Oncology Nursing Society

Cancer Chemotherapy and Biotherapy Update/Renewal Course

Chemotherapeutic and Biologic Agents

Please note that this table is provided for educational purposes only and reflects the information available when a drug has been newly released. Any procedures, medications, or other courses of diagnosis or treatment discussed or suggested by the authors should not be used by clinicians without evaluation of their patients' conditions and of possible contraindications or dangers in use, review of any applicable manufacturer's product information, and comparison with the recommendations of other authorities.

References

Manufacturers' prescribing information.

Polovich, M., White, J.M., & Kelleher, L.O. (Eds.). (2005). *Chemotherapy and biotherapy guidelines and recommendations for practice* (2nd ed.). Pittsburgh, PA: Oncology Nursing Society.

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Drug Table Classification: Table of Contents

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

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Arsenic Trioxide Antiangiogenic Agent
(Trisenox®, Cephalon, Inc.)

Mechanism of Action	Arsenic trioxide causes morphologic changes and DNA fragmentation characteristic of apoptosis in NB4 human promyelocytic leukemia cells in vitro. Arsenic trioxide also causes damage or degradation of the fusion protein PML/RAR-alpha.
Dose	Adults and children five years of age and older: • **Induction**—0.15 mg per kg of body weight daily until bone marrow remission occurs (up to 60 doses) • **Consolidation**—0.15 mg per kg of body weight daily for 25 doses over a period of up to five weeks
Indications	Indicated for induction of remission and consolidation in patients with acute promyelocytic leukemia (APL) who are refractory to or have relapsed from retinoid and anthracycline chemotherapy and whose APL is characterized by the presence of the t(15;17) translocation or PML/RAR-alpha gene expression
Side Effects	Leukocytosis, nausea, vomiting, diarrhea, abdominal pain, fatigue, edema, hyperglycemia, dyspnea, cough, rash, headache, and dizziness
Nursing Considerations	Monitor for symptoms of APL differentiation syndrome during or after treatment. These symptoms include fever, weight gain, shortness of breath, and musculoskeletal pain. High-dose steroids and diuretics often manage these symptoms. Prior to initiating therapy, perform electrocardiogram (ECG), and assess and correct serum electrolytes. If possible, discontinue drugs that prolong the QT interval.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Lenalidomide Antiangiogenic Agent
(Revlimid®, Celgene Corp.)

Mechanism of Action	Possesses immunomodularity and antiangiogenic properties. Full mechanism of action is unknown. Lenalidomide is structurally similar to thalidomide.
Dose	Recommended starting dose is 10 mg daily by mouth, with dose reductions for thrombocytopenia and neutropenia.
Indications	Indicated for the treatment of patients with transfusion-dependent anemia due to myelodysplastic syndromes (MDS) associated with deletion of chromosome 5q Also indicated for use in combination with dexamethasone in patients with multiple myeloma who have received one prior therapy.
Side Effects	Neutropenia and thrombocytopenia, requiring dose interruptions or reduction, deep vein thrombosis, pulmonary embolism, diarrhea, pruritus, and fatigue There is insufficient information regarding lenalidomide's teratogenic properties. It must be considered a potential teratogen because of its structural similarities to thalidomide.
Nursing Considerations	Oral medication Participation in Celgene's restricted distribution program, RevAssist®, is mandatory. Patient education available through Celgene emphasizes the need for effective contraception for four weeks for all patients and two negative pregnancy tests for women prior to starting treatment. Pregnancy tests are continued weekly for four weeks with the start of treatment and at the end of treatment. May require blood product support and/or growth factors.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Thalidomide Antiangiogenic Agent
(Thalomid®, Celgene Corp.)

Mechanism of Action	Unknown; possible modulation of tumor necrosis factor–alpha (TNF-a) and vascular endothelial growth factor (VEGF).
Dose	–
Indications	Currently in clinical trial phases I, II, and III for Kaposi sarcoma; prostate, lung, breast, colon, and renal cancers; hepatocellular cancer; glioblastoma; and myeloma. Indicated in combination with dexamethasone for treatment of newly-diagnosed multiple myeloma.
Side Effects	Birth defects, drowsiness and/or somnolence, orthostatic hypotension, peripheral neuropathy, dizziness, rash, anorexia, increased appetite and/or weight gain, constipation, neutropenia, and increase in HIV viral load
Nursing Considerations	Oral medication Participation in the S.T.E.P.S.® program is mandatory. Administer weekly pregnancy test during the first four weeks of therapy, then monthly or every two weeks depending on menses regularity. Obtain monthly labs, including complete blood count with differential. Perform monthly weight check. Discontinue treatment if patient • Becomes pregnant • Develops peripheral neuropathy. Provide extensive birth control education in conjunction with Celgene's literature.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Azacitidine Antimetabolite
(Vidaza™, Pharmion)

Mechanism of Action	Azacitidine is believed to cause hypomethylation of DNA and direct cytotoxicity on abnormal hematopoietic cells in bone marrow. Abnormal cells, including cancer cells, no longer respond to normal growth control mechanisms. The cytotoxic effects of azacitidine cause the death of these cells, whereas nonproliferating cells are relatively insensitive to the medication.
Dose	75 mg/m^2 daily for seven days every four weeks; increase to 100 mg/m^2 if no beneficial effect is seen after two treatment cycles.
Indications	Indicated for the treatment of patients with specific subtypes of MDS
Side Effects	Bone marrow suppression, including neutropenia, thrombocytopenia, and anemia. Additional side effects seen include nausea, vomiting, diarrhea, fatigue, fever, erythema at injection site, elevated serum creatinine, renal failure, hypokalemia, renal tubular acidosis, and hepatic coma.
Nursing Considerations	Gently roll syringe between palms to mix medication. Administer azacitidine subcutaneously. Divide doses greater than 4 ml into two syringes and inject into two separate sites. Rotate sites for administration among thigh, abdomen, and upper arm. Administer new injections at least one inch from old site. Avoid sites that are tender, bruised, red, or hard. Monitor blood counts and liver and renal function during therapy. Azacitidine requires the use of chemotherapy safe-handling precautions. Azacitidine is contraindicated in patients with hypersensitivity to azacitidine or mannitol and those with advanced malignant hepatic tumors. This medication has been shown to have teratogenic effects. Female patients should avoid becoming pregnant while taking this medication. Male patients should be advised not to father a child while receiving azacitidine therapy. Must be administered within one hour after reconstitution at room temperature. For delayed administration, may be refrigerated for up to eight hours. Allow refrigerated solution to come to room temperature for 30 minutes prior to administration.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Clofarabine Antimetabolite
(Clolar™, Genzyme Corp.)

Mechanism of Action	A purine nucleoside antimetabolite that inhibits DNA repair by incorporation into the DNA chain during the repair process
Dose	Recommended pediatric dose is 52 mg/m^2 administered by IV infusion over two hours daily for five consecutive days. Treatment cycles are repeated following recovery or return to baseline organ function, approximately every two to six weeks. The dosage is based on the patient's actual height and weight before the start of each cycle.
Indications	Indicated for the treatment of patients who are 1–21 years old with relapsed or refractory acute lymphoblastic leukemia after at least two prior regimens
Side Effects	Nausea; vomiting; diarrhea; bone marrow suppression, including anemia, leukopenia, thrombocytopenia, neutropenia, and febrile neutropenia; infections; hepatobiliary and renal toxicity; and rare cases of systemic inflammatory response syndrome (SIRS)/capillary leak syndrome and cardiac toxicity, including tachycardia, pericardial effusion, and left ventricular systolic dysfunction.
Nursing Considerations	Continuous IV fluid administration during the five days of chemotherapy administration is encouraged in order to reduce the risk of tumor lysis syndrome and other adverse effects. Prophylactic steroids may be used to help prevent SIRS. Monitor respiratory status and blood pressure during infusion. Monitor renal and hepatic function during the days of administration. Hematologic status should be monitored closely following treatment.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Decitabine Antimetabolite
(Dacogen®, MGI Pharma, Inc.)

Mechanism of Action	Decitabine is believed to exert its antineoplastic effects after phosphorylation and direct incorporation into DNA and inhibition of DNA methyltransferase, causing hypomethylation of DNA and cellular differentiation or apoptosis.
Dose	15 mg/m^2 administered by continuous IV infusion over three hours repeated every eight hours for three days, every six weeks for a minimum of four cycles. Treatment may be prolonged as long as the patient continues to benefit.
Indications	Indicated for the treatment of patients with MDS, including previously treated and untreated, de novo and secondary MDS of all French-American-British subtypes (refractory anemia, refractory anemia with ringed sideroblasts, refractory anemia with excess blasts, refractory anemia with excess blasts in transformation, and chronic myelomonocytic leukemia) and intermediate-1, intermediate-2, and high-risk International Prognostic Scoring System groups
Side Effects	Myelosuppression, including neutropenia, thrombocytopenia, anemia, and febrile neutropenia Nausea, vomiting, diarrhea, and constipation Fever, edema, hyperglycemia, hypomagnesemia, hypokalemia, arthralgias, back pain, cough, headache, insomnia, rash, petechiae, and pallor
Nursing Considerations	Patients may be premedicated with standard antiemetic therapy. Bone marrow suppression is the most frequent cause of dose reduction, delay, and discontinuation. Refer to prescribing information. If not used within 15 minutes of reconstitution, the solution must be prepared using cold (2°–8°C) infusion fluids and stored at 2°–8°C (36°–46°F) for up to a maximum of seven hours until administration.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Nelarabine Antimetabolite
(Arranon®, GlaxoSmithKline)

Mechanism of Action	Inhibits DNA synthesis, leading to cell death
Dose	**Adult Dosage:** 1,500 mg/m² IV over two hours on days 1, 3, and 5, repeated every 21 days **Pediatric Dosage:** 650 mg/m² IV over one hour daily for 5 consecutive days repeated every 21 days
Indications	Indicated for the treatment of patients with T-cell acute lymphoblastic leukemia and T-cell lymphoblastic lymphoma whose disease has not responded to or has relapsed following treatment with at least two chemotherapy regimens
Side Effects	Neurotoxicity (somnolence, confusion, convulsions, ataxia, paresthesia, and hypoesthesia) is the dose-limiting toxicity. Severe neurologic toxicity may include coma, status epilepticus, craniospinal demyelination, or ascending neuropathy similar to Guillain-Barré syndrome in presentation. Gastrointestinal (GI): nausea, diarrhea, vomiting, and constipation Hematologic: anemia, neutropenia, thrombocytopenia, and febrile neutropenia Headache, increased transaminase levels, decreased blood potassium, decreased blood albumin, increased blood bilirubin, fatigue, cough, and dyspnea
Nursing Considerations	Monitor closely for signs and symptoms of neurologic toxicity. Nelarabine should be discontinued for neurologic events of National Cancer Institute Common Terminology Criteria for Adverse Events grade 2 or greater. Dosage may be delayed for other toxicity, including hematologic toxicity. Patients treated previously or concurrently with intrathecal chemotherapy or previously with craniospinal irradiation may be at increased risk for neurologic adverse events. Regularly monitor complete blood counts, including platelets. Take appropriate measures (e.g., hydration, urine alkalinization, prophylaxis with allopurinol) to prevent hyperuricemia or tumor lysis syndrome. Administer undiluted.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Pemetrexed Antimetabolite
(Alimta®, Eli Lilly & Co.)

Mechanism of Action	Disrupts folate-dependent metabolic processes essential for cell replication
Dose	500 mg/m^2 IV infusion over 10 minutes every 21 days with cisplatin (75 mg/m^2 over two hours) to follow 30 minutes later
Indications	Given in combination with cisplatin for the treatment of malignant pleural mesothelioma for nonsurgical candidates Given as a single agent for patients with locally advanced or metastatic nonsmall cell lung cancer who have received one prior chemotherapy treatment.
Side Effects	Side effects with pemetrexed plus cisplatin regimen include myelosuppression, fatigue, nausea, vomiting, chest pain, dermatologic toxicity, and dyspnea. Side effects were reduced with vitamin supplementation.
Nursing Considerations	To decrease side effects, administer folic acid, 350–1,000 mcg daily, starting one to three weeks prior to the first cycle and daily for one to three weeks after the final cycle (should take at least five doses in the week prior to first treatment). Vitamin B_{12} injection of 1,000 mcg intramuscularly was given one to three weeks before the first cycle and repeated every nine weeks until treatment was completed. Administering dexamethasone 4 mg bid for three days starting the day before treatment decreases the incidence of skin rash. Monitor complete blood count on days 8 and 15. Hold treatment if absolute neutrophil count < 1,500; platelet count < 100,000; or creatinine clearance < 45 ml/minute. Monitor renal and hepatic function. The concurrent use of ibuprofen may increase the risk of renal damage.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Pegfilgrastim Hematopoietic Growth Factor
(Neulasta®, Amgen Inc.)

Mechanism of Action	–
Dose	Dose is a single 6 mg subcutaneous injection once per chemotherapy cycle. Should not be given between 14 days before and 24 hours after administration of cytotoxic chemotherapy.
Indications	Decreases the incidence of infection, as manifested by febrile neutropenia, in patients with nonmyeloid cancers who are receiving myelosuppressive chemotherapy that is associated with an incidence of febrile neutropenia
Side Effects	Bone pain, muscle ache, and injection site reaction
Nursing Considerations	Should not be used with infants, children, and adolescents weighing less than 45 kg Drug is supplied in prefilled syringes. Refrigerate. Do not freeze. Do not shake product. Protect from light.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Palifermin Keratinocyte Growth Factor
(Kepivance™, Amgen Inc.)

Mechanism of Action	Binds to the keratinocyte growth factor receptor, resulting in proliferation, differentiation, and migration of epithelial cells
Dose	Recommended dose is 60 mcg/kg/day, administered as an IV bolus injection for three consecutive days before and three consecutive days after myelotoxic therapy for a total of six doses. The first three doses should be administered prior to myelotoxic therapy, with the third dose given 24–48 hours before myelotoxic therapy. The last three doses should start after, but on the same day of, hematopoietic stem cell infusion and at least four days after the most recent administration of palifermin.
Indications	Indicated to decrease the incidence and duration of severe oral mucositis in patients with hematologic malignancies receiving myelotoxic therapy that requires hematopoietic stem cell support
Side Effects	Skin rash (erythema, edema, pruritus), oral toxicities, pain, arthralgias, and dysesthesia. Other effects include hypertension, proteinuria, and reversible elevation in serum lipase and amylase.
Nursing Considerations	Flush IV line with normal saline before and after palifermin administration. Do not administer palifermin within 24 hours before, during infusion of, or within 24 hours after administration of myelotoxic chemotherapy.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Bortezomib Miscellaneous Agent
(Velcade®, Millennium Pharmaceuticals, Inc.)

Mechanism of Action	Targets and inhibits proteasome activity, causing disruption of normal homeostatic mechanisms and leading to cell death
Dose	Given as 1.3 mg/m^2 per dose IV bolus administered twice weekly for two weeks followed by a 10-day rest period
Indications	Indicated for patients with multiple myeloma who have received at least one prior therapy and patients with mantle cell lymphoma who have received at least one prior therapy
Side Effects	Myelosuppression, nausea, vomiting, diarrhea, constipation, anorexia, dose-limiting peripheral neuropathy, hepatic and renal toxicity, rash, orthostatic hypotension, flu-like symptoms, fever, and fatigue
Nursing Considerations	Administer reconstituted agent within eight hours of preparation; use within three hours of preparation if stored in a syringe. Use caution in patients who are taking antihypertensives. Thrombocytopenia occurs in approximately 40% of patients, peaking around day 11. CBC should be monitored throughout therapy. Peripheral neuropathy reported is predominantly sensory, although some cases of sensory-motor peripheral neuropathy have been reported.
FDA approval granted May 13, 2003.	Manufacturer's prescribing information dated May 13, 2003.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Ixabepilone Miscellaneous Agent
(Ixempra™, Bristol-Myers Squibb)

Mechanism of Action	Ixabepilone is a semi-synthetic analog of epothilone B. It binds to microtubules, suppressing mitotic function. Cells are blocked in the mitotic phase of the cell division cycle, leading to cell death.
Dose	The recommended dose of ixabepilone is 40 mg/m2 infused intravenously over 3 hours every 3 weeks.
Indications	Ixabepilone is indicated in combination with capecitabine for the treatment of metastatic or locally advanced breast cancer in patients after failure of an anthracycline and a taxane. It is also indicated as monotherapy for the treatment of metastatic or locally advanced breast cancer in patients after failure of an anthracycline, a taxane, and capecitabine.
Side Effects	The most common adverse reactions are peripheral sensory neuropathy, fatigue/asthenia, myalgia/arthralgia, alopecia, nausea, vomiting, stomatitis/mucositis, diarrhea, and musculoskeletal pain. Additional reactions in combination treatment: palmar-plantar erythrodysesthesia syndrome, anorexia, abdominal pain, nail disorder, and constipation. Hematologic abnormalities include neutropenia, leukopenia, anemia, and thrombocytopenia.
Nursing Considerations	Premedicate all patients with an H1 antagonist and an H2 antagonist before treatment. Dose reduction is required in certain patients with elevated AST, ALT, or bilirubin. Ixabepilone for Injection must be constituted with supplied DILUENT. The concentration in constituted solution is 2 mg/mL. Constituted solution must be diluted with Lactated Ringer's Injection, USP, to a final concentration of 0.2 mg/mL to 0.6 mg/mL. The final solution must be used within 6 hours of preparation. Contraindications include hypersensitivity to drugs formulated with Cremophor® EL., baseline neutrophil count <1500 cells/mm3 or a platelet count <100,000 cells/mm3. Patients with AST or ALT >2.5 x ULN or bilirubin >1 x ULN must not be treated with ixabepilone in combination with capecitabine. Fetal harm can occur when administered to a pregnant woman. Women should be advised not to become pregnant when this medication.
FDA approval granted October 16, 2007.	Manufacturer's prescribing information dated October, 2007.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Paclitaxel Protein-Bound Particles for Injectable Suspension Miscellaneous Agent
(Abraxane™, Abraxis Oncology)

Mechanism of Action	Stabilizes microtubules and inhibits the reorganization needed for mitotic division and other cellular functions
Dose	Recommended dose is 260 mg/m^2 IV administered over 30 minutes every three weeks.
Indications	Indicated for the treatment of metastatic breast cancer after failure of combination chemotherapy or relapse within six months of adjuvant therapy. An anthracycline should have been part of the prior chemotherapy. This chemotherapy agent is not interchangeable with paclitaxel in its approved indications.
Side Effects	Dose-dependent and dose-limiting myelosuppression (especially neutropenia), sensory neuropathy, myalgia, arthralgia, nausea, diarrhea, alopecia (complete hair loss), injection site reactions, vesicant reactions, and ECG abnormalities.
Nursing Considerations	Drug is free of solvents; therefore, no premedication is required to prevent hypersensitivity reactions. No inline filter or use of polyvinyl chloride tubing is required. Drug is composed of albumin, which brings a remote risk of viral disease transmission. Consider dose reduction by about 20% for grade 3 sensory neuropathy; resume treatment with reduced dose when neuropathy improves to grade 1 or 2. Do not use in patients with baseline neutrophil count < 1,500 cells/mm^3 and/or platelet count < 100,000 cells/mm^3.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Vorinostat Miscellaneous Agent
(Zolinza™, Merck & Co., Inc.)

Mechanism of Action	Vorinostat is a histone deacetylase (HDAC) inhibitor. HDAC inhibitors work by interfering with the cell's ability to transmit genetic information from the DNA to cellular proteins.
Dose	400 mg orally once daily with food. May adjust dose to 300 mg daily for intolerance to therapy.
Indications	Indicated for the treatment of cutaneous manifestations in patients with cutaneous T-cell lymphoma who have progressive persistent or recurrent disease on or following two systemic therapies
Side Effects	Side effects include diarrhea, fatigue, nausea, thrombocytopenia, anorexia, and dysgeusia. Pulmonary embolism and deep vein thrombosis have been reported. QT prolongation has been observed.
Nursing Considerations	Avoid concomitant use with other HDAC inhibitors (e.g., valproic acid). Monitor blood cell counts and chemistry tests, including potassium, magnesium, calcium, glucose, and serum creatinine, every two weeks during the first two months of therapy, and then monthly after that time. Avoid use in pregnant women. Capsules should not be opened or crushed. Monitor prothrombin time and international normalized rate (INR) in patients receiving warfarin derivatives concurrently with vorinostat.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Alemtuzumab Monoclonal Antibody—Unconjugated
(Campath®, Berlex Laboratories)

Mechanism of Action	Binds to CD52, a nonmodulating antigen present on the surface of essentially all B and T lymphocytes; a majority of monocytes, macrophages, and NK cells; and a subpopulation of granulocytes
Dose	Alemtuzumab is initiated at a dose of 3 mg and administered as a two-hour IV infusion daily. When the 3 mg daily dose is tolerated, the daily dose should be escalated to 10 mg and continued until tolerated. When the 10 mg dose is tolerated, the maintenance dose of 30 mg may be initiated. The maintenance dose is 30 mg/day administered three times per week on alternate days for up to 12 weeks. Gradual escalation to the recommended maintenance dose is required at the initiation of therapy and after interruption of therapy for seven or more days.
Indications	Indicated for the treatment of B-cell chronic lymphocytic leukemia.
Side Effects	Serious hematologic complications; serious infusion reactions; and serious, sometimes fatal, bacterial, viral, fungal, and protozoan infections have been reported in patients receiving alemtuzumab therapy.
Nursing Considerations	Alemtuzumab has been associated with infusion-related events (e.g., hypotension, rigors, fever, shortness of breath, bronchospasm, chills, rash). To ameliorate or avoid infusion-related events, premedicate with an oral antihistamine and acetaminophen prior to dosing, and monitor closely for infusion-related adverse events. Careful monitoring of blood pressure and hypotensive symptoms is recommended. Complete blood count and platelet count should be obtained at least weekly during therapy.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Bevacizumab (Formally Anti-VEGF Antibody) Monoclonal Antibody—Unconjugated
(Avastin®, Genentech, Inc.)

Mechanism of Action	Binds and inhibits VEGF, a protein critical to tumor angiogenesis
Dose	5 mg/kg IV infusion every 14 days until disease progression is detected. Administer as a 90-minute infusion following chemotherapy. If the first infusion is well tolerated, the second may be administered over 60 minutes. If that is well tolerated, all subsequent infusions may be over 30 minutes.
Indications	Used in combination with 5-fluorouracil as first-line and second-line therapy for patients with metastatic carcinoma of the colon or rectum
Side Effects	Side effects include asthenia, pain, abdominal pain, headache, hypertension, diarrhea, nausea, vomiting, anorexia, stomatitis, clot formation, constipation, dyspnea, rash, and proteinuria. Serious but less common side effects include GI perforation/wound healing complications and hemorrhage (lung and abdomen). This drug causes a risk of the occurrence of reversible posterior leukoencephalopathy syndrome (RPLS) and should be discontinued in patients who develop RPLS. Risk of nasal septum perforation and non-gastrointestinal fistula formation exists.
Nursing Considerations	Monitor blood pressure every two to three weeks during treatment and more frequently if the patient develops hypertension. Therapy should not be started for at least 28 days following surgery. Surgical incision should be fully healed prior to starting therapy. Do not administer or mix with dextrose solutions. Permanently discontinue medication if the patient develops GI perforation, wound dehiscence requiring medical intervention, serious bleeding, nephrotic syndrome, or hypertensive crisis. Temporarily suspend if evidence exists of moderate to severe proteinuria and severe hypertension until evaluation and appropriate treatment are provided.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Cetuximab Monoclonal Antibody—Unconjugated
(Erbitux®, ImClone Systems Inc. and Bristol-Myers Squibb Co.)

Mechanism of Action	Cetuximab is believed to bind to the natural protein epidermal growth factor receptor (EGFR) found on the surface of cancer cells, inhibiting cell growth. It is derived from both mouse and human antibodies.
Dose	Loading dose of 400 mg/m^2 is given IV infusion over two hours. If tolerated, patients are given a weekly dose of 250 mg/m^2 over 60 minutes. Maximum rate is 5 ml/minute.
Indications	May be given alone or in combination with irinotecan in the treatment of colorectal cancer. Adjuvant therapy with radiation therapy for locally advanced head and neck cancer and as a single agent in patients who have failed chemotherapy. Effective only in patients who test positive for the HER1 protein.
Side Effects	A risk exists of severe infusion reaction (bronchospasm, stridor, urticaria, and hypotension), usually occurring with the first dose. Dermatologic toxicity (including acneform rash, skin drying and fissuring, and inflammatory and infectious sequelae) may be severe. Less common side effects include weakness, fever, nausea, constipation, diarrhea, and abdominal pain. In studies, a small number of patients developed interstitial lung disease (ILD), including difficulty breathing and low blood pressure. Etiology is unclear.
Nursing Considerations	Prepare emergency equipment and medications before starting infusion. Premedication with an H_1 antagonist (diphenhydramine, 50 mg IV) is recommended. Severe infusion reactions require immediate interruption of infusion and permanent discontinuation of further treatment. Medication should be delivered through an inline 0.22 micron filter placed as proximal to the patient as practical. Prime tubing with cetuximab, and flush with 0.9% saline solution after infusion. Cetuximab should be piggybacked to the patient's infusion line. A one-hour observation period is recommended following infusion. Longer observation periods may be required in patients who experience infusion reactions. Sunlight may exacerbate skin reactions. Patients should limit sun exposure, wearing sunscreen and hats. Monitor for infectious sequelae of dermatologic toxicities. Patients developing pulmonary disorders should be investigated promptly. If ILD develops, cetuximab should be discontinued and the patient treated appropriately. Also monitor for hypomagnesemia and accompanying hypocalcemia and hypokalemia during therapy and following completion.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Eculizumab Monoclonal Antibody—Unconjugated
(Soliris™, Alexion Pharmaceuticals, Inc.)

Mechanism of Action	Inhibits the terminal components of complement, reducing hemolysis
Dose	600 mg via 35-minute IV infusion every 7 days for the first four weeks, followed by 900 mg for the fifth dose 7 days later, then 900 mg every 14 days thereafter
Indications	Indicated for the treatment of patients with paroxysmal nocturnal hemoglobinuria to reduce hemolysis
Side Effects	Effects include headache, nasopharyngitis, back pain, and nausea. Eculizumab increases the risk of meningococcal infections. Vaccinate patients with a meningococcal vaccine at least two weeks prior to receiving the first dose of eculizumab; revaccinate according to current medical guidelines for vaccine use. Monitor patients for early signs of meningococcal infections; evaluate immediately if infection is suspected; and treat with antibiotics if necessary.
Nursing Considerations	Do not administer as an IV push or bolus. Dilute to a final concentration of 5 mg/ml prior to administration. Administer by IV infusion over 35 minutes. Do not use in patients with unresolved serious *Neisseria meningitides* infection or those who are not currently vaccinated against *Neisseria meningitides*.
FDA approval granted March 16, 2007	Manufacturer's prescribing information dated March 2007.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Gemtuzumab Ozogamicin Monoclonal Antibody
(Mylotarg®, Wyeth Pharmaceuticals)

Mechanism of Action	Binds to the CD33 antigen
Dose	9 mg/m^2 IV infusion over two hours One hour before infusion, premedicate with diphenhydramine 50 mg po and acetaminophen 650–1,000 mg po, with two additional doses of acetaminophen every four hours, as needed.
Indications	Indicated for CD33+ acute myeloid leukemia in cases where the patient is older than 60 years of age at first relapse
Side Effects	Severe neutropenia, anemia, thrombocytopenia, chills, fever, nausea, vomiting, headache, hypotension, rash, mucositis, and hepatic toxicity
Nursing Considerations	Do not administer via IV push or bolus. Keep emergency drugs at the bedside because of the potential for allergic reactions. Infusion-related reaction symptoms occur 30–120 minutes after infusion starts. Gemtuzumab ozogamicin is administered IV through a 1.2 or 2.2 micron filter. Protect from light during preparation and administration. Observe hazardous drug precautions. Monitor for tumor lysis.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Panitumumab Monoclonal Antibody—Unconjugated
(Vectibix™, Amgen Inc.)

Mechanism of Action	Panitumumab binds to EGFR, inhibiting the binding of ligands for EGFR, resulting in inhibition of cell growth, induction of apoptosis, decreased proinflammatory cytokine and vascular growth factor production, and internalization of the EGFR. Panitumumab is a recombinant, human IgG2 kappa monoclonal antibody.
Dose	6 mg/kg administered over 60 minutes as an IV infusion every 14 days. Doses higher than 1,000 mg should be administered over 90 minutes.
Indications	Indicated for the treatment of EGFR-expressing, metastatic colorectal carcinoma with disease progression on or following chemotherapy regimens containing fluoropyrimidine, oxaliplatin, and irinotecan
Side Effects	Most common effects include skin rash, hypomagnesemia, paronychia, fatigue, abdominal pain, nausea, and diarrhea. Serious toxicities include pulmonary fibrosis, severe dermatologic toxicity complicated by infectious sequelae and septic death, infusion reactions, abdominal pain, hypomagnesemia, nausea, vomiting, and constipation.
Nursing Considerations	Prepare for potential severe infusion reaction during infusion. Reduce infusion rate by 50% in patients experiencing a mild or moderate (grade 1 or 2) infusion reaction for the duration of that infusion. Immediately and permanently discontinue infusion in patients experiencing severe (grade 3 or 4) infusion reaction. Withhold or adjust dose for moderate to severe dermatologic toxicity. Do not administer by IV push or bolus. Administer by an IV infusion pump using a low-protein-binding 0.2 micron or 0.22 micron inline filter.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Trastuzumab Monoclonal Antibody—Unconjugated
(Herceptin®, Genentech, Inc.)

Mechanism of Action	Recombinant DNA-derived humanized monoclonal antibody that selectively binds with high affinity to the human EGFR2 protein, HER2
Dose	The recommended initial loading dose of trastuzumab is 4 mg/kg administered as a 90-minute infusion. The recommended weekly maintenance dose of trastuzumab is 2 mg/kg and can be administered as a 30-minute infusion if the initial loading dose was well tolerated.
Indications	Indicated as a single agent for the treatment of patients with metastatic breast cancer whose tumors overexpress the HER2 protein and who have received one or more chemotherapy regimens for their metastatic disease; it also is indicated in combination with paclitaxel for treatment of patients with metastatic breast cancer whose tumors overexpress the HER2 protein and who have not received chemotherapy for their metastatic disease. Approved as part of a treatment regimen containing doxorubicin, cyclophosphamide, and paclitaxel for the adjuvant treatment of women with node-positive, HER2-overexpressing breast cancer.
Side Effects	Chills, fever, nausea, vomiting, pain at tumor site, severe hypersensitivity reaction, and cardiac toxicity During the first infusion with trastuzumab, a symptom complex most commonly consisting of chills and/or fever was observed in about 40% of patients in clinical trials. The symptoms were usually mild to moderate in severity and were treated with acetaminophen, diphenhydramine, and meperidine (with or without reduction in the rate of trastuzumab infusion).
Nursing Considerations	Do not administer by IV push or bolus. Do not freeze reconstituted product. Pretreatment cardiac assessment is required.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Capromab Pendetide Radioimmunoconjugate
(ProstaScint®, Cytogen Corp.)

Mechanism of Action	Murine monoclonal antibody whose target is prostate-specific membrane antigen. The antibody carries a scintigraphic agent, indium-111, to its target for diagnostic imaging purposes.
Dose	0.5 mg radiolabeled with 5 mCi of ^{111}In chloride IV over five minutes
Indications	Used in patients with clinically localized disease, patients with biopsy-proven, newly diagnosed prostate cancer, and those at high risk for pelvic lymph node metastasis. May also be indicated in patients after prostatectomy who have a rising prostate-specific antigen level with stable or absent metastatic disease with suspicion of occult metastasis. Not indicated for use after radiation therapy. This medication is not to be used as a screening tool for prostate cancer.
Side Effects	Possible allergic reaction
Nursing Considerations	Not to be used to assess response to treatment. May be readministered if scan results are inadequate. The results achieved with capromab pendetide should be evaluated with the results of other diagnostic studies. Specifically, it is recommended that metastatic results be confirmed with histology before treating the disease with surgery or radiation therapy. Adhere to radiation precautions of time, distance, and shielding. Bone scans are more sensitive for the detection of metastases to bone. Administered by a health professional who is qualified to handle radionucleotides. Two images are acquired, the first at 30 minutes and the second at 72–120 hours after administration of the medication.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Tositumomab and Iodine ^{131}I Tositumomab Radioimmunoconjugate
(Bexxar®, GlaxoSmithKline)

Mechanism of Action	Monoclonal antibody that targets the CD20+ protein on the B cell in follicular non-Hodgkin lymphoma and carries with it iodine-131 to induce cell death
Dose	Single treatment course consisting of two steps: **Dosimetric dose** • Tositumomab 450 mg IV over 60 minutes • Iodine-131 5 mCi, tositumomab 35 mg IV over 20 minutes • Allows for individualized dosing. Nonradioactive tositumomab administered via IV injection followed by trace amount of radioactive iodine-131 to evaluate clearance of radiation from patient. Gamma scan is performed immediately following and at two and four days following dosimetric dose. **Therapeutic dose** • Tositumomab 450 mg IV over 60 minutes. Iodine-131 at precalculated dose and 35 mg tositumomab IV over 20 minutes. • Tositumomab labeled with iodine-131 dose as determined by dosimetric dose, given 7–14 days following dosimetric dose. • Physician must be certified in initial dose determinations before calculating doses independently.
Indications	Indicated for the treatment of patients with CD20+ follicular non-Hodgkin lymphoma with or without transformation whose disease is refractory to rituximab and has relapsed following chemotherapy
Side Effects	Potentially severe and prolonged myelosuppression, hypersensitivity, infections, infusion-related reaction, asthenia, nausea, cough, fever, and rash
Nursing Considerations	Dosimetric dose may be given outside of the nuclear medicine or radiation oncology department. Therapeutic dose is given in nuclear medicine or the radiation oncology department. Infusion rate may need to be decreased to treat infusion-related reaction. Also, patients require written instructions on radiation safety precautions to follow for several days after receiving therapeutic dose to minimize exposure to people who are in their immediate vicinity. Radioactivity of patient is negligible, but patient is cautioned to avoid close contact for a specified period of time. Thyroid medications must be given one day prior to the start of the dosimetric dose and continued for 14 days following the therapeutic dose to avoid hypothyroidism. Perform baseline complete blood counts with differential and weekly for 10 weeks or more after administration. Baseline and annual thyroid-stimulating hormone are recommended.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Ibritumomab Tiuxetan Radioimmunoconjugate
(Zevalin®, Biogen Idec Inc.)

Mechanism of Action	Monoclonal antibody that targets CD20+ protein on the B cell in follicular non-Hodgkin lymphoma and carries with it yttrium-90 to induce cell death.
Dose	The therapeutic regimen is administered in two steps: • **Step 1:** Infusion of rituximab 250 mg/m^2, 50 mg/hour and increase according to package directions up to 400 mg/hour max, then a fixed dose of 5 mCi of ^{111}In ibritumomab as 10-minute IV push. • **Step 2:** Seven to nine days later, infusion of rituximab 250 mg/m^2, 100 mg/hour, and increase according to package directions up to 400 mg/hour max prior to 0.4 mCi/kg of ^{90}Y ibritumomab as a 10-minute IV push. *Note that the dose of rituximab is lower when used as part of the ibritumomab therapeutic regimen, as compared to the dose of rituximab when used as a single agent. Do not administer rituximab as an IV push or bolus.* The maximum allowed dose of ^{90}Y ibritumomab is 32 mCi or 1,184 MBq.
Indications	Indicated for the treatment of patients with relapsed or refractory low-grade, follicular or transformed B-cell non-Hodgkin lymphoma, *including* patients with rituximab-refractory follicular non-Hodgkin lymphoma. (Accelerated approval, clinical benefit was not yet established.) Contraindicated in patients with known hypersensitivity or anaphylactic reactions to murine proteins or to any component of this treatment, including rituximab, yttrium chloride, or indium chloride.
Side Effects	Thrombocytopenia, neutropenia, infusion reactions, which may include pulmonary infiltrates, and secondary malignancies. If given when platelet count is $\geq$ 150,000, can give whole dose. Reduced dose of ^{90}Y is recommended when platelet count is < 149,000.
Nursing Considerations	Premedication with acetaminophen and diphenhydramine is recommended before the rituximab. Radiation precautions of time, distance, and shielding are important, based on dose delivered. Nuclear medicine healthcare professionals will prepare and administer ibritumomab, whereas the nurse is primarily responsible for administration of rituximab. Nadirs ranged from seven to nine weeks and lasted for 22–35 days. Not to be given to patients with > 25% bone marrow involvement of lymphoma, if platelet count < 100,000 cells/mm^3, if neutrophils count < 1,500 cells/mm^3, if hypocellular bone marrow, or if patient has a history of failed stem cell collection.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Dasatinib Targeted Therapy

(Sprycel™, Bristol-Myers Squibb Co.)

Mechanism of Action	Dasatinib inhibits multiple tyrosine kinases, including *BCR-ABL*, *SRC* family, c-*KIT*, EPHA2 and PDGFRβ. Dasatinib is predicted to bind to multiple confirmations of the ABL kinase.
Dose	Recommended dose is 140 mg/day, administered orally in two divided doses of 70 mg. One dose is given in the morning and one in the evening, with or without meals. When administered for chronic phase chronic myeloid leukemia, recommended dose is 100 mg daily.
Indications	Indicated for the treatment of adults with chronic, accelerated, or myeloid or lymphoid blast-phase chronic myeloid leukemia with resistance or intolerance to prior therapy including imatinib
Side Effects	Severe bone marrow suppression, including neutropenia, thrombocytopenia, and anemia Platelet dysfunction may lead to bleeding, with the highest risk to the central nervous system, GI tract, and mucous membranes. Fluid retention, including pleural and pericardial effusion Prolonged QT interval by ECG Diarrhea, nausea, abdominal pain, and vomiting
Nursing Considerations	Do not crush or cut tablets. They should be taken whole. Use with great caution if patients are taking anticoagulants. Drug interactions can occur with CYP3A4 inducers (e.g., dexamethasone, phenytoin, carbamazepine) and substrates (e.g., cyclosporine, fentanyl), St. John's wort, antacids, H_2 blockers, and proton pump inhibitors. Elevation of transaminases or bilirubin, hypocalcemia, and hypophosphatemia. Hypocalcemia may require oral calcium supplements.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Erlotinib Targeted Therapy

(Tarceva™, OSI Pharmaceuticals, Inc., and Genentech, Inc.)

Mechanism of Action	Erlotinib inhibits the intracellular phosphorylation of tyrosine kinase associated with EGFR, which also is expressed on cancer cells.
Dose	Recommended dose is 150 mg daily at least one hour before or two hours after the ingestion of food. Treatment should continue until disease progression or unacceptable toxicity occurs. Dose adjustments may be necessary for hepatic impairment and drug interactions. If dose reduction is necessary, reduce in 50 mg decrements.
Indications	Indicated in locally advanced or metastatic non-small cell lung cancer after failure of at least one prior chemotherapy regimen. Also approved in combination with gemcitabine for the treatment of locally advanced, unresectable or metastatic pancreatic carcinoma.
Side Effects	Rash and diarrhea may be severe (grade 3–4). Other effects include anorexia, fatigue, and dyspnea. Abnormal liver function tests may be transient or associated with liver metastases. GI bleeding, conjunctivitis, and keratitis have occurred. Rare reports of serious ILD.
Nursing Considerations	Educate the patient to report severe or persistent diarrhea, nausea, anorexia or vomiting, worsening of unexplained shortness of breath or cough, and eye irritation. Cotreatment with ketoconazole or other potent CYP3A4 inhibitors may increase erlotinib levels, requiring a lower dose. Pretreatment with rifampicin and other CYP3A4 inducers (includes phenytoin, phenobarbital, and St. John's wort) may decrease erlotinib activity, requiring an increased dose. Monitor liver function tests, and consider dose reductions for abnormal tests, including INR, especially if the patient is on warfarin. Monitor the patient for signs of GI bleeding and elevated INR. Patients on anticoagulants should be monitored for changes in prothrombin time and INR. Diarrhea usually can be managed with loperamide. Both diarrhea and severe skin reactions may require dose reduction or temporary interruption of therapy. In patients who develop an acute onset of new or progressive pulmonary symptoms (dyspnea, cough, or fever), therapy should be interrupted pending diagnostic evaluation. If ILD is diagnosed, discontinue therapy, and treat the patient as needed.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Lapatinib Targeted Therapy
(Tykerb®, GlaxoSmithKline)

Mechanism of Action	Lapatinib is a 4-anilinoquinazoline kinase inhibitor of the intracellular tyrosine kinase domains of both EGFR and of HER2 receptors.
Dose	Recommended dose is 1,250 mg (5 tablets) given orally once daily on days 1–21 continuously in combination with capecitabine 2,000 mg/m^2/day (administered orally in two doses approximately 12 hours apart) on days 1–14 in a repeating 21-day cycle.
Indications	Indicated in combination with capecitabine, for the treatment of patients with advanced or metastatic breast cancer whose tumors overexpress HER2 and who have received prior therapy including an anthracycline, a taxane, and trastuzumab.
Side Effects	Most common adverse reactions during treatment of lapatinib plus capecitabine were diarrhea, palmar-plantar erythrodysesthesia, nausea, rash, vomiting, and fatigue.
Nursing Considerations	Should be taken at least one hour before or one hour after a meal. However, capecitabine should be taken with food or within 30 minutes of food. Should be taken once daily. Do not divide the daily dose. Modify the dose for cardiac and other toxicities, severe hepatic impairment, and CYP3A4 drug interactions. Decreases in left ventricular ejection fraction (LVEF) have been reported. Confirm normal LVEF function before therapy begins. May prolong QT interval in some patients. Monitor with ECG as needed. Consider dose reduction in patients with severe hepatic impairment. Multiple CYP3A4 drug interactions exist. Severe diarrhea may be managed with antidiarrheal agents, and replace fluids and electrolytes if severe. Lapatinib may cause fetal harm when administered to pregnant women. Advise women not to become pregnant while on lapatinib.
FDA approval granted March 13, 2007	Manufacturer's prescribing information dated March 2007.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Nilotinib Targeted Therapy

(Tasigna®, Novartis Pharmaceuticals Corp.)

Mechanism of Action	Nilotinib is inhibitor of the Bcr-Abl kinase.
Dose	400 mg orally twice daily, approximately 12 hours apart and should not be taken with food.
Indications	Indicated for the treatment of chronic phase (CP) and accelerated phase Philadelphia chromosome positive chronic myelogenous leukemia (CML) in adult patients resistant to or intolerant to prior therapy that included imatinib.
Side Effects	The most commonly reported drug-related adverse reactions were rash, pruritis, nausea, fatigue, headache, constipation, diarrhea and vomiting. Serious reactions included thrombocytopenia, neutropenia and elevated lipase, hepatic and electrolyte abnormalities. Sudden deaths have been reported in patients receiving nilotinib. It should not be used in patients with hypokalemia, hypomagnesemia, or long QT syndrome.
Nursing Considerations	CBC should be done every 2 weeks for the first 2 months, then monthly. Hypokalemia or hypomagnesemia must be corrected prior to nilotinib administration and should be periodically monitored. Use with caution in patients with hepatic impairment. ECGs should be obtained to monitor the QTc at baseline, seven days after initiation, and periodically thereafter, as well as following any dose adjustments. Nilotinib prolongs the QT interval. The capsules should be swallowed whole with water. No food should be consumed for at least 2 hours before the dose is taken and no food should be consumed for at least one hour after. Drug interactions: Avoid concomitant use of strong inhibitors or inducers of CYP3A4. If patients must be co-administered, a strong CYP3A4 inhibitor, dose reduction should be considered and the QT interval should be monitored closely. Should not be used during pregnancy or breast-feeding. Sexually active female patients should use effective contraception during treatment.
FDA approval granted October 29, 2007	Manufacturer's prescribing information dated October 2007.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Sorafenib Targeted Therapy

(Nexavar®, Bayer Pharmaceuticals Corp.)

Mechanism of Action	Multikinase inhibitor decreasing tumor cell proliferation and reducing tumor angiogenesis
Dose	Recommended daily dose is 400 mg (2 x 200 mg tablets) taken twice daily without food.
Indications	Indicated for the treatment of advanced renal cell carcinoma and treatment of patients with unresectable hepatocellular carcinoma (HCC).
Side Effects	Dermatologic: hand-foot syndrome, rash Cardiovascular: hypertension, myocardial infarction GI: mucositis, dyspepsia, increased lipase, increased amylase, diarrhea, nausea and vomiting, decreased appetite Increased risk of bleeding Peripheral neuropathy
Nursing Considerations	Treatment continues until the patient is no longer benefitting from the therapy or until unacceptable toxicity occurs. Patients should be cautioned to prevent pregnancy during treatment and for two weeks after treatment. Sorafenib has been shown to cause birth defects or fetal loss.

Note. Based on information from Polovich et al., 2005 and manufacturers' prescribing information.

Sunitinib Targeted Therapy
(Sutent®, Pfizer Labs)

Mechanism of Action	Multikinase inhibitor decreasing tumor cell proliferation and reducing tumor angiogenesis
Dose	One 50 mg oral tablet taken daily for four weeks followed by two weeks off treatment
Indications	Indicated for GI stromal tumor after disease progression while on imatinib mesylate or intolerance to imatinib mesylate and also for advanced renal cell carcinoma.
Side Effects	Myelosuppression Cardiac: left ventricular dysfunction Endocrine: hypothyroidism GI: diarrhea, nausea and vomiting, stomatitis, dyspepsia Cutaneous: skin discoloration, depigmentation of hair, hand-foot syndrome Other: fatigue, hypertension, bleeding, edema
Nursing Considerations	Oral medication, taken with or without food Baseline and periodic follow-up LVEF evaluations are needed for patients with cardiac risk factors; baseline LVEF evaluation should be considered for all patients. **Drug-Drug Interactions** Coadministration with ketoconazole, itraconazole, clarithromycin, atazanavir, indinavir nefazodone, nelfinavir, ritonavir, saquinavir, telithromycin, or voriconazole may increase sunitinib concentrations. Grapefruit also may *increase* concentrations. Coadministration with dexamethasone, phenytoin, carbamazepine, rifampin, rifabutin, rifapentine, phenobarbital, or St. John's Wort may *decrease* sunitinib concentrations.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.

Temsirolimus Targeted Therapy
(Torisel™, Wyeth, Inc.)

Mechanism of Action	Kinase inhibitor which inhibits mTOR, controlling cell division, resulting in the arrest of growth of tumor cells. Inhibited activity of mTOR resulted in reduced levels of the hypoxia-inducible factors HIF-1 and HIF-2 alpha, and the vascular endothelial growth factor.
Dose	25mg infused over a 30-60 minute period once a week. Treat until disease progression or unacceptable toxicity.
Indications	Indicated for the treatment of advanced renal cell carcinoma.
Side Effects	The most common adverse reactions are rash, asthenia, mucositis, nausea, edema, and anorexia. The most common laboratory abnormalities are anemia, hyperglycemia, hyperlipemia, hypertriglyceridemia, elevated alkaline phosphatase, elevated serum creatinine, lymphopenia, hypophosphatemia, thrombocytopenia, elevated AST, and leukopenia.
Nursing Considerations	Pretreat with prophylactic IV diphenhydramine 25-50 mg (or similar antihistamine) approximately 30 minutes before the start of each dose. To treat hypersensitivity reactions, stop infusion and treat with antihistamine. Drug may be restarted at physician discretion at a slower rate. Hyperglycemia and hyperlipemia re likely and may require treatment. Monitor glucose and lipid profiles. Monitor for symptoms or radiographic changes of interstitial lung disease. Bowel perforation may occur. Evaluate fever, abdominal pain, bloody stools, and/or acute abdomen promptly. Renal failure, sometimes fatal, has occurred. Monitor renal function at baseline and throughout treatment. Due to abnormal wound healing, use with caution in the perioperative period. Live vaccinations and close contact with those who received live vaccines should be avoided. Women of childbearing potential should be advised of the potential hazard to the fetus and to avoid becoming pregnant.
FDA approval granted May 30, 2007	Manufacturer's prescribing information dated May, 2007.

Note. Based on information from Polovich et al., 2005
and manufacturers' prescribing information.