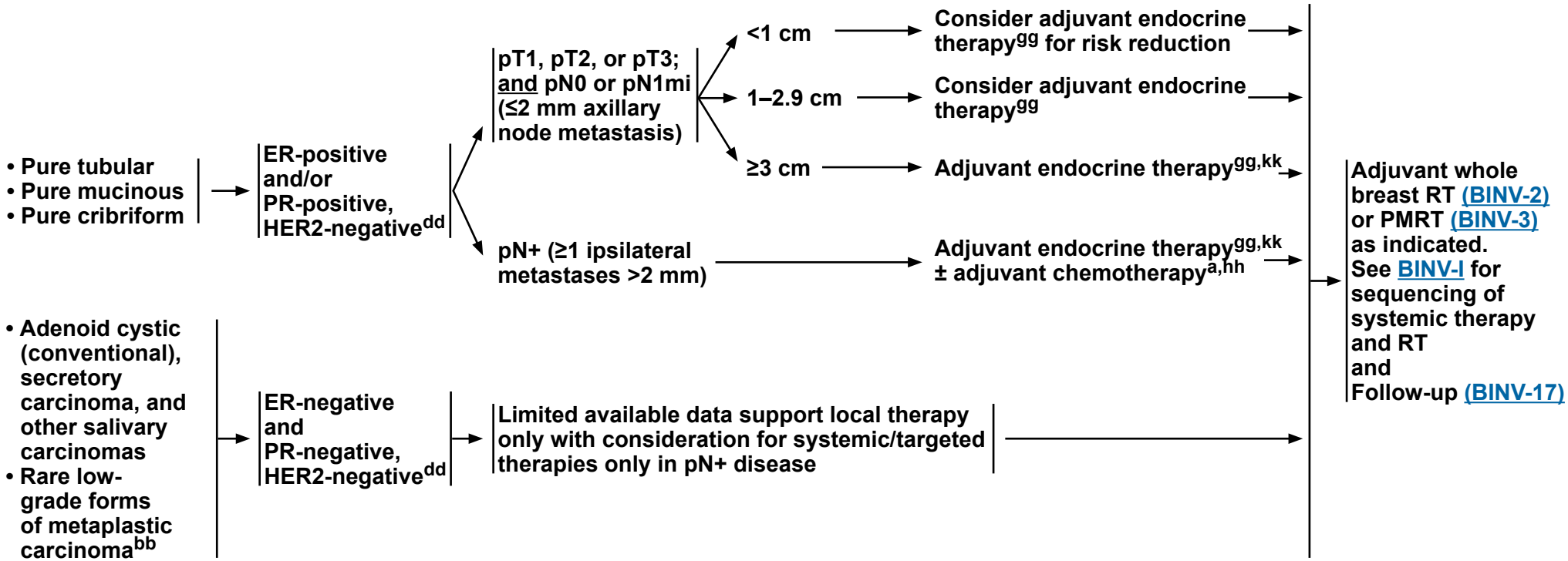
SYSTEMIC ADJUVANT TREATMENT: FAVORABLE HISTOLOGIES[k,cc]



[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.

[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).

[bb] There are rare subtypes of metaplastic carcinoma (eg, low-grade adenosquamous and low-grade fibromatosis-like carcinoma) that are considered to have a favorable prognosis without adjuvant systemic therapies.

[cc] To be associated with favorable prognosis, the favorable histologic type should not be high grade, should be pure (>90% as classified on the surgical excision, not core biopsy alone), and should be HER2 negative. If atypical pathologic or clinical features are present, consider treating as ductal/NST.

[dd] Correlation of histology, HR, and HER2 status should always be done with awareness of unusual/discordant or borderline results. See Principles of Biomarker Testing (BINV-A).

[gg] Adjuvant Endocrine ± CDK/4/6 Inhibitor Therapy and Principles of Adjuvant Endocrine Therapy (BINV-K).

[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).

[kk] Consider adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in postmenopausal patients (natural or induced) with high-risk node-negative or node-positive tumors.

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WORKUP PRIOR TO PREOPERATIVE SYSTEMIC THERAPY

CLINICAL STAGE

c≥T2[tt] or cN+ and M0
or
cT1c, cN0 HER2-positive disease
or
cT1c, cN0 TNBC
(For preoperative systemic therapy criteria, see BINV-L 1)

ADDITIONAL WORKUP[a]

- **Axillary assessment with exam**
  - ***Consider TAD***
  - **Axillary ultrasound unless prior MRI demonstrated negative axillary nodes**
  - ***Consider* percutaneous biopsy of suspicious nodes[uu]**
- **Complete blood count (CBC)**
- **Comprehensive metabolic panel, including liver function tests (LFTs) and alkaline phosphatase**

Additional tests ~~to consider as~~ *if* clinically indicated

- **Chest diagnostic CT ± contrast**
- **Abdomen ± pelvis diagnostic CT with contrast or MRI with contrast**
- **Bone scan ~~or sodium fluoride PET/CT~~ (category 2B)**
- **FDG-PET/CT[vv] *(useful in certain circumstances)***
- **Breast MRI[b,*] (optional), with special consideration for mammographically occult tumors, ~~if not previously done~~**
- ***CEM (if breast MRI is contraindicated or not available)***

For operable breast cancers: see Breast and Axillary Evaluation Prior to Preoperative Systemic Therapy (BINV-13)

For inoperable breast cancers: see Preoperative Systemic Therapy (BINV-15)

** Basic indications for preoperative MRI include: (1) Patients with newly diagnosed invasive lobular cancer (LoE-2a, DoR-B). Preoperative MRI changes management in approximately 28% and significantly reduces the number of re-operations. (2) Patients under 60 years of age with tumor size discrepancy >1 cm between mammography and US with a potential impact on treatment decision (LoE-2b, DoR-B). (3) Patients eligible for PBI based on CBE and conventional imaging (LoE-3b, DoR-B).*

[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.

[b] Breast MRI may be useful for characterizing axillary and/or internal mammary nodal disease. See Principles of Dedicated Breast MRI Testing (BINV-B) and NCCN Guidelines for Breast Cancer Screening and Diagnosis.

[tt] If considering preoperative therapy, consider use of a gene expression assay during workup for pre- and postmenopausal patients with cN0 and postmenopausal patients with cN1, operable ER-positive, HER2-negative disease. (Iwata H, et al. Breast Cancer Res Treat 2019;173:123–133; Ma SJ, et al. Breast Cancer Res Treat 2021;189:737–745; Hanson K, et al. J Clin Oncol 2021;39(15_suppl):Abstract 591; Beitsch PD, et al. J Clin Oncol 2023;41(16_suppl):Abstract 523).

[uu] At the time of biopsy of the most suspicious axillary lymph node(s), a marker should be placed to allow for identification and removal at the time of definitive surgery.

[vv] FDG-PET/CT is most beneficial and accurate for advanced disease (stage III) and invasive ductal (compared to lobular) histology, but may be useful in selected circumstances of earlier stage disease (stage IIA disease: cT1cN1, cT2cN0) such as: equivocal CT+ bone scan results; suspicion of undetected nodal and/or distant disease; and treatment response assessment. An FDG-PET/CT may be utilized as an adjunct to, or in lieu of, initial standard staging and may be performed simultaneously with diagnostic CT. Conversely, a bone scan or sodium fluoride PET/CT may not be needed if an upfront FDG-PET/CT clearly indicates consistent findings on both PET and CT components.

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OPERABLE DISEASE: BREAST AND AXILLARY EVALUATION PRIOR TO PREOPERATIVE SYSTEMIC THERAPY

Prior to preoperative systemic therapy, perform:
- **Core biopsy of breast with placement of image-detectable clips or marker(s), if not previously performed, should be performed prior to preoperative therapy to demarcate the tumor bed**
- **Axillary imaging with ultrasound or MRI (if not previously done)**
  and
- ***Consider* biopsy *+/-* marker placement ~~recommended~~ ~~of~~ *in* the most suspicious and/or clinically positive axillary lymph node, if not previously done; only the most suspicious node should be marked and retrieved along with SLNs***

→ **Preoperative systemic therapy based on HR and HER2 status (BINV-L 1 and BINV-M)** → **Surgical Treatment and Adjuvant Therapy After Preoperative Systemic Therapy (BINV-14)**

** Surgeons should be reassured that SLNB with dual-tracer mapping and TAD have similar outcomes.*

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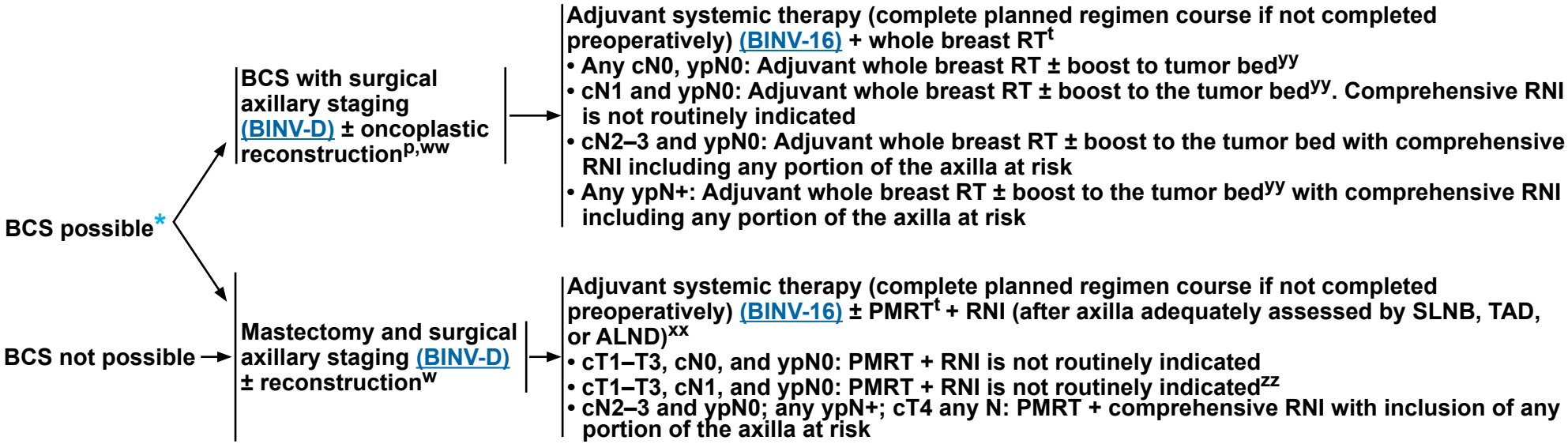
OPERABLE DISEASE:
SURGICAL TREATMENT AND ADJUVANT THERAPY AFTER PREOPERATIVE SYSTEMIC TREATMENT[ww]



** The optimal timing of surgery after completion of NACT is 4–8 weeks.*

[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).

[p] Includes techniques such as local tissue rearrangement, local flaps, regional flaps, breast reduction, and mastopexy to allow for greater volumes of resection while optimizing aesthetic outcomes in patients undergoing BCS.

[t] Principles of Radiation Therapy (BINV-I).

[w] Principles of Breast Reconstruction Following Surgery (BINV-H).

[ww] The accurate assessment of in-breast tumor or regional lymph node response to preoperative systemic therapy is difficult, and should include physical examination and performance of imaging studies (mammogram and/or breast ultrasound and/or breast MRI) that were abnormal at the time of initial tumor staging. Selection of imaging methods prior to surgery should be determined by the multidisciplinary team. MRI is more accurate than mammography for assessing tumor response to preoperative therapy. *MRI is not mandatory for patients undergoing preoperative systemic therapy.*

[xx] Among patients shown to be N+ prior to preoperative systemic therapy, SLNB has a >10% false-negative rate when performed after preoperative systemic therapy, which can be improved by marking the most suspicious biopsied node prior to treatment, and at the time of surgery, using dual tracers, obtaining ≥3 sentinel lymph nodes nodes and removal of the marked node (Targeted Axillary Dissection [TAD]).

[yy] Strongly consider RT boost for high-risk features (~~eg, central/medial tumors~~, tumors ≥2 cm with ≥1 of the following: grade 3, ER-negative, LVI, high residual cancer in the breast, or young age/longevity).

[zz] When considering PMRT + RNI for cN1 that has become ypN0 (after preoperative therapy), based on limited followup duration of NSABP B-51 study (Mamounas EP, et al. N Engl J Med 2025;392:2113-2124) and the inability to demonstrate long-term non-inferiority for this subgroup, a discussion of potential risks of under-treatment should be weighed against the previously established long-term survival benefits of PMRT+RNI, particularly for patients of younger age/longevity with ER-positive tumors, residual disease in the breast, and/or those with multiple traditional clinical pathologic high-risk features.

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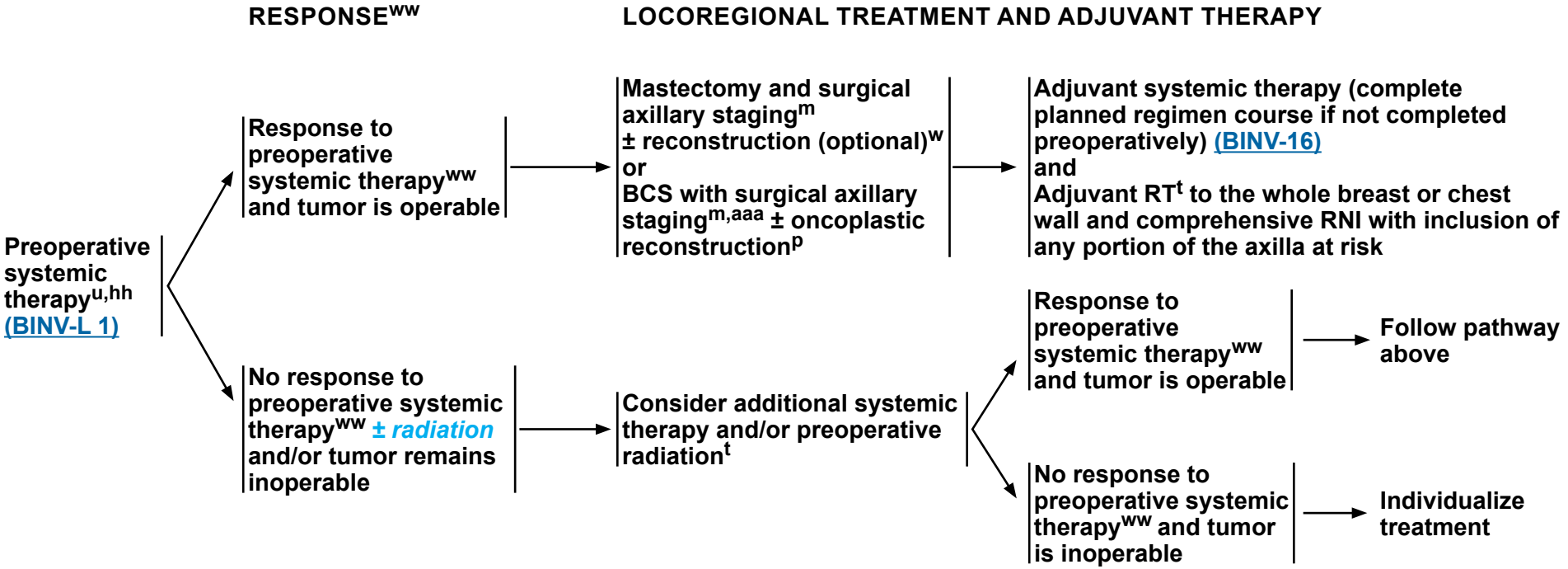
INOPERABLE OR LOCALLY ADVANCED DISEASE (NON-INFLAMMATORY): PREOPERATIVE SYSTEMIC THERAPY AND SUBSEQUENT TREATMENT



[m] Considerations for Surgical Axillary Staging (BINV-D).
[p] Includes techniques such as local tissue rearrangement, local flaps, regional flaps, breast reduction, and mastopexy to allow for greater volumes of resection while optimizing aesthetic outcomes in patients undergoing BCS.
[t] Principles of Radiation Therapy (BINV-I).
[u] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[w] Principles of Breast Reconstruction Following Surgery (BINV-H).
[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).

[ww] The accurate assessment of in-breast tumor or regional lymph node response to preoperative systemic therapy is difficult, and should include physical examination and performance of imaging studies (mammogram and/or breast ultrasound and/or breast MRI) that were abnormal at the time of initial tumor staging. Selection of imaging methods prior to surgery should be determined by the multidisciplinary team. ~~MRI is more accurate than mammography for assessing tumor response to preoperative therapy.~~
[aaa] For patients with skin and/or chest wall involvement (T4 non-inflammatory) prior to preoperative systemic therapy, breast conservation may be performed in carefully selected patients based on a multidisciplinary assessment of local recurrence risk. In addition to standard contraindications to breast conservation (BINV-G), exclusion criteria for breast conservation include: inflammatory (T4d) disease before preoperative systemic therapy and incomplete resolution of skin involvement after preoperative systemic therapy.

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ADJUVANT SYSTEMIC THERAPY AFTER PREOPERATIVE SYSTEMIC THERAPY[kk]

RESPONSE/PATHOLOGIC STAGE AFTER PREOPERATIVE THERAPY		ADJUVANT SYSTEMIC THERAPY[k,gg,hh,kk]
HR-positive/ HER2-negative	ypT0N0 or pCR	Adjuvant endocrine therapy (category 1), consider ribociclib for eligible patients, see BINV-K 2 of 4 for eligibility criteria.
	ypT1–4,N0 or ypN≥1	Adjuvant endocrine therapy (category 1) + adjuvant olaparib if germline *BRCA1/2* PV (category 1). Consider adjuvant abemaciclib or ribociclib for eligible patients, see BINV-K 2 of 4 for eligibility criteria.
HR-negative/ HER2-positive	ypT0N0 or pCR	Complete up to 1 year of HER2-targeted therapy with trastuzumab (category 1) ± pertuzumab. If node positive at initial staging, pertuzumab + trastuzumab (category 1).
	ypT1–4,N0 or ypN≥1	Ado-trastuzumab emtansine (category 1) alone for 14 cycles.[bbb] If ado-trastuzumab emtansine discontinued for toxicity, then complete (up to) 1 year of HER2-directed therapy with trastuzumab (category 1) ± pertuzumab. If node positive at initial staging, pertuzumab[mm] + trastuzumab (category 1); or fam-trastuzumab deruxtecan-nxki (category 1) for those with high risk of recurrence (see BINV-M 4 of 10 for high-risk criteria) and If HR-positive, adjuvant endocrine therapy[ll] (category 1)
HR-positive/ HER2-positive	ypT0N0 or pCR	Endocrine therapy (category 1) + complete (up to) 1 year of HER2-directed therapy with trastuzumab (category 1) ± pertuzumab. If node positive at initial staging, pertuzumab + trastuzumab (category 1)
HR-negative/ HER2-negative	ypT0N0 or pCR	For high risk: Adjuvant pembrolizumab (if pembrolizumab-containing regimen was given preoperatively)
	ypT1–4,N0 or ypN≥1	Adjuvant pembrolizumab (if pembrolizumab-containing regimen was given preoperatively) (category 1)[ccc] and/or Adjuvant capecitabine (6–8 cycles)[bbb,ccc] and/or Adjuvant olaparib for 1 year if germline *BRCA1/2* PV[ccc] (category 1)

→ Follow-Up (BINV-17)

[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[gg] Adjuvant Endocrine ± CDK/4/6 Inhibitor Therapy and Principles of Adjuvant Endocrine Therapy (BINV-K).
[hh] Preoperative/Adjuvant Therapy Regimens (BINV-M).
[kk] Consider adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in postmenopausal patients (natural or induced) with high-risk node-negative or node-positive tumors.
[ll] Consider extended adjuvant neratinib following adjuvant trastuzumab-containing therapy for patients with HR-positive, HER2-positive disease with a perceived high risk of recurrence. The benefit or toxicities associated with extended neratinib in patients who have received Pertuzumab or Ado-trastuzumab emtansine is unknown.
[mm] Updated results from the adjuvant APHINITY trial in HER2-positive early breast cancer, with a median follow-up of 11.3 years, have confirmed the benefit of adding pertuzumab to trastuzumab plus chemotherapy in preventing recurrences.
[bbb] Recommendations do not apply to residual DCIS (ypTis).
[ccc] There are no data on sequencing or combining adjuvant pembrolizumab with capecitabine or olaparib in patients who meet criteria for treatment with one or more of these agents. However, their sequential/combined use may be considered given high risk of recurrence in patients with residual disease.

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SURVEILLANCE/FOLLOW-UP

Exam:
- History and physical exam 1–4 times per year as clinically appropriate for 5 years, then annually

Genetic screening:
- Periodic screening for changes in family history and genetic testing indications and referral to genetic counseling as indicated, see NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate

Postsurgical management:
- Educate, monitor, and refer for lymphedema management, see NCCN Guidelines for Survivorship: Lymphedema

Breast imaging:
- Mammography every 12 months, beginning 6 months or more after completion of breast-conservation therapy[ddd],*
- Routine imaging of reconstructed breast is not indicated after mastectomy
- For patients with germline mutations or family history of breast cancer, please refer to NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate

Fertility, birth control, and sexual health (see BINV-C)

Screening for metastases:
- In the absence of clinical signs and symptoms suggestive of recurrent disease, there is no indication for laboratory or imaging studies for metastases screening.

Post-treatment monitoring:
- Cardiotoxicity monitoring for patients who received left-sided RT, anthracyclines, or HER2-targeted therapy. For anthracycline-induced toxicity, see NCCN Guidelines for Survivorship
- Provide guidance on risk of comorbidities

Endocrine therapy:
- *Patients with treatment-induced menopause receiving aromatase inhibitors should have estradiol levels checked regularly*
- Assess and encourage adherence to adjuvant endocrine therapy
- Patients on tamoxifen:
  - Age-appropriate gynecologic screening
  - Routine annual pelvis ultrasound is not recommended
- Patients on an aromatase inhibitor or who experience ovarian failure secondary to treatment should have monitoring of bone health with a bone mineral density (BMD) determination at baseline and periodically thereafter[eee]

Lifestyle:
- Evidence suggests that active lifestyle, healthy diet, limited alcohol intake, and achieving and maintaining an ideal body weight (20–25 body mass index [BMI]) may lead to optimal breast cancer outcomes. See NCCN Guidelines for Breast Cancer Risk Reduction
- Menopausal hormone therapy is relatively contraindicated in survivors of hormonally mediated cancers; should be used with caution in those with increased genetic cancer risk. See NCCN Guidelines for Survivorship

Psychosocial support:
- Survivors are at elevated risk for fear of recurrence, distress, anxiety, and depression that may persist for many years after diagnosis. Periodic screening and referral to mental health professionals if needed are recommended. See NCCN Guidelines for Survivorship

Communication:
- Coordination of care between the primary care physician (PCP) and specialists is encouraged. Additionally, a personalized survivorship treatment plan including personalized treatment summary of possible long-term toxicity and clear follow-up recommendations is recommended. See NCCN Guidelines for Survivorship

Engagement:
- *Patients should be provided access to rehabilitation and psychological support at all steps of treatment and follow-up*
- Patients frequently require follow-up encouragement in order to improve adherence to ongoing screening and medication adherence. See NCCN Guidelines for Patients

→ Recurrent Disease (BINV-18)

* *For patients aged >50 years without germline mutations or family history of breast cancer, beginning 3 years after completion of curative surgery + RT, mammography every 2 years after BCT and every 3 years after mastectomy (Dunn JA et al. Lancet 2025; 405: 396–407).*

[ddd] Studies indicate that annual mammograms are the appropriate frequency for surveillance of patients with breast cancer who have had BCS and RT with no clear advantage to shorter interval imaging. Patients should wait 6 to 12 months after the completion of RT to begin their annual mammogram surveillance. Suspicious findings on physical examination or surveillance imaging should warrant immediate follow-up/workup.

[eee] The use of estrogen, progesterone, or selective ER modulators to treat osteoporosis or osteopenia in patients with breast cancer is discouraged. The use of a bisphosphonate (oral/IV) ~~or denosumab~~ is acceptable to maintain or to improve BMD and reduce risk of fractures in postmenopausal (natural or induced) patients receiving adjuvant aromatase inhibitor therapy. Optimal duration of either therapy has not been established. Benefits of duration beyond 3 years or optimal duration beyond 3 years is not known. Factors to consider for duration of anti-osteoporosis therapy include BMD, response to therapy, and risk factors for continued bone loss or fracture. ~~There are case reports of spontaneous fractures after denosumab discontinuation.~~ Patients treated with a bisphosphonate ~~or denosumab~~ should undergo a dental examination with preventive dentistry prior to the initiation of therapy, and should take supplemental calcium and vitamin D.

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RECURRENT/STAGE IV (M1) DISEASE

CLINICAL STAGE

Stage IV (M1) or Recurrent

WORKUP[a]

- History and physical exam
- Discuss goals of therapy, adopt shared decision-making, and document course of care
- CBC
- Comprehensive metabolic panel, including LFTs and alkaline phosphatase
- Imaging for systemic staging:
  - Chest diagnostic CT ± contrast
  - Abdomen ± pelvis diagnostic CT with contrast or MRI with contrast
  - Brain MRI with contrast *(preferred) or brain CT* if suspicious CNS symptoms[fff]
  - Spine MRI with contrast if back pain or symptoms of cord compression
  - Bone scan ~~or sodium fluoride PET/CT~~ (category 2B)
  - Useful in certain circumstances:
    - ◊ FDG-PET/CT ~~(consider FES-PET/CT for ER-positive disease and lobular histology)~~
  - X-rays of symptomatic bones and long and weight-bearing bones abnormal on bone scan
- Biomarker testing:
  - Biopsy of at least first recurrence of disease (consider re-biopsy if progression)
  - Evaluation of ER/PR and HER2 status[e,ggg,hhh]
  - Multigene panel testing (MGPT) (somatic and germline) to identify candidates for targeted therapies,[iii] see BINV-Q 6 of 15
- Genetic counseling if patient is at risk[f] for hereditary breast cancer
- Assess for distress[h]

→ Treatment of Local and Regional Recurrence (BINV-19) and Supportive care[jjj]

→ Systemic Treatment of Recurrent Unresectable (local or regional) or Stage IV (M1) (BINV-21) and Supportive care[jjj,kkk]

[a] For tools to aid optimal assessment and comprehensive care of older adults, see NCCN Guidelines for Older Adult Oncology.

[e] Principles of Biomarker Testing (BINV-A).

[f] For risk criteria, see NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate.

[h] Refer to the NCCN Guidelines for Distress Management (DIS-A) for the NCCN Distress Thermometer and Problem List, which includes social determinants of health.

[fff] For the treatment of brain metastases, see NCCN Guidelines for Central Nervous System Cancers.

[ggg] ~~False-negative ER and/or PR determinations occur, and there may be discordance between the ER and/or PR determination between the primary and metastatic tumor(s). Therefore,~~ *In case of discordant ER and/or PR determination between primary and metastatic tumor(s),* endocrine therapy with its low attendant toxicity may be considered in patients with non-visceral or asymptomatic visceral tumors, especially in patients with clinical characteristics predicting for an HR-positive tumor (eg, long disease-free interval, limited sites of recurrence, indolent disease, older age).

[hhh] In clinical situations where a biopsy cannot safely be obtained but the clinical evidence is strongly supportive of recurrence, treatment may commence based on the ER/PR/HER2 status of the primary tumor. Since ER/PR and HER2 status can change with treatment and metastatic progression, it may be appropriate to consider repeat testing on new samples in these scenarios if management will change.

[iii] Tumor tissue or plasma-based circulating tumor DNA (ctDNA) assays may be used and each of these have benefits and limitations for diagnosis and disease progression. Tissue-based assays have greater sensitivity for some alterations, but ctDNA may reflect tumor heterogeneity more accurately. If one specimen is negative for actionable biomarkers, testing on the alternative specimen can be considered.

[jjj] See NCCN Guidelines for Palliative Care and NCCN Guidelines for Supportive Care.

[kkk] Optimal management of oligometastatic stage IV breast cancers remains uncertain. Routine utilization of locoregional treatment of the primary tumor and ablative treatment for metastatic sites have not been demonstrated to improve survival outcomes in prospective trials, however, may reduce the risk of local progression and palliate symptoms. Compared with recurrent oligometastatic disease, patients with de novo oligometastatic cancer have better outcomes and therapeutic decisions should be individualized and discussed in a multidisciplinary context. A large number of case series document long-term disease-free survival (DFS) for patients with de novo oligometastatic breast cancer who received multimodality therapy leading to “no evidence of disease” (NED). For de novo oligometastatic disease with favorable features (HER2+ or ER+, induced NED status after receipt of optimal multi-agent systemic regimens, limited sites of metastases, bone-only metastases, and young age/longevity), an aggressive multimodality approach involving locoregional therapy of the primary tumor, ablative treatment to all sites of metastases, and "adjuvant-like" systemic therapy may offer improved long-term PFS and may be considered.

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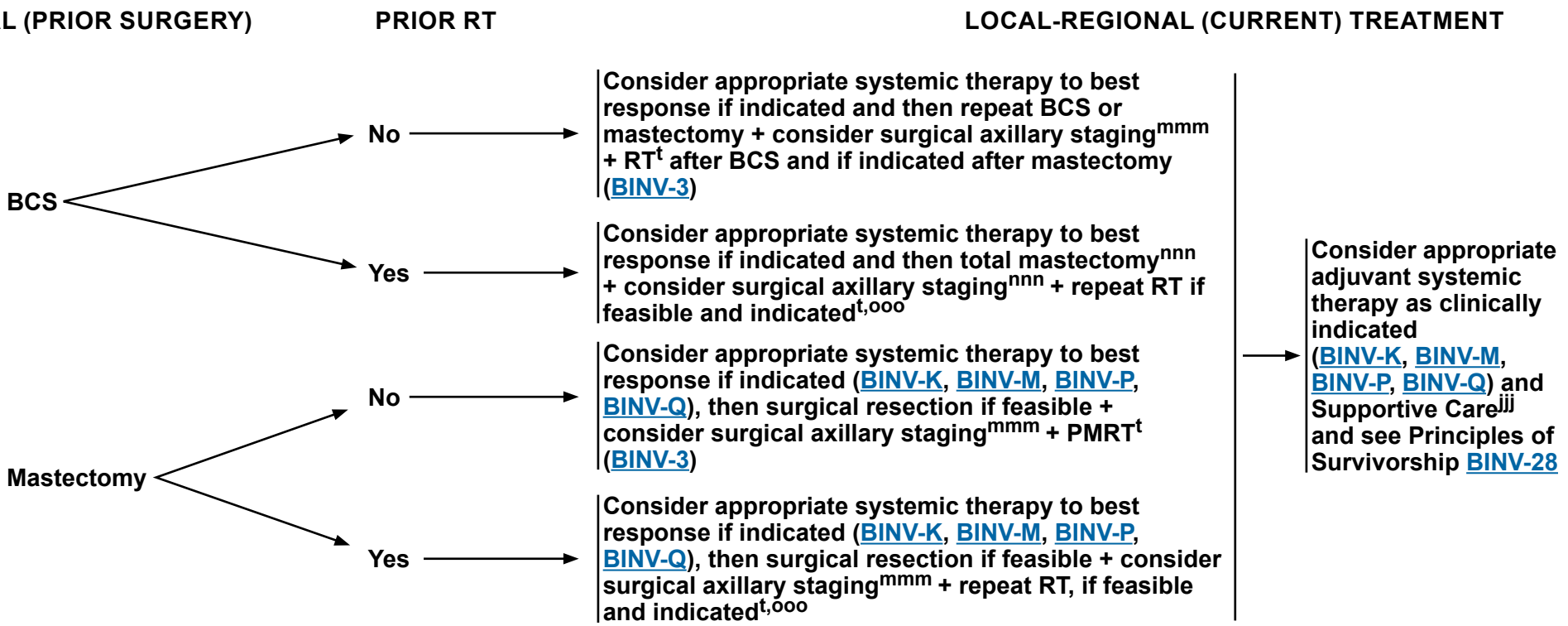
TREATMENT OF LOCAL RECURRENCE: In-Breast or Chest Wall Recurrence[lll] (Without clinically overt axillary recurrence)

(For REGIONAL ± LOCAL RECURRENCE, see BINV-20)



[t] Principles of Radiation Therapy (BINV-I).
[jjj] See NCCN Guidelines for Palliative Care and NCCN Guidelines for Supportive Care.
[lll] Multidisciplinary approach is especially important in the management of breast cancer recurrence to consider all potential treatment options for optimal outcomes.
[mmm] In patients with a local breast recurrence after BCS who had a prior SLNB, a repeat SLNB may be considered although the accuracy of repeat SLNB is unproven. After mastectomy, repeat SLNB may be considered although there are limited data in this setting. In patients who had a prior axillary lymph node dissection (ALND) or mastectomy, repeat SLNB with lymphoscintigraphy may be considered rather than ALND (Poodt IGM, et al. Ann Surg Oncol 2019;26:2417-2427).
[nnn] Repeat BCS ± adjuvant APBI/PBI may be considered in selected patients who decline mastectomy and otherwise meet consensus criteria for radiotherapy omission or APBI/PBI. There are limited data for a repeat BCS in this setting.
[ooo] The decision to use RT to treat locoregional recurrence must factor in any prior radiation to the area and the risk of late normal tissue toxicity from the sum of the prior and planned radiation courses.

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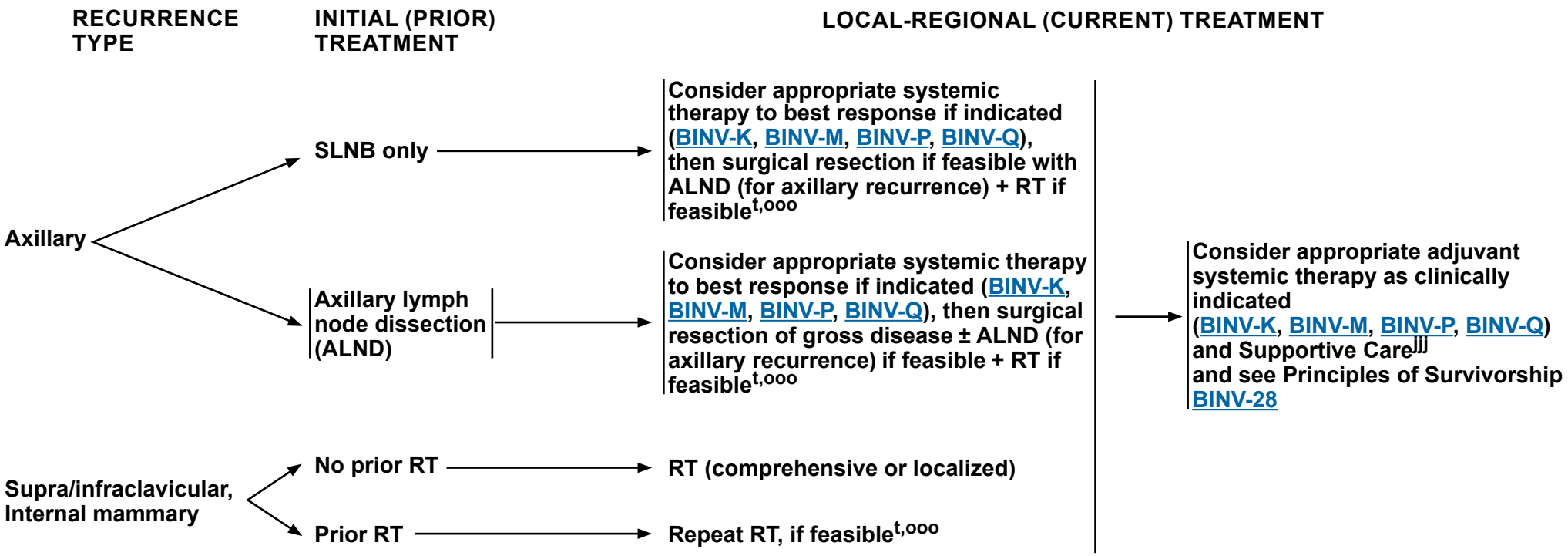
TREATMENT OF REGIONAL ± LOCAL RECURRENCE[lll]

(For LOCAL ONLY RECURRENCE, see BINV-19)



[t] Principles of Radiation Therapy (BINV-I).
[jjj] See NCCN Guidelines for Palliative Care and NCCN Guidelines for Supportive Care.
[lll] Multidisciplinary approach is especially important in the management of breast cancer recurrence to consider all potential treatment options for optimal outcomes.
[ooo] The decision to use RT to treat locoregional recurrence must factor in any prior radiation to the area and the risk of late normal tissue toxicity from the sum of the prior and planned radiation courses.

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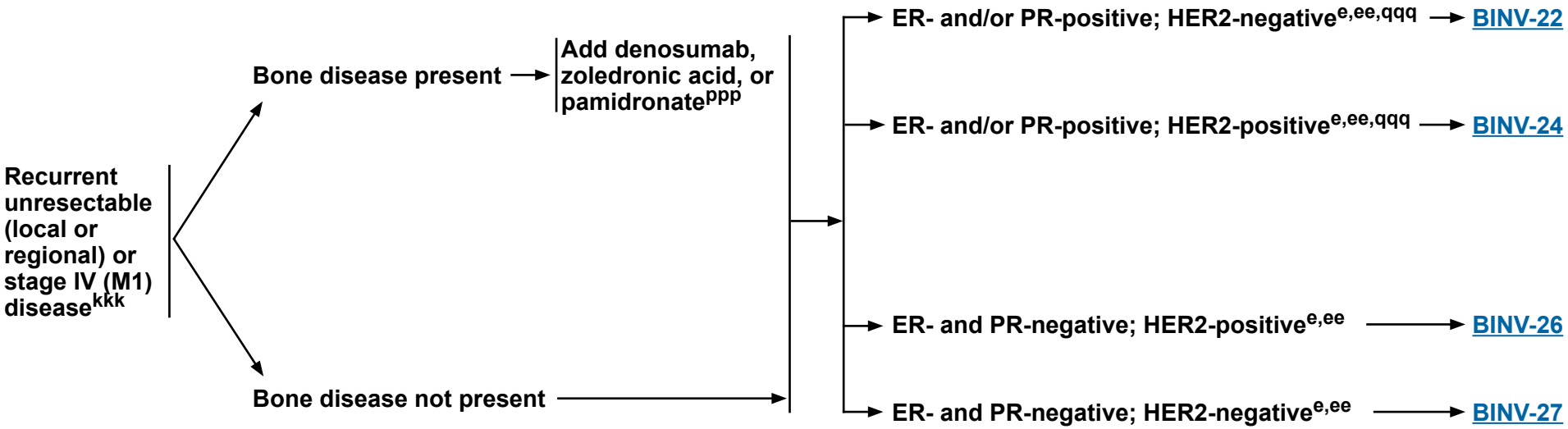
SYSTEMIC TREATMENT OF RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE[k]



[e] Principles of Biomarker Testing (BINV-A).

[k] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).

[ee] Although patients with cancers with 1%–100% ER IHC staining are considered ER-positive and eligible for endocrine therapies, there are more limited data on the subgroup of cancers with ER-low–positive (1%–10%) results. The ER-low–positive group is heterogeneous with reported biologic behavior often similar to ER-negative cancers; thus, individualized consideration of risks versus benefits of endocrine therapy and additional adjuvant therapies should be incorporated into decision-making. See Principles of Biomarker Testing (BINV-A).

[kkk] Optimal management of oligometastatic stage IV breast cancers remains uncertain. Routine utilization of locoregional treatment of the primary tumor and ablative treatment for metastatic sites have not been demonstrated to improve survival outcomes in prospective trials, however, may reduce the risk of local progression and palliate symptoms. Compared with recurrent oligometastatic disease, patients with de novo oligometastatic cancer have better outcomes and therapeutic decisions should be individualized and discussed in a multidisciplinary context. A large number of case series document long-term DFS for patients with de novo oligometastatic breast cancer who received multimodality therapy leading to NED. For de novo oligometastatic disease with favorable features (HER2+ or ER+, induced NED status after receipt of optimal multi-agent systemic regimens, limited sites of metastases, bone-only metastases, and young age/longevity), an aggressive multimodality approach involving locoregional therapy of the primary tumor, ablative treatment to all sites of metastases and "adjuvant-like" systemic therapy may offer improved long-term PFS and may be considered.

[ppp] Denosumab, zoledronic acid, or pamidronate (all with calcium and vitamin D supplementation) should be given (category 1) in addition to systemic therapy or endocrine therapy if bone metastasis is present, expected survival is ≥3 months, and renal function is adequate. Patients should undergo a dental examination with preventive dentistry prior to initiation of this therapy. The optimal schedule for zoledronic acid is every 12 weeks.

[qqq] Baseline assessment of bone density is recommended for patients receiving an aromatase inhibitor who are at risk of osteoporosis (eg, age >65, family history, chronic steroids).

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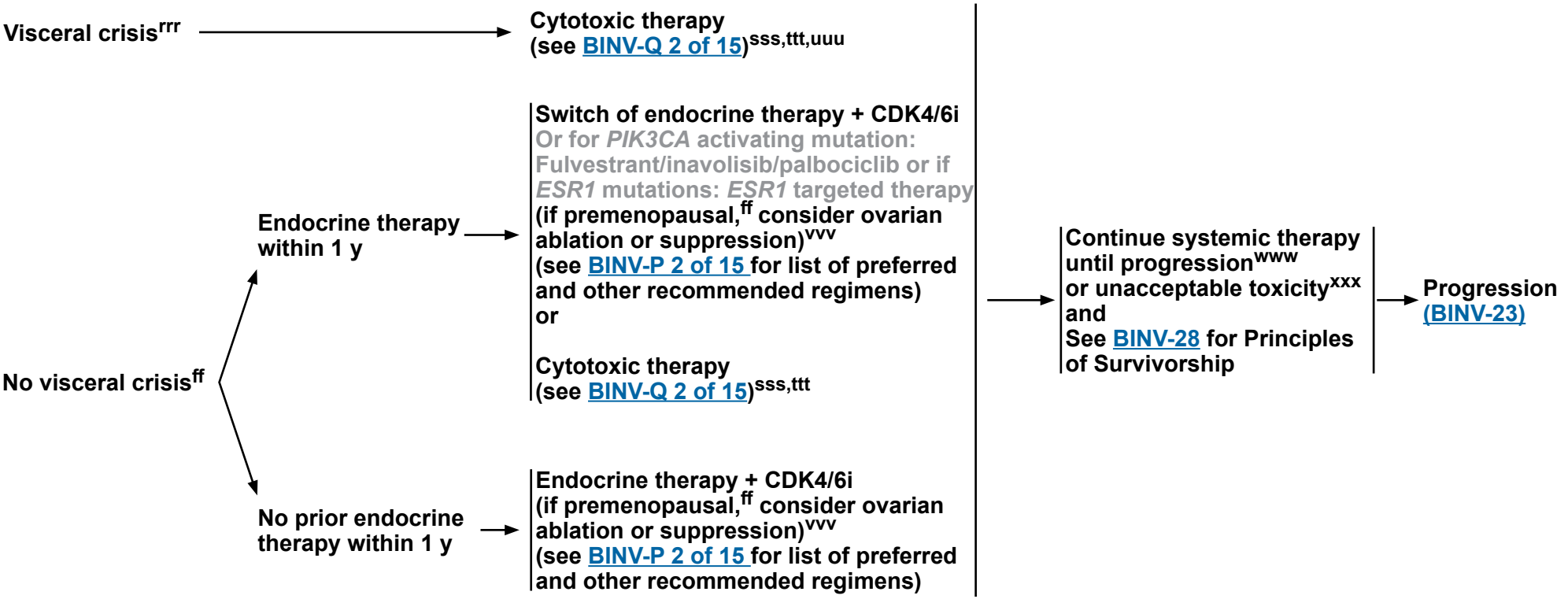
SYSTEMIC TREATMENT OF RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE: ER- AND/OR PR-POSITIVE; HER2-NEGATIVE[e]



[e] Principles of Biomarker Testing (BINV-A).
[ff] Definition of Menopause (BINV-O).
[rrr] According to the 5th ESO-ESMO international consensus guidelines (Cardoso F, et al. Ann Oncol 2020;31:1623-1649) for advanced breast cancer visceral crisis is defined as: "severe organ dysfunction, as assessed by signs and symptoms, laboratory studies and rapid progression of disease. Visceral crisis is not the mere presence of visceral metastases but implies important organ compromise leading to a clinical indication for the most rapidly efficacious therapy."
[sss] Cytotoxic Regimens for Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-Q).
[ttt] Cytotoxic therapy includes chemotherapy or antibody-drug conjugates (ADCs), or targeted therapy.
[uuu] Endocrine therapy combinations with targeted therapies (doublet with CDK4/6i or triplets with CDK4/6i and PI3Ki) may be considered in certain circumstances with visceral crisis.
[vvv] Systemic Therapy for ER- and/or PR-Positive Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-P).
[www] Principles of Monitoring Metastatic Disease (BINV-R).
[xxx] It is acceptable to switch to endocrine-based therapy (BINV-P) after disease stabilizes or response is observed.

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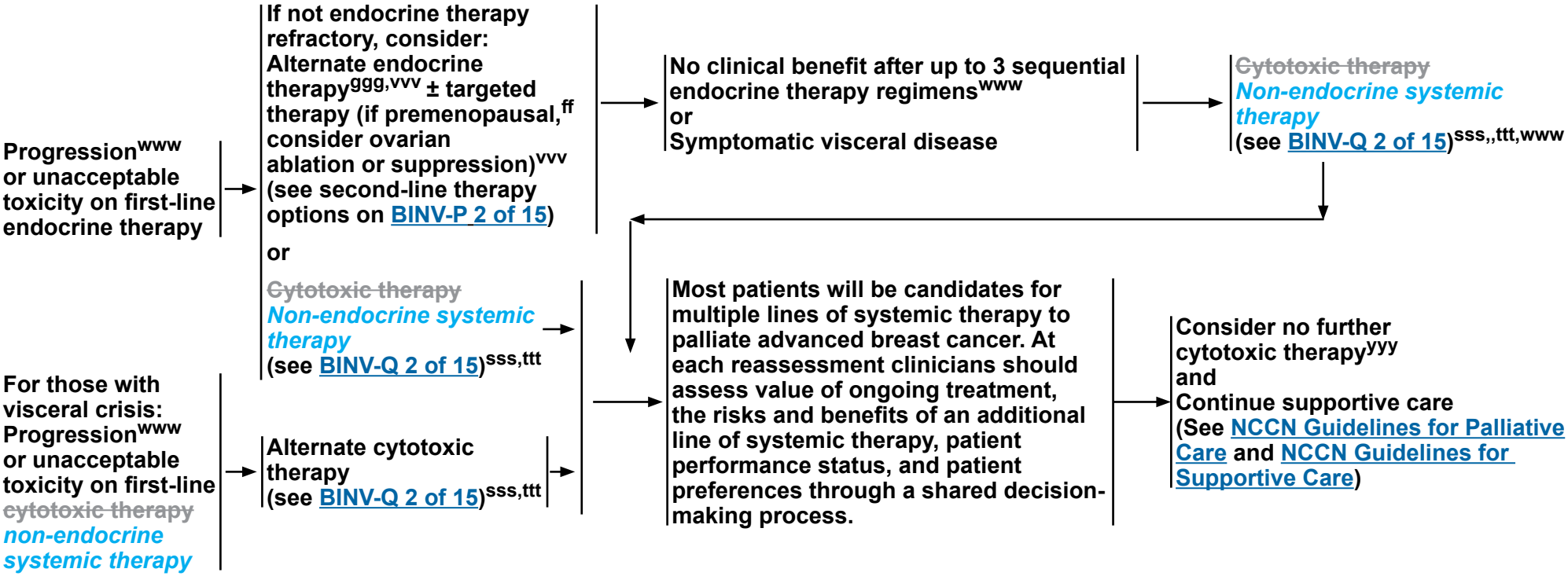
SYSTEMIC TREATMENT OF RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE: ER- AND/OR PR-POSITIVE; HER2-NEGATIVE[e] (SEE BINV-28 FOR PRINCIPLES OF SURVIVORSHIP)



[e] Principles of Biomarker Testing (BINV-A).
[ff] Definition of Menopause (BINV-O).
[ggg] False-negative ER and/or PR determinations occur, and there may be discordance between the ER and/or PR determination between the primary and metastatic tumor(s). Therefore, endocrine therapy with its low attendant toxicity may be considered in patients with non-visceral or asymptomatic visceral tumors, especially in patients with clinical characteristics predicting for an HR-positive tumor (eg, long disease-free interval, limited sites of recurrence, indolent disease, older age).
[sss] Systemic Therapy Regimens for Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-Q).
[ttt] Cytotoxic therapy includes chemotherapy or ADCs, or targeted therapy.
[vvv] Systemic Therapy for ER- and/or PR-Positive Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-P).
[www] Principles of Monitoring Metastatic Disease (BINV-R).
[yyy] The potential side effects of additional lines of therapy may outweigh any clinical benefit in a patient who has a compromised performance status. Patient preference must be taken into account.

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SYSTEMIC TREATMENT OF RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE: ER- and/or PR-POSITIVE; HER2-POSITIVE[e] (SEE BINV-28 FOR PRINCIPLES OF SURVIVORSHIP)

Cytotoxic therapy + HER2-targeted therapy (see BINV-Q 4 of 15)[sss,ttt,vvv]
or
Endocrine therapy[zzz] ± HER2-targeted therapy (see BINV-P 3 of 3 and BINV-Q 4 of 15 if premenopausal,[ff] consider ovarian ablation or suppression)[vvv,aaaa]

→ **Continue therapy until progression[www] or unacceptable toxicity and See BINV-28 for Principles of Survivorship**

→ **Progression (BINV-25)**

[e] Principles of Biomarker Testing (BINV-A).
[ff] Definition of Menopause (BINV-O).
[sss] Systemic Therapy Regimens for Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-Q).
[ttt] Cytotoxic therapy includes chemotherapy or ADCs, or targeted therapy.
[vvv] Systemic Therapy for ER- and/or PR-Positive Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-P).
[www] Principles of Monitoring Metastatic Disease (BINV-R).
[zzz] If prior endocrine therapy within 1 year, consider a different endocrine therapy.
[aaaa] For premenopausal patients, tamoxifen alone (without ovarian ablation/suppression) + HER2-targeted therapy is also an option.

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SYSTEMIC TREATMENT OF RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE: ER- and/or PR-POSITIVE; HER2-POSITIVE[e] (SEE BINV-28 FOR PRINCIPLES OF SURVIVORSHIP)

Progression[www] on first-line endocrine therapy ± HER2-targeted therapy → **~~Consider~~ alternate endocrine therapy, if not endocrine refractory[ggg,vvv] ± HER2-targeted therapy (see BINV-P 3 of 3 and BINV-Q 4 of 15)[sss]** → **No clinical benefit after up to 3 sequential endocrine therapy regimens ± HER2-targeted therapy[www] or Symptomatic visceral disease** → **Cytotoxic therapy[ttt] ± HER2-targeted therapy until progression[sss,www,bbbb]** → **Most patients will be candidates for multiple lines of systemic therapy to palliate advanced breast cancer. At each reassessment clinicians should assess value of ongoing treatment, the risks and benefits of an additional line of systemic therapy, patient performance status, and patient preferences through a shared decision-making process.** → **Consider no further HER2-targeted therapy[yyy] and continue supportive care**
See NCCN Guidelines for Palliative Care and NCCN Guidelines for Supportive Care

Progression[www] on cytotoxic therapy[ttt] + HER2-targeted therapy → **Alternate cytotoxic therapy[ttt] + HER2-targeted therapy (see BINV-Q 4 of 15)[sss]** → **Continue HER2-targeted therapy until progression[www,bbbb]** → (**Most patients will be candidates for multiple lines of systemic therapy to palliate advanced breast cancer. At each reassessment clinicians should assess value of ongoing treatment, the risks and benefits of an additional line of systemic therapy, patient performance status, and patient preferences through a shared decision-making process.**)

[e] Principles of Biomarker Testing (BINV-A).
[ggg] False-negative ER and/or PR determinations occur, and there may be discordance between the ER and/or PR determination between the primary and metastatic tumor(s). Therefore, endocrine therapy with its low attendant toxicity may be considered in patients with non-visceral or asymptomatic visceral tumors, especially in patients with clinical characteristics predicting for an HR-positive tumor (eg, long disease-free interval, limited sites of recurrence, indolent disease, older age).
[sss] Systemic Therapy Regimens for Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-Q).
[ttt] Cytotoxic therapy includes chemotherapy or ADCs, or targeted therapy.
[vvv] Systemic Therapy for ER- and/or PR-Positive Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-P).
[www] Principles of Monitoring Metastatic Disease (BINV-R).
[yyy] The potential side effects of additional lines of therapy may outweigh any clinical benefit in a patient who has a compromised performance status. Patient preference must be taken into account.
[bbbb] The optimal duration of *HER2-targeted therapy* ~~trastuzumab~~ in patients with long-term control of disease is unknown.

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SYSTEMIC TREATMENT OF RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE: ER- and/or PR-NEGATIVE; HER2-POSITIVE[e] (SEE BINV-28 FOR PRINCIPLES OF SURVIVORSHIP)

~~Cytotoxic therapy~~ *Non-endocrine systemic therapy* + HER2-targeted therapy[sss,ttt] → Continue therapy until progression[www] or unacceptable toxicity[bbbb] and See BINV-28 for Principles of Survivorship → Alternate cytotoxic therapy + HER2-targeted therapy until progression (see BINV-Q 4 of 15)[sss,www,ttt,bbbb] → Most patients will be candidates for multiple lines of systemic therapy to palliate advanced breast cancer. At each reassessment clinicians should assess value of ongoing treatment, the risks and benefits of an additional line of systemic therapy, patient performance status, and patient preferences through a shared decision-making process. → Consider no further HER2-targeted therapy[yyy] and continue supportive care NCCN Guidelines for Palliative Care and NCCN Guidelines for Supportive Care

[e] Principles of Biomarker Testing (BINV-A).
[sss] Systemic Therapy Regimens for Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-Q).
[ttt] Cytotoxic therapy includes chemotherapy or ADCs, or targeted therapy.
[www] Principles of Monitoring Metastatic Disease (BINV-R).
[yyy] The potential side effects of additional lines of therapy may outweigh any clinical benefit in a patient who has a compromised performance status. Patient preference must be taken into account.
[bbbb] The optimal duration of *HER2-targeted therapy* ~~trastuzumab~~ in patients with long-term control of disease is unknown.

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SYSTEMIC TREATMENT OF RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE: ER- AND/OR PR-NEGATIVE; HER2-NEGATIVE[e] (SEE BINV-28 FOR PRINCIPLES OF SURVIVORSHIP)

~~Cytotoxic therapy~~
Non-endocrine systemic therapy[sss]

→ Continue therapy until progression[www] or unacceptable toxicity and See BINV-28 for Principles of Survivorship

→ Alternative cytotoxic therapy (see BINV-Q 3 of 15)[sss,ttt]

→ Most patients will be candidates for multiple lines of systemic therapy to palliate advanced breast cancer. At each reassessment clinicians should assess value of ongoing treatment, the risks and benefits of an additional line of systemic therapy, patient performance status, and patient preferences through a shared decision-making process.

→ Consider no further cytotoxic therapy[yyy] and continue supportive care
NCCN Guidelines for Palliative Care
and
NCCN Guidelines for Supportive Care

[e] Principles of Biomarker Testing (BINV-A).
[sss] Systemic Therapy Regimens for Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-Q).
[ttt] Cytotoxic therapy includes chemotherapy or ADCs, or targeted therapy.
[www] Principles of Monitoring Metastatic Disease (BINV-R).
[yyy] The potential side effects of additional lines of therapy may outweigh any clinical benefit in a patient who has a compromised performance status. Patient preference must be taken into account.

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PRINCIPLES OF SURVIVORSHIP FOR THOSE LIVING WITH ADVANCED OR METASTATIC BREAST CANCER

General Principles
- The management unresectable, stage IV (M1) or metastatic disease requires a multifaceted approach, encompassing treatment and a comprehensive survivorship plan.
- For principles of monitoring metastatic disease, see BINV-R.
- Encourage patients to promptly report any new or worsening symptoms. A comprehensive evaluation is essential, as these symptoms could indicate disease progression, treatment effects, or other unrelated medical issues.
- Additional health monitoring, management, and immunizations should be performed as appropriate to the prognosis under the care of a PCP.
- Patients are encouraged to maintain a therapeutic relationship with a PCP throughout their lifetime.

Treatment Management and Supportive Care
- Regular follow-up discussions about goals of care and care coordination may be necessary to improve both survival and quality of life. Engaging patients in these discussions, including therapy cessation, ensures that care aligns with their values and preferences.
- Surveillance and follow-up plans should be individualized for all patients, particularly older patients, considering comorbidities, functional status, and life expectancy. Personalization of care is key to managing the complexities of older adults or disease in those with multiple medical comorbidities.
- Patients should receive multidisciplinary and interprofessional care that seeks to prevent and/or manage morbidities associated with breast cancer or its treatment.
- Patients often experience multiple transitions between different care settings and health care providers. Coordination between primary care providers and specialists is essential to ensure continuity of care.
- Addressing all treatment options at each progression, including the option of supportive care alone or hospice care, is appropriate in patients with stage IV disease.
- Early involvement of a palliative care team should be considered to provide advance care planning, goals of care discussions, care transitions, psychosocial support, and management of cancer and therapy-related symptoms.
- Routine screening, evaluation, and assessment for supportive care interventions and referrals are necessary. Some of the symptoms are:
  - Hormone-related symptoms (NCCN Guidelines for Survivorship)
  - Cognitive dysfunction (NCCN Guidelines for Survivorship)
  - Peripheral neuropathy
  - Cancer-related pain (NCCN Guidelines for Adult Cancer Pain)
  - Cancer-related fatigue (NCCN Guidelines for Cancer-Related Fatigue)
  - Cancer-related infections (NCCN Guidelines for Prevention and Treatment of Cancer-Related Infections)
  - Chemotherapy-induced anemia, neutropenia, and thrombocytopenia (NCCN Guidelines for Hematopoietic Growth Factors)
  - Immunotherapy-related toxicities (NCCN Guidelines for Management of Immune Checkpoint Inhibitor-Related Toxicities)
  - Cardiac monitoring for patients treated with anthracyclines or HER2-targeted therapy (NCCN Guidelines for Survivorship)
  - Nausea/vomiting, anorexia, cachexia, diarrhea, dyspnea, malignant wounds, sleep-wake disturbances (NCCN Guidelines for Antiemesis and other NCCN Guidelines for Supportive Care)

Lifestyle, Wellness, and Psychosocial Support:
- Patients should be encouraged to maintain a physically active lifestyle and a healthy diet whenever possible. See NCCN Guidelines for Survivorship.
- Consider appropriate cancer and preventive health screenings per patient age and sex assigned-at-birth. These decisions should be individualized according to the patients prognosis.
- Screen for anxiety, fear of progression, depression, and post-traumatic stress disorder (PTSD) related to cancer and its treatment. See NCCN Guidelines for Distress Management and NCCN Guidelines for Survivorship.
- ~~Social determinants of health monitoring and referrals~~
  - ~~Provide resources and assistance through financial navigators, social workers, or other specified personnel to address financial concerns, employment issues, and family support. Ensuring access to these services can alleviate significant stress for patients.~~
    - ◊ ~~See NCCN Guidelines for Palliative Care: Social Support/Resource Management.~~
    - ◊ ~~Financial Advocacy Services Guidelines (Association of Cancer Care Centers).~~
    - ◊ ~~Financial Toxicity and Cancer Treatment (National Cancer Institute).~~
  - See NCCN Guidelines for Distress Management.
- Facilitate connections with consumer groups, support networks, and organizations that advocate for accessible and equitable care. Engagement with these groups can empower patients and provide additional support.
- For any patients with sexual health concerns or for fertility and birth control in premenopausal patients, see BINV-C.

Communication
- Consistent and clear communication while acknowledging uncertainties of disease trajectory and prognosis is crucial.
- Treatment goals, survivorship issues, and the specific roles of each provider should be communicated to the patient.

Engagement
- See NCCN Resources for Patients and Caregivers and Guidelines for Patients.
- Address long-term survivorship issues specific to younger patients, such as psychosocial development and educational or vocational support. These patients may face unique challenges that require targeted interventions.
- Living will/end-of-life planning should be discussed.

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PRINCIPLES OF BIOMARKER TESTING
HER2 (*ERBB2*) TESTING[a]

- HER2 testing should be performed on all new primary or newly metastatic breast cancers using methodology outlined in the ASCO/CAP HER2 testing guideline.[a]
- A re-review of the pathology with consideration for repeat or consultative HER2 testing should be made if a grade 1 (any histologic type), pure mucinous, pure tubular, or pure cribriform carcinoma tests HER2-positive.[a]
- After a negative HER2 test result on initial biopsy sample, consider retesting on subsequent surgical or other additional sample if the initial sample was suboptimal (eg, minimal invasive cancer was present, cold ischemic time or fixation was suboptimal), testing error is expected, additional samples contain higher grade morphologically distinct cancer from the biopsy, to rule out heterogeneity in a high-grade cancer, or if it will otherwise aid in clinical decision-making.[a]
- HER2 immunohistochemistry (IHC) results with a score of 0 should include the specific staining pattern present (0/absent membrane staining or 0+/with membrane staining) per current CAP Breast Cancer Biomarker Reporting Protocol.
- Pathologists should be encouraged to examine any IHC 0/no staining carefully for any staining at high power, since the distinction between HER2 (*ERBB2*) IHC 0/absent membrane staining, IHC 0+/with membrane staining (faint, partial membrane staining in ≤10%), IHC 1+, or 2+/ISH negative results (on primary or metastatic samples) is currently clinically relevant since patients with metastatic disease may be eligible for treatment targeting non-amplified levels of HER2 expression.
- Laboratory must participate in a quality assurance accreditation program for HER2 testing. Otherwise, tissue specimen should be sent to an accredited laboratory for testing. Health care systems and providers must cooperate to ensure the highest quality testing.

[a] NCCN endorses the ASCO/CAP HER2 testing guideline. “Principles of HER2 Testing” modified with permission from Wolff AC, Somerfield MR, Dowsett M, et al. Human epidermal growth factor receptor 2 testing in breast cancer. Arch Pathol Lab Med 2023;147:993-1000.

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PRINCIPLES OF BIOMARKER TESTING
HER2 TESTING BY VALIDATED IMMUNOHISTOCHEMISTRY (IHC) ASSAY
For HER2 (*ERBB2*) testing validated by dual-probe ISH assay, see BINV-A 3 of 4.

Result Category	Score/Pattern	Criteria	Clinical Relevance
Negative[b]	0/absent membrane staining	No staining observed	HER2 protein not detected in sample Not included in DESTINY-Breast04 (DB-04) and DESTINY-Breast06 (DB-06) trials Considered "HER2 Null"
Negative	0+/with membrane staining	Membrane stating that is incomplete and is faint/barely perceptible and within ≤10% of tumor cells	Treat as HER2-negative disease Considered “HER2 Ultralow” in DB-06
Negative	1+	Incomplete membrane staining that is faint/barely perceptible and within >10% of tumor cells	Treat as HER2-negative disease Considered “HER2 Low” in DB-04/-06
Equivocal	2+	Weak to moderate complete membrane staining in >10% of tumor cells[c] or Complete membrane staining that is intense but within ≤10% of tumor cells[c,d]	Reflex to in situ hybridization (ISH) testing to determine if HER2 (*ERBB2*) gene amplification present (see BINV-A 3 of 4) If ISH+ : HER2 (*ERBB2*) positive If ISH- : HER2 (*ERBB2*) negative (considered “HER2 Low” in DB-04/-06)
Positive	3+	Complete membrane staining that is intense and >10% of tumor cells[d]	HER2 protein overexpression present Treat as HER2-positive disease Eligible for various HER2-targeted treatments

[b] The distinction between HER2 (*ERBB2*) IHC 0/absent membrane staining, IHC 0+/with membrane staining (faint, partial membrane staining in ≤10%), IHC 1+, or 2+/ISH negative results (on primary or metastatic samples) is currently clinically relevant since patients with metastatic disease may be eligible for treatment targeting non-amplified levels of HER2 expression.

[c] Additional less common staining patterns such as moderate to intense but incomplete membrane staining (basolateral staining often seen in micropapillary cancers) are also categorized as having a score of 2+. Equivocal 2+ results should reflex to testing to determine final HER2 status (same specimen using ISH) or order a new test (new specimen if available, using IHC or ISH).

[d] Readily appreciated using a low-power objective and observed within a homogeneous and contiguous population of invasive tumor cells.

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PRINCIPLES OF BIOMARKER TESTING
HER2 (*ERBB2*) TESTING VALIDATED BY DUAL-PROBE ISH ASSAY[a,e,f,g]

For HER2 testing validated by immunohistochemistry (IHC) assay, see BINV-A 2 of 4.

HER2-Negative
• (Group 5) HER2 (*ERBB2*)/CEP17 ratio <2.0 AND average HER2 (*ERBB2*) copy number <4.0 signals/cell
HER2-Negative[h] (Determined by concurrent IHC and ISH results)
• (Group 2) HER2 (*ERBB2*)/CEP17 ratio ≥2.0 AND average HER2 (*ERBB2*) copy number <4.0 signals/cell and concurrent IHC 0-1+ or 2+ • (Group 3) HER2 (*ERBB2*)/CEP17 ratio <2.0 AND average HER2 (*ERBB2*) copy number ≥6.0 signals/cell and concurrent IHC 0-1+ • (Group 4) HER2 (*ERBB2*)/CEP17 ratio <2.0 AND average HER2 (*ERBB2*) copy number ≥4.0 and <6.0 signals/cell and concurrent IHC 0-1+ or 2+
HER2-Positive[h] (Determined by concurrent IHC and ISH results)
• (Group 2) HER2 (*ERBB2*)/CEP17 ratio ≥2.0 AND average HER2 (*ERBB2*) copy number <4.0 signals/cell and concurrent IHC 3+ • (Group 3) HER2 (*ERBB2*)/CEP17 ratio <2.0 AND average HER2 (*ERBB2*) copy number ≥6.0 signals/cell and concurrent IHC 2+ or 3+ • (Group 4) HER2 (*ERBB2*)/CEP17 ratio <2.0 AND average HER2 (*ERBB2*) copy number ≥4.0 and <6.0 signals/cell and concurrent IHC 3+
HER2-Positive
• (Group 1) HER2 (*ERBB2*)/CEP17 ratio ≥2.0 AND average HER2 (*ERBB2*) copy number ≥ 4.0 signals/cell

[a] NCCN endorses the ASCO/CAP HER2 testing guideline. “Principles of HER2 Testing” modified with permission from Wolff AC, Somerfield MR, Dowsett M, et al. Human epidermal growth factor receptor 2 testing in breast cancer. Arch Pathol Lab Med 2023;147:993-1000.

[e] Laboratory must participate in a quality assurance accreditation program for HER2 testing. Otherwise, tissue specimen should be sent to an accredited laboratory for testing. Health care systems and providers must cooperate to ensure the highest quality testing.

[f] Single-probe ISH assays are not preferentially recommended but, if used, cases with average HER2 (*ERBB2*) copy number ≥4.0 and <6.0 signals/cell should base final results on concurrent IHC and if 2+ reflexed to dual probe ISH testing.

[g] Evidence from trastuzumab adjuvant trials show that HER2 (*ERBB2*) testing by ISH or IHC have similar utility to predict clinical benefit from HER2-targeted therapy.

[h] For ISH Groups 2–4 final ISH results are based on review of concurrent IHC, with recounting of the ISH test by a second reviewer if IHC is 2+ (per 2018 CAP/ASCO Update recommendations). Additional report comments are recommended for negative final results in these ISH groups.

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PRINCIPLES OF BIOMARKER TESTING
HR TESTING

- HR testing (ER and PR) by IHC should be performed on any new primary or newly metastatic breast cancer using methodology outlined in the latest ASCO/CAP HR testing guideline.[1] DCIS should be tested for ER (PR not required).
- ER testing should be used to determine if a patient is a candidate for endocrine therapies.
  - Cancers with 1%–100% of cells positive for ER expression are considered ER-positive. Patients with these results are considered eligible for endocrine therapies (applies to DCIS and invasive cancers).
  - Invasive cancers with between 1%–10% ER positivity are considered ER-low–positive. While the potential benefit of endocrine therapy is largest in patients with the highest percentage of ER expression, the potential for some benefit should also be discussed with patients with low ER expression.
  - Cancers with <1% staining are considered ER-negative. Patients with cancers with these results have not been shown to benefit from endocrine therapies.
- Laboratories should have standard operating procedures to maximize accuracy and reproducibility of results for cases with <10% ER staining or weak intensity staining (to avoid false negatives). The status of controls should be reported for cases with these results.
- PR testing by IHC on invasive cancers can aid in the prognostic classification of cancers and serve as a control for possible false-negative ER results. Patients with ER-negative, PR-positive cancers may be considered for endocrine therapies, but the data on this group are noted to be limited. The same overall interpretation principles apply but PR should be interpreted as either positive (if 1%–100% of cells have nuclear staining) or negative (if <1% or 0% of cells have nuclear staining).
- Interpretation of any ER result by pathology should include evaluation of the concordance with the histologic findings of each case. Clinicians should be aware of when results are unusual and work with pathologists to attempt to resolve (eg, repeat testing, consultative review) or explain atypical reported findings. See tables below.

Summary of ER IHC Scoring/Interpretation

Results (following ER testing by validated IHC assay)		Interpretation/ Report As:
0% to <1% of nuclei stain		ER-negative
1%–100% of nuclei stain	1%–10% of nuclei stain	ER-low–positive (with recommended comment)
	>10% of nuclei stain	ER-positive

Correlation of ER and Histology: Highly Unusual Results

Highly Unusual ER-Negative Results	Highly Unusual ER-Positive Results
Low-grade invasive carcinomas of NST (also known as invasive ductal carcinoma)	Metaplastic carcinomas of all subtypes
Lobular carcinomas (classic type)	Adenoid cystic carcinomas and other salivary gland-like carcinomas of the breast
Pure tubular, cribriform, or mucinous carcinomas	Secretory carcinoma
Encapsulated papillary and solid papillary carcinomas	Carcinomas with apocrine differentiation (apocrine carcinoma)

[1] Allison KH, Hammond MEH, Dowsett M, et al. Estrogen and progesterone receptor testing in breast cancer: ASCO/CAP guideline update. J Clin Oncol 2020;38:1346-1366; Arch Pathol Lab Med 2020;144:545-563.

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PRINCIPLES OF DEDICATED BREAST MRI TESTING

See NCCN Guidelines for Breast Cancer Screening and Diagnosis for indications for screening MRI in patients at increased breast cancer risk.

Personnel, Facility, and Equipment

- Breast MRI examinations are performed with IV contrast and should be performed and interpreted by an expert breast imaging team working in concert with the multidisciplinary treatment team.
- Breast MRI examinations require a dedicated breast coil and breast imaging radiologists familiar with the optimal timing sequences and other technical details for image interpretation. The imaging center should have the ability to perform MRI-guided needle sampling and/or image-guided localization of MRI-detected findings.

Clinical Indications and Applications

- May be used for staging evaluation to define extent of cancer or presence of multifocal or multicentric cancer in the ipsilateral breast, or as screening of the contralateral breast cancer at time of initial diagnosis (category 2B). Available data do not demonstrate that the use of preoperative MRI improves re-excision rates, local recurrence, or survival for DCIS or invasive breast cancer in patients pursuing BCS.[1,2]
- May be helpful for breast cancer evaluation before and after preoperative systemic therapy to define extent of disease, response to treatment, and potential for breast-conservation therapy.
- May be useful in identifying otherwise clinically occult disease in patients presenting with axillary nodal metastases (cT0, cN+), with Paget disease, or with invasive lobular carcinoma poorly (or inadequately) defined on mammography, ultrasound, or physical examination.
- False-positive findings on breast MRI are common. Surgical decisions should not be based solely on the MRI findings. Additional tissue sampling of areas of concern identified by breast MRI is recommended.
- ~~The utility of MRI in follow-up screening of most patients with prior breast cancer is undefined and annual MRI is recommended in patients with a personal history of breast cancer who:[3]~~
  ~~1) were diagnosed at age ≤50 or~~
  ~~2) have dense breasts~~
- ***Routine annual follow-up using MRI screening is not indicated, except in women with a high lifetime risk of a second primary breast cancer.[3,4,5]***

[1] Houssami N, Turner RM, Morrow M. Meta-analysis of pre-operative magnetic resonance imaging (MRI) and surgical treatment for breast cancer. Breast Cancer Res Treat 2017;165:273-283.
[2] Canelo-Aybar C, Taype-Rondan A, Zafra-Tanaka JH, et al. Preoperative breast magnetic resonance imaging in patients with ductal carcinoma in situ: a systematic review for the European Commission Initiative on Breast Cancer (ECIBC). Eur Radiol 2021;31:5880-5893.
[3] ~~Monticciolo DL, Newell MS, Moy L, et al. Breast cancer screening for women at higher-than-average risk: Updated recommendations from the ACR. J Am Coll Radiol 2023;20:902-914~~.
[3] *Sardanelli F. et al. Magnetic Resonance Imaging of the Breast: Recommendations from the EUSOMA Working Group. Eur J Cancer 2010;46:1296–316.*
[4] *Consensus Guideline on Diagnostic and Screening Magnetic Resonance Imaging of the Breast. The American Society of Breast Surgeons. June 22, 2017.*
[5] *Forrai G et al. Use of Diagnostic Imaging Modalities in Modern Screening, Diagnostics and Management of Breast Tumours 1st Central-Eastern European Professional Consensus Statement on Breast Cancer. Pathol Oncol Res. 2022;28:1610382.*

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FERTILITY, BIRTH CONTROL, AND SEXUAL HEALTH

The general considerations for fertility and sexual health/function outlined for specific populations in the NCCN Guidelines for NCCN Guidelines for Adolescent and Young Adult (AYA) Oncology and NCCN Guidelines for Survivorship are applicable to all patients diagnosed with breast cancer.

- All premenopausal patients should be informed about the potential impact of chemotherapy on fertility and asked about their desire for potential future pregnancies. Patients who may desire future pregnancies should be referred to fertility specialists before chemotherapy and/or endocrine therapy to discuss the options based on patient specifics, disease stage, and biology (which determine the urgency, type, and sequence of treatment). Timing and duration allowed for fertility preservation, options inclusive of oocyte and embryo cryopreservation as well as evolving technologies, and the probability of successful pregnancies subsequent to completion of breast cancer therapy are also to be discussed.
- Although amenorrhea frequently occurs during or after chemotherapy, it appears that the majority of patients <35 years resume menses within 2 years of finishing adjuvant chemotherapy.
- Menses and fertility are not necessarily linked. Absence of regular menses, particularly if the patient is taking tamoxifen, does not necessarily imply infertility. Conversely, the presence of menses does not guarantee fertility. There are limited data regarding continued fertility after chemotherapy.
- Patients should be advised not to become pregnant while on any systemic therapy, and specific drug package inserts should be consulted for recommendations.
- A prospective trial (Partridge AH, Niman SM, Ruggeri M, et al. Breast 2021;59:327-338) evaluated premenopausal patients who had completed between 18–30 months of endocrine therapy before temporarily interrupting endocrine therapy for up to 2 years to allow for pregnancy. At short-term follow-up, the risk of recurrence was not increased among those patients who enrolled or those who became pregnant. This approach is an option for patients who desire pregnancy, although long-term safety is still unknown.
- Although data are limited, hormone-based birth control is discouraged regardless of the HR status of the patient's cancer.
- Alternative methods of birth control include non-hormonal–based intrauterine devices (IUDs), barrier methods, or, for patients with no intent of future pregnancies, tubal ligation or vasectomy for the partner.
- Randomized trials have shown that ovarian suppression with GnRH agonist therapy administered during adjuvant chemotherapy in premenopausal patients with breast tumors (regardless of HR status) may preserve ovarian function and diminish the likelihood of chemotherapy-induced amenorrhea.
- Smaller historical experiences in patients with ER-positive disease have reported conflicting results with regard to the protective effect of GnRH agonist therapy on fertility.
- Breastfeeding after breast-conservation therapy is not contraindicated. However, the quantity and quality of breast milk produced by the conserved breast may not be sufficient or may be lacking some of the nutrients needed. Breastfeeding is not recommended during active treatment with chemotherapy and endocrine therapy or within 6 months of completing pertuzumab or trastuzumab.

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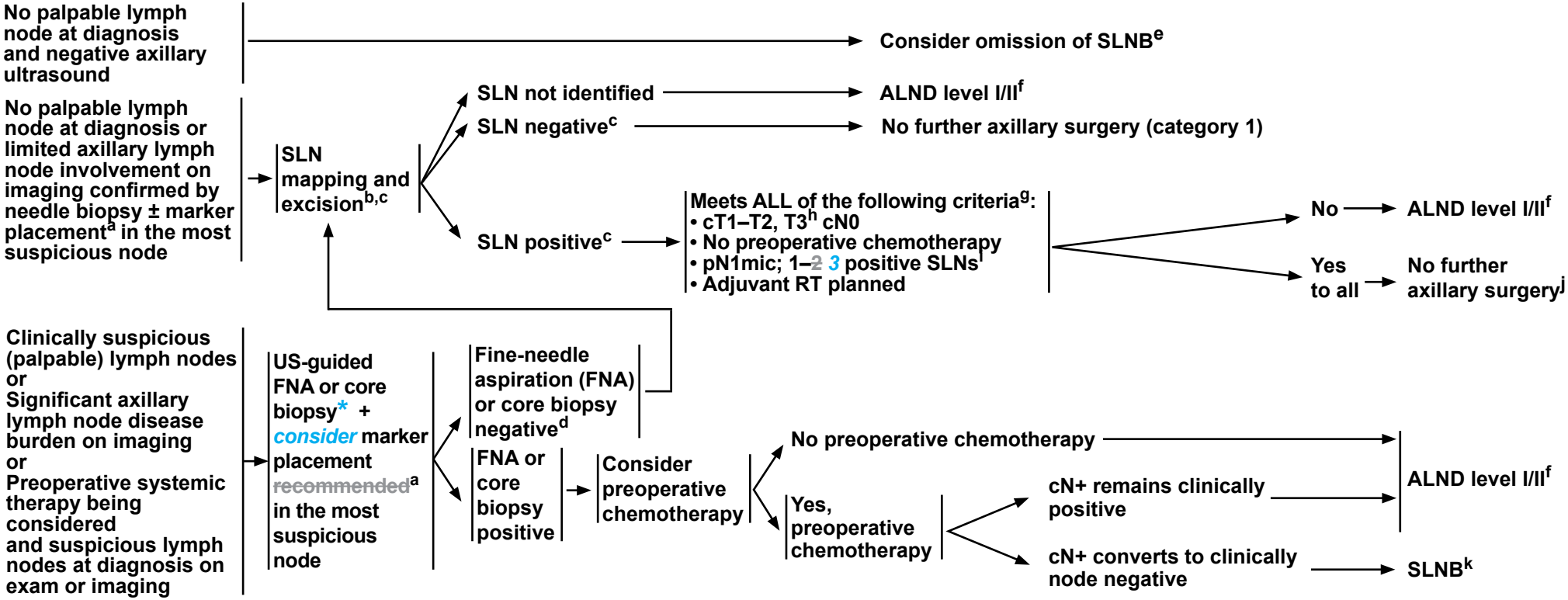
CONSIDERATIONS FOR SURGICAL AXILLARY STAGING



* *Lymph node biopsy may be foregone in patients presenting with clinically unequivocal nodal involvement or metastatic disease. Axillary recurrence is rare in this setting and is not significantly reduced with marker placement (Montagna G et al. JAMA Oncol 2024;10(6):793-798).*

[a] If a positive lymph node is clipped or tattooed during biopsy, every effort should be made to remove the clipped or tattooed node at the time of surgery. Only the most suspicious node should be marked and retrieved along with SLNs to reduce the false negative rate.

[b] SLN mapping injections may be peritumoral, subareolar, or subdermal.

[c] Sentinel node involvement is defined by multilevel node sectioning with hematoxylin and eosin (H&E) staining. Cytokeratin IHC may be used for equivocal cases on H&E. Routine cytokeratin IHC to define node involvement is not recommended in clinical decision-making.

[d] If clinically negative axilla before chemotherapy and then have a positive sentinel node after chemotherapy, consider completion ALND or multidisciplinary tumor board discussion on appropriateness of radiation of axilla without further surgery.

[e] Based on SOUND and INSEMA trials, patients >50 years and postmenopausal with cT1N0 (node negative by axillary ultrasound), with HR+/HER2-negative, grade 1–2 tumors who are agreeable to receiving whole breast RT and endocrine therapy may be considered for omission of SLNB. Caution should be used in those with lobular histology.

[f] Axillary Lymph Node Staging (BINV-E).

[g] ACOSOG Z0011: Giuliano AE, et al. JAMA 2017;318:918-926. EORTC AMAROS: Donker M, et al. Lancet Oncol 2014;15:1303-1310; Ruters E, et al. Cancer Res 2019;79-GS4-01-GS04-01. SENOMAC: de Boniface J, et al. N Engl J Med 2024;390:1163-1175. OTOASAR: Sávolt Á, et al. Ann Oncol 2017;28:v49. SINODAR-One: Tinterri C, et al. Br J Surg 2023;110:1143-1152. Galimberti V, et al. Lancet Oncol 2013;14:297-305.

[h] ~~Limited data exist for T3 tumors~~. *In the SENOMAC trial, more than one third of the patients underwent mastectomy. The omission of completion axillary lymph node dissection was noninferior to the more extensive surgery in patients with clinically node-negative breast cancer who had sentinel lymph node macrometastases, most of whom received nodal radiation therapy (de Boniface J, et al. N Engl J Med. 2024; 390(13):1163-117).*

[i] Limited data exist for ≥3 positive SLNs.

[j] In the mastectomy setting, in patients who were initially cN0, who have positive nodes on SLNB, and have no axillary dissection, RT to the chest wall should include undissected axilla at risk ± RNI.

[k] ~~Among patients shown to be N+ prior to preoperative systemic therapy, SLNB has a >10% false-negative rate when performed after preoperative systemic therapy, which can be improved by marking the most suspicious biopsied node prior to treatment, and at the time of surgery, using dual tracers, obtaining ≥3 sentinel lymph nodes nodes and removal of the marked node (Targeted Axillary Dissection [TAD]).~~ *Among patients with cN1-2 who convert to cN0 after preoperative systemic therapy, the SLNB false-negative rate is >10%. This can be improved by marking the positive node with a clip or removal of ≥3 sentinel lymph nodes using a dual tracer (targeted axillary dissection [TAD]). (Caudle AS, et al. J Clin Oncol 2016;34:1072–1078.) However, removing ≥2 sentinel nodes (standard SLNB - without TAD) is acceptable and will not result in worse outcomes. (Kahler-Ribeiro-Fontana, Sabrina et al Eur J Surg Oncol. 2021;47(4):804–812).*

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AXILLARY LYMPH NODE STAGING

SLNB should be performed and is the preferred method of axillary lymph node staging if the patient is an appropriate SLNB candidate (BINV-D).

In the absence of definitive data demonstrating superior survival, the performance of axillary staging may be considered optional in patients who have particularly favorable tumors, patients for whom the selection of adjuvant systemic and/or RT is unlikely to be affected, or those with serious comorbid conditions.[a]

Patients with small BC and without involvement of axillary lymph nodes on ultrasonography can be spared any axillary surgery whenever the lack of pathological information does not affect the postoperative treatment plan.

Level III dissection to the thoracic inlet should be performed only in cases with gross disease in level II and/or III.
In the absence of gross disease in level II nodes, lymph node dissection should include tissue inferior to the axillary vein from the latissimus dorsi (LD) muscle laterally to the medial border of the pectoralis minor muscle (level I/II).

Lymphedema is a potential side effect after the treatment of axillary lymph node surgery resulting from damage to the lymphatic system. Early detection/diagnosis of lymphedema is key for optimal management. Consider pretreatment measurement of both arms as a baseline for patients with risk factors for lymphedema. See NCCN Guidelines for Survivorship: Lymphedema (SLYMPH-1).

[a] *Based on emerging data from the SOUND and INSEMA trials and according to SSO Choosing Wisely, SLNB may be considered optional or omitted in: (a) patients >65 years, with HR+/HER2-negative tumors, pT1–2, N0 (node-negative by axillary ultrasound); (b) patients who are postmenopausal and ≥50 years, with HR+/HER2-negative grade 1–2 tumors, T1, N0 (node negative by axillary ultrasound), and who undergo breast-conserving therapy (Grossi S, et al. Surgery. 2023;174:413-415; Gentilini OD, et al. JAMA Oncol 2023;9:1557-1564; Reimer, et al. N Engl J Med 2025;392:1051-1064).*
~~Based on SOUND and INSEMA trials, patients >50 years and postmenopausal with cT1N0 (node negative by axillary ultrasound), with HR+/HER2-negative, grade 1–2 tumors who are agreeable to receiving whole breast RT and endocrine therapy may be considered for omission of SLNB. Caution should be used in those with lobular histology.~~

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MARGIN STATUS RECOMMENDATIONS AFTER BREAST-CONSERVING SURGERY (BCS) FOR INVASIVE CANCERS AND DCIS

- Margins should be evaluated on all surgical specimens from BCS. Accurate orientation of the surgical specimens is required for optimal margin evaluation.
- Pathology report should include:
  - Description of the gross and microscopic margin status.
  - Reporting of the distance, orientation, and type of tumor (invasive or DCIS) in relation to the closest margin.
  - Quantification of the extent of disease that is approximating the inked margin.
- For mammographically detected DCIS with microcalcifications, complete resection should be documented by analysis of margins and specimen radiography. Post-excision mammography can be considered if there is uncertainty.
- The NCCN Panel accepts the definitions of negative margins after breast-conservation therapy from the 2014 SSO/ASTRO Margins Guideline[1] for Stage I/II Invasive Cancers and the 2016 SSO/ASTRO/ASCO Guideline for DCIS.[2] For patients with stage I or II invasive cancers after BCS, a positive margin is defined as “ink on tumor” (any invasive cancer or DCIS cells on ink). These patients generally require further surgery—either a re-excision to achieve a negative margin or a mastectomy. If re-excision is technically feasible to allow for BCS to achieve “no ink on tumor,” this can be done with resection of the involved margin guided by the orientation of the initial resection specimen or re-excision of the entire original excision cavity. There may be select patients with stage III invasive cancers who may be eligible for BCS. For these patients, the margins status would be accessed with similar definitions.

DCIS

- For patients with pure DCIS treated by BCS and whole breast RT, a quantitative description of any tumor close to margin resection width of at least 2 mm is associated with a reduced risk of ipsilateral breast tumor recurrence (IBTR) relative to narrower negative margin widths, while the routine practice of obtaining margins >2 mm to further improve outcomes is not supported by the evidence. When there is only minimal or focal DCIS involvement near the margin, clinical judgment should be utilized to weigh the risks of re-excision with risk of recurrence for an individual patient.
- For patients with DCIS treated with excision alone (no whole breast RT), regardless of margin width, there is a substantially higher rate of IBTR than treatment with excision and whole breast RT, even in predefined patients who are low risk. Although the optimal margin width for treatment with excision alone is unknown, it should be at least 2 mm, with some evidence suggesting improved IBTR rates with margin widths wider than 2 mm.
- DCIS with microinvasion (DCIS-M), defined as an invasive focus ≤1 mm in size, should refer to the DCIS margin definition when considering the optimal margin width (>2 mm), given that the majority of DCIS-M is comprised of DCIS and systemic therapy utilization for this lesion more closely reflects the treatment pattern for DCIS than for invasive carcinoma.

[1] Moran MS, Schnitt SJ, Giuliano AE, et al. Society of Surgical Oncology-American Society for Radiation Oncology consensus guideline on margins for breast-conserving surgery with whole-breast irradiation in stages I and II invasive breast cancer. J Clin Oncol 2014;32:1507-1515.
[2] Morrow M, Van Zee KJ, Solin LJ, et al. Society of Surgical Oncology-American Society for Radiation Oncology-American Society of Clinical Oncology Consensus Guideline on Margins for Breast-Conserving Surgery With Whole-Breast Irradiation in Ductal Carcinoma In Situ. J Clin Oncol 2016;34:4040-4046.

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MARGIN STATUS RECOMMENDATIONS AFTER BCS FOR INVASIVE CANCERS AND DCIS

Invasive Breast Cancer

- For invasive breast cancers that have a component of DCIS, regardless of the extent of DCIS, the negative margin definition of "no ink on tumor" should be based on the invasive margin guideline. In this setting, "no ink on tumor" is recommended for either DCIS or invasive cancer cells, primarily because the natural history, treatment, and outcomes of these lesions are more similar to invasive cancer than DCIS. For specifically challenging cases, clinical judgment and discussion with the patient should precede routine re-excision.
- These margin recommendations cannot be applied directly to patients undergoing APBI/PBI,[1] where data regarding local recurrence are more limited. Furthermore, individualized clinical judgment should be utilized on a case-by-case basis, using postoperative mammography to identify residual calcifications and clinical-pathologic factors such as quantitative extent of disease near margin, presence of extensive intraductal component (EIC),[3] young age, or multiple close margins to assist in identifying patients who may have an increased risk of IBTR and therefore may be selected to benefit from re-excision.
- For patients with invasive breast cancer after BCS, with microscopically focally positive margins (in the absence of an EIC),[3] the use of a higher radiation boost dose to the tumor bed may be considered, since generally a boost to the tumor bed is recommended for patients at higher risk of recurrence. See BINV-I.

	No ink on tumor	2-mm margin	No margin necessary
Invasive breast cancer	X		
Invasive breast cancer + DCIS	X		
Invasive breast cancer + extensive DCIS	X		
Invasive breast cancer (treated with neoadjuvant chemotherapy followed by breast-conservation therapy)[4,5]	X		
Pure DCIS		X	
DCIS-M		X	
Classic LCIS* at surgical margin			X
Atypia at surgical margin			X

*For pleomorphic lobular carcinoma in situ (LCIS), the optimal width of margins is not known.

[1] Moran MS, Schnitt SJ, Giuliano AE, et al. Society of Surgical Oncology-American Society for Radiation Oncology consensus guideline on margins for breast-conserving surgery with whole-breast irradiation in stages I and II invasive breast cancer. J Clin Oncol 2014;32:1507-1515.
[3] EIC is defined as an infiltrating ductal cancer where >25% of the tumor volume is DCIS and DCIS extends beyond the invasive cancer into surrounding normal breast parenchyma.
[4] Choi J, Laws A, Hu J, et al. Margins in breast-conserving surgery after neoadjuvant therapy. Ann Surg Oncol 2018;25:3541-3547.
[5] Wimmer K, Bolliger M, Bago-Horvath Z, et al. Impact of surgical margins in breast cancer after preoperative systemic chemotherapy on local recurrence and survival. Ann Surg Oncol 2020;27:1700-1707.

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CONTRAINDICATIONS TO BREAST-CONSERVING APPROACHES REQUIRING RT

Absolute Contraindications for BCS (mastectomy is recommended)

- Inflammatory breast cancer or invasive breast cancer with extensive skin or dermal lymphatic involvement
- Diffuse suspicious or malignant-appearing microcalcifications
- Inability to clear multiple positive pathologic margins after one or more re-excision attempts, see BINV-F
- Homozygous *ATM* mutation (often leads to ataxia-telangiectasia syndrome) (category 2B)[a]
- Patients diagnosed with gestational breast cancer (not receiving systemic chemotherapy) who cannot receive RT within 12–16 weeks[a]; see PREG-1

- Multicentric disease with any of the following criteria (mandate mastectomy)[1,b]:
  - ~~Receipt of neoadjuvant chemotherapy or endocrine therapy~~
  - Age ≤40
  - ~~Triple-negative breast cancer (ER-, PR-, and HER2-negative)~~
  - More than 2 lesions involving more than 2 quadrants by MRI evaluation
  - Any individual lesion ≥5 cm
  - *BRCA1* and/or *BRCA2* PV carrier
  - Multicentric pure DCIS
  - Inability to achieve negative margins (defined as no ink on tumor for invasive cancers ± DCIS), see BINV-F
  - ~~cN2–N3~~
  - Any reason for precluding the delivery of adjuvant whole breast RT + ± boost *(in select patients boost may be foregone)*

Relative Contraindications for BCS (mastectomy should be considered, but breast-conserving therapy may be appropriate)

- Patients with a known genetic predisposition to breast cancer[b]
- *TP53* PV carrier (eg, Li-Fraumeni syndrome) (category 2B)[a,b]
  - See NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate
- Active connective tissue disease involving the skin (eg, scleroderma or lupus)[a]
- A history of prior RT to the affected area; knowledge of doses and volumes prescribed is important[a,c,2]
- *Multicentric disease with any of the following criteria:[1,b,c,d]*
  - *Receiving neoadjuvant chemotherapy or endocrine therapy*
  - *Triple-negative breast cancer (ER-, PR-, and HER2-negative)*
  - *cN2–N3*

[1] Boughey JC, Rosenkranz KM, Ballman KV, et al. Local recurrence after breast-conserving therapy in patients with multiple ipsilateral breast cancer: Results from ACOSOG Z11102 (Alliance). J Clin Oncol 2023;41:3184-3193.
[2] Arthur DW, Winter KA, Kuerer HM, et al. Effectiveness of breast-conserving surgery and 3-dimensional conformal partial breast reirradiation for recurrence of breast cancer in the ipsilateral breast: The NRG Oncology/RTOG 1014 Phase 2 Clinical Trial. JAMA Oncol 2020;6:75-82.
[a] Contraindications to radiation delivery where toxicity may be increased.
[b] Patients with a known genetic predisposition to breast cancer may have an increased risk of contralateral or ipsilateral breast cancers after breast-conservation therapy. Risk reduction strategies including prophylactic mastectomies should be discussed. See NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate.
[c] For patients >40 years of age with 2 biopsy-proven cTis–cT2 lesions (with at least one site invasive) after MRI evaluation, intending on adjuvant whole breast radiation with boost, breast-conservation therapy may be considered. See Boughey JC, et al. J Clin Oncol 2023;41:3184-3193.
[d] *Patients with multiple breast tumors should be referred to specialized breast cancer centers.*

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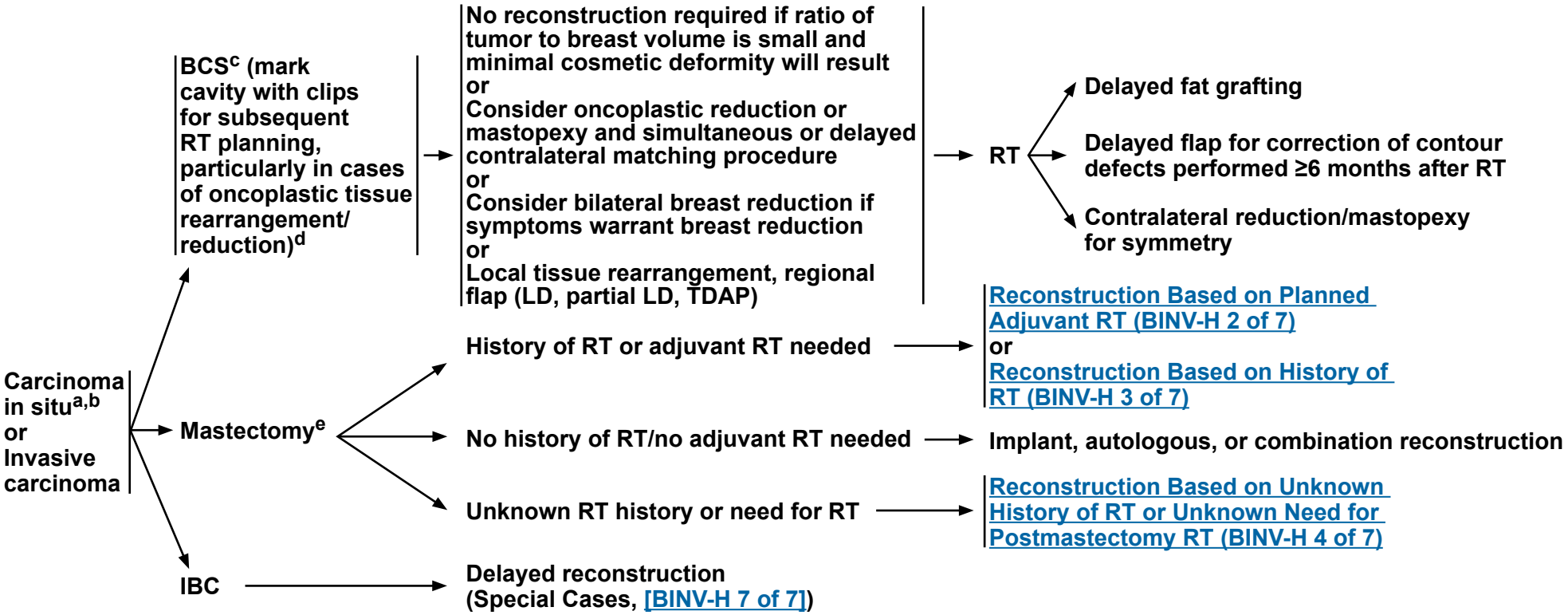
PRINCIPLES OF BREAST RECONSTRUCTION AFTER SURGERY



[a] General Principles of Breast Reconstruction (BINV-H 5 of 7).
[b] Patient Factors Influencing Breast Reconstruction (BINV-H 6 of 7).
[c] An evaluation of the likely cosmetic outcome of BCS should be performed prior to surgery. Oncoplastic techniques for breast conservation can extend breast-conserving surgical options in situations where the resection by itself would likely yield an unacceptable cosmetic outcome. Application of these oncoplastic techniques may reduce the need for mastectomy and decrease the need for a secondary surgery to minimize breast deformity. Patients should be informed of the possibility of positive margins and potential need for secondary surgery, which could include either segmental re-excision, or mastectomy with or without loss of the nipple. Systematic oncoplastic reduction specimen orientation as well as highly specific operative documentation regarding tissue rearrangement should be conducted. Enhanced communication between the radiation oncology team and reconstructive team will be necessary for boost cavity localization for RT treatment planning (Shah C, et al. Ann Surg Oncol 2018;25:2509-2511).
[d] Consider staged partial mastectomy reconstruction (oncoplastic approaches) if preoperative margin status is unclear (lobular, multifocal/centric).
[e] As with any mastectomy, there is a risk of locoregional cancer recurrence, and evidence suggests skin-sparing or skin- and nipple-sparing mastectomy is probably equivalent to standard mastectomy in this regard. Indications for PMRT following skin-sparing mastectomy should not differ from standard mastectomy.

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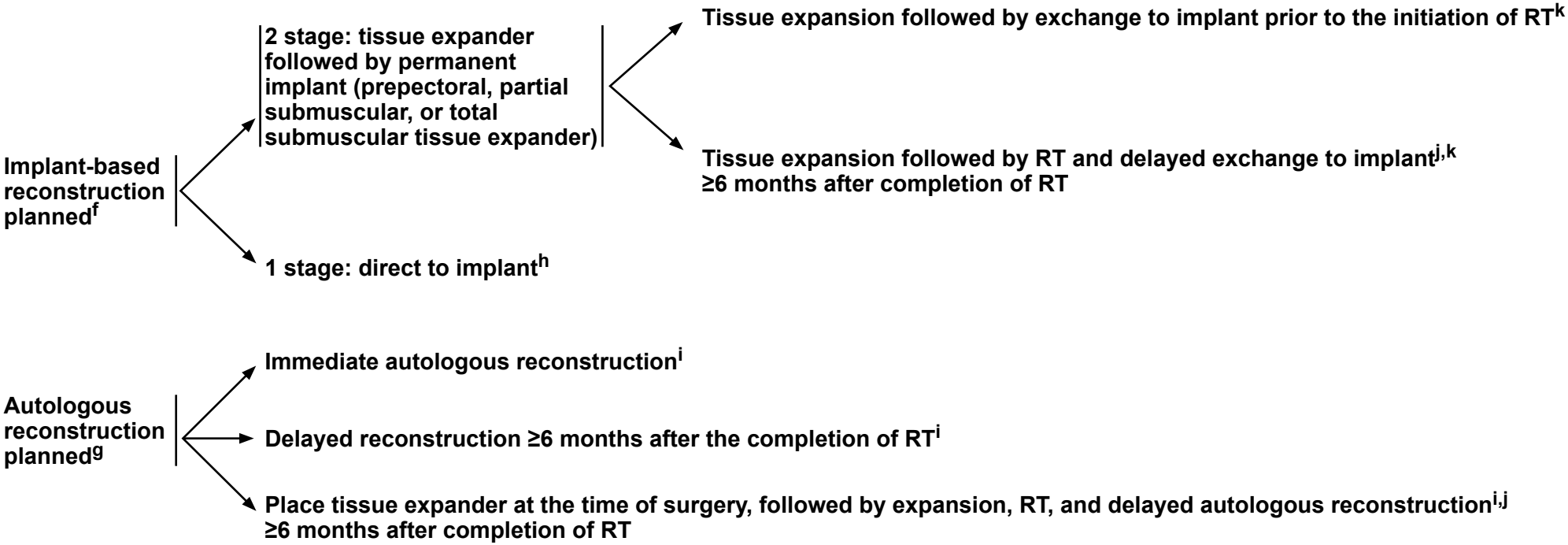
PRINCIPLES OF BREAST RECONSTRUCTION AFTER SURGERY

RECONSTRUCTION BASED ON PLANNED ADJUVANT RT[a,b]



[a] General Principles of Breast Reconstruction (BINV-H 5 of 7).
[b] Patient Factors Influencing Breast Reconstruction (BINV-H 6 of 7).
[f] The use of RT significantly increases the baseline risk of capsular contracture, aesthetic deformity, malposition, implant exposure, infection, and reconstructive failure.
[g] Common donor sites for autologous tissue include the abdomen (ie, DIEP, MS-TRAM, SIEA, free TRAM, pedicled TRAM), gluteal region (ie, SGAP, IGAP), thigh (ie, TUG, VUG, DUG, PAP), or the back (ie, LD, TDAP, LAP).
[h] Determined by preoperative size and ptosis, patient desire of postoperative size, and assessment intraoperatively of skin and soft-tissue quality and perfusion, with consideration for patient-specific relative contraindications (eg, smoking, obesity) to single-stage versus two-stage approaches. Healing issues may occur and delay initiation of RT.
[i] Consider delaying autologous reconstruction until after RT is completed, as RT to a flap may cause loss of cosmesis and/or fat necrosis.
[j] Consultation with radiation oncologists may be necessary to determine if volume of contralateral tissue expander will affect RT treatment planning. In some cases, contralateral deflation may be required prior to CT simulation. Radiation oncology consultation should also be requested in cases of an anticipated close or positive deep margin, as this may impact the optimal placement of the expander (pre- vs. subpectoral). Clips to identify the close/positive margins should be placed to assist in delineating the tumor bed boost.
[k] Exchange of tissue expander to implant should be timed to avoid any delay in adjuvant RT.

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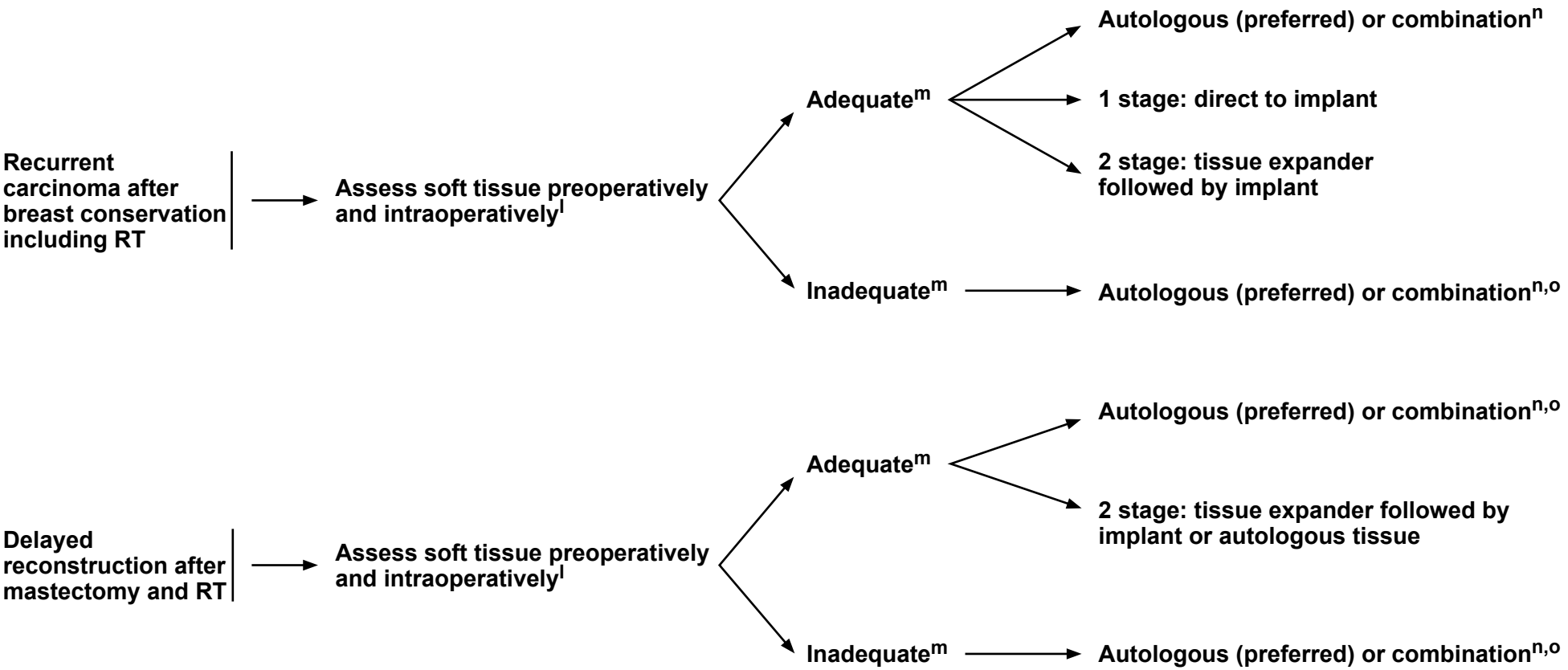
PRINCIPLES OF BREAST RECONSTRUCTION AFTER SURGERY

RECONSTRUCTION BASED ON PRIOR HISTORY OF RT[a,b]



[a] General Principles of Breast Reconstruction (BINV-H 5 of 7).
[b] Patient Factors Influencing Breast Reconstruction (BINV-H 6 of 7).
[l] Assessment includes clinical examination and may also include intraoperative technologies to assess perfusion.
[m] In patients with a history of RT to the breast, implant-based reconstruction carries a significantly increased risk of capsular contracture, aesthetic deformity, malposition, implant exposure, infection, and reconstructive failure.
[n] Addition of latissimus or other regional or free flap to prosthetics in the patient who has previously had irradiation mitigates many of the effects specified in the previous footnote.
[o] In the patient with delayed reconstruction, there is often limited soft tissue even with the addition of a latissimus flap. Therefore, latissimus flap + tissue expander placement may be required if a permanent implant cannot be accommodated under the latissimus flap.

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PRINCIPLES OF BREAST RECONSTRUCTION AFTER SURGERY

RECONSTRUCTION BASED ON NO OR UNKNOWN HISTORY OF RT OR UNKNOWN NEED FOR POSTMASTECTOMY RT[a,b]

Immediate placement of tissue expander at the time of mastectomy (prepectoral, partial submuscular, total submuscular tissue expander placement)[f]

- **Adjuvant chemotherapy planned** → **Tissue expansion during chemotherapy**
  - **No RT planned** → **Exchange tissue expander to implant or Convert to autologous tissue reconstruction**
  - **RT planned** → **Exchange tissue expander to permanent implant[f,j] (prior to initiation of RT, if no delay to initiation of RT or ≥6 months after RT) or Conversion to autologous tissue reconstruction ≥6 months after RT**
- **No adjuvant chemotherapy planned**
  - **No RT planned** → **Tissue expansion followed by exchange to permanent implant or autologous tissue reconstruction**
  - **RT planned** → **Tissue expansion followed by RT; conversion to permanent implant or autologous tissue ≥6 months after completion of RT (category 2B)[j] or Tissue expansion followed by exchange to permanent implant before RT (if no delay to initiation of RT)**

1 stage: direct to implant[h] or Immediate autologous reconstruction or LD with implant at time of mastectomy[i] → **Consider revisional surgeries to the ipsilateral or contralateral breast after RT if needed**

Delayed reconstruction

- **RT not required** → **Reconstruction with implant, autologous tissue, or a combination**
- **RT required** → **Reconstruction Based on Prior History of RT (BINV-H 3 of 7)**

[a] General Principles of Breast Reconstruction (BINV-H 5 of 7).
[b] Patient Factors Influencing Breast Reconstruction (BINV-H 6 of 7).
[f] The use of RT significantly increases the baseline risk of capsular contracture, aesthetic deformity, malposition, implant exposure, infection, and reconstructive failure.
[h] Determined by preoperative size and ptosis, patient desire of postoperative size, and assessment intraoperatively of skin and soft-tissue quality and perfusion, with consideration for patient-specific relative contraindications (eg, smoking, obesity) to single-stage versus two-stage approaches. Healing issues may occur and delay initiation of RT.
[i] Consider delaying autologous reconstruction until after RT is completed, as RT to a flap may cause loss of cosmesis and/or fat necrosis.
[j] Consultation with radiation oncologists may be necessary to determine if volume of contralateral tissue expander will affect RT treatment planning. In some cases, contralateral deflation may be required prior to CT simulation. Radiation oncology consultation should also be requested in cases of an anticipated close or positive deep margin, as this may impact the optimal placement of the expander (pre- vs. subpectoral). Clips to identify the close/positive margins should be placed to assist in delineating the tumor bed boost.

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PRINCIPLES OF BREAST RECONSTRUCTION AFTER SURGERY

General Principles of Breast Reconstruction

- Breast reconstruction may be an option for any patient receiving surgical treatment for breast cancer. All patients undergoing breast cancer treatment should be educated about breast reconstructive options as adapted to their individual clinical situation. However, breast reconstruction should not interfere with the appropriate surgical, medical, and radiation management of the cancer or the scope of appropriate surgical treatment for this disease. Coordinating consultation and surgical treatment with a reconstructive surgeon should be executed within a reasonable time frame. The process of breast reconstruction should not govern the timing or the scope of appropriate surgical treatment for this disease. The availability of or the practicality of breast reconstruction should not result in the delay or refusal of appropriate surgical, medical, and radiation intervention.
- Some patients may choose not to have reconstruction after mastectomy. The option to undergo mastectomy alone with a surgically optimized closure should be offered to all patients as part of a comprehensive discussion of reconstructive options. Achieving the optimal result in this scenario may require additional procedures beyond the initial mastectomy. See BINV-H (6 of 7) for patient factors influencing choice of reconstruction.
- Selection of reconstructive option and timing of reconstruction option is based on an assessment of cancer treatment, body habitus of patients, obesity, smoking history, comorbidities, and patient concerns. Smoking and obesity (WHO Class 2 and 3) increase the risk of perioperative complications for all types of breast reconstruction. Patients with these high-risk factors should be counseled about their increased risk for complications following breast reconstruction, including donor site complications/hernias and bulges of the abdominal wall, delayed healing, mastectomy skin flap necrosis, total flap failure (obesity), and implant failure (smoking).
- Nipple areolar reconstruction should be offered to patients if the nipple-areolar complex (NAC) has been removed as part of their cancer treatment. Various techniques are available for nipple reconstruction. Three-dimensional (3D) tattooing can be offered to patients as an option for NAC reconstruction.
- Additionally, patients who are not satisfied with the cosmetic outcome following completion of breast cancer treatment should be offered reconstructive surgery consultation.
- Patients known to harbor genetic mutations that increase the risk of breast cancer may opt to undergo bilateral prophylactic mastectomies with reconstruction. Reconstruction can be performed with prosthetic, autologous tissue, or a combination of implant with autologous tissue.
- Skin- and nipple-sparing mastectomy should be performed by an experienced breast surgery team that works in a coordinated, multidisciplinary fashion to guide proper patient selection for skin-sparing mastectomy, determine optimal sequencing of the reconstructive procedure(s) in relation to adjuvant therapies, and perform a resection that achieves appropriate surgical margins.
- Revisional surgery may be necessary after breast reconstruction. This may include procedures such as fat grafting, mastopexy, direct excision/suction-assisted lipectomy, contralateral procedures (in cases of unilateral reconstruction), and others. Patients should be informed before reconstruction that revision surgery may be necessary.
- Routine imaging of reconstructed breast is not indicated after mastectomy but diagnostic imaging may be required for new symptomatic concerns.

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PRINCIPLES OF BREAST RECONSTRUCTION AFTER SURGERY

Patient Factors Influencing Breast Reconstruction

- Breast reconstruction is elective and patients may choose to not have breast reconstruction. Individual patients present preoperatively with a variety of factors that may impact the choice of reconstruction, the risk of complications, donor site morbidity, and aesthetic result. Each of these factors must be taken into account, along with patient desire, to choose the optimal method of reconstruction.
- Patient desire
  - The patient may have a strong feeling towards one form of reconstruction after being given the options. Breast reconstruction should be a shared decision.
- Medical comorbidities
  - Medical comorbidities may preclude longer reconstructive procedures such as autologous tissue reconstruction in some patients.
  - The selection of the reconstructive method of choice should take into consideration patient comorbidities.
  - Poorly controlled diabetes is a risk factor for postoperative complications in both implant and autologous tissue reconstruction.
  - Patients should be screened for personal or familial thrombophilia. Thrombophilia may result in reconstructive failure of microsurgical reconstruction or thromboembolic events.
- Tobacco use
  - Smoking has been associated with increased risk of delayed wound healing, mastectomy flap necrosis, NAC necrosis in the setting of nipple-sparing mastectomy, infection, and failure of implant-based reconstruction. In free flap reconstruction, smoking increases the risk of donor complications. Patients should be encouraged to stop smoking prior to reconstruction.
  - Smoking has not definitively been shown to increase the risk of microvascular thrombosis in free flap breast reconstruction.
- Breast size/shape
  - If patient has significant macromastia or ptosis, consideration can be given to a reduction pattern mastectomy with either implant-based or autologous tissue reconstruction, or oncoplastic reduction techniques.
  - The volume limitations of implants may preclude an acceptable reconstruction in patients with macromastia if preservation of volume is a priority.
- BMI
  - Patients with a markedly elevated BMI may be at increased risk of infectious complications and seromas as well as donor site complications from autologous reconstruction, including delayed healing and hernia formation. Immediate reconstruction can be performed, but delayed reconstruction can be considered if the patient is motivated to lose weight. Oncoplastic reduction techniques can be considered if the breast is large/ptotic.
- Breast implant-associated anaplastic large cell lymphoma (BIA-ALCL) and other rare implant-associated malignancies
  - BIA-ALCL commonly presents with delayed periprosthetic effusion and breast asymmetry occurring >1 year after implantation.
  - Rarely, BIA-ALCL can present with a mass, regional lymphadenopathy, overlying skin rash, and/or capsular contracture.
  - Similar symptoms can also be seen in breast implant-associated squamous cell carcinoma (BIA-SCC), another rare implant-associated malignancy. Individuals with breast implants have a very small risk of developing BIA-ALCL (average 7–9 years after implantation) and BIA-SCC (average 22 years after implantation).
  - The majority of cases of BIA-ALCL have been seen in textured implants, while BIA-SCC is associated with either smooth or textured implants. Rare cases of implant-associated diffuse large B-cell lymphomas have also been reported. See NCCN Guidelines for T-Cell Lymphomas.

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PRINCIPLES OF BREAST RECONSTRUCTION AFTER SURGERY

Special Cases

- Nipple-sparing mastectomy
  - NAC-sparing procedures may be an option in patients with cancer who are carefully selected by experienced multidisciplinary teams. Retrospective data support the use of NAC-sparing procedures for early-stage breast cancer, DCIS, risk-reduction procedures, and in some locally advanced invasive cancers (ie, with complete clinical response to preoperative chemotherapy and no nipple involvement with cancer).
  - Contraindications to NAC include: Preoperative clinical or radiographic evidence of nipple involvement, including Paget disease, bloody nipple discharge associated with malignancy, IBC, and/or imaging findings suggesting malignant involvement of the nipple or subareolar tissues.
  - Nipple margin assessment is mandatory and should be clearly designated on the specimen.
  - Preoperative breast size, shape, and nipple position should also be considered in the decision to perform NAC-sparing mastectomy. Patients with small to moderate breast volume with good nipple position are ideal candidates. In patients with large or significantly ptotic breasts, NAC-sparing mastectomies may be offered in select cases by using various reduction patterns or delay techniques to augment the NAC perfusion, either in an immediate or delayed fashion, as long as it does not delay oncologic care. Intraoperative assessment of the NAC perfusion should also guide the decision to preserve the NAC or remove it.
  - Patients should be counseled on the risk of delayed healing, nipple necrosis, loss of pigmentation, loss of sensation, loss of projection, and need for subsequent removal of the NAC.
  - Topical 2% nitroglycerine (45 mg total dose) used prophylactically has been shown to reduce mastectomy skin flap necrosis in both skin-sparing mastectomy and nipple-sparing mastectomy in one randomized control trial.
- Inflammatory breast cancer
  - Delayed reconstruction after mastectomy for IBC remains the clinical standard for several reasons. The need to resect involved skin negates the benefit of skin-sparing mastectomy for immediate reconstruction, and high rates of local and distant recurrence warrant comprehensive RNI in a timely fashion, which may be technically more challenging or subject to delay after immediate reconstruction.
  - Advances in multimodal therapy have improved 5-year survival in patients with IBC, justifying clinical studies to see if immediate reconstruction may be appropriate for certain patients with IBC, but neither the outcomes nor the clinical features to predict such outcomes are known at this time.
  - In the uncommon clinical circumstance that the extent of skin excision at the time of mastectomy precludes primary or local closure, reconstruction of the chest wall defect with autologous tissue is necessary, and concomitant immediate reconstruction may be accomplished.

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PRINCIPLES OF RADIATION THERAPY

Optimizing Delivery of Individual Therapy

- It is important to individualize RT planning and delivery.
  - 3D CT-based treatment planning should routinely be utilized to delineate target volumes and organs at risk (OAR), and assess dose distribution across the entire treatment volume.
  - Radiation is generally delivered with single or mixed energy photons ± electrons.
  - Treatment planning should be optimized to maximally improve homogeneity across the target volume while minimizing dose to OAR.
  - Additional techniques such as respiratory control (deep-inspiratory breath-hold [DIBH]), prone positioning, and cardiac blocks may also be used to try to further reduce dose to heart, lung, and adjacent normal tissue.
  - At a minimum, weekly imaging to verify treatment setup should be utilized. More frequent imaging may be needed for selected cases with inconsistent reproducibility. *Imaging before each ultra-hypofractionated radiotherapy fraction is recommended.* Image-guided RT (IGRT) may be utilized with DIBH technique to reduce normal tissue exposure of the heart, lung, or liver. Consider daily imaging for patients receiving prone breast radiotherapy.[c]
  - Dose-volume histograms (DVHs) should be used to evaluate dose, normal tissue constraints (ie, heart, lung), and planning target volumes (PTVs).
- It is common for RT to follow chemotherapy when chemotherapy is indicated. See BINV-I 2 of 3.
- In the setting of oligometastatic breast cancer, the currently available data do not support ablative metastasis-directed RT (ie, stereotactic body RT [SBRT]) for extending overall survival (OS) or PFS. In some cases, SBRT may be preferred over palliative radiotherapy to provide more durable local control and pain relief.

Whole Breast RT

- Target definition is the breast tissue at risk.
- RT dosing:
  - The whole breast should receive a ~~hypofractionated~~ dose of 40–42.5 Gy in 15–16 fractions; ~~in selected cases 45–50.4 Gy in 25–28 fractions~~ *in selected patients 26 Gy in 5 fractions* may be considered *though the optimal fractionation for the boost delivery is unknown for this regimen. A dose of 45–50.4 Gy in 25–28 fractions is generally not recommended, even when the radiotherapy volume includes regional lymph nodes.*[d]
  - A boost to the tumor bed is recommended in patients at higher risk for recurrence. The boost can be given sequentially after whole breast RT or as a simultaneous integrated boost. Typical boost doses when given sequentially are 10–16 Gy in 4–8 fractions. When given concurrently, the whole breast should receive 40 Gy in 15 fractions and the lumpectomy site should receive 48 Gy in 15 fractions.[a,b]
  - Available data support the use of ultra-hypofractionated regimens (28.5 Gy in 5 once-a-week fractions or 26 Gy in 5 daily fractions). The optimal way to incorporate a tumor bed boost and the long-term toxicity associated with its delivery in the ultrahypofractionated setting is yet to be established. Lumpectomy cavity boost can be delivered using enface electrons, photons, or brachytherapy.

[a] Vicini FA, Winter K, Freedman GM, et al. NRG RTOG 1005: A phase III trial of hypo fractionated whole breast irradiation with concurrent boost vs. conventional whole breast irradiation plus sequential boost following lumpectomy for high risk early-stage breast cancer. Int J Radiation Oncol 2022;114;S1.

[b] Coles CE, Haviland JS, Kirby AM, et al. Dose-escalated simultaneous integrated boost radiotherapy in early breast cancer (IMPORT HIGH): a multicentre, phase 3, non-inferiority, open-label, randomised controlled trial. Lancet 2023;401:2124-2137.

[c] Daily image guidance in conjunction with regular 3D assessments (eg, cone-beam CT, surface-guided RT [SGRT]) for intensity-modulated RT (IMRT)/volumetric modulated arc therapy (VMAT) techniques.

[d] *Rivera S, et al. 5-year results of hypofractionated locoregional radiotherapy in early breast cancer HypoG-01 (UNICANCER): a French multicentre, randomised, non-inferiority, phase 3, open-label, controlled trial. Lancet. 2026;407:976-987.*

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PRINCIPLES OF RADIATION THERAPY

PMRT (including breast reconstruction)

- The target includes the ipsilateral chest wall and the clinically relevant mastectomy scar ± drain sites.
  - Regional nodal RT is typically delivered with the chest wall. See below.
- Based on anatomic considerations and presence of reconstruction, various 3D-, intensity-modulated RT [IMRT], or volumetric modulated arc therapy (VMAT) techniques using photons and/or electrons are appropriate.
- PMRT details and dosing:
  - The routine use of bolus is not recommended. Bolus should be used for inflammatory breast cancer and considered in clinically relevant situations where the dose to the skin may not be adequate.[d]
  - Chest wall RT dose may be delivered in conventional dosing of 45–50.4 Gy in 25–28 fractions or moderately hypofractionated dosing of 40–42.5 Gy in 15–16 fractions.[e]
  - In patients who are at high risk for local recurrence, a chest wall scar boost may be considered of approximately 10 Gy delivered in 4-5 fractions with or without bolus.
- For patients with positive surgical margins after neoadjuvant systemic therapy, re-excision to negative margins is preferred. If not feasible, then strongly consider PMRT to chest wall ± comprehensive RNI (including any portion of the undissected axilla at risk).

RNI

- ~~For supra/infraclavicular and axillary nodes, prescription depth varies based on the patient anatomy.~~
- Regional nodes should be contoured when RNI is indicated. Refer to breast atlases for contouring guidelines.[f,g]
- RNI generally includes supraclavicular, infraclavicular, internal mammary, and axillary nodes at risk. Coverage of the internal mammary nodes may be individually determined based on tumor location (medial/central), tumor size, extent of nodal involvement, and dose to the OAR.
- RT dosing:
  - RT doses to the regional nodes of 46–50 Gy (conventional fractionation) or 39–42.56 Gy (moderately hypofractionated) dosing schedules are similar to PMRT and whole breast.[e]
  - A supplemental boost of RT can be delivered to grossly involved or enlarged lymph nodes (ie, internal mammary, supra/infraclavicular) that have not been surgically removed.

RT with Preoperative or Adjuvant Systemic Therapy

- In patients treated with preoperative systemic therapy, adjuvant RT is based on the maximal disease stage (ie, clinical stage, pathologic stage, tumor characteristics) at diagnosis (before preoperative systemic therapy) and pathology results after preoperative systemic therapy.
- Sequencing of RT with systemic therapy:
  - It is common for RT to follow chemotherapy when chemotherapy is indicated. However,
    - CMF (cyclophosphamide/methotrexate/fluorouracil) is the only standard regimen that can be given concurrently with RT.
    - Capecitabine *may be* ~~is typically~~ given *concurrently or* after completion of RT.
    - Olaparib should be given after completion of RT.
  - Available data suggest that ~~sequential or~~ concurrent endocrine therapy with RT is ~~acceptable~~ *preferred to sequential approach*. ~~Due to compounding side effects, initiating endocrine therapy at the completion of RT may be preferred.~~
    - ◊ Abemaciclib or ribociclib should be initiated after completion of surgery/RT/chemotherapy, concurrently with endocrine therapy.
  - Adjuvant HER2-targeted therapy ± endocrine therapy may be delivered concurrently with RT.

[d] Bolus should be used for patients with skin involvement, positive superficial margins, and those with dermal lymphatic invasion and/or extensive LVI.
[e] Preliminary data show similar normal tissue toxicity at 5 years with 26 Gy in 5 fractions, for patients receiving regional nodal irradiation without inclusion of internal mammary nodes. Longer-term toxicity and efficacy data are not yet available, and limited data are available in the context of reconstruction (UK FF Nodal Sub-study; Murray Brunt AM, et al. Rad Onc 2025).
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[g] Gentile MS, Usman AA, Neuschler EI, et al. Contouring guidelines for the axillary lymph nodes for the delivery of radiation therapy in breast cancer: Evaluation of the RTOG Breast Cancer Atlas. Int J Radiat Oncol Biol Phys 2015;93:257-265.

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PRINCIPLES OF RADIATION THERAPY

Accelerated Partial Breast Irradiation (APBI)/Partial Breast Irradiation (PBI)

- ~~The NCCN Panel endorses~~ APBI/PBI *may be considered* for any patient without germline *BRCA1/2* PVs who meets the criteria outlined in the 2024 ASTRO guidelines. Patients aged ≥40 years are recommended for APBI/PBI if they have:
  - Invasive ER-positive ductal carcinoma measuring ≤2 cm (pT1 disease), grade 1–2, with negative margin widths, no LVSI, and negative nodes
    Or
  - DCIS measuring size ≤2 cm with low-intermediate grade with negative margins
- APBI offers comparable local control and comparable or improved cosmesis to whole breast RT when delivered with the following dose regimens. The APBI regimens have not been compared directly but 30 Gy/5 fractions is preferred based on the highest rated cosmesis outcomes.
- RT dosing:

Dose	Regimen
EBRT APBI	
30 Gy/5 fractions QOD ~~(preferred)~~; IMRT/VMAT protocol mandated	• Livi L, Meattini I, Marrazzo L, et al. Accelerated partial breast irradiation using intensity-modulated radiotherapy versus whole breast irradiation: 5-year survival analysis of a phase 3 randomised controlled trial. Eur J Cancer 2015;51:451-463. • Meattini I, Marrazzo L, Saieva C, et al. Accelerated partial-breast irradiation compared with whole-breast irradiation for early breast cancer: Long-term results of the randomized phase III APBI-IMRT-Florence Trial. J Clin Oncol 2020;38:4175-4183. • Franceschini D, Loi M, Chiola I, et al. Preliminary results of a randomized study on postmenopausal women with early stage breast cancer: Adjuvant hypofractionated whole breast irradiation versus accelerated partial breast irradiation (HYPAB Trial). Clin Breast Cancer 2021;21:231-238. • Lo Faro L, Fogliata A, Franceschini D, et al. Adjuvant hypofractionated whole breast irradiation (WBI) vs. accelerated partial breast irradiation (APBI) in postmenopausal women with early stage breast cancer: 5 years update of the HYPAB trial. Clin Breast Cancer 2024;24:253-260.
~~**40 Gy/15 fractions**~~	~~• Coles CE, Griffin CL, Kirby AM, et al. Partial-breast radiotherapy after breast conservation surgery for patients with early breast cancer (UK IMPORT LOW trial): 5-year results from a multicentre, randomised, controlled, phase 3, non-inferiority trial. Lancet 2017;390:1048-1060.~~
26 Gy/5 fractions QD	*• ESTRO recomendations: Meattini I, Becherini C, Boersma L, et al. European Society for Radiotherapy and Oncology Advisory Committee in Radiation Oncology Practice consensus recommendations on patient selection and dose and fractionation for external beam radiotherapy in early breast cancer. Lancet Oncol. 2022;23:e21-e31.*
Brachytherapy APBI (including balloon/interstitial)	
~~**34 Gy/10 fractions BID;**~~ **32 Gy/8 fractions BID; 30.1 Gy/7 fractions BID**	~~• Vicini FA, Cecchini RS, White JR, et al. Long-term primary results of accelerated partial breast irradiation after breast-conserving surgery for early-stage breast cancer: a randomised, phase 3, equivalence trial. Lancet 2019;394:2155-2164.~~ • Strnad V, Ott OJ, Hildebrandt G, et al. 5-year results of accelerated partial breast irradiation using sole interstitial multicatheter brachytherapy versus whole-breast irradiation with boost after breast-conserving surgery for low-risk invasive and in-situ carcinoma of the female breast: a randomised, phase 3, non-inferiority trial. Lancet 2016;387:229-238. • Polgár C, Ott OJ, Hildebrandt G, et al. Late side-effects and cosmetic results of accelerated partial breast irradiation with interstitial brachytherapy versus whole-breast irradiation after breast-conserving surgery for low-risk invasive and in-situ carcinoma of the female breast: 5-year results of a randomised, controlled, phase 3 trial. Lancet Oncol 2017;18:259-268.

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SPECIAL CONSIDERATIONS FOR BREAST CANCER IN MALES (SEX ASSIGNED AT BIRTH)

NCCN recommendations have been developed to be inclusive of individuals of all sexual and gender identities to the greatest extent possible. On this page, the terms males and females refer to sex assigned at birth.

- Few males have been included in breast cancer trials.[1] Therefore, recommendations regarding management of breast cancer in males are generally extrapolated from findings of clinical trials focusing on breast cancer in females.
- Although there are some biologic and clinical differences between breast cancer in males and females, management of breast cancer in males is similar overall to management of breast cancer in females, with the following special considerations pertinent to male patients[2]:
  - Genetics: The NCCN Panel recommends consideration of genetic testing for all males with breast cancer (see NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate).
  - Breast surgery: Historically, males with breast cancer have undergone mastectomy more often than BCS. However, breast-conservation therapy is increasingly being performed in males and evolving data indicate that breast conservation in males is associated with equivalent outcomes to mastectomy and that it is safe and feasible. Decisions about breast conservation versus mastectomy in males should be made according to similar criteria as for females.[2-9]
  - Axillary lymph node surgery: As in females, SLNB should be performed in the setting of male breast cancer with a clinically node-negative axilla.[2,4]
  - RT: Indications for radiation after breast surgery in males with breast cancer are the same as for females with breast cancer.[2,5,10,11]
  - Use of molecular assays: Data are limited regarding the use of molecular assays to assess prognosis and to predict benefit from chemotherapy in males with breast cancer.[2] Available data suggest the 21-gene assay recurrence score provides prognostic information in males with breast cancer.[12,13]
  - Preoperative/adjuvant systemic therapy: Chemotherapy with/without HER2-targeted therapy should be recommended for males with breast cancer according to guidelines for females with breast cancer.[2] Options for adjuvant endocrine therapy for males with breast cancer include tamoxifen for 5–10 years or, if tamoxifen is contraindicated, a GnRH analog plus an aromatase inhibitor. In males, single-agent adjuvant treatment with an aromatase inhibitor has been associated with inferior outcomes compared to tamoxifen alone, likely due to inadequate estradiol suppression, and is not recommended.[2,14-17]
  - Follow-up after treatment for early-stage disease: There are only limited data to support screening for breast cancer in males.[2] The NCCN Panel recommends that bone density be assessed at baseline and every 2 years in males with breast cancer who receive adjuvant GnRH analog therapy. Low bone density should be managed according to standard guidelines.[18]
  - Systemic therapy for advanced disease: Management of advanced breast cancer in males is similar to that in females; however, it is preferred that when an aromatase inhibitor is used, a GnRH analog should be given concurrently.[2] Available data suggest single-agent fulvestrant has similar efficacy in males as in females.[19] CDK4/6 inhibitors in combination with an aromatase inhibitor or fulvestrant, mTOR inhibitors, and PIK3CA inhibitors have not been systematically evaluated in clinical trials in males with breast cancer. However, available real-world data suggest comparable efficacy and safety profiles and it is reasonable to recommend these agents to males based on extrapolation of data from studies comprised largely of female participants with advanced breast cancer. Indications for and recommendations regarding chemotherapy, HER2-targeted therapy, immunotherapy, and PARP inhibitors for advanced breast cancer in males are similar to those for advanced breast cancer in females.[1]

References on BINV-J 2 of 2

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SPECIAL CONSIDERATIONS FOR BREAST CANCER IN MALES (SEX ASSIGNED AT BIRTH)
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PRINCIPLES OF ADJUVANT ENDOCRINE THERAPY
(for pT1-3,pN+,M0)

General Principles

- Hormone receptor-positive (HR+) tumors: Breast tumors may be positive for estrogen receptors (ER+), progesterone receptors (PR+), or both (ER+/PR+). See Principles of Biomarker Testing (BINV-A).
  - ER+ tumors: ER testing should be used to determine if a patient is a candidate for endocrine therapies.[a] Patients with cancers with 1%–100% ER IHC staining are considered ER+ and eligible for endocrine therapies; there are limited efficacy data on the subgroup of cancers with ER-low-positive (1%–10%) results. High ER+ expression is more likely to benefit from endocrine therapy; however, the potential benefit of endocrine therapy should be discussed even with low ER expression.
  - PR+ tumors: Patients with ER-negative, PR+ cancers may be considered for endocrine therapies, but the data on this group are noted to be limited. The same overall interpretation principles apply, but PR should be interpreted as either positive (if 1%–100% of cells have nuclear staining) or negative (if <1% or 0% of cells have nuclear staining).
- The majority of hormone-sensitive tumors are ER+/PR+ or ER+/PR-negative. Considering that ER-negative/PR+ tumors are relatively uncommon, in these guidelines, ER and/or PR+ tumors are referred to as HR+.
- The magnitude of risk reduction from adjuvant endocrine therapy is dependent on:
  - Level of ER expression: High ER expression is more likely to benefit from endocrine therapy; however, the potential benefit of endocrine therapy should be discussed even with low ER expression.
  - Recurrence score on gene expression assay test results: Patients with high recurrence scores will gain relatively less benefit from adjuvant endocrine therapy alone compared to those with low recurrence scores.
- Baseline assessment of BMD is recommended for patients receiving an aromatase inhibitor who are at risk of osteoporosis (eg, age >65, family history, chronic steroids). Monitor bone density with periodic dual-energy x-ray absorptiometry (DEXA) scans (every 1–2 years depending on risk) while on aromatase inhibitors. See NCCN Guidelines for Breast Cancer Risk Reduction.
- The use of a bisphosphonate (oral/IV) or denosumab is acceptable to maintain or to improve BMD and reduce risk of fractures in postmenopausal (natural or induced) patients receiving adjuvant aromatase inhibitor therapy.
- Some selective serotonin reuptake inhibitors (SSRIs) like fluoxetine and paroxetine decrease the formation of endoxifen, 4-OH tamoxifen, and active metabolites of tamoxifen, and may impact its efficacy. Caution is advised about coadministration of these drugs with tamoxifen. However, serotonin-norepinephrine reuptake inhibitors (SNRIs) (citalopram and venlafaxine) appear to have minimal impact on tamoxifen metabolism. At this time, based on current data the Panel does not recommend *CYP2D6* gene testing for patients being considered for tamoxifen therapy.

[a] Definition of Menopause (BINV-O).

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PRINCIPLES OF ADJUVANT ENDOCRINE THERAPY
(for pT1–3,pN+,M0)

Candidates for Ovarian Suppression + Endocrine Therapy
- Premenopausal patients
- Endocrine-sensitive tumors with high enough recurrence risk where the additional absolute decrease in recurrence compared with tamoxifen alone is worth the additional toxicity (young age/longevity, high-grade tumor, lymph node involvement)[b]

Ovarian Function Assessment
- Menopausal status cannot be determined while receiving ovarian function suppression (OFS).[a]
- Monitor estradiol ± follicle-stimulating hormone (FSH)/luteinizing hormone (LH) levels:
  - If <60 years and amenorrheic for ≤12 months prior to treatment with adjuvant endocrine therapy
  - Amenorrheic after chemotherapy or after tamoxifen +/- OFS
  - After switching from tamoxifen to an aromatase inhibitor, or if taken off OFS
  - Frequency of testing of estradiol ± FSH/LH levels should be individualized.
- Aromatase inhibitors can stimulate ovarian function. If vaginal bleeding occurs while on AI, contact physician immediately.
- If patient is not postmenopausal, sequential evaluation of hormonal status is recommended.

Methods for OFS
- GNRH agonists
  - Goserelin 3.6 mg SC every 4 weeks or 10.8 mg SC every 12 weeks
  - Leuprolide 3.75–7.5 mg IM or SC every 4 weeks or 11.25–22.5 mg IM or SC every 12 weeks
  - Triptorelin: 3.75 mg IM every 4 weeks or 11.25 mg IM every 12 weeks
- RT
- Bilateral oophorectomy

Options for Initiation of OFS
- Prior to or with start of chemotherapy (preoperative or adjuvant)
- If no chemotherapy planned, then OFS should be started alone for at least 1–2 cycles or concurrently with tamoxifen until estradiol level in postmenopausal range at which time an aromatase inhibitor could be considered.
  - Concurrently with RT or upon completion

Duration of OFS
- 5 years of OFS is optimal based on SOFT and TEXT trials. The 15-year DFS in the SOFT trial was 73.5% with OFS + exemestane versus 70.5% with OFS + tamoxifen versus 67.0% for tamoxifen alone. A minimum of 2 years of OFS is encouraged. There are no data on efficacy or safety to support prolonging OFS for >5 years.[c]
- Premenopausal patients wishing to continue adjuvant endocrine therapy after OFS stopped should use tamoxifen.

[a] Definition of Menopause (BINV-O).
[b] A balanced discussion of the risks and benefits associated with ovarian suppression therapy is critical, including the potential side effects of premature menopause. Aromatase inhibitor or tamoxifen for 5 years plus ovarian suppression should be considered, based on SOFT and TEXT clinical trial outcomes, for premenopausal patients at higher risk of recurrence (ie, young age/longevity, high-grade tumor, lymph node involvement).
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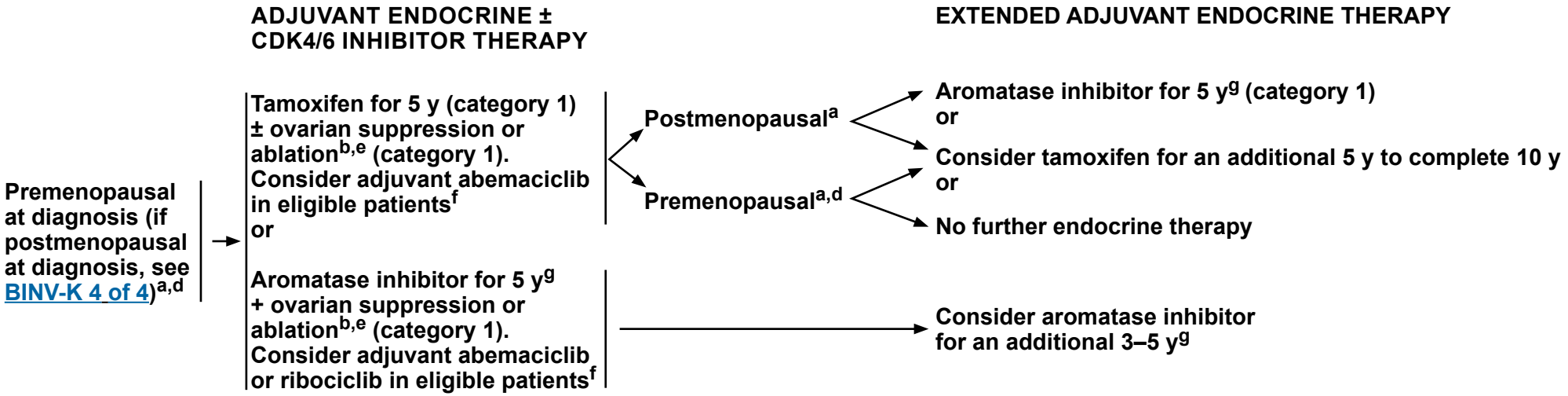

[a] Definition of Menopause (BINV-O).

[b] A balanced discussion of the risks and benefits associated with ovarian suppression therapy is critical, including the potential side effects of premature menopause. Aromatase inhibitor or tamoxifen for 5 years plus ovarian suppression should be considered, based on SOFT and TEXT clinical trial outcomes, for premenopausal patients at higher risk of recurrence (ie, young age/longevity, high-grade tumor, lymph node involvement).

[d] Safety data support administration of GnRH agonists before or with chemotherapy, especially if there is a goal to enhance fertility preservation. They can also be initiated after chemotherapy in patients who remain premenopausal.

[e] Evidence suggests that the magnitude of benefit from surgical or radiation ovarian ablation in premenopausal patients with HR-positive breast cancer is similar to that achieved with CMF alone.

[f] In patients with HR-positive/HER2-negative breast cancer: 1) for those with high-risk breast cancer (ie, those with ≥4 positive lymph nodes [confirmed preoperatively and/or at surgery], or 1–3 positive lymph nodes with either grade 3 disease or tumor size ≥5 cm (on preoperative imaging and/or at surgery), 2 years of adjuvant abemaciclib can be considered in combination with endocrine therapy (category 1, preferred). VTE risk should be considered when combining abemaciclib with tamoxifen. 2) For those with any lymph node involvement (excluding microscopic nodal involvement), or if no nodal involvement either tumor size >5 cm, or if tumor size 2–5 cm, either grade 2 (and high genomic risk or Ki-67 ≥20%), or grade 3, 3 years of ribociclib with aromatase inhibitor may be considered (category 1, preferred). Notably, adjuvant CDK4/6 inhibitors have been studied in patients at high risk who mostly received adjuvant/neoadjuvant chemotherapy; there are limited data in those who did not receive chemotherapy. In patients eligible for adjuvant olaparib (see BINV-L) and abemaciclib or ribociclib, the benefit and optimal sequence is not known.

[g] The three selective aromatase inhibitors (ie, anastrozole, exemestane, letrozole) have shown similar anti-tumor efficacy and toxicity profiles in randomized studies in the adjuvant and preoperative settings. The optimal duration of aromatase inhibitors in adjuvant therapy is uncertain. Patients with lymph node involvement may benefit from extended aromatase inhibitor duration (7.5–10 years total). See BINV-N 4 of 5.

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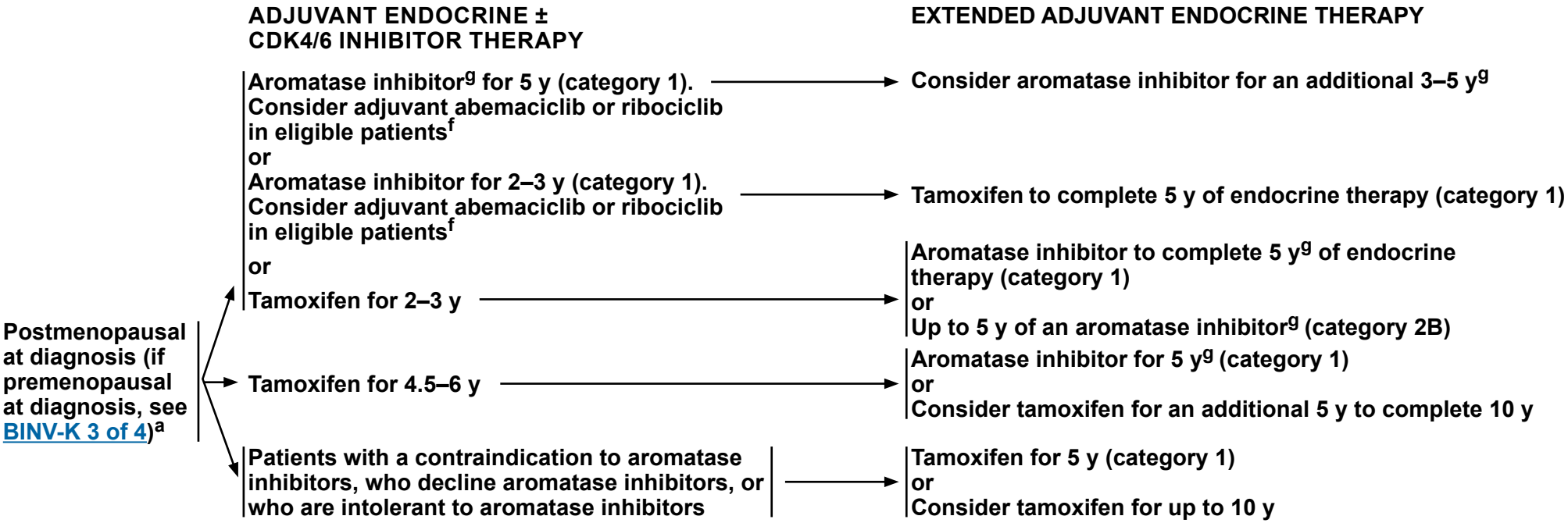

[a] Definition of Menopause (BINV-O).

[f] In patients with HR-positive/HER2-negative breast cancer: 1) for those with high-risk breast cancer (ie, those with ≥4 positive lymph nodes [confirmed preoperatively and/or at surgery], or 1–3 positive lymph nodes with either grade 3 disease or tumor size ≥5 cm (on preoperative imaging and/or at surgery), 2 years of adjuvant abemaciclib can be considered in combination with endocrine therapy (category 1, preferred). VTE risk should be considered when combining abemaciclib with tamoxifen. 2) For those with any lymph node involvement (excluding microscopic nodal involvement), or if no nodal involvement either tumor size >5 cm, or if tumor size 2–5 cm, either grade 2 (and high genomic risk or Ki-67 ≥20%), or grade 3, 3 years of ribociclib with aromatase inhibitor may be considered (category 1, preferred). Notably adjuvant CDK4/6 inhibitors have been studied in patients at high risk who mostly received adjuvant/neoadjuvant chemotherapy; there are limited data in those who did not receive chemotherapy. In patients eligible for adjuvant olaparib (see BINV-L) and abemaciclib or ribociclib, the benefit and optimal sequence is not known.

[g] The three selective aromatase inhibitors (ie, anastrozole, exemestane, letrozole) have shown similar anti-tumor efficacy and toxicity profiles in randomized studies in the adjuvant and preoperative settings. The optimal duration of aromatase inhibitors in adjuvant therapy is uncertain. Patients with lymph node involvement may benefit from extended aromatase inhibitor duration (7.5–10 years total). See BINV-N 4 of 5.

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PRINCIPLES OF PREOPERATIVE SYSTEMIC THERAPY

Known Benefits of Preoperative Systemic Therapy

- Facilitates breast conservation
- Can render inoperable tumors operable
- Treatment response provides important prognostic information at an individual patient level, particularly in patients with TNBC or HER2-positive breast cancer
- Identifies patients with residual disease at higher risk for relapse to allow for the addition of supplemental adjuvant regimens, particularly in patients with TNBC or HER2-positive breast cancer

Opportunities

- May allow SLNB alone if initial cN+ becomes cN0 after preoperative therapy
- May provide an opportunity to modify systemic treatment if no preoperative therapy response or progression of disease
- May allow for more limited radiation fields in patients with cN+ who become cN0/pN0 after preoperative therapy
- Provides excellent research platform to test novel therapies and predictive biomarkers
- May allow time for genetic testing
- May allow time to plan breast reconstruction in patients electing mastectomy
- May allow time for delayed decision-making for definitive surgery

Cautions

- Possible overtreatment with systemic therapy if clinical stage is overestimated
- Possible undertreatment locoregionally with radiotherapy if clinical stage is underestimated
- Possibility of disease progression during preoperative systemic therapy

Candidates for Preoperative Systemic Therapy

- Patients with inoperable breast cancer:
  - IBC
  - Bulky or matted cN2 axillary nodes
  - cN3 nodal disease
  - cT4 tumors
- In select patients with operable breast cancer
  - Preoperative systemic therapy is preferred for:
    - ◊ HER2-positive disease and TNBC, if ≥cT2 or ≥cN1
    - ◊ Large primary tumor relative to breast size in a patient who desires breast conservation
    - ◊ cN+ disease likely to become cN0 with preoperative systemic therapy
  - Preoperative systemic therapy can be considered for cT1c, cN0 HER2-positive disease and TNBC
- Patients in whom definitive surgery may be delayed

Non-candidates for Preoperative Systemic Therapy *(if the only aim is to decrease the extent of surgery)*

- Patients with extensive in situ disease when extent of invasive carcinoma is not well-defined
- Patients with a poorly delineated extent of tumor
- Patients whose tumors are not palpable or clinically assessable

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PRINCIPLES OF PREOPERATIVE SYSTEMIC THERAPY

- Pathology evaluation of surgical resection specimens following preoperative systemic therapy should include the standardized tissue sampling and reporting elements of the residual cancer burden (RCB) (category 2B).[a]
- Randomized trials of chemotherapy demonstrate similar long-term outcomes when patients are given the same treatment preoperatively compared with postoperatively.[b]
- Pathologic complete response (pCR) to preoperative systemic therapy is associated with an extremely favorable disease-free and OS, particularly in situations in which all treatment is given preoperatively. The correlation between pathologic response and long-term outcome is strongest for TNBC, somewhat less so for HER2-positive disease, and least for ER-positive disease.[c,d]
- A number of chemotherapy regimens have activity in the preoperative setting. In general, those chemotherapy regimens recommended in the adjuvant setting may be considered in the preoperative setting. See Preoperative/Adjuvant Therapy Regimens (BINV-M).
- Preoperative endocrine therapy alone may be considered for patients with ER-positive disease based on comorbidities or low-risk luminal biology based on clinical characteristics and/or genomic signatures (until desired effect is achieved). Data show that optimal duration for response if achieved between 4–6 months.[e]
- Patients with HER2-positive, ≥cT2 and/or cN+ should be considered for HER2-directed therapy preoperatively. See Preoperative/Adjuvant Therapy Regimens (BINV-M).
- Some studies suggest an increased risk of locoregional recurrence following use of preoperative chemotherapy.[f] These trials delivered chemotherapy regimens that are no longer standard, did not include targeted therapies, did not use modern imaging techniques, and/or used non-standard locoregional management. Care should be taken to follow the procedures outlined in BINV-12 and BINV-14 to assure appropriate locoregional management. Not all patients are appropriate candidates for preoperative systemic therapy. Accurate clinical staging at baseline prior to initiation of preoperative systemic therapy is critical. See Potentially Operable Disease: Breast and Axillary Evaluation Prior to Preoperative Systemic Therapy (BINV-12).
- Tumor response should be routinely assessed by clinical exam and imaging studies (see footnote uu on BINV-12) during delivery of preoperative therapy. It is preferred that the standard regimen is completed prior to surgery. If all intended treatment is not completed prior to surgery, the remainder may be given in the adjuvant setting. Patients with operable breast cancer experiencing progression of disease during preoperative systemic therapy may be given an alternate systemic regimen or proceed to surgery if deemed resectable. Locoregional therapy principles should be applied in the same manner as in patients treated with adjuvant systemic therapy.

[a] Yau C, Osdoit M, van der Noorda M, et al. Residual cancer burden after neoadjuvant chemotherapy and long-term survival outcomes in breast cancer: a multicentre pooled analysis of 5161 patients. Lancet Oncol 2022;23:149-160.
[b] Rastogi P, Anderson SJ, Bear HD, et al. Preoperative chemotherapy: Updates of National Surgical Adjuvant Breast and Bowel Project Protocols B-18 and B-27. J Clin Oncol 2008;26:778-785.
[c] von Minckwitz G, Untch M, Blohmer JU, et al. Definition and impact of pathologic complete response on prognosis after neoadjuvant chemotherapy in various intrinsic breast cancer subtypes. J Clin Oncol 2012;30:1796-1804.
[d] Cortazar P, Zhang L, Untch M, et al. Pathological complete response and long-term clinical benefit in breast cancer: the CTNeoBC pooled analysis. Lancet 2014;384:164-172.
[e] Hunt KK, Suman VJ, Wingate HF, et al. Local-regional recurrence after neoadjuvant endocrine therapy: Data from ACOSOG Z1031 (Alliance), a Randomized Phase 2 neoadjuvant comparison between letrozole, anastrozole, and exemestane for postmenopausal women with estrogen receptor-positive clinical stage 2 or 3 breast cancer. Ann Surg Oncol 2023;30:2111-2118.
[f] Early Breast Cancer Trialists' Collaborative Group (EBTCG). Long-term outcomes for neoadjuvant versus adjuvant chemotherapy in early breast cancer: metaanalysis of individual patient data from ten randomised trials. Lancet Oncol 2018;19:27-39.

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PREOPERATIVE/ADJUVANT THERAPY REGIMENS

Considerations for Those Receiving Preoperative/Adjuvant Systemic Therapy

General Considerations

- ~~An FDA-approved biosimilar~~ *A biosimilar validated with the reference biologic product* is an appropriate substitute for any recommended systemic biologic therapy in the NCCN Guidelines.
- Screen for and manage immunotherapy-related toxicities and endocrine dysfunctions (eg, hypothyroidism, adrenal insufficiency) in patients treated with immune checkpoint inhibitors. See NCCN Guidelines for Management of Immune Checkpoint Inhibitor-Related Toxicities.
- Regular cardiac monitoring is recommended for patients on anthracyclines or HER2-targeted therapies. See NCCN Guidelines for Survivorship: Cardiovascular Disease Risk Assessment.
- The selection, dosing, and administration of anti-cancer agents and the management of associated toxicities are complex. Modifications of drug dose and schedule and initiation of supportive care interventions are often necessary because of expected toxicities and individual patient variability, prior treatment, and comorbidities. The optimal delivery of anti-cancer agents therefore requires a health care delivery team experienced in the use of anti-cancer agents and the management of associated toxicities in patients with cancer.

For Those Receiving Preoperative/Adjuvant Chemotherapy

- Patients at a higher risk of taxane-induced peripheral neuropathy (TIPN) (eg, African descent, diabetes) may consider docetaxel as the preferred taxane based on data supporting less TIPN and less dose reductions (Schneider BP, Zhao F, Ballinger TJ, et al. ECOG-ACRIN EAZ171: prospective validation trial of germline predictors of taxane-induced peripheral neuropathy in Black women with early-stage breast cancer. J Clin Oncol 2024;42:2899-2907).
- Consider cryotherapy of hands and feet to decrease the risk of peripheral neuropathy when receiving taxane therapies. Use of glove constriction may be considered as it helps with reducing peripheral neuropathy.[1]
- Consider scalp cooling to reduce incidence of chemotherapy-induced alopecia for patients receiving neoadjuvant/adjuvant chemotherapy. Results may be less effective with anthracycline-containing regimens.
- Alternative taxanes (ie, albumin-bound paclitaxel, docetaxel, paclitaxel) may be substituted for select patients due to medical necessity (ie, hypersensitivity reaction). If substituted for weekly docetaxel or paclitaxel, then the weekly dose of albumin-bound paclitaxel should not exceed 125 mg/m^2.
- Pembrolizumab and berahyaluronidase alfa-pmph subcutaneous injection may be substituted for IV pembrolizumab. Pembrolizumab and berahyaluronidase alfa-pmph has different dosing and administration instructions compared to IV pembrolizumab.
- Sequence of therapies in the adjuvant setting:
  - Chemotherapy and endocrine therapy should be given sequentially, with endocrine therapy given after chemotherapy.
  - Adjuvant olaparib can be given concurrently with endocrine therapy.
  - For sequencing of RT with systemic therapy, see BINV-I 2 of 3.

For Those Receiving HER2-Targeted Therapy

- Trastuzumab and hyaluronidase-oysk subcutaneous injection may be substituted for trastuzumab IV; however, dosing and administration instruction differ. Do not substitute trastuzumab and hyaluronidase-oysk for or with ado-trastuzumab emtansine.
- Pertuzumab, trastuzumab, and hyaluronidase-zzxf injection for subcutaneous use may be substituted anywhere that the combination of intravenous pertuzumab and intravenous trastuzumab are given as part of systemic therapy. Pertuzumab, trastuzumab, and hyaluronidase-zzxf injection for subcutaneous use has different dosing and administration instructions compared to the intravenous products.
- Evaluate left ventricular ejection fraction (LVEF) prior to and during treatment. The optimal frequency of LVEF assessment during adjuvant trastuzumab therapy is not known. The FDA label recommends LVEF measurements prior to initiation of trastuzumab and every 3 months during therapy.

[1] Michel LL, Schwarz D, Romar P, et al. Efficacy of hand cooling and compression in preventing taxane-induced neuropathy: The POLAR randomized clinical trial JAMA Oncol 2025;11:408-415.

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PREOPERATIVE/ADJUVANT THERAPY[a,b]

The regimens listed in the table are all category 1 (except where indicated) when used in the adjuvant setting. See BINV-M 1 of 10 for Considerations for Those Receiving Preoperative/Adjuvant Systemic Therapy.

<table>
<tr><th colspan="2">HR-Positive, HER2-Negative</th></tr>
<tr><td colspan="2">Patients with HR-positive disease are recommended to receive adjuvant endocrine therapy ± CDK4/6 inhibitor therapy (see BINV-K).</td></tr>
<tr><td colspan="2">Preferred:
Preoperative or adjuvant setting:
• Dose-Dense AC (Doxorubicin/Cyclophosphamide) followed by Paclitaxel every 2 weeks[c]
• Dose-Dense AC followed by weekly Paclitaxel[c]
• TC (Docetaxel/Cyclophosphamide)

Adjuvant setting only:
• If germline BRCA1/2 PVs[d]: Olaparib</td></tr>
<tr><td>Useful in Certain Circumstances:
Preoperative or adjuvant setting:
• Dose-Dense AC
• AC every 3 weeks (category 2B)
• CMF (Cyclophosphamide/Methotrexate/Fluorouracil)
• AC followed by weekly Paclitaxel[c]
• EC (epirubicin/cyclophosphamide)</td><td>Other Recommended:
Preoperative or adjuvant setting:
• AC followed by Docetaxel every 3 weeks[c] or AC followed by weekly paclitaxel[c]
• ~~EC (Epirubicin/Cyclophosphamide)~~
• TAC (Docetaxel/Doxorubicin/Cyclophosphamide)</td></tr>
</table>

[a] *Docetaxel and paclitaxel may be used interchangeably.* Alternative taxanes (ie, docetaxel, paclitaxel, albumin-bound paclitaxel) may be substituted for select patients due to medical necessity (ie, hypersensitivity reaction). If substituted for weekly paclitaxel or docetaxel, then the weekly dose of albumin-bound paclitaxel should not exceed 125 mg/m².

[b] Principles of Preoperative Systemic Therapy (BINV-L).

[c] It is acceptable to change the administration sequence to taxane followed by AC.

[d] Patients in the OlympiA trial did not receive capecitabine; thus, there are no data on sequencing or to guide selection of one agent over the other. In patients eligible for both adjuvant olaparib and abemaciclib, the optimal sequence is not known. See BINV-K 3 of 4.

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PREOPERATIVE/ADJUVANT THERAPY[a,b]

The regimens listed in the table are all category 1 (except where indicated) when used in the adjuvant setting. See BINV-M 1 of 10 for Considerations for Those Receiving Preoperative/Adjuvant Systemic Therapy.

<table>
<tr><th colspan="2">HR-Negative, HER2-Negative</th></tr>
<tr><td colspan="2">Preferred:
Stage 1
Preoperative or adjuvant setting:
• Dose-dense AC followed by Paclitaxel every 2 weeks[c,e]
• Dose-dense AC followed by weekly Paclitaxel[c,e]
• TC (Docetaxel/Cyclophosphamide)[e]

Stage II–III
Preoperative followed by adjuvant:
• Carboplatin/Paclitaxel + Pembrolizumab (preoperative) followed by Cyclophosphamide/Doxorubicin or Epirubicin + Pembrolizumab (preoperative) followed by Pembrolizumab (adjuvant) (category 1)

Stages I–III
Adjuvant setting only:
• If residual disease after preoperative therapy with taxane-, alkylator-, and anthracycline-based chemotherapy[e,f]: Capecitabine
• Germline BRCA1/2 PVs[f]: Olaparib</td></tr>
<tr><td>Useful in Certain Circumstances:
Preoperative only:
• Carboplatin/Docetaxel + Pembrolizumab
Preoperative or adjuvant:
• Dose-Dense AC
• AC every 3 weeks (category 2B)
• CMF
• AC followed by weekly Paclitaxel[c]
• AC followed by Carboplatin + taxane (Docetaxel or Paclitaxel)[c]
• EC (Epirubicin/Cyclophosphamide)
Maintenance therapy after adjuvant chemotherapy:
• Capecitabine</td><td>Other Recommended:
Preoperative or adjuvant setting:
• AC followed by Docetaxel every 3 weeks[c] or AC followed by weekly Paclitaxel[c]
• ~~EC (Epirubicin/Cyclophosphamide)~~
• TAC (Docetaxel/Doxorubicin/Cyclophosphamide)
• Carboplatin/Paclitaxel (various schedules) (category 2A)
• Carboplatin[1]/Docetaxel (category 2A)
• Regimens listed as “Preferred” for stage I, may be considered for patients with stage II–III disease who are not eligible for Pembrolizumab</td></tr>
</table>

[a] *Docetaxel and paclitaxel may be used interchangeably.* Alternative taxanes (ie, docetaxel, paclitaxel, albumin-bound paclitaxel) may be substituted for select patients due to medical necessity (ie, hypersensitivity reaction). If substituted for weekly paclitaxel or docetaxel, then the weekly dose of albumin-bound paclitaxel should not exceed 125 mg/m^2.
[b] Principles of Preoperative Systemic Therapy (BINV-L).
[c] It is acceptable to change the administration sequence to taxane followed by AC.
[e] For patients with stage II–III disease who are not eligible for pembrolizumab, the regimens listed as "preferred" for stage 1 could be considered as other recommended options.
[f] Patients in the OlympiA trial did not receive capecitabine; thus, there are no data on sequencing or to guide selection of one agent over the other.

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References on BINV-M 10 of 10

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PREOPERATIVE/ADJUVANT THERAPY[a]

See BINV-M 1 of 10 for Considerations for Those Receiving Preoperative/Adjuvant Systemic Therapy.

HR-Positive or -Negative and HER2-Positive[g]

Preferred:
Preoperative or adjuvant setting:

- TCHP (Docetaxel/Carboplatin + Trastuzumab + Pertuzumab) *(preoperative setting only)*

Adjuvant setting:

- TCH (Docetaxel/Carboplatin + Trastuzumab)
- If no residual disease after preoperative therapy or no preoperative therapy: Complete up to 1 year of HER2-targeted therapy with Trastuzumab[h,i] (category 1) ± Pertuzumab. If node positive at initial staging, Pertuzumab + Trastuzumab (category 1)[j]
- If residual disease after preoperative therapy:
  - Ado-trastuzumab emtansine (category 1) alone. If Ado-trastuzumab emtansine discontinued for toxicity, then Trastuzumab (category 1) ± Pertuzumab to complete 1 year of therapy.[h] If node positive at initial staging, Pertuzumab + Trastuzumab (category 1)[j]
  - Fam-trastuzumab deruxtecan-nxki (category 1) for those with high risk of recurrence defined as inoperable cancer (cT4, N0–3, M0 or cT1–3, N2–3, M0) at presentation prior to neoadjuvant therapy or operable cancer (cT1–3, N0–1, M0) with axillary node–positive disease (ypN1–3) following preoperative therapy.

Useful in Certain Circumstances:
Preoperative or adjuvant setting:

- Cyclophosphamide/Docetaxel + Trastuzumab
- AC followed by T[c] (Paclitaxel) + Trastuzumab[h,i] (various schedules)
- AC followed by T[c] + Pertuzumab[h,i] + Trastuzumab (various schedules) *(preoperative setting only)*
- Taxane (Paclitaxel or Docetaxel) + Pertuzumab + Trastuzumab
- *PCTP (paclitaxel/carboplatin/trastuzmab/pertuzumab) (preoperative setting only)*

Adjuvant setting only:

- Neratinib[i]
- Ado-trastuzumab emtansine (T-DM1)
- Paclitaxel + Trastuzumab[k]

Other Recommended:
Preoperative or adjuvant setting:

- AC followed by Docetaxel[c] + Trastuzumab[h,i]
- AC followed by Docetaxel[c] + Pertuzumab[h,i] + Trastuzumab
- Carboplatin/Paclitaxel + Pertuzumab[i] + Trastuzumab

[a] *Docetaxel and paclitaxel may be used interchangeably* Alternative taxanes (ie, docetaxel, paclitaxel, albumin-bound paclitaxel) may be substituted for select patients due to medical necessity (ie, hypersensitivity reaction). If substituted for weekly paclitaxel or docetaxel, then the weekly dose of albumin-bound paclitaxel should not exceed 125 mg/m^2.

[c] It is acceptable to change the administration sequence to taxane (with or without HER2-targeted therapy) followed by AC.

[g] CDK 4/6 inhibitor therapy has not be studied in the HER2+ setting.

[h] Trastuzumab given in combination with an anthracycline is associated with significant cardiac toxicity. Concurrent use of trastuzumab and pertuzumab with an anthracycline should be avoided.

[i] Consider extended adjuvant neratinib following adjuvant trastuzumab-containing therapy for patients with HR-positive, HER2-positive disease with a perceived high risk of recurrence. The benefit or toxicities associated with extended neratinib in patients who have received pertuzumab or ado-trastuzumab emtansine is unknown.

[j] Updated results from the adjuvant APHINITY trial in HER2-positive early breast cancer, with a median follow-up of 11.3 years, have confirmed the benefit of adding pertuzumab to trastuzumab plus chemotherapy in preventing recurrences in those with node-positive disease.

[k] Paclitaxel + trastuzumab may be considered for patients with low-risk T1,N0,M0, HER2-positive disease, particularly those not eligible for other standard adjuvant regimens due to comorbidities.

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DOSING: PREOPERATIVE/ADJUVANT THERAPY REGIMENS

HER2-Negative

- **Dose-Dense AC followed by Paclitaxel**[1]
  - Doxorubicin 60 mg/m² IV Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 14 days for 4 cycles[l]
    - ◊ Followed by:
  - Paclitaxel 175 mg/m² IV Day 1
    - ◊ Cycled every 14 days for 4 cycles[l]
- **Dose-Dense AC followed by weekly Paclitaxel**[1]
  - Doxorubicin 60 mg/m² IV Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 14 days for 4 cycles[l]
    - ◊ Followed by:
  - Paclitaxel 80 mg/m² IV weekly for 12 weeks
- **TC (Docetaxel/Cyclophosphamide)**[2,3]
  - Docetaxel 75 mg/m² IV Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 21 days for 4–6 cycles[l]
- **Ribociclib (in combination with an aromatase inhibitor)**[4]
  - Ribociclib 400 mg PO once daily on Days 1–21
  - Cycled every 28 days for 3 years
- **Carboplatin/Paclitaxel + Pembrolizumab (preoperative) followed by Cyclophosphamide/Doxorubicin or Epirubicin + Pembrolizumab (preoperative) followed by Pembrolizumab (adjuvant)**[5]
  - Preoperative:[l]
    - ◊ Pembrolizumab 200 mg IV or 2 mg/kg Day 1
    - ◊ Paclitaxel 80 mg/m² IV Days 1, 8, and 15
    - ◊ Carboplatin AUC 5 IV Day 1

      Or
    - ◊ Carboplatin AUC 1.5 IV Days 1, 8, and 15
      - – Cycled every 21 days x 4 cycles (cycles 1–4)

    Followed by:
    - ◊ Pembrolizumab 200 mg IV or 2 mg/kg Day 1
    - ◊ Doxorubicin 60 mg/m² IV Day 1 or Epirubicin 90 mg/m² IV Day 1
    - ◊ Cyclophosphamide 600 mg/m² IV Day 1
      - – Cycled every 21 days x 4 cycles (cycles 5–8)

    Followed by:
  - Adjuvant Pembrolizumab 200 mg IV or 2 mg/kg Day 1
    - ◊ Cycled every 21 days x 9 cycles
- **Capecitabine**[6,*]
  - 1000–1250 mg/m² PO twice daily on Days 1–14
    - ◊ Cycled every 21 days for 6–8 cycles
- **Olaparib**[7]
  - 300 mg PO twice daily on Days 1–28
  - Cycled every 28 days for 1 year
- **Abemaciclib**[8]
  - 150 mg PO twice daily on Days 1–28
  - Cycled every 28 days for 2 years

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** In patients without pCR after preoperative chemotherapy.*

[l] All cycles are with myeloid growth factor support. See NCCN Guidelines for Hematopoietic Growth Factors.

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DOSING: PREOPERATIVE/ADJUVANT THERAPY REGIMENS

HER2-Negative

Preferred regimens

- **AC followed by Docetaxel every 3 weeks[9]**
  - Doxorubicin 60 mg/m² IV on Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 21 days for 4 cycles
    - ◊ Followed by:
  - Docetaxel *75*–100 mg/m² IV on Day 1
    - ◊ Cycled every 21 days for 4 cycles
- ***AC followed by weekly paclitaxel[23]***
  - *Doxorubicin 60 mg/m² IV day 1*
  - *Cyclophosphamide 600 mg/m² IV day 1*
    - ◊ *Cycled every 21 days for 4 cycles.*
    - ◊ *Followed by:*
  - *Paclitaxel 80 mg/m² by 1 h IV infusion weekly for 12 weeks*
- **EC[10]**
  - Epirubicin 100 *75–90* mg/m² IV Day 1
  - Cyclophosphamide 830 *600* mg/m² IV Day 1
    - ◊ Cycled every 21 days for 8 cycles
- **TAC (Docetaxel/Doxorubicin/ Cyclophosphamide)[11]**
  - Docetaxel 75 mg/m² IV Day 1
  - Doxorubicin 50 mg/m² IV Day 1
  - Cyclophosphamide 500 mg/m² IV Day 1
    - ◊ Cycled every 21 days for 6 cycles[l]
- **Carboplatin/Paclitaxel**
  - **Carboplatin/Paclitaxel weekly (preoperative setting only)[12,13]**
    - ◊ Carboplatin AUC 5 or 6 IV Day 1;
    - ◊ Paclitaxel 80 mg/m² IV Days 1, 8, and 15
      - – Cycled every 21 days x 4 cycles
  - **Weekly Carboplatin/weekly Paclitaxel[14,15]**
    - ◊ Carboplatin AUC 1.5–2 IV Days 1, 8, and 15
    - ◊ Paclitaxel 80 mg/m² IV Days 1, 8, and 15
      - – Cycled every 28 days x 6 cycles
- **Carboplatin/Docetaxel[l,16,17]**
  - Carboplatin AUC 6 IV Day 1
  - Docetaxel 75 mg/m² IV Day 1
    - ◊ Cycled every 21 days x 4–6 cycles

Alternative regimens

- **Dose-dense AC[1]**
  - Doxorubicin 60 mg/m² IV Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 14 days for 4 cycles[l]
- **AC[18]**
  - Doxorubicin 60 mg/m² IV on Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 21 days for 4 cycles
- **AC followed by Carboplatin + taxane (Docetaxel or Paclitaxel)[19]**
  - Doxorubicin 60 mg/m² IV Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 21 days for 4 cycles
    - ◊ Followed by
  - Carboplatin AUC 5 IV on Day 1
  - Docetaxel 75 mg/m² IV Day 1
    - ◊ Cycled every 21 days x 4 cycles

  Or
  - Carboplatin AUC 5 IV on Day 1
  - Paclitaxel 80 mg/m² IV on Days 1, 8, and 15
    - ◊ Cycled every 21 days x 4 cycles
- **CMF[20-22]**
  - Cyclophosphamide 100 mg/m² PO daily on Days 1–14
  - Methotrexate 40 mg/m² IV Days 1 & 8
  - Fluorouracil 600 mg/m² IV Days 1 & 8
    - ◊ Cycled every 28 days for 6 cycles

  Or
  - Cyclophosphamide 600 mg/m² IV Day 1
  - Methotrexate 40 mg/ m² IV Day 1
  - Fluorouracil 600 mg/m² IV Day 1
    - ◊ Cycled every 21 days for 8 cycles
- ~~**AC followed by weekly Paclitaxel[23]**~~
  - ~~Doxorubicin 60 mg/m² IV Day 1~~
  - ~~Cyclophosphamide 600 mg/m² IV Day 1~~
    - ◊ ~~Cycled every 21 days for 4 cycles~~
    - ◊ ~~Followed by~~
  - ~~Paclitaxel 80 mg/m² IV weekly for 12 weeks~~
- **Capecitabine (maintenance therapy)[24]**
  - 650 mg/m² PO twice daily on Days 1–28
  - Cycled every 28 days for 1 year
- **Carboplatin/Docetaxel + Pembrolizumab[l,m,25]**
  - Carboplatin AUC 6 IV Day 1
  - Docetaxel 75 mg/m² IV Day 1
  - Pembrolizumab 200 mg IV or 2 mg/kg Day 1
    - ◊ Cycled every 21 days x 6 cycles

[l] All cycles are with myeloid growth factor support. See NCCN Guidelines for Hematopoietic Growth Factors.

[m] Pembrolizumab 400 mg or 4mg/kg every 42 days may be given instead of Pembrolizumab 200 mg every 21 days in this regimen.

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DOSING: PREOPERATIVE/ADJUVANT THERAPY REGIMENS

HER2-Positive

Paclitaxel + Trastuzumab[26]
- Paclitaxel 80 mg/m² IV weekly for 12 weeks
  - ◊ With:
- ~~Trastuzumab 4 mg/kg IV with first dose of Paclitaxel~~ *Trastuzumab 8 mg/kg IV wk 1*
  - ◊ Followed by:
- Trastuzumab 2 mg/kg IV weekly to complete 1 year of treatment. As an alternative, Trastuzumab 6 mg/kg IV every 21 days may be used following the completion of Paclitaxel, and given to complete 1 year of Trastuzumab treatment.

TCH (Docetaxel/Carboplatin + Trastuzumab)[27]
- Docetaxel 75 mg/m² IV Day 1
- Carboplatin AUC 6 IV Day 1
  - ◊ Cycled every 21 days for 6 cycles
  - ◊ With:
- Trastuzumab 4 mg/kg IV week 1
  - ◊ Followed by:
- Trastuzumab 2 mg/kg IV for 17 weeks
  - ◊ Followed by:
- Trastuzumab 6 mg/kg IV
  - ◊ Cycled every 21 days to complete 1 year of therapy

OR
- Trastuzumab 8 mg/kg IV week 1
  - ◊ Followed by:
- Trastuzumab 6 mg/kg IV
  - ◊ Cycled every 21 days to complete 1 year of therapy

TCHP (Docetaxel/Carboplatin + Trastuzumab + Pertuzumab)[28]
- Docetaxel 75 mg/m² IV Day 1
- Carboplatin AUC 6 IV Day 1
  - ◊ Cycled every 21 days for 6 cycles

With:
- Trastuzumab 8 mg/kg IV Day 1
- Pertuzumab 840 mg IV Day 1
  - ◊ Followed by:
- Trastuzumab 6 mg/kg IV on Day 1
- Pertuzumab 420 mg IV Day 1
  - ◊ Cycled every 21 days to complete 1 year of therapy

T-DM1
- 3.6 mg/kg IV Day 1
  - ◊ Cycled every 21 days for 14 cycles*

Docetaxel + Pertuzumab + Trastuzumab[29]
- Docetaxel 75 mg/m² IV on Day 1
  - ◊ Cycled every 21 days for 4 cycles
  - ◊ With:
- Trastuzumab 8 mg/kg IV Day 1
- Pertuzumab 840 mg IV Day 1
  - ◊ Followed by:
- Trastuzumab 6 mg/kg IV on Day 1
- Pertuzumab 420 mg IV Day 1
  - ◊ Cycled every 21 days to complete 1 year of therapy

Fam-trastuzumab deruxtecan-nxki[30]
- 5.4 mg/kg IV Day 1
  - ◊ Cycled every 21 for 14 cycles

** In postoperative setting, only in patients without pCR.*

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DOSING: PREOPERATIVE/ADJUVANT THERAPY REGIMENS

HER2-Positive

AC followed by T (Paclitaxel) + Trastuzumab[31]

- Doxorubicin 60 mg/m² IV Day 1
- Cyclophosphamide 600 mg/m² IV Day 1
  - ◊ Cycled every 21 days for 4 cycles.
  - ◊ Followed by:
- Paclitaxel 80 mg/m² IV weekly for 12 weeks
  - ◊ With:
- Trastuzumab 4 mg/kg IV with first dose of Paclitaxel
  - ◊ Followed by:
- Trastuzumab 2 mg/kg IV weekly to complete 1 year of treatment. As an alternative, Trastuzumab 6 mg/kg IV every 21 days may be used following the completion of paclitaxel, and given to complete 1 year of Trastuzumab treatment.

Dose-Dense AC followed by Paclitaxel + Trastuzumab[32]

- Doxorubicin 60 mg/m² IV Day 1
- Cyclophosphamide 600 mg/m² IV Day 1
  - ◊ Cycled every 14 days for 4 cycles
  - ◊ Followed by:
- Paclitaxel 175 mg/m² by IV Day 1
  - ◊ Cycled every 14 days for 4 cycles[l]
  - ◊ With:
- Trastuzumab 4 *8* mg/kg IV with first dose of Paclitaxel
  - ◊ Followed by:
- Trastuzumab 2 mg/kg IV weekly to complete 1 year of treatment. As an alternative, Trastuzumab 6 mg/kg IV every 21 days may be used following the completion of Paclitaxel, and given to complete 1 year of Trastuzumab treatment.

AC or Dose-Dense AC followed by T (Paclitaxel) + Pertuzumab[33] + Trastuzumab

- Doxorubicin 60 mg/m² IV Day 1
- Cyclophosphamide 600 mg/m² IV Day 1
  - ◊ Cycled every 21 days for 4 cycles or
    For dose-dense: Cycle every 14 days for 4 cycles
  - ◊ Followed by:
- *Paclitaxel 80 mg/m² IV by 1h IV weekly for 12 wks*
  - ◊ *With:*
- Pertuzumab 840 mg IV Day 1 followed by 420 mg IV
- Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV
- Paclitaxel 80 mg/m² IV Days 1, 8, and 15
  - ◊ Cycled every 21 days for 4 cycles
  - ◊ Followed by:
- Pertuzumab 420 mg IV Day 1
- Trastuzumab 6 mg/kg IV Day 1
  - ◊ Cycled every 21 days to complete 1 year of therapy

Cyclophosphamide/Docetaxel + Trastuzumab[34]

- Cyclophosphamide 600 mg/m² IV Day 1
- Docetaxel 75 mg/m² IV Day 1
  - ◊ Cycled every 21 days for 4 cycles
  - ◊ With:
- Trastuzumab 4 mg/kg IV week 1
  - ◊ Followed by
- Trastuzumab 2 mg/kg IV weekly for 11 weeks
  - ◊ Followed by
- Trastuzumab 6 mg/kg IV
  - ◊ Cycled every 21 days to complete 1 year of therapy of Trastuzumab therapy

OR

- Trastuzumab 8 mg/kg IV week 1
  - ◊ Followed by:
- Trastuzumab 6 mg/kg IV every 21 days to complete 1 year of Trastuzumab therapy

[l] All cycles are with myeloid growth factor support. See NCCN Guidelines for Hematopoietic Growth Factors.

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DOSING: PREOPERATIVE/ADJUVANT THERAPY REGIMENS

HER2-Positive

AC followed by Docetaxel + Trastuzumab[26,35,36]
- Doxorubicin 60 mg/m² IV Day 1
- Cyclophosphamide 600 mg/m² IV Day 1
  - Cycled every 21 days for 4 cycles
  - Followed by:
- Docetaxel 100 mg/m² IV Day 1
  - Cycled every 21 days for 4 cycles
  - With:
- Trastuzumab
  - 4 mg/kg IV week 1; Followed by:
  - 2 mg/kg IV weekly for 11 weeks;
    or
  - *8 mg/kg IV day 1* Followed by:
  - 6 mg/kg IV
  - Cycled every 21 days to complete 1 year of Trastuzumab therapy

Carboplatin/Paclitaxel + Pertuzumab[37] **+ Trastuzumab**
- Carboplatin AUC 6 IV Day 1
- Paclitaxel 80 mg/m² IV Days 1 and 8
  - Cycled every 21 days for 9 cycles
- Pertuzumab 840 mg IV Day 1
- Trastuzumab 8 mg/kg IV Day 1
  - Followed by:
- Pertuzumab 420 mg IV Day 1
- Trastuzumab 6 mg/kg IV Day 1
  - Cycled every 21 days to complete 1 year of therapy

AC followed by Docetaxel + Pertuzumab[38] **+ Trastuzumab**
- Doxorubicin 60 mg/m² IV Day 1
- Cyclophosphamide 600 mg/m² IV Day 1
  - Cycled every 21 days for 4 cycles
  - Followed by:
- Pertuzumab 840 mg IV Day 1 followed by 420 mg IV
- Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV
- Docetaxel 75–100 mg/m² IV Day 1
  - Cycled every 21 days for 4 cycles
  - Followed by:
- Pertuzumab 420 mg IV Day 1
- Trastuzumab 6 mg/kg IV
  - Cycled every 21 days to complete 1 year of therapy

PCTP (paclitaxel/carboplatin/trastzumab/pertuzumab) (preoperative)
- *Paclitaxel; 80 mg/m² IV day 1 and 8*
- *Carboplatin IV; AUC 6; day 1 or AUC 3; day 1, 8*
  - *Cycled every 21 days*
  - *With:*
- *Pertuzumab 840 mg IV day 1 followed by 420 mg IV*
  - *Cycled every 21 days (preoperative only)*
- *Trastuzumab 8 mg/kg IV day 1 followed by 6 mg/kg IV*
  - *Cycled every 21 days to complete 1 y of trastuzumab treatment*

Neratinib[39]
- 120 mg PO daily on Days 1–7; Followed by:
- 160 mg PO daily on Days 8–14; Followed by:
- 240 mg PO daily on Days 15–28
  - Cycled every 28 days x 1 cycle
  - Followed by:
- 240 mg PO daily on Days 1–28
  - Cycled every 28 days x 12 cycles beginning with cycle 2

Paclitaxel + Pertuzumab[40] **+ Trastuzumab**
- Paclitaxel 80 mg/m² IV Day 1
  - Cycled every 7 days x 12–18 cycles
- Pertuzumab 840 mg IV Day 1 followed by 420 mg IV
- Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV
  - Cycled every 21 days x 4 cycles
  - Followed by:
- Pertuzumab 420 mg IV Day 1;
- Trastuzumab 6 mg/kg IV
  - Cycled every 21 days to complete 1 year of therapy

T-DM1[41]
- 3.6 mg/kg IV Day 1
  - Cycled every 21 days for ~~17~~ *14* cycles *(post-operatively in patients with residual disease)*

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GENE EXPRESSION ASSAYS FOR CONSIDERATION OF ADJUVANT SYSTEMIC THERAPY[a,b]

Assay	Predictive	Prognostic	NCCN Category of Preference	NCCN Category of Evidence and Consensus	Recurrence Risk and Treatment Implications
21-gene (Oncotype Dx) (for pN0)	Yes	Yes	Preferred	1	BINV-N (2)
21-gene (Oncotype Dx) for pN1 (1–3 positive nodes)[c]	Yes	Yes	Postmenopausal: Preferred	1	BINV-N (2)
			Premenopausal: Other	2A	
70-gene (MammaPrint) for pN0 and pN1 (1–3 positive nodes)	Not determined	Yes	Other	1	BINV-N (3)
50-gene (Prosigna) for pN0 and pN1 (1–3 positive nodes)	Not determined	Yes	Other	2A	BINV-N (3)
12-gene (EndoPredict) for pN0 and pN1 (1–3 positive nodes)	Not determined	Yes	Other	2A	BINV-N (3)
Breast Cancer Index (BCI)	Predictive of benefit of extended adjuvant endocrine therapy	Yes	Other	2A	BINV-N (4)

[a] Gene expression assays provide prognostic and therapy-predictive information that complements T,N,M and biomarker information. Use of these assays is not required for staging. The 21-gene assay (Oncotype Dx) is preferred by the NCCN Breast Cancer Panel for prognosis and prediction of chemotherapy benefit. Other prognostic gene expression assays can provide prognostic information but the ability to predict chemotherapy benefit is unknown.
[b] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).
[c] In the overall study population of the RxPONDER trial, 10.3% had high-grade disease and 9.2% had 3 involved nodes.

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GENE EXPRESSION ASSAYS FOR CONSIDERATION OF ADJUVANT SYSTEMIC THERAPY[a,b]

Assay	Recurrence Risk	Treatment Implications
21-gene (Oncotype Dx) (for postmenopausal patients with pN0 and pN1 [1–3 positive nodes])[c]	<26	Patients with pT1b/c–2, pN0, HR-positive, HER2-negative tumors, with recurrence scores between 0–10 have a risk of distant recurrence of <4% and those with recurrence scores 11–25 derived no benefit from the addition of chemotherapy to endocrine therapy in the prospective TAILORx study.[1] Postmenopausal patients with pT1–3, pN1, HR-positive, HER2-negative, with recurrence scores <26 derived no benefit from the addition of chemotherapy to endocrine therapy in the prospective RxPONDER study.[2]
	≥26	In postmenopausal patients with pT1–3, HR-positive, HER2-negative, and pN0 and pN1 (1–3 positive nodes) tumors and a recurrence score ≥26, the addition of chemotherapy to endocrine therapy is recommended.[1,2]
21-gene (Oncotype Dx) (for premenopausal patients: pN0)	≤15	Premenopausal patients with pT1b/c –2, pN0, HR-positive, HER2-negative tumors with recurrence scores <16 derived no benefit from the addition of chemotherapy to endocrine therapy in the prospective TAILORx study.[1]
	16–25	In premenopausal patients with recurrence scores between 16–25, a small benefit from the addition of chemotherapy could not be ruled out, but it is unclear if the benefit was due to the ovarian suppression effect promoted by chemotherapy in premenopausal patients.[1,2] For this group, consider chemotherapy followed by endocrine therapy or alternatively, OFS combined with either tamoxifen or an aromatase inhibitor.
	≥26	In premenopausal patients with HR-positive, HER2-negative, and pN0 tumors and a recurrence score ≥26, the addition of chemotherapy to endocrine therapy is recommended.[1]
21-gene (Oncotype Dx) (for premenopausal patients with 1–3 positive nodes)[c]	<26	In premenopausal patients with pT1–3 and pN1 (1–3 positive nodes) tumors and a recurrence score <26, the addition of chemotherapy to endocrine therapy was associated with a lower rate of distant recurrence compared with endocrine monotherapy[2] but it is unclear if the benefit was due to the ovarian suppression effects promoted by chemotherapy. For this group of patients, consider chemotherapy followed by endocrine therapy or alternatively, OFS combined with either tamoxifen or an aromatase inhibitor.[2]
	≥26	In premenopausal patients with HR-positive, HER2-negative, pT1–3 and pN1 (1–3 positive nodes) tumors and a recurrence score ≥26, the addition of chemotherapy to endocrine therapy is recommended.[2]

[a] Gene expression assays provide prognostic and therapy-predictive information that complements T,N,M and biomarker information. Use of these assays is not required for staging. The 21-gene assay (Oncotype Dx) is preferred by the NCCN Breast Cancer Panel for prognosis and prediction of chemotherapy benefit. Other prognostic gene expression assays can provide prognostic information but the ability to predict chemotherapy benefit is unknown.

[b] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).

[c] In the overall study population of the RxPONDER trial, 10.3% had high-grade disease and 9.2% had 3 involved nodes.

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GENE EXPRESSION ASSAYS FOR CONSIDERATION OF ADJUVANT SYSTEMIC THERAPY[a,b]

Assay	Recurrence Risk	Treatment Implications
70-gene (MammaPrint) (for pN0 and 1–3 positive nodes)	High	Patients with high clinical risk and low genomic risk were randomly assigned to receive chemotherapy (n = 749) or not (n = 748); this was the intention-to-treat population. The 8-year estimates for distant metastasis-free survival in the intention-to-treat population were 92.0% (95% CI, 89.6–93.8) for chemotherapy versus 89.4% (86.8–91.5) for no chemotherapy (HR, 0.66; 95% CI, 0.48–0.92). An exploratory analysis confined to the subset of patients with HR-positive, HER2-negative disease (1358 [90.7%] of 1497 randomly assigned patients, of whom 676 received chemotherapy and 682 did not) shows different effects of chemotherapy administration on 8-year distant metastasis-free survival according to age: 93.6% (95% CI, 89.3–96.3) with chemotherapy versus 88.6% (83.5–92.3) without chemotherapy in 464 patients aged ≤50 years (absolute difference 5.0 percentage points [SE, 2.8; 95% CI, −0.5 to 10.4]) and 90.2% (86.8–92.7) versus 90.0% (86.6–92.6) in 894 females >50 years (absolute difference 0.2 percentage points [2.1, −4.0 to 4.4]). The 8-year distant metastasis-free survival in the exploratory analysis by nodal status in these patients was 91.7% (95% CI, 88.1–94.3) with chemotherapy and 89.2% (85.2–92.2) without chemotherapy in 699 patients who are node-negative (absolute difference 2.5 percentage points [SE, 2.3; 95% CI, −2.1 to 7.2]) and 91.2% (87.2–94.0) versus 89.9% (85.8–92.8) for 658 patients with 1–3 positive nodes (absolute difference 1.3 percentage points [2.4, −3.5 to 6.1]). Non-randomized data suggest that patients with MammaPrint-high 2 (MP-H2) tumors have significantly worse outcomes when treated with taxane-based regimens without anthracyclines compared to MP-H1 tumors, suggesting benefit of addition of anthracyclines to taxane-based chemotherapy in MP-H2 tumors.[3]
	Low[d]	
50-gene (Prosigna) (for pN0 and 1–3 positive nodes)	Node negative: Low (0–40), Intermediate (41–60), High (61–100)	For patients with pT1 and pT2 HR-positive, HER2-negative, pN0 tumors, a risk of recurrence score in the low range, regardless of T size, places the tumor into the same prognostic category as pT1a–T1b,N0,M0.[4]
	Node positive: Low (0–40)	In patients with HR-positive, HER2-negative, pN+ tumors (1–3 positive lymph nodes) with low risk of recurrence score, treated with endocrine therapy alone, the distant recurrence risk was <3.5% at 10 years and no distant recurrence was seen at 10 years in the TransATAC study in a similar group.[5]
	Node positive: High (41–100)	
12-gene (EndoPredict) (pN0 and 1–3 positive nodes)	Low (≤3.3)	For patients with pT1 and pT2 HR-positive, HER2-negative, and pN0 tumors, a 12-gene low-risk score, regardless of T size, places the tumor into the same prognostic category as pT1a–T1b,N0,M0.[6] In ABCSG 6/8, patients in the low-risk group had risk of distant recurrence of 4% at 10 years and in the TransATAC study, patients with 1–3 positive nodes in the low-risk group had a 5.6% risk of distant recurrence at 10 years.[6,7] The assay is prognostic in patients treated with endocrine and chemo-endocrine.[7]
	High (>3.3)	

[a] Gene expression assays provide prognostic and therapy-predictive information that complements T,N,M and biomarker information. Use of these assays is not required for staging. The 21-gene assay (Oncotype Dx) is preferred by the NCCN Breast Cancer Panel for prognosis and prediction of chemotherapy benefit. Other prognostic gene expression assays can provide prognostic information but the ability to predict chemotherapy benefit is unknown.

[b] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).

[d] Postmenopausal patients with ultralow risk in the Stockholm Tamoxifen trial had a 20-year breast cancer specific survival of 97% with 2–5 years of tamoxifen (Esserman LJ, et al. JAMA Oncol 2017;3:1503-1510). Patients with an ultralow risk in the MINDACT trial have shown 8-year breast cancer-specific survival >95.6%. (Lopes Cardozo JMN, et al. J Clin Oncol 2022;40:1335-1345).

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GENE EXPRESSION ASSAYS FOR CONSIDERATION OF EXTENDED ADJUVANT SYSTEMIC THERAPY[a,b]

Assay	Recurrence Risk/ Predictive Result	Treatment Implications
Breast Cancer Index (BCI)[e]	BCI (H/I) Low	**pN0** • For patients with pT1–T2 HR-positive, HER2-negative, and pN0 tumors, a BCI (H/I) in the low-risk range (0–5), regardless of T size, places the tumor into the same prognostic category as pT1a–T1b, pN0, M0.[8-12] • Patients with BCI (H/I) low demonstrated a lower risk of distant recurrence (compared to BCI [H/I] high) and no significant improvement in disease-free survival (DFS) or OS compared to the control arm in terms of extending endocrine therapy duration.[8] **pN1 (1–3 positive nodes)** • For patients with HR-positive, HER2-negative, and pN1 tumors (1–3 positive lymph nodes), an optimized BCI model integrating tumor size and grade is prognostic for distant recurrence at 10 years.[8-10,12]
	BCI (H/I) High	• For patients with pT1 HR-positive, HER2-negative, and pN0 tumors or pN1 tumors (1–3 positive lymph nodes), a BCI (H/I) high (5.1–10) demonstrated significant rates of late distant recurrence.[8-12] • In secondary analyses of the MA.17, Trans-aTTom, and IDEAL trials, patients with HR-positive, pT1–T3, pN0 or pN1 tumors (1–3 positive lymph nodes) who had a BCI (H/I) high demonstrated significant improvements in DFS when adjuvant endocrine therapy was extended, compared to the control arm.[8-10]

[a] Gene expression assays provide prognostic and therapy-predictive information that complements T,N,M and biomarker information. Use of these assays is not required for staging. The 21-gene assay (Oncotype Dx) is preferred by the NCCN Breast Cancer Panel for prognosis and prediction of chemotherapy benefit. Other prognostic gene expression assays can provide prognostic information but the ability to predict chemotherapy benefit is unknown.

[b] Special Considerations for Breast Cancer in Males (Sex Assigned at Birth) (BINV-J).

[e] The benefit of testing BCI (H/I) for extended adjuvant endocrine therapy is unknown in patients who had OFS, CDK4/6 inhibitors, or olaparib in addition to adjuvant endocrine therapy.

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GENE EXPRESSION ASSAYS FOR CONSIDERATION OF ADJUVANT SYSTEMIC THERAPY
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[4] Laenkholm AV, Jensen MB, Eriksen JO, et al. PAM50 risk of recurrence score predicts 10-year distant recurrence in a comprehensive Danish cohort of postmenopausal women allocated to 5 years of endocrine therapy for hormone receptor-positive early breast cancer. J Clin Oncol 2018;36:735-740.
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[6] Filipits M, Rudas M, Jakesz R, et al. A new molecular predictor of distant recurrence in ER-positive, HER2-negative breast cancer adds independent information to conventional clinical risk factors. Clin Cancer Res 2011;17:6012-6020.
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DEFINITION OF MENOPAUSE

- Menopause is the permanent cessation of menses and includes a profound and permanent decrease in ovarian estrogen synthesis.
- Determination of menopausal status may be required to guide selection of endocrine therapy for breast cancer.
- Menopause is usually a clinical diagnosis made after ≥12 months of amenorrhea. Natural menopause is experienced between ages 42–58 years.
- Breast cancer treatments may affect ovarian function and menses.
  - In those who are premenopausal at the beginning of chemotherapy and who develop chemotherapy-induced amenorrhea, ovarian function may still be intact despite amenorrhea or may resume over time. The likelihood of ovarian function resuming after chemotherapy is higher among those aged <40 years.
  - Tamoxifen may cause amenorrhea without inducing menopause in premenopausal individuals.
  - OFS induces amenorrhea and reduces ovarian estrogen synthesis without causing permanent menopause.
- Twelve months of amenorrhea alone is insufficient to diagnose menopause with chemotherapy-induced amenorrhea or with tamoxifen ± ovarian suppression. FSH and estradiol levels are used to support the diagnosis of menopause; however, clear criteria to guide interpretation of FSH and estradiol in this population is lacking.
  - Tamoxifen may alter FSH levels, limiting its utility in determination of menopausal status.
  - FSH and estradiol should be repeated serially to ensure menopausal status in patients with breast cancer with chemotherapy-induced amenorrhea.
- Evidence-based criteria for the diagnosis of menopause in patients with breast cancer are lacking. Clinical trials in breast cancer have utilized a variety of definitions of menopause. Reasonable criteria for determining menopause in patients with breast cancer include any of the following:
  - Prior bilateral oophorectomy
  - Age ≥60 years
  - Age <60 with amenorrhea for ≥12 months in the absence of prior chemotherapy, receipt of tamoxifen, toremifene, or ovarian suppression and estradiol and FSH in the postmenopausal range
  - Age <60 years: chemotherapy-induced amenorrhea for ≥12 months with FSH and estradiol in postmenopausal range on serial assessments
  - Age <60 years: on tamoxifen with FSH and estradiol level in postmenopausal range
- Menopausal status cannot be determined in those receiving OFS

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SYSTEMIC THERAPY FOR ER- AND/OR PR-POSITIVE RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

General Considerations for Therapy Selection for HR-Positive Disease

Ovarian function assessment: (see BINV-O and BINV-K 1 of 4)
- Assess serum estradiol prior to therapy initiation.
- If premenopausal or perimenopausal,
  - Ovarian suppression/ablation/resection plus anti-estrogen therapy is more effective than endocrine therapy alone.
  - Start OFS with or prior to initiation of endocrine therapy.

Choice of endocrine therapy:
- Depends on prior adjuvant endocrine agent and disease-free interval (see BINV-P 2 of 3).
- Must balance benefit with additional side effects.

Endocrine + CDK4/6 inhibitor therapy:
- Endocrine therapy + CDK4/6 inhibitor is preferred over chemotherapy, even for extensive visceral involvement.
- Chemotherapy recommended only if true visceral crisis (see BINV-Q 2 of 14).
- If frail or extensive comorbidity, consider single agent aromatase inhibitor.

Management of toxicity (particularly early in initiation of these therapies) is essential.

Duration of initial response to endocrine therapy can guide likelihood of benefit of continued endocrine therapy as later line therapy.

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SYSTEMIC THERAPY FOR ER- AND/OR PR-POSITIVE RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE[a]

HER2-Negative and Postmenopausal or Premenopausal Receiving Ovarian Ablation or Suppression

See BINV-P 1 of 3 for general considerations for therapy selection for HR-positive, HER2-negative disease.

First-Line Therapy

Preferred First-Line Therapy

- Aromatase inhibitor + CDK4/6 inhibitor[b]
  - Aromatase inhibitor + Ribociclib (category 1)[c]
  - Aromatase inhibitor + Abemaciclib
  - Aromatase inhibitor + Palbociclib
- For HER2-negative tumors with *PIK3CA* activating mutations:
  - Fulvestrant/Inavolisib/Palbociclib, see BINV-Q 6 of 15

If disease progression on adjuvant endocrine therapy or relapse within 12 months of adjuvant endocrine therapy completion consider:

- Fulvestrant[d] + CDK4/6 inhibitor[b]
  - Fulvestrant + Ribociclib (category 1)[e]
  - Fulvestrant + Abemaciclib (category 1)[e]
  - Fulvestrant + Palbociclib

Second- and/or Subsequent-Line Therapy

Preferred Second- and/or Subsequent-Line Therapy

- Fulvestrant *or AI if fulvestrant was used in the first line* + CDK4/6 inhibitor (Abemaciclib, Palbociclib, or Ribociclib) if CDK4/6 inhibitor not previously used (category 1)[f,g]
- For HER2-negative tumors with *PIK3CA* or *AKT1* activating mutations or *PTEN* inactivating mutations and genomic changes (eg, deletion), see BINV-Q 6 of 15[h]
- Everolimus + endocrine therapy (Exemestane, Fulvestrant, Tamoxifen)[i,j]

Useful in Certain Circumstances for Second- and/or Subsequent-Line Therapy

- Megestrol acetate
- Estradiol
- Abemaciclib[l]
- Imlunestrant + Abemaciclib[m]
- Targeted therapy, see BINV-Q 7 of 15, and emerging biomarker options, see BINV-Q 8 of 15

Other Recommended for First- and/or Subsequent-Line Therapy

- For HER2-negative and *ESR1* mutated tumors after a prior line of aromatase inhibitor ± CDK 4/6 inhibitor therapy (in adjuvant or metastatic setting), see BINV-Q 6 of 15 for options.
- Fulvestrant + aromatase inhibitor (Anastrozole, Letrozole) (category 1)[k]
- Fulvestrant
- Anastrozole
- Letrozole
- Tamoxifen
- Exemestane

Footnotes on BINV-P 3 of 3

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SYSTEMIC THERAPY FOR ER- AND/OR PR-POSITIVE RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE[a]

HER2-Positive and Postmenopausal or Premenopausal Receiving Ovarian Ablation or Suppression
See BINV-Q 1 of 15 for Considerations for Systemic Therapy.
If treatment was initiated with chemotherapy and Pertuzumab + Trastuzumab, and the chemotherapy was stopped, endocrine therapy (Aromatase inhibitor ± Palbociclib) may be added to Pertuzumab + Trastuzumab.
Other Recommended • Aromatase inhibitor ± Trastuzumab • Aromatase inhibitor ± Lapatinib • Aromatase inhibitor ± Lapatinib + Trastuzumab • Fulvestrant ± Trastuzumab • Tamoxifen ± Trastuzumab • Abemaciclib/Fulvestrant + Trastuzumab (category 2B) • Targeted therapy see BINV-Q 7 of 15 and emerging biomarker options see BINV-Q 8 of 15

[a] Baseline assessment of bone density recommended for patients receiving an aromatase inhibitor who are at risk of osteoporosis (eg, age >65, family history, chronic steroids).
[b] There is controversy on the choice of CDK4/6 inhibitor as there are no randomized comparisons between the agents and there are some differences in the study populations in the phase 3 randomized studies.
[c] In phase 3 randomized controlled trials, ribociclib + endocrine therapy have shown OS benefit in the first-line setting.
[d] Consider for disease progression on adjuvant endocrine therapy or with early disease relapse within 12 months of adjuvant endocrine therapy completion.
[e] In phase 3 randomized controlled trials, fulvestrant + abemaciclib or ribociclib has shown OS benefit in the first-line setting.
[f] In phase 3 randomized controlled trials, fulvestrant in combination with a CDK4/6 inhibitor (abemaciclib, palbociclib, and ribociclib) has shown OS benefit in the second-line setting.
[g] If there is disease progression while on palbociclib, there are limited phase II data to support the use of ribociclib in the second-line setting.
[h] If there is progression while on a PI3K inhibitor, there are limited data to support another line of therapy with a PI3K-pathway inhibitor-containing regimen.
[i] If there is disease progression while on an everolimus-containing regimen, there are no data to support an additional line of therapy with another everolimus regimen.
[j] A combination of everolimus with exemestane can be considered for patients who meet the eligibility criteria for BOLERO-2 (progressed within 12 mo or on non-steroidal aromatase inhibitor).
[k] A single study (S0226) in patients with HR-positive breast cancer and no prior chemotherapy, biological therapy, or endocrine therapy for metastatic disease demonstrated that the addition of anastrozole to fulvestrant resulted in prolongation of time to progression and OS. Subset analysis suggested that patients without prior adjuvant tamoxifen and >10 years since diagnosis experienced the greatest benefit. Two studies with similar design (FACT and SOFEA) demonstrated no advantage in time to progression with the addition of fulvestrant to anastrozole.
[l] Indicated after progression on prior endocrine therapy and prior chemotherapy in the metastatic setting.
[m] The combination of imlunestrant + abemaciclib may be most effective in those with *ESR1* mutations and no prior CDK4/6 inhibitor. The EMBER-3 trial (Jhaveri KL, et al. N Engl J Med 2025;392:1189-1202) included patients with and without *ESR1* mutations and compared the combination of imlunestrant + abemaciclib to imlunestrant alone versus comparing with the standard treatment containing an endocrine therapy plus CDK4/6 inhibitor.

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CYTOTOXIC THERAPY FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

- **For treatment of brain metastases, see NCCN Guidelines for Central Nervous System Cancers.**

General Considerations

- The selection, dosing, and administration of anti-cancer agents and the management of associated toxicities are complex. Modifications of drug dose and schedule and initiation of supportive care interventions are often necessary because of expected toxicities and individual patient variability, prior treatment, and comorbidities. The optimal delivery of anti-cancer agents therefore requires a health care delivery team experienced in the use of anti-cancer agents and the management of associated toxicities in patients with cancer.
- For information regarding *DPYD* testing, see the NCCN Guidelines for Colon Cancer.
- ~~An FDA-approved biosimilar~~ *A biosimilar validated with the reference biologic product* is an appropriate substitute for any recommended systemic biologic therapy in the NCCN Guidelines.
- Screen for and manage immunotherapy-related toxicities and endocrine dysfunctions (eg, hypothyroidism, adrenal insufficiency) in patients treated with immune checkpoint inhibitors. See NCCN Guidelines for Management of Immune Checkpoint Inhibitor-Related Toxicities.
- Consider scalp cooling to reduce incidence of chemotherapy-induced alopecia for patients receiving chemotherapy. Results may be less effective with anthracycline.
- When receiving a taxane-containing regimen:
  - Alternative taxanes (ie, docetaxel, paclitaxel, albumin-bound paclitaxel) may be substituted for select patients due to medical necessity (ie, hypersensitivity reaction). If substituted for weekly paclitaxel or docetaxel, then the weekly dose of albumin-bound paclitaxel should not exceed 125 mg/m^2.
  - Consider cryotherapy of hands and feet to decrease the risk of peripheral neuropathy.[1,2] Use of glove constriction may be considered as it helps with reducing peripheral neuropathy.[3]
- Pembrolizumab and berahyaluronidase alfa-pmph subcutaneous injection may be substituted for IV pembrolizumab. Pembrolizumab and berahyaluronidase alfa-pmph has different dosing and administration instructions compared to IV pembrolizumab.

For Those Receiving HER2-Targeted Therapy

- Trastuzumab and hyaluronidase-oysk subcutaneous injection may be substituted for trastuzumab IV; however, dosing and administration instruction differ. Do not substitute trastuzumab and hyaluronidase-oysk for or with ado-trastuzumab emtansine or fam-trastuzumab deruxtecan-nxki.
- Pertuzumab, trastuzumab, and hyaluronidase-zzxf injection for subcutaneous use may be substituted anywhere that the combination of intravenous pertuzumab and intravenous trastuzumab are given as part of systemic therapy. Pertuzumab, trastuzumab, and hyaluronidase-zzxf injection for subcutaneous use has different dosing and administration instructions compared to the intravenous products.
- ~~Patients previously treated with chemotherapy plus trastuzumab in the absence of pertuzumab in the metastatic setting may be considered for one line of therapy including both pertuzumab + trastuzumab in combination with or without cytotoxic therapy (such as vinorelbine or taxane). Further research is needed to determine the ideal sequencing strategy for anti-HER2 therapy.~~
- Regular cardiac monitoring for patients with current or prior use of anthracyclines or HER2-targeted therapy. See NCCN Guidelines for Survivorship: Cardiovascular Disease Risk Assessment.

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CYTOTOXIC REGIMENS FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE[a]

HR-Positive and HER2-Negative with Visceral Crisis[†] or Endocrine Refractory		
See BINV-Q 1 of 15 for Considerations for Systemic Therapy.		
Setting	**Subtype/Biomarker**	**Regimen**
First Line	No germline *BRCA1/2* PV[b] and/or HER2 (*ERBB2*) IHC 0+, 1+, or 2+/ISH negative[d]	Systemic chemotherapy[e] (category 1, preferred) (BINV-Q 5 of 15), or Fam-trastuzumab deruxtecan-nxki[e,f] (other recommended)
	Germline *BRCA1/2* PV[b]	PARPi (Olaparib or Talazoparib)[c] (category 1, preferred)
Second Line	*Germline BRCA1/2 mutation[b]*	*PARPi (olaparib, talazoparib)[c] (Category 1, preferred)*
	HER2 (*ERBB2*) IHC 1+ or 2+/ISH negative[d]	Fam-trastuzumab deruxtecan-nxki[f] (category 1, preferred)
	HER2 (*ERBB2*) IHC 0+[d]	Fam-trastuzumab deruxtecan-nxki[f] (other recommended)
	Not a candidate for Fam-trastuzumab deruxtecan-nxki; *no germline BRCA1/2 mutation[b]*	Sacituzumab govitecan-hziy[g] (category 1, preferred)
		Systemic chemotherapy (BINV-Q 5 of 15)
		Targeted therapy (BINV-Q 6 of 15 and BINV-Q 7 of 15)
		For HER2 (*ERBB2*) IHC 0, 1+, or 2+/ISH negative:[d] Datopotamab deruxtecan-dlnk[h] (other recommended)
Third Line and Beyond	Any	Systemic chemotherapy (BINV-Q 5 of 15)
	Germline BRCA1/2 mutation[b]	*Olaparib, talazoparib*
	NTRK fusion	*Larotrectinib, entrectinib*
	Biomarker positive (ie, MSI-H, *NTRK1/2/3* and *RET* gene fusions, TMB-H)	Targeted agents and emerging biomarker options (BINV-Q 6 of 15, BINV-Q 7 of 15, and BINV-Q 8 of 15)

[†] According to the 5th ESO-ESMO international consensus guidelines (Cardoso F, et al. Ann Oncol 2020;31:1623-1649) for advanced breast cancer, visceral crisis is defined as: "severe organ dysfunction, as assessed by signs and symptoms, laboratory studies and rapid progression of disease. Visceral crisis is not the mere presence of visceral metastases but implies important organ compromise leading to a clinical indication for the most rapidly efficacious therapy."

[a] For treatment of brain metastases, see NCCN Guidelines for Central Nervous System Cancers.
[b] Assess for germline BRCA1/2 PVs in all patients with recurrent or metastatic breast cancer to identify candidates for PARP inhibitor (PARPi) therapy.
[c] PARPi can be considered for a later line for those with germline BRCA1/2 PV; however, available evidence suggests it is more effective if used earlier.
[d] See Principles of HER2 Testing (BINV-A). The distinction between HER2 (ERBB2) test results of IHC 0/absent membrane staining, IHC 0+/with membrane staining (faint, partial membrane staining in ≤10%), IHC 1+, or 2+/ISH negative is currently clinically relevant for therapy selection.
[e] Chemotherapy (eg, oral chemotherapy) is generally preferred in the first-line setting. Selection of chemotherapy versus fam-trastuzumab-nxki for first-line therapy should be individualized based on clinical features and patient preference.
[f] Fam-trastuzumab deruxtecan-nxki may be used in those previously treated with at least one line of endocrine-based therapy in the metastatic setting. Fam-trastuzumab deruxtecan-nxki is associated with interstitial lung disease (ILD)/pneumonitis. Regular monitoring for this serious side effect is recommended. For patients with a history of ILD/pneumonitis, there are no data on managing safety or toxicity of this drug in a trial.
[g] Sacituzumab govitecan-hziy may be used after prior treatment including endocrine therapy, a CDK4/6 inhibitor, and at least two lines of chemotherapy, one of which was a taxane, and at least one of which was in the metastatic setting. It may be considered for later line if not used as second-line therapy.
[h] Datopotamab deruxtecan-dlnk is indicated as second- or subsequent-line therapy for those who have received a prior endocrine-based therapy and chemotherapy for unresectable or metastatic disease. Datopotamab deruxtecan-dlnk did not meet the OS endpoint in the TROPION-Breast01 trial. Whereas the previously approved ADCs, fam-trastuzumab deruxtecan-nxki and sacituzumab govitecan-hziy have shown a benefit in OS in randomized phase III trials. The benefit of using datopotamab deruxtecan-dlnk in patients with prior ADC treatment are not known as the TROPION-Breast01 trial did not include patients with prior ADC treatment.

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CYTOTOXIC REGIMENS FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE[a]

HR-Negative and HER2-Negative (Triple-Negative Breast Cancer; TNBC)		
See BINV-Q 1 of 15 for Considerations for systemic therapy.		
Setting	**Subtype/Biomarker**	**Regimen**
First Line	PD-L1 CPS ≥10[i] regardless of germline *BRCA1/2* PV status[b]	• Chemotherapy (Albumin-bound Paclitaxel, Carboplatin/Gemcitabine, or Paclitaxel,)[j] + Pembrolizumab (category 1, preferred) • Sacituzumab govitecan-hziy + Pembrolizumab (category 1, preferred)
	PD-L1 CPS <10[i] and no germline *BRCA1/2* PV[b]	• Sacituzumab govitecan-hziy (category 1, preferred)[k] • Datopotamab deruxtecan-dlnk (preferred) • Systemic chemotherapy BINV-Q 5 of 15
	PD-L1 CPS <10[i] and germline *BRCA1/2* PV[b]	• PARPi (Olaparib or Talazoparib)* (category 1, preferred) • Platinum (Carboplatin or Cisplatin) (category 1, preferred)
Second Line	Germline *BRCA1/2* PV[b]	PARPi (category 1, preferred)
	Any	Sacituzumab govitecan-hziy[l] (category 1, preferred)
		Systemic chemotherapy BINV-Q 5 of 15 or targeted agents BINV-Q 7 of 15
	No germline *BRCA1/2* PV[b] and HER2 (*ERBB2*) IHC 1+ or 2+/ISH negative[d]	Fam-trastuzumab deruxtecan-nxki[m] (other recommended)
Third Line and Beyond	Biomarker positive (ie, MSI-H, *NTRK1/2/3 fusion* and *RET* gene fusions, TMB-H)	Targeted agents and emerging biomarker options BINV-Q 7 of 15 and BINV-Q 8 of 15 *Larotrectinib, Entrectinib*
	Any	Systemic chemotherapy BINV-Q 5 of 15 *or sacituzumab govitecan if not previously used (Category 1, preferred), or targeted agents if not previously used*

** First-line only in patients treated with anthracyclines and taxanes in the perioperative setting.*

[a] For treatment of brain metastases, see NCCN Guidelines for Central Nervous System Cancers.

[b] Assess for germline *BRCA1/2* PVs in all patients with recurrent or metastatic breast cancer to identify candidates for PARPi therapy.

[d] See Principles of HER2 Testing (BINV-A). The distinction between HER2 (*ERBB2*) test results of IHC 0/absent membrane staining, IHC 0+/with membrane staining (faint, partial membrane staining in ≤10%), IHC 1+, or 2+/ISH negative is currently clinically relevant for therapy selection.

[i] Programmed death ligand 1 (PD-L1) expression is assessed using 22C3 antibody. Threshold for positivity combined positive score (CPS) ≥10.

[j] While available data are in the first-line setting, this regimen can be used for second and subsequent lines of therapy if programmed cell death protein 1 (PD-1)/PD-L1 inhibitor therapy has not been previously used. If there is disease progression while on a PD-1/PD-L1 inhibitor, there are no data to support an additional line of therapy with another PD-1/PD-L1 inhibitor.

[k] See NCCN Guidelines for Hematopoietic Growth Factors.

[l] Sacituzumab govitecan-hziy may be considered for later line if not used as second-line therapy.

[m] Fam-trastuzumab deruxtecan may be considered in a later line for HER2 (*ERBB2*) IHC 1+ or 2+/ISH negative, if not used in second line or may be considered first-line therapy when disease has progressed during or within 6 months after completing adjuvant chemotherapy. Fam-trastuzumab deruxtecan-nxki is associated with ILD/pneumonitis. Regular monitoring for this serious side effect is recommended. For patients with a history of ILD/pneumonitis, there are no data on managing safety or toxicity of this drug in a trial.

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CYTOTOXIC REGIMENS FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE[a,n]

HR-Positive or -Negative and HER2-Positive	
See BINV-Q 1 of 15 for Considerations for systemic HER2-targeted therapy.	
Setting	**Regimen**
First Line	Docetaxel + Pertuzumab + Trastuzumab (category 1, preferred) with maintenance Pertuzumab + Trastuzumab If HR-positive: Aromatase inhibitor ± Palbociclib + Pertuzumab + Trastuzumab
	Paclitaxel + Pertuzumab + Trastuzumab (preferred) with maintenance Pertuzumab + Trastuzumab If HR-positive: Aromatase inhibitor ± Palbociclib + Pertuzumab + Trastuzumab
	Fam-trastuzumab deruxtecan-nxki[o] + Pertuzumab (other recommended)
Second Line/Third Line	Capecitabine/Tucatinib + Trastuzumab[p] (category 1, preferred)
	Fam-trastuzumab deruxtecan-nxki[o,q] (category 1, preferred)
	T-DM1[r]
Fourth Line and Beyond (optimal sequence is not known)[s]	Docetaxel or Vinorelbine + Trastuzumab
	Paclitaxel + Trastuzumab ± Carboplatin
	Capecitabine/Lapatinib or Capecitabine + Trastuzumab
	Lapatinib + Trastuzumab (without cytotoxic therapy)
	Other chemotherapy agents[t] + Trastuzumab
	Capecitabine/Neratinib
	Chemotherapy (Capecitabine, Eribulin, Gemcitabine, or Vinorelbine) + Margetuximab-cmkb
	Abemaciclib/Fulvestrant + Trastuzumab (for HR+ only) (category 2B)
	Targeted Therapy and emerging biomarker Options BINV-Q 7 of 15 and BINV-Q 8 of 15

[a] For treatment of brain metastases, see NCCN Guidelines for Central Nervous System Cancers.
[n] Assess for germline *BRCA1/2* PVs in all patients with recurrent or metastatic breast cancer to identify candidates for PARPi therapy. While olaparib and talazoparib are FDA-indicated in HER2-negative disease, the Panel supports use in any breast cancer subtype associated with a germline PV. There is lower-level evidence for HER2-positive tumors, therefore category 2A for this setting.
[o] Fam-trastuzumab deruxtecan-nxki is associated with ILD/pneumonitis. Regular monitoring for this serious side effect is recommended. For patients with a history of ILD/pneumonitis, there are no data on managing safety or toxicity of this drug in a trial.
[p] Capecitabine/tucatinib + trastuzumab is preferred in patients with both systemic and CNS progression in the third-line setting and beyond; and it may be given in the second-line setting.
[q] Single-agent fam-trastuzumab deruxtecan-nxki may be considered in the first-line setting as an option for select patients (ie, those with rapid progression within 6 months of neoadjuvant or adjuvant therapy [12 months for pertuzumab-containing regimens]).
[r] May be used as an option for third-line and beyond; the optimal sequence for third-line therapy and beyond is not known. If not a candidate for fam-trastuzumab, T-DM1 could be considered in the second-line.
[s] Multiple lines of concurrent chemotherapy with anti-HER2 therapy (trastuzumab or a TKI) offer clinical benefit for recurrent unresectable HER2+ metastatic breast cancer and have been studied in phase 2 or 3 trials. Clinical experience suggests frequent clinical benefit for such treatment. However, there are no meaningful data for use of any of these regimens among patients previously treated with pertuzumab-based chemotherapy, ado-trastuzumab emtansine, fam-trastuzumab deruxtecan-nxki, or capecitabine/tucatinib + trastuzumab regimens. Thus, the optimal sequence or true benefit of therapy is not known.
[t] Trastuzumab given in combination with an anthracycline is associated with significant cardiac toxicity. Concurrent use of trastuzumab and pertuzumab with an anthracycline should be avoided. Trastuzumab may be safely combined with all non-anthracycline–containing preferred and other single agents listed on (BINV-Q 5 of 15) for recurrent or metastatic breast cancer.

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RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

Cytotoxic Regimens for HR-Positive or -Negative and HER2-Negative[a]		
See BINV-Q 1 of 15 for Considerations for systemic chemotherapy. Sequential single agents are preferred, but chemotherapy combinations may be used in select patients with high tumor burden, rapidly progressing disease, and visceral crisis.		
Preferred	**Other Recommended**	**Useful in Certain Circumstances**
• Anthracyclines ▸ Doxorubicin ▸ Liposomal Doxorubicin • Taxanes ▸ Paclitaxel • Anti-metabolites ▸ Capecitabine ▸ Gemcitabine • Microtubule inhibitors ▸ Eribulin ▸ Vinorelbine	• Albumin-bound Paclitaxel • Cyclophosphamide • Docetaxel • Epirubicin • Ixabepilone	• AC • EC • CMF • Capecitabine/Docetaxel • GT (Gemcitabine/Paclitaxel) • Carboplatin/Gemcitabine • Carboplatin + Albumin-bound Paclitaxel or Paclitaxel

- For specific lines of systemic therapy options for HR-positive and HER2-negative with visceral crisis or endocrine refractory, see BINV-Q 2 of 15.
- For specific lines of systemic therapy options for HR-negative and HER2-negative (TNBC), see BINV-Q 3 of 15.
- For specific lines of systemic therapy options for HR-negative or -positive and HER2-positive, see BINV-Q 4 of 15.

[a] For treatment of brain metastases, see NCCN Guidelines for Central Nervous System Cancers.

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TARGETED THERAPIES AND ASSOCIATED BIOMARKER TESTING FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

Biomarkers Associated with ~~FDA-Approved~~ *Targeted* Therapies					
Breast Cancer Subtype	**Biomarker**	**Detection[u]**	**~~FDA-Approved~~ *Targeted* Agents**	**NCCN Category of Evidence**	**NCCN Category of Preference**
HR-positive, HER2-negative	*PIK3CA* activating mutation	NGS, PCR	Fulvestrant/Inavolisib/Palbociclib[x]	Category 1	Preferred
HR-positive/ HER2-negative	*PIK3CA* activating mutation	NGS, PCR	Alpelisib/Fulvestrant	Category 1	Preferred
HR-positive/ HER2-negative	*PIK3CA or AKT1* activating mutations or *PTEN*[w] inactivating mutations and genomic changes (eg, deletion)	NGS, PCR	Capivasertib/Fulvestrant[y]	Category 1	Preferred[y]
HR-positive/ HER2-negative[u,v]	*ESR1* mutation[v]	NGS, PCR	Elacestrant[z]	Category 2A	Other recommended
			Imlunestrant[aa]	Category 2A	Other recommended

[u] Some plasma-based ctDNA assays include a measure of tumor fraction (TF), which can aid in identification of low ctDNA content. Samples with low TF, especially <1% or negative, should be interpreted with caution. Tests have varying sensitivities at low TF. Additional sampling from current tumor sample or future plasma can be considered.
[v] Assess for *ESR1* mutations at progression following prior lines of endocrine therapy (ctDNA preferred). If *ESR1* negative and TF is low, consider reflex testing with tissue-based next-generation sequencing (NGS) assay.
[w] Tissue biopsy is preferred to ctDNA at detecting homozygous copy loss of *PTEN* or TMB.
[x] Consider for disease progression on adjuvant endocrine therapy or with early disease relapse within 12 months of adjuvant endocrine therapy completion.
[y] In adult patients with *PIK3CA* or *AKT1* activating mutations, or for *PTEN* inactivating mutations and genomic changes (eg, deletion) after disease progression or recurrence after a prior line of endocrine therapy + CDK4/6 inhibitor.
[z] For disease progression during or a after prior line of aromatase inhibitor plus CDK 4/6 inhibitor therapy in the adjuvant or metastatic setting.
[aa] For disease progression during or after a prior line of aromatase inhibitor with or without CDK 4/6 inhibitor therapy in the adjuvant or metastatic setting.

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TARGETED THERAPIES AND ASSOCIATED BIOMARKER TESTING FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

Biomarkers Associated with ~~FDA-Approved~~ *Targeted* Therapies					
Breast Cancer Subtype	**Biomarker**	**Detection[u]**	**~~FDA-Approved~~ *Targeted* Agents**	**NCCN Category of Evidence**	**NCCN Category of Preference**
Any *HER2-negative*	Germline *BRCA1* or *BRCA2* PV	Germline sequencing	Olaparib Talazoparib	Category 1	Preferred
Any	Germline *PALB2* PVs	Germline sequencing	Olaparib[bb]	Category 2A	Other recommended
Any	*NTRK1/2/3* gene fusion	FISH, NGS, PCR	Entrectinib[cc] Larotrectinib[cc] Repotrectinib[dd]	Category 2A[dd]	Useful in certain circumstances
Any	MSI-H/dMMR	IHC, NGS, PCR	Pembrolizumab[ee]	Category 2A	
			Dostarlimab-gxly[ff]		
Any	TMB-H[w] (≥10 mut/Mb)	NGS	Pembrolizumab[ee]	Category 2A	
Any	*RET* gene fusion	NGS	Selpercatinib[gg]	Category 2A	

[u] Some plasma-based ctDNA assays include a measure of TF, which can aid in identification of low ctDNA content. Samples with low TF, especially <1% or negative, should be interpreted with caution. Tests have varying sensitivities at low TF. Additional sampling from current tumor sample or future plasma can be considered.

[w] Tissue biopsy is preferred to ctDNA at detecting homozygous copy loss of *PTEN* or TMB.

[bb] This regimen is not FDA approved for this indication. Tung NM, Robson ME, Ventz S, et al. TBCRC 048: phase II study of olaparib for metastatic breast cancer and mutations in homologous recombination-related genes. J Clin Oncol 2020;38:4274-4282.

[cc] Entrectinib and larotrectinib are indicated for the treatment of solid tumors that have an *NTRK1/2/3* gene fusion without a known acquired resistance mutation and have no satisfactory alternative treatments or that have progressed following treatment.

[dd] Repotrectinib is indicated for the treatment of solid tumors that have an *NTRK1/2/3* gene fusion and are locally advanced or metastatic or where surgical resection is likely to result in severe morbidity and have progressed following treatment or have no satisfactory alternative therapy. The recommendation in the first-line setting is category 2B.

[ee] Pembrolizumab is indicated for the treatment of patients with unresectable or metastatic, microsatellite instability-high (MSI-H) or mismatch repair deficient (dMMR) solid tumors, or TMB-H tumors that have progressed following prior treatment and who have no satisfactory alternative treatment options.

[ff] Dostarlimab-gxly is indicated for adult patients with MSI-H/dMMR unresectable or metastatic tumors that have progressed on or following prior treatment and who have no satisfactory alternative treatment options.

[gg] Selpercatinib is indicated for adult patients with locally advanced or metastatic solid tumors with a *RET* gene fusion that have progressed on or following prior systemic treatment or who have no satisfactory alternative treatment options.

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EMERGING BIOMARKERS AND NOVEL THERAPIES FOR PATIENTS WITH STAGE IV (M1) DISEASE

Breast Cancer Subtype	Emerging Biomarkers	Detection[u]	Potential Targeted Therapy[hh]	NCCN Category of Evidence	NCCN Category of Preference
ER+/HER2- ER-/HER2-	*HER2* (*ERBB2*) activating mutations	NGS, PCR	Fulvestrant/Neratinib + Trastuzumab[ii]	Category 2A	Useful in certain circumstances • If ER+/HER2-, in patients who have already received CDK4/6 inhibitor therapy
			Tucatinib + Trastuzumab ± Fulvestrant[jj]		
			Neratinib ± Fulvestrant[kk]	Category 2B	
Any	Somatic *BRCA1/2* mutations	NGS	Olaparib[ll]	Category 2B	Useful in certain circumstances
Any	*FGFR1-3* gene fusion/mutation	NGS	Erdafitinib[mm]	Category 2B	Useful in certain circumstances

[u] Some plasma-based ctDNA assays include a measure of TF, which can aid in identification of low ctDNA content. Samples with low TF, especially <1% or negative, should be interpreted with caution. Tests have varying sensitivities at low TF. Additional sampling from current tumor sample or future plasma can be considered.

[hh] At the present time, the data for the emerging biomarkers for the potential targeted agents noted in the table are promising but limited.

[ii] Jhaveri K, Eli LD, Wildiers H, et al. Neratinib + fulvestrant + trastuzumab for HR-positive, HER2-negative, HER2-mutant metastatic breast cancer: outcomes and biomarker analysis from the SUMMIT trial. Ann Oncol 2023;34:885-898.

[jj] Okines AFC, Curigliano G, Mizuno N, et al. Tucatinib and trastuzumab in HER2-mutated metastatic breast cancer: a phase 2 basket trial. Nature Medicine 2025;31:909-916.

[kk] Ma CX, Luo J, Freedman RA, et al. The phase II MutHER study of neratinib alone and in combination with fulvestrant in HER2-mutated, non-amplified metastatic breast cancer. Clin Cancer Res 2022;28:1258-1267.

[ll] Tung NM, Robson ME, Ventz S, et al. TBCRC 048: phase II study of olaparib for metastatic breast cancer and mutations in homologous recombination-related genes. J Clin Oncol 2020;38:4274-4282.

[mm] Pant S, Schuler M, Iyer G, et al. Erdafitinib in patients with advanced solid tumours with FGFR alterations (RAGNAR): an international, single-arm, phase 2 study. Lancet Oncol 2023;24:925-935.

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DOSING: CYTOTOXIC REGIMENS FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

HER2-Negative Regimens:

- **Doxorubicin**
  - 60–75 mg/m² IV Day 1; cycled every 21 days[1]
- **Doxorubicin**
  - 20 mg/m² IV Day 1 weekly[2]
- **Liposomal Doxorubicin[3]**
  - 50 mg/m² IV Day 1; cycled every 28 days
- **Paclitaxel**
  - 175 mg/m² IV Day 1; cycled every 21 days[4]
- **Paclitaxel**
  - 80 mg/m² IV Day 1 weekly[5]
- **Capecitabine[6]**
  - 1000–1250 mg/m² PO twice daily on Days 1–14; cycled every 21 days
- **Capecitabine[7]**
  - 1500 mg PO twice daily on Days 1–7 and Days 15–21 cycled every 28 days
- **Gemcitabine[8]**
  - 800–1200 mg/m² IV Days 1, 8, and 15; cycled every 28 days
- **Eribulin[9]**
  - 1.4 mg/m² IV Days 1 and 8; cycled every 21 days
- **Vinorelbine[10,11]**
  - 25 mg/m² IV Day 1 weekly; or
  - *25–30 mg/m² IV days 1, 8, cycled every 21 days; or*
  - *60–80 mg/m² PO day 1 weekly*
  - 20–35 mg/m² IV Days 1 and 8; cycled every 21 days; or
  - 25–30 mg/m² IV Days 1, 8, and 15; cycled every 28 days

- **For TNBC and germline *BRCA1* and/ or *BRCA2* PV carrier:**
  - Carboplatin[12] AUC 6 IV on Day 1
    - ◊ Cycled every 21–28 days
  - *Carboplatin AUC 2 IV on day 1 weekly*
  - Cisplatin[13] 75 mg/m² IV on Day 1
    - ◊ Cycled every 21 days
- **Cyclophosphamide[14]**
  - 50 mg PO daily on Days 1–21
  - Cycled every 28 days
- **Datopotamab deruxtecan-dlnk[15]**
  - 6 mg/kg IV Day 1
  - Cycled every 21 days
- **Docetaxel[16,17]**
  - 60–100 mg/m² IV Day 1
  - Cycled every 21 days
- **Docetaxel[18]**
  - 35 mg/m² IV weekly for 6 weeks followed by a 2-week rest, then repeat
- **Albumin-bound Paclitaxel[19,20]**
  - 100 mg/m²
    or 125 mg/m² IV Days 1, 8, and 15
  - Cycled every 28 days
- **Albumin-bound Paclitaxel[19]**
  - 260 mg/m² IV Day 1
  - Cycled every 21 days
- **Epirubicin[21]**
  - 60–90 mg/m² IV Day 1
  - Cycled every 21 days
- **Ixabepilone[22]**
  - 40 mg/m² IV Day 1
  - Cycled every 21 days

- **Sacituzumab govitecan-hziy[23,24]**
  - 10 mg/kg IV on Days 1 and 8
  - Cycled every 21 days
- **Sacituzumab govitecan-hziy + Pembrolizumab[nn,25]**
  - Sacituzumab govitecan-hziy 10 mg/kg IV Days 1 and 8
  - Pembrolizumab 200 mg IV Day 1
    - ◊ Cycled every 21 days
- **Fam-trastuzumab deruxtecan-nxki[26]**
  - 5.4 mg/kg IV Day 1
  - Cycled every 21 days
- **AC[28]**
  - Doxorubicin 60 mg/m² IV Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 21 days
- **EC[29]**
  - Epirubicin 75 mg/m² IV Day 1
  - Cyclophosphamide 600 mg/m² IV Day 1
    - ◊ Cycled every 21 days
- **CMF[30]**
  - Cyclophosphamide 100 mg/m² PO daily on Days 1–14
  - Methotrexate 40 mg/m² IV Days 1 and 8
  - Fluorouracil 600 mg/m² IV Days 1 and 8
    - ◊ Cycled every 28 days
- **Capecitabine/Docetaxel[31]**
  - Capecitabine 950 mg/m² PO twice daily on Days 1–14
  - Docetaxel 75 mg/m² IV Day 1
    - ◊ Cycled every 21 days

- **GT[32]**
  - Gemcitabine 1250 mg/m² IV Days 1 and 8 (following paclitaxel on Day 1)
  - Paclitaxel 175 mg/m² IV Day 1
    - ◊ Cycled every 21 days
- **Carboplatin/Gemcitabine[32]**
  - Carboplatin AUC 2 IV on Days 1 and 8
  - Gemcitabine 1000 mg/m² IV on Days 1 and 8
    - ◊ Cycled every 21 days
- **Albumin-bound Paclitaxel/ Carboplatin[33]**
  - Albumin-bound Paclitaxel 125 mg/m² IV on Days 1 and 8
  - Carboplatin AUC 2 IV on Days 1 and 8
  - Cycled every 21 days
- **Carboplatin/Paclitaxel[34,35]**
  - Carboplatin AUC 6 IV Day 1
  - Paclitaxel 175–200 mg/m² IV Day 1
  - Cycled every 21 days
    or
  - Carboplatin AUC 2 IV Days 1, 8, and 15
  - Paclitaxel 100 *80* mg/m² IV Days 1, 8, and 15
  - Cycled every 28 days

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[nn] Pembrolizumab 400 mg or 4 mg/kg every 42 days may be given instead of pembrolizumab 200 mg every 21 days in this regimen.

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DOSING: CYTOTOXIC REGIMENS FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

HER2-Positive Regimens:

- **Docetaxel + Pertuzumab + Trastuzumab**[36]
  - Docetaxel 75–100 mg/m² IV Day 1
    - ◊ Cycled every 21 days
  - Pertuzumab 840 mg IV Day 1 followed by 420 mg IV
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV Day 1 every 21 days

- **Paclitaxel + Pertuzumab + Trastuzumab**[37,38]
  - Paclitaxel 80 mg/m² IV Day 1 weekly[37] or
  - Paclitaxel 175 mg/m² IV Day 1
    - ◊ Cycled every 21 days
  - Pertuzumab 840 mg IV Day 1 followed by 420 mg IV
    - ◊ Cycled every 21 days
  - Trastuzumab 4 mg/kg IV Day 1 followed by 2 mg/kg IV weekly
    or
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV Day 1 every 21 days[39]

- **Capecitabine/Tucatinib + Trastuzumab**[39]
  - Capecitabine 1000 mg/m² PO twice daily on Days 1–14
  - Tucatinib 300 mg PO twice daily on Days 1–21
  - Trastuzumab 8 mg/kg IV day 1 followed by 6 mg/kg IV Day 1 every 21 days
  - Cycled every 21 days

- **T-DM1**[40]
  - 3.6 mg/kg IV Day 1
    - ◊ Cycled every 21 days

- **Fam-trastuzumab deruxtecan-nxki**[41]
  - 5.4 mg/kg IV Day 1
    - ◊ Cycled every 21 days

- **Fam-trastuzumab deruxtecan-nxki + Pertuzumab**[27]
  - Fam-trastuzumab deruxtecan-nxki 5.4 mg/kg IV Day 1
  - Cycled every 21 days
  - With Pertuzumab 840 mg IV Day 1 followed by 420 mg IV
    - ◊ Cycled every 21 days

- **Carboplatin/Paclitaxel + Trastuzumab**[42]
  - Carboplatin AUC 6 IV Day 1
  - Paclitaxel 175 mg/m² IV Day 1
    - ◊ Cycled every 21 days
  - ~~Trastuzumab 4 mg/kg IV Day 1 followed by 2 mg/kg IV weekly~~
    or
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV Day 1 every 21 days[38]

- **Carboplatin/Paclitaxel Weekly + Trastuzumab**[43]
  - Carboplatin AUC 2 IV Days 1, 8, and 15
  - Paclitaxel 80 mg/m² IV Days 1, 8, and 15
    - ◊ Cycled every 28 days
  - ~~Trastuzumab 4 mg/kg IV Day 1 followed by 2 mg/kg IV weekly~~
    or
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV day 1 every 21 days[38]

- **Paclitaxel + Trastuzumab**[44,45]
  - Paclitaxel 175 mg/m² IV Day 1 cycled every 21 days[44]
    or
  - Paclitaxel 80–90 mg/m² IV Day 1 weekly[46]
  - ~~Trastuzumab 4 mg/kg IV Day 1 followed by 2 mg/kg IV weekly~~
    or
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV day 1 every 21 days[38]

- **Docetaxel + Trastuzumab**[46-48]
  - Docetaxel 80–100 mg/m² IV Day 1 cycled every 21 days[46]
    or
  - Docetaxel 35 mg/m² IV Days 1, 8, and 15 weekly cycled every 28 days[48]
  - ~~Trastuzumab 4 mg/kg IV Day 1 followed by 2 mg/kg IV weekly~~
    or
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV day 1 every 21 days[38]

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DOSING: CYTOTOXIC REGIMENS FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

HER2-Positive Regimens (continued):

- **Vinorelbine + Trastuzumab**[11,47,49]
  - Vinorelbine
    - ◊ 25 mg/m² IV Day 1 weekly; or
    - ◊ 20–*30*–35 mg/m² IV Days 1 and 8; cycled every 21 days; or
    - ◊ 25–30 mg/m² IV Days 1, 8, and 15; cycled every 28 days
  - Trastuzumab 4 mg/kg IV Day 1 followed by 2 mg/kg IV weekly
    or
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV Day 1 every 21 days[38]

- **Capecitabine + Trastuzumab**[50-52]
  - Capecitabine 1000–1250 mg/m² PO twice daily on Days 1–14 cycled every 21 days
  - Trastuzumab 4 mg/kg IV Day 1 followed by 2 mg/kg IV weekly[44,51]
    or
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV day 1 every 21 days[36,38]

- **Capecitabine/Lapatinib**[53]
  - Capecitabine 1000 mg/m² PO twice daily on Days 1–14
  - Lapatinib 1250 mg PO daily on Days 1–21
    - ◊ Cycled every 21 days

- **Lapatinib + Trastuzumab**[54]
  - Lapatinib 1000 mg PO daily for 21 days
  - Trastuzumab 4 mg/kg IV Day 1 followed by 2 mg/kg IV weekly
    or
  - Trastuzumab 8 mg/kg IV Day 1 followed by 6 mg/kg IV day 1 every 21 days[38]

- **Capecitabine/Neratinib**[55]
  - Capecitabine 750 mg/m² PO twice daily on Days 1–14
  - Neratinib 240 mg PO daily on Days 1–21
    - ◊ Cycled every 21 days

  or
  - Capecitabine 750 mg/m² PO twice daily on Days 1–14
  - Neratinib
    - ◊ 120 mg PO daily on Days 1–7; followed by
    - ◊ 160 mg PO daily on Days 8–14; followed by
    - ◊ 240 mg PO daily on Days 15–21
    - ◊ Cycled every 21 days x 1 cycle

  Followed by
  - Capecitabine 750 mg/m² PO twice daily on Days 1–14
  - Neratinib 240 mg PO daily on Days 1–21
    - ◊ Cycled every 21 days beginning with cycle 2

- **Capecitabine + Margetuximab-cmkb**[56]
  - Capecitabine 1000 mg/m² PO twice daily on Days 1–14
  - Margetuximab 15 mg/kg IV Day 1
    - ◊ Cycled every 21 days

- **Eribulin + Margetuximab-cmkb**[56]
  - Eribulin 1.4 mg/m² IV Days 1 and 8
  - Margetuximab 15 mg/kg IV Day 1
    - ◊ Cycled every 21 days

- **Gemcitabine + Margetuximab-cmkb**[56]
  - Gemcitabine 1000 mg/m² IV Days 1 and 8
  - Margetuximab 15 mg/kg IV Day 1
    - ◊ Cycled every 21 days

- **Vinorelbine + Margetuximab-cmkb**[56]
  - Vinorelbine 25–30 mg/m² IV Days 1 and 8
  - Margetuximab 15 mg/kg IV Day 1
    - ◊ Cycled every 21 days

See dosing for targeted therapies on BINV-Q 14 of 15

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DOSING: TARGETED THERAPIES AND ASSOCIATED BIOMARKER TESTING FOR RECURRENT UNRESECTABLE (LOCAL OR REGIONAL) OR STAGE IV (M1) DISEASE

- **Alpelisib/Fulvestrant**[1]
  - Alpelisib 300 mg PO daily on Days 1–28; fulvestrant 500 mg IM on Days 1 and 15
    - ◊ 28-day cycle for 1 cycle
  - Followed by Alpelisib 300 mg PO daily on Days 1–28; Fulvestrant 500 mg IM on Day 1
    - ◊ Cycled every 28 days
- **Capivasertib/Fulvestrant**[2]
  - Capivasertib 400 mg PO twice daily on Days 1–4, 8–11, 15–18, 22–25
  - Fulvestrant 500 mg IM Day 1 and Day 15
    - ◊ Cycled every 28 days for 1 cycle
  - Followed by
  - Capivasertib 400 mg PO twice daily on Days 1–4, 8–11, 15–18, 22–25
  - Fulvestrant 500 mg IM day 1 starting with cycle 2
    - ◊ Cycled every 28 days
- **Dostarlimab-gxly**[3]
  - 500 mg IV on Day 1
    - ◊ Cycled every 21 days for cycles 1–4
  - Followed by 1000 mg IV on Day 1 of cycle 5
    - ◊ Cycled every 42 days starting with cycle 5
- **Elacestrant**[4]
  - 345 mg PO daily on days 1-28
    - ◊ Cycled every 28 days
- **Entrectinib**[5]
  - 600 mg PO daily on Days 1–28
    - ◊ Cycled every 28 days
- **Imlunestrant**[6]
  - 400mg PO daily on Days 1–28
    - ◊ Cycled every 28 days
- **Imlunestrant + Abemaciclib**[6]
  - Abemaciclib 150 mg PO twice daily on Days 1–28
  - Imlunestrant 400 mg PO daily on Days 1–28
  - Cycled every 28 days
- **Fulvestrant/Inavolisib/Palbociclib**[7]
  - Fulvestrant 500 mg IM on Days 1 and 15
  - Inavolisib 9 mg PO daily on Days 1–28
  - Palbociclib 125 mg PO daily on Days 1–21
    - ◊ 28-day cycle for 1 cycle
  - Followed by
  - Fulvestrant 500 mg IM on Day 1
  - Inavolisib 9 mg PO daily on Days 1–28
  - Palbociclib 125 mg PO daily on Days 1–21
    - ◊ 28-day cycle
- **Larotrectinib**[8]
  - 100 mg PO twice daily on Days 1–28
    - ◊ Cycled every 28 days
- **Olaparib**[9] **tablet**
  - 300 mg PO twice daily on Days 1–28
    - ◊ Cycled every 28 days
- **Pembrolizumab**[nn,10-13]
  200 mg IV on Day 1, every 21 days until disease progression or unacceptable toxicity, or up to 24 months
  or
  - 400 mg IV on Day 1, every 6 weeks until disease progression or unacceptable toxicity, or up to 24 months
- **Chemotherapy (Albumin-bound Paclitaxel, Carboplatin/Gemcitabine, or Paclitaxel) + Pembrolizumab**[14]
  - Albumin-bound Paclitaxel 100 mg/m^2 Days 1, 8, and 15 (given every 28 days)
  - or
  - Paclitaxel 90 mg/m^2 IV Days 1, 8, and 15 (given every 28 days)
  - Pembrolizumab 200 mg IV or 2 mg/kg Day 1 (given every 21 days)
  - or
  - Carboplatin AUC 2 IV Days 1 and 8
  - Gemcitabine 1000 mg/m^2 IV Days 1 and 8
  - Pembrolizumab 200 mg IV or 2 mg/kg Day 1
    - ◊ Given every 21 days
- **Repotrectinib**[15]
  - 160 mg PO once daily on Days 1–14;
  - Followed by
  - 160 mg PO twice daily on Days 15–28
  - Cycled every 28 days x 1 cycle
  - Followed by
  - Repotrectinib 160 mg PO twice daily on Days 1–28
    - ◊ Cycled every 28 days
- **Selpercatinib**[16]
  - Patients <50 kg: 120 mg PO twice daily on Days 1–28
  - Patients ≥50 kg: 160 mg PO twice daily on Days 1–28
    - ◊ Cycled every 28 days
- **Talazoparib**[17] **tablet**
  - 1 mg PO daily on Days 1–28
    - ◊ Cycled every 28 days

[nn] Pembrolizumab 400 mg or 4 mg/kg every 42 days may be given instead of pembrolizumab 200 mg every 21 days in this regimen.

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PRINCIPLES OF MONITORING METASTATIC DISEASE

Monitoring of patient symptoms and cancer burden during treatment of metastatic breast cancer is important to determine whether the treatment is providing benefit and that the patient does not have toxicity from an ineffective therapy.

Components of Monitoring

Monitoring includes periodic assessment of varied combinations of symptoms, physical examination, routine laboratory tests, imaging studies, and blood biomarkers where appropriate. Results of monitoring are classified as response/continued response to treatment, stable disease, uncertainty regarding disease status, or progression of disease. The clinician typically must assess and balance multiple different forms of information to make a determination regarding whether disease is being controlled and the toxicity of treatment is acceptable. Sometimes, this information may be contradictory. Clinicians should take into account patient preferences through a shared decision-making process.

Definition of Disease Progression

Unequivocal evidence of progression of disease by one or more of these factors is required to establish progression of disease, either because of ineffective therapy or acquired resistance of disease to an applied therapy. Progression of disease may be identified through evidence of growth or worsening of disease at previously known sites of disease and/or of the occurrence of new sites of metastatic disease.

- Findings concerning for progression of disease include:
  - Worsening symptoms such as pain or dyspnea
  - Evidence of worsening or new disease on physical examination
  - Declining performance status
  - Unexplained weight loss
  - Increasing alkaline phosphatase, alanine aminotransferase (ALT), aspartate aminotransferase (AST), or bilirubin
  - Hypercalcemia
  - New radiographic abnormality or increase in the size of pre-existing radiographic abnormality
  - New areas of abnormality on functional imaging (eg, bone scan, PET/CT)
  - Increasing tumor markers (eg, carcinoembryonic antigen [CEA], CA 15-3, CA 27.29)[a]

[a] Rising tumor markers (eg, CEA, CA 15-3, CA 27.29) are concerning for tumor progression, but may also be seen in the setting of responding disease. An isolated increase in tumor markers should rarely be used to declare progression of disease. Changes in bone lesions are often difficult to assess on plain or cross-sectional radiology or on bone scan. For these reasons, patient symptoms and serum tumor markers may be more helpful in patients with bone-dominant metastatic disease.

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PRINCIPLES OF MONITORING METASTATIC DISEASE

Use of Objective Criteria for Response/Stability/Progression

- The most accurate assessments of disease activity typically occur when previously abnormal studies are repeated on a serial and regular basis. Generally, the same method of assessment should be used over time (eg, an abnormality found on chest CT should generally be monitored with repeat chest CT).
- Some non-clinically important variation in measurement of abnormalities by all serial studies is common and expected. Therefore, the use of objective and widely accepted criteria for response, stability, and progression of disease are encouraged. Such systems include the Response Evaluation Criteria In Solid Tumors (RECIST) guidelines (Eisenhauer EA, Therasse P, Bogaerts J, et al. New response evaluation criteria in solid tumours: revised RECIST guideline [version 1.1]. Eur J Cancer 2009;45:228-247) ~~and the WHO criteria (Miller AB, Hoogstraten B, Staquet M, Winkler A. Reporting results of cancer treatment. Cancer 1981;47:207-214)~~.
- Studies of functional imaging, such as radionuclide bone scans and PET imaging, are particularly challenging when used to assess response. In the case of bone scans, responding disease may result in a flare or increased activity on the scan that may be misinterpreted as disease progression, especially on the first follow-up bone scan after initiating a new therapy. PET imaging is challenging because of the absence of a reproducible, validated, and widely accepted set of standards for disease activity assessment.

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PRINCIPLES OF MONITORING METASTATIC DISEASE

Frequency of Monitoring

The optimal frequency of repeat testing is uncertain, and is primarily based on the monitoring strategies utilized in breast cancer clinical trials. The frequency of monitoring must balance the need to detect progressive disease, avoid unnecessary toxicity of any ineffective therapy, resource utilization, and determine cost. The following table is to provide guidance, and should be modified for the individual patient based on sites of disease, biology of disease, and treatment regimen. Reassessment of disease activity should be performed in patients with new or worsening signs or symptoms of disease, regardless of the time interval from previous studies.

Suggested Intervals of Follow-up for Patients with Metastatic Disease[b]

	Baseline Prior to New Therapy	Chemotherapy or Targeted Therapy	Endocrine Therapy Alone or in Combination with CDK 4/6 Inhibitor or Other Targeted Therapy	Restaging if Concern for Progression of Disease
Symptom Assessment	Yes	Prior to each cycle	Every 1–3 months	Yes
Physical Examination	Yes	Prior to each cycle	Every 1–3 months	Yes
Performance Status	Yes	Prior to each cycle	Every 1–3 months	Yes
Weight	Yes	Prior to each cycle	Every 1–3 months	Yes
LFTs, CBC	Yes	Prior to each cycle, as indicated	Every 1–3 months	Yes
CT Chest/Abdomen/ Pelvis with Contrast	Yes	Every 2–4 cycles	Every 2–6 months	Yes
Bone Scan	~~Yes~~ *As clinically indicated*	Every 4–6 cycles	Every 2–6 months	~~Yes~~ *As clinically indicated*
PET/CT	As clinically indicated	As clinically indicated	As clinically indicated	As clinically indicated
Tumor Markers	As clinically indicated	As clinically indicated	As clinically indicated	As clinically indicated
Brain MRI with Contrast	As clinically indicated	As clinically indicated	As clinically indicated	As clinically indicated

[b] In patients who have long-term stable disease, the frequency of monitoring can be reduced.

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Phyllodes Tumor

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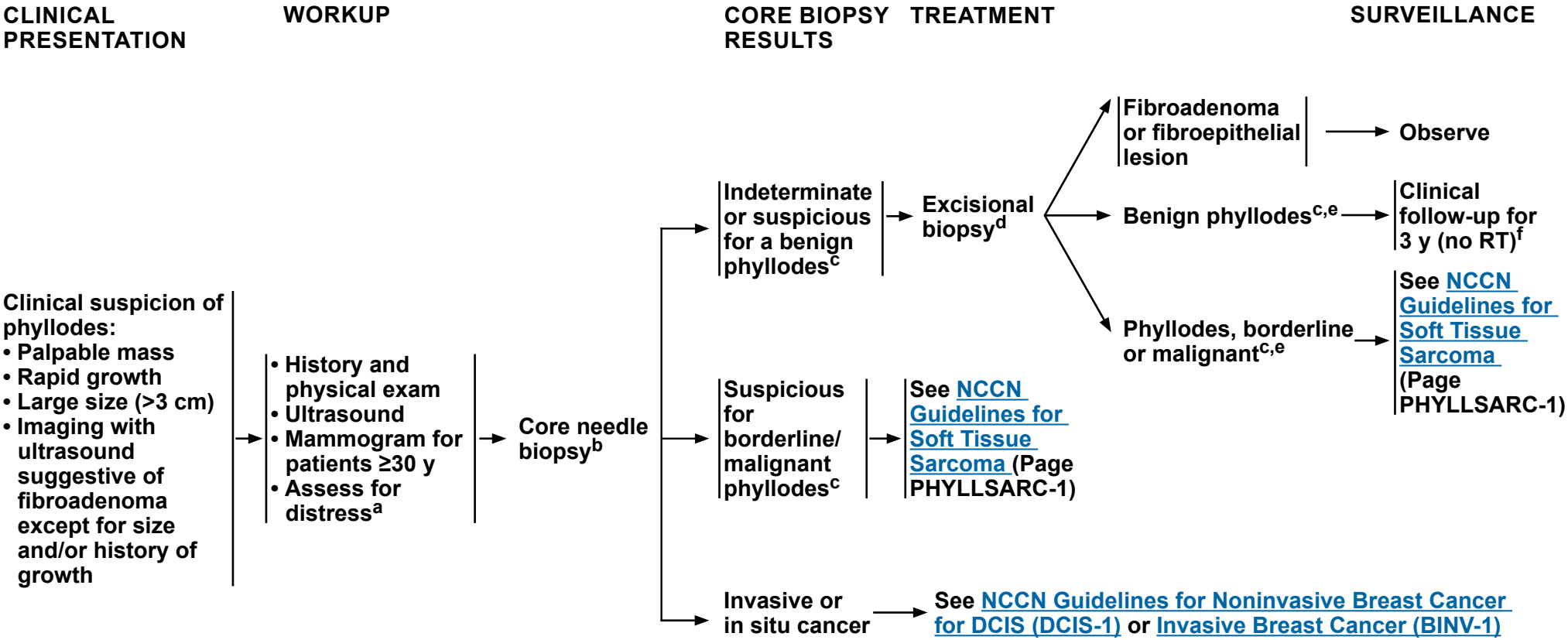

[a] Refer to the NCCN Guidelines for Distress Management (DIS-A) for the NCCN Distress Thermometer and Problem List, which includes social determinants of health.

[b] FNA or core biopsy may not distinguish a fibroadenoma from a phyllodes tumor in some cases. The sensitivity of core biopsy for the diagnosis of phyllodes tumor is greater than that of FNA biopsy, but neither core biopsy nor FNA biopsy can always differentiate phyllodes tumors from fibroadenomas. In cases with clinical suspicion for phyllodes tumor, excision of the lesion may be needed for definitive pathologic classification.

[c] Genetic counseling and testing if patient is at risk for hereditary cancer syndromes, particularly breast, ovarian, and pancreatic cancer.

[d] Excisional biopsy includes complete mass removal, but without the intent of obtaining surgical margins.

[e] The Panel endorses the College of American Pathologists Protocol for standardized pathology reporting for all phyllodes tumors (https://documents.cap.org/protocols/Breast.Phyllodes_1.1.0.1.REL_CAPCP.pdf).

[f] Adjuvant RT is not indicated for positive margins.

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NCCN Guidelines for Poland
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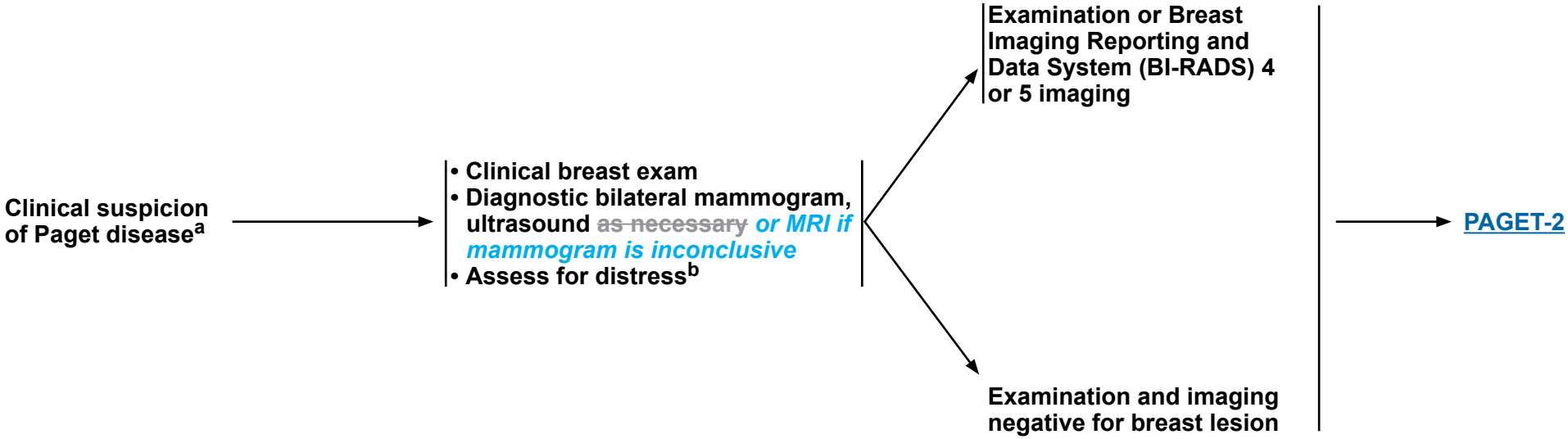
Paget Disease

CLINICAL PRESENTATION

WORKUP



[a] Nipple or areolar eczema, ulceration, bleeding, or itching.
[b] Refer to the NCCN Guidelines for Distress Management (DIS-A) for the NCCN Distress Thermometer and Problem List, which includes social determinants of health.

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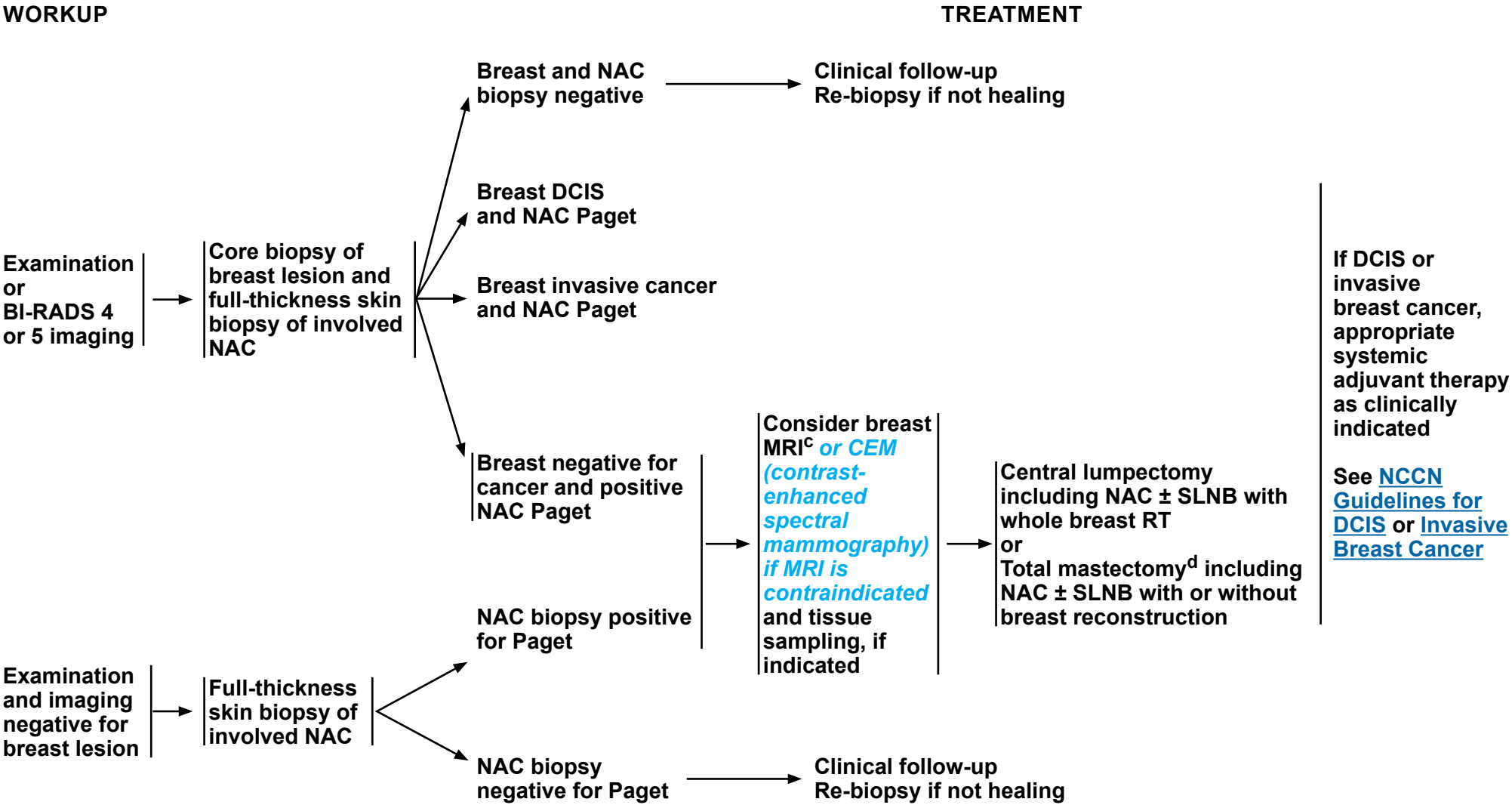

[c] Principles of Dedicated Breast MRI Testing (BINV-B).
[d] Mastectomy is always an option with any manifestation of Paget disease (Discussion).

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NCCN Guidelines for Poland
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Breast Cancer During Pregnancy

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WORKUP

If indicated[a]:
- **Chest x-ray (with abdominal shielding) *if requested by anesthesiologist***
- **Abdominal ultrasound to assess liver metastases**
- **Consider non-contrast MRI of spine if indicated to assess for bone metastases**

Assess for distress[b]

CLINICAL PRESENTATION

If pregnant with confirmed breast cancer; No distant metastases on staging

PRIMARY TREATMENT

First trimester[c] → **Discuss termination: Non-therapeutic** → **Continuing pregnancy** → **Mastectomy[d] *or BCS*** **+ axillary staging (see PREG-2)**

Second trimester/ Early third trimester → **Mastectomy or BCS[d] + axillary staging (see PREG-2)**

or

Preoperative chemotherapy, mastectomy, or BCS[d] + axillary staging (see PREG-2)

Late third trimester → **Mastectomy[c] or *defer* BCS[d] + axillary staging *until the postpartum period*** **(see PREG-2)***

ADJUVANT TREATMENT

Begin adjuvant chemotherapy in second trimester
± RT postpartum
± Adjuvant endocrine therapy postpartum
(see PREG-2)

Adjuvant chemotherapy
± RT postpartum
± Adjuvant endocrine therapy postpartum
(see PREG-2)

± RT postpartum
± Adjuvant endocrine therapy postpartum
(see PREG-2)

Adjuvant chemotherapy
± RT postpartum
± Adjuvant endocrine therapy postpartum
(see PREG-2)

** Premature pregnancy termination is not recommended; surgical treatment may be postponed in the late third trimester in selected cases.*

[a] CT scans and nuclear imaging (bone scan or PET/CT) and contrast-enhanced MRI are contraindicated during pregnancy.

[b] Refer to the NCCN Guidelines for Distress Management (DIS-A) for the NCCN Distress Thermometer and Problem List, which includes social determinants of health.

[c] If late first trimester, may consider preoperative chemotherapy in the second trimester.

[d] Survival outcomes of breast-conservation therapy are equivalent to mastectomy in both non-pregnancy and pregnancy-associated breast cancers. Therapeutic RT is generally avoided during pregnancy due to potential risks to the fetus. Mastectomy may be preferred, particularly for early (first trimester) gestational diagnosis, as early BCS may preclude timely administration of RT. Generally, intervals of 12–16 weeks between treatment modalities (surgery, RT, and chemotherapy) are considered acceptable.

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GENERAL CONSIDERATIONS FOR MANAGEMENT OF BREAST CANCER DURING PREGNANCY[1-3]

General Considerations

- Considerations and selection of optimal local therapy and systemic therapy are similar to that recommended in non–pregnancy-associated breast cancer.
- The selection and timing of chemotherapy, endocrine therapy, and RT are different for pregnancy-associated breast cancer compared to non–pregnancy-associated breast cancer.
- BCS during the first trimester of pregnancy can be considered in those who will require adjuvant chemotherapy and can have adjuvant RT delayed until after delivery.
- Chemotherapy should not be administered during the first trimester of pregnancy.
- RT should not be administered during any trimester of pregnancy.
- Coordination is recommended between the oncology and obstetrics teams to plan the optimal timing of systemic therapy administration during pregnancy.
- Considerations for postpartum chemotherapy are the same as for non–pregnancy-associated breast cancer.

Considerations for Systemic Therapy

- A fetal examination with ultrasound should be performed prior to systemic therapy administration to exclude pre-existing abnormalities.
- Standard-dose chemotherapy should be used based on actual weight.
- Anthracycline, cyclophosphamide, and taxanes appear to be safe during the second and third trimesters.
  - Doxorubicin/cyclophosphamide every 3 weeks is preferred. Limited data suggest that dd AC with granulocyte colony-stimulating factor (G-CSF) use during pregnancy appears to be safe.
  - Weekly paclitaxel is preferred.
- Avoid chemotherapy after 35 weeks to allow maternal bone marrow to recover before the delivery.
- The following agents are ***contraindicated***:
  - Anti-HER2 therapies: trastuzumab, pertuzumab, ado-trastuzumab emtansine, fam-trastuzumab-deruxtecan-nxki, neratinib, lapatinib, tucatinib
  - CDK4/6 inhibitors (there are no data on safety)
  - Antibody-drug conjugates (ADCs): fam trastuzumab-deruxtecan-nxki, datopotamab deruxtecan-dlnk, sacituzumab govitecan-hziy
  - Endocrine therapy: tamoxifen, aromatase inhibitor, gonadotropin-releasing hormone agonists/antagonists
  - PARP inhibitors
  - Immune checkpoint inhibitors

Supportive Care Considerations

- Antiemetics: Ondansetron and metoclopramide are considered safe.
- NK1 inhibitors: Avoid using these, as data from human studies are lacking.
- Steroids:
  - Methylprednisolone, prednisolone, or hydrocortisone are preferred.
  - Avoid dexamethasone or betamethasone if possible.
- G-CSF: Use with caution. There are insufficient data to support G-CSF use, but it appears to be safe during pregnancy.

[1] Kesireddy M, Krishnamurthy J. Pregnancy-associated breast cancer: Key concepts for optimizing diagnosis and treatment. JCO Oncol Pract 2025;21:275-277.
[2] Poggio F, Tagliamento M, Pirrone C, et al. Update on the management of breast cancer during pregnancy. Cancers 2020;12:3616.
[3] Boere I, Lok C, Poortmans P, et al. Breast cancer during pregnancy: epidemiology, phenotypes, presentation during pregnancy and therapeutic modalities. Best Pract Res Clin Obstet Gynaecol 2022;82:46-59.

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NCCN Guidelines for Poland
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Inflammatory Breast Cancer

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CLINICAL PRESENTATION[a]

Clinical pathologic diagnosis of IBC →

WORKUP

- **History and physical exam by multidisciplinary team and obtain medical photography**
- **CBC**
- **Comprehensive metabolic panel, including LFTs and alkaline phosphatase**
- **Pathology review[b]**
- **Determination of tumor ER/PR status and HER2 status[c]**
- **Fertility counseling if premenopausal[d]**
- **Genetic counseling if patient is at risk[e] for hereditary breast cancer**
- **Assess for distress[f]**
- **Imaging:**
  - **Bilateral diagnostic mammogram, ultrasound as necessary**
  - **Chest diagnostic CT ± contrast**
  - **Abdomen ± pelvis diagnostic CT with contrast or MRI with contrast**
  - **Bone scan or FDG-PET/CT *(as an alternative to chest, abdominal, pelvic and bone imaging)*[g,h]**
  - **Breast MRI (optional)**

→ **Preoperative/Adjuvant Therapy Regimens (BINV-L)[i]** → **See IBC-2**

[a] IBC is characterized by:
1) Rapid onset (≤6 months) of erythema, edema, p'eau d'orange occupying ≥1/3 of the breast, with or without a palpable mass.
2) Pathologic confirmation of invasive breast cancer.
3) Dermal lymphatic involvement may be seen but is not required for the diagnosis.

[b] The Panel endorses the College of American Pathologists Protocol for pathology reporting for all invasive and noninvasive carcinomas of the breast. http://www.cap.org.

[c] Principles of Biomarker Testing (BINV-A).

[d] Fertility, Birth Control, and Sexual Health (BINV-C).

[e] For risk criteria, see NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, Pancreatic, and Prostate.

[f] Refer to the NCCN Guidelines for Distress Management (DIS-A) for the NCCN Distress Thermometer and Problem List, which includes social determinants of health.

[g] If FDG-PET/CT is performed and clearly indicates bone metastasis on both the PET and CT component, bone scan or sodium fluoride PET/CT may not be needed.

[h] FDG-PET/CT can be performed at the same time as diagnostic CT. FDG-PET/CT is most helpful in situations where standard staging studies are equivocal or suspicious. FDG-PET/CT may also be helpful in identifying unsuspected regional nodal disease and/or distant metastases when used in addition to standard staging studies.

[i] A pertuzumab-containing regimen may be administered preoperatively to patients with HER2-positive IBC.

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RESPONSE TO PREOPERATIVE THERAPY | **TREATMENT[k]**

Response[j] → **Total mastectomy (skin-sparing and nipple-sparing mastectomy are contraindicated) + level I/II axillary dissection + RT to chest wall and comprehensive RNI with inclusion of any portion of the undissected axilla at risk ± delayed breast reconstruction[l]** →

- **Complete planned cytotoxic regimen course if not completed preoperatively plus endocrine treatment if ER-positive and/or PR-positive (sequential chemotherapy followed by endocrine therapy).[o]**
- **Complete up to one year of HER2-targeted therapy if HER2-positive (category 1). May be administered concurrently with RT[p] and with endocrine therapy if indicated.**

No response[j] → **Consider additional cytotoxic chemotherapy[m,n] and/or preoperative radiation** → **Patients may be candidates for multiple lines of cytotoxic therapy to palliate advanced breast cancer. At each reassessment clinicians should assess value of ongoing treatment, the risks and benefits of an additional line of cytotoxic therapy, patient performance status, and patient preferences through a shared decision-making process.**

- **Response[j]** → **See above pathway**
- **No response[j]** → **Individualized treatment**

[j] The accurate assessment of in-breast tumor or regional lymph node response to preoperative systemic therapy is difficult, and should include physical examination and performance of imaging studies (mammogram and/or breast ultrasound and/or breast MRI) that were abnormal at the time of initial tumor staging. Selection of imaging methods prior to surgery should be determined by the multidisciplinary team. ~~MRI is more accurate than mammography for assessing tumor response to preoperative therapy.~~

[k] Patients with recurrent IBC should be treated according to the guideline for recurrence/stage IV (M1) disease (BINV-19).

[l] Principles of Breast Reconstruction Following Surgery (BINV-H).

[m] Cytotoxic Therapy Regimens for Recurrent Unresectable (Local or Regional) or Stage IV (M1) Disease (BINV-Q).

[n] Cytotoxic therapy includes chemotherapy or ADCs, or targeted therapy.

[o] Adjuvant Endocrine Therapy (BINV-K).

[p] Principles of Radiation Therapy (BINV-I).

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American Joint Committee on Cancer (AJCC)
TNM Staging System For Breast Cancer

Primary Tumor (T) The T category of the primary tumor is defined by the same criteria regardless of whether it is based on clinical or pathological criteria, or both. The T category is based primarily on the size of the invasive component of the cancer. The maximum size of a tumor focus is used as an estimate of disease volume. The largest contiguous dimension of a tumor focus is used, and small satellite foci of noncontiguous tumor are not added to the size. The cellular fibrous reaction to invasive tumor cells is generally included in the measurement of a tumor prior to treatment; however, the dense fibrosis observed following neoadjuvant treatment is generally not included in the pathological measurement because its extent may overestimate the residual tumor volume. The clinical size of a primary tumor (T) can be measured based on clinical findings (physical examination and imaging modalities, such as mammography, ultrasound, and MR imaging) and pathological findings (gross and microscopic measurements). Clinical tumor size (cT) should be based on the clinical findings that are judged to be most accurate for a particular case, although it may still be somewhat inaccurate because the intent of some breast cancers is not always apparent with current imaging techniques and because tumors are composed of varying proportions of noninvasive and invasive disease, which these techniques are currently unable to distinguish. Size should be measured to the nearest millimeter. If the tumor size is slightly less than or greater than a cutoff for a given T classification the size should be rounded to the millimeter reading that is closest to the cutoff. For example, a reported size of 4.9 mm is reported as 5 mm, or a size of 2.04 cm is reported as 2.0 cm (20 mm). The exception to this rounding rule is for a breast tumor sized between 1.0 and 1.4 mm. These sizes are rounded up to 2 mm, because rounding down would result in the cancer's being categorized as microinvasive carcinoma (T1mi) defined as a size of 1.0 mm or less.

Table 1. **Definitions for T, N, M**

TX	Primary tumor cannot be assessed
T0	No evidence of primary tumor
Tis (DCIS)*	Ductal carcinoma *in situ*
Tis (Paget)	Paget disease of the nipple NOT associated with invasive carcinoma and/or carcinoma *in situ* (DCIS) in the underlying breast parenchyma. Carcinomas in the breast parenchyma associated with Paget disease are categorized based on the size and characteristics of the parenchymal disease, although the presence of Paget disease should still be noted
T1	Tumor ≤20 mm in greatest dimension
T1mi	Tumor ≤1 mm in greatest dimension
T1a	Tumor >1 mm but ≤5 mm in greatest dimension (round any measurement >1.0–1.9 mm to 2 mm)
T1b	Tumor >5 mm but ≤10 mm in greatest dimension
T1c	Tumor >10 mm but ≤20 mm in greatest dimension
T2	Tumor >20 mm but ≤50 mm in greatest dimension
T3	Tumor >50 mm in greatest dimension
T4	Tumor of any size with direct extension to the chest wall and/or to the skin (ulceration or macroscopic nodules); invasion of the dermis alone does not qualify as T4
T4a	Extension to the chest wall; invasion or adherence to pectoralis muscle in the absence of invasion of chest wall structures does not qualify as T4
T4b	Ulceration and/or ipsilateral macroscopic satellite nodules and/or edema (including peau d'orange) of the skin that does not meet the criteria for inflammatory carcinoma
T4c	Both T4a and T4b are present
T4d	Inflammatory carcinoma

*Note: Lobular carcinoma *in situ* (LCIS) is a benign entity and is removed from TNM staging in the AJCC Cancer Staging Manual, 8th Edition.

Continued

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Table 1. **Definitions for T, N, M (continued)**

Regional Lymph Nodes (N)

Clinical (cN)

cNX*	Regional lymph nodes cannot be assessed (e.g., previously removed)
cN0	No regional lymph node metastases (by imaging or clinical examination)
cN1	Metastases to movable ipsilateral level I, II axillary lymph node(s)
cN1mi**	Micrometastases (approximately 200 cells, larger than 0.2 mm, but none larger than 2.0 mm)
cN2	Metastases in ipsilateral level I, II axillary lymph nodes that are clinically fixed or matted; *or* in ipsilateral internal mammary nodes in the absence of axillary lymph node metastases
cN2a	Metastases in ipsilateral level I, II axillary lymph nodes fixed to one another (matted) or to other structures
cN2b	Metastases only in ipsilateral internal mammary nodes in the absence of axillary lymph node metastases
cN3	Metastases in ipsilateral infraclavicular (level III axillary) lymph node(s) with or without level I, II axillary lymph node involvement; *or* in ipsilateral internal mammary lymph node(s) with level I, II axillary lymph node metastases; *or* metastases in ipsilateral supraclavicular lymph node(s) with or without axillary or internal mammary lymph node involvement
cN3a	Metastases in ipsilateral infraclavicular lymph node(s)
cN3b	Metastases in ipsilateral internal mammary lymph node(s) and axillary lymph node(s)
cN3c	Metastases in ipsilateral supraclavicular lymph node(s)

Note: (sn) and (f) suffixes should be added to the N category to denote confirmation of metastasis by sentinel node biopsy or fine needle aspiration/core needle biopsy respectively.
*The cNX category is used sparingly in cases where regional lymph nodes have previously been surgically removed or where there is no documentation of physical examination of the axilla.
**cN1mi is rarely used but may be appropriate in cases where sentinel node biopsy is performed before tumor resection, most likely to occur in cases treated with neoadjuvant therapy.

Pathologic (pN)

pNX	Regional lymph nodes cannot be assessed (e.g., not removed for pathological study or previously removed)
pN0	No regional lymph node metastasis identified or ITCs only
pN0(i+)	ITCs only (malignant cells clusters no larger than 0.2 mm) in regional lymph node(s)
pN0(mol+)	Positive molecular findings by reverse transcriptase polymerase chain reaction (RT-PCR); no ITCs detected
pN1	Micrometastases; or metastases in 1–3 axillary lymph nodes; and/or in clinically negative internal mammary nodes with micrometastases or macrometastases by sentinel lymph node biopsy
pN1mi	Micrometastases (approximately 200 cells, larger than 0.2 mm, but none larger than 2.0 mm)
pN1a	Metastases in 1–3 axillary lymph nodes, at least one metastasis larger than 2.0 mm
pN1b	Metastases in ipsilateral internal mammary sentinel nodes, excluding ITCs
pN1c	pN1a and pN1b combined.
pN2	Metastases in 4–9 axillary lymph nodes; or positive ipsilateral internal mammary lymph nodes by imaging in the absence of axillary lymph node metastases
pN2a	Metastases in 4–9 axillary lymph nodes (at least one tumor deposit larger than 2.0 mm)
pN2b	Metastases in clinically detected internal mammary lymph nodes with or without microscopic confirmation; with pathologically negative axillary nodes

Continued

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Table 1. **Definitions for T, N, M (continued)**

Pathologic (pN)

pN3	Metastases in 10 or more axillary lymph nodes; *or* in infraclavicular (level III axillary) lymph nodes; *or* positive ipsilateral internal mammary lymph nodes by imaging in the presence of one or more positive level I, II axillary lymph nodes; *or* in more than three axillary lymph nodes and micrometastases or macrometastases by sentinel lymph node biopsy in clinically negative ipsilateral internal mammary lymph nodes; *or* in ipsilateral supraclavicular lymph nodes
pN3a	Metastases in 10 or more axillary lymph nodes (at least one tumor deposit larger than 2.0 mm); *or* metastases to the infraclavicular (level III axillary lymph) nodes
pN3b	pN1a or pN2a in the presence of cN2b (positive internal mammary nodes by imaging); *or* pN2a in the presence of pN1b
pN3c	Metastases in ipsilateral supraclavicular lymph nodes

Note: (sn) and (f) suffixes should be added to the N category to denote confirmation of metastasis by sentinel node biopsy or FNA/core needle biopsy respectively, with NO further resection of nodes

Distant Metastasis (M)

M0	No clinical or radiographic evidence of distant metastases*
cM0(i+)	No clinical or radiographic evidence of distant metastases in the presence of tumor cells or deposits no larger than 0.2 mm detected microscopically or by molecular techniques in circulating blood, bone marrow, or other nonregional nodal tissue in a patient without symptoms or signs of metastases
cM1	Distant metastases detected by clinical and radiographic means
pM1	Any histologically proven metastases in distant organs; or if in non-regional nodes, metastases greater than 0.2 mm

Table 2. **AJCC Anatomic Stage Groups**

The Anatomic Stage Group table should only be used in global regions where biomarker tests are not routinely available.
Cancer registries in the U.S. must use the Clinical and Pathological Prognostic Stage Group tables for case reporting.

Stage 0	Tis	N0	M0	**Stage IIIA**	T0	N2	M0
Stage IA	T1	N0	M0		T1	N2	M0
Stage IB	T0	N1mi	M0		T2	N2	M0
	T1	N1mi	M0		T3	N1	M0
Stage IIA	T0	N1	M0		T3	N2	M0
	T1	N1	M0	**Stage IIIB**	T4	N0	M0
	T2	N0	M0		T4	N1	M0
Stage IIB	T2	N1	M0		T4	N2	M0
	T3	N0	M0	**Stage IIIC**	Any T	N3	M0
				Stage IV	Any T	Any N	M1

Notes:
1. T1 includes T1mi.
2. T0 and T1 tumors with nodal micrometastases (N1mi) are staged as Stage IB.
3. T2, T3, and T4 tumors with nodal micrometastases (N1mi) are staged using the N1 category.
4. M0 includes M0(i+).
5. The designation pM0 is not valid; any M0 is clinical.
6. If a patient presents with M1 disease prior to neoadjuvant systemic therapy, the stage is considered Stage IV and remains Stage IV regardless of response to neoadjuvant therapy.
7. Stage designation may be changed if postsurgical imaging studies reveal the presence of distant metastases, provided the studies are performed within 4 months of diagnosis in the absence of disease progression, and provided the patient has not received neoadjuvant therapy.
8. Staging following neoadjuvant therapy is designated with “yc” or “yp” prefix to the T and N classification. There is no anatomic stage group assigned if there is a complete pathological response (pCR) to neoadjuvant therapy, for example, ypT0ypN0cM0.

Continued

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Table 2. **AJCC Anatomic Stage Groups (continued)**

Histologic Grade (G)

All invasive breast carcinomas should be assigned a histologic grade. The Nottingham combined histologic grade (Nottingham modification of the SBR grading system) is recommended and is stipulated for use by the College of American Pathologists (see www.cap.org). The grade for a tumor is determined by assessing morphologic features (tubule formation, nuclear pleomorphism, and calibrated mitotic count), assigning a value from 1 (favorable) to 3 (unfavorable) for each feature, and totaling the scores for all three categories. A combined score of 3–5 points is designated as grade 1; a combined score of 6–7 points is grade 2; a combined score of 8–9 points is grade 3. The use of subjective grading alone is discouraged.

Invasive Cancer (Scarff-Bloom-Richardson [SBR] Grading System, Nottingham Modification)

GX	Grade cannot be assessed
G1	Low combined histologic grade (favorable); SBR score of 3–5 points
G2	Intermediate combined histologic grade (moderately favorable); SBR score of 6–7 points
G3	High combined histologic grade (unfavorable); SBR score of 8–9 points

Ductal Carcinoma *in situ*: Nuclear Grade
The grade that should be used for ductal carcinoma in situ is nuclear grade (www.cap.org)

GX	Grade cannot be assessed
G1	Low nuclear grade
G2	Intermediate nuclear grade
G3	High nuclear grade

Continued

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Histopathologic Type - WHO Classification 5th Edition (2019)

In situ carcinomas

- Ductal carcinoma in situ (DCIS) (low nuclear grade, intermediate nuclear grade, and high nuclear grade)
- In situ papillary neoplasms (papillary DCIS, encapsulated papillary carcinoma, solid papillary carcinoma in situ)

Invasive Carcinomas

- Invasive breast carcinoma of no special type (ductal and other special patterns)
- Microinvasive carcinoma
- Invasive lobular carcinoma
- Tubular carcinoma
- Cribriform carcinoma
- Mucinous carcinoma
- Mucinous cystadenocarcinoma
- Invasive micropapillary carcinoma
- Invasive papillary carcinoma
- Invasive solid papillary carcinoma
- Carcinoma with apocrine differentiation
- Metaplastic carcinoma (spindle cell, squamous, with heterologous differentiation, low-grade adenosquamous carcinoma, low-grade fibromatosis-like and mixed metaplastic)
- Neuroendocrine tumor (NET)
- Neuroendocrine carcinoma (NEC)
- Salivary gland-type (acinic cell, adenoid cystic, secretory, mucoepidermoid, polymorphous adenocarcinoma)
- Tall cell carcinoma with reversed polarity

Favorable Histologic Types

- Tubular carcinoma
- Cribriform carcinoma
- Mucinous carcinoma
- Adenoid cystic
- Low-grade adenosquamous carcinoma metaplastic carcinoma
- Low-grade fibromatosis-like metaplastic carcinoma

Continued

WHO Classification of Tumors Editorial Board, ed. WHO Classification of Tumors, 5th Edition – Breast Tumors. Lyon: International Agency for Research on Cancer 2019.

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Table 3. **Clinical Prognostic Stage**

Clinical Prognostic Stage applies to ALL patients with breast cancer for clinical classification and staging. It uses clinical tumor (T), node (N) and metastases (M) information based on history, physical examination, any imaging performed (not necessary for clinical staging) and relevant biopsies. Genomic profile information is not included in Clinical Prognostic Stage as pathologic information from surgery is necessary to ascertain the prognosis using these tools.

TNM	Grade	HER2	ER	PR	Stage
Tis N0 M0	Any	Any	Any	Any	0
T1* N0 M0 T0 N1mi M0 T1* N1mi M0	G1	Positive	Positive	Positive	IA
				Negative	
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	
			Negative	Positive	
				Negative	IB
	G2	Positive	Positive	Positive	IA
				Negative	
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	
			Negative	Positive	
				Negative	IB
	G3	Positive	Positive	Positive	IA
				Negative	
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	
			Negative	Positive	IB
				Negative	

TNM	Grade	HER2	ER	PR	Stage
T0 N1** M0 T1* N1** M0 T2 N0 M0	G1	Positive	Positive	Positive	IB
				Negative	IIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IB
				Negative	IIA
			Negative	Positive	
				Negative	
	G2	Positive	Positive	Positive	IB
				Negative	IIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IB
				Negative	IIA
			Negative	Positive	
				Negative	IIB
	G3	Positive	Positive	Positive	IB
				Negative	IIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	IIB
			Negative	Positive	
				Negative	

Continued

*T1 includes T1mi.

**N1 does not include N1mi. T1 N1mi M0 and T0 N1mi M0 cancers are included for prognostic staging with T1 N0 M0 cancers of the same prognostic factor status.

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Table 3. **Clinical Prognostic Stage (continued)**

TNM	Grade	HER2	ER	PR	Stage
T2 N1*** M0 T3 N0 M0	G1	Positive	Positive	Positive	IB
				Negative	IIA
			Negative	Positive	
				Negative	IIB
		Negative	Positive	Positive	IIA
				Negative	IIB
			Negative	Positive	
				Negative	
	G2	Positive	Positive	Positive	IB
				Negative	IIA
			Negative	Positive	
				Negative	IIB
		Negative	Positive	Positive	IIA
				Negative	IIB
			Negative	Positive	
				Negative	IIIB
	G3	Positive	Positive	Positive	IB
				Negative	IIB
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	IIIA
			Negative	Positive	
				Negative	IIIB

TNM	Grade	HER2	ER	PR	Stage
T0 N2 M0 T1* N2 M0 T2 N2 M0 T3 N1*** M0 T3 N2 M0	G1	Positive	Positive	Positive	IIA
				Negative	IIIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IIA
				Negative	IIIA
			Negative	Positive	
				Negative	IIIB
	G2	Positive	Positive	Positive	IIA
				Negative	IIIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IIA
				Negative	IIIA
			Negative	Positive	
				Negative	IIIB
	G3	Positive	Positive	Positive	IIB
				Negative	IIIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	IIIB
			Negative	Positive	
				Negative	IIIC

Continued

*T1 includes T1mi.
***N1 includes N1mi. T2, T3, and T4 cancers and N1mi are included for prognostic staging with T2 N1, T3 N1 and T4 N1, respectively.

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Table 3. **Clinical Prognostic Stage (continued)**

TNM	Grade	HER2	ER	PR	Stage
T4 N0 M0 T4 N1*** M0 T4 N2 M0 Any T N3 M0	G1	Positive	Positive	Positive	IIIA
				Negative	IIIB
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	
			Negative	Positive	
				Negative	IIIC
	G2	Positive	Positive	Positive	IIIA
				Negative	IIIB
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	
			Negative	Positive	
				Negative	IIIC
	G3	Positive	Positive	Positive	IIIB
				Negative	
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	IIIC
			Negative	Positive	
				Negative	
Any T Any N M1	Any	Any	Any	Any	IV

Notes:
1. Because N1mi categorization requires evaluation of the entire node, and cannot be assigned on the basis of an FNA or core biopsy, N1mi can only be used with Clinical Prognostic Staging when clinical staging is based on a resected lymph node in the absence of resection of the primary cancer, such as the situation where sentinel node biopsy is performed prior to receipt of neoadjuvant chemotherapy or endocrine therapy.
2. For cases with lymph node involvement with no evidence of primary tumor (e.g. T0 N1, etc.) or with breast ductal carcinoma *in situ* (e.g. Tis N1, etc.), the grade, HER2, ER, and PR information from the tumor in the lymph node should be used for assigning stage group.
3. For cases where HER2 is determined to be “equivocal” by ISH (FISH or CISH) testing under the 2013 ASCO/CAP HER2 testing guidelines, the HER2 “negative” category should be used for staging in the Clinical Prognostic Stage Group.
4. The prognostic value of these Prognostic Stage Groups is based on populations of persons with breast cancer that have been offered and mostly treated with appropriate endocrine and/or systemic chemotherapy (including anti-HER2 therapy).

Continued

***N1 includes N1mi. T2, T3, and T4 cancers and N1mi are included for prognostic staging with T2 N1, T3 N1 and T4 N1, respectively.

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Table 4. **Pathological Prognostic Stage**

Pathological Prognostic Stage applies to patients with breast cancer treated with surgery as the initial treatment. It includes all information used for clinical staging plus findings at surgery and pathological findings from surgical resection. Pathological Prognostic Stage does not apply to patients treated with systemic or radiation prior to surgical resection (neoadjuvant therapy).

TNM	Grade	HER2	ER	PR	Stage
Tis N0 M0	Any	Any	Any	Any	0
T1* N0 M0 T0 N1mi M0 T1* N1mi M0	G1	Positive	Positive	Positive	IA
				Negative	
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	
			Negative	Positive	
				Negative	
	G2	Positive	Positive	Positive	
				Negative	
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	
			Negative	Positive	
				Negative	IB
	G3	Positive	Positive	Positive	IA
				Negative	
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	
				Negative	
			Negative	Positive	
				Negative	IB
T0 N1** M0 T1* N1** M0 T2 N0 M0	G1	Positive	Positive	Positive	IA
				Negative	IB
			Negative	Positive	
				Negative	IIA
		Negative	Positive	Positive	IA
				Negative	IB
			Negative	Positive	
				Negative	IIA
	G2	Positive	Positive	Positive	IA
				Negative	IB
			Negative	Positive	
				Negative	IIA
		Negative	Positive	Positive	IA
				Negative	IIA
			Negative	Positive	
				Negative	
	G3	Positive	Positive	Positive	IA
				Negative	IIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IB
				Negative	IIA
			Negative	Positive	
				Negative	

Continued

*T1 includes T1mi.

**N1 does not include N1mi. T1 N1mi M0 and T0 N1mi M0 cancers are included for prognostic staging with T1 N0 M0 cancers of the same prognostic factor status.

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Table 4. **Pathological Prognostic Stage (continued)**

TNM	Grade	HER2	ER	PR	Stage
T2 N1*** M0 T3 N0 M0	G1	Positive	Positive	Positive	IA
				Negative	IIB
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IA
				Negative	IIB
			Negative	Positive	
				Negative	
	G2	Positive	Positive	Positive	IB
				Negative	IIB
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IB
				Negative	IIB
			Negative	Positive	
				Negative	
	G3	Positive	Positive	Positive	IB
				Negative	IIB
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IIA
				Negative	IIB
			Negative	Positive	
				Negative	IIIA

TNM	Grade	HER2	ER	PR	Stage
T0 N2 M0 T1* N2 M0 T2 N2 M0 T3 N1*** M0 T3 N2 M0	G1	Positive	Positive	Positive	IB
				Negative	IIIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IB
				Negative	IIIA
			Negative	Positive	
				Negative	
	G2	Positive	Positive	Positive	IB
				Negative	IIIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IB
				Negative	IIIA
			Negative	Positive	
				Negative	IIIB
	G3	Positive	Positive	Positive	IIA
				Negative	IIIA
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IIB
				Negative	IIIA
			Negative	Positive	
				Negative	IIIC

Continued

*T1 Includes T1mi.
***N1 includes N1mi. T2, T3, and T4 cancers and N1mi are included for prognostic staging with T2 N1, T3 N1 and T4 N1, respectively.

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Table 4. **Pathological Prognostic Stage (continued)**

TNM	Grade	HER2	ER	PR	Stage
T4 N0 M0 T4 N1*** M0 T4 N2 M0 Any T N3 M0	G1	Positive	Positive	Positive	IIIA
				Negative	IIIB
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IIIA
				Negative	IIIB
			Negative	Positive	
				Negative	
	G2	Positive	Positive	Positive	IIIA
				Negative	IIIB
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IIIA
				Negative	IIIB
			Negative	Positive	
				Negative	IIIC
	G3	Positive	Positive	Positive	IIIB
				Negative	
			Negative	Positive	
				Negative	
		Negative	Positive	Positive	IIIC
				Negative	
			Negative	Positive	
				Negative	
Any T Any N M1	Any	Any	Any	Any	IV

Notes:
1. For cases with lymph node involvement with no evidence of primary tumor (e.g. T0 N1, etc.) or with breast ductal carcinoma *in situ* (e.g. Tis N1, etc.), the grade, HER2, ER and PR information from the tumor in the lymph node should be used for assigning stage group.
2. For cases where HER2 is determined to be “equivocal” by ISH (FISH or CISH) testing under the 2013 ASCO/CAP HER2 testing guidelines, HER2 “negative” category should be used for staging in the Pathological Prognostic Stage Group.
3. The prognostic value of these Prognostic Stage Groups is based on populations of persons with breast cancer that have been offered and mostly treated with appropriate endocrine and/or systemic chemotherapy (including anti-HER2 therapy).

Table 5. **Genomic Profile for Pathologic Prognostic Staging**

When Oncotype DX Score is Less than 11...

TNM	Grade	HER2	ER	PR	Stage
T1 N0 M0 T2 N0 M0	Any	Negative	Positive	Any	IA

Notes:
1. Obtaining genomic profiles is NOT required for assigning Pathological Prognostic Stage. However genomic profiles may be performed for use in determining appropriate treatment. If the OncotypeDx® test is performed in cases with a T1N0M0 or T2N0M0 cancer that is HER2-negative and ER-positive, and the recurrence score is less than 11, the case should be assigned Pathological Prognostic Stage Group IA.
2. If OncotypeDx® is not performed, or if it is performed and the OncotypeDx® score is not available, or is 11 or greater for patients with T1–2 N0 M0 HER2–negative, ER-positive cancer, then the Prognostic Stage Group is assigned based on the anatomic and biomarker categories shown above.
3. OncotypeDx® is the only multigene panel included to classify Pathologic Prognostic Stage because prospective Level I data supports this use for patients with a score less than 11. Future updates to the staging system may include results from other multigene panels to assign cohorts of patients to Prognostic Stage Groups based on the then available evidence. Inclusion or exclusion in this staging table of a genomic profile assay is not an endorsement of any specific assay and should not limit appropriate clinical use of any genomic profile assay based on evidence available at the time of treatment.

***N1 includes N1mi. T2, T3, and T4 cancers and N1mi are included for prognostic staging with T2 N1, T3 N1 and T4 N1, respectively.

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ABBREVIATIONS

3D	three-dimensional
ADC	antibody-drug conjugate
ALND	axillary lymph node dissection
APBI	accelerated partial breast irradiation
ALT	alanine aminotransferase
AST	aspartate aminotransferase
AUC	area under the curve
BCI	breast cancer index
BCS	breast-conserving surgery
BIA-ALCL	breast implant-associated anaplastic large cell lymphoma
BIA-SCC	breast implant-associated squamous cell carcinoma
BI-RADS	Breast Imaging Reporting and Data System
BMD	bone mineral density
BMI	body mass index
CBC	complete blood count
CEA	carcinoembryonic antigen
CPS	combined positive score
ctDNA	circulating tumor DNA
DCIS	ductal carcinoma in situ
DCIS-M	DCIS with microinvasion
DEXA	dual-energy x-ray absorptiometry
DFS	disease-free survival
DIBH	deep-inspiratory breath hold
DIEP	deep inferior epigastric perforator
dMMR	mismatch repair deficient
DUG	diagonal upper gracilis
DVH	dose-volume histogram
EBRT	external beam radiation therapy
EIC	extensive intraductal component
EPC	encapsulated papillary carcinoma
FDG	fluorodeoxyglucose
FISH	fluorescence in situ hybridization
FSH	follicle-stimulating hormone
FNA	fine-needle aspiration
G-CSF	granulocyte colony-stimulating factor
GnRH	gonadotropin-releasing hormone
H&E	hematoxylin and eosin
IBC	inflammatory breast cancer
IBTR	ipsilateral breast tumor recurrence
IGAP	inferior gluteal artery perforator
IGRT	image-guided radiation therapy
IHC	immunohistochemistry
ILD	interstitial lung disease
IMRT	intensity-modulated radiation therapy
ISH	in situ hybridization
IUD	intrauterine device
LAP	lumbar artery perforator
LCIS	lobular carcinoma in situ
LD	latissimus dorsi
LFT	liver function test
LH	luteinizing hormone
LVEF	left ventricular ejection fraction
LVI	lymphovascular invasion
MGPT	multigene panel testing
MP	MammaPrint
MP-H	MammaPrint-high
MSI-H	microsatellite instability-high
MS-TRAM	muscle-sparing transverse rectus abdominis myocutaneous
NAC	nipple-areolar complex
NED	no evidence of disease
NGS	next-generation sequencing
NST	no special type
OAR	organs at risk
OFS	ovarian function suppression
OS	overall survival
PBI	partial breast irradiation
pCR	pathologic complete response
PAP	profunda artery perforator flap
PARPi	PARP inhibitor
PCP	primary care physician
PCR	polymerase chain reaction
PD-1	programmed cell death protein 1
PD-L1	programmed death ligand 1
PFS	progression-free survival
PMRT	postmastectomy radiation therapy
PTSD	post-traumatic stress disorder
PTV	planning target volume
PV	pathogenic variant
RCB	residual cancer burden
RECIST	Response Evaluation Criteria in Solid Tumors
RNI	regional nodal irradiation
RT-PCR	reverse transcriptase polymerase chain reaction
SBRT	stereotactic body radiation therapy
SE	standard error
SGAP	superior gluteal artery perforator
SGRT	surface-guided radiation therapy
SIEA	superficial inferior epigastric artery
SLN	sentinel lymph node
SLNB	sentinel lymph node biopsy
SPC	solid papillary carcinoma
SNRI	serotonin-norepinephrine reuptake inhibitor
SSRI	selective serotonin reuptake inhibitor
TAD	targeted axillary dissection
TDAP	thoracodorsal artery perforator
TF	tumor fraction
TIPN	taxane-induced peripheral neuropathy
TMB-H	tumor mutational burden-high
TNBC	triple-negative breast cancer
TUG	transverse upper gracilis
VMAT	volumetric modulated arc therapy
VUG	vertical upper gracilis

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NCCN Categories of Evidence and Consensus	
Category 1	Based upon high-level evidence (≥1 randomized phase 3 trials or high-quality, robust meta-analyses), there is uniform NCCN consensus (≥85% support of the Panel) that the intervention is appropriate.
Category 2A	Based upon lower-level evidence, there is uniform NCCN consensus (≥85% support of the Panel) that the intervention is appropriate.
Category 2B	Based upon lower-level evidence, there is NCCN consensus (≥50%, but <85% support of the Panel) that the intervention is appropriate.
Category 3	Based upon any level of evidence, there is major NCCN disagreement that the intervention is appropriate.

All recommendations are category 2A unless otherwise indicated.

NCCN Categories of Preference	
Preferred	Interventions that are based on superior efficacy, safety, and evidence; and, when appropriate, affordability.
Other recommended	Other interventions that may be somewhat less efficacious, more toxic, or based on less mature data; or significantly less affordable for similar outcomes.
Useful in certain circumstances	Other interventions that may be used for selected patient populations (defined with recommendation).

All recommendations are considered appropriate.

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NCCN Guidelines Version 2.2026
Breast Cancer

Discussion

This Discussion corresponds to the NCCN Guidelines for Breast Cancer. The section for systemic therapies (preoperative and adjuvant) was updated on June 7th, 2024. The update to the rest of the Discussion section is in progress.

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Overview

Breast cancer is the most common malignancy in females in the United States and is second only to lung cancer as a cause of cancer death. The American Cancer Society has estimated that 313,510 Americans will be diagnosed with breast cancer and 42,780 will die of disease in the United States in 2024.[1,2] The therapeutic options for patients with noninvasive or invasive breast cancer are complex and varied. The NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Breast Cancer include guidelines for clinical management of patients with carcinoma in situ, invasive breast cancer, Paget disease, Phyllodes tumor, inflammatory breast cancer (IBC), male breast cancer, and breast cancer during pregnancy. These Guidelines have been developed and are updated continuously by a multidisciplinary panel of representatives from NCCN Member Institutions with breast cancer-focused expertise in the fields of medical oncology, surgical oncology, radiation oncology, pathology, reconstructive surgery, and patient advocacy.

Sensitive/Inclusive Language Usage

NCCN Guidelines strive to use language that advances the goals of equity, inclusion, and representation. NCCN Guidelines endeavor to use language that is person-first; not stigmatizing; anti-racist, anti-classist, anti-misogynist, anti-ageist, anti-ableist, and anti-weight-biased; and inclusive of individuals of all sexual orientations and gender identities. NCCN Guidelines incorporate non-gendered language, instead focusing on organ-specific recommendations. This language is both more accurate and more inclusive and can help fully address the needs of individuals of all sexual orientations and gender identities. NCCN Guidelines will continue to use the terms men, women, female, and male when citing statistics, recommendations, or data from organizations or sources that do not use inclusive terms. Most studies do not report how sex and gender data are collected and use these terms interchangeably or inconsistently. If sources do not differentiate gender from sex assigned at birth or organs present, the information is presumed to predominantly represent cisgender individuals. NCCN encourages researchers to collect more specific data in future studies and organizations to use more inclusive and accurate language in their future analyses.

Guidelines Update Methodology

Literature Search Criteria and Guidelines Update Methodology

Prior to the update of this version of the NCCN Guidelines® for Breast Cancer, an electronic search of the PubMed database was performed to obtain key literature using the following search terms: Breast Cancer, Breast Neoplasms, DCIS, Inflammatory Breast Cancer, OR Phyllodes. The PubMed database was chosen as it remains the most widely used resource for medical literature and indexes peer-reviewed biomedical literature.[3]

The search results were narrowed by selecting studies in humans published in English. Results were confined to the following article types: Clinical Trial, Phase III; Clinical Trial, Phase IV; Guideline; Randomized Controlled Trial; Meta-Analysis; Systematic Reviews; and Validation Studies.

The potential relevance of the PubMed search was examined. The data from key PubMed articles selected by the Panel for review during the Guidelines update meeting as well as articles from additional sources deemed as relevant to these Guidelines and discussed by the Panel have been included in this version of the Discussion section. Recommendations for which high-level evidence is lacking are based on the Panel's review of lower-level evidence and expert opinion. The complete details of the Development and Update of the NCCN Guidelines are available at www.NCCN.org.

Discussion update in progress

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Ductal Carcinoma in Situ (Tis, N0, M0)

The diagnosis of ductal carcinoma in situ (DCIS) has increased since the introduction and increased utilization of screening mammography. According to the American Cancer Society, over 50,000 cases of DCIS of the female breast will be diagnosed in the United States in 2022.[1]

Workup for DCIS

The recommended workup and staging of DCIS includes history and physical examination, bilateral diagnostic mammography, pathology review, determination of tumor estrogen receptor (ER) status, and MRI, as indicated.

For pathology reporting, the NCCN Panel endorses the College of American Pathologists (CAP) Protocol for both invasive and noninvasive carcinomas of the breast.[4]

The NCCN Panel recommends testing for ER status in order to determine the benefit of adjuvant endocrine therapy or risk reduction. This is in accordance with the American Society for Clinical Oncology (ASCO)/CAP guidelines,[5] which recommend that ER testing of newly diagnosed DCIS to determine potential benefit of endocrine therapies for breast cancer risk reduction and progesterone receptor (PR) testing be considered optional. Although the tumor HER2 status is of prognostic significance in invasive cancer, its importance in DCIS has not been established. To date, studies have either found unclear or weak evidence of HER2 status as a prognostic indicator in DCIS,[6-9] and no statistically significant benefit to the use of trastuzumab concurrently with radiation in HER2-amplified DCIS.[10] The NCCN Panel has concluded that HER2 status for DCIS does not alter the management strategy and therefore is not recommended for DCIS.

Genetic counseling is recommended if the patient is considered to be at high risk for hereditary breast cancer as defined by the NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic.

The role of MRI in management of DCIS remains unclear. MRI has been prospectively shown to have a sensitivity of up to 98% for high-grade DCIS.[11] In a prospective, observational study of 193 patients with pure DCIS who underwent both mammography and MRI imaging preoperatively; 93 (56%) patients were diagnosed by mammography and 153 (92%) were diagnosed by MRI ($P < .0001$). Of the 89 patients with high-grade DCIS, 43 (48%) who were not diagnosed by mammography were diagnosed by MRI alone.[11] However, other studies suggest that MRI can overestimate the extent of disease.[12] Therefore, the surgical decisions for performing a mastectomy for DCIS should not be solely based on MRI findings alone. If MRI findings suggest more extensive disease than is seen on mammography such that a markedly larger resection is required for complete excision, the findings should be verified histologically through MRI-guided biopsy of the more extensive enhancement. Studies performed to determine whether the use of MRI reduces re-excision rates and decreases local recurrence in patients with DCIS show conflicting results. While several studies suggest no reduction in re-excision rates in patients with pure DCIS undergoing breast-conserving surgery (BCS) following MRI compared with those who did not undergo preoperative MRI,[13,14] some have demonstrated a reduction in re-excision rate with use of preoperative MRI for DCIS.[15,16] One study showed an additional cancer detection rate of 6.2% with preoperative MRI.[16] Therefore, the use of preoperative MRI remains controversial. The NCCN Panel recommends only performing breast MRI for DCIS in select circumstances where additional information is warranted during the initial workup, noting that the use of MRI has not been shown to increase likelihood of negative margins or decrease conversion to mastectomy for DCIS.

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Primary Treatment for DCIS

The goal of primary therapy for DCIS is to prevent progression to invasive breast carcinoma. Management strategies for DCIS treatment include surgery (mastectomy or BCS), and/or radiation therapy (RT), followed by adjuvant endocrine therapy in eligible patients to reduce risk of recurrence.

The choice of local treatment does not impact overall disease-related survival; therefore, the individual's preferences for risk reduction must be considered.

Several prospective randomized trials of pure DCIS have shown that the addition of whole breast RT (WBRT) after BCS decreases the rate of in-breast disease recurrence,[17-24] but not distant metastasis-free survival.[25] A meta-analysis of four large multicenter randomized trials confirmed the results of the individual trials, demonstrating that the addition of WBRT after BCS for DCIS provides a statistically and clinically significant reduction in ipsilateral breast events (hazard ratio [HR], 0.49; 95% confidence interval [CI]; 0.41–0.58, $P < .00001$).[26] However, these trials did not show that the addition of RT has an overall survival (OS) benefit. The long-term follow-up of the NSABP B-17 trial showed that at 15 years, RT resulted in a 52% reduction of ipsilateral invasive recurrence compared with excision alone (HR, 0.48; 95% CI, 0.33–0.69, $P < .001$).[23] The OS and cumulative all-cause mortality rates through 15 years were similar between the two groups (HR for death, 1.08; 95% CI, 0.79–1.48).[23] Similar findings were reported by a large observational study of the SEER database that included 108,196 patients with DCIS.[27] In a subgroup analysis at 10 years, of 60,000 patients treated with BCS, with or without WBRT, a 50% reduction in the risk of ipsilateral recurrence (adjusted HR, 0.47 [95% CI, 0.42–0.53]; $P < .001$) was associated with the addition of WBRT. However, in this study, breast cancer-specific mortality was found to be similar (HR, 0.86 [95% CI, 0.67–1.10]; $P = .22$).[27]

In contrast, several population-based studies suggest beneficial effects of WBRT for DCIS after BCS; for example, the use of WBRT in patients with higher-risk DCIS (eg, higher nuclear grade, younger age, larger tumor size) was demonstrated to be associated with a modest but statistically significant improvement in OS.[28] In another observational study of the SEER database including 140,366 patients with DCIS, the 15-year breast cancer mortality rate was 1.7% for those treated with breast-conserving therapy (BCT) versus 2.3% for patients treated with BCS alone (HR, 0.77; 95% CI, 0.67–0.88; $P < .001$), demonstrating a small but significant reduction in breast cancer mortality with BCS and WBRT compared with BCS alone.[29]

RT Boost: The use of RT boost has been demonstrated to provide a small but statistically significant reduction in ipsilateral breast tumor recurrence (IBTR) risk (4% at 20 years) in all age groups for invasive breast cancers.[30-33]

A pooled analysis of patient-level data from 10 academic institutions evaluated outcomes of pure DCIS patients, all treated with BCS and WBRT (n = 4131) who either received RT boost with a median dose of 14 Gy (n = 2661) or received no boost (n = 1470). The median follow-up of patients was 9 years. A decrease in IBTR was seen in patients who received a boost compared with those who did not at 5 years (97.1% vs. 96.3%), 10 years (94.1% vs. 92.5%), and 15 years (91.6% vs. 88.0%) ($P = .0389$ for all). The use of RT boost was associated with significantly decreased IBTR across the entire cohort of patients (HR, 0.73; 95% CI, 0.57–0.94; $P = .01$).[34] In a multivariate analysis that took into account factors associated with lower IBTR, including grade, ER positive status, use of adjuvant tamoxifen, margin status, and age, the benefit of RT boost still remained statistically significant (HR, 0.69; 95% CI, 0.53–0.91; $P < .010$).[34] Even in patients considered very low risk based on negative margins status (defined as no ink on tumor as per NSABP definition, or margins >2 mm as per Society of Surgical Oncology [SSO]/American

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Society for Radiation Oncology [ASTRO]/ASCO definition), the RT boost remained statistically significant for decreasing the rate of local relapse.

Similar to invasive cancers, though RT boost was beneficial in all age groups studied, the magnitude of the absolute benefit of the boost was greatest in younger patients. Two randomized phase III trials are studying whether an RT boost reduces recurrence in patients with DCIS (ClinicalTrials.gov Identifiers: NCT00470236 and NCT00907868). These trials have completed accrual and are now in active follow-up. A recent publication on the health-related quality of life (HRQOL) in patients enrolled in the BIG 3-07/TROG 07.01 phase III trial (NCT00470236) showed that after 2 years, the cosmetic status was impacted negatively with the boost versus no boost, suggesting the importance of informed shared decision-making regarding addition of boost until data related to impact on local recurrence and OS are published.[35] According to the 5-year data from this trial, presented at the 2021 annual San Antonio Breast Cancer Symposium (SABCS) meeting, 93% of patients in the group who did not receive a boost were free from local recurrence compared with 97% in the group who received an RT boost (HR, 0.47; 95% CI, 0.31–0.72; *P* < .001).[36] The peer-reviewed publication of these data is awaited.

Breast Conserving Surgery Alone Without WBRT: RT adds to treatment cost and is accompanied by adverse effects. Therefore, in an attempt to de-escalate treatment and limit morbidity and preserve quality of life (QOL), several trials have examined omission of RT in carefully selected patients at low risk of disease recurrence.

There are retrospective series suggesting that selected patients have a low risk of in-breast recurrence when treated with excision alone (without WBRT).[37-40] For example, in one retrospective review, 10-year disease-free survival (DFS) rates of 186 patients with DCIS treated with BCS alone were 94% for patients with low-risk DCIS and 83% for patients with both intermediate- and high-risk DCIS.[37] In another retrospective study of 215 patients with DCIS treated with BCS without RT, or systemic risk reduction therapy, the recurrence rates over 8 years were 0%, 21.5%, and 32.1% in patients with low-, intermediate-, or high-risk DCIS, respectively.[38] The stratification for risk of recurrence in this retrospective study was calculated using the modified Van Nuys Prognostic Index based on tumor grade, size, absence of comedo necrosis, margin width, and age at diagnosis.[38]

A multi-institutional, non-randomized, prospective study of selected patients with low-risk DCIS treated without radiation has also provided some support for BCS alone without radiation.[41] Patients were enrolled onto one of two low-risk cohorts: 1) low- or intermediate-grade DCIS, tumor size ≤2.5 cm (n = 561); or 2) high-grade DCIS, tumor size ≤1 cm (n = 104). Protocol specifications included excision of the DCIS tumor with a minimum negative margin width of ≥3 mm. Only 30% of the patients received tamoxifen. Of note, margins were substantially wider than the 3-mm protocol requirement in many patients (ie, the low-/intermediate-risk patient group margins were ≥5 mm in 62% of patients and >10 mm or no tumor on re-excision in 48% of patients).[41] Although the rate of IBTR was acceptably low for the low-/intermediate-grade group at 5 years, at a median follow-up of 12.3 years, the rates of developing an IBTR were 14.4% for low-/intermediate-grade and 24.6% for high-grade DCIS (*P* = .003). This suggests that IBTR events may be delayed but not prevented in the seemingly low-risk population.

The RTOG 9804 trial investigated outcomes of RT omission in the setting of low-risk DCIS, randomizing 636 patients with low-risk disease to either RT or observation after surgery.[24] In this study, low risk consisted of low- to intermediate-grade DCIS measuring <2.5 cm, with negative margins of ≥3 mm. With a median follow-up of 7 years, a reduced risk of local recurrence was seen with use of RT compared with observation (0.9% vs. 6.7%; HR, 0.11; 95% CI, 0.03–0.47). No difference was seen in either DFS or OS. With a follow-up of 15 years, local recurrence rates were

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reduced by 50% with RT versus without RT (7.1% vs. 15.1%; HR, 0.36; 95% CI, 0.20–0.66).[42]

The available evidence from four randomized trials (NSABP B-39/RTOG 0413,[43] OCOG-RAPID,[44] University of Florence,[45] and GEC-ESTRO[46]) of patients with breast cancer (tumors ≤3 cm) has shown that accelerated partial breast irradiation (APBI) delivered with multi-catheter brachytherapy is noninferior in local control compared with WBRT, with similar toxicity and breast cosmetic outcomes. Patients with DCIS constituted 25%, 18%, 8.8%, and 6% of patients in the NSABP B-39/RTOG 0413, OCOG-RAPID, University of Florence, and GEC-ESTRO trials, respectively. Per the ASTRO guideline for APBI, patients with screen-detected DCIS measuring <2.5 cm, with grade I or II disease, and with negative margins of 3 mm or more are "suitable" candidates for APBI.[47]

Margin Status After Breast-Conserving Therapy: Prospective randomized trials have not been carried out to analyze whether wider margins can replace the need for RT for DCIS. Results from a retrospective study of 445 patients with pure DCIS treated by excision alone indicated that margin width was the most important independent predictor of local recurrence, although the trend for decreasing local recurrence risk with increasing margin width was most apparent with margins <1 mm compared to ≥10 mm.[48] In a meta-analysis of 4660 patients with DCIS treated with BCS and radiation, a surgical margin of <2 mm was associated with increased rates of IBTR compared with margins of 2 mm, although no significant differences were observed when margins of >2 mm to 5 mm or >5 mm were compared with 2-mm margins.[49]

A study retrospectively reviewed a database of 2996 patients with DCIS who underwent BCS to investigate the association between margin width and recurrence, controlling all other characteristics.[50] Wider margins were significantly associated with a lower rate of recurrence only in patients who did not receive RT ($P < .0001$), but not in those treated with radiation ($P = .95$).[50]

According to the DCIS Consensus Guideline on Margins by SSO/ASTRO/ASCO, the use of at least a 2-mm margin in DCIS treated with WBRT is associated with low rates of IBTR.[47] Additional factors to consider in assessing adequacy of excision for DCIS include presence of residual calcifications, which margin is close (anterior against skin or posterior against muscle vs. medial, superior, inferior, or lateral), and life expectancy of the patient. Notably, in situations where DCIS is admixed with invasive carcinoma, the SSO/ASTRO/ASCO Consensus Guideline on Margins for invasive breast cancer should be utilized, which supports "no tumor on ink" as an adequate margin applying to both the invasive and noninvasive components in this mixed tumor scenario.

Mastectomy: Patients with DCIS and evidence of widespread disease (ie, disease involving two or more quadrants) on diagnostic mammography or other imaging, physical examination, or biopsy may require mastectomy.

For DCIS patients undergoing mastectomy, or for local excision in an anatomic location that could compromise the lymphatic drainage pattern to the axilla (eg, tail of the breast), a sentinel lymph node biopsy (SLNB) procedure should *strongly* be considered at the time of definitive surgery to avoid necessitating a full axillary lymph node dissection (ALND) for evaluation of the axilla.[51-54] Since only a small proportion of patients (about 25%) with seemingly pure DCIS on initial biopsy will have invasive breast cancer at the time of the definitive surgical procedure[55] and will ultimately require axillary lymph node (ALN) staging, ALND is *not* recommended unless there is pathologically documented invasive cancer or ALN metastatic disease in patients (by either biopsy or SNLB).

NCCN Recommendations for Primary Treatment of DCI

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Trials are ongoing to determine if there might be a selected favorable biology DCIS subgroup where surgical excision is not required. Until such time that definitive evidence regarding the safety of this non-surgical approach is demonstrated, the NCCN Panel continues to recommend surgical excision for all DCIS.

According to the NCCN Panel, primary treatment options for patients with DCIS along with their respective categories of consensus are:
1) BCS plus WBRT with or without boost (category 1). While considering RT boost for DCIS, the NCCN Panel recommends an individualized approach based on patient preference and other factors such as longevity. The NCCN Panel notes that WBRT following BCS reduces IBTR rates in DCIS by about 50% to 70%. For DCIS patients treated with BCS alone (without radiation), irrespective of margin width, the risk of IBTR is substantially higher than treatment with excision followed by WBRT (even for predefined low-risk subsets of DCIS patients).
2) Total mastectomy, with or without SLNB with optional reconstruction (category 2A).
3) BCS plus APBI in carefully selected patients (category 2A). According to the Panel, select patients with low-risk DCIS may be considered suitable for APBI if they meet all aspects of the definition of RTOG 9804 low-risk DCIS or ASTRO “suitable” DCIS for APBI.
4) BCS alone (category 2B). The option of BCS alone should be considered only in cases where the patient and the physician view the individual as having a low risk of disease recurrence. For patients with low-risk disease that has been fully resected with negative margins and particularly if they are ER-positive and will be receiving endocrine therapy, the absolute reduction of in-breast recurrence may not be large enough to justify the risks associated with RT. Therefore, according to the NCCN Panel, it may be reasonable to omit RT in such cases.

Contraindications to BCT are listed in the algorithm (see *Special Considerations to Breast Conservation Therapy Requiring RT*). Patients treated with mastectomy are appropriate candidates for breast reconstruction (see *Principles of Breast Reconstruction Following Surgery* in the algorithm).

According to the NCCN Panel, complete resection should be documented by analysis of margins and specimen radiography. Post-excision mammography can be considered for any uncertainty about adequacy of the excision remains (eg, the mass and/or microcalcifications are not clearly within the specimen). Clips may be used to delineate the tumor bed and ensure adequate coverage with radiation, provide design of boost and APBI fields, and provide markers should additional surgery be required pending the pathologic margin status review.

For patients with pure DCIS treated by BCS and WBRT, a quantitative description of any tumor close to margin is helpful as a resection width of at least 2 mm is associated with a reduced risk of IBTR relative to narrower negative margin widths. The routine practice of obtaining margins >2 mm to further improve outcomes is not supported by the evidence. When there is only minimal or focal DCIS involvement near the margin, clinical judgment should be utilized to weigh the risks of re-excision with risk of recurrence for an individual patient.

For patients with DCIS treated with excision alone (no WBRT), regardless of margin width, there is a substantially higher rate of IBTR than treatment with excision and WBRT, even in predefined, low-risk patients. Although the optimal margin width for treatment with excision alone is unknown, it should be *at least* 2 mm, with some evidence suggesting improved IBTR rates with margin widths wider than 2 mm.

For DCIS with microinvasion (DCIS-M), defined as an invasive focus 1 mm or smaller in size, the optimal margin width should refer to the DCIS

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margin definition (≥2 mm), given that the majority of DCIS-M is comprised of DCIS and the natural history and systemic therapy utilization for DCIS-M more closely reflect the treatment pattern for pure DCIS than for invasive carcinoma.

Management of DCIS After Primary Treatment

Tamoxifen: DCIS falls between atypical ductal hyperplasia (ADH) and invasive ductal carcinoma within the spectrum of breast proliferative abnormalities. The Breast Cancer Prevention Trial performed by NSABP showed a 75% reduction in the occurrence of invasive breast cancer in patients with ADH treated with tamoxifen.[56,57] These data also showed that tamoxifen led to a substantial reduction in the risk of developing invasive breast disease.[58] The Early Breast Cancer Trialists' Collaborative Group (EBCTCG) overview analysis showed that, with 5 years of tamoxifen therapy, patients with ER-positive or receptor-unknown invasive tumors had a 39% reduction in the annual odds of recurrence of invasive breast cancer.[59]

Similarly, the NSABP B-24 trial found a benefit from tamoxifen for patients with DCIS after treatment with breast conservation surgery and RT. In that study, patients with DCIS who were treated with BCT were randomized to receive placebo or tamoxifen. At a median follow-up of 13.6 years, patients who received tamoxifen had a 3.4% absolute reduction in ipsilateral in-breast tumor recurrence risk (HR, 0.30; 95% CI, 0.21–0.42; $P < .001$) and a 3.2% absolute reduction in contralateral breast cancers (HR, 0.68; 95% CI, 0.48–0.95; $P = .023$).[23] The patients receiving tamoxifen had a 10-year cumulative rate of 4.6% for invasive and 5.6% for noninvasive breast cancers in the ipsilateral breast, compared with 7.3% invasive and 7.2% noninvasive recurrences for those treated with placebo. The cumulative 10-year frequency of invasive and noninvasive breast cancer in the contralateral breast was 6.9% and 4.7% in the placebo and tamoxifen groups, respectively. No differences in OS were noted. A retrospective analysis of ER expression in NSABP B-24 suggests that increased levels of ER expression predict for tamoxifen benefit in terms of risk reduction for ipsilateral and contralateral breast cancer development following BCT.[60]

A phase III trial randomized patients with excised DCIS to receive WBRT or no WBRT and tamoxifen versus no tamoxifen.[22] The randomization was independent for each of the two treatments (RT and tamoxifen). With 12.7 years of median follow-up, the use of tamoxifen decreased all new breast events (HR, 0.71; 95% CI, 0.58–0.88; $P = .002$). The use of tamoxifen decreased ipsilateral and contralateral breast events in the subjects not given WBRT (ipsilateral HR, 0.77; 95% CI, 0.59–0.98; contralateral HR, 0.27; 95% CI, 0.12–0.59), but not in those receiving WBRT (ipsilateral HR, 0.93; 95% CI, 0.50–1.75; $P = .80$; contralateral HR, 0.99; 95% CI, 0.39–2.49; $P = 1.0$).

The standard dose of tamoxifen is 20 mg/day for 5 years. The phase III TAM-01 trial studied a lower dose of tamoxifen (5 mg for 3 years) in 501 patients with breast intraepithelial neoplasia including DCIS, lobular carcinoma in situ (LCIS), and ADH. The rate of recurrence of either intraepithelial neoplasia or invasive breast cancer was 5.7% among those receiving tamoxifen 5 mg daily versus 11.9% for those receiving placebo (HR, 0.48; 95% CI, 0.25–0.89) at a median follow-up of 5.1 years.[61] The relative risk (RR) reduction with low-dose tamoxifen seen in the TAM-01 trials is consistent with that seen in trials that used a higher dose of tamoxifen, but the rate of severe toxicity compared with placebo was less.

Anastrozole: In patients with ER-positive and/or PR-positive DCIS treated by wide local excision with or without RT, a large, randomized, double-blind, placebo-controlled trial (IBIS-II) compared anastrozole (n = 1471) with tamoxifen (n = 1509). The results demonstrated non-inferiority of anastrozole to tamoxifen.[62] After a median follow-up of 7.2 years, 67 recurrences were reported with anastrozole versus 77 for tamoxifen (HR, 0.89; 95% CI, 0.64–1.23). A total of 33 deaths were recorded for

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anastrozole and 36 for tamoxifen (HR, 0.9393; 95% CI, 0.58–1.50; *P* = .78).[62] Although the number of patients reporting any adverse event was similar between anastrozole (n = 1323, 91%) and tamoxifen (n = 1379, 93%), the side-effect profiles of the two drugs were different. There were more fractures, musculoskeletal events, hypercholesterolemia, and strokes reported with anastrozole and more muscle spasms, gynecologic cancers and symptoms, vasomotor symptoms, and deep vein thromboses reported with tamoxifen. The NSABP B-35 study randomly assigned 3104 postmenopausal patients with hormone-positive DCIS treated with lumpectomy and radiation to either tamoxifen or anastrozole for 5 years. Prior to being randomly assigned, patients were stratified by age—<60 years or >60 years. The primary endpoint was breast cancer-free interval.[63] Anastrozole treatment resulted in an overall statistically significant decrease in breast cancer-free interval events compared with tamoxifen (HR, 0.73; 95% CI, 0.56–0.96; *P* = .0234). The significant difference in breast cancer-free interval between the two treatments was apparent in the study only after 5 years of follow-up. The estimated percentage of patients with a 10-year breast cancer-free interval was 89.1% in the tamoxifen group and 93.1% in the anastrozole group.[63] In addition, anastrozole resulted in further improvement in breast cancer-free interval in younger postmenopausal patients (<60 years of age). With respect to adverse effects, the overall incidence of thrombosis or embolism was higher in the tamoxifen group while the anastrozole group had slightly more cases of arthralgia and myalgia.[63]

Results of the IBIS-II and the NSABP-B-35 studies indicate that anastrozole provides at least a comparable benefit as adjuvant treatment for postmenopausal patients with hormone receptor (HR)-positive DCIS treated with BCS and RT, with a different toxicity profile.

Surveillance after treatment for DCIS helps early recognition of disease recurrences (either DCIS or invasive disease) and evaluation and management of therapy-related complications. The majority of recurrences of DCIS are in-breast recurrences after BCT, and recurrences mostly occur in close proximity to the location of the prior disease. Overall, approximately one-half of the local recurrences after initial treatment for a pure DCIS are invasive in nature, whereas the remainder recur as pure DCIS.

NCCN Recommendations for Management of DCIS After Primary Treatment

According to the NCCN Panel, in patients with ER-positive DCIS treated with BCT, endocrine therapy with tamoxifen (for premenopausal and postmenopausal patients) or an aromatase inhibitor (AI) (for postmenopausal patients, especially those <60 years of age or in those with concerns of embolism) may be considered as a strategy to reduce the risk of ipsilateral breast cancer recurrence (category 1 for those undergoing BCT followed by RT; category 2A for those undergoing excision alone). The benefit of endocrine therapy for ER-negative DCIS is not known. Low-dose tamoxifen (5 mg/day for 3 years) is an option only if the 20-mg standard-dose of tamoxifen is not tolerated (see DCIS-2 in the algorithm).

Follow-up of patients with DCIS includes interval history and physical examination every 6 to 12 months for 5 years and then annually, as well as yearly diagnostic mammography. In patients treated with BCT, the first follow-up mammogram should be performed 6 to 12 months after the completion of RT (category 2B) (see DCIS-2 in the algorithm). Patients receiving endocrine therapy for risk reduction should be monitored as described in the NCCN Guidelines for Breast Cancer Risk Reduction.

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Invasive Breast Cancer

Workup for Non-metastatic (M0) Invasive Breast Cancer

The recommended workup of localized invasive breast cancer (listed on BINV-1 in the algorithm) includes a history and physical examination. Complete blood count (CBC) and liver function tests (LFTs) have no added benefit in the detection of underlying metastatic disease in patients with asymptomatic early-stage breast cancers.[64] In addition, monitoring of disease relapse with any tumor markers is *not* recommended.

Imaging: Imaging with bilateral diagnostic mammography is recommended; breast ultrasonography is recommended only if necessary.

The use of MRI in the workup remains controversial. Breast MRI advocates note its high sensitivity for evaluation of extent of disease, particularly for invasive cancer and in dense breasts where mammographically occult disease is more likely to elude preoperative detection. MRI detractors note that MRI has a high percentage of false-positive findings, resulting in further diagnostic workup—including MRI-guided biopsy—in many circumstances.[65-67] MRI findings tend to overestimate extent of disease,[68] resulting in increased frequency of mastectomies.[69-72]

MRI findings alone are not sufficient to determine whether BCT is optimal, as additional tissue sampling is needed to verify true malignant disease warranting excision. MRI use may increase mastectomy rates by identifying areas of mammographically occult disease that may have been adequately treated with radiation after BCS had the disease remained undiscovered without MRI.[72]

Two prospective randomized studies have examined the utility of preoperative MRI in determining disease extent, and neither demonstrated improvement in rates of re-excision after initial BCS.[73,74] Retrospective review of the utility of MRI showed conflicting outcome results— one with benefit[75] and another without.[76] One systematic review[67] documented that breast MRI staging altered surgical treatment in 7.8% to 33.3% of patients;[67] however, no differences in local recurrence or survival have been demonstrated. In addition, there is no evidence that use of breast MRI increases rates of margin-negative resection.[77,78]

Breast MRI may assist with identification and management of clinically occult primary tumors presenting with axillary nodal metastases.[79] In patients with Paget disease not identifiable on mammography, breast MRI may help determine the extent of disease.[80,81] Breast MRI also has utility in screening patients with higher than average risk based on family history.[82]

If breast MRI imaging is performed, a dedicated breast coil, an imaging team experienced with reading breast MRI and performing MRI-guided biopsy, and multidisciplinary management are the standard of care.

According to the NCCN Panel, the use of MRI is optional and is not universally recommended by experts in the field. Breast MRI may be used for staging evaluation to define extent of cancer, in the adjuvant or neoadjuvant setting, to detect the presence of multifocal or multicentric cancer in the ipsilateral breast, or as screening of the contralateral breast cancer at time of initial diagnosis. Additional indications for breast MRI include: clinical axillary metastasis with an occult primary cancer; Paget disease of the nipple with breast primary not identified by other breast imaging modalities or physical examination; follow-up screening of patients with prior mammographically undetected breast cancers; and those whose lifetime risk of a second primary breast cancer is >20% (based on models largely dependent on family history).

Pathology Assessment: A central component of the treatment of breast cancer is full knowledge of extent of disease and biologic features. Full

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knowledge of extent of disease and biologic features is central to the treatment of breast cancer.

The specimens should be oriented for the pathologist, and specific requests for determination of biomarkers should be stated (eg, ER, PR, and HER2 status). The Panel also recommends testing for Ki-67 if HR-positive, HER2-negative, and considering adjuvant abemaciclib.

Accurate pathology reporting requires communication between the clinician and the pathologist relating to relevant patient history, prior breast biopsies, prior irradiation to the chest, pregnancy status, characteristics of the abnormality biopsied (eg, palpable, mammographically detected microcalcifications), clinical state of lymph nodes, presence of inflammatory change or other skin abnormality, and any prior treatment administered (eg, chemotherapy, RT). The specimens should be oriented for the pathologist, and specific requests for determination of biomarkers should be stated. The use of consistent, unambiguous standards for reporting is strongly encouraged. Data from both national and local surveys show that as many as 50% of pathology reports for breast cancer are missing some elements critical to disease management.[12,13] Significant omissions include failure to orient and report surgical margins and failure to report tumor grade consistently. The CAP has developed pathology reporting protocols to promote complete and standardized reporting of malignant specimens. CAP provides a protocol for each disease site that includes cancer case summaries (checklists) along with background documentation. These checklists form the basis for a synoptic, standardized reporting of pathologic findings. The checklists are available without charge through the CAP website at www.cap.org. Consistent, unambiguous, and complete pathology reporting is a cornerstone of quality breast cancer care. The NCCN Breast Cancer Panel endorses the use of the CAP protocols for reporting the pathologic analysis of all breast cancer specimens.[5]

Genetic Counseling: For patients considered to be at high risk for hereditary breast cancer as defined by the NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, genetic counseling is recommended.

Distress Assessment: Levels of distress may vary in patients and should be addressed individually. Psychological distress can be impacted by body image and other factors. Younger patients have higher rates of psychosocial distress than patients diagnosed at older ages.[83-87] The NCCN Breast Cancer Panel recommends assessing for distress in patients newly diagnosed with breast cancer using guidance from NCCN Guidelines for Distress Management.

Fertility and Sexual Health: The general considerations for fertility and sexual health/function outlined for specific populations in NCCN Guidelines for Adolescent and Young Adult (AYA) Oncology and NCCN Guidelines for Survivorship are applicable to all patients diagnosed with breast cancer. The Panel recommends referring to those guidelines for guidance.

Numerous epidemiologic studies have demonstrated that childbearing after treatment for invasive breast cancer does not increase rates of recurrence or death from breast cancer.[88] The offspring of pregnancies after treatment for breast cancer do not have an increased rate of birth defects or other serious childhood illness. However, treatment for breast cancer, especially with cytotoxic agents, may impair fertility and fertility may wane during the 5 to 10 years of adjuvant endocrine therapy.

While the potential to regain menstrual function within 2 years of completing chemotherapy is possible, especially for those <35 years of age,[89] resumption of menses does not correlate with fertility, and conversely, fertility may be preserved without menses. Therefore, all

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premenopausal patients should be informed about the potential impact of chemotherapy on fertility and offered the option of fertility preservation if future childbearing is desired.

Considerations for fertility preservation should incorporate patient preference, tumor stage and biology, age of the patient, risk of premature ovarian failure based on anticipated type and duration of chemotherapy and/or endocrine therapy, as well as the timing and duration allowed for fertility preservation.

Several studies report lower rates of fertility discussion among female patients with cancer[90-92] despite the updated ASCO guidelines stating that patients should not be excluded from consideration for discussion of fertility preservation for any reason, including parity, prognosis, age, and socioeconomic status.[93] The NCCN Panel recommends that all treating physicians should have a discussion with their patients of childbearing potential regarding the options for fertility preservation. Patients who desire to bear children after systemic therapy should be referred to a fertility specialist prior to initiating systemic (chemotherapy or endocrine) therapy.[93-99]

Randomized trials have demonstrated that GnRH agonists (such as goserelin) administered prior to initiating chemotherapy and then administered concurrently with adjuvant chemotherapy protect against ovarian failure and reduce the risk of early menopause.[100-102] In one trial goserelin improved the probability of pregnancy from 11% to 21% in patients with HR-negative early-stage breast cancer.[103] Smaller historical experiences in patients with HR-positive disease have conflicting results with respect to the protective effects of GnRH agonists in fertility preservation.

Patients should be informed of all the various modalities available to minimize gonadal damage and preserve ovarian function and future fertility. The fertility specialist should discuss specifics of fertility preservation options including hormonal interventions, ovarian stimulation, embryo or oocyte cryopreservation, and other investigational options, as well as the probability of successful gestation and childbirth.[104,105]

Combining the various modalities for a specific patient may increase the odds of preservation of future fertility. It is important for fetal safety that patients actively avoid becoming pregnant during breast cancer treatment.

Additional Diagnostic Workup

The Panel has reiterated that routine systemic imaging is ***not*** indicated for patients with early-stage breast cancer *in the absence* of signs/symptoms of metastatic disease. Recommendations for additional metastatic workup should be performed for those patients with signs or symptoms suspicious for metastatic disease, based on lack of evidence to demonstrate any benefits with metastatic workup in early-stage disease.[106-108] In one study, metastases were identified by bone scan in 5.1%, 5.6%, and 14% of patients with stage I, II, and III disease, respectively, and no evidence of metastasis was detected by liver ultrasonography or chest radiography in patients with stage I or II disease.[106] For patients with stage III breast cancer, the prevalence of a positive liver ultrasound and positive chest x-ray was 6% and 7%, respectively.[106]

CBC, comprehensive metabolic panel, liver function, and alkaline phosphatase tests should be considered only if the patient is a candidate for preoperative or adjuvant systemic therapy. A bone scan or sodium fluoride PET/CT is indicated in patients presenting with localized bone pain or elevated alkaline phosphatase. Bone scan or sodium fluoride PET/CT may not be needed if FDG-PET/CT is performed and clearly indicates bone metastasis, on both the PET and CT component.

A diagnostic chest CT is indicated only if pulmonary symptoms (ie, cough or hemoptysis) are present. Likewise, abdominal and pelvic imaging using

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diagnostic CT or MRI is indicated if the patient has elevated alkaline phosphatase, abnormal results on LFTs, abdominal symptoms, or abnormal physical examination of the abdomen or pelvis.

FDG-PET/CT may be performed at the same time as diagnostic CT, and may be helpful in situations where standard staging studies are equivocal or suspicious. FDG-PET/CT may also be helpful in identifying unsuspected regional nodal disease and/or distant metastases when used in addition to standard staging studies. The routine use of FDG-PET/CT scanning is not recommended in the staging of clinical stage I, II, or operable III (T3,N1) breast cancer, due to its high false-negative rate for the detection of lesions that are small (<1 cm) and/or low-grade disease, the high rate of false-positive scans in patients without locally advanced disease, the low sensitivity for detection of axillary nodal metastases, and the low probability of these patients having detectable metastatic disease.[109-112]

Locoregional Treatment of cT1–3, cN0 or cN+, M0 Disease

Surgery

Patients with early-stage operable breast cancer initially undergo upfront definitive surgery (BCS or mastectomy), and adjuvant systemic therapy if indicated, based on primary tumor characteristics, such as tumor size, grade, lymph node involvement, ER/PR status, expression of HER2 receptor, and tumor genomics. Some patients with early-stage operable HER2-positive or triple-negative disease may be treated with preoperative systemic therapy first, followed by surgery. For NCCN Panel recommendations and consideration for preoperative systemic therapy, refer to www.NCCN.org. Radiation is typically sequenced after definitive surgery and after systemic chemotherapy (if delivered).

Several randomized trials document that mastectomy is equivalent to BCT, which includes BCS with WBRT with respect to OS as primary treatment for the majority of patients with stage I and stage II breast cancers (category 1).[113-117] The optimal choice of surgery is based on a shared decision made by the patient and clinician after discussing benefits and risks of mastectomy versus BCT in regards to long-term survival, risk of local recurrence, and the impact on cosmetic outcome and overall QOL.

Breast Conserving Surgery

BCS allows patients to preserve their breast without sacrificing oncologic outcome. BCS is contraindicated for patients who are pregnant and would require radiation during pregnancy; have diffuse suspicious or malignant-appearing microcalcifications on mammography; have widespread disease that cannot be incorporated by local excision of a single region or segment of the breast tissue with a satisfactory cosmetic result; have diffusely positive pathologic margins; or have homozygous (biallelic) inactivation for *ATM* mutation (category 2B). Relative contraindications to lumpectomy include previous RT to the breast or chest wall; active connective tissue disease involving the skin (especially scleroderma and lupus); persistently positive pathologic margin; or those with a known or suspected genetic predisposition to breast cancer who may have an increased risk of ipsilateral breast recurrence or contralateral breast cancer with BCT or who may be considered for prophylactic bilateral mastectomy for risk reduction as per the criteria in the NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic or may have known or suspected Li-Fraumeni syndrome (category 2B).

Several studies of patients with early-stage breast cancer treated with BCS have identified young age as a significant predictor of an increased likelihood of IBTRs after BCT.[118-120] Risk factors, such as a family history of breast cancer or a genetic predisposition for breast cancer (ie, *BRCA1/2* or other cancer-predisposing mutation), are more likely to exist in the

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population of young patients with breast cancer, thereby confounding the independent contributions of age and treatment to clinical outcome.[121]

With respect to OS outcomes for young patients with breast cancer, BCT or mastectomy are similar.[115,116,122-124] Some studies have shown improved survival[125-127] and fewer post-surgical complications[128] with BCS.

Mastectomy

Mastectomy is indicated for patients who are not candidates for BCS or those who choose to undergo this procedure over BCS.

Only limited data are available on the survival impact of risk-reducing contralateral mastectomy in patients with a unilateral breast cancer.[129] Analysis of patients included in the SEER database treated with mastectomy for a unilateral breast cancer from 1998 to 2003 showed that contralateral risk-reducing mastectomy performed at the time of treatment of a unilateral cancer was associated with a reduction in breast cancer-specific mortality only in the population of young patients (18–49 years of age) with stage I/II, ER-negative breast cancer (HR, 0.68; 95% CI, 0.53–0.88; *P* = .004).[130] The 5-year breast cancer survival for this group was only *slightly* improved with contralateral risk-reducing mastectomy versus without (88.5% vs. 83.7%, difference = 4.8%).[130] These differences observed in retrospective analysis could be due to selection bias among patients who chose risk-reducing contralateral mastectomy.[131] A statistical simulation of survival outcomes after risk-reducing contralateral mastectomy among patients with stage I or II breast cancer with no *BRCA* mutation found that the absolute 20-year survival benefit from risk-reducing contralateral mastectomy was <1% among all age, ER status, and cancer stage groups.[132] Data from another meta-analysis found no absolute reduction in risk of distant metastases with risk-reducing mastectomy.[133] Furthermore, among patients with unilateral breast cancer who have an increased familial/genetic risk, a decrease in metastatic contralateral breast cancer incidence was observed in those who received risk-reducing contralateral mastectomy, although no improvement was seen in OS of these patients.[133]

The Panel recommends that patients with breast cancer who are ≤35 years or premenopausal and carriers of a known *BRCA1/2* mutation consider additional risk reduction strategies following appropriate risk assessment and counseling (see NCCN Guidelines for Breast Cancer Risk Reduction and NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic). This process should involve multidisciplinary consultations prior to surgery, and should include a discussion of the risks associated with development of a contralateral breast cancer as compared with the risks associated with recurrent disease from the primary cancer. Except as specifically outlined in the NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic, risk reduction mastectomy of the contralateral breast to a known unilateral breast cancer treated with mastectomy or BCT is discouraged by the Panel.

The NCCN Panel recommends referring to the NCCN Guidelines for Older Adult Oncology for special considerations for this population.

Margin Assessment: After surgical resection, a careful histologic assessment of resection margins is essential. The NCCN Panel notes that benefit of BCS is predicated on achieving pathologically negative margins after resection. The NCCN Panel accepts the most recent definition outlined in the guidelines established by the SSO/ASTRO as the standard for negative surgical margins for invasive cancer.[134]

For patients with stage I or II invasive cancers after BCS, a *positive* margin is defined as “ink on tumor” (any invasive cancer or DCIS cells on ink). Patients with positive margins generally require further surgery—either a re-excision to achieve a negative margin or a mastectomy. If re-excision is technically feasible to achieve “no ink on tumor,” this can be done with

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resection of the involved margin guided by the orientation of the initial resection specimen or re-excision of the entire original excision cavity. There may be select patients with stage III invasive cancers who may be eligible for BCS. For these patients, the margin status would be assessed with similar definitions. If margins remain positive after further surgical re-excision(s), then mastectomy may be required for optimal local disease control.

In order to adequately assess margins following surgery, the Panel recommends that the surgical specimens be directionally oriented and that the pathologist provide descriptions of the gross and microscopic margin status and the distance, orientation, and type of tumor (invasive cancer or pure DCIS) in relation to the closest margin. Marking the tumor bed with clips facilitates accurate planning of the radiation boost field, where appropriate.

For invasive breast cancers that have a component of DCIS, the negative margin definition of "no ink on tumor" should be utilized based on the SSO/ASTRO Consensus Guideline on Margins unless it is DCIS-M, which behaves more like pure DCIS and 2-mm margins are recommended. In this setting, "no ink on tumor" is recommended for either DCIS or invasive cancer cells, primarily because the natural history, treatment, and outcomes of these lesions are more similar to invasive cancer than DCIS. For specifically challenging cases, clinical judgment and discussion with the patient should precede routine re-excision.

The same margin recommendations cannot be applied directly to patients undergoing APBI, where data regarding local recurrence are more limited than WBRT. Individualized clinical judgment should be utilized on a case-by-case basis, using postoperative mammography to identify residual calcifications and clinical-pathologic factors such as quantitative extent of disease near margin, presence of extensive intraductal component (EIC), young age, or multiple close margins to assist in identifying patients who may have an increased risk of ipsilateral recurrence and therefore may benefit from re-excision.

Surgical Axillary Staging

Axillary status is important for planning systemic adjuvant treatment and RT. The lymphatic pathways from the breast go to the ALNs, internal mammary, infraclavicular, and/or supraclavicular lymph nodes.

Traditional level I and level II ALNDs require that at least 10 lymph nodes be provided for pathologic evaluation to accurately stage the axilla.[135,136] ALND should be extended to include level III nodes only if gross disease is apparent in the level II and I nodes. In the absence of gross disease in level II nodes, lymph node dissection should include tissue inferior to the axillary vein from the latissimus dorsi muscle laterally to the medial border of the pectoralis minor muscle (levels I and II).

Historically, ALND has been the standard of care for axillary staging.[137] However, ALND is associated with lymphedema and other significant morbidities.[138-140] This has been largely replaced with SLNB.

SLN mapping injections may be peritumoral, subareolar, or subdermal. SLNs can be assessed for the presence of metastases by both hematoxylin and eosin (H&E) staining and cytokeratin immunohistochemistry (IHC). The clinical significance of a lymph node that is negative by H&E staining but positive by cytokeratin IHC is not clear. Because the historical and clinical trial data on which treatment decisions are based have relied on H&E staining, the Panel does not recommend routine cytokeratin IHC to define node involvement and believes that current treatment decisions should be made based solely on H&E staining. This recommendation is further supported by a randomized clinical trial (ACOSOG Z0010) for patients with H&E negative nodes where further examination by cytokeratin IHC was not associated with improved OS over

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a median of 6.3 years.[141] In the uncommon situation in which H&E staining is equivocal, reliance on the results of cytokeratin IHC is appropriate.

Two randomized trials compared SLNB alone versus ALND. The Milan trial (1998–1999) randomized 516 patients treated with BCS with tumors ≤2 cm to two arms, one receiving immediate axillary dissection and the other receiving the dissection only if the sentinel node was involved.[142] After 79 months of follow-up, there was no difference in OS and DFS.[143]

Another similar study, NSABP B-32, conducted between 1999 and 2004, randomized 5611 patients with invasive breast cancer ≤2 cm to either ALND or SLNB alone with ALND performed only if the SLN was positive.[144] After 95.6 months of follow-up, OS and DFS were similar in the two groups. Results of a subgroup analysis of this study showed patients with ALND had significantly higher arm morbidity and significantly more restricted work and social activity and impaired QOL.[145,146]

The ALMANAC trial studied the QOL in patients (n= 1031) with SLNB versus ALND.[147] After 12 months, lymphedema and sensory loss were higher in the ALND group. Operative time, drainage use, hospitalization, and resumption of normal life were much longer in ALND compared to the SLNB group. The SNAC trial[148] and the DBCCG trial[149] also showed less morbidity with SLNB compared with ALND.

Based on the results of the above studies, it was clarified that for *negative* sentinel nodes, ALND is not needed.

The ACOSOG Z0011 trial addressed the role of ALND in those with a clinically negative axilla but pathologically positive lymph nodes from an SLNB. This trial randomized patients ≥18 years of age with clinical T1/T2 tumors, fewer than 3 positive SLNs, undergoing BCS and WBRT, to SLNB alone (n = 436) or to a completion ALND (n = 420). In this study, there was no difference in local recurrence, DFS, or OS between patients with positive SLN undergoing a completion ALND versus no ALND. Only ER-negative status, age <50 years, and lack of adjuvant systemic therapy were associated with decreased OS.[150] At a median follow-up of 6.3 years, locoregional recurrences were noted in 4.1% of patients in the ALND group and 2.8% of patients in the SLNB group (P = .11). Median OS was approximately 92% in each group.[151] Long-term follow-up (median 9.25 years) results of the ACOSOG Z0011 study showed no statistically significant difference in local recurrence-free survival (RFS) between trial arms (P = .13).[152] The cumulative incidence of ipsilateral axillary recurrences at 10 years was 0.5% (2 patients) in those who underwent ALND and 1.5% (5 patients) in those who underwent SLNB alone (P = .28).[152] The 10-year cumulative incidence of locoregional recurrences was 6.2% with ALND and 5.3% with SLNB alone (P = .36).[152]

The results of the ACOSOG Z0011 trial demonstrate that there is no benefit to ALND in patients with early-stage breast cancer who have only one or two SLN metastases (minimal nodal burden) on SLNB after receiving WBRT as part of BCT. Mastectomy patients were not enrolled in the ACOSOG Z0011 trial since these patients do not routinely receive radiation.

Another randomized trial (IBCSG 23-01) was specifically designed to compare outcomes in patients with sentinel micrometastases (≤2 mm) treated with ALND versus no ALND.[153] While the ACOSOG Z0011 trial was limited to those undergoing BCT, this trial included patients undergoing mastectomy (9%).[153] Between the group treated with SLNB plus ALND versus the group that had SLNB alone, there were no differences in 5-year DFS (84.4%; 95% CI, 80.7%–88.1% vs. 87.8%; 95% CI, 84.4%–91.2%); cumulative incidence of breast cancer events, including local, regional, contralateral breast, and distant recurrence (10.8%; 95% CI, 7.6–14.0 vs. 10.6%; 95% CI, 7.5–13.8); or OS (97.6%; 95% CI, 96.0%–99.2% vs. 97.5%; 95% CI, 95.8%–99.1%).[153] Regional

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recurrence was <1% for those who underwent ALND and 1% for those who did not undergo ALND.[153] The results of this trial show that in patients with micrometastases on SLNB, ALND is not needed.

The results of a trial by the European EORTC group (AMAROS) assessed whether axillary RT provides regional control with fewer side effects compared with ALND.[154] This trial included patients (n = 4823) with T1 or T2 breast cancer with positive SLNs randomized to an ALND or axillary RT. One thousand four hundred twenty-five patients had positive SLNs (micrometastatic or macrometastatic), which included a small fraction of patients (n = 248) treated with mastectomy (17%).[154] The results reported no difference in 5-year OS or DFS for patients randomized to ALND versus axillary radiation.[154] The 5-year DFS was 86.9% (95% CI, 84.1–89.3) in the ALND group and 82.7% (79.3–85.5) in the axillary RT group. The 5-year OS was 93.3% (95% CI, 91.0–95.0) in the ALND group and 92.5% (90.0–94.4) in the axillary RT group.[154] At the end of 5 years, lymphedema was less frequent in the group treated with axillary RT versus ALND (11% vs. 23%).[154] The 10-year follow-up results presented at the 2021 SABCS showed no significant differences between the two arms with respect to OS (with ALND, OS was 84.6% vs. 81.4% with axillary RT), distant metastasis-free survival (with ALND was 81.7% vs. 78.2% with axillary RT), or locoregional recurrence rate (3.59% with ALND vs. 4.07% with axillary RT). The axillary recurrence with axillary RT was 1.8% versus 0.93% with ALND.[155]

The OTOASAR trial was designed similarly to the AMAROS trial; patients (n = 2100) with tumors ≤3.0 cm who were clinically node negative were randomized to receive either ALND or axillary RT if they had 1 to 2 positive SLNs.[156] The results showed no difference in axillary recurrence with ALND compared with SLNB plus RT to the axilla.[156]

In the setting of preoperative chemotherapy, the question that is being explored is whether ALND may be omitted in patients with complete pathologic response after preoperative therapy.

Several prospective studies have evaluated patients with positive lymph nodes before preoperative systemic therapy who had clinical complete response to preoperative therapy and underwent SLNB and ALND. The results of these studies have shown that in those with node-positive disease prior to preoperative systemic therapy, SLNB has a >10% false-negative rate when performed after preoperative systemic therapy. In the SENTINA study,[157] the overall false-negative rate was 14.2%. In the ACOSOG-Z1071 trial,[158] the false-negative rate was 12.6% and in the SN FNAC trial,[159] the false-negative rate was 13.3%.

Subgroup analyses from studies have shown that 1) using dual-agent lymphatic mapping (radiotracer and blue dye); 2) identifying three or more SLNs; and 3) marking the metastatic lymph node with a clip before neoadjuvant therapy and then resecting it at the time of surgery reduces false-negative rates to <10%.

A subgroup analysis of the ACOSOG Z1071 trial showed lower false-negative rates in patients who had a clip placed in the positive lymph nodes at the time of initial biopsy followed by removal of the clipped node during SLN surgery after preoperative systemic therapy.[160] A another study of selective localization and removal of clipped nodes with SLNB, known as targeted axillary dissection (TAD), showed false-negative rates reduced to approximately 2% compared with 4% with removal of the clipped lymph node alone.[161]

Several ongoing clinical trials are examining further de-escalation of axillary surgery in those who have positive nodes after preoperative systemic treatment. The Alliance A011202/MAC19 trial (NCT01901094) is randomly assigning patients who have sentinel node–positive disease

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after neoadjuvant chemotherapy to ALND versus no further axillary surgery. Both arms will receive regional nodal radiation. The SLNB alone arm will include axillary RT to the undissected axilla (levels I–III), whereas the ALND arm will not include RT to levels I or II axillae.

NCCN Recommendations for Surgical Axillary Staging: If ALNs are clinically negative (no palpable nodes) at the time of diagnosis, ≤2 suspicious lymph nodes are found on imaging, or ≤2 positive lymph nodes are confirmed by needle biopsy, the Panel recommends SLN mapping.

If SLN is negative, no further surgery is needed in these patients. If SLN is positive, based on the ACOSOG Z 0011 data, no further surgery is recommended only if all of the following criteria are met: the patients have cT1–2, N0 tumors, have not received preoperative systemic therapy, only have 1 or 2 positive SLNs, and will undergo BCT (BCS + WBRT). If any of the above criteria are not met, the Panel recommends level I and II axillary dissection.

Based on the AMAROS and OTASAR trial data, no further surgery is recommended only if all of the following criteria are met: the patients have cT1–2, N0 tumors, have not received preoperative systemic therapy, have 1 to 2 positive SLNs, and will undergo lumpectomy or mastectomy along with adjuvant RT with *intentional* inclusion of undissected axilla at risk. If any of the above criteria are not met, the Panel recommends level I and II axillary dissection. In select patients undergoing mastectomy with clinically negative axillae but 1 to 2 positive SLNs, the Panel notes that axillary radiation may replace ALND for regional control of disease. Based on the results of the IBCSG 23-01 trial, the NCCN Panel recommends no ALND for patients with positive SLNs when that disease is limited to *only* micrometastatic. According to the American Joint Committee on Cancer (AJCC) staging, micrometastatic nodal involvement is defined as a metastatic deposit or >0.2 mm but ≤2.0 mm.[162]

In patients with clinically suspicious (palpable) lymph nodes or 3 or more suspicious lymph nodes on imaging, or if preoperative systemic therapy is being considered for patients with suspicious lymph nodes at diagnosis on examination or imaging, the Panel recommends pathologic confirmation of malignancy using ultrasound-guided fine-needle aspiration (FNA)[163] or core biopsy of suspicious nodes with clip placement.

According to the NCCN Panel, the recommendation for ALND of level I and II nodes is limited to patients with biopsy-proven axillary metastases (in those who did not receive preoperative systemic therapy) or who have residual disease after preoperative chemotherapy. Highly selected patients with biopsy-proven axillary metastases, who then converted to clinically node negative *after* preoperative systemic therapy, may undergo SLNB with removal of the clipped lymph node. This is a currently a category 2B recommendation as the rate of false negatives is high when SLN is performed after preoperative systemic therapy.

According to the NCCN Panel, based on available data, the false-negative rate can be reduced by marking biopsied lymph nodes to document their removal, using dual tracer, and by removing 3 or more sentinel nodes (targeted ALND). When sentinel nodes are *not* successfully identified, the Panel recommends level I and II axillary dissection be performed for axillary staging.

Radiation Therapy

Principles of Radiation Therapy

It is important to individualize RT planning and delivery. CT-based treatment planning is encouraged to delineate target volumes and adjacent organs at risk. Greater target dose homogeneity and sparing of normal tissues can be accomplished using compensators such as wedges, forward planning using segments, and intensity-modulated RT (IMRT). Respiratory control techniques including deep inspiration

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breath-hold and prone positioning may be used to try to further reduce dose to adjacent normal tissues, particularly the heart and lung.[164] Verification of treatment setup consistency is done with weekly imaging. When using certain techniques (ie, prone breast), more frequent imaging may be appropriate. Standard utilization of daily imaging is not recommended. Radiation to the breast/chest wall and nodal regions is generally delivered with single-energy or mixed-energy photons with or without electrons. Dose-volume histograms (DVHs) should be used to evaluate dose constraints, evaluate dose to normal tissues (ie, heart, lung), and ensure adequate coverage to the intended planning target volumes (PTVs), including the breast/chest wall, supraclavicular fossa, axillary levels I–III, and internal mammary nodes.

Whole Breast Radiation Therapy

WBRT reduces the risk of local recurrence and has shown to have a beneficial effect on survival.[114,117] Randomized trials have demonstrated decreased in-breast recurrences with an additional boost dose of radiation (by photons, brachytherapy, or electron beam) to the tumor bed.[165,166] For greater homogeneity of target dose and to spare normal tissues using compensators such as tissue wedges, forward planning using segments and IMRT may be used.[167,168]

Four randomized clinical trials have investigated hypofractionated WBRT schedules (39–42.9 Gy in single fractions of 2.6–3.3 Gy) compared to standard 50 Gy in single fractions of 2 Gy.[169-172] The 10-year follow-up data from the START trials[173] are consistent with the 10-year results of the Canadian trial,[172] which reported that local tumor control and breast cosmesis were similar with a regimen of 42.5 Gy in 16 fractions over 3.2 weeks compared with the standard dose of 50 Gy in 25 fractions over 5 weeks.[172] The START trials reported radiation-related effects to normal breast tissue such as breast shrinkage, telangiectasia, and breast edema as less common with the hypofractionated regimen.[173]

Another randomized trial showed similar outcomes among patients receiving a hypofractionated schedule (40 Gy in 15 fractions) compared with standard fractionation (50 Gy in 25 fractions) in patients (n = 1854) with node-negative breast cancer (n = 1608) or DCIS (n = 246).[174] The 9-year risk of locoregional recurrence was 3.3% in the 50-Gy group and 3.0% in the 40-Gy group. The 9-year OS was 93.4% in the 50-Gy group and 93.4% in the 40-Gy group. Radiation-associated cardiac and lung disease were comparable between the groups.

Other shorter schedules of delivering WBRT have also been studied with similar results. The FAST trial compared patients >50 years of age with low-risk invasive breast carcinoma (pT1–2, pN0) randomly assigned to the standard schedule of 50 Gy in 25 fractions over 5 weeks or 30 Gy or 28.5 Gy in 5 fractions once weekly. After 10-year follow-up, there were no significant differences reported in normal tissue effects for the standard 50 Gy in 25 fractions schedule versus a once-weekly schedule for 5 weeks totaling 28.5 Gy, but normal tissue effects were higher with a weekly schedule for 5 weeks totaling 30 Gy.[175]

The FAST Forward trial randomized patients with non-metastatic breast cancer (n = 4096) after BCS or mastectomy to one of the following: 40 Gy in 15 fractions over 3 weeks; 27 Gy in 5 fractions over 1 week; or 26 Gy in 5 fractions over 1 week to either whole beast or chest wall.[176] The 5-year incidence of ipsilateral breast tumor relapse was 2.1% with the standard 40 Gy in 15 fractions over 3 weeks versus 1.7% with 27 Gy in 5 fractions over 1 week (5.4 Gy per fraction; HR, 0.86; 95% CI, 0.51–1.44) and 1.4% with 26 Gy in 5 fractions over 1 week (5.2 Gy per fraction; HR, 0.67; 95% CI, 0.38–1.16).[176] The moderate or marked tissue effects in the breast or chest wall were 15% with 27 Gy, 12% with 26 Gy, and 10% with 40 Gy, but differences between the 40 Gy and 26 Gy groups were not statistically different.[176]

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RT Boost to Tumor Bed: In patients with higher risk characteristics (such as age <50 years, high-grade disease, or patients with focally positive margins) an RT boost has been shown to reduce local relapse.[30,32,166,173,177-179] RT boost treatment in the setting of breast conservation can be delivered using enface electrons, photons, or brachytherapy.[180]

NCCN Recommendations for WBRT: The Panel has defined the target as breast tissue at risk. The NCCN Panel recommends a dose of 40 to 42.5 Gy in 15 to 16 fractions for all patients getting whole breast radiation without regional nodal radiation, based on its equivalence in efficacy and toxicity demonstrated in the moderately hypofractionated trials.[173] While these abbreviated courses of RT of 40 to 42.5 Gy in 15 to 16 fractions are the NCCN Panel's preferred fractionation schema for whole breast radiation, the conventionally fractionated regimen of 46 to 50 Gy in 23 to 25 fractions may be utilized in selected patients. The RT boost doses intended to decrease rate of local recurrence are 10 to 16 Gy in 4 to 8 fractions.

Ultra-hypofractionated WBRT of 28.5 Gy delivered as 5 (once weekly) fractions may be considered in select patients with pTis/T1/T2/N0 aged >50 years after BCS, though the optimal fractionation for the boost delivery is unknown for this regimen. Alternatively, 26 Gy in 5 daily fractions over one week may be considered, though data beyond 5 years for local relapse or toxicity are not yet available for this regimen and should be discussed with patients prior to its use. The Panel also notes that when using ultra-hypofractionated dosing, it is essential to utilize 3D planning to minimize inhomogeneity and exposure to heart and lung.

Chest Wall Radiation

The target includes the ipsilateral chest wall, mastectomy scar, and drain sites when indicated. Depending on whether the patient has had breast reconstruction, several techniques using photons and/or electrons are appropriate. Chest wall scar boost may be delivered with or without bolus using electrons or photons.

NCCN Recommendations for Chest Wall Radiation: The NCCN Panel recommends a dose of 45 to 50.4 Gy in 25 to 28 fractions to the chest wall. A boost at the scar of 1.8 to 2 Gy per fraction to a total dose of approximately 60 to 66 Gy may be considered in some cases based on risk. Special consideration should be given to the use of bolus material to ensure that the skin dose is adequate, particularly in the case of IBC.

Regional Nodal Irradiation

Two studies, MA.20 and EORTC 22922/10925, evaluated the addition of regional nodal irradiation (RNI) to the internal mammary nodes and the upper axillary nodes including the supraclavicular region, in addition to WBRT or chest wall irradiation after BCS or mastectomy, respectively. In MA.20, regional recurrences were reduced from 2.7% with breast irradiation only to 0.7% with the addition of nodal irradiation.[181] The distant recurrences were reduced from 17.3% to 13.4%.[181] An improvement in DFS was seen from 77% to 82% at 10 years in those who received RNI compared to those who did not.[181] In EORTC 22922/10925, regional RT reduced the incidence of regional recurrences from 4.2% to 2.7% and decreased the rate of distant metastases from 19.6% to 15.9% at a median follow-up of 10.9 years.[182] Results of 15.7 years follow-up showed that breast cancer mortality (19.8% vs. 16%; 95% CI, 0.70–0.94) and breast cancer recurrence (27.1% vs. 24.5%; 95% CI, 0.77%–0.98%) were reduced with internal mammary and medial supraclavicular RT.[183]

The independent contribution of internal mammary nodal RT as a component of RNI continues to be debated as it is associated with higher risk of cardiac and lung toxicity, and data regarding its benefits are conflicting (discussed in detail below).

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NCCN Recommendation for RNI: When considering RNI, anatomic variations across patients result in significant differences in prescription depth and field design. The NCCN Panel therefore recommends contouring the individual nodal basins that are at risk using one of the various breast atlases, to ensure adequate RT coverage. [184,185]

The recommended dose for RNI is 45 to 50.4 Gy in 25 to 28 fractions to the regional nodal fields. A supplemental RT boost can be delivered to grossly involved or enlarged lymph nodes (ie, internal mammary or clavicular) that have not been surgically addressed.

Accelerated Partial Breast Irradiation

Several large, randomized trials have been published using various forms of APBI rather than WBRT after BCS. Most of these studies have found that rates of local control in selected patients, with early-stage breast cancer and low risk of recurrence, are equal to those treated with WBRT.[44,46,186-188] In the NSABP B-39 trial, 10-year cumulative incidence of IBTR with APBI was 4.6% compared with 3.9% with WBRT, yielding an absolute difference of 0.7% with an HR of 1.22 (90% CI, 0.94–1.58) that did not meet the prespecified criteria for equivalence.[43] However, given the small magnitude in IBTR differences between WBRT and APBI, it is not likely to be of clinical significance in appropriately selected patients.

QOL, toxicity, and cosmetic outcomes have generally been comparable or slightly favored APBI in randomized trials. For example, the IMPORT-LOW study compared WBRT with partial breast irradiation delivered as 40 Gy in 15 once-daily fractions using reduced-size breast tangents and found less breast firmness, less change in breast appearance, and lower average number of adverse events per person with partial breast irradiation.[186,189] The University of Florence compared WBRT with intensity-modulated APBI (30 Gy in 5 fractions, delivered every other day), and 10-year results have shown that APBI produced less acute and late toxicity and better cosmetic outcomes.[187] However, the RAPID trial found significantly higher rates of fair/poor cosmetic outcome with 3D conformal APBI delivered as 38.5 Gy in 10 twice-daily fractions.[44,190] The majority of APBI patients on NSABP B-39 were treated with the same external beam regimen, and treatment-related toxicities were not different for APBI versus WBRT as currently reported.[43] Cosmetic outcome analysis, however, is pending.

NCCN Recommendation for APBI: The Panel accepts the updated ASTRO APBI consensus statement for guidance on APBI use.[191] The NCCN Panel recommends APBI for any *BRCA*-negative patient who meets the ASTRO 2016 “suitable” criteria defined as age >50 years, ER-positive invasive ductal carcinoma measuring ≤2 cm (pT1 disease) with negative margin widths of ≥2 mm, and no lymphovascular invasion (LVI), and also permits APBI in patients >50 years of age with screen-detected low- or intermediate-grade DCIS measuring ≤2.5 cm, resected with ≥3 mm margins. The Panel prefers the APBI regimen and method followed in the trial by University of Florence (30 Gy/5 fractions every other day delivered using IMRT).[187] The Panel encourages participation in clinical trials for patients who do not meet the above criteria.

Adjuvant Radiation Therapy After BCS

Those who have a positive lymph node have a high risk of recurrence. Therefore, after BCS WBRT is strongly recommended with or without boost to tumor bed for node-positive disease (category 1 for those with positive nodes; category 2A for those with negative axillary nodes). This recommendation is supported by the results of a meta-analysis by the EBCTCG showing reduction in 10-year risk of recurrence in those who received WBRT versus those who did not (19% vs. 35%; RR, 0.52; 95% CI 0.48–0.56).[117] In addition, a significant reduction in 15-year risk of breast cancer death (21% vs. 25%; RR, 0.82; 95% CI, 0.75–0.90) was also observed.[117]

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For patients with a pathologically confirmed, focally positive margin without EIC, who do not undergo re-excision after BCS, the use of a higher radiation boost dose to the tumor bed may be considered, since generally a boost to the tumor bed is recommended for patients at higher risk of recurrence.

Regional Nodal Irradiation After BCS

The reduction in the risk of locoregional and distant recurrence and improvement in DFS seen in the MA.20 and EORTC 22922/10925 trials,[181,182] and the reduction in breast cancer mortality with 15-year follow-up of the EORTC 22922 patients,[183] support the importance of RNI after BCS.

As mentioned previously, routine inclusion of the internal mammary nodes as a component of RNI remains somewhat controversial due to the associated cardiac and lung toxicities. A Korean trial KROG 08-06 studied independent effect on DFS of RT to internal mammary nodes after BCS or mastectomy for node-positive disease,[192] randomizing patients to RNI with internal mammary RT versus RNI without internal mammary RT. Radiation to the internal mammary nodes did not significantly improve the DFS in patients with node-positive breast cancer. However, there was a statistically significant benefit in outcomes with internal mammary nodal RT for patients with medially or centrally located tumors.[192] Conflicting data have arisen from the Danish Breast Cancer Cooperative Group that recently reported 15-year follow-up of their study on RT to internal mammary nodes in patients (n = 3089) with positive nodes and early-stage breast cancer.[193] In this study, RT to the internal mammary nodes was delivered to right-sided patients (n = 1,491), while no RT to internal mammary nodes was delivered to left-sided patients (n = 1,598). The study reported a 15-year improved OS rate of 60.1% with RT to internal mammary nodes compared to 55.4% with no RT to internal mammary nodes. Improvements were also seen with respect to risk of developing distant recurrence and breast cancer-specific mortality favoring RT to internal mammary nodes.[193]

Clinical judgment is needed when determining inclusion of the internal mammary nodes during RNI. Therefore, the NCCN Panel no longer specifies the fields that should be included for RNI and refers to it as comprehensive RNI. According to the Panel, patient selection should consider risks versus benefits including long-term organ (cardiac and lung) toxicities, comorbidities of the patient, age, and life expectancy. In including RT to the internal mammary nodes, meticulous treatment planning with normal tissue dose constraints is mandatory.

RNI After BCS for Node-Negative Disease: The NCCN Panel recommends consideration of comprehensive RNI in patients with central/medial tumors (in accordance with EORTC 22922 trial criteria) and in accordance with the MA.20 criteria: 3 tumors, as well as those with T2 tumors who have undergone limited axillary dissection (<10 lymph nodes) and also have other risk factors, including high-grade histology, ER-negative disease, or LVI.[181]

RNI After BCS for Node-Positive Disease: For those with 1 to 3 positive nodes, if a patient meets all of the following criteria—has cT1–T2, cN0; did not receive preoperative chemotherapy; and has 1 to 2 positive SLNs—the use of comprehensive RNI with or without the intentional inclusion of the axilla is at the discretion of the radiation oncologist. If the patients do not meet all the criteria listed, the NCCN Panel recommends WBRT with inclusion of any portion of the undissected axilla at risk (category 1) with strong consideration of comprehensive RNI.

For those with 4 or more positive nodes, the NCCN Panel recommends comprehensive RNI with inclusion of any portion of the undissected axilla at risk (category 1).

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Radiation Therapy After BCS in Older Adults with ER-Positive Tumors

WBRT as a component of BCT does not affect breast cancer-specific survival in selected patients >70 years of age with more indolent disease. In a study of patients with clinical stage I, ER-positive breast cancer who were ≥70 years of age at diagnosis, patients were randomized to receive BCS with WBRT or BCS alone, both with tamoxifen for 5 years. Locoregional recurrence rates were 1% in the BCS, radiation, and tamoxifen arm and 4% in the BCS plus tamoxifen arm. There were no differences in OS, DFS, or need for mastectomy.[194] These results were confirmed in an updated analysis of this study with a median follow-up of 12.6 years.[195] At 10 years, a statistically significant reduction in IBTR was seen with RT with 90% of patients in the BCS and tamoxifen arm compared with 98% in the BCS plus radiation and tamoxifen arm.[195] Concordant results have been demonstrated in other studies of similar design.[196,197] Whether the increase in local relapse without RT is relevant for an individual patient should be individualized after a discussion of the risks and benefits of RT and patient commitment to 5 years of endocrine therapy if RT omission is being considered.

The NCCN Guidelines allow for the use of BCS (pathologically negative margin required) with 5 years of tamoxifen or an AI, without breast irradiation, for patients >70 years with clinically negative lymph nodes and ER-positive, T1 breast cancers (category 1).

Adjuvant Radiation Therapy After Mastectomy

Post-Mastectomy RT for Node-Positive Disease

Randomized clinical trials have shown that a DFS and OS advantage is conferred by the irradiation of chest wall and regional lymph nodes in patients with positive ALNs after mastectomy and ALND.[198-202] In these trials, the ipsilateral chest wall and the ipsilateral locoregional lymph nodes were irradiated. The results of EBCTCG meta-analyses show that RT after mastectomy and axillary node dissection reduced both recurrence and breast cancer mortality in the patients with 1 to 3 positive lymph nodes even when systemic therapy was administered.[182,203] According to the NCCN Panel, post-mastectomy radiation to the chest wall is recommended in all of these patients (category 1). Data from the EORTC 22922/10925 trial support the inclusion of RNI in patients undergoing post-mastectomy radiation. The trial assessed the independent effects of including RNI versus no RNI when treating the chest wall after mastectomy. Based on the benefits demonstrated in this trial, the NCCN Panel recommends comprehensive RNI to include any undissected axilla at risk (category 1 for 1 or more positive nodes).

Post-Mastectomy RT for Node-Negative Disease:

In patients with negative nodes, tumor ≤5 cm, and clear margins (≥1 mm), post-mastectomy RT (PMRT) is typically not recommended. However, the Panel has noted that it may be considered in subsets of these patients with high-risk features. Based on the inclusion criteria of node-negative patients enrolled onto the RNI trials (MA-20 and EORTC 22922), any patients with the following high-risk features, including central/medial tumors, T3 tumors, or tumors ≥2 cm with <10 axillary nodes removed and at least one of the following: grade 3, ER-negative, or LVI, should be considered for PMRT with RNI to include any undissected axilla at risk. Features in node-negative tumors that predict a high rate of local recurrence include primary tumors >5 cm or positive pathologic margins.[204]

In patients with positive pathologic margin, if re-resection to negative margins is not possible, the Panel recommends strongly considering chest wall irradiation with the addition of comprehensive RNI including any portion of the axilla at risk. Chest wall irradiation should be considered with addition of comprehensive RNI, including any portion of the axilla at risk in those with tumors >5 cm. In patients with tumors ≤5 cm and negative margins ≤1 mm, chest wall irradiation should be considered with

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consideration of comprehensive RNI including any portion of the undissected axilla at risk *only* in those with high-risk features.

Considerations for RT in Patients Receiving Preoperative Systemic Therapy

The Panel recommends that decisions related to administration of adjuvant RT for patients receiving preoperative systemic chemotherapy should be made based on maximal stage (ie, clinical/anatomic stage, tumor characteristics) at diagnosis (before preoperative systemic therapy) and pathologic stage at definitive surgery (after preoperative systemic therapy). Data from numerous studies in patients with stage III disease suggest that postoperative RT improves local control even for patients who have a pathologic complete response (pCR) to neoadjuvant chemotherapy.[205-208]

RT After Preoperative Therapy and BCS:

Those who have clinically negative nodes at diagnosis, that remain pathologically node-negative at definitive surgery (after systemic therapy), should receive adjuvant RT to the whole breast with the addition of boost to the tumor bed after SLNB.

Patients who have clinically/radiographically positive nodes at diagnosis and convert to clinically/radiographically node-negative after preoperative chemotherapy are candidates for the NSABP B-51 trial assessing the benefit of RNI. Until the results of this trial become available, the existing data suggest that node-positive disease at presentation is at high risk for locoregional recurrence and should be considered to receive comprehensive RNI with inclusion of any portion of the undissected axilla at risk.

Patients who have clinically/radiographically positive nodes at diagnosis who convert to clinically/radiographically negative nodes after preoperative chemotherapy, but are found to have persistent nodal disease on SLNB, are candidates for the ALLIANCE 11202 trial assessing whether ALND can be safely replaced with axillary RT. ALND is the standard arm of this trial; however, in the event that a neoadjuvant therapy patient with node-positive disease (ypN1+) does not undergo a complete axillary dissection, all levels of the undissected axilla should be included with the radiation treatment.

RT After Preoperative Therapy and Mastectomy:

Those who have clinically positive nodes at diagnosis that respond to preoperative systemic therapy and become node-negative should be strongly considered to receive RT to the chest wall and comprehensive RNI with inclusion of any portion of the undissected axilla at risk based on the discussion above.

For those with positive nodes (ypN1+) after preoperative systemic therapy, axillary dissection is the standard treatment arm of the ongoing Alliance 11202 trial; however, if RT is indicated it should include chest wall along with comprehensive RNI with inclusion of any portion of the undissected axilla at risk.

Those who have node-negative disease at diagnosis and after preoperative systemic therapy and whose axilla was assessed by SLNB or axillary node dissection may forego RT.

Two prospective trials are ongoing and will prospectively evaluate the benefit of RT in patients treated with neoadjuvant therapy (NSABP B-51/RTOG 1304 [NCT01872975] and the Alliance A011202/MAC19 trial [NCT01901094]).

Sequencing of RT and Systemic Therapy

If chemotherapy and radiation are indicated after surgery, adjuvant radiation is typically delivered after the completion of chemotherapy.[209,210]

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This recommendation is based on results of the “Upfront-Outback” trial in which patients who had undergone BCS and axillary dissection were randomly assigned to receive chemotherapy following RT or RT following chemotherapy. The initial results showed an increased rate of local recurrence in the group with delayed RT at a median follow-up of 58 months;[210] however, differences in rates of distant or local recurrence were not statistically significant when the two arms were compared at 135-month follow-up.[209] While it is common for RT to follow chemotherapy when chemotherapy is indicated, based on data from prospective and retrospective studies, CMF (cyclophosphamide/methotrexate/fluorouracil) and RT may be given concurrently.

Data from multiple studies of patients treated with endocrine therapy either before, during, or after RT suggest no difference in outcomes or toxicity.[211-214] Therefore, according to the NCCN Panel, sequential or concurrent endocrine therapy with RT is acceptable. However, due to compounding side effects, initiating endocrine therapy at the completion of RT may be preferred.

When adjuvant capecitabine[215] is indicated, since it is a known radiosensitizing agent with potential to increase toxicity to normal tissue, it should be given after completion of adjuvant RT.

When adjuvant olaparib is used, the Panel recommends that olaparib be given after completion of RT. In the OlympiA trial,[216] olaparib was not administered concurrently with RT and there are limited data on safety of concurrent administration.

Adjuvant HER2-targeted therapy may be delivered concurrently with RT. Data from clinical trials in the adjuvant setting do not suggest an increased complication rate with the concurrent administration of HER2-targeted therapies with adjuvant RT.[217]

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Breast Reconstruction

Breast reconstruction may be an option for anyone receiving surgical treatment for breast cancer. Therefore, all patients undergoing breast cancer treatment should be educated about breast reconstructive options as adapted to their individual clinical situation and be offered an opportunity to consult with a reconstructive plastic surgeon. Breast reconstruction should not interfere with the appropriate surgical management. This may increase the risk of overall and cancer-related death, especially in those with late-stage disease.[218] Coordinating consultation and surgical treatment with a reconstructive surgeon should be executed within a reasonable timeframe.

Several reconstructive approaches are summarized for these patients in the NCCN Guidelines for Breast Cancer under *Principles of Breast Reconstruction Following Surgery*.

The decision regarding type of reconstruction includes patient preference, body habitus, smoking history, comorbidities, plans for irradiation, and expertise and experience of the reconstruction team. Smoking and obesity increase the risk of complications for all types of breast reconstruction whether with implant or flap.[219-223] Smoking and obesity are therefore considered a relative contraindication to breast reconstruction by the NCCN Panel. Patients should be informed of increased rates of wound healing complications and partial or complete flap failure among patients who smoke and have obesity.

Reconstruction is an optional procedure that does not impact the probability of recurrence or death, but it is associated with an improved QOL for many patients. It is sometimes necessary to perform surgery on the contralateral breast (ie, breast reduction, implantation) to achieve optimal symmetry between the ipsilateral reconstructed breast and the contralateral breast.

Breast Reconstruction After Mastectomy

Mastectomy results in loss of the breast for breastfeeding, loss of sensation in the skin of the breast and nipple-areolar complex (NAC), and loss of the breast for cosmetic, body image, and psychosocial purposes. The loss of the breast for cosmetic, body image, and psychosocial issues may be partially overcome through the performance of breast reconstruction with or without reconstruction of the NAC.

Those undergoing mastectomy should be offered consultation regarding options and timing of breast reconstruction.

Many factors must be considered in the decision-making about breast reconstruction. There are several different types of breast reconstruction that include the use of implants, autogenous tissues, or both.[224-226] Reconstruction with implants can be performed either by immediate placement of a permanent subpectoral implant or initial placement of a subpectoral expander implant followed by gradual expansion of the implant envelope with stretching of the pectoralis major muscle and overlying skin followed by replacement of the expander with a permanent implant. A wide variety of implants are available that contain saline, silicone gel, or a combination of saline and silicone gel inside a solid silicone envelope.

Autogenous tissue methods of reconstruction use various combinations of fat, muscle, skin, and vasculature from donor sites (ie, abdomen, buttock, back) that may be brought to the chest wall with their original blood supply (pedicle flap) or as free flaps with microvascular anastomoses to supply blood from the chest wall/thorax.[227] Several procedures using autologous tissue are available including transverse rectus abdominis myocutaneous flap, latissimus dorsi flap, and gluteus maximus myocutaneous flap reconstruction.

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Composite reconstruction techniques use implants in combination with autogenous tissue reconstruction to provide volume and symmetry. Patients with underlying diabetes or who smoke tobacco have increased rates of complications following autogenous tissue breast cancer reconstruction, presumably because of underlying microvascular disease.

Reconstruction can be performed either at the time of the mastectomy known as "immediate breast reconstruction" and under the same anesthetic or in a delayed fashion any time, known as "delayed breast reconstruction." In many cases, breast reconstruction involves a staged approach requiring more than one procedure such as surgery on the contralateral breast to improve symmetry, revision surgery involving the breast and/or donor site, and/or nipple and areola reconstruction and tattoo pigmentation.

Plans for post-mastectomy RT can impact decisions related to breast reconstruction since there is a significantly increased risk of implant capsular contracture following irradiation of an implant. Furthermore, post-mastectomy irradiation may have a negative impact on breast cosmesis when autologous tissue is used in immediate breast reconstruction, and may interfere with the targeted delivery of radiation when immediate reconstruction is performed using either autologous tissue or breast implants.[228,229] Some studies, however, have not found a significant compromise in reconstruction cosmesis after RT.[230] The preferred approach to breast reconstruction for irradiated patients was a subject of controversy among the Panel. While some experienced breast cancer teams have employed protocols in which immediate tissue reconstructions are followed by RT, generally RT is preferred to precede autologous reconstruction due to the reported loss in reconstruction cosmesis (category 2B). When implant reconstruction is planned in a post-mastectomy patient requiring RT, the NCCN Panel prefers a staged approach with immediate tissue expander placement followed by implant placement. Immediate placement of an implant in patients requiring postoperative radiation has an increased rate of capsular contracture, malposition, poor cosmesis, and implant exposure. Surgery to exchange the tissue expanders with permanent implants can be performed prior to radiation or after completion of RT.

In a previously radiated patient, the use of tissue expanders/implants is relatively contraindicated.[231] Tissue expansion of irradiated skin can result in a significantly increased risk of capsular contracture, malposition, poor cosmesis, implant exposure, and failed reconstruction.[232,233] If a patient has previously received RT to the breast, autologous tissue reconstruction is the preferred method of breast reconstruction.

Skin-Sparing Mastectomy

Skin-sparing mastectomy procedures are appropriate for some patients and involve removal of the breast parenchyma including the NAC while preserving the majority of the original skin envelope, and are followed by immediate reconstruction with autogenous tissue, a prosthetic implant, or a composite of autogenous tissue and an implant. Skin-sparing mastectomy involving preservation of the skin of the NAC has become the subject of increased attention. Possible advantages of this procedure include improvements in breast cosmesis, body image, and nipple sensation following mastectomy, although the impact of this procedure on these QOL issues has not been well-studied.[234-236] There are limited data from surgical series, with short follow-up, that suggest that performance of NAC-sparing mastectomy in selected patients is associated with low rates of occult involvement of the NAC with breast cancer and local disease recurrence.[235,237,238] NAC-sparing procedures may be an option in patients who are carefully selected by experienced multidisciplinary teams. According to the NCCN Panel, when considering a NAC-sparing procedure, assessment of nipple margins is mandatory. Retrospective data support the use of NAC-sparing procedures for patients with breast

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cancer with low rates of nipple involvement and low rates of local recurrence due to early-stage, biologically favorable (ie, Nottingham grade 1 or 2, node-negative, HER2-negative, no LVI) invasive cancers and/or DCIS that are peripherally located in the breast (>2 cm from nipple).[239,240] Contraindications for nipple preservation include evidence of nipple involvement such as Paget disease or other nipple discharge associated with malignancy and/or imaging findings suggesting malignant involvement of nipple and subareolar tissues. Several prospective trials are underway to evaluate NAC-sparing mastectomy in the setting of cancer and enrollment in such trials is encouraged.

Advantages of a skin-sparing mastectomy procedure include an improved cosmetic outcome resulting in a reduction in the size of the mastectomy scar and a more natural breast shape, especially when autologous tissue is used in reconstruction,[241] and the ability to perform immediate reconstruction. Although no randomized studies have been performed, results of several mostly retrospective studies have indicated that the risk of local recurrence is not increased when patients receiving skin-sparing mastectomies are compared with those undergoing non-skin–sparing procedures. However, strong selection biases almost certainly exist in the identification of patients appropriate for skin-sparing procedures.[242-246] Reconstruction of the NAC may also be performed in a delayed fashion if desired by the patient. Reconstructed nipples are devoid of sensation. According to the NCCN Panel, skin-sparing mastectomy should be performed by an experienced breast surgery team that works in a coordinated, multidisciplinary fashion to guide proper patient selection for skin-sparing mastectomy, determine optimal sequencing of the reconstructive procedure(s) in relation to adjuvant therapies, and perform a resection that achieves appropriate surgical margins. Post-mastectomy radiation should still be applied for patients treated by skin-sparing mastectomy following the same selection criteria as for standard mastectomy.

Breast Reconstruction After Lumpectomy

Issues related to breast reconstruction also pertain to those who undergo or have undergone a lumpectomy, particularly in situations where the surgical defect is large and/or expected to be cosmetically unsatisfactory. An evaluation of the likely cosmetic outcome of lumpectomy should be performed prior to surgery. Oncoplastic techniques for breast conservation can extend breast-conserving surgical options in situations where the resection by itself would likely yield an unacceptable cosmetic outcome.[247] The evolving field of oncoplastic surgery includes the use of “volume displacement” techniques performed in conjunction with a large partial mastectomy.[248] Oncoplastic volume displacement procedures combine the removal of generous regions of breast tissue (typically designed to conform to the segmentally distributed cancer in the breast) with “mastopexy” techniques in which remaining breast tissues are shifted together within the breast envelope to fill the resulting surgical defect and thereby avoid the creation of significant breast deformity. Volume displacement techniques are generally performed during the same operative setting as the breast-conserving lumpectomy by the same surgeon who is performing the cancer resection.[248,249]

Advantages of oncoplastic volume displacement techniques are that they permit the removal of larger regions of breast tissue, thereby achieving wider surgical margins around the cancer, and at the same time better preserve the natural shape and appearance of the breast than do standard breast resections.[250]

Limitations of oncoplastic volume displacement techniques include lack of standardization among centers, performance at only a limited number of sites in the United States, and the possible necessity for subsequent mastectomy if pathologic margins are positive when further breast-conserving attempts are deemed impractical or unrealistic. Nevertheless, the Panel consensus is that these issues should be

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considered prior to surgery for individuals who are likely to have a surgical defect that is cosmetically unsatisfactory. Those who undergo lumpectomy and are dissatisfied with the cosmetic outcome after treatment should be offered a consultation with a plastic surgeon to address the repair of resulting breast defects. Patients should be informed of the possibility of positive margins and potential need for secondary surgery, which could include re-excision segmental resection, or could require mastectomy with or without loss of the nipple. Oncoplastic procedures can be combined with surgery on the contralateral unaffected breast to minimize long-term asymmetry.

Finally, decisions regarding breast reconstruction should primarily focus on treatment of the tumor, and such treatment should not be compromised.

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Systemic Therapies (Preoperative and Adjuvant)

This section for systemic therapies (preoperative and adjuvant) was updated on June 7th, 2024.

Preoperative Systemic Therapy

The NCCN Panel has outlined the rationale, appropriate patient selection, and response assessment for preoperative systemic therapy in a new section titled, *Principles of Preoperative Chemotherapy*.

Randomized clinical trials have found no significant differences in long-term outcomes when systemic chemotherapy is given before or after surgery.[251,252] Historically, a primary advantage of administering preoperative systemic therapy has been to improve surgical outcomes. Preoperative systemic therapy can convert inoperable tumors to operable and also downstage a significant number of patients with operable breast cancer to allow for more limited breast conservation procedures. [253] Results from large clinical trials and retrospective reviews indicate that breast conservation rates are improved with preoperative systemic therapy.[252,254] Clinicians need to carefully consider the extent of disease in the breast, tumor biology and likelihood of adequate tumor response before recommending preoperative systemic therapy to improve the likelihood of successful breast conservation.

In addition, use of preoperative systemic therapy may provide important prognostic information based on response to therapy. Achieving a pathologic complete response (pCR) to neoadjuvant therapy is associated with favorable disease-free and OS in early-stage breast cancer. The correlation between pathologic response and long-term outcomes in patients with early-stage breast cancer is strongest for patients with triple-negative breast cancer, less so for HER2-positive disease, and least for hormone-positive disease.[255-257]

Other benefits of preoperative systemic therapy include allowing time for appropriate genetic testing and for planning potential breast reconstruction in patients proceeding with mastectomy. For those with significant residual disease after standard preoperative systemic therapy, it may provide an opportunity to identify patients who may benefit from further adjuvant therapy after surgery. It many allow sentinel lymph node biopsy (SLNB) alone or allow for limited radiation fields if clinically node positive disease becomes clinically node negative after preoperative systemic therapy. In addition, preoperative systemic therapy also serves as an excellent research platform to test novel therapies and predictive biomarkers by providing tumor specimens and blood samples prior to and during systemic treatment.

Selection of Patients for Preoperative Therapy

Not all patients are appropriate candidates for preoperative systemic therapy. According to the NCCN Panel, among those with inoperable breast tumors, preoperative systemic therapy is indicated in patients with locally advanced or inoperable breast cancer including those with inflammatory breast cancer; those with bulky or matted cN2 axillary nodes; cN3 regional lymph node nodal disease; and cT4 tumors.

In patients with operable tumors, preoperative systemic therapy is the preferred approach for the following scenarios: for patients with TNBC and HER2+ breast cancer that is clinical stage T2N0 and higher or is clinically node positive; if the patient's breast cancer subtype is associated with a high likelihood of response; or if a patient desires BCS and the size of the tumor is large relative to that of the breast.

When preoperative systemic therapy is used to improve the likelihood of successful breast conservation, the surgical plan should consider the possibility that clear surgical margins may not always be obtained, and a follow-up mastectomy may be required, with or without breast reconstruction. This consideration is especially important when oncoplastic

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breast reduction techniques or contralateral breast symmetry procedures are added to the breast-conserving surgery to achieve optimal cosmetic outcomes.

The NCCN Panel cautions that preoperative systemic therapy is not appropriate for certain patients. Preoperative systemic therapy should not be offered in patients with extensive in situ disease when the extent of invasive disease cannot be defined; in patients where the extent of the tumor is poorly delineated; or in those whose tumors are not clinically assessable. The decision to utilize preoperative therapy should be made in the context of a coordinated and collaborative multi-disciplinary team.

For predicting the response of pre-operative endocrine therapy for postmenopausal women with ER-positive, HER2-negative, cN0 breast cancer, data from the TransNEOS study demonstrate a significant correlation between 21 gene assay Recurrence Score and clinical response to preoperative letrozole. Those whose tumors had a Recurrence Score between 0-17 were significantly more likely to respond to preoperative letrozole compared with Recurrence Score of 31-100.[258]

For predicting the response to pre-operative chemotherapy for post-menopausal, ER-positive, HER2-negative patients with T1/T2, node negative tumors, another study evaluated the role of the Recurrence Score with pathologic response rates after pre-operative systemic therapy. Their findings suggest high Recurrence Scores are associated with a higher likelihood of pCR after preoperative chemotherapy.[259]

Based on the above two studies that showed the use of 21-gene Recurrence Score in predicting response to preoperative chemotherapy, [258,259] the NCCN panel has added a footnote for considering the use of a gene expression assay during workup when contemplating preoperative endocrine or systemic therapy for postmenopausal patients with cN0, operable ER-positive, HER2-negative disease, to aid in predicting response to preoperative therapy.

Preoperative therapy options:
Chemotherapy: A number of chemotherapy regimens have activity in the preoperative setting. According to the NCCN Panel, those regimens recommended in the adjuvant setting may be considered in the preoperative setting. In both settings, the underlying aim remains the same: eradication or control of undiscovered distant metastases.

Endocrine Therapy: Preoperative endocrine therapy alone may be offered to those with strongly HR-positive tumors based on comorbidities or low-risk luminal biology based on clinical characteristics and/or genomic signatures (until desired effect is achieved).[260-267] The results of the ACOSOG Z1031 trial show that preoperative endocrine therapy is effective in reducing residual disease and enabling BCS for many patients with low rates of local-regional recurrence post-surgery. [268]

According to the NCCN Panel, the endocrine therapy options include an aromatase inhibitor (with ovarian function suppression (OFS) for premenopausal patients) or tamoxifen (with or without OFS for premenopausal patients). The preferred endocrine therapy option for postmenopausal patients is an aromatase inhibitor. The panel has added a comment that the optimal response to endocrine therapy, if achieved is anywhere between 4-6 months based on the above trials.

HER2-Targeted Therapy: For patients with HER2-positive breast cancer, that are candidates for preoperative systemic therapy, chemotherapy and trastuzumab-based therapy is recommended.[269] Chemotherapy and dual anti-HER2 blockade associated with trastuzumab plus pertuzumab has shown significant improvements in the pCR rate when compared with chemotherapy and trastuzumab in the preoperative setting.

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In the TRYPHAENA trial, preoperative therapy with pertuzumab and trastuzumab given along with anthracycline-containing or anthracycline-free standard chemotherapy regimens to patients with operable, locally advanced, or inflammatory HER2-positive breast cancer showed pCR rates in all treatment arms ranging from 57% to 66%.[270] In the Neosphere trial, the addition of pertuzumab to trastuzumab and docetaxel preoperatively led to a statistically significant increase in pCR in the breast which in turn led to improves outcomes in those with node-positive disease.[271,272] The NCCN Panel supports the FDA-approved indication that a pertuzumab-containing regimen may be administered preoperatively to patients with greater than or equal to cT2, or greater than or equal to cN1, HER2-positive, early-stage breast cancer.

Immunotherapy: The randomized phase III multicenter, double-blind, placebo-controlled trial (KEYNOTE-522) compared preoperative carboplatin and paclitaxel followed by doxorubicin or epirubicin and cyclophosphamide in combination with either pembrolizumab (n=784) or placebo (n=390), followed by pembrolizumab or placebo administered every 3 weeks for up to nine cycles after surgery, in patients with previously untreated stage II-III TNBC.[273] After a median follow-up of 39.1 months, a significant improvement in event-free survival was seen with the addition of pembrolizumab compared with placebo plus chemotherapy. The 3-year event-free survival rates were 84.5% and 76.8%, respectively (HR = 0.63, 95% CI = 0.48–0.82; P < .001).[273]

The 5-year follow-up of KEYNOTE-522 trial results showed an improvement in EFS rate in patients treated with chemotherapy plus pembrolizumab compared with the placebo arm (81.3% vs. 72.3%), with reduction in risk for recurrence, progression, complications, or death of 37% (HR, 0.63; 95% CI, 0.49-0.81).[274] Among patients in the trial who had a pCR and received adjuvant pembrolizumab, the 5-year EFS rate was 92.2% compared with 88.2% in patients who received only chemotherapy.[274] There are no data comparing adjuvant pembrolizumab with other newer adjuvant therapies such as adjuvant capecitabine and/or olaparib in patients who meet criteria for treatment with one or more of these agents.

Response Assessment During Preoperative Chemotherapy

The NCCN panel recommends that tumor response should be routinely assessed by clinical exam during the delivery of preoperative systemic therapy. Patients with operable breast cancer experiencing progression of disease while undergoing preoperative systemic therapy should be taken promptly to surgery. Imaging during preoperative systemic therapy should not be done routinely but may be considered if tumor progression is suspected. Imaging prior to surgery should be determined by a multi-disciplinary team.

In a multicenter analysis of patients (n=5161), the residual cancer burden (RCB) after preoperative chemotherapy was seen to be prognostic within each breast cancer subtype.[275] Higher RCB scores were significantly associated with worse event-free survival, with hazard ratios ranging from 1.55 to 2.16 across different breast cancer subtypes.

This study highlights RCB as a prognostic factor for outcomes in patients with breast cancer patients undergoing preoperative chemotherapy.[275]

As noted under the “workup” section, in order to have a standardized method of pathology reporting, the NCCN endorses the CAP protocol for pathology reporting for all invasive and noninvasive carcinomas of the breast. On the Principles of Preoperative Therapy page, the panel encourages that the pathology report from definitive surgery after preoperative systemic therapy include the standardized tissue sampling and reporting elements of the Residual Cancer Burden (RCB). However, since RCB reporting is currently not mandatory given its main purpose for prognostication only, there is inconsistent reporting of RCB across

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institutions and no uniform agreement among the panel that RCB is required in the pathology report, rendering it a category 2B recommendation.

Adjuvant Systemic Therapy

After surgical treatment, adjuvant systemic therapy should be considered. In patients with early-stage breast cancer, systemic adjuvant therapy is administered to reduce risk of cancer recurrence. The decision is often based on individual risk of relapse and predicted sensitivity to a particular treatment (eg, ER/PR and HER2 status). The decision to use systemic adjuvant therapy requires considering and balancing risk for disease recurrence with local therapy alone, the magnitude of benefit from applying adjuvant therapy, toxicity of the therapy, and comorbidity. The decision-making process requires collaboration between the health care team and patient.

Stratification for Systemic Adjuvant Therapy

The NCCN Guidelines stratify, patients with breast cancer based on their HR- status and HER2 expression. Patients are then further stratified based on risk of disease recurrence based on anatomic and pathologic characteristics (ie, tumor grade, tumor size, ALN status, angiolymphatic invasion).

Adjuvant Systemic therapy for HR-positive, HER2-negative tumors

Patients with HR positive, HER2-negative tumors, receive adjuvant endocrine therapy to reduce the risk of recurrence and those deemed at high risk for distant recurrence despite adjuvant endocrine therapy, receive adjuvant chemotherapy. The NCCN Guidelines call for the determination of ER and PR content in all primary invasive breast cancers[276] to determine whether a patient is a candidate for endocrine therapies. Patients with cancers with 1%–100% ER IHC staining are considered ER+ and eligible for endocrine therapies. Given the limited efficacy data on the ER-low-positive (1%-10%) group, with ER-low-positive patients reported to be a heterogeneous group with a natural history/biologic behavior often similar to ER-negative cancers, individualized consideration of risks versus benefits of endocrine therapy and additional adjuvant therapies should be incorporated into decision-making. Patients with ER-negative, PR-positive cancers may also be considered for endocrine therapies, however, the efficacy data on this group are also limited. The same overall interpretation principles apply but PR should be interpreted as either positive (if 1%–100% of cells have nuclear staining) or negative (if <1% or 0% of cells have nuclear staining). For the purposes of this guideline, any ER and/or PR-positive tumors is referred to as 'hormone receptor (HR)-positive', given that the majority of all breast cancers are ER-positive or ER and PR-positive and the subgroup of ER negative/PR-positive tumors are relatively uncommon.

The magnitude of risk reduction from adjuvant endocrine therapy is dependent on level of ER-expression and on recurrence score (RS) of gene expression assay test results. Low level of ER expression is less likely to benefit from endocrine therapy and a high RS will gain less benefit with endocrine therapy *alone* versus those with low RS.

Patients with invasive breast cancers that are HR- positive should be considered for adjuvant endocrine therapy regardless of patient age, lymph node status, or whether adjuvant chemotherapy is to be administered.[277] Selected studies suggest that HER2-positive breast cancers may be less sensitive to some endocrine therapies, although other studies have failed to confirm this finding.[278-286] A retrospective analysis of tumor blocks collected in the ATAC trial indicated that HER2 amplification is a marker of relative endocrine resistance independent of type of endocrine therapy.[287] However, given the favorable toxicity profile of the available endocrine therapies, the panel recommends the use of adjuvant endocrine therapy in the majority of patients with HR-positive

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breast cancer regardless of menopausal status, age, or HER2 status of the tumor.

Tamoxifen: The most firmly established adjuvant endocrine therapy is tamoxifen for both premenopausal and postmenopausal patients.[59] In patients with ER-positive breast cancer, adjuvant tamoxifen decreases the annual odds of recurrence by 41% and the annual odds of death by 31% irrespective of the use of chemotherapy, patient age, menopausal status, or ALN status.[59] In patients receiving both tamoxifen and chemotherapy, chemotherapy should be given first, followed by sequential tamoxifen.[288] Prospective randomized trials have demonstrated that 5 years of tamoxifen is more effective than 1 to 2 years of tamoxifen.[289,290]

The ATLAS trial randomly allocated pre- and postmenopausal patients to 5 or 10 years (extended therapy) of tamoxifen. The outcome analyses of 6846 patients with ER-positive disease showed that by extending adjuvant treatment to 10 years, the risk of relapse and breast cancer-related mortality was reduced.[291] The risk of recurrence during years 5 to 14 was 21.4% for patients receiving tamoxifen versus 25.1% for controls (absolute recurrence reduction 3.7%). Patients who received tamoxifen for 10 years had a greater reduction in risk of progression, possibly due to a "carryover effect." The reduction in risk of recurrence was 0.90 (95% CI, 0.79–1.02) during 5 to 9 years of tamoxifen treatment and 0.75 (0.62–0.90) after 10 years of treatment. There were decreases in the incidence of contralateral breast cancer as well. Furthermore, reduced mortality was also apparent after completion of 10 years of treatment with tamoxifen. With regards to toxicity, the most important adverse effects noted in all patients in the ATLAS trial after with 10 years of tamoxifen treatment were an increased risk for endometrial cancer and pulmonary embolism.[291] The results of the aTTom trial confirm the significant reduction in recurrence and death from breast cancer seen in the ATLAS trial with 10 versus 5 years of tamoxifen therapy.[292]

Aromatase inhibitors: Several studies have evaluated aromatase inhibitors (AI) in the treatment of postmenopausal patients with early-stage breast cancer. These studies have utilized AI as initial adjuvant therapy, as sequential therapy following 2 to 3 years of tamoxifen, or as extended therapy following 4.5 to 6 years of tamoxifen. The AIs are not active in the treatment of patients with functioning ovaries and should not be used in patients whose ovarian function cannot reliably be assessed owing to treatment-induced amenorrhea.

The results from two prospective, randomized, clinical trials have provided evidence of an OS benefit for patients with early-stage breast cancer receiving initial endocrine therapy with tamoxifen followed sequentially by anastrozole (HR, 0.53; 95% CI, 0.28–0.99; *P* = .045) or exemestane (HR, 0.83; 95% CI, 0.69–1.00; *P* = .05 [excluding patients with ER-negative disease]) when compared with tamoxifen as the only endocrine therapy.[293,294] In addition, the NCIC-CTG MA-17 trial demonstrated a survival advantage with extended therapy with letrozole compared with placebo in patients with ALN-positive (but not lymph node-negative), ER-positive breast cancer.[295] Tamoxifen and aromatase inhibitors have different side effect profiles. Both contribute to hot flashes and night sweats and may cause vaginal dryness. AIs are more commonly associated with musculoskeletal symptoms, osteoporosis, and increased rate of bone fracture, while tamoxifen is associated with an increased risk for uterine cancer and deep venous thrombosis.

Two studies have examined initial adjuvant endocrine treatment with either tamoxifen or an AI. The ATAC trial demonstrated that anastrozole is superior to tamoxifen or the combination of tamoxifen and anastrozole in the adjuvant endocrine therapy of postmenopausal patients with HR-positive breast cancer.[296,297] With a median of 100 months follow-up, results in 5216 postmenopausal patients with HR-positive, early-stage breast cancer enrolled in the ATAC trial demonstrated fewer recurrences

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(HR for DFS, 0.85; 95% CI, 0.76–0.94; *P* = .003) with anastrozole compared with tamoxifen.[298] No difference in survival has been observed (HR, 0.90; 95% CI, 0.75–1.07; *P* = .2). Patients in the combined tamoxifen and anastrozole group gained no benefit over those in the tamoxifen group, suggesting a possible deleterious effect from the weak estrogenic effect of tamoxifen in patients with near complete elimination of endogenous estrogen levels.[297] ATAC trial sub-protocols show a lesser effect of anastrozole compared with tamoxifen on endometrial tissue;[299] similar effects of anastrozole and tamoxifen on quality of life, with most patients reporting that overall quality of life was not significantly impaired;[300] a greater loss of bone mineral density with anastrozole;[301] a small pharmacokinetic interference of anastrozole in the presence of tamoxifen of unclear significance;[302] and no evidence for an interaction between prior chemotherapy and anastrozole.[303]

BIG 1-98 is a randomized trial testing the use of tamoxifen alone for 5 years, letrozole alone for 5 years, or tamoxifen for 2 years followed sequentially by letrozole for 3 years, or letrozole for 2 years followed sequentially by tamoxifen for 3 years. An early analysis compared tamoxifen alone versus letrozole alone, including those patients in the sequential arms during their first 2 years of treatment only.[304] With 8010 patients included in the analysis, DFS was superior in the letrozole-treated patients (HR, 0.81; 95% CI, 0.70–0.93; log rank *P* = .003). No interaction between PR expression and benefit was observed. No difference in OS was observed. A comparison of the cardiovascular side effects in the tamoxifen and letrozole arms of the BIG 1-98 trial showed that the overall incidence of cardiac adverse events was similar (letrozole, 4.8%; tamoxifen, 4.7%). However, the incidence of grade 3 to 5 cardiac adverse events was significantly higher in the letrozole arm, and both the overall incidence and incidence of grade 3 to 5 thromboembolic events was significantly higher in the tamoxifen arm.[305] In addition, a higher incidence of bone fracture was observed for patients in the letrozole arm compared with those in the tamoxifen arm (9.5% vs. 6.5%).[306] After a longer follow-up (median 71 months) no significant improvement in DFS was noted with either tamoxifen followed by letrozole or the reverse sequence as compared with letrozole alone (HR for tamoxifen followed by letrozole, 1.05; 99% CI, 0.84–1.32; HR for letrozole followed by tamoxifen, 0.96; 99% CI, 0.76–1.21).[307]

Five trials have studied the use of tamoxifen for 2 to 3 years followed sequentially by a third-generation AI versus continued tamoxifen in postmenopausal patients. The Italian Tamoxifen Anastrozole (ITA) trial randomized 426 postmenopausal patients with breast cancer who had completed 2 to 3 years of tamoxifen to either continue tamoxifen or to switch to anastrozole to complete a total of 5 years of endocrine therapy.[308] The HR for relapse strongly favored sequential treatment with anastrozole (HR, 0.35; 95% CI, 0.18–0.68; *P* = .001) with a trend towards fewer deaths (*P* = .10).[308] Updated results from this study show the HR for relapse-free survival as 0.56 (95% CI, 0.35–0.89; *P* = .01); P value for OS analysis remained at 0.1.[309] The IES trial randomized 4742 postmenopausal patients with breast cancer who had completed a total of 2 to 3 years of tamoxifen to either continue tamoxifen or to switch to exemestane to complete a total of 5 years of endocrine therapy.[310] The results at a median of 55.7 months of follow-up demonstrated the superiority of sequential exemestane in DFS (HR, 0.76; 95% CI, 0.66–0.88; *P* = .0001) with a significant difference in OS in only patients with ER-positive tumors (HR, 0.83; 95% CI, 0.69–1.00; log rank *P* = .05). A prospectively planned, combined analysis of 3224 patients enrolled in the ABCSG 8 trial and the ARNO 95 trial has also been reported.[311] Patients in this combined analysis had been randomized following 2 years of tamoxifen to complete 5 years of adjuvant tamoxifen or 3 years of anastrozole. With 28 months of median follow-up available, event-free survival was superior with crossover to anastrozole (HR, 0.60; 95% CI, 0.44–0.81; *P* = .0009). No statistically significant difference in survival has

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been observed. An analysis of the ARNO 95 trial alone after 58 months of median follow-up demonstrated that switching from tamoxifen to anastrozole was associated with significant increases in both DFS (HR, 0.66; 95% CI, 0.44–1.00; *P* = .049) and OS (HR, 0.53; 95% CI, 0.28–0.99; *P* = .045).[294] A meta-analysis of ABCSG 8, ARNO 95, and ITA studies showed significant improvement in OS (HR, 0.71; 95% CI, 0.52-0.98; *P* = .04) with a switch to anastrozole.[312]

The TEAM trial compared treatment of exemestane alone versus sequential therapy of tamoxifen for 2.5 to 3.0 years followed by exemestane to complete 5 years of hormone therapy.[313] At the end of 5 years, 85% of patients in the sequential group versus 86% in the exemestane group were disease free (HR, 0.97; 95% CI, 0.88–1.08; *P* = .60). This is consistent with the data from the BIG 1-98 trial,[307] in which tamoxifen followed by letrozole or the reverse sequence of letrozole followed by tamoxifen was not associated with significant differences in efficacy versus letrozole monotherapy after a median follow-up of 71 months.

The NCCN panel finds no meaningful differences in terms of efficacy or toxicity between the available AIs: anastrozole, letrozole, and exemestane. All three have shown similar anti-tumor efficacy and toxicity profiles in randomized studies in the adjuvant settings.

Ovarian Function Suppression and Endocrine Therapy:
Ovarian function suppression (OFS) is achieved with a gonadotropin-releasing hormone (GnRH) agonist, oophorectomy, or ovarian irradiation. Available GnRH agonists in the United States include goserelin and leuprolide. OFS is generally considered in those who are premenopausal and for tumors with high enough recurrence risk where the additional absolute decrease in recurrence compared with tamoxifen alone is worth the additional toxicity (young age, high-grade tumor, lymph node involvement). A balanced discussion of the risks and benefits associated with OFS is critical, including the potential side effects of premature menopause.

In two randomized trials (TEXT and SOFT), premenopausal patients with HR-positive early-stage breast cancer were assigned to receive AI (exemestane) plus OFS or tamoxifen plus OFS for a period of 5 years.[314] Suppression of ovarian estrogen production was achieved with the use of GnRH agonist triptorelin, oophorectomy, or ovarian irradiation. The DFS was 92.8% in the exemestane plus OFS as compared with 88.8% in the tamoxifen plus OFS (HR for recurrence, 0.66; 95% CI, 0.55–0.80; *P* < .001).[314] The OS did not differ significantly between the two groups (HR for death in the exemestane plus OFS group, 1.14; 95% CI, 0.86–1.51; *P* = .37).[314]

A 9-year median follow-up analysis of the TEXT-SOFT trials showed sustained improvements in DFS with exemestane plus OFS versus tamoxifen plus OFS (HR- 0.77; 95% CI, 0.67 to 0.90) and in distant recurrence-free interval but not OS (HR, 0.98; 95% CI, 0.79 to 1.22).[315] Ultimately, with longer follow-up (median = 13 years), an OS was demonstrated for OFS + exemestane in patients with high-risk of recurrence, but not in .exemestane plus OFS in patients with lower risk of relapse not receiving chemotherapy.[316]

The benefit of OFS in premenopausal patients with high-risk of recurrence was also seen in the results of the ASTRRA trial. This trial studied premenopausal patients (n= 1483) with HR-positive breast cancer younger than 45 years treated with surgery and who received chemotherapy (as adjuvant or preoperative therapy) and received 5 years of tamoxifen alone or 5 years of tamoxifen with OFS for 2 years. The 8-year DFS with tamoxifen plus OFS was 85.4% versus 80.2% with tamoxifen alone (HR-0.67; 95% CI, 0.51 to 0.87).[317]

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The results of the TEXT-SOFT trials suggest an optimal OFS duration of 5 years and data from the ASTRA trial suggests a benefit with a minimum of at least 2 years of OFS. The NCCN Panel has included OFS plus endocrine therapy for 5 years as an option for premenopausal patients with HR–positive breast cancer at higher risk of recurrence (eg, young age, high-grade tumor, lymph-node involvement). Premenopausal patients wishing to continue adjuvant endocrine therapy after ovarian suppression is stopped should continue with tamoxifen versus AI.

Duration of Adjuvant Endocrine Therapy

Adjuvant endocrine therapy is recommended for a minimum of 5 years. A recent retrospective analysis by the Oxford University studied risk of recurrence for years 5 through 20 after 5 years of endocrine therapy. [318] These data showed a considerable risk of recurrence between years 5 and 20 in these patients treated with initial 5 years of endocrine therapy.[318] Data has now emerged showing benefit of extended endocrine therapy in improving DFS.

Data from the ATLAS trial (discussed above)[291] and the aTTom trial confirm greater reduction in recurrence and death from breast cancer with 10 versus 5 years of tamoxifen therapy.[292]

For those treated initially with adjuvant tamoxifen, there is evidence for benefit from extended adjuvant endocrine therapy from several randomized trials. Results of the MA-17 trial in 5187 patients who had completed 4.5 to 6 years of adjuvant tamoxifen demonstrated that extended therapy with letrozole provides benefit in postmenopausal patients with HR-positive, early-stage breast cancer.[295,319] With a median follow-up of 64 months, letrozole was associated with improved DFS (HR 0.52, 95% CI 0.45-0.61) and an improved OS (HR 0.61, 95% CI 0.52-0.71) compared with placebo.[320]

In a separate cohort analysis of the MA-17 trial, the efficacy of letrozole versus placebo was evaluated after un-blinding of the study in the 1579 patients who had been randomly assigned to placebo after 4.5 to 6 years of tamoxifen.[321,322] The median time since completion of tamoxifen was 2.8 years. Both DFS and distant DFS were significantly improved in the group receiving letrozole, thereby providing some evidence for the efficacy of letrozole in patients who had received 4.5 to 6 years of tamoxifen therapy followed by no endocrine therapy for an extended period. A formal quality-of-life analysis demonstrated reasonable preservation of quality of life during extended endocrine therapy, although patients may experience ongoing menopausal symptoms and loss of bone mineral density.[323,324] No data are available regarding use of aromatase inhibitors for more than 5 years or long-term toxic effects from extended treatment. In addition, the ATLAS trial data do not provide clear direction for treatment of postmenopausal patients.[291] There are no data available to suggest that an AI for 5 years is better for long-term benefit than 10 years of tamoxifen.

In the extension study of ABCSG trial 6, HR-positive postmenopausal patients received 5 years of adjuvant tamoxifen and were randomized to 3 years of anastrozole or no further therapy.[325] At a median follow-up of 62.3 months, patients who received anastrozole (n = 387) were reported to have a statistically significantly reduced risk of recurrence compared with patients who received no further treatment (n = 469; HR, 0.62; 95% CI, 0.40–0.96; *P* = .031).[325]

The differences in design and patient populations among the studies of the aromatase inhibitors do not allow for the direct comparison of the results of these studies. A meta-analysis of adjuvant trials of aromatase inhibitors versus tamoxifen alone versus after 2 or 3 years of tamoxifen documented lower recurrence rates with the aromatase inhibitor-containing regimen, with no clear impact on OS.[326] It is not known whether initial, sequential, or extended use of adjuvant aromatase inhibitors is the optimal strategy.

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In patients initially treated with an AI, a randomized phase III trial (MA17.R) evaluated the effects of extending adjuvant AI therapy from 5 to 10 years.[327] Postmenopausal patients who had completed 4.5 to 6 years of therapy with an AI (with a median duration of prior tamoxifen of 5 years), were randomized to letrozole or placebo for an additional 5 years.[327] Improvement was seen in five-year DFS in those receiving letrozole compared to those who received placebo (95% [95% CI 93 - 96%] vs. 91% [95% CI 89 -93%]). The annual rate of contralateral breast cancer reported was lower with letrozole (0.49% vs. 0.21%; HR 0.42, 95% CI 0.22-0.81%). However, longer duration of AI resulted in more frequent bone-related adverse effects compared with those who received placebo and no improvement was observed with respect to OS. Bone-related adverse effects included bone pain (18% vs. 14%), fractures (14% vs. 9%), and new-onset osteoporosis (11% vs. 6%).[327] Patients with high-risk of recurrence (eg. those with lymph node involvement) may benefit from extended AI duration (7.5–10 years total).[328,329]

NCCN Recommendations: The decision of whether or not to extend adjuvant treatment based on the evidence available should be individualized. When considering endocrine therapy, the Panel recommends the following adjuvant endocrine therapy options for patients with early-stage breast cancer.

Adjuvant Endocrine Therapy for Postmenopausal Patients: The NCCN Panel recommends AI as initial adjuvant therapy for 5 years (category 1); and tamoxifen for 2 to 3 years followed by one of the following options: an AI to complete 5 years of adjuvant endocrine therapy (category 1) or 5 years of AI therapy (category 2B); or tamoxifen for 4.5 to 6 years followed by 5 years of AI (category 1) or consideration of tamoxifen for up to 10 years. In postmenopausal patients, the use of tamoxifen alone for 5 years (category 1) or up to 10 years is limited to those who decline or who have a contraindication to AIs.

Adjuvant Endocrine Therapy for Premenopausal Patients: If premenopausal at diagnosis, the NCCN Panel recommend 5 years of tamoxifen alone (category 1) or tamoxifen with OFS (category 1) or OFS plus AI for 5 years (category 1). Patients who are premenopausal at diagnosis and who become amenorrheic with chemotherapy may have continued estrogen production from the ovaries without menses. Menopausal status cannot be determined while receiving OFS. AI can stimulate ovarian function. To assure a true postmenopausal status, serial assessment of circulating LH, FSH, and estradiol is mandatory when considering this subset for AI therapy.[330,331] Frequency of testing of estradiol and FSH/LH levels should be individualized.

After 5 years of initial endocrine therapy, for patients who are postmenopausal at that time (including those who have become postmenopausal during the 5 years of tamoxifen therapy), the NCCN Panel recommends considering extended therapy with an AI for up to 5 years (category 1) or based on the data from the ATLAS trial considering tamoxifen for an additional 5 years. For those who remain premenopausal after the initial 5 years of tamoxifen, the panel recommends considering continuing up to 10 years of tamoxifen therapy.

Additional considerations during Adjuvant Endocrine Therapy: Symptom management for patients on adjuvant endocrine therapies often requires treatment of hot flashes and the treatment of concurrent depression.

Venlafaxine, a serotonin-norepinephrine reuptake inhibitor (SNRI) has been studied and is an effective intervention in decreasing hot flashes.[332-335] There is evidence suggesting that concomitant use of tamoxifen with certain SSRIs (eg, paroxetine, fluoxetine) may decrease plasma levels of endoxifen, an active metabolite of tamoxifen.[336,337] These SSRIs/SNRIs

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may interfere with the enzymatic conversion of tamoxifen to endoxifen by inhibiting a particular isoform of cytochrome P-450 (CYP450) enzyme. Individuals with wild-type *CYP2D6* alleles are classified as extensive metabolizers of tamoxifen. Those with one or two variant alleles with either reduced or no activity are designated as intermediate metabolizers and poor metabolizers, respectively. The mild CYP2D6 inhibitors such as citalopram, escitalopram, sertraline, and venlafaxine appear to have no or only minimal effect on tamoxifen metabolism.[330,338,339]

With respect to CYP2D6 mutation status, a large retrospective study of 1325 patients found that time to disease recurrence was significantly shortened in poor metabolizers of tamoxifen.[340] However, the BIG 1-98 trial reported on the outcome based on CYP2D6 genotype in a subset of postmenopausal patients with endocrine-responsive, early invasive breast cancer. The study found no correlation between CYP2D6 allelic status and disease outcome or between CYP2D6 allelic status and tamoxifen-related adverse effects.[341] A genetic analysis of the ATAC trial found no association between CYP2D6 genotype and clinical outcomes.[342,343] Given the limited and conflicting evidence at this time,[344] the NCCN Breast Cancer Panel does not recommend CYP2D6 testing as a tool to determine the optimal adjuvant endocrine strategy. This recommendation is consistent with the ASCO Guidelines.[345] When prescribing a selective serotonin reuptake inhibitor (SSRI), it is reasonable to avoid potent and intermediate CYP2D6 inhibiting agents, particularly paroxetine and fluoxetine, if an appropriate alternative exists.

For those on tamoxifen, while age-appropriate gynecologic screening is recommended, the use of routine annual pelvic ultrasound is not recommended. For those receiving AI or who experience ovarian failure secondary to treatment should have monitoring of bone health with a bone mineral density determination at baseline and periodically thereafter. .The panel discourages the selective ER modulators to treat osteoporosis or osteopenia in patients with breast cancer. The use of a bisphosphonate (oral/IV) or denosumab is recommended to maintain or to improve bone mineral density and reduce risk of fractures in postmenopausal (natural or induced) patients receiving adjuvant AI therapy. Optimal duration of either therapy has not been established. The optimal duration and benefits beyond 3 years is not known. Factors to consider for duration of anti-osteoporosis therapy include bone mineral density, response to therapy, and risk factors for continued bone loss or fracture. There are case reports of spontaneous fractures after denosumab discontinuation. Patients treated with bisphosphonates or denosumab should undergo a dental examination with preventive dentistry prior to the initiation of therapy, and should take supplemental calcium and vitamin D.

The incremental benefit of adding adjuvant chemotherapy to endocrine therapy in patients with low clinical risk of recurrence such as those with very small, low grade, lymph node-negative tumors is relatively small.[346] The decision whether or not to administer adjuvant chemotherapy in patients with HR-positive, HER2-negative tumors is based on many factors including lymph node status, size, grade, lymphovascular invasion, age, comorbid conditions and/or the results of a gene expression profile test using multigene assays.

Several commercially-available gene-based assays are useful in determining prognosis by predicting distant recurrence, local recurrence, or survival. Of these, only one, the 21-gene assay (Oncotype Dx) has been clinically validated for predicting the benefit of adding adjuvant chemotherapy to further reduce the risk of recurrence.

21-gene assay (Oncotype DX) in Node-negative, HR-positive, HER2-negative disease: The 21-gene recurrence score (RS) is one of the most validated multigene assays. The RS is helpful in determining the prognosis in patients with HR-positive, HER2-negative tumors treated with

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endocrine therapy alone by predicting locoregional and distant recurrence.[347-349] This assay has also been validated to predict the benefit from adding adjuvant chemotherapy to adjuvant endocrine therapy for patients with HR-positive, HER2-negative, node-negative breast cancer.[286,350,351]

Among patients with T1b/c and T2, lymph node-negative, HR-positive, HER2-negative tumors with RS between 0-10, the risk of distant recurrence is low and these patients derive no incremental benefit from the addition of adjuvant chemotherapy to endocrine therapy.[286,352] At the other end of the spectrum, patients with lymph node-negative, HR-positive, HER2-negative cancers with high RS (≥ 31) have a higher risk of distant recurrence and secondary analyses of prospective studies demonstrate a clear benefit from adjuvant chemotherapy.[286,353]

For those with intermediate RS (11-25), the TAILORx trial of postmenopausal patients (n= 6711) with lymph node-negative, HR-positive, HER-2 negative breast cancer, showed similar disease-free survival rates at 9-years in those who received adjuvant chemotherapy followed by endocrine therapy compared with endocrine therapy alone.[353] However, in a subset analysis, patients 50 years of age or younger with RS 16-25 had lower rates of distance recurrence with the addition of adjuvant chemotherapy to endocrine therapy.[353] The cutoff for low, intermediate, and high RS was different in TAILORx versus NSABP B-20. The NSABP-B20 was the first trial to validate the 21-gene assay both as a prognostic as well as a predictive tool and identified RS cut-offs to predict the magnitude of chemotherapy benefit in patients with node-negative, HR-positive breast cancer.[7]

21-gene assay (Oncotype DX) in Node- positive, HR-positive, HER2-negative disease: In the West German Plan B study, patients (n = 110) with lymph node-positive, HR-positive, HER2-negative tumors, and a RS of ≤11, were found to have a 5-year disease-free survival of94.4% when treated with endocrine therapy alone.[354] In a secondary analysis of a prospective registry of patients with HR-positive, HER2-negative, lymph node-positive tumors, the 5-year risk of distant recurrence in patients with a RS of <18, treated with endocrine therapy alone was 2.7%.[355] These results suggest that in patients with limited nodal disease (1-3 positive lymph nodes) and a low RS, the absolute benefit from chemotherapy is likely to be very small.[355,356]

There is a clear benefit from adjuvant chemotherapy in patients with node positive, HR-positive, HER2-negative tumors, if the RS is high (≥ 31). In a secondary analysis of the SWOG 8814 trial of patients with HR-positive, lymph node-positive tumors, high RS (≥31) was predictive of chemotherapy benefit. This study evaluated breast cancer specimens from node-positive, HR-positive postmenopausal patients (n= 367) randomized to endocrine therapy with tamoxifen alone or chemotherapy with CAF followed by tamoxifen.[350] Compared with tamoxifen alone, treatment with CAF among patients with a high RS (≥31) resulted in improved 10-year DFS (55% vs. 43%; HR 0.59, 95% CI 0.35-1.01) and OS (73% vs. 54%; HR 0.56, 95% CI 0.31-1.02).[350]

The Southwest Oncology Group (SWOG) S1007 RxPONDER trial,[357] assigned patients with 1-3 lymph node-positive nodes, HR-positive, HER2-negative breast cancer and a RS ≤ 25 to standard endocrine therapy with or without adjuvant chemotherapy. The results showed that the addition of adjuvant chemotherapy to endocrine therapy improved invasive disease–free survival among premenopausal—but not postmenopausal—women with hormone receptor–positive, HER2-negative, node-positive breast cancer and a 21-gene assay recurrence score up to 25.[358]

70-gene assay (MammaPrint): Results from the randomized MINDACT trial,[359] demonstrated that the 70-gene assay can identify a subset of patients who have a low likelihood of distant recurrence despite high-risk

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clinical features (based on tumor size, grade, nodal status). In this trial, 79% had lymph node-negative disease and 21% had 1-3 positive lymph nodes and all patients underwent risk assessment by clinical criteria (using Adjuvant! Online) and genomic risk assessment by the 70-gene assay.

Patients with low-risk disease according to both clinical criteria and genomic assay results did not receive adjuvant chemotherapy, whereas patients categorized as high-risk by both assessments received chemotherapy. Patients with discordant results (i.e., either high clinical risk/low genomic risk or low clinical risk/high genomic risk) were randomized to the chemotherapy group or the no-chemotherapy group on the basis of either the clinical result or the genomic result. The primary outcome of the study was met with the demonstration that among those with high clinical risk/low genomic risk, the 5-year rate of survival without distant metastasis in those did not receive adjuvant chemotherapy was 94.7% (95% CI, 92.5 to 96.2).[359]

In the intention-to-treat population, among patients at high clinical risk/low genomic risk by the 70-gene assay, the 5-year rate of survival with no distant metastasis in those who received chemotherapy was 95.9% (95% CI, 94.0 to 97.2) versus 94.4% (95% CI, 92.3 to 95.9) in those who did not receive chemotherapy (adjusted HR for distant metastasis or death with chemotherapy vs.no chemotherapy 0.78; 95% CI, 0.50 to 1.21).[359] Among patients at low clinical risk/ high genomic risk, 5-year survival with no distant metastasis was 95.8% with chemotherapy (95% CI, 92.9 to 97.6), compared with a rate of 95.0% (95% CI, 91.8 to 97.0%) without chemotherapy (adjusted HR for distant metastasis or death with chemotherapy vs. no chemotherapy,1.17; 95% CI, 0.59 to 2.28). These data suggest that the results of the 70-gene signature do not provide evidence for making recommendations regarding chemotherapy for patients at low clinical risk.[359]

In a subgroup analysis by nodal status, among node-negative patients with high clinical risk/low genomic risk, the 5-year rate of survival with no distant metastasis was 95.7% (95% CI, 93.0 to 97.4) in those who received adjuvant chemotherapy compared with 93.2% (95% CI, 90.1 to 95.4) in those who did not receive chemotherapy.[359] Among patients with 1-3 positive lymph nodes, the rates of survival without distant metastases were 96.3% (95% CI, 93.1 to 98.1) in those who received adjuvant chemotherapy versus 95.6 (95% CI, 92.7 to 97.4) in those who did not receive adjuvant chemotherapy.[359] These data suggest that the additional benefit of adjuvant chemotherapy in patients with high-clinical risk/low genomic risk is likely to be small.

50-gene assay (PAM50): The 50-gene assay (PAM-50) risk of recurrence (ROR) score stratifies patients with HR-positive disease into high, medium, and low risk groups. Several studies have demonstrated the prognostic value of ROR score in estimating risk of disease recurrence.[360-362]

In a study from the Danish Breast Cancer Cooperative Group database, patients with lymph node node-negative tumors and low ROR had a distant recurrence risk of 5.0% (95% CI, 2.9% to 8.0%) whereas tumors with high ROR had a distant recurrence risk of 17.8% (95% CI, 14.0% to 22.0%).[361] Based on these analyses, patients with T1 and T2, HR-positive, HER2- negative, lymph node-negative tumors, a ROR score in the low range, regardless of tumor size, places the individual into the same prognostic category as those with T1a–T1b, N0, M0 tumors.[361]

In patients with 1-3 lymph-node positive, HR-positive, HER2-negative disease with low-risk of recurrence score, the distant recurrence risk was less than 3.5% at 10 years with endocrine therapy alone.[361] In TransATAC study, no distant recurrence was seen at 10 years in a similar group.[362]

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12-gene assay (EndoPredict): This assay utilizes 12-genes to calculate a prognostic score. This assay appears to be useful in identifying a subgroup of patients with ER-positive, HER2-negative tumors with very low risk of recurrence without adjuvant chemotherapy and helpful in identifying patients at low risk for a late recurrence.[363] Based on results of two Austrian Breast Cancer Study Group trials- ABCSG-6 and ABCSG-8, patients with HR-positive, HER-2 negative, and lymph-node node-negative disease with a low-risk score by the 12-gene assay had risk of distant recurrence of 4% at 10 years.[363] The prognostic value of the risk score from the 12-gene assay was found to be independent of conventional clinicopathological factors. Patients with T1 and T2 HR-positive, HER2-negative, and lymph node-negative tumors, a 12-gene low-risk score, regardless of T size, places the tumor into the same prognostic category as T1a–T1b, N0, M0.

In TransATAC study, patients with 1-3 positive nodes in the low-risk group had a 5.6% risk of distant recurrence at 10 years,[362] suggesting that chemotherapy would be of limited benefit in these patients.

Breast Cancer Index: The Breast Cancer Index (BCI) is a combination of two profiles, the HOXB13-to-IL17BR expression ratio (H:I ratio) and the Molecular Grade Index (MGI). Compared with clinical prognostic factors (eg, age, tumor size, tumor grade, and lymph node status), the H:I ratio has been shown to be prognostic in the setting of adjuvant tamoxifen monotherapy.[362,364] The addition of MGI to H:I was determined to provide additional prognostic discrimination, leading to the BCI assay.[364] In a secondary analysis of the ATAC trial, BCI was prognostic in node negative breast cancer for both early (years 0-5) and late (years 5-10) distant recurrence.[365] For patients with T1 and T2 HR-positive, HER2-negative, and lymph node-negative tumors, a BCI in the low-risk range, regardless of T size, places the tumor into the same prognostic category as T1a-T1b, N0, M0. Secondary analyses of the MA.17, Trans-aTTom, and IDEAL trials showed that in patients with HR-positive T1–T3 tumors that are lymph-node negative or positive, those that had a high BCI (H/I) demonstrated significant improvements in DFS when adjuvant endocrine therapy was extended, compared to the control arm.[366-368] Considering the ability of the multigene assays to predict benefit of adjuvant systemic chemotherapy and ability to determine prognosis by predicting risk of distant recurrence, the NCCN Panel has summarized the treatment implications based on risk scores and nodal status.

Multigene Assays for Axillary Lymph Node-Negative HR-Positive, HER2-Negative Tumors

Small tumors (up to 0.5 cm in greatest diameter) that do not involve the lymph nodes have a favorable prognosis so adjuvant chemotherapy is not recommended. According to the NCCN Panel, adjuvant endocrine therapy may be considered in this group of patients to reduce the risk for a second contralateral breast cancer, as well as the small benefit in reducing the risk of local/regional and distant recurrence.(Category 2B).

For patients with invasive ductal or lobular tumors greater than 0.5 cm in diameter and no lymph node involvement (lymph node node-negative), the NCCN panel recommends strongly considering the 21-gene RT-PCR assay to help estimate likelihood of recurrence *and* benefit from chemotherapy (category 1). The panel has noted that on an exploratory analysis from the TAILORx study,[353] adjuvant chemotherapy may be considered in patients 50 years of age or younger with a 21-gene RS of 16-25. Also, patients with T1b tumors with low grade histology should be considered for endocrine monotherapy, as the TAILORx study[353] did not include patients with such tumors.

The panel notes that other prognostic multigene assays may be considered to help estimate risk of recurrence, but these assays have not been validated to predict the benefit of systemic chemotherapy. Also,

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amongst the other assays, the panel has listed the 70-gene assay as a category 1 option based on the results of the prospective MINDACT[359] trial demonstrating the ability of the 70-gene assay to identify a good genomic risk population despite a high clinical risk, in whom chemotherapy may be omitted without a detrimental effect. High clinical risk in the MINDACT trial was defined for grade 1 tumors as >3 cm N0 or T2N1, for grade 2 tumors T2N0-1, and for grade 3 tumors T1c-2N0-1.

Furthermore, given no difference in outcomes with or without chemotherapy in the discordant low clinical risk/high genomic risk group, the MINDACT study suggests that the 70-gene panel is not useful guiding systemic chemotherapy decisions in this subgroup of patients.

Since results of different assays may not be concordant with each other and these assays have not been compared head-to-head prospectively, clinicians should only order one of the available assays for a specific patient and tumor.

Multigene Assays for Axillary Lymph Node-Positive HR- Positive, HER2-Negative Tumors

For patients with four or more involved nodes the panel recommends systemic adjuvant chemotherapy followed by endocrine therapy (category 1).

Patients with less than four involved nodes or with pN1mi and less than or equal to 2 mm axillary node metastasis, are most often candidates for chemotherapy in addition to endocrine therapy. The panel recommends that clinical decision making for adjuvant chemotherapy be based on elements of clinical risk stratification such as clinical characteristics, tumor stage, pathology and comorbid conditions. If the patient is not a candidate for chemotherapy, the panel recommends adjuvant endocrine therapy alone (category 2A).

For those who are candidates for systemic adjuvant chemotherapy based on clinical characteristics, tumor stage, and pathology, the panel recommends consideration of multigene assays to assess prognosis as a tool to assist with treatment decision making. The panel notes in those with N1mi and N1 tumors, while multigene assays have yet to be proven to be predictive for adjuvant chemotherapy benefit, they are prognostic and can be used to identify low-risk patients who are likely to derive little or no absolute benefit from addition of adjuvant chemotherapy to adjuvant endocrine therapy. A secondary analysis of the prospective SWOG 8814 trial using the 21-gene assay demonstrated no benefit for chemotherapy for patients with 1-3 involved axillary lymph nodes and a low RS, and a significant benefit for the addition of adjuvant chemotherapy in those with high-RS (≥ 31).[350] The phase III RxPONDER trial prospectively demonstrated that for premenopausal patients with hormone receptor–positive, HER2-negative, node-positive breast cancer , a 21-gene assay Recurrence Scores up to 25 had an addition benefit of adjuvant chemotherapy to endocrine therapy for improving invasive disease–free survival .[358] In the MINDACT trial, among patients with 1-3 positive nodes who had a high clinical risk of recurrence but low risk by the 70-gene assay, the rates of survival were similar between those who received adjuvant chemotherapy in addition to adjuvant endocrine therapy versus those received adjuvant endocrine therapy alone, suggesting that chemotherapy could be omitted in this group.[359] Other multigene assays have not proven to be predictive of benefit from chemotherapy.

For those who are candidates for systemic adjuvant chemotherapy based on clinical characteristics, tumor stage, and pathology, if multigene assay is not available, the panel recommends systemic adjuvant chemotherapy followed by endocrine therapy (category 1).

Adjuvant Targeted therapies for HR-positive, HER2-negative tumors

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Adjuvant therapies are rapidly evolving and CDK 4/6 inhibitors and PARP inhibitors are now indicated in this setting.

Adjuvant CDK 4/6 inhibitors: In the MonarchE study, the addition of 2 years of abemaciclib to endocrine therapy reduced the absolute risk of recurrence at 4 years by 6.4% (HR 0.664, 95% CI 0.578-0.762, *P* < .0001) in patients with HR-positive/HER2-negative, high-risk breast cancer, defined as 4 or more pathologically involved lymph nodes confirmed preoperatively and/or at surgery, or 1–3 pathologically involved lymph nodes with additional high risk features (grade 3 or size ≥5 cm based on pre-operative imaging and/or pathologically at surgery).[369]

Two trials of palbociclib as adjuvant therapy in HR-positive, HER2–negative early breast cancer did not show benefit of adding palbociclib to adjuvant endocrine therapy in terms of invasive disease-free survival.[370,371]

The results from the NATALEE trial reported after a median follow-up of 34 months, showed a statistically significant improvement (3.3%) in invasive disease-free survival with the addition of ribociclib to adjuvant endocrine therapy (HR-0.75, 95% CI 0.62-0.91, *P* = .003).) for stage II and stage III HR-positive, HER2-negative breast cancer.[372] Additional follow-up is needed to characterize the long-term efficacy of ribociclib in this setting.

According to the current guidelines, 2 years of adjuvant CDK 4/6 therapy with abemaciclib should be considered in combination with endocrine therapy in patients with HR-positive/HER2-negative, high-risk breast cancer (as detailed above). This is a category 1, preferred option for this setting.

Adjuvant Olaparib: In patients with germline *BRCA* 1/2 mutations and high-risk HER2-negative tumors, the results of the OlympiA trial showed that the 4-year OS in the group that received 1 year of adjuvant olaparib was 89.8% and 86.4% in the placebo group (95% CI -0.1% -6.8%). The 4-year invasive DFS for the olaparib group versus placebo group was 82.7% versus 75.4% (95% CI 3.0% - 11.5%) and 4-year distant DFS was 86.5% versus 79.1% (95% CI 3.6% -11.3%).[373]

According to the NCCN panel, addition of adjuvant olaparib for 1 year may be considered for those with germline *BRCA* 1/2 mutations in patients with HR-positive, HER2-negative tumors with ≥4 positive lymph nodes after adjuvant chemotherapy or residual disease after preoperative therapy and a clinical stage, pathologic stage, ER status, and tumor grade (CPS+EG) score ≥3 (category 2A).

Adjuvant olaparib may be used concurrently with endocrine therapy. In patients eligible for both adjuvant olaparib and abemaciclib, the optimal sequencing is not known. (For sequencing of olaparib and/or abemaciclib with RT, see BINV-I on nccn.org)

Adjuvant bisphosphonate therapy

Antiresorptive agents (bisphosphonates and denosumab) have an established role as preventative and therapeutic agents for the management of osteoporosis, hypercalcemia of malignancy, and bone metastases.

Bisphosphonates: In the Austrian Breast and Colorectal Cancer Study Group trial-12 (ABCSG-12) trial, for patients over 40 years, zoledronic acid significantly reduced the risk of recurrence by 34% (HR, 0.66; *P*=.014) and the risk of death by 49% (HR, 0.51; *P*=.020). However, no improvement was seen in either DFS or OS in this post hoc analysis among patients under 40 years.[374] In a planned subgroup analysis of the AZURE trial, zoledronic acid improved DFS in patients who were more than 5 years since menopause at trial entry.[375] A meta-analysis of data from seven adjuvant bisphosphonate trials (AZURE, ABCSG-12, ZO-FAST, Z-FAST, EZO-FAST, NSABP-B34, GAIN), including only those known to be over 50 years, postmenopausal, or with ovarian suppression, showed a significant

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benefit for the use of adjuvant bisphosphonates in patients with a low-estrogen state and early-stage breast cancer.[376] More recently, the Early Breast Cancer Trialists' Collaborative Group (EBTCG) conducted a meta-analysis of all randomized adjuvant bisphosphonate studies (26 studies) and reported convincing evidence that adjuvant bisphosphonates provide benefits to postmenopausal (natural or induced) patients with breast cancer.[377] With bisphosphonate therapy, the greatest improvement was seen in bone recurrence (RR=0.83, *P* = .004) and bone fractures (RR=0.85, *P* = .02). No effect was seen on distant recurrence outside bone (RR =0.98, *P* =0.69).[377] In premenopausal patients, bisphosphonate therapy did not seem to have a significant effect on bone recurrence. However, in postmenopausal patients, zoledronic acid significantly reduced bone recurrence (3.4% vs. 4.5%, RR=0.73, 99% CI 0.53 to 1.00); the difference in breast cancer mortality was not statistically significant (7.1% vs. 7.9%, RR=0.88, 99% CI 0.69 to 1.11).[377]

Denosumab: In the adjuvant setting, the ABCSG-18 trial studied the effect of denosumab in postmenopausal patients treated with adjuvant AIs and showed a reduction in clinical fractures (HR 0.5, *P* < .0001), which was the primary endpoint of this study.[378] The final analysis after a median follow-up of 8 years continued to show a benefit with denosumab. Adjuvant denosumab improved bone metastasis-free survival (88.9 vs. 86.4%; HR, 0.81; 95% CI, 0.65 to 1.00) and OS (90.9 vs. 89.9%; HR, 0.80; 95% CI, 0.64 to 1.01).[379] In contrast, results of the phase III trial (D-Care) trial failed to demonstrate a difference in bone metastasis-free survival in those receiving denosumab versus placebo.[380]

Due to these conflicting results from phase III trials, denosumab is currently not recommended in the adjuvant setting.[379] The panel recommends considering adjuvant bisphosphonate therapy for risk reduction of distant metastasis for 3–5 years in patients with high-risk node negative or node-positive tumors.

Adjuvant Therapy for HER2-negative tumors

Several combination chemotherapy regimens are appropriate to consider for HR-positive or negative and HER2-negative tumors. All adjuvant chemotherapy regimens listed in the NCCN Guidelines have been evaluated in phase III clinical trials and are category 1 unless otherwise noted.

Preferred Regimens

Regimens listed as preferred include dose-dense doxorubicin and cyclophosphamide (AC) followed or preceded by paclitaxel either weekly or biweekly; docetaxel plus cyclophosphamide (TC); olaparib for germline *BRCA* 1/2 mutations; pembrolizumab for high-risk ER- disease; and capecitabine for residual ER- disease after preoperative chemotherapy.

Meta-analysis from Early Breast Cancer Trialists' Collaborative Group (EBCTCG) has shown that anthracycline and taxane-based combination chemotherapy reduces the risk of breast cancer mortality compared with no chemotherapy. The use of dose-dense schedules has shown to further reduce the risk of breast cancer recurrence or death without increasing mortality. [381]

The results of two randomized trials comparing AC chemotherapy with or without sequential paclitaxel chemotherapy in patients with axillary node-positive breast cancer suggest improved disease-free rates and results from one of the trials showed an improvement in OS, with the addition of paclitaxel.[382,383] On retrospective analysis, the apparent advantage of the paclitaxel-containing regimen appears greater in patients with ER-negative breast cancers.

A randomized trial evaluated the use of concurrent versus sequential chemotherapy (doxorubicin followed by paclitaxel followed by cyclophosphamide vs. doxorubicin plus cyclophosphamide followed by

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paclitaxel) given either every 2 weeks with filgrastim support or every 3 weeks. The results show no significant difference between the two chemotherapy regimens but demonstrate a 26% reduction in hazard of recurrence (*P* = .01) and a 31% reduction in the hazard of death (*P* = .013) for the dose-dense regimens.[384]

The ECOG E1199 study was a four-arm trial that randomized 4950 patients to receive AC chemotherapy followed by either paclitaxel or docetaxel given by either an every-3-week schedule or a weekly schedule.[385] In a secondary series of comparisons, weekly paclitaxel was superior to every-3-week paclitaxel in DFS (HR, 1.27; 95% CI, 1.03–1.57; *P* = .006) and OS (HR, 1.32; 95% CI, 1.02–1.72; *P* = .01), and every-3-week docetaxel was superior to every-3-week paclitaxel in DFS (HR, 1.23; 95% CI, 1.00–1.52; *P* = .02) but not in OS.[385] Based on these results, as well as the findings from the CALGB trial 9741 that showed dose-dense AC followed by paclitaxel every 2 weeks to have a survival benefit when compared with the regimen of AC followed by every-3-week paclitaxel,[384] the every-3-week paclitaxel regimen has been removed from the guidelines.

Combination TC was compared with AC chemotherapy in a trial that randomized 1016 patients with stage I to III breast cancer.[386] At a median follow-up of 7 years, overall DFS (81% vs. 75%; HR, 0.74; 95% CI, 0.56–0.98; *P* = .033) and OS (87% vs. 82%; HR, 0.69; 95% CI, 0.50–0.97; *P* = .032) were significantly improved with TC compared with AC. Non-anthracycline, taxane-based regimen, such as TC may be preferred options in patients for whom anthracyclines are contraindicated.

Residual disease after preoperative systemic therapy indicates higher risk (20% to 30%) of disease relapse.[256,387] CREATE-X, a multicenter, open-label, randomized, phase 3 trial evaluated the efficacy and safety of adjuvant capecitabine in patients with HER2-negative primary breast cancer who had residual invasive disease after standard (anthracycline and/or taxane-based) preoperative chemotherapy. The results showed improved DFS (HR 0.70, 95% CI 0.53-0.92, *P* = .01) and OS (HR for death 0.59, 95% CI 0.39-0.90, *P* = .01) with adjuvant capecitabine. The OS was higher in those with TNBC (HR for death, 0.52). Results of two other similar trials with adjuvant capecitabine have showed a similar impact with adjuvant capecitabine in patients with TNBC with no significant impact in those with HR-positive disease.[388,389] Based on the above trial results, the NCCN panel has included adjuvant capecitabine an adjuvant therapy option for those with TNBC and residual disease after preoperative therapy. For those with germline *BRCA* 1/2 mutations and TNBC, according to the NCCN panel, based on the results of OlympiA trial (discussed in section adjuvant therapy for HR-positive, HER2-negative disease) adjuvant olaparib for 1 y may be considered if tumors ≥ pT2 or ≥ pN1 disease after adjuvant chemotherapy or in those with residual disease after preoperative chemotherapy (catgeory1). Patients in the OlympiA trial did not receive capecitabine; thus, there are no data on sequencing or to guide selection of one agent over the other. (For sequencing of capecitabine or Olaparib with RT, see BINV-I on nccn.org)

If pembrolizumab was given in combination with chemotherapy in the preoperative setting, based on the KEYNOTE-522 trial data, the panel recommends adjuvant pembrolizumab.[274]

Other Recommended Regimens

Other recommended regimens included in the guidelines include: AC; epirubicin and cyclophosphamide (EC); docetaxel, doxorubicin, and cyclophosphamide (TAC); paclitaxel + carboplatin (various schedules); and docetaxel + carboplatin.

A trial compared 2 dose levels of EC chemotherapy with CMF chemotherapy in patients with node-positive breast cancer.[390] This study showed that higher-dose EC chemotherapy was equivalent to CMF

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chemotherapy and superior to moderate-dose EC in event-free survival and OS.

Final results from a randomized trial of TAC versus FAC chemotherapy in node-positive breast cancer demonstrated that TAC is superior to FAC.[391] Estimated 5-year DFS was 75% with TAC and 68% with FAC (HR, 0.72; 95% CI, 0.59–0.88; *P* =.001); survival was 87% with TAC and 81% with FAC (HR, 0.70; 95% CI, 0.53–0.91; *P* = .008). DFS favored TAC in both ER-positive and ER-negative tumors. At a median follow-up of 73 months, results from the 3-arm randomized NSABP B-30 trial comparing TAC versus AT versus AC followed by docetaxel (AC followed by T) demonstrated that AC followed by T had a significant advantage in DFS (HR, 0.83; *P* = .006) but not in OS (HR, 0.86; *P* = .086) when compared with TAC. In addition, both DFS (HR, 0.080; *P* = .001) and OS (HR, 0.83; *P* = .034) were significantly increased when AC followed by T was compared with AT, with AT demonstrating non-inferiority compared with TAC.[392]

Useful in Certain Circumstances:

Regimens included in this category include dose dense AC; AC every 3 weeks (Category 2B); CMF; AC followed by weekly paclitaxel; and capecitabine as maintenance therapy for TNBC after adjuvant chemotherapy.

The phase III E1199 trial compared patients with node-positive or high-risk node-negative breast cancer who received 4 cycles of AC every 3 weeks, followed by either paclitaxel or docetaxel, either weekly or every 3 weeks. The 10-year updated results of this trial showed that incorporation of weekly paclitaxel and docetaxel every 3 weeks was associated with significant improvements in DFS, and marginal improvements in OS, compared with paclitaxel given every 3 weeks. Among patients with triple-negative disease, the10-year DFS rate with weekly paclitaxel was 69% and the 10-year OS rate was 75%.[393]

The AC regimen for four cycles has been studied in randomized trials, resulting in relapse-free survival and OS equivalent to CMF chemotherapy.[394,395] No benefit from dose escalation of either doxorubicin or cyclophosphamide was shown.[382,396] Studies of CMF chemotherapy versus no chemotherapy have shown DFS and OS advantages with CMF chemotherapy.[59,397]

Results of a randomized trial in patients with TNBC (n=434) who received standard adjuvant chemotherapy demonstrated that maintenance therapy with low-dose capecitabine (dose of 650 mg/m^2 twice a day by mouth for 1 year) improved 5-year DFS and OS. The invasive DFS in those who receive adjuvant low-dose capecitabine was 85.8% compared with 75.8% in those who did not (HR for risk of distant metastasis or death, 0.60 [95% CI, 0.38-0.92]; *P* = .02), the estimated 5-year OS with maintenance capecitabine was 85.5% versus 81.3% (HR for risk of death, 0.75 [95% CI, 0.47-1.19]; *P* = .22).[398]

Adjuvant Therapy for HER2-positive tumors

Trastuzumab containing chemotherapy regimens followed by one year of HER2-targeted therapy are a backbone of adjuvant therapy patients with HER2-positive disease.

The panel recommends HER2-targeted therapy in patients with HER2-positive tumors (see Principles of HER2 Testing in the NCCN Guidelines for Breast Cancer). Pre-operative systemic therapy incorporating HER-2 targeted agent(s) should be considered for HER-2 positive patients presenting with clinical node-positive tumors or those measuring ≥2 cm (cT2) at presentation.)

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The NCCN Panel suggests trastuzumab and chemotherapy be used for patients with HER2-positive, node-negative tumors measuring 0.6 to 1.0 cm (T1b) and for smaller tumors that have less than or equal to 2 mm axillary node metastases (pN1mi). Some support for this recommendation comes from studies showing a higher risk of recurrence for patients with HER2-positive, node-negative tumors less than or equal to 1 cm compared to those with HER2-negative tumors of the same size.[399]

Ten-year breast cancer-specific survival and 10-year recurrence-free survival were 85% and 75%, respectively, in patients with tumors characterized as HER2-positive, ER-positive tumors, and 70% and 61%, respectively, in patients with HER2-positive, ER-negative tumors. Two additional retrospective series report recurrence-free survival in this subpopulation of HER-2 positive, node-negative tumors measuring 0.6 to 1.0 cm (T1b) and/or pN1mi. all treated without trastuzumab. In the first study, 5-year recurrence-free survival rates of 77.1% and 93.7% (P < .001) were observed for patients with HER2-positive and HER2-negative T1a-bN0M0 breast tumors, respectively, with no recurrence-free survival differences seen in the HER2-positive group when hormonal receptor status was considered.[400] In the other retrospective study of patients with small HER2-positive tumors, the risk of recurrence at 5 years was low (99% [95% CI; 96%–100%] for HER2-negative disease and 92% [95% CI; 86%–99%] for HER2-positive disease).[401] Subgroup analyses from several of the randomized trials have shown consistent benefit of trastuzumab irrespective of tumor size or nodal status.[402,403]

Preferred Regimens:
The NCCN Panel has included paclitaxel and trastuzumab as an option for patients with low-risk, HER2-positive, stage 1 tumors, based on a trial of 406 patients with small, node-negative, HER2-positive tumors treated with this combination. The 3-year rate of DFS was 98.7% (95% CI, 97.6–99.8) and the risk of serious toxic effects with this regimen was low (incidence of heart failure reported was 0.5%).[404] The long-term follow-up data reported 10-year invasive DFS of 91.3%, breast cancer-specific survival of 98.8% and OS rates of 94.3%.[405] Accordingly, NCCN panel has listed paclitaxel and trastuzumab as a less intensive therapeutic option, preferred for patients with low-risk T1,N0,M0, HER2-positive disease, particularly those not eligible for other standard adjuvant regimens due to comorbidities.[405]

The BCIRG 006 study randomized 3222 patients with HER2-positive, node-positive, or high-risk node-negative breast cancer to AC followed by docetaxel; AC followed by docetaxel plus trastuzumab for one year; or carboplatin, docetaxel, and trastuzumab for one year.[403] At 65-month follow-up, patients receiving AC followed by docetaxel with trastuzumab (AC-TH) had an HR for DFS of 0.64 (P < .001) when compared with the group of patients in the control arm receiving the same chemotherapy regimen without trastuzumab (AC-T). The HR for DFS was 0.75 (P = .04) when patients in the carboplatin/docetaxel/ trastuzumab (TCH)-containing arm were compared to patients in the control arm. No statistically significant difference in the HR for DFS was observed between the two trastuzumab-containing arms. An OS advantage was reported for patients in both trastuzumab-containing arms relative to the control arm (HR for AC-TH vs. AC-T = 0.63; P = .001; HR for TCH vs. AC-T = 0.77; P = .04). Cardiac toxicity was significantly lower in the TCH arm (9.4% patients with >10% relative decline in left ventricular ejection fraction) compared with the AC-TH arm (18.6%; P < .0001). CHF was also more frequent with AC-TH than TCH (2% vs. 0.4%; P < .001). Analysis of this trial by critical clinical event revealed more distant breast cancer recurrences with TCH (144 vs. 124) but fewer cardiac events with TCH compared with AC-TH (4 vs. 21).[403] In the FinHer trial, 1010 patients were randomized to 9 weeks of vinorelbine followed by 3 cycles of FEC chemotherapy versus docetaxel for 3 cycles followed by 3 cycles of FEC chemotherapy.[406] Patients (n = 232) with HER2-positive cancers that were either node-positive or node-negative and greater than or equal to 2 cm and PR-negative were

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further randomized to receive or not receive trastuzumab for 9 weeks during the vinorelbine or docetaxel portions of the chemotherapy only. With a median follow-up of 3 years, the addition of trastuzumab was associated with a reduction in risk of recurrence (HR, 0.42; 95% CI, 0.21–0.83; *P* = .01). No statistically significant differences in OS (HR, 0.41; 95% CI, 0.16–1.08; *P* = .07) or cardiac toxicity were observed with the addition of trastuzumab.[406] At 5-year follow-up, a comparison of the two arms (ie, chemotherapy with and without trastuzumab) demonstrated that the HRs for distant DFS (HR, 0.65; 95% CI, 0.38–1.12; *P* = .12) and OS (HR, 0.55; 95% CI, 0.27–1.11; *P* = .094) were higher relative to those reported at 3 years.[407] The TCH regimen is a preferred regimen, especially for those with risk factors for cardiac toxicity, based on the results of the BCIRG 006 study.

The APHINITY trial compared adjuvant trastuzumab plus pertuzumab with trastuzumab–placebo, both in combination with standard adjuvant chemotherapy in patients with node-positive or high-risk node-negative HER2-positive, operable tumors. The study demonstrated that trastuzumab plus pertuzumab significantly improved 3-year iDFS (HR 0.81, 95% CI 0.66-1.00, *P* =.045).[408] With long-term (8-year) follow-up, the node positive subgroup maintained a clear invasive DFS benefit favoring the dual HER-2 agent arm demonstrating 8-year invasive DFS of 86% versus 81% (HR; 0.72, 95% CI 0.60-0.87) with no OS difference; no benefit was seen in the node-negative subgroup.[409] These updated results from the adjuvant APHINITY trial confirm the long-term benefit of adding pertuzumab to trastuzumab plus chemotherapy for node positive disease. The panel has designated use of trastuzumab with chemotherapy as a category 1 recommendation for all HER2-positive tumors >1 cm, and based on the data above, chemotherapy plus trastuzumab and pertuzumab as a category 1, preferred regimen for all HER-2 positive, node-positive disease.

The data from the phase III KATHERINE trial reported improved outcomes in patients who had residual invasive cancer and received adjuvant trastuzumab emtansine (T-DM1). Invasive DFS at 3 years was 88.3% with T-DM1 versus 77.0% with trastuzumab.[410] T-DM1 significantly decreased the invasive breast cancer recurrence risk or death (HR 0.50, 95% CI 0.39-0.64, *P* < .001).[410]

The ATEMPT trial was designed to determine whether T-DM1 was more toxic than paclitaxel/Trastuzumab. The long-term followup data of patients who received 1 year of adjuvant T-DM1 (n = 383) or trastuzumab/paclitaxel (n = 114) reported the 5-year invasive disease free survival rate with T-DM1 of 97.0% (95% CI, 95.2%-98.7%), the 5-year recurrence-free interval of 98.3% (95% CI, 96.3%-99.0%), and the 5-year OS rate of 97.8% (95% CI, 96.3%-99.3%).[411] The study was not powered to evaluate the efficacy of paclitaxel/trastuzumab, among those who received it, the reported 5-year invasive disease-free survival with this combination was 91.3% (95% CI: 86.0-96.9%), 5-year recurrence free interval was 93.3% (95% CI: 88.6-98.2%) and 5-year OS was 97.9% (95% CI: 95.2-100%).[411] Based on these data, T-DM1 may be considered an alternative for these patients ineligible for paclitaxel/Trastuzumab.

Other recommended regimens:
Anthracycline followed by taxane-containing chemotherapy regimens were used in the NSABP trial B-31,[412] NCCTG trial,[413] and BCIRG 006 trial.[403]

In the NOAH trial, patients were given concurrent taxane and anthracycline, then taxane alone followed by cyclophosphamide–methotrexate–fluorouracil.[414] In the FinHER patients were randomized to docetaxel or vinorelbine before anthracyclines,[406] and PACS 04 randomized patients to fluorouracil/epirubicin/cyclophosphamide or to epirubicin plus docetaxel.[415] The HERA trial did not mandate the choice of chemotherapy, 94% receiving anthracyclines and 26% receiving a taxane in addition to an anthracycline.

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All of the above adjuvant trials of trastuzumab have demonstrated clinically significant improvements in DFS. Furthermore, the HERA trial[416] and the combined analysis of the NSABP B31 and NCCTG N9831 trials[417] showed significant improvement in OS with the use of trastuzumab. A more recent meta-analysis of all the above (excluding the BCIRG 006 Trial) showed that addition of trastuzumab resulted in an average absolute reduction in 10-year risk of recurrence of 9.0% (95% CI 7.4 to 10.7; $P < .0001$), a reduction in 10-year breast cancer mortality by 6.4% (4.9 to 7.8; $P < .0001$), and a reduction in mortality (all causes) by 6.5% (5.0 to 8.0; $P < .0001$).[418] The benefits of trastuzumab are independent of ER status.[412,419]

The NCCN Panel considers it reasonable to incorporate pertuzumab into the above adjuvant regimens[272,420,421]

The results of theTRAIN-2 trial showed high pCR rates after treatment regimen with anthracycline plus trastuzumab and pertuzumab (67%) and also without anthracycline plus trastuzumab and pertuzumab (68%).[420] Patients who received anthracycline-containing regimen experienced more febrile neutropenia, hypokalemia, and left ventricular ejection fraction (LVEF) decline to grade 2 or worse (≥10% or to <50%).[420]

A follow-up analysis of the TRAIN-2 study showed similar 3-year EFS and OS with or without anthracyclines in patients with stage II and III HER2-positive breast cancer. Based on these results, considering the added toxicity of anthracycline containing regimens the panel has added non-anthracycline containing regimens with trastuzumab and pertuzumab as treatment options.[422]

The NCCN panel has included the following regimen as other recommended regimens for HER2-positive disease: doxorubicin/cyclophosphamide (AC) followed by docetaxel + trastuzumab (followed by docetaxel + trastuzumab); AC followed by docetaxel + trastuzumab + pertuzumab and paclitaxel/carboplatin + trastuzumab + pertuzumab.

Regimens Useful in Certain Circumstances:
One year of extended therapy with neratinib after completion of 1 year of adjuvant trastuzumab without pertuzumab was evaluated in the phase III ExteNET trial. Neratinib improved invasive DFS (HR 0.73, 95% CI 0.57-0.92, $P = .0083$) primarily in the subgroup of HR-positive tumors (HR 0.60, 95% CI 0.43-0.83, $P = .063$). Neratinib is associated with moderate to severe diarrhea.

Based on the trials listed in the section for “other recommended regimen and the above data from ExteNET, the NCCN panel has included following regimens have been included as useful in certain circumstances: Docetaxel + cyclophosphamide + trastuzumab; AC followed by paclitaxel + trastuzumab followed by paclitaxel plus trastuzumab, various schedules); AC followed by paclitaxel + trastuzumab + pertuzumab, various schedules); Paclitaxel + trastuzumab + pertuzumab; adjuvant neratinib and adjuvant T-DM1.

Therapeutic duration and Other Considerations in those receiving HER2-targeted therapy

The length of trastuzumab administration in the adjuvant setting trials listed above is 12 months. The HERA trial demonstrated no additional benefit extending trastuzumab to 2 years compared with 1 year.

With respect to a duration less than 12 months, the results of the PERSEPHONE trial showed non-inferiority for 6 months versus 12 months of trastuzumab treatment,[423] However, the PHARE study observed more events in the 6 month cohort compared to the 12 month cohort, and non-inferiority was not established.[424] Furthermore, adverse events over time

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remained similar in both arms, and comparable to data reported in other trials.

Considering the conflicting results between PERSEPHONE and PHARE, in addition to the protocol design of the majority of the randomized trials establishing the benefits of trastuzumab which utilized 12 months of therapy, the NCCN panel recommends up to one year of HER2-targeted therapy with trastuzumab. Based on the updated APHINITY trial data, the addition of pertuzumab may be considered with trastuzumab in those with node-positive disease.

Increased cardiac toxicity has been observed in patients treated with trastuzumab.[412,425,426] In addition, anthracycline and taxane-based regimens in combination with HER2-targeted agents are associated with further increased risk of cardiac toxicity.[427] The panel recommends evaluation of left ventricular ejection fraction (LVEF) prior to and during treatment. The optimal frequency of LVEF assessment during adjuvant trastuzumab therapy is not known. The FDA label recommends LVEF measurements prior to initiation of trastuzumab and every 3 months during therapy.

According to the panel, use of a FDA-approved biosimilar is an appropriate substitute for trastuzumab. Trastuzumab and hyaluronidase-oysk injection approved for subcutaneous use may be substituted for intravenous trastuzumab. It is important to note that it has a different dosage and administration compared to intravenous trastuzumab.

Adjuvant Therapy for Tumors of Favorable Histologies

The guidelines provide systemic treatment recommendations for the favorable histology of invasive breast cancers (including pure tubular and pure mucinous cancers, pure cribriform, adenoid cystic secretory carcinoma and other salivary carcinoma, rare low-grade forms of metaplastic carcinoma) based on ER/PR status, tumor size and ALN status. If used, the treatment options for endocrine therapy, chemotherapy, and sequencing of treatment with other modalities are similar to those of the usual histology of breast cancers. There are rare subtypes of metaplastic carcinoma (eg, low-grade adenosquamous and low-grade fibromatosis-like carcinoma) that have a favorable prognosis even without administration of adjuvant systemic therapies.

The vast majority of pure tubular, pure mucinous, and pure cribriform breast cancers are both ER-positive and HER2-negative. To be associated with favorable prognosis, the favorable histologic type should not be high grade, should be pure (>90% as classified on the surgical excision, not core biopsy alone), and should be HER-2 negative. If atypical pathologic or clinical features are present, consider treating as ductal/NST.

The pathology evaluation and accuracy of the ER and/or HER2 determination should be reviewed if these are ER-negative and/or HER2-positive, or if a tumor with an ER- and PR-negative status is grade 1.[276] Should a breast cancer be histologically identified as a pure tubular or mucinous breast cancer and be confirmed as ER-negative, then the tumor should be treated according to the guideline for the usual histology, ER-negative breast cancers. The panel acknowledges that prospective data regarding systemic adjuvant therapy of pure tubular and mucinous histologies are lack

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Post-Therapy Surveillance and Follow-up for T0–3, N1, M0 and T1–3, N0–1, M0 Tumors

Post-therapy follow-up is optimally performed by members of the treatment team and includes the performance of regular history/physical examinations every 4 to 6 months for the first 5 years after primary therapy and annually thereafter. Mammography should be performed annually.

Regarding frequency of mammograms after BCS followed by radiation, the NCCN Panel agrees with ASTRO's "Choosing Wisely" list of recommendations released in 2014.[428] The recommendations state that "annual mammograms are the appropriate frequency for surveillance of breast cancer patients who have had BCS and RT with no clear advantage to shorter interval imaging. Patients should wait 6 to 12 months after the completion of RT to begin their annual mammogram surveillance. Suspicious findings on physical examination or surveillance imaging might warrant a shorter interval between mammograms."

The NCCN Panel notes that any imaging of reconstructed breast is not indicated.

According to the NCCN Panel, in the absence of clinical signs and symptoms suggestive of recurrent disease, laboratory or imaging studies to screen for metastasis are not necessary. The routine performance of alkaline phosphatase tests and LFTs are not included in the guidelines.[429-431] In addition, the Panel notes no evidence to support the use of "tumor markers" for breast cancer, and routine bone scans, CT scans, MRI scans, PET scans, or ultrasound examinations in the asymptomatic patient provide no advantage in survival or ability to palliate recurrent disease and are, therefore, not recommended.[110,432]

The use of breast MRI in follow-up of patients with prior breast cancer is undefined. It may be considered as an option in patients with high lifetime risk (>20% based on models largely dependent on family history) of developing a second primary breast cancer. Rates of contralateral breast cancer after either breast-conserving therapy or mastectomy have been reported to be increased in patients with *BRCA1/2* mutations when compared with patients with sporadic breast cancer.[433-435]

The Panel recommends that patients with intact uteri who are taking adjuvant tamoxifen should have yearly gynecologic assessments and rapid evaluation of any vaginal spotting that might occur because of the risk of tamoxifen-associated endometrial carcinoma in postmenopausal patients.[436] The performance of routine endometrial biopsy or ultrasonography in the asymptomatic woman is not recommended. Neither test has demonstrated utility as a screening test in any population of patients. The vast majority of patients with tamoxifen-associated uterine carcinoma have early vaginal spotting.

If an adjuvant AI is considered in patients with amenorrhea following treatment, baseline levels of estradiol and gonadotropin followed by serial monitoring of these hormones should be performed if endocrine therapy with an AI is initiated.[330] Bilateral oophorectomy assures postmenopausal status in young patients with therapy-induced amenorrhea and may be considered prior to initiating therapy with an AI in a young woman.

Symptom management for patients on adjuvant endocrine therapies often requires treatment of hot flashes and the treatment of concurrent depression. Venlafaxine, a serotonin-norepinephrine reuptake inhibitor (SNRI), has been studied and is an effective intervention in decreasing hot flashes.[332-335] There is evidence suggesting that concomitant use of tamoxifen with certain selective serotonin reuptake inhibitors (SSRIs) (eg, paroxetine, fluoxetine) may decrease plasma levels of endoxifen, an active metabolite of tamoxifen.[336,337] These SSRIs/SNRIs may interfere with the enzymatic conversion of tamoxifen to endoxifen by inhibiting a particular isoform of CYP2D6. However, the mild CYP2D6 inhibitors such as

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citalopram, escitalopram, sertraline, and venlafaxine appear to have no or only minimal effect on tamoxifen metabolism.[330,338,339]

Follow-up also includes assessment of patient adherence to ongoing medication regimens such as endocrine therapies. Predictors of poor adherence to medication include the presence of side effects associated with the medication, and incomplete understanding by the patient of the benefits associated with regular administration of the medication.[437] The Panel recommends the implementation of simple strategies to enhance patient adherence to endocrine therapy, such as direct questioning of the patient during office visits, as well as brief, clear explanations on the value of taking the medication regularly and the therapeutic importance of longer durations of endocrine therapy.

Lymphedema is a common complication after treatment for breast cancer. Factors associated with increased risk of lymphedema include extent of axillary surgery, axillary radiation, infection, and patient obesity.[438,439] The Panel recommends educating the patients on lymphedema, monitoring for lymphedema, and referring for lymphedema management as needed.

Many young patients treated for breast cancer maintain or regain premenopausal status following treatment for breast cancer. For these patients, the NCCN Panel discourages the use of hormonal birth control methods, regardless of the HR status of the tumor.[440] Alternative birth control methods are recommended, including intrauterine devices, barrier methods, and, for those with no intent of future pregnancy, tubal ligation or vasectomy. Breastfeeding during endocrine or chemotherapy treatment is not recommended by the NCCN Panel because of risks to the infant. Breastfeeding after breast-conserving treatment for breast cancer is not contraindicated. However, lactation from an irradiated breast may not be possible, or may occur only with a diminished capacity.[440,441]

The Panel recommends that patients on an adjuvant AI or who experience ovarian failure secondary to treatment should have monitoring of bone health with a bone mineral density determination at baseline and periodically thereafter. The use of estrogen, progesterone, or selective ER modulators to treat osteoporosis or osteopenia in patients with breast cancer is discouraged. The use of a bisphosphonate is generally the preferred intervention to improve bone mineral density. A single phase 3 study, ABCSG12, demonstrated improved outcomes with the addition of zoledronic acid in premenopausal patients receiving endocrine therapy with ovarian suppression.[442] Use of bisphosphonates in such patients and in other subgroups remains controversial. Denosumab has shown to significantly reduce fractures in postmenopausal patients receiving adjuvant therapy AIs, and improves bone mineral density.[378]

Optimal duration of bisphosphonate therapy has not been established. Factors to consider for duration of anti-osteoporosis therapy include bone mineral density, response to therapy, and risk factors for continued bone loss or fracture. Patients treated with a bisphosphonate should undergo a dental examination with preventive dentistry prior to the initiation of therapy, and should take supplemental calcium and vitamin D.

Evidence suggests that a healthy lifestyle may lead to better breast cancer outcomes. A nested case control study of 369 patients with ER-positive tumors who developed a second primary breast cancer compared with 734 matched control patients who did not develop a second primary tumor showed an association between obesity (body mass index [BMI] ≥30), smoking, and alcohol consumption and contralateral breast cancer.[443] A prospective study of 1490 patients diagnosed with stage I–III breast cancer showed an association between high fruit and vegetable consumption, physical activity, and improved survivorship, regardless of obesity.[444] There is emerging evidence that obesity is associated with poorer outcomes for certain subtypes of breast cancers. The study by the

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Women's Intervention Nutrition group randomized patients with early-stage breast cancer to an intervention group and a control group. The intervention consisted of eight one-on-one visits with a registered dietitian who had been trained on a low-fat eating plan. OS analysis showed no significant difference between the two study arms (17% for the intervention vs. 13.6% without); however, subgroup analysis showed that those with ER- and PR-negative disease who were part of the intervention group saw a 54% improvement in OS.[445]

The NCCN Panel recommends an active lifestyle and ideal body weight (BMI 20–25) for optimal overall health and breast cancer outcomes as there are reports of proven benefits of exercise and active lifestyle during and after treatment.[446-448]

For management of issues related to survivorship including late/long-term effects of cancer and its treatment, see the NCCN Guidelines for Survivorship.

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Recurrent/Stage IV Breast Cancer

Staging and Workup for Recurrent and Stage IV Breast Cancer

The staging evaluation of patients who present with recurrent or stage IV breast cancer includes: history and physical examination; the performance of a CBC, LFTs, chest diagnostic CT, bone scan, and radiographs of any long or weight-bearing bones that are painful or appear abnormal on bone scan; diagnostic CT of the abdomen (with or without diagnostic CT of the pelvis) or MRI scan of the abdomen; and biopsy documentation of first recurrence if possible. The NCCN Panel generally discourages the use of sodium fluoride PET or PET/CT scans for the evaluation of patients with recurrent disease. There is limited evidence (mostly from retrospective studies) to support the use of PET/CT scanning to guide treatment planning through determination of the extent of disease in select patients with recurrent or metastatic disease.[110,111,449,450] In general, the non-diagnostic CT scans used for PET under-evaluate the lungs and the liver compared with contrast-enhanced diagnostic CT scans. The Panel considers biopsy of equivocal or suspicious sites to be more likely than PET/CT scanning to provide accurate staging information in this patient population.

The consensus of the NCCN Panel is that FDG-PET/CT is optional and most helpful in situations where standard imaging results are equivocal or suspicious. The NCCN Panel recommends bone scan or sodium fluoride PET/CT (category 2B) to detect bone metastases. However, if the FDG-PET results clearly indicate bone metastases, these scans can be omitted.

The NCCN Panel recommends that metastatic disease at presentation or first recurrence of disease should be biopsied as a part of the workup for patients with recurrent or stage IV disease. This ensures accurate determination of metastatic/recurrent disease and tumor histology, and allows for biomarker determination and selection of appropriate treatment. Soft tissue tumor biopsy is preferred over bone sites unless a portion of the biopsy can be protected from harsh decalcification solution to preserve more accurate biomarker assessment.

Determination of HR status (ER and PR) and HER2 status should be repeated in all cases when diagnostic tissue is obtained. ER and PR assays may be falsely negative or falsely positive, and there may be discordance between the primary and metastatic tumors.[451,452] The reasons for the discordance may relate to change in biology of disease, differential effect of prior treatment on clonal subsets, tumor heterogeneity, or imperfect accuracy and reproducibility of assays.[452] Discordance between the receptor status of primary and recurrent disease has been reported in a number of studies. The discordance rates are in the range of 3.4% to 60% for ER-negative to ER-positive; 7.2% to 31% for ER-positive to ER-negative; and 0.7% to 11% for HER2.[453-462]

The NCCN Panel recommends that re-testing the receptor status of recurrent disease be performed, *especially* in cases when it was previously unknown, originally negative, or not overexpressed. For patients with clinical courses consistent with HR–positive breast cancer, or with prior positive HR results, the Panel has noted that a course of endocrine therapy is reasonable, regardless of whether the receptor assay is repeated or the result of the most recent HR assay.

Genetic counseling is recommended if the patient is considered to be at high risk for hereditary breast cancer, as defined by the NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian, and Pancreatic.

Genetic testing: In the metastatic setting, results from genetic testing may have therapeutic implications. Germline mutations in *BRCA1/2* have proven clinical utility and therapeutic impact. Therefore, germline *BRCA1/2* mutations should be assessed in all patients with recurrent or metastatic breast cancer to identify candidates for PARP inhibitor therapy.

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Management of Locally Recurrent Disease

Patients with local recurrence only are divided into three groups: 1) those who had been treated initially by mastectomy alone; 2) those who had been treated initially by mastectomy plus RT; and 3) those who had received breast-conserving therapy plus RT.

In one retrospective study of local recurrence patterns in patients with breast cancer who had undergone mastectomy and adjuvant chemotherapy without RT, the most common sites of local recurrence were at the chest wall and the supraclavicular lymph nodes.[463] The recommendations for treatment of the population of patients experiencing a local recurrence only are supported by analyses of a combined database of patients from the EORTC 10801 and Danish Breast Cancer Cooperative Group 82TM trials. The analyses compared breast-conserving therapy with mastectomy in patients with stage I and stage II disease. The 133 (approximately 8%) patients experiencing a local recurrence as an initial event were approximately equally divided between those who had undergone mastectomy and those who had received breast-conserving therapy as initial treatment for breast cancer. Of those in the former group, 51 (76%) were able to undergo RT with or without surgery as treatment for local disease recurrence. No difference in survival emerged between patients receiving treatment after initial treatment with mastectomy or breast-conserving therapy; approximately 50% of both groups were alive at 10-year follow-up.[464]

According to the NCCN Panel, mastectomy-treated patients should undergo surgical resection of the local recurrence (if it can be accomplished with limited morbidity) and involved-field RT to the chest wall and supraclavicular area (if the chest wall was not previously treated or if additional RT may be safely administered). The use of surgical resection in this setting implies the use of limited excision of disease with the goal of obtaining clear margins of resection. Unresectable chest wall recurrent disease should be treated with RT if no prior radiation has been given.

In patients with a local breast recurrence after BCS and RT who had a prior sentinel lymph node (SLN) biopsy, a repeat SLNB may be considered although the accuracy of repeat SLNB is unproven, and the prognostic significance of repeat SLNB after mastectomy is unknown and its use is discouraged.[465,466] On the other hand, the prognostic significance of repeat SLNB after mastectomy is unknown and its use is discouraged. The consensus recommendation of the Panel for most patients with a local recurrence following breast-conserving therapy and SLNB is mastectomy and a level I/II axillary dissection.

The results of the CALOR trial found that after complete resection in patients with isolated locoregional recurrence, adjuvant chemotherapy improves both DFS and OS.[467] After a median follow-up of 4.9 years, the overall DFS was 69% in the chemotherapy group versus 57% in the group that did not receive chemotherapy (HR, 0.59; $P = .046$).[467] Five-year OS in all patients in the study was also significantly improved with chemotherapy (88% vs. 76%, $P = .024$).[467] The benefit of adjuvant chemotherapy was mostly seen in patients with ER-*negative* disease. Among patients with ER-negative disease, 5-year DFS was 67% versus 35% (HR, 0.32; 95% CI, 0.14–0.73) and in those ER-positive disease, the 5-year DFS was 70% versus 69% (HR, 0.94; 95% CI, 0.47–1.89).[467] However these patients received endocrine therapy.

According to the NCCN Panel, after local treatment, patients with local recurrences only should be considered for limited duration systemic chemotherapy or endocrine therapy similar to that outlined in the adjuvant chemotherapy section. The Panel emphasized the importance of individualizing treatment strategies in patients with a recurrence of disease limited to a local site.

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Management of Recurrent or Stage IV Disease

From the time of diagnosis of recurrent/stage IV metastatic disease, patients should be offered appropriate supportive care and symptom-related interventions as a routine part of their care. NCCN recognizes the importance of clinical trials and encourages participation when applicable and available.

Surgery for Recurrent or Stage IV Disease

The primary treatment approach recommended by the NCCN Panel for patients with metastatic breast cancer and an intact primary tumor is systemic therapy, with consideration of surgery after initial systemic treatment for those requiring palliation of symptoms or with impending complications, such as skin ulceration, bleeding, fungation, and pain.[468] Generally such surgery should be undertaken only if complete local clearance of tumor may be obtained and if other sites of disease are not immediately life-threatening. Alternatively, RT may be considered instead of surgery. Often such surgery requires collaboration between the breast surgeon and the reconstructive surgeon to provide optimal cancer control and wound closure.

Retrospective studies suggest a potential survival benefit from complete excision of the in-breast tumor in select patients with metastatic breast cancer.[469-472] Substantial selection biases exist in all of these studies and are likely to confound the study results.[473,474]

Two prospective, randomized studies assessed whether or not surgery on the primary tumor in the breast is necessary for patients who are diagnosed with metastatic/stage IV breast cancer.[475,476] In the first prospective trial, patients (n = 350) with de novo metastatic breast cancer who achieved a partial or complete response to anthracycline-based chemotherapy were randomly assigned to either surgery of the primary tumor plus adjuvant radiation or no locoregional treatment.[475] There was no difference in the OS between the group that received surgery and the group that did not (19.2 vs. 20.5 months; HR, 1.04; 95% CI, 0.81–1.34).[475] In a separate multicenter prospective registry study patients whose disease responded to first-line systemic therapy were randomized to management of the primary tumor by surgery or not. [477] Preliminary data showed no difference in OS between the two groups [477]

However, in another trial by the Turkish Federation (MF07-01), patients (n = 274) with de novo metastatic breast cancer who were randomized to local management (mastectomy, or BCS with radiation) followed by systemic therapy versus systemic therapy only observed a benefit with surgery.[478] While no difference in survival was seen at 36 months, at 40 months, patients treated with local management showed an improvement in survival with locoregional treatment (46.4% vs. 26.4%; HR, 0.66; 95% CI, 0.49–0.88).[478] The design of this trial is different from the other, the first difference being the inclusion of two prospective studies described above in which patients were included only if they had experienced a response to systemic therapy. Second, randomization in the Turkish trial was not balanced. Patients who received surgery had lower rates of triple-negative disease (7% vs. 17%), visceral metastases (29% vs. 45%), and many had solitary bone metastases only (33% vs. 20%).[478] In an unplanned subgroup analysis, patients who appeared to derive the greatest OS benefit from local management included those with HR-positive disease (HR, 0.63; 95% CI, 0.44–0.89; *P* = .008); those with HER2-negative disease (HR, 0.64; 95% CI, 0.45–0.91; *P* = .01); those <55 years (HR, 0.57; 95% CI, 0.38–0.86; *P* = .007); and those with solitary bone metastases (HR, 0.47; 95% CI, 0.23–0.98; *P* = .04). [478]

The Panel recognizes the need for more data from randomized clinical trials that will address the risks and benefits of local therapy for patients with stage IV disease while eliminating selection biases. Though the available data do not support broadly considering local therapy with

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surgery and/or RT, this may be reasonable in select patients with disease responding to initial systemic therapy. In such clinical scenarios, patient engagement in the decision is encouraged.

Guideline Stratification for Systemic Therapy for Stage IV/Recurrent Disease

The systemic treatment of breast cancer recurrence or stage IV disease prolongs survival and enhances QOL but is not curative. Therefore, treatments associated with minimal toxicity are preferred. Thus, the use of the minimally toxic endocrine therapies is preferred to the use of cytotoxic therapy whenever reasonable.[479] Guidance for treatment of patients with breast cancer and brain metastases is included the NCCN Guidelines for Central Nervous System Cancers.

Patients with recurrent or stage IV breast cancer at diagnosis are initially stratified according to whether bone metastases are present. These two patient subsets (those with and without bony metastases) are then further stratified by tumor HR and HER2 status.

Therapy for Bone Metastases

Complications from bone metastases include pain, decreased performance status, and decreased QOL, as well as skeletal-related events (SREs), which are defined as the need for radiation or surgery to bone, pathologic fractures, spinal cord compression, and hypercalcemia of malignancy.

The NCCN Panel recommends treatment with a bone-modifying agent such as zoledronic acid, pamidronate, or denosumab (category 1) in addition to chemotherapy or endocrine therapy if bone metastasis is present; expected survival is ≥3 months. Patients should undergo a dental examination with preventive dentistry prior to initiation of this therapy. The bisphosphonates and denosumab are associated with a risk of development of osteonecrosis of the jaw (ONJ). Poor baseline dental health or dental procedures during treatment are known risk factors for ONJ. Thus, a dental examination with preventive dentistry intervention is recommended prior to treatment with intravenous bisphosphonate or denosumab, and dental procedures invasive of gum or bone during treatment should be avoided if at all possible. Additional risk factors for the development of ONJ include administration of chemotherapy or corticosteroids and poor oral hygiene with periodontal disease and dental abscess.[480]

Bisphosphonates

There are extensive data from randomized trials in support of the use of bisphosphonates for patients with metastatic disease to bone. The randomized clinical trial data include the use of zoledronic acid and pamidronate in the United States and ibandronate and clodronate in European countries.[481-488] In metastatic bone disease, bisphosphonate treatment is associated with fewer SREs, fewer pathologic fractures, and less need for RT and surgery to treat bone pain.

The use of bisphosphonates in metastatic disease is a palliative care measure. No impact on OS has been observed in patients treated with bisphosphonates.

The data indicate that zoledronic acid and pamidronate may be given on a 3- to 4-week schedule in conjunction with antineoplastic therapy (ie, endocrine therapy, chemotherapy, biologic therapy) or every 12 weeks. Three randomized trials have compared zoledronic acid dosed every 4 weeks versus every 12 weeks.[489-491] Data from these trials show that among patients with breast cancer and bone metastases zoledronic acid administered once every 12 weeks versus once every 4 weeks does not compromise efficacy and has similar rates of SREs.[489,490,492] In the ZOOM trial,[489] the rate of skeletal morbidities was 0.22 (95% CI, 0.14–0.29) in those receiving zoledronic acid every 4 weeks versus 0.26 (95% CI, 0.15–0.37) in those receiving zoledronic acid every 12 weeks. In the CALGB

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70604 trial,[490] the rate of SREs in the 4-week arm was 29.5% versus 28.6% in the 12-week arm. In OPTIMIZE-2 trial,[491] the rate of SREs was 22% in the 4-week arm and 23.2% in the 12-week arm.[491] The NCCN Panel recommends an optimal dosing of every 12 weeks.

The use of bisphosphonates should be accompanied by calcium and vitamin D supplementation with daily doses of calcium of 1200 to 1500 mg and vitamin D_3 of 400 to 800 IU. Recommended agents for use in the United States are pamidronate 90 mg intravenously over 2 hours or zoledronic acid 4 mg intravenously over 15 minutes. The original studies continued treatment for up to 24 months; however, there are limited long-term safety data indicating treatment can continue beyond that time.[484,486,493] The risk of renal toxicity necessitates monitoring of serum creatinine prior to administration of each dose and dose reduction or discontinuation if renal function is reduced. Current clinical trial results support the use of bisphosphonates for up to 2 years. Longer durations of bisphosphonate therapy may provide additional benefit, but this has not yet been tested in clinical trials.

Denosumab

Patients with metastatic breast cancer to bone who are candidates for bisphosphonate therapy may also be considered for treatment with denosumab. This recommendation is based on the results of a single randomized trial comparing denosumab to zoledronic acid.[494] All trial patients were recommended to supplement with vitamin D and calcium. Patients on the experimental arm were given 120 mg of denosumab injected subcutaneously every 4 weeks plus intravenous placebo versus the control arm where patients were given an intravenous infusion of 4 mg of zoledronic acid every 4 weeks, and a subcutaneous placebo. In this trial with non-inferiority as the primary endpoint, denosumab was shown to significantly delay time to first SRE by 18% as compared with zoledronic acid (HR, 0.82; 95% CI, 0.71–0.95; $P < .001$ for non-inferiority; $P = .01$ for superiority) and time to first and subsequent SREs (rate ratio, 0.77; 95% CI, 0.66–0.89; $P = .001$). No difference in time to progression or OS was observed.[494] Dosing of denosumab outside of every 3 to 6 weeks has not been studied.

Systemic Therapy for Stage IV or Recurrent Metastatic HR-Positive, HER2-Negative Breast Cancer

Patients with stage IV or recurrent disease characterized by HR-positive, HER2-negative tumors with no visceral crisis are treated with endocrine therapy alone or endocrine therapy in combination with targeted agents. Patients whose disease progresses after a year from the end of adjuvant endocrine-based therapy and those who present with de novo stage IV/metastatic breast cancer are eligible for first-line endocrine therapies.

Many premenopausal and postmenopausal patients with HR-positive breast cancer benefit from sequential use of endocrine therapies at disease progression. Therefore, patients with breast cancers whose disease responds to an endocrine-based therapy with either shrinkage of the tumor or long-term disease stabilization (clinical benefit) should receive additional endocrine therapy at disease progression. For disease progression on or within 12 months of completing adjuvant endocrine therapy or for disease progression on first-line endocrine therapy for metastatic disease, patients are eligible for second-line endocrine therapy either as monotherapy or in combination with a targeted agent. The optimal sequence for endocrine therapy is not well defined. The choice would depend on previous tolerance of treatment and patient preference.

Many trials in HR-positive patients have not included premenopausal patients. The NCCN Panel recommends that patients with HR-positive disease should have adequate ovarian suppression/ablation and then be treated in the same way as postmenopausal patients. The NCCN Panel has outlined endocrine-based therapies that would be used in the first-line versus second- and subsequent-line settings.

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Preferred First-Line Therapy for HR-Positive, HER2-Negative Breast Cancer

AI in combination with CDK 4/6 inhibitor: In postmenopausal patients or premenopausal patients receiving ovarian ablation or ovarian function suppression with a luteinizing hormone-releasing hormone (LHRH) agonist, combinations of AIs with CDK 4/6 inhibitors (palbociclib, ribociclib, or abemaciclib) have demonstrated improved progression-free survival (PFS) relative to an AI alone.

Palbociclib in combination with letrozole was studied in a phase III study that included postmenopausal patients (n = 666) with metastatic, HR-positive, HER2-negative breast cancer who had not received prior treatment for advanced disease.[495] An improvement in PFS (24.8 vs. 14.5 months; HR, 0.58; 95% CI, 0.46–0.72) and objective response rate (ORR; 42% vs. 35%) was seen with the combination of palbociclib and letrozole compared with letrozole alone.[495] Grade 3 and 4 adverse effects seen with the combination of palbociclib and letrozole included neutropenia (66.5% vs. 1.4%), leukopenia (24.8% vs. 0%), anemia (5.4% vs. 1.8%) and fatigue (1.8% vs. 0.5%).[495]

Ribociclib in combination with letrozole was also studied as first-line therapy in a phase III study of postmenopausal patients (n = 668) with HR-positive, HER2-negative recurrent/stage IV breast cancer. At a median follow-up of 26.4 months, an improvement in PFS (25.3 vs. 16.0 months; HR for progression or death was 0.56; 95% CI, 0.45–0.70) and improved ORR of 43% vs. 29% was seen with ribociclib plus letrozole compared with letrozole alone.[496] Grade 3 or 4 adverse events were more common with the combination and included neutropenia (62% vs. 1.2%), leukopenia (21.3% vs. 0.9%), and abnormal LFTs (10.2% vs. 2.4%).[496]

The phase III MONARCH trial studied the combination of abemaciclib with either an AI (letrozole or anastrozole) or AI monotherapy as first-line treatment of patients with advanced HR-positive, HER2-negative breast cancer. The combination of abemaciclib with the AI improved PFS, compared with the AI alone (median not reached vs. 14.7 months, respectively; HR, 0.54; 95% CI, 0.41–0.72).[497] The ORR was higher with the combination compared with AI monotherapy (59% vs. 44 %).[497] The most frequent grade 3 or higher adverse events for abemaciclib versus placebo included diarrhea (9.5% vs.1.2%), neutropenia (21.1% vs. 1.2%), leukopenia (8% vs. 0.6%), and fatigue (2% vs. 0%).[497]

Most trials studying CDK 4/6 inhibitor with an AI have mainly included postmenopausal patients and only a small subset of premenopausal patients on ovarian suppression. However, in the phase III MONALEESA-7 trial, 672 pre- or perimenopausal patients with HR-positive, HER2-negative advanced breast cancer were randomly assigned to first-line treatment with ribociclib or placebo with goserelin plus either a nonsteroidal AI or tamoxifen.[498] An improvement in PFS was seen with the addition of ribociclib (median PFS, 24 vs. 13 months; HR, 0.55; 95% CI, 0.4–0.69).[498]

At 3.5 years, an improvement in OS was reported with ribociclib (70% vs. 46%; HR, 0.71; 95% CI, 0.54–0.95).[499] Grade 3 and 4 adverse events reported in >10% of patients in either group included neutropenia (61% vs. 4%) and leukopenia (14% vs. 1%).[498]

Based on the above data, the NCCN Panel has included AI in combination with CDK 4/6 inhibitors as a category 1 first-line option for postmenopausal patients and premenopausal patients with ovarian ablation/suppression with HR-positive, HER2-negative recurrent/stage IV breast cancer.

Single-Agent Fulvestrant: Fulvestrant is an ER antagonist and was originally approved as a monthly intramuscular injection (250 mg per month); higher dose has been proven to be more effective in subsequent randomized trials. In the first-line setting, fulvestrant was found to be as

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effective as anastrozole in terms of ORR (36.0% vs. 35.5%; OR, 1.02; 95% CI, 0.56–1.87).[500] An improved time to progression was seen with fulvestrant compared to anastrozole (median time to progression was 23.4 months for fulvestrant vs. 13.1 months for anastrozole; HR, 0.63; 95% CI, 0.39–1.00; *P* = .0496).[501] This study also used a higher loading dose of 500 mg every 2 weeks for 3 doses and then maintenance dose of 500 mg monthly.[500] The median OS was observed to be longer in the fulvestrant group than in the anastrozole group (54.1 months vs. 48.4 months; HR, 0.70; *P* = .041).[502]

A separate phase III randomized study in postmenopausal patients with metastatic HR-positive breast cancer compared fulvestrant 500 mg every 2 weeks for 3 doses followed by 500 mg monthly versus fulvestrant 250 mg monthly. The PFS was superior with the fulvestrant 500 mg regimen (HR, 0.80; 95% CI, 0.68–0.94; *P* = .006),[503] indicating an increased duration of response with the higher dose of fulvestrant. The final analyses demonstrated an increase in median OS (4.1 months) and reduced risk of death (19%) with a dose of 500 mg compared with 250 mg. Median OS was 26.4 versus 22.3 months (HR, 0.81; 95% CI, 0.69–0.96; *P* = .02).[504]

Results from another phase III trial (FALCON) of first-line treatment with fulvestrant compared with anastrozole in endocrine therapy-naïve patients with metastatic ER-positive breast cancer, demonstrated improved PFS with fulvestrant (at the higher dose, 500 mg) over anastrozole at a median follow-up of 25.0 months (16.6 vs. 13.8 months; HR for progression or death, 0.797; 95% CI, 0.637–0.999).[505] The QOL outcomes were similar between the two groups, with the most common adverse effects being arthralgia (17% vs. 10%) and hot flashes (11% vs. 10%) for fulvestrant and anastrozole, respectively.[505]

Fulvestrant + CDK 4/6 Inhibitor: In the phase III trial, MONALEESA-3, in patients (n = 726) with advanced HR-positive breast cancer who had no prior endocrine therapy or had disease progression on prior therapy, the combination of ribociclib with fulvestrant showed improved PFS versus fulvestrant alone (21 vs. 13 months; HR, 0.59; 95% CI, 0.48–0.73).[506] The PFS benefits were consistent across patients with and without prior endocrine treatment. In a subsequent analysis, a significant improvement in OS was observed.[507] At 42 months the estimated OS was 57.8% (95% CI, 52.0–63.2) in the ribociclib group and 45.9% (95% CI, 36.9–54.5) in the placebo group.[507]

Comparison across multiple trials, including those in the second-line settings studying combination of fulvestrant with palbociclib or abemaciclib have shown statistically significant improvement in PFS. Based on the results of the MONALEESA-3 trial and extrapolation results from the second-line setting, the NCCN Panel has included fulvestrant in combination with CDK 4/6 inhibitors as a category 1 first-line option for postmenopausal patients and premenopausal patients with ovarian ablation/suppression with HR-positive, HER2-negative recurrent/stage IV breast cancer.

Fulvestrant + Nonsteroidal AI: The combination of two endocrine agents as first-line treatment in postmenopausal patients with HR-positive, metastatic breast cancer has been reported from studies comparing single-agent anastrozole versus anastrozole plus fulvestrant.

In one study (FACT), combination of fulvestrant with anastrozole was not superior to single-agent anastrozole (time to progression HR, 0.99; 95% CI, 0.81–1.20; *P* = .91).[508] In a second phase III trial (SoFEA), the effect of fulvestrant alone or in combination with anastrozole or exemestane was studied in patients with advanced breast cancer with acquired resistance to a nonsteroidal AI.[509] An AI had been given as adjuvant treatment to 18% of patients for a median of 27.9 months, and to 82% of patients for locally advanced/metastatic disease for a median of 19.3 months. Median PFS was 4.8 months, 4.4 months, and 3.4 months for patients treated with fulvestrant alone, anastrozole plus fulvestrant, and fulvestrant plus

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exemestane, respectively. No differences were observed for ORR, clinical benefit rate, and OS.

In the trial by the Southwest Oncology Group (SWOG), S0226, PFS (HR, 0.80; 95% CI, 0.68–0.94; stratified log-rank *P* = .007) and OS (HR, 0.81; 95% CI, 0.65–1.00; stratified *P* = .049) were superior with combination anastrozole plus fulvestrant.[510] A subgroup analysis in this trial suggested that patients without prior adjuvant tamoxifen experienced the greatest OS benefit with combination therapy compared with monotherapy (median, 52.2 months vs. 40.3 months, respectively; HR, 0.73; 95% CI, 0.58–0.92).[511]

The reasons for the divergent outcomes in the above trials is not very clear. The three trials discussed above had slightly different patient populations—there were more cases of patients with no prior endocrine exposure (with de novo stage IV metastatic disease) in the SWOG S0226 trial compared with the FACT trial. The FACT trial included a more heterogeneous population of both premenopausal and postmenopausal patients with locally advanced and metastatic disease. The SoFEA trial only enrolled patients with acquired endocrine resistance (who had disease progression while they were receiving an AI). Further studies are needed to confirm the results of the SWOG S0226 trial.

The NCCN Panel has included an AI and fulvestrant as first-line therapy (category 1) for postmenopausal patients based on the above data.

Monotherapy with Endocrine Agents: In postmenopausal patients there is evidence supporting the use of an AI as first-line therapy for their recurrent disease.[512,513]

Prospective randomized trials comparing the AI head-to-head have demonstrated that all AIs are the same.[514] Tamoxifen is the commonly used selective estrogen receptor modulator (SERM) for premenopausal patients.[515] In postmenopausal patients, AI monotherapy has been shown to have superior outcome compared with tamoxifen, although the differences are modest.[516-520] A randomized phase III trial comparing tamoxifen with exemestane as first-line endocrine therapy for postmenopausal patients with metastatic breast cancer showed no significant differences in PFS or OS between the two arms.[518]

NCCN recommendations for first-line therapy: For postmenopausal patients with HR-positive, HER2-negative recurrent/stage IV breast cancer, NCCN category 1, preferred regimens include a cyclin-dependent kinase CDK 4/6 inhibitor with an AI; fulvestrant with or without a CDK 4/6 inhibitor; and fulvestrant with a nonsteroidal AI. The NCCN category 2A, preferred regimen includes nonsteroidal AI (ie, anastrozole, letrozole); steroidal AI (exemestane), and selective ER modulator (tamoxifen or toremifene). For premenopausal patients, first-line endocrine treatment includes ovarian suppression/ablation and endocrine therapy listed above for postmenopausal patients or alternately with a SERM alone.

Preferred Regimens for Second and Subsequent Lines of Therapy for HR-Positive, HER2-Negative Breast Cancer

Fulvestrant-Containing Regimens

Fulvestrant + CDK 4/6 Inhibitors: Fulvestrant in combination with a CDK 4/6 inhibitor may be offered to patients who experienced disease progression during prior treatment with AIs with or without one line of prior chemotherapy (category 1), because PFS was improved compared with fulvestrant alone in a phase III trial (PALOMA-3).[521] The NCCN Panel notes that treatment should be limited to those *without* prior exposure to CDK 4/6 inhibitors.

The PALOMA-3 compared the combination of palbociclib and fulvestrant to fulvestrant in pre- or postmenopausal patients with HR-positive, HER2-negative advanced breast cancer, whose disease progressed on

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prior endocrine therapy. Pre- or perimenopausal patients also received goserelin. The median PFS was 9.5 months for the combination compared to 4.6 months for fulvestrant (HR, 0.46; *P* < .000001)[522] Grade 3/4 adverse events of palbociclib and fulvestrant were mainly confined to neutropenia (in 65% of patients).

In the MONARCH 2 phase III trial, patients who had disease progression while receiving endocrine therapy were randomly assigned to fulvestrant with or without abemaciclib.[523] Those receiving combination therapy experienced an improved PFS relative to those receiving fulvestrant alone (16.4 vs. 9.3 months; HR, 0.55; 95% CI, 0.45–0.68). The ORR was higher in those receiving abemaciclib and fulvestrant (48% vs. 21%).[523] In addition, an improvement was seen in OS with abemaciclib plus fulvestrant compared with fulvestrant alone (46.7 vs. 37.3 months; HR, 0.757; 95% CI, 0.606–0.945).[524]

Based on the above data that shows addition of a CDK 4/6 inhibitor to fulvestrant in patients previously exposed to prior endocrine therapy provides a significant improvement in median PFS, the NCCN Panel has included fulvestrant in combination with a CDK 4/6 inhibitor as a category 1 option for postmenopausal patients and premenopausal patients with ovarian ablation/suppression with HR-positive, HER2- negative, recurrent/stage IV breast cancer. The Panel notes that if there is disease progression while on CDK 4/6 inhibitor therapy, there are limited data to support an additional line of therapy with another CDK 4/6 inhibitor-containing regimen.

Fulvestrant Monotherapy: Fulvestrant monotherapy appears to be at least as effective as anastrozole in patients whose disease progressed on previous tamoxifen.[525,526] A randomized phase II study compared anastrozole versus fulvestrant in over 200 patients with advanced breast cancer.[500,501] In the initial analysis, fulvestrant was as effective as anastrozole in terms of ORR (36.0% vs. 35.5%; OR, 1.02; 95% CI, 0.56–1.87; *P* = .947) in evaluable patients (n = 89 for fulvestrant and n = 93 for anastrozole).[500] An improved time to progression was seen with fulvestrant compared to anastrozole (median time to progression was 23.4 months for fulvestrant vs. 13.1 months for anastrozole; HR, 0.63; 95% CI, 0.39–1.00; *P* = .0496).[501] This study used a higher 500 mg loading dose every 2 weeks for 3 doses and then 500 mg monthly.[500] The median OS was observed to be longer in the fulvestrant group than in the anastrozole group (54.1 months vs. 48.4 months; HR, 0.70; *P* = .041).[502]

A phase II study of fulvestrant in postmenopausal patients with advanced breast cancer and disease progression following AI therapy documented a partial response rate of 14.3% with an additional 20.8% of patients achieving stable disease for at least 6 months.[527] The clinical benefit rates of exemestane versus fulvestrant observed in a phase III trial of postmenopausal patients with HR-positive advanced breast cancer who experienced disease progression on prior nonsteroidal AI therapy were comparable (32.2% vs. 31.5%; *P* = .853).[528] In that study, fulvestrant was administered as a 500 mg loading dose followed by doses of 250 mg on day 14, day 28, and then monthly.[528]

Fulvestrant Plus Alpelisib: In a randomized phase III trial, patients (n = 572) with advanced HR-positive breast cancer and confirmed *PIK3CA* status had received a prior AI either for local or advanced disease. Patients were enrolled into either the *PIK3CA* mutant (n = 341) cohort or the *PIK3CA* non-mutant cohort and each cohort was randomized to receive fulvestrant plus the phosphoinositide 3-kinase (PI3K) inhibitor, alpelisib versus fulvestrant plus placebo. Patients with a *PIK3CA* mutation receiving alpelisib showed improved PFS compared to fulvestrant alone. At a median follow-up of 20 months PFS was 11.0 months (95% CI, 7.5–14.5) in the alpelisib group compared with 5.7 months (95% CI, 3.7–7.4) in the group that received fulvestrant alone (HR for progression or death, 0.65; 95% CI, 0.50–0.85; *P* < .001); in the cohort without *PIK3CA*-mutated

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tumors, the HR was 0.85 (95% CI, 0.58–1.25). In the overall population, the most frequently reported grade 3 or 4 adverse events seen with alpelisib and fulvestrant versus fulvestrant alone were hyperglycemia (36.6% vs. 0.7%), rash (9.9% vs. 0.3%), and diarrhea (6.7% vs. 0.3%) (grade 3); no diarrhea or rash of grade 4 were reported.[529]

Everolimus Plus Endocrine Therapy: Resistance to endocrine therapy in patients with HR-positive disease is frequent. One mechanism of resistance to endocrine therapy is activation of the mammalian target of rapamycin (mTOR) signal transduction pathway.

A randomized phase II study estimated the efficacy of tamoxifen alone versus tamoxifen combined with everolimus, an oral inhibitor of mTOR, in patients with HR-positive, HER2-negative metastatic breast cancer previously treated with an AI.[530] After a median follow-up of 13 months, an intent-to-treat analysis showed that the clinical benefit was 42.1% (95% CI, 29.1–55.9) with tamoxifen alone and 61.1% (95% CI, 46.9–74.1) with tamoxifen plus everolimus. An improvement in median time to progression was seen when everolimus was combined with tamoxifen compared with tamoxifen alone. Median time to progression was 4.5 months (95% CI, 3.7–8.7) with tamoxifen alone versus 8.5 months (95% CI, 6.01–13.9) with everolimus and tamoxifen.[530]

In a phase III trial in postmenopausal patients with advanced, HR-positive breast cancer with no prior endocrine therapy for advanced disease, randomized subjects to letrozole with or without the mTOR inhibitor temsirolimus,[531] PFS was not different between the treatment arms (HR, 0.89; 95% CI, 0.75–1.05; log-rank $P = .18$).

The results of this trial differ from that of the BOLERO-2 trial (described below). The reasons for the differences in the outcomes of these two randomized phase III studies[531,532] is uncertain, but may be related to the issues of patient selection and extent of prior endocrine therapy.

A phase III study (BOLERO-2) randomized postmenopausal patients with HR-positive advanced breast cancer that had disease progression or recurrence during treatment with a nonsteroidal AI to exemestane with or without the mTOR inhibitor everolimus.[533] Final results reported after median 18-month follow-up show that median PFS (by central review) remained significantly longer with everolimus plus exemestane versus placebo plus exemestane at 11.0 versus 4.1 months, respectively (HR, 0.38; 95% CI, 0.31–0.48; $P < .0001$).[532] The adverse events (all grades) that occurred more frequently in those receiving everolimus included stomatitis, infections, rash, pneumonitis, and hyperglycemia.[532,533] Analysis of safety and efficacy in the older patients enrolled in this trial showed that older patients treated with an everolimus-containing regimen had similar incidences of these adverse events, but the younger patients had more on-treatment deaths.[534] Based on the evidence from the BOLERO-2 trial, the NCCN Panel has included everolimus plus exemestane as an option for patients who fulfill the entry criteria for BOLERO-2. Tamoxifen or fulvestrant in combination with everolimus have also been included as options. The NCCN Panel also notes that if there is disease progression while on an everolimus-containing regimen, there are no data to support an additional line of therapy with another everolimus regimen.

Aromatase Inhibitors: AIs as monotherapy are options as subsequent-line therapy. The three AIs (anastrozole, letrozole, and exemestane) have shown similar efficacy in the second-line setting.[514,535,536] AI monotherapy maybe be useful in patients desiring single-agent treatment, if they have not received an AI as first-line treatment or if they may not be suitable for combination therapy. Patients who have received a prior nonsteroidal AI may benefit from a steroidal AI as a subsequent line of therapy or vice versa.

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Selective ER Modulator: An analysis of two randomized studies of first-line treatment with anastrozole followed by second-line tamoxifen and vice versa showed that tamoxifen is effective as a second-line option.[537]

NCCN Recommendations for Second-line Therapy: For postmenopausal patients with HR-positive, HER2-negative recurrent/stage IV breast cancer, the preferred options available include fulvestrant with a CDK 4/6 inhibitor (ie, palbociclib, ribociclib, abemaciclib) (category 1), or for those with tumor *PIK3CA* mutations, fulvestrant with alpelisib; everolimus with either an AI, tamoxifen, or fulvestrant; monotherapy with fulvestrant; nonsteroidal or steroidal AI; or SERM. Estrogen receptor 1 (ESR1) activating mutations are frequently detected in patients with prior exposure to AIs. Tumors with these mutations are generally resistant to both AIs and tamoxifen. Certain tumors with these mutations retain sensitivity to fulvestrant. All may benefit by adding one of the following to fulvestrant: a CDK 4/6-inhibitor, or an mTOR-inhibitor, or alpelisib, if the tumor has *PIK3CA* mutation.

Regimens Useful in Certain Circumstances for Therapy for HR-Positive, HER2-Negative Breast Cancer

Megestrol acetate,[512,538-540] estradiol[541] androgens such as fluoxymesterone, and single-agent abemaciclib have been listed as options useful in certain circumstances.

The phase II MONARCH 1 trial evaluated the activity of abemaciclib as a single agent in patients (n = 132) with refractory HR-positive, HER2-negative metastatic breast cancer who had disease progression while on endocrine therapy and already received multiple systemic therapies (average of three prior systemic regimens).[542] Ninety percent of patients had visceral disease and 50.8% had more than three sites of metastases.[542] Single-agent abemaciclib induced a partial response in 26 patients (19.7%) and demonstrated an ORR of 19.7% (95% CI, 13.3–27.5).[542] Median PFS was 6 months (95% CI, 4.2–7.5). At the final analysis, at 18 months, median OS was 22.3 months (95% CI, 17.7–not reached).[542] Diarrhea was the most frequent adverse event reported in 90.2% of patients. Other common adverse events were fatigue (65.2%), nausea (64.4%), and decreased appetite (45.5%). Grade 3 and 4 neutropenia occurred in 26.9% of patients.[542] The NCCN Panel has included single-agent abemaciclib as an option for those with disease progression on prior endocrine therapy and prior chemotherapy in the metastatic setting.

Systemic Therapy for Stage IV or Recurrent HR-Negative, HER2-Positive Breast Cancer

For patients with HER2-positive, HR-negative recurrent/stage IV breast cancer, the treatment approach is HER2-targeted therapy in combination with systemic chemotherapy. The NCCN Panel notes that an FDA-approved biosimilar is an appropriate substitute for trastuzumab. Also, trastuzumab and hyaluronidase-oysk injection for subcutaneous use may be substituted for trastuzumab. This subcutaneous option has different dosage and administration instructions compared to intravenous trastuzumab. Doses and schedules of representative regimens for use in HER2-positive metastatic breast cancer are also included in NCCN Guidelines.

Patients with disease progression while being treated with HER2-targeted therapy should be offered an additional line of treatment with a HER2-targeted therapy since it is beneficial to continue suppression of the HER2 pathway. The choice of the HER2-targeted therapy will depend on previously administered therapy, relapse-free interval, and patients' preference and access.

The optimal sequence of available HER2-targeted therapies and the optimal duration of HER2-targeted therapy for recurrent/stage IV breast cancer is currently unknown. The NCCN Panel recommends continuing HER2-targted therapy until progression/unacceptable toxicity.

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Preferred Regimens for Stage IV/Recurrent HER2-Positive Breast Cancer

A randomized, double-blind, phase III study (CLEOPATRA) compared the efficacy and safety of pertuzumab in combination with trastuzumab and docetaxel versus trastuzumab and docetaxel as first-line treatment for 808 patients (n = 808) with HER2-positive metastatic breast cancer.[543] This trial included patients (about 10%) who had previously received trastuzumab in the adjuvant or neoadjuvant setting. At a median follow-up of 19 months, the addition of pertuzumab to docetaxel plus trastuzumab resulted in improvement in PFS compared with placebo (median, 18.5 vs. 12.4 months; HR, 0.62; 95% CI, 0.51–0.75; $P < .001$).[543] At a median follow-up of 30 months the results showed a statistically significant improvement in OS in favor of the pertuzumab-containing regimen, with a 34% reduction in the risk of death (HR, 0.66; 95% CI, 0.52–0.84; $P = .0008$).[544] The most common adverse reactions reported in the pertuzumab group compared to the control group were diarrhea (67% vs. 46%), rash (34% vs. 24%), mucosal inflammation (27% vs. 20%), febrile neutropenia (14% vs. 8%), and dry skin (10% vs. 4%). Peripheral edema and constipation were greater in the control group.[543] Cardiac adverse events or left ventricular systolic dysfunction were reported slightly more frequently in the control group.[545] HRQOL was not different in the two treatment groups.[546] In the PERUSE study, patients (n = 1436) with advanced HER2-positive breast cancer and no prior systemic therapy (except endocrine therapy) received docetaxel, paclitaxel, or nab-paclitaxel with trastuzumab and pertuzumab until disease progression or unacceptable toxicity. The preliminary results after 52 months of median follow-up show that median PFS was comparable between docetaxel, paclitaxel, and nab-paclitaxel (median PFS reported was 19.6, 23.0, and 18.1 months with docetaxel, paclitaxel, and nab-paclitaxel, respectively).[547] Compared with docetaxel-containing therapy, paclitaxel-containing therapy was associated with more neuropathy (31% vs. 16%), but less febrile neutropenia (1% vs. 11%) and mucositis (14% vs. 25%).

Phase II trials have also found activity and tolerability for pertuzumab, pertuzumab with trastuzumab, and for other regimens combining pertuzumab and trastuzumab together with other active cytotoxic agents (ie, paclitaxel, vinorelbine).[548,549,550] Phase III trials of pertuzumab plus chemotherapy without trastuzumab have not been reported.

The NCCN Panel recommends pertuzumab plus trastuzumab in combination with a taxane as a preferred option for first-line treatment of patients with HER2-positive metastatic breast cancer. Pertuzumab plus trastuzumab in combination with docetaxel is an NCCN category 1 and in combination with paclitaxel is an NCCN category 2A recommendation.

Other Regimens for Stage IV/Recurrent HER2-Positive Breast Cancer

Ado-trastuzumab emtansine (T-DM1): T-DM1 is an antibody-drug conjugate that stably links the HER2-targeting property of trastuzumab to the cytotoxic activity of the microtubule-inhibitory agent DM1 (derivative of maytansine).

In a phase III trial (MARIANNE), 1095 patients with locally advanced or metastatic breast cancer were randomized to first-line treatment with T-DM1 with or without pertuzumab or trastuzumab plus a taxane. The primary endpoints were safety and PFS assessed by independent review. The PFS for T-DM1 with pertuzumab was found to be non-inferior to trastuzumab and a taxane (15.2 and 13.7 months, respectively; HR, 0.87; 97.5% CI, 0.69–1.08; $P = .14$).[551] The PFS for T-DM1 alone was non-inferior to trastuzumab plus a taxane (14.1 and 13.7, respectively; HR, 0.91; 97.5% CI, 0.73–1.13; $P = .31$).[551] The incidence of grade 3–5 adverse events was 54.1%, 45.4%, and 46.2% in the trastuzumab plus a taxane arm, T-DM1 arm, and T-DM1 plus pertuzumab arm, respectively. HRQOL was maintained for a longer duration with a median of 7.7 months for T-DM1 (HR, 0.70; 95% CI, 0.57–0.86) and a median of 9 months for

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T-DM1 plus pertuzumab (HR, 0.68; 95% CI, 0.55–0.84) compared with a median of 3.9 months for trastuzumab and a taxane.[551]

Based on the MARIANNE trial data demonstrating T-DM1 and T-DM1 with pertuzumab being non-inferior, with better QOL compared with trastuzumab plus a taxane and possibly better tolerated for some patients,[551] the NCCN Panel included T-DM1 as an option for treatment of patients with HER2-positive metastatic breast cancer. Pertuzumab, trastuzumab, and a taxane, however, remains the preferred first-line regimen for HER2-positive metastatic disease based on data demonstrating improved OS compared to trastuzumab and a taxane. TDM-1 as first-line therapy should be considered only in those not suitable for the preferred treatment.

First-line trastuzumab in combination with selected chemotherapy[552] are additional options for patients with HER2-positive metastatic breast cancer. Randomized trials demonstrate benefit from adding trastuzumab to other agents including paclitaxel with or without carboplatin,[552-555] docetaxel,[553] and vinorelbine,[553] for patients with HER2-positive metastatic disease. In addition, the combination of trastuzumab and capecitabine has also shown efficacy as a first-line trastuzumab-containing regimen in this setting.[556,557] The NCCN Panel believes the 27% frequency of significant cardiac dysfunction in patients treated with the combination of trastuzumab and doxorubicin/cyclophosphamide chemotherapy in the metastatic setting is too high for use of this combination outside the confines of a prospective clinical trial.[552,557,558]

In those with disease progression on first-line trastuzumab-containing regimens, the NCCN Panel recommends continuation of HER2 blockade. This recommendation also applies to patients who are diagnosed with HER2-positive metastatic disease after prior exposure to trastuzumab in the adjuvant setting. Several trials have demonstrated benefit of continuation of trastuzumab therapy following disease progression on a trastuzumab-containing regimen.[559-561] However, the optimal duration of trastuzumab in patients with long-term control of disease is unknown.

Pertuzumab is active in patients beyond the first-line setting. The results of a multicenter, open-label, single-arm, phase II study (n = 66) show that the combination of pertuzumab and trastuzumab is active and well tolerated in patients with HER2-positive metastatic breast cancer that has progressed on prior trastuzumab therapy.[562] The trial reported an ORR of 24.2% (16 patients out of 66). The median PFS time observed with pertuzumab and trastuzumab combination was 15.5 months (range, 0.9–17.0 months; 80% CI, 18–31 months).[562] The reported median duration of response with the combination was 5.8 months (range, 2.9–15.3 months).[562]

To determine whether the clinical benefit seen in the study was from pertuzumab alone or was a result of the combined effect of pertuzumab and trastuzumab, a cohort of patients (n = 29) whose disease progressed during prior trastuzumab-based therapy received pertuzumab monotherapy until progressive disease or unacceptable toxicity. Of these, patients with disease progression (n = 17) continued to receive pertuzumab with the addition of trastuzumab. In the 29 patients who received pertuzumab monotherapy, the ORR and clinical benefit rate reported were 3.4% and 10.3%, respectively, whereas in the patients who received dual blockade after disease progression while on pertuzumab, the ORR and clinical benefit rate were 17.6% and 41.2%, respectively.[563]

According to the NCCN Panel, for patients with disease progression after treatment with trastuzumab-based therapy without pertuzumab, a line of therapy containing both trastuzumab plus pertuzumab with or without a cytotoxic agent (such as vinorelbine or taxane) may be considered. Further research is needed to determine the ideal sequencing strategy for HER2-targeted therapy.

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T-DM1 also has also shown activity in the second-line setting. A randomized, international, multicenter, open-label, phase III study (EMILIA) evaluated the safety and efficacy of T-DM1 compared with lapatinib plus capecitabine for HER2-positive patients with locally advanced breast cancer or metastatic breast cancer previously treated with trastuzumab and a taxane.[564] The primary endpoints of this study were PFS, OS, and safety. T-DM1 demonstrated a statistically significant improvement in both primary endpoints of PFS and OS. PFS (assessed by independent review) was significantly improved with T-DM1 with median PFS of 9.6 months vs. 6.4 months with lapatinib plus capecitabine; HR for progression or death from any cause was 0.65 (95% CI, 0.55–0.77; $P <$ .001). At the first interim analysis, T-DM1 also demonstrated significant improvement in OS. The stratified HR for death from any cause with T-DM1 versus lapatinib plus capecitabine was 0.62 (95% CI, 0.48–0.81; P = .0005).[564] Rates of grade 3 or 4 adverse events were higher with lapatinib plus capecitabine than with T-DM1 (57% vs. 41%). The incidences of thrombocytopenia and increased serum aminotransferase levels were higher with T-DM1 (frequency >25%), whereas the incidences of diarrhea, nausea, vomiting, and palmar-plantar erythrodysesthesia were higher with lapatinib plus capecitabine.[564]

A phase II single-arm study evaluated fam-trastuzumab deruxtecan-nxki, a HER2 antibody conjugated with a topoisomerase I inhibitor, in adults (n = 184) with pathologically documented HER2-positive metastatic breast cancer who had received multiple previous treatments including treatment with T-DM1.[565] After a median duration of follow-up of 11.1 months (range 0.7–19.9), the median response duration with fam-trastuzumab deruxtecan-nxki was 14.8 months (95% CI, 13.8–16.9), and the median PFS was 16.4 months (95% CI, 12.7–not reached).[565] Most commonly reported adverse events (grade 3 or higher) were a decreased neutrophil count (20.7%), anemia (8.7%), nausea (7.6%), and fatigue (6%).[565] Interstitial lung disease (ILD) was reported in 13.6% of the patients (grade 1 or 2, 10.9%; grade 3 or 4, 0.5%; and grade 5, 2.2%). Based on this study and the approval from the FDA, the NCCN Panel has included this as an option for HER2-positive metastatic disease noting that it is indicated in patients after two or more lines of prior HER2-targeted therapy in the metastatic setting and contraindicated for those with a history of or active ILD.

Lapatinib in combination with capecitabine or trastuzumab are options for patients with HER2-positive disease following disease progression on a trastuzumab-containing regimen.

A phase III study compared lapatinib plus capecitabine with capecitabine alone in patients with advanced or metastatic breast cancer refractory to trastuzumab in the metastatic setting and with prior treatment with an anthracycline and a taxane in either the metastatic or adjuvant setting.[566] Time to progression was increased in the group receiving combination therapy when compared with the group receiving capecitabine monotherapy (8.4 months vs. 4.4 months; HR, 0.49; 95% CI, 0.34–0.71; $P <$ .001). The patients who had disease progression on monotherapy were allowed to cross over to the combination arm. This resulted in insufficient power to detect significant differences in OS; an exploratory analysis demonstrated a trend toward a survival advantage with lapatinib plus capecitabine.[567] The analysis reported a median OS of 75.0 weeks for the combination arm and 64.7 weeks for the monotherapy arm (HR, 0.87; 95% CI, 0.71–1.08; P = .210).[567]

Results from a phase III trial in which patients with heavily pretreated metastatic breast cancer and disease progression on trastuzumab therapy randomly assigned to trastuzumab plus lapatinib or lapatinib monotherapy showed that PFS was increased from 8.1 weeks to 12 weeks (P = .008) with the combination.[568] The OS analysis data showed that lapatinib plus trastuzumab improved median survival by 4.5 months, with median OS of 14 months for the combination therapy and 9.5 months for lapatinib alone

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(HR, 0.74; 95% CI, 0.57–0.97; *P* = .026). [569] This improvement in OS analysis included patients who were initially assigned to monotherapy and crossed over to receive combination therapy at the time of progression.[569] Based on the absence of data, the Panel does not recommend the addition of chemotherapy to the trastuzumab and lapatinib combination.

In a phase II trial of patients (n = 49) with progressive, HER2-positive disease and brain metastases (92% received CNS surgery and/or radiotherapy),[570] patients were treated with capecitabine plus neratinib, a second-generation (irreversible) pan-HER tyrosine kinase inhibitor (TKI) of the tyrosine kinase domains of EGFR, HER2, and HER4. The patients were separated based on prior lapatinib treatment. The combination therapy resulted in a CNS ORR of 49% (95% CI, 32%–66%), among lapatinib-naïve patients, and 33% (95% CI, 10%–65%) among those with prior lapatinib treatment.[570] Median PFS and OS among lapatinib-naïve patients was 5.5 and 13.3 months, and 3.1 and 15.1 months among those with prior lapatinib treatment. Grade 3 diarrhea occurred in 29% of patients.[570]

A prospective randomized phase III trial (NALA) randomized patients (n = 621) with HER2-positive breast cancer to neratinib in combination with capecitabine or lapatinib plus capecitabine until disease progression.[571] All enrolled patients received a least two lines of prior HER2-targeted treatment in the metastatic setting. Approximately 30% had received ≥3 prior treatment lines. About a third of all patients had received prior treatment with trastuzumab, pertuzumab, and T-DM1.

The ORR (32.8% vs. 26.7%; *P* = .1201), clinical benefit rate (44.5% vs. 35.6%; *P* = .0328), and median duration of response (8.5 vs. 5.6 months) all favored the neratinib arm. Fewer patients required intervention for CNS metastases with neratinib. The risk of progression was reduced by 24% in the neratinib group (HR, 0.76; 95% CI, 0.63–0.93; *P* = .0059). There was a non-significant trend towards improved survival. The OS rates at 6 and 12 months were 90.2% versus 87.5% with neratinib + capecitabine compared with 72.5% versus 66.7% for lapatinib in combination with capecitabine (HR, 0.88; 95% CI, 0.72–1.07; *P* = .2086). Diarrhea was the most frequently reported side effect in the NALA trial in both arms, but a higher rate was observed in patients in the neratinib group (any grade diarrhea, 83% vs. 66%; grade 3/4 diarrhea, 24% vs. 13%).

Based on the results of the NALA trial and the recent FDA approval, NCCN has included neratinib plus capecitabine as a category 2A option in this setting.

Systemic Therapy for Recurrent or Stage IV HR-Positive, HER2-Positive Breast Cancer

Patients with stage IV or recurrent disease characterized by tumors that are HR-positive, HER2-positive tumors have the option of receiving HER2-directed therapy as a component of their treatment plan. Options include treatment with a HER2-targeted therapy plus chemotherapy or endocrine therapy alone or in combination with HER2-targeted therapy. Endocrine therapy alone or in combination with HER2-targeted therapy is a less toxic approach compared with HER2-targeted therapy combined with chemotherapy. Premenopausal patients treated with HER2-targeted therapy *and* endocrine therapy should receive ovarian suppression or ablation.

Adding trastuzumab or lapatinib to an AI has demonstrated a PFS advantage compared with AI alone in postmenopausal patients with stage IV or recurrent HR-positive, HER2-positive tumors.

In the TAnDEM study, postmenopausal patients (n = 207) with metastatic HR-positive and HER2-positive tumors were randomized to receive anastrozole alone or anastrozole plus trastuzumab.[572] Compared with single-agent anastrozole, an improvement in PFS was seen with combination therapy (4.8 vs. 2.4 months; HR, 0.63; 95% CI, 0.47–0.84; *P*

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= .0016). The combination was associated with a higher incidence of toxicities (all grades), fatigue (21% vs. 9%), diarrhea (20% vs. 8%), vomiting (21% vs. 4%), and pyrexia (18% vs. 7%); serious (grade 3/4) toxicities were rare in both treatment arms.

The phase III eLEcTRA trial studied the efficacy and safety of trastuzumab plus letrozole in patients (n = 93) with HER2-positive and HR-positive metastatic breast cancer. Median time to progression was 3.3 months with letrozole and 14.1 months with trastuzumab plus letrozole. The results are consistent with the TAnDEM trial; however, due to smaller numbers of patients enrolled in this trial, this was not statistically significant (HR, 0.67; 95% CI, 0.35–1.29; *P* = .23).[573]

In a phase III study of postmenopausal patients (n = 219) with HER2-positive and HR-positive disease, first-line treatment with lapatinib plus letrozole reduced the risk of disease progression compared to treatment with letrozole alone (median PFS, 8.2 months vs. 3.0 months; HR, 0.71; 95% CI, 0.53–0.96; *P* = .019).[574] The combination of letrozole plus trastuzumab was associated with a higher rate of grade 3 or grade 4 toxicities, including diarrhea (10% vs. 1%) and rash (1% vs. 0%).[574]

In the randomized phase II study (PERTAIN), postmenopausal patients (n = 258) were randomly assigned to either first-line pertuzumab plus trastuzumab and an AI (anastrozole or letrozole) or trastuzumab plus an AI. There was an improvement in PFS with the three-drug combination (18.9 vs. 15.8 months; HR, 0.65; 95% CI, 0.48–0.89).[575] Grade 3 or higher adverse events observed were higher trastuzumab and pertuzumab versus pertuzumab alone (50% vs. 39%). Of note, about half of patients received induction therapy with a taxane for 18 to 24 weeks prior to the initiation of endocrine therapy. Based on the results of the PERTAIN trial,[575] the NCCN Panel notes that if treatment was initiated with chemotherapy and trastuzumab plus pertuzumab, and the chemotherapy was stopped, endocrine therapy may be added to the trastuzumab plus pertuzumab.

In the ALTERNATIVE trial, postmenopausal patients (n = 355) with HER2-positive, HR-positive metastatic breast cancer were randomized to receive lapatinib plus trastuzumab plus an AI, lapatinib plus an AI, or trastuzumab plus an AI without chemotherapy.[576] All patients in the trial received prior trastuzumab and prior endocrine therapy, either in the adjuvant or metastatic disease setting. An AI in combination with lapatinib plus trastuzumab demonstrated a significant increase in PFS compared with trastuzumab without lapatinib (11 vs. 5.7 months; HR, 0.62; 95% CI, 0.45–0.88, *P* = .0064).[576] The most common adverse events with the combination compared with trastuzumab or lapatinib monotherapy were diarrhea (69%, 9%, 51%), rash (36%, 2%, 28%), nausea (22%, 9%, 22%), and paronychia (30%, 0%, 15%).

The NCCN Panel has also included other combinations of available endocrine therapies such as fulvestrant or tamoxifen with trastuzumab as options for HR-positive and HER2-positive metastatic disease. These options would be mostly considered after completion of chemotherapy plus HER2-therapy or in a few patients with indolent or asymptomatic disease based on the need for continuing HER2-targeted therapy for disease control. The selection of appropriate endocrine therapy would depend on agents the patient has already received.

Systemic Therapy for Recurrent or Stage IV Disease with Germline BRCA1/2 Mutations

About 5% of all patients with breast cancer carry the germline breast cancer susceptibility gene (*BRCA)* mutations, and rates of these mutations are higher among those with HER2-negative disease. [577,578]

PARP Inhibitors: The phase III OlympiAD trial randomized patients (n = 302) with metastatic breast cancer harboring the germline *BRCA*

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mutations to the PARP inhibitor, olaparib (n = 205) or physician's choice (n = 97) of non-platinum chemotherapy (capecitabine, eribulin, or vinorelbine).[579] An improvement in PFS was seen in those receiving olaparib relative to those receiving chemotherapy [7.0 vs. 4.2 months; HR, 0.58; 95% CI, 0.43–0.80; *P* < .001].[579] The study, included all subtypes—those with HR-positive, HER2-negative and -positive, and triple-negative disease. The PFS improvements noted with olaparib were noted in all subtypes and were greatest in the triple-negative population. Subsequent follow-up did not show a statistically significant difference in OS between treatment arms and the study was also not powered to evaluate OS. The median OS with olaparib compared with treatment of physician's choice was 19.3 months versus 17.1 months, respectively (HR, 0.90; 95% CI, 0.66–1.23; *P* = .513).[580] The QOL was significantly better in the olaparib arm. It is interesting to note that patients who had not received prior chemotherapy in the metastatic setting achieved a 7.9-month longer median OS with olaparib compared with treatment of physician's choice.[580]

The phase III EMBRACA trial of patients with advanced breast cancer harboring the germline *BRCA* mutations and no prior exposure to a PARP inhibitor, were randomized to talazoparib (n = 287) or to physician's choice of single-agent chemotherapy (n = 144).[581] The median PFS among patients in the talazoparib group was longer than in the control group (8.6 months [95% CI, 7.2–9.3] vs. 5.6 months [95% CI, 4.2–6.7]; HR for disease progression or death, 0.54; 95% CI, 0.41–0.71; *P* < .001).[581]

Based on the results of the above phase III trials, the two FDA-approved PARP inhibitors, olaparib and talazoparib, are included as category 1, preferred options for those with germline *BRCA1/2* mutations. The NCCN Panel recommends assessing germline *BRCA1/2* mutations in all patients with recurrent or metastatic breast cancer to identify candidates for PARP inhibitor therapy. While olaparib and talazoparib are FDA-indicated in HER2-negative disease, the NCCN Panel supports use in any breast cancer subtype associated with germline *BRCA1/2* mutations.

Platinums: The phase III TNT trial compared docetaxel with carboplatin in the first-line setting in patients (n = 376) with triple-negative breast cancer. In the unselected population, carboplatin was not more active than docetaxel (ORR, 31.4% vs. 34.0%; *P* = .66). [582] Patients with a germline *BRCA1/2* mutation had a significantly better response to carboplatin than docetaxel (ORR, 68.0% vs. 33.3%, absolute difference, 34.7%; *P* = .03). [582] PFS was also improved with carboplatin treatment in patients with a germline *BRCA1/2* mutation (median PFS, 6.8 months vs. 4.4 months); no difference was found in OS. However, patients with somatic *BRCA1/2* mutation in the tumor DNA did not appear to have the same advantage.

For those with triple-negative recurrent/stage IV breast cancer and germline *BRCA1/2* mutations, the NCCN Panel has included platinum agents (cisplatin and carboplatin) as preferred treatment options. It is unknown how PARP inhibitors compare with platinums in this setting.

Systemic Chemotherapy for Recurrent or Stage IV Disease

Patients with HR-negative tumors not localized to the bone or soft tissue only, or that are associated with symptomatic visceral metastasis irrespective of HR- or HER-status, or that have HR-positive tumors that are refractory to endocrine therapy should receive systemic chemotherapy.

A variety of chemotherapy regimens are felt to be appropriate, as outlined in the treatment algorithm. Combination chemotherapy generally provides higher rates of objective response and longer time to progression, in comparison to single-agent chemotherapy. Combination chemotherapy is, however, associated with an increase in toxicity and is of little survival benefit.[583-587] Furthermore, administering single agents sequentially decreases the likelihood that dose reductions will be needed. Thus, the

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NCCN Panel finds no compelling evidence that combination chemotherapy is superior to sequential single agents. Therefore, sequential monotherapy is preferred and combination therapy is useful in patients with rapid clinical progression or need for rapid symptom and/or disease control.

Usually the first-line regimens are given until progression or unacceptable toxicity. Considering what is unacceptable toxicity and considering no further cytotoxic therapy should be decided together with the patient. Adverse effects may require dose reduction and cessation of chemotherapy prior to disease progression.

The NCCN Panel recommends considering scalp cooling to reduce incidence of chemotherapy-induced alopecia for patients receiving chemotherapy. The data on efficacy of scalp cooling is mainly from the adjuvant setting and also show that results may be less effective with anthracycline-containing regimens.[588-592]

A meta-analysis showed favorable impact on OS by prolonging treatment until disease progression.[593] In this analysis, data from four studies involving 666 patients indicated that median OS was increased by 23% (95% CI, 9–38%; *P* = .01) in patients receiving longer durations of chemotherapy versus a limited number of cycles.[593] In a systematic review, longer durations of chemotherapy demonstrated a marginal increase in OS (HR, 0.91; 95% CI, 0.84–0.99) and a significant improvement in PFS (HR, 0.66; 95% CI, 0.6–0.72), compared with shorter durations.[587]

A more recent study of patients (n = 420) with HER2-negative, advanced breast cancer showed that intermittent first-line treatment with paclitaxel plus bevacizumab was not inferior to continuous treatment. The median overall PFS for intermittent versus continuous treatment was 7.4 months and 9.7 months, respectively (HR, 1.17; 95% CI, 0.88–1.57). Median OS was 17.5 months versus 20.9 months for intermittent versus continuous treatment (HR, 1.38; 95% CI, 1.00–1.91).[594]

Determining the duration of chemotherapy in an individual patient typically depends on the efficacy and tolerability and shared decision-making between the treating physician and patient.

Most patients will be candidates for multiple lines of systemic therapy for palliation. At each reassessment clinicians should assess the value of ongoing treatment, the risks and benefits of an additional line of systemic therapy, patient performance status, and patient preferences through a shared decision-making process.

Preferred Chemotherapy Regimens for Stage IV or Recurrent Metastatic Disease

The NCCN Panel has classified the chemotherapy agents into three categories: preferred, other recommended, and useful in certain circumstances. The treatment decision should be individualized and consider previous therapies, pre-existing comorbidities, nature of the disease, toxicity profiles, patient preferences, and in some cases access to agents.

Among preferred single agents, the NCCN Panel has included taxanes (paclitaxel), anthracyclines (doxorubicin and liposomal doxorubicin), antimetabolites (capecitabine and gemcitabine), microtubule inhibitors (eribulin and vinorelbine), and platinum agents for patients with triple-negative tumors and germline *BRCA1/2* mutations.

Paclitaxel can be administered weekly (80 mg/m^2)[595] or every 3 weeks (175 mg/m^2).[596] A meta-analysis of randomized controlled trials that compared weekly and every-3-week taxane regimens in advanced breast cancer showed that compared with every-3-week treatment, weekly

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administration of paclitaxel resulted in an improvement in OS (HR, 0.78; 95% CI, 0.67–0.89).[597]

Doxorubicin (60–75 mg/m^2) every 3 weeks, or 20 mg/m^2 weekly has shown an ORR between 30% to 47%.[598-601] Liposomal doxorubicin (50 mg/m^2 every 4 weeks) has been shown to have efficacy similar to doxorubicin (60 mg/m^2 every 3 weeks).[602] It has also been shown to have efficacy in the second-line setting for patients with metastatic breast cancer.[602] Compared with doxorubicin, liposomal doxorubicin has a less frequent dosing schedule, decreased risk of cardiotoxicity (7% vs. 26%; HR, 3.16; 95% CI, 1.58–6.31), decreased rate of nausea (37% vs. 53%) and vomiting (19% vs. 31%), lower rates of alopecia (20% vs. 66%), and lower rates of neutropenia (4% vs. 10%).[602] However, compared with doxorubicin it was associated with a higher rate of palmar-plantar erythrodysesthesia (48% vs. 2%), stomatitis (22% vs. 15%), and mucositis (23% vs. 13%).[602]

The benefit of capecitabine as a treatment option for patients with metastatic breast cancer has been demonstrated in multiple phase II trials. Results of one study of patients (n = 126) treated with capecitabine showed an ORR of 28%, median time to progression of 4.9 months, and median OS of 15.2 months (95% CI, 13.5–19.6 months).[603] In another study, patients (n = 95) were randomized to receive capecitabine or cyclophosphamide, methotrexate, and fluorouracil (CMF).[604] Treatment with single-agent capecitabine resulted in a higher ORR compared with CMF (30% vs. 16%). The median time to progression and OS were similar in both groups.[604]

Eribulin is a non-taxane microtubule inhibitor used for the treatment of patients with metastatic breast cancer who have previously received at least two chemotherapeutic regimens for the treatment of metastatic disease. Prior therapy should have included an anthracycline and a taxane in either the adjuvant or metastatic setting. In a phase III trial, patients (n = 762) with metastatic breast cancer were randomized 2:1 to eribulin or treatment of physician's choice. OS was improved in patients assigned to eribulin (median 13.1 months; 95% CI, 11.8–14.3) compared with those receiving other treatments (10.6 months, 9.3–12.5), a 19% statistically significant risk reduction (HR, 0.81; 95% CI, 0.66–0.99; *P* = .041).[605]

A phase III trial compared eribulin with capecitabine in patients with metastatic breast cancer and showed that both treatments were similar with respect to OS and PFS.[606] The median PFS times for eribulin and capecitabine were 4.1 and 4.2 months, respectively (HR, 1.08; 95% CI, 0.93–1.25; *P* = .30), and the OS with eribulin versus capecitabine was 15.9 months versus 14.5 months (HR, 0.88; 95% CI, 0.77–1.00). [606]

In addition to the above, gemcitabine[607] and vinorelbine are both active as a single agents even in heavily pretreated patients with metastatic breast cancer.[608-610]

Among other recommended single agents, the NCCN Panel has included taxanes (docetaxel,[611] albumin-bound paclitaxel[612-614]), anthracyclines (epirubicin [615]), and ixabepilone[616-618] as other recommended regimens.

Ixabepilone as monotherapy has been evaluated in several phase II trials of patients with metastatic breast cancer: in a first-line setting in patients previously treated with anthracycline chemotherapy [616]; in patients with taxane-resistant metastatic breast cancer[617]; and in patients with advanced breast cancer resistant to an anthracycline, a taxane, and capecitabine.[618] In the phase II trials, ORR, median duration of response, and median OS duration were 41.5% (95% CI, 29.4%–54.4%), 8.2 months (95% CI, 5.7–10.2 months), and 22.0 months (95% CI, 15.6–27.0 months) in the first-line setting;[616] 12% (95% CI, 4.7%– 26.5%), 10.4 months, and 7.9 months for the taxane-resistant patients;[617] and 11.5% (95% CI, 6.3%–18.9%), 5.7 months, and 8.6 months for the patients previously treated with an anthracycline, a taxane, and capecitabine.[618] In the study by Perez

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et al,[618] grade 3/4 treatment-related toxicities included peripheral sensory neuropathy (14%) and neutropenia (54%).

The NCCN Panel has included combination chemotherapy regimens as useful in certain circumstances. The combination regimen options include doxorubicin/cyclophosphamide (AC)[619,620]; epirubicin/cyclophosphamide (EC)[621]; docetaxel/capecitabine[585]; gemcitabine/paclitaxel (GT)[622]; cyclophosphamide/methotrexate/fluorouracil (CMF)[623]; gemcitabine/carboplatin[624-626]; carboplatin with paclitaxel or albumin-bound paclitaxel[627-629]; and paclitaxel/bevacizumab.[630-632]

For the doublet regimens that are included, randomized phase III trials have shown that the ORR with first-line AC treatment ranges from 47% to 54% and OS is around 20 months.[619,620] For first-line EC, a phase III trial reported the ORR of 55%, PFS of 7.1 months, and OS of 14 months.[621] For first-line capecitabine/docetaxel, a phase III trial reported an ORR of 53% and time to progression of 11 months.[633] In the second-line setting, another phase III trial compared the efficacy and tolerability of capecitabine/docetaxel therapy in anthracycline-pretreated patients and showed significantly superior efficacy in time to disease progression (HR, 0.652; 95% CI, 0.545–0.780; P = .0001; median, 6.1 vs. 4.2 months), OS (HR, 0.775; 95% CI, 0.634–0.947; P = .0126; median, 14.5 vs. 11.5 months), and ORR (42% vs. 30%, P = .006) compared with single-agent docetaxel.[585]

Combination chemotherapy regimens containing a platinum agent or a taxane have been shown to be efficacious in patients with metastatic triple-negative breast cancer. A randomized phase II study compared the addition of iniparib to gemcitabine/carboplatin versus gemcitabine/carboplatin in patients with triple-negative breast cancer who had received no more than two prior chemotherapies. ORR was similar in both groups, 30.2% (95% CI, 24.6–35.8) with gemcitabine/carboplatin,[624] and the median OS was 11.1 months with gemcitabine/carboplatin (HR, 0.88; 95% CI, 0.69–1.12).[624]

Several phase II studies have evaluated the efficacy of paclitaxel/carboplatin as first-line treatment for patients with metastatic breast cancer and found the combination to be an effective therapeutic option in this setting.[628,629] The randomized trial, tnAcity, evaluated the efficacy and safety of first-line albumin-bound paclitaxel plus carboplatin, albumin-bound paclitaxel plus gemcitabine, and gemcitabine plus carboplatin in patients with metastatic triple-negative breast cancer.[627] The results of this trial reported that median PFS was significantly longer with albumin-bound paclitaxel plus carboplatin versus albumin-bound paclitaxel/gemcitabine (8.3 vs. 5.5 months; HR, 0.59; 95% CI, 0.38–0.92; P = .02) or gemcitabine/carboplatin (8.3 vs. 6.0 months; HR, 0.58; 95% CI, 0.37–0.90; P = .02). The median OS was also longer with albumin-bound paclitaxel plus carboplatin versus albumin-bound paclitaxel/gemcitabine (16.8 vs. 12.1 months; HR, 0.73; 95% CI, 0.47–1.13; P = .16) or gemcitabine/carboplatin (16.8 vs. 12.6 months; HR, 0.80; 95% CI, 0.52–1.22; P = .29). The ORR was 73%, 39%, and 44%, respectively.[627]

The NCCN Panel notes that albumin-bound paclitaxel may be substituted for paclitaxel or docetaxel due to medical necessity (ie, hypersensitivity reaction). If substituted for weekly paclitaxel or docetaxel, then the weekly dose of nab-paclitaxel should not exceed 125 mg/m^2.

The only triplet regimen listed as an option in the metastatic setting is CMF. This regimen was compared in the first-line setting with capecitabine monotherapy, and results show similar ORR and PFS.[623] However, CMF resulted in a shorter OS (median, 22 vs. 18 months; HR, 0.72; 95% CI, 0.55–0.94) compared to capecitabine.

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Additional Targeted Therapies for Stage IV Disease Useful in Certain Circumstances

NTRK gene fusions are seen in a few rare types of cancer, such as secretory carcinoma of the breast or salivary gland and infantile fibrosarcoma and also infrequently in some common cancers, such as melanoma, glioma, and carcinomas of the thyroid, lung, and colon.[634] *NTRK* fusions are identified by fluorescence in situ hybridization (FISH), next-generation sequencing (NGS), or polymerase chain reaction (PCR). Larotrectinib[635-637] and entrectinib[637,638] are two NTRK inhibitors that are FDA-approved for the treatment of solid tumors that have an *NTRK* gene fusion without a known acquired resistance mutation and have no satisfactory alternative treatments or that have progressed following treatment. If a patient with recurrent/stage IV breast cancer presents with a tumor with an *NTRK* fusion, treatment with an NTRK inhibitor is an option if no satisfactory alternative treatments exist or for disease progression following treatment.

Pembrolizumab is FDA-approved for the treatment of patients with unresectable or metastatic, microsatellite instability-high (MSI-H) or mismatch repair deficient (dMMR) solid tumors that have progressed following prior treatment and who have no satisfactory alternative treatment options.[639-641] Pembrolizumab has demonstrated anti-tumor activity in heavily pretreated patients with metastatic breast cancer and high tumor mutational burden (≥9 mutations/megabase) determined by commercially available tests.[642] If a patient with recurrent/stage IV breast cancer presents with a tumor with MSI-H/mismatch repair (MMR) mutation, whose disease has progressed following prior treatments and no satisfactory alternative treatment options, treatment pembrolizumab is an option.

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Monitoring Metastatic Disease

Monitoring the treatment of metastatic breast cancer involves a wide array of assessments and the need for the clinician to integrate several different forms of information to decide on the effectiveness of treatment and the acceptability of toxicity. The information includes those from direct observations of the patient, including patient-reported symptoms, performance status, change in weight, and physical examination; laboratory tests such as alkaline phosphatase, liver function, blood counts, and calcium; radiographic imaging; functional imaging; and, where appropriate, tumor biomarkers. The results of these evaluations generally are classified as response, continued response to treatment, stable disease, uncertainty regarding disease status, or progression of disease. The clinician typically must assess and balance multiple different forms of information to decide, along with the patient, whether disease is being controlled and the toxicity of treatment is acceptable. Sometimes individual pieces of information can be conflicting with regard to disease response, and clinical judgment along with patient input is critical.

The NCCN Panel recommends using widely accepted criteria for reporting response, stability, and progression of disease such as the RECIST criteria[643] and the WHO criteria.[644] The Panel also recommends using the same method of response assessment over time. For example, an abnormality initially found on diagnostic CT scan of the chest should be monitored with repeat diagnostic CT scans of the chest.

The optimal frequency of testing is uncertain and primarily based on the monitoring strategies utilized in breast cancer clinical trials. The page titled *Principles of Monitoring Metastatic Disease* in the algorithm provides a table outlining general recommendations for the frequency and type of monitoring as a baseline before initiation of a new therapy, for monitoring the effectiveness of cytotoxic chemotherapy and endocrine therapy, and as an assessment when there is evidence of disease progression. The

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Panel has indicated in a footnote that the frequency of monitoring can be reduced in patients who have long-term stable disease. These are guidelines and should be modified for the individual patient using clinical judgment, especially for those with stable or responding disease for long periods of time.

The clinical use of circulating tumor cells (CTC) or circulating tumor DNA (ctDNA) in metastatic breast cancer is not yet included in the NCCN Guidelines for Breast Cancer for disease assessment and monitoring. Patients with persistently increased CTC after 3 weeks of first-line chemotherapy have a poor PFS and OS.[645] In spite of its prognostic ability, CTC count has failed to show a predictive value. A prospective, randomized, phase 3 trial (SWOG S0500) evaluated the clinical utility of serial enumeration of CTC in patients with metastatic breast cancer. [645] According to the study results, switching to an alternative cytotoxic therapy after 3 weeks of first-line chemotherapy in patients with persistently increased CTC did not affect either PFS or OS.[645]

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Special Situations

Paget Disease

Paget disease of the breast is a rare manifestation of breast cancer characterized by neoplastic cells in the epidermis of the NAC.[646] It most commonly presents with eczema of the areola, bleeding, ulceration, and itching of the nipple. The diagnosis is often delayed because of the rare nature of the condition and confusion with other dermatologic conditions. There is an associated cancer elsewhere in the breast in up to about 80% to 90% of cases.[647-649] The associated cancers are not necessarily located adjacent to the NAC and may be either DCIS or invasive cancer.

Patients with clinical signs that raise suspicion for Paget disease require a complete history and physical examination and diagnostic breast imaging. Any breast lesion identified by imaging or examination should be evaluated according to the NCCN Guidelines for Breast Cancer Screening and Diagnosis. The skin of the NAC should undergo surgical biopsy, including the full thickness of the epidermis including at least a portion of any clinically involved NAC. When biopsy of the NAC is positive for Paget disease, breast MRI is recommended to define the extent of disease and identify additional disease.[649,650]

There are no category 1 data that specifically address local management of Paget disease. Systemic therapy is based on the stage and biological characteristics of any underlying cancer, and is supported by the evidence cited in the relevant stage-specific breast cancer treatment guidelines.

Management of Paget disease has traditionally been total mastectomy with axillary dissection. Total mastectomy remains a reasonable option for patients regardless of the absence or presence of an associated breast cancer.[648] Data demonstrate that satisfactory local control may be achieved with BCS including the excision with negative margins of any underlying breast cancer along with resection of the NAC followed by WBRT.[651-655] The risk of ipsilateral breast recurrence after breast-conserving NAC resection and RT with or without an associated cancer is similar to that with BCS and RT with the typical invasive or in situ cancer.

For Paget disease without an associated cancer (ie, no palpable mass or imaging abnormality), it is recommended that BCS consist of removal of the entire NAC with a negative margin of underlying breast tissue. In cases with an associated cancer elsewhere in the breast, the surgery includes removal of the NAC with a negative margin and removal of the peripheral cancer using standard breast-conserving technique to achieve a negative margin. It is not necessary to remove the NAC and the peripheral cancer in continuity in a single surgical specimen or through a single incision. Mastectomy also remains an appropriate treatment option.

ALN staging is not necessary when breast-conserving therapy is used to treat Paget disease with underlying DCIS without evidence of invasive cancer following clinical examination, imaging evaluation, and full-thickness skin biopsy of the involved NAC. In the presence of an underlying invasive breast cancer treated with BCS, axillary surgery should be performed according to the *Considerations for Surgical Axillary Staging* outlined in the NCCN Guidelines algorithm. In cases treated by total mastectomy, axillary staging is recommended for patients with invasive disease and should also be considered for patients with underlying DCIS without evidence of invasive disease. This is because the final pathology may reveal an invasive cancer in the mastectomy specimen and the mastectomy precludes subsequent sentinel node biopsy. Two retrospective studies have provided evidence for a high degree of accuracy in the identification of the sentinel node(s) in patients with Paget disease.[656,657] Patients treated with breast conservation should receive whole breast radiation. Extended-field radiation to regional lymph nodes should be used in cases of an associated invasive breast cancer

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with involved lymph nodes as for any breast cancer as described in the initial sections of the NCCN Guidelines. A radiation boost should be considered for the site of the resected NAC and any associated resected cancer site, if applicable.

Patients with an associated invasive cancer have substantial risk of developing metastases. Adjuvant systemic therapy should be administered according to the stage of the cancer. Patients with Paget disease treated with breast conservation and without an associated cancer or those with associated ER-positive DCIS should consider tamoxifen for risk reduction. Those with an associated invasive cancer should receive adjuvant systemic therapy based on the stage and HR status.

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Phyllodes Tumors of the Breast

(also known as phyllodes tumors, cystosarcoma phyllodes)

Phyllodes tumors of the breast are rare tumors comprised of both stromal and epithelial elements.[658] Phyllodes tumors exist in benign, borderline, and malignant subtypes, although there is not uniform agreement on the criteria for assigning subtype or for predicting biological behavior.[659] The subtype of phyllodes tumor appears less important for risk of recurrence than does the margin of tumor-free resection achieved by surgical treatment. Diagnosis of phyllodes tumors prior to excisional biopsy/lumpectomy is uncommon. Phyllodes tumors occur in an older age distribution than fibroadenoma, a younger age distribution than the invasive ductal and lobular cancers, and with a mean age of 40 years.[660] Phyllodes tumors often enlarge rapidly and are usually painless. Phyllodes tumors often appear on ultrasound and mammography as fibroadenomas, and FNA cytology and even core needle biopsy are inadequate to reliably distinguish phyllodes tumors from fibroadenomas.[660] Thus, in the setting of a large or rapidly enlarging clinical fibroadenoma, excisional biopsy should be considered to pathologically exclude a phyllodes tumor. Patients with Li-Fraumeni syndrome (germline *TP53* mutation, see NCCN Guidelines for Genetic/Familial High Risk Assessment: Breast, Ovarian, and Pancreatic) have an increased risk for phyllodes tumors.[661] Local recurrences of phyllodes tumors are the most common site of recurrence. Most distant recurrences occur in the lung, and may be solid nodules or thin-walled cavities.

Treatment of phyllodes tumors (which includes benign, borderline, and malignant subtypes) is with local surgical excision with tumor-free margins of ≥1 cm. Lumpectomy or partial mastectomy is the preferred surgical therapy. Total mastectomy is necessary only if negative margins cannot be obtained by lumpectomy or partial mastectomy.[662] Since phyllodes tumors rarely metastasize to the ALNs, surgical axillary staging or ALND is not necessary unless the lymph nodes are pathologic on clinical examination.[663] In those patients who experience a local recurrence, resection of the recurrence with wide, tumor-free surgical margins should be performed. Some Panel members recommend local RT of the remaining breast or chest wall following resection of a local recurrence, but this recommendation is controversial (category 2B).[664]

While the epithelial component of most phyllodes tumors contains ER (58%) and/or PR (75%),[665] endocrine therapy has no proven role in the treatment of phyllodes tumors. Similarly, there is no evidence that adjuvant cytotoxic chemotherapy provides benefit in reduction of recurrences or death. In the rare patient who experiences a systemic recurrence (usually in the lung), treatment should be as recommended in the NCCN Guidelines for Soft Tissue Sarcoma.

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Breast Cancer During Pregnancy

Breast cancer occurring concurrently with pregnancy is an infrequent clinical event. In a California registry study, there were 1.3 breast cancers diagnosed per 10,000 live births.[666] Unfortunately, breast cancer during pregnancy is most often ALN-positive and with larger primary tumor size. Histologically the tumors are poorly differentiated, are more frequently ER/PR-negative, and approximately 30% are HER2-positive.[667,668] The diagnosis is often delayed because neither the patient nor the physician suspects malignancy.

Evaluation of the pregnant patient with suspected breast cancer should include a physical examination with particular attention to the breast and regional lymph nodes. Mammogram of the breast with shielding can be done safely and the accuracy is reported to be >80%.[669] Ultrasound of the breast and regional lymph nodes can be used to assess the extent of disease and also to guide biopsy. Ultrasound has been reported to be abnormal in up to 100% of breast cancers occurring during pregnancy.[669] Biopsies for cytologic evaluation of a suspicious breast mass may be done with FNA of the breast and suspicious lymph nodes. However, the preferred technique is core needle biopsy. This provides tissue for histologic confirmation of invasive disease as well as adequate tissue for HR and HER2 analyses.

Staging assessment of the pregnant patient with breast cancer may be guided by clinical disease stage. The staging studies should be tailored to minimize fetal exposure to radiation. For clinically node-negative T1–T2 tumors, a chest x-ray (with shielding), liver function and renal function assessment, and a CBC with differential are appropriate. In patients who have clinically node-positive or T3 breast lesions, in addition to the aforementioned tests an ultrasound of the liver and consideration of a screening MRI of the thoracic and lumbar spine without contrast may be employed. The documentation of the presence of metastases may alter the treatment plan and influence the patient's decision regarding maintenance of the pregnancy. Assessment of the pregnancy should include a maternal fetal medicine consultation and review of antecedent maternal risks such as hypertension, diabetes, and complications with prior pregnancies. Documentation of fetal growth and development and fetal age by means of ultrasonographic assessment is appropriate. Estimation of the date of the delivery will help with systemic chemotherapy planning. In addition, maternal fetal medicine consultation should include counseling regarding maintaining or terminating pregnancy. Counseling of the pregnant patient with breast cancer should include a review of the treatment options, which include mastectomy or BCS as well as the use of systemic therapy. The most common surgical procedure has been modified radical mastectomy. However, BCS is possible if RT can be delayed to the postpartum period,[670] and breast-conserving therapy during pregnancy does not appear to have a negative impact on survival.[670,671] When surgery is performed at 25 weeks of gestation or later, obstetrical and prenatal specialists must be onsite and immediately available in the event of precipitous delivery of a viable fetus.

Although there are a limited number of isolated case reports and small retrospective studies evaluating use of SLNB in pregnant patients,[672,673] the sensitivity and specificity of the procedure have not been established in this setting. Thus, there are insufficient data on which to base recommendations for its use in pregnant patients. Decisions related to use of SLNB in pregnancy should be individualized. A review of the relative and absolute contraindications to sentinel node biopsy concluded that sentinel node biopsy should not be offered to pregnant patients <30 weeks gestation.[674] There are limited data with only case reports and estimations of fetal radiation dose regarding use of radioactive tracer (eg, technetium 99m sulfur colloid).[675-677] Isosulfan blue or methylene blue dye for sentinel node biopsy procedures is discouraged during pregnancy.

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The indications for systemic chemotherapy are the same in the pregnant patient as in the non-pregnant patient with breast cancer, although chemotherapy should not be administered at any point during the first trimester of pregnancy. The largest experience in pregnancy has been with anthracycline and alkylating agent chemotherapy.[678,679] Collected data of chemotherapy exposure in utero indicate that the first trimester has the greatest risk of fetal malformation.[680,681] Fetal malformation risks in the second and third trimester are approximately 1.3%, not different than that of fetuses not exposed to chemotherapy during pregnancy. If systemic therapy is initiated, fetal monitoring prior to each chemotherapy cycle is appropriate. Chemotherapy during pregnancy should not be given after week 35 of pregnancy or within 3 weeks of planned delivery in order to avoid the potential for hematologic complications during delivery. Data from a single-institution prospective study indicate that FAC chemotherapy (5-fluorouraci 500 mg/m^2 IV days 1 and 4, doxorubicin 50 mg/m^2 by IV infusion over 72 hours, and cyclophosphamide 500 mg/m^2 IV day 1) may be given with relative safety during the second and third trimesters of pregnancy.[679] As reported by Gwyn et al, the median gestational age at delivery was 38 weeks, more than 50% of the patients had a vaginal delivery, and there were no fetal deaths.[667] An update of this experience reported on 57 patients treated with FAC in the adjuvant or neoadjuvant setting. There were 57 live births. A survey of parents/guardians reported on the health of 40 children. There was one child with Down syndrome and two with congenital abnormalities (club foot, congenital bilateral ureteral reflux). The children are reported to be healthy and progressing well in school.[679,682] Ondansetron, lorazepam, and dexamethasone can be used as part of the pre-chemotherapy antiemetic regimen.

There are limited data on the use of taxanes during pregnancy.[683-686] If used, the NCCN Panel recommends weekly administration of paclitaxel after the first trimester if clinically indicated by disease status. There are only case reports of trastuzumab use during pregnancy.[687-694] The majority of these case reports indicated oligohydramnios or anhydramnios with administration of trastuzumab; fetal renal failure occurred in one case. If trastuzumab is otherwise indicated, it should be administered in the postpartum period; the Panel recommends against its use during pregnancy.

A single case report of first-trimester exposure to lapatinib during treatment for breast cancer reported an uncomplicated delivery of a healthy female neonate.[695]

Endocrine therapy and RT are contraindicated during pregnancy. Endocrine therapy and RT, if indicated, should thus not be initiated until the postpartum period.

Communication between the oncologist and maternal fetal medicine specialist is essential at every visit and for every treatment decision point for the patient.

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Inflammatory Breast Cancer

IBC is a rare, aggressive form of breast cancer estimated to account for 1% to 6% of breast cancer cases in the United States.[696,697] IBC is a clinical diagnosis that requires erythema and dermal edema (peau d'orange) of a third or more of the skin of the breast.

IBC is usually HR-negative and is more frequently HER2-positive than the usual ductal breast cancers. Studies on gene expression profiling of IBC have demonstrated that all the subtypes of IBC exist, but basal and HER2 overexpressed are more frequent.[698-701] According to the 7th edition of the AJCC Cancer Staging Manual, IBC is classified as stage IIIB, stage IIIC, or stage IV breast cancer, depending on the degree of nodal involvement and whether distant metastases are present. The primary tumor of IBC is classified as T4d by definition, even when no mass is specifically apparent in the breast. On radiographic imaging, findings of skin thickening and, in some cases, an underlying mass are observed. Despite use of the term "inflammatory," the characteristic clinical features of IBC are due to blockage of dermal lymphatics by tumor emboli. Although a biopsy is required to evaluate for the presence of cancer in breast tissue and the dermal lymphatics, a diagnosis of IBC is based on clinical findings, and dermal lymphatic involvement is neither required, nor sufficient by itself, to assign a diagnosis of IBC.[702,703] The differential diagnosis includes cellulitis of the breast and mastitis.

In the past, IBC has often been placed under the general heading of locally advanced breast cancer. There is a growing body of evidence that patients with IBC, when compared with patients with noninflammatory forms of locally advanced breast cancer, are more likely to have a less favorable prognosis[704-706] and to be younger at the time of disease presentation.[707]

The NCCN Panel acknowledges that studies focusing on genetic characterization of IBC are needed to more clearly define IBC as a disease entity and to optimize treatment.[708,709] Nevertheless, current evidence provides justification for a separate guideline for the workup and treatment of patients diagnosed with IBC.

StageT4d, N0–N3, M0

Workup

Patients with a clinical/pathologic diagnosis of IBC without distant metastasis (stage T4d, N0–N3, M0) should undergo a thorough staging evaluation by a multidisciplinary team.

Recommendations for workup include a complete history and physical examination involving a CBC and platelet count.

A pathology review and pre-chemotherapy determinations of tumor HR- and HER2- status should be performed. HER2 has a predictive role in determining which patients with IBC will benefit from HER2-targeted therapy. The NCCN Panel endorses the CAP protocol for pathology reporting (www.cap.org) and endorses the ASCO CAP recommendations for quality control performance of HER2 testing and interpretation of IHC and ISH results.[710]

Imaging studies help facilitate image-guided biopsy, delineate locoregional disease, and identify distant metastases. Evaluation of all patients suspected with IBC must include diagnostic bilateral mammogram, with the addition of ultrasound as necessary. A breast MRI scan is optional.

Evaluations for the presence of distant metastasis in the asymptomatic patient include LFTs, bone scan or sodium fluoride PET/CT (category 2B), and diagnostic CT imaging of the chest, abdomen, and pelvis (category 2B; category 2A for diagnostic CT imaging of the chest when pulmonary symptoms are present).

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FDG-PET/CT may be most helpful in situations where standard imaging results are equivocal or suspicious. However, there is limited evidence suggesting that PET/CT may be a useful adjunct to standard imaging of IBC due to the increased risk of regional lymph node involvement and distant spread of disease in this group of patients.[110,111,711,712] Nevertheless, equivocal or suspicious sites identified by FDG-PET/CT scanning or other imaging methods should be biopsied for confirmation of stage IV disease whenever possible. FDG-PET/CT is a category 2B recommendation. The consensus of the Panel is that FDG-PET/CT can be performed at the same time as diagnostic CT. If FDG-PET and diagnostic CT are performed and both clearly indicate bone metastases, bone scan or sodium fluoride PET/CT may not be needed.

Genetic counseling is recommended if the patient is considered to be at high risk for hereditary breast cancer as defined by the NCCN Guidelines for Genetic/Familial High-Risk Assessment: Breast, Ovarian and Pancreatic.

Treatment

The treatment of patients with IBC should involve a combined modality approach[696] comprising preoperative systemic therapy followed by surgery (mastectomy) and radiotherapy.

Preoperative Chemotherapy

There are no large randomized trials evaluating the optimal systemic treatment of IBC, since it is a rare disease. The systemic therapy recommendations are based on data from retrospective analyses, small prospective studies, and data from non-IBC, locally advanced breast cancer.

The benefit of preoperative systemic therapy followed by mastectomy over preoperative systemic therapy alone in patients with IBC was shown in a retrospective analysis in which lower local recurrence rates and longer disease-specific survival were reported for the combined modality approach.[713] Results from a large retrospective study of patients with IBC performed over a 20-year period at The University of Texas MD Anderson Cancer Center demonstrated that initial treatment with doxorubicin-based chemotherapy followed by local therapy (ie, RT or mastectomy, or both) and additional postoperative chemotherapy resulted in a 15-year DFS rate of 28%.[714]

A retrospective study demonstrated that the addition of a taxane to an anthracycline-based regimen improved PFS and OS in patients with ER-negative IBC.[715] A systematic review found evidence for an association between the intensity of preoperative therapy and the likelihood of a pCR.[716] A study of IBC patients, with cytologically confirmed ALN metastases, treated with anthracycline-based chemotherapy with or without a taxane indicated that more patients receiving the anthracycline-taxane combination achieved a pCR compared with those who received only anthracycline-based therapy. In addition, patients who had a pCR in the ALNs had superior OS and DFS compared with those with residual axillary disease.[717]

The NCCN Panel recommends preoperative systemic therapy with an anthracycline-based regimen with or without taxanes for the *initial* treatment of patients with IBC. The Panel also recommends completing the planned chemotherapy prior to mastectomy. If the chemotherapy was not completed preoperatively, it should be completed postoperatively.

Targeted Therapy

All patients with HR-positive IBC are recommended to receive endocrine therapy sequentially after completing the planned preoperative systemic therapy.

HER2-positive IBC is associated with a poor prognosis.[700,718] For patients with HER2-positive disease, the addition of trastuzumab to primary

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systemic chemotherapy is associated with better response rates.[414,719-722] A prospective study that randomized patients with locally advanced breast cancers, including those with IBC, to neoadjuvant anthracycline-based chemotherapy with or without trastuzumab for 1 year demonstrated that the addition of trastuzumab significantly improved the response rate and event-free survival.[414] The NCCN Panel recommends inclusion of trastuzumab in the chemotherapy regimen and is recommended for patients with HER2-positive disease. There are no available data to indicate the optimal duration of trastuzumab, specifically among patients with IBC. However, based on the available data,[414] the Panel recommends continuing trastuzumab therapy for up to 1 year.

Results of small phase II trials indicate that other HER2-targeting agents such as lapatinib and pertuzumab have a clinical benefit in IBC.[723,724] The results of the NEOSPHERE trial that included patients with IBC showed increased pCR with the pertuzumab-containing regimens. Therefore, the NCCN Panel has included in a footnote that a pertuzumab-containing regimen may be administered preoperatively in patients with HER2-positive IBC.[724]

Determination of response to neoadjuvant chemotherapy in IBC should include a combination of physical examination and radiologic assessment.

Surgery

Patients with a clinical/pathologic diagnosis of IBC should always be treated with chemotherapy before surgery. It has been known for many years that surgical treatment as *primary* treatment of patients with IBC is associated with poor outcomes.[725] SLN dissection is not a reliable method of assessing ALNs among patients with IBC.[726] Use of BCS in patients with IBC has been associated with poor cosmesis, and limited data suggest that rates of local recurrence may be higher when compared with mastectomy. Breast-conserving therapy is not recommended for patients with IBC.

Mastectomy with level I/II ALND is the recommended surgical procedure recommended by the NCCN Panel for patients whose tumor responds to neoadjuvant chemotherapy. The NCCN Panel has listed delayed breast reconstruction as an option that can be recommended to patients with IBC who have undergone a modified radical mastectomy. Reconstruction of the breasts soon after mastectomy may compromise the post-mastectomy RT outcomes.[727]

For patients with IBC who *do not* respond to preoperative systemic therapy, mastectomy is not generally recommended. Additional systemic chemotherapy and/or preoperative radiation should be considered for these patients. Patients with tumors responding to this secondary therapy should undergo mastectomy and subsequent treatment as described above.

Radiation

After mastectomy, RT is recommended after the completion of the planned chemotherapy.

The probability of locoregional lymph node involvement is high for patients with IBC. To reduce the risk of local recurrence, the Panel recommends RT to the chest wall and the supraclavicular region. If the internal mammary lymph node(s) is clinically or pathologically involved, RT should include the internal mammary nodes. If the internal mammary nodes are not clinically or pathologically involved, then including the internal mammary nodes in the RT field is at the discretion of the treating radiation oncologist (category 3). For HER2-positive disease, trastuzumab may be administered concomitantly with RT.

Stage IV or Recurrent IBC

Patients with stage IV or recurrent IBC should be treated according to the guidelines for recurrence/stage IV breast cancer.

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Axillary Breast Cancer

Occult breast cancer presenting with axillary metastases is an unusual presentation that can be a diagnostic and therapeutic challenge. Evidence to support recommendations for patients presenting with axillary breast cancer comes from a limited number of retrospective studies involving small numbers of patients[728-730] (see also references therein). Although treatment of patients with axillary metastases from an unknown primary tumor has typically involved mastectomy and axillary nodal dissection, some of these patients have also been successfully treated with axillary nodal dissection followed by RT.[729,730]

Patients with a suspected occult primary breast cancer will typically present to the oncologist after undergoing an initial biopsy: core needle biopsy (preferred), and/or FNA. Accurate pathologic assessment of the biopsied material is most important. Therefore, the pathologist must be consulted to determine whether the available biopsy material is adequate, or if additional biopsy material is necessary (eg, core needle, incisional, or excisional biopsy) to provide an accurate and complete diagnosis.

Workup for Possible Primary Breast Cancer

MRI of the breast can facilitate the identification of occult breast cancer, and can help select those patients most likely to benefit from mastectomy.[731] For example, in a study of 40 patients with biopsy-proven breast cancer in the axilla, and a negative or indeterminate mammogram, MRI identified the primary breast lesion in 70% of the patients.[729] In addition, of the 7 patients with a negative MRI who subsequently underwent ALND and RT to the whole breast, no evidence of local recurrence was evident at a median follow-up of 19 months.

The NCCN Guidelines for Occult Primary provide guidance on the diagnosis and initial workup of patients with a suspicious axillary mass without any signs of a primary tumor. A small subset of these patients may have a primary cancer in the axillary tail of the breast. Adenocarcinoma with positive axillary nodes and mediastinal nodes is highly suggestive of a breast primary. Adenocarcinoma in the supraclavicular nodes, chest, peritoneum, retroperitoneum, liver, bone, or brain could also indicate primary breast cancer in patients. The guidelines suggest the use of a mammogram and breast ultrasound for such patients.

Testing for immunohistochemical markers including ER/PR and HER2 is recommended. Elevated ER/PR levels provide strong evidence for a breast cancer diagnosis.[732] MRI of the breast should be considered for a patient with histopathologic evidence of breast cancer when mammography and ultrasound are not adequate to assess the extent of the disease. MRI may be especially helpful in patients with dense breast tissue, positive axillary nodes, and suspected occult primary breast tumor or to evaluate the chest wall.[733] Breast MRI has been shown to be useful in identifying the primary site in patients with occult primary breast cancer and may also facilitate breast conservation in selected patients by allowing for lumpectomy instead of mastectomy.[729,734] In one report, the primary site was identified using MRI in about half of the patients presenting with axillary metastases, irrespective of the breast density.[735]

The NCCN Guidelines for Occult Primary also provide recommendations for additional workup, including chest and abdominal CT to evaluate for evidence of distant metastases for patients diagnosed with adenocarcinoma (or carcinoma not otherwise specified) of the axillary nodes without evidence of a primary breast lesion. In particular, breast MRI and ultrasound are recommended. Axillary ultrasound should also be performed.

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Treatment for Possible Primary Breast Cancer

Patients with MRI-positive breast disease should undergo evaluation with ultrasound or MRI-guided biopsy and receive treatment according to the clinical stage of the breast cancer. Treatment recommendations for those with MRI-negative disease are based on nodal status. For patients with T0, N1, M0 disease, options include mastectomy plus axillary nodal dissection or axillary nodal dissection plus whole breast irradiation with or without nodal irradiation. Systemic chemotherapy, endocrine therapy, or trastuzumab is given according to the recommendations for stage II or III disease. Neoadjuvant chemotherapy, trastuzumab, and endocrine therapy should be considered for patients with T0, N2–N3, M0 disease followed by axillary nodal dissection and mastectomy as for patients with locally advanced disease.

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Summary

The therapeutic options for patients with noninvasive or invasive breast cancer are complex and varied. In many situations, the patient and physician have the responsibility to jointly explore and select the most appropriate option from among the available alternatives. With few exceptions, the evaluation, treatment, and follow-up recommendations in these guidelines are based on the results of past and present clinical trials. However, there is not a single clinical situation in which the treatment of breast cancer has been optimized with respect to either maximizing cure or minimizing toxicity and disfigurement. Therefore, patient/physician participation in prospective clinical trials allows patients to not only receive state-of-the-art cancer treatment but also to contribute to improving the treatment outcomes.

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