

## Breast Cancer Treatments<sup>1,2</sup>

Advances of breast cancer treatment over time have led to a wide variety of prevention and treatment options available to optimize patient outcomes. The following information serves to supplement your current knowledge of the available medications used for breast cancer. Here, you are provided with the drug name, class, and important monitoring parameters, side effects and notes for each respective medication. The brief overview provided here should be used in addition to knowledge gathered from evidence-based data to determine the best clinical approach.

In all patient cases, medications should be avoided and are contraindicated if hypersensitivity reactions are observed or if the patient has a history of hypersensitivity reactions to any component

Drug Type	Drug Name	Monitoring Parameters	Side Effects (most common/most reported)	Notes
<b>Kinase inhibitor</b>	Abemaciclib	Diarrhea, CBC prior to start of abemaciclib then q2 weeks for the first 2 months, monthly for the next 2 months, then as clinically indicated, LFTs q2 weeks for the first 2 months, monthly for the next 2 months, then as clinically indicated, monitor for signs and symptoms of VTE	Diarrhea, neutropenia, fatigue, nausea, abdominal pain, infections, vomiting, constipation, anemia, leukopenia, thrombocytopenia, decreased appetite, headache	Antidiarrheal may be warranted (i.e. loperamide), counsel patients on monitoring diarrhea  Avoid grapefruit juice  May be taken with or without food, should be taken at the same time each day
<b>Anti-HER2 monoclonal antibody</b>	Ado-trastuzumab emtansine	Platelet count, HER2 status, infusion site, signs and symptoms of bleeding, neuropathy and/or pulmonary toxicity, thrombocytopenia (esp in patients of Asian ancestry), serum transaminases, LFTs	Fatigue, HA, peripheral neuropathy, rash, decreased potassium, decreased platelet count, decreased hemoglobin, decreased neutrophils, hemorrhage, thrombocytopenia, anemia, NVDC, xerostomia, stomatitis, increased AST/ALT/serum transaminases/bilirubin, pain, cough, dyspnea, fever	Not interchangeable with trastuzumab  HER2 expression must be determined  Check label prior to administration
<b>Aromatase inhibitor</b>	Anastrozole	Bone mineral density, total cholesterol, LDL, mammograms and clinical breast exam	Vasodilation, ischemic heart disease, angina pectoris, edema, fatigue, mood disorder, headache, pain, depression, skin rash, hot flash, GI distress, NV, weakness, arthritis, arthralgia, back pain, ostealgia, osteoporosis, pharyngitis, dyspnea, increased cough	First line for locally advanced or metastatic BC hormone receptor + or unknown in postmenopausal women
<b>Monoclonal Ab, Vascular endothelial growth factor (VEGF) inhibitor</b>	Bevacizumab	Monitor during infusion for signs and symptoms of infusion reaction, CBC with diff, signs and symptoms of GI perforation, fistula or abscess, SS of bleeding, BP (q2-3 weeks) and upon discontinuation, proteinuria/nephrotic syndrome, SS of thromboembolism	URTI, dyspnea, increased SCr, HTN, venous thromboembolism, edema, hypotension, fatigue, taste disorder, headache, xeroderma, exfoliative dermatitis, NVDC, decreased appetite, proteinuria, UTI, pelvic pain, hemorrhage, leukopenia, neutropenia, lymphocytopenia, infection, myalgia, back pain	Must obtain Patient Authorization and Notice of Release of Information forms signed and dated to enroll in Avastin Access Solutions for access to reimbursement program

				Discuss ovarian failure especially in women of child bearing age
<b>Antimetabolite pyrimidine analog</b>	Capecitabine	Renal function, CBC with diff, hepatic function, INR and PT (if taking warfarin concurrently), pregnancy status, hand-foot syndrome, SJS and TENs, stomatitis and cardiotoxicity	Edema, fatigue, paresthesia, palmar-plantar erythrodysesthesia, dermatitis, NVDC, pain, decreased appetite, stomatitis, lymphocytopenia, anemia, neutropenia, thrombocytopenia, hyperbilirubinemia, weakness, eye irritation, fever	Usually doses 12 hours apart, should be taken with full glass of water within 30 minutes of eating a meal  Prodrug of fluorouracil
<b>Alkylating agent, platinum analog</b>	carboplatin	CBC with diff and platelet count, serum electrolytes, SCr, BUN, CrCl, liver function tests	Pain, hyponatremia, hypomagnesemia, hypokalemia, hypocalcemia, NV, abdominal pain, bone marrow depression, anemia, neutropenia, thrombocytopenia, increased serum alkaline phosphatase, increased serum AST, weakness, decreased CrCl, increased BUN	Administer 75% of dose if platelets <50,000 cells/mm <sup>3</sup> or ANC <500 cells/mm <sup>3</sup>  moderate emetic potential (adult), antiemetics recommended  avoid IV administration sets that contain aluminum (can react with carboplatin)
<b>Nitrogen mustard, alkylating agent</b>	Cyclophosphamide	CBC with diff and platelets, BUN, urine analysis, serum electrolytes, SCr, signs/symptoms of hemorrhagic cystitis or signs of toxicity, pulmonary/hepatotoxicity	Alopecia, amenorrhea, anorexia, NVD, increased gonadotropin secretion, anemia, azoospermia, hemorrhagic cystitis, bone marrow depression, febrile neutropenia, thrombocytopenia	Moderate to high emetic potential, antiemetics are recommended
<b>Colony stimulating factor, erythropoiesis-stimulating agent (ESA), hematopoietic agent</b>	Darbepoetin alfa	Prior to initiation of treatment peripheral blood smear should be assessed for folate, iron or Vit B12 deficiency, reticulocyte count, renal function and occult blood loss, iron levels and total iron binding capacity, hemoglobin (qWeekly until maintenance dose achieved and after any dose changes until hemoglobin is stabilized, then monitoring of Hgb can occur less frequently, CKD patients require additional monitoring), transferrin saturation and ferritin before and during surgery, serum chemistry, BP, fluid balance, seizure activity	Hypertension, hypotension, peripheral edema, edema, abdominal pain, dyspnea, cough	Used for chemo-induced anemia (NCCN Guidelines)  REMS Program: Providers and hospitals must enroll in ESA APPRISE Oncology Program click <a href="#">here</a> for more info  Packaging contains latex and polysorbate 80  Supplemental iron may be needed for patient with low iron stores
<b>Anthracycline, topoisomerase II inhibitor</b>	Daunorubicin	CBC with diff and platelets, liver function, ECG, left ventricular ejection function, renal function, signs and symptoms of extravasation, uric acid levels	Cardiac/ECG abnormalities, alopecia, NV, stomatitis, red urine discoloration, bone marrow depression	Associated with moderate emetic potential, antiemetics are recommended  Due to myocardial toxicity max cumulative lifetime dose <550mg/m <sup>2</sup>

				Extravasation antidote: cold compress, dexrazoxane, DMSO
<b>Bone modifying monoclonal antibody</b>	Denosumab	SCr, calcium, phosphorous, magnesium, signs and symptoms of hyper/hypocalcemia, infection, dental exam (if risk for ONJ)	Hypertension, HA, edema, dermatitis, rash, hypophosphatemia, hypocalcemia, NCD, decreased appetite, anemia, influenza. Arthralgia, dyspnea, cough	May be administered with calcium and vitamin D to prevent or treat hypocalcemia  Subcutaneous administration only  REMS: Communication Plan plus medication guide available <a href="#">here</a>
<b>Antimicrotubular taxane derivative</b>	Docetaxel	CBC with diff, LFTs, renal function, GI toxicity, cutaneous reactions, visual impairments, fluid retention, epiphora, canalicular stenosis, neutropenia, infection, anemia	CNS toxicity, alopecia, skin reactions, nail disease, fluid retention, stomatitis, NVD, neutropenia, leukopenia, anemia, thrombocytopenia, febrile neutropenia, increased serum transaminases, infection, weakness, fever	Premedicate with corticosteroids 3 days prior to treatment  Some dosage forms may contain polysorbate 80
<b>Anthracycline, Topoisomerase II Inhibitor</b>	Doxorubicin	CBC with diff and platelet count, liver function tests, serum uric acid, calcium, potassium, phosphate, creatinine, hydration, cardiac function, infusion site	Acute and delayed cardiotoxicity, malaise, alopecia, discoloration of sweat, NVD, mucositis, urine discoloration, discoloration of tears, infertility (possibly temporary)	Premedication with antiemetics due to moderate to high emetic potential is recommended  Extravasation management: dry cold compresses, dexrazoxane or DMSO
<b>Anthracycline, topoisomerase II inhibitor</b>	Doxorubicin	CBC with diff and platelets, liver function, serum uric acid, calcium, potassium, phosphate, creatinine, hydration status, cardiac function, ECG, left ventricular ejection fraction, infusion site	Acute/delayed cardiotoxicity, malaise, alopecia, discoloration of sweat, pruritus, photosensitivity, skin rash, urticaria, abdominal pain, discoloration of saliva, GI ulcer, NVD, leukopenia, neutropenia, anemia, thrombocytopenia, post injection flare, weakness, discoloration of tears	Moderate to high emetic potential, antiemetics recommended  Myocardial toxicity increases as total cumulative lifetime dose reaches 300-500 mg/m <sup>2</sup> Extravasation antidote: cold compress, dexrazoxane, DMSO
<b>Anthracycline, topoisomerase II inhibitor</b>	Epirubicin	CBC with diff, liver function tests, serum creatinine, electrolytes, ECG, LVEF	Alopecia, lethargy, skin changes, NVD, anorexia, amenorrhea, hot flashes, esophagitis, enterocolitis, abdominal pain, menopause, neutropenia, leukopenia, thrombocytopenia, febrile neutropenia, acute myelocytic leukemia, ascites, hepatomegaly, increased serum transaminases, conjunctivitis, pulmonary edema, dyspnea	Moderate to high emetic potential, antiemetics recommended  CEF-120 regimen should receive antibiotic therapy  Recommended lifetime max dose = 900mg/m <sup>2</sup>

				Extravasation antedote: dry cold compress, dexrazoxane, DMSO
<b>Colony stimulating factor, erythropoiesis-stimulating agent (ESA)</b>	Epoetin alfa	Prior to treatment: assessment of iron, folate or B <sub>12</sub> , reticulocyte count, renal function test, occult blood loss During treatment: baseline and periodic iron, total iron binding capacity, transferrin saturation, ferritin levels, monitor for HTN and thrombotic events, edema and anemia.	Hypertension, HA, pruritus, skin rash, NV, cough, fever, arthralgia	Evaluate iron status prior and during treatment  REMS: healthcare providers and hospitals must enroll and comply with the ESA APPRISE Oncology Program  Increased risk of MI/stroke/thromboembolism and mortality when goal is to raise hemoglobin >11  Depending on dosage form, may include aluminum, benzoyl alcohol and derivatives, or polysorbate 80
<b>Colony stimulating factor, erythropoiesis-stimulating agent (ESA)</b>	Epoetin alfa	Transferrin saturation, serum ferritin, assess for iron, folate or vitamin B <sub>12</sub> deficiency, prior to administration, hemoglobin, reticulocyte count, renal status, occult blood loss, seizures	Hypertension, pruritus, rash, NV, injection site reaction, arthralgia, cough, fever	Iron should be evaluated prior to and during treatment  Some dosage forms contain benzyl alcohol, polysorbate 80 or albumin  REMS: healthcare providers and hospitals must enroll in ESA APPRISE Oncology Program  Avoid in patient with history of uncontrolled HTN, seizure, stroke, or MI
<b>mTOR kinase inhibitor, immunosuppressant agent</b>	Everolimus	CBC with diff (baseline and periodic), liver function, SCr, urinary protein, BUN (baseline and periodic), fasting serum glucose and lipid profile (baseline and periodic), SS of infection, noninfectious pneumonitis or malignancy	Edema, malaise, insomnia, skin rash, increased cholesterol, decreased bicarb, hyperglycemia, increased triglycerides, hypophosphatemia, decreased serum calcium, hypokalemia, amenorrhea or irregular menses, stomatitis, NVDC, UTI, neutropenia, leukopenia, liver enzyme abnormalities, increased SCr, infection, fever	Hormone receptor positive, HER2-negative advanced breast cancer  Advise women of child-bearing age to protect against pregnancy during and 8 weeks after treatment discontinuation
<b>Aromatase inhibitor</b>	Exemestane	25-hydroxy vitamin D levels, bone mineral density	Increased serum alkaline phosphatase, arthralgia, dyspnea, HTN, hot flash,	Administer after a meal

			nausea, edema, ischemic heart disease, chest pain, fatigue, insomnia, pain, HA, depression, dizziness, anxiety	
<b>Colony stimulating factor (CSF)</b>	Filgrastim	CBC with diff and platelets (baseline and periodically)	Chest pain, fatigue, dizziness, pain, nausea, thrombocytopenia, splenomegaly, petechia, increased serum alkaline phosphatase, ostealgia, back pain, epistaxis, cough, dyspnea, fever	Some dosage forms contain latex, polysorbate 80  Avoid administration within 24 hours before or after chemotherapy, or while undergoing radiation
<b>Antimetabolite pyrimidine analog</b>	Fluorouracil	CBC with diff and platelets, renal function, LFTs, INR, prothrombin time, signs/symptoms of Hand Foot Syndrome, CNS toxicity, cardiotoxicity, stomatitis, diarrhea, hyperammonemic encephalopathy	Angina pectoris, cardiac arrhythmia/failure, ischemic heart disease, MI, vein pigmentation, confusion, disorientation, NVD, GI ulcer, leukopenia, pancytopenia, thrombocytopenia, lacrimation, visual disturbance, epistaxis, SJS	Significant interaction with warfarin  Importance of hydration should be stressed  Antidote: uridine triacetate
<b>Androgen</b>	Fluoxymesterone	Periodic liver function tests, lipid panel, hemoglobin, hematocrit, hyperviscosity, sleep patterns, urine, calcium, signs of virilization, glucose	Edema, anxiety, depression, HA, paresthesia, acne, androgenic alopecia, change in libido, electrolyte disturbances, virilization, cholestatic jaundice, abnormal hepatic function tests	For female administration, administer in divided doses  C-III
<b>Estrogen receptor antagonist</b>	Fulvestrant	Liver function tests, pregnancy test (7 days prior to initiation in females of child bearing age), signs/symptoms of bleeding	Fatigue, headache, NDC, stomatitis, anemia, increase liver enzymes, infection, injection site pain	Hormone receptor positive, HER-2 negative  Some dosage forms may contain benzyl alcohol and derivatives
<b>Antimetabolite, pyrimidine analog</b>	Gemcitabine	CBC with diff and platelets, hepatic and renal function, electrolytes, pulmonary function, signs and symptoms of capillary leak syndrome and posterior encephalopathy syndrome	Peripheral edema, drowsiness, alopecia, rash, proteinuria, hematuria, NVD, stomatitis, anemia, neutropenia, thrombocytopenia, hemorrhage, increased ALT/AST/serum alkaline phosphatase/bilirubin/BUN, infection, dyspnea, flu-like symptoms, fever	Prolonging infusion duration by 60 minutes or more and/or administration more frequently than once weekly may increase toxicity
<b>Gonadotropin releasing hormone agonist</b>	Goserelin	Blood glucose, HbA <sub>1c</sub> , BMD, calcium, cholesterol/lipids, signs and symptoms of abdominal hemorrhage	Vasodilatation, edema, HA, emotional lability, depression, acne, seborrhea, hot flash, increased libido, abdominal pain, N, vaginitis, breast atrophy, pelvic symptoms, tumor flare, infection, decreased BMD, weakness	
<b>Antimicrotubular, epothilone B analog</b>	Ixabepilone	CBC with diff, hepatic function, signs/symptoms of neuropathy, evaluate for contraindications (i.e. CVD), GI upset, myelosuppression, peripheral neuropathy	Peripheral neuropathy, HA, alopecia, NVDC, anorexia, stomatitis, weakness, arthralgia, myalgia, musculoskeletal pain	Premedicate with H <sub>1</sub> -antagonist and H <sub>2</sub> -antagonist about 1 hour prior to infusion. If patient has history of hypersensitivity, may need to premedicate with corticosteroids.

				For dose calculations, max BSA = 2.2m <sup>2</sup>
<b>Anti-HER2, EGFR inhibitor, tyrosine kinase inhibitor</b>	Lapatinib	LVEF, CBC with diff, LFTs, electrolytes, fluid retention, ECG activity (assess for QT <sub>c</sub> prolongation), symptoms of ILD or pneumonitis, diarrhea and skin toxicity	Fatigue, HA, palmar-plantar erythrodysesthesia, alopecia, xeroderma, pruritus, nail disease, NVD, mucositis, pain, stomatitis, dyspepsia, decreased hemoglobin/neutrophils/platelet count, increased AST/ALT/serum bilirubin, limb pain, weakness, dyspnea, epistaxis, insomnia	Used for HER2(+), hormone receptor positive in postmenopausal women  Administer on empty stomach (1 hour before or after meal)  Typically reserved for use in disease progression despite use of trastuzumab  Available through specialty pharmacies only, click <a href="#">here</a> for more information
<b>Aromatase inhibitor</b>	Letrozole	CBC, thyroid function, serum electrolytes, cholesterol, transaminases, creatinine, BP, bone density	Edema, HA, dizziness/fatigue, diaphoresis, night sweats, weight gain, hypercholesteremia, hot flash, NC, weakness, arthralgia, ostealgia, arthritis, back pain, decreased bone mineral density, osteoporosis, bone fracture, dyspnea, cough	For use in postmenopausal women only - Contraindicated in women who are, or may become pregnant  May increase effects/levels of methadone
<b>Modulating agent, antidote, water soluble vitamin</b>	Leucovorin	CBC with diff and platelets, liver function, electrolytes	GI toxicity (increased if used with leucovorin), erythema, pruritus, rash, urticaria, thrombocytopenia, wheezing	NOT for intrathecal administration  All doses >25mg should not be administered orally  Some dosage forms contain benzyl alcohol  Due to calcium content, avoid administrations at rate >160 mg/minute
<b>Gonadotropin releasing hormone agonist</b>	Leuprolide	BMD, GnRH testing (blood LH and FSH), blood glucose, CVD risk factors	Tumor flare, edema, HA, pain, depression, insomnia, fatigue, dizziness, allergic skin reaction, hot flash, weight loss, hyperlipidemia, decreased libido, NV, GI disease, change in bowel habits, vaginitis, burning sensation at sight of administration, weakness, flu-like symptoms	Some dosage forms contain benzyl alcohol or polysorbate 80  Depot formulations have different release properties and are not interchangeable with other dosage forms
<b>Progestin Hormone</b>	Megesterol	Thromboembolic events, BP, weight serum glucose, CNS changes, rash, changes in menses, GI upset, jaundice, adequate hydration	Hypertension, chest pain, edema, cardiac abnormalities, confusion, HA, insomnia, paresthesia, mood changes, rash, diaphoresis, vaginal bleeding,	Some dosage forms contain benzyl alcohol

			hyperglycemia, decreased libido, hot flash, NVDC, flatulence, xerostomia, UTI, hepatomegaly, leukopenia, tumor flare, weakness, cough, dyspnea, fever	
<b>Antifolate</b>	Methotrexate	CBC with diff and platelets, SCr, BUN, LFTs, methotrexate levels and urine pH (with high dose), fluid and electrolyte status, pulmonary function tests, renal/liver function	Cardiovascular abnormalities, dizziness, fatigue, alopecia, psoriasis, skin photosensitivity, rash, skin necrosis, SJS, decreased libido, decreased serum albumin, hyperglycemia, NVD, GI toxicities, azotemia, hematologic and oncologic abnormalities, increased liver enzymes, blurred vision, tinnitus	Some dosage forms contain benzyl alcohol  Use preservative free formulations for intrathecal or high-dose methotrexate  Ensure proper patient education
<b>Antineoplastic Antibiotic</b>	Mitomycin	CBC with diff, SCr, pulmonary function tests, signs and symptoms of HUS (see notes)	Anorexia, NV, bone marrow depression, HUS, thrombotic thrombocytopenia, fever	Black box warning: bone marrow suppression, hemolytic-uremic syndrome (HUS)
<b>Anthracedione, topoisomerase II inhibitor</b>	Mitoxantrone	CBC with diff, serum uric acid, liver function tests, cardiac function, GI upset, glucose levels, infection	Edema, cardiac disease, arrhythmia, ECG changes, pain, fatigue, HA, alopecia, nail bed changes, menstrual disease, hyperglycemia, weight gain or loss, increased gamma-glutamyl transferase, NVDC, stomatitis, GI hemorrhage, abdominal pain, urine abnormality, neutropenia, leukopenia, lymphocytopenia, anemia, decreased hemoglobin, thrombocytopenia, febrile neutropenia, increased serum alkaline phosphatase and transaminases, infection, weakness, increased BUN and SCr, fever	<u>Not</u> for IM or IA administration
<b>Antimicrotubular, Taxane</b>	Paclitaxel	CBC with diff and platelet count, liver function, kidney function, vital signs (especially during the first hour of infusion), continuous cardiac monitoring in patients with conduction abnormalities	ECG abnormalities, flushing, edema, hypotension, peripheral neuropathy, alopecia, skin rash, NVD, hematologic abnormalities, increased serum AST and alkaline phosphatase, hypersensitivity, injection site pain, increased SCr, weakness and arthralgia	Recommended premedication treatment with dexamethasone, diphenhydramine, and cimetidine, famotidine, or ranitidine  Extravasation management: hyaluronidase
<b>Cyclin-dependent kinase inhibitor</b>	Palbociclib	CBC with diff prior to initiation, q2 weeks for the first 2 cycles, then as clinically relevant, signs/symptoms of infection and pulmonary embolism	Fatigue, HA, peripheral neuropathy, alopecia, rash, NVDC, stomatitis, decreased appetite, neutropenia, decreased absolute lymphocyte count, anemia, leukopenia, thrombocytopenia, infection, weakness, URTO, epistaxis, fever	If dose is vomited/skipped/missed, avoid additional dosing and resume regular dosing schedule on the next scheduled dose day  Administer with food

				Available through specialty pharmacies, click <a href="#">here</a> for more information
<b>Bisphosphonate derivative</b>	Pamidronate	SCr prior to each treatment, calcium, phosphate, magnesium and potassium, CBC with diff, hypocalcemia (for at least 2 weeks after initiation of therapy), dental exam and monitoring for patients at increased risk of osteonecrosis, urine albumin in certain patients	Fatigue, insomnia, HA, hypophosphatemia, hypokalemia, hypomagnesemia, NV, anorexia, dyspepsia, UTI, anemia, metastases, granulocytopenia, infusion site reaction, myalgia, ONJ, increased SCr, fever, dyspnea, cough, URTI, sinusitis, pleural effusion	Single doses should not > 90mg  Importance of oral hygiene should be reinforced
<b>Anti- HER2 monoclonal antibody</b>	Pertuzumab	HER2 expression (via IHC or FISH amplification), pregnancy status, LVEF at baseline and during treatment, infusion reactions, edema, increasing shortness of breath, CBC with diff, metabolic panel	Fatigue, HA, decreased LVEF, insomnia, dizziness, rash, pruritus, palmar plantar erythrodysesthesia, xerostomia, NVDC, decreased appetite, mucositis, stomatitis, febrile neutropenia, abdominal pain, anemia, leukopenia, weakness, myalgia, arthralgia, URTI, epistaxis, infusion reactions	Establish HER2 status prior to initiation
<b>Selective estrogen receptor modulator (SERM)</b>	Raloxifene	Lipid profile, mammogram and breast exam, bone mineral density, monitor for DVT, PE, chest pain, migraine, and rash.	Peripheral edema, hot flash, infection, arthralgia, leg cramps, muscle spasm, flu like symptoms	Contraindicated in patients with current or history of venous thromboembolic disorders, avoid in pregnant and breast feeding women  Advise patients to move periodically during prolonged travel and the dangers against prolonged immobilization
<b>Cyclin-dependent kinase inhibitor</b>	Ribociclib	CBC with diff, pregnancy status, electrolytes, cardiac function, LFTs	Peripheral edema, fatigue, HA, insomnia, alopecia, rash, pruritus, decreased serum potassium, UTI, decreased appetite, NVDC, neutropenia, leukopenia, decreased platelet count, abnormal phosphorous levels, lymphocytopenia, increased AST/ALT/serum bilirubin/SCr, dyspnea, fever	Use for HR(+), HER2(-) status in postmenopausal women  Administer at the same time each day, preferably in the morning  Avoid pomegranates, pomegranate juice and grapefruit juice
<b>Selective estrogen receptor modulator (SERM)</b>	Tamoxifen	CBC with diff and platelets, serum calcium, LFTs, triglycerides, cholesterol, INR/PT (if patient is taking Vit K analog concurrently), abnormal vaginal bleeding, breast and gynecological exams, mammogram, signs and symptoms of DVT/PE, ophthalmic exam, BMD, mood changes	Vasodilation, flushing, hypertension, edema, mood changes, pain, depression, skin changes, hot flash, menstrual disease, weight loss, amenorrhea, NV, vaginal discharge, vaginal hemorrhage, lymphedema, weakness, arthralgia, pharyngitis	Contraindicated with history of DVT/PE  Avoid use with warfarin  Black box warning: endometrial cancer

<b>Alkylating agent</b>	Thiotepa	CBC with diff and platelets, renal and liver function, uric acid, urinalysis, hydration	Chills, dizziness, fatigue, HA, alopecia, contact dermatitis, rash, urticaria, abdominal pain, anorexia, NV, dysuria, hematuria, urinary retention, anemia, hemorrhage, leukopenia, thrombocytopenia, infection, weakness blurred vision, wheezing, fever	Associated with moderate emetic potential, antiemetics are recommended  Thiotepa is dialyzable
<b>Selective estrogen receptor modulator (SERM)</b>	Toremifene	CBC with diff, electrolytes, hepatic function, ECG, hypercalcemia, monitor for thromboembolism, MI, edema, endometriosis, NV or vision changes	Diaphoresis, hot flash, nausea, vaginal discharge, increased serum alkaline phosphatase, increased serum AST	Contraindicated in patients with long QT syndrome, uncorrected hypokalemia or hypomagnesemia
<b>Anti-HER2 monoclonal antibody</b>	Trastuzumab	HER2 overexpression and gene amplification determined by IHC or FISH, pregnancy test, vital signs (during infusion), signs/symptoms of cardiac dysfunction, LVEF, infusion reactions, pulmonary toxicity	Decreased LVEF, pain, HA, insomnia, dizziness, NVD, abdominal pain, anorexia, infection, weakness, back pain, cough, dyspnea, rhinitis, pharyngitis, fever	Conventional trastuzumab is not interchangeable with ado-trastuzumab emtansine – check label prior to administration  Treatment with APAP, diphenhydramine and/or meperidine are usually effective infusion related event management options
<b>Gonadotropic releasing hormone agonist</b>	Triptorelin	Bone density, signs and symptoms of cardiovascular disease, electrolytes, spinal cord compression, diabetes	Hot flash, increased serum glucose, increased testosterone, decreased hemoglobin and RBC count, increased alkaline phosphatase/ALT/AST, pain, increased BUN	
<b>Antimicrotubular vinca alkaloid</b>	Vincristine	Electrolytes, hepatic function, CBC with diff, serum uric acid, neurologic activity, signs and symptoms of constipation/ileus and neuropathy	Edema, hepatic venoocclusive disease, hyper/hypotension, IHD, MI, abnormal gait, decreased deep tendon reflex, neurotoxicity, pain, paralysis, paresthesia, seizure, vertigo, alopecia, rash, weight loss, uric acid neuropathy, anorexia, NVDC, intestinal necrosis, dysuria, leukopenia, thrombocytopenia, cortical blindness, deafness, polyuria, bronchospasm, dyspnea, fever	May premedicate with antiemetic  <u>Fatal</u> if given intrathecally  Antidote: hyaluronidase and moderate heat
<b>Bisphosphonate derivative</b>	Zoledronic acid	Dental exam prior to administration, SCr, electrolytes, phosphate, magnesium, hemoglobin, hematocrit, calcium, oral hygiene	Edema, hypotension, fatigue, HA, dizziness, insomnia, confusion, agitation, rigors, hypoesthesia, depression, alopecia, dermatitis, dehydration, hypophosphatemia, hypokalemia, hypomagnesemia, NVDC, weight loss, decreased appetite, UTI, anemia, arthralgia, ostealgia, dyspnea, fever, cough	APAP prior to administration may reduce symptoms of acute phase reactions  Use caution in patients with asthma sensitive asthma  FDA approved patient medication guide available <a href="#">here</a>

Resources and Additional Reading:

1. NCCN Clinical Practice Guidelines in Oncology Breast Cancer. Version 1.2018. March 20, 2018. Available at: [https://www.nccn.org/professionals/physician\\_gls/pdf/breast.pdf](https://www.nccn.org/professionals/physician_gls/pdf/breast.pdf)
2. Clinical Pharmacology Drug Monographs. Available at: [http://www.clinicalpharmacology-ip.com/help/clinical\\_content/clinical\\_pharmacology\\_drug\\_monographs.htm](http://www.clinicalpharmacology-ip.com/help/clinical_content/clinical_pharmacology_drug_monographs.htm)
3. Cardoso F, Costa A, Senkus E, et al. 3<sup>rd</sup> ESO-ESMO International Consensus Guidelines for Advanced Breast Cancer. *Annals of Oncology*. 28:16-33,2017. Doi:10.1093/annonc/mdw544
4. USP 800 Hazardous Drug Handling in Health Care Setting. PDF Available: [https://www.usp.org/sites/default/files/usp\\_pdf/EN/m7808\\_pre-post.pdf](https://www.usp.org/sites/default/files/usp_pdf/EN/m7808_pre-post.pdf)
5. National Cancer Institute. Drugs Approved for Breast Cancer. Available at: <https://www.cancer.gov/about-cancer/treatment/drugs/breast>