ACYCLOVIR: Zovirax, Various

Class: Viral DNA Polymerase Inhibitor

Dosage Forms. Capsule: 200 mg; **Suspension:** 200 mg/5 mL; **Tablet:** 400 mg, 800 mg

Teva generic 200 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Genital herpes simplex: Adults, initial episode, 400 mg po tid or 200 mg po 5 times a day × 7-10 d; Children ≥12 y of age, 1000-1200 mg/d po in 3-5 divided doses for 7-10 d
2. Genital herpes simplex, suppressive therapy: 400 mg po bid for up to 12 mo
3. Herpes zoster, shingles: 800 mg po 5 times a day × 7-10 d
4. Varicella: Adults and Children ≥2 y of age and ≥40 kg, 800 mg po qid × 5 d; Children ≥2 y of age and <40 kg, 20 mg/kg po qid × 5 d

Off-Label Uses.

1. Genital herpes simplex in HIV-positive patients, initial or recurrent: 400 mg po tid × 5-10 d
2. Genital herpes simplex in HIV-positive patients, chronic suppression: 400-800 mg po bid-tid

MOA. Acyclovir is an acyclic nucleoside analogue of deoxyguanosine that is selectively phosphorylated by the virus-encoded thymidine kinase to its monophosphate form. Cellular enzymes then convert the monophosphate to the active antiviral acyclovir triphosphate, which competitively inhibits viral DNA synthesis by inactivation of viral DNA polymerase and incorporation into and termination of viral DNA replication. Acyclovir has potent activity against herpes simplex virus (HSV) I and II and herpes zoster virus (varicella-zoster virus [VZV]).

Drug Characteristics: Acyclovir

Dose Adjustment Hepatic	Not required	**Absorption**	F = 10-20%, food has no effect on absorption
Dose Adjustment Renal	CrCl 10-25 mL/min, increase interval to q8h; CrCl <10 mL/min, increase interval to q12h	**Distribution**	Vd = 0.8 L/kg; 9-33% protein bound Placenta, CSF, kidney, brain, lung, heart
Dialyzable	Hemodialysis removes 60% of dose. No adjustment for peritoneal (<10% removed)	**Metabolism**	Not metabolized
Pregnancy Category	B	**Elimination**	Renal elimination is 62-90% with a half-life of 2.5-3.3 h
Lactation	Compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to acyclovir or valacyclovir	**Black Box Warnings**	None

Medication Safety Issues: Acyclovir

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

Drug Interactions: Acyclovir

Typical Agents	Mechanism	Clinical Management
Phenytoin, fosphenytoin, valproic acid	Decreased absorption and lower plasma concentration of phenytoin	Monitor phenytoin levels and adjust, if necessary
Varicella virus vaccine	Decreased vaccine effectiveness via antagonism	Avoid concurrent use

Adverse Reactions: Acyclovir

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Malaise	Nausea, vomiting, headache, diarrhea	Severe hypersensitivity, renal failure, TTP

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

Toxicity Monitoring Parameters. Seek medical attention if decreased urination, unusual bruising or bleeding, blistering skin rash, shortness of breath, confusion, lethargy, or seizures.

Key Patient Counseling Points. Complete full course of therapy. Ensure adequate hydration. For HSV, initiate treatment as soon as possible at first sign of lesion. For VZV, treatment should begin within 24 h of appearance of rash. Symptoms should improve within 2-3 d; if they worsen, seek follow-up with health-care practitioner. If using for prophylaxis, this medication should reduce the number of breakouts.

Clinical Pearls. Not indicated for children <2 y of age. Use caution with concurrent nephrotoxins. Topical and parenteral products also available.

ADAPALENE: Differin, Various

Class: Retinoid, Antiacne

Dosage Forms. Cream: 0.1%; **Gel/Jelly:** 0.1%, 0.3%; **Lotion:** 0.1%

Common FDA Label Indication, Dosing, and Titration.

1. Acne vulgaris: Adults and Children >12 y of age, apply thin film topically to affected area(s) daily hs

Galderma 0.3% gel pictured

Off-Label Uses. None

MOA. Adapalene exhibits retinoic acid-like activity, reducing important features of the pathology of acne vulgaris by normalizing the differentiation of follicular epithelial cells and keratinization to prevent microcomedone formation. Adapalene enhances keratinocyte differentiation without inducing epidermal hyperplasia and severe irritation, which is associated with retinoic acid. Adapalene decreases formation of comedones, and inflammatory and noninflammatory acne lesions.

Drug Characteristics: Adapalene

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

Medication Safety Issues: Adapalene

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

Drug Interactions: Adapalene

Typical Agents	Mechanism	Clinical Management
Oral contraceptives	Decreased serum concentration of progestin	Consider 2 forms of contraception, particularly if patient is taking progesterone-only preparation

Adverse Reactions: Adapalene

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Dry skin, scaly skin, erythema, burning/stinging	Skin irritation, skin discomfort, pruritus	Angioedema

Efficacy Monitoring Parameters. Improvement in acne.

Toxicity Monitoring Parameters. Severe dry skin or severe skin irritation.

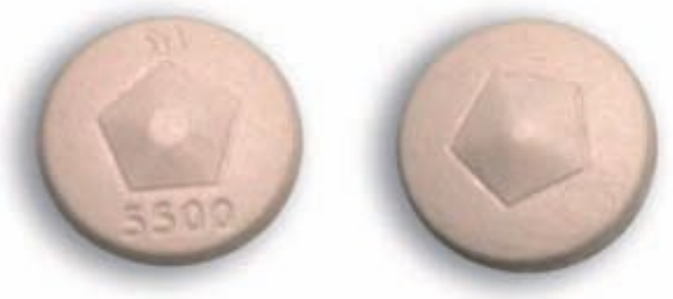
Key Patient Counseling Points. Avoid contact with eyes, lips, angles of nose, and mucous membranes; do not apply on cuts, abrasions, eczematous, or sunburned skin. Wash, then dry hands and affected area prior to application. Use of moisturizers may be necessary for relief of dry skin or irritation. Avoid products that can dry or irritate skin further. If cutaneous reactions (such as erythema, scaling, and stinging/burning) are severe, the frequency should be reduced or adapalene discontinued. Other topical preparations (sulfur, resorcinol, or salicylic acid) should not be used prior to using topical adapalene. Adapalene causes sun sensitivity. Avoid sun exposure and tanning beds. Protective clothing and application of sunscreen are recommended when sun exposure cannot be avoided. Cold temperatures or wind may also increase skin irritation during drug therapy. Symptomatic improvement may not be seen for a few months.

Clinical Pearls. Safety and efficacy have not been established in children <12 y of age.

ALBENDAZOLE: Albenza

Class: Anthelmintic

Dosage Forms. Tablet: 200 mg



GlaxoSmithKline 200 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Parenchymal neurocysticercosis caused by *Taenia solium*: Adults ≥60 kg, 400 mg po bid with meals × 8-30 d; Children <60 kg, 15 mg/kg/d (*max* 800 mg/d) in 2 divided doses × 8-30 d
2. Cystic hydatid disease of the liver, lung, and peritoneum caused by *Echinococcus granulosus*: Adults ≥60 kg, 400 mg po bid with meals × 8-30 d; Children <60 kg, 15 mg/kg/d (*max* 800 mg/d) in 2 divided doses × 8-30 d

Off-Label Uses.

1. *Ancylostoma caninum, Ascaris lumbricoides* (roundworm), *Ancylostoma duodenale* (hookworm), and *Necator americanus* (hookworm): 400 mg po as a single dose
2. *Enterobius vermicularis* (pinworm): 400 mg po as a single dose, repeat in 2 wk
3. *Giardia duodenalis* (giardiasis): 400 mg po once daily × 5 d

MOA. Selective degeneration of cytoplasmic microtubules in intestinal and tegmental cells of intestinal helminths and larvae. This leads to impaired glucose uptake in parasites and ATP production decreases leading to energy depletion and death.

Drug Characteristics: Albendazole

Dose Adjustment Hepatic	Caution with hepatic dysfunction	**Absorption**	F <5%, food enhances absorption up to 5 times
Dose Adjustment Renal	Not required	**Distribution**	Cyst, CSF
Dialyzable	Not dialyzable	**Metabolism**	Hepatic to 1 active metabolite; minor substrate of CYP3A4/5, 1A2
Pregnancy Category	C	**Elimination**	<1% renal with half-life of 8-15 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to albendazole	**Black Box Warnings**	None

Medication Safety Issues: Albendazole

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

Drug Interactions: Albendazole

Typical Agents	Mechanism	Clinical Management
Grapefruit juice	Increased oral availability of albendazole	Often administered together to enhance absorption

Adverse Reactions: Albendazole

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Headaches, elevated LFTs	Nausea, vomiting, abdominal pain, dizziness, diarrhea, alopecia	Severe hypersensitivity, renal failure, hepatic failure, aplastic anemia, agranulocytosis, Stevens-Johnson syndrome

Efficacy Monitoring Parameters. Monitor fecal specimens for ova and parasites for 3 wk after treatment; if positive, retreat. Ophthalmic examination in those with neurocysticercosis.

Toxicity Monitoring Parameters. LFTs and CBC at beginning of each 28-d cycle and every 2 wk. Negative pregnancy test prior to starting therapy.

Key Patient Counseling Points. Complete full course of therapy; administer with high-fat meals or grapefruit juice. Avoid pregnancy for at least 1 mo post-treatment. In children or those with difficulty swallowing tablets, tablets can be crushed or chewed and swallowed with water.

Clinical Pearls. Single-dose therapy makes this agent a treatment of choice for nematode infections. Neurocysticercosis: Use concurrent corticosteroids to minimize inflammatory reactions and anticonvulsant therapy to prevent seizures. Echinococcosis: More effective than mebendazole, so may be treatment of choice.

ALBUTEROL: ProAir HFA, Proventil HFA, Ventolin HFA, Various

A

Class: Selective β_2-Adrenergic Agonist

Dosage Forms. **Metered-Dose Inhaler (MDI):** 90 (base) mcg/actuation; **Tablet:** 2 mg, 4 mg; **Extended-Release Tablet:** 4 mg, 8 mg; **Syrup:** 2 mg/5 mL; **Inhalation Solution:** 0.021%, 0.042%, 0.083%

Common FDA Label Indication, Dosing, and Titration.

1. Asthma (acute exacerbation): Adults, MDI, 4-8 inhalations every 20 min up to 4 h, then every 1-4 h prn; Children, 4-8 inhalations every 20 min for 3 doses, then every 1-4 h prn (use mask for children <4 y of age)
2. Asthma (bronchospasm): Adults and Children, MDI, 2 inhalations every 4-6 h prn; Adults and Children ≥12 y of age, oral, 2-4 mg immediate-release tablet po tid or qid or 4-8 mg extended-release tablet po q12h (*max* of 32 mg/d); Children 6-11 y of age, 2 mg immediate-release tablet po tid or qid or 4 mg extended-release tablet po q12h; Children 2-6 y of age, 0.1 mg/kg oral syrup po tid
3. Exercise-induced asthma, prevention: Adults, 2 inhalations 15-30 min prior to exercise; Children ≥4 y of age, 2 inhalations 15-30 min prior to exercise

ProAir HFA by Teva pictured

Off-Label Uses.

COPD: 2 inhalations every 4-6 h prn

MOA. Albuterol is a selective β_2-adrenergic agonist that acts on β_2-adrenergic receptors of intracellular adenyl cyclase to increase cyclic AMP levels resulting in bronchial smooth muscle relaxation.

Drug Characteristics: Albuterol

Dose Adjustment Hepatic	Not required	**Absorption**	F = 50-85% (oral tablet), 100% (extended-release tablet), food decreases rate (but not extent) of absorption of extended-release tablet
Dose Adjustment Renal	Not required	**Distribution**	Vd = 156 L; 10% protein bound
Dialyzable	Unknown	**Metabolism**	20% via sulfotransferases
Pregnancy Category	C	**Elimination**	80% renal elimination, half-life (inhalation) 3.8 h, (oral) 3.7-5 h
Lactation	Compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Albuterol

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Do not crush extended-release tablets	No	Albutein, atenolol, Prilosec, Prinivil, Vantin	No

Drug Interactions: Albuterol

Typical Agents	Mechanism	Clinical Management
Other short-acting sympathomimetics	May potentiate albuterol effect and increase risk of cardiovascular adverse effects	Avoid concurrent use
Beta-blockers (nonselective)	May decrease effectiveness of albuterol and produce bronchospasms	Avoid nonselective beta-blockers; monitor PFT if cardioselective beta-blockers used
Diuretics (non-potassium sparing)	May potentiate hypokalemia	Monitor potassium levels
Digoxin	May decrease digoxin levels	Monitor digoxin levels
MAOI and tricyclic antidepressants	May potentiate albuterol effect on cardiovascular system	Consider alternative therapy

Adverse Reactions: Albuterol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Nausea, pharyngitis, rhinitis, throat irritation, upper respiratory tract infections	Angina, tachycardia, hypokalemia, tremor, nervousness, insomnia, cough, headache, viral lower respiratory infection	Paradoxical bronchospasms, pulmonary edema, atrial fibrillation

Efficacy Monitoring Parameters. Resolution of asthma symptoms and PFTs.

Toxicity Monitoring Parameters. Use alternative therapy or seek emergency treatment if paradoxical bronchospasm occurs.

Key Patient Counseling Points. Instruct patient on inhaler technique, including priming and shaking well before using. Wash the mouthpiece and air dry thoroughly at least once a week (may cease to deliver medication if mouthpiece becomes blocked). Part of the extended-release tablet may pass into stool. Contact prescriber if more albuterol is needed to control symptoms than usual as this may indicate asthma deterioration. Report need to increase frequency of use for symptomatic relief to physician. Do not use more frequently than recommended.

Clinical Pearls. The National Heart, Lung, and Blood Institute asthma guidelines recommend short-acting beta-agonists (SABA) as the drug of choice for treating acute asthma symptoms and exacerbations. Do not use SABA as a component of chronic therapy without an anti-inflammatory agent. Solution for nebulization also available. MDI can be used with spacer if need be for proper administration. Some MDIs have a dose counter to help patient keep track of doses.

ALENDRONATE: Fosamax, Binosto, Various

Class: Bisphosphonate

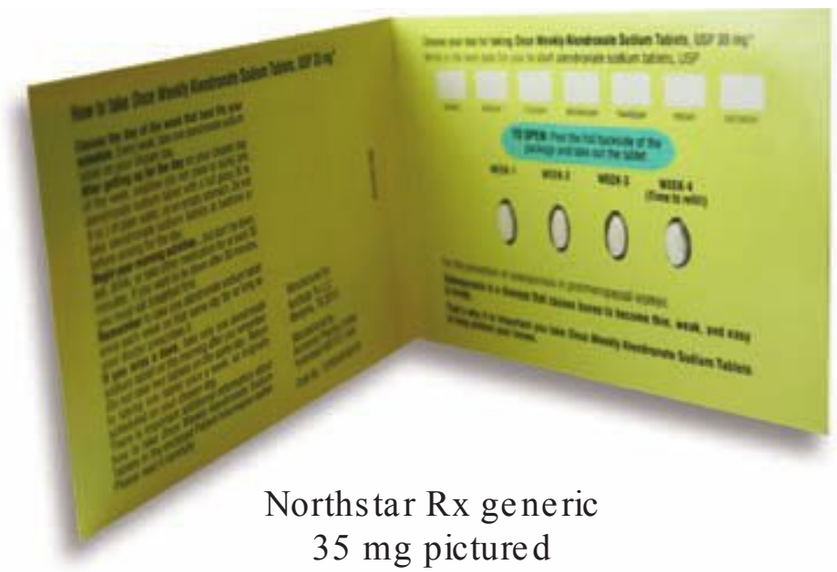
Dosage Forms. Tablet: 5 mg, 10 mg, 35 mg, 40 mg, 70 mg; **Solution:** 70 mg/75 mL; **Effervescent Tablet:** 70 mg

Common FDA Label Indication, Dosing, and Titration.

1. Postmenopausal osteoporosis: 70 mg po once weekly or 10 mg po daily
2. Postmenopausal osteoporosis, prophylaxis: 5 mg po daily or 35 mg po once weekly
3. Paget disease: 40 mg po daily for 6 mo
4. Osteoporosis, male: 10 mg once daily or 70 mg once weekly
5. Glucocorticoid-induced osteoporosis in those with daily dosage ≥7.5 mg of prednisone (or equivalent): 5 mg once daily; a dose of 10 mg once daily should be used in postmenopausal females who are not receiving estrogen

Off-Label Uses.

1. Postoperative knee arthroplasty: 10 mg once daily beginning after knee arthroplasty for up to 1 y



Northstar Rx generic
35 mg pictured

MOA. Alendronate binds to bone hydroxyapatite, and at the cellular level, inhibits osteoclast activity, thereby inhibiting bone resorption and modulating bone metabolism.

Drug Characteristics: Alendronate

Dose Adjustment Hepatic	Not required	**Absorption**	F <1%, food impairs absorption, take 30-60 min prior to meal
Dose Adjustment Renal	CrCl <35 mL/min: avoid use	**Distribution**	Vd = 2576 L; 78% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Not metabolized
Pregnancy Category	C	**Elimination**	Renal elimination is 50% with a half-life in bone of more than 10 y
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Esophageal abnormalities, hypersensitivity, hypocalcemia, inability to sit or stand upright for at least 30 min; increased risk for adverse esophageal effects	**Black Box Warnings**	None

Medication Safety Issues: Alendronate

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
Fosamax Plus D	No	No	No	Risedronate, Flomax, Zithromax, fosinopril	No

Drug Interactions: Alendronate

Typical Agents	Mechanism	Clinical Management
Aluminum, calcium, magnesium, or iron-containing products	Decreased bisphosphonate absorption	Separate administration by at least 30 min after alendronate, ideally 1-2 h

Adverse Reactions: Alendronate

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Fever, flu-like syndrome, gastric ulcer	Myalgia, bone pain, esophageal ulcer, abdominal pain, constipation, diarrhea, flatulence, indigestion, headache	Osteonecrosis of the jaw, esophageal cancer, immune hypersensitivity, arrhythmia, fractures

Efficacy Monitoring Parameters. Increased BMD (T-score), decreased incidence of bone fractures.

Toxicity Monitoring Parameters. Baseline serum creatinine, calcium, phosphorous, severe skin rash, difficulty swallowing, swelling, tooth problems, severe pain.

Key Patient Counseling Points. Swallow the noneffervescent tablet whole with a large glass (240 mL) of plain water only. Dissolve 1 effervescent tablet in 120 mL of room temperature plain water only (not mineral water or flavored water); once effervescence stops, wait ≥5 min and stir the solution for ~10 s and then drink. Wait at least 30 min after you swallow the tablet before you eat or drink anything or take any other medicines. This will help your body absorb the medicine. Do not lie down for at least 30 min after taking this medicine, and do not lie down until after you have eaten some food.

Clinical Pearls. Concurrent chemotherapy and poor oral hygiene increase the risk of osteonecrosis of the jaw. Atypical fractures of the thigh have been reported in patients taking bisphosphonates for osteoporosis; discontinue therapy in patients who develop evidence of a femoral shaft fracture. Adequate calcium and vitamin intake required for efficacy. Men >70 y of age and women >50 y of age should consume 1200 mg of elemental calcium from all sources (dietary + supplements) and all adults >50 y of age should consume 800-1000 units of vitamin D daily with a target serum level of >30 ng/mL.

ALLOPURINOL: Zyloprim, Various

A

Class: Xanthine Oxidase Inhibitor; Antigout

Dosage Forms. Tablet: 100 mg, 300 mg

Northstar Rx generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Gout, mild: 100-300 mg po daily; *max* dose 800 mg/d
2. Gout, moderate to severe: 400-600 mg po daily in 2-3 divided doses, *max* dose 800 mg/d
3. Hyperuricemia, tumor lysis syndrome: Children <6 y, 50 mg po tid or 150 mg po daily for 2-3 d; Children 6-10 y, 100 mg po tid or 300 mg po daily for 2-3 d; Adults, 600-800 mg/d po daily in 2-3 divided doses for 2-3 d; starting 12 h-3 d prior to chemotherapy

Off-Label Uses.

1. Malaria: 12 mg/kg/d po in 3 divided doses × 5 d, with quinine

MOA. Allopurinol decreases the production of uric acid by inhibiting the action of xanthine oxidase, the enzyme that converts hypoxanthine to xanthine and xanthine to uric acid.

Drug Characteristics: Allopurinol

Dose Adjustment Hepatic	Not required	**Absorption**	F = 80-90%, no effect of food on absorption
Dose Adjustment Renal	CrCl 10-20 mL/min, 200 mg po daily; CrCl 3-9 mL/min, 100 mg po daily, CrCl <3 mL/min, 100 mg at extended intervals (>24 h)	**Distribution**	Vd = 1.6-2.43 L/kg; <1% protein bound
Dialyzable	Yes, supplementation may be needed after dialysis	**Metabolism**	Metabolized in the liver (78%) and red blood cells
Pregnancy Category	C	**Elimination**	Renal elimination is 80% with a half-life of 2 h, active metabolite (oxypurinol) has half-life of 15-25 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to allopurinol, concurrent use of didanosine	**Black Box Warnings**	None

Medication Safety Issues: Allopurinol

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

Drug Interactions: Allopurinol

Typical Agents	Mechanism	Clinical Management
Didanosine	Increased didanosine bioavailability	Avoid concurrent use
Azathioprine	Xanthine oxidase needed to eliminate azathioprine metabolite, mercaptopurine; when xanthine oxidase is inhibited by allopurinol, increases azathioprine effect and toxicity	Reduce azathioprine dose by 1/3 or avoid concurrent use
Cyclophosphamide	Unknown; increased cyclophosphamide toxicity (bone marrow suppression)	Avoid concurrent use

Adverse Reactions: Allopurinol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Rash, maculopapular eruption, acute attacks of gout with initiation	Stevens-Johnson syndrome, toxic epidermal necrolysis, agranulocytosis, aplastic anemia, thrombocytopenia, granulomatous hepatitis, hepatotoxicity, immune hypersensitivity reaction, renal failure

Efficacy Monitoring Parameters. Resolution of clinical signs of gout (pain, stiffness), serum uric acid concentrations measured after 48 h of therapy.

Toxicity Monitoring Parameters. LFTs, renal function, CBC.

Key Patient Counseling Points. Take after meals to lessen gastric irritation. Maintain adequate hydration during therapy to prevent kidney stones. Patient should avoid alcohol or caffeine while taking allopurinol. Seek medical attention if signs and symptoms of myelosuppression, agranulocytosis (severe neutropenia), or Stevens-Johnson syndrome (flu-like symptoms, spreading red rash, or skin/mucous membrane blistering) occur.

Clinical Pearls. Allopurinol for injection is also available, and has been designated an orphan product for use in the treatment of elevated serum or urinary uric acid levels secondary to lymphomas, leukemias, or solid tumors in patients intolerant of oral therapy. Full effect of allopurinol in chronic gout may take 2-6 wk, slow dose titration recommended.

ALPRAZOLAM: Xanax, Various

Class: Benzodiazepine, Short or Intermediate. C-IV

Dosage Forms. Tablet: 0.25 mg, 0.5 mg, 1 mg, 2 mg; **Tablet, Disintegrating:** 0.25 mg, 0.5 mg, 1 mg, 2 mg; **Tablet, Extended Release:** 0.5 mg, 1 mg, 2 mg, 3 mg; **Solution:** 1 mg/mL

Sandoz generic
1 mg pictured

Sandoz generic
2 mg pictured

Dava generic
0.5 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Anxiety: immediate-release or orally disintegrating tablet, 0.25-0.5 mg po tid; *max* daily dose, 4 mg in divided doses
2. Panic disorder, with or without agoraphobia: immediate-release or orally disintegrating tablets, 0.5 mg po tid, extended-release 3-6 mg po daily; dose may be increased every 3-4 d by <1 mg/d

Off-Label Uses.

1. Alcohol withdrawal syndrome: 0.5-1 mg po bid × 7-10 d

MOA. Enhances the postsynaptic effect of the inhibitory neurotransmitter, γ-aminobutyric acid (GABA).

Drug Characteristics: Alprazolam

Dose Adjustment Hepatic	Reduce initial dose to 0.25 mg in advanced liver disease	**Absorption**	F = 80%, no effect of food on absorption of immediate release, food increases absorption of ER by 25%
Dose Adjustment Renal	Not required	**Distribution**	Vd = 0.9-1.2 L/kg, 80% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, 20-30%; major substrate of CYP3A4/5
Pregnancy Category	D	**Elimination**	Renal 80% with a half-life of 10-12 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to benzodiazepines, narrow-angle glaucoma, concurrent ketoconazole, or itraconazole	**Black Box Warnings**	None

Medication Safety Issues: Alprazolam

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	ALPRAZolam	ALPRAZolam ER	No	Zantac, LORazepam, Xopenex	Avoid benzodiazepines (any type) for treatment of insomnia, agitation, or delirium

Drug Interactions: Alprazolam

Typical Agents	Mechanism	Clinical Management
Alfentanil, opioids, and other respiratory depressants	Additive respiratory depression	Avoid if possible and consider dose reductions of both agents
CYP3A4/5 inducers	Increased alprazolam metabolism reduces alprazolam effectiveness	Monitor and consider dose increases of alprazolam
CYP3A4/5 inhibitors	Decreased alprazolam metabolism increases risk of alprazolam toxicity	Monitor and consider dose decreases of alprazolam
Digoxin	Reduced renal clearance of digoxin and increased digoxin toxicity	Monitor digoxin levels and consider dose reductions
Ethinyl estradiol and other estrogen-based birth control products	Inhibition of alprazolam metabolism and additional toxicity	Use with caution

Adverse Reactions: Alprazolam

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Ataxia, lethargy, retrograde amnesia, somnolence, weight gain, change in appetite, constipation, fatigue, cognitive dysfunction, decreased libido	Tachycardia, palpitations, nausea and vomiting, blurred vision, confusion	Seizures, mania, depression, liver failure, Stevens-Johnson syndrome

Efficacy Monitoring Parameters. Reduction in anxiety symptoms.

Toxicity Monitoring Parameters. Seek medical attention if severe drowsiness, slow or rapid heartbeat or skipped beats, thoughts of suicide.

Key Patient Counseling Points. May cause drowsiness; avoid driving or other tasks requiring motor coordination. Do not crush or break extended-release product. Oral disintegrating tablet may be divided, but are unstable after breaking. If only 1/2 tablet taken, discard the other half. Allow oral disintegrating tablet to dissolve on your tongue. Avoid alcohol. Do not self-increase or abruptly discontinue use.

Clinical Pearls. Not for use in children. Consider reduced dose of benzodiazepines in hepatic impairment. Avoid use in elderly, appear more sensitive to the effects. Use CNS depressants concurrently with caution, may have additive effects. Avoid abrupt discontinuation after chronic use, may cause seizures. In general, should only be used for short periods of time, reevaluate need frequently.

AMITRIPTYLINE: Elavil, Various

Sandoz generic pictured

Class: Tricyclic Antidepressant

Dosage Forms. Tablet: 10 mg, 25 mg, 50 mg, 75 mg, 100 mg, 150 mg

Common FDA Label Indication, Dosing, and Titration.

1. Depression: Adults, 75 mg po divided into 1-3 daily doses, titrate to *max* 300 mg/d; Children ≥12 y of age, 10 mg po tid or 20 mg po daily hs

Off-Label Uses.

1. Migraine prophylaxis: 10-25 mg po daily hs; titrate to *max* 150 mg/d
2. Chronic pain: 25-100 mg po daily hs; titrate to *max* 150 mg/d
3. Polyneuropathy, postherpetic neuralgia, treatment and prophylaxis: 10-25 mg po daily hs; may titrate to *max* 200 mg/d
4. Post-traumatic stress disorder (PTSD): 50 mg po daily; titrate to *max* 300 mg/d

MOA. Amitriptyline is a tricyclic antidepressant that blocks presynaptic reuptake of serotonin and norepinephrine with subsequent down-regulation of adrenergic receptors.

Drug Characteristics: Amitriptyline

Dose Adjustment Hepatic	Start with low initial doses and increase as needed and tolerated	**Absorption**	F = 100%; no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd is highly variable
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic; minor substrate of CYP1A2, 2B6, 2C9, 2C19, and 3A4/5; major substrate of CYP2D6
Pregnancy Category	C	**Elimination**	Renal elimination is minimal with a half-life of 9-27 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity; concurrent MAOI or MAOI use in last 14 d; use during acute recovery period after MI	**Black Box Warnings**	Suicidality; not approved for children <12 y of age

Medication Safety Issues: Amitriptyline

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Enalapril, imipramine, nortriptyline	Avoid. Highly anticholinergic, sedating, and cause orthostatic hypotension

Drug Interactions: Amitriptyline

Typical Agents	Mechanism	Clinical Management
Anticholinergics	Additive adverse effects	Avoid concurrent use or monitor carefully
Antiarrhythmics, and drugs that cause QT prolongation	Increased risk of cardiotoxicity (QT prolongation, torsades de pointes, cardiac arrest)	Avoid concurrent use
CYP2D6 inducers	Increased amitriptyline metabolism reduces amitriptyline effectiveness	Monitor and consider dose increases of amitriptyline
CYP2D6 inhibitors	Decreased amitriptyline metabolism increases risk of amitriptyline toxicity	Monitor and consider dose decreases of amitriptyline
Linezolid, MAOIs, methylene blue, SSRIs	Increased risk of serotonin syndrome	Concomitant use with MAOIs contraindicated, others with caution

Adverse Reactions: Amitriptyline

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

Efficacy Monitoring Parameters. Improvement in target symptoms of depression. Reduction or improvement in pain or decreased frequency of migraines.

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 ECGs and LFTs.

Key Patient Counseling Points. Avoid activities requiring mental alertness, alcohol, and other CNS depressants. Symptomatic improvement may not be seen for a few weeks. Avoid sudden discontinuation of drug. Do not use alcohol.

Clinical Pearls. Safety and effectiveness in children <12 y of age have not been established. Antidepressants increased the risk of suicidal thinking and behavior in children, adolescents, and young adults in short-term studies with major depressive disorder (MDD) and other psychiatric disorders. This drug can cause anticholinergic side effects.

AMLODIPINE: Norvasc, Various

Class: Calcium Channel Blocker

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

Zygenerics generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Hypertension: Children 6-17 y of age , 2.5-5 mg po daily; Adults, 5-10 mg po daily
2. Stable angina: 5-10 mg po daily
3. Variant angina: 5-10 mg po daily

Off-Label Uses.

1. Diabetic nephropathy: 5-15 mg po daily
2. Left ventricular hypertrophy: 5-10 mg po daily
3. Raynaud phenomenon: 10 mg po daily

MOA. Amlodipine is a long-acting dihydropyridine calcium-channel-blocking drug with potent arterial and coronary vasodilating properties.

Drug Characteristics: Amlodipine

Dose Adjustment Hepatic	Reduce initial dose to 2.5 mg po daily in hepatic impairment	**Absorption**	F = 64-90%; no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 21 L/kg; 93% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, 90%; major substrate of CYP3A4/5
Pregnancy Category	C	**Elimination**	Renal elimination is 10% with a half-life of 30-50 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to amlodipine	**Black Box Warnings**	None

Medication Safety Issues: Amlodipine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	AmLODIPine	No	No	aMILoride Navane, Norvir, Vascor	No

Drug Interactions: Amlodipine

Typical Agents	Mechanism	Clinical Management
Beta-blockers	Increased risk of hypotension, bradycardia	Avoid concurrent use or monitor BP and HR
Clopidogrel	Decreased antiplatelet activity of clopidogrel by amlodipine	Avoid concurrent use
CYP3A4/5 inducers	Increased amlodipine metabolism reduces amlodipine effectiveness	Monitor and consider dose increases of amlodipine
CYP3A4/5 inhibitors	Decreased amlodipine metabolism increases risk of amlodipine toxicity	Monitor and consider dose decreases of amlodipine
NSAIDs	Decreased antihypertensive effect of amlodipine	Avoid concurrent use or monitor BP

Adverse Reactions: Amlodipine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Peripheral edema, pulmonary edema	Abdominal pain, arthralgia, constipation, dizziness, fatigue, f ushing, headache, hypotension, hyperkalemia, impotence, myalgia, nausea, palpitations, pruritus, rash, tachycardia, urticaria	Hepatotoxicity, thrombocytopenia, AMI, angina

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 peripheral edema, increased HR, LFTs.

Key Patient Counseling Points. Instruct patient to report signs/symptoms of hypotension or exacerbation of angina with initial dosing and dose changes. Avoid alcohol while taking drug. Report signs/symptoms of peripheral edema, fatigue, hypotension, or hepatic dysfunction. Do not discontinue drug suddenly as this may cause rebound hypertension. This medicine may cause dizziness. Avoid activities that could be dangerous if not alert. Dizziness may be worse if too much water is lost from the body due to excessive sweating, diarrhea, or vomiting.

Clinical Pearls. Safety and efficacy not established in pediatric patients <6 y of age. Elderly, small, or frail patients, or when adding to other antihypertensive therapy, decrease initial dose by 2.5 mg po daily.

AMOXICILLIN: Amoxil, Various

Class: β-Lactam Antibiotic

Dosage Forms. Capsule: 250 mg, 500 mg; **Chewable Tablet:** 125 mg, 200 mg, 250 mg, 400 mg; **Drop:** 50 mg/mL; **Suspension:** 125 mg/5 mL, 200 mg/5 mL; 250 mg/5 mL, 400 mg/5 mL; **Tablet:** 500 mg, 875 mg; **Tablet, Extended Release:** 775 mg

Sandoz generic 250 mg pictured

Teva generic 250 mg pictured

Aurobindo generic 875 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Acute otitis media: Adults, 500-875 mg po q12h × 10 d; Children, 80-90 mg/kg/d po in 2-3 divided doses
2. Lower respiratory tract infection: Adults, 1 g po tid × 10 d; Children, 45 mg/kg/d divided q12h
3. Pharyngitis, tonsillitis: Adults and Children >12 y, 775 mg po daily × 10 d
4. Streptococcal pharyngitis: Adults, 1 g po daily × 10 d; Children, 50 mg/kg po once daily for 10 d, *max* 1 g daily
5. Ear, nose, and throat infection, infection of skin and/or subcutaneous tissue, infection of genitourinary system: Adults, 500-875 mg po q12h × 10 d; Children, 25-45 mg/kg/d po divided q12h
6. *Helicobacter pylori* gastrointestinal tract infection: 1 g po bid with PPI

Off-Label Uses.

1. Bacterial endocarditis, prophylaxis: Adults, 2 g po 1 h before procedure; Children, 50 mg/kg po 1 h prior to procedure, *max* 2 g daily
2. Lyme disease: 500 mg po tid × 21-30 d; Children: 50 mg/kg/d po in 3 divided doses × 21-30 d

MOA. Semisynthetic penicillin derivative that inhibits the biosynthesis of bacterial cell wall mucopeptide. Typically active against *Streptococcus*, *Enterococcus, Staphylococcus*, and Enterobacteriaceae.

Drug Characteristics: Amoxicillin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 85%, no effect of food on absorption
Dose Adjustment Renal	Moderate, increase interval to 8-12 h; severe, increase interval to q24h	**Distribution**	17-20% protein bound. Lung, pleural f uid, bile, liver, and inner ear
Dialyzable	Yes (hemodialysis only)	**Metabolism**	Partially hepatic
Pregnancy Category	B	**Elimination**	Renal elimination is 50-70% with a half-life of 1-2 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Amoxicillin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Extended-release tablet	No	Amoxapine, Augmentin	No

Drug Interactions: Amoxicillin

Typical Agents	Mechanism	Clinical Management
Methotrexate	Decreased methotrexate clearance	Avoid concurrent use or consider methotrexate dose reduction or monitoring levels
Venlafaxine	Increased risk of serotonin syndrome	Avoid concurrent use
Warfarin	Increased risk of bleeding	Increase warfarin monitoring

Adverse Reactions: Amoxicillin

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

Efficacy Monitoring Parameters. Resolution of clinical signs of infection.

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

Key Patient Counseling Points. Complete full course of therapy and take exactly as directed. For the suspension, shake well and store in the refrigerator. Note short expiration after reconstitution. Can take with food if causes upset stomach. Avoid mixing suspension with food or beverages and use with measuring device that comes with prescription. Symptoms should improve within 2-3 d; if they worsen, seek follow-up with health-care practitioner.

Clinical Pearls. There is cross-hypersensitivity between penicillin and cephalosporins; use with caution in cephalosporin allergic. May resume normal activities after 24 h of antibiotics if afebrile. Extended-release tablet not approved for children <12 y of age. Combination with clavulanate preferred for acute bacterial rhinosinusitis. May decrease effectiveness of oral contraceptives.

AMOXICILLIN/CLAVULANATE: Augmentin, Various

Class: β-Lactam Antibiotic

875 mg/125 mg 500 mg/125 mg

Teva generic pictured

Dosage Forms. Tablet: 250 mg amoxicillin/125 mg clavulanate, 500 mg amoxicillin/125 mg clavulanate; 875 mg amoxicillin/125 mg clavulanate; **Tablet, Extended Release:** 1000 mg amoxicillin/62.5 mg clavulanate; **Chewable Tablet:** 200 mg amoxicillin/28.5 mg clavulanate, 400 mg amoxicillin/57 mg clavulanate; **Suspension:** 125 mg amoxicillin/31.25 mg clavulanate/5 mL, 200 mg amoxicillin/28.5 mg clavulanate/5 mL, 250 mg amoxicillin/62.5 mg clavulanate/5 mL; 400 mg amoxicillin/57 mg clavulanate/5 mL, 600 mg amoxicillin/42.9 mg clavulanate/5 mL

Common FDA Label Indication, Dosing, and Titration.

1. Acute otitis media: Adults, 500-875 mg po q12h × 10 d; Children, 80-90 mg/kg/d po in 2-3 divided doses
2. Community acquired pneumonia: Adults, 2000 mg po bid × 7-10 d
3. Lower respiratory tract infection: Adults, 1000 mg po tid × 10 d; Children, 45 mg/kg/d po divided q12h
4. Sinusitis, infection of skin or subcutaneous tissue, infectious disease of genitourinary system: Adults, 500-875 mg po q12h × 10 d; Children, 25-45 mg/kg/d po divided q12h

Other Uses.

1. Streptococcal pharyngitis: Adults, 875 mg po q12h or 500 mg po q8h; Children, 45 mg/kg/d divided q12h

MOA. Amoxicillin is a semisynthetic penicillin derivative. Typically active against *Streptococcus, Enterococcus, Staphylococcus*, and Enterobacteriaceae. Amoxicillin is not effective against β-lactamase–producing bacteria. Clavulanate, a β-lactamase inhibitor, has weak antibacterial activity but is a potent inhibitor of plasmid-mediated β-lactamases and protects amoxicillin from degradation by β-lactamases.

Drug Characteristics: Amoxicillin/Clavulanate

Dose Adjustment Hepatic	Consider dose adjustment in severe impairment	**Absorption**	F = 85%, no effect of food on absorption
Dose Adjustment Renal	CrCl 10-30 mL/min, increase interval to q12h; CrCl <10 mL/min, increase interval to q24h; avoid 875 mg tablet and extended-release tablet for those on hemodialysis or CrCl <30 mL/min	**Distribution**	17-20% protein bound. Lung, pleural f uid, bile, liver, and inner ear
Dialyzable	Yes (peritoneal and hemodialysis)	**Metabolism**	Amoxicillin not metabolized, extensive metabolism of clavulanic acid
Pregnancy Category	B	**Elimination**	Renal elimination of amoxicillin is 50-70% with a half-life of 1-2 h
Lactation	Compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to penicillins, extended-release products are contraindicated in patients on dialysis or severe renal dysfunction	**Black Box Warnings**	None

Medication Safety Issues: Amoxicillin/Clavulanate

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
Augmentin XR, ES 600	No	Extended-release tablet	No	Amoxicillin	No

Drug Interactions: Amoxicillin/Clavulanate

Typical Agents	Mechanism	Clinical Management
Methotrexate	Decreased methotrexate clearance	Avoid concurrent use or consider methotrexate dose reduction or monitoring levels
Venlafaxine	Increased risk or serotonin syndrome	Avoid concurrent use
Warfarin	Increased risk of bleeding	Increase warfarin monitoring

Adverse Reactions: Amoxicillin/Clavulanate

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Nausea, diarrhea	Skin rash, vomiting, mycosis, candidiasis	Severe hypersensitivity, renal failure, hepatic failure, pancytopenia

Efficacy Monitoring Parameters. Resolution of clinical signs of infection.

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

Key Patient Counseling Points. Complete full course of therapy. Take dose with food to ensure proper absorption. For the suspension, shake well and store in the refrigerator. Note short expiration after reconstitution of 10 d. Avoid mixing suspension with food or beverages. Symptoms should improve within 2-3 d; if they worsen, seek follow-up with health-care practitioner.

Clinical Pearls. There is cross-hypersensitivity between penicillin and cephalosporin; use with caution in cephalosporin-allergic patients. Incidence of diarrhea is higher than with amoxicillin alone. May decrease effectiveness of oral contraceptives.

ANASTROZOLE: Arimidex, Various

Class: Aromatase Inhibitor

Dosage Forms. Tablet: 1 mg

Astra Zeneca 1 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Breast cancer, adjuvant, postmenopausal, hormone receptor-positive: 1 mg po daily × 5 y
2. Breast cancer, advanced or metastatic, postmenopausal, following tamoxifen therapy: 1 mg po daily, until tumor progression

Off-Label Uses.

1. Breast cancer, neoadjuvant, postmenopausal, hormone receptor-positive: 1 mg po daily for 3-6 mo
2. Breast cancer, prophylaxis, postmenopausal women at high risk: 1 mg po daily × 5 y

MOA. Adrenally generated androstenedione is the primary source of estrogen in postmenopausal women and is converted to estrone by aromatase. Anastrozole is a nonsteroidal aromatase inhibitor.

Drug Characteristics: Anastrozole

Dose Adjustment Hepatic	Severe, use with caution	**Absorption**	F = 80%, minimal food effect
Dose Adjustment Renal	Not required	**Distribution**	Vd = 300-500 L; 40% protein bound
Dialyzable	Unknown	**Metabolism**	85% metabolism but not by CYP
Pregnancy Category	X	**Elimination**	Renal elimination is 10% with a half-life of 50 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity and pregnancy	**Black Box Warnings**	None

Medication Safety Issues: Anastrozole

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

Drug Interactions: Anastrozole

Typical Agents	Mechanism	Clinical Management
Tamoxifen	Reduced anastrozole levels	Avoid concurrent use

Adverse Reactions: Anastrozole

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Edema, hypertension, vasodilation, nausea, vomiting, arthralgia, arthritis, osteoporosis, hot f ashes, depression, GI tract disorder	Angina, chest pain, thrombophlebitis, alopecia, pruritus, rash, weight gain, hyperlipidemia, xerostomia, elevated LFTs, thromboembolic events, ischemic cardiovascular disease, diarrhea, elevated serum cholesterol	Myocardial infarction, endometrial cancer, cerebrovascular accident

Efficacy Monitoring Parameters. Decrease in tumor size if used in metastatic or neoadjuvant setting. Absence of tumor recurrence if used in adjuvant setting.

Toxicity Monitoring Parameters. BP, cholesterol panel, BMD panel (serum albumin, calcium and alkaline phosphatase, and phosphate and osteocalcin measurements), dual-energy x-ray absorptiometry for monitoring osteoporosis.

Key Patient Counseling Points. Seek medical attention if shortness of breath, swelling, chest pain, vaginal bleeding, blistering rash, rapid weight gain, severe nausea and vomiting, yellowing of the eyes or skin. Take with or without food. Because anastrozole lowers level of estrogen, can lead to loss of BMD and increase risk of fractures.

Clinical Pearls. As effective as tamoxifen in treating metastatic breast cancer, but decreased incidence of adverse effects (thromboembolic events and endometrial cancer). Not indicated in premenopausal women.

ARIPIPRAZOLE: Abilify

Class: Antipsychotic

Dosage Forms. Tablet: 2 mg, 5 mg, 10 mg, 15 mg, 20 mg, 30 mg; **Tablet (Disintegrating):** 10 mg, 15 mg; **Solution:** 1 mg/mL

Common FDA Label Indication, Dosing, and Titration.

1. Bipolar disorder, manic or mixed episodes: Adults, 2 mg po daily, may titrate to 15-30 mg po daily; Children >10 y, 2 mg po daily, may titrate to 10 mg po daily
2. Schizophrenia: Adults, 10-15 mg po daily, may titrate to *max* 30 mg/d; Children >13 y, 2 mg po daily, may titrate to 10 mg po daily
3. Depression, adjunctive with antidepressant: 2-4 mg po daily, may titrate to 15 mg po daily

Bristol-Myers Squibb 15 mg pictured

Off-Label Uses. None

MOA. Aripiprazole is an atypical antipsychotic agent (quinolinone derivative). It exhibits relatively high affinity for dopamine D_2 and D_3 receptors and serotonin 5-HT_{1A} and 5-HT_{2A} receptors.

Drug Characteristics: Aripiprazole

Dose Adjustment Hepatic	Not required	**Absorption**	F = 87%; no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 4.9 L/kg; >99% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, 80%; major substrate of CYP2D6 and 3A4/5
Pregnancy Category	C	**Elimination**	Renal elimination is 10-20% with a half-life of 75-94 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	CYP2D6 poor metabolizers should receive 50% lower dose
Contraindications	Hypersensitivity	**Black Box Warnings**	Dementia, suicidality

Medication Safety Issues: Aripiprazole

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	ARIPiprazole	No	No	Omeprazole, pantoprazole, RABEprazole	Avoid use for behavioral problems of dementia unless nonpharmacologic options have failed and patient is threat to self or others

Drug Interactions: Aripiprazole

Typical Agents	Mechanism	Clinical Management
CYP3A4/5 inducers	Increased aripiprazole metabolism reduces aripiprazole effectiveness	Use with caution; monitor efficacy. Consider aripiprazole dose increase of 50%
CYP3A4/5, 2D6 inhibitors	Decreased aripiprazole metabolism increases risk of aripiprazole toxicity	Initiate aripiprazole at 50% lower doses; monitor for side effects

Adverse Reactions: Aripiprazole

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Akathisia, anxiety, extrapyramidal disease, headache, increased appetite, somnolence, weight gain	Blurred vision, constipation, diarrhea, dizziness, excessive salivation, fatigue, hyperglycemia, insomnia, nausea, orthostatic hypotension, rash, restlessness, somnolence, tremor, vomiting, xerostomia	Neuroleptic malignant syndrome, pancytopenia, QT prolongation, seizures, suicidal thoughts, tardive dyskinesia

Efficacy Monitoring Parameters. Improvement in mental status (schizophrenia, mania, depression symptoms).

Toxicity Monitoring Parameters. FPG and CBC prior to treatment and periodically in patients with risk factors for diabetes. Patients at high risk for suicide should be closely supervised during therapy. Monitor ECG at baseline and periodically during therapy.

Key Patient Counseling Points. Avoid activities requiring mental alertness or coordination until drug effects are realized. Drug may impair heat regulation. Drug may also lower seizure threshold. Patients with history of seizures or conditions that lower seizure threshold should report increased seizure activity. Report worsening depression, suicidal ideation, or unusual changes in behavior, especially at initiation of therapy or with dose changes. Children, adolescents, and young adults are at higher risk for these effects during the first few months of therapy. Report signs/symptoms of hyperglycemia, extrapyramidal effects, and neuroleptic malignant syndrome. Avoid sudden discontinuation. Avoid alcohol.

Clinical Pearls. Solution may be substituted for the tablet dosages on an mg-per-mg basis for up to a 25-mg dose; patients on 30-mg tablets should receive 25 mg of the solution. Elderly patients with dementia-related psychosis treated with antipsychotic drugs are at an increased risk of death. Injectable formulation also available.

ATAZANAVIR: Reyataz

Class: Antiretroviral Agent, Protease Inhibitor

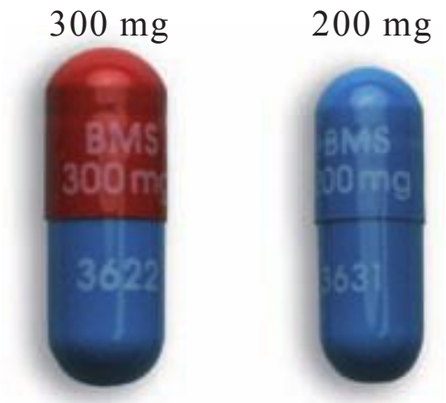
Dosage Forms. Capsule: 150 mg, 200 mg, 300 mg

Common FDA Label Indication, Dosing, and Titration.

1. Treatment of HIV-1 infections in combination with at least 2 other antiretroviral agents: Adults and Children ≥13 y of age and ≥40 kg, 300-400 mg po daily; Children <13 y of age, weight based and used in combination with ritonavir

Off-Label Uses. None

MOA. Binds to the site of HIV-1 protease activity and inhibits cleavage of viral Gag-Pol polyprotein precursors into individual functional proteins required for infectious HIV. This results in the formation of immature, noninfectious viral particles.



Bristol-Myers Squibb pictured

Drug Characteristics: Atazanavir

Dose Adjustment Hepatic	Use with caution if moderate hepatic impairment	**Absorption**	F approaches 100%, food increases absorption by 50%
Dose Adjustment Renal	Not required	**Distribution**	CSF and semen
Dialyzable	Yes	**Metabolism**	Hepatic; substrate of CYP3A4/5, strong inhibitor of CYP3A4/5 and UGT1A1
Pregnancy Category	B	**Elimination**	80% hepatic, with half-life of 7 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	Resistance is associated with HIV mutations
Contraindications	Hypersensitivity or concurrent therapy with alfuzosin, cisapride, ergot derivatives indinavir, irinotecan, lovastatin, midazolam (oral), pimozide, rifampin, sildenafil, simvastatin, or triazolam	**Black Box Warnings**	None

Medication Safety Issues: Atazanavir

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

Drug Interactions: Atazanavir

Typical Agents	Mechanism	Clinical Management
Antacids	Decreased absorption of atazanavir	Separate use by 2 h
CYP3A4/5 inhibitors	Decreased metabolism and increased toxicity of atazanavir	Avoid strong inhibitors, monitor and dose reduce atazanavir with concurrent moderate or weak inhibitors
CYP3A4/5 inducers	Increased metabolism and decreased efficacy of atazanavir	Avoid
CYP3A4/5 substrates	Decreased metabolism and increased toxicity of CYP3A4/5 substrates via inhibition of CYP3A4/5	Avoid sensitive CYP3A4/5 substrates
Drugs that prolong PR or QT	Additive PR or QT prolongation and cardiotoxicity	Avoid or monitor ECGs
Oral contraceptives	Reduced efficacy of oral contraceptives, unknown mechanism	Use an alternative form of contraception
Proton pump inhibitors, H_2 antagonists	Decreased absorption of atazanavir	Avoid
UGT1A1 substrates	Decreased metabolism and increased toxicity of UGT1A1 substrates via inhibition of UGT1A1	Avoid sensitive UGT1A1 substrates

Adverse Reactions: Atazanavir

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Rash, hyperlipidemia, elevated LFTs, abdominal pain, elevated bilirubin level, cough, fever	Nausea, vomiting, diarrhea, headaches, hyperglycemia, nausea, AV block, peripheral edema	Hypersensitivity, renal failure, PR and QT prolongation, torsades de pointes, cholelithiasis, left bundle branch block

Efficacy Monitoring Parameters. HIV viral load, CD4 count, drug levels with some concomitant medications.

Toxicity Monitoring Parameters. LFTs, bilirubin, ECG monitoring in patients with prolonged PR interval or with concurrent AV nodal blocking drugs, CBCs, lipid panel.

Key Patient Counseling Points. Multiple, potentially serious drug interactions; do not take new medications without consulting health-care provider. Take with food. Do not open, chew, or crush capsule. Does not prevent transmission of HIV; practice safe sex. Do not skip doses. Report cardiac symptoms to physician. Do not take antacids within 2 h of this medication.

Clinical Pearls. Not recommended for infants <3 mo of age. Atazanavir dose varies with concurrent medications, pregnancy, and prior HIV therapy.

ATENOLOL: Tenormin, Various

A

Class: β-Adrenergic Blocker, Cardioselective

Dosage Forms. Tablet: 25 mg, 50 mg, 100 mg

Sandoz generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Angina pectoris, chronic: 50 mg po daily; titrate to 100-200 mg po daily
2. Hypertension: Adults, 50 mg po daily, titrate to 100 mg po daily; Children, 0.5-1 mg/kg/d po in 1-2 divided doses, titrate to 2 mg/kg/d po in 1-2 divided doses (*max* 100 mg/d)

Off-Label Uses.

1. Cardiac dysrhythmia: Adults, 50-100 mg po daily; Children, 0.3-1.4 mg/kg po daily, titrate to 2 mg/kg po daily
2. Migraine prophylaxis: 50-100 mg po daily

MOA. Atenolol is a cardioselective β-adrenergic that decreases AV nodal conduction in supraventricular tachycardias and blockade of catecholamine-induced dysrhythmias.

Drug Characteristics: Atenolol

Dose Adjustment Hepatic	Not required	**Absorption**	F = 50%; food decreases AUC by 20%
Dose Adjustment Renal	CrCl 15-35 mL/min, *max* dose 50 mg po daily; CrCl <15 mL/min, *max* dose 25 mg po daily	**Distribution**	Vd = 50-75 L; <5% protein bound
Dialyzable	Yes, give 25-50 mg after each dialysis procedure	**Metabolism**	Not metabolized
Pregnancy Category	D	**Elimination**	Renal elimination of atenolol is 40-50% and 50% in feces as unchanged drug, with a half-life of 6-7 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to atenolol, severe sinus bradycardia, 2nd- or 3rd-degree AV block, overt heart failure or cardiogenic shock	**Black Box Warnings**	Avoid abrupt withdrawal

Medication Safety Issues: Atenolol

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

Drug Interactions: Atenolo

Typical Agents	Mechanism	Clinical Management
NSAIDs	Decreased antihypertensive effect of atenolol	Avoid concurrent use or monitor blood pressure
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 AV block	Avoid concurrent use
Clonidine	Exaggerated clonidine withdrawal response	Avoid abrupt withdrawal of clonidine while on concomitant beta-blocker therapy
Digoxin	Increased risk of AV block	Monitor HR, ECG, and serum digoxin concentrations
Alpha-blockers, fentanyl	Increased risk of hypotension	Monitor blood pressure

Adverse Reactions: Atenolol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Bradyarrhythmias, cold extremities, dizziness, fatigue, hypotension, depression	Bronchospasm, dyspnea, somnolence, sexual dysfunction	Heart failure, pulmonary embolism

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. Report signs/symptoms of hypotension, heart failure, or exacerbation of angina with initial dosing and dose changes. May cause dizziness or drowsiness. Diabetic patients to carefully follow blood sugar levels as beta-blockers may mask symptoms of hypoglycemia.

Clinical Pearls. Safety and efficacy not established in children. Full effectiveness may not be seen for 1-2 wk. Taper slowly before stopping as sudden discontinuation can cause angina or MI.

ATOMOXETINE: Strattera

Class: Norepinephrine Reuptake Inhibitor, CNS Stimulant

Dosage Forms. Capsule: 10 mg, 18 mg, 25 mg, 40 mg, 60 mg, 80 mg, 100 mg

Lilly pictured

Common FDA Label Indication, Dosing, and Titration.

1. ADHD: Children >6 y of age and weighing ≤70 kg, 0.5 mg/kg/d po, may titrate to lower of 1.4 mg/kg/d or 100 mg/d; Children >6 y of age and weighing >70 kg, 40 mg/d po, may titrate to 100 mg/d; Adults, 40 mg po daily, may titrate to 100 mg/d

Off-Label Uses. None

MOA. Atomoxetine is a selective norepinephrine reuptake inhibitor that produces therapeutic effects in patients with ADHD. The exact mechanism of how selective inhibition of presynaptic norepinephrine exerts effects in ADHD has not been determined.

Drug Characteristics: Atomoxetine

Dose Adjustment Hepatic	Child-Pugh Class B: initial and target doses should be reduced to 50% of normal dose; Child-Pugh Class C: initial and target doses should be reduced to 25% of normal dose	**Absorption**	F = 63% (normal metabolizers); 94% (poor metabolizers); food does not affect absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 0.85 L/kg; 98% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic metabolism to 1 active metabolite; major substrate of CYP2D6
Pregnancy Category	C	**Elimination**	Renal elimination is 80% and 17% in feces, with a half-life of 5.2-21.6 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	CYP2D6 poor metabolizers, dose as with drug interaction with CYP2D6 inhibitor
Contraindications	Hypersensitivity to atomoxetine; concomitant use of MAOIs or use within 2 wk; narrow-angle glaucoma, pheochromocytoma	**Black Box Warnings**	Suicidality in children and adolescents

Medication Safety Issues: Atomoxetine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	AtoMOXetine	Do not open capsules	No	AtorvaSTATin	No

Drug Interactions: Atomoxetine

Typical Agents	Mechanism	Clinical Management
CYP2D6 inhibitors	Decreased atomoxetine metabolism increases risk of atomoxetine toxicity	Children >6 y of age weighing >70 kg, dose 0.5 mg/kg/d po, may titrate up to 1.2 mg/kg/d; Children >6 y of age weighing >70 kg, dose 40 mg po daily, may titrate to 80 mg/d
Albuterol	Increased HR	Monitor BP and HR
MAOIs	Increased risk of hypertensive crisis (headache, hyperpyrexia, hypertension)	Concomitant use contraindicated

Adverse Reactions: Atomoxetine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Abdominal pain, headache, insomnia, loss of appetite, nausea, weight loss, xerostomia	Agitation, anxiety, decreased growth and development, dysmenorrhea, erectile dysfunction, increased blood pressure, rash, somnolence, urinary retention, vomiting, weight loss	Dyskinesia, mania, prolonged QT interval, psychotic disorders, seizure, suicidal thoughts, sudden cardiac death, tachycardia, hepatotoxicity

Efficacy Monitoring Parameters. Improvement of mental and behavioral symptoms of ADHD.

Toxicity Monitoring Parameters. BP and HR. Signs of clinical worsening, suicidality, or unusual changes in behavior; particularly at start of and during first few months of therapy or when dose is adjusted. Aggressive behavior or hostility, new onset or worsening; in pediatric patients at start of treatment.

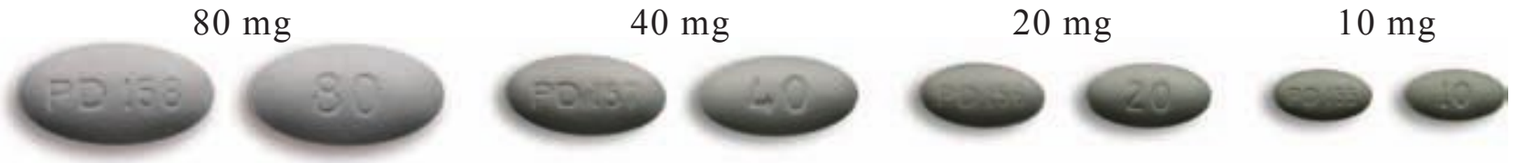
Key Patient Counseling Points. Avoid activities requiring mental alertness or coordination until drug effects are realized. Growth rate and weight may need to be monitored more frequently in children. Report new or worsened psychiatric problems, chest pain, palpitations, dyspnea, or signs/symptoms of cardiac dysrhythmias, MI, or cerebrovascular accident. Do not open capsules as atomoxetine is an ocular irritant.

Clinical Pearls. Safety and effectiveness not established in children <6 y of age. Increased risk of suicidal ideation in short-term studies in children or adolescents with ADHD. Monitor patients closely for suicidality (suicidal thinking and behavior), clinical worsening, or unusual changes in behavior. Close observation and communication with the prescriber by families and caregivers is recommended.

ATORVASTATIN: Lipitor, Various

Class: HMG-CoA Reductase Inhibitor

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



Pfizer pictured

Common FDA Label Indication, Dosing, and Titration.

1. Hyperlipidemia: 10-20 mg po daily, may increase to 80 mg po daily
2. Primary and secondary prevention of atherosclerotic cardiovascular disease: 20-40 mg po daily, may increase to 80 mg po daily for those patients requiring high-intensity therapy (eg, LDL >190 mg/dL)
3. Secondary prevention of cardiovascular events in patients with or at high risk for CAD: 80 mg daily, may reduce dose to 40 mg po daily if high dose not tolerated
4. Familial hypercholesterolemia (homozygous): Children (boys and postmenarchal girls aged 10-17 y), 10 mg po daily, may titrate to 40 mg po daily; Adults 10-80 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 also can decrease because of decreased production of VLDL-cholesterol or increased VLDL; removal by LDL receptors.

Drug Characteristics: Atorvastatin

Dose Adjustment Hepatic	Avoid use in patients with active liver disease or unexplained persistent elevated LFTs	**Absorption**	F = 14%; food slows rate of absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 381 L; 98% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic; major substrate of CYP3A4/5 and P-glycoprotein; inhibits P-glycoprotein
Pregnancy Category	X	**Elimination**	Biliary elimination, renal elimination 1-2%, with a half-life of 7-14 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	LDL receptor alters efficacy
Contraindications	Hypersensitivity to atorvastatin, pregnancy or lactation	**Black Box Warnings**	None

Medication Safety Issues: Atorvastatin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	AtorvaSTATin	No	No	AtoMOXetine, lovastatin, nystatin, pravastatin, simvastatin	No

Drug Interactions: Atorvastatin

Typical Agents	Mechanism	Clinical Management
Aliskiren	Increased aliskiren concentrations and risk of toxicity	Monitor for hypotension
CYP3A4/5 inducers	Increased atorvastatin metabolism reduces atorvastatin effectiveness	Monitor fasting lipid panels
CYP3A4/5 inhibitors	Decreased atorvastatin metabolism increases risk of atorvastatin toxicity	Avoid concurrent use or monitor for myopathy and measure CK levels; *max* dose 20 mg/d
Clopidogrel	Decreased antiplatelet activity of clopidogrel by atorvastatin	Avoid concurrent use
Cyclosporine, HIV protease inhibitors, hepatitis C protease inhibitors	Increased risk of myopathy or rhabdomyolysis	Avoid concurrent use
P-glycoprotein substrates	Metabolism of P-glycoprotein substrates inhibited by atorvastatin, resulting in substrate toxicity	Monitor for adverse effects and reduce substrate dose if necessary

Adverse Reactions: Atorvastatin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Arthralgia, diarrhea, headache	Increased liver enzymes, indigestion, insomnia, musculoskeletal pain, myalgia, nasopharyngitis, nausea, increased hemoglobin A1c	Rhabdomyolysis, tendon rupture

Efficacy Monitoring Parameters. Total cholesterol, LDL-cholesterol, and triglycerides levels; HDL-cholesterol levels.

Toxicity Monitoring Parameters. Signs/symptoms of rhabdomyolysis (myalgias, dark urine, arthralgias, fatigue) or hepatotoxicity; LFTs should be performed at baseline, 12 wk after initiation of therapy, and every 6 mo thereafter; serum creatine kinase should be measured in patients experiencing muscle pain and in those receiving other drugs associated with myopathy.

Key Patient Counseling Points. Contact prescriber immediately if pregnancy occurs while taking atorvastatin. Avoid alcohol, grapefruit, and grapefruit juice while taking drug. Atorvastatin does not take the place of lifestyle changes (diet, exercise) to lower cholesterol levels.

Clinical Pearls. Lipid level assessment should be done within 6-12 wk following dose initiation or titration, then every 3-12 mo. If 2 consecutive LDL levels are <40 mg/dL, consider decreasing dose. Statins have been reported to increase risk of diabetes, although this data is controversial as statins are only associated with very mild increase in blood glucose and there is no established causal relationship.

AZELASTINE: Astelin, Astepro, Various

A

Class: Nasal Antihistamine

Dosage Forms. Nasal Spray: 0.15%, 137 mcg/actuation

Common FDA Label Indication, Dosing, and Titration.

1. Perennial allergic rhinitis: Adults and Children ≥12 y of age, 2 sprays per nostril bid; Children 6-12 y of age, 1 spray per nostril bid
2. Seasonal allergic rhinitis: Adults and Children ≥12 y of age 1-2 sprays per nostril bid; Children 6-12 y of age, 1 spray per nostril bid
3. Vasomotor rhinitis: Adults and Children ≥12 y of age, 2 sprays per nostril bid

Off-Label Uses. None

MOA. Azelastine is a selective H_1-receptor antagonist that blocks release of histamine from cells involved in the allergic response. It also inhibits other mediators of allergic reactions (eg, leukotrienes, etc), and reduces chemotaxis and eosinophil activation.

Drug Characteristics: Azelastine

Dose Adjustment Hepatic	Not required	**Absorption**	F = 40% when administered nasally
Dose Adjustment Renal	Not required	**Distribution**	Vd = 14.5 L/kg; 78-95% protein bound
Dialyzable	Unknown	**Metabolism**	Hepatic, 90%
Pregnancy Category	C	**Elimination**	Fecal elimination is 75% with a half-life of 22-25 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Meda pictured

Medication Safety Issues: Azelastine

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

Drug Interactions: Azelastine

Typical Agents	Mechanism	Clinical Management
Cimetidine	Inhibition of azelastine metabolism	Avoid concurrent use or monitor for increased azelastine adverse effects

Adverse Reactions: Azelastine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Bitter taste in mouth, headache, somnolence	Fatigue, epistaxis, pharyngitis, rhinitis, sneezing	

Efficacy Monitoring Parameters. Decrease in rhinitis symptoms.

Toxicity Monitoring Parameters. Seek medical attention if severe allergic reactions occur.

Key Patient Counseling Points. Avoid spraying in eyes. Somnolence has been reported with nasal administration; instruct patient to avoid alcohol use and hazardous activities such as driving or operating machinery until level of sedation is known. Review proper instillation technique, including priming the spray with initial use and if have not used for 3 or more days. Blow nose prior to using. Do not spray into wall separating nostrils. To prevent contamination, keep tip of nose spray clean.

Clinical Pearls. Also available as ophthalmic product for ocular rhinitis symptoms. Also available in nasal product in combination with fluticasone.

AZITHROMYCIN: Zithromax, Various

Class: Macrolide Antibiotic

Dosage Forms. Oral Tablet: 250 mg, 500 mg, 600 mg; **Microspheres for Suspension:** 2 g/bottle; **Powder for Oral Suspension:** 100 mg/5 mL, 200 mg/5 mL, 1 g packet

Wockhardt generic 250 mg pictured

Teva generic 500 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Acute infective exacerbation of COPD, skin or tissue infection: 500 mg po daily × 3 d or 500 mg po × 1 dose, then 250 mg po daily × 2-5 d
2. Bacterial sinusitis: Adults, 500 mg po daily × 3 d; Children, 10 mg/kg po daily × 3 d, or 2 g po × 1 dose
3. Chancroid, nongonococcal cervicitis, nongonococcus urethritis: 1 g po × 1 dose
4. Community-acquired pneumonia: 500 mg po daily × 3 d or 500 mg po × 1, then 250 mg po daily × 2-5 d; Infants ≥6 mo of age, tablets and immediate-release suspension, 10 mg/kg po on day 1, then 5 mg/kg po daily × 2-5 d *or* extended-release suspension, <34 kg, 60 mg/kg po × 1; >34 kg, 2 g po × 1 dose
5. Gonorrhea, urethritis, or cervicitis: 2 g po × 1 dose
6. Streptococcal pharyngitis: 500 mg po × 1 dose, then 250 mg po daily × 2-5 d; Children, 12 mg/kg po daily × 5 d

Other Uses.

1. Traveler's diarrhea: Adults, 1000 mg po × 1 dose, or 500 mg po daily × 3 d; Children, 10 mg/kg po daily × 3 d
2. Bacterial endocarditis, prophylaxis: Adults, 500 mg po 30-60 min prior to procedure; Children, 15 mg/kg po 30-60 min prior to procedure

MOA. Azithromycin is a macrolide antibiotic that is slightly less active than erythromycin against gram-positive bacteria but substantially more active against *M.* (*B.*) *catarrhalis, Haemophilus* sp., *Legionella* sp., *Neisseria* sp., *Bordetella* sp., *Mycoplasma* spp., and *C. trachomatis*. Azithromycin binds to the 50S ribosomal subunit, thus interfering with microbial protein synthesis.

Drug Characteristics: Azithromycin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 38%, no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Blister f uid, bronchial secretions, cervix, ear f uid, ovaries, sputum, soft tissue
Dialyzable	Not dialyzable	**Metabolism**	Hepatic
Pregnancy Category	B	**Elimination**	Renal elimination is 6% with a half-life of 68 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to azithromycin, erythromycin, or any macrolide or ketolide antibiotic	**Black Box Warnings**	None

Medication Safety Issues: Azithromycin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Azathioprine, erythromycin, Fosamax	No

Drug Interactions: Azithromycin

Typical Agents	Mechanism	Clinical Management
Agents that prolong the QT interval and class III antiarrhythmics	Additive cardiotoxicity	Avoid concurrent use
Statins	Increased risk of rhabdomyolysis; mechanism unknown	Use caution with concurrent use
Digoxin	Increased digoxin toxicity via decreased bacterial metabolism of digoxin in the lower intestine	Use caution with concurrent use
Ergot alkaloids	Increased risk of acute ergotism via inhibition of ergot metabolism	Contraindicated
Nelfinavir	Increased azithromycin concentrations via decreased clearance	Caution with concurrent use
Warfarin	Increased risk of bleeding via inhibition of warfarin metabolism	Monitor INR closely

Adverse Reactions: Azithromycin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Diarrhea, nausea, vomiting, abdominal pain	Headache, elevated liver enzymes, flatulence	Stevens-Johnson syndrome, chest pain, severe hypersensitivity, myasthenia gravis, QT prolongation, torsades de pointes, hepatitis

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

Toxicity Monitoring Parameters. Seek medical attention if chest pain, blistering skin rash, or extreme fatigue.

Key Patient Counseling Points. Complete full course of therapy. Take tablets with or without food, although some patients report increased tolerability when given with food. Avoid mixing suspension with food or beverages, but food can be taken afterward. Take extended-release suspension (Zmax) on empty stomach, at least 1 h before or 2 h after a meal. Zmax must be used in the first 12 h of reconstitution. Avoid concurrent use of aluminum or magnesium-containing antacids (exception: Zmax can be taken without regards to antacids containing magnesium hydroxide and/or aluminum hydroxide). Symptoms should improve within 2-3 d; if they worsen, seek follow-up with health-care practitioner.

Clinical Pearls. Use with caution in severe renal, hepatic, or cardiac disease. Pediatric use of extended-release tablets is restricted to community-acquired pneumonia. Max dose in children is 500 mg. There is a small absolute increase in the risk of cardiovascular death during a 5-d course of oral azithromycin. Also available as ophthalmic for bacterial conjunctivitis, and injectable for severe infections.

BACLOFEN: Lioresal, Various

Class: Centrally Acting Skeletal Muscle Relaxant

Dosage Forms. Oral Tablet: 10 mg, 20 mg

Northstar Rx generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Spasticity: 5 mg orally tid; may increase dose in 5-15 mg/d increments; *max* dose in Adults and Children ≥12 y of age, 80 mg/d; *max* dose in children 8-12 y of age, 60 mg/d; *max* dose in children <8 y of age, 40 mg/d

Off-Label Uses.

1. Intractable hiccoughs, 5 mg po bid, increasing to 15-45 mg/d in 3 divided doses; or 10-20 mg 2-3 times daily

MOA. Baclofen inhibits both monosynaptic and polysynaptic reflexes at the spinal level, possibly by hyperpolarization of afferent terminals, although actions at supraspinal sites may also occur and contribute to its clinical effect. Baclofen is an analogue of γ-aminobutyric acid (GABA), but there is no conclusive evidence that actions on GABA systems are involved in the production of its clinical effects.

Drug Characteristics: Baclofen

Dose Adjustment Hepatic	Not required	**Absorption**	F = 100%, no effect of food on absorption
Dose Adjustment Renal	In patients with renal dysfunction, monitor carefully for toxicity and reduce dose as necessary	**Distribution**	Vd = 59.1 L; 30% protein bound
Dialyzable	Yes	**Metabolism**	Limited hepatic metabolism
Pregnancy Category	C	**Elimination**	Renal elimination is 60-80% with a half-life of 3-7 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	Avoid abrupt discontinuation of intrathecal product

Medication Safety Issues: Baclofen

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

Drug Interactions: **Baclofen.** None known

Adverse Reactions: Baclofen

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Nausea, asthenia, dizziness, somnolence	Constipation, fatigue, hypotension, shivering, urinary complication	Pneumonia, GI hemorrhage

Efficacy Monitoring Parameters. Reduction in muscle spasm, passive limb movement, pain relief.

Toxicity Monitoring Parameters. Seek medical attention if severe dizziness, confusion, sedation, or rebound spasticity occurs.

Key Patient Counseling Points. Because of the possibility of sedation, patients should be cautioned regarding the operation of motor vehicles or dangerous machinery while taking baclofen. Patients should be cautioned that the CNS effects of baclofen may be additive to those of alcohol and other CNS depressants.

Clinical Pearls. Implantable pumps that administer baclofen intrathecally are also available for patients with spasticity. Constipation occurs in 100% of patients undergoing intrathecal administration, and abrupt discontinuation of intrathecal therapy (intentional or inadvertent) is commonly fatal.

BENAZEPRIL: Lotensin, Various

Class: ACE-I, Antihypertensive

Dosage Forms. Oral Tablet: 5 mg, 10 mg, 20 mg, 40 mg

Teva generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Hypertension: Adults, 10 mg po daily, may titrate to 20-40 mg po daily (*max* 80 mg/d); Children ≥6 y of age, 0.2 mg/kg po daily (*max* 0.6 mg/kg/d or 40 mg/d)

Off-Label Uses.

1. Diabetic nephropathy: 10 mg po daily
2. Heart failure: 5-40 mg po daily
3. Kidney disease: 10 mg po daily

MOA. Benazepril is a competitive ACE-I. It also reduces serum aldosterone, leading to decreased sodium retention, potentiates the vasodilator kallikrein–kinin system, and can alter prostanoid metabolism, inhibit the sympathetic nervous system, and inhibit the tissue renin–angiotensin system.

Drug Characteristics: Benazepril

Dose Adjustment Hepatic	Not required	**Absorption**	F = 37%, no effect of food on absorption
Dose Adjustment Renal	CrCl <30 mL/min, initial dose is 5 mg po daily, titrate to effect (*max* 40 mg/d)	**Distribution**	Vd = 8.7 L; 97% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic metabolism to 1 active metabolite (benazeprilat)
Pregnancy Category	D	**Elimination**	Renal elimination is 33%, bile 12% with a half-life of 0.6 h (parent drug) and 22 h (benazeprilat)
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity; history of angioedema; anuria; concomitant use with aliskiren in patients with diabetes mellitus	**Black Box Warnings**	Pregnancy

Medication Safety Issues: Benazepril

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

Drug Interactions: Benazepril

Typical Agents	Mechanism	Clinical Management
Potassium-sparing diuretics	Increased risk of hypotension, hyperkalemia	Avoid concurrent use or monitor BP and serum potassium levels
Angiotensin receptor blockers (ARBs)	Increased risk of hypotension, hyperkalemia, nephrotoxicity	Avoid concurrent use or monitor BP, SCr, and potassium levels
Potassium supplements, salt substitutes	Increased risk of hyperkalemia and cardiac arrhythmias	Avoid concurrent use or monitor serum potassium level
NSAIDs	Decrease antihypertensive and natriuretic effect of benazepril, increased risk of nephrotoxicity	Avoid concurrent use or monitor BP and SCr level
Azathioprine	Increased risk of myelosuppression	Avoid concurrent use, monitor for anemia or leucopenia
Diuretics	Increased risk of postural hypotension due to hypovolemia	Monitor BP, rise from seated position slowly

Adverse Reactions: Benazepril

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Diarrhea, dizziness, dry cough, fatigue, headache, hyperkalemia, nausea, nephrotoxicity, rash, tachycardia, vomiting	Angioedema, birth defects, liver failure, Stevens-Johnson syndrome

Efficacy Monitoring Parameters. Decreased BP.

Toxicity Monitoring Parameters. Signs/symptoms of angioedema (swelling of the face, eyes, lips, tongue, or throat), severe persistent cough, hypotension; monitor baseline and periodic electrolytes, SCr, BUN, urine protein.

Key Patient Counseling Points. Avoid pregnancy. Use potassium supplements or salt substitutes only under medical supervision. May cause dizziness that may worsen if dehydrated. Take at the same time daily.

Clinical Pearls. Observe patients who are volume depleted for at least 2 h after taking the initial dose of benazepril. A liquid suspension can be made for patients who cannot swallow pills.

BENZONATATE: Tessalon Perles, Various

Class: Antitussive

Dosage Forms. **Oral Capsule, Liquid Filled:** 100 mg, 150 mg, 200 mg

Common FDA Label Indication, Dosing, and Titration.

1. Cough: Adults and Children >10 y of age, 100-200 mg po tid prn, *max* 600 mg/d

Off-Label Uses.

1. Endotracheal intubation hiccups: 100 mg po × 1 dose, may repeat in 4 h

MOA. Benzonatate acts peripherally by anesthetizing the stretch receptors located in the respiratory passages, lungs, and pleura by dampening their activity and thereby reducing the cough reflex at its source.

Amneal generic 100 mg pictured

Drug Characteristics: Benzonatate

Dose Adjustment Hepatic	Not required	**Absorption**	Unknown
Dose Adjustment Renal	Not required	**Distribution**	Unknown
Dialyzable	Not dialyzable	**Metabolism**	Unknown
Pregnancy Category	C	**Elimination**	Unknown
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Benzonatate

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Do not bite, chew, or open; swallow capsule whole	No	No	No

Drug Interactions: Benzonatate. None known

Adverse Reactions: Benzonatate

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
If capsules are broken or chewed, oral and pharyngeal numbness	Dizziness, headache, sedation, somnolence, bizarre behavior (mental confusion and visual hallucinations)	Severe hypersensitivity reactions

Efficacy Monitoring Parameters. Resolution of clinical signs of cough.

Toxicity Monitoring Parameters. Seek medical attention if rash or hives, itching, difficulty breathing or swallowing, confusion, or hallucinations occur.

Key Patient Counseling Points. Do not chew capsules or allow capsules to dissolve in mouth as oropharyngeal anesthesia will occur, plus the liquid in the capsule has an incredibly foul taste. Administer with food or milk if GI upset occurs. Accidental ingestion of as few as 1-2 capsules by children <2 y of age has been fatal. The drug appearance (round, clear liquid-filled capsules) may be attractive to children, so particular care should be taken to keep out of reach.

Clinical Pearls. Benzonatate was approved by the FDA in 1958. Very little pharmacologic or pharmacokinetic data exist for this product. Do not spill the bottle—will take you hours to track down capsules that are spilled.

BENZTROPINE: Cogentin, Various

Class: Antiparkinsonian, Anticholinergic

Dosage Forms. Oral Tablet: 0.5 mg, 1 mg, 2 mg

Core Pharma generic 1 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Extrapyramidal disease, medication-induced movement disorder: Adults, 1-4 mg po daily or bid; Children ≥3 y of age, 0.02-0.05 mg/kg/dose once or twice daily
2. Parkinsonism: 1-2 mg/d po, may titrate to range 0.5-6 mg/d po

Off-Label Uses. None

MOA. Benztropine possesses anticholinergic and antihistamine effects. May inhibit reuptake and storage of dopamine.

Drug Characteristics: Benztropine

Dose Adjustment Hepatic	Not required	**Absorption**	F = 29%
Dose Adjustment Renal	Not required	**Distribution**	Protein binding unknown
Dialyzable	Not dialyzable	**Metabolism**	Unknown
Pregnancy Category	B	**Elimination**	Unknown
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to benztropine, patients <3 y of age	**Black Box Warnings**	None

Medication Safety Issues: Benztropine

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

Drug Interactions: Benztropine

Typical Agents	Mechanism	Clinical Management
Amantadine	Increased CNS toxicity (confusion, hallucinations)	Monitor for signs of toxicity
Phenothiazines	Decreased phenothiazine concentrations, enhanced anticholinergic effects	Monitor for efficacy
Haloperidol	Excessive anticholinergic effects	Monitor for signs of toxicity

Adverse Reactions: Benztropine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Blurred vision, confusion, constipation, disorientation, dysuria, mydriasis, nausea, urinary retention, xerostomia	Anhidrosis, drug-induced psychosis, heat stroke, increased body temperature, tachycardia, visual hallucinations

Efficacy Monitoring Parameters. Reduction in extrapyramidal movements, rigidity, tremor, gait disturbances.

Toxicity Monitoring Parameters. Monitor for anticholinergic effects including dry mouth and constipation.

Key Patient Counseling Points. Drug may impair heat regulation. Advise patient to use caution with activities leading to an increased core temperature, such as strenuous exercise, exposure to extreme heat, or dehydration. Patient should avoid activities requiring mental alertness or coordination until drug effects are realized. Instruct patient to report sudden muscle weakness or stiffness, and signs/symptoms of tardive dyskinesia (tongue thrusting, facial grimacing/tics, random movements of extremities). Patient should not drink alcohol while taking this drug.

Clinical Pearls. Benztropine may have more adverse effects than amantadine when used for Parkinson disease. Injectable formulation also available but must be administered at hospital or MD office.

BIMATOPROST: Lumigan, Latisse

Class: Prostaglandin, Antiglaucoma Agent, Cosmetic Agent for Eyelash Growth

Dosage Forms. Ophthalmic Solution: 0.01%, 0.03%

Common FDA Label Indication, Dosing, and Titration.

1. Ocular hypertension and open-angle glaucoma: 1 drop in affected eye(s) daily in the evening
2. Hypotrichosis of the eyelashes: 1 drop nightly to clean, upper eyelid margin at base of eyelashes, blot excess, repeat with new sterile applicator to opposite eyelid, do not apply to lower eyelids

Off-Label Uses. None

MOA. Bimatoprost is a synthetic prostaglandin analogue. Bimatoprost lowers intraocular pressure (IOP) by increasing the outflow of aqueous humor through both the trabecular meshwork and uveoscleral drainage systems. The exact mechanism of action for bimatoprost in stimulating eyelash growth is unknown.

Drug Characteristics: Bimatoprost

Dose Adjustment Hepatic	Not required	**Absorption**	Systemic absorption following ocular instillation is very low
Dose Adjustment Renal	Not required	**Distribution**	88% protein binding after systemic absorption
Dialyzable	Not dialyzable	**Metabolism**	Hepatic metabolism, extent unknown
Pregnancy Category	C	**Elimination**	Renal elimination is 67% with a half-life of 45 min
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Allergan 0.03% solution pictured

Medication Safety Issues: Bimatoprost

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

Drug Interactions: Bimatoprost

Typical Agents	Mechanism	Clinical Management
Latanoprost	Increased IOP	Avoid concurrent use

Adverse Reactions: Bimatoprost

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Conjunctival hyperemia, eyelash growth, ocular pruritus	Application pigmentation changes to the eyelid, eyelash and periocular skin, abnormal hair growth, eyelid erythema, dry eye, eye irritation, photophobia	Macular retinal edema, bacterial keratitis

Efficacy Monitoring Parameters. Reduction in IOP. Desired growth of eyelashes and resulting improvement in social life.

Toxicity Monitoring Parameters. Seek medical attention if symptoms of ocular irritation are severe.

Key Patient Counseling Points. Wash your hands and remove contact lenses before using the medicine. For administration of Lumigan, 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 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. Separate from other eye drops by 5 min. For administration of Latisse, wash face and remove makeup before applying. Do not rinse eye if solution gets into the eye. Do not reuse supplied sterile applicators or use any other brush/applicator other than those supplied. Use a new applicator for second eye. Do not apply to lower lid, or more than once per day. Reinsert contact lens after 15 min.

Clinical Pearls. There is a risk of permanent increased iris pigmentation associated with instillation of this product, and with leakage of Latisse into the eye. The effect of Latisse on eyelash length, thickness, and darkness is not permanent and will return to baseline upon discontinuation of bimatoprost.

BISOPROLOL: Zebeta, Various

Class: Cardioselective β-Adrenergic Blocker

Dosage Forms. Oral Tablet: 5 mg, 10 mg

Sandoz generic 5 mg pictured

Sandoz generic 10 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Hypertension: 2.5-5 mg po daily, may titrate to *max* of 20 mg po daily

Off-Label Uses.

1. Angina: 5-20 mg po daily
2. Atrial fibrillation: 2.5-10 mg po daily
3. Heart failure: 1.25-10 mg po daily

MOA. Bisoprolol is a cardioselective β-adrenergic blocker that decreases AV nodal conduction in supraventricular tachycardia and blockade of catecholamine-induced dysrhythmias. The antihypertensive mechanism is unknown, but contributing factors are, renin blockade, and decreases in myocardial contractility and cardiac output.

Drug Characteristics: Bisoprolol

Dose Adjustment Hepatic	Initiate with 2.5 mg po daily, may titrate to *max* of 10 mg po daily	**Absorption**	F = 80%; food has no effect on absorption
Dose Adjustment Renal	Initiate with 2.5 mg po daily, may titrate to *max* of 10 mg po daily	**Distribution**	Protein binding 30%; distribution limited to extracellular f uid space and kidneys
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic; major substrate of CYP3A4/5
Pregnancy Category	C	**Elimination**	Eliminated 50% unchanged in urine with a half-life of 9-12 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to bisoprolol, severe sinus bradycardia, 2nd- or 3rd-degree AV block, overt heart failure, cardiogenic shock	**Black Box Warnings**	None

Medication Safety Issues: Bisoprolol

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

Drug Interactions: Bisoprolol

Typical Agents	Mechanism	Clinical Management
CYP3A4/5 inducers	Increased bisoprolol metabolism reduces bisoprolol effectiveness	Monitor and consider dose increases of bisoprolol
CYP3A4/5 inhibitors	Decreased bisoprolol metabolism increases risk of bisoprolol toxicity	Monitor and consider dose decreases of bisoprolol
NSAIDs	Decreased antihypertensive effect of bisoprolol	Avoid concurrent use or monitor BP
Antidiabetic drugs	Decreased glycemic control	Monitor FBG
Calcium channel blockers, amiodarone, dronedarone	Increased risk of hypotension and/or bradycardia and AV block	Avoid concurrent use
Clonidine	Exaggerated clonidine withdrawal response	Avoid abrupt withdrawal of clonidine while on concomitant beta-blocker therapy
Digoxin	Increased risk of AV block	Monitor heart rate, ECG, and serum digoxin concentrations
Alpha-blockers, ACE-Is, fentanyl	Increased risk of hypotension	Monitor BP

Adverse Reactions: Bisoprolol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Bradyarrhythmias, cold extremities, dizziness, fatigue, hypotension	Anorexia, bronchospasm, dyspnea, depression, diarrhea, headache, hyperglycemia, hyperuricemia, hypokalemia, hyponatremia, nausea, orthostatic hypotension, rash, somnolence, sexual dysfunction, vomiting	Heart failure

Efficacy Monitoring Parameters. Decreased BP.

Toxicity Monitoring Parameters. Signs/symptoms of heart failure, decreased heart rate, ECG. Baseline and periodic serum, and urine electrolytes; renal function; uric acid and FBG.

Key Patient Counseling Points. Instruct patient to report signs/symptoms of dyspnea, hypotension, or heart failure. May cause dizziness; avoid alcohol, CNS depressants, or activities that require alertness. Rise slowly from a sitting/supine position, as drug may cause orthostatic hypotension. Avoid abrupt discontinuation, may cause rebound hypertension. Recommend avoiding NSAIDs while taking this drug.

Clinical Pearls. Safety in children has not been established.

BRIMONIDINE: Alphagan P, Various

Class: Adrenergic Agonist; Antiglaucoma Agent

Dosage Forms. Ophthalmic Solution: 0.1%, 0.15%, 0.2%

Common FDA Label Indication, Dosing, and Titration.

1. Ocular hypertension: 1 drop in affected eye(s) q8h, strength chosen based on therapeutic effect
2. Open-angle glaucoma: 1 drop in affected eye(s) q8h, strength chosen based on therapeutic effect

Off-Label Uses.

1. Capsulotomy of posterior lens capsule: 1 drop of 0.2% solution in operative eye 1 h prior to surgery, then 1 drop in operative eye immediately following procedure

MOA. Brimonidine, a relatively selective α-adrenergic agonist, reduces aqueous humor production and increases uveoscleral outflow. It is used to lower IOP in open-angle glaucoma or ocular hypertension.

Allergan 0.15% solution pictured

Drug Characteristics: Brimonidine

Dose Adjustment Hepatic	Not required	**Absorption**	Minor systemic absorption following ocular instillation
Dose Adjustment Renal	Not required	**Distribution**	Effective penetration of brimonidine into aqueous humor
Dialyzable	Not dialyzable	**Metabolism**	24% and occurs by unknown enzymes
Pregnancy Category	B	**Elimination**	Renal elimination is 74% with a half-life of 3 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to brimonidine, concurrent MAOIs, age <2 y	**Black Box Warnings**	None

Medication Safety Issues: Brimonidine

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

Drug Interactions: Brimonidine

Typical Agents	Mechanism	Clinical Management
MAOIs	Increased risk of CNS depression	Avoid concurrent use

Adverse Reactions: Brimonidine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Allergic conjunctivitis, conjunctival discoloration	Burning sensation in eye, hypertension, xerostomia, somnolence, hypersensitivity reaction, visual disturbance	Syncope, arrhythmias

Efficacy Monitoring Parameters. Reduction in IOP.

Toxicity Monitoring Parameters. Seek medical attention if syncope occurs or if symptoms of ocular irritation are severe.

Key Patient Counseling Points. Wash your hands and remove contact lenses before using the medicine. 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 bottle right away. Reinsert contacts after 15 min. Separate administration of other ophthalmic agents by 5 min.

Clinical Pearls. This agent has no specific advantage over other similar products for the reduction in IOP in chronic ocular hypertension or in the treatment of glaucoma. Topical product available for treatment of rosacea.

BUDESONIDE: Pulmicort Respules, Pulmicort Flexhaler, Various

Class: Inhaled Corticosteroid

Dosage Forms. **Inhalation Suspension:** 0.25 mg/2 mL, 0.5 mg/2 mL, 1 mg/2 mL; **Metered-Dose Inhaler (MDI):** 90 mcg/actuation, 180 mcg/actuation

Common FDA Label Indication, Dosing, and Titration.

1. Asthma: Children 1-8 y of age with no previous inhaled corticosteroid therapy, 0.5 mg inhaled via nebulization in 1 or 2 divided doses; Children 1-8 y of age previously treated with corticosteroids, 0.5 mg inhaled via nebulization daily or bid, may titrate to 1 mg/d; Children >8 y of age and Adults, 180-360 mcg bid via MDI, *max* 720 mcg bid via MDI

Off-Label Uses. None

MOA. Budesonide is an anti-inflammatory with potent glucocorticoid and weak mineralocorticoid activity. It exhibits a broad range of active inhibition against multiple cell types and mediators involving allergic and nonallergic/irritant-mediated inflammation.

Drug Characteristics: Budesonide

Dose Adjustment Hepatic	Not required	**Absorption**	F = 6%
Dose Adjustment Renal	Not required	**Distribution**	Vd = 3 L/kg; protein binding 85-90%
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic; major substrate of CYP3A4/5
Pregnancy Category	B	**Elimination**	Renal elimination 60%, fecal elimination 15-29%, with a half-life of 2-3 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to budesonide; hypersensitivity to milk proteins (Flexhaler); primary treatment of status asthmaticus or other acute episodes of asthma	**Black Box Warnings**	None

AstraZeneca pictured

B

Medication Safety Issues: Budesonide

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

Drug Interactions: Budesonide

Typical Agents	Mechanism	Clinical Management
Azole antifungals and macrolides	Increase budesonide concentrations	Avoid long-term concomitant therapy with budesonide
CYP3A4/5 inducers	Increased budesonide metabolism reduces budesonide effectiveness	Monitor and consider dose increases of budesonide
CYP3A4/5 inhibitors	Decreased budesonide metabolism increases risk of budesonide toxicity	Monitor and consider dose decreases of budesonide

Adverse Reactions: Budesonide

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Upper respiratory tract infections	Cough, diarrhea, dysphonia, headache, nausea, oral candidiasis, throat irritation	Cataracts, decreased body growth, decreased bone mineral density

Efficacy Monitoring Parameters. Monitor PFTs. Resolution of asthma symptoms (symptoms, number of exacerbations, nighttime awakenings, need for rescue albuterol).

Toxicity Monitoring Parameters. Growth velocity in pediatric patients during prolonged therapy.

Key Patient Counseling Points. Advise patient on proper inhalation technique. Gently swirl nebulizer suspension before use. Use entire vial of inhalation suspension immediately after opening to avoid contamination; deliver over 5-15 min using a jet nebulizer with mouthpiece or face mask. After administration, rinse mouth with water and spit, and wash face to minimize risk of developing oral candidiasis. Provided as a strip of 5 small plastic containers with sealed caps; each container holds 1 dose. The strip of containers is sealed inside a foil pouch. Keep any unused containers inside the pouch. Once foil pouch is opened, the containers will only be good for 2 wk.

Clinical Pearls. This drug is not indicated for acute asthma attacks. Respules indicated only in children; budesonide in MDI form available for treatment of older children and adults. Also available in rectal and nasal formulations, and in MDI in combination with formoterol. Oral tablets and capsules available for systemic treatment of Crohn disease and ulcerative colitis.

BUDESONIDE/FORMOTEROL: Symbicort

Class: Inhaled Corticosteroid/Bronchodilator Combination

Dosage Forms. Metered-Dose Inhaler (MDI): (Budesonide/Formoterol) 80 mcg/4.5 mcg/inhalation, 160 mcg/4.5 mcg/inhalation

Common FDA Label Indication, Dosing, and Titration.

1. Asthma: Children ≥12 y of age and Adults, 80 mcg/4.5 mcg, 2 inhalations bid, may titrate to 160 mcg/4.5 mcg, 2 inhalations bid
2. COPD: 160 mcg/4.5 mcg 2 inhalations bid

Off-Label Uses.

1. Asthma: Children 5-11 y of age, 80 mcg/4.5 mcg, 2 inhalations bid

MOA. Budesonide is an anti-inflammatory with potent glucocorticoid and weak mineralocorticoid activity. It exhibits a broad range of active inhibition against multiple cell types and mediators involving allergic and nonallergic/irritant-mediated inflammation. Formoterol is a long-acting selective β_2-adrenergic agonist that produces bronchodilation.

80 mcg/4.5 mcg 160 mcg/4.5 mcg
AstraZeneca pictured

Drug Characteristics: Budesonide/Formoterol

Dose Adjustment Hepatic	Not required	**Absorption**	F = 39% for budesonide; unknown for formoterol inhalation
Dose Adjustment Renal	Not required	**Distribution**	Protein binding 85-90% (budesonide); 31-64% for formoterol
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic; major substrate of CYP3A4/5 (budesonide)
Pregnancy Category	C	**Elimination**	Renal elimination is 60% with a half-life of 2-3 h (budesonide); renal elimination is 1-28% with a half-life of 10 h (formoterol)
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to budesonide or formoterol; primary treatment of status asthmaticus or acute episodes of asthma or COPD	**Black Box Warnings**	Asthma deaths; pediatrics, increased risk of hospitalization

Medication Safety Issues: Budesonide/Formoterol

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

Drug Interactions: Budesonide/Formoterol

Typical Agents	Mechanism	Clinical Management
Short-acting sympathomimetics	May potentiate formoterol effect	Avoid concurrent use
Beta-blockers	May decrease effectiveness of formoterol and produce bronchospasms	Avoid use of nonselective beta-blocker in patients with COPD. Monitor PFTs if cardioselective beta-blockers clinically indicated
MAOI and tricyclic antidepressants	May potentiate formoterol effect on cardiovascular system	Consider alternative therapy
Azole antifungals and macrolides	Increased budesonide concentrations	Avoid long-term concomitant therapy with budesonide
CYP3A4/5 inducers	Increased budesonide metabolism reduces budesonide effectiveness	Monitor and consider dose increases of budesonide
CYP3A4/5 inhibitors	Decreased budesonide metabolism increases risk of budesonide toxicity	Monitor and consider dose decreases of budesonide

Adverse Reactions: Budesonide/Formoterol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Upper respiratory tract infections	Cough, decrease in bone mineral density, dysphonia, headache, tremor, nasopharyngitis, nervousness, oral candidiasis, pain in throat	Asthma-related death, bronchospasm, hypokalemia, arrhythmias

Efficacy Monitoring Parameters. Monitor PFTs. Resolution of asthma symptoms (symptoms, number of exacerbations, nighttime awakenings, need for rescue albuterol).

Toxicity Monitoring Parameters. Growth velocity in pediatric patients during prolonged therapy; use alternative therapy or seek emergency treatment if paradoxical bronchospasms occur.

Key Patient Counseling Points. Advise patient on proper inhalation technique. If more than 1 inhalation is prescribed, wait 1 min after initial inhalation and shake the inhaler again before the next inhalation. After administration, rinse mouth with water and spit, and wash face to minimize risk of developing oral candidiasis. Wash the mouthpiece and air-dry thoroughly at least once a week.

Clinical Pearls. Long-acting beta-agonists (LABAs) increase the risk of asthma-related deaths. Budesonide/formoterol should only be used for patients not adequately controlled on a long-term asthma control medication. This drug is not indicated for acute asthma exacerbations. LABAs may increase the risk of asthma-related hospitalization in pediatric and adolescent patients.

BUPRENORPHINE/NALOXONE: Bunavail, Suboxone, Zubsolv, Various

Class: Opioid Partial Agonist and Antagonist Combination. C-III

Dosage Forms. Sublingual Film: (Buprenorphine/Naloxone) 2 mg/0.5 mg, 8 mg/2 mg; **Sublingual Tablet:** (Buprenorphine/Naloxone) 1.4 mg/0.36 mg, 2 mg/0.5 mg, 5.7 mg/1.4mg, 8 mg/2 mg; **Buccal Film:** (Buprenorphine/Naloxone) 2.1 mg/0.3 mg, 4.2 mg/0.7 mg, 6.3 mg/1 mg

Reckitt Benckiser 8 mg/2 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Opioid dependence: Adults and children >16 y of age, 12-16 mg (buprenorphine component) once daily sublingually, titrate to response; typical dose range from 4 to 24 mg/d

Off-Label Uses. None

MOA. Buprenorphine is a μ-opioid receptor partial agonist and a κ-opioid receptor antagonist. Naloxone is a μ-opioid receptor antagonist that causes opioid withdrawal when injected parenterally and is included in the formulation to reduce the risk of abuse.

Drug Characteristics: Buprenorphine/Naloxone

Dose Adjustment Hepatic	Use with caution	**Absorption**	F = 15% (buprenorphine); F = 3% (naloxone)
Dose Adjustment Renal	Not required	**Distribution**	Vd = 97-187 L (buprenorphine)
Dialyzable	Unknown	**Metabolism**	Buprenorphine, hepatic, major substrate of CYP3A4/5; naloxone: hepatic via glucuronidation
Pregnancy Category	C	**Elimination**	30% renal elimination with half-life of 33 h (buprenorphine); half-life of 6 h (naloxone)
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Buprenorphine/Naloxone

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	Yes, medication guide required	No	No

Drug Interactions: Buprenorphine/Naloxone

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 buprenorphine metabolism reduces buprenorphine effectiveness	Monitor and consider dose increases of buprenorphine
CYP3A4/5 inhibitors	Decreased buprenorphine metabolism increases risk of buprenorphine toxicity	Monitor and consider dose decreases of buprenorphine

Adverse Reactions: Buprenorphine/Naloxone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Vasodilation, sweating, headaches, insomnia, constipation, GI distress, opioid withdrawal, dizziness	Dyspnea, respiratory depression, glossodynia	Stevens-Johnson syndrome, physical dependence, tolerance, elevated liver functions tests, seizures

Efficacy Monitoring Parameters. Urine drug screening tests that are negative for illicit drugs. Relief of signs and symptoms associated with narcotic addiction.

Toxicity Monitoring Parameters. Severe skin rash, excessive drowsiness, decreased breathing, severe constipation.

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. Do not crush or swallow the sublingual tablet. Place the tablet under the tongue until it is dissolved. If you take 2 or more tablets at a time, place all of the tablets under the tongue together. If this is uncomfortable, place 2 tablets at a time under the tongue and repeat the process until all tablets have been taken. If you are using the sublingual film, place the film under the tongue until it is dissolved. If you need to take an additional film, place the new film on the opposite side from the first film. Do not chew, swallow, or move the film after placing it under the tongue. If using the buccal film, press and hold film to moistened cheek for 5 s with finger. If you need an additional film, place on the inside of other cheek. Do not use more than 2 buccal films simultaneously.

Clinical Pearls. Taking opioids will result in precipitation of withdrawal symptoms. The opioid agonist properties of buprenorphine are limited by a ceiling effect which occurs at higher doses. The strength of sublingual films and tablets are not interchangeable. For example, one 8 mg film is not equivalent to 4 films of 2 mg each. Do not substitute multiple smaller dose films to equal a larger dose. Recommended as a component of therapy including counseling and psychosocial support. Not recommended for treatment of dependence on long-acting opiates or methadone; useful for withdrawal of short-acting opiates and heroin.

BUPROPION: Wellbutrin, Zyban, Various

Class: Monocyclic Antidepressant

Dosage Forms. Oral Tablet (Immediate Release): 75 mg, 100 mg; **Oral Tablet (Sustained Release 12 h):** 100 mg, 150 mg, 200 mg; **Oral Tablet (Hydrochloride, Extended Release 24 h):** 150 mg, 300 mg, 450 mg; **Oral Tablet (Hydrobromide. Extended Release 24 h):** 174 mg, 348 mg, 522 mg

Sandoz generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Depression: Immediate release, 100 mg po bid × 3 d, increase to 100 mg po tid (*max* 450 mg/d); Sustained release, 150 mg po daily in the morning × 3 d, then increase to 150 mg po bid (*max* 200 mg bid); Extended release, 150 mg po daily × 3 d, then increase to 300 mg po daily (*max* 450 mg/d)
2. Seasonal affective disorder (SAD): 150 or 174 mg once daily in the morning, may titrate to 300 or 348 mg once daily in the morning
3. Smoking cessation assistance: Sustained release, 150 mg po daily in the morning × 3 d, then 150 mg po bid (*max* 300 mg/d) for 7-12 wk; begin treatment 1 wk prior to smoking quit date

Off-Label Uses. None

MOA. Bupropion is a monocyclic antidepressant, unique as a mild dopamine and norepinephrine uptake inhibitor with no direct effect on serotonin receptors or MAO.

Drug Characteristics: Bupropion

Dose Adjustment Hepatic	Mild to moderate: reduce frequency and/or dose. Severe liver disease: *max* dose 75 mg daily	**Absorption**	Food has minimal effect on absorption
Dose Adjustment Renal	Reduce frequency and/or dose	**Distribution**	Vd = 19-21 L/kg; 84% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic, 10-15%; major substrate of CYP2B6; inhibitor of CYP2D6
Pregnancy Category	C	**Elimination**	Renal elimination is 87% and 10% in feces, with a half-life of 14-37 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Seizure disorder; history of anorexia/bulimia; use of MAOI within 14 d; patients undergoing abrupt discontinuation of ethanol, benzodiazepines, barbiturates, or antiepileptics	**Black Box Warnings**	Suicidality

Medication Safety Issues: Bupropion

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
SR and XL	BuPROPion	SR and XL formulations	No	BusPIRone	No

Drug Interactions: Bupropion

Typical Agents	Mechanism	Clinical Management
Alcohol	Increased risk of seizures	Avoid concomitant use
CYP3A4/5 inducers	Increased bupropion metabolism reduces bupropion effectiveness	Monitor and consider dose increases of bupropion
CYP3A4/5 inhibitors	Decreased bupropion metabolism increases risk of bupropion toxicity	Monitor and consider dose decreases of bupropion
CYP2D6 substrates	Decreased metabolism or activation of prodrugs requiring CYP2D6	Avoid concurrent use if substrate is narrow therapeutic index, otherwise consider dose modification

Adverse Reactions: Bupropion

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Agitation, constipation, dizziness, headache, insomnia, nausea, tachyarrhythmia, tremor, xerostomia	Anxiety, arthralgia, confusion, hostile behavior, hypertension, myalgia, pruritus, rash, urticaria	Cardiac dysrhythmia, mania, seizure, suicidal thoughts, wide QRS complex

Efficacy Monitoring Parameters. Improvement in depressive symptoms, may require 4-6 wk. Abstinence from tobacco products.

Toxicity Monitoring Parameters. Worsening of depression, suicidality, or unusual changes in behavior, especially at the initiation of therapy or with dosage increases or decreases. BP and heart rate in patients using concomitant nicotine replacement therapy.

Key Patient Counseling Points. Avoid alcohol, CNS depressants, and activities requiring mental alertness. Take at the same time each day and at bedtime if possible. If taking the extended-release tablet, the tablet shell may remain intact and be visible in the stool.

Clinical Pearls. Not FDA approved for use in children. Depression, suicidal ideation, attempts, and suicides occur in patients with and without preexisting psychiatric disease. When switching patients from immediate- or sustained-release tablets to extended-release tablets, give the same total daily dose when possible. Medication safety guide required.

BUSPIRONE: BuSpar, Various

Class: Antianxiety

Dosage Forms. Oral Tablet: 5 mg, 7.5 mg, 10 mg, 15 mg, 30 mg

Teva generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Anxiety: Adults, 5 mg po bid-tid or 7.5 mg po bid, may titrate to 20-30 mg/d in 2-3 divided doses (*max* 60 mg/d)

Off-Label Uses.

1. Anxiety: Children, 5 mg/d po, may titrate to 15 mg po bid (*max* 50 mg/d)
2. Depression: Adults, 5 mg po tid, may titrate to 40-55 mg/d in 2-3 divided doses (*max* 90 mg/d)

MOA. Buspirone is the first of a class of selective serotonin-5-HT_{1A} receptor partial agonists. It also has some effect on dopamine-D_2 auto-receptors and, like antidepressants, can down-regulate β-adrenergic receptors. Unlike benzodiazepines, it lacks amnestic, anticonvulsant, muscle relaxant, and hypnotic effects. Its exact anxiolytic mechanism of action is complex and not clearly defined.

Drug Characteristics: Buspirone

Dose Adjustment Hepatic	Use lower initial doses and increase gradually as needed and tolerated	**Absorption**	F = 90%; food increases AUC and Cmax
Dose Adjustment Renal	Use lower initial doses and increase gradually as needed and tolerated	**Distribution**	Vd = 5.3 L/kg; 86% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic; major substrate of CYP3A4/5
Pregnancy Category	B	**Elimination**	Renal elimination is 29-63% (primarily as metabolites), with a half-life of 2-3 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Buspirone

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

Drug Interactions: Buspirone

Typical Agents	Mechanism	Clinical Management
Linezolid, SSRIs, St. John's wort	Increased risk of serotonin syndrome	Monitor for symptoms (hypertension, hyperthermia, myoclonus, mental status changes)
CYP3A4/5 inducers	Increased buspirone metabolism reduces buspirone effectiveness	Monitor and consider dose increases of buspirone
CYP3A4/5 inhibitors	Decreased buspirone metabolism increases risk of buspirone toxicity	Monitor and consider dose decreases of buspirone

Adverse Reactions: Buspirone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Dizziness	Asthenia, confusion, diarrhea, excitement, feeling nervous, fatigue, headache, hostile behavior, nausea	Mania, psychiatric disorder

Efficacy Monitoring Parameters. Reduction in symptoms of anxiety.

Toxicity Monitoring Parameters. Signs and symptoms of withdrawal upon abrupt dose reduction or discontinuation.

Key Patient Counseling Points. Patient should avoid activities requiring mental alertness or coordination until drug effects are realized. Advise patient that symptomatic improvement may not be seen for a few weeks. Advise patient against sudden discontinuation of drug. Patient may take with or without food, but should always take drug consistently. Patient should not drink alcohol or large amounts of grapefruit juice while taking this drug. Avoid concomitant use with MAOI.

Clinical Pearls. Safety and efficacy not established in pediatric patients <18 y of age.

CANDESARTAN: Atacand, Various

Class: Angiotensin II Receptor Antagonist

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

AstraZeneca pictured

Common FDA Label Indication, Dosing, and Titration.

1. Heart failure: 4 mg po daily, may titrate to 32 mg/d po
2. Hypertension: Adults, 16 mg po daily or in 2 divided doses, may titrate to 32 mg po daily; Children 1-5 y of age, 0.2 mg/kg po daily, may titrate to 0.4 mg/kg daily; Children 6-16 y of age and <50 kg, 4-8 mg po daily, may titrate to 32 mg daily; Children 6-16 y of age and ≥50 kg, 8-16 mg po daily, may titrate to 32 mg daily

Off-Label Uses. None

MOA. Candesartan is a selective, reversible, competitive antagonist of the angiotensin II receptor type 1 (AT1).

Drug Characteristics: Candesartan

Dose Adjustment Hepatic	Decrease dose in patients with moderate hepatic impairment	**Absorption**	F = 15%, food does not affect absorption
Dose Adjustment Renal	CrCl 15-60 mL/min, 8 mg po daily	**Distribution**	Vd = 0.13 L; >99% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Parent compound bioactivated during absorption via ester hydrolysis within intestinal wall to candesartan
Pregnancy Category	D	**Elimination**	Renal elimination is 33% and fecal elimination is 67% with a half-life of 5-10 h (metabolite)
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to candesartan or other ARB, pregnancy	**Black Box Warnings**	Pregnancy

Medication Safety Issues: Candesartan

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

Drug Interactions: Candesartan

Typical Agents	Mechanism	Clinical Management
Potassium-sparing diuretics	Increased risk of hypotension, hyperkalemia	Avoid concurrent use or monitor BP and serum 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 candesartan, increased risk of nephrotoxicity	Avoid concurrent use or monitor BP and SCr
Diuretics	Increased risk of postural hypotension due to hypovolemia	Monitor BP

Adverse Reactions: Candesartan

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Hypotension	Back pain, constipation, dizziness, dyspepsia, f ushing, hyperkalemia, nephrotoxicity, tachycardia	Angioedema, birth defects, hepatotoxicity, rhabdomyolysis

Efficacy Monitoring Parameters. Decreased BP, resolution of heart failure; may require 3-6 wk to obtain therapeutic response.

Toxicity Monitoring Parameters. Report signs/symptoms of hypotension, tachycardia. Baseline and periodic sodium, potassium, total bicarbonate, BUN, SCr, and urinalysis prior to initiating therapy.

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.

Clinical Pearls. Not indicated for use in children <1 y of age. Observe volume-depleted patient for hypotension with first dose. May cause progressive renal impairment and acute renal failure; those with preexisting renal impairment, heart failure, or diabetes are at increased risk.

CARBAMAZEPINE: Tegretol, Various

Class: Anticonvulsant

Dosage Forms. **Oral Tablet:** 200 mg; **Tablet, Chewable:** 100 mg; **Oral Tablet, Extended Release:** 100 mg, 200 mg, 400 mg; **Oral Suspension:** 100 mg/5 mL; **Oral Capsule, Extended Release:** 100 mg, 200 mg, 300 mg

Taro generic 200 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Bipolar disease, acute manic and mixed episodes: 200 mg po bid, may titrate to 1600 mg/d po
2. Epilepsy, partial, generalized, and mixed types: Adults, 200 mg po bid, may titrate to 1200 mg po daily; Children <6 y of age, 10-20 mg/kg/d po in 2-3 divided doses, may titrate to 250-350 mg/d po; Children 6-12 y of age, 100 mg po bid, may titrate to 800 mg po daily
3. Trigeminal neuralgia: Regular release, 100 mg po q12h, may titrate to 1200 mg po daily prn for pain control

Off-Label Uses.

1. Neuropathic pain: 50-100 mg po bid in combination with opioids, may titrate to 1200 mg/d po

MOA. Carbamazepine acts presynaptically to block firing of action potentials, which decreases the release of excitatory neurotransmitters, and postsynaptically by blocking high-frequency repetitive discharge initiated at cell bodies.

Drug Characteristics: Carbamazepine

Dose Adjustment Hepatic	Avoid	**Absorption**	F = 89%; no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 0.59-2 L/kg; 75-90% protein bound
Dialyzable	Yes	**Metabolism**	Hepatic; major substrate of CYP3A4/5; strong inducer of CYP1A2, 2B6, 2C19, 2C8, 2C9, 3A4/5 and P-glycoprotein
Pregnancy Category	D	**Elimination**	Renal elimination 72%, with an initial half-life of 25-65 h, then 12-17 h after 3-5 wk due to autoinduction
Lactation	Compatible	**Pharmacogenetics**	Serious and sometimes fatal dermatologic reactions are more likely in patients with the inherited allelic variant HLA-B*1502. Avoid in individuals with this genotype
Contraindications	Hypersensitivity to carbamazepine, history of bone marrow depression, MAOIs, nefazodone	**Black Box Warnings**	Agranulocytosis; aplastic anemia; dermatological reactions (especially in Asians); screen for HLA-B*1502

Medication Safety Issues: Carbamazepine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
XR	CarBAMazepine, TEGretol	Do not crush or chew ER tablets or capsules	No	OXcarbazepine, Toradol	No

Drug Interactions: Carbamazepine

Typical Agents	Mechanism	Clinical Management
Acetaminophen	Increased risk of hepatotoxicity	Monitor LFTs
CYP3A4/5 inducers	Increased carbamazepine metabolism reduces carbamazepine effectiveness	Monitor and consider dose increases of carbamazepine
CYP3A4/5 inhibitors	Decreased carbamazepine metabolism increases risk of carbamazepine toxicity	Monitor and consider dose decreases of carbamazepine
CYP1A2, 2B6, 2C19, 2C8, 2C9, 3A4/5 and P-glycoprotein substrates	Carbamazepine increases metabolism of substrates drugs, lowers plasma concentration, and decreases substrate drug activity	Avoid concurrent use, or monitor substrate drug and consider dose increase
Ergocalciferol	Increased catabolism of vitamin D	Monitor vitamin D levels and supplement
Diuretics	Increased risk of hyponatremia	Monitor electrolytes
MAOIs	Increased risk or ergotism	Contraindicated
Nefazodone	Inhibition of carbamazepine metabolism, induction of nefazodone metabolism	Contraindicated
Warfarin	Decreased anticoagulant effectiveness	Monitor INR

Adverse Reactions: Carbamazepine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Hyponatremia	Blurred vision, confusion, hypocalcaemia, nausea, nystagmus, somnolence	Cardiac dysrhythmia, hepatitis, nephrotoxicity, pancreatitis, pancytopenia, Stevens-Johnson syndrome, syncope, toxic epidermal necrolysis

Efficacy Monitoring Parameters. Reduction in number of seizures, decreased pain, therapeutic concentrations for epilepsy: 4-12 mcg/mL.

Toxicity Monitoring Parameters. Emergence or worsening of depression, suicidal behavior or ideation, or unusual changes in behavior; baseline CBC, serum sodium, LFTs, complete urinalysis, and BUN; thyroid function test at baseline and during therapy, eye examinations at baseline and during therapy.

Key Patient Counseling Points. May decrease effectiveness of oral contraceptives; use an alternative form of birth control. Avoid activities requiring mental alertness or coordination until drug effects are realized. Take with food, but not alcohol, grapefruit, or grapefruit juice. Avoid abrupt discontinuation.

Clinical Pearls. Carbamazepine is a drug of first choice for seizure disorder due to equivalent activity and decreased toxicity compared to other anti-seizure medications. Suspension is dosed 3-4 times per day.

CARBIDOPA/LEVODOPA: Sinemet, Various

Class: Antiparkinsonian

Dosage Forms. **Oral Tablet, Immediate Release:** (Carbidopa/Levodopa) 10 mg/100 mg, 25 mg/100 mg, 25 mg/250 mg; **Oral Tablet, Extended Release:** (Carbidopa/Levodopa) 25 mg/100 mg, 50 mg/200 mg; **Orally Disintegrating Tablet:** (Carbidopa/Levodopa) 10 mg/100 mg, 25 mg/100 mg, 25 mg/250 mg

25 mg/100 mg

25 mg/250 mg

Teva generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Parkinson disease: Immediate release, 25 mg/100 mg po tid, increasing dose to therapeutic response; Extended release, 50 mg/200 mg po bid, separate doses by at least 6 h; patients generally treated with 400-1600 mg of levodopa per day; *max* 200 mg of carbidopa and 2000 mg of levodopa

Off-Label Uses.

1. Restless legs syndrome: 25 mg/100 mg po qhs, may repeat dose if awakening within 2 h

MOA. When levodopa is administered orally, it is rapidly decarboxylated to dopamine in extracerebral tissues so that only a small portion of a given dose is transported unchanged to the CNS. For this reason, when given alone, large doses of levodopa are required for adequate therapeutic effect. However, these doses often result in nausea and other adverse reactions. Carbidopa inhibits decarboxylation of circulating levodopa, preventing nausea and allowing more levodopa to reach the CNS. Carbidopa does not cross the blood-brain barrier and does not affect the metabolism of levodopa within the CNS.

Drug Characteristics: Carbidopa/Levodopa

Dose Adjustment Hepatic	Not required	**Absorption**	Carbidopa F = 60%; levodopa F = 70-75%
Dose Adjustment Renal	Not required	**Distribution**	CSF concentrations of levodopa are 10-20% of plasma levels
Dialyzable	Not dialyzable	**Metabolism**	Levodopa undergoes extensive decarboxylation to dopamine in the gut wall, liver, and kidney; when given with carbidopa, peripheral decarboxylation of levodopa is blocked, increasing availability of levodopa for brain transport
Pregnancy Category	C	**Elimination**	Carbidopa renal elimination is 30% with a half-life of 1-2 h; levodopa renal elimination is 70-80% with a half-life of 45-90 min
Lactation	Avoid; may inhibit lactation	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to carbidopa or levodopa, narrow-angle glaucoma	**Black Box Warnings**	None

Medication Safety Issues: Carbidopa/Levodopa

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
CR	No	Do not crush CR or oral disintegrating products	No	Serevent	No

Drug Interactions: Carbidopa/Levodopa

Typical Agents	Mechanism	Clinical Management
Dopamine D_2 receptor antagonists (isoniazid)	Reduction in therapeutic effect of levodopa	Increase dose of carbidopa/levodopa
Linezolid	Unknown; serotonin toxicity with severe hypertension	Concurrent use contraindicated; must wait at least 2 wk after discontinuing linezolid before initiating carbidopa/levodopa
MAOIs	Severe hypertension	Concurrent use contraindicated; must wait at least 2 wk after discontinuing MAOI before initiating carbidopa/levodopa
Phenytoin	Phenytoin reverses the effects of levodopa in Parkinson disease	Increase dose of carbidopa/levodopa

Adverse Reactions: Carbidopa/Levodopa

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Dyskinesia	Nausea	Orthostatic hypotension, neuroleptic malignant syndrome

Efficacy Monitoring Parameters. Reduction in symptoms of Parkinson disease (extrapyramidal movements, rigidity, tremor, gait disturbances).

Toxicity Monitoring Parameters. Seek medical attention if GI bleeding and dyskinesia occur; monitor IOP in glaucoma patients who take this product.

Key Patient Counseling Points. Patients using concomitant antihypertensive may be at increased risk for postural hypotension. If you are using the oral disintegrating tabs, place on top of the tongue; does not require water or swallowing.

Clinical Pearls. Since levodopa competes with certain amino acids for transport across the gut wall, the absorption of levodopa may be impaired in some patients on a high protein diet. Parkinson disease is a progressive, neurodegenerative disorder of the extrapyramidal nervous system affecting the mobility and control of the skeletal muscular system. Its characteristic features include resting tremor, rigidity, and bradykinetic movements. Similar symptoms can occur (known as “parkinsonism”) due to manganese or carbon monoxide intoxication, after encephalitic conditions, and idiopathically. All are treated with levodopa/carbidopa at the same doses as used for Parkinson disease.

CARISOPRODOL: Soma, Various

Class: Centrally Acting Skeletal Muscle Relaxant. C-IV

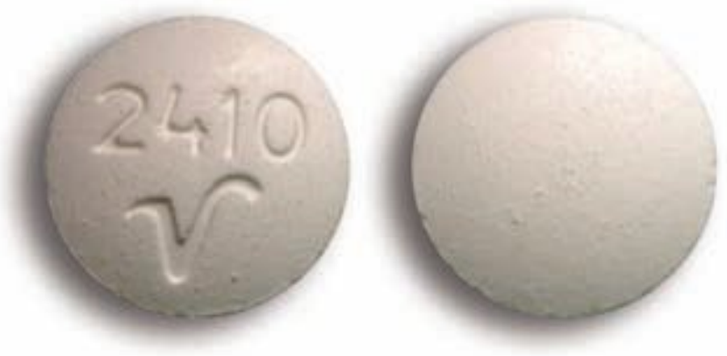
Dosage Forms. Oral Tablet: 250 mg, 350 mg

Common FDA Label Indication, Dosing, and Titration.

1. Disorder of musculoskeletal system: 250-350 mg po tid and hs

Off-Label Uses. None

MOA. Carisoprodol blocks interneuronal activity in descending reticular formation and spinal cord, resulting in muscle relaxation.



Qualitest generic 350 mg pictured

Drug Characteristics: Carisoprodol

Dose Adjustment Hepatic	Use lower doses initially and increase dose carefully in patients with hepatic failure	**Absorption**	Unknown
Dose Adjustment Renal	Not required	**Distribution**	Unknown
Dialyzable	Yes	**Metabolism**	Hepatic; major substrate of CYP2C19
Pregnancy Category	C	**Elimination**	Renal elimination is slight with a half-life of 8 h
Lactation	Avoid	**Pharmacogenetics**	CYP2C19 poor metabolizers at increased risk of toxicity
Contraindications	Hypersensitivity to carisoprodol or meprobamate, acute intermittent porphyria	**Black Box Warnings**	None

Medication Safety Issues: Carisoprodol

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

Drug Interactions: Carisoprodol

Typical Agents	Mechanism	Clinical Management
CYP2C19 inducers	Increased carisoprodol metabolism reduces carisoprodol effectiveness	Monitor and consider dose increases of carisoprodol
CYP2C19 inhibitors	Decreased carisoprodol metabolism increases risk of carisoprodol toxicity	Monitor and consider dose decreases of carisoprodol
CNS depressants (opioids, benzodiazepines, alcohol)	Additive sedative effects	Avoid concurrent use or monitor carefully for signs of toxicity

Adverse Reactions: Carisoprodol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Drowsiness, dizziness	Headache	Seizure, drug dependence, withdrawal symptoms upon discontinuation after chronic use

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, confusion occur within minutes or hours after first dose.

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. Patients withdrawing from prolonged therapy should be monitored carefully for withdrawal symptoms, including seizures.

Clinical Pearls. Carisoprodol 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). The drug was approved by the FDA in 1959 and limited pharmacologic and pharmacokinetic data are available.

CARVEDILOL: Coreg, Coreg CR, Various

Class: α/β-Adrenergic Blocker

Dosage Forms. Oral Tablet: 3.125 mg, 6.25 mg, 12.5 mg, 25 mg; **Oral Capsule, Extended Release:** 10 mg, 20 mg, 40 mg, 80 mg

Teva generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Heart failure: Tablets, 3.125 mg po bid, *max* 25 mg po bid for patients weighing <85 kg, 50 mg po bid for patients weighing >85 kg; Extended-release capsule, 10 mg po daily in the morning, *max* 80 mg po daily
2. Hypertension: Tablet, 6.25 mg po bid; *max* 25 mg po bid; Extended-release capsule, 20 mg po daily in the morning, *max* 80 mg po daily
3. Impaired left ventricular function, myocardial infarction: Tablet, 3.125-6.25 mg po bid, may titrate to 25 mg po bid; Extended-release capsule, 10-20 mg po daily in the morning, *max* 80 mg po daily

Off-Label Uses.

1. Angina pectoris: 25-50 mg po bid
2. Cardiac dysrhythmia: 6.25 mg po bid, may titrate to 50 mg po bid

MOA. Carvedilol is a selective α_1- and nonselective β-adrenergic blocker that decreases AV nodal conduction in supraventricular tachycardias and blockade of catecholamine-induced dysrhythmias.

Drug Characteristics: Carvedilol

Dose Adjustment Hepatic	Avoid use in patients with hepatic impairment; contraindicated in severe liver dysfunction	**Absorption**	F = 25-35%; food significantly increases AUC and Cmax for extended-release product
Dose Adjustment Renal	Not required	**Distribution**	Vd = 115 L; >95% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Hepatic 98%; major substrate of CYP2D6, P-glycoprotein; inhibitor of P-glycoprotein
Pregnancy Category	C	**Elimination**	Renal elimination is 16% and 60% in feces, with a half-life of 6-10 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	CYP2D6 poor metabolizers with higher plasma levels, consider lower initial dose
Contraindications	Hypersensitivity, bronchial asthma, severe sinus bradycardia, 2nd- or 3rd-degree AV block, sick sinus syndrome, overt heart failure, cardiogenic shock, severe hepatic impairment	**Black Box Warnings**	None

Medication Safety Issues: Carvedilol

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
CR	No	No	No	Corgard, Cortef, Cozaar	No

Drug Interactions: Carvedilol

Typical Agents	Mechanism	Clinical Management
Calcium channel blockers, quinidine, amiodarone, dronedarone	Increased risk of bradycardia, atrioventricular block, sinus arrest	Avoid concurrent use in patients with sick sinus syndrome or AV block
P-glycoprotein inducers	Increased carvedilol metabolism reduces carvedilol effectiveness	Monitor and consider dose increases of carvedilol
CYP2D6, P-glycoprotein inhibitors	Decreased carvedilol metabolism increases risk of carvedilol toxicity	Monitor and consider dose decreases of carvedilol
P-glycoprotein substrates	Carvedilol inhibits metabolism of substrates resulting in increased risk of substrate toxicity	Monitor and consider dose decreases of substrates
Insulin, oral hypoglycemic agents	May enhance the hypoglycemic effect of sulfonylureas, may also mask hypoglycemia	Monitor blood glucose levels
NSAIDs	Decreased antihypertensive effect of carvedilol	Avoid concurrent use or monitor BP

Adverse Reactions: Carvedilol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Cold extremities, dizziness, erectile dysfunction, fatigue, hypotension, weight gain	Arthralgia, bradyarrhythmias, bronchospasm, diarrhea, hyperglycemia, dyspnea, depression, headache, nausea, somnolence, syncope, vomiting	Heart failure, hepatotoxicity, Stevens-Johnson syndrome

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, bronchospasm, increased blood glucose levels in diabetic patients, and hepatotoxicity.

Key Patient Counseling Points. Take carvedilol with food or milk. Report signs/symptoms of heart failure, bradyarrhythmias, bronchospasm, hepatotoxicity, hypotension, syncope, or exacerbation of angina with initial dosing and dose changes. Avoid alcohol. Avoid abrupt discontinuation, may cause rebound hypertension. Avoid driving, using machinery, or doing anything else that could be dangerous if not alert. Diabetic patients carefully follow blood sugar levels as β-blockers may mask symptoms of hypoglycemia.

Clinical Pearls. Safety and efficacy not established in pediatric patients. Reduce dose with bradycardia (<55 beats/min).

CEFDINIR: Omnicef, Various

Class: Third-Generation Cephalosporin

Dosage Forms. **Powder for Oral Suspension:** 125 mg/5 mL, 250 mg/5 mL; **Oral Capsule:** 300 mg

Common FDA Label Indication, Dosing, and Titration.

1. Acute otitis media, pharyngitis, tonsillitis: Children 6 mo through 12 y, 7 mg/kg po bid × 5-10 d or 14 mg/kg po daily x 10 d; *max* 600 mg/d; Adults, 300 mg po bid × 5-10 d
2. Bronchitis, acute, secondary bacterial infection: Adults and Children >12 y of age, 300 mg po bid × 5-10 d
3. Community-acquired pneumonia, uncomplicated skin, and/or subcutaneous tissue infection: 300 mg po bid × 10 d

Off-Label Uses. None

MOA. Cefdinir is a third-generation cephalosporin with activity against a number of gram-positive and gram-negative bacteria including β-lactamase–producing strains.

Aurobindo generic 300 mg pictured

C

Drug Characteristics: Cefdinir

Dose Adjustment Hepatic	Not required	**Absorption**	F = 25%, food decreases absorption by 30%
Dose Adjustment Renal	CrCl <30 mL/min, decrease interval to daily	**Distribution**	Lung, maxillary sinus, middle ear fluid, skin, sputum
Dialyzable	Administer after hemodialysis and decrease interval to every other day	**Metabolism**	Not metabolized
Pregnancy Category	B	**Elimination**	Renal elimination is 18% with a half-life of 2 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to cephalosporin	**Black Box Warnings**	None

Medication Safety Issues: Cefdinir

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

Drug Interactions: Cefdinir

Typical Agents	Mechanism	Clinical Management
Antacids, iron, vitamins	Decreased absorption	Separate administration by 2 h

Adverse Reactions: Cefdinir

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Diarrhea	Nausea and vomiting, vaginitis, headache	Increased liver enzymes, hypersensitivity

Efficacy Monitoring Parameters. Resolution of infection.

Toxicity Monitoring Parameters. Seek medical attention if severe diarrhea.

Key Patient Counseling Points. Complete full course of therapy. For the suspension, shake well and can be stored at room temperature. Note short expiration after reconstitution. 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 with health-care practitioner. Separate administration of antacids, iron, and vitamins by 2 h.

Clinical Pearls. May resume normal activities after 24 h of antibiotics and if afebrile. Approximately 10% of patients allergic to penicillin are also allergic to cephalosporin; use with caution in penicillin-allergic patients.

CEFUROXIME: Ceftin, Various

Class: Second-Generation Cephalosporin

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

Northstar Rx generic 500 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Acute infective exacerbation of COPD, uncomplicated skin and/or subcutaneous tissue infection, acute bacterial maxillary sinusitis, uncomplicated urinary tract infection: Adults, 250-500 mg po bid × 10 d
2. Acute otitis media: Children who are able to swallow tablets, 250 mg po bid × 10 d
3. Bronchitis, acute, secondary bacterial infection: Adults and Children >12 y of age, 250-500 mg po bid × 5-10 d
4. Gonorrhea, uncomplicated: 1 g po × 1 dose
5. Impetigo: Children 3 mo to 12 y of age, suspension 30 mg/kg/d po in 2 divided doses × 10 d, *max* 1 g/d
6. Lyme disease: 500 mg po bid × 14-21 d
7. Pharyngitis, tonsillitis: Adults: 250 mg po bid × 10 d; Children 3 mo to 12 y of age, suspension 20 mg/kg/d po in 2 divided doses for 10 d, *max* 500 mg/d

Off-Label Uses. None

MOA. Cefuroxime is a second-generation cephalosporin whose activity is better than cefazolin but less than cefotaxime, against *H. influenzae*, including β-lactamase–producing strains. The activity of cefuroxime against *S. aureus* is slightly less than that of cefazolin. Its activity against anaerobes is poor, similar to the first-generation cephalosporins.

Drug Characteristics: Cefuroxime

Dose Adjustment Hepatic	Not required	**Absorption**	F = 37%, food increases absorption to 52%, suspension must be taken with food; tablets can be taken without regard to food
Dose Adjustment Renal	CrCl = 10-30 mL/min, administer full dose every 24 h; CrCl ≤10 mL/min, administer full dose every 48 h	**Distribution**	Aqueous humor, bronchial secretions, ear fluid, placenta, sinus
Dialyzable	Dialyzable by both hemodialysis and peritoneal dialysis	**Metabolism**	Cefuroxime is rapidly hydrolyzed by plasma and GI esterases
Pregnancy Category	B	**Elimination**	Renal elimination is 50% with a half-life of 2 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to cephalosporins	**Black Box Warnings**	None

Medication Safety Issues: Cefuroxime

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Do not crush or chew tablets due to persistent bitter taste	No	Cefzil, Cipro	No

Drug Interactions: Cefuroxime

Typical Agents	Mechanism	Clinical Management
Ethinyl estradiol and other estrogen-based birth control products	Alters intestinal flora which, in turn, reduces the enterohepatic circulation of estrogen metabolites; decreased efficacy of birth control	Use an alternative form of birth control

Adverse Reactions: Cefuroxime

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Diarrhea	Nausea and vomiting, vaginitis, increased liver enzymes	Stevens-Johnson syndrome, hepatotoxicity, severe hypersensitivity, anemia, neutropenia, pancytopenia, seizure

Efficacy Monitoring Parameters. Resolution of infection.

Toxicity Monitoring Parameters. Yellowing of the eyes, blistering skin rash or extreme fatigue, unusual bruising or bleeding, shortness of breath.

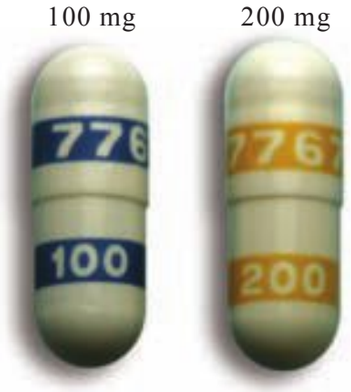
Key Patient Counseling Points. Seek medical attention if rash develops. Complete full course of therapy. For the suspension, shake well and store in the refrigerator. Note short expiration after reconstitution. Avoid mixing suspension with food or beverages, but food can be taken afterward. Symptoms should improve within 2-3 d; if they worsen, seek follow-up with health-care practitioner.

Clinical Pearls. May resume normal activities after 24 h of antibiotics if afebrile. Approximately 10% of patients allergic to penicillins are also allergic to cephalosporins; use with caution in penicillin-allergic patients. Dosing of suspension and tablets are not interchangeable. Also available in injectable formulation.

CELECOXIB: Celebrex

Class: Cyclooxygenase-2 Inhibitor

Dosage Forms. Oral Capsule: 50 mg, 100 mg, 200 mg, 400 mg



Pfizer pictured

Common FDA Label Indication and Dosing.

1. Osteoarthritis: 100 mg po bid or 200 mg po daily
2. Rheumatoid arthritis: Adults, 100-200 mg po bid; Children >2 y of age, 10-25 kg, 50 mg po bid, >25 kg, 100 mg po bid
3. Ankylosing spondylitis: 100 mg po bid
4. Acute pain, primary dysmenorrhea: 200 mg po bid prn

Off-Label Uses.

1. Gout: 400 mg po bid × 7 d

MOA. Inhibition of the COX-2 enzyme isoform is thought to be responsible for the anti-inflammatory effects of NSAIDs, whereas inhibition of COX-1 results in GI and possibly other side effects.

Drug Characteristics: Celecoxib

Dose Adjustment Hepatic	Moderate: reduce dose by 50%; severe: avoid use	**Absorption**	Well absorbed, food enhances absorption
Dose Adjustment Renal	CrCl <30 mL/min: avoid use	**Distribution**	Vd = 400 L; 97% protein bound
Dialyzable	Unknown	**Metabolism**	Hepatic 97%; major substrate of CYP2C9; moderate inhibitor of CYP2C8 and 2D6
Pregnancy Category	D	**Elimination**	27% renal elimination with a half-life of 11 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	Consider dose reduction of 50% in CYP2C9 poor metabolizers
Contraindications	Asthma, urticaria, or allergic-type reaction following aspirin or other NSAID administration; CABG surgery, treatment of perioperative pain, hypersensitivity to sulfonamides	**Black Box Warnings**	GI toxicity, cardiotoxicity, CABG

Medication Safety Issues: Celecoxib

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	CeleBREX	No	No	CeleXA, Cerebyx, Cervarix, Clarinex	No

Drug Interactions: Celecoxib

Typical Agents	Mechanism	Clinical Management
Aspirin, SSRIs	Additive GI toxicity	Monitor for GI toxicity
Angiotensin II receptor blockers, thiazide diuretics	Decreased diuretic and antihypertensive efficacy via decreased renal prostaglandin production	Monitor and consider alternative therapy
CYP2C9 inducers	Increased celecoxib metabolism reduces celecoxib effectiveness	Monitor and consider dose increases of celecoxib
CYP2C9 inhibitors	Decreased celecoxib metabolism increases risk of celecoxib toxicity	Monitor and consider dose decreases of celecoxib
CYP2D6 and 2C8 substrates	Decreased metabolism and increased toxicity of substrates	Monitor and consider substrate dose reduction
Lithium	Increased lithium levels, unknown mechanism	Monitor lithium concentrations and adjust
Pemetrexed	Decreased renal clearance and increased toxicity of pemetrexed	Avoid NSAIDs in combination with pemetrexed in patients with renal dysfunction
Warfarin	Both substrates for CYP2C9, competitive metabolism	Monitor INR and adjust warfarin dose

Adverse Reactions: Celecoxib

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Hypertension, headaches, GI distress, diarrhea	Myocardial infarction, bronchospasm	Stevens-Johnson syndrome, GI ulcers and bleeding, thrombosis, elevated liver functions, acute renal failure

Efficacy Monitoring Parameters. Decreased pain and improved range of motion, regression of colonic polyps on colonoscopy.

Toxicity Monitoring Parameters. CBC, LFTs, SCr, fecal occult blood tests, BP, severe skin rash, black tarry stools, swelling or weight gain, severe pain, yellowing of eyes of skin, change in urination.

Key Patient Counseling Points. Take with food or milk to decrease GI upset. May open capsule and pour into a teaspoon of applesauce.

Clinical Pearls. Elderly patients are at increased risk of GI ulceration. Patients with underlying cardiac dysfunction are at increased risk for cardiovascular effects. Celecoxib has less risk of GI effects than other NSAIDs, but increased cardiovascular toxicity.

CEPHALEXIN: Keflex, Various

Class: First-Generation Cephalosporin

Dosage Forms. **Powder for Oral Suspension:** 125 mg/5 mL, 250 mg/5 mL; **Oral Tablet:** 250 mg, 500 mg; **Oral Capsule:** 250 mg, 500 mg, 750 mg

Teva generic 500 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Infection of skin and/or subcutaneous tissue: Adults, 500 mg po q12h; Children, 25-50 mg/kg/d po divided q12h
2. Osteomyelitis: Adults, 250 mg-1 g po q6h; Children, 25-100 mg/kg/d po divided q6h, *max* 4 g/d
3. Otitis media, respiratory tract infection, urinary tract infection: Adults, 250 mg-1 g po q6h; Children, 25-100 mg/kg/d po divided q6h, *max* 4 g/d
4. Streptococcal pharyngitis: Adults, 500 mg po q12h × 10 d; Children, 25-50 mg/kg/d po divided q6h × 10 d, *max* 4 g/d

Off-Label Uses.

1. Bacterial endocarditis; prophylaxis for high-risk patients; dental, respiratory, or infected skin/skin structure or musculoskeletal tissue procedures: Adults, 2 g po 30-60 min prior to procedure; Children, 50 mg/kg 30-60 min prior to procedure

MOA. Cephalexin is a first-generation cephalosporin that inhibits bacterial wall synthesis of actively dividing cells by binding to one or more penicillin-binding proteins (PBPs). Most gram-positive bacteria, including non-penicillinase and penicillinase-producing staphylococci, and streptococci. Activity against gram-negative bacteria is less than that observed with the second- and third-generation cephalosporins and is primarily restricted to *E. coli*, *Klebsiella*, and *P. mirabilis*.

Drug Characteristics: Cephalexin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 90%, food has little effect on absorption
Dose Adjustment Renal	CrCl <50 mL/min, 500 mg q12h	**Distribution**	Bile, joints, placenta, sputum
Dialyzable	Dialyzable by both hemodialysis and peritoneal dialysis	**Metabolism**	Not metabolized
Pregnancy Category	B	**Elimination**	Renal elimination is 69-100% with a half-life of 1 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to cephalosporins	**Black Box Warnings**	None

Medication Safety Issues: Cephalexin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Cefaclor, ceFAZolin, ciprofloxacin, Valtrex	No

Drug Interactions: Cephalexin

Typical Agents	Mechanism	Clinical Management
Cholestyramine	Cholestyramine may bind to and decrease absorption of cephalexin	Administer cephalexin 1 h before or 6 h after cholestyramine
Metformin	Cephalexin may decrease metformin renal excretion leading to increased metformin toxicity	Use with caution; increase monitoring for metformin toxicity

Adverse Reactions: Cephalexin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Nausea and vomiting	Stevens-Johnson syndrome, renal failure, severe hypersensitivity, anemia, neutropenia, seizure

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

Toxicity Monitoring Parameters. Seek medical attention if decreased urination, blistering skin rash or extreme fatigue, unusual bruising or bleeding, shortness of breath.

Key Patient Counseling Points. Seek medical attention if rash develops. Complete full course of therapy. For the suspension, shake well and store in the refrigerator. Note short expiration after reconstitution. 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 with health-care practitioner.

Clinical Pearls. May resume normal activities after 24 h of antibiotics and if afebrile. Approximately 10% of patients allergic to penicillins are also allergic to cephalosporins; use with caution in penicillin-allergic patients.

CETIRIZINE: Zyrtec, Various

Class: Antihistamine

Dosage Forms. **Oral Tablet:** 5 mg, 10 mg; **Oral Tablet, Chewable:** 5 mg, 10 mg; **Oral Capsule:** 10 mg; **Oral Solution:** 1 mg/mL; **Oral Syrup:** 1 mg/mL

Common FDA Label Indication, Dosing, and Titration.

1. Perennial or seasonal allergic rhinitis: Children 6-23 mo of age, 2.5 mg po daily; Children 2-5 y of age, 2.5-5 mg po daily; Children ≥6 y of age and Adults, 5-10 mg po daily
2. Urticaria, chronic: Children 6-23 mo of age, 2.5 mg po daily; Children 2-5 y of age, 2.5-5 mg po daily; Children ≥6 y of age and Adults, 5-10 mg po daily

Off-Label Uses.

1. Atopic dermatitis: Children 6-23 mo of age, 2.5 mg po daily; Children 2-5 y of age, 2.5-5 mg po daily; Children ≥6 y of age and Adults, 5-10 mg po daily

MOA. Cetirizine is a low-sedating, long-acting H_1-receptor antagonist that is a metabolite of hydroxyzine. Cetirizine competitively inhibits the interaction of histamine with H_1 receptors, thereby preventing the allergic response.

Drug Characteristics: Cetirizine

Dose Adjustment Hepatic	Chronic liver failure, 5 mg po daily	**Absorption**	F = 70%, limited effect of food on absorption
Dose Adjustment Renal	CrCl <30 mL/min, 5 mg po daily	**Distribution**	Vd = 0.5-0.8 L/kg with 90% protein binding
Dialyzable	Yes	**Metabolism**	Limited hepatic; substrate of P-glycoprotein
Pregnancy Category	B	**Elimination**	Renal elimination is 70% with a half-life of 8.3 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to cetirizine or hydroxyzine	**Black Box Warnings**	None

Sunmark 1 mg/mL generic solution pictured

Medication Safety Issues: Cetirizine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
ZyrTEC-D	ZyrTEC	No	No	ZyrTEC Itchy Eye (ketotifen), Zantac	No

Drug Interactions: Cetirizine

Typical Agents	Mechanism	Clinical Management
CNS depressants (opioids, benzodiazepines, alcohol)	Possible increase in sedation effects	Use concurrently with caution
P-glycoprotein inducers	Increased cetirizine metabolism reduces cetirizine effectiveness	Monitor and consider dose increases of cetirizine
P-glycoprotein inhibitors	Decreased cetirizine metabolism increases risk of cetirizine toxicity	Monitor and consider dose decreases of cetirizine

Adverse Reactions: Cetirizine

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

Efficacy Monitoring Parameters. Improvement in rhinitis or urticaria symptoms.

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

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. Product is available in several nonprescription dosage forms.

CHLORHEXIDINE: Peridex, Hibiclens, Various

Class: Antibacterial Cleansing Agent

Dosage Forms. **Liquid Oral Rinse:** 0.12%; **Topical Solution:** 2%, 4%

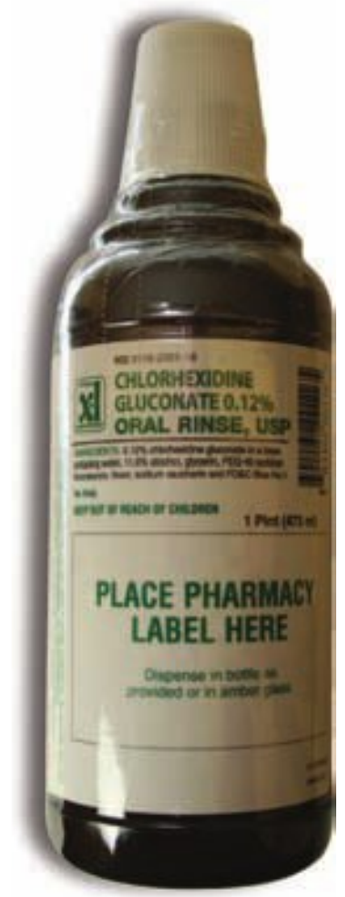
Common FDA Label Indication, Dosing, and Titration.

1. Gingivitis: 15 mL oral rinse (undiluted, 0.12%), swish 30 s and spit bid (morning and evening) after tooth brushing
2. Skin or wound cleansing: Rinse area to be cleansed, apply minimum amount of solution necessary to cover skin or wound area, and wash gently; then rinse

Off-Label Uses.

1. Burn, prevention of nosocomial infectious disease: Rinse area to be cleansed, apply minimum amount of 4% solution necessary to cover skin or wound area, and wash gently; then rinse
2. Oropharyngeal decontamination, to reduce risk of ventilator-associated pneumonia in critically ill patients: 15 mL oral rinse (undiluted, 0.12%), swab oral area q8h

MOA. Chlorhexidine, a polybiguanide, is an antiseptic and antimicrobial drug with bactericidal activity. The bactericidal effect of chlorhexidine is a result of the binding of this cationic molecule to negatively charged bacterial cell walls and extracellular microbial complexes.



Xttrium generic pictured

Drug Characteristics: Chlorhexidine

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**	Not absorbed
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to chlorhexidine	**Black Box Warnings**	None

Medication Safety Issues: Chlorhexidine

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

Drug Interactions: Chlorhexidine. None

Adverse Reactions: Chlorhexidine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Tooth aches and discolored teeth with oral rinse	GI irritation	Allergic reactions, skin irritation

Efficacy Monitoring Parameters. Oral rinse: resolution of gingivitis. Topical: no signs of bacterial infection (redness, pruritus, burning, swelling).

Toxicity Monitoring Parameters. Tooth discoloration, skin irritation.

Key Patient Counseling Points. For oral rinse, measure out 1/2 fluid ounce (15 mL) as marked in the cap which comes with the bottle, swish the solution in mouth for at least 30 s; do not swallow. Wait several hours after use of chlorhexidine to eat or drink. Likely to cause tooth discoloration, which can be removed by dental cleaning. For topical product, use only on unbroken skin, do not swallow, or get in the eyes, ears, mouth, nose, genital area, or anal area. Contains large amounts of alcohol (70%) and are flammable. Apply the medicine in a well-ventilated place. Do not cover the treated area until the medicine is completely dry. This is usually 3 min or longer for hairless skin. If you must apply the medicine to a hairy area of the body, wipe the area with a towel to remove extra medicine.

Clinical Pearls. Not for use in children. Several nonprescription products also available.

CHLORTHALIDONE: Hygroton, Thalitone, Various

Class: Thiazide Diuretic

Dosage Forms. Oral Tablet: 25 mg, 50 mg, 100 mg

Mylan generic 25 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Hypertension: Adults, 25 mg po daily, may titrate to *max* of 100 mg po daily
2. Edema: 50 mg po daily, may titrate to *max* of 200 mg po daily; heart failure–associated edema, 12.5-25 mg po daily, may titrate to *max* of 100 po daily

Off-Label Uses.

1. Hypertension: Children, 0.3 mg/kg po daily, may titrate to *max* of 2 mg/kg/d or 50 mg/d, whichever is less
2. Calcium nephrolithiasis, prevention of recurrent kidney stones: 25 mg po daily

MOA. Chlorthalidone increases sodium and chloride excretion by interfering with their reabsorption in the cortical-diluting segment of the nephron.

Drug Characteristics: Chlorthalidone

Dose Adjustment Hepatic	Not required	**Absorption**	F = 65%, food has no effect on absorption
Dose Adjustment Renal	CrCl <10 mL/min: increase dosing interval to q48h	**Distribution**	Vd = 3-13 L/kg; protein binding 75%
Dialyzable	Not dialyzable	**Metabolism**	Hepatic
Pregnancy Category	B	**Elimination**	Renal elimination 50-74%, half-life of 40-60 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to chlorthalidone or sulfonamides; anuria	**Black Box Warnings**	None

Medication Safety Issues: Chlorthalidone

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

Drug Interactions: Chlorthalidone

Typical Agents	Mechanism	Clinical Management
NSAIDs	Decreased antihypertensive effect of chlorthalidone	Avoid concurrent use or monitor BP
Calcium channel blockers, quinidine	Increased risk of hypotension and/or bradycardia and atrioventricular block	Avoid concurrent use
Digoxin	Increased risk of AV block	Monitor HR, ECG, and serum digoxin concentrations
ACE-Is	Increased risk of postural hypotension (first dose)	Start with low dose of ACE-I and monitor BP
Dofetilide	Increased risk of ventricular arrhythmias (torsades de pointes) due to hypokalemia, hypomagnesemia	Avoid concurrent use

Adverse Reactions: Chlorthalidone

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Dizziness, hypotension, hyperuricemia	Anorexia, diarrhea, headache, hypokalemia, hyponatremia, nausea, orthostatic hypotension, rash	Heart failure, pancreatitis

Efficacy Monitoring Parameters. Decreased BP, swelling, edema.

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

Key Patient Counseling Points. Instruct patient to report signs/symptoms of dyspnea, hypotension, gout, or heart failure. Avoid alcohol and NSAIDs. Avoid abrupt discontinuation. This medicine may cause dizziness. Avoid driving, using machinery, or doing anything else that could be dangerous if not alert. Instruct patient to rise slowly from sitting/supine position, as drug may cause orthostatic hypotension. Instruct patient to eat high-potassium foods during therapy.

Clinical Pearls. Chlorthalidone is not FDA approved for use in children, but it is included in guidelines and can be used off label.

CIPROFLOXACIN ORAL: Cipro, Cipro XR, Various

Class: Fluoroquinolone Antibiotic

Dosage Forms. **Microcapsules for Oral Suspension:** 250 mg/5 mL, 500 mg/5 mL; **Oral Tablet:** 100 mg, 250 mg, 500 mg, 750 mg; **Oral Tablet, Extended Release:** 500 mg, 1000 mg

Northstar Rx generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Anthrax, postexposure prophylaxis: Adults, 500 mg po q12h × at least 60 d, Children, 15 mg/kg po bid × at least 60 d, *max* 500 mg/dose
2. Bacterial prostatitis, chronic: 500 mg po q12h × 28 d
3. Bronchitis, lower respiratory tract infection, infection of bone, skin, or soft tissue, sinusitis: 500-750 mg po q12h × 7-14 d
4. Urinary tract infectious disease: 250-500 mg po q12h or 500 mg (extended release) q24h × 3 d

Off-Label Uses.

1. Chancroid: 500 mg po bid × 3 d
2. Traveler's diarrhea: 750 mg po as a single dose (mild); 500 mg po bid × 3 d (severe)

MOA: Ciprofloxacin is a fluoroquinolone that inhibits bacterial DNA gyrase. It is highly active against aerobic, gram-negative bacilli.

Drug Characteristics: Ciprofloxacin Oral

Dose Adjustment Hepatic	Not required	**Absorption**	F = 60-80%, minor food effect
Dose Adjustment Renal	CrCl 30-50 mL/min, 250-500 mg q12h; CrCl 5-29 mL/min, 250-500 mg q18h	**Distribution**	Widespread (bile, CSF, gynecologic tissues, liver, lung, prostate, peritoneum, synovial fluid, sputum, etc)
Dialyzable	Dialyzable by both hemodialysis and peritoneal dialysis. Give 250-500 mg q24h after dialysis	**Metabolism**	Not metabolized; substrate of P-glycoprotein; strong inhibitor of CYP1A2
Pregnancy Category	C	**Elimination**	Renal elimination is 30-57% with a half-life of 3-6 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	Serious and sometimes fatal hemolytic reactions may occur in patients with glucose-6-phosphate dehydrogenase (G6PD) deficiency
Contraindications	Hypersensitivity to ciprofloxacin or other quinolones, concomitant tizanidine	**Black Box Warnings**	Myasthenia gravis, tendon inflammation and rupture

Medication Safety Issues: Ciprofloxacin Oral

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
XR	No	Do not crush Cipro XR	No	Ceftin, cephalexin	No

Drug Interactions: Ciprof oxacin Oral

Typical Agents	Mechanism	Clinical Management
Diabetic agents	Hypoglycemic or hyperglycemic episodes, mechanism unknown	Avoid concurrent use; monitor FPG and consider dose adjustments of antidiabetic agent
Aluminum, calcium, and magnesium-containing antacids, calcium fortified foods, didanosine, iron, sevelamer	Decreased absorption of ciprof oxacin caused by chelation	Take ciprof oxacin 2 h before or 6 h after
Corticosteroids	Increased risk of tendon rupture	Counsel patients to discontinue ciprof oxacin and seek medical attention if tendon pain or rupture
CYP1A2 substrates	Ciprof oxacin inhibits CYP1A2 reducing substrate metabolism and increased substrate toxicity	Monitor for toxicity and consider dose reductions of substrates
Warfarin	Increased risk of bleeding	Increased monitoring of INR and warfarin adjustments
P-glycoprotein inducers	Increased ciprof oxacin metabolism reduces ciprof oxacin effectiveness	Monitor and consider dose increases of ciprof oxacin
P-glycoprotein inhibitors	Decreased ciprof oxacin metabolism increases risk of ciprof oxacin toxicity	Monitor and consider dose decreases of ciprof oxacin

Adverse Reactions: Ciprof oxacin Oral

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Tooth discoloration in infants	Nausea and vomiting, rash, myalgia, arthralgia, tendinitis, headache	Stevens-Johnson syndrome, renal failure, severe hypersensitivity, anemia, neutropenia, thrombocytopenia, seizure, cardiac effects, liver failure, myasthenia gravis, tendon rupture, renal failure, psychosis, QT prolongation

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

Toxicity Monitoring Parameters. Baseline SCr. If obtained, levels should be between 0.5 and 5 mcg/mL.

Key Patient Counseling Points. Seek medical attention if decreased urination, yellowing of eyes, blistering skin rash or extreme fatigue, unusual bruising or bleeding, shortness of breath or chest pain, tendon pain. Take with or without food, but not with milk or other dairy products. Take ciprofloxacin at least 2 h before or 6 h after antacids, sucralfate, or mineral supplements and multivitamins with calcium, iron, or zinc. If using the suspension, shake well before use; suspension may be stored at room temperature.

Clinical Pearls. Not approved in children <18 y of age except for anthrax and complicated UTIs. Requires medication guide when dispensed. Also available in injectable, otic, and ophthalmic formulations.

CIPROFLOXACIN OTIC: Cipro HC, Cetraxal, Various

Class: Fluoroquinolone Antibiotic

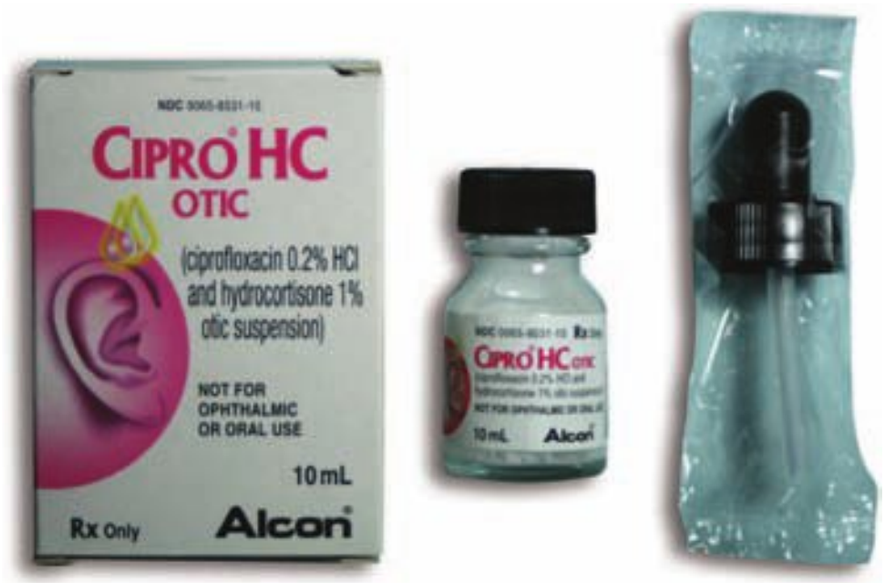
Dosage Forms. Otic Solution: 0.2%

Common FDA Label Indication, Dosing, and Titration.

1. Otitis externa, acute: Adults and Children >1 y of age, 0.25 mL (entire single-use container) into affected ear(s) bid (approximately q12h) × 7 d

Off-Label Uses. None

MOA. Ciprofloxacin is a fluoroquinolone that inhibits bacterial DNA gyrase, an enzyme responsible for the unwinding of DNA for transcription and subsequent supercoiling of DNA for packaging into chromosomal subunits. It is highly active against aerobic, gram-negative bacilli, especially Enterobacteriaceae, with MICs often <0.1 mg/L. It is also active against some strains of *P. aeruginosa* and *Staphylococcus* spp., with an MIC of 0.5-1 mg/L. However, recent reports indicate increasing resistance to this agent in *S. aureus*. It has poor activity against streptococci and anaerobes.



Alcon pictured

Drug Characteristics: Ciprofloxacin Otic

Dose Adjustment Hepatic	Not required	**Absorption**	Not systemically absorbed
Dose Adjustment Renal	Not required	**Distribution**	Not systemically absorbed
Dialyzable	Not absorbed	**Metabolism**	Not systemically absorbed
Pregnancy Category	C	**Elimination**	Not systemically absorbed
Lactation	Unknown if ciprofloxacin otic solution is excreted into breast milk. Weigh risks and benefits	**Pharmacogenetics**	None known that affect otic solution administration
Contraindications	Hypersensitivity to ciprofloxacin or other quinolones	**Black Box Warnings**	None

Medication Safety Issues: Ciprofloxacin Otic

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

Drug Interactions: Ciprofloxacin Otic. None known

Adverse Reactions: Ciprof oxacin Otic

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Application site pain and itching, fungal ear superinfection	Hypersensitivity reactions

Efficacy Monitoring Parameters. Resolution of signs and symptoms of infection. Cultures may be required if infection does not improve within 1 wk of therapy.

Toxicity Monitoring Parameters. Ear pain, local hypersensitivity reaction, secondary fungal infections.

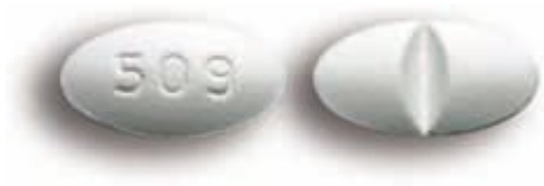
Key Patient Counseling Points. Warm solution by holding container in hands for at least 1 min before administering. Patient should lie with affected ear upward; position should be maintained for at least 1 min after instillation; repeat in the opposite ear if necessary.

Clinical Pearls. Ciprofloxacin otic is not approved in children <1 y of age. Not for ophthalmologic use, otic use only. Also available as injectable, ophthalmic, and oral formulations.

CITALOPRAM: Celexa, Various

Class: SSRI Antidepressant

Dosage Forms. Oral Tablet: 10 mg, 20 mg, 40 mg; **Oral Solution:** 10 mg/5 mL



Sun Pharmaceuticals generic 40 mg pictured

Greenstone generic 20 mg pictured

Blu Pharmaceuticals generic 10 mg pictured

C

Common FDA Label Indication, Dosing, and Titration.

1. Depression: 20 mg po daily, may titrate to 40 mg po daily

Off-Label Uses.

1. OCD: 20 mg po daily, may titrate to 40 mg/d
2. Panic disorder: 20-30 mg po daily, may titrate to 40 mg po daily

MOA. Citalopram is a bicyclic antidepressant that is a selective and potent inhibitor of presynaptic reuptake of serotonin (an SSRI). It does not affect reuptake of norepinephrine or dopamine and has a relative lack of affinity for muscarinic, histamine, α_1- and α_2-adrenergic, and serotonin receptors.

Drug Characteristics: Citalopram

Dose Adjustment Hepatic	*Max* dose 20 mg po daily in hepatic impairment	**Absorption**	F = 80%; no effect of food on absorption
Dose Adjustment Renal	Use with caution in severe renal impairment	**Distribution**	Vd = 12 L/kg; 80% protein bound
Dialyzable	Not dialyzed	**Metabolism**	Hepatic >90%; substrate of CYP2C19 and 3A4/5
Pregnancy Category	C	**Elimination**	Fecal elimination is 20%, renal elimination is 20% (12-13% unchanged), with a half-life of 33-37 h
Lactation	Avoid	**Pharmacogenetics**	CYP2C19 poor metabolizers, *max* dose 20 mg/d
Contraindications	Hypersensitivity, concomitant use of pimozide, MAOIs	**Black Box Warnings**	Suicidal ideation; not approved for use in children

Medication Safety Issues: Citalopram

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	CeleXA	No	No	CeleBREX, ZyPREXA	No

Drug Interactions: Citalopram

Typical Agents	Mechanism	Clinical Management
Anticoagulants, antiplatelet drugs, NSAIDs	Increased risk of bleeding	Monitor for bleeding
Dextroamphetamine, triptans, linezolid, lithium, MAOIs	Increased risk of serotonin syndrome	Monitor closely for symptoms of serotonin syndrome (restlessness, hyperthermia, hyperref exia, incoordination), do not use MAOIs
CYP2C19 and CYP3A4/5 inducers	Increased citalopram metabolism reduces citalopram effectiveness	Monitor and consider dose increases of citalopram
CYP2C19 and CYP3A4/5 inhibitors	Decreased citalopram metabolism increases risk of citalopram toxicity	Monitor and consider dose decreases of citalopram

Adverse Reactions: Citalopram

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation, dizziness, headache, insomnia, nausea, sedation, xerostomia	Agitation, anxiety, diaphoresis, diarrhea, disorder of ejaculation, fatigue, impotence, reduced libido, tremor	Prolonged QT interval, serotonin syndrome, suicidal thoughts, torsades de pointes, agranulocytosis

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

Toxicity Monitoring Parameters. Worsening of mental health symptoms, 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. Avoid activities requiring mental alertness or coordination until drug effects are realized. Symptomatic improvement may not be seen for several weeks. Report worsening depression, suicidal ideation, unusual changes in behavior, or unusual bleeding. Avoid abrupt discontinuation, may precipitate withdrawal symptoms. Do not drink alcohol or use 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. Medication guide required when dispensing.

CLARITHROMYCIN: Biaxin, Various

Class: Macrolide Antibiotic

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

Dava generic 500 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Acute infective exacerbation of COPD: 250-500 mg po bid × 7-14 d
2. Community-acquired pneumonia, skin infection, sinusitis, pharyngitis: Adults, 250 mg po bid × 7-14 d or extended-release tablets, 1000 mg po daily for 7 d; Children ≥6 mo of age, 15 mg/kg/d divided q12h × 10 d
3. Disseminated infection due to *M. avium*-intracellulare group, prophylaxis-HIV infection, primary prevention and treatment: 500 mg po bid
4. *H. pylori* GI tract infection: 500 mg, bid × 10-14 d in combination with various other antibiotics and PPIs

Off-Label Uses.

1. Bacterial endocarditis prophylaxis for high-risk patients; dental, respiratory, or infected skin/skin structure or musculoskeletal tissue procedures: Adults, 500 mg po 30-60 min prior to procedure; Children, 15 mg/kg po 30-60 min prior to procedure

MOA. Clarithromycin binds to the 50S ribosomal subunit of the 70S ribosome of susceptible organisms, thereby inhibiting bacterial RNA-dependent protein synthesis.

Drug Characteristics: Clarithromycin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 50%, extended release should be taken with food, immediate release can be taken without regard to food
Dose Adjustment Renal	CrCl <30 mL/min, reduce dose by 50% or increase interval to q24h	**Distribution**	Gastric tissue, lung, ear f uid, prostate, sputum, soft tissue
Dialyzable	Unknown	**Metabolism**	Hepatic; substrate of CYP3A4/5 to active metabolites, inhibitor of CYP3A4/5, P-glycoprotein
Pregnancy Category	C	**Elimination**	Renal elimination is 20-40% with a half-life of 5-7 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to any macrolide or ketolide antibiotic; concomitant cisapride, pimozide, astemizole, terfenadine, ergotamine, or dihydroergotamine	**Black Box Warnings**	None

Medication Safety Issues: Clarithromycin

Suf xes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
XL	No	Do not crush XL formulation	No	Claritin	No

Drug Interactions: Clarithromycin

Typical Agents	Mechanism	Clinical Management
Drugs known to prolong the QT interval	Increased risk of cardiotoxicity via additive QT prolongation	Avoid concurrent use or consider monitoring ECG
CYP3A4/5, P-glycoprotein substrates	Inhibition of CYP3A4/5, P-glycoprotein by clarithromycin reduces substrate metabolism and increases substrate toxicity	Monitor for toxicity and consider dose reductions of substrates; do not use substrates if narrow therapeutic index or if known to prolong QT interval
CYP3A4/5 inducers	Increased clarithromycin metabolism reduces clarithromycin effectiveness	Monitor and consider dose increases of clarithromycin
CYP3A4/5 inhibitors	Decreased clarithromycin metabolism increases risk of clarithromycin toxicity	Monitor and consider dose decreases of clarithromycin
Digoxin	Increased bioavailability and digoxin toxicity	Caution with concurrent use
Sulfonylureas	Increased risk of hypoglycemia	Use with caution and increase blood glucose monitoring
SSRIs	Increased risk of serotonin syndrome	Consider dose reduction of SSRI
Warfarin	Increased risk of bleeding via inhibition of warfarin metabolism	Monitor INR closely

Adverse Reactions: Clarithromycin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Taste disturbance	Headache, diarrhea, nausea, vomiting, rash	QT prolongation, Stevens-Johnson syndrome, anemia, neutropenia, thrombocytopenia, severe hypersensitivity, myasthenic crisis, elevated LFTs, hallucinations, nephrotoxicity

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

Toxicity Monitoring Parameters. Seek medical attention if heart palpitations, blistering skin rash, unusual bruising or bleeding, yellowing of skin or eyes, or extreme fatigue.

Key Patient Counseling Points. Complete full course of therapy. Symptoms should improve within 2-3 d; if they worsen, seek follow-up with healthcare practitioner.

Clinical Pearls. Use with caution in severe renal, hepatic, or cardiac disease. Extended-release and immediate-release formulations are not interchangeable. Multiple drug interactions. *Max* dose in children, 1 g/d.

CLINDAMYCIN ORAL: Cleocin, Various

Class: Lincosamide Antibiotic

Dosage Forms. **Oral Capsule:** 75 mg, 150 mg, 300 mg; **Granules for Oral Solution:** 75 mg/5 mL

Greenstone generic 300 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Bacterial infectious disease, susceptible infections due to anaerobic organisms, staphylococci, streptococci, pneumococci: Adults, 150-450 mg po q6h; Children, 8-20 mg/kg/d po divided q6-8h
2. Infection of skin and/or subcutaneous tissue: Adults, 150-450 mg po q6h; Children, 8-20 mg/kg/d po divided q6-8h
3. Infectious disease of abdomen: Adults, 150-450 mg po q6h; Children, 8-20 mg/kg/d po divided q6-8h
4. Lower respiratory tract infection: Adults, 150-450 mg po q6h; Children, 8-20 mg/kg/d po divided q6-8h
5. Pelvic inflammatory disease: Adults, 150-450 mg po q6h; Children, 8-20 mg/kg/d po divided q6-8h
6. Septicemia: Adults, 150-450 mg po q6h; Children, 8-20 mg/kg/d po divided q6-8h

Off-Label Uses.

1. Bacterial vaginosis, oral treatment, pregnant women with symptomatic disease: 300 mg po bid × 7 d
2. Streptococcal pharyngitis, penicillin-allergic patients: Children, 20 mg/kg/d po in 3 divided doses (*max* 1.8 g/d)

MOA. Clindamycin is a semisynthetic 7-chloro-7-deoxylincomycin derivative that is active against most gram-positive organisms except enterococci and *C. difficile*. Gram-negative aerobes are resistant, but most anaerobes are sensitive. It inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit; it is bactericidal or bacteriostatic depending on the concentration, organism, and inoculums.

Drug Characteristics: Clindamycin

Dose Adjustment Hepatic	Not required	**Absorption**	F = 90%, no food effect
Dose Adjustment Renal	If CrCl <30 mL/min, reduce dose by 50% or double interval	**Distribution**	Appendix, bone, gastric tissue, head and neck, sputum, peritoneal f uid, uterus
Dialyzable	Unknown	**Metabolism**	Minor hepatic
Pregnancy Category	B	**Elimination**	Renal elimination 5-28% with a half-life of 1.5-5 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to clindamycin	**Black Box Warnings**	Colitis

Medication Safety Issues: Clindamycin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
Pediatric	No	Do not open capsules	No	Bleomycin, Clinoril, Claritin, clarithromycin	No

Drug Interactions: Clindamycin

Typical Agents	Mechanism	Clinical Management
Atracurium and nondepolarizing muscle relaxants	Clindamycin may have added effect on muscle contractility	Monitor for excessive neuromuscular blockade, consider dose reduction of muscle relaxant
Cyclosporine	Decreased bioavailability of cyclosporine; mechanism unknown	Monitor cyclosporine levels and consider dose adjustments
Erythromycin	Competition for the same binding site decreased antibiotic effect; theoretical additive effects on QT prolongation	Avoid concurrent use

Adverse Reactions: Clindamycin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Diarrhea, nausea, vomiting, rash	QT prolongation, Stevens-Johnson syndrome, pseudomembranous colitis, esophagitis

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

Toxicity Monitoring Parameters. Seek medical attention if heart palpitations, blistering skin rash, or profuse watery diarrhea.

Key Patient Counseling Points. Complete full course of therapy. Symptoms should improve within 2-3 d; if they worsen, seek follow-up with healthcare practitioner. Take with full glass of water. Remain upright for 30 min after dose to minimize risk of GI ulceration.

Clinical Pearls. May resume normal activities after 24 h of antibiotics and if afebrile. Prolonged use may result in fungal or bacterial superinfection, including *C. difficile*–associated diarrhea, which has been observed >2 m postantibiotic treatment. Also available as injectable, topical, and vaginal formulations. Common antibiotic for anaerobes infections above the diaphragm. Potential alternative in patients with gram-positive infection and allergy to penicillin (immediate-type hypersensitivity reactions).

CLINDAMYCIN TOPICAL: Cleocin T, Various

Class: Lincosamide Antibiotic

Dosage Forms. **Topical Foam:** 1%; **Topical Solution:** 1%; **Topical Gel:** 1%; **Topical Pad:** 1%; **Topical Lotion:** 1%

Common FDA Label Indication, Dosing, and Titration.

1. Acne vulgaris: Topical solution, lotion, gel; apply thin-film bid to affected areas; Foam: apply once daily to affected areas

Off-Label Uses.

1. Acneiform eruptions induced by epidermal growth factor receptor inhibitors: Topical gel or lotion; apply thin-film bid to affected areas

MOA. Clindamycin is a semisynthetic 7-chloro-7-deoxylincomycin derivative that is active against most gram-positive organisms except enterococci and *C. difficile*. Gram-negative aerobes are resistant, but most anaerobes are sensitive. It inhibits bacterial protein synthesis by binding to the 50S ribosomal subunit; it is bactericidal or bacteriostatic depending on the concentration, organism, and inoculums.

1% Solution

1% Gel

Fougera generic pictured

Drug Characteristics: Clindamycin

Dose Adjustment Hepatic	Not required	**Absorption**	Not systemically absorbed
Dose Adjustment Renal	Not required	**Distribution**	Not systemically absorbed
Dialyzable	Not systemically absorbed	**Metabolism**	Not systemically absorbed
Pregnancy Category	B	**Elimination**	Not systemically absorbed
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Clindamycin

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
T	No	No	No	Bleomycin, Clinoril, Claritin, clarithromycin	No

Drug Interactions: Clindamycin. None known

Adverse Reactions: Clindamycin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Dry skin	Itching pruritus, rash	

Efficacy Monitoring Parameters. Resolution of acne lesions.

Toxicity Monitoring Parameters. Seek medical attention if blistering skin rash.

Key Patient Counseling Points. Wash and dry face prior to application. Use on skin only, avoid eyes and mucous membranes, avoid cut or broken skin. Shake well before use. Liquid is flammable; avoid smoking while applying or exposure to heat or open flame. For the foam, apply to tissue and use that to apply to face.

Clinical Pearls. May have increased sensitivity to sun; may use sunscreen but wait 1-2 h after applying clindamycin topical solution. Also available as injectable, oral, and vaginal formulations.

CLOBAZAM: Onfi

Class: Anticonvulsant. C-IV

Dosage Forms. Oral Tablet: 5 mg, 10 mg, 20 mg; **Oral Suspension:** 2.5 mg/mL

Lundbeck 5 mg pictured

Common FDA Label Indication, Dosing, and Titration.

1. Lennox-Gastaut syndrome: Children ≥2 y of age and ≤30 kg, 5 mg po daily, may titrate to 20 mg po daily; Adults and Children ≥2 y of age and >30 kg, 10 mg po daily, may titrate to 40 mg po daily

Off-Label Uses.

1. Alcohol withdrawal syndrome: 0.3-0.9 mg/kg/d po × 1 wk
2. Anxiety: 20-80 mg po daily (single or divided doses) × 5-14 d

MOA. Clobazam is a benzodiazepine. The exact mechanism of action for clobazam is not known, but is thought to involve potentiation of neurotransmission resulting from binding at the benzodiazepine site of the $GABA_A$ receptor.

Drug Characteristics: Clobazam

Dose Adjustment Hepatic	Initial dose no higher than 5 mg po daily; titrate slowly to *max* of 40 mg po daily	**Absorption**	F = 87%, no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 100 L; 90% protein bound
Dialyzable	Hemodialysis has no effect on plasma concentration of parent or metabolite	**Metabolism**	Extensive hepatic; substrate of CYP2C19, P-glycoprotein to active metabolite (norclobazam); inhibits CYP2D6, UGT1A4, UGT1A6, UGT2B4
Pregnancy Category	C	**Elimination**	Renal elimination is 82% with a half-life of 36-42 h for parent, 71-82 h for metabolite
Lactation	Compatible (small amounts expressed in breast milk)	**Pharmacogenetics**	Use with caution and reduce dose in CYP2C19 poor metabolizers
Contraindications	Hypersensitivity to clobazam	**Black Box Warnings**	None

Medication Safety Issues: Clobazam

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

Drug Interactions: Clobazam

Typical Agents	Mechanism	Clinical Management
CYP2C19, P-glycoprotein inducers	Increased clobazam metabolism reduces clobazam effectiveness	Monitor and consider dose increases of clobazam
CYP2C19, P-glycoprotein inhibitors	Decreased clobazam metabolism increases risk of clobazam toxicity	Monitor and consider dose decreases of clobazam
CYP2D6, UGT1A4, UGT1A6, UGT2B4 substrates	Decreased substrate metabolism may result in substrate toxicity	Monitor and consider decreasing dose of substrate
Alcohol, opioids, and other CNS depressants	Additive CNS and respiratory depression	Avoid if possible and consider dose reductions of both agents
Phenytoin, fosphenytoin	Decreased metabolism of phenytoin	Monitor for phenytoin toxicity, reduce dose if necessary

Adverse Reactions: Clobazam

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation, drooling, ataxia, lethargy, respiratory infections, somnolence, fever	Dysarthria, insomnia, sedation, aggressive behavior, couth	Depression, Stevens-Johnson syndrome, suicidal attempts, toxic epidermal necrolysis

Efficacy Monitoring Parameters. Decrease in the frequency of seizures. Reduction in anxiety.

Toxicity Monitoring Parameters. Signs and symptoms of CNS depression, suicidal thoughts or behaviors, unusual changes in mood or behavior. Seek medical attention immediately if rash occurs, as significant risk of Stevens-Johnson syndrome.

Key Patient Counseling Points. Often causes lethargy and somnolence. Avoid alcohol while using. Avoid activities requiring mental alertness.

Clinical Pearls. Not indicated for children <2 y of age. Many drug-drug interactions; monitor concurrent drug use carefully. Medication guide required when dispensing.

CLOBETASOL: Temovate, Various

Class: Topical Corticosteroid

Dosage Forms. Cream: 0.05%; **Ointment:** 0.05%; **Topical Solution:** 0.05%; **Aerosol Foam:** 0.05%; **Gel:** 0.05%; **Shampoo:** 0.05%

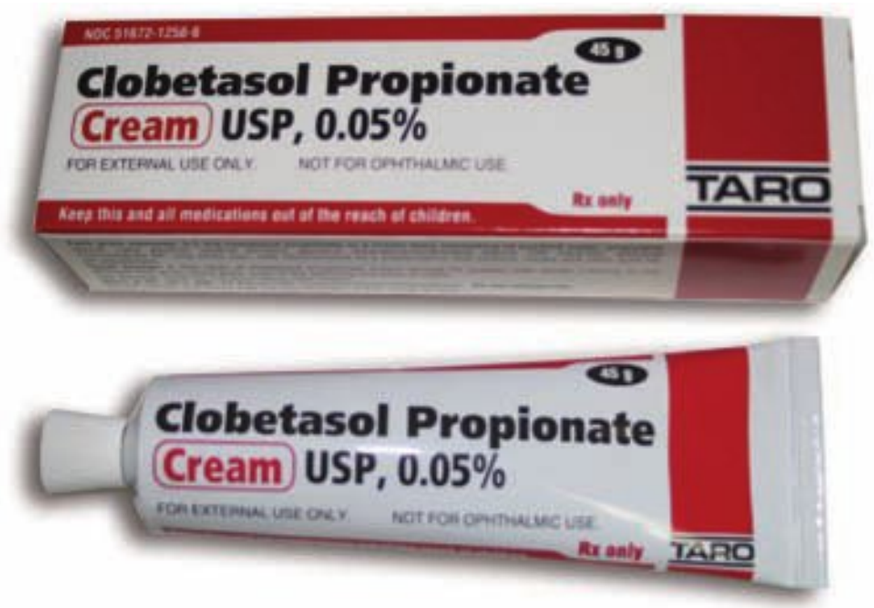
Common FDA Label Indication, Dosing, and Titration.

1. Skin disorders, corticosteroid responsive: Children ≥12 y of age and Adults, apply thin layer topically to affected area bid for a *max* of 2 wk
2. Plaque psoriasis: Children >12 y of age and adults, apply thin layer topically to affected area bid for a *max* of 2-4 wk

Off-Label Uses.

1. Oral lichen planus: Apply thin layer topically bid with antimycotics

MOA. Clobetasol 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.



Taro generic 0.05% cream pictured

Drug Characteristics: Clobetasol

Dose Adjustment Hepatic	Not required	**Absorption**	Minimal absorption unless covering large surface area or covering areas lacking skin integrity
Dose Adjustment Renal	Not required	**Distribution**	Not absorbed
Dialyzable	Unknown	**Metabolism**	Not absorbed
Pregnancy Category	C	**Elimination**	Not absorbed
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	None

Medication Safety Issues: Clobetasol

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

Drug Interactions: Clobetasol. None known

Adverse Reactions: Clobetasol

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Burning sensation, stinging, pruritus at site of administration, headache	Hypothalamic axis (HPA) suppression has been reported when used with occlusive dressings, over larger surface areas

Efficacy Monitoring Parameters. Improvement in clinical signs of skin disorder.

Toxicity Monitoring Parameters. Seek medical attention if severe skin irritation or symptoms worsen after administration.

Key Patient Counseling Points. Apply thin layer to affected area of skin. Skin should be clean and intact at site of application. Avoid contact with eyes and do not ingest by mouth. Avoid occlusive dressings or tight-fitting clothes over site of administration.

Clinical Pearls. Various dosage forms (foams, gels, shampoos, etc) available. Very high-potency corticosteroid. Application to large surface areas, prolonged use, and occlusive dressings may increase risk of systemic absorption and toxicity. Pediatric patients are more susceptible to systemic absorption.

CLONAZEPAM: Klonopin, Various

Teva generic pictured

Class: Benzodiazepine. C-IV

Dosage Forms. **Oral Tablet:** 0.5 mg, 1 mg, 2 mg; **Oral Tablet, Disintegrating:** 0.125 mg, 0.25 mg, 0.5 mg, 1 mg, 2 mg

Common FDA Label Indication, Dosing, and Titration.

1. Panic disorder: 0.25 mg po bid, may titrate by 0.125-0.25 mg po bid every 3 d to a *max* total daily dose of 1-4 mg (divided into 2-3 daily doses)
2. Seizure: Children ≥10 y of age or ≥30 kg and Adults, 0.5 mg po tid, may titrate by 0.125-0.25 mg po bid every 3 d to a *max* of 1-4 mg/d (divided into 2-3 daily doses); Children <10 y of age or <30 kg, 0.01-0.03 mg/kg/d po divided into 2-3 daily doses, may titrate by 0.25-0.5 mg po every 3 d to *max* of 0.1-0.2 mg/kg/d (divided into 3 daily doses)

Off-Label Uses.

1. Restless legs syndrome: 0.5-2 mg po qhs

MOA. Enhances the postsynaptic effect of the inhibitory neurotransmitter, γ-aminobutyric acid (GABA).

Drug Characteristics: Clonazepam

Dose Adjustment Hepatic	Decrease usual dose by 50%	**Absorption**	F = 90%, no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 1.5-3 L; 85% protein bound
Dialyzable	Supplemental dose not required	**Metabolism**	Hepatic; substrate of CYP3A4/5
Pregnancy Category	D	**Elimination**	Renal elimination is 1% with a half-life of 30-40 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to benzodiazepines, narrow-angle glaucoma, liver disease	**Black Box Warnings**	None

Medication Safety Issues: Clonazepam

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	ClonazePAM	Oral disintegrating tablets	No	cloBAZam, cloNIDine, clorazepate, cloZAPine, LORazepam	Avoid benzodiazepines (any type) for treatment of insomnia, agitation, or delirium.

Drug Interactions: Clonazepam

Typical Agents	Mechanism	Clinical Management
Alfentanil, opioids, and other respiratory depressants	Additive respiratory depression	Avoid if possible and consider dose reductions of both agents
CYP3A4/5 inducers	Increased clonazepam metabolism reduces clonazepam effectiveness	Monitor and consider dose increases of clonazepam
CYP3A4/5 inhibitors	Decreased clonazepam metabolism increases risk of clonazepam toxicity	Monitor and consider dose decreases of clonazepam
Theophylline	Decreased clonazepam effectiveness via inhibition of adenosine receptors	Monitor and consider dose increases for clonazepam

Adverse Reactions: Clonazepam

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Ataxia, lethargy, somnolence, weight gain	Tachycardia, palpitations, nausea and vomiting, blurred vision	Seizures, mania, depression, withdrawal symptoms

Efficacy Monitoring Parameters. Reduction in anxiety symptoms or seizures.

Toxicity Monitoring Parameters. Seek medical attention if severe drowsiness, slow or rapid heartbeat or skipped beats, thoughts of suicide.

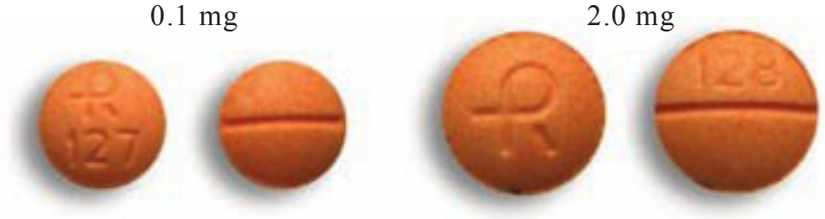
Key Patient Counseling Points. May cause drowsiness; avoid driving or other tasks requiring motor coordination. Allow orally disintegrating tablet to dissolve on your tongue. Avoid alcohol.

Clinical Pearls. Consider dose reductions of benzodiazepine in hepatic impairment. Use caution in elderly, appear more sensitive to the effects; dose reductions of 50% have been recommended. Use CNS depressants with caution, may have additive effects. Avoid abrupt discontinuation after chronic use, may cause seizures. Medication guide required when dispensing. Higher abuse potential among benzodiazepines.

CLONIDINE: Catapres, Various

Class: α_2-Adrenergic Agonist

Dosage Forms. **Oral Tablet:** 0.1 mg, 0.2 mg, 0.3 mg; **Oral Tablet, Extended Release:** 0.1 mg, 0.2 mg; **Transdermal Patch:** 0.1 mg/24 h, 0.2 mg/24 h, 0.3 mg/24 h



Actavis generic pictured

Common FDA Label Indication, Dosing, and Titration.

1. Attention-deficit hyperactivity disorder: Children >6 y of age, 0.1 mg extended-release tablet po qhs, may titrate in increments of 0.1 mg/d at weekly intervals to desired effect; give doses >0.1 mg/d in 2 divided doses; *max* dose 0.4 mg/d
2. Essential hypertension: 0.1 mg/d transdermal patch applied every 7 d, may titrate by 0.1 mg/d transdermal patch increments every 1-2 wk; *max* 0.6 mg/d every 7 d
3. Hypertension: 0.1 mg po bid, may titrate by 0.1 mg/d at weekly intervals, to 0.2-0.6 mg in 2 divided doses, *max* 2.4 mg/d

Off-Label Uses.

1. Hot sweats: 0.1 mg/d transdermal patch every 7 d or 0.2 mg po daily
2. Nicotine dependence: 0.1-0.2 mg/24 h transdermal patch daily or 0.1-0.45 mg po daily
3. Spasticity: 0.05-0.4 mg po daily in divided doses

MOA. Clonidine stimulates postsynaptic α_2-adrenergic receptors in the CNS by activating inhibitory neurons to decrease sympathetic outflow. Clonidine is not a complete agonist, so some of its effects might result from antagonist actions at presynaptic α-receptors. These actions reduce peripheral vascular resistance, renal vascular resistance, HR, and BP.

Drug Characteristics: Clonidine

Dose Adjustment Hepatic	Not required	**Absorption**	F = 75-100% immediate-release tablet, F = 60% patch; no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Vd = 2.9 L/kg; 20-40% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic metabolism, unknown pathway
Pregnancy Category	C	**Elimination**	Renal elimination of clonidine is 40-60% with a half-life of 12.5-16 h (41 h in patients with renal disease)
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity	**Black Box Warnings**	Epidural use

Medication Safety Issues: Clonidine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
TTS	CloNIDine	Extended-release tablets	No	Clomid, clomiPHENE, clonazePAM, cloZAPine, KlonoPIN, quiNIDine	Avoid clonidine as a first-line antihypertensive. High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension.

Drug Interactions: Clonidine

Typical Agents	Mechanism	Clinical Management
NSAIDs	Decreased antihypertensive effect of clonidine	Avoid concurrent use or monitor BP
TCAs	Decreased antihypertensive effect of clonidine by increasing release of norepinephrine	Avoid concurrent use or monitor BP
Beta-blockers, calcium channel blockers	Increased risk of hypotension and sinus bradycardia	Avoid concurrent use or monitor BP and HR
Cyclosporine	Increased risk of cyclosporine toxicity	Monitor serum cyclosporine levels

Adverse Reactions: Clonidine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Feeling nervous, headache, somnolence, erythema (patch), xerostomia	Bradycardia, constipation, contact dermatitis (patch), fatigue, hypotension, increased body temperature, irritability, nausea, palpitations, rash, rebound hypertension, sedation, tachycardia, urticaria	AV block

Efficacy Monitoring Parameters. Decreased BP or improvement of mental and behavioral symptoms of ADHD.

Toxicity Monitoring Parameters. Rebound hypertension, increased HR, palpitations, syncope.

Key Patient Counseling Points. Avoid alcohol, CNS depressants. Caution with driving and other tasks requiring alertness. Swallow extended-release tablet whole, may be taken with or without food. Apply patch to hairless area of intact skin on upper outer arm or chest; rotate patch location. If patch loosens during the 7-d wearing, secure adhesive cover. Report signs/symptoms of hypotension, exacerbation of angina peripheral edema, fatigue, hypotension, or hepatic dysfunction with initial dosing and dose changes. Avoid abrupt discontinuation to avoid rebound hypertension.

Clinical Pearls. Safety and efficacy of the immediate-release tablet for the treatment of hypertension not established in children. Extended-release tablets and immediate-release tablet formulation are not interchangeable. Injectable formulation available for epidural infusion (pain management).

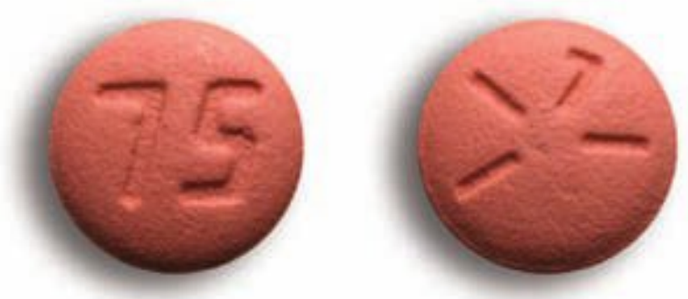
CLOPIDOGREL: Plavix, Various

Class: Platelet Aggregation Inhibitor

Dosage Forms. **Oral Tablet:** 75 mg, 300 mg

Common FDA Label Indication, Dosing, and Titration.

1. Acute ST and non–ST segment elevation myocardial infarction: 300-600 mg po loading dose, followed by 75 mg po daily (in combination with aspirin for those not at risk of bleeding)
2. Thrombosis prevention in arteriosclerotic vascular disease, following stroke, in peripheral arterial occlusive disease: 75 mg po daily



Bristol-Myers Squibb/Sanofi Aventis
75 mg pictured

Off-Label Uses.

1. Thrombosis prevention in atrial fibrillation or following percutaneous coronary intervention: 75 mg po daily (in combination with aspirin for those not at risk of bleeding)

MOA. Clopidogrel is an antiplatelet agent that prevents platelet aggregation by direct inhibition of ADP binding to receptor sites, inhibiting subsequent activation of the glycoprotein IIb/IIIa complex. This action is irreversible; therefore, platelets exposed to clopidogrel are inhibited for their life spans.

Drug Characteristics: Clopidogrel

Dose Adjustment Hepatic	Not required	**Absorption**	F = 50%; no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	93% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Prodrug, requires activation by CYP2C19; substrate of CYP2C19, inhibitor of CYP2B6, CYP2C8
Pregnancy Category	B	**Elimination**	Renal elimination of clopidogrel is 50% with a half-life of 6 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	CYP2C19 poor metabolizers; increased risk of cardiovascular events due to reduced efficacy of clopidogrel; consider alternative treatment or a higher dose
Contraindications	Hypersensitivity to clopidogrel and active bleeding	**Black Box Warnings**	Reduced CYP2C19 function

Medication Safety Issues: Clopidogrel

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Elavil, Paxil, Pradaxa	No

Drug Interactions: Clopidogrel

Typical Agents	Mechanism	Clinical Management
Amiodarone, azole antifungals, calcium channel blockers, cimetidine, fluoxetine, fluvoxamine, PPIs	Decreased platelet inhibitory effect of clopidogrel	Avoid concurrent use or monitor for signs/symptoms of thrombus formation
Aspirin, cilostazol, direct thrombin inhibitors, fibrinolytics, fondaparinux, low-molecular-weight heparin, NSAIDs, SSRIs, ticlopidine, unfractionated heparin, warfarin	Increased risk of bleeding	Monitor for signs/symptoms of bleeding
CYP2B6, CYP2C8 substrates	Reduced metabolism of substrates via inhibition of CYP2B6, CYP2C8	Monitor and consider substrate dose reductions
CYP2C19 inducers	Increased clopidogrel activation increases clopidogrel toxicity	Monitor and consider decreasing dose of clopidogrel
CYP2C19 inhibitors	Decreased clopidogrel activation decreases clopidogrel efficacy	Monitor and consider increasing dose of clopidogrel

Adverse Reactions: Clopidogrel

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Arthralgia, backache, epistaxis, gastritis, headache, hypertension, pruritus	Agranulocytosis, Stevens-Johnson syndrome, GI hemorrhage, GI ulcer, pancytopenia, thrombotic thrombocytopenic purpura

Efficacy Monitoring Parameters. Prevention of thrombotic events.

Toxicity Monitoring Parameters. Signs/symptoms of bleeding, especially with concomitant anticoagulant therapy.

Key Patient Counseling Points. Report signs/symptoms of bleeding, especially if used concomitantly with anticoagulant therapy. Do not stop therapy abruptly without first talking with prescriber to minimize the risk of re-thrombosis, particularly after stent placement. Clopidogrel should be discontinued 5 d prior to elective surgery, if an antiplatelet effect is not desired.

Clinical Pearls. Safety and efficacy not established in pediatric patients. Clopidogrel effectiveness is dependent on its activation to an active metabolite by CYP2C19. In patients who are CYP2C19 poor metabolizers or taking concurrent CYP2C19 inhibitors, clopidogrel at recommended doses forms less of the active metabolite and has a smaller effect on platelet function. Compared with normal metabolizers, poor CYP2C19 metabolizers with acute coronary syndrome, or undergoing percutaneous coronary intervention treated with clopidogrel at recommended doses, exhibit higher cardiovascular event rates. Consider alternative treatment or a higher dose in CYP2C19 poor metabolizers.

CLOTRIMAZOLE/BETAMETHASONE: Lotrisone, Various

Class: Anti-infective/Anti-inflammatory Combination

Dosage Forms. **Topical Cream:** (Clotrimazole/Betamethasone) 1%/0.05%**, Topical Lotion:** (Clotrimazole/Betamethasone) 1%/0.05%

Common FDA Label Indication, Dosing, and Titration.

1. Tinea: Adults and children >12 y, apply to affected area bid, for a *max* of 2 wk (for tinea corporis or tinea cruris) or 4 wk (for tinea pedis)

Off-Label Uses. None

MOA. Clotrimazole inhibits biosynthesis of ergosterol or other sterols, damaging the fungal cell wall membrane and altering its permeability. Betamethasone dipropionate is a corticosteroid that stimulates synthesis of enzymes thought to be responsible for anti-inflammatory effects.

Taro generic 1%/0.05% cream pictured

Drug Characteristics: Betamethasone/Clotrimazole

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**	Minimal absorption
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to clotrimazole or betamethasone	**Black Box Warnings**	None

Medication Safety Issues: Betamethasone/Clotrimazole

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

Drug Interactions: Betamethasone/Clotrimazole. None known

Adverse Reactions: Betamethasone/Clotrimazole

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
	Dry skin	Rash, HPA suppression has been reported in children, therefore not recommended in children <12 y of age

Efficacy Monitoring Parameters. Resolution of erythema and pruritus. Improvement in erythema and pruritus usually occurs within 3-5 d. If no improvement is seen after 1 wk of treatment for tinea cruris or tinea corporis, or after 2 wk of treatment for tinea pedis, then the diagnosis should be reviewed.

Toxicity Monitoring Parameters. Seek medical attention if severe skin irritation or rash. Various cortisol tests could be utilized to evaluate HPA suppression.

Key Patient Counseling Points. Apply thin layer to affected area. If using lotion, shake well before use.

Clinical Pearls. Patients receiving the combination therapy show an earlier, better clinical response than patients treated with clotrimazole cream or betamethasone cream alone. Cure rates with clotrimazole/betamethasone are at least as good or better as compared to clotrimazole alone. Do not use with occlusive dressings or on larger areas. This can lead to systemic absorption of betamethasone and HPA suppression.

CODEINE: Tylenol with Codeine, Various

Class: Opioid. C-II (when in combination with acetaminophen, C-III)

Dosage Forms. Oral Tablet (Codeine Alone): 15 mg, 30 mg, 60 mg; **Oral Solution (Codeine Alone):** 30 mg/5 mL; **Oral Tablet (With Acetaminophen):** Acetaminophen/Codeine 300 mg/15 mg, Acetaminophen/Codeine 300 mg/30 mg, Acetaminophen/Codeine 300 mg/60 mg; **Oral Elixir, Oral Solution (With Acetaminophen):** Acetaminophen/Codeine 120 mg/12 mg per 5 mL

300 mg/30 mg

Teva generic pictured

C

Common FDA Label Indication, Dosing, and Titration.

1. Pain: Adults, 15-60 mg po q4h prn; with acetaminophen 300-1000 mg (*max* 4000 mg/d); Children 3-6 y of age, 12 mg po 3-4 times a day prn, with acetaminophen 120 mg/dose; Children 7-10 y of age, 24 mg po 3-4 times a day prn, with acetaminophen 240 mg/dose

Off-Label Uses. None

MOA. Codeine is 3-methoxymorphine, a phenanthrene opioid with very low affinity for opioid receptors. Its analgesic activity appears to result from conversion to morphine.

Drug Characteristics: Codeine

Dose Adjustment Hepatic	Avoid chronic use in hepatic impairment	**Absorption**	Well absorbed; food has no effect on absorption
Dose Adjustment Renal	Codeine: CrCl 10-50 mL/min, 75% of dose; CrCl <10 mL/min, 50% of dose	**Distribution**	Vd = 2.6 L/kg; 7-25% protein bound
Dialyzable	Unknown	**Metabolism**	Codeine is a prodrug that requires activation by CYP2D6 to morphine; substrate of CYP2D6
Pregnancy Category	C	**Elimination**	Renal elimination approaches 100% with a half-life of 2-4 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	CYP2D6 variants with altered response
Contraindications	Hypersensitivity to codeine	**Black Box Warnings**	Hepatotoxicity

Medication Safety Issues: Codeine

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
Tylenol 3 and Tylenol	No	No	Yes (opioids)	Cardene, Lodine	No

Drug Interactions: Codeine

Typical Agents	Mechanism	Clinical Management
Alcohol, opioids, and other CNS depressants	Additive CNS and respiratory depression	Avoid if possible and consider dose reductions of both agents
Buprenorphine, opioid agonists/ antagonists, opioid antagonists	Precipitation of withdrawal symptoms	Avoid concurrent use with opioids
CYP2D6 inhibitors	Decreased effectiveness of codeine; prevents conversion of codeine to active metabolite, morphine	Monitor and consider increasing dose of codeine or choose alternative analgesic agent

Adverse Reactions: Codeine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Nausea, vomiting, constipation, somnolence	Pruritus, euphoria, dizziness	Stevens-Johnson syndrome, GI bleeding, elevated liver functions, thrombocytopenia, physical dependence, tolerance, respiratory depression

Efficacy Monitoring Parameters. Decreased pain.

Toxicity Monitoring Parameters. LFTs, SCr, if chronic use; severe skin rash, black tarry stools, excessive drowsiness, yellowing of eyes of skin, change in urination.

Key Patient Counseling Points. If using chronically, use a stool softener and/or laxative for preventing constipation. May cause drowsiness; avoid driving or other tasks requiring motor coordination. Avoid alcohol.

Clinical Pearls. Use caution in elderly, appear more sensitive to the effects. Use of CNS depressants with caution, may have additive effects. Tolerance and physical dependence may occur, avoid abrupt discontinuation. Oral solution contains 7% alcohol. Patients with multiple CYP2D6 gene copies metabolize codeine more rapidly (ultrarapid metabolism), whereas patients who lack functional CYP2D6 genes do not metabolize codeine to morphine and do not experience analgesic effects. Multiple CYP2D6 gene copies occur in 4-5% of Caucasians and is absent in 5-10% of the Caucasian population. In ultrarapid metabolizers, pediatric deaths post-tonsillectomy have been reported. CYP2D6 inhibitors, especially SSRIs, may also prevent activation of codeine to morphine. Codeine also available in combination with guaifenesin for cough.

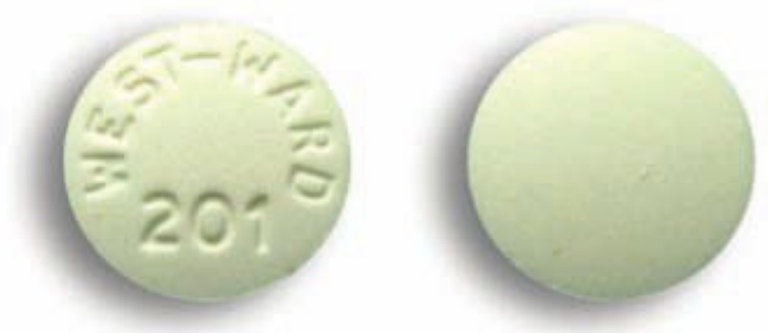
COLCHICINE: Colcyrs, Various

Class: Antigout

Dosage Forms. **Oral Tablet:** 0.6 mg

Common FDA Label Indication, Dosing, and Titration.

1. Gout, acute: 1.2 mg po at the first sign of a flare followed by 0.6 mg 1 h later; *max* 1.8 mg over 1 h
2. Gout, prophylaxis: 0.6 mg po daily to bid, *max* of 1.2 mg/d or onset of diarrhea
3. Familial Mediterranean fever: Children 4-6 y of age, 0.3-1.8 mg po daily; Children 6-12 y, 0.9-1.8 mg po daily; Children ≥12 y of age and Adults, 1.2-2.4 mg po daily, increase or decrease dose in increments of 0.3 mg/d



West-ward generic 0.6 mg pictured

Off-Label Uses.

1. Amyloidosis: 0.6 mg po bid
2. Constipation: 0.6 mg po q30 min until onset of diarrhea

MOA. Exact mechanism unknown. In patients with gout, may interrupt the cycle of monosodium urate crystal deposition in joint tissues and the resultant inflammatory response that initiates and sustains an acute attack. Colchicine also inhibits urate crystal deposition, which is enhanced by a low pH in the tissues, probably by inhibiting oxidation of glucose and subsequent lactic acid production in leukocytes.

Drug Characteristics: Colchicine

Dose Adjustment Hepatic	Severe hepatic failure, do not repeat gout f are courses more than once every 2 wk	**Absorption**	F = 45%, no effect of food on absorption
Dose Adjustment Renal	CrCl <30 mL/min, for gout f are, do not repeat course more than once every 2 wk	**Distribution**	Vd = 5-8 L/kg, 39% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Partial hepatic; substrate of CYP3A4/5, P-glycoprotein
Pregnancy Category	C	**Elimination**	Renal elimination is 40-65% with a half-life of 26-32 h
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to colchicine; concurrent use with strong CYP3A4/5 inhibitors in patients with renal or hepatic failure	**Black Box Warnings**	None

Medication Safety Issues: Colchicine

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

Drug Interactions: Colchicine

Typical Agents	Mechanism	sClinical Management
CYP3A4/5, P-glycoprotein inducers	Increased colchicine metabolism reduces colchicine effectiveness	Monitor and consider dose increases of colchicine
CYP3A4/5, P-glycoprotein inhibitors	Decreased colchicine metabolism increases risk of colchicine toxicity	Monitor and consider dose decreases of colchicine, particularly if renal or hepatic dysfunction exists
Lipid-lowering agents (fibrates, statins)	Coadministration of colchicine and lipid-lowering agents may result in myopathy and rhabdomyolysis; mechanism unknown	Avoid concurrent use

Adverse Reactions: Colchicine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Diarrhea, nausea	Vomiting	Agranulocytosis, rhabdomyolysiss

Efficacy Monitoring Parameters. Resolution of clinical signs and symptoms of gout (pain, stiffness, swelling).

Toxicity Monitoring Parameters. CBC, alkaline phosphatase at baseline and periodically during treatment. Instruct patients to discontinue the medication immediately and seek medical attention if signs and symptoms of agranulocytosis (severe neutropenia), or myotoxicity (including rhabdomyolysis). Monitor renal and hepatic function.

Key Patient Counseling Points. Instruct patient on appropriate dosing strategy for gout flares (dosing to symptom relief or onset of adverse effects, particularly diarrhea).

Clinical Pearls. Colchicine is a natural alkaloid found in plants such as the autumn crocus (*Colchicum autumnale*) and glory lily (*Gloriosa superba*). Medication guide required with dispensing.

COLESEVELAM: Welchol

Class: Hypolipidemic, Bile Acid Sequestrant

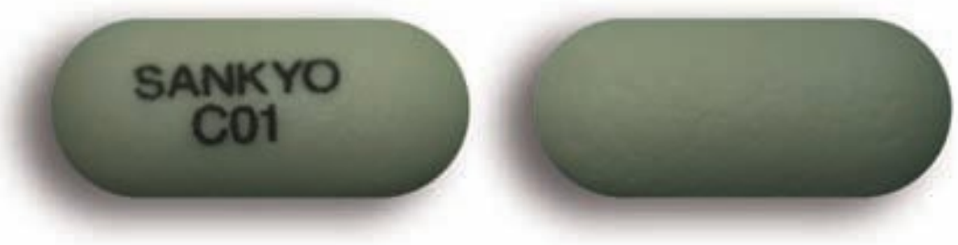
Dosage Forms. **Oral Tablet:** 625 mg; **Granules for Oral Suspension:** 3.75 g/packet

Common FDA Label Indication, Dosing, and Titration.

1. Primary hyperlipidemia: 1875 mg (3 tablets or 1.875 g powder packet) po bid or 3750 mg (6 tablets or 3.75 g powder packet) po daily

Off-Label Uses.

1. Familial hypercholesterolemia: 1875 mg (3 tablets or 1.875 g powder packet) po bid or 3750 mg (6 tablets or 3.75 g powder packet) po daily



Daichi-Sankyo 625 mg pictured

C

MOA. Colesevelam is a nonabsorbed, polymeric, lipid-lowering agent that binds intestinal bile acids, resulting in the increased clearance of LDL-cholesterol and a reduction in total cholesterol. Unlike cholestyramine and colestipol, colesevelam is not an anion exchange resin but binds bile acids and impedes their reabsorption.

Drug Characteristics: Colesevelam

Dose Adjustment Hepatic	Not required	**Absorption**	Not absorbed
Dose Adjustment Renal	Not required	**Distribution**	Not absorbed
Dialyzable	Not dialyzable	**Metabolism**	Not absorbed
Pregnancy Category	B	**Elimination**	Fecal elimination is >99% and renal elimination is 0.05%
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	History of bowel obstruction, hypertriglyceridemia-induced pancreatitis; serum triglyceride level >500 mg/dL	**Black Box Warnings**	None

Medication Safety Issues: Colesevelam

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	Tablets (use granules instead)	No	No	No

Drug Interactions: Colesevelam

Typical Agents	Mechanism	Clinical Management
Antidiabetic drugs, diltiazem, ezetimibe, fibrates, levothyroxine, mycophenolate, oral contraceptives	Decreased bioavailability of colesevelam due to binding and decreased absorption	Take drug 4 h prior to colesevelam
Cyclosporine, phenytoin	Decreased bioavailability of cyclosporine and phenytoin due to binding and decreased absorption	Take drug 4 h prior to colesevelam; monitor drug serum levels
Warfarin	Decreased bioavailability of warfarin due to binding and decreased absorption	Take warfarin 4 h prior to colesevelam; monitor INR values

Adverse Reactions: Colesevelam

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Constipation	Asthenia, nasopharyngitis, myalgia, nausea, hypertension, hypertriglyceridemia, hypoglycemia	Pancreatitis, bowel obstruction

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

Toxicity Monitoring Parameters. Signs/symptoms of GI side effects, vitamin A, D, E, or K deficiencies.

Key Patient Counseling Points. Should be used together with diet and exercise to lower cholesterol levels. Empty contents of powder packet into a glass and mix with 120-240 mL of water; stir well and drink. Oral suspension should not be taken in its dry form. Take with a meal. Tablet should be swallowed with liquid (water, milk, or juice). May be dosed concomitantly with an HMG-CoA reductase inhibitor.

Clinical Pearls. Safety and efficacy not established in pediatric patients <10 y of age or in premenarcheal girls. Patients with difficulty swallowing should use oral suspension instead of tablets.

CONJUGATED ESTROGENS: Premarin

Class: Estrogen Hormone

Dosage Forms. Oral Tablet: 0.3 mg, 0.45 mg, 0.625 mg, 0.9 mg, 1.25 mg

Wyeth pictured

Common FDA Label Indication, Dosing, and Titration.

1. Abnormal vasomotor function (menopause), atrophy of vagina or vulva, postmenopausal osteoporosis prophylaxis, female hypogonadism syndrome: 0.3 mg po daily, continuously or cyclically; adjust dose to individual response
2. Primary ovarian failure: 1.25 mg po daily cyclically (3 wk on, 1 wk off); adjust dose to individual response

Off-Label Uses. None

MOA. Estrogens are largely responsible for the development and maintenance of the female reproductive system and secondary sexual characteristics. The primary source of estrogen in normally cycling adult women is the ovarian follicle. After menopause, most endogenous estrogen is produced by conversion of androstenedione to estrone by peripheral tissues. Estrogens act through binding to nuclear receptors in estrogen-responsive tissues. Circulating estrogens modulate the pituitary secretion of the gonadotropins, luteinizing hormone (LH), and follicle-stimulating hormone (FSH), through a negative-feedback mechanism. Estrogens act to reduce the elevated levels of these gonadotropins seen in postmenopausal women.

Drug Characteristics: Conjugated Estrogens

Dose Adjustment Hepatic	Avoid in severe liver dysfunction	**Absorption**	Well absorbed, no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	Largely distributed; bound to sex hormone proteins
Dialyzable	Not dialyzable	**Metabolism**	Hepatic; substrate of CYP3A4/5 and 1A2
Pregnancy Category	X	**Elimination**	Primary renal elimination with a half-life of 26 h
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity, undiagnosed abnormal genital bleeding, history of estrogen- or progesterone-dependent neoplasia, active or history of deep vein thrombosis or pulmonary embolism, severe liver dysfunction, known or suspected pregnancy	**Black Box Warnings**	Breast cancer, cardiovascular disease, endometrial cancer, dementia risks

Medication Safety Issues: Conjugated Estrogens

Suffixes	Tall Man Letters	Do Not Crush	High Alert	Confused Names	Beers Criteria
No	No	No	No	Primaxin, Provera, Remeron	Avoid oral and topical patch.

Drug Interactions: Conjugated Estrogens

Typical Agents	Mechanism	Clinical Management
CYP3A4/5, 1A2 inducers	Increased estrogen metabolism reduces estrogen effectiveness	Monitor and consider dose increases of estrogen
CYP3A4/5, 1A2 inhibitors	Decreased estrogen metabolism increases risk of estrogen toxicity	Monitor and consider dose decreases of estrogen
Levothyroxine	Estrogen increases serum thyroxine-binding globulin, reducing free thyroxine resulting in hypothyroid effects	Measure TSH and adjust dose if necessary

Adverse Reactions: Conjugated Estrogens

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Weight change, headache, migraine, depression, disorder of menstruation, breast pain	Edema, vasodilation, abdominal pain, hirsutism, diarrhea, nausea, stomach cramps, vomiting, backache	Heart disease, hypertension, myocardial infarction, breast cancer, diabetes mellitus, hypercalcemia, venous thromboembolism, anaphylaxis, cerebrovascular accident, cervical cancer, malignant neoplasm of endometrium of corpus uteri, ovarian cancer, pulmonary embolism

Efficacy Monitoring Parameters. Resolution of clinical signs of abnormal bleeding or hot flashes or other symptoms, prevention of osteoporosis.

Toxicity Monitoring Parameters. Monitor BMD; conduct diagnostic evaluation to rule out malignancy in the event of persistent or recurring vaginal bleeding.

Key Patient Counseling Points. Discuss potential long-term adverse effects of hormone therapy including myocardial infarction, stroke, deep vein thrombosis, pulmonary embolism, and breast cancer. Take at bedtime to minimize side effects. Take with or without meals.

Clinical Pearls. Injectable and vaginal cream is also available for other indications requiring estrogen replacement therapy. Combination of estrogens and progestins should not be used for the prevention of cardiovascular disease. Increased risk (over placebo) of myocardial infarction, stroke, invasive breast cancer, pulmonary emboli, and DVT has been shown in postmenopausal women. Because of these risks, estrogens with or without progestins should be prescribed at the lowest effective doses and for the shortest duration consistent with treatment goals and risks for the individual woman. In postmenopausal women with a uterus, a progestin (eg, medroxyprogesterone) should be added to estrogen to reduce the risk of endometrial cancer. Increased incidence of dementia was observed in women ≥65 y of age taking estrogens. Also available in combination with bazedoxifene (Duavee) for osteoporosis prevention and vasomotor symptoms.

CYANOCOBALAMIN: Cobolin-M, Various

Class: Essential B Vitamin (B_{12})

Dosage Forms. Injection Solution: 1000 mcg/mL; **Mucous Membrane Lozenge/Troche:** 50 mcg, 100 mcg, 250 mcg, 500 mcg; **Oral Tablet:** 50 mcg, 100 mcg, 250 mcg, 500 mcg, 1 mg; **Oral Tablet, Extended Release:** 1 mg; **Sublingual Tablet:** 2.5 mg; **Nasal Solution:** 500 mcg/0.1 mL

Common FDA Label Indication, Dosing, and Titration.

1. Cobalamin deficiency, normal absorption: Oral, 1000 mcg po daily; Nasal, 500 mcg in 1 nostril once weekly
2. Cobalamin deficiency, malabsorption: 100 mcg IM or deep subq injection daily for 6-7 d, then 100 mcg monthly for life

Off-Label Uses. None

MOA. B_{12} is required for the synthesis of the amino acid methionine from homocysteine. A deficiency of B_{12} results in hyperhomocysteinemia and a decrease in methionine. Since methionine is required for DNA synthesis, B_{12} deficiency also results in decreased DNA synthesis, which presents clinically as macrocytic anemia when red blood cells are unable to extrude their nucleus.

Drug Characteristics: Cyanocobalamin

Dose Adjustment Hepatic	Not required	**Absorption**	Oral: Absorption is poor and requires intrinsic factor, patients without intrinsic factor require IM supplementation; IM: approaches 100%
Dose Adjustment Renal	Not required	**Distribution**	Stored in the liver and most tissues
Dialyzable	Not dialyzable	**Metabolism**	Enterohepatic cycling occurs
Pregnancy Category	C	**Elimination**	Dose dependent, renal 50-98% with 100-1000 mcg IM dose
Lactation	Usually compatible	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to cyanocobalamin or cobalt	**Black Box Warnings**	None

American Regent 1000 mcg/mL generic pictured

Medication Safety Issues: Cyanocobalamin

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

Drug Interactions: Cyanocobalamin. None known

Adverse Reactions: Cyanocobalamin

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Injection site pain, arthralgia, fatigue, dizziness, headache	Edema	Anaphylaxis, worsening of heart failure, angioedema

Efficacy Monitoring Parameters. Baseline and periodic B_{12} and folic acid levels, intrinsic factor, normalization of MCV, normalization of Hgb, resolution of symptoms of anemia (fatigue, shortness of breath).

Toxicity Monitoring Parameters. Seek medical attention if severe shortness of breath, swelling, skin rash, or hives.

Key Patient Counseling Points. May require several weeks for maximum effect. Take extended-release products with food. Avoid alcohol as it inhibits the absorption of B_{12}.

Clinical Pearls. Drugs that interfere with folate metabolism (methotrexate, hydroxyurea, pemetrexed) will cause an elevated MCV in the absence of vitamin B deficiency. Patients on pemetrexed receive B_{12} to prevent toxicity. Metformin decreases B_{12} concentrations.

CYCLOBENZAPRINE: Flexeril, Various

Class: Centrally Acting Skeletal Muscle Relaxant

Dosage Forms. **Oral Tablet:** 5 mg, 7.5 mg, 10 mg; **Oral Capsule, Extended Release:** 15 mg, 30 mg

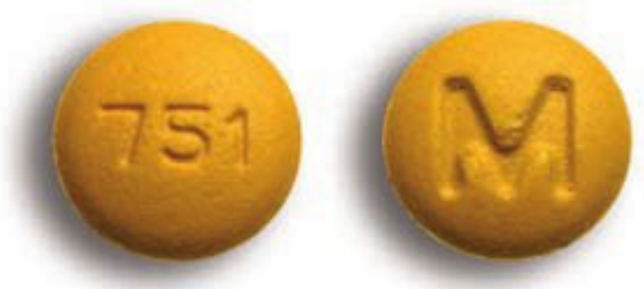
Common FDA Label Indication, Dosing, and Titration.

1. Skeletal muscle spasm: 5 mg po tid; may titrate to 10 mg po tid, may treat up to 2-3 wk

Off-Label Uses.

1. Temporomandibular joint disorder, 10 mg po daily × 3 wk

MOA. Cyclobenzaprine relieves skeletal muscle spasm of local origin without interfering with muscle function. It is ineffective in muscle spasm due to CNS disease. Evidence suggests that the net effect of cyclobenzaprine is a reduction in tonic somatic motor activity, influencing both gamma (γ) and alpha (α) motor systems.



Mylan generic 10 mg pictured

Drug Characteristics: Cyclobenzaprine

Dose Adjustment Hepatic	Mild hepatic dysfunction, 5 mg po daily; moderate, severe hepatic dysfunction, avoid	**Absorption**	F = 33-55%, no effect of food on absorption
Dose Adjustment Renal	Not required	**Distribution**	93% protein bound
Dialyzable	Not dialyzable	**Metabolism**	Extensive hepatic; substrate of CYP1A2
Pregnancy Category	B	**Elimination**	Renal elimination is 50% with a half-life of 18 h
Lactation	Weigh risks and benefits	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to cyclobenzaprine, concomitant MAOI use, heart failure, acute coronary phase of AMI, heart block	**Black Box Warnings**	None

Medication Safety Issues: Cyclobenzaprine

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

Drug Interactions: Cyclobenzaprine

Typical Agents	Mechanism	Clinical Management
CYP1A2 inducers	Increased cyclobenzaprine metabolism reduces cyclobenzaprine effectiveness	Monitor and consider dose increases of cyclobenzaprine
CYP1A2 inhibitors	Decreased cyclobenzaprine metabolism increases risk of cyclobenzaprine toxicity	Monitor and consider dose decreases of cyclobenzaprine
CNS depressants (opioids, benzodiazepines, alcohol)	Additive sedative effects	Avoid concurrent use or monitor carefully for signs of toxicity

Adverse Reactions: Cyclobenzaprine

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Xerostomia, headache, drowsiness	Constipation, indigestion, nausea, pharyngeal dryness, asthenia, dizziness, confusion, blurred vision	Cardiac dysrhythmia, cholestasis, hepatitis, jaundice, anaphylaxis, immune hypersensitivity reaction

Efficacy Monitoring Parameters. Reduction in pain and muscle spasms.

Toxicity Monitoring Parameters. Seek medical attention if symptoms of hepatic failure occur during therapy with this agent.

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. Take extended-release capsule same time each day.

Clinical Pearls. Cyclobenzaprine 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 2-3 wk). Should be used with caution in patients with glaucoma, increased IOP, urinary retention, etc, as cyclobenzaprine has anticholinergic-like effects. Avoid use in elderly, may be more sensitive to effects.

CYCLOSPORINE OPHTHALMIC: Restasis

Class: Calcineurin Inhibitor

Dosage Forms. Ophthalmic Emulsion: 0.5%

Common FDA Label Indication, Dosing, and Titration.

1. Keratoconjunctivitis sicca, when associated ocular inflammation results in scanty tear production: 1 drop in affected eye(s) q12h

Off-Label Uses. None

MOA. Ocular inflammation associated with keratoconjunctivitis sicca results in reduced tear production. Cyclosporin binds to cyclophilin, which inhibits the antigenic response of helper T lymphocytes which reduces the production of interleukin-2 and suppresses interferon-γ. Inhibition of the immune response limits inflammation.

Allergan 0.05% emulsion pictured

Drug Characteristics: Cyclosporine Ophthalmic

Dose Adjustment Hepatic	Not required	**Absorption**	Minimal absorption
Dose Adjustment Renal	Not required	**Distribution**	Minimal absorption
Dialyzable	Not dialyzable	**Metabolism**	Minimal absorption
Pregnancy Category	C	**Elimination**	Minimal absorption
Lactation	Avoid	**Pharmacogenetics**	None known
Contraindications	Hypersensitivity to cyclosporine, active ocular infection	**Black Box Warnings**	None

Medication Safety Issues: Cyclosporine Ophthalmic

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

Drug Interactions: Cyclosporine Ophthalmic. None known

Adverse Reactions: Cyclosporine Ophthalmic

Common (>10%)	Less Common (1-10%)	Rare but Serious (<1%)
Burning sensation in eye	Conjunctivitis, blurred vision	Hypersensitivity

Efficacy Monitoring Parameters. Improved tear production.

Toxicity Monitoring Parameters. Severe burning of the eye, active ocular infection.

Key Patient Counseling Points. This medicine comes in single-use packages. After you open a single-use package, use the medicine right away. Mix the medicine well just before using it. To do this, turn the single-use package upside down a few times. Remove contact lenses before using this medicine. Wait at least 15 min before inserting contact lenses after using the medicine. May be used with artificial tears as long as there is 15-min interval in between.

Clinical Pearls. Not for use in children <16 y of age. Oral formulation available for transplant rejection prevention.