Oncology Nursing Society

Oral Therapies for Cancer

Drug Table

Please Note:

This table is provided for educational purposes and has been assembled using the most current information possible. The state of the evidence on these drugs is incomplete, overlaps, and is at times, conflicting. Because of the complexity of these medications, any one resource may not identify all of the characteristics of a drug. Although this table is as complete as possible, it may not be a comprehensive source. Those who use this information should make their own determinations regarding specific safe and appropriate patient-care practices based on the setting and patient situation.

Updates:

7/5/2011 Updated table regarding tamoxifen inducers.

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Altretamine	
Trade Name	Hexalen®; hexamethylmelamine
Class	Alkylating agent
Indication	Ovarian
Drug Interactions	Concurrent administration with monoamine oxidase inhibitors can cause severe orthostatic hypotension.
Food Interactions	Food may increase nausea and vomiting. Food causes decreased absorption (effect on extent).
Treatment Considerations	Is a prodrug, requiring metabolization for cytotoxic activity. Monitor for progressive neurotoxicity. Drug is mutagenic, carcinogenic, teratogenic. Causes testicular atrophy and decreased spermatogenesis. Unknown if secreted in breast milk.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Take two hours after meals and at bedtime to minimize nausea and vomiting.
Contraindications	Caution with monoamine oxidaseinhibitors.
Significant side effects	Neurotoxicity, peripheral neuropathy, nausea, vomiting, skin rash, hypersensitivity, increased liver function tests, abdominal cramps, diarrhea, anorexia, and myelosuppression
Aminoglutethimide	
Trade Name	Cytadren®, Elipten®
Class	Adrenal steroid inhibitor
Indication	Cushing's syndrome
Drug Interactions	Enhances dexamethasone metabolism; hydrocortisone should be used for glucocorticoid replacement. Interacts with warfarin—dose may need to be increased. May need to increase theophylline, digitoxin, or medroxyprogesterone if taken concurrently.
Food Interactions	Alcohol potentiates drug side effects.
Treatment Considerations	Adjuvant corticosteroids need to be administered. Causes reversible chemical adrenalectomy. Patient will experience side effects of adrenal insufficiency if not enough replacement therapy is given (such as hyponatremia, hypoglycemia, dizziness, postural hypotension, possible ovarian blockade). Weekly weights, monitor electrolytes, especially sodium, potassium, and calcium.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	No Specific directions.
Contraindications	None
Significant side effects	Skin rash, often presenting with malaise and fever. If continues for more than 14 days, discontinue drug; transient drowsiness, lethargy, somnolence, blurry vision, vertigo, and ataxia may occur; transient nystagmus, nausea, vomiting, anorexia, and hypotension.
Anastrozole	
Trade Name	Arimidex®
Class	Nonsteroidal aromatase inhibitor
Indication	Adjuvant treatment of postmenopausal women with hormone receptor positive

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	early breast cancer, as first line therapy for postmenopausal women with hormone receptor positive or hormone receptor unknown locally advanced or metastatic breast cancer, and for treatment of advanced breast cancer in postmenopausal women with disease progression following tamoxifen therapy.
Drug Interactions	Co-administration with tamoxifen decreases anastrozole serum levels. Co-administration with estrogen may decrease anastrozole serum levels—do not use concurrently. Herbal estrogen-containing supplements may decrease drug effect.
Food Interactions	None
Treatment Considerations	Can cause elevated GGT (gamma-glutamyltransferase), especially in patients with liver metastases. Can cause decreased total hip and lumbar spine bone mineral density; total cholesterol may increase. Drug shows no benefit in estrogen receptor-negative patients.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	With or without food about the same time daily.
Contraindications	Absolutely contraindicated in pregnancy.
Significant side effects	Hot flashes, asthenia, loss of energy, vaginal dryness, uncommon thrombophlebitis, mild headaches, weakness, mild swelling of arms/legs, arthrosis, arthralgias, arthritis, mild nausea, and rarely diarrhea
Bexarotene	
Trade Name	Targretin®
Class	Retinoid
Indication	Cutaneous T-cell lymphoma
Drug Interactions	Substrate of CYP3A4. Theoretically can displace drugs or be displaced by drugs which bind to plasma proteins (such as methotrexate)—use together cautiously. May increase the action of insulin, sulfonylureas, or insulin-sensitizers with resultant hypoglycemia—use cautiously. May increase the effects of tamoxifen. Avoid high doses of Vitamin A (more than 15,000 IU/day) as it may increase retinoid toxicity. Bexarotene gel will increase DEET toxicity.
Food Interactions	Grapefruit and grapefruit juice—can increase serum concentrations of drug.
Treatment Considerations	Women of child-bearing potential must have negative pregnancy test within one week prior to initiation of drug, and use two forms of contraception during therapy. Men should use condoms during sexual intercourse. Minimize exposure to sunlight. Baseline labs should include white blood cell count with differential, thyroid levels, fasting blood lipid profile, and liver function tests. Patients should avoid direct sunlight and artificial ultraviolet light and wear SPF 30 or higher.
CYP3A4 Inducers	Inducers may decrease serum bexarotene concentrations (rifampin, phenytoin, St. John's wort, phenobarbital). If used concomitantly, assess response, and increase bexarotene as necessary.
CYP3A4 Inhibitors	Inhibitors can theoretically increase serum levels of bexarotene (detoconazole, itraconazole, erythromycin, gemfibrozil).
Administration Instructions	Take gelatin capsule with or immediately following a meal. Also available in topical gel for skin lesions in patients with early stage cutaneous T-cell lymphoma who have failed other therapies. Store topical gel at 36–77° F. Apply gel to affected areas only.

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Contraindications	Do not give gemfibrozil concomitantly with bexarotene. Do not give together with St. John's wort. Use cautiously in patients with hypersensitivity to other retinoids. Patients with risk factors for pancreatitis should not take bexarotine. Use cautiously in patients with hepatic dysfunction.
Significant side effects	Oral capsules may cause abnormal lipid levels, pancreatitis, elevated liver function tests, and nausea. May cause cataracts. May cause hypothyroidism, diarrhea, leukopenia, headache, abdominal pain, chills, fever, flu syndrome, back pain, insomnia, rash, dry skin, alopecia, and peripheral edema. Gel may cause rash, pruritus, and pain at gel application site.
Busulfan	
Trade Name	Myleran®
Class	Alkylating agent
Indication	CML; BMT prep
Drug Interactions	Is a CYP3A4 substrate. Combination with thioguanine may cause hepatic dysfunction and the development of esophageal varices in a small number of patients. May interact with itraconazole. Patients receiving concomitant cyclophosphamide with phenytoin pretreatment have shown increased cyclophosphamide and busulfan clearance, leading to decreased concentrations of both drugs. Causes additive myelosuppressive effect when used with other drugs causing the same effect.
Food Interactions	Food may increase nausea and vomiting. Food may delay absorption (effect on rate).
Treatment Considerations	Monitor blood counts closely. Discontinue drug for leukocyte count less than 20,000/mm^3. Premenopausal women often experience ovarian suppression and amenorrhea with menopausal symptoms; men experience azoospermia and testicular atrophy. Is potentially teratogenic. Unknown if secreted in breast milk.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Take on empty stomach to decrease nausea and vomiting. Administer seizure prophylaxis.
Contraindications	Caution with thioguanine
Significant side effects	Profound tachycardia, hypertension, chest pain, myelosuppression, hyperpigmentation, alopecia, sperm/ovarian suppression, confusion, seizures, mucositis, pumonary fibrosis, nausea, vomiting, insomnia, hyperglycemia, and blurred vision.
Capecitabine	
Trade Name	Xeloda®
Class	Antimetabolite
Indication	Breast; metastatic colon
Drug Interactions	Potentiates warfarin/coumarin derived anticoagulants—can increase International Normalized Ratio (INR) dramatically. Should not be given with leucovorin (increases dose-limiting toxicities, especially diarrhea and hand-foot syndrome). May interact with phenytoin, increasing phenytoin toxicity. Metronidazole may increase capecitabine concentrations. Antacids containing aluminum can increase bioavailability of capecitabine.
Food Interactions	Food causes decreased absorption (effect on extent).
Treatment	Monitor prothrombin time/INR closely. Stress importance of reporting toxicities.

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Considerations	Use low molecular weight heparin if needed.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Take with food and water (or at least within 30 minutes of a meal). Ensure adequate hydration of 2–3 liters water per day.
Contraindications	Known sensitivity to 5-fluorouracil. Do not give with leucovorin.
Significant side effects	Diarrhea, palmar-plantar erythrodysesthesia (hand-foot syndrome), mucositis, nausea, vomiting, anemia, increased bilirubin, fatigue.
Chlorambucil	
Trade Name	Leukeran®
Class	Alkylating agent
Indication	Chronic myeloid leukemia; Hodgkin disease; non-Hodgkin lymphoma
Drug Interactions	Increased toxicity when used with barbiturates.
Food Interactions	Food causes decreased absorption (effect on extent).
Treatment Considerations	Monitor blood urea nitrogen, uric acid, liver function tests, complete blood count with differential.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	No specific directions
Contraindications	Do not use with patients with seizure history, or within one month of radiation or cytotoxic therapy.
Significant side effects	Myelosuppression, sperm/ovarian suppression, nausea, vomiting, secondary malignancy, hyperuricemia, pulmonary fibrosis, seizure
Cyclophosphamide	
Trade Name	Cytoxan®
Class	Alkylating agent
Indication	Breast; ovarian; multiple myeloma; leukemias; lymphomas; neuroblastomas; retinoblastomas; mycosis fungoides
Drug Interactions	Is a CYP3A4 substrate. Increases chloramphenicol half-life. Increases duration of leukopenia when given with thiazide diuretics. Increases the effects of anticoagulant drugs. Decreases digoxin levels. Potentiates doxorubicin-induced cardiomyopathy. Increases succinylcholine action with prolonged neuromuscular blockage. Increases drug action of barbiturates, induces hepatic microsomes. Interacts with allopurinol, chloramphenicol, chlorthiazide, chlorthalidone, ciprofloxacin, digoxin ,hydrochlorthiazide, indapamide, levofloxacin, lomefloxacin, methotrexate, metolazone, norfloxacin, ofloxacin, ondansetron, prednisone, sparfloxacin, succinylcholine, sulfadiazine, sulfamethizole, sulfamethoxazole, trovofloxacin. Decreases absorption of oral digoxin.
Food Interactions	None
Treatment Considerations	Potential for radiation recall with subsequent doses when used with radiation therapy. Use with caution in patients with hepatic insufficiency, as drug is metabolized by hepatic cytochrome P4503A4.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Give dose early in the day to allow time for excretion. Take with food. Ensure adequate hydration (2–3 liters/day).

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Contraindications	See drug interactions for cautions.
Significant side effects	Hemorrhagic cystitis, nausea, vomiting, dose-limiting myleosuppression, alopecia, secondary malignancy, ovarian/testicular failure.
Dasatinib	
Trade Name	Sprycel®
Class	Multikinase inhibitor (BCR-ABL, SRC family, c-KIT, EPHA2, PDGFR-β)
Indication	Adults with chronic, accelerated, or lyeloid or lymphoid blast-phase chronic myeloid leukemia with resistance or intolerance to prior therapy including imatinib; Ph+ acute lymphoblastic leukemia
Drug Interactions	Dasatinib is a CYP3A4 inhibitor. Antacids (aluminum hydroxide, magnesium hydroxide) decreases drug AUC (area under curve). Avoid concurrent administration or take two hours prior to or two hours after dasatinib dose. H_2 blockers/proton pump inhibitors (famotidine) decreases drug AUC: avoid concurrent administration. Dasatinib is a time-dependent inhibitor of CYP3A4 and may decrease the metabolism of durgs such as alfentanil, astemizole, terfenadine, cisapride, cyclosporine, fentanyl, pimozide, quinidine, sirolimus, tacrolimus, ergot alkaloids, simvastatin. Avoid co-administration or administer cautiously.
Food Interactions	Avoid grapefruit juice and grapefruit.
Treatment Considerations	Is teratogenic and embryo-fetal toxic. Women of childbearing potential should be advised to avoid pregnancy. Women should not breastfeed while on dasatinib. Can impair reproductive function and fertility in both men and women. Use cautiously, if at all, in patients with hepatic dysfunction.
CYP3A4 Inducers	Concomitant use of rifampin may decrease serum concentration by as much as 81%; others include dexamethasone, phenytoin, carbamazepine, phenobarbital, St. John's wort. If co-administration must occur (except for St. John's wort), increase dose of dasatinib, but concurrent therapy not recommended.
CYP3A4 Inhibitors	Inhibitors (ketoconazole, itraconazole, erythromycin, clarithromycine, atazanavir, indinavir, nefazodone, nelfinavir, ritonavir, saquinavir, telithromycin) may increase serum dasatinib concentrations. Reduce dose if they must be given together.
Administration Instructions	Administer once in the morning and once in the evening, with or without food. Do not crush.
Contraindications	St. John's wort and dasatinib co-administration is contraindicated.
Significant side effects	Myelosuppression (can be severe), fluid retention, including pleural and pericardial effusion, prolonged QT interval by electrocardiogram, diarrhea, nausea, vomiting, and abdominal pain.
Erlotinib	
Trade Name	Tarceva®
Class	EGFR/HER1 tyrosine kinase inhibitor
Indication	Locally advanced or metastatic non-small cell lung cancer after failure of at least one prior chemotherapy regimen; in combination with gemcitabine for locally advanced, unresectable, or metastatic pancreatic cancer.
Drug Interactions	Warfarin given concurrently increases INR—monitor closely for increased INR and bleeding. Interacts with H_2 antagonists and proton pump inhibitors—avoid co-administration. When tested co-administered with rifampin, the AUC of erlotinib was decreased by 60%–70%. Expect decreased erlotinib concentrations

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	when given with phenytoin as well as an increase in phenytoin concentrations and toxicity.
Food Interactions	Food increases drug absorption (effect on extent and rate). Is affected by cigarette smoking. Avoid grapefruit and grapefruit juice.
Treatment Considerations	Monitor liver function tests, and consider a dose reduction especially if pretreated with CYP3A4 inducers. Monitor INR in patients receiving warfarin. Monitor for gastrointestinal bleeding and increased INR. Manage diarrhea with loperamide. Diarrhea and skin reactions may require dose reduction or temporary interruption of therapy. Uncommonly may cause interstitial lung disease (ILD), which can be serious.
CYP3A4 Inducers	Pretreatment with rifampicin and other CYP3A4 inducers (such as phenobarbital and St. John's wort) may decrease drug activity, requiring an increased dose.
CYP3A4 Inhibitors	Cotreatment with ketoconazole or other CYP3A4 inhibitors may increase drug levels, requiring a lower dose.
Administration Instructions	Should be taken on an empty stomach, either one hour before or two hours after meals.
Contraindications	Avoid co-administration with H_2 blockers and proton-pump inhibitors. Do not take with St. John's wort.
Significant side effects	Rash and diarrhea (may be grade 3–4), anorexia, fatigue, dyspnea, abnormal liver function tests (may be transient or associated with liver metastasis), gastrointestinal bleeding, conjunctivitis, and keratitis. Reports of acute ILD (acute onset of new or progressive pulmonary symptoms such as dyspnea, cough, and fever) Treatment should be interrupted and evaluated if these ILD symptoms develop.
Estramustine	
Trade Name	Estracyte®; Emcyt®
Class	Alkylating agent
Indication	Metastatic or progressive prostate.
Drug Interactions	Calcium-containing antacids impair drug absorption—take one hour prior to drug dose, or two hours after drug dose. Has synergy with vinblastine.
Food Interactions	Milk, milk products, and calcium rich foods may decrease drug absorption. Food in general causes decreased absorption (effect on extent).
Treatment Considerations	Check for changes in calcium levels. Monitor serum glucose, LDH, triglycerides. May increase liver enzymes, may affect certain endocrine levels (thyroid, prolactin, cortisol) because it contains estrogen. May increase risk of embolic events; may consider prophylactic warfarin or aspirin. Assess baseline calcium and phosphorus levels and monitor weekly. Daily or weekly weights.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Give orally with water at least one hour before or two hours after meals, in three divided doses daily. Store in the refrigerator (36–46°F); may be stored at room temperature for 24–48 hours.
Contraindications	Contraindicated or use with great caution in children or patients who have thrombophlebitis or thromboembolic dsiorders, peptic ulcers, severe hepatic dysfunction, cardiac disease, hypertension, or diabetes. Drug may increase risk of embolic events.
Significant side	Thrombophlebitis, thrombosis, gynecomastia, nausea, vomiting, diarrhea,

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effects	hepatic dysfunction.
Etoposide	
Trade Name	VP-16; Vespid®
Class	Plant alkaloid
Indication	Breast; testicular; small cell lung; MM; bone marrow transplant
Drug Interactions	Is a CYP3A4 substrate. Is a pro-drug. Interacts with other protein-bound drugs such as warfarin; monitor closely. Increases toxicity of methotrexate when given together. Co-administration of cyclosporin increases cytotoxicity. Has synergistic effect with cisplatin. Interacts with atovaquone. Co-administration with phenobarbitone and phenytoin decreases plasma AUC of etoposide.
Food Interactions	Except for grapefruit juice, food has no affect on rate or extent of drug absorption.
Treatment Considerations	Increases PT with patients on warfarin. Increases liver enzymes and metabolic acidosis at higher doses. Radiation recall may occur when combined therapies are used. Is mutagenic and teratogenic—appropriate contraception must be used during therapy. If pt's BUN and creatinine levels are elevated, drug will not clear (expect toxicities). Co-administration of any drug that alters hepatic or renal function may alter etoposide clearance.
CYP3A4 Inducers	Concomitant use of inducers (rifampin, St. John's wort, phenytoin, carbamazepine, phenobarbital, dexamethasone) may decrease serum concentrations.
CYP3A4 Inhibitors	Cotreatment with ketoconazole or other CYP3A4 inhibitors may increase drug levels, requiring a lower dose.
Administration Instructions	May give as a single dose up to 400 mg; otherwise, divide into two to four doses.
Contraindications	Bilirubin greater than 5 mg/dl; use of St. John's wort concurrently is contraindicated.
Significant side effects	Myelosuppression, nausea, vomiting, alopecia, anorexia, hyperuricemia, hypersensitivity reaction, andanaphylaxis. Mucositis and diarrhea at high doses, radiation recall, skin lesions with high-dose therapy, rarely peripheral neuropathy, rare myocardial infarction and arrhythmias.
Everolimus	
Trade Name	Afinitor®
Class	mTOR inhibitor
Indication	Advanced renal cell after failure of treatment with sunitinib or sorafenib.
Drug Interactions	Use with caution when co-administering with moderate inhibitors or PgP inhibitors (amprevenavir, fosamprevenavir, aprepitant, erythromycin, fluconazole, verapamil, diltiazem. If required, reduce everolimus dose. St. John's wort may decrease everolimus exposure unpredictably and should be avoided. Avoid the use of live vaccines and being in close contact with those who have used lived vaccines while taking drug.
Food Interactions	Grapefruit, grapefruit juice, and other foods known to inhibit cytochrome P450 and PgP activity may increase everolimus exposure and should be avoided during treatment.
Treatment Considerations	Interrupt dose if moderate or severe symptoms of noninfectious pneumonitis occur until symptoms improve. Fatal outcomes have been observed. Fetal harm possible if administered to pregnant women. Women of childbrearing potential

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	should use appropriate contraception while on drug, and for up to eight weeks after discontinuation of drug. Do not use if breastfeeding .Monitor renal function, blood glucose and lipids, hematologic parameters.
CYP3A4 Inducers	Avoid the use of strong inducers (phenytoin, carbamazepine, rifampin, rifabutin, rifapentin, phenobarbital). If required, double the everolimus dose. Return to prior dose after discontinuation of inducer.
CYP3A4 Inhibitors	Avoid the use of strong inhibitors (ketoconazole, itraconazole, clarifthromycin, atazanavir, erythromycin, verapamil, nefazodone, saquinavir, telithromycin, ritonavir, indinavir, nelfinavir, voriconazole).
Administration Instructions	Take once daily, whole with a glass of water. Do not chew or crush. If patient is unable to swallow pill, disperse tablet in 30 ml water, stir gently immediately prior to drinking. Rinse glass with the same volume of water and swallow rinse to ensure entire dose received. Protect from light and water; store at 77 F. Take with or without food.
Contraindications	Hypersensitivity to rapamycin derivatives or to any of the excipients.
Significant side effects	Mucositis, asthenia, fatigue, cough, diarrhea, myelosuppression, oral ulcerations, infections. Box warning: noninfectious pneumonitis.
Exemestane	
Trade Name	Aromasin®
Class	Steroidal aromatase inhibitor
Indication	Adjuvant treatment of postmenopausal women with ER-positive early breast cancer who received two to three years of tamoxifen and who are switched to exemestane for completion of a total of five consecutive years of adjuvant hormonal therapy; treatment of advanced breast cancer in postmenopausal women ONLY, whose disease has progressed following tamoxifen.
Drug Interactions	Although metabolized by the P4503A4 (CYP3A4) system, it is unlikely that inhibitors will significantly increase drug serum levels, but caution should be used if known inhibitors are co-administered.
Food Interactions	
Treatment Considerations	Should not be given to premenopausal women as the presence of estrogen may interfere with drug action. Do not give to pregnant women.
CYP3A4 Inducers	Inducers (carbamazepine, nafcillin, phenobarbital, phenytoin) may decrease serum levels, and should be used cautiously, if at all.
CYP3A4 Inhibitors	See drug interactions.
Administration Instructions	Once daily, after a meal. Store at 77 F.
Contraindications	St. John's wort—do not use concurrently (decreases drug levels).
Significant side effects	Fatigue, hot flashes, sweating, pain, nausea, increased appetite, depression, insomnia. Late effects include lymphopenia, elevated liver enzymes.
Gefitinib	
Trade Name	Iressa®
Class	EGFR tyrosine kinase inhibitor
Indication	Monotherapy for locally advanced or metastatic non-small cell lung cancer in patients who have failed to respond to either a platinum-based regimen or docetaxel.
Drug Interactions	Ranitidine with sodium bicarbonate (high gastric pH) decreases gefitinib AUC—do not give together. Warfarin: co-administration causes increased INR and

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	bleeding; monitor INR frequently and dose accordingly. Interacts with H_2 antagonists. Administer antacids two hours before or after gefitinib if needed.
Food Interactions	Food causes decreased absorption (effect on extent). Avoid grapefruit and grapefruit juice.
Treatment Considerations	Dose may be held up to 14 days to manage poorly tolerated diarrhea. Evaluate for new onset or worsening pulmonary symptoms. Avoid administration in women who are pregnant or breastfeeding. May experience asymptomatic increased liver enzymes.
CYP3A4 Inducers	Inducers decrease drug plasma concentrations (rifamycin, phenytoin, carbamazepine, griseofulvin, modafinil, nafcillin, nevirapine, phenobarbital, primidone, rifabutin, St. John's wort).
CYP3A4 Inhibitors	Inhibitors increase drug plasma concentrations (itraconazole,atazanavir, clarithromycin, indinavir, ketoconazole, nefazodone, nelfinavir, ritonavir, saquinavir, telithromycin, voriconazole). Consider another antifungal or decrease drug dosing.
Administration Instructions	Take with or without food about the same time each day.
Contraindications	St. John's wort should be discontinued; pregnancy, breastfeeding.
Significant side effects	Diarrhea, rash, acne, dry skin, nausea, vomiting, pruritus, anorexia, asthenia, weight loss, increase in hepatic transaminases, visual and ocular changes,. Rarely associated with ILD, pancreatitis, and allergic reactions (angioedema, urticaria, toxic epidermal necrolysis, erthema multiforme).
Hydroxyurea	
Trade Name	Hydrea®; Droxia®
Class	Antimetabolite
Indication	Radiosensitizer (primary brain; head/neck; cervix/uterus, non-small cell lung cancer); sickle cell crisis prevention; chronic myeloid leukemia in chronic phase.
Drug Interactions	None significant
Food Interactions	
Treatment Considerations	Should not be used during pregnancy or breastfeeding—is mutagenic and teratogenic. May cause dermatologic radiation recall. Can dramatically lower white blood cells (WBCs)within 24–48 hours. May need to pretreat with allopurinol to protect patient from tumor lysis syndrome.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Orally daily
Contraindications	
Significant side effects	Dramatic lowering of WBCs within 24–48 hours, nausea, vomiting, diarrhea, anorexia, hepatic dysfunction, tumor lysis syndrome, drowsiness, and hallucinations (also possible confusion, disorientation, headache, vertigo)
Imatinib mesylate	
Trade Name	Gleevec®
Class	BCR-ABL tyrosine kinase inhibitor
Indication	Newly diagnosed Ph+ chronic myeloid leukemia (CML) in chronic phase; Ph+ CML in blast crisis, accelerated phase, or chronic phase after failure of interferon-alfa therapy; relapsed or refractory Ph+ acute lymphoblastic leukemia;

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	myelodysplastic/myeloproliferative disorders associated with PDGFR gene rearrangements; systemic mastocytosis without certain c-Kit mutations; hypereosinophilic syndrome and chronic eosinophilic leukemia in the presence of certain mutations; unresectable, recurrent, or metastatic dermatofibrosarcoma protuberans; unresectable or metastatic gastrointestinal stromal tumors; adjuvant treatment of resected gastrointestinal stromal tumors.
Drug Interactions	Imatinib is a CYP3A4 inhibitor, and a weaker inhibitor of CYP2D6 and CYP2C9. Substrates of these enzymes include some beta-blockers, calcium channel blockers, cyclosporine, and some HIV medications. Drug increases simvastatin serum levels 2–3.5 times. Use together cautiously, if at all, and monitor blood pressure and reduce dose of simvastatin if needed. Increases plasma concentrations of cyclosporine and pimozide if co-administered with imatinib. Do not administer together. Triazolo-benzadiazepines, dihydropyridine calcium channel blockers, HMG-CoA reductase inhibitors may have increased serum levels when given with imatinib. Use together cautiously and monitor closely. Do not administer eletriptan within 72 hours of imatinib. Monitor vital signs closely. Interacts wtih carbamazepine and warfarin (inhibits warfarin metabolism—use low molecular weight heparin instead). Co-administration with acetaminophen increases acetaminophen levels.
Food Interactions	Food has no effect on rate or extent of drug absorption.
Treatment Considerations	Weigh patients frequently. Monitor for signs and symptoms of fluid retention. Monitor complete blood count with differential and liver function tests. Advise women of childbearing potential not to become pregnant while taking drug. Researchers have not conducted studies of the drug in pregnant women. Use cautiously in patients with liver impairment.
CYP3A4 Inducers	Concomitant use of dexamethasone, phenytoin, carbamazepine, rifampicin, phenobarbital, St. John's wort may decrease drug concentrations. Use together cautiously, if at all. When used with dexamethasone, phenytoin, carbamazepine, phenobarbital, rifabutin, or rifampin, increase drug imatinib dose by 50%.
CYP3A4 Inhibitors	Strong inhibitors (ketoconazole, itraconazole, erythromycin, clarithromycin, voriconazole, aprepitant) may increase plasma concentrations of imatinib—*avoid* co-administering, or monitor closely for adverse effects.
Administration Instructions	Take with food and a large glass of water, once a day, (unless the total dose is 800 mg, which is given as 400 mg twice daily).
Contraindications	Warfarin: imatinib inhibits warfarin metabolism. Use low molecular heparin or standard heparin instead. St. John's wort decreases drug absorption—do not give together with St. John's wort.
Significant side effects	Edema and fluid retention, gastrointestinal irritation, nausea, vomiting, neutropenia, thrombocytopenia, hepatotoxicity, hyperbilirubinemia
Lapatinib ditosylate	
Trade Name	Tykerb®
Class	EGFR tyrosine kinase inhibitor; HER-1/HER-2/neu inhibitor
Indication	In combination with capecitabine for advanced or metastatic breast cancer whose tumors express HER2 and who have received prior therapy including an anthracycline, a taxane, and trastuzumab.
Drug Interactions	Lapatinib inhibits CYP3A4 and CYP2C8; interacts with drugs metabolized by the CYP3A4 and CYP2C8 systems—monitor for toxicity of drug co-administered with

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	lapatinib. Inhibits p-glycoprotein: assess for toxicity resulting from increased substrate concentration.
Food Interactions	Grapefruit and grapefruit juice may increase plasma concentrations of drug. If must be used, dose reduce. Food may affect drug absorption.
Treatment Considerations	Modify dose for cardiac and other toxicities, severe hepatic impairment, and CYP3A4 drug interactions. Confirm normal ejection fraction before beginning drug. Manage severe diarrhea with antidiarrheal agents. Replace fluids and electrolytes as needed. May cause fetal harm when administered to pregnant women.
CYP3A4 Inducers	Concomitant use of strong inducers should be avoided (dexamethasone, phenytoin, carbamazepine, rifampin, rifabutin, rifapentin, phenobarbital, St. John's wort). If must be used, may require gradually titrated increased dosing. Also affected by barbiturates, bexarotene, bosentan, carbamazepine, corticosteroids, efavirenz, fosphenytoin, modafinil, nafcillin, nevirapine, omeprazole, oxcarbazepinne, primidone.
CYP3A4 Inhibitors	Concomitant use of strong inhibitors should be avoided (ketoconazole, itraconaxole, clarithromycin, atazanavir, indinavir, nefazodone, nelfinavir, ritonavir, saquinavir, telithromycin, voriconazole.
Administration Instructions	Take lapatinib at least one hour before or two hours after a meal. Take capecitabine with food or within 30 minutes of food. Dose should be taken once daily; do not divide dose.
Contraindications	Do not give with St. John's wort.
Significant side effects	Diarrhea, palmar-plantar erythrodysesthensia, nausea, rash, vomiting, fatigue, decreased left ventricular ejection fraction .
Lenalidomide	
Trade Name	Revlimid®
Class	Immunomodulator with antiangiogenic properties.
Indication	Myelodysplastic syndrome (MDS); in combination with dexamethasone for multiple myeloma; transfusion-dependent anemia due to low or intermediate risk MDS associated with a deletion cytogenetic abnormality.
Drug Interactions	Additive anti-tumor effect when combined with dexamethasone. Co-administration with one marrow suppressive agents cause additive bone marrow depression. Interacts with digoxin (may increase digoxin levels)—monitor closely.
Food Interactions	None
Treatment Considerations	10,000 times more potent than thalidomide. Is not teratogenic at similar doses, but is embryotoxic in animal studies. Significantly increases risk of deep vein thrombosis and pulmonary embolism in patients with multiple myeloma treated with lenolidomide combination therapy. Use cautiosuly in patient with renal impairment. May cause tumor lysis syndrome in newly diagnosed patients with multiple myeloma and large tumor burdens.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Pregnancy test must be verified by provider before administration. Must meet all provisions of the RevAssist® program. For MDS: daily with water at least one hour after a meal with dose adjustment based on AUC and blood counts. For multiple myeloma: Daily with water at least one hour after a meal, together with dexamethasone.

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Contraindications	*Absolute* contraindication is pregnancy.
Significant side effects	Decreased neutrophil, platelet and red blood cell counts, decreased potassium and magnesium (uncommon), rash, fatigue, light-headedness, leg cramps, diarrhea, constipation, nausea, and electrolyte disturbances
Start here Letrozole	
Trade Name	Femara
Class	Nonsteroidal aromatase inhibitor
Indication	Adjuvant treatment of postmenopausal women with hormone receptor–positive early breast cancer; the extended adjuvant treatment of early breast cancer in postmenopausal women who have received five years of adjuvant tamoxifen therapy; the first-line treatment of postmenopausal women with hormone receptor positive or unknown, locally advanced or metastatic breast cancer; treatment of advanced breast cancer in postmenopausal women with disease progression following antiestrogen therapy.
Drug Interactions	Co-administration with tamoxifen decreased letrozole concentrations, but not significantly when letrozole was administered immediately after tamoxifen. Estrogen may decrease letrozole effect.
Food Interactions	
Treatment Considerations	Can cause fetal harm when given to pregnant woman. Is embryotoxic and fetotoxic in lab animals.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Given daily. No specific instructions.
Contraindications	Premenopausal women- as not been evaluated in this population.
Significant side effects	Musculoskeletal pain, arthralgia, headache, fatigue, chest pain. Hot flashes. Nausea, vomiting, anorexia, diarrhea, constipation.
Lomustine	
Trade Name	CeeNu®
Class	Nitrosourea
Indication	Pancreatic; liver; gastric; colorectal; CNS and brain tumors; MM; Hodgkin lymphoma; non-Hodgkin lymphoma.
Drug Interactions	Co-administration with myelosuppressive drugs increase hematologic toxicity-reduce dose.
Food Interactions	ETOH should be avoided for a short period after taking drug. Food may affect drug absorption.
Treatment Considerations	Crosses blood brain barrier. Due to delayed myelosuppression, do not repeat dosing more than once every 6 weeks. Dosing based on blood counts. Monitor pulmonary, liver, and renal functions. Is absorbed within 30-60 minutes of administration, so vomiting does not usually affect efficacy. Mutagenic, carcinogenic, and teratogenic. Appropriate birth control should be used during therapy.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Take on empty stomach and **at bedtime.**
Contraindications	

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Significant side effects	Nausea, vomiting, diarrhea, anorexia, renal compromise (can lead to renal failure after prolonged therapy), lethargy, confusion, disorientation, ataxia. Rarely occular damage can occur, including optic neuritis, retinopathy, blurred vision.
Melphalan	
Trade Name	Alkeran®; L-Phhenylalanine Mustard, L-PAM, L-Sarcolysin
Class	Alkylating agent
Indication	MM; ovarian; testicular;breast; melanoma; sarcoma
Drug Interactions	Co-administration with cyclosporine increases nephrotoxicity. Co-administration with H2 blockers may decrease melphalan bioavailability. Other myelosuppressive chemotherapy increases melphalan's hematologic toxicity- monitor carefully or dose reduce.
Food Interactions	Food causes decreased absorption (effect on extent).
Treatment Considerations	Dose reduce for patients with renal compromise. Potentially mutagenic and teratogenic.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Take on an empty stomach.
Contraindications	See drug interactions for cautions.
Significant side effects	Myelosuppression nausea,vomiting, anorexia, potential anphylaxis, mucositis, hypersensitivity reaction, potential for secondary malignancy, pulmonary toxicity, maculopapular rash, alopecia, urticaria.
Mercaptopurine	
Trade Name	6-MP; Purinethol®
Class	Antimetabolite
Indication	ALL; AML; CML; non-Hodgkin lymphoma
Drug Interactions	Reduce dose by 75% when used concurrently with allopurinol. Increases hepatotoxicity when used with other hepatotoxic drugs- monitor LFTs closely. Can decrease or increase INR- monitor closely if patient is on warfarin. Use cautiously with nonpolarizing muscle relaxants- can decrease neuromuscular blockage. Interacts with atricurium, sulfasalazine, tubocuraruine, vecuronium.
Food Interactions	Food has no effect on rate or extent of drug absorption.
Treatment Considerations	Caution in those with hepatic or renal dysfunction.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Take on an empty stomach, one hour before or two hours after meals.
Contraindications	See drug interactions for cautions.
Significant side effects	Leukopenia, thrombocytopenia (can be dose-limiting), hepatotoxicity (cholestatic jaundice, hepatic necrosis), nausea, vomiting, anorexia, diarrhea, stomatitis (uncommon), rash.
Methotrexate	
Trade Name	MTX; Rheumatrex®; Trexall®
Class	Antimetabolite; folic acid antagonist
Indication	Hodgkin lymphoma; non-Hodgkin lymphoma; leukemia; CNS metastasis; lung, breast, head/neck cancers; gestational trophoblastic tumor; osteogenic sarcoma;

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	rheumatoid arthritis; tubal ectopic pregnancy.
Drug Interactions	Avoid multivitamins with folic acid. Do not take with nonsteroidal anti-inflammatory drugs(increases and prolongs MTX levels- ibuprofen, diclofenac, ketoprofen, naproxen), large doses of penicillins (amoxicillin, ticarcillin, amoxicillin with clavulanic acid, ampicillin, cloxacillin, mezlocillin, methicillin, dicloxacillin, piperacillin with tazobactam, and penicillin), alcohol, aspirin including magnesium salyicylate, bismuth subsalicylate), sulfonamides Bactrim ®, tolbutamide, tolazamide, chlorpropamide, glyburide, glipizide), sulfonylureas, phenytoin, tetracycline, chloramphenicol,, warfarin, aminoglycosides as interactions are possible. Monitor closely if co-administered. Thymidine and leucovorin may nullify antitumor effect- give at least 24 hours after MTX. L-asparaginase reduces antitumor effect- give several days before or after the administration of MTX. Interacts with aminophylline, azathioprine, chloroquine,chlorothiazide, choline magnesium salicylate, cyclophosphamide,ketorlac doxycycline, etodolac, fenoprofen, flurbiprofen, haloperidol, hydrochlorthiazide, indapamide, indomethacin, mefenamic acid, metolazone, nabumetone, omeprazole, pantoprazole, piroxicam, potassium acetate, potassium citrate, probenecid, procarbazine, sodium acetate, sodium citrate, sodium bicarbonate, sodium lactate, sodium salicylate, sulfadiazine, sulfamethizole, sulfa methoxazole, sulfasalazine, sulfasoxazole, sulindac, tetracycline, tolmetin,trimethoprim,trimethoprim-sulfmethoxasole, vancomycin.
Food Interactions	Food may delay absorption (effect on rate). High doses of vitamin C can lead to acute renal insufficiency with high dose methotrexate.
Treatment Considerations	Photosensitivity precautions. Ensure strict mouth care. Teratogenic; can cause spontaneous abortion of a fetus. Excreted in breast milk.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Store at room temperature and avoid light. Take with or without food.
Contraindications	Pleural or pericardial effusions, or ascites can cause severe toxicity due to MTX accumulation. Do not take with high dose antiinflammatory drugs. Do not use concurrently with cotrimoxazole or omeprazole. Do not co-administer with folic acid.
Significant side effects	Mucositis, nausea, myelosuppression, oral or gastrointestinal ulceration, renal toxicity, photosensitivity, liver toxicity, pruritus, alopecia, rash.
Mitotane	
Trade Name	P'-DDD; Lysodren®
Class	Antihormone
Indication	Inoperable adrenal cortical carcinoma
Drug Interactions	Neurotoxic drugs may have additive toxicity; use cautiously. May decrease effect of warfarin- monitor INR. Spirolactone may decrease effect of mitotane- do not use together. Mitotane may decrease effectiveness of steroids, requiring increased dose. Assess effects of phenytoin, cyclophosphamide, barbiturates- may need to dose adjust.
Food Interactions	
Treatment Considerations	Hypersensitivity reacions are rare but have occurred. Use cautiously in patients with hepatic dysfunction. If pt. undergoes stress (shock, trauma) and requires IV

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	steroids, drug may cause lethargy and somnolence.
CYP3A4 Inducers	
CYP3A4 Inhibitors	
Administration Instructions	Daily dose divided into 3-4 doses. Usually begins with low doses and gradually increases.
Contraindications	Spirolactone use. Temporarily discontinue use if patient experiences severe shock or trauma.
Significant side effects	Nausea, vomiting, anorexia, diarrhea, lethargy, somnolence, dizziness, vertigo. Other CNE manifestations (depression, muscle tremors, confusion, headache), rash.
Nilotinib	
Trade Name	Tasigna®
Class	BCR-ABL tyrosine kinase inhibitor
Indication	Chronic phase and accelerated phase Ph+ CML in adults resistant or intolerant to prior therapy including imatinib.
Drug Interactions	Nilotinib is a CYP3A4 inhibitor. Nilotinib increases simvastatin serum levels. Use together cautiously, if at all, and monitor BP-dose reduce simvastatin if necessary. Nilotinib increases plasma concentrations of cyclosporine and pimozide if co-administered. Do not administer together. Triazolo-benzadiazepines, dihydropyridine calcium channel blockers, HMG-CoA reductase inhibitors may cause increased serum levels when given with nilotinib. Use together cautiously/monnitor closely. Do not administer eletriptan within 72 hours of nilotinib. Monitor vital signs closely. INR must be monitored closely if given with warfarin and warfarin dose adjusted frequently. Concurrent administration with another drug that causes prolonged QT interval could result in potential arrhythmias. Is a substrate of the efflux transporter PgP- if administered with PgP inhibitors (like quinine) serum concentrations of nilotinib will be increased.
Food Interactions	Food may affect drug absorption and toxicity. Do not take with grapefruit or grapefruit juice.
Treatment Considerations	Check CBC every 2 weeks for the first 2 months, then monthly. Correct electrolyte abnormalities prior to treatment. ECG should be obtained at baseline, 7 days after start of drug, and periodically to monitor QTc. Sexually active women should use effective contraception during treatment.
CYP3A4 Inducers	Concomitant use of dexamethasone, phenytoin, carbamazepine, rifampicin, phenobarbital, and St. John's wort may decrease concentrations of nilotinib. Use together cautiously, if at all. When used with dexamethasone, phenytoin, carbamazepine, phenobarbital, rifabutin, or rifampin, increase nilotinib dose by 50%.
CYP3A4 Inhibitors	Concomitant use of ketoconazole, itraconazole, erythromycin, clarithromycin, voriconazole, and aprepitant may increase drug concentrations. Do not co-administer, or monitor closely.
Administration Instructions	Swallow whole with water. Administer two capsules 2 hours after a meal or 1 hour before a meal with a glass of water. Drink only water for the 1 hour after drug administration (critical patient education information).
Contraindications	Patients with hypokalemia, hypomagnesemia, or long QT syndrome. Do not use in patients who are pregnant or breastfeeding. Do not take St. John's wort if

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	taking nilotinib.
Significant side effects	Rash, pruritus, nausea, fatigue, headache, constipation, diarrhea, vomiting. headache, fatigue, arthralgia, myalgia. Serious reactions include thrombocytopenia, neutropenia, elevated lipase, hepatic and electrolyte abnormalities, prolonged QT interval. Sudden deaths have been reported.
Pazopanib	
Trade Name	Votrient®
Class	Multikinase inhibitor (VEGF and others)
Indication	Advanced renal cell carcinoma
Drug Interactions	Is a weak inhibitor of CYP3A4, CYP2C8, and CYP2D6 in vivo. Avoid co-administration with other agents metabolized by these enzyme systems.
Food Interactions	Food may affect drug absorption. Do not take grapefruit juice or grapefruit.
Treatment Considerations	Suspend treatment for surgical procedures. Monitor LFTs, thyroid function, and urine protein during therapy. Increases serum transaminase and bilirubin levels. Severe and fatal hepatotoxicity is possible. Prolonged QT intervals and torsades de pointes possible. Use with caution if history of these conditions. Monitor LFTs and ECG/electrolytes through treatment. Fatal hemorrhagic events are possible. Arterial thrombotic events possible and can be fatal. Use wtih caution if at risk. Gastrointestinal perforation or fistula possible, and possibly fatal. Use with caution if at risk. Monitor for hypertension, hypothyroidism, proteinuria. Can cause fetal harm. Women of childbearing potential should avoid becoming pregnant while on treatment.
CYP3A4 Inducers	The concomitant use of strong inducers (rifampin, St. John's wort) may decrease pazopanib concentrations. Avoid, or dose reduce.
CYP3A4 Inhibitors	The concomitant use of strong inhibitors (ketoconazole, ritonavir, clarithromycin) may increase pazopanib concentrations. Avoid, or dose reduce.
Administration Instructions	Should be taken without food, at least 1 hour before or 2 hours after a meal.
Contraindications	Should not be used in patients with a history of hemoptysis, cerebral, or clinical significant gastrointestinal hemorrhage in the prior 6 months. Do not take St. John's wort.
Significant side effects	Diarrhea, hypertension, hair color changes, nausea, anorexia, vomiting. Life-threatening hepatotoxicities, QT prolongation, torsades de pointes, hemorrhagic events that can be life-threatening, arterial thrombotic events (myocardial infarction, angina, ischemic stroke, inschemic attacks), gastrointestinal perforation or fistula, hypertension, may impair wound healing, hypothyroidism, proteinuria.
Procarbazine hydrochloride	
Trade Name	Matulane®
Class	Miscellaneous agent/alkylating agent
Indication	Hodgkin lymphoma; glioblastoma multiforme
Drug Interactions	Is synergistic with CNS depressants. Interacts with ethyl alcohol. Use barbiturates, antihistamines, narcotics, and hypotensive agents or phenothiazine antiemetics with caution. A disulfiram (antabuse)-like reaction may occur if pt. consumes alcohol. Do no co-administer with levodopa or meperidine (causes hypertension); causes CNS excitation, hypertension, palpitations, angina, hypertensive crisis when co-administered with sympathomimetics or tricyclic

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	antidepressants. Potentiates hypoglycemic effect of antidiabetics (sulfonylurea, insulin)- monitor closely. Decreases bioavailability of digoxin when co-administered.
Food Interactions	Has weak monoamine oxidaseinhibitor activity: should avoid foods containing high amounts of tyramine such as beer, wine, cheese, brewer's yeast, chicken livers, bananas. Consumption of high tyramine foods could lead to intracranial hemorrhage or hypertensive crisis.
Treatment Considerations	Discontinue if CNS signs.symptoms (paresthesia, neuropathy, confusion), stomatitis, diarrhea, or hypersensitivity reaction occur. Patients with G6PD should be monitored for hemolytic anemia. DISCONTINUE if pulmonary infiltrates develop. Causes azoospermia. Causes cessation of menses, although may be reversible. Is teratogenic.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Orally daily, 30 minutes after antiemetics and at bedtime (some sources say with or without food).
Contraindications	Sympathomimetics, tricyclic antidepressants, levodopa, meperidine.
Significant side effects	Bone marrow depression (thrombocytopenia, leukopenia, anemias), nausea, vomiting, diarrhea, sensory/perceptual alterations, peripheral neuropathy, flu-like symptoms, rare dermatitis reactions.
Raloxifene	
Trade Name	Evista®
Class	Estrogen agonist/antagonist
Indication	Treatment and prevention of osteoporosis in postmenopausal women; reduction in risk of invasive breast cancer in postmenopausal women with osteoporosis; reduction in risk of invasive breast cancer in postmenopausal wormen at high risk for invasive breast cancer.
Drug Interactions	Using drug with cholestyramine reduces the absorption and enterhepatic cycling of raloxifene. Monitor prothrombin time when starting or stopping raloxifene if using warfarin. Use with any other highly protein-bound drug with caution, including diazepam, diazoxide, and lidocaine. Safety with use of estrogens is not established, and not recommended.
Food Interactions	
Treatment Considerations	Increased risk of DVT and PE. Increased risk of death due to stroke in patients with documented coronary heart disease or at increased risk for major coronary events. Drug does affect fertility; effects are reversible.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Once daily without regard to meals.
Contraindications	Active or past history of venoous thromboembolism, including DVT, PE, and retinal vein thrombosis. Pregnancy, nursing. Do not use with cholestyramine.
Significant side effects	Hot flashes, leg cramps, flu syndrome, headache, migraine, syncope, varicose vein, nausea, diarrhea, dyspepsia, vomiting, weight gain, peripheral edema, arthralgia, myalgia, arthritis, depression, neuralgia, sinusitis, rhinitis, bronchitis, pharyngitis, rash, sweating, conjunctivitis, vaginitis, cystitis, breast pain, vaginal bleeding.

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Sorafinib	
Trade Name	Nexavar®
Class	Multikinase inhibitor (VEGF and others)
Indication	Unresectable hepatocellular carcinoma; advanced renal.
Drug Interactions	Is a substrate. Interacts with CYP2C9 substrates. Warfarin: monitor INR carefully. Increases doxorubicin AUC by 21 %; causes 67-120% increase in irinotecan active metabolite; causes 26-42% increase in irinotecan serum concentrations- do not give concomitantly, or dose reduce. Interacts with docetaxel, fluroruracil. Interacts with CYP 2B6 (bupropion, propofol, ifosfamide) and CYP2C8 (rapaglinide, amiodarone, ibuprofen, loperamide). Monitor for toxicity.
Food Interactions	Food may affect drug absorption.
Treatment Considerations	Continue treatment until patient no longer benefits from therapy or until unacceptable toxicities. Caution patient to prevent pregnancy during treatment and for 2 weeks after treatment ends. Has been shown to cause birth defects or fetal loss. Temporarily interrupt treatment prior to major surgical procedures and resume after wound heals. May rarely cause gastric perforation.
CYP3A4 Inducers	Concomitant use of inducers (rifampin, St. John's wort, phenytoin, carbamazepine, phenobarbital, dexamethasone) may decrease sorafenib serum concentrations.
CYP3A4 Inhibitors	No
Administration Instructions	Take on an empty stomach.
Contraindications	
Significant side effects	Palmar-plantar erythrodysesthesia, rash, hypertension, myocardial infaction, mucositis, dyspepsia, increased lipase, increased amylase, diarrhea, nausea, vomiting, decreased appetite, increased risk of bleeding, peripheral neuropathy.
Sunitinib	
Trade Name	Sutent®
Class	Multikinase inhibitor (VEGF and others)
Indication	GIST after disease progression while on imatinib or intolerance to imatinib; advanced renal cell carcinoma
Drug Interactions	Substrate of CYP3A4
Food Interactions	Grapefruit or Grapefruit juice may increase drug concentrations- do not give together.
Treatment Considerations	Baseline ejection fraction should be obtained prior to treatment. Is teratogenic and embyo-fetal toxic. Women of childbearing potential should avoid pregnancy. Women should not breastfeed while on drug. Obtain baseline CBC with platelet count, serum chemistries, including phosphate, LFTs, thyroid function tests. Hypothyroidism may occur. Monitor values at the beginning of each treatment. May cause adrenal insufficiency- monitoR pts. under stress (surgery, trauma, infection) closely.
CYP3A4 Inducers	Concomitant use of strong inducers will decrease drug concentrations (dexamethasone, phenytoin, carbamazepine, rifampin, rifabutin, rifapentin, phenobarbital, St. John's wort).
CYP3A4 Inhibitors	Inhibitors (e.g., ketoconazole, ritonavir, clarithromycin) may increase pazopanib concentrations.
Administration	May be taken with or without food.

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Instructions	
Contraindications	
Significant side effects	Myelosuppression, left ventricular dysfunction, prolonged QTc interval, hypothyroidism, diarrhea, nausea, vomiting, stomatitis, dyspepsia, skin discoloration, depigmentation of hair, palmar-plantar erythrodysesthesia, fatigue, hypertension, bleeding, edema, uncommon DVT. Patients with brain metastases may experience seizures. Rare: pancreatitis (discontinue drug).
Tamoxifen	
Trade Name	Nolvadex®
Class	Antiestrogen
Indication	Adjuvant therapy in lymph node negative breast cancer after surgical resection; adjuvant therapy in lymph node negative breast cancer in postmenopausal women after surgical resection; metastatic breast cancer in men and women; chemoprevention of breast cancer in high risk women.
Drug Interactions	Avoid antacids within 2 hours of taking enteric-coated tablets. Co-administration with anticoagulants may cause increased PT- monitor closely and reduce anticoagulant as needed. May inhibit metabolic activation of cyclophosphamide. Drug decreases serum levels of letrozole- do not give concurrently. St. John's wort decreases tamoxifen levels- do not give concurrently. Increased risk of thromboembolic events when used with cytotoxic agents. Concomitnat bromocriptine therapy increased serum tamoxifen levels. Should not be administered with anastrozole. Cyclosporine, nifedipine, and diltiazen may affect tamoxifen levels if given concurrently. Rifampin reduces tamoxifen AUC. Aminoglutethimide reduces tamoxifen plasma concentrations. Medroxyprogesterone reduces plasma concentrations of N-desmethyl, but not tamoxifen, when given together.
Food Interactions	
Treatment Considerations	Is a substrate. Use cautiously in patients with abnormal liver function or history of thromboembolic disease. Teach to notify physician immediately if patient develops abnormal uterine bleeding, pelvic pain, pain in the legs, or breathing problems. Flare reaction with bone pain may occur, along with hypercalcemia. Decreases CBC, increases LFTs and calcium. May interfere with lab tests such as hyperlipidemia and LFTs. Impairs fertility; fetal mortality is also possible. Tamoxifen may inhibit lactation.
CYP3A4 Inducers	Inducers (carbamazepine, glucocorticoids, phenobarbitalk, phenytoin, rifamycin, rifabutin, nevirapine) may decrease serum levels of tamoxifen.
CYP3A4 Inhibitors	Inhibitors (ciprofloxacin, clarithromycin, doycycline, erythromycin, imatinib, diclofenac, nicardipine, nefazodone, protease inhibitors, verapamil, quinidine, cimetidine, codeine, fluoxetine, haloperidol, paroxetine) may increase tamoxifen serum levels.
Administration Instructions	Give daily.
Contraindications	St. John's wort; letrozole. Contraindicated in women with a history of deep vein thrombosis or PE; contraindicated in women who take concomitant courmarin-type anticoagulant therapy.
Significant side effects	Menstrual irregularity, hot flashes, milk production in breasts, vaginal discharge, bleeding, endometrial hyperplasia, polyps, endometrial cancer ,uterine sarcoma,

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	thromboembolic events, PE, stroke, flare reaction (bone and tumor pain, transient increase in tumor size, nausea, vomiting, anorexia), retinopathy, cataracts, decreased visual acuity, blurred vision, headache, dizziness, light-headedness, mild leukopenia, mild thrombocytopenia, rash, alopecia, peripheral edema (rare), uncommon hypercalcemia.
Temozolomide	
Trade Name	Temodar®
Class	Alkylating agent
Indication	Adult refractory anaplastic astrocytoma with progression on nitrosureas and procarbazine; newly diagnosed glioblastoma multiforme
Drug Interactions	Valproic acid reduces temozolomide clearance minimally and may not be clinically significant, but should be monitored.
Food Interactions	Food has no effect on rate or extent of drug absorption.
Treatment Considerations	Avoid sun exposure for several days after therapy. Administer *pneumocystis carinii* pneumonia prophylaxis with trimethoprim-sulfamethoxazole in patients receiving radiation therapy for 42-day regimen.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Store at room temperature, protected from light and moisture. Do not open capsules. Take on an empty stomach but with a full glass of water, 30 minues after antiemetics, to decrease nausea and vomiting. Take with full glass of water, around the same time each day. Bedtime administration may be advised.
Contraindications	Allergic reaction to dacarbazine.
Significant side effects	Dose-limiting myelosuppression, nausea, vomiting, headache, fatigue, photosensitivity, liver toxicity, rash, pruritus, alopecia, CNS effects may occur (lethargy, headache, ataxia, dizziness).
Thalidomide	
Trade Name	Thalidomid®
Class	TNF-alpha, antiangiogenesis agent
Indication	Newly diagnosed MM in combination with dexamethasone; erythema nodosum leprosum (ENL).
Drug Interactions	Co-administration with barbiturates, alcohol, opioids, hypnotics, chlorpromazine or reserpine causes increased sedation. Risk of DVT increases dramatically when given with dexamethasone, doxorubicin, or other combination chemotherapy regimens. Higher risk of renal impairment when given with zoledronic acid. Medications known to cause peripheral neuropathy should be used with caution with thalidomide.
Food Interactions	Food may affect drug absorption.
Treatment Considerations	Pregnancy tests must be routinely negative prior to beginning therapy in women of child-bearing potential. Contraception is mandatory in men and women. If female patient is taking hormonal contraception as well as barbiturates, glucocorticoids, phenytoin, or barbamazepine must use barrier contraception as well. Prophylaxis with LMWH or warfarin is recommended for most patients on thalidomide. It is not known if it is secreted in breast milk. Concomitant use of HIV protease inhibitors, griseofulvin, modafinil, penicillins, rifampin, rifabutin, phenytoin,carbamazepine, or St. John's wort with hormonal contraceptive drugs may reduce the effectiveness of the contraception. If taken concurrently, pt.

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	must use two other effective methods of contraception or abstain from heterosexual sexual contact while on therapy.
CYP3A4 Inducers	See treatment considerations.
CYP3A4 Inhibitors	No
Administration Instructions	Pregnancy tests must be negative prior to administration, Must meet all provisions of STEPS program for male and female patients.Daily with water, perferably at bedtime, at least 1 hour after a meal.
Contraindications	ABSOLUTE contraindication in pregnancy.
Significant side effects	Dry skin, occasional tingling of extremities, somnolence, fatigue, constipation, neutropenia, rash, serious dermatologic disorders, increased HIV viral load, peripheral neuropathy, lightheadedness, dizziness, and edema. Uncommonly, severe rash, DVT, PE, URI and pneumonia, renal insufficiencey, seizures, severe neutropenia, and bradycardia. Severe thromboembolic events are more common when given in combination with dexamethasone.
Thioguanine	
Trade Name	6-thioguanin; 6-TG
Class	Antimetabolite
Indication	ALL; AML; CML
Drug Interactions	Bulsulfan increases hepatotoxicity; use together with caution. Other hepatoxic drugs increase risk of hepatotoxicity. Can be used in full doses with allopurinol.
Food Interactions	Food causes decreased absorption (effect on extent).
Treatment Considerations	Dose is titrated to avoid stomatitis and diarrhea. Monitor LFTs.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Take on empty stomach, 30 minutes after antiemetics. Can be given as a single dose.
Contraindications	See drug interactions for cautions.
Significant side effects	Myelosuppression, hyperuricemia, nausea, vomiting hepatotoxicity (rare but could be associated with hepatic veno-occlusive disease or jaundice), diarrhea, loss of vibratory sense.
Topotecan	
Trade Name	Hycamtin
Class	Topoisomerase I inhibitor
Indication	Relapsed SCLC
Drug Interactions	Is a substrate for both ABCB1 and ABCG2. Elacridar given with hycamtin capsules increases topotecan levels 2.5 fold. Cyclosporine A given with topotecan increases levels 2.5 fold. Monitor carefully when given with drugs known to inhibit these transporters.
Food Interactions	Conflicting data supports that it can be taken without regard to food, or that food may delay absorption.
Treatment Considerations	Women of childbearing potential should avoid becoming pregnant during treatment. May cause renal and hepatic impairment. Known genotoxic and probably carcinogen. Is mutagenic.
CYP3A4 Inducers	No effect
CYP3A4 Inhibitors	P-glycoprotein inhibitors (cyclosporine A, elacridar, ketoconazole, ritonavir, and saquinavir) increases topotecan drug levels. Avoid concomitant use.

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Administration Instructions	Can be taken with or without food. Must be swallowed whole without crushing, chewing, or dividing. Do not take a replacement dose if the patient vomits. Store at 77 F. protected from light in the original outer carton. Protect from heat.
Contraindications	Severe bone marrow depression. Should be given only to patients with baseline neutrophil count greater or equal to 1,500/mm3 and platelets greater or equal to 100.000 /mm3. Pregnancy and breastfeeding. History of anaphylactic reaction to topotecan and/or its ingredients.
Significant side effects	Neutropenia, anemia, thrombocytopenia,nausea, diarrhea, vomiting, fatigue, alopecia.
Toremifene citrate	
Trade Name	Fareston®
Class	Sythetic tamoxifen analog; Selective estrogen receptor modulator (SERM)
Indication	Metastatic breast cancer in postmenopausal women with estrogen-receptor positive or unknown tumors.
Drug Interactions	Coadminstration with warfarin increases anticoagulation effect - monitor INR closely. Co-administration with thiazide diuretics increases risk of hypercalcemia (decreased excretion). Metabolism is inhibited by testosterone and cyclosporin. Appears to enhance inhibition of multidrug-resistant cell lines by vinblastine. Appears to be cross-resistance with tamoxifen.
Food Interactions	
Treatment Considerations	See contraindications. At risk for endometrial cancer. Have baseline eval with endometrial biopsy. Have patient call immediately if bleeding occurs. May develop cataracts. Have baseline and q 6 month eye exams.
CYP3A4 Inducers	Inducers (carbamazepine, phenbarbital, phenytoin, ranitidine, rifampin, St. John's wort) may decrease drug level and effect.
CYP3A4 Inhibitors	Inhibitors (ciprofloxacin, clarithromycin, doxycycline, erythromycin, isoniazid, itraconazole, propofol, verapamil, others) may increase drug serum level and toxicity- assess for adverse effects.
Administration Instructions	
Contraindications	St. John's wort. Use cautiously in patients with history of thromboembolic events and patients with brain or vertebral metastases. Contraindicated in patients with endometrial hyperplasia (increased risk of endometrial cancer).
Significant side effects	Menstrual irregularities, hot flashes, milk production in breasts, vaginal discharge and bleeding.flare reaction (bone and tumor pain, transient increase in tumor size), nausea, vomiting, anorexia, tremor, bone marrow depression, rash, alopecia, peripheral edema (rare).
Tretinoin	
Trade Name	Vesamoid®
Class	Retinoid
Indication	Induction of remission in promyelocytic leukemia
Drug Interactions	Interacts with antifibrinolytic agents (tranexamic acid, aminocaproic acid, aprotinin)- may cause fatal thrombotic complications. Use together cautiously.
Food Interactions	Food may increase drug absorption (effect on extent and/or rate).
Treatment Considerations	Women of child-bearing potential must have negative pregnancy test within 1 week prior to initiation of drug, and use two forms of contraception during therapy. Monitor for retinoic acid-APL syndrome. Increases cholesterol and

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	triglyceride levels, and LFTs. Monitor platelets, CBC, coagulation studies, LFTs, cholesterol and triglycerides frequently. Approximately 25% of patients experience retinoic acid-APL syndrome, which can result in death. Symptoms include fever, dyspnea, weight gain, pulmonary infiltrates on X-ray, pleural or pericardial effusions. May also present with impaired mycardial function, hypotension, leukocytosis. usually occurs during first month of treatment, but can occur as early as after the first dose.
CYP3A4 Inducers	Drugs that induce the enzyme system will interact with tretinoin but there are no data to suggest that they will either increase of decrease tretinoin efficacy.
CYP3A4 Inhibitors	Drugs that inhibit the enzyme system will interact with tretinoin but there are no data to suggest that they will either increase of decrease tretinoin efficacy. However, ketoconazole has been shown to increase tretinoin plasma AUC.
Administration Instructions	Divide into equal daily doses. May take without regard to meals. Protect from light.
Contraindications	
Significant side effects	Headache, earache, fever, weakness, fatigue, abdominal pain, diarrhea, constipation, dyspepsia, flushing, arrhythmia, hypotension, hypertension, phlebitis, cardiac failure, dizziness, paresthesias, anxiety, insomnia, depression, confusion, leukocytosis, GI bleeding/hemorrhage, disseminated intravascular coagulation (DIC), myalgia. Symptoms of retinoic acid-acute promyelocytic leukemia (APL) syndrome: fever, dyspnea, weight gain, pulmonary infiltrates, pleural and pericardial effusions. Uncommonly, renal insufficiency can occur, including acute renal failure.
Uracil and tegafur	
Trade Name	UFT
Class	Antimetabolite
Indication	Breast; colorectal; gastric; pancreatic
Drug Interactions	Pts. Taking phenytoin along with UFT should be monitored closely for increased phenytoin concentrations. Interacts with courmarin anticoagulants, including warfarin- prothrombin time or INR should be monitored closely. Co-administration of 5-fluorouracil or its prodrugs with medicinal products that inhibit dihydropyrimidine dehydrogenase theoretically may lead to increased fluoropyrimidine toxicity which is potentially lethal. UFT must not be co-administered with dihydropyrimidine dehydrogenase inhibitors such as brivudine. A time interval of 4 weeks must pass before administration of UFT following administration of brivudine. In vitro studies suggest that UFT should be administered with caution in combination with substrates or inhibitors of the CYP2A6 enzyme.
Food Interactions	Food may affect absorption.
Treatment Considerations	Use with calcium folinate in patients with renal or hepatic impairment, signs and symptoms of bowel obstruction, and in elderly patients. Is suspected to cause serious birth defects when administered during pregnancy. Contraceptive measures must be taken by male and female patients during and up to 3 months after therapy. Treat with caution patients with history of significant cardiac disease.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No

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Administration Instructions	Take on empty stomach with a large glass of water. Take at least one hour before or one hour after meals. Given in three divided doses, preferably every eight hours, with calcium folinate taken at the same time. Do not store above 77 F.
Contraindications	Patients who have known hypersensitivity to 5-florouricil, tegafur, uracil, or any of the excipients, are pregnant or attempting to become pregnant, are breast feeding, are adolescents, children or infants, have severe hepatic impairment, have evidence of bone marrow suppression from previous radiotherapy or antineoplastic agents, have a known deficiency of hepatic CYP2A6, have a known or suspected dihydropyrimidine dehydrogenase deficiency, are treated or have recently been treated with dihydropyrimidine dehydrogenase inhibitors such as brivudine.
Significant side effects	Diarrhea, nausea, vomiting, stomatitis, anorexia, abdominal pain, constipation, flatulence,dyspepsia, mucositis, dry mouth, eructation,intestinal obstruction, fatigue, rash, neurotoxicity, myelosuppression, renal insufficiency, hepatic disorders, significant cardiac disease, deep thrombophlebitis, dyspnea, alopecia, rash, exfoliative dermatitis, skin discoloration, pruritus, photosensitivity. Uncommon side effects include enteritis, gastritis, ileitis, intestinal perforation.
Vorinostat	
Trade Name	Zolinza®; suberoylanilide hydroxamic acid; SAHA
Class	Histone deacetylase (HDAC) inhibitor
Indication	Cutaneous manifestations of cutaneous T-cell lyphoma in patients who have progresseive, persistent, or recurrent disease on or after two systemic therapies.
Drug Interactions	Causes severe thrombocytopenia, GI bleeding when co-administered with other HDACs such as valproic acid—use together cautiously if at all and monitor platelet count every 2 weeks during first 2 months. Interacts with coumadine-derivative anticoagulants.
Food Interactions	None
Treatment Considerations	Fetotoxic—avoid pregnancy and breastfeeding. Rarely causes pulmonary embolism or squamous cell carcinoma. Dose-related thrombocytopenia and anemia requires dose modification. Monitor diabetic patients carefully for hyperglycemia. Electrocardiogram with QTc measurement at baseline and periodically through treatment.
CYP3A4 Inducers	No
CYP3A4 Inhibitors	No
Administration Instructions	Take once daily with food. Do not crush or open capsules.
Contraindications	None
Significant side effects	Myelosuppression (platelet and red blood cell), increased serum creatinine, increased protein in urine, nausea, vomiting, diarrhea, anorexia, weight loss, constipation, fatigue, chills, dysgeusia, dry mouth, hyperglycemia, QTc prolongation, and rarely pulmonary embolism or squamous cell carcinoma.
Herbal Therapies	
Note:	Herbals to be wary of if patient is taking and if antineoplastic is a substrate to CYP3A4
CYP3A4 Inducers	Pomelo, bitter orange, berberine, St. John's wort, grapefruit, garlic (dissenting study), long pepper. artemisia annua (sweet Annie), resveratrol (found in grapes), arachis hypogaea (found in peanuts).

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Note. Based on information from AstraZeneca Pharmaceuticals, 2007; Celgene, 2010; Eli Lilly and Company, 2008; GlaxoSmithKline, 2007, 2009; Irwin & Klemm, 2001; Jatol, 2010; Lohr, 2009; McLeod, 1998; Merck, 2007; Novartis, 2010a, 2010b; Oncology Nursing Society, 2010; Scripture & Figg, 2006; Steinberg, 2008; Sztela, 2007; Wilkes, 2011; Wilkes & Barton-Burke, 2010; Yarnell, 2007.

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