

Table 18.4 Supportive Therapies Used in the Cancer Patient

Medication	Indications	Dosing	Side effects affecting rehab	Other side effects or considerations
Granulocyte and macrophage colony-stimulating factors: Increase production of granulocytes or macrophages in bone marrow; increase phagocytic activity of mature granulocytes and macrophages.				
Filgrastim (Neupogen) Pegfilgrastim (Neulasta)	Increases production of granulocytes.	Start at 5 mcg/kg/day; may increase by 5 mcg/kg/day in subsequent cycles of chemotherapy for poor response. Discontinue once ANC is 10000/mm <sup>3</sup> . Decrease dose to 5 mcg/kg/day once ANC reaches 1000/mm <sup>3</sup> .	Cog: 0 S: 0 A: 0 Motor: + D: 0 Com: 0 F: +	Bone pain, rupture of the spleen. Avoid administration during period 24 hrs before chemotherapy through 24 hrs after completion of chemotherapy. Drug interactions: None identified.
Sargramostim (Leukine)	Increases production of granulocytes and macrophages in bone marrow.	250 mcg/m <sup>2</sup> continuous IV/day over 24 hrs or SC daily for up to 14 days, depending on indication.	Cog: + S: + A: 0 Motor: ++ D: + Com: 0 F: +	Flu-like syndrome (fever, chills, lethargy, malaise, headache), transient bone pain (may be prevented by acetaminophen), fluid-retention syndrome, injection reaction, transient elevation in serum bilirubin and liver transaminases. Hold for at least 24 hrs after last dose of chemotherapy and 12 hrs after radiation therapy. Monitor complete blood counts at least twice/wk during treatment. Therapy should be terminated once total white blood cells >10000/mm <sup>3</sup> or ANC >1000/mm <sup>3</sup> for 3 days. Drug interactions: None identified.
Erythropoietin-stimulating factor: Increases production of erythropoietin, a hormone manufactured in the kidney that stimulates the formation of red blood cells.				
Erythropoietin (Procrit, Epogen) Darbepoetin (Aranesp)	Increases production of erythropoietin.	Start at 150 units/kg SC three times/wk. Reduce dose by 25% when hemoglobin (Hb) >12 g/dl or if Hb increases >1 g/dl in any 2 wk period. Withhold dose if Hb increases to >12 g/dl and restart at 25% below the previous dose. Do not initiate if baseline Hb is >10 g/dl.	Cog: 0 S: 0 A: 0 Motor: + D: 0 Com: 0 F: 0	DLT: Increased risk of tumor progression, increased risk of thrombus in patients with cancer. Indicated only in patients not expected to attain cancer cure; Food and Drug Administration restrictions for use (Risk Evaluation and Mitigation Strategy program) apply. Not indicated for treating anemia in cancer patients due to other factors such as iron or folate deficiencies, hemolysis, or gastrointestinal bleeding. Drug interactions: Administration requires concurrent monitoring of iron levels and stores and the administration of iron supplementation.
Substance P inhibitor antiemetic therapy: Highly effective in preventing acute and delayed nausea and vomiting with highly emetogenic chemotherapy.				

Medication	Indications	Dosing	Side effects affecting rehab	Other side effects or considerations
Aprepitant (oral) Fosaprepitant (IV) (Emend)	Used in combination with serotonin antagonist and dexamethasone.	Oral: 125 mg by mouth before initial chemotherapy dose each cycle. IV: 115 mg IV before each chemotherapy dose each cycle.	Cog: ++ S: ++ A: 0 Motor: ++ D: + Com: + F: ++	Fatigue, nausea, weakness, hiccups. Expensive therapy. Drug interactions: Induces CYP2C9; decreases effects of warfarin (Coumadin), dexamethasone, methylprednisolone, ethinyl estradiol, and norgestimate contraceptives. Avoid concurrent ingestion of grapefruit juice; it can increase levels and toxicity.
Serotonin receptor antagonist antiemetics: Highly effective in treating nausea and vomiting associated with chemotherapy and upper-abdominal irradiation and other causes of nausea and vomiting. Oral doses are the same as the IV doses.				
Ondansetron (Zofran)	Highly effective antiemetics used to treat nausea and vomiting associated with chemotherapy and upper-abdominal irradiation and other causes of nausea and vomiting.	8 mg given orally or intravenously 30 min before chemotherapy, repeat 8 mg dose 8 h later, and then 8 mg every 12 h for 2-3 days, up to 24 h after chemotherapy dose. Oral doses are the same as the IV doses.	Cog: + S: + A: 0 Motor: ++ D: + Com: + F: ++	Constipation, insomnia, diarrhea, dizziness, headache, arrhythmia with QT prolongation, dystonia, extrapyramidal symptoms, arthralgias, depression. Drug interactions: Antiarrhythmics, tricyclic antidepressants thioridazine, mesoridazine, and ziprasidone, and anesthetics can increase QT interval and cause life threatening arrhythmias.
Granisetron (Kytril)		2 mg by mouth or intravenously within 1 h of chemotherapy or radiation, or 1 mg one h before treatment and then repeated in 12 h. Oral doses are the same as the IV dose. Transdermal patch provides 3.1 mg/24 h for up to 7 days or 24 h after chemotherapy course completion.	Cog: + S: + A: 0 Motor: ++ D: + Com: + F: ++	
Dolasetron (Anzemet)		Adults: 100 mg by mouth or IV within 1 h of chemotherapy. Children: 1.8 mg/kg within 1 hr of chemotherapy.	Cog: + S: + A: 0 Motor: ++ D: + Com: + F: ++	
Palonosetron (Aloxi)		0.25 mg IV on day 1 of each chemotherapy cycle. Half-life is 40 h.	Cog: + S: + A: 0 Motor: ++ D: + Com: + F: ++	
Benzodiazepine antiemetics: Effective for treating anticipatory nausea and vomiting.				

From L. Carl, J. Gallo, and P. Johnson, 2014, *Practical Pharmacology in Rehabilitation: Effect of Medication on Therapy* (Champaign, IL: Human Kinetics).

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Lorazepam (Ativan) IV and oral	Used to treat anticipatory nausea and vomiting.	IV or oral: 0.5-2 mg by mouth 60 min before chemotherapy or IV 10 min before chemotherapy. Repeat every 6 h as needed.	Cog: +++ S: +++ A: 0 Motor: ++ D: ++ Com: ++ F: ++	Sedation, confusion, hypotension, ataxia. Drug interactions: Some antidepressants, anti-epileptic drugs (e.g., phenobarbital, phenytoin, carbamazepine), sedative antihistamines, opiates, antipsychotics, and alcohol may enhance sedative effects of these agents.
Alprazolam (Xanax) oral		0.25-0.5 mg by mouth 60 min before chemotherapy. Repeat every 6 h as needed.	Cog: +++ S: +++ A: 0 Motor: ++ D: ++ Com: ++ F: ++	
Glucocorticoid: Used in combination with a serotonin antagonist before each dose of chemotherapy. May be useful in treating delayed and refractory nausea and vomiting. Treats nausea in patients with disseminated cancer by suppressing inflammation and prostaglandin production caused by tumor encroachment.				
Dexamethasone (Decadron) Prednisone	Used in combination with a serotonin antagonist before each dose of chemotherapy. May be useful in treating delayed and refractory nausea and vomiting. Treats nausea in patients with disseminated cancer by suppressing inflammation and prostaglandin production caused by tumor encroachment.	4-8 mg by mouth or by IV before each dose of chemotherapy.	Cog: + S: 0 A: + Motor: + D: + Com: 0 F: +	Gastrointestinal upset, hyperglycemia, altered mental status. Drug interactions: Increased immunosuppression and infection risk with other immunosuppressives, antagonizes hypoglycemic effects of diabetic agents.
Cannabinoid antiemetic: Derivative of marijuana that is used in treatment of nausea in cancer patients in which other agents have failed.				
Dronabinol (Marinol)	Derivative of marijuana that is used in treatment of nausea in cancer patients in which other agents have failed.	5 mg/m <sup>2</sup> immediately before chemotherapy and then every 2-4 h as needed. Maximum of 6 doses/day.	Cog: +++ S: +++ A: 0 Motor: ++ D: 0 Com: ++ F: ++	Sedation, altered mental status. Most effective in patients with previous positive experiences with marijuana. Drug interactions: Can increase sedation and CNS depression when combined with other CNS depressants such as alcohol, sedatives, antipsychotics.
Dopamine antagonist antiemetic: Rescue antiemetic in chemotherapy patients; used postoperative and in other causes of nausea and vomiting. Metoclopramide has additional prokinetic activity associated with effects on muscarinic receptors.				
Metoclopramide	Rescue antiemetic	10 mg by mouth or by IV	Cog: +++	Restlessness, drowsiness, dizziness,

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(Reglan)	in chemotherapy patients; used postoperative and in other causes of nausea and vomiting. Metoclopramide has additional prokinetic activity associated with effects on muscarinic receptors.	every 6 h as needed. Reduce dose for renal impairment. Creatinine clearance < 30 mls/min and in the elderly to reduce risk of extrapyramidal side effects.	S: +++ A: ++ Motor: +++ D: + Com: +++ F: +++	lassitude, dystonia, headache, changes in blood pressure, extrapyramidal effects, hyperprolactinemia, constipation, depression Drug interactions: Additive sedation when used with other central nervous system depressants. Antagonizes dopamine-enhancer therapy used in treatment of Parkinson's disease.

Phenothiazine antiemetics: Anticholinergic and antihistaminic properties make them useful in treating motion sickness, postoperative nausea, and other types of nausea.

Promethazine (Phenergan)	Antiemetics with anticholinergic and antihistaminic properties that make them useful in treating motion sickness, postoperative nausea, and other types of nausea.	25 mg by mouth or intramuscularly every 6 h as needed. IV administration contraindicated due to severe necrosis associated with extravasation.	Cog: +++ S: +++ A: ++ Motor: +++ D: + Com: +++ F: +++	Strong sedative and anticholinergic effects, dry mouth and throat, increased heart rate, pupil dilation, urinary retention, constipation. At high doses: Hallucinations or delirium, motor impairment (ataxia), flushed skin, blurred vision, abnormal sensitivity to bright light, difficulty concentrating, short-term memory loss, visual disturbances, irregular breathing, dizziness, irritability, itchy skin, confusion, decreased body temperature (generally in the hands or feet), erectile dysfunction, additive sedation when used with other central nervous system depressants. Drug interactions: Additive sedation when used with other central nervous system depressants. Additive confusion and anticholinergic side effects when combined with other anticholinergic agents. Antagonizes dopamine-enhancer therapy used in treatment of Parkinson's disease.
Prochlorperazine (Compazine)		25 mg by mouth or 10 mg IV every 6 h as needed.	Cog: +++ S: +++ A: ++ Motor: +++ D: + Com: +++ F: +++	

Histamine-1 receptor antagonist (antihistamine) antiemetics: Used as rescue antiemetics and in treating delayed nausea and vomiting associated with chemotherapy; used in treating postoperative nausea and vomiting and other causes of nausea and vomiting, especially with vestibular effects. These agents are useful in treating postoperative nausea and motion sickness due to additional effects on the muscarinic receptors. Diphenhydramine is often used to treat allergic reactions.

Hydroxyzine (Vistaril)	Used as rescue antiemetics and in treating delayed nausea and vomiting associated with chemotherapy; used in treating	25-50 mg by mouth or intramuscularly every 6 h as needed.	Cog: +++ S: +++ A: ++ Motor: +++ D: + Com: +++ F: +++	Strong sedative and anticholinergic effects, dry mouth and throat, increased heart rate, pupil dilation, urinary retention, constipation. At high doses: Hallucinations or delirium, motor impairment (ataxia), flushed skin, blurred vision, abnormal sensitivity to bright light, difficulty
Diphenhydramine		25-50 mg by mouth or IV	Cog: +++	

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(Benadryl)	postoperative nausea and vomiting and other causes of nausea and vomiting	every 6 h as needed.	S: +++ A: ++ Motor: +++ D: + Com: +++ F: +++	concentrating, short-term memory loss, visual disturbances, irregular breathing, dizziness, irritability, itchy skin, confusion, decreased body temperature (generally in the hands or feet), erectile dysfunction, Drug interactions: Additive sedation when used with other central nervous system depressants. Additive confusion and anticholinergic side effects when combined with other anticholinergic agents. Antagonizes dopamine-enhancer therapy used in treatment of Parkinson's disease.
Meclizine (Dramamine)	(especially with vestibular effects), and motion sickness due to additional effects on the muscarinic receptors.	25 mg by mouth every 6 h as needed.	Cog: +++ S: +++ A: ++ Motor: +++ D: + Com: +++ F: +++	
Scopolamine (Hyoscine, Transderm Scop patch)	Diphenhydramine is often used to treat allergic reactions.	0.4 mg IM every 6 h as needed or apply 1.5 mg patch every 3 days.	Cog: +++ S: +++ A: ++ Motor: +++ D: + Com: +++ F: +++	
Bisphosphonates: Used to prevent fracture and to treat hypercalcemia; inhibits osteoclasts to reduce metastatic bone pain.				
Pamidronate (Aredia)	Used to prevent fracture and reduce metastatic bone pain.	90 mg given IV once every 30 days.	Cog: 0 S: 0 A: 0 Motor: 0 D: ++ Com: 0 F: 0	Common side effects: Fatigue, anemia, muscle aches, fever, swelling in the feet or legs, flu-like symptoms with initial infusion. Uncommon side effects: Severe bone, joint, or musculoskeletal pain. Drug interactions: Increased nephrotoxicity when combined with other agents associated with nephrotoxicity (aminoglycosides; polypeptide, glycopeptide, and polymyxin antibiotics; amphotericin B; adefovir; cidofovir; foscarnet; cisplatin; deferasirox; gallium nitrate; lithium; mesalamine; certain immunosuppressants; intravenous pentamidine; high intravenous dosages of methotrexate; high dosages or chronic use of nonsteroidal anti-inflammatory drugs or immunoglobulin therapy).
Zoledronate (Zometa, Aclasta)	Used to prevent fracture and reduce metastatic bone pain.	4 mg given IV over 15 min every 3-4 wk.	Cog: 0 S: 0 A: 0 Motor: 0 D: ++ Com: 0 F: 0	
Xanthine oxidase inhibitors				
Allopurinol (Zyloprim)	Used to reduce uric acid levels in tumor lysis syndrome.	600 mg by mouth or IV once daily to prevent increased uric acid levels; 600-800 mg by mouth once daily for up to 10 days to treat hyperuricemia associated with tumor lysis	Cog: 0 S: 0 A: 0 Motor: 0 D: + Com: 0 F: 0	Rash, kidney stones, acute interstitial nephritis, pneumopathy, fever, eosinophilia. Drug interactions: Reduce dose when used with 6-mercaptopurine, 6-thioguanine, or azathioprine.

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		syndrome. Maximum dose of 400 mg/m <sup>2</sup> /day. Reduce dose for renal insufficiency. Use with aggressive hydration therapy.		
Rasburicase (Elitek)	Tumor lysis syndrome if allopurinol is ineffective.	0.2 mg/kg as a 30 minute intravenous infusion daily for up to 5 days.	Cog: 0 S: 0 A: 0 Motor: 0 D: + Com: 0 F: 0	Converts uric acid to water-soluble metabolites. Effectively decreases plasma and urinary uric acid levels. Does not increase excretion of xanthine and is not associated with xanthine stone uropathy. Contraindicated in glucose-6-phosphate dehydrogenase deficiency and pregnancy. Very expensive.

Cog = cognition; S = sedation; A = agitation or mania; Motor = discoordination; D = dysphagia; Com = communication; F = falls; IV = intravenous; SC = subcutaneous; DLT= dose-limiting toxicities; mcg = microgram (1/1000 of a milligram); ANC = absolute neutrophil count; CNS = central nervous system; IM = intramuscular.

The likelihood rating scale for encountering the side effects is as follows: 0 = Almost no probability of encountering side effects. + = Little likelihood of encountering side effects. +/++ = Low probability of encountering side effects; however, probability increases with increased dosage. ++ = Medium likelihood of encountering side effects. +++ = High likelihood of encountering side effects, particularly with high doses. ++++ = Highest likelihood of encountering side effects; best to avoid in at-risk patients.