MARAVIROC: Selzentry

Class: Antiretroviral Agent, CCR5 Antagonist

Dosage Forms. Oral Tablet: 150 mg, 300 mg

Common FDA Label Indication, Dosing, and Titration.

1. Treatment of CCR5-tropic HIV-1 infection, in combination with other antiretroviral agents: Adults, 300 mg po bid

Off-Label Uses. None

MOA. Selectively and reversibly binds to the chemokine (C-C motif receptor 5 [CCR5]) coreceptors located on human CD4 cells. CCR5 antagonism prevents interaction between the human CCR5 coreceptor and the gp120 subunit of the viral envelope glycoprotein, thereby inhibiting gp120 conformational change required for CCR5-tropic HIV-1 fusion with the CD4 cell and subsequent cell entry.

Viir Healthcare pictured

Drug Characteristics: Maraviroc

Dose Adjustment Hepatic	Use with caution if moderate or severe hepatic impairment	**Absorption**	F = 23-33%, food decreases absorption by 30-60%
Dose Adjustment Renal	Reduce dose to 150 mg bid if CrCl <30 mL/min; avoid if on interacting meds	**Distribution**	CSF
Dialyzable	No	**Metabolism**	Hepatic, CYP3A4/5 and ABCB1 major substrate
Pregnancy Category	B	**Elimination**	20% unchanged in feces, 14-34% renally eliminated as parent, half-life 14-18 h
Lactation	Weight risks and benefits	**Pharmacogenetics**	Requires trophism test for the presence of CCR5 on patient CD4 cells
Contraindications	Patients with CrCl <30 mL/min or ESRD who are taking potent CYP3A4/5 inhibitors or inducers	**Black Box Warnings**	Hepatotoxicity

Medication Safety Issues: Maraviroc

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Yes	Yes	No	No

Drug Interactions: Maraviroc

Typical Agents	Mechanism	Clinical Management
CYP3A4/5 inhibitors	Decreased maraviroc metabolism and increased risk of maraviroc toxicity	Reduce dose of maraviroc to 150 mg bid if strong CYP3A5/5 inhibitor, monitor and consider dose reduction with moderate CYP3A4/5 inhibitors
CYP3A4/5 inducers	Increased maraviroc metabolism and decreased maraviroc efficacy	Increase dose of maraviroc to 600 mg bid with strong inducers

Adverse Reactions: Maraviroc

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Fever, rash, cough	Hypertension, insomnia, anxiety, fatigue, benign skin neoplasms, neutropenia, elevated LFTs, constipation, herpes infection	Coronary artery disease, angina, jaundice, hepatic failure, seizures

Efficacy Monitoring Parameters. HIV viral load, CD4 count, tropism assay, HIV resistance testing.

Toxicity Monitoring Parameters. LFTs, bilirubin.

Key Patient Counseling Points. Take with or without food. Do not chew or crush tablet. Does not prevent transmission of HIV, practice safe sex, do not share needles, etc. May cause drowsiness, avoid driving and concurrent CNS depressants.

Clinical Pearls. Not recommended for children <16 y of age. HIV may enter the cell via CCR5, CXCR4, or both receptors (called dual or mixed). Maraviroc is only indicated for HIV viruses that only use CCR5 for cell entry. Does not cure HIV. Medication guide required at dispensing.

MEASLES, MUMPS, RUBELLA VACCINE, LIVE: MMR-II

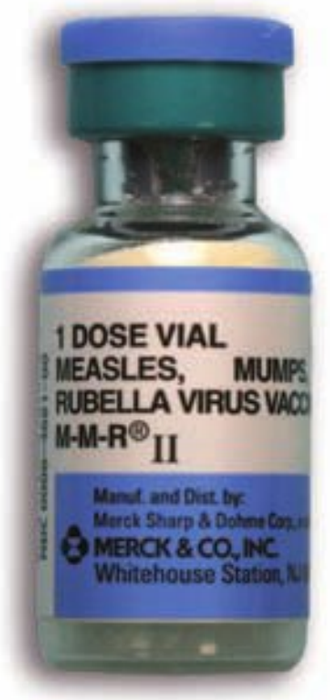
Class: Vaccine

Dosage Forms. **Lyophilized Powder for Subcutaneous Injection:** 0.5 mL after reconstitution with supplied diluent; also available in combination with varicella vaccine

Common FDA Label Indication, Dosing, and Titration.

1. Prevention of measles, mumps, and rubella infections: Adults, 1 dose (2nd dose indicated for adults who are at high risk); Children, 1 dose at age 12 mo with a 2nd dose at age 4-6 y, prior to entering school

Off-Label Uses. None



Merck pictured

Drug Characteristics: Measles, Mumps, Rubella Vaccine, Live

Pregnancy Category	C	**ADME**	None known
Lactation	Generally considered safe during lactation	**Pharmacogenetics**	Not yet clinically relevant
Contraindications	Hypersensitivity to MMR vaccine or a component of the vaccine (egg, gelatin, neomycin); immunosuppression; pregnancy	**Black Box Warnings**	None

Medication Safety Issues: Measles, Mumps, Rubella Vaccine, Live

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
MMR-II, MMRV	No	No	No	None	No

Drug Interactions: Measles, Mumps, Rubella Vaccine, Live

Typical Agents	Mechanism	Clinical Management
Moderate- to high-dose corticosteroids	Immunosuppression reduces vaccine efficacy and patients are at increased risk of measles infection	Delay MMR vaccine administration until corticosteroid therapy has been discontinued
Immunosuppressing agents	Immunosuppression reduces vaccine efficacy and patients are at increased risk of measles infection	Delay MMR vaccine administration until immunosuppressive therapy has been discontinued
Immune globulin or blood products	Interference with immune response to live vaccines	Delay MMR vaccine administration for a period of time depending on type and dose of immune globulin or blood product

Adverse Reactions: Measles, Mumps, Rubella Vaccine, Live

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Fever, arthralgia (adult females)	Rash	Thrombocytopenia, anaphylaxis, Guillain-Barré syndrome, febrile seizure

Efficacy Monitoring Parameters. Prevention of measles, mumps, and rubella infections; although antibody concentrations might be measured, routine measurement for vaccine response is not recommended.

Toxicity Monitoring Parameters. Monitor for syncope after administration.

Key Patient Counseling Points. Some children may experience mild fever and rash 7-10 d after vaccine administration. Avoid pregnancy for 28 d following vaccine administration.

Clinical Pearls. Individuals born before 1957 can be considered immune unless a female of childbearing potential. Administer to females found to be seronegative to rubella following completion of pregnancy. If not administered simultaneously, MMR must be separated by at least 4 wk from other live vaccines. Ensure that international travelers are appropriately immunized. Avoid confusion with MMRV, which also contains varicella vaccine. Administer 2nd dose at least 28 d after 1st dose.

MECLIZINE: Antivert, Dramamine, Various

Class: Antihistamine, Antiemetic

Dosage Forms. Oral Tablet: 12.5 mg, 25 mg, 32 mg; **Oral Tablet, Chewable:** 25 mg

Common FDA Label Indication, Dosing, and Titration.

1. Motion sickness: 25-50 mg po 1 h before departure, may repeat q24h prn
2. Vertigo: 25-100 mg po daily in 1-3 divided doses, depending on clinical response

Off-Label Uses. None

MOA. Meclizine is an antihistamine that suppresses the vasodepressor response to histamine while only slightly inhibiting acetylcholine.

Rugby generic 25 mg pictured

Drug Characteristics: Meclizine

Dose Adjustment Hepatic	Not required	**Absorption**	Not known
Dose Adjustment Renal	Not required	**Distribution**	Vd = 7 L/kg
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, minor CYP2D6 substrate
Pregnancy Category	B	**Elimination**	Excreted in urine and feces, half-life of 6 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Meclizine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Anzemet, Axert	No

Drug Interactions: Meclizine

Typical Agents	Mechanism	Clinical Management
CNS depressants (opioids, benzodiazepines, alcohol)	Possible increase in sedation effects	Use concurrently with caution

Adverse Reactions: Meclizine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Sedation, headache, dry mouth, fatigue, and nausea	

Efficacy Monitoring Parameters. Improvement in nausea or vertigo symptoms.

Toxicity Monitoring Parameters. Seek medical attention for signs of severe CNS toxicity.

Key Patient Counseling Points. Since drowsiness may, on occasion, occur with use of this drug, patients should be warned of this possibility and cautioned against driving a car or operating dangerous machinery. Patients should avoid alcoholic beverages while taking this drug. Because of its potential anticholinergic action, this drug should be used with caution in patients with asthma, glaucoma, or enlargement of the prostate gland.

Clinical Pearls. Meclizine is available over the counter in many different products, and by prescription. Caution should be used to avoid duplication of therapy and patients should be advised on product selection.

MEDROXYPROGESTERONE: Provera, Various

Class: Progestin Hormone

Dosage Forms. Oral Tablet: 2.5 mg, 5 mg, 10 mg; **Oral Suspension:** 104 mg/0.65 mL, 150 mg/mL, 400 mg/mL

Common FDA Label Indication, Dosing, and Titration.

1. Abnormal uterine bleeding unrelated to menstrual cycle: 5-10 mg po daily × 5-10 d starting on days 16 or 21 of the menstrual cycle
2. Prevention of estrogen-induced endometrial hyperplasia: 5-10 mg po daily for 12-14 d starting on days 1 or 16 of the menstrual cycle, when estrogen is being administered
3. Secondary physiologic amenorrhea: 5-10 mg po daily × 5-10 d

Off-Label Uses.

1. Breast cancer, endometrial carcinoma: Dose is individualized

Barr generic pictured

MOA. Medroxyprogesterone transforms proliferative into secretory endometrium. Androgenic and anabolic effects have been noted, but the drug is apparently devoid of significant estrogenic activity.

Drug Characteristics: Medroxyprogesterone

Dose Adjustment Hepatic	Mild or moderate hepatic dysfunction, reduce dose or dose frequency; severe, contraindicated	**Absorption**	F = 0.6-10%, food increases AUC and Cmax
Dose Adjustment Renal	Not required	**Distribution**	86-90% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 substrate; induces CYP3A4/5
Pregnancy Category	X	**Elimination**	Primarily renal elimination (metabolites) with a half-life of 11-16 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to medroxyprogesterone, abnormal genital bleeding, history of estrogen- or progesterone-dependent neoplasia, active or history of DVT or PE, severe liver dysfunction, known or suspected pregnancy	**Black Box Warnings**	Cardiovascular, dementia risk, loss of BMD (Depo-Provera)

Medication Safety Issues: Medroxyprogesterone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	MedroxyPROGESTERone	No	No	Covera, methylPREDNISolone	No

Drug Interactions: Medroxyprogesterone

Typical Agents	Mechanism	Clinical Management
CYP3A4/5 inducers	Increased medroxyprogesterone metabolism reduces medroxyprogesterone effectiveness	Consider dose increases of medroxyprogesterone
CYP3A4/5 inhibitors	Decreased medroxyprogesterone metabolism increases risk of medroxyprogesterone toxicity	Consider dose decreases of medroxyprogesterone
CYP3A4/5 substrates	Increased substrate metabolism may decrease effectiveness of substrates	Monitor and consider increasing dose of substrate
Corticosteroids	Clearance of corticosteroid reduced by inhibition of corticosteroid metabolism by the medroxyprogesterone resulting in steroid toxicity	Monitor for corticosteroid toxicity and reduce dose if necessary
Warfarin	Medroxyprogesterone may increase or decrease warfarin effectiveness; mechanism unknown	Monitor INR

Adverse Reactions: Medroxyprogesterone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Weight gain, headache, amenorrhea, breast tenderness	Abdominal pain, asthenia, feeling nervous, breakthrough bleeding	Deep venous thrombosis, thrombophlebitis, osteoporosis, pulmonary embolism

Efficacy Monitoring Parameters. Resolution of clinical signs of abnormal bleeding.

Toxicity Monitoring Parameters. Baseline pelvic and breast exam at therapy initiation; monitor BMD; diagnostic evaluation to rule out malignancy in the event of persistent or recurring vaginal bleeding.

Key Patient Counseling Points. Menstrual bleeding should occur 3-7 d after last dose. Patients should report if menstruation does not occur within 7 d after last dose.

Clinical Pearls. Injectable formulation of medroxyprogesterone is administered every 3 mo for contraception and for pain associated with endometriosis. Combination of estrogens and progestins should not be used for the prevention of cardiovascular disease. Increased risk of myocardial infarction, stroke, invasive breast cancer, PE, and DVT has been shown in postmenopausal women.

MELOXICAM: Mobic, Various

Class: NSAID

Dosage Forms. **Oral Tablet:** 7.5 mg, 15 mg; **Oral Suspension:** 7.5 mg/5 mL

Common FDA Label Indication, Dosing, and Titration.

1. Osteoarthritis: 7.5 mg po daily, may titrate to *max* of 15 mg/d
2. Rheumatoid arthritis: 7.5 mg po daily, may titrate to *max* of 15 mg/d
3. Juvenile rheumatoid arthritis: Children ≥2 y of age, 0.125 mg/kg po daily, may titrate to *max* of 7.5 mg/d

Off-Label Uses. None

MOA. Nonselective inhibitor of COX-1 and COX-2, and reversibly alters platelet function and prolongs bleeding time.

Mylan generic pictured

Drug Characteristics: Meloxicam

Dose Adjustment Hepatic	Not required	**Absorption**	F = 89%, food has minimal effect on absorption
Dose Adjustment Renal	Avoid if CrCl <20 mL/min	**Distribution**	Vd = 10-16 L; 99% protein bound
Dialyzable	Not dialyzable, *max* dose 7.5 mg/d	**Metabolism**	Hepatic, minor substrate of CYP3A4/5
Pregnancy Category	C (D ≥30 weeks gestation)	**Elimination**	Renal elimination with a half-life of 15-20 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Sensitivity to meloxicam; concurrent ketorolac, pentoxifylline use, asthma, allergic-type reaction following other NSAID use, CABG	**Black Box Warnings**	Cardiovascular and GI risk, CABG

Medication Safety Issues: Meloxicam

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	No	Avoid chronic use unless other alternatives are not effective and patient can take gastroprotective agent

Drug Interactions: Meloxicam

Typical Agents	Mechanism	Clinical Management
Aspirin, low-molecular-weight heparins, SSRIs, NSAIDs, pentoxifylline	Additive GI toxicity and increased risk of bleeding	Concurrent ketorolac, pentoxifylline contraindicated; others, monitor for GI toxicity
ACE-Is, ARBs, beta-blockers, loop and thiazide diuretics	Decreased diuretic and antihypertensive efficacy via decreased renal prostaglandin production	Monitor and consider alternative therapy
Cholestyramine	Decreased absorption of meloxicam	Separate administration by 1-2 h
Cyclosporine, tacrolimus	Increased risk of cyclosporine, tacrolimus toxicity, unknown mechanism	Monitor cyclosporine and tacrolimus levels and consider dose adjustments
Pemetrexed	Decreased renal clearance and increased toxicity of pemetrexed	Avoid concurrent use in patients with renal dysfunction
Sulfonylureas	Increased risk of hypoglycemia via inhibition of sulfonylurea metabolism	Monitor FPG and adjust as necessary
Warfarin	Both substrates for CYP2C9, competitive metabolism	Monitor INR and adjust warfarin dose

Adverse Reactions: Meloxicam

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Edema, itching, rash, GI distress, dizziness, tinnitus, ototoxicity	Stevens-Johnson syndrome, GI bleeding, thrombosis, elevated liver functions, acute renal failure, congestive heart failure, aplastic anemia

Efficacy Monitoring Parameters. Decreased pain and improved range of motion.

Toxicity Monitoring Parameters. CBC, LFTs, SCr, fecal occult blood tests if chronic use. Seek medical attention if severe skin rash, black tarry stools, chest pains, yellowing of eyes or skin, or change in urination.

Key Patient Counseling Points. Take with food or milk to decrease GI upset. For suspension, shake gently before using.

Clinical Pearls. Elderly patients are at increased risk of GI ulceration. Use lowest effective dose for shortest possible duration; after observing initial response, adjust dose and frequency to meet individual patient's needs.

MEMANTINE: Namenda

Class: *N*-Methyl-d-Aspartate (NMDA) Receptor Antagonist

Dosage Forms. **Oral Solution:** 10 mg/5 mL; **Oral Tablet:** 5 mg, 10 mg; **Oral Capsule, Extended Release:** 7 mg, 14 mg, 21 mg, 28 mg

Common FDA Label Indication, Dosing, and Titration.

1. Alzheimer disease: 5 mg po daily, may titrate dose no more than once per week to target dose of 10 mg po bid

Forest Laboratories 10 mg pictured

Off-Label Uses. None

MOA. Activation of NMDA receptors by glutamate is believed to contribute to the symptomatology of Alzheimer disease. Memantine is believed to act as an uncompetitive (open-channel) NMDA receptor antagonist that binds preferentially to the NMDA receptor–operated cation channels. There is no evidence that memantine prevents or slows neurodegeneration in patients with Alzheimer disease.

Drug Characteristics: Memantine

Dose Adjustment Hepatic	Not required	**Absorption**	F = 100%, no effect of food on absorption
Dose Adjustment Renal	CrCl <30 mL/min, target dose of 5 mg po bid	**Distribution**	Vd = 9-11 L; 45% protein bound
Dialyzable	Not dialyzable	**Metabolism**	50% and occurs by glucuronidation
Pregnancy Category	B	**Elimination**	Renal elimination is 50% (unchanged) with a half-life of 60-80 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Memantine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
XR	No	Do not chew or crush XR capsule	No	Mesalamine	No

Drug Interactions: Memantine. None known

Adverse Reactions: Memantine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Hypertension, hypotension, syncope, vomiting, dizziness, headache, cough, pain	Stevens-Johnson syndrome, deep venous thrombosis, hepatitis, liver failure, cerebrovascular accident, grand mal seizure, transient ischemic attack, acute renal failure

Efficacy Monitoring Parameters. Improvement in cognitive function and ability to take part in activities of daily living.

Toxicity Monitoring Parameters. Seek medical attention if severe adverse effects occur; BP, eye exams, LFTs, electrolytes, SCr.

Key Patient Counseling Points. May be taken with or without food.

Clinical Pearls. There is sparse evidence that this product is clinically effective in the treatment of Alzheimer disease. It may slow progression but does not reverse or improve symptoms once present.

MENINGOCOCCAL VACCINE: Menactra, Menveo, Menomune, MenHibrix

Class: Vaccine

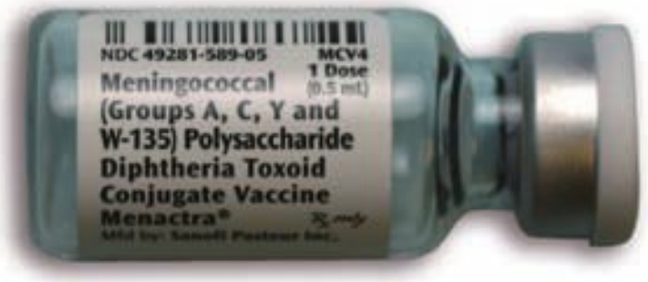
Dosage Forms. **Solution for Intramuscular Injection:** Quadrivalent conjugate vaccine (serogroups A,C,Y,W-135; MCV4) 0.5 mL (Menactra, Menveo); Bivalent conjugate vaccine (serogroups C and Y; MenHibrix); **Solution for Subcutaneous Injection:** Polysaccharide vaccine (MPSV4) 0.5 mL (Menomune)

Common FDA Label Indication, Dosing, and Titration.

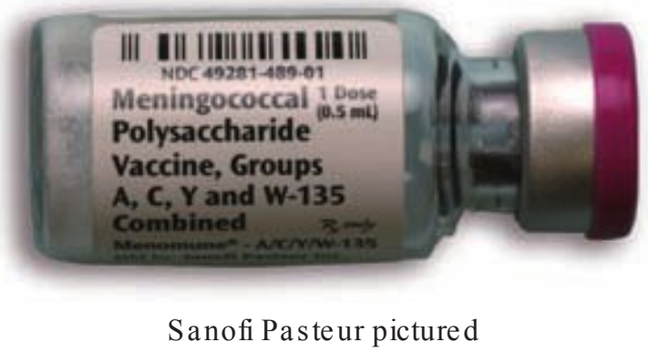
1. Prevention of invasive meningococcal disease caused by serotypes A, C, Y, W-135: Adults, single dose of MCV4 or MPSV4 (through age 55 y for MCV4); Children 2 mo of age, use 4 dose series of Menveo at age 2, 4, 6, and 12 mo; Children 9-23 mo of age, 2 doses of Menactra; Children ≥2 y of age, a single dose of either Menactra or Menveo
2. Prevention of invasive meningococcal disease caused by serotypes C and Y

Off-Label Uses.

1. Prevention of invasive meningococcal disease caused by serotypes A, C, Y, W-135: Routine immunization of adolescents 11-12 y of age and a 2nd dose at 16 y of age
2. Prevention of invasive meningococcal disease caused by serotypes A, C, Y, W-135 in individuals at high risk of invasive meningococcal disease or those at ongoing risk of exposure, in individuals with complement deficiencies, asplenia, HIV, individuals who work with *N. meningitides* in the laboratory: MCV4, 2 doses 3 mo apart and then every 5 y
3. Prevention of invasive meningococcal disease caused by serotypes A, C, Y, W-135 for military recruits, travelers to or people who live in epidemic areas or endemic countries or 1st-year college students up to 21 y of age who live in dormitory and did not receive a dose at 16 y of age: MCV4, single dose



Sanofi Pasteur pictured



Sanofi Pasteur pictured

Drug Characteristics: Meningococcal Vaccine

Pregnancy Category	MCV4, B; MPSV4, B	**ADME**	Not known
Lactation	Infant risk is minimal	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to meningococcal vaccine or a component of the vaccine	**Black Box Warnings**	None

Medication Safety Issues: Meningococcal Vaccine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
CRM, D	No	No	No	None	No

Drug Interactions: Meningococcal Vaccine

Typical Agents	Mechanism	Clinical Management
Moderate- to high-dose corticosteroids	Immunosuppression may decrease therapeutic effect	Delay meningococcal vaccine administration until corticosteroid therapy has been discontinued if possible; clinical judgment
Immunosuppressing agents: cyclosporine, tacrolimus, azathioprine, methotrexate	Immunosuppression may decrease therapeutic effect	Delay meningococcal vaccine administration until immunosuppressive therapy has been discontinued if possible; clinical judgment

Adverse Reactions: Meningococcal Vaccine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Injection site reactions, including erythema and soreness. Irritability, abnormal crying, decreased appetite, diarrhea, malaise, fatigue headache, asthenia	Rash, nausea, arthralgia, myalgia, fever	Febrile seizure, anaphylaxis, Guillain-Barré syndrome

Efficacy Monitoring Parameters. Prevention of invasive meningococcal disease.

Toxicity Monitoring Parameters. Monitor for syncope after administration.

Key Patient Counseling Points. Used to prevent meningitis and other serious infections. In addition to recommended primary vaccination, patients at risk for infection (asplenic, immune compromised) should receive boosters every 5 y; first-year college students up through age 21 y living in dormitories should be vaccinated if not vaccinated on or after their 16th birthday. Infants at high risk of invasive infection (asplenia, immune compromised) should be immunized starting at age 2 mo with Menveo. Optional MenACWY for healthy infants.

Clinical Pearls. MenACWY-CRM is used to describe Menveo, while MenACWY-D is used to describe Menactra. MenACWY is used to describe all vaccines in this category. Use caution to avoid confusing products. MCV4 should be used to immunize individuals aged 2 mo (Menveo) or 9 mo (Menactra) up to age 55 y. Use MPSV4 for individuals ≥56 y of age who require immunization. MCV4 is administered IM, while MPSV4 is administered SQ. Immunized individuals remain at risk for invasive disease caused by *N. meningitides* serogroup B.

METAXALONE: Skelaxin, Various

Class: Centrally Acting Skeletal Muscle Relaxant

Dosage Forms. Oral Tablet: 800 mg

Common FDA Label Indication, Dosing, and Titration.

1. Musculoskeletal pain or spasm: 800 mg po tid-qid

Off-Label Uses. None

MOA. The mechanism of action of metaxalone in humans has not been established, but may be due to general CNS depression. Metaxalone has no direct action on the contractile mechanism of striated muscle, the motor end plate, or the nerve fiber.

King Pharmaceuticals 800 mg pictured

Drug Characteristics: Metaxalone

Dose Adjustment Hepatic	Use lower initial doses and increase dose carefully	**Absorption**	F is unknown, food enhances absorption
Dose Adjustment Renal	Use lower initial doses and increase dose carefully	**Distribution**	Vd = 800 L
Dialyzable	Not dialyzable	**Metabolism**	Hepatic metabolism, substrate of multiple CYP enzymes
Pregnancy Category	D	**Elimination**	Renal elimination with a half-life of 8-9 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to metaxalone, significantly impaired renal or hepatic function	**Black Box Warnings**	None

Medication Safety Issues: Metaxalone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Mesalamine, metolazone	Avoid. Most muscle relaxants poorly tolerated by older adults, because of anticholinergic adverse effects, sedation, increased risk of fractures

Drug Interactions: Metaxalone

Typical Agents	Mechanism	Clinical Management
CNS depressants (opioids, benzodiazepines, alcohol)	Additive sedative effects	Avoid concurrent use or monitor carefully for signs of toxicity

Adverse Reactions: Metaxalone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Nausea, vomiting, dizziness, headache, somnolence	Hemolytic anemia, leukopenia, jaundice, immune hypersensitivity reaction, maculopapular rash

Efficacy Monitoring Parameters. Reduction in pain and muscle spasms.

Toxicity Monitoring Parameters. Monitor LFTs and CBC periodically.

Key Patient Counseling Points. Patients should avoid activities requiring mental alertness or coordination until drug effects are known, as drug may cause dizziness or sedative effects.

Clinical Pearls. Metaxalone is used for the relief of discomfort associated with acute, painful musculoskeletal conditions in adults and should be used for only short periods (up to 2 or 3 wk). Not for use in children <12 y of age. Use with caution in elderly who may be more susceptible to adverse effects.

METFORMIN: Glucophage, Various

Class: Biguanide, Hypoglycemic

Dosage Forms. Oral Tablet: 500 mg, 850 mg, 1000 mg; **Oral Tablet, Extended Release:** 500 mg, 750 mg, 1000 mg; **Oral Solution:** 500 mg/5 mL

Common FDA Label Indication, Dosing and Titration.

1. Diabetes mellitus, type 2: Adults, immediate release, 500-1000 mg po bid, may titrate to *max* dose 2250 mg/d; extended release, 500-2000 mg po daily, may titrate to *max* dose 2000 mg/d; Children ≥10 y of age, immediate release, 500-1000 mg po bid, may titrate to *max* dose 2000 mg/d

Off-Label Uses. None

MOA. Metformin is a biguanide antihyperglycemic agent. It does not affect insulin secretion; rather, it reduces hepatic glucose production and enhances glucose utilization by muscle.

Teva generic 850 mg pictured

Teva generic 1000 mg pictured

Teva generic 500 mg ER pictured

Barr generic 750 mg ER pictured

Drug Characteristics: Metformin

Dose Adjustment Hepatic	Severe hepatic insufficiency, avoid use	**Absorption**	F = 40-60%; immediate release: absorption reduced with food; extended release and oral solution: absorption enhanced with food
Dose Adjustment Renal	SCr >1.4 mg/dL, contraindicated	**Distribution**	Vd = 654 L; not protein bound
Dialyzable	Yes	**Metabolism**	Not metabolized
Pregnancy Category	B	**Elimination**	90% renal elimination with a half-life of 7-12 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to metformin, contrast media, SCr >1.4 mg/dL, metabolic acidosis	**Black Box Warnings**	Lactic acidosis

Medication Safety Issues: Metformin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
Glucophage and Glucophage XR	MetFORMIN	Do not chew or crush ER formulation	Yes	MetroNIDAZOLE	No

Drug Interactions: Metformin

Typical Agents	Mechanism	Clinical Management
Acetrizoic acid and other contrast media	Increased risk of lactic acidosis and renal failure	Contraindicated
Beta-blockers	Altered glucose metabolism and increased risk of hypoglycemia	Avoid propranol; use others with caution and increased monitoring
Cationic drugs, amiloride, cimetidine, cephalexin	Competition for proximal renal tubular secretion and reduced metformin clearance	Monitor and consider dose adjustments of both agents
Fluoroquinolones	Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia	Avoid concurrent use if possible; monitor and consider dose adjustments
MAOIs	Stimulation of insulin secretion, hypoglycemic effects	Avoid concurrent use if possible; monitor and consider dose adjustments
Psyllium	Psyllium may delay absorption of glucose from meals, leading to less postprandial hyperglycemia and potentially allowing a reduced dosage of the antidiabetic agent	Avoid concurrent use if possible; monitor and consider dose adjustments

Adverse Reactions: Metformin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Diarrhea, malabsorption, nausea, cobalamin deficiency, asthenia, vomiting, f atulence	Headaches, indigestion	Lactic acidosis, weight loss, hepatoxicity, hemolytic anemia, hypersensitivity

Efficacy Monitoring Parameters. Pre-prandial blood glucose between 70 and 130 mg/dL, HbA_{1c} <7%.

Toxicity. Renal function, CBC, B_{12} levels. Seek medical attention if severe skin rash, muscle weakness or pain, yellowing of eyes or skin, unusual bruising, or bleeding.

Key Patient Counseling Points. Monitor blood glucose in frequent intervals (2-4 times per day); if <70 mg/dL, eat candy or sugar and contact prescriber. Take with morning meal if daily dosing. Take with morning and evening meal if bid. Drink plenty of liquids to improve elimination of metformin. Avoid alcohol; this increases the risk of lactic acidosis.

Clinical Pearls. Patient having procedure with iodinated contrast: withhold metformin prior to or at the time of the procedure and for 48 h following the procedure. Restart metformin only after kidney function has been reevaluated and found to be normal. Take extended-release product with food or milk. Immediate release may be taken with food, if GI upset occurs. Metformin is first-line therapy for type 2 diabetes. Metformin does not cause hypoglycemia when used as a single agent. Response typically not seen at doses <1500 mg/d.

METHADONE: Dolophine, Various

Class: Opioid Analgesic. C-II

Dosage Forms. **Oral Tablet:** 5 mg, 10 mg; **Oral Tablet for Suspension:** 40 mg; **Oral Solution:** 5 mg/5 mL, 10 mg/5 mL, 10 mg/1 mL

Common FDA Label Indication, Dosing, and Titration.

1. Pain, chronic (moderate-severe): Opioid naive patients, 2.5 mg po q8h, may titrate to response
2. Drug detoxification, opioid abuse: 15-30 mg po q8h, titrate to response; when used for treatment of opioid addiction (detoxification or maintenance), may only be dispensed by certified opioid treatment programs

Roxane generic 10 mg pictured

Off-Label Uses. None

MOA. Methadone is a phenylethylamine opioid agonist qualitatively similar to morphine but with a chemical structure unrelated to the alkaloid-type structures of the opium derivatives. Analgesic activity of (R)-methadone is 8-50 times that of (S)-methadone, and (R)-methadone has a tenfold higher affinity for opioid receptors.

Drug Characteristics: Methadone

Dose Adjustment Hepatic	Not required	**Absorption**	F = 85% with minimal food effect
Dose Adjustment Renal	Not required	**Distribution**	Vd = 3.6 L/kg; 85-90% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP2B6 and 3A4/5 substrate. Moderate CYP2D6 inhibitor
Pregnancy Category	C	**Elimination**	Renal elimination is 10-20% with a half-life of 20-24 h
Lactation	Usually compatible, peak concentration 4-5h after dose	**Pharmacogenetics**	None known
Contraindications	Bronchial asthma, hypersensitivity to opioids, paralytic ileus, respiratory depression, hypercarbia	**Black Box Warnings**	Accidental ingestion; drug abuse; opioid addiction/use; QT prolongation; respiratory depression; tablets contain excipients

Medication Safety Issues: Methadone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
Intensol	No	Tablet for suspension	Yes	Dexmethylphenidate, Mephyton	No

Drug Interactions: Methadone

Typical Agents	Mechanism	Clinical Management
Amiodarone, agents that prolong the QT interval	Additive QT prolongation	Avoid concurrent use
Barbiturates, benzodiazepines, centrally acting muscle relaxants, opioids, phenothiazines	Additive CNS depression	Monitor and consider dose adjustments
Buprenorphine, opioid agonists/antagonists, opioid antagonists	Precipitation of withdrawal symptoms	Avoid concurrent use with opioids
CYP3A4/5 and CYP2B6 inducers	Increased methadone metabolism and decreased methadone efficacy	Consider methadone dose increases
CYP3A4/5 and CYP2B6 inhibitors	Decreased methadone metabolism increases risk of methadone toxicity	Consider methadone dose decreases
CYP2D6 substrates	Reduced metabolism of substrates and increased toxicity	Avoid concurrent use or consider dose reduction of substrates
Didanosine	Decreased didanosine absorption	Separate use by 1-2 h
MAOIs	Additive respiratory depression, increased risk of serotonin syndrome	Contraindicated

Adverse Reactions: Methadone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation, GI distress, hypotension, dizziness, sedation	Arrhythmias, edema, dyspnea, respiratory depression	Stevens-Johnson syndrome, physical dependence, tolerance, QT prolongation

Efficacy Monitoring Parameters. Relief of pain. Relief of signs and symptoms associated with narcotic addiction.

Toxicity Monitoring Parameters. Seek medical attention if severe skin rash, excessive drowsiness, decreased breathing, severe constipation, chest pain, or dizziness; vital signs.

Key Patient Counseling Points. Use a stool softener and stimulant combination or laxative for preventing constipation. May cause drowsiness; avoid driving or other tasks requiring motor coordination. Avoid alcohol and other CNS depressants. Seek medical attention if short of breath or extremely drowsy. Breast-feeding women should monitor child for signs of sedation and respiratory depression.

Clinical Pearls. Tolerance and physical dependence may occur with chronic use; avoid abrupt discontinuation. High interpatient variability in absorption, metabolism, and relative analgesic potency of methadone requires careful dose initiation and titration. Fatal respiratory depression has occurred; the highest risk is at initiation and with dosage increases. For oral administration only; excipients to deter use by injection are contained in tablets. Do not chew or swallow tablet for suspension—dissolve in liquid and drink. Keep away from children and pets. Medication guide required at dispensing. Included in REMS program requiring additional education for prescribers.

METHOCARBAMOL: Robaxin, Various

Class: Centrally Acting Skeletal Muscle Relaxant

Dosage Forms. Oral Tablet: 500 mg, 750 mg

Common FDA Label Indication, Dosing, and Titration.

1. Musculoskeletal pain or spasm: 1500 mg po qid × 48-72 h, may titrate to 750 mg po q4h, or 1500 mg po tid or 1000 mg po qid

Qualitest generic pictured

Off-Label Uses. None

MOA. The mechanism of action of methocarbamol in humans has not been established, but may be due to general CNS depression. It has no direct action on the contractile mechanism of striated muscle, the motor end plate, or the nerve fiber.

Drug Characteristics: Methocarbamol

Dose Adjustment Hepatic	Use lower doses initially and increase dose carefully in patients with hepatic failure	**Absorption**	Food has no effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Protein binding 45-50%
Dialyzable	Not dialyzable	**Metabolism**	Hepatic via dealkylation and hydroxylation
Pregnancy Category	C	**Elimination**	Renal elimination of metabolites with a half-life of 1-2 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Methocarbamol

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Mephobarbital, Skelaxin	Avoid. Most muscle relaxants poorly tolerated by older adults, because of anticholinergic adverse effects, sedation, increased risk of fractures

Drug Interactions: Methocarbamol

Typical Agents	Mechanism	Clinical Management
CNS depressants (opioids, benzodiazepines, alcohol)	Additive sedative effects	Avoid concurrent use or monitor carefully for signs of toxicity

Adverse Reactions: Methocarbamol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Flushing, pruritus, rash, urticaria, nausea, vomiting, dizziness, headache, nystagmus, somnolence, vertigo, blurred vision, conjunctivitis	Bradyarrhythmia, hypotension, syncope, leukopenia, anaphylactoid reaction

Efficacy Monitoring Parameters. Reduction in pain and muscle spasms.

Toxicity Monitoring Parameters. Seek medical attention if idiosyncratic symptoms such as extreme weakness, transient quadriplegia, dizziness, and confusion occur within minutes or hours after 1st dose; vital signs.

Key Patient Counseling Points. Patients should avoid activities requiring mental alertness or coordination until drug effects are known, as drug may cause dizziness or sedative effects.

Clinical Pearls. Methocarbamol is used for the relief of discomfort associated with acute, painful musculoskeletal conditions in adults and should be used for only short periods (up to 2 or 3 wk). Drug may color urine brown, black, or green. Injectable form available, used for spasticity associated with tetanus.

METHOTREXATE: Trexall, Various

Class: Antimetabolite

Dosage Forms. Oral Tablet: 2.5 mg, 5 mg, 7.5 mg, 10 mg, 15 mg

Dava generic 2.5 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Non-Hodgkin lymphoma, advanced (Burkitt lymphoma, stages I and II): 10-25 mg/d po for 4-8 d for several courses with a 7-10 d rest period
2. Psoriasis (Severe): initial, 2.5-5 mg q12h × 3 doses/wk, may titrate dose to 10-25 mg/wk po
3. Rheumatoid arthritis, severe: 7.5-15 mg po once weekly, may titrate by 5 mg/wk every 2-3 wk to *max* 20-30 mg/wk
4. Juvenile rheumatoid arthritis, polyarticular course: 10 mg/m^2 po once weekly, may titrate to clinical response

Off-Label Uses.

1. Many cancers: Dose varies with cancer, stage, and concurrent chemotherapy

MOA. Reversibly inhibits dihydrofolate reductase (DHFR). Dihydrofolates are reduced to tetrahydrofolates by DHFR before they are used in DNA synthesis. Methotrexate interferes with DNA synthesis, repair, and cellular replication.

Drug Characteristics: Methotrexate

Dose Adjustment Hepatic	Bilirubin = 3.1-5 mg/dL, reduce dose by 25%; bilirubin >5 mg/dL, avoid	**Absorption**	Dose-dependent, doses <40 mg/m^2, F = 42%; doses >40 mg/m^2, F = 17%
Dose Adjustment Renal	CrCl = 10-50 mL/min, reduce dose by 50%; CrCl <10 mL/min: avoid	**Distribution**	Vd = 0.4-0.8 L/kg; 50% protein bound
Dialyzable	Yes, hemodialysis	**Metabolism**	Intracellular polyglutamation, excreted by P-glycoprotein
Pregnancy Category	X	**Elimination**	Renal elimination is 48-100% with a dose-dependent half-life of 4-10 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to methotrexate, pregnancy, nursing, preexisting blood dyscrasias in patients treated for psoriasis and rheumatoid arthritis	**Black Box Warnings**	Acute renal failure; ascites; bone marrow suppression; dermatologic toxicity; diarrhea; hepatotoxicity; lymphomas; NSAIDs; opportunistic infections; pneumonitis; renal impairment; tumor lysis syndrome; CBC w/diff, platelet, liver, and renal lab testing mandatory

Medication Safety Issues: Methotrexate

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	Yes	Mercaptopurine, methylPREDNISolone	No

Drug Interactions: Methotrexate

Typical Agents	Mechanism	Clinical Management
Aspirin, dantrolene, loop diuretics, NSAIDs, penicillins, PPIs, salicylates, trimethoprim, sulfisoxazole	Competition for renal tubular secretion, increased methotrexate toxicity and nephrotoxicity	Avoid concurrent use, or consider methotrexate dose reductions. NSAIDs are contraindicated.
BCG vaccine, other live vaccines and immunostimulants	Increased risk of infection from live vaccine	Contraindicated
Eltrombopag	Inhibition of OATP1B1 by eltrombopag results in decreased methotrexate clearance and increased toxicity	Avoid concurrent use, or consider methotrexate dose reductions
Leucovorin, folic acid	Leucovorin is a reduced folate that counteracts the anticancer effects of methotrexate	Avoid concurrent use, unless using as a rescue agent

Adverse Reactions: Methotrexate

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Myelosuppression, nausea, vomiting, alopecia, stomatitis, photosensitivity, rash	Elevated LFTs, diarrhea	Acute renal failure, liver failure, interstitial lung disease, Stevens-Johnson syndrome, secondary malignancies (lymphomas), opportunistic infections

Efficacy Monitoring Parameters. Resolution of symptoms of psoriasis. Decreased pain and improved range of motion in rheumatoid arthritis. Shrinkage or disappearance of tumor. Methotrexate levels may be monitored and used to adjust leucovorin.

Toxicity Monitoring Parameters. Baseline and periodic CBC, SCr, LFTs, negative pregnancy test. Seek medical attention if severe mouth ulcerations, fever >101.5°F, shortness of breath, changes in urination, yellowing of eyes or skin, unusual bruising, or bleeding.

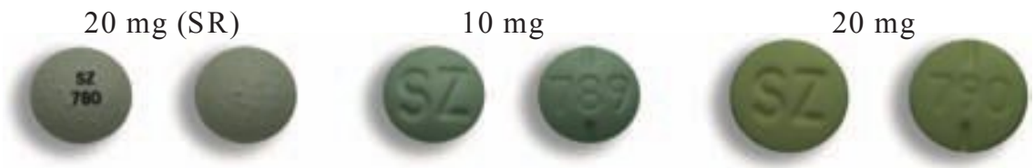
Key Patient Counseling Points. Causes nausea and vomiting; ensure patients have antiemetics and know how to take them. Avoid sun exposure. May take with food.

Clinical Pearls. Baseline and regular CBC w/diff, platelet, liver, and renal lab testing are mandatory. High-dose methotrexate requires urine alkalinization with sodium bicarbonate infusions to enhance methotrexate excretion and requires leucovorin administration started 24 h after methotrexate to rescue normal cells. Elimination is reduced in patients with ascites and/or pleural effusions related to third spacing, resulting in prolonged half-life and toxicity. Concomitant methotrexate administration with radiotherapy may increase the risk of soft tissue necrosis and osteonecrosis. Numerous dosing regimens are used; do not confuse daily and weekly dosing strategies.

METHYLPHENIDATE: Ritalin, Various

Class: CNS Stimulant. C-II

Dosage Forms. **Oral Tablet:** 5 mg, 10 mg, 20 mg; **Oral Tablet, Chewable:** 2.5 mg, 5 mg, 10 mg; **Oral Tablet, Extended Release:** 10 mg, 18 mg, 20 mg, 27 mg, 36 mg, 54 mg; **Oral Capsule, Extended Release:** 10 mg, 20 mg, 30 mg, 40 mg, 50 mg, 60 mg; **Oral Capsule Extended Release, 24 h:** 10 mg, 20 mg, 30 mg, 40 mg; **Oral Solution:** 5 mg/5 mL, 10 mg/5 mL; **Oral Suspension:** 25 mg/5 mL; **Patch:** 10 mg/9 h, 15 mg/9 h, 20 mg/9 h, 30 mg/9 h



Sandoz generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Attention-deficit hyperactivity disorder: Adults, immediate-release tablets, solution, and chewable tablets, 10-60 mg/d po divided 2-3 times daily, preferably 30-45 min before meals; Children ≥6 y of age, initial, 5 mg po bid, may titrate in increments of 5-10 mg at weekly intervals; doses above 60 mg/d not recommended
2. Attention-deficit hyperactivity disorder, no prior methylphenidate therapy: Adults and Children ≥6 y of age, extended release, 20 mg po daily, may titrate in increments of 10 mg at weekly intervals; *max* 60 mg/d
3. Narcolepsy: Adults, immediate-release tablets, solution, and chewable tablets, 10-60 mg/d po divided 2-3 times daily; sustained release; Adults and Children ≥6 y of age, 20-60 mg/d po divided q8h

Off-Label Uses.

1. Depression: 5-30 mg po daily

MOA. Amphetamines are non-catecholamine sympathomimetic amines with CNS stimulant activity. Amphetamines are thought to block the reuptake of norepinephrine and dopamine into the presynaptic neuron and increase the release of these monoamines into the extraneuronal space.

Drug Characteristics: Methylphenidate

Dose Adjustment Hepatic	Not required	**Absorption**	F = 22-25%, minimal food effect
Dose Adjustment Renal	Not required	**Distribution**	Vd = 2.6 L/kg; 10-30% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive metabolism, predominately via de-esterification
Pregnancy Category	C	**Elimination**	Renal elimination is 78-98% with a half-life of 3 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to amphetamines, anxiety, agitation, concurrent MAOIs, drug dependence, glaucoma, tics or history of Tourette syndrome, hypertension, angina, heart failure, concurrent isof urane anesthetics	**Black Box Warnings**	Abuse and dependence potential

Medication Safety Issues: Methylphenidate

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
CD, ER, XL, LA, SR	No	Do not crush or chew ER formulations	No	Methadone	No

Drug Interactions: Methylphenidate

Typical Agents	Mechanism	Clinical Management
Amitriptyline, citalopram, TCAs	Enhanced amphetamine effects from the release of norepinephrine (hypertension, CNS stimulation)	Avoid concurrent use
Citalopram, SSRIs	Increased risk of serotonin syndrome (muscle rigidity, tachycardia, agitation)	Avoid concurrent use if possible, monitor for serotonin syndrome if used together
MAOIs	Hypertensive crisis	Contraindicated within 14 d

Adverse Reactions: Methylphenidate

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Weight loss, loss of appetite, headache, insomnia, irritability	Anxiety, tachycardia, nausea, vomiting	Seizures, spasmodic movement, anemia, thrombocytopenia, psychosis, mania, drug dependence, suicidal thoughts, priapism

Efficacy Monitoring Parameters. Resolution of signs of ADHD, patients should have improved attention span and reduced impulsivity.

Toxicity Monitoring Parameters. BP, HR, and weight. CBC. Seek medical attention if chest pain, seizures, heart palpitations, change in behavior or personality, or hostility. Growth in children.

Key Patient Counseling Points. Avoid late evening doses due to resulting insomnia. Swallow the extended-release capsule whole. Do not crush, break, or chew it. If you cannot swallow the extended-release capsule, you may open it and pour the medicine into a small amount of soft food such as pudding, yogurt, or applesauce. Stir this mixture well and swallow it without chewing. Avoid abrupt discontinuation. For the patch, apply same time each day, alternating hips. Remove after 9 h.

Clinical Pearls. Amphetamines have a high potential for abuse, and administration for prolonged periods of time may lead to drug dependence and must be avoided. Misuse of amphetamines may cause sudden death and serious cardiovascular adverse events. Treatment may include drug holidays to assess ongoing need of medication, decrease tolerance, and limit growth suppression. Avoid confusion of multiple different brand names and formulations. Medication guide required at dispensing. Some generic versions of the extended-release product are BX rated and are not interchangeable.

METHYLPREDNISOLONE: Medrol, Various

Class: Adrenal Corticosteroid

Dosage Forms. **Oral Tablet:** 2 mg, 4 mg, 8 mg, 16 mg, 32 mg

Common FDA Label Indication and Dosing.

Dosing for indications listed below: Adults, 4-48 mg po daily; Children, specific dosing parameters not specified; for all patients, adjust dose according to patient response

1. Allergic states (eg, asthma, etc)
2. Dermatologic diseases (eg, exfoliative erythroderma, etc)
3. Endocrine disorders (eg, adrenocortical insufficiency, etc)
4. Gastrointestinal diseases (eg, regional enteritis, ulcerative colitis, etc)
5. Hematologic disorders (eg, acquired hemolytic anemia, etc)
6. Neoplastic diseases (eg, palliative management of leukemias and lymphomas, etc)
7. Nervous system (eg, multiple sclerosis, cerebral edema, etc)
8. Renal diseases (eg, idiopathic nephrotic syndrome, systemic lupus erythematosus, etc)
9. Respiratory diseases (eg, idiopathic eosinophilic pneumonia, etc)
10. Rheumatic disorders (eg, rheumatoid arthritis, etc)

Sandoz generic 4 mg pictured

Off-Label Uses. None

MOA. Corticosteroids are naturally occurring and synthetic adrenocortical steroids cause varied metabolic effects, modify the body's immune responses to diverse stimuli, and are used primarily for their anti-inflammatory effects in disorders of many organ systems.

Drug Characteristics: Methylprednisolone

Dose Adjustment Hepatic	Not required	**Absorption**	Well absorbed
Dose Adjustment Renal	Not required	**Distribution**	Vd = 1.5 L/kg
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	C	**Elimination**	Primarily renal elimination with a half-life of 2-3 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to methylprednisolone or other glucocortosteroids, administration of live vaccines, fungal infections	**Black Box Warnings**	None

Medication Safety Issues: Methylprednisolone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	MethylPREDNISolone	No	No	PrediniSONE	No

Drug Interactions: Methylprednisolone

Typical Agents	Mechanism	Clinical Management
CYP3A4/5 inhibitors	Decreased methylprednisolone metabolism increases risk of methylprednisolone toxicity	Monitor for toxicity and reduce methylprednisolone dose if necessary
CYP3A4/5 inducers	Increased methylprednisolone metabolism decreases methylprednisolone efficacy	Monitor for efficacy and consider methylprednisolone dose increases
Fluoroquinolones	Concurrent use of steroids and fluoroquinolones can increase risk of tendon rupture, especially in elderly	Avoid concurrent use, or monitor carefully for tendon rupture
Phenytoin	Phenytoin increases methylprednisolone metabolism; methylprednisolone can increase or decrease phenytoin metabolism	Monitor methylprednisolone efficacy and phenytoin concentrations
Warfarin	Steroids can either increase or decrease INR in patients taking warfarin	Monitor INR carefully

Adverse Reactions: Methylprednisolone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
GI upset	Hypertension, atrophic condition of skin, impaired skin healing, osteoporosis, depression, euphoria, pulmonary tuberculosis, hyperglycemia	Primary adrenocortical insufficiency, Cushing syndrome, decreased body growth, increased risk of infection

Efficacy Monitoring Parameters. Improvement or resolution of clinical signs and symptoms; monitor for decrease in ESR, or improvement of PFT.

Toxicity Monitoring Parameters. Monitor for signs of hyperglycemia, osteoporosis, adrenocortical insufficiency, and infection; frequency and severity of adverse effects are dependent on the length of treatment and dose.

Key Patient Counseling Points. For short-term treatment, inform patients to take doses with meals to prevent GI upset. For high-dose or longer-term treatment, inform patients to monitor for signs of hyperglycemia, osteoporosis, adrenocortical insufficiency, and infection.

Clinical Pearls. Available in a variety of dosage forms for various indications, including ophthalmic preparations. Use lowest effective dose and discontinue as soon as possible to avoid serious long-term adverse effects. Injectable formulations sold by compounding pharmacies have been associated with outbreak of fatal fungal infections.

METOCLOPRAMIDE: Reglan, Various

Class: Dopamine Antagonist

Dosage Forms. Oral Tablet: 5 mg, 10 mg; **Oral Solution:** 5 mg/5 mL, 10 mg/2 mL 10 mg/10 mL; **Oral Dispersible Tablet:** 5 mg

NorthStar Rx generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Diabetic gastroparesis: 10 mg po 30 min before meals and at bedtime × 2-8 wk; *max* 12 wk duration
2. Gastroesophageal reflux disease: Adults, 10-15 mg po qid 30 min before meals and at bedtime; Neonates, 0.15 mg/kg po q6h; Infants, 0.1 mg/kg po tid-qid 10-30 min before meals and at hs, *max* dose 0.3-0.75 mg/kg/d × 2 wk to 6 mo

Off-Label Uses.

1. Decreased lactation: 30-45 mg po daily × 7-15 d or 10-15 mg po tid × 7-15 d
2. Nondiabetic gastroparesis: 10 mg po 30 min before meals and at hs for 2-8 wk; *max* 12 wk duration

MOA. Metoclopramide stimulates motility of the upper GI tract without stimulating gastric, biliary, or pancreatic secretions. Its mode of action is unclear. It seems to sensitize tissues to the action of acetylcholine. It is also a dopamine receptor antagonist at dose >5 mg/kg.

Drug Characteristics: Metoclopramide

Dose Adjustment Hepatic	Not required	**Absorption**	F = 80%, minimal food effect
Dose Adjustment Renal	CrCl = 10-50 mL/min, reduce dose by 25%; CrCl <10 mL/min, reduce dose by 50%	**Distribution**	Vd = 3.5 L/kg; 30% protein bound
Dialyzable	2-38% by hemodialysis	**Metabolism**	Hepatic, minor CYP1A2 and CYP2D6 substrate
Pregnancy Category	B	**Elimination**	Renal 75-80%, with a half-life of 5-6 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity, GI hemorrhage, mechanical obstruction or perforation, pheochromocytoma, concomitant use with drugs likely to cause extrapyramidal reactions, epilepsy	**Black Box Warnings**	Tardive dyskinesia

Medication Safety Issues: Metoclopramide

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
ODT	No	Dispersible tablet	No	Metolazone, metoprolol, metroNIDAZOLE	Avoid, unless for gastroparesis

Drug Interactions: Metoclopramide

Typical Agents	Mechanism	Clinical Management
Amitriptyline, antipsychotics, bupropion, TCAs	Increased risk of neuroleptic malignant syndrome and extrapyramidal symptoms	Contraindicated
Cabergoline, dopamine agonists	Decreased effect of dopamine agonists	Avoid concurrent use
Cyclosporine, levodopa, tacrolimus	Increased absorption and toxicity	Avoid concurrent use or monitor cyclosporine or tacrolimus levels and adjust dosage; avoid concurrent levodopa
Didanosine	Increased didanosine plasma concentrations	Avoid concurrent use
Digoxin, posaconazole	Decreased GI absorption and decreased efficacy of digoxin, posaconazole	Avoid concurrent use or monitor digoxin levels and adjust dosage
MAOIs	Increased risk of hypertensive crisis	Avoid concurrent use
Linezolid, SSRIs	Increased risk serotonin syndrome	Avoid concurrent use

Adverse Reactions: Metoclopramide

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Asthenia, somnolence	Dizziness, headache	Malignant hypertension, arrhythmias, galactorrhea, amenorrhea, gynecomastia, and impotence secondary to hyperprolactinemia, agranulocytosis, dystonia, extrapyramidal reactions, tardive dyskinesia

Efficacy Monitoring Parameters. Reduction in nausea and vomiting.

Toxicity Monitoring Parameters. Seek medical attention if elevated BP, heart palpitation, fluid retention, unusual bruising or bleeding, or involuntary jerking movements.

Key Patient Counseling Points. Take this medicine on an empty stomach, 30 min before each meal and at bedtime. Not for long-term use. If using the oral dispersible tablet, make sure your hands are dry. Place the tablet in your mouth. It should melt quickly. After the tablet has melted, swallow or take a drink of water.

Clinical Pearls. Extrapyramidal reactions may consist of torticollis, facial spasms, urinary retention, and tetanus-like reactions. Young patients receiving high doses are at increased risk. Most patients respond to anticholinergic agents such as benztropine. Tardive dyskinesia is reported with the use of metoclopramide tablets. The symptoms of tardive dyskinesia are characterized by involuntary movements of the tongue, face, mouth, or jaw.

METOPROLOL: Toprol XL, Various

Class: β-Adrenergic Blocker, Cardioselective

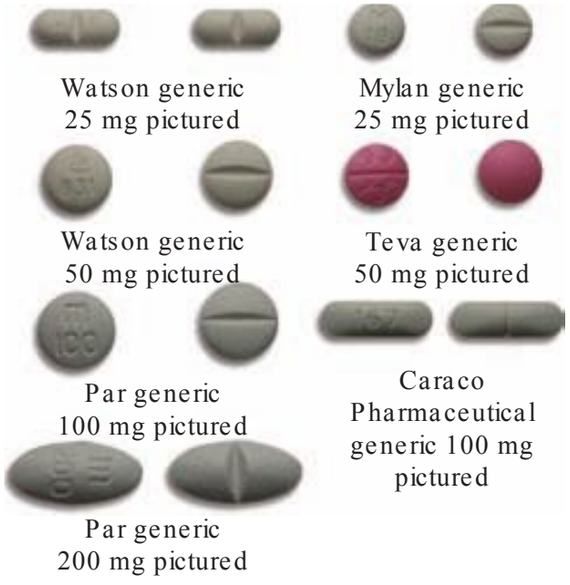
Dosage Forms. Oral Tablet: 25 mg, 50 mg, 100 mg; **Oral Tablet, Extended Release:** 25 mg, 50 mg, 100 mg, 200 mg

Common FDA Label Indication, Dosing, and Titration.

1. Angina: Adults, 50 mg po bid or 100 mg extended release po daily, may titrate to 100-400 mg total daily dose
2. Heart failure: Adults, NYHA Class II, 25 mg po daily for 2 wk, may titrate to *max* 200 mg/d; NYHA Class III-IV, 12.5 mg po daily for 2 wk, may titrate to *max* 200 mg/d
3. Hypertension: Adults, initial, immediate release, 50 mg po bid, may titrate up to 450 mg po per day in 2-3 divided doses; initial, extended release, 25-100 mg po daily, may titrate to 100-400 mg once daily; Children >6 y of age, 1 mg/kg po daily, may titrate to *max* 50 mg/d

Off-Label Uses.

1. Acute myocardial infarction: Adults, immediate release, 25-50 mg po q6-12h, convert to bid dosing over 2-3 d, or to daily extended release dosing with a *max* dose of 200 mg po daily
2. Atrial fibrillation-cardioversion: Adults, 50-200 mg po daily
3. Cardiac dysrhythmia: Adults, immediate release, 25–100 mg po bid; extended release, 50-400 mg po daily



MOA. Metoprolol is a cardioselective β-adrenergic blocker used in arrhythmias, hypertension, angina pectoris, and heart failure. It is also effective in decreasing post-MI mortality.

Drug Characteristics: Metoprolol

Dose Adjustment Hepatic	Liver disease, use slow-dose titration	**Absorption**	F = 65-70%; food increases Cmax and AUC
Dose Adjustment Renal	Not required	**Distribution**	Vd = 3-5 L; 12% protein bound
Dialyzable	Yes, give maintenance dose after dialysis completed	**Metabolism**	Hepatic, CYP2D6 substrate
Pregnancy Category	C	**Elimination**	Renal elimination of metabolite is 95% with a half-life of 3-7 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	Use with caution in known CYP2D6 poor metabolizers
Contraindications	Hypersensitivity; severe bradycardia, 2nd- or 3rd-degree AV block, sick sinus syndrome; decompensated heart failure; cardiogenic shock	**Black Box Warnings**	Abrupt withdrawal

Medication Safety Issues: Metoprolol

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
XL	No	Do not crush or chew ER formulation ER formulation is scored and can be broken in half	Yes (IV only)	TEGretol, Topamax	No

Drug Interactions: Metoprolol

Typical Agents	Mechanism	Clinical Management
Alpha-blockers, fentanyl	Increased risk of hypotension	Monitor BP
Amiodarone, dronedarone	Increased risk of bradycardia, heart block, sinus arrest	Avoid concurrent use in patients with sick sinus syndrome or AV block
Antidiabetic drugs	Decreased glycemic control	Monitor blood glucose levels
Calcium channel blockers, quinidine	Increased risk of hypotension and/or bradycardia and atrioventricular block	Avoid concurrent use
Clonidine	Exaggerated clonidine withdrawal response	Avoid abrupt withdrawal of clonidine while on concomitant beta-blocker therapy
CYP2D6 inhibitors	Decreased metoprolol metabolism increases risk of metoprolol toxicity	Initiate metoprolol at lower doses, monitor HR and BP
NSAIDs, venlafaxine	Decreased antihypertensive effect of metoprolol	Avoid concurrent use or monitor BP

Adverse Reactions: Metoprolol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Dizziness, fatigue, hypotension	Arthralgia, bradyarrhythmias, bronchospasm, cold extremities, diarrhea, depression, dyspnea, disorder of glucose regulation, headache, heart block, impotence, nausea, rash, somnolence, syncope, vomiting	Heart failure

Efficacy Monitoring Parameters. Decreased BP, reduction in chest pain, decreased number of weekly angina attacks, reduction in use of prophylactic nitroglycerin to relieve chest pain, improvement in signs/symptoms of heart failure.

Toxicity Monitoring Parameters. Signs/symptoms of heart failure, decreased HR. Monitor serum electrolytes, and renal function at baseline and periodically.

Key Patient Counseling Points. Take on an empty stomach and avoid alcohol. Avoid abrupt discontinuation, exacerbations of angina may occur. Instruct patients to report signs/symptoms of hypotension, heart failure, or exacerbation of angina with initial dosing and dose changes. This medicine may cause dizziness. Avoid driving, using machinery, or doing anything else that could be dangerous if not alert. Advise diabetic patients to carefully follow blood sugar levels as beta-blockers may mask symptoms of hypoglycemia.

Clinical Pearls. Avoid concomitant use of calcium channel blockers, as concomitant use may significantly affect HR or rhythm. Increase dose weekly when titrating for HTN/angina but every 2 wk for HF. Injectable metoprolol is also used for cardioversion in atrial fibrillation patients.

METRONIDAZOLE: Flagyl, Various

Class: Nitroimidazole Antibiotic, Antiprotozoal

Dosage Forms. Oral Capsule: 375 mg; **Oral Tablet, Extended Release:** 750 mg; **Oral Tablet:** 250 mg, 500 mg

Barr generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Abscess, anaerobic: 7.5 mg/kg po q6h; *max* 4 g/d
2. Amebic dysentery, acute: Adults, 750 mg po tid × 5-10 d; Children, 35-50 mg/kg/d po in 3 divided doses for 10 d; *max* 750 mg/dose
3. Bacterial vaginosis: Extended-release tablets, 750 mg po daily × 7 d
4. Trichomoniasis (for patient and sex partner): 2 g po × 1 dose or 250 mg po q8h × 7 d or 1 g bid × 2 doses

Off-Label Uses.

1. *C. difficile* diarrhea, including pseudomembranous colitis, mild-moderate initial episode or 1st recurrence: 500 mg po tid × 10-14 d
2. *H. pylori* GI tract infection: 500 mg po bid in combination with clarithromycin and a PPI ("triple therapy")

MOA. Metronidazole is a synthetic nitroimidazole active against *T. vaginalis* (trichomoniasis), *E. histolytica* (amebiasis), and *G. lamblia* (giardiasis); it is bactericidal against nearly all obligate anaerobic bacteria including *B. fragilis*.

Drug Characteristics: Metronidazole

Dose Adjustment Hepatic	Severe hepatic dysfunction, consider dose reduction by 50%	**Absorption**	F = 100%, food effects rate, but not extent of absorption
Dose Adjustment Renal	CrCl <10 mL/min, reduce dose by 50%	**Distribution**	Abscess, bronchial f uids, peritoneal, saliva, crosses BBB
Dialyzable	Yes, supplement after hemodialysis, Peritoneal dialysis—no adjustment	**Metabolism**	Hepatic (30-60%) and occurs by glucuronidation. Moderate CYP3A4/5 inhibitor
Pregnancy Category	B	**Elimination**	Renal elimination is 60-80% of unchanged drug with a half-life of ~8 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to metronidazole, 1st trimester of pregnancy	**Black Box Warnings**	Carcinogenic

Medication Safety Issues: Metronidazole

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
ER	MetroNIDAZOLE	Do not crush or chew ER formulation	No	Mebendazole, meropenem, metFORMIN, methotrexate, metoclopramide, miconazole	No

Drug Interactions: Metronidazole

Typical Agents	Mechanism	Clinical Management
Antiarrhythmic agents, TCAs	Increased risk of QT prolongation and other cardiac events	Avoid concurrent use if possible; if used together, monitor carefully and consider dose reductions
Amprenavir oral solution	Contains propylene glycol, an increased risk of propylene glycol toxicity	Solution contraindicated (reaction does not occur with amprenavir capsules)
CYP3A4/5 substrates	Decreases substrate metabolism and increased risk of substrate toxicity	Use with caution and consider dose reductions of CYP3A4/5 substrates. MAOIs are contraindicated
Cholestyramine	Decreased absorption of metronidazole	Separate administration by 2 h
Disulfiram	Increased CNS toxicity and disulfiram reactions	Contraindicated
Warfarin	Increase in warfarin concentration resulting in increase in INR and risk of bleeding	Consider reducing the dose of warfarin; monitor INR and bleeding

Adverse Reactions: Metronidazole

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Headaches, nausea	Diarrhea, dizziness, neuropathy, abnormal taste	Severe hypersensitivity, seizures, ototoxicity, clinically insignificant dark urine, Stevens-Johnson syndrome, neutropenia/thrombocytopenia

Efficacy Monitoring Parameters. Resolution of clinical signs of infection (fever, cultures) within 2-3 d.

Toxicity Monitoring Parameters. Seek medical attention if severe diarrhea, dark urine, yellowing of skin or eyes, unusual bruising or bleeding, blistering skin rash, or shortness of breath. Monitor CBC for prolonged/repeated courses of therapy.

Key Patient Counseling Points. Avoid alcohol while taking this medicine and for 3 d after, may cause severe disulfiram-like reaction. Complete full course of therapy. Symptoms should improve within 2-3 d; if they worsen, seek follow-up with health-care practitioner. Extended-release tablets should be taken on an empty stomach (1 h before or 2 h after meals). Immediate-release tablets and capsules may be administered with food to minimize stomach upset.

Clinical Pearls. May resume normal activities after 24 h of antibiotics and afebrile. Drug of choice for mild-moderate *C. difficile* infection.

MINOCYCLINE: Minocin, Various

Class: Tetracycline Antibiotic

Dosage Forms. **Oral Tablet:** 50 mg, 75 mg, 100 mg; **Oral Tablet, Extended Release:** 45 mg, 55 mg, 65 mg, 80 mg, 90 mg, 105 mg, 115 mg, 135 mg; **Oral Capsule:** 50 mg, 75 mg, 100 mg

Common FDA Label Indication, Dosing, and Titration.

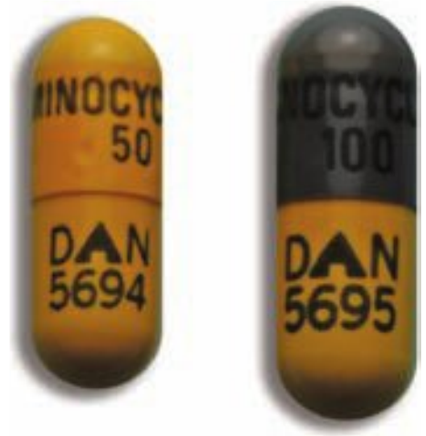
1. Acne vulgaris: Extended-release, 1 mg/kg/d po daily × 12 wk
2. Allergy to penicillin—bacterial infectious disease: Adults, initial, 200 mg po, followed by 100 mg po q12h; Children >8 y of age, 4 mg/kg po, followed by 2 mg/kg/dose q12h (*max* dose 400 mg)

Off-Label Uses.

1. Leprosy: 100 mg po daily

MOA. Tetracyclines are broad-spectrum bacteriostatic compounds that inhibit protein synthesis at the 30S ribosomal subunit. Activity includes gram-positive, gram-negative, aerobic, and anaerobic bacteria, as well as spirochetes, mycoplasmas, rickettsiae, chlamydiae, and some protozoa. Many bacteria have developed plasmid-mediated resistance. Most Enterobacteriaceae and *P. aeruginosa* are resistant.

50 mg 100 mg



Watson generic pictured

Drug Characteristics: Minocycline

Dose Adjustment Hepatic	Not required	**Absorption**	F = 90%; can be taken without regard to food
Dose Adjustment Renal	No specific recommendations, but consider dose reduction or extending the interval. Do not exceed 200 mg daily.	**Distribution**	Aqueous humor, CSF, gingival fluids, sinus, saliva, tears
Dialyzable	Not dialyzable	**Metabolism**	Hepatically metabolized, extent unknown
Pregnancy Category	D	**Elimination**	Renal elimination is 10-20% with a half-life of 11-22 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Minocycline

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	ER formulations	No	Indocin, Lincocin, Minizide, niacin, Dyazide, Dynapen	No

Drug Interactions: Minocycline

Typical Agents	Mechanism	Clinical Management
Acitretin	Risk of increased intracranial pressure; mechanism unknown	Concurrent use contraindicated
Aluminum, calcium, and magnesium containing antacids, iron	Decreased absorption via binding	Separate use by 1-2 h
Ethinyl estradiol and other estrogen-based birth control products	Alters intestinal f ora that, in turn, reduces the enterohepatic circulation of estrogen metabolites; decreased efficacy of birth control	Use an alternative form of birth control
Digoxin	Tetracyclines alter bacterial f ora resulting in decreased metabolism of digoxin	Monitor and consider dose adjustments of digoxin
Isotretinoin and vitamin A	Additive risk of intracranial hypertension	Avoid concurrent use
Penicillin	Bacteriostatic drugs, such as the tetracyclines, may interfere with the bactericidal effect of penicillin	Avoid concurrent use

Adverse Reactions: Minocycline

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Dizziness and vertigo, tooth discoloration in children <8 y of age, headache	Nausea, vomiting, diarrhea, fatigue	Hypersensitivity, hepatotoxicity, renal toxicity, *C. diff cile* colitis, increased intracranial pressure, decreased growth in children

Efficacy Monitoring Parameters. Resolution of signs and symptoms of infection, or decreased acne.

Toxicity Monitoring Parameters. Seek medical attention if extreme headache, bloody diarrhea, tooth darkening, or yellowing of the eyes/skin occurs. LFTs, SCr in patients receiving long-term treatment.

Key Patient Counseling Points. May take with food that does not contain calcium (dairy). Complete full course of therapy. Symptoms should improve within 2-3 d if treating infection; if they worsen, seek follow-up with health-care practitioner. Acne should improve within 1-2 wk. Wear sunscreen. Avoid driving or using hazardous machines until side effects are known (dizziness). Warn patients (both male and female) to avoid pregnancy.

Clinical Pearls. Dosing is not interchangeable with extended-release and immediate-release products. Dizziness occurs more frequently in women than men. Less hepatotoxicity than is usually seen with doxycycline. May resume normal activities after 24 h of antibiotics and afebrile. Not for use in children <8 y of age due to bone and tooth discoloration.

MIRTAZAPINE: Remeron, Various

Class: Antidepressant, α_2-Antagonist

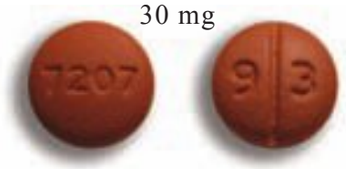
Dosage Forms. Oral Tablet: 7.5 mg, 15 mg, 30 mg, 45 mg; **Oral Disintegrating Tablet:** 15 mg, 30 mg, 45 mg

Common FDA Label Indication, Dosing, and Titration.

1. Depression: 15 mg po daily hs, may titrate to 45 mg po daily hs

15 mg

30 mg



Teva generic pictured

45 mg

Sandoz generic pictured

Off-Label Uses. None

MOA. Mirtazapine is an antidepressant that antagonizes presynaptic α_2-adrenergic auto- and heteroreceptors that are responsible for controlling the release of norepinephrine and serotonin (5-HT). It is also a potent antagonist of postsynaptic 5-HT_2 and 5-HT_3 receptors. The net outcome of these effects is increased noradrenergic activity and enhanced 5-HT activity, especially at 5-HT_{1A} receptors. This unique mechanism of action preserves antidepressant efficacy but minimizes many of the adverse effects common to heterocyclic antidepressants and SSRIs.

Drug Characteristics: Mirtazapine

Dose Adjustment Hepatic	Increase dose slowly as needed and tolerated	**Absorption**	F = 50%; minimal effect of food on absorption
Dose Adjustment Renal	CrCl <40 mL/min, increase dose slowly as needed and tolerated	**Distribution**	Vd = 4.5 L/kg; 85% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5, 2D6 and 1A2 substrate
Pregnancy Category	C	**Elimination**	Renal elimination (metabolites) is 75% and 15% in feces, with a half-life of 20-40 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to mirtazapine; concurrent MAOI, linezolid, IV methylene blue use	**Black Box Warnings**	Suicidality; not for use in children

Medication Safety Issues: Mirtazapine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
SolTab	No	Disintegrating tablet	No	Premarin, ramelteon, Rozerem, Zemuron	No

Drug Interactions: Mirtazapine

Typical Agents	Mechanism	Clinical Management
CYP2D6, CYP3A4/5, and CYP1A2 inducers	Increased metabolism of mirtazapine and decreased efficacy	Avoid concomitant use if possible or consider dose increases of mirtazapine
CYP2D6, CYP3A4/5, and CYP1A2 inhibitors	Decreased metabolism of mirtazapine and increased toxicity	Avoid concomitant use if possible or consider dose decreases of mirtazapine
Fluoxetine, fluvoxamine, linezolid, MAOIs, olanzapine, tramadol, venlafaxine	Increased risk of serotonin syndrome	Avoid concomitant use

Adverse Reactions: Mirtazapine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation, increased appetite, somnolence, xerostomia, increased serum cholesterol	Asthenia, dizziness, increased liver enzymes, increased serum triglycerides, weight gain, edema, flu-like symptoms, abnormal thinking	Neutropenia, suicidal thoughts

Efficacy Monitoring Parameters. Improvement in symptoms of depression (suicidal thoughts or intent, change in appetite, lack of energy, change in sleep patterns, etc).

Toxicity Monitoring Parameters. Worsening of depression, suicidality, or unusual changes in behavior, especially at the initiation of therapy or with dosage increases or decreases; monitor CBC, lipid panel, body weight, and LFTs.

Key Patient Counseling Points. Orally disintegrating tablet blister pack should be opened with dry hands and placed on tongue; no water is needed; tablet should be used immediately after removal from package; once removed, it cannot be stored. Avoid activities requiring mental alertness until drug effects are realized. Report worsening depression, suicidal ideation, or unusual changes in behavior. Do not drink alcohol while taking this drug. Take in the evening prior to sleep.

Clinical Pearls. Safety and effectiveness in pediatric patients have not been established. Use with caution in elderly patients who may be more susceptible to adverse effects. Medication guide required at dispensing. QT prolongation/torsades de pointes has been reported.

MODAFINIL: Provigil, Various

Class: CNS Stimulant. C-IV

Dosage Forms. Oral Tablet: 100 mg, 200 mg

Cephalon pictured

Common FDA Label Indication, Dosing, and Titration.

1. Narcolepsy: 200 mg po daily in the morning, *max* 400 mg/d
2. Obstructive sleep apnea, improve excessive sleepiness; adjunct: 200 mg po daily in the morning, *max* 400 mg/d
3. Shift work-sleep disorder: 200 mg po daily 1 h before start of work shift, *max* 400 mg/d

Off-Label Uses.

1. Attention-deficit hyperactivity disorder: 200 mg po daily

MOA. The mechanism of action of modafinil is uncertain. Modafinil is a wakefulness-promoting agent acting as a CNS stimulant. It is chemically and pharmacologically unrelated to other CNS stimulants, such as methylphenidate, amphetamine, or pemoline.

Drug Characteristics: Modafinil

Dose Adjustment Hepatic	Severe hepatic impairment, 100 mg po daily	**Absorption**	Rapid absorption, food slows absorption but does not affect extent
Dose Adjustment Renal	CrCl <20 mL/min, initial dose 100-200 mg/d	**Distribution**	Vd = 0.9 L/kg; 60% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 substrate. Strong CYP2C19 inhibitor
Pregnancy Category	C	**Elimination**	Renal elimination is 80% (10% unchanged) and 1% in feces, with a half-life of 7.5-15 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	Use with caution in CYP2C19 poor metabolizers
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Modafinil

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Plaquenil	No

Drug Interactions: Modafinil

Typical Agents	Mechanism	Clinical Management
CYP3A4/5 inducers	Increased modafinil metabolism and decreased modafinil efficacy	Avoid concurrent use or monitor efficacy and consider modafinil dose increases
CYP3A4/5 inhibitors	Decreased modafinil metabolism increases risk of modafinil toxicity	Avoid concurrent use or monitor toxicity and consider modafinil dose decreases
CYP2C19 substrates	Decreased metabolism of substrates, increased risk of substrate toxicity	Avoid concurrent use if possible or consider dose reductions of substrates
Combination contraceptives	Decreased contraceptive bioavailability and reduced effectiveness	Use alternative non-hormonal contraceptive method of birth control; monitor closely for signs of breakthrough bleeding and/or pregnancy

Adverse Reactions: Modafinil

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Anxiety, headache, insomnia, nausea	Chest pain, dizziness, feeling nervous, hypertension, loss of appetite, palpitations, rash, tachycardia, xerostomia	Cardiac dysrhythmia, Stevens-Johnson syndrome

Efficacy Monitoring Parameters. Degree of sleepiness, improvement of mental, and behavioral symptoms.

Toxicity Monitoring Parameters. Palpitations, near syncope, or syncope; may be indicative of a cardiac condition; BP and HR. Weight.

Key Patient Counseling Points. This drug may decrease effectiveness of hormonal or IUD contraception. Recommend additional form of birth control during therapy and 1 mo after last dose. Avoid activities requiring mental alertness or coordination until drug effects are realized. If using drug for daytime wakefulness, take in the morning; if using to maintain wakefulness during shift work, take drug 1 h prior to working. Do not drink alcohol while taking this drug. Practice good sleep hygiene. Does not replace need for CPAP machines in patients with obstructive sleep apnea.

Clinical Pearls. Safety and effectiveness in children <16 y old have not been established. HR and BP should be evaluated at baseline, during routine follow-up within 1-3 mo, and at follow-up visits every 6-12 mo. Increases in BP and HR have been reported with the use of certain ADHD drugs. Dispense with medication safety guide.

MOMETASONE NASAL: Nasonex, Various

Class: Intranasal Corticosteroid

Dosage Forms. Nasal Spray: 50 mcg/actuation

Common FDA Label Indication, Dosing, and Titration.

1. Seasonal and perennial allergic rhinitis: Children 2-11 y of age, 1 spray/nostril daily (100 mcg/d); Children ≥12 y of age and Adults, 2 sprays/nostril daily (200 mcg/d)
2. Nasal polyp: 2 sprays/nostril (50 mcg/spray) bid (400 mcg/d), reduce dose to 2 sprays/nostril daily if possible

Off-Label Uses. None

MOA. Mometasone has anti-inflammatory, antipruritic, and vasoconstrictive properties. Corticosteroids are thought to act by the induction of phospholipase A2 inhibitory proteins, lipocortins. It is postulated that these proteins control the biosynthesis of potent mediators of inflammation such as prostaglandins and leukotrienes by inhibiting the release of their common precursor, arachidonic acid. Arachidonic acid is released from membrane phospholipids by phospholipase A2.

Schering Corporation pictured

Drug Characteristics: Mometasone Nasal

Dose Adjustment Hepatic	Not required	**Absorption**	Minimal (<2%) absorption after nasal administration
Dose Adjustment Renal	Not required	**Distribution**	Not absorbed
Dialyzable	Not dialyzable	**Metabolism**	Not absorbed
Pregnancy Category	C	**Elimination**	Not absorbed
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Mometasone Nasal

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	No	No

Drug Interactions: **Mometasone Nasal.** None known

Adverse Reactions: Mometasone Nasal

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Nasal irritation and burning, headache, pharyngitis	Epistaxis, cough	Severe hypersensitivity, glaucoma, pneumonia, secondary hypocortisolism; osteoporosis

Efficacy Monitoring Parameters. Control of rhinitis signs and symptoms.

Toxicity Monitoring Parameters. While only small amounts of mometasone reach systemic circulation, BMD and growth and development in children should be monitored. Routine ophthalmologic examinations should be performed. Monitor for signs and symptoms of adrenal suppression or infection.

Key Patient Counseling Points. Advise patients on the proper administration technique for this product. Nasal spray needs to be primed before using and if not used for 1 wk. Instruct patients to monitor for signs of toxicity, especially adrenal insufficiency.

Clinical Pearls. Oral inhalation and topical dosage forms of mometasone are also available for treatment of other allergic disorders. While oral antihistamines (either over the counter or prescription) remain the mainstay for treatment of rhinitis, nasal steroids are a recommended option if symptoms are severe, unresolved with oral antihistamines, or if oral antihistamines cause undesirable adverse effects. May begin treatment for seasonal allergic rhinitis 2-4 wk before the expected start of allergy season at the dose approved for the treatment of allergic rhinitis.

MONTELUKAST: Singulair, Various

Class: Leukotriene Receptor Antagonist

Dosage Forms. **Oral Tablet:** 10 mg; **Oral Chewable Tablet:** 4 mg, 5 mg; **Oral Granules:** 4 mg/packet

Common FDA Label Indication, Dosing, and Titrations.

1. Asthma: Children 12 mo to 5 y of age, 4 mg po daily; Children 6-14 y of age, 5 mg po daily; Children ≥15 y of age and Adults, 10 mg po daily
2. Exercise-induced asthma: Children 6-14 y of age, 5 mg po 2 h before exercise; Children ≥15 y of age and Adults, 10 mg po 2 h before exercise, *max* 1 dose/24 h
3. Seasonal allergic rhinitis: Children 2 to 5 y of age, 4 mg po daily; Children 6-14 y of age, 5 mg po daily; Children ≥15 y of age and Adults, 10 mg po daily

Merck 10 mg pictured

Off-Label Uses.

1. Atopic dermatitis: 10 mg po daily

MOA. Leukotrienes are products of arachidonic acid metabolism and are released from various cells, including mast cells and eosinophils, and bind to leukotriene receptors. Montelukast binds with leukotriene receptors to inhibit physiologic actions of leukotriene.

Drug Characteristics: Montelukast

Dose Adjustment Hepatic	Not required	**Absorption**	F = 63-73%, food decreases bioavailability
Dose Adjustment Renal	Not required	**Distribution**	Vd = 8-11 L; >99% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 and CYP2C9 substrate
Pregnancy Category	B	**Elimination**	Renal elimination is <1% with a half-life of 3-6 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Montelukast

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Oralair, SINEquan	No

Drug Interactions: Montelukast

Typical Agents	Mechanism	Clinical Management
CYP2C9 and CYP3A4/5 inducers	Increased metabolism of montelukast decreases montelukast efficacy	Monitor for efficacy of montelukast; consider dose increases
CYP2C9 and CYP3A4/5 inhibitors	Decreased metabolism of montelukast increases the risk of montelukast toxicity	Monitor for toxicity of montelukast; consider dose reductions
Prednisone	Severe peripheral edema	Use with caution; monitor for edema

Adverse Reactions: Montelukast

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Headache	Dizziness, fatigue, rash, increased LFTs, dyspepsia	Allergic granulomatosis angiitis, cholestatic hepatitis, aggressive behavior, altered behavior, suicidal thoughts

Efficacy Monitoring Parameters. Resolution of clinical signs of asthma (improved pulmonary function tests) or symptoms of rhinitis.

Toxicity Monitoring Parameters. Seek medical attention if change in behavior/mood, including suicidal thinking or suicide or neuropsychiatric symptoms (eg, agitation, aggression, anxiousness, etc,) occurs; monitor blood chemistry and LFT monitoring.

Key Patient Counseling Points. Not indicated for acute asthma attacks. Report increased use or frequency of short-acting inhaled bronchodilators and advise patients not to discontinue or decrease the dose of other asthma medications unless instructed by a health-care professional. Patients with asthma or allergic rhinitis should take dose in the evening.

Clinical Pearls. Current treatment guidelines published by the National Heart, Lung, and Blood Institute (NHLBI) emphasize the use of inhaled corticosteroids as first-line therapy for long-term control of persistent asthma symptoms in both children and adults. Leukotriene receptor antagonists are alternative agents, but not preferred, for the treatment of mild persistent asthma in children ≥5 y of age, and in adults. Consult guidelines for more information on asthma management.

MORPHINE ER: MS Contin, Avinza, Kadian, Various

Class: Opioid Analgesic. C-II

Dosage Forms. Oral Tablet: 15 mg 30 mg; **Oral Tablet, Extended Release:** 15 mg, 30 mg, 60 mg, 100 mg, 200 mg; **Oral Capsule, Extended Release, 24 h:** Avinza: 30 mg, 45 mg, 60 mg, 75 mg, 90 mg, 120 mg; Kadian: 10 mg, 20 mg, 30 mg, 40 mg, 50 mg, 80 mg, 100 mg, 200 mg; **Oral Solution:** 10 mg/5 mL, 20 mg/5 mL, 20 mg/1 mL, 100 mg/5 mL; **Rectal Suppository:** 5 mg, 10 mg, 20 mg, 30 mg

15 mg

Endo generic pictured

30 mg

Mallinckrodt generic pictured

60 mg

Endo generic pictured

Common FDA Label Indication and Dosing.

1. Pain, chronic, moderate to severe: 10-20 mg po q12h, titrate to response; use immediate-release formulation to determine patient's morphine requirement and titrate to response. Avinza is given once daily; Kadian may be given once daily or q12h. MS Contin is given q8-12h.

Off-Label Uses. None

MOA. Morphine is a pure mu agonist. Mu receptors are responsible for analgesia, respiratory depression, miosis, decreased GI motility, and euphoria. In the CNS, it promotes analgesia and respiratory depression by decreasing brain stem respiratory centers' response to carbon dioxide tension and electrical stimulation. It also decreases gastric, biliary, and pancreatic secretion, induces peripheral vasodilation, and promotes opioid-induced hypotension due to histamine release.

Drug Characteristics: Morphine ER

Dose Adjustment Hepatic	Severe impairment, extend dosing interval or start with lower doses	**Absorption**	F = <40%, food slows rate, but not extent of absorption
Dose Adjustment Renal	CrCl 10-50 mL/min, reduce dose by 25%; CrCl <10 mL/min, reduce dose by 50%	**Distribution**	Vd = 1-6 L/kg; 20-36% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic by glucuronidation
Pregnancy Category	C	**Elimination**	Renal elimination (metabolites) is 90% with a half-life of 15 h
Lactation	Compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to opioids, acute or severe asthma, paralytic ileus, respiratory depression, GI obstruction	**Black Box Warnings**	Abuse/misuse/diversion; ethanol; extended release products; concentrated oral solutions; overdose; respiratory depression

Medication Safety Issues: Morphine ER

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	AVINza	ER formulations	Yes	Evista, INVanza, OxyCONTIN, hydromorphone, methadone, magnesium sulfate	No

Drug Interactions: Morphine ER

Typical Agents	Mechanism	Clinical Management
Barbiturates, benzodiazepines, centrally acting muscle relaxants, opioids, phenothiazines	Additive CNS depression	Monitor and consider dose adjustments
Buprenorphine, opioid agonists/antagonists, opioid antagonists	Precipitation of withdrawal symptoms	Avoid concurrent use with opioids
MAOIs	Additive respiratory depression, increased serotonin syndrome	Contraindicated

Adverse Reactions: Morphine ER

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation, nausea, vomiting, hypotension, dizziness, sedation, edema, pruritus, headaches, depression, xerostomia	Dyspnea	Cardiac arrest, physical dependence, tolerance, respiratory depression

Efficacy Monitoring Parameters. Relief of pain.

Toxicity Monitoring Parameters. Excessive drowsiness, decreased breathing, severe constipation, chest pain, dizziness, vital signs.

Key Patient Counseling Points. Use a stool softener and stimulant or laxative for preventing constipation. May cause drowsiness; avoid driving or other tasks requiring motor coordination. Avoid alcohol and other CNS depressants. Extended-release products must not be crushed or chewed. Crushing or chewing will release the total dose of morphine at once and increase risk of respiratory depression. ER capsule can be opened and sprinkled on soft food, but must be swallowed whole and not chewed.

Clinical Pearls. Tolerance and physical dependence may occur with chronic use; avoid abrupt discontinuation. Extended-release products are not for use in children. Fatal respiratory depression has occurred; highest risk at initiation and with dosage increases. Do not administer Avinza with alcoholic beverages or ethanol-containing products, which may disrupt extended-release characteristic of product. Highly concentrated oral solutions are available. Check doses carefully when using highly concentrated oral solutions. The 100 mg/5 mL (20 mg/mL) concentration is indicated for use in opioid-tolerant patients only. Now in an REMS program.

MOXIFLOXACIN: Avelox

Class: Fluoroquinolone Antibiotic

Dosage Forms. **Oral Tablet:** 400 mg

Bayer 400 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Acute infective exacerbation of chronic obstructive pulmonary disease: 400 mg po daily × 5 d
2. Bacterial sinusitis, acute: 400 mg po daily × 10 d
3. Community-acquired pneumonia: 400 mg po daily × 7-14 d
4. Infection of skin and/or subcutaneous tissue: 400 mg po daily × 7-21 d

Off-Label Uses.

1. Tuberculosis: 400 mg po daily × 6 mo

MOA. Moxifloxacin is a fluoroquinolone that inhibits bacterial topoisomerase II and IV. It has a broad spectrum of activity, including gram-positive and gram-negative organisms, *Chlamydia*, and anaerobes. It is effective for respiratory tract infections caused by *S. pneumoniae*, *H. influenzae*, and others.

Drug Characteristics: Moxifoxacin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 90%, no food effect, take without regard to meals
Dose Adjustment Renal	Not required	**Distribution**	Abdominal tissue, bronchial mucosa CSF, sinus, sputum
Dialyzable	Not dialyzable	**Metabolism**	52% hepatic via glucuronide and sulfate conjugation
Pregnancy Category	C	**Elimination**	Renal elimination is 20% with a half-life of 12 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	Myasthenia gravis; tendinitis and tendon rupture

Medication Safety Issues: Moxifoxacin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Avonex	No

Drug Interactions: Moxif oxacin

Typical Agents	Mechanism	Clinical Management
Antidiabetic agents	Hypoglycemic or hyperglycemic episodes have been reported when f uoroquinolones were used with antidiabetic agents; mechanism unknown	Caution with concurrent use; monitor plasma glucose and consider dose adjustments of antidiabetic agent
Aluminum, calcium and calcium-fortified foods, didanosine, iron	Decreased absorption of f uoroquinolones caused by chelation	Moxif oxacin should be taken 4 h before or 8 h after agents that decrease moxif oxacin absorption
Class III antiarrhythmic agents or other agents that effect the QTc interval	Additive potential for QTc prolongation	Contraindicated
Corticosteroids	Increased risk of tendon rupture	Counsel patients to discontinue moxif oxacin and seek medical attention if tendon pain or rupture
NSAIDs	Increased risk of seizures via inhibition of GABA resulting in CNS stimulation	Avoid NSAIDs if possible

Adverse Reactions: Moxif oxacin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Nausea, dizziness, diarrhea, headache	Stevens-Johnson syndrome, renal failure, severe hypersensitivity, anemia, neutropenia, thrombocytopenia, seizure, cardiac arrhythmias, liver failure, tendon rupture, psychosis, exacerbation of myasthenia gravis

Efficacy Monitoring Parameters. Resolution of signs and symptoms of infection. WBC.

Toxicity Monitoring Parameters. Seek medical attention if decreased urination, yellowing of eyes/skin, blistering skin rash or extreme fatigue, unusual bruising or bleeding, shortness of breath or chest pain, tendon pain, unusual thoughts, or numbness or tingling in the arms or legs. Baseline renal function tests.

Key Patient Counseling Points. Seek medical attention if rash develops. Complete full course of therapy. Symptoms should improve within 2-3 d; if they worsen, seek follow-up with health-care practitioner. If tendon pain develops, discontinue use and seek medical attention. Patients >65 y of age and on concurrent steroids are at increased risk. You may take this medicine with or without food. Do not take this medicine with milk, yogurt, or other dairy products or calcium-fortified products (some juices and breads). If using antacids, sucralfate, or mineral supplements and multivitamins with calcium, iron, or zinc, take moxifloxacin at least 4 h before or 8 h after these medicines. Wear sunscreen.

Clinical Pearls. Moxifloxacin is not approved for children <18 y of age. Oral and IV dosing is interchangeable. May be used for patients with β-lactam allergy or if initial therapy fails.

MOXIFLOXACIN OPHTHALMIC: Vigamox

Class: Fluoroquinolone Antibiotic, Ophthalmic

Dosage Forms. Ophthalmic Solution: 0.5%

Common FDA Label Indication and Dosing.

1. Bacterial conjunctivitis: Adults and Children >1 y of age, 1 drop to affected eye(s) tid × 7 d

Off-Label Uses. None

MOA. Moxifloxacin is a fluoroquinolone that inhibits bacterial topoisomerase II and IV. It has a broad spectrum of activity, including gram-positive and gram-negative organisms, and anaerobes.

Alcon pictured

Drug Characteristics: Moxifoxacin Ophthalmic

Dose Adjustment Hepatic	Not required	**Absorption**	Not absorbed after ocular administration
Dose Adjustment Renal	Not required	**Distribution**	Not absorbed
Dialyzable	Not dialyzable	**Metabolism**	Not absorbed
Pregnancy Category	C	**Elimination**	Not absorbed
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Moxifoxacin Ophthalmic

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Fisamox	No

Drug Interactions: Moxifloxacin Ophthalmic. None known

Adverse Reactions: Moxifoxacin Ophthalmic

Common (>10%)	Less Common (1-10%)	Rare but Serious (>1%)
	Conjunctivitis, dry eyes, eye pain, subconjunctival hemorrhage, tearing and burning of the eyes, reduced visual acuity	Fungal or bacterial ocular superinfection

Efficacy Monitoring Parameters. Resolution of signs and symptoms of infection.

Toxicity Monitoring Parameters. Seek medical attention if severe eye pain, itching, redness, or burning.

Key Patient Counseling Points. Symptoms should improve within 2-3 d, but complete full course of therapy. If symptoms worsen, seek follow-up with health-care practitioner. Wash hands with soap and water before and after use. Lie down or tilt your head back. With your index finger, pull down the lower lid of your eye to form a pocket. Hold the dropper close to your eye, but not touching, with the other hand. Drop the correct number of drops into the pocket made between your lower lid and eyeball. Gently close your eyes. Place your index finger over the inner corner of your eye for 1 min. Do not rinse or wipe the dropper or allow it to touch anything, including your eye. Contact lenses should not be worn during therapy.

Clinical Pearls. Bacterial conjunctivitis is very contagious and spreads by direct contact.

MUPIROCIN: Bactroban, Various

Class: Topical Antibacterial

Dosage Forms. **Topical Ointment:** 2%; **Topical Cream:** 2%; **Nasal Ointment:** 2%

Common FDA Label Indication and Dosing.

1. Impetigo: Apply topically tid × 3-5 d, reevaluate if no response
2. Secondary skin infections: Apply topically tid × 10 d, reevaluate if no response in 3-5 d
3. Eradication of nasal colonization of MRSA during institutional outbreaks: Apply one-half of single use tube to each nostril bid × 5 d

Off-Label Uses.

1. Surgical prophylaxis in MRSA carriers: Apply one-half of single tube to each nostril bid × 5 d

MOA. Mupirocin is an antibacterial agent active against a wide range of gram-positive bacteria including methicillin-resistant *S. aureus*. It is also active against certain gram-negative bacteria. Mupirocin inhibits bacterial protein synthesis by reversibly and specifically binding to bacterial isoleucyl transfer-RNA synthetase. Because of this unique mode of action, mupirocin demonstrates no in vitro cross-resistance with other classes of antimicrobial agents.

Teva generic 2% ointment pictured

Drug Characteristics: Mupirocin

Dose Adjustment Hepatic	Not required	**Absorption**	Minimal absorption after application to intact skin
Dose Adjustment Renal	Not required	**Distribution**	Not absorbed
Dialyzable	Not dialyzable	**Metabolism**	Not absorbed
Pregnancy Category	B	**Elimination**	Not absorbed
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Mupirocin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
AT Nasal	No	No	No	Bacitracin, baclofen, Bactrim	No

Drug Interactions: Mupirocin. None known

Adverse Reactions: Mupirocin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Headache, pruritus, burning at site of application, stinging sensation, rhinitis	*C. diff cile* diarrhea

Efficacy Monitoring Parameters. Resolution of clinical signs of infection within 3-5 d. Eradication of nasal colonization.
Toxicity Monitoring Parameters. Seek medical attention if local adverse effects are severe.
Key Patient Counseling Points. Instruct patients on proper application technique. Avoid drug exposure to open wounds, burns, or eyes.
Clinical Pearls. The area treated may be covered with gauze dressing if desired.

NAPROXEN: Naprosyn, Various

Class: NSAID

Dosage Forms. **Oral Tablet:** 250 mg, 275 mg, 375 mg, 500 mg; **Oral Tablet, Extended Release:** 375 mg, 500 mg, 750 mg; **Oral Tablet, Enteric Coated, Delayed Release:** 375 mg, 500 mg; **Oral Capsule:** 220 mg; **Oral Suspension:** 125 mg/5 mL

Teva generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Osteoarthritis: 250-500 mg po bid, extended-release 750-1000 mg po once daily
2. Rheumatoid arthritis: 250-500 mg po bid, extended-release 750-1000 mg po once daily
3. Gout, acute: 250 mg po tid
4. Fever: Adults and Children >12 y of age, 200-400 mg po q8-12h prn, to a *max* of 600 mg daily
5. Pain: Adults, 500 mg po q12h or 25 mg po q6-8h

Off-Label Uses.

1. Migraine: Initial, 750 mg po; may administer an additional 250-500 mg prn, *max* of 1250 mg/24 h

MOA. Nonselective inhibitor of COX-1 and COX-2.

Drug Characteristics: Naproxen

Dose Adjustment Hepatic	Not required, use at lowest effective dose, reduced dose may be considered	**Absorption**	F = 95%, food has minimal effect on absorption
Dose Adjustment Renal	Avoid if CrCl <30 mL/min	**Distribution**	Vd = 0.16 L/kg; >99% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic not via CYP450
Pregnancy Category	C	**Elimination**	Renal elimination is 95% with a half-life of 12-17 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to naproxen, other NSAIDs, aspirin or sulfonamides; asthma or allergic-type reaction following aspirin or other NSAID administration, CABG surgery, treatment of perioperative pain	**Black Box Warnings**	Cardiovascular and GI risk; CABG

Medication Safety Issues: Naproxen

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
DS, DR, EC	No	Do not crush or chew extended-release formulation	No	Natacyn, Anaspaz, Nebcin, Avapro, Naprelan	Avoid chronic use unless other alternatives are not effective and patient can take gastroprotective agent

Drug Interactions: Naproxen

Typical Agents	Mechanism	Clinical Management
Aspirin, low-molecular-weight heparins, SSRIs, NSAIDs, pentoxifylline	Additive GI toxicity and increased risk of bleeding	Concurrent ketorolac, contraindicated; others, monitor for GI toxicity
Antihypertensive agents: ACE-Is, ARBs, beta-blockers, loop and thiazide diuretics	Decreased diuretic and antihypertensive efficacy via decreased renal prostaglandin production	Monitor and consider alternative therapy
Cyclosporine, tacrolimus	Increased risk of cyclosporine, tacrolimus toxicity, unknown mechanism	Monitor cyclosporine and tacrolimus levels and consider dose adjustments
Pemetrexed	Decreased renal clearance and increased toxicity of pemetrexed	Avoid concurrent use in patients with renal dysfunction
Sulfonylureas	Increased risk of hypoglycemia via inhibition of sulfonylurea metabolism	Monitor FBG and adjust as necessary
Warfarin, rivaroxaban, apixaban, dabigatran	Increased risk of bleeding	Monitor for GI toxicity/bleeding

Adverse Reactions: Naproxen

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Edema, itching, rash, GI distress, dizziness, tinnitus, ototoxicity	Stevens-Johnson syndrome, GI bleeding, thrombosis, elevated LFTs, acute renal failure, congestive heart failure, aplastic anemia

Efficacy Monitoring Parameters. Decreased pain and improved range of motion.

Toxicity Monitoring Parameters. Severe skin rash, black tarry stools, chest pain, yellowing of eyes or skin, change in urination; monitor CBC, LFTs, SCr, fecal occult blood tests, BP (if patient has hypertension) if chronic use.

Key Patient Counseling Points. Take with food or milk to decrease GI upset.

Clinical Pearls. Elderly patients are at increased risk of GI ulceration. Patients with underlying cardiac dysfunction are at increased risk of cardiovascular effects. Use lowest dose for shortest period of time to minimize toxicity. Naproxen is also available OTC as a 220-mg tablet. If taken as OTC for fever, do not take longer than 10 d unless directed by physician. Medication guide required at dispensing.

NEBIVOLOL: Bystolic

Class: β-Adrenergic Blocker, Cardioselective, B_1 Selective

Dosage Forms. Oral Tablet: 2.5 mg, 5 mg, 10 mg, 20 mg

Common FDA Label Indication, Dosing, and Titration.

1. Hypertension: 5 mg po daily; may titrate to *max* 40 mg po daily

Off-Label Uses.

1. Heart failure: 1.25 mg po daily, may titrate to 10 mg po daily

MOA. Nebivolol is a long-acting cardioselective β_1-adrenoceptor antagonist without intrinsic sympathomimetic activities. The mechanism of action of the antihypertensive response of nebivolol is not fully understood. Possible mechanisms include decreased heart rate, decreased myocardial contractility and vasodilation, and decreased peripheral vascular resistance.

Forest Laboratories 5 mg pictured

Drug Characteristics: Nebivolol

Dose Adjustment Hepatic	Moderate hepatic dysfunction, initial dose 2.5 mg po daily, titrate carefully Severe impairment, avoid	**Absorption**	F = 12% (extensive metabolizers), F = 96% (poor metabolizers); no effect of food on absorption
Dose Adjustment Renal	CrCl <30 mL/min, initial dose 2.5 mg po daily, titrate carefully	**Distribution**	Vd = 695-2755 L; 98% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, via CYP2D6
Pregnancy Category	C	**Elimination**	Renal elimination is 38% (extensive metabolizers) to 67% (poor metabolizers) with a half-life of 12-19 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to nebivolol; severe bradycardia, 2nd- or 3rd-degree AV block, sick sinus syndrome; decompensated heart failure, cardiogenic shock; severe hepatic impairment	**Black Box Warnings**	None

Medication Safety Issues: Nebivolol

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	No	No

Drug Interactions: Nebivolol

Typical Agents	Mechanism	Clinical Management
NSAIDs	Decreased antihypertensive effect of nebivolol	Avoid concurrent use or monitor BP
Amiodarone, dronedarone	Increased risk of bradycardia, heart block, sinus arrest	Avoid concurrent use in patients with sick sinus syndrome or AV block
Antidiabetic drugs	Decreased glycemic control	Monitor blood glucose levels
Calcium channel blockers	Increased risk of hypotension and/or bradycardia and AV block (non-dihydropyridine)	Monitor BP and HR, may need to avoid with non-dihydropyridines
Digoxin	Increased risk of AV block	Monitor HR, ECG, and serum digoxin concentrations
Alpha-blockers, fentanyl	Increased risk of hypotension	Monitor BP
CYP2D6 inhibitors	Decreased nebivolol metabolism increases risk of nebivolol toxicity	Monitor and consider dose decreases of nebivolol

Adverse Reactions: Nebivolol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Bradyarrhythmias, bronchospasm, disorder of glucose regulation, dizziness, dyspnea, headache, hypotension, nausea, diarrhea, somnolence	Heart block, withdrawal symptoms (angina, myocardial infarction, ventricular arrhythmias)

Efficacy Monitoring Parameters. Decreased BP and HR.

Toxicity Monitoring Parameters. Decreased HR, bronchospasm, blood glucose levels in diabetic patients.

Key Patient Counseling Points. Report signs/symptoms of hypotension, worsening heart failure, or bronchospastic disease. Do not drink alcohol. May cause dizziness. Avoid activities that could be dangerous if not alert. Diabetic patients should carefully monitor blood sugar levels as beta-blockers may mask symptoms of hypoglycemia. Do not discontinue drug abruptly, as this may cause rebound angina or, in some cases, myocardial infarction.

Clinical Pearls. Safety and efficacy not established in children. Patients should avoid concomitant use of calcium channel blockers, as concomitant use may significantly affect HR or heart rhythm.

NIACIN: Niaspan, Slo-Niacin, Various

Abbott Laboratories pictured

Class: Antihyperlipidemic

Dosage Forms. **Oral Capsule, Extended Release:** 250 mg, 500 mg; **Oral Tablet:** 50 mg, 100 mg, 250 mg, 500 mg; **Oral Tablet, Extended Release:** 250 mg, 500 mg, 750 mg, 1000 mg

Common FDA Label Indication, Dosing, and Titration.

1. Coronary arteriosclerosis, hypercholesterolemia: Extended release, 500 mg po daily, may titrate to 2000 mg/d po
2. Dyslipidemia: Adults, immediate release, 100-1000 mg po tid, may titrate to 3000 mg/d po; extended release, 500-2000 mg po daily hs, may titrate to 2000 mg/d po; Children, 100-250 mg/d in 3 divided doses with meals, may titrate to 10 mg/kg/d
3. Myocardial infarction, secondary prophylaxis: Extended release, 500-2000 mg po daily hs, may titrate to 2000 mg/d po

Off-Label Uses.

1. Pellagra: 50-100 mg po tid-qid, may titrate to 500 mg/d po

MOA. Not well defined. May involve partial inhibition of release of free fatty acids from adipose tissue, and increased lipoprotein lipase activity, which may increase the rate of chylomicron triglyceride removal from plasma. Niacin decreases the rate of hepatic synthesis of VLDL and LDL.

Drug Characteristics: Niacin

Dose Adjustment Hepatic	Contraindicated in patients with significant or unexplained hepatic dysfunction	**Absorption**	F = 60%, fatty meals decrease absorption
Dose Adjustment Renal	Not required, use caution	**Distribution**	Unknown
Dialyzable	Unknown	**Metabolism**	Hepatic not via CYP450
Pregnancy Category	C	**Elimination**	Renal elimination is 60-88% with a half-life of 20-45 min
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to niacin, active liver disease, PUD, arterial hemorrhage	**Black Box Warnings**	None

Medication Safety Issues: Niacin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
Slo	No	Long-acting formulations	No	Minocin	No

Drug Interactions: Niacin

Typical Agents	Mechanism	Clinical Management
Statins, colchicine	Increased risk of myopathy or rhabdomyolysis	Avoid concurrent use, or monitor for myopathy and consider dose reductions
Cholestyramine, colestipol	Decreased absorption of niacin	Separate administration by 1 h before or 4 h after

Adverse Reactions: Niacin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Flushing	Atrial fibrillation, pruritus, rash, nausea, vomiting, reduced platelet count, elevated LFTs, myalgia	Hypophosphatemia, hepatotoxicity, rhabdomyolysis

Efficacy Monitoring Parameters. Reduction in total cholesterol, LDL, and triglycerides levels; increase in HDL.

Toxicity Monitoring Parameters. Signs/symptoms of rhabdomyolysis (myalgias, dark urine, arthralgias, fatigue), yellowing of eyes or skin, severe abdominal pain, monitor LFT, CBC; serum creatine kinase if muscle pain occurs, FBG or HbA_{1c}, uric acid

Key Patient Counseling Points. Start with a low dose and titrate based on tolerability (primarily flushing). Avoid alcohol and warm beverages with niacin to reduce flushing. If discontinued for several days, may need to restart on a lower dose and retitrate. Aspirin or NSAID 30 min prior to niacin may reduce flushing. Take at bedtime with a low-fat snack to help with flushing.

Clinical Pearls. Also known as vitamin B_3. Statins are first-line therapy for hyperlipidemia. Niacin may be added for high-risk patients not able to achieve lipid goals with statin therapy.

NIFEDIPINE: Adalat CC, Procardia XL, Various

Class: Calcium Channel Blocker

Dosage Forms. **Oral Tablet, Extended Release:** 30 mg, 60 mg, 90 mg; **Oral Capsule:** 10 mg, 20 mg

Teva generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Hypertension: Adults, 30 mg po daily, may titrate to 90 mg/d po (Adalat CC) or 120 mg/d po (Procardia XL); Children, 0.25 mg/kg po daily in 1 or 2 divided doses, may titrate to 3 mg/kg/d po (*max* of 180 mg/d)
2. Stable chronic angina: 30-60 mg po daily, may titrate to 120 mg/d po
3. Variant angina: 30-60 mg po daily, may titrate to 120 mg/d po

Off-Label Uses.

1. Raynaud phenomenon: 30-60 mg po daily

MOA. Nifedipine is a calcium ion influx inhibitor that selectively inhibits the transmembrane influx of calcium ions into cardiac muscle and smooth muscle. Nifedipine does not alter serum calcium concentrations.

Drug Characteristics: Nifedipine

Dose Adjustment Hepatic	Clearance is reduced in patients with cirrhosis, use with caution	**Absorption**	Complete absorption, food delays absorption of Adalat CC
Dose Adjustment Renal	Not required	**Distribution**	Vd = 1.4-202 L/kg; 92-98% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic, CYP3A4/5 substrate
Pregnancy Category	C	**Elimination**	Renal elimination is 70-80% with a half-life of ~7 h (Adalat CC)
Lactation	Compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to nifedipine, cardiogenic shock, concurrent CYP3A4/5 inducers	**Black Box Warnings**	None

Medication Safety Issues: Nifedipine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
CC, XL	NIFEdipine	Extended-release tablets	No	niCARdipine, niMODipine, nisoldipine, Cartia XT	Avoid immediate release. Potential for hypotension; risk of precipitating myocardial ischemia

Drug Interactions: Nifedipine

Typical Agents	Mechanism	Clinical Management
NSAIDs	Decreased antihypertensive effect of nifedipine	Avoid concurrent use or monitor BP
Amiodarone	Increased amiodarone concentrations and toxicity which may result in bradycardia, AV block, or sinus arrest	Caution is advised, may avoid concurrent use
Beta-blockers	Increased hypotension, bradycardia	Avoid concurrent use or monitor BP and HR
Clopidogrel	Decreased antiplatelet activity of clopidogrel	Avoid concurrent use
CYP3A4/5 inducers	Increased nifedipine metabolism reduces nifedipine effectiveness	Avoid concurrent use or consider dose increases of nifedipine
CYP3A4/5 inhibitors	Decreased nifedipine metabolism increases risk of nifedipine toxicity	Avoid concurrent use or consider dose decreases of nifedipine
Tacrolimus	Increased risk of tacrolimus toxicity	Monitor plasma concentrations
Quinidine	Decreased efficacy of quinidine, increased risk of nifedipine toxicity	Monitor quinidine plasma concentrations, monitor BP

Adverse Reactions: Nifedipine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Flushing, headache, peripheral edema, dizziness	Constipation, fatigue, gastroesophageal ref ux, hypotension, myalgia, myocardial infarction, nausea, palpitations, pruritus, rash, sleep disturbances, gingival hyperplasia,	Aplastic anemia, thrombocytopenia, angina, tachycardia

Efficacy Monitoring Parameters. BP, reduction in chest pain, decreased number of angina attacks, reduction in use of nitroglycerin to relieve chest pain.

Toxicity Monitoring Parameters. Signs/symptoms of peripheral edema, angina, tachycardia, heart failure.

Key Patient Counseling Points. Take Adalat CC on an empty stomach. Report signs/symptoms of hypotension, exacerbation of angina, peripheral edema, fatigue, or hypotension. Do not drink alcohol. Avoid sudden discontinuation of drug as this may cause rebound hypertension. May cause dizziness; avoid driving or using hazardous machinery until effects are known. Avoid grapefruit juice.

Clinical Pearls. With Adalat CC, two 30-mg tablets may be interchanged for one 60-mg tablet, but using three 30-mg tablets results in 29% higher peak plasma concentrations than a single 90-mg tablet; not considered interchangeable.

NITAZOXANIDE: Alinia

Class: Antiprotozoal

Dosage Forms. Oral Tablet: 500 mg; **Oral Suspension:** 100 mg/5 mL

Common FDA Label Indication, Dosing, and Titration.

1. Diarrhea caused by *C. parvum* or *G. lamblia*: Adults and Children ≥12 y of age, 500 mg po q12h × 3 d; Children 1-3 y of age, 100 mg po q12h × 3 d; Children 4-11 y of age, 200 mg po q12h × 3 d

Off-Label Uses.

1. *C. difficile*–associated diarrhea: 500 mg po q12h × 10 d

MOA. Interference with the pyruvate ferredoxin oxidoreductase (PFOR) enzyme-dependent electron transfer reaction, which is essential to anaerobic metabolism of protozoans.

Romark 500 mg pictured

Drug Characteristics: Nitazoxanide

Dose Adjustment Hepatic	Use with caution	**Absorption**	F <5%, food enhances absorption by 50%
Dose Adjustment Renal	Use with caution	**Distribution**	98-99% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Metabolized to 1 active metabolite by plasma esterases
Pregnancy Category	B	**Elimination**	33% renal, 67% fecal
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to nitazoxanide	**Black Box Warnings**	None

Medication Safety Issues: Nitazoxanide

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	No	No

Drug Interactions: Nitazoxanide. None known

Adverse Reactions: Nitazoxanide

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Nausea, vomiting, diarrhea, headache, abdominal pain	Elevated LFTs

Efficacy Monitoring Parameters. Resolution of signs and symptoms of infection, improvement in diarrhea.

Toxicity Monitoring Parameters. Consider LFTs and CBC prior to therapy.

Key Patient Counseling Points. Complete full course of therapy; take with food. Store suspension at room temperature (expiration = 1 wk).

Clinical Pearls. Suspension bioavailability is 70% of tablet, not interchangeable. Preferred agent for treating *Cryptosporidium* diarrhea in immunocompetent adults; has not been proven to be superior to placebo in HIV-infected individuals. Equivalent efficacy to metronidazole for *C. difficile* and *Giardia*, however, based on cost metronidazole remains the treatment of choice.

NITROFURANTOIN: Macrodantin, Macrobid, Various

Class: Nitrofuran Antibiotic

Dosage Forms. Oral Capsule: 25 mg, 50 mg, 100 mg;

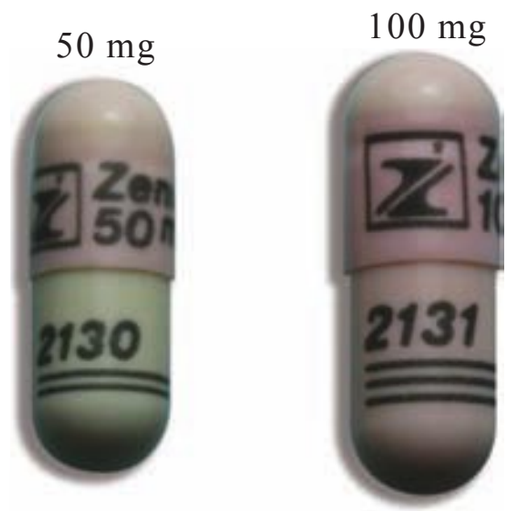
Oral Suspension: 25 mg/ 5mL; **Oral Capsule, Extended Release:** 100 mg

Common FDA Label Indication, Dosing, and Titration.

1. Urinary tract infection treatment: Adults and Children >12 y of age, Macrobid 100 mg po bid × 7 d; Furadantin, Macrodantin, 50-100 mg po q6h × 7 d; Children ≥1 mo of age, 5-7 mg/kg/d in divided doses q6h po × 7 d (*max* 400 mg/d)
2. Urinary tract infection prophylaxis: Adults, Furadantin, Macrodantin, 50-100 mg po daily hs; Children ≥1 mo of age, 1 mg/kg/d po in divided doses every 12-24 h (*max* dose 100 mg/d)

Off-Label Uses. None

MOA. Nitrofurantoin is a synthetic nitrofuran that inactivates bacterial ribosomes and is bactericidal in urine at therapeutic doses. It is active against most bacteria that cause UTIs except nearly all strains of *Pseudomonas* are resistant.



Teva generic pictured

Drug Characteristics: Nitrofurantoin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 94%, food increases absorption
Dose Adjustment Renal	Contraindicated if CrCl <60 mL/min	**Distribution**	90% protein bound
Dialyzable	Yes, hemodialysis only	**Metabolism**	Metabolism in all tissues to inactive metabolite
Pregnancy Category	B, contraindicated in pregnancy at term	**Elimination**	Renal elimination is 40% with a half-life of 1 h
Lactation	Usually compatible	**Pharmacogenetics**	Those with G6PD deficiency are more likely to develop hemolytic anemia
Contraindications	Hypersensitivity to nitrofurantoin, use in neonates or during delivery (risk of hemolytic anemia), anuria or oliguria	**Black Box Warnings**	None

Medication Safety Issues: Nitrofurantoin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Do not open capsules	No	Nitro-Bid, nitroglycerine, microK, Neurontin, nitroglycerin	Avoid for long-term suppression; avoid in patients with CrCl <60 mL/min

Drug Interactions: Nitrofurantoin

Typical Agents	Mechanism	Clinical Management
Fluconazole	Increased risk of hepatic and pulmonary toxicity, unknown mechanism	Avoid concurrent use, or increase monitoring of toxicity
Norfloxacin	Antagonism of the antibacterial effect of norfloxacin	Avoid concurrent use

Adverse Reactions: Nitrofurantoin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Nausea, headache, discoloration of urine	Diarrhea	Severe hypersensitivity, hepatic failure, hemolytic anemia, interstitial lung disease

Efficacy Monitoring Parameters. Resolution of clinical signs of infection within 2-3 d.

Toxicity Monitoring Parameters. Severe diarrhea, yellowing of skin or eye, unusual bruising or bleeding, blistering skin rash, or shortness of breath.

Key Patient Counseling Points. May make urine brown; this is not harmful and is a breakdown product of the drug. Complete full course of therapy. For the suspension, shake well and store at room temperature, use within 30 d. Avoid mixing suspension with food or beverages, but food can be taken afterward. Symptoms should improve within 2-3 d; if they worsen, seek follow-up care.

Clinical Pearls. Nitrofurantoin does not reach effective levels in tissue and is only indicated for UTIs (not pyelonephritis). May resume normal activities after 24 h of antibiotics if afebrile. The drug is used primarily to prevent recurrent UTIs but is also effective in the treatment of uncomplicated UTIs.

NITROGLYCERIN: Minitran, Nitro-Dur, Nitrostat, Various

Class: Nitrate, Antianginal

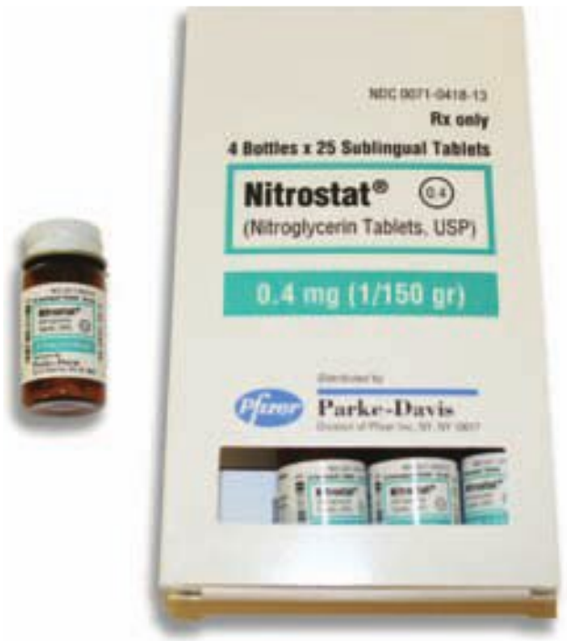
Dosage Forms. **Oral Capsule, Extended Release:** 2.5 mg, 6.5 mg, 9 mg; **Sublingual Tablet:** 0.3 mg, 0.4 mg, 0.6 mg; **Patch:** 0.1 mg/h, 0.2 mg/h, 0.3 mg/h, 0.4 mg/h, 0.6 mg/h, 0.8 mg/h; **Sublingual Spray:** 0.4 mg/actuation; **Ointment:** 2%

Common FDA Label Indication, Dosing, and Titration.

1. Angina, prophylaxis: Extended release, 2.5-6.5 mg po tid-qid; Sublingual, 1 tab or 1-2 sprays 5-10 min before activity, which may induce angina; Transdermal, 0.2-0.4 mg/h worn topically 12-14 h per day, may titrate to 0.8 mg/h worn topically
2. Angina, acute: Sublingual, 1 tab or 1-2 sprays at first sign of angina, repeat every 5 min if needed for total of 3 tabs or doses in 15 min

Off-Label Uses. None

MOA. Nitroglycerin is believed to be converted to nitric oxide (NO) by vascular endothelium. NO activates guanylate cyclase, increasing cyclic GMP that in turn decreases intracellular calcium, resulting in direct relaxation of vascular smooth muscle. In myocardial ischemia, nitrates dilate large epicardial vessels, enhance collateral size and flow, and reduce coronary vasoconstriction.



Pfizer 0.4 mg pictured

Drug Characteristics: Nitroglycerin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 38-75%, food has no effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 3 L/kg; 60% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic not via CYP
Pregnancy Category	C	**Elimination**	Renal elimination is 22% with a half-life of 2-3 min
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to nitrates, concurrent use with erectile dysfunction meds, symptomatic hypotension, severe anemia or increased intracranial pressure	**Black Box Warnings**	None

Medication Safety Issues: Nitroglycerin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
BID, DUR, TIME	No	Extended-release capsules	No	Macrobid, NicoDerm, nitrofurantoin, nitroprusside, Nizoral, Nilstat, nystatin	No

Drug Interactions: Nitroglycerin

Typical Agents	Mechanism	Clinical Management
Phosphodiesterase inhibitors	Excessive hypotension	Concurrent use contraindicated

Adverse Reactions: Nitroglycerin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Headache	Bradycardia, drug tolerance, flushing, hypotension, light-headedness, nausea, orthostatic hypotension, tachycardia, vomiting	Increased intracranial pressure, severe hypotension, syncope, methemoglobinemia

Efficacy Monitoring Parameters. Decreased use of sublingual nitroglycerin to treat anginal episodes, reduction in angina episodes, reduction in anginal pain.

Toxicity Monitoring Parameters. Signs/symptoms of hypotension, problematic headaches, or decreasing efficacy (drug tolerance). BP and HR.

Key Patient Counseling Points. Sit prior to using sublingual tablets, lingual aerosol, or spray. Tablet should be dissolved under tongue or in buccal pouch at 1st sign of angina; do not swallow. Spray should be sprayed onto or under tongue; do not inhale; do not spit out or rinse mouth after use. Rise slowly from a sitting position in order to prevent light-headedness. Allow a 10- to 12-h/d drug-free interval to avoid development of nitrate tolerance for both patches and extended-release capsules. Avoid concurrent use of alcohol, CNS depressants, antihypertensives, or other drugs that cause hypotension. Do not use with phosphodiesterase inhibitors, which may result in hypotension. The ointment may stain clothing.

Clinical Pearls. Safety and efficacy not established in children. Patch contains aluminum; remove before MRI.

NORTRIPTYLINE: Pamelor, Various

Class: Tricyclic Antidepressant

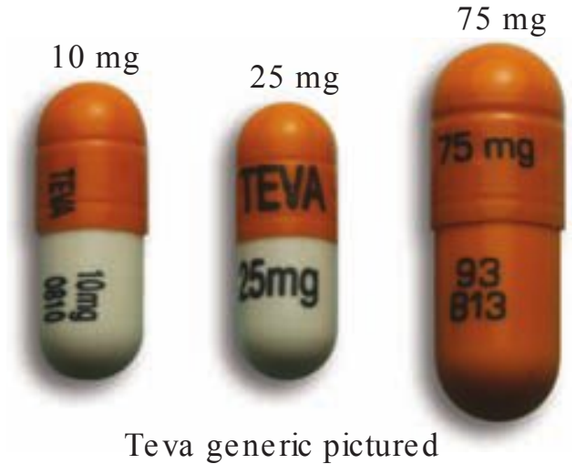
Dosage Forms. Oral Tablet: 10 mg, 25 mg, 50 mg, 75 mg; **Oral Solution:** 10 mg/5 mL

Common FDA Label Indication, Dosing, and Titration.

1. Depression: Adults, 25 mg po tid-qid, may titrate to 150 mg/d po; Adolescents, 30-50 mg/d po in single or divided doses

Off-Label Uses. None

MOA. Nortriptyline is the demethylated metabolite of amitriptyline, a heterocyclic antidepressant that blocks presynaptic reuptake of norepinephrine with subsequent downregulation of adrenergic receptors. Heterocyclic antidepressants have less effect on serotonergic activity than on other neurotransmitters.



Teva generic pictured

Drug Characteristics: Nortriptyline

Dose Adjustment Hepatic	Not required	**Absorption**	F = 60%, food has no effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 15-27 L/kg; 86-95% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP2D6 substrate
Pregnancy Category	C	**Elimination**	Renal elimination is 2% with a half-life of 15-39 h
Lactation	Compatible	**Pharmacogenetics**	Caution with CYP2D6 poor metabolizers; at risk for drug interactions and greater toxicity
Contraindications	Hypersensitivity to nortriptyline or other TCAs; concurrent MAOI; use during acute recovery period after MI, patient using linezolid or IV methylene blue	**Black Box Warnings**	Suicidality

Medication Safety Issues: Nortriptyline

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Amitriptyline, Demerol, Bentyl, desipramine, Norpramin, Tambocor	No

Drug Interactions: Nortriptyline

Typical Agents	Mechanism	Clinical Management
Amphetamines	Increased risk of hypertension, cardiac effects, and CNS stimulation	Use caution with concomitant therapy
Linezolid, MAOIs, methylene blue, SSRIs	Increased risk of serotonin syndrome	Concomitant use with MAOIs contraindicated, others with caution
Antiarrhythmics, and drugs that cause QT prolongation	Increased risk of cardiotoxicity (QT prolongation, torsades de pointes, cardiac arrest)	Avoid concurrent use
CYP2D6 inhibitors	Decreased metabolism of nortriptyline increases risk of nortriptyline toxicity	Avoid concurrent use

Adverse Reactions: Nortriptyline

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation	Blurred vision, confusion, constipation, dizziness, headache, sexual dysfunction, somnolence, urinary retention, weight gain, xerostomia	Cardiac dysrhythmia, heart block, hepatotoxicity, seizures, suicidal thoughts

Efficacy Monitoring Parameters. Improvement in symptoms of depression (suicidal thoughts or intent, change in appetite, lack of energy, change in sleep patterns, etc).

Toxicity Monitoring Parameters. Worsening of depression, suicidality, or unusual changes in behavior; monitor ECG and LFTs, BP, weight. Signs and symptoms of serotonin syndrome.

Key Patient Counseling Points. Avoid activities requiring mental alertness or coordination until drug effects are realized, as drug may cause somnolence and dizziness. Report worsening depression, suicidal ideation, unusual changes in behavior, or unusual bleeding. Avoid abrupt discontinuation, may precipitate withdrawal symptoms. Do not drink alcohol while taking this drug.

Clinical Pearls. Symptomatic improvement may not be seen for several weeks. Medication guide required at dispensing.

NYSTATIN SYSTEMIC: Bio-Statin, Various

Class: Polyene Antifungal

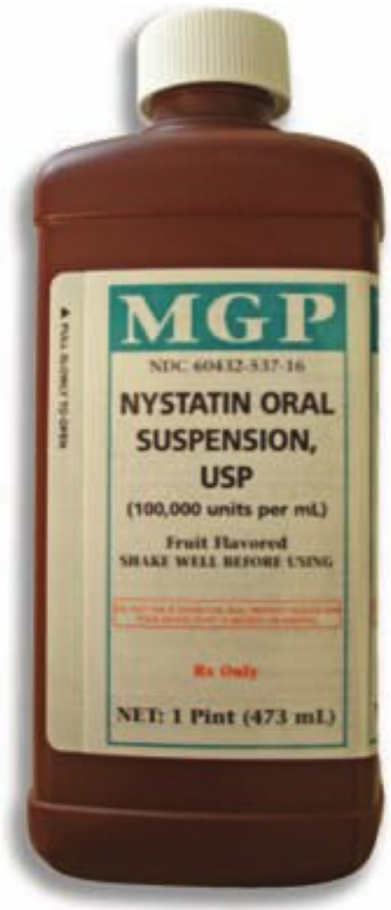
Dosage Forms. Oral Suspension: 100,000 units/mL; **Oral Tablet:** 500,000 units; **Oral Capsule:** 500,000 units, 1,000,000 units

Common FDA Label Indication, Dosing, and Titration.

1. GI candidiasis, nonesophageal: 500,000-1,000,000 units po tid
2. Oropharyngeal candidiasis: 400,000-600,000 units po qid (retained in mouth as long as possible prior to swallowing)

Off-Label Uses. None

MOA. Nystatin binds to the sterols in fungal cell walls, damaging the fungal cell wall membrane and altering its permeability.



MGP generic pictured

Drug Characteristics: Nystatin Systemic

Dose Adjustment Hepatic	Not required	**Absorption**	Minimal absorption
Dose Adjustment Renal	Not required	**Distribution**	Minimal absorption
Dialyzable	Unknown	**Metabolism**	Minimal absorption
Pregnancy Category	C	**Elimination**	Unknown
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to nystatin	**Black Box Warnings**	None

Medication Safety Issues: Nystatin Systemic

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	HMG-CoA agents (“statins”)	No

Drug Interactions: Nystatin Systemic. None known

Adverse Reactions: Nystatin Systemic

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	GI distress, nausea, vomiting constipation	Rash

Efficacy Monitoring Parameters. Resolution of clinical symptoms.
Toxicity Monitoring Parameters. Seek medical attention if severe mucosal irritation or rash occurs.
Key Patient Counseling Points. Store the oral liquid or tablets at room temperature. Shake suspension well before using.
Clinical Pearls. As effective as clotrimazole in treating topical *Candida* infections. Nystatin is not absorbed and will not treat systemic infections.

NYSTATIN TOPICAL: Mycostatin, Nyamyc, Nystop, Various

Fougera generic ointment pictured

Class: Polyene Antifungal

Dosage Forms. **Topical Cream:** 100,000 units/g; **Topical Ointment:** 100,000 units/g; **Topical Powder:** 100,000 units/g

Common FDA Label Indication, Dosing, and Titration.

1. Candidiasis of skin (cutaneous and mucocutaneous infections): Apply liberally to affected areas topically bid until healing complete

Off-Label Uses. None

MOA. Nystatin binds to the sterols in fungal cell walls, damaging the fungal cell wall membrane and altering its permeability.

Drug Characteristics: Nystatin Topical

Dose Adjustment Hepatic	Not required	**Absorption**	Not absorbed
Dose Adjustment Renal	Not required	**Distribution**	Not absorbed
Dialyzable	Unknown	**Metabolism**	Not absorbed
Pregnancy Category	C	**Elimination**	Unknown
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to nystatin	**Black Box Warnings**	None

Medication Safety Issues: Nystatin Topical

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
AF	No	No	No	HMG-CoA agents ("statins"), Nitrostat	No

Drug Interactions: **Nystatin Topical**. None known

Adverse Reactions: Nystatin Topical

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Dry skin, skin irritation	Rash, hypersensitivity reaction, Stevens-Johnson syndrome

Efficacy Monitoring Parameters. Resolution of clinical symptoms.

Toxicity Monitoring Parameters. Severe skin irritation or rash.

Key Patient Counseling Points. Apply to affected area of skin. Skin should be intact. Do not get it in eyes, nose, or mouth. Avoid occlusive dressings, tight-fitting diapers, and plastic pants if using on diaper area of children.

Clinical Pearls. As effective as clotrimazole in treating topical *Candida* infections. Vaginal tablet for vaginal *Candida* infections is still available but infrequently used. Miconazole and terconazole are both more effective than nystatin and are available OTC for vaginal candidiasis.

OLANZAPINE: Zyprexa, Various

Class: Thienobenzodiazepine, Antipsychotic

Dosage Forms. **Oral Tablet:** 2.5 mg, 5 mg, 7.5 mg, 10 mg, 15 mg, 20 mg; **Oral Disintegrating Tablet:** 5 mg, 10 mg, 15 mg, 20 mg

Lilly pictured

Common FDA Label Indication, Dosing, and Titration.

1. Bipolar disorder, acute mixed or manic episodes: Adults, 10-15 mg/d po, may titrate in 5 mg/d increments; Children 13-17 y of age, 2.5-5 mg/d po, may titrate in 2.5-5 mg/d increments
2. Schizophrenia: Adults, 5-10 mg/d po, may titrate in 5 mg/d increments at 1-wk intervals to 10-20 mg/d po; Children 13-17 y of age, 2.5-5 mg/d po, may titrate in 2.5-5 mg increments
3. Depression, treatment resistant, in combination with fluoxetine: Adults, 2.5-20 mg po daily

Off-Label Uses. None

MOA. Olanzapine is an atypical antipsychotic agent that is a potent serotonin-5-HT_2 and dopamine-D_2 antagonist. Antipsychotic effect is most likely related to blockade of postsynaptic dopaminergic receptors in the mesolimbic and prefrontal cortexes of the brain, although other neurotransmitter systems also are involved.

Drug Characteristics: Olanzapine

Dose Adjustment Hepatic	Not required, except when used with fluoxetine (limit initial olanzapine dose to 2.5-5 mg daily)	**Absorption**	Well absorbed, food has no effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 1000 L; 93% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic via glucuronidation, CYP1A2 substrate
Pregnancy Category	C	**Elimination**	Renal elimination is 57% with a half-life of 21-54 h
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to olanzapine	**Black Box Warnings**	Mortality in elderly patients with dementia-related psychosis; coma and excessive sedation with injectable formulation

Medication Safety Issues: Olanzapine

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	ZyPREXA, OLANZapine	Disintegrating tablet	No	CeleXA, ZyrTEC, olsalazine, QUEtiapine, Reprexain, Zestril, Zelapar, zolpidem	Avoid use for behavioral problems of dementia unless nonpharmacologic options have failed and patient is threat to self or others

Drug Interactions: Olanzapine

Typical Agents	Mechanism	Clinical Management
Tramadol	Additive serotonergic effects	Avoid concurrent use or monitor for adverse effects
Haloperidol	Increased risk of parkinsonism	Monitor for signs of parkinsonism; adjust haloperidol dose
Metoclopramide	Increased risk of extrapyramidal symptoms	Concurrent use contraindicated
CYP1A2 inducers	Increased olanzapine metabolism reduces olanzapine effectiveness	Consider dose increases of olanzapine
CYP1A2 inhibitors	Decreased olanzapine metabolism increases risk of olanzapine toxicity	Consider dose decreases of olanzapine
QTc-prolonging agents	May increase the QTc interval	Avoid combining olanzapine with other agents that prolong the QTc interval

Adverse Reactions: Olanzapine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Akathisia, asthenia, dizziness, hypercholesterolemia, hyperglycemia, increased appetite, increased prolactin levels, increased triglycerides, somnolence, tremor, weight gain, xerostomia	Constipation, orthostatic hypotension, peripheral edema, personality disorder	Neuroleptic malignant syndrome, pancreatitis, sudden cardiac death, suicidal thoughts, tardive dyskinesia

Efficacy Monitoring Parameters. Improvement in schizophrenia, bipolar disorder, agitation, or treatment-resistant depression.

Toxicity Monitoring Parameters. FBG/HbA_{1c} prior to treatment and periodically in patients with DM. CBC, lipid profiles at baseline and periodically thereafter. Check body weight and BMI regularly during treatment. LFTs and electrolytes. Symptoms of neuroleptic malignant syndrome and involuntary movements/parkinsonian signs.

Key Patient Counseling Points. Avoid activities requiring mental alertness or coordination until drug effects are realized. Drug may impair heat regulation. Rise from a sitting/lying-down position slowly. Report symptoms of tardive dyskinesia or neuroleptic malignant syndrome. Diabetic patients should monitor for hyperglycemia and report difficulties with glycemic control. Avoid alcohol while taking this drug.

Clinical Pearls. *Max* dose is 20 mg/d. Elderly patients with dementia-related psychosis treated with antipsychotic drugs are at an increased risk of death compared to placebo. Although the causes of death in clinical trials were varied, most of the deaths were cardiovascular or infectious in nature. Also available as an extended-release IM injection, which is used after establishing tolerance with oral olanzapine.

OLMESARTAN: Benicar

Daichi-Sankyo 40 mg pictured

Class: Angiotensin II Receptor Antagonist

Dosage Forms. **Oral Tablet:** 5 mg, 20 mg, 40 mg

Common FDA Label Indication, Dosing, and Titration.

1. Hypertension: Adults, 20 mg po daily, may titrate to 40 mg po daily; Children 6-16 y of age weighing 20-34 kg, 10 mg po daily, may titrate to 20 mg po daily; Children 6-16 y of age weighing >35 kg, 20 mg po daily, may titrate to 40 mg po daily

Off-Label Uses. None

MOA. Olmesartan is a selective, reversible, competitive antagonist of the angiotensin II receptor (AT1).

Drug Characteristics: Olmesartan

Dose Adjustment Hepatic	Not required	**Absorption**	F = 26%, food has no effect on absorption
Dose Adjustment Renal	Not required, use with caution with CrCl <20 mL/min	**Distribution**	Vd = 17 L; 99% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Intestinal wall; not via CYP
Pregnancy Category	D	**Elimination**	Renal elimination is 35-50% with a half-life of 3 h
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to olmesartan or other ARB, pregnancy, concurrent use with aliskiren in patients with DM	**Black Box Warnings**	Pregnancy

Medication Safety Issues: Olmesartan

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Mevacor	No

Drug Interactions: Olmesartan

Typical Agents	Mechanism	Clinical Management
Potassium-sparing diuretics	Increased risk of hypotension, hyperkalemia	Avoid concurrent use or monitor BP and serum potassium levels
ACE-Is	Increased risk of hypotension, hyperkalemia, nephrotoxicity	Avoid concurrent use or monitor BP, SCr, and potassium levels
Eplerenone	Increased risk of hyperkalemia	Avoid concurrent use or monitor serum potassium levels
Potassium supplements	Increased risk of hyperkalemia and cardiac arrhythmias	Avoid concurrent use or monitor serum potassium levels
NSAIDs	Decreased antihypertensive and natriuretic effect of olmesartan, increased risk of nephrotoxicity	Avoid concurrent use or monitor BP and SCr level
Diuretics	Increased risk of postural hypotension due to hypovolemia	Monitor BP
Aliskiren	Increased risk of hyperkalemia, hypotension, nephrotoxicity	Avoid use in with GFR <60 mL/min; monitor K, SCr, and BP

Adverse Reactions: Olmesartan

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Back pain, dizziness, headache, hyperkalemia, hypotension	Angioedema, birth defects, hepatotoxicity, rhabdomyolysis, acute renal failure

Efficacy Monitoring Parameters. Decreased BP.

Toxicity Monitoring Parameters. Report signs/symptoms of hypotension. Baseline and periodic potassium, SCr, prior to initiating therapy and periodically thereafter.

Key Patient Counseling Points. Avoid pregnancy. Use potassium supplements or salt substitutes only under medical supervision. May cause dizziness that may worsen if dehydrated. Seek care if angioedema, excessive fluid loss, hyperkalemia, reduction in urination, or jaundice occurs. May cause orthostatic hypotension.

Clinical Pearls. ARBs can cause injury or death to the developing fetus; therapy should be stopped as soon as possible if pregnancy is detected.

OLOPATADINE: Patanol, Pataday

Class: Ophthalmic Antihistamine

Dosage Forms. Ophthalmic Solution: 0.1%, 0.2%

Common FDA Label Indication, Dosing, and Titration.

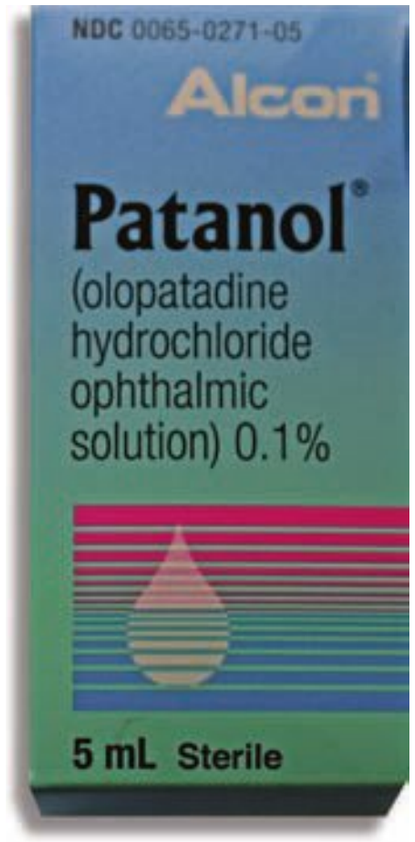
1. Allergic conjunctivitis: 1 drop of 0.1% solution in affected eye bid or 1 drop of 0.2% solution in affected eyes daily

Off-Label Uses. None

MOA. Olopatadine hydrochloride is a relatively selective histamine H_1-antagonist that exerts its effect by inhibiting the release of histamine from mast cells. It also blocks the type 1 immediate hypersensitivity reactions, including prevention of histamine-mediated effects on human conjunctival epithelial cells. It has no activity on dopamine, α-adrenergic, and muscarinic type 1 and type 2 receptors.

Drug Characteristics: Olopatadine

Dose Adjustment Hepatic	Not required	**Absorption**	Not measurable after ocular instillation
Dose Adjustment Renal	Not required	**Distribution**	Not measurable after ocular instillation
Dialyzable	Not dialyzable	**Metabolism**	Not absorbed
Pregnancy Category	C	**Elimination**	Not absorbed
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to olopatadine	**Black Box Warnings**	None



Alcon 0.1% solution pictured

Medication Safety Issues: Olopatadine

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Platinol	No

Drug Interactions: Olopatadine. None known

Adverse Reactions: Olopatadine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Taste sense altered, unpleasant taste in mouth, burning sensation in eye, keratitis, xerophthalmia, pharyngitis, cold syndrome, headache, nausea	Hypersensitivity reaction

Efficacy Monitoring Parameters. Reduction in ocular redness, itching, and irritation.

Toxicity Monitoring Parameters. Signs of hypersensitivity.

Key Patient Counseling Points. Wash hands. For administration, lie down or tilt head back. With index finger, pull down the lower lid of eye to form a pocket. Hold the dropper close to eye with the other hand. Drop the correct number of drops into the pocket made between lower lid and eyeball. Gently close eyes. Place index finger over the inner corner of your eye for 1 min. Do not rinse or wipe the dropper or allow it to touch anything, including eye. Put the cap on the bottle right away. Twice-daily dosing should be at least 6-8 h apart. Remove contact lens prior to administration and wait at least 10 min before reinserting. Do not use contact lenses if eyes are red.

Clinical Pearls. Not for use to treat contact lens-related irritation. Efficacy and safety established for patients ≥3 y of age. Also available in nasal formulation for seasonal allergic rhinitis.

OMEGA-3-ACID ETHYL ESTERS: Lovaza, Various

Class: Antihyperlipidemic, Omega-3 Fatty Acids

Dosage Forms. **Oral Capsule, Liquid Filled:** 1 g

Common FDA Label Indication, Dosing, and Titration.

1. Hypertriglyceridemia, adjunct to diet in adults with triglyceride levels 500 mg/dL or higher: 4 g po daily or divided into 2 doses

Off-Label Uses.

1. Coronary arteriosclerosis, hypertriglyceridemia: 4 g po daily or divided into 2 doses
2. Familial combined hyperlipidemia: 4 g po daily or divided into 2 doses
3. Heart failure: 4 g po daily or divided into 2 doses
4. Hyperlipidemia, hypertriglyceridemia, triglyceride levels <500 mg/dL: 4 g po daily or divided into 2 doses

GlaxoSmithKline 1 g pictured

MOA. Potential mechanisms of action include inhibition of acyl-CoA:1,2-diacylglycerol acyltransferase, increased mitochondrial and peroxisomal β-oxidation in the liver, decreased lipogenesis in the liver, and increased plasma lipoprotein lipase activity. Lovaza may reduce the synthesis of triglycerides in the liver because eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are poor substrates for the enzymes responsible for TG synthesis, and EPA and DHA inhibit esterification of other fatty acids.

Drug Characteristics: Omega-3-Acid Ethyl Esters

Dose Adjustment Hepatic	Not required	**Absorption**	Unknown
Dose Adjustment Renal	Not required	**Distribution**	Unknown
Dialyzable	Unknown	**Metabolism**	Oxidized in the liver similar to fatty acids derived from dietary sources; EPA: minor via CYP450
Pregnancy Category	C	**Elimination**	Half-life: EPA: ~37-89 h, DHA: ~46 h
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to omega-3–acid ethyl esters, f sh, or shellf sh	**Black Box Warnings**	None

Medication Safety Issues: Omega-3-Acid Ethyl Esters

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Liquid capsules	No	LORazepam	No

Drug Interactions: Omega-3-Acid Ethyl Esters. None known

Adverse Reactions: Omega-3–Acid Ethyl Esters

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Indigestion, taste alterations, rash, burping, diarrhea, arthralgia	Anaphylaxis, elevated LFTs

Efficacy Monitoring Parameters. Reduction in triglyceride levels.

Toxicity Monitoring Parameters. LDL, LFTs.

Key Patient Counseling Points. Swallow the whole capsule; take with food. Seek medical attention if severe rash, chest pain, heart palpitations, or shortness of breath.

Clinical Pearls. Omega-3–acid ethyl esters are available OTC as fish oil and contain lower amounts of DHA and EPA than the prescription version. OTC products have varying amounts of DHA and EPA. Each Lovaza capsule contains ~375 mg of DHA and 465 mg of EPA. Treatment of hypertriglyceridemia with omega-3–acid ethyl esters has shown to be equivalent to gemfibrozil in efficacy. Omega-3–acid ethyl esters have not been shown to decrease cardiovascular mortality.

OMEPRAZOLE: Prilosec, Various

Class: Proton Pump Inhibitor

Dosage Forms. Oral Capsule, Delayed Release: 10 mg, 20 mg, 40 mg; **Oral Tablet, Delayed Release:** 20 mg; **Oral Suspension:** 2 mg/mL; **Oral Packet:** 2.5 mg, 10 mg

Kremers Urban generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Duodenal ulcer disease: 20 mg po daily × up to 4 wk
2. Gastric ulcer disease: 40 mg po daily × up to 8 wk
3. *H. pylori* GI infection: 20 mg po bid × 10-14 d in combination with amoxicillin 1000 mg and clarithromycin 500 mg po bid
4. Erosive esophagitis, GERD: Adults and Children ≥1 y of age and ≥20 kg, 20 mg po daily; Children ≥1 y of age, 5-10 kg, 5 mg po daily; Children ≥1 y of age, 10-20 kg, 10 mg po daily

Off-Label Uses.

1. Drug-induced GI disturbance, indigestion: 20-40 mg po daily

MOA. Omeprazole is a PPI that, when protonated in the secretory canaliculi of the parietal cells, covalently binds to H^+/K^+-ATPase (proton pump), which is the final pathway for acid secretion. Produces a profound and prolonged antisecretory effect and inhibits basal, nocturnal, and pentagastrin- and food-stimulated gastric acid secretion.

Drug Characteristics: Omeprazole

Dose Adjustment Hepatic	Consider dose adjustment in hepatic failure	**Absorption**	F = 30-40%, food delays but does not reduce absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 0.34-0.37 L/kg; 95% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP2C19 substrate
Pregnancy Category	C	**Elimination**	Renal elimination is 77% with a half-life of 30-60 min
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	CYP2C19 poor metabolizers have greater gastric acid suppression
Contraindications	Hypersensitivity to omeprazole or esomeprazole	**Black Box Warnings**	None

Medication Safety Issues: Omeprazole

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
OTC	PriLOSEC	ER capsules and tablets	No	Plendil, Prevacid, PROzac	No

Drug Interactions: Omeprazole

Typical Agents	Mechanism	Clinical Management
Clopidogrel	Competitive inhibition of clopidogrel metabolism to active form, reducing clopidogrel effectiveness	Avoid concurrent use
CYP2C19 inhibitors	Decreased omeprazole metabolism increases risk of omeprazole toxicity	Consider dose decreases of omeprazole
CYP2C19 inducers	Increased omeprazole metabolism reduces omeprazole effectiveness	Consider dose increases of omeprazole
pH-dependent drugs	Lower gastric pH reduces absorption	Avoid concurrent use
Warfarin	Increased anticoagulant effect	Monitor INR and adjust warfarin dose accordingly

Adverse Reactions: Omeprazole

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Abdominal pain, diarrhea, headache	Toxic epidermal necrolysis, *C. diff cle* diarrhea, pancreatitis, hepatotoxicity, hip fracture, rhabdomyolysis, acute interstitial nephritis

Efficacy Monitoring Parameters. Resolution of GI discomfort, resolution of ulcers shown on endoscopy; for treatment of *H. pylori*, negative urea breath test.

Toxicity Monitoring Parameters. Severe headache or blistering skin rash. Seek medical attention for signs of liver failure, elevated LFTs.

Key Patient Counseling Points. Should be taken 1 h before meals.

Clinical Pearls. Multiple *H. pylori* regimens exist that include different combinations of PPIs and antibiotics; patients should complete full regimen if prescribed for *H. pylori* management. Many PPI and H_2 antagonists available OTC; warn patients not to take multiple products concurrently to avoid additive risk of adverse effects. Increased risk of fractures, especially in elderly. Use lowest effective dose for those at risk for osteoporosis. Medication guide required at dispensing.

ONDANSETRON: Zofran, Various

Class: Antiemetic

Dosage Forms. **Oral Tablet:** 4 mg, 8 mg, 24 mg; **Oral Dispersible Tablet:** 4 mg, 8 mg; **Oral Solution:** 4 mg/5 mL; **Oral Film:** 4 mg, 8 mg

Sandoz generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Chemotherapy-induced nausea and vomiting, highly emetogenic chemotherapy: 24 mg po 30 min prior to the start of chemotherapy
2. Chemotherapy-induced nausea and vomiting, moderately emetogenic chemotherapy: Adults and Children >12 y of age, 8 mg po 30 min prior to chemotherapy and repeated in 8 h, then 8 mg po q12h for 1-2 d post chemotherapy; Children 4-11 y of age, 4 mg po 30 min prior to chemotherapy, repeated 4 and 8 h after the 1st dose, then q8h for 1-2 d postchemotherapy
3. Prevention of postoperative nausea and vomiting: 16 mg po 1 h before anesthesia induction
4. Radiation-induced nausea and vomiting: 8 mg po 1-2 h prior to radiotherapy and q8h after 1st dose of radiation on each day of radiotherapy

Off-Label Uses.

1. Severe hyperemesis associated with pregnancy: 8 mg po q12h

MOA. Ondansetron is a selective 5-HT_3 receptor antagonist. Serotonin receptors of the 5-HT_3 type are present both peripherally and centrally in the chemoreceptor trigger zone. Cytotoxic chemotherapy releases serotonin from the enterochromaffin cells of the small intestine, initiating the vomiting reflex.

Drug Characteristics: Ondansetron

Dose Adjustment Hepatic	Severe hepatic dysfunction, *max* daily dose 8 mg	**Absorption**	F = 56%, food has minimal effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 2.5 L/kg
Dialyzable	Unknown	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	B	**Elimination**	Renal 5%, with a half-life of 4.6 h
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to ondansetron, concurrent apomorphine or drugs that increase QT interval	**Black Box Warnings**	None

Medication Safety Issues: Ondansetron

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
ODT	No	Film and disintegrating tablet	No	Zantac, Zosyn	No

Drug Interactions: Ondansetron

Typical Agents	Mechanism	Clinical Management
Apomorphine	Additive hypotension	Contraindicated
Agents that increase QT interval	Increased risk of QT prolongation (torsades de pointes, cardiac arrest)	Contraindicated
Cyclophosphamide	Ondansetron decreases the systemic exposure of cyclophosphamide	Avoid concurrent use

Adverse Reactions: Ondansetron

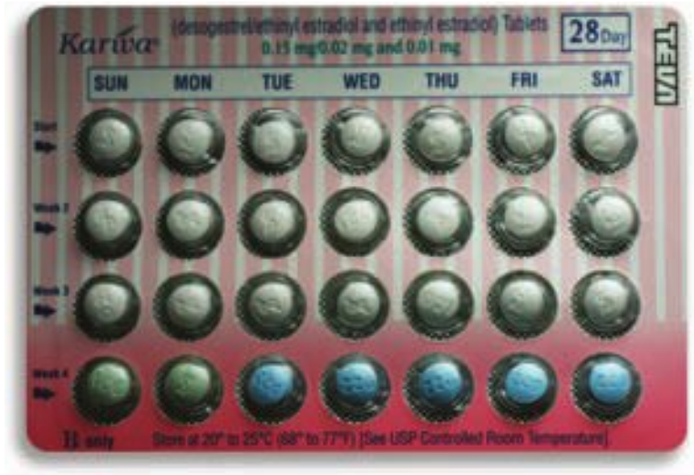
Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation, diarrhea, headache	Xerostomia, increased LFTs, dizziness, fever	Arrhythmias, anaphylaxis, serotonin syndrome

Efficacy Monitoring Parameters. Reduction in nausea and vomiting.

Toxicity Monitoring Parameters. Heart palpitations, shortness of breath, severe rash.

Key Patient Counseling Points. Dry hands before handling disintegrating tablet. Do not open the blister pack that contains the tablet until you are ready to take it. Do not push the oral disintegrating tablet through the foil. Place tablet in mouth, allow to melt, swallow, or drink water.

Clinical Pearls. Tablets, disintegrating tablets, and solution are bioequivalent and are dosed interchangeably. 5-HT_3 receptor antagonists are often combined with dexamethasone and aprepitant for the prevention of chemotherapy-induced nausea/vomiting. Also available in injectable formulation.



Kariva by Teva pictured

Class: Oral Contraceptive

Product Contents: Oral Contraceptive—Biphasic

Phase 1 Content	Phase 2 Content	Example Brand Names
Ethinyl estradiol 20 mcg; desogestrel 0.15 mg (21 d)	Ethinyl estradiol 10 mcg (5 d)	Kariva, Azurette, Mircette
Ethinyl estradiol 20 mcg; levonorgestrel 0.1 mg (84 d)	Ethinyl estradiol 10 mcg (7 d)	LoSeasonique, Amethia Lo
Ethinyl estradiol 30 mcg; levonorgestrel 0.15 mg (84 d)	Ethinyl estradiol 10 mcg (7 d)	Seasonique, Amethia
Ethinyl estradiol 35 mcg; norethindrone 0.5 mg (10 d)	Ethinyl estradiol 35 mcg; norethindrone 1 mg (11 d)	Necon 10/11
Ethinyl estradiol 10 mcg; norethindrone 1 mg (24 d)	Ethinyl estradiol 10 mcg (2 d)	Lo Loestrin Fe

Dosage Forms. **Oral Tablet:** Biphasic products contain 2 sets of tablets, each phase containing a combination of varying doses of estrogen/progestin agents, or an estrogen agent alone; products are either in 28-d or in 90-d cycles; may also include inert tablets containing either plain lactose or iron supplements, generally as 75-mg ferrous fumarate

Common FDA Label Indication, Dosing, and Titration.

1. Contraception: 1 tablet po daily beginning either on the 1st Sunday after menstruation begins ("Sunday start") or on the 1st day of menstruation ("day 1 start"); tablets are taken sequentially, following the arrows marked on the dispenser

Off-Label Uses. None

MOA. See Preface C Card: General Content Related to All Oral Contraceptives.

Drug Characteristics: Oral Contraceptive—Biphasic[a]

Dose Adjustment Hepatic	Not required	**Absorption**	F = 40% for ethinyl estradiol; food has no effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 45 L/kg for ethinyl estradiol; highly protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	X	**Elimination**	Renal elimination with a half-life of 24 h for ethinyl estradiol
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to ethinyl estradiol or progestin component; history of thromboembolic disorders, endometrial cancer, uncontrolled hypertension, known or suspected pregnancy; smoking 15 or more cigarettes per day	**Black Box Warnings**	Cigarette smokers >35 y old

[a]See Preface C Card: General Content Related to All Oral Contraceptives for ADME data on progestins.

Medication Safety Issues: Oral Contraceptive—Biphasic

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Multiple product names	Avoid oral estrogen and topical patch

Drug Interactions and Adverse Reactions: Oral Contraceptive—Biphasic. See Preface C Card: General Content Related to All Oral Contraceptives.

Efficacy Monitoring Parameters. Lack of pregnancy.

Toxicity Monitoring Parameters. Annual physical examination including cervical cytology (Pap smear) and breast exam.

Key Patient Counseling Points. See Preface C Card: General Content Related to All Oral Contraceptives.

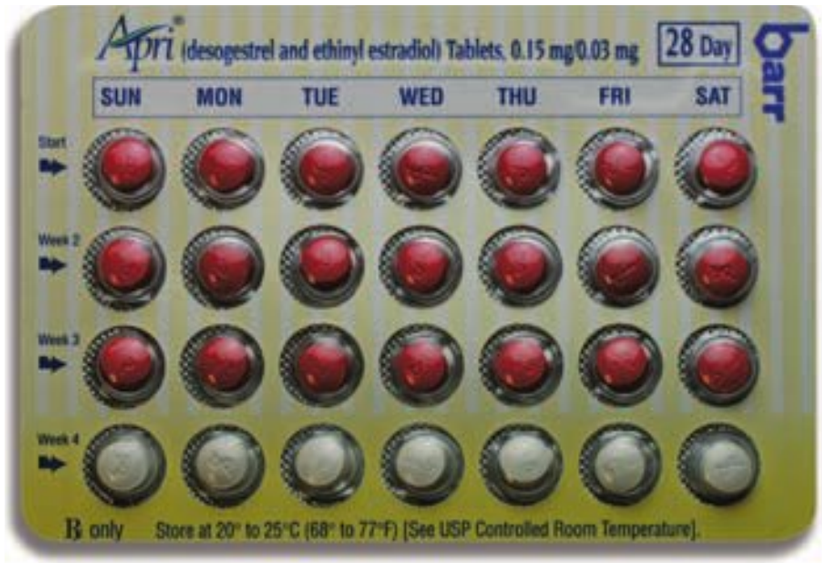
Clinical Pearls. Patients should not smoke during therapy, as this increases the risk of serious cardiovascular side effects. Noncontraceptive benefits (non-FDA approved) of oral contraceptive use include treatment of dysmenorrhea; acne; menstrual migraine; pelvic pain due to endometriosis; and decreased risk of endometrial, ovarian, and colorectal cancer. Multiphasic products have a lower total steroid dose than monophasic products and may have lower adverse effect rates, but treatment is usually initiated with monophasic products. Multiple non-oral hormonal contraceptive products also available.

ORAL CONTRACEPTIVE—MONOPHASIC: Various

Class: Oral Contraceptive

Product Contents: Oral Contraceptive—Monophasic

Estrogen Component	Progestin Component	Example Brand Names
Ethinyl estradiol 50 mcg	Norgestrel 0.5 mg	Ogestrel 0.5/50
Ethinyl estradiol 35 mcg	Norethindrone 1 mg	Ortho-Novum 1/35, Norinyl 1 + 35
Ethinyl estradiol 35 mcg	Norethindrone 0.5 mg	Brevicon, Modicon
Ethinyl estradiol 35 mcg	Norethindrone 0.4 mg	Ovcon-35, Balziva
Ethinyl estradiol 35 mcg	Norethindrone 0.25 mg	MonoNessa, Ortho-Cyclen
Ethinyl estradiol 30 mcg	Drospirenone 3 mg	Ocella, Yasmin
Ethinyl estradiol 30 mcg	Norethindrone 1.5 mg	Loestrin 21 1.5/30
Ethinyl estradiol 30 mcg	Norgestrel 0.3 mg	Low-Ogestrel, Lo/Ovral
Ethinyl estradiol 30 mcg	Desogestrel 0.15 mg	Apri, Ortho-Cept
Ethinyl estradiol 30 mcg	Levonorgestrel 0.15 mg	Levora, Nordette-28
Ethinyl estradiol 20 mcg	Drospirenone 3 mg	Yaz, Loryna
Ethinyl estradiol 20 mcg	Levonorgestrel 0.1 mg	Aviane, Lutera
Ethinyl estradiol 20 mcg	Norethindrone 1 mg	Loestrin 21 1/20



Apri by Barr pictured

Dosage Forms. **Oral Tablet:** Monophasic products include tablets that each contains the same dose of an estrogen and progestin agent; products are either in 21-d or in 28-d cycles; may also include inert tablets containing either plain lactose or iron supplements, generally as 75-mg ferrous fumarate.

Common FDA Label Indication, Dosing, and Titration.

1. Contraception: 1 tablet po daily beginning either on the 1st Sunday after menstruation begins ("Sunday start") or on the 1st day of menstruation ("day 1 start"); tablets are taken sequentially, following the arrows marked on the dispenser

Off-Label Uses. None

MOA. See Preface C Card: General Content Related to All Oral Contraceptives.

Drug Characteristics: Oral Contraceptive—Monophasic[a]

Dose Adjustment Hepatic	Not required	**Absorption**	F = 40% for ethinyl estradiol; food has no effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 45 L/kg for ethinyl estradiol; highly protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	X	**Elimination**	Renal elimination with a half-life of 24 h for ethinyl estradiol
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to ethinyl estradiol or progestin component; history of thromboembolic disorders, endometrial cancer, uncontrolled hypertension, known or suspected pregnancy; smoking 15 or more cigarettes per day	**Black Box Warnings**	Cigarette smokers >35 y old

[a]See Preface C Card: General Content Related to All Oral Contraceptives for ADME data on progestins.

Medication Safety Issues: Oral Contraceptive—Monophasic

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Multiple product names	Avoid oral estrogen and topical patch

Drug Interactions and Adverse Reactions: Oral Contraceptive—Monophasic. See Preface C Card: General Content Related to All Oral Contraceptives.

Efficacy Monitoring Parameters. Lack of pregnancy.

Toxicity Monitoring Parameters. Annual physical examination including cervical cytology (Pap smear) and breast exam.

Key Patient Counseling Points. See Preface C Card: General Content Related to All Oral Contraceptives.

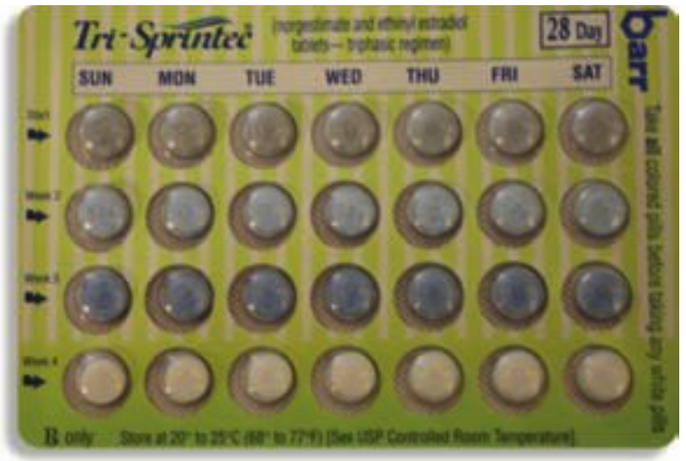
Clinical Pearls. Patients should not smoke during therapy, as this increases the risk of serious cardiovascular side effects. Noncontraceptive benefits (non-FDA approved) of oral contraceptive use include treatment of dysmenorrhea; acne; menstrual migraine; pelvic pain due to endometriosis; and decreased risk of endometrial, ovarian, and colorectal cancer. Multiphasic products have a lower total steroid dose than monophasic products and may have lower adverse effect rates, but treatment is usually initiated with monophasic products. Multiple non-oral hormonal contraceptive products also available.

ORAL CONTRACEPTIVE—TRIPHASIC: Various

Class: Oral Contraceptive

Product Contents: Oral Contraceptive—Triphasic

Phase 1	Phase 2	Phase 3	Example Brand Names
Ethinyl estradiol 35 mcg; norethindrone 0.5 mg (7 d)	Ethinyl estradiol 35 mcg; norethindrone 1 mg (9 d)	Ethinyl estradiol 35 mcg; norethindrone 0.5 mg (5 d)	Tri-Norinyl, Aranelle
Ethinyl estradiol 35 mcg; norethindrone 0.5 mg (7 d)	Ethinyl estradiol 35 mcg; norethindrone 0.75 mg (7 d)	Ethinyl estradiol 35 mcg; norethindrone 1 mg (7 d)	Ortho-Novum 7/7/7, Necon 7/7/7
Ethinyl estradiol 35 mcg; norgestimate 0.18 mg (7 d)	Ethinyl estradiol 35 mcg; norgestimate 0.215 mg (7 d)	Ethinyl estradiol 35 mcg; norgestimate 0.25 mg (7 d)	Ortho Tri-Cyclen, Tri-Sprintec, TriNessa
Ethinyl estradiol 25 mcg; norgestimate 0.18 mg (7 d)	Ethinyl estradiol 25 mcg; norgestimate 0.215 mg (7 d)	Ethinyl estradiol 25 mcg; norgestimate 0.25 mg (7 d)	Ortho Tri-Cyclen Lo
Ethinyl estradiol 20 mcg; norethindrone 1 mg (5 d)	Ethinyl estradiol 30 mcg; norethindrone 1 mg (7 d)	Ethinyl estradiol 35 mcg; norethindrone 1 mg (9 d)	Estrostep Fe, Tri-Legest



Tri-Sprintec by Barr pictured

Dosage Forms. **Oral Tablet:** Triphasic products contain 3 sets of tablets, each phase containing a combination of varying doses of estrogen/progestin agents; products are either in 21-d or in 28-d cycles; may also include inert tablets containing either plain lactose or iron supplements, generally as 75-mg ferrous fumarate.

Common FDA Label Indication, Dosing, and Titration.

1. Contraception: 1 tablet po daily beginning either on the 1st Sunday after menstruation begins ("Sunday start") or on the 1st day of menstruation ("day 1 start"); tablets are taken sequentially, following the arrows marked on the dispenser
2. Acne vulgaris, moderate: In females at least 15 y of age who have achieved menarche and are unresponsive to topical antiacne medications, same dosing as for contraception (Ortho Tri-Cyclen and Estrostep Fe are the only products with this FDA-approved indication)

Off-Label Uses. None

MOA. See Preface C Card: General Content Related to All Oral Contraceptives.

Drug Characteristics: Oral Contraceptive—Triphasic[a]

Dose Adjustment Hepatic	Not required	**Absorption**	F = 40% for ethinyl estradiol; food has no effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 45 L/kg for ethinyl estradiol; highly protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	X	**Elimination**	Renal elimination with a half-life of 24 h for ethinyl estradiol
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to ethinyl estradiol or progestin component; history of thromboembolic disorders, endometrial cancer, uncontrolled hypertension, known or suspected pregnancy; smoking 15 or more cigarettes per day	**Black Box Warnings**	Cigarette smokers >35 y old

[a]See Preface C Card: General Content Related to All Oral Contraceptives for ADME data on progestins.

Medication Safety Issues: Oral Contraceptive—Triphasic

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Multiple product names	Avoid oral estrogen and topical patch

Drug Interactions and Adverse Reactions: Oral Contraceptive—Triphasic. See Preface C Card: General Content Related to All Oral Contraceptives.

Efficacy Monitoring Parameters. Lack of pregnancy.

Toxicity Monitoring Parameters. Annual physical examination including cervical cytology (Pap smear) and breast exam.

Key Patient Counseling Points. See Preface C Card: General Content Related to All Oral Contraceptives.

Clinical Pearls. Patients should not smoke during therapy, as this increases the risk of serious cardiovascular side effects. Noncontraceptive benefits (non-FDA approved) of oral contraceptive use include treatment of dysmenorrhea; acne; menstrual migraine; pelvic pain due to endometriosis; and decreased risk of endometrial, ovarian and colorectal cancer. Multiphasic products have a lower total steroid dose than monophasic products and may have lower adverse effect rates, but treatment is usually initiated with monophasic products. Multiple non-oral hormonal contraceptive products also available.

OSELTAMIVIR: Tamiflu

Class: Neuraminidase Inhibitor, Antiviral

Dosage Forms. Oral Capsule: 30 mg, 45 mg, 75 mg; **Oral Suspension:** 6 mg/mL

Common FDA Label Indication, Dosing, and Titration.

1. Influenza virus types A and B, treatment: Children >1 y of age and <15 kg, 30 mg po bid × 5 d; Children >1 y of age and 15-23 kg, 45 mg po bid × 5 d; Children >1 y of age and 23-40 kg, 60 mg po bid × 5 d; Adults and Children >1 y of age and >40 kg, 75 mg po bid × 5 d
2. Influenza virus types A and B, prophylaxis: Same dose as for treatment; may dose for 6 wk during a community outbreak

Off-Label Uses.

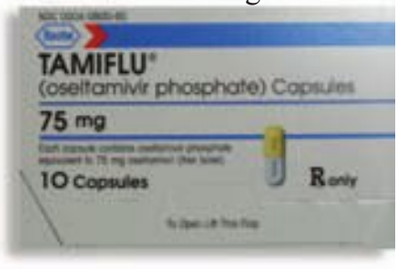
1. Influenza virus types A and B, prophylaxis: Children >2 wk and <3 mo of age, 3 mg/kg/d for up to 6 wk during community outbreak

MOA. Oseltamivir is an inhibitor of influenza virus neuraminidase affecting release of viral particles.

30 mg

45 mg

75 mg



Roche pictured

Drug Characteristics: Oseltamivir

Dose Adjustment Hepatic	Not required	**Absorption**	F = 75%, food has minimal effect on absorption
Dose Adjustment Renal	CrCl = 10-30 mL/min, reduce dose to 30 mg po daily for prophylaxis and 75 mg po daily × 5 d for treatment	**Distribution**	Vd = 23-26 L; 42% protein bound
Dialyzable	Yes	**Metabolism**	Oseltamivir phosphate is a prodrug that is extensively metabolized to oseltamivir carboxylate by ester hydrolysis
Pregnancy Category	C	**Elimination**	Renal elimination 99%, with a half-life of 1-3 h
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to oseltamivir	**Black Box Warnings**	None

Medication Safety Issues: Oseltamivir

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Thera-Flu	No

Drug Interactions: Oseltamivir

Typical Agents	Mechanism	Clinical Management
Influenza vaccine (live)	Interferes with vaccine effectiveness	Vaccinate 2 wk before or 48 h after administration of oseltamivir

Adverse Reactions: Oseltamivir

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Nausea, vomiting	Diarrhea, elevated LFTs	Arrhythmias, anaphylaxis, Stevens-Johnson syndrome, seizures, delirium

Efficacy Monitoring Parameters. Prevention or resolution of influenza infection symptoms.

Toxicity Monitoring Parameters. Seek care if heart palpitations, shortness of breath, severe rash, swelling, confusion, or anxiety occurs.

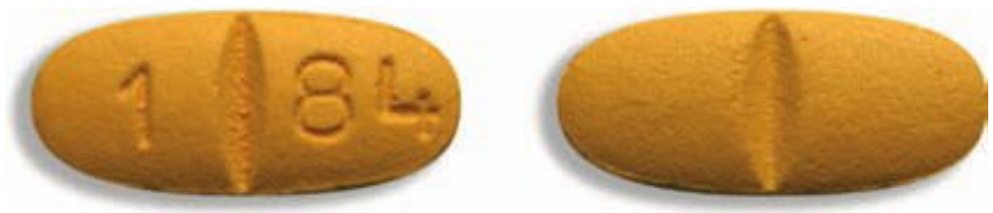
Key Patient Counseling Points. Complete full course of therapy. Symptoms should improve within 2-3 d; if they worsen, seek care. Suspension is available in a 6-mg/mL concentration and is packaged with an oral syringe calibrated in milliliters up to a total of 10 mL. Instructions to the patient should be provided based on these units of measure (ie, mL). When providing oseltamivir suspension for children <1 y of age, use a lower calibrated (ie, <10 mL) oral syringe to ensure accurate dosing. If suspension unavailable, open capsules and compound a 6-mg/mL suspension.

Clinical Pearls. Candidates for prophylaxis include close contacts of a confirmed or suspected case during their infectious period who are at high risk for influenza complications, health-care workers and emergency medical personnel, and pregnant women; treatment must start within 48 h of exposure. Capsules may be opened and administered in liquid or via nasogastric tube. Severely ill patients may require longer treatment.

OXCARBAZEPINE: Trileptal, Various

Class: Dibenzazepine Carboxamide, Anticonvulsant

Dosage Forms. Oral Tablet: 150 mg, 300 mg, 600 mg; **Oral Tablet, Extended Release:** 150 mg, 300 mg, 600 mg; **Oral Suspension:** 300 mg/5 mL



Sun Pharma generic 300 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Partial seizure: Adults, 300 mg po bid, may titrate to 1200 mg/d po; Children 4-16 y of age, 8-10 mg/kg/d po in 2 divided doses, may titrate to 600 mg/d po

Off-Label Uses.

1. Trigeminal neuralgia: 300 mg po bid-qid, may titrate to 2400 mg po daily

MOA. Oxcarbazepine is a 10-keto analogue of carbamazepine that exerts its anticonvulsant effect through an active 10-monohydroxy metabolite (MHD). Its mechanism of action is not known but likely involves blockade of voltage-dependent sodium channels and inhibition of repetitive neuronal firing.

Drug Characteristics: Oxcarbazepine

Dose Adjustment Hepatic	Not required	**Absorption**	F = 100%, food has no effect on absorption
Dose Adjustment Renal	CrCl <30 mL/min, initiate at 300 mg/d and increase slowly	**Distribution**	Vd = 49 L; 40-60% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic metabolism, CYP3A4/5 substrate; inducer of CYP3A4/5
Pregnancy Category	C	**Elimination**	Renal elimination is >95% with a half-life of 8-13 h
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	None
Contraindications	Hypersensitivity to oxcarbazepine	**Black Box Warnings**	None

Medication Safety Issues: Oxcarbazepine

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
XR	OXcarbazepine	Extended-release tablets	No	CarBAMazepine	No

Drug Interactions: Oxcarbazepine

Typical Agents	Mechanism	Clinical Management
CYP3A4/5 inducers	Increased oxcarbazepine metabolism reduces oxcarbazepine effectiveness	Consider dose increases of oxcarbazepine
CYP3A4/5 inhibitors	Decreased oxcarbazepine metabolism increases oxcarbazepine toxicity	Monitor and consider dose decreases of oxcarbazepine
CYP3A4/5 substrates	Oxcarbazepine increases metabolism of substrates drugs, lowers plasma concentration, and decreases substrate drug activity	Avoid concurrent use or monitor substrate drug and increase dose
Carbamazepine, phenobarbital, valproic acid, verapamil	Decreased oxcarbazepine concentrations	Monitor eff cacy of oxcarbazepine
Oral contraceptives	Decreased contraceptive eff cacy	Use an alternative form of birth control

Adverse Reactions: Oxcarbazepine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Somnolence, headache, diplopia, dizziness	Abnormal vision, anorexia, ataxia, constipation, diarrhea, drowsiness, fatigue, hyponatremia, nausea, rash, tremor, vomiting, weight gain	Anaphylaxis, angioedema, Stevens-Johnson syndrome, suicidal thoughts

Efficacy Monitoring Parameters. Reduction in seizure frequency.

Toxicity Monitoring Parameters. Serum sodium during maintenance treatment, emergence or worsening of depression, suicidal behavior or ideation, or unusual changes in behavior.

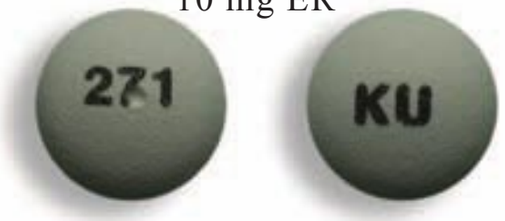
Key Patient Counseling Points. Suspension should be shaken well and dose prepared immediately using oral dosing syringe. Suspension can be mixed in a small glass of water just prior to administration or may be swallowed directly from the syringe. Avoid activities requiring mental alertness or coordination until drug effects are realized. Advise patient to report signs/symptoms of serious dermatologic reactions, myelosuppression, or hepatotoxicity. Take with food, but not alcohol, grapefruit, or grapefruit juice. Avoid abrupt discontinuation to avoid risk of seizure.

Clinical Pearls. Safety and efficacy not established in pediatric patients <4 y of age. With adjunctive therapy, children 2-4 y of age may require up to twice the oxcarbazepine dose per body weight compared to adults, and children 4-12 y of age may require a 50% higher oxcarbazepine dose per body weight compared to adults. Medication guide required at dispensing.

OXYBUTYNIN: Ditropan, Various

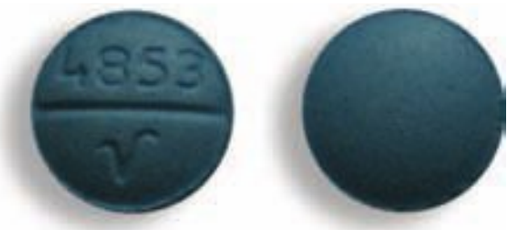
5 mg ER

10 mg ER



Kremers Urban generic ER pictured

5 mg
immediate release



Qualitest generic pictured

Class: Urinary Antispasmodic

Dosage Forms. **Oral Tablet:** 5 mg; **Oral Tablet, Extended Release:** 5 mg, 10 mg, 15 mg; **Oral Syrup:** 5 mg/5 mL; **Transdermal Gel**: 3%, 10%; **Transdermal Patch:** 3.9 mg/24 h

Common FDA Label Indication, Dosing, and Titration.

1. Overactive or neurogenic bladder: Oral, 5-10 mg/d po, may titrate to 30 mg/d po; Gel, 100 mg/g applied once daily; Patch, 1 patch applied twice weekly

Off-Label Uses. None

MOA. Oxybutynin is a competitive muscarinic receptor antagonist. Muscarinic receptors play an important role in several major cholinergically mediated functions, including contractions of the urinary bladder smooth muscle and stimulation of salivary secretion.

Drug Characteristics: Oxybutynin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 6%, food has no effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 193 L
Dialyzable	Unknown	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	B	**Elimination**	Renal with a half-life of 2-3 h
Lactation	Weigh risks and benef ts	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to oxybutynin, gastric retention, glaucoma, urinary retention	**Black Box Warnings**	None

Medication Safety Issues: Oxybutynin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
XL	No	Extended-release formulation	No	OxyCONTIN, Diprivan	No

Drug Interactions: Oxybutynin

Typical Agents	Mechanism	Clinical Management
CYP3A4/5 inhibitors	Decreased oxybutynin metabolism increases risk of oxybutynin toxicity	Consider dose decreases of oxybutynin
CYP3A4/5 inducers	Increased oxybutynin metabolism decreases oxybutynin efficacy	Consider dose increases of oxybutynin
Anticholinergic agents	Additive anticholinergic adverse effects can occur	Avoid concurrent use or monitor carefully for adverse effects

Adverse Reactions: Oxybutynin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation, xerostomia, blurred vision	Abdominal pain, dizziness, indigestion, urinary retention, arthralgias, hyperglycemia	Prolonged QTc interval, seizures, tachycardia

Efficacy Monitoring Parameters. Resolution of clinical signs of incontinence, urinary frequency, urinary urgency.

Toxicity Monitoring Parameters. Seek medical attention if anticholinergic effects (dry mouth, constipation, cognitive impairment, vision changes) are severe; monitor FBG, HR.

Key Patient Counseling Points. This drug may cause anticholinergic effects, including constipation, urinary retention, blurred vision, dyspepsia, or xerostomia. Heat prostration (due to decreased sweating) can occur when used in a hot environment.

Clinical Pearls. Patients should be advised to exercise caution in decisions to engage in potentially dangerous activities until the drug's effects have been determined. May note decline in cognitive function, especially in elderly. The transdermal patch is available OTC.

OXYCODONE: Oxycontin, Various

Class: Opioid Analgesic. C-II

Dosage Forms. **Oral Tablet, Immediate Release**: 5 mg, 10 mg, 15 mg, 20 mg, 25 mg; **Oral Tablet, Extended Release:** 10 mg, 15 mg, 20 mg, 30 mg, 40 mg, 60 mg, 80 mg; **Oral Capsule:** 5 mg; **Oral Concentrate**: 100 mg/5 mL

Common FDA Label Indication, Dosing, and Titration.

1. Pain, chronic, moderate to severe: Extended release, 10-20 mg po q12h prn pain, may titrate to response; immediate release, 5-15 mg po q4-6h prn pain

Off-Label Uses. None

MOA. Oxycodone is pure mu agonist. Mu receptors are responsible for analgesia, respiratory depression, miosis, decreased GI motility, and euphoria. In the CNS, it promotes analgesia and respiratory depression by decreasing the brain stem respiratory centers' response to carbon dioxide tension and electrical stimulation. It also decreases gastric, biliary, and pancreatic secretion, induces peripheral vasodilation, and promotes opioid-induced hypotension due to histamine release.

Purdue Pharma pictured

Drug Characteristics: Oxycodone

Dose Adjustment Hepatic	Moderate impairment, reduce dose by 33%; severe impairment, reduce dose by 50%	**Absorption**	F = 60-87%; absorption enhanced by food
Dose Adjustment Renal	CrCl <60 mL/min, reduce starting dose	**Distribution**	Vd = 2.6 L/kg; 45% protein bound
Dialyzable	Unknown	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	B	**Elimination**	Renal elimination is 20% with a half-life of 5 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to oxycodone or other opioids, asthma, paralytic ileus, respiratory depression, hypercarbia	**Black Box Warnings**	Abuse potential; do not crush ER tablet

Medication Safety Issues: Oxycodone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	OxyCODONE	Do not crush or chew ER or abuse deterrent formulation	Yes	HYDROcodone, MS Contin, oxybutynin	No

Drug Interactions: Oxycodone

Typical Agents	Mechanism	Clinical Management
Barbiturates, benzodiazepines, centrally acting muscle relaxants, opioids, phenothiazines	Additive CNS depression	Monitor and consider dose adjustments
Opioid agonists/antagonists, opioid antagonists	Precipitation of withdrawal symptoms	Avoid concurrent use with opioids
CYP3A4/5 inducers	Increased oxycodone metabolism decreases efficacy	Use with caution, consider increasing dose of oxycodone
CYP3A4/5 inhibitors	Decreased oxycodone metabolism increases risk of toxicity	Use with caution, consider decreasing dose of oxycodone

Adverse Reactions: Oxycodone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation, GI distress, sedation, sweating, pruritus	Asthenia, dyspnea, hypotension, euphoria	Cardiac arrest, physical dependence, tolerance, severe hypersensitivity

Efficacy Monitoring Parameters. Relief of pain.

Toxicity Monitoring Parameters. Excessive drowsiness, severe skin rash, decreased breathing, severe constipation, chest pain, dizziness. Monitor vital signs, specifically respiratory rate and BP.

Key Patient Counseling Points. Use a stool softener and/or laxative for preventing constipation. May cause drowsiness; avoid driving or other tasks requiring motor coordination. Avoid alcohol and other CNS depressants.

Clinical Pearls. Tolerance and physical dependence may occur with chronic use; avoid abrupt discontinuation. Extended-release products must not be crushed or chewed. Crushing or chewing will release the total dose of oxycodone at once and increase risk of respiratory depression. Extended-release products are not for use in children. Advise patients to keep in safe place, and dispose of properly when no longer needed. Now in REMS program prescribers are required to receive appropriate training. Medication guide required when dispensing.

PANTOPRAZOLE: Protonix, Various

Class: Proton Pump Inhibitor

Dosage Forms. **Oral Tablet, Delayed Release:** 20 mg, 40 mg; **Oral Packet:** 40 mg

Teva generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Erosive esophagitis, GERD: Children ≥5 y of age and 15-40 kg, 20 mg po daily × up to 8 wk; Adults and Children ≥5 y of age and >40 kg, 40 mg po daily
2. Gastric hypersecretion: 40 mg po bid, may titrate to 240 mg/d po
3. Zollinger-Ellison syndrome: 40 mg po bid, may titrate to 240 mg/d po

Off-Label Uses.

1. *H. pylori* GI tract infection: 40 mg po bid × 10-14 d in combination with amoxicillin 1000 mg and clarithromycin 500 mg po bid
2. Duodenal ulcer disease: 40-80 mg po daily × up to 4-8 wk

MOA. Pantoprazole is a PPI that, when protonated in the secretory canaliculi of the parietal cells, covalently binds to H^+/K^+-ATPase (proton pump), which is the final pathway for acid secretion. Produces a profound and prolonged antisecretory effect and inhibits basal, nocturnal, pentagastrin-stimulated, and food-stimulated gastric acid secretion.

Drug Characteristics: Pantoprazole

Dose Adjustment Hepatic	Not required	**Absorption**	F = 77%, food has no effect on absorption of delayed release tablet
Dose Adjustment Renal	Not required	**Distribution**	98% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, substrate for CYP2C19
Pregnancy Category	B	**Elimination**	Renal elimination is 71% with a half-life of 1 h (10 h in CYP2C19-deficient patients)
Lactation	Weigh risks and benefits	**Pharmacogenetics**	Poor CYP2C19 metabolizers; if known, consider lower dose
Contraindications	Hypersensitivity to pantoprazole	**Black Box Warnings**	None

Medication Safety Issues: Pantoprazole

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Delayed-release tablet, oral packet	No	ARIPiprazole	No

Drug Interactions: Pantoprazole

Typical Agents	Mechanism	Clinical Management
CYP2C19 inducers	Increased pantoprazole metabolism reduces pantoprazole effectiveness	Consider dose increases of pantoprazole
CYP2C19 inhibitors	Decreased pantoprazole metabolism increases risk of pantoprazole toxicity	Consider dose decreases of pantoprazole
Clopidogrel	Competitive inhibition of clopidogrel metabolism to active form, reducing clopidogrel effectiveness	Avoid concurrent use
Methotrexate	Pantoprazole blocks the active secretion of methotrexate, increasing methotrexate levels	Use with caution; monitor for signs of methotrexate toxicity
pH dependent drugs	Lower gastric pH reduces absorption	Monitor for lack of effectiveness of interacting drug and adjust dose as necessary

Adverse Reactions: Pantoprazole

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Abdominal pain, diarrhea, f atulence, headache	Toxic epidermal necrolysis, Stevens-Johnson syndrome, thrombocytopenia, hip fracture, rhabdomyolysis, acute interstitial nephritis

Efficacy Monitoring Parameters. Resolution of GI discomfort, resolution of ulcers shown on endoscopy; for treatment of *H. pylori*, negative urea breath test.

Toxicity Monitoring Parameters. Seek medical care for severe headache or blistering skin rash.

Key Patient Counseling Points. Can be taken with or without food but best if taken before meals to reduce acid production caused by food.

Clinical Pearls. When the intravenous route is used, converted to oral route as soon as possible to avoid cost and risks of intravenous therapy. Multiple *H. pylori* regimens exist that include different combinations of PPIs and antibiotics; counsel patient to complete full regimen if prescribed for *H. pylori* management. Other PPI and H_2 antagonists are available OTC; do not take multiple products concurrently to avoid additive risk of adverse effects. Also available as IV formulation. Packet formulation is delayed release; sprinkle into apple sauce or apple juice only, swallow immediately.

PAROXETINE: Paxil, Paxil CR, Various

Class: SSRI Antidepressant

Dosage Forms. Oral Tablet: 10 mg, 20 mg, 30 mg, 40 mg; **Oral Tablet, Controlled Release:** 12.5 mg, 25 mg, 37.5 mg; **Oral Solution, Oral Syrup:** 10 mg/5 mL; **Oral Suspension:** 10 mg/5 mL; **Oral Capsule:** 7.5 mg

Aurobindo generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Depression: Adults, immediate release, 20 mg po daily, may titrate to 50 mg po daily; Adults, controlled release, 25 mg po daily, may titrate to 62.5 mg po daily; Children ≥8 y of age, 10-20 mg po daily
2. Generalized anxiety disorder: Adults, 20 mg po daily
3. Social anxiety disorder: Adults, 20 mg po daily; Children ≥8 y of age, 10 mg po daily
4. OCD: Adults, 20 mg po daily, titrate to 60 mg po daily; Children ≥8 y of age, 10 mg po daily, may titrate to 30 mg daily
5. Panic disorder: Immediate release, 10 mg po daily, may titrate to 60 mg po daily; controlled release, 12.5 mg po daily, may titrate to 75 mg po daily
6. Posttraumatic stress disorder (PTSD): Adults, 20 mg po daily, may titrate to 50 mg po daily
7. Premenstrual dysphoric disorder (PMDD): 12.5 mg po daily or × 14 d prior to expected start of menses, may titrate to 25 mg po daily
8. Vasomotor symptoms of menopause: 7.5 mg po daily at bedtime

Off-Label Uses. None

MOA. Paroxetine is a highly selective and potent inhibitor of serotonin reuptake (SSRI).

Drug Characteristics: Paroxetine

Dose Adjustment Hepatic	*Max* dose 40 mg immediate release, or 50 mg controlled release	**Absorption**	F = 100%, food increases Cmax and AUC
Dose Adjustment Renal	*Max* dose 40 mg immediate release, or 50 mg controlled release	**Distribution**	93-95% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP2D6 substrate
Pregnancy Category	D	**Elimination**	Renal elimination is 64% with a half-life of 15-22 h
Lactation	Avoid	**Pharmacogenetics**	Use with caution in CYP2D6 poor metabolizers
Contraindications	Hypersensitivity to paroxetine; concomitant use of thioridazine or MAOIs	**Black Box Warnings**	Suicidality

Medication Safety Issues: Paroxetine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
CR	PARoxetine	CR or film-coated product	No	Doxil, Plavix, PROzac, FLUoxetine	No

Drug Interactions: Paroxetine

Typical Agents	Mechanism	Clinical Management
CYP2D6 inhibitors	Decreased paroxetine metabolism increases risk of paroxetine toxicity	Consider dose decreases of paroxetine
Antiplatelet drugs, NSAIDs	Increased risk of bleeding	Monitor for bleeding
Triptans, dextroamphetamine, tramadol, linezolid, MAOIs	Increased risk of serotonin syndrome	Monitor closely for symptoms of serotonin syndrome; linezolid, MAOIs contraindicated
Clozapine	Increased clozapine concentrations	Monitor for adverse effects
Agents that increase QT interval	Increased risk of QT prolongation (torsades de pointes, cardiac arrest)	Avoid concurrent use or monitor carefully

Adverse Reactions: Paroxetine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Abnormal ejaculation, asthenia, constipation, diarrhea, headache, insomnia, nausea, somnolence	Anxiety, asthenia, bleeding, dizziness, diaphoresis, feeling nervous, impotence, insomnia, loss of appetite, rash, reduced libido, tremor, vomiting, xerostomia	Serotonin syndrome, suicidal thoughts

Efficacy Monitoring Parameters. Improvement in symptoms of depression, panic disorder, OCD, premenstrual syndrome, vasomotor symptoms.

Toxicity Monitoring Parameters. Worsening of depression, suicidality, or unusual changes in behavior, especially at the initiation of therapy or with dosage increases or decreases; signs/symptoms of abnormal bleeding.

Key Patient Counseling Points. Do not chew or crush controlled-release tablet or film-coated tablet (Pexeva). Shake suspension well before using. Avoid activities requiring mental alertness or coordination until drug effects are realized. Symptomatic improvement may not be seen for several weeks. Avoid abrupt discontinuation. Do not drink alcohol. Use caution with NSAIDs or aspirin while taking this drug.

Clinical Pearls. If intolerable withdrawal symptoms occur following a decrease in dose or therapy discontinuation, may need to resume the previous dose and taper at a more gradual rate.

PENICILLIN: Various

Class: Antibiotic

Dosage Forms. **Oral Tablet:** 250 mg, 500 mg; **Oral Solution:** 125 mg/5 mL, 250 mg/5 mL

Sandoz generic 500 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Bacterial endocarditis, prophylaxis in patients with congenital heart disease or rheumatic/acquired valvular heart disease: Adults, 2 g po 1 h prior to procedure and then 1 g po 6 h later; Children <60 lb, 1 g po 1 h prior to procedure and then 500 mg po 6 h later
2. Otitis media, mild-moderate, pneumococcal: Adults, 250-500 mg po q6h until afebrile for at least 2 d; Children <12 y of age, 25-50 mg/kg/d po in 3-4 divided doses, *max* 3 g/d
3. Streptococcal pharyngitis: Adults, 500 mg po bid × 10 d; Children <60 lb, 250 mg po bid × 10 d

Off-Label Uses.

1. Pneumococcal infectious disease, prophylaxis in patients with sickle cell disease or asplenia: Children 2 mo to 5 y of age, 125 mg po bid; Children ≥5 y of age, 250 mg po bid; discontinue at age 5 y for children who received pneumococcal vaccination and who have not experienced invasive pneumococcal disease

MOA. Penicillins are active against most gram-positive organisms and some gram-negative organisms, notably *Neisseria* spp., by interfering with late stages of bacterial cell wall synthesis; resistance is caused primarily by bacterial production of β-lactamases; some organisms have altered penicillin-binding protein targets (eg, *Enterococci* spp. and *S. pneumoniae*); others have impermeable outer cell wall layers.

Drug Characteristics: Penicillin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 25%, food delays but does not reduce absorption
Dose Adjustment Renal	Not required	**Distribution**	Pericardium, pleural f uid, and inner ear
Dialyzable	Unknown	**Metabolism**	Not metabolized
Pregnancy Category	B	**Elimination**	Renal elimination is 20-40% with a half-life of 30 min
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to penicillins	**Black Box Warnings**	None

Medication Safety Issues: Penicillin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Penicillin G	No

Drug Interactions: Penicillin

Typical Agents	Mechanism	Clinical Management
Probenecid	Increases serum concentration of penicillin	Avoid concurrent use
Tetracyclines	Decreased effectiveness of penicillins	Avoid concurrent use

Adverse Reactions: Penicillin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Diarrhea, nausea	Skin rash	Severe hypersensitivity, renal failure, hepatic failure, hemolytic anemia

Efficacy Monitoring Parameters. Resolution of clinical signs of infection.

Toxicity Monitoring Parameters. Seek care for severe diarrhea, dark urine, yellowing of skin or eyes, unusual bruising or bleeding, blistering skin rash, or shortness of breath. Assess SCr and CBC if prolonged therapy.

Key Patient Counseling Points. Complete full course of therapy. Symptoms should improve within 2-3 d; if they worsen, seek medical care. Take on an empty stomach.

Clinical Pearls. There is cross-hypersensitivity between penicillin and cephalosporins (<10%); use with caution in cephalosporin allergy if severe penicillin reaction. May resume normal activities after 24 h of antibiotics if afebrile. First antibiotic, produced in 1943, referred to as the "magic bullet." Aminopenicillins have replaced use of penicillin for many indications, including endocarditis and otitis media.

PENTOSAN: Elmiron

Class: Urinary Analgesic

Dosage Forms: Oral Capsule: 100 mg

Common FDA Label Indication, Dosing, and Titration.

1. Pain relief from interstitial nephritis: 100 mg po tid

Off-Label Uses. None

MOA. Pentosan is a low-molecular-weight heparin-like compound. The mechanism of action of pentosan in relieving pain associated with interstitial cystitis is not known, but it has been found to adhere to the mucosal membrane of the bladder wall and may act as a buffer to control cell permeability, which prevents irritating solutes in urine from reaching the cells.

Janssen 100 mg pictured

Drug Characteristics: Pentosan

Dose Adjustment Hepatic	Not required	**Absorption**	F = 6%
Dose Adjustment Renal	Not required	**Distribution**	Uroepithelium of genitourinary tract
Dialyzable	Not known	**Metabolism**	Metabolized in liver and spleen via desulfation
Pregnancy Category	B	**Elimination**	Majority of dose eliminated unchanged in feces with half-life of 20-27 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	None	**Black Box Warnings**	None

Medication Safety Issues: Pentosan

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Imuran, pentostatin	No

Drug Interactions: Pentosan

Typical Agents	Mechanism	Clinical Management
Antiplatelet agents, NSAIDs, and anticoagulants	Additive risk of bleeding	Use with caution and monitor carefully

Adverse Reactions: Pentosan

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Alopecia, rash, diarrhea, nausea, dizziness, headache, ecchymosis, epistaxis, gum bleeding	Rectal hemorrhage, thrombocytopenia

Efficacy Monitoring Parameters. Resolution of signs and symptoms of interstitial nephritis, including nocturia, urinary pain, urinary frequency, or urinary urgency.

Toxicity Monitoring Parameters. Monitor for bleeding complications.

Key Patient Counseling Points. Take 1 h before or 2 h after meals. Use caution and monitor for bleeding if using concomitant NSAIDs or aspirin-containing products.

Clinical Pearls. Patients should be evaluated after 3 mo, and if treatment has not provided benefit, a 2nd 3-mo trial may be attempted (provided no adverse effects have occurred). If the patient does not respond after 6 mo, the product is not likely to provide benefit.

PERTUSSIS VACCINE, ACELLULAR: Daptacel, Adacel, Boostrix

Class: Vaccine

Dosage Forms. **Suspension for Intramuscular Injection:** For Adults, available in combination with tetanus and diphtheria toxoids (Tdap); for Children, available in combination with diphtheria and tetanus toxoids (DTaP), and in combination with other pediatric vaccines

Infanrix, GlaxoSmithKline pictured

Common FDA Label Indication, Dosing, and Titration.

1. Prevention of pertussis: Children, all infants at age 2, 4, 6, and 12-15 mo, and a 5th dose at age 4-6 y, as primary series of DTaP; Tdap at age 11-12 y; single dose of Tdap for all adults at next opportunity

Off-Label Uses.

1. Prevention of pertussis during pregnancy and in early infancy: Pregnant females, preferably during 27-36 wk gestation of each pregnancy, Tdap.

Drug Characteristics: Pertussis Vaccine, Acellular

Pregnancy Category	C	**ADME**	None known
Lactation	Caution advised; weigh risk and benefit	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to pertussis vaccine or a component of the vaccine; Encephalopathy without known cause within 7 d of a pertussis containing vaccine	**Black Box Warnings**	None

Medication Safety Issues: Pertussis Vaccine, Acellular

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names
No	No	No	No	Adacel, Daptacel

Drug Interactions: Pertussis Vaccine, Acellular

Typical Agents	Mechanism	Clinical Management
Moderate- to high-dose corticosteroids	Immunosuppression reduces vaccine efficacy	Delay pertussis vaccine administration until corticosteroid therapy has been discontinued if possible
Immunosuppressing agents	Immunosuppression reduces vaccine efficacy	Delay pertussis vaccine administration until immunosuppressive therapy has been discontinued if possible

Adverse Reactions: Pertussis Vaccine, Acellular

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Injection site reactions, including erythema and soreness. Fever, headache, fatigue, swelling of limb	GI symptoms	Anaphylaxis, swelling or severe arm pain, Guillain-Barré syndrome

Efficacy Monitoring Parameters. Prevention of pertussis.

Toxicity Monitoring Parameters. Monitor for syncope, fever after administration.

Key Patient Counseling Points. Return to provider for each dose in the series.

Clinical Pearls. Use the same brand of vaccine to complete the entire series, if possible. Adacel not for use in children <11 y of age. Daptacel not for use in children <6 wk or >6 y of age. Use caution to avoid mistaking Tdap and DTaP products.

PHENAZOPYRIDINE: Pyridium, Various

Class: Urinary Tract Analgesic

Dosage Forms. Oral Tablet: 95 mg, 97.2 mg, 100 mg, 200 mg

Common FDA Label Indication, Dosing, and Titration.

1. Dysuria (pain, burning, and other discomforts of the lower urinary tract caused by infection, trauma, surgery, endoscopic procedures, or the passage of catheters): 100-200 mg po tid after meals; should not be used for >2 d when administered in conjunction with an antibiotic

Off-Label Uses. None

MOA. Phenazopyridine is excreted in the urine where it exerts a topical analgesic effect on the mucosa of the urinary tract. This action helps relieve pain, burning, urgency, and frequency. The precise mechanism of action is not known.

Breckenridge generic
100 mg pictured

Drug Characteristics: Phenazopyridine

Dose Adjustment Hepatic	Not required	**Absorption**	Not known
Dose Adjustment Renal	CrCl <50 mL/min, avoid	**Distribution**	Not known
Dialyzable	Unknown	**Metabolism**	Some hepatic metabolism
Pregnancy Category	B	**Elimination**	Renal elimination is 66%
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to phenazopyridine, renal failure	**Black Box Warnings**	None

Medication Safety Issues: Phenazopyridine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Phenoxybenzamine, pyridoxine	No

Drug Interactions: Phenazopyridine. None known

Adverse Reactions: Phenazopyridine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Headache, rash, pruritus, GI upset	Anaphylaxis, methemoglobinemia, hemolytic anemia, hepatotoxicity, nephrotoxicity

Efficacy Monitoring Parameters. Resolution of clinical symptoms of dysuria (painful urination).

Toxicity Monitoring Parameters. Signs of hemolytic anemia, hepatotoxicity, or nephrotoxicity.

Key Patient Counseling Points. Drug may discolor urine and sclera to red or orange, causing staining of undergarments and contact lenses. Patient should take drug with food to minimize gastric irritation.

Clinical Pearls. When used in the treatment of a urinary tract infection, phenazopyridine should not exceed 2 d because there is a lack of evidence that the combined administration of phenazopyridine and an antibacterial provides greater benefit than administration of the antibacterial alone after 2 d. Many OTC products containing phenazopyridine are also available.

PHENOBARBITAL: Luminal, Various

Class: Long-Acting Barbiturate. C-IV

Dosage Forms. Oral Tablet: 15 mg, 16.2 mg, 30 mg, 32.4 mg, 60 mg, 64.8 mg, 97.2 mg, 100 mg; **Oral Elixir, Oral Solution:** 20 mg/5 mL

Excellium generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Epilepsy: Adults, 50-100 mg po bid-tid; Children, 15-50 mg po bid-tid (tablet) or 3-6 mg/kg/d po (solution)
2. Daytime sedation: Adults, 30-120 mg po divided into 2-3 doses, may titrate to 400 mg/d; Children, 6 mg/kg/d po divided into 3 doses

Off-Label Uses.

1. Sleep: Adults, 100-320 mg po as single dose.

MOA. Phenobarbital produces different degrees of depression within the CNS, from sedation to general anesthesia. It has been demonstrated to depress monosynaptic responses in the CNS only transiently, but synaptic recovery is delayed and a decrease in postsynaptic resistance is observed at some synapses.

Drug Characteristics: Phenobarbital

Dose Adjustment Hepatic	Dosage reduction recommended	**Absorption**	F = 80-100%, food has no effect on absorption
Dose Adjustment Renal	CrCl <10 mL/min, extend dosing interval to q12-16h	**Distribution**	Vd = 0.5-1 L/kg; 20-60% protein bound
Dialyzable	Yes	**Metabolism**	Hepatic, CYP2C19 substrate; strong inducer of CYP1A2, 2A6, 2B6, 2C8, 2C9, and 3A4/5
Pregnancy Category	D	**Elimination**	Renal elimination is 21% with a half-life of 1.5-4.9 d
Lactation	Compatible, monitor infant for side effects	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to barbiturates; marked liver function impairment; respiratory disease with evidence of dyspnea or obstruction; history of sedative or hypnotic addiction; personal or family history of acute intermittent porphyria	**Black Box Warnings**	None

Medication Safety Issues: Phenobarbital

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	PHENobarbital	No	No	PENTobarbital, Phenergan	Avoid

Drug Interactions: Phenobarbital

Typical Agents	Mechanism	Clinical Management
Substrates of CYP1A2, 2A6, 2B6, 2C8, 2C9, and 3A4/5	Increases metabolism of substrates, reducing effectiveness	Consider increasing dose of substrates
CYP2C19 inducers	Increased phenobarbital metabolism reduces phenobarbital effectiveness	Consider dose increases of phenobarbital
CYP2C19 inhibitors	Decreased phenobarbital metabolism increases risk of phenobarbital toxicity	Consider dose decreases of phenobarbital
Barbiturates, benzodiazepines, opioids	Additive CNS respiratory depression	Avoid concomitant use
Phenytoin	Increased or decreased phenytoin concentrations	Monitor phenytoin levels
Valproic acid	Increased risk of phenobarbital toxicity or decreased valproic acid efficacy	Monitor phenobarbital and valproic acid levels

Adverse Reactions: Phenobarbital

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Apnea, ataxia, confusion, dizziness, hypotension, hypoventilation, rash, somnolence, syncope	Barbiturate withdrawal, bradyarrhythmia, megaloblastic anemia

Efficacy Monitoring Parameters. Control of seizures, achieving adequate sleep; phenobarbital serum levels: therapeutic 10-40 mcg/mL; toxic >40 mcg/mL.

Toxicity Monitoring Parameters. SCr, LFTs, and CBC annually.

Key Patient Counseling Points. Avoid activities requiring mental alertness or coordination until drug effects are realized, as drug may cause dizziness, light-headedness, or somnolence. Advise patient against sudden discontinuation of drug. Do not drink alcohol or use other CNS depressant drugs while taking phenobarbital. Many drug interactions; check with pharmacist when starting new medications or OTC products.

Clinical Pearls. Efficacy for inducing and maintaining sleep begins to decline after ~2 wk; should not be used long term. Avoid use in children and elderly who are at higher risk of toxicity. Avoid abrupt withdrawal to decrease risk of seizures.

PHENTERMINE: Adipex-P, Various

Class: Centrally Acting Appetite Suppressant, C-IV

Dosage Forms. Oral Capsule: 15 mg, 30 mg, 37.5 mg; **Oral Tablet:** 37.5 mg; **Oral Dispersible Tablet:** 15 mg, 30 mg, 37.5 mg

Common FDA Label Indication, Dosing, and Titration.

1. Simple obesity (BMI ≥30 kg/m^2 or >27 kg/m^2 with risk factors), short-term, adjunct treatment: 15-37.5 mg (capsules) or 37.5 mg (tablets) po daily either before breakfast or 1-2 h after breakfast; may titrate to response

Mutual Pharmaceutical generic 37.5 mg pictured

Off-Label Uses. None

MOA. Phentermine is a sympathomimetic amine with pharmacologic activity similar to amphetamines. Actions include CNS stimulation and elevation of BP. Weight loss is due to anorectic effect, primarily one of appetite suppression, but may also have other CNS or metabolic effects.

Drug Characteristics: Phentermine

Dose Adjustment Hepatic	Not required	**Absorption**	Not known
Dose Adjustment Renal	Not required	**Distribution**	Not known
Dialyzable	Unknown	**Metabolism**	Not metabolized
Pregnancy Category	C	**Elimination**	Renal elimination is 80% with a half-life of 20 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to phentermine or other sympathomimetic amines, use in agitated states, cardiovascular disease, history of drug abuse, glaucoma, moderate to severe hypertension, hyperthyroidism	**Black Box Warnings**	None

Medication Safety Issues: Phentermine

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Dispersible tablet	No	Phenytoin, Phentolamine	No

Drug Interactions: Phentermine

Typical Agents	Mechanism	Clinical Management
Fenfluramine, dexfenfluramine, TCAs	Unknown; combined use associated with primary pulmonary hypertension, valvular disorders, and death	Avoid concurrent use
MAOIs	Increases hypertensive effects of phentermine	Avoid phentermine within 14 d of MAOI discontinuation; do not use MAOIs within 5 wk of phentermine discontinuation

Adverse Reactions: Phentermine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Increased BP, palpitations, tachyarrhythmia, urticaria, constipation, diarrhea, xerostomia, dizziness, excitement, headache, insomnia, tremor, dysphoric mood, euphoria, restlessness	Heart valve disorder, psychotic disorder, primary pulmonary hypertension

Efficacy Monitoring Parameters. Weight loss.

Toxicity Monitoring Parameters. Signs and symptoms of heart valve disorders and primary pulmonary hypertension, ECG, BP.

Key Patient Counseling Points. Phentermine may impair the ability of the patient to engage in potentially hazardous activities such as operating machinery or driving a motor vehicle; the patient should therefore be cautioned accordingly.

Clinical Pearls. Phentermine is indicated only as short-term monotherapy for the management of exogenous obesity. The safety and efficacy of combination therapy with phentermine and any other drug products for weight loss, including SSRIs, have not been established. Primary pulmonary hypertension and valvular heart disease have been reported to occur in patients receiving a combination of phentermine with fenfluramine or dexfenfluramine and should be avoided. Tolerance to the anorectic effect usually develops within a few weeks. When this occurs, the recommended dose should not be exceeded in an attempt to increase the effect; rather, the drug should be discontinued. Should be used in conjunction with a comprehensive weight management program.

PHENYTOIN: Dilantin, Various

Class: Hydantoin Anticonvulsant

Dosage Forms. Oral Capsule: 30 mg, 100 mg, 200 mg, 300 mg; **Oral Chewable Tablet**: 50 mg; **Oral Suspension:** 125 mg/5 mL

Taro generic 100 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Seizure, generalized tonic-clonic, complex partial, or following neurosurgery, treatment, and prophylaxis: Adults, 100 mg po tid, may titrate to 200 mg po tid; Children, 5 mg/kg/d po divided into 2-3 doses, may titrate to 300 mg/d

Off-Label Uses. None

MOA. Phenytoin is a hydantoin that suppresses the spread of seizure activity mainly by inhibiting synaptic post-tetanic potentiation and blocking the propagation of electric discharge. Phenytoin might decrease sodium transport and block calcium channels at the cellular level to produce these actions.

Drug Characteristics: Phenytoin

Dose Adjustment Hepatic	Monitor and consider dose adjustments	**Absorption**	F = 70-100%, food increases absorption
Dose Adjustment Renal	Monitor and consider dose adjustments	**Distribution**	Vd = 0.75 L/kg; 88-93% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic, CYP2C19 and CYP2C9 substrate; strong inducer of CYP2B6, 2C19, 2C8, 2C9, and 3A4/5
Pregnancy Category	D	**Elimination**	Fecal elimination with a half-life of 7-42 h
Lactation	Compatible	**Pharmacogenetics**	Patient with HLA-B*1502 at increased risk of Stevens-Johnson syndrome
Contraindications	Hypersensitivity to phenytoin, sinus bradycardia, AV block	**Black Box Warnings**	Hypotension and arrhythmias with IV administration

Medication Safety Issues: Phenytoin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	ER capsules	Yes	PHENobarbital, Dilaudid, diltiazem	No

Drug Interactions: Phenytoin

Typical Agents	Mechanism	Clinical Management
CYP2C19, CYP2C9 inducers	Increased phenytoin metabolism reduces phenytoin effectiveness	Consider dose increases of phenytoin
CYP2C19, CYP2C9 inhibitors	Decreased phenytoin metabolism increases risk of phenytoin toxicity	Consider dose decreases of phenytoin
Substrates of CYP2B6, 2C19, 2C8, 2C9 and 3A4/5	Metabolism of substrates increased, reducing effectiveness of substrates	Consider increasing dose of substrate if necessary
Acetaminophen	Decreased acetaminophen efficacy and increased risk of hepatotoxicity	Avoid large and/or chronic acetaminophen doses; monitor for hepatotoxicity.
Carbamazepine, valproic acid	Altered phenytoin carbamazepine or valproic acid concentrations	Monitor concentrations; adjust doses as necessary

Adverse Reactions: Phenytoin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Gingival hyperplasia	Ataxia, confusion, constipation, decreased coordination, dizziness, feeling nervous, headache, hypertrichosis, impaired cognition, insomnia, intentional tremor, nausea, nystagmus, osteomalacia, peripheral neuropathy, rash, slurred speech, spasmodic movement, vomiting	Hepatotoxicity, pancytopenia, systemic lupus erythematosus, Stevens-Johnson syndrome, suicidal behavior, withdrawal seizures

Efficacy Monitoring Parameters. Reduction in the frequency and severity of seizures; phenytoin serum level range 10-20 mcg/mL (obtain after at least 5-7 half-lives after treatment initiation or dosage change).

Toxicity Monitoring Parameters. Emergence or worsening of depression, suicidal behavior or ideation, or unusual changes in behavior; monitor CBC and LFTs.

Key Patient Counseling Points. Do not crush extended-release capsules. Avoid activities requiring mental alertness or coordination until drug effects are realized. Report signs/symptoms of pancytopenia, hepatotoxicity, systemic lupus erythematosus, or severe skin reaction. Do not drink alcohol while taking this drug. Many drug interactions; check with health-care provider when starting new medications or OTC products.

Clinical Pearls. Highly protein bound, so albumin levels should be taken into account when measuring phenytoin concentration; dose adjustment based on free phenytoin concentration. Injectable formulation available, but not for use IM (causes “purple glove syndrome” related to tissue necrosis). Medication guide required at dispensing.

PIOGLITAZONE: Actos, Various

Class: Thiazolidinedione Antidiabetic

Dosage Forms. Oral Tablet: 15 mg, 30 mg, 45 mg

Common FDA Label Indication, Dosing, and Titration.

1. Diabetes mellitus, type 2: 15-30 mg po daily; may titrate to *max* of 45 mg po daily as monotherapy, or in combination with sulfonylurea or metformin

Off-Label Uses. None

MOA. Pioglitazone is a thiazolidinedione antihyperglycemic and a potent peroxisome proliferator-activated receptor-γ (PPAR-γ) agonist used to improve insulin sensitivity in patients with type 2 diabetes. Insulin-dependent glucose disposal in skeletal muscle is improved and hepatic glucose production is decreased; both actions contribute to pioglitazone's glucose-lowering effects.

Takeda 30 mg pictured

Drug Characteristics: Pioglitazone

Dose Adjustment Hepatic	Avoid if LFTs elevated	**Absorption**	F = 50%, food delays but does not reduce absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 0.63 L/kg; 99% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP2C8 substrate; moderate inhibitor of CYP2C8
Pregnancy Category	C	**Elimination**	Renal elimination is 15-30% with a half-life of 16-24 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to pioglitazone, NYHA III/IV heart failure	**Black Box Warnings**	Heart failure risk

Medication Safety Issues: Pioglitazone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	Yes	Actidose, Actonel	No

Drug Interactions: Pioglitazone

Typical Agents	Mechanism	Clinical Management
CYP2C8 inducers	Increased pioglitazone metabolism reduces pioglitazone effectiveness	Consider dose increases of pioglitazone
CYP2C8 inhibitors	Decreased pioglitazone metabolism increases risk of pioglitazone toxicity	Consider dose decreases of pioglitazone
Substrates of CYP2C8	Metabolism of substrates decreased, increasing risk of toxicity	Monitor for toxicity and consider decreasing dose of substrate if necessary
Corticosteroids	May diminish or increase hypoglycemic effect of pioglitazone	Monitor and consider pioglitazone dose adjustment if chronic steroid use
NSAIDs, SSRIs	Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia	Monitor blood glucose and consider dose adjustments
MAOIs	Stimulation of insulin secretion, hypoglycemic effects	Monitor blood glucose and consider dose adjustments

Adverse Reactions: Pioglitazone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Edema, weight gain	Myalgia, bone fractures, sinusitis, headache	Heart failure, anemia, hepatotoxicity, diabetic macular edema, hypoglycemia when used in combination with insulin or sulfonylureas

Efficacy Monitoring Parameters. Pre-prandial blood glucose between 70 and 130 mg/dL, HbA_{1c} <7% (goal HbA_{1c} may be 6.5-8% based on patient-specific characteristics).

Toxicity Monitoring Parameters. Weight for assessment of edema, Hgb, LFTs; symptoms of hypoglycemia include, nausea, sweating, and loss of consciousness; seek care for bone pain, yellowing of skin or eyes, eye pain, or shortness of breath; eye exams.

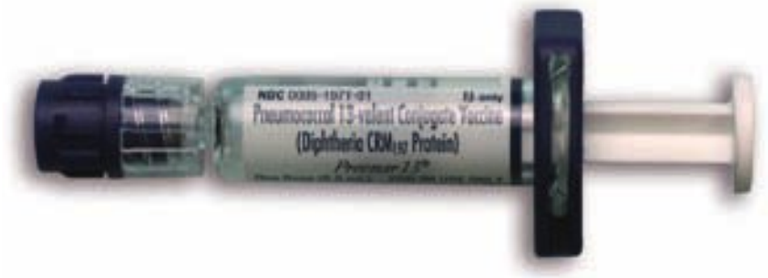
Key Patient Counseling Points. Monitor blood glucose in frequent intervals (2-4 times per d). May take without regard to food. May require several weeks for max effect.

Clinical Pearls. Pioglitazone causes edema, which may exacerbate underlying heart failure; contraindicated with NYHA III/IV heart failure. Stimulates ovulation. Premenopausal anovulatory individuals may resume ovulation. Increased risk of pregnancy in premenopausal female diabetics; use effective birth control. Not for use in children. Medication guide required at dispensing.

PNEUMOCOCCAL VACCINE: Prevnar13, Pneumovax23

Class: Vaccine, Inactivated, Bacterial

Dosage Forms. **Suspension for Intramuscular Injection:** 0.5 mL (13 valent conjugate vaccine, PCV13, Prevnar13); **Solution for Intramuscular or Subcutaneous Injection:** 0.5 mL (23 valent polysaccharide vaccine, PPSV23, Pneumovax23)



Wyeth pictured

Common FDA Label Indication, Dosing, and Titration.

1. Prevention of invasive pneumococcal disease: Adults ≥50 y of age, single dose IM once (either product); Children, single dose at 2, 4, 6, and 12-15 mo of age as primary series (conjugate product), multiple approved schedules for "catching up" in children who do not start their vaccine series on time

Off-Label Uses.

1. Prevention of invasive pneumococcal disease, immunosuppressed individuals ≥6 y of age: If vaccine naive, single-dose PCV13 IM once, followed by single dose PPSV23 IM once in 8 wk; if previously vaccinated with PPSV23, single-dose PCV13 IM at least 12 mo after last PPSV23
2. Prevention of invasive pneumococcal disease, individuals ≥65 y of age: If vaccine naive, single-dose PCV13 IM once, followed by single dose PPSV23 IM once in 6-12 mo; if previously vaccinated with PPSV23, single-dose PCV13 IM at least 12 mo after last PPSV23
3. Prevention of invasive pneumococcal disease in individuals at high risk for invasive pneumococcal disease, including asplenia, chronic heart disease, chronic lung disease, diabetes, cerebrospinal fluid leak, cochlear implant, alcoholism, chronic liver disease (including asthma if ≥19 y of age), cigarette smoker ≥19 y of age, hemoglobinopathy, immunocompromised (congenital or acquired, HIV infection, leukemia, lymphoma, generalized malignancy, iatrogenic immunosuppression, solid-organ transplant, multiple myeloma): single-dose PPSV23 IM once
4. Prevention of invasive pneumococcal disease in individuals at high risk for invasive pneumococcal disease, including asplenia, hemoglobinopathy, immunocompromised: Single dose PPSV23 IM once and repeat single dose IM once.

Merck pictured

Drug Characteristics: Pneumococcal Vaccine

Pregnancy Category	PCV13, B PPSV23, C	**ADME**	Not known
Lactation	Infant risk is minimal	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to pneumococcal vaccine or a component of the vaccine	**Black Box Warnings**	None

Medication Safety Issues: Pneumococcal Vaccine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Prevnar13, Pneumovax23	No

Drug Interactions: Pneumococcal Vaccine

Typical Agents	Mechanism	Clinical Management
Moderate- to high-dose corticosteroids	Immunosuppression reduces vaccine efficacy	Delay vaccination until corticosteroid therapy has been discontinued, if possible
Immunosuppressing agents	Diminished immune response to vaccine due to immunosuppression	Delay pneumococcal vaccine administration until immunosuppressive therapy has been discontinued, if possible
Herpes zoster vaccine	Immunologic interference	Concomitant administration with PPSV23 lowers antibody concentrations to zoster vaccine; clinical consequences are unknown and no change in efficacy observed if administered simultaneously; separate vaccines by 4 wk if follow-up assured

Adverse Reactions: Pneumococcal Vaccine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Injection site reactions, including erythema and soreness. Rash, decreased appetite, arthralgia, myalgia, decreased sleep, somnolence, headache, asthenia	Diarrhea, vomiting, fever	Thrombocytopenia, anaphylaxis

Efficacy Monitoring Parameters. Prevention of invasive pneumococcal disease, including bacterial meningitis.

Toxicity Monitoring Parameters. Monitor for syncope, fever after administration.

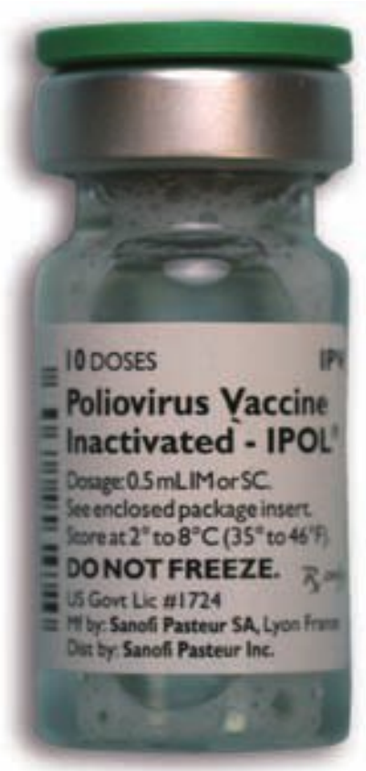
Key Patient Counseling Points. May administer antipyretics to reduce fever after vaccine administration.

Clinical Pearls. PCV13 used for routine immunization of infants and young children, for immunosuppressed individuals ≥6 y of age and those ≥65 y of age. PPSV23 should not be used in children <2 y of age. PPSV23 used for individuals with chronic diseases, including immunosuppressive diseases.

POLIOVIRUS VACCINE, INACTIVATED: Ipol

Class: Vaccine, Inactivated, Viral

Dosage Forms. Solution for Intramuscular or Subcutaneous Injection: 0.5 mL; also available in combination with other pediatric vaccines



Sanofi Pasteur pictured

Common FDA Label Indication, Dosing, and Titration.

1. Prevention of poliomyelitis: Children, one 0.5-mL dose IM or sq at 2, 4, and 6-18 mo of age, and a booster at 4-6 y of age as primary series

Off-Label Uses.

1. Prevention of poliomyelitis, in adults previously vaccinated but who are at risk for polio exposure: One 0.5-mL dose IM or sq
2. Prevention of poliomyelitis, in adults previously incompletely vaccinated but who are at risk for polio exposure: One 0.5-mL dose IM or sq
3. Prevention of poliomyelitis, in adults previously unvaccinated but who are at risk for polio exposure: Two 0.5-mL doses IM or sq at 1-2 mo intervals followed by a 3rd dose 6-12 mo later

Drug Characteristics: Poliovirus Vaccine, Inactivated

Pregnancy Category	C	**ADME**	None known
Lactation	Infant risk is minimal	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to Hib vaccine or a component of the vaccine (2-phenoxyethanol, calf serum, formaldehyde, neomycin, polymixin, streptomycin)	**Black Box Warnings**	None

Medication Safety Issues: Poliovirus Vaccine, Inactivated

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	PPD	No

Drug Interactions: Poliovirus Vaccine, Inactivated

Typical Agents	Mechanism	Clinical Management
Moderate- to high-dose corticosteroids	Immunosuppression reduces vaccine efficacy	Delay vaccination until corticosteroid therapy has been discontinued, if possible
Immunosuppressing agents	Diminished immune response to vaccine due to immunosuppression	Delay vaccination until immunosuppressive therapy has been discontinued, if possible

Adverse Reactions: Poliovirus Vaccine, Inactivated

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Injection site reactions, including erythema and soreness, loss of appetite, fatigue, irritability	Vomiting, fever	Anaphylaxis, febrile seizure, Guillain-Barré syndrome

Efficacy Monitoring Parameters. Prevention of poliomyelitis.

Toxicity Monitoring Parameters. Monitor for syncope, fever after administration.

Key Patient Counseling Points. Return to provider for each dose in the series.

Clinical Pearls. Adults, even those without evidence of previous immunization, rarely need poliovirus vaccine. A single dose is needed only if exposure likely, such as travel to an endemic area (eg, Pakistan, Nigeria). The United States has been polio-free since 1979.

POLYETHYLENE GLYCOL: Golytely, Various

Class: Hyperosmotic Laxative

Dosage Forms. Powder for Oral Solution: 119-420 g

Common FDA Label Indication, Dosing, and Titration.

1. Colonoscopy or barium enema preparation: Adults, 17 g of powder dissolved in 240 mL of reconstituted solution po q10min until diarrhea is clear or 4 L are consumed or 20-30 mL/min via nasogastric tube until rectal effluent is clear or 4 L are administered
2. Constipation: Adults, 17g of powder dissolved in 240 mL of reconstituted solution once daily; Children, 0.5-1.5 g/kg po daily

Off-Label Uses.

1. Whole bowel irrigation after toxic ingestions, 240 mL of reconstituted solution q10min until diarrhea is clear or 4 L are consumed or 20-30 mL/min via nasogastric tube until rectal effluent is clear or 4 L are administered

MOA. Polyethylene glycol (PEG) electrolyte lavage solution is a hyperosmotic solution that includes various electrolytes (sodium sulfate, sodium bicarbonate, sodium chloride, potassium chloride).

Kremer Urban generic pictured

Drug Characteristics: Polyethylene Glycol

Dose Adjustment Hepatic	Not required	**Absorption**	Not absorbed
Dose Adjustment Renal	Not required	**Distribution**	Not absorbed
Dialyzable	Not dialyzable	**Metabolism**	Not absorbed
Pregnancy Category	C	**Elimination**	Not absorbed
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Bowel perforation, gastric retention, GI obstruction, ileus, toxic colitis	**Black Box Warnings**	None

Medication Safety Issues: Polyethylene Glycol

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
C G	GoLYTELY, NuLYTRLY	No	No	NuLYTELY	No

Drug Interactions: Polyethylene Glycol

Typical Agents	Mechanism	Clinical Management
Potassium supplements	Additive hyperkalemia	Monitor serum potassium and SCr
Potassium-sparing diuretics	Additive hyperkalemia	Monitor serum potassium and SCr
ACE-Is	Additive hyperkalemia	Monitor serum potassium and SCr

Adverse Reactions: Polyethylene Glycol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Anal irritation, bloating symptom, epigastric fullness, nausea, stomach cramps, vomiting	Urticaria	Anaphylaxis, dehydration, seizures

Efficacy Monitoring Parameters. Bowel movements should begin within 60 min of initiating administration and dosing should continue until rectal effluent is clear if utilized as bowel preparation for imaging study.

Toxicity Monitoring Parameters. Seek medical attention if urticaria, rhinorrhea, or dermatitis occurs.

Key Patient Counseling Points. This preparation may cause nausea, anal irritation, or vomiting. If severe bloating, abdominal distension, or abdominal pain occurs, patient should slow the consumption of solution, and once symptoms have resolved, the patient may resume administration. If utilized as bowel preparation for imaging study, advise patient to avoid solid foods for 3-4 h before beginning this treatment.

Clinical Pearls. Encourage patients to drink each portion rapidly, as this method is preferred over drinking small amounts continuously. The solution tastes better chilled, but ice should not be added to the solution. Since oral medications are flushed from their system by this treatment and may not be absorbed, patients should receive guidance from the prescriber of PEG solution regarding whether and when to take oral doses of other medications. Risk of drug interactions resulting in hyperkalemia offset by diarrheal loss of potassium, clinical relevance uncertain.

POTASSIUM CHLORIDE: Klor-con, Various

Upsher-Smith pictured

Class: Electrolyte, Potassium

Dosage Forms. Oral Capsule, Extended Release: 8 mEq, 10 mEq; **Powder for Oral Solution:** 20 mEq, 25 mEq; **Oral Solution:** 20 mEq/15 mL; **Oral Tablet, Extended Release:** 8 mEq, 10 mEq, 15 mEq, 20 mEq

Common FDA Label Indication, Dosing, and Titration.

1. Hypokalemia: Adults, 20-100 mEq/d po divided 1-5 times daily after meals; Children, 3-8 mEq/d po divided 1-5 times daily after meals
2. Hypokalemia, prophylaxis: 20 mEq/d po daily

Off-Label Uses. None

MOA. Potassium is an electrolyte required for maintenance of the excitatory properties of neuromuscular tissues, and the resting membrane potential of cells is related to potassium concentrations, varying directly with the ratio of intracellular to extracellular potassium level.

Drug Characteristics: Potassium Chloride

Dose Adjustment Hepatic	Not required	**Absorption**	Well absorbed
Dose Adjustment Renal	Contraindicated	**Distribution**	98% of total body potassium is located intracellularly
Dialyzable	Yes	**Metabolism**	Not metabolized
Pregnancy Category	C	**Elimination**	Renal elimination is 85-95%
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to potassium, acute renal failure, structural, pathological, or pharmacologic cause delay in tablet passage through the GI tract, hyperkalemia, Addison disease, acute dehydration	**Black Box Warnings**	None

Medication Safety Issues: Potassium Chloride

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
10, M10, M20, K	No	Do not crush extended-release products	Yes (IV)	HCl, Macrobid, Micronase	No

Drug Interactions: Potassium Chloride

Typical Agents	Mechanism	Clinical Management
Anticholinergics	Decreased GI motility and increased risk of erosions caused by potassium	Contraindicated
Potassium-sparing diuretics	Increased risk of hyperkalemia	Monitor potassium levels and consider alternative therapies
ACE-Is, ARBs	ACE-Is and ARBs may lower aldosterone levels, which may result in potassium retention	Monitor potassium levels

Adverse Reactions: Potassium Chloride

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Nausea, indigestion, flatulence	Vomiting	ECG changes with hypokalemia or hyperkalemia, esophagitis

Efficacy Monitoring Parameters. Monitor serum potassium and adjust dose to maintain serum potassium in the normal range 3.5-5 mEq/L.

Toxicity Monitoring Parameters. SCr, ECG if hypokalemic or hyperkalemic.

Key Patient Counseling Points. Take with food. Take the powder, granule, or oral liquid only after mixing in 4 oz of water or juice. Crush or break only specifically designed extended-release formulations. Capsules may be opened, sprinkled on apple sauce, and ingested immediately.

Clinical Pearls. The total potassium content in a 70-kg male is approximately 3500 mEq. Some drugs (insulin, β-agonists) decrease potassium levels by causing an intracellular shift of potassium. If replacement does not normalize potassium level, check magnesium levels and calcium levels and replace as necessary.

POTASSIUM IODIDE: SSKI, ThyroShield, Various

Class: Antithyroid Agent

Dosage Forms. Oral Solution: 65 mg/mL (SSKI), 1 g/mL (ThyroShield)

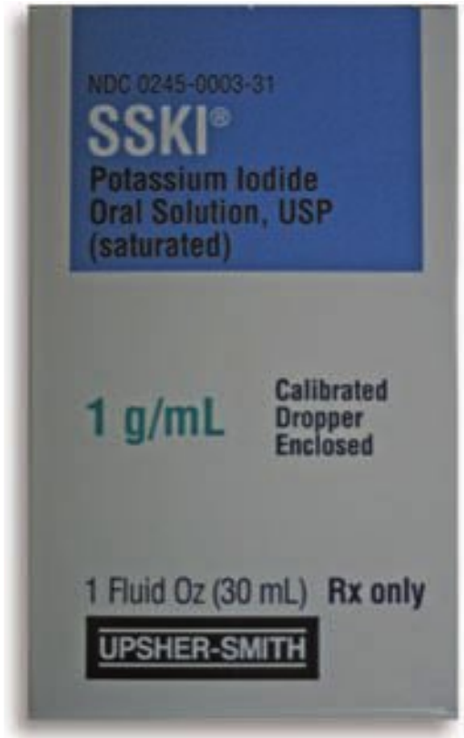
Common FDA Label Indication, Dosing, and Titration.

1. Prevention of thyroid dysfunction due to radiation exposure: Children, birth to 1 mo of age, 16.25 mg po daily; Children 1 mo to 3 y of age, 32.5 mg po daily; Children 3-12 y of age, 65 mg po daily; Children >12 y of age but <150 lb, 65 mg po daily; Children >12 y of age and ≥150 lb and Adults, 130 mg po daily

Off-Label Uses.

1. Induction or involution of thyroid: 60-250 mg po tid × 10 d preoperatively to reduce vascularity of the gland prior to thyroidectomy
2. Graves disease (short-term reduction in thyroid hormone production prior to ablation or surgery): 50 mg po q8h

MOA. Iodine is needed for the production of thyroid hormones. In patients with disorders causing hyperthyroidism, iodide is administered to inhibit the release of thyroid hormones via direct effect on the thyroid gland and inhibits synthesis of thyroid hormones. Also attenuates effects of TSH mediated via cAMPb and decreases vascularity of thyroid gland. When administered before or promptly after radioactive iodine exposure, potassium iodide blocks or reduces accumulation of radioactive iodine in the thyroid gland.



Upsher-Smith 1 g/mL solution pictured

Drug Characteristics: Potassium Iodide

Dose Adjustment Hepatic	Not required	**Absorption**	Readily absorbed
Dose Adjustment Renal	Not required	**Distribution**	Iodide concentrates in the thyroid gland, salivary glands, gastric mucosa, choroid plexus, placenta, and mammary glands
Dialyzable	Yes	**Metabolism**	Taken up by the thyroid; not metabolized
Pregnancy Category	D	**Elimination**	Renal elimination is 85-90%
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to potassium iodide	**Black Box Warnings**	None

Medication Safety Issues: Potassium Iodide

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Potassium iodine	No

Drug Interactions: Potassium Iodide

Typical Agents	Mechanism	Clinical Management
Warfarin	Hyperthyroid patients metabolize clotting factors more quickly than normal. By decreasing thyroid hormone production, potassium iodide may alter metabolism of clotting factors and affect the INR	Monitor INR carefully and adjust warfarin dose as required

Adverse Reactions: Potassium Iodide

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Stomach upset, diarrhea, nausea, vomiting, stomach pain	Rash, salivary gland swelling or tenderness	Goiter, hypothyroidism, thyroid adenoma, immune hypersensitivity reaction

Efficacy Monitoring Parameters. Thyroid function tests.

Toxicity Monitoring Parameters. Serum potassium, SCr, BUN, signs/symptoms of goiter, hypothyroidism, thyroid adenoma, allergic reaction, hyperkalemia.

Key Patient Counseling Points. To minimize GI irritation, administer with food. Take with 4 oz of water. Other liquids can be used; dilution in chocolate milk can mask the taste. During a radiation emergency, understand the nature of the radiation hazard and the potential benefits and adverse effects of potassium iodide. Administer potassium iodide only as directed by public health authorities. Adhere to other emergency measures recommended by public health authorities.

Clinical Pearls. Potassium iodide has been used in the past as an expectorant and cough suppressant, which is not appropriate given the risk of adverse effects. Potassium iodide crosses into breast milk, but most guidelines consider it compatible with breast-feeding.

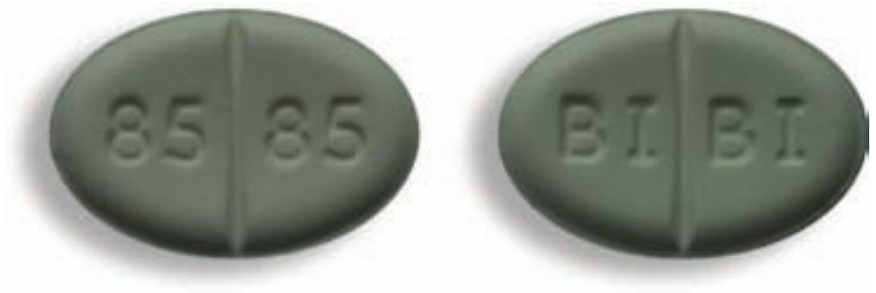
PRAMIPEXOLE: Mirapex, Mirapex ER

Class: Dopamine Agonist, Anti-Parkinson

Dosage Forms. Oral Tablet: 0.125 mg, 0.25 mg, 0.5 mg, 0.75 mg, 1 mg, 1.5 mg; **Oral Tablet, Extended Release):** 0.375 mg, 0.75 mg, 1.5 mg, 2.25, 3 mg, 3.75 mg, 4.5 mg

Common FDA Label Indication, Dosing, and Titration.

1. Parkinson disease: Immediate release, 0.125 mg po tid, may titrate to 0.5-1.5 mg po tid; extended release, 0.375 mg po daily, may titrate to 4.5 mg po daily
2. Restless legs syndrome: 0.125 mg po daily taken 2-3 h prior to bedtime, may titrate to 0.5 mg po daily



Boehringer Ingelheim 0.5 mg pictured

Off-Label Uses. None

MOA. Pramipexole is a nonergot-derived dopamine subtype selective agonist that exerts activity in the CNS at D_2 and D_3 receptors but has no activity at the D_1 receptor. D_2 receptors are thought to play an important role in improving the akinesia, bradykinesia, rigidity, and gait disturbances of Parkinson disease.

Drug Characteristics: Pramipexole

Dose Adjustment Hepatic	No adjustment needed	**Absorption**	F = 90%, food reduces Tmax
Dose Adjustment Renal	Immediate release: CrCl 35-50 mL/min, 0.125 mg po bid, to *max* of 1.5 mg po bid; CrCl 15-34 mL/min, 0.125 mg po daily, to *max* of 1.5 mg po daily, CrCl <15 mL/min: avoid; Extended release: CrCl 30-50 mL/min, 0.375 mg po qod, to *max* of 2.25 mg po daily; CrCl <30 mL/min: avoid	**Distribution**	Vd = 500 L; 15% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Not metabolized
Pregnancy Category	C	**Elimination**	Renal elimination is 90% with a half-life of 8-12 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to pramipexole	**Black Box Warnings**	None

Medication Safety Issues: Pramipexole

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
ER	No	Extended-release tablets	No	MiraLax	No

Drug Interactions: Pramipexole

Typical Agents	Mechanism	Clinical Management
Cimetidine	Increased pramipexole concentrations	Choose an alternative acid-reducing agent
Antipsychotics	May reduce the effectiveness of antipsychotic or dopamine agonists	Avoid, or monitor effect of both agents and increase dose if necessary

Adverse Reactions: Pramipexole

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Asthenia, dream disorder, dyskinesia, extrapyramidal movements, nausea, somnolence	Amnesia, confusion, compulsive behavior, constipation, diarrhea, dizziness, fatigue, hallucinations, headache, insomnia, orthostatic hypotension, peripheral edema, xerostomia	Blackouts, heart failure, impulsive behavior, melanoma

Efficacy Monitoring Parameters. Improvement in Parkinson symptoms or restless legs syndrome.

Toxicity Monitoring Parameters. Hypotension, drowsiness, hallucinations, or behavior changes; melanoma screening.

Key Patient Counseling Points. Take with food if nausea occurs. Avoid activities requiring mental alertness or coordination until drug effects are realized. Rise slowly from a sitting/lying down position. Report new or increased gambling urges, sexual urges, compulsive eating or buying, as well as new-onset or worsening dyskinesia. Do not discontinue abruptly, as this may cause emergent hyperpyrexia and confusion. Do not drink alcohol, and avoid concomitant use of other CNS depressants.

Clinical Pearls. Safety and efficacy in children not established. May switch patient from immediate-release to extended-release tablets overnight at same daily dose.

PRASUGREL: Effient

Class: Antiplatelet Agent

Dosage Forms. Oral Tablet: 5 mg, 10 mg

Lilly 10 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Prevention of thromboembolism after percutaneous coronary intervention: 60 mg po once, then 10 mg po daily, in combination with aspirin 75-325 mg po daily

Off-Label Uses.

1. Prevention of thromboembolism in acute coronary syndrome: 30 mg po once, then 10 mg po daily, in combination with aspirin ≤100 mg po daily

MOA. Prasugrel is an inhibitor of platelet activation and aggregation through the irreversible binding of its active metabolite to the $P2Y_{12}$ class of ADP receptors on platelets.

Drug Characteristics: Prasugrel

Dose Adjustment Hepatic	Not required for mild or moderate impairment; risk in severe impairment not known	**Absorption**	F = 79%, food delays rate but not extent of absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 44-68 L; 98% albumin bound
Dialyzable	Not known	**Metabolism**	Rapid hepatic metabolism to active metabolite, which is further metabolized in the liver to an active metabolite
Pregnancy Category	B	**Elimination**	Renal elimination is 68-70% with a half-life of 7-8 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Active bleeding, history of transient ischemic attack or stroke	**Black Box Warnings**	Bleeding risk; not recommended in patients ≥75 y of age; CABG

Medication Safety Issues: Prasugrel

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Pravastatin	No

Drug Interactions: Prasugrel

Typical Agents	Mechanism	Clinical Management
SSRIs	Serotonin released from platelets is necessary for hemostasis; bleeding can result if antiplatelet agents are given with SSRIs	Monitor for bleeding
Antiplatelet agents, NSAIDs, and anticoagulants	Additive risk of bleeding	Avoid concurrent use or monitor carefully and adjust dose if necessary

Adverse Reactions: Prasugrel

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Hypertension, hyperlipidemia, backache, headache, epistaxis	Atrial fibrillation, colon cancer, major bleeding, TTP, angioedema

Efficacy Monitoring Parameters. Stent patency and prevention of clotting.

Toxicity Monitoring Parameters. Monitor for signs and symptoms of bleeding. Consider periodic hematocrit/hemoglobin, as well as platelet function testing.

Key Patient Counseling Points. May be given with or without food. Tablet may be crushed, but should not be split for purposes of dividing doses.

Clinical Pearls. After percutaneous coronary intervention, continue for 12 mo if stent is placed, and at least 15 mo if drug-eluting stent is placed. In patients weighing <60 kg, may consider dose of 5 mg po daily. May need to hold prior to surgical intervention; consult with cardiologist.

PRAVASTATIN: Pravachol, Various

Class: HMG-CoA Reductase Inhibitor

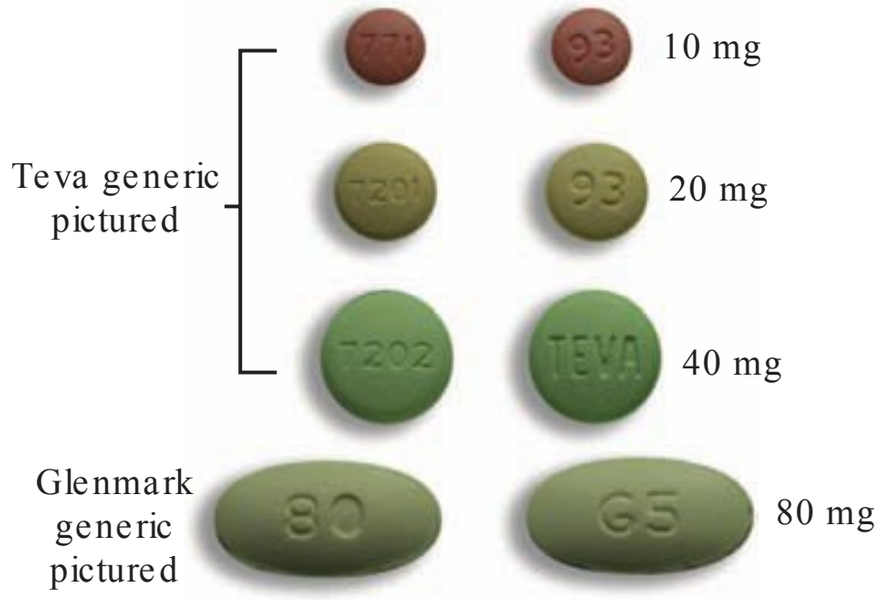
Dosage Forms. Oral Tablet: 10 mg, 20 mg, 40 mg, 80 mg

Common FDA Label Indication, Dosing, and Titration.

1. Cerebrovascular accident (prevention), coronary arteriosclerosis (primary or secondary prevention): 40 mg po daily
2. Familial hypercholesterolemia: Children 8-13 y of age, 20 mg po daily; Children 14-18 y of age, 40 mg po daily
3. Hyperlipidemia: Children (boys and postmenarchal girls) 10-17 y of age, 10 mg po daily, may titrate to 20 mg/d; Adults, 40 mg po daily, may titrate to 40-80 mg po daily

Off-Label Uses. None

MOA. HMG-CoA reductase inhibitors competitively inhibit conversion of HMG-CoA to mevalonate, an early rate-limiting step in cholesterol synthesis. A compensatory increase in LDL receptors, which bind and remove circulating LDL-cholesterol, results. Production of LDL-cholesterol can decrease because of decreased production of VLDL-cholesterol or increased VLDL removal by LDL receptors.



Drug Characteristics: Pravastatin

Dose Adjustment Hepatic	Avoid use in patients with active liver disease or unexplained persistent elevated LFTs	**Absorption**	F = 17%, food has no effect on absorption
Dose Adjustment Renal	Initial dose 10 mg po daily	**Distribution**	Vd = 0.46 L/kg; 43-55% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic via hydroxylation
Pregnancy Category	X	**Elimination**	Renal elimination is 20% with a half-life of 2.6-3.2 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	Effective in lowering lipids in patients with the ApoE E2/E2 genotype and Fredrickson type III dysbetalipoproteinemia
Contraindications	Hypersensitivity to pravastatin, pregnancy or lactation	**Black Box Warnings**	None

Medication Safety Issues: Pravastatin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Prevacid, prasugrel	No

Drug Interactions: Pravastatin

Typical Agents	Mechanism	Clinical Management
Bile acid–binding resins	Binding by bile acid resins decrease efficacy of pravastatin	Give pravastatin 1 h before or 4 h after resin
Efavirenz, nelfinavir	Decreased pravastatin levels decreases efficacy of pravastatin	Monitor fasting lipid panels
Fibrates, niacin, cyclosporine	Increased risk of myopathy or rhabdomyolysis	Avoid concurrent use or monitor for myopathy and measure creatine kinase levels

Adverse Reactions: Pravastatin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Headache, heartburn, increased liver enzymes, influenza-like symptoms, musculoskeletal pain, myalgia, nausea, rash, vomiting	Rhabdomyolysis, tendon rupture

Efficacy Monitoring Parameters. Baseline fasting lipid panel (total cholesterol, LDL, HDL, and triglycerides), repeat 4-12 wk after initiation or dose adjustment.

Toxicity Monitoring Parameters. Signs/symptoms of rhabdomyolysis (myalgias, dark urine, arthralgias, fatigue) or hepatotoxicity; LFTs at baseline and if concern for hepatotoxicity; check serum creatine kinase in patients experiencing myopathy.

Key Patient Counseling Points. Take in the evening. Contraindicated in pregnancy. Avoid concurrent heavy alcohol use. Pravastatin does not take the place of diet and exercise to lower cholesterol levels.

Clinical Pearls. Repeat fasting lipid panel 4-12 wk following initiation or titration. Consider holding pravastatin 4-7 d before major surgery as patient is at higher risk for occurrence of rhabdomyolysis. May increase the risk of diabetes.

PREDNISOLONE ORAL: Orapred, Prelone, Various

Class: Adrenal Glucocorticosteroid

Dosage Forms. **Oral Tablet:** 5 mg; **Oral Dispersible Tablet:** 10 mg, 15 mg, 30 mg; **Oral Solution:** 5 mg/5 mL, 10 mg/5 mL, 15 mg/5 mL 20 mg/5 mL; **Oral Syrup:** 15 mg/5 mL; **Oral Suspension:** 15 mg/5 mL

Common FDA Label Indication, Dosing, and Titration.

Dosing for indications listed below: Adults, 5-60 mg po daily; Children, 0.1-2 mg/kg/d; adjust dose according to patient response

1. Allergic states (eg, asthma, etc): 1-2 mg/kg/d divided 1-2 times daily, *max* of 60 mg/dose
2. Dermatologic diseases (eg, exfoliative erythroderma, etc)
3. Endocrine disorders (eg, adrenocortical insufficiency, etc)
4. GI diseases (eg, regional enteritis, ulcerative colitis, etc)
5. Hematologic disorders (eg, acquired hemolytic anemia, etc)
6. Neoplastic diseases (eg, palliative management of leukemias and lymphomas, etc)
7. Nervous system (eg, multiple sclerosis, cerebral edema, etc)
8. Renal diseases (eg, idiopathic nephrotic syndrome, systemic lupus erythematosus, etc)
9. Respiratory diseases (eg, idiopathic eosinophilic pneumonia, etc)
10. Rheumatic disorders (eg, rheumatoid arthritis, etc)

Off-Label Uses.

1. Croup: 1 mg/kg po once

MGP generic 15 mg /5 mL solution pictured

MOA. Glucocorticosteroids are naturally occurring and synthetic adrenocortical steroids that cause varied metabolic effects, modify the body's immune responses to diverse stimuli, and are used primarily for their anti-inflammatory effects in disorders of many organ systems.

Drug Characteristics: Prednisolone Oral

Dose Adjustment Hepatic	Not required	**Absorption**	F = 85%
Dose Adjustment Renal	Not required	**Distribution**	Vd = 1.5 L/kg; 70-90% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	C	**Elimination**	Primarily renal elimination with a half-life of 2-4 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to prednisolone or other glucocorticosteroids, administration of live vaccines, fungal infections	**Black Box Warnings**	None

Medication Safety Issues: Prednisolone Oral

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
DP, ODT, PRED, 20	PrednisoLONE	Dispersible tablet	No	PredniSONE	No

Drug Interactions: Prednisolone Oral

Typical Agents	Mechanism	Clinical Management
Antacids	Decreased absorption of corticosteroids	Separate administration by 2 h
CYP3A4/5 inhibitors	Decreased prednisolone metabolism increases risk of prednisolone toxicity	Monitor for toxicity and reduce prednisolone dose if necessary
CYP3A4/5 inducers	Increased prednisolone metabolism decreases prednisolone efficacy	Monitor for lack of efficacy and consider dose increase of prednisolone
Fluoroquinolones	Concurrent use of steroids and fluoroquinolones can increase risk of tendon rupture, especially in elderly	Avoid concurrent use, or monitor carefully for tendon rupture
Phenytoin	Phenytoin increases prednisolone metabolism; prednisolone can increase or decrease phenytoin metabolism	Monitor prednisolone efficacy and phenytoin concentrations
Warfarin	Steroids can increase or decrease INR in patients taking warfarin	Monitor INR carefully

Adverse Reactions: Prednisolone Oral

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
GI upset	Hypertension, atrophic condition of skin, impaired skin healing, osteoporosis, depression, euphoria, pulmonary tuberculosis, hyperglycemia	Primary adrenocortical insufficiency, Cushing syndrome, decreased body growth, increased risk of infection

Efficacy Monitoring Parameters. Improvement or resolution of clinical signs and symptoms; monitor for decrease in ESR, or improvement of PFT.

Toxicity Monitoring Parameters. Hyperglycemia, osteoporosis, adrenocortical insufficiency, and infection. Mood changes may also occur; frequency and severity of adverse effects are dependent on the length of treatment and dose.

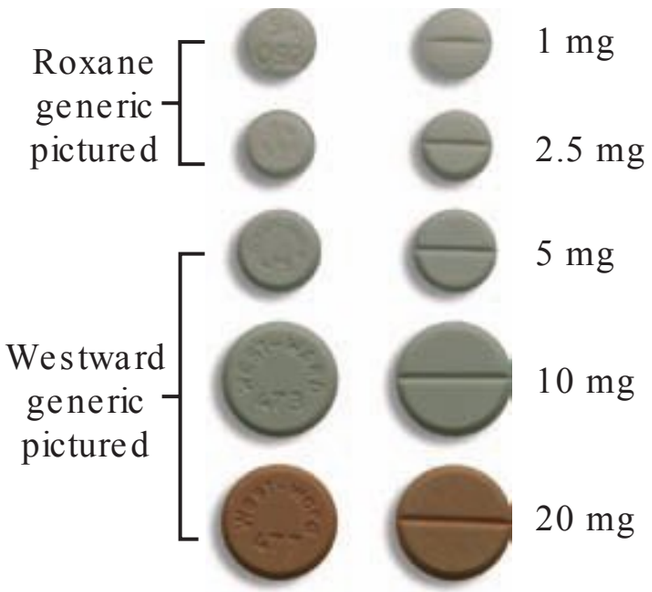
Key Patient Counseling Points. Take with food or milk to prevent GI upset. Take in the morning to help prevent insomnia. For high-dose or longer term treatment, inform patients to monitor for signs of hyperglycemia, osteoporosis, adrenocortical insufficiency, and infection.

Clinical Pearls. Available in a variety of dosage forms and concentrations, including ophthalmic preparations. Use lowest effective dose and discontinue as soon as possible to avoid serious long-term adverse effects. Some formulations taste worse than others; chocolate milk may mask taste best; oral disintegrating tablets are an expensive alternative. Taper required after chronic use (courses >14 d). 1 mg prednisolone is typically equivalent to 1 mg prednisone.

PREDNISONE: Deltasone, Various

Class: Adrenal Corticosteroid

Dosage Forms. Oral Tablet: 1 mg, 2.5 mg, 5 mg, 10 mg, 20 mg, 50 mg; **Oral Tablet, Delayed Release:** 1 mg, 2 mg, 5 mg; **Oral Solution:** 5 mg/1 mL; 5 mg/5 mL



Common FDA Label Indication, Dosing, and Titration.

Dosing for indications listed below: Adults and Children, 5-60 mg po daily; for all patients, adjust dose according to patient response

1. Allergic states (eg, asthma, etc)
2. Dermatologic diseases (eg, exfoliative erythroderma, etc)
3. Endocrine disorders (eg, adrenocortical insufficiency, etc)
4. GI diseases (eg, regional enteritis, ulcerative colitis, etc)
5. Hematologic disorders (eg, acquired hemolytic anemia, etc)
6. Neoplastic diseases (eg, palliative management of leukemias and lymphomas, etc)
7. Nervous system (eg, multiple sclerosis, cerebral edema, etc)
8. Renal diseases (eg, idiopathic nephrotic syndrome, systemic lupus erythematosus, etc)
9. Respiratory diseases (eg, idiopathic eosinophilic pneumonia, etc)
10. Rheumatic disorders (eg, rheumatoid arthritis, etc)

Off-Label Uses.

1. Graft-versus-host disease: 60 mg/m^2 po daily

MOA. Glucocorticosteroids are naturally occurring and synthetic adrenocortical steroids that cause varied metabolic effects, modify the body's immune responses to diverse stimuli, and are used primarily for their anti-inflammatory effects in disorders of many organ systems.

Drug Characteristics: Prednisone

Dose Adjustment Hepatic	Not required	**Absorption**	F = 92%
Dose Adjustment Renal	Not required	**Distribution**	Vd = 0.4-1 L/kg
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 substrate
Pregnancy Category	C	**Elimination**	Primarily renal elimination with a half-life of 2.6-3 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to prednisone or other glucocorticosteroids, administration of live vaccines, fungal infections	**Black Box Warnings**	None

Medication Safety Issues: Prednisone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
Intensol	PredniSONE	Delayed-release formulation	No	prednisoLONE	No

Drug Interactions: Prednisone

Typical Agents	Mechanism	Clinical Management
Antacids	Decreased absorption of corticosteroids	Separate administration by 2 h
CYP3A4/5 inhibitors	Decreased prednisone metabolism increases risk of prednisone toxicity	Monitor for toxicity and reduce prednisone dose if necessary
CYP3A4/5 inducers	Increased prednisone metabolism decreases prednisone efficacy	Monitor for lack of efficacy and consider dose increase of prednisolone
Fluoroquinolones	Concurrent use of steroids and fluoroquinolones can increase risk of tendon rupture, especially in elderly	Avoid concurrent use, or monitor carefully for tendon rupture
Phenytoin	Phenytoin increases prednisone metabolism; prednisone can increase or decrease phenytoin metabolism	Monitor prednisone efficacy and phenytoin concentrations
Warfarin	Steroids can increase or decrease INR in patients taking warfarin	Monitor INR carefully

Adverse Reactions: Prednisone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
GI upset	Hypertension, atrophic condition of skin, impaired skin healing, osteoporosis, depression, euphoria, pulmonary tuberculosis, hyperglycemia	Primary adrenocortical insufficiency, Cushing syndrome, decreased body growth, increased risk of infection

Efficacy Monitoring Parameters. Improvement or resolution of clinical signs and symptoms.

Toxicity Monitoring Parameters. Monitor for signs of hyperglycemia, osteoporosis, adrenocortical insufficiency, and infection; frequency and severity of adverse effects are dependent on the length of treatment and dose.

Key Patient Counseling Points. Take with food or milk to prevent GI upset. Take in the morning to help prevent insomnia. For high-dose or longer term treatment, inform patients to monitor for signs of hyperglycemia, osteoporosis, adrenocortical insufficiency, and infection.

Clinical Pearls. See National Heart, Lung, and Blood Institute guidelines for dosing of prednisone for moderate to severe asthma exacerbation; after chronic use (>2 wk), dose tapering required prior to discontinuation of therapy.

PREGABALIN: Lyrica

Class: Analgesic, Anticonvulsant. C-V

Dosage Forms. Oral Capsule: 25 mg, 50 mg, 75 mg, 100 mg, 150 mg, 200 mg, 225 mg, 300 mg; **Oral Solution:** 20 mg/mL

Pfizer pictured

Common FDA Label Indication, Dosing, and Titration.

1. Neuropathic pain, diabetes associated or spinal cord injury associated: 50-100 mg po tid
2. Fibromyalgia: 75-150 mg po bid; may titrate to *max* 225 mg bid
3. Partial seizure, adjunct: 25-75 mg po bid; may titrate to *max* 600 mg/d in 2-3 divided doses
4. Postherpetic neuralgia: Initial, 75 mg po bid; may titrate to 300 mg/d; maintenance 75-150 mg bid or 50-100 mg tid; may titrate to *max* 600 mg/d

Off-Label Uses. None

MOA. Pregabalin is a GABA analogue that strongly binds to the α_2-delta site (a subunit of voltage-gated calcium channels) in CNS tissues. Binding to the α_2-delta subunit may be involved in pregabalin's effects on neuropathic pain and seizure control. Pregabalin reduces the calcium-dependent release of several neurotransmitters; however, the exact mechanism of action is unknown.

Drug Characteristics: Pregabalin

Dose Adjustment Hepatic	Not required	**Absorption**	F >90%, food has no effect on absorption
Dose Adjustment Renal	CrCl 30-60 mL/min, 75-300 mg/d; CrCl 15-30 mL/min, 25-150 mg/d; CrCl <15 mL/min, 25-75 mg/d	**Distribution**	Vd = 0.5 L/kg; no protein binding
Dialyzable	Yes	**Metabolism**	Negligible hepatic metabolism
Pregnancy Category	C	**Elimination**	Renal elimination is 90-99% with a half-life of 5-6.5 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to pregabalin	**Black Box Warnings**	None

Medication Safety Issues: Pregabalin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Lopressor, Hydrea	No

Drug Interactions: Pregabalin

Typical Agents	Mechanism	Clinical Management
CNS depressants	Additive CNS depression	Consider dose reduction of pregabalin or other agent

Adverse Reactions: Pregabalin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Dizziness, somnolence, ataxia, headache, peripheral edema	Arthralgia, asthenia, blurred vision, confusion, constipation, diplopia, disturbance in thinking, euphoria, fatigue, incoordination, increased appetite, muscle spasm, tremor, vomiting, weight gain, xerostomia	Angioedema

Efficacy Monitoring Parameters. Reduction in seizure frequency, improvement in pain, reduced symptoms of fibromyalgia.

Toxicity Monitoring Parameters. Creatine kinase, emergence or worsening of depression, suicidal behavior or ideation, or unusual changes in behavior, symptoms of angioedema, during initial and chronic therapy.

Key Patient Counseling Points. Solution must be used within 45 d of first opening the bottle. Avoid activities requiring mental alertness or coordination until drug effects are realized. Avoid sudden discontinuation of drug due to risk of withdrawal, including increased seizure frequency. Avoid drinking alcohol.

Clinical Pearls. Safety and efficacy have not been established in children. Data suggest an increased risk of suicidal behavior or ideation may exist in patients receiving therapy with AEDs.

PRENATAL VITAMIN: Various

Class: Vitamin Supplement

Dosage Forms. Oral Tablet: Containing various combinations of vitamins and minerals, including folic acid and iron

Amneal generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Diet supplementation during pregnancy: 1 tablet po daily

Off-Label Uses. None

MOA. Provide vitamin and mineral supplementation throughout pregnancy and during the postnatal period for both the lactating and the nonlactating mother. It is also useful for improving nutritional status prior to conception.

Drug Characteristics: Prenatal Vitamin

Dose Adjustment Hepatic	Not required	**Absorption**	Unknown
Dose Adjustment Renal	Not required	**Distribution**	Unknown
Dialyzable	Not dialyzable	**Metabolism**	Unknown
Pregnancy Category	A	**Elimination**	Unknown
Lactation	Compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to any component of vitamin and mineral supplement	**Black Box Warnings**	Iron toxicity

Medication Safety Issues: Prenatal Vitamin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	No	No

Drug Interactions: Prenatal Vitamin. None known

Adverse Reactions: Prenatal Vitamin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Nausea, vomiting, constipation	

Efficacy Monitoring Parameters. Improvement in nutritional status.

Toxicity Monitoring Parameters. Seek medical attention if severe GI distress occurs.

Key Patient Counseling Points. May contain iron, so important to keep out of the reach of children.

Clinical Pearls. Various prescription and OTC products are available. May take with food to avoid GI upset, but administration with milk will decrease extent of iron absorption.

PROCHLORPERAZINE: Compazine, Various

Class: Phenothiazine

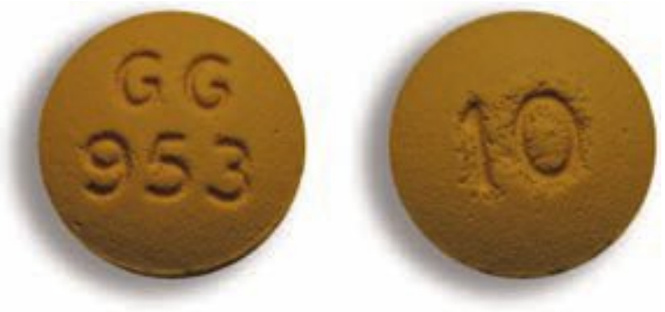
Dosage Forms. Oral Tablet: 5 mg, 10 mg; **Rectal Suppositories:** 25 mg

Common FDA Label Indication, Dosing, and Titration.

1. Nausea and vomiting: Adults, 5-10 mg po 3-4 times daily; daily dosages above 40 mg should be used only in resistant cases; Children ≥2 y of age and 20-29 lb, 2.5 mg po or pr daily-bid, *max* of 7.5 mg/d; Children 30-39 lb, 2.5 mg po or pr bid-tid, *max* 10 mg/d; Children 40-85 lb, 2.5-5 mg po or pr tid, *max* of 15 mg/d

Off-Label Uses. None

MOA. Prochlorperazine is dopamine (D_2) receptor antagonist that belongs to the phenothiazine class of antipsychotic agents.



Goldline 10 mg generic pictured

Drug Characteristics: Prochlorperazine

Dose Adjustment Hepatic	Not required	**Absorption**	F = 12.5%, food has minimal effect on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 12.9-17 L/kg
Dialyzable	Not dialyzable	**Metabolism**	Not metabolized
Pregnancy Category	C	**Elimination**	Half-life of 7-9 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to phenothiazines, bone marrow depression, children <20 lb or 2 y of age, comatose or greatly depressed states, severe hypotension	**Black Box Warnings**	Mortality in elderly with dementia

Medication Safety Issues: Prochlorperazine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	ChlorproMAZINE	No

Drug Interactions: Prochlorperazine

Typical Agents	Mechanism	Clinical Management
Agents that prolong the QT interval	Additive QT prolongation	Use with caution in combination with other agents that may prolong QTc or in congenital long QT syndrome
Barbiturates, benzodiazepines, centrally acting muscle relaxants, opioids	Additive CNS depression	Monitor and consider dose adjustments
Dopamine agonists	Decreased effect of dopamine agonists	Avoid concurrent use
MAOIs	Additive respiratory depression, increased risk of serotonin syndrome	Contraindicated

Adverse Reactions: Prochlorperazine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Somnolence	Headache	Respiratory depression, hypotension, neuroleptic malignant syndrome, agranulocytosis, extrapyramidal symptoms (increased risk in children <5 y of age), seizures, QTc prolongation

Efficacy Monitoring Parameters. Resolution of nausea and vomiting.

Toxicity Monitoring Parameters. Excessive drowsiness, decreased breathing, seizures, unusual bruising or bleeding.

Key Patient Counseling Points. May cause drowsiness; avoid driving or other tasks requiring motor coordination. Avoid concurrent use of other CNS depressants.

Clinical Pearls. Use caution in elderly; appear more sensitive to the effects. Prochlorperazine is FDA approved for schizophrenia, although seldom used. Atypical antipsychotics are generally more effective and less toxic. Injection contains benzyl alcohol, which can cause gasping syndrome in neonates; should be avoided.

PROGESTERONE: Prometrium, Various

Class: Progestin Hormone

Dosage Forms. **Oral Capsule:** 100 mg, 200 mg; **Vaginal Jelly:** 4%, 8%

Common FDA Label Indication, Dosing, and Titration.

1. Prevention of estrogen-induced endometrial hyperplasia: 200 mg po daily hs × 12 sequential d per 28-d cycle while conjugated estrogens are administered
2. Secondary physiologic amenorrhea: 400 mg po daily hs × 10 d

Off-Label Uses. None

MOA. Progesterone transforms proliferative endometrium into secretory endometrium. Parenterally administered progesterone inhibits gonadotropin production, which in turn prevents follicular maturation and ovulation.

Solvay 100 mg pictured

Drug Characteristics: Progesterone

Dose Adjustment Hepatic	Mild, moderate, lower dose; severe, avoid	**Absorption**	F = 10-15%, food increases AUC
Dose Adjustment Renal	Not required	**Distribution**	90% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP3A4/5 and CYP2C19 substrate
Pregnancy Category	B	**Elimination**	Renal elimination of metabolites, 50-60%, with half-life of 25 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Abnormal vaginal bleeding, history of estrogen- or progesterone-dependent neoplasia, active or history of DVT or PE, known or suspected pregnancy	**Black Box Warnings**	Cardiovascular disorders, breast cancer, dementia risk

Medication Safety Issues: Progesterone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Yes	No	No	No

Drug Interactions: Progesterone

Typical Agents	Mechanism	Clinical Management
CYP2C19, CYP3A4/5 inducers	Increased progesterone metabolism reduces progesterone effectiveness	Consider dose increases of progesterone
CYP2C19, CYP3A4/5 inhibitors	Decreased progesterone metabolism increases risk of progesterone toxicity	Consider dose decreases of progesterone
Warfarin	Progesterone may increase or decrease warfarin effectiveness; mechanism unknown	Monitor INR

Adverse Reactions: Progesterone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Weight change, headache, amenorrhea, breast tenderness, abdominal pain	Nausea, asthenia, feeling nervous, break-through bleeding	Thromboembolism (DVT, PE), thrombophlebitis, osteoporosis

Efficacy Monitoring Parameters. Resolution of clinical signs of abnormal bleeding or symptoms being managed with this product.

Toxicity Monitoring Parameters. Annual physical including BP monitoring and annual breast exam; diagnostic evaluation to rule out malignancy in event of persistent or recurring vaginal bleeding.

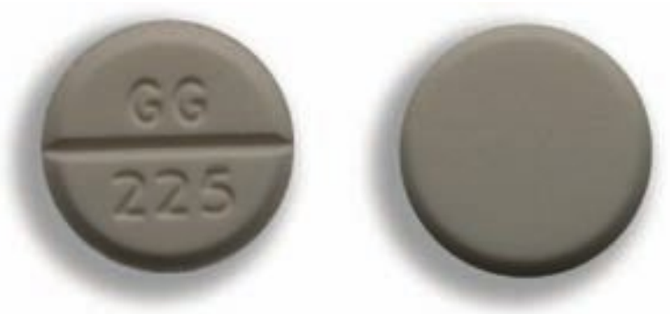
Key Patient Counseling Points. Advise patients that menstrual bleeding should occur 3-7 d after last dose. Patient should report if menstruation does not occur within 7 d after last dose.

Clinical Pearls. Injectable depot formulation of progesterone (medroxyprogesterone) is used for contraception (150 mg IM q3mo). Topical formulation is also available for other indications. Combination of estrogens and progestins should not be used for the prevention of cardiovascular disease. Increased risk of myocardial infarction, stroke, invasive breast cancer, PE, and DVT has been shown in postmenopausal women. Evidence regarding teratogenicity is conflicting; some studies show birth defects, and other studies show no effect.

PROMETHAZINE: Phenergan, Various

Class: Phenothiazine Antihistamine

Dosage Forms. Oral Syrup: 6.25 mg/5 mL; **Oral Tablet:** 12.5 mg, 25 mg, 50 mg; **Oral Solution:** 6.25 mg/5 mL; **Rectal Suppository:** 12.5 mg, 25 mg, 50 mg



Sandoz generic 25 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Motion sickness: Adults, 25 mg po or pr bid; Children ≥2 y of age, 12.5-25 mg po or pr bid
2. Allergy: Adults, 25 mg po or pr daily hs or 12.5 mg po or pr tid; Children ≥2 y of age, 25 mg po or pr daily hs or 6.25 mg po or pr tid
3. Nausea and vomiting: Adults, 25 mg po or pr q4-6h prn; Children ≥2 y of age, 12.5 mg po or pr q4-6h prn

Off-Label Uses. None

MOA. Promethazine hydrochloride is a phenothiazine derivative that competitively blocks histamine H_1 receptors without blocking the secretion of histamine. The drug has sedative, antimotion-sickness, antiemetic, and anticholinergic effects, but it has no dopaminergic action due to a structural difference with other phenothiazines.

Drug Characteristics: Promethazine

Dose Adjustment Hepatic	Not required, but use with caution	**Absorption**	Well absorbed with high first-pass metabolism; minimal effect of food absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 171 L; 93% protein bound
Dialyzable	Unknown	**Metabolism**	Hepatic, CYP2B6 and CYP2D6 substrate
Pregnancy Category	C	**Elimination**	Renal elimination of metabolites with a half-life of 9-16 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to promethazine, asthma, children <2 y, comatose state	**Black Box Warnings**	Children <2 y (fatal respiratory depression), tissue injury (IV)

Medication Safety Issues: Promethazine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	Yes (IV only)	PredniSONE, chlorproMAZINE	Avoid. Highly anticholinergic

Drug Interactions: Promethazine

Typical Agents	Mechanism	Clinical Management
CYP2B6 inducers	Increased promethazine metabolism reduces promethazine effectiveness	Consider dose increases of promethazine
CYP2B6, CYP2D6 inhibitors	Decreased promethazine metabolism increases risk of promethazine toxicity	Consider dose decreases of promethazine
Anticholinergics	Additive anticholinergic effects	Avoid concurrent use
Agents that prolong the QT interval	Additive QT prolongation	Use with caution in combination with other agents that may prolong QTc or in congenital long QT syndrome
Barbiturates, benzodiazepines, centrally acting muscle relaxants, opioids	Additive CNS depression	Monitor and consider dose adjustments
MAOIs	Additive respiratory depression, increased risk of serotonin syndrome	Contraindicated

Adverse Reactions: Promethazine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Somnolence, xerostomia	Constipation, nausea	Respiratory depression, hypotension, neuroleptic malignant syndrome, agranulocytosis, extrapyramidal symptoms, seizures, photosensitivity

Efficacy Monitoring Parameters. Relief of nausea or allergy symptoms.
Toxicity Monitoring Parameters. Mental status, vital signs.
Key Patient Counseling Points. May cause drowsiness; avoid driving or other tasks requiring motor coordination. Avoid alcohol.
Clinical Pearls. Use caution in elderly; appear more sensitive to the anticholinergic adverse effects.

PROPRANOLOL: Inderal, Inderal LA, Inderal XL, Various

Class: β-Adrenergic Blocker, Nonselective

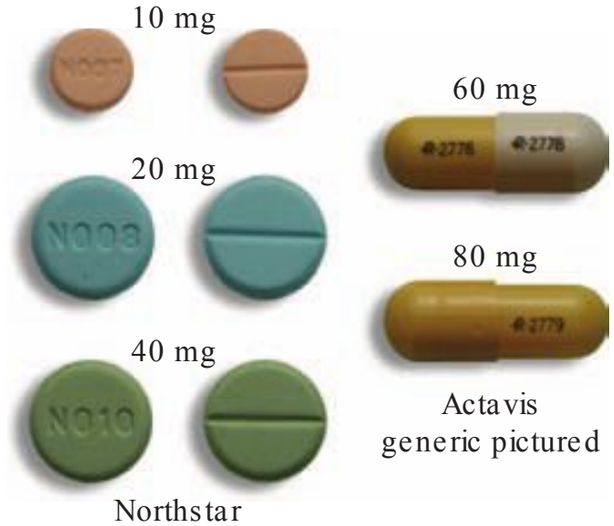
Dosage Forms. Oral Tablet: 10 mg, 20 mg, 40 mg, 60 mg, 80 mg; **Oral Capsule, Extended Release:** 60 mg, 80 mg, 120 mg, 160 mg; **Oral Solution:** 20 mg/5 mL, 40 mg/5 mL, 4.28 mg/mL

Common FDA Label Indication, Dosing, and Titration.

1. Angina pectoris, chronic: Immediate release, 80-320 mg po daily in 2-4 doses; extended release, 80-160 mg po daily
2. Cardiac dysrhythmia: Adults, 10-30 mg po tid-qid; Children, 2-6 mg/kg po in 3-4 doses, *max* 60 mg/d
3. Hypertension: Adults, immediate release, 40 mg po bid, may titrate to 240 mg po daily in 2-3 doses; Adults, extended release, 80 mg po daily, may titrate to 160 mg po daily; Children, immediate release, 0.5-1 mg/kg po daily in 3-4 doses, may titrate to 16 mg/kg/d
4. Migraine, prophylaxis: Immediate release, 80 mg po daily in divided doses, may titrate to 240 mg po daily; extended release, 80 mg po daily; may titrate to 240 mg po daily

Off-Label Uses.

1. Anxiety: 10 mg po 1 h prior to event



Northstar Rx generic pictured

Actavis generic pictured

MOA. Propranolol is a nonselective β-adrenergic blocker (class II antiarrhythmic) that competitively blocks β_1 and β_2 receptors, thereby preventing β-adrenergic stimulation. The mechanism of its antihypertensive and antimigraine effects is not completely understood.

Drug Characteristics: Propranolol

Dose Adjustment Hepatic	Titrate with caution	**Absorption**	F = 30-70%, food increases absorption
Dose Adjustment Renal	Titrate with caution	**Distribution**	Vd = 6 L/kg; 93% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, CYP1A2, CYP2D6 substrate
Pregnancy Category	C	**Elimination**	Renal elimination is 1% with a half-life of 3-4 h
Lactation	Compatible	**Pharmacogenetics**	Use with caution in CYP2D6 poor metabolizers
Contraindications	Hypersensitivity to propranolol; asthma; sinus bradycardia, AV block, sick sinus syndrome, cardiogenic shock	**Black Box Warnings**	Avoid abrupt withdrawal

Medication Safety Issues: Propranolol

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
LA, XL	No	Extended-release formulations	Yes	Adderall, Isordil, prasugrel	No

Drug Interactions: Propranolol

Typical Agents	Mechanism	Clinical Management
CYP1A2 inducers	Increased propranolol metabolism reduces propranolol effectiveness	Consider dose increases of propranolol
CYP1A2, CYP2D6 inhibitors	Decreased propranolol metabolism increases risk of propranolol toxicity	Consider dose decreases of propranolol
NSAIDs	Decreased antihypertensive effect of propranolol	Avoid concurrent use or monitor BP
Antidiabetic drugs	Decreased glycemic control	Monitor blood glucose levels
Calcium channel blockers, alpha-blockers	Increased risk of hypotension and/or bradycardia and AV block	Avoid concurrent use, or monitor BP and HR
Digoxin	Increased risk of AV block	Monitor HR, ECG, and serum digoxin concentrations

Adverse Reactions: Propranolol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Hypotension	Bradyarrhythmias, bronchospasm, constipation, dizziness, dyspnea, disorder of glucose regulation, fatigue, headache, heart block, impotence, nausea, pruritus, rash, vomiting, urticaria	Heart failure, interstitial nephritis

Efficacy Monitoring Parameters. Decreased BP, chest pain, number of angina attacks, nitroglycerin use, signs/symptoms of CHF, reduction in tremors, frequency of migraines.

Toxicity Monitoring Parameters. Signs/symptoms of CHF, decreased HR, bronchospasm, increased FPG, exacerbations of angina pectoris, or acute coronary insufficiency. Monitor HR and BP.

Key Patient Counseling Points. Take immediate-release tablets on an empty stomach; ER can be taken with or without food but consistently. Avoid alcohol. Avoid abrupt discontinuation; exacerbations of angina may occur. Report signs/symptoms of hypotension, CHF, or exacerbation of angina with initial dosing and dose changes. This medicine may cause dizziness. Diabetic patients should carefully follow blood glucose as beta-blockers may mask symptoms of hypoglycemia.

Clinical Pearls. When discontinuance of propranolol is planned, dosage should be gradually reduced. Avoid in patients with poorly controlled asthma or bronchospasm as beta-blockade may exacerbate symptoms. Consider cardioselective beta-blocker as an alternative.