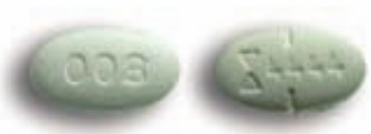
# GABAPENTIN: Neurontin, Gralise, Various

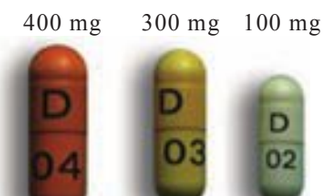
**Class:** Gamma Aminobutyric Acid, Anticonvulsant

**Dosage Forms. Oral Capsule:** 100 mg, 300 mg, 400 mg; **Oral Tablet:** 300 mg, 600 mg, 800 mg; **Oral Solution:** 250 mg/5 mL; **Oral Tablet, Extended Release:** 300 mg, 600 mg



Teva generic 800 mg pictured

Glenmark generic 600 mg pictured




Northstar Rx generic pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Partial seizure, adjunct: Immediate release, Adults and Children ≥12 y of age, initial, 300 mg po tid, may titrate to 1800 mg/d in 3 divided doses (*max* 2400-3600 mg/d); Children 3-11 y of age, initial, 10-15 mg/kg/d in 3 divided doses, maintenance (Children 3-4 y of age), may titrate over 3 d to 40 mg/kg/d in 3 divided doses, maintenance (Children 5-11 y of age), may titrate over 3 d to 25-35 mg/kg/d in 3 divided doses.
2. Postherpetic neuralgia: Immediate release, Adults, 300 mg po on day 1, 300 mg bid on day 2, 300 mg tid on day 3, may titrate dose to 1800 mg/d in 3 divided doses; extended release, 300 mg on day 1, 600 mg on day 2, 900 mg days 3-6, 1200 mg days 7-10, 1500 mg days 11-14, and 1800 mg po daily thereafter

**Off-Label Uses.**

1. Diabetic peripheral neuropathy: Adults, 900-3600 mg/d po
2. Restless leg syndrome: 300 mg po 2 h prior to bedtime
3. Neuropathic pain: Immediate release, 300 mg po daily, may titrate to 3600 mg po daily

**MOA.** Gabapentin is a cyclohexane compound that is structurally related to GABA; its mechanism of action is not known. Gabapentin does not interact with GABA receptors or alter the formation, release, degradation, or reuptake of GABA.



**Drug Characteristics: Gabapentin**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 27-60%; food increases absorption |
| **Dose Adjustment Renal** | CrCl ≥60 mL/min, 900-3600 mg/d in 3 divided doses; CrCl 30-59 mL/min, 400-1400 mg/d in 2 divided doses; CrCl 15-29 mL/min, 200-700 mg/d given once daily | **Distribution** | Vd = 58 L; <3% protein bound |
| **Dialyzable** | Hemodialysis: 100-300 mg/d given once daily; give supplemental dose postdialysis | **Metabolism** | Not metabolized |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 76-81% (unchanged) and 10-23% in feces, with a half-life of 5-7 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

### Medication Safety Issues: Gabapentin

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | Do not crush or chew ER tablet | No | Motrin, Neoral, Nitrofurantoin, Noroxin | No |

### Drug Interactions: Gabapentin

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Antacids | Decreased gabapentin absorption | Separate administration by 2 h |

### Adverse Reactions: Gabapentin

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Dizziness, somnolence | Ataxia, blurred vision, diarrhea, fatigue, hostile behavior, peripheral edema, nausea, nystagmus, vomiting, weight gain, xerostomia | Stevens-Johnson syndrome, suicidal thoughts |

**Efficacy Monitoring Parameters.** Reduction in seizure frequency or relief of pain associated with postherpetic neuralgia.

**Toxicity Monitoring Parameters.** Emergence or worsening of depression, suicidality, and/or any unusual behavioral or mood changes (anxiety, agitation, hostility, mania, and hypomania).

**Key Patient Counseling Points.** First dose on 1st day should be taken at bedtime. ER formulation should be taken with the evening meal. Patient should avoid activities requiring mental alertness or coordination until drug effects are realized, as drug may cause dizziness and somnolence. Report worsening depression, suicidal ideation, or unusual changes in behavior. Avoid sudden discontinuation of drug, as this may precipitate status epilepticus. Wait 2 h after antacid before taking gabapentin.

**Clinical Pearls.** Use in renally compromised patients <12 y of age has not been studied. Dosage interval should not exceed 12 h. Gabapentin dose reductions, discontinuation, or substitutions with alternative medications should be performed gradually over a min of 1 wk. Medication guide required at dispensing.

# GATIFLOXACIN OPHTHALMIC: Zymar, Zymaxid

**Class:** Fluoroquinolone Antibiotic

**Dosage Forms.** **Ophthalmic Solution:** 0.5%

**Common FDA Label Indication, Dosing, and Titration.**

1. Bacterial conjunctivitis: Adults and Children ≥1 y of age, 0.5% ophthalmic solution, 1 drop to affected eye(s) q2h while awake × 2 days, then qid while awake for 5 more d

**Off-Label Uses.** None

**MOA.** Gatifloxacin is a fluoroquinolone that inhibits bacterial topoisomerase II and IV. It is highly active against aerobic, gram-negative bacilli, especially Enterobacteriaceae. It has poor activity against streptococci and anaerobes.

**Drug Characteristics: Gatifloxacin Ophthalmic**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | After ocular instillation, serum concentrations are undetectable |
| **Dose Adjustment Renal** | Not required | **Distribution** | Not absorbed |
| **Dialyzable** | Not dialyzable | **Metabolism** | Not absorbed |
| **Pregnancy Category** | C | **Elimination** | Not absorbed |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to gatif oxacin or other quinolones | **Black Box Warnings** | None |


Allergan 0.3% solution pictured

**Medication Safety Issues: Gatifloxacin Ophthalmic**

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

**Drug Interactions: Gatifloxacin Ophthalmic.** None known

**Adverse Reactions: Gatifloxacin Ophthalmic**

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| | Conjunctivitis, dry eyes, eye pain, subconjunctival hemorrhage, tearing and burning of the eyes, decreased visual acuity | Conjunctival hemorrhage |

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

**Toxicity Monitoring Parameters.** Severe eye pain, itching, redness, or burning.

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

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

# GEMFIBROZIL: Lopid, Various

**Class:** Antihyperlipidemic

**Dosage Forms. Oral Tablet:** 600 mg

Teva generic 600 mg pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Coronary arteriosclerosis; prophylaxis-familial combined hyperlipidemia: 600 mg po bid
2. Familial type V hyperlipoproteinemia-Fredrickson type IV hyperlipoproteinemia: 600 mg po bid

**Off-Label Uses.** None

**MOA.** Fibric acid derivatives activate PPARα, which increases lipolysis and elimination of triglyceride-rich particles from plasma by activating lipoprotein lipase and reducing production of apoprotein C-III (an inhibitor of lipoprotein lipase activity). Activation of PPARα also induces an increase in the synthesis of apoproteins A-I and A-II and HDL-cholesterol.

**Drug Characteristics: Gemfibrozil**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Avoid in severe liver impairment | **Absorption** | Well absorbed, food reduces absorption, take on empty stomach |
| **Dose Adjustment Renal** | CrCl 10-50 mL/min, administer 75% of the dose; CrCl <10 mL/min, reduce dose by 50% | **Distribution** | Vd = 60 L; 99% protein bound |
| **Dialyzable** | Unknown | **Metabolism** | <20% hepatic, CYP3A4/5 substrate. Inhibitor of CYP1A2 (moderate), CYP2C19 (strong), CYP2C8 (strong), CYP2C9 (strong) |
| **Pregnancy Category** | C | **Elimination** | Renal elimination 70%, with a half-life of 2 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to gemfibrozil, concurrent repaglinide or simvastatin, gallbladder disease, severe renal or hepatic dysfunction | **Black Box Warnings** | None |

**Medication Safety Issues: Gemfibrozil**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | Levbid, Lipitor, Lodine | No |

### Drug Interactions: Gemf brozil

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Atorvastatin, HMG-CoA reductase inhibitors, colchicine, fibrates, niacin | Increased risk of myopathy or rhabdomyolysis | Avoid concurrent use, or monitor for myopathy and consider dose reductions |
| Cholestyramine, colestipol | Decreased absorption of gemfibrozil | Separate administration by 2 h |
| CYP1A2, CY2C19, CYP2C8, CYP2C9 substrates | Increased plasma concentrations of substrates via inhibition of CYPs by gemfibrozil | Avoid concurrent use if narrow therapeutic index, or monitor and consider dose reductions of substrate |
| CYP3A4/5 inhibitors | Decreased metabolism of gemfibrozil increases risk of gemfibrozil toxicity | Monitor for toxicity and consider dose reductions of gemfibrozil |
| CYP3A4/5 inducers | Increased metabolism of gemfibrozil reduces gemfibrozil efficacy | Monitor for efficacy and consider dose increases of gemfibrozil |
| Glyburide | Increased risk of hypoglycemia via competition for renal tubular secretion | Avoid concurrent use |

### Adverse Reactions: Gemf brozil

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Indigestion | Abdominal pain, constipation, diarrhea, headache, increased liver enzymes, myopathy, nausea, rash | Rhabdomyolysis, cholelithiasis, hepatotoxicity, mood disorder, impotence, agranulocytosis |

**Efficacy Monitoring Parameters.** Primary, reduction in triglyceride levels. Secondary, reduction in total cholesterol, LDL-cholesterol, increase in HDL-cholesterol levels. Monitor baseline and every 6 mo.

**Toxicity Monitoring Parameters.** Seek medical attention if signs/symptoms of rhabdomyolysis (myalgias, dark urine, arthralgias, fatigue), yellowing of eyes or skin, and severe abdominal pain. LFTs and complete blood counts should be performed at baseline, 12 wk after initiation of therapy or dose increases. Serum creatine kinase should be measured in patients experiencing muscle pain and in those receiving other drugs associated with myopathy.

**Key Patient Counseling Points.** Take 30 min before breakfast and dinner. Instruct patient to report signs/symptoms of rhabdomyolysis, jaundice (yellowing of skin or eyes), or renal failure.

**Clinical Pearls.** The fibric acid derivatives (gemfibrozil, clofibrate, and fenofibrate) are recommended as alternatives to niacin in the treatment of types IIb, III, IV, and V hyperlipidemia.

# GLIMEPIRIDE: Amaryl, Various

**Class:** Second-Generation Sulfonylurea, Antidiabetic

**Dosage Forms. Oral Tablet:** 1 mg, 2 mg, 4 mg

**Common FDA Label Indication, Dosing, and Titration.**

Diabetes mellitus, type 2: 1-2 mg po daily, may titrate by 1-2 mg every 1-2 wk to effect, *max* dose 8 mg po daily

**Off-Label Uses.** None

**MOA.** Sulfonylureas enhance insulin secretion from pancreatic β-cells and potentiate insulin action on several extrahepatic tissues. Long-term sulfonylureas increase peripheral utilization of glucose, suppress hepatic gluconeogenesis, and possibly increase the sensitivity and/or number of peripheral insulin receptors.

2 mg 4 mg


Teva generic pictured

## Drug Characteristics: Glimepiride

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Avoid use in patients with severe liver dysfunction | **Absorption** | F = 100%, food decreases absorption |
| **Dose Adjustment Renal** | Start with 1 mg po daily | **Distribution** | Vd = 8.8 L; >99% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | >90% hepatic, CYP2C9 substrate |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 60% with a half-life of 5-9 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | G6PD |
| **Contraindications** | Hypersensitivity to sulfonylureas, diabetic ketoacidosis | **Black Box Warnings** | None |

## Medication Safety Issues: Glimepiride

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

## Drug Interactions: Glimepiride

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Beta-blockers | Altered glucose metabolism and increased risk of hypoglycemia. Symptoms of hypoglycemia masked | Avoid propranol; use others with caution and increased monitoring |
| CYP2C9 inducers | Increased glimepiride metabolism and decreased glimepiride efficacy | Monitor blood glucose and consider dose increases of sulfonylureas |
| CYP2C9 inhibitors | Decreased glimepiride metabolism and increased risk of glimepiride toxicity | Monitor blood glucose and consider dose decreases of sulfonylureas |
| Fluoroquinolones, NSAIDs, fenofibrate, SSRIs, somatostatin analogues | Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| MAOIs | Stimulation of insulin secretion, hypoglycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Psyllium | Psyllium may delay absorption of glucose from meals, hypoglycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Sulfonamides | Increased risk of hypoglycemia | Monitor blood glucose and consider dose adjustments of sulfonylureas |

## Adverse Reactions: Glimepiride

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| | Hypoglycemia, nausea, headache, dizziness, asthenia | Cutaneous hypersensitivity, hemolytic anemia, hepatotoxicity, disulfiram reaction |

**Efficacy Monitoring Parameters.** Preprandial blood glucose between 70 and 130 mg/dL, $HbA_{1c}$ <7%.

**Toxicity Monitoring Parameters.** Symptoms of hypoglycemia include nausea, sweating, and loss of consciousness. Seek medical attention if yellowing of skin or eyes, severe skin rash, unusual bruising, or bleeding.

**Key Patient Counseling Points.** Monitor blood glucose in frequent intervals (2-4 times per day); if <70 mg/dL, eat candy or sugar and contact prescriber. Take with food or milk in the morning. Use a sunscreen and avoid sunlamps and tanning beds. Do not drink alcohol; may cause a disulfiram reaction.

**Clinical Pearls.** Metformin is first-line therapy for type 2 diabetes. A sulfonylurea may be added if $HbA_{1c}$ goals are not achieved with metformin alone. Not for use in children. Hemolytic anemia is most likely to occur in patients with G6PD deficiency.

# GLIPIZIDE: Glucotrol, Various

**Class:** Second-Generation Sulfonylurea, Antidiabetic

**Dosage Forms. Oral Tablet:** 5 mg, 10 mg; **Oral Tablet, Extended Release:** 2.5 mg, 5 mg, 10 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Diabetes mellitus: Immediate release, 5-10 mg po daily, may titrate to *max* of 40 mg daily, divide bid if doses >15 mg; extended release, 5-10 mg po daily, may titrate to *max* of 20 mg daily

**Off-Label Uses.** None

**MOA.** Sulfonylureas enhance insulin secretion from pancreatic β-cells and potentiate insulin action on several extrahepatic tissues. Long-term sulfonylureas increase peripheral utilization of glucose, suppress hepatic gluconeogenesis, and possibly increase the sensitivity and/or number of peripheral insulin receptors.

Sandoz generic
5 mg pictured


Watson generic
5 mg ER pictured


Greenstone generic
2.5 mg ER pictured


Sandoz generic
10 mg pictured


Watson generic
10 mg ER pictured


Greenstone generic
5 mg ER pictured

## Drug Characteristics: Glipizide

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Start with 2.5 mg po daily | **Absorption** | Immediate release and extended release: F = 100%, food delays absorption by 40 min |
| **Dose Adjustment Renal** | Start with 2.5 mg po daily | **Distribution** | Vd = 11 L; 99% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | 80% hepatic, CYP2C9 substrate |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 70% with a half-life of 2-5 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | G6PD |
| **Contraindications** | Hypersensitivity to sulfonylureas, diabetic ketoacidosis, type 1 diabetes | **Black Box Warnings** | None |

## Medication Safety Issues: Glipizide

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| XL | GlipiZIDE | Do not crush XL form | Yes | Glimepiride, glyBURIDE | No |

## Drug Interactions: Glipizide

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Beta-blockers | Altered glucose metabolism and increased risk of hypoglycemia. Symptoms of hypoglycemia masked | Avoid propranol; use others with caution and increased monitoring |
| CYP2C9 inducers | Increased glipizide metabolism and decreased glipizide efficacy | Monitor blood glucose and consider dose increases of sulfonylureas |
| CYP2C9 inhibitors | Decreased glipizide metabolism and increased risk of glipizide toxicity | Monitor blood glucose and consider dose decreases of sulfonylureas |
| Fluoroquinolones, NSAIDs, fenofibrate, SSRIs, somatostatin analogues | Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| MAOIs | Stimulation of insulin secretion, hypoglycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Psyllium | Psyllium may delay absorption of glucose from meals, glycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Sulfonamides | Increased risk of hypoglycemia | Monitor blood glucose and consider dose adjustments of sulfonylureas |

## Adverse Reactions: Glipizide

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Asthenia | Hypoglycemia, nausea, headache, tremors, constipation, diarrhea, dizziness, nervousness, tremor | Cutaneous hypersensitivity, hemolytic anemia, hepatotoxicity, disulfiram reaction |

**Efficacy Monitoring Parameters.** Preprandial blood glucose between 70 and 130 mg/dL, $HbA_{1c}$ <7%.

**Toxicity Monitoring Parameters.** Symptoms of hypoglycemia include nausea, sweating, and loss of consciousness. Seek medical attention if yellowing of skin or eyes, severe skin rash, unusual bruising, or bleeding.

**Key Patient Counseling Points.** Monitor blood glucose in frequent intervals (2-4 times per day); if <70 mg/dL, eat candy or sugar and contact prescriber. Use a sunscreen and avoid sunlamps and tanning beds. Do not drink alcohol; may cause a disulfiram reaction. Take 30 min before morning meal. Do not chew or crush extended-release formulation.

**Clinical Pearls.** Metformin is first-line therapy for type 2 diabetes. A sulfonylurea may be added if $HbA_{1c}$ goals are not achieved with metformin alone. Not for use in children. Hemolytic anemia is most likely to occur in patients with G6PD deficiency. Patients on insulin: when starting glipizide, reduce insulin dose by 50%, or discontinue if <20 units/d.

# HAEMOPHILUS INFLUENZAE, TYPE B, CONJUGATE: Hiberix, PedvaxHIB, ActHIB

**Class:** Vaccine

**Dosage Forms.** **Lyophilized Powder for Intramuscular Injection:** 0.5 mL after reconstitution; also available in combination with other pediatric vaccines

**Common FDA Label Indication, Dosing, and Titration.**

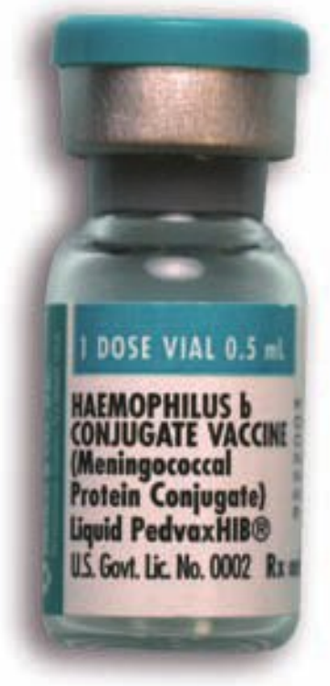
1. Prevention of invasive *H. influenzae* type B infection, Children: Dose schedule depends on product and timing of start of vaccination series. For ActHIB, dose at 2, 4, 6, and 12-15 mo of age as primary series. If PedvaxHIB used, doses at 2, 4, and 12-15 mo are used. If dosing begins later than 2 mo, adjusted dosing schedule used and number of doses changes. Hiberix can be used only for the last dose for children aged 12 mo to 4 y.

**Off-Label Uses.**

1. Prevention of invasive *H. influenzae* type B infection, Adults: 1 dose. May use any of the Hib conjugate vaccines for unvaccinated or partially vaccinated persons aged ≥5 y who have leukemia, malignant neoplasms, anatomic or functional asplenia (including sickle cell disease), HIV infection, or other immunocompromising conditions.

**Drug Characteristics:** H. influenzae **Type B, Conjugate**

| | | | |
|---|---|---|---|
| **Pregnancy Category** | C | **ADME** | None known |
| **Lactation** | Unlikely to be used in lactating woman; vaccines generally considered safe during lactation | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to Hib vaccine or a component of the vaccine | **Black Box Warnings** | None |




Merck pictured

**Medication Safety Issues:** H. influenzae **Type B, Conjugate**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | None | No |

**Drug Interactions:** H. influenzae **Type B, Conjugate**

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

**Adverse Reactions:** H. influenzae **Type B, Conjugate**

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, including erythema and soreness. Headache, irritability, and somnolence | Fever, nausea, malaise | Thrombocytopenia, anaphylaxis, Guillain-Barré syndrome |

**Efficacy Monitoring Parameters.** Prevention of invasive *H. influenzae* type B infection.

**Toxicity Monitoring Parameters.** Monitor for syncope for 15 min after administration. Monitor for fever following administration.

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

**Clinical Pearls.** Clinicians can exchange among brands of vaccines for the primary series (with the exception of Hiberix). Seroconversion after 1 dose is 75-90%. Onset of action is 1-2 wk and immunity lasts 1.5 y.

# HEPATITIS A VACCINE, INACTIVATED: Havrix, Vaqta

**Class:** Vaccine

**Dosage Forms.** **Intramuscular Suspension:** Havrix, 720 ELISA units/0.5 mL, 1440 ELISA units/mL; Vaqta 25 units/0.5 mL, 50 units/1 mL; also available in combination with hepatitis B vaccine

**Common FDA Label Indication, Dosing, and Titration.**

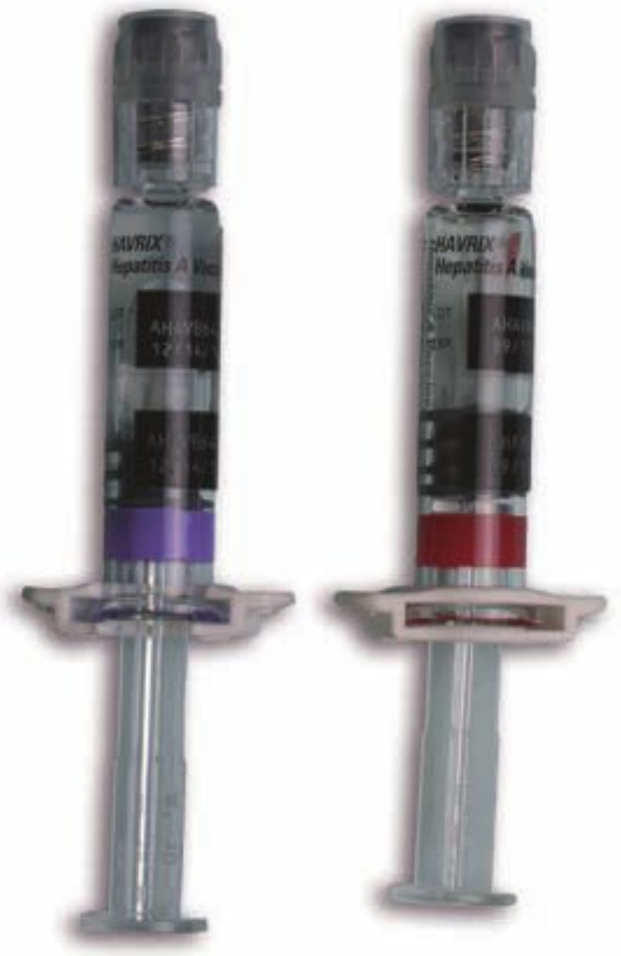
1. Hepatitis A prophylaxis: Adults, Havrix 1440 ELISA units IM once, with a 2nd dose 6-12 mo later, or Vaqta 50 units IM once, with a 2nd dose 6-18 mo later; Children 12 mo to 18 y, Havrix 720 ELISA units IM once, with a 2nd dose 6-12 mo later, or Vaqta 25 units IM once, with a booster dose 6-18 mo later

**Off-Label Uses.**

1. Hepatitis A postexposure prophylaxis for individuals aged 1-40 y: Same regimen as for preexposure prophylaxis; vaccine series should be started within 2 wk of exposure

**Drug Characteristics: Hepatitis A Vaccine, Inactivated**

| | | | |
|---|---|---|---|
| **Pregnancy Category** | C | **ADME** | None known |
| **Lactation** | Infant risk is minimal | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to hepatitis A vaccine or a component of the vaccine | **Black Box Warnings** | None |



GlaxoSmithKline pictured

**Medication Safety Issues: Hepatitis A Vaccine, Inactivated**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | None | No |

**Drug Interactions: Hepatitis A Vaccine, Inactivated**

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

### Adverse Reactions: Hepatitis A Vaccine, Inactivated

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, including erythema and soreness. Headache, irritability, and somnolence | Fever, nausea, malaise | Thrombocytopenia, anaphylaxis, Guillain-Barré syndrome |

**Efficacy Monitoring Parameters.** Prevention of hepatitis A infection; although antibody concentrations might be measured, routine measurement for vaccine response is not recommended.

**Toxicity Monitoring Parameters.** Monitor for syncope, fever, or anaphylactic hypersensitivity reaction after administration. LFTs for adults at risk for liver failure.

**Key Patient Counseling Points.** Return to provider for booster dose in 6-12 mo or 6-18 mo after 1st dose (depending on product initially used).

**Clinical Pearls.** Not indicated for children <12 mo of age. The vaccines are interchangeable, so 2nd dose can be administered with the other brand of vaccine. Administer 2 wk prior to exposure (travel or international adoption of child). Vaccination recommended for all children ≥12 mo of age, and adults at risk for hepatitis A infection, including homosexual men, IV drug users, patients with chronic liver disease, international travelers, and those in close contact with those from endemic areas (Africa, India, etc). Hepatitis A transmits via oral/fecal route. After vaccination, 94-100% seroconversion within 1 mo.

# HEPATITIS B VACCINE, RECOMBINANT: Engerix-B, Recombivax HB

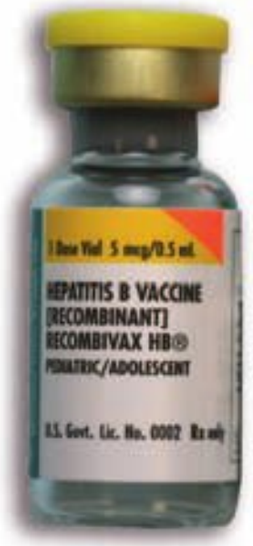
**Class:** Vaccine

**Dosage Forms.** **Suspension for Intramuscular Injection:** Engerix 10 mcg/0.5 mL, 20 mcg/1 mL; Recombivax 5 mcg/0.5 mL, 10 mcg/1 mL, 40 mcg/1 mL; also available in combination with hepatitis A vaccine and in combination products with other pediatric vaccines

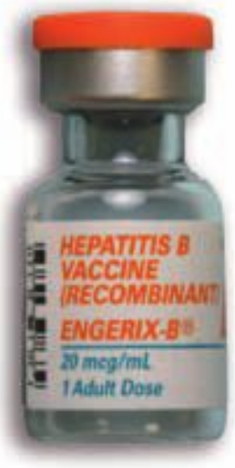
**Common FDA Label Indication, Dosing, and Titration.**

1. Prevention of hepatitis B infection: Adults ≥20 y of age, Engerix 20 mcg IM or Recombivax 10 mcg IM given once, with 2 additional doses given 1 and 5 mo later; Children, Engerix 10 mcg IM or Recombivax 5 mcg IM given once, with 2 additional doses given 1 and 5 mo later; Patients undergoing hemodialysis, 40 mcg IM given once, with 2 additional doses given 1 and 5 mo later; several alternative regimens approved for adults and children of varying ages

**Off-Label Uses.** None




GlaxoSmithKline pictured




Merck pictured

**Drug Characteristics: Hepatitis B Vaccine, Recombinant**

| | | | |
|---|---|---|---|
| **Pregnancy Category** | C | **ADME** | None known |
| **Lactation** | Infant risk is minimal | **Pharmacogenetics** | Not clinically relevant |
| **Contraindications** | Hypersensitivity to hepatitis B vaccine or a component of the vaccine, including yeast | **Black Box Warnings** | None |

**Medication Safety Issues: Hepatitis B Vaccine, Recombinant**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| Engerix-B, Recombivax HB | No | No | No | Adult and pediatric formulations of Engerix-B | No |

**Drug Interactions:** **Hepatitis B Vaccine, Recombinant.** None

**Adverse Reactions: Hepatitis B Vaccine, Recombinant**

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, including erythema and soreness | Fever | Anaphylaxis, pancytopenia |

**Efficacy Monitoring Parameters.** Prevention of hepatitis B infection; measurement of antibody to the surface antigen (anti-HBs) 1-2 mo after dose 3 is recommended for individuals at risk for vaccine nonresponse and is required for those at occupational risk for hepatitis B exposure.

**Toxicity Monitoring Parameters.** Monitor for syncope, fever, seizure-like activity, or anaphylactic hypersensitivity reaction after administration.

**Key Patient Counseling Points.** Return to provider for all doses in the series.

**Clinical Pearls.** The brands of vaccines are considered interchangeable for the series. Use a needle of appropriate length to ensure intramuscular administration. Recommended for all infants, adolescents, health-care personnel, patients with renal failure, individuals with hepatitis C, residents and staff of psychiatric institutions, household and contacts of individuals with chronic hepatitis B, those with frequent exposure to blood products, international travelers, those at increased risk due to sexual practices, prisoners, and injection drug users. Lifetime immunity achieved in those with initial response.

# HUMAN PAPILLOMAVIRUS VACCINE: Cervarix, Gardasil

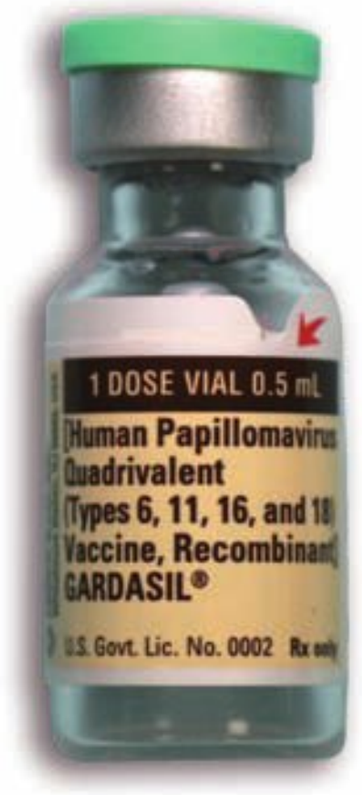
**Class:** Vaccine

**Dosage Forms.** **Intramuscular Suspension**: Cervarix HPV (bivalent) 16 L1 protein 20 mcg/0.5 mL and HPV 18 L1 protein 20 mcg/0.5 mL; Gardasil HPV (quadrivalent) 6 L1 protein 20 mcg/0.5 mL, HPV 11 L1 protein 40 mcg/0.5 mL, HPV 16 L1 protein 40 mcg/0.5 mL, and HPV 18 L1 protein 20 mcg/0.5 mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Human papillomavirus bivalent vaccine (HPV2, Cervarix, types 16 and 18): Prevention of cervical cancer and precancerous lesions in females aged 10-25 y, 3 dose series at 0, 1, and 6 mo
2. Human papillomavirus quadrivalent vaccine (HPV4, Gardasil, types 6, 11, 16, and 18): Prevention of cancer and precancerous lesions of the cervix, vulva, vagina, and anus and genital warts in individuals aged 9-26 y, 3 dose series at 0, 2, and 6 mo
3. Routine immunization of females is recommended at age 11-12 y with either vaccine preparation. Catch-up immunization is recommended for females aged 13-26 y
4. Routine immunization of males is recommended at age 11-12 y with HPV4 (Gardasil). Catch-up immunization is recommended for males aged 13-21 y. HPV4 (Gardasil) is recommended for men who have sex with men aged 22-26 y

**Off-Label Uses.** None



Merck pictured

**Drug Characteristics: Human Papillomavirus Vaccine**

| | | | |
|---|---|---|---|
| **Pregnancy Category** | B; recommend completing the series after pregnancy completion | **ADME** | None known |
| **Lactation** | Caution advised; weigh risk and benefit | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to HPV vaccine or a component of the vaccine; Cervarix, yeast allergy; Gardasil, latex allergy | **Black Box Warnings** | None |

**Medication Safety Issues: Human Papillomavirus Vaccine**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | Bivalent and quadrivalent products often confused | No |

### Drug Interactions: Human Papillomavirus Vaccine

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

### Adverse Reactions: Human Papillomavirus Vaccine

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, including erythema and soreness. Arthralgia, myalgia, headache, fever | Rash, GI symptoms | Anaphylaxis, Guillain-Barré syndrome |

**Efficacy Monitoring Parameters.** Prevention of cervical cancer, other diseases caused by HPV.

**Toxicity Monitoring Parameters.** Syncope; continue routine cervical cancer screening; negative HPV test not required for vaccination.

**Key Patient Counseling Points.** Return to provider for all doses in the series.

**Clinical Pearls.** Complete the vaccine series with the same brand whenever possible. Syncope is common following vaccine administration. Observe immunized individual for 15 min following vaccine administration. Individuals already infected with HPV will not be protected by vaccine. Does not treat active HPV infection or other subtypes of HPV not included in vaccine. HPV types 16 and 18 cause 70% of cervical cancers; Cervarix only protects against cervical cancer. HPV types 6 and 11 cause 90% of genital warts; Gardasil protects against both cervical cancer and genital warts.

# HYDRALAZINE: Apresoline, Various


Barr generic pictured

Par generic
10 mg pictured

**Class:** Peripheral Vasodilator

**Dosage Forms.** **Oral Tablet:** 10 mg, 25 mg, 50 mg, 100 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Hypertension: Adults, initial, 10 mg po qid for 2-4 d, may titrate to 25 mg po qid for 3-5 d, then titrate to lowest effective dose at intervals of 1 wk (*max* 300 mg/d); Children, 0.75-1 mg/kg/d po in 2-4 divided doses; may titrate dose gradually over 3-4 wk (*max* dose 7.5 mg/kg or 200 mg/d)

**Off-Label Uses.**

1. Heart failure: Adults, 25-50 mg po daily in 3-4 divided doses in combination with isosorbide dinitrate (*max* hydralazine dose of 300 mg/d in divided doses)

**MOA.** Hydralazine is a vasodilator that reduces total peripheral resistance by direct action on vascular smooth muscle, with an effect greater on arterioles than on veins.



**Drug Characteristics: Hydralazine**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 38-50%, no effect of food on absorption |
| **Dose Adjustment Renal** | CrCl 10-50 mL/min, increase dosing interval to q8h; CrCl <10 mL/min, increase dosing interval to q8-16h | **Distribution** | 88-90% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | Extensive hepatic metabolism to 2 metabolites not via CYP |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 3-14% and 3-12% in feces, with a half-life of 3-5 h |
| **Lactation** | Compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to hydralazine; dissecting aortic aneurysm | **Black Box Warnings** | None |

### Medication Safety Issues: Hydralazine

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | HydrALAZINE | No | No | HydrOXYzine | No |

### Drug Interactions: Hydralazine

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| NSAIDs | Decreased antihypertensive effect of hydralazine | Avoid concurrent use or monitor BP |
| Furosemide | Increased diuretic response to furosemide | Monitor serum electrolytes, diuresis, CrCl |
| Metoprolol, propranolol | Increased beta-blocker toxicity (bradycardia, fatigue, shortness of breath) | If concurrent therapy required, take with food or switch to sustained-release beta-blocker; monitor BP |

### Adverse Reactions: Hydralazine

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| | Anorexia, chest pain, diarrhea, dizziness, headache, hypotension, nasal congestion, palpitations, reflex tachycardia, vomiting | Agranulocytosis, hepatotoxicity, leucopenia, systemic lupus erythematosus |

**Efficacy Monitoring Parameters.** Decrease in systolic and diastolic BP, improvement in signs/symptoms of heart failure.

**Toxicity Monitoring Parameters.** Signs/symptoms of hypotension or liver damage. CBC and antinuclear antibody titers at baseline and periodically during prolonged treatment.

**Key Patient Counseling Points.** Patient should not drink alcohol while taking drug. Advise patient against sudden discontinuation of drug as this may cause rebound hypertension. This medicine may cause dizziness. Avoid driving, using machinery, or doing anything else that could be dangerous if not alert. Patient should report chest pain, palpitations, signs/symptoms of tachyarrhythmia, hypotension, agranulocytosis, systemic lupus erythematosus, or hepatotoxicity.

**Clinical Pearls.** Hydralazine is not a first-line therapy for hypertension. Hydralazine may cause drug-induced lupus erythematosus (DILE), and has a higher incidence compared to other drugs associated with DILE. Thiazide diuretics, calcium channel blockers, ACE-Is, and ARBs are preferred. Hydralazine may be beneficial in patients intolerant of ACE-Is or ARBs and when added ACE-Is or ARBs in African Americans.

# HYDROCHLOROTHIAZIDE: Esidrix, Various

**Class:** Thiazide Diuretic, Antihypertensive

**Dosage Forms.** **Oral Capsule:** 12.5 mg; **Oral Tablet:** 12.5 mg, 25 mg, 50 mg


Teva generic pictured

Watson generic 12.5 mg pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Edema; adjunct: Adults, 25-100 mg po daily in single or divided doses; Children, 1-2 mg/kg po daily in single or divided doses; Infants <6 mo of age may require doses up to 3 mg/kg po daily in 2 divided doses; Infants <2 y of age, *max* dose 37.5 mg/d; Children 2-12 y of age, *max* dose 100 mg/d
2. Hypertension: Adult, initial, 12.5-25 mg po daily, may titrate to 50-100 mg po daily in single or divided doses; Children, 1-2 mg/kg po daily in single or divided doses; Infants <6 mo of age may require doses up to 3 mg/kg po daily in 2 divided doses, *max* dose 37.5 mg/d; Infants <2 y of age, *max* dose 37.5 mg/d; Children 2-12 y of age, *max* dose 100 mg/d

**Off-Label Uses.**

1. Hypercalciuria: Adults, 25 mg po bid; Children, 1-2 mg/kg/d po

**MOA.** Thiazides increase sodium and chloride excretion by interfering with their reabsorption in the cortical diluting segment of the nephron.

**Drug Characteristics: Hydrochlorothiazide**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 60-80%, reduced in patients with hepatic, renal, or cardiac (heart failure) disease |
| **Dose Adjustment Renal** | CrCl <25 mL/min, avoid | **Distribution** | Vd = 3.6-7.8 L/kg; 40% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | Not metabolized |
| **Pregnancy Category** | B | **Elimination** | Eliminated 50-70% unchanged in urine, half-life 10-12 h (prolonged in patients with heart failure or renal disease) |
| **Lactation** | Avoid | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to hydrochlorothiazide or sulfonamide, concomitant dofetilide therapy, or anuric patients | **Black Box Warnings** | None |

**Medication Safety Issues: Hydrochlorothiazide**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | HCTZ is an error-prone abbreviation<br>Maxide, Micronase | No |

### Drug Interactions: Hydrochlorothiazide

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| ACE-Is | Increased risk of postural hypotension (1st dose) | Start with low dose of ACE-I and monitor BP |
| Antiarrhythmic agents, digoxin | Increased risk of ventricular arrhythmias (torsades de pointes) due to hypokalemia, hypomagnesemia | Monitor serum potassium and magnesium levels; supplement electrolyte if necessary |
| Antidiabetic medications | Decreased hypoglycemic effect | Monitor blood glucose levels |
| Calcium supplements | Increased risk of hypercalcemia | Avoid concurrent use or monitor serum calcium levels |
| Carbamazepine | Increased risk of hyponatremia | Avoid concurrent use or monitor serum sodium levels |
| NSAIDs | Decreased antihypertensive and diuretic effect, increased risk of nephrotoxicity | Avoid concurrent use or monitor BP and serum creatinine levels |
| Topiramate, lithium | Increased topiramate or lithium concentrations and increased risk of toxicity | Monitor levels and consider dose reduction |

### Adverse Reactions: Hydrochlorothiazide

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Hypotension, dizziness, headache | Constipation, hypercalcemia, hyperglycemia, hyperuricemia, hypokalemia, hypomagnesemia, hyponatremia, impotence, loss of appetite, nausea, photosensitivity, rash | Cardiac arrhythmias, hepatitis, pancreatitis, Stevens-Johnson syndrome |

**Efficacy Monitoring Parameters.** Decreased BP, reductions in edema.

**Toxicity Monitoring Parameters.** Decreased serum and urine electrolytes, decreased renal function, increased serum uric acid or blood glucose. Seek medical attention if skin rash, yellowing of eyes or skin, decreased urine output, or symptoms of gout occur.

**Key Patient Counseling Points.** May be taken with or without food. Take early in the day to avoid nocturia. May cause dizziness. Avoid driving, using machinery, or doing anything else that could be dangerous if not alert. Report signs/symptoms of hypotension. Eat high-potassium foods during therapy. Avoid alcohol and using NSAIDs.

**Clinical Pearls.** Full hypotensive effect may require 2-3 wk. Thiazides are first-line therapies for managing hypertension. Available as a component of many combination products with other antihypertensives.

# HYDROCODONE: Zohydro ER, Vicodin, Various

5 mg/325 mg | 7.5 mg/325 mg | 10 mg/325 mg | 10 mg/500 mg | 7.5 mg/500 mg


Mallinckrodt generic pictured

**Class:** Opioid Analgesic. C-II

**Dosage Forms.** **Oral Capsule, Extended Release (Hydrocodone Alone):** 10 mg, 15 mg, 20 mg, 30 mg, 40 mg, 50 mg; **Oral Tablet (With Acetaminophen):** Hydrocodone/Acetaminophen 2.5 mg/325 mg, Hydrocodone/Acetaminophen 5 mg/325 mg, Hydrocodone/Acetaminophen 7.5 mg/325 mg, Hydrocodone/Acetaminophen 10 mg/325 mg; **Oral Elixir, Oral Solution (With Acetaminophen):** Hydrocodone/Acetaminophen 7.5 mg/325 mg per 15 mL, Hydrocodone/Acetaminophen 10 mg/325 mg per 15 mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Pain, moderate to moderately severe: Adults: 10 mg q 12 h initially, may titrate to response

**Off-Label Uses.** None

**MOA.** Hydrocodone is an opioid analgesic and antitussive with unknown mechanism of action, but it is thought to be related to the presence of opiate receptors in the CNS.

## Drug Characteristics: Hydrocodone

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Severe: Start with 10mg dose | **Absorption** | Well absorbed, minimal food effect |
| **Dose Adjustment Renal** | Severe: Start with 10mg dose | **Distribution** | Unknown |
| **Dialyzable** | Not dialyzable | **Metabolism** | Pro-drug activated to hydromorphone by CYP2D6, deactivated by CYP3A4/5 |
| **Pregnancy Category** | C | **Elimination** | 26% renal, half-life of 8 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity, paralytic ileus, respiratory depression, severe asthma | **Black Box Warnings** | Addiction potential, respiratory depression, accidental exposure, neonatal opioid withdrawal, alcohol, CYP3A4/5 interactions |

## Medication Safety Issues: Hydrocodone

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| ER | HYDROcodone | Do not chew or crush ER formulation | Yes | HYDROmorphone, oxyCODONE | No |

### Drug Interactions: Hydrocodone

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Barbiturates, benzodiazepines, centrally acting muscle relaxants, opioids, phenothiazines | Additive CNS depression | Monitor and consider dose adjustments |
| Buprenorphine, opioid agonists/antagonists, opioid antagonists | Precipitation of withdrawal symptoms | Avoid concurrent use with opioids |
| CYP3A4/5 inducers | Increased hydrocodone metabolism decreases hydrocodone efficacy | Monitor and consider hydrocodone dose increase |
| CYP3A4/5 inhibitors | Decreased hydrocodone metabolism and increased hydrocodone toxicity | Avoid concurrent strong CYP3A4/5 inhibitors, uses moderate CYP3A4/5 inhibitors with caution and consider a hydrocodone dose decrease |
| CYP2D6 inhibitors | Decreased activation of hydrocodone to hydromorphone, decreased hydrocodone efficacy | Monitor and consider dose increases of hydrocodone |
| MAOIs | Additive respiratory depression | Avoid concurrent use |

### Adverse Reactions: Hydrocodone/Acetaminophen

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Constipation, GI distress, somnolence | Rash, respiratory depression, euphoria, pruritus | Stevens-Johnson syndrome, physical dependence, tolerance, respiratory depression |

**Efficacy Monitoring Parameters.** Relief of pain.

**Toxicity Monitoring Parameters.** Seek medical attention if severe skin rash, excessive drowsiness, decreased breathing, severe constipation, black tarry stools, or yellowing of eyes or skin.

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

**Clinical Pearls.** Use caution in elderly, appear more sensitive to the effect. Tolerance and physical dependence may occur with chronic use; avoid abrupt discontinuation. If using a combination product including acetaminophen, do not exceed *max* daily dose (4 g) of acetaminophen. The *max* dose of acetaminophen in combination products is 325 mg per dosage unit as of April 2014; higher strengths were common and are in the process of being withdrawn from the market. All hydrocodone-containing combination products are now schedule II, including Vicodin. Various other combinations available, including hydrocodone with chlorpheniramine cough liquid (Tussionex).

# HYDROCORTISONE TOPICAL: Various



2.5% cream



1% cream

Fougera generic pictured

**Class:** Topical Corticosteroid

**Dosage Forms.** **Rectal Cream:** 1%, 2.5%; **Topical Cream:** 0.5%, 1%, 2.5%; **Topical Lotion:** 1%, 2.5%; **Topical Ointment:** 0.5%, 1%, 2.5%

H

**Common FDA Label Indication, Dosing, and Titration.**

1. Skin disorders, corticosteroid responsive: Apply thin layer topically to affected area daily to bid

**Off-Label Uses.** None

**MOA.** Hydrocortisone 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.

**Drug Characteristics: Hydrocortisone Topical**

| | | | |
|---|---|---|---|
| **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** | Not dialyzable | **Metabolism** | Not absorbed |
| **Pregnancy Category** | C | **Elimination** | Not absorbed |
| **Lactation** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to hydrocorti-sone or other corticosteroids | **Black Box Warnings** | None |

### Medication Safety Issues: Hydrocortisone Topical

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| HC, Maximum strength | No | No | No | HCT (occasional abbreviation for hydrocortisone) is an error-prone abbreviation, may be confused with HCTZ (hydrochlorothiazide) | No |

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

### Adverse Reactions: Hydrocortisone Topical

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| | Dry skin, burning sensation, stinging, pruritus at site of administration; headache | HPA suppression has been reported when used with occlusive dressings, or when applied 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. Wash hands after application.

**Clinical Pearls.** Large number of dosage presentations (foams, gels, shampoos, etc), both by prescription and over the counter, are available. Oral and rectal formulations, administered for systemic action, also available and used for similar indications as other oral corticosteroids (eg, prednisone). 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.

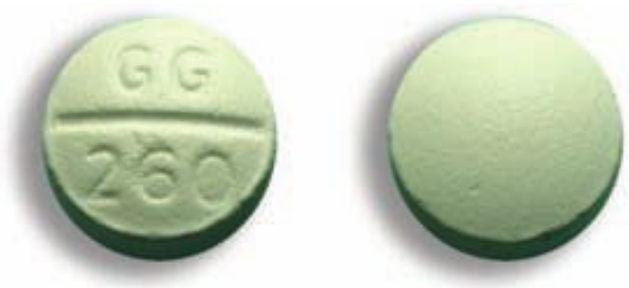
# HYDROXYCHLOROQUINE: Plaquenil, Various

**Class:** Aminoquinoline

**Dosage Forms. Oral Tablet:** 200 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Lupus erythematosus: 400-800 mg po daily (may divide into 2 doses), then may reduce to maintenance dose of 200-400 mg po daily
2. Malaria, suppression: Adults, 400 mg po q week on the same day; Children, 5 mg base/kg (200 mg hydroxychloroquine sulfate = 155 mg hydroxychloroquine base); begin 2 wk prior to entering an endemic area and continue for 4 wk after leaving the endemic area
3. Rheumatoid arthritis: maintenance: 400-600 mg po daily, after 4-12 wk reduce dose to 200-400 mg for maintenance therapy




Goldline generic 200 mg pictured

**Off-Label Uses.** None

**MOA.** The mechanism of action of hydroxychloroquine is unknown. It is effective in treating *P. vivax, P. malariae*, and susceptible strains of *P. falciparum*.

**Drug Characteristics: Hydroxychloroquine**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Severe hepatic dysfunction, avoid | **Absorption** | F = 74%, minimal food effect |
| **Dose Adjustment Renal** | Severe renal dysfunction, avoid | **Distribution** | Concentration in red blood cells is 5 times higher than plasma |
| **Dialyzable** | Not dialyzable | **Metabolism** | 40% and occurs by unknown enzymes |
| **Pregnancy Category** | D | **Elimination** | Renal elimination 16-25%, with a half-life of 40 d |
| **Lactation** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to hydroxychloroquine, retinal or visual field changes from prior hydroxychloroquine, long-term use in children | **Black Box Warnings** | Experienced physician |

### Medication Safety Issues: Hydroxychloroquine

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

### Drug Interactions: Hydroxychloroquine

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Aurothioglucose | Increased risk of blood dyscrasias | Contraindicated |
| Digoxin | Increased digoxin levels | Avoid concurrent use or monitor digoxin levels |
| Fibrates | Increased risk of cholelithiasis | Avoid concurrent use or monitor for cholelithiasis |
| Metoprolol | Decreased metabolism and increased toxicity of metoprolol | Avoid concurrent use |

### Adverse Reactions: Hydroxychloroquine

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| | Abdominal pain, constipation, diarrhea, headache, nausea, dizziness, visual disturbances, hyperpigmentation | Arrhythmias, cardiomyopathy, Stevens-Johnson syndrome, agranulocytosis, seizures, retinopathy, psychosis |

**Efficacy Monitoring Parameters.** Rheumatoid arthritis: decreased pain and improved range of motion. Lupus: decreased joint pain, decrease in butterfly rash, improved energy.

**Toxicity Monitoring Parameters.** Seek medical attention if heart palpitations, severe rash, unusual bruising or bleeding, or difficulty seeing or changes in visual fields. Baseline and periodic eye exams.

**Key Patient Counseling Points.** If taking weekly, take on same day each week. Take with food or milk.

**Clinical Pearls.** One tablet of 200 mg of hydroxychloroquine sulfate is equivalent to 155 mg base. If serious adverse effects or overdose occurs, ammonium chloride (8 g daily in divided doses for adults) may be administered 3-4 d a week for several months to increase the renal excretion of hydroxychloroquine.

# HYDROXYZINE: Atarax, Vistaril, Various

**Class:** Antihistamine

**Dosage Forms.** **Oral Tablet:** 10 mg, 25 mg, 50 mg; **Oral Capsule:** 25 mg, 50 mg, 100 mg; **Oral Syrup:** 10 mg/5 mL; **Oral Solution:** 10 mg/5 mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Anxiety: 50-100 mg po qid
2. Pruritus: 25 mg po tid-qid
3. Sedation: 50-100 mg po q4h prn

**Off-Label Uses.**

1. Seasonal allergic rhinitis: 10-25 mg po tid-qid

Northstar Rx generic pictured

**MOA.** Hydroxyzine hydrochloride is a rapid-acting agent with probable action of suppressing activity in key locations of the CNS's subcortical area. Primary skeletal muscle relaxation, bronchodilator activity, antiemetic effects, and antihistaminic and analgesic effects have been demonstrated experimentally and confirmed clinically.

**Drug Characteristics: Hydroxyzine**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Patients with chronic liver failure receive a lower dose; administer lowest effective dose once daily only and increase carefully to avoid toxicity | **Absorption** | Rapidly absorbed after oral administration |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 16 L/kg |
| **Dialyzable** | Not dialyzable | **Metabolism** | Metabolized to cetirizine in the liver |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 70% with a half-life of 3-20 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to cetirizine or hydroxyzine | **Black Box Warnings** | None |

### Medication Safety Issues: Hydroxyzine

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | HydrOXYzine | No | No | HydrALAZINE, hydroxyurea | Avoid. Highly anticholinergic. |

### Drug Interactions: Hydroxyzine

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

### Drug Interactions: Hydroxyzine

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

**Efficacy Monitoring Parameters.** Improvement in symptoms for which administered (anxiety, pruritus, insomnia).

**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 OTC in several dosage forms. Injectable formulation available for use as an adjunct to pain medications and antiemetics for perioperative pain, nausea, and vomiting, and alone as a sedative.

# IBANDRONATE: Boniva, Various

**Class:** Bisphosphonate

**Dosage Forms. Oral Tablet:** 150 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Postmenopausal osteoporosis (Treatment): 150 mg po once monthly
2. Postmenopausal osteoporosis (Prophylaxis): 150 mg po once monthly

**Off-Label Uses.** None

**MOA.** Ibandronate binds to bone hydroxyapatite and, at the cellular level, inhibits osteoclast activity, thereby modulating bone metabolism.

**Drug Characteristics: Ibandronate**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F <1%, food impairs absorption; take 30-60 min prior to meal |
| **Dose Adjustment Renal** | CrCl <30 mL/min, avoid use | **Distribution** | Vd = 90 L; 85-99% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | Not metabolized |
| **Pregnancy Category** | C | **Elimination** | 50% renal elimination with a half-life of 37-157 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Esophageal abnormalities, which delay esophageal emptying, hypocalcemia, inability to sit or stand upright for at least 60 min | **Black Box Warnings** | None |


GlaxoSmithKline 150 mg pictured

### Medication Safety Issues: Ibandronate

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | Do not chew, crush, or suck tablet | No | No | No |

### Drug Interactions: Ibandronate

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Aluminum, calcium-containing products | Decreased bisphosphonate absorption | Separate administration by 1-2 h |
| $H_2$-blockers and PPIs | Decreased bisphosphonate absorption | Separate administration by 1-2 h |

### Adverse Reactions: Ibandronate

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Indigestion, backache, respiratory tract infections | Hypertension, diarrhea, abdominal pain, headache, myalgia | Osteonecrosis of the jaw, esophageal cancer, esophageal ulcers, immune hypersensitivity, arrhythmia, bone fractures, severe muscle pain |

**Efficacy Monitoring Parameters.** Increased BMD. Decreased incidence of bone fractures.

**Toxicity Monitoring Parameters.** Baseline serum creatinine, calcium, phosphorous. Seek medical attention if severe skin rash, difficulty swallowing, swelling, tooth problems, or severe pain.

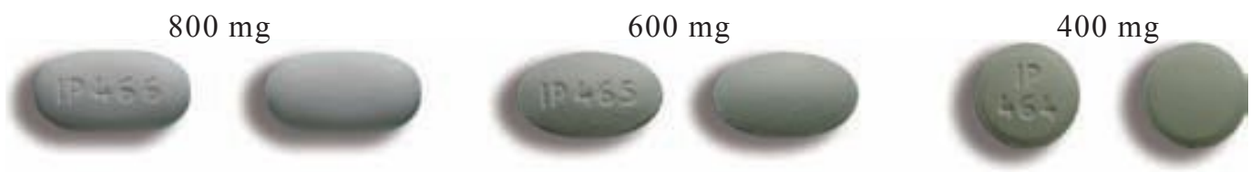
**Key Patient Counseling Points.** Take this medicine as soon as you get out of bed in the morning, before you eat or have anything to drink. Swallow the tablet whole with a large glass (240 mL) of plain water only (not mineral water, coffee, juice, or any other liquid). Do not take the medicine while you are still in bed, and do not take it at bedtime. Wait for at least 60 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 60 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 for osteonecrosis of the jaw. Atypical fractures of the thigh (subtrochanteric and diaphyseal femur fractures) have been reported in patients taking bisphosphonates for osteoporosis; discontinue therapy in patients who develop evidence of a femoral shaft fracture. Given the toxicities, FDA recommends consideration of discontinuation of ibandronate in patients at lower risk of osteoporosis after 3-5 y of therapy. Medication guide required at dispensing. Recommend adjunct calcium and vitamin D if dietary intake is inadequate.

# IBUPROFEN: Motrin, Various

**Class:** NSAID

**Dosage Forms. Oral Tablet:** 100 mg, 200 mg, 400 mg, 600 mg, 800 mg; **Oral Suspension:** 100 mg/5 mL, 50 mg/1.25 mL, 40 mg/mL; **Oral Capsule:** 200 mg; **Oral Tablet, Chewable**: 50 mg, 100 mg



Amneal generic pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Fever: Children, 6 mo-12 y of age, 5-10 mg/kg po q6-8h prn; Children ≥12 y of age and Adults, 200-400 mg po q4-6h prn, *max* 1200 mg/d for OTC use
2. Pain, headache: Children, 6 mo-12 y of age, 5-10 mg/kg po q6-8h prn; Children ≥12 y of age and Adults, 200-400 mg po q4-6h prn, *max* 1200 mg/d for OTC use
3. Osteoarthritis or rheumatoid arthritis: 1200-3200 mg/d po in 3-4 divided doses
4. Juvenile rheumatoid arthritis: 30-50 mg/kg/d divided qid, *max* 2400 mg/d

**Off-Label Uses.** None

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

**Drug Characteristics: Ibuprofen**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 90%, minimal food effect |
| **Dose Adjustment Renal** | Severe renal dysfunction, avoid | **Distribution** | Vd = 0.1 L/kg; 99% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | 20% hepatic metabolism, CYP2C19 substrate |
| **Pregnancy Category** | C (1st and 2nd trimesters); D (3rd trimester) | **Elimination** | 45-80% renal elimination with a half-life of 1.8-2.2 h |
| **Lactation** | Compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to ibuprofen; concurrent use with ketorolac or pentoxifylline; asthma, urticaria, or allergic-type reaction following aspirin or other NSAID administration; CABG surgery, treatment of perioperative pain | **Black Box Warnings** | Cardiovascular events, GI toxicity, CABG |

**Medication Safety Issues: Ibuprofen**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| Junior, Migraine, 200, Prin | No | No | No | Halfprin, Neurontin | Avoid chronic use unless other alternatives are not effective and patient can take gastroprotective agent. |

### Drug Interactions: Ibuprofen

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Aspirin, low-molecular-weight heparins, SSRIs | Additive GI toxicity and increased risk of bleeding | Monitor for GI toxicity |
| ACE-Is, angiotensin II receptor blockers, beta-blockers, loop diuretics, thiazide diuretics | Decreased diuretic and antihypertensive efficacy via decreased renal prostaglandin production | Monitor and consider alternative therapy |
| Cyclosporine, tacrolimus, lithium | Increased risk of cyclosporine, lithium toxicity, unknown mechanism | Monitor cyclosporine, tacrolimus, or lithium levels and consider dose adjustments |
| Ketorolac, pentoxifylline | Additive GI toxicity and increased risk of bleeding | Contraindicated |
| Pemetrexed | Decreased renal clearance and increased toxicity of pemetrexed | Avoid NSAIDs in combination with pemetrexed in patients with renal dysfunction |
| Sulfonylurea antidiabetic agents | Increased risk of hypoglycemia via inhibition of sulfonylurea metabolism | Monitor blood glucose and adjust as necessary |
| Warfarin | Competitive metabolism | Monitor INR and adjust warfarin dose |

### Adverse Reactions: Ibuprofen

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

**Efficacy Monitoring Parameters.** Osteoarthritis and rheumatoid arthritis: decreased pain and improved range of motion.

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

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

**Clinical Pearls.** Elderly patients are at increased risk of GI ulceration. NSAIDs are associated with an increased risk of adverse cardiovascular thrombotic events, including fatal MI and stroke. Use lowest effective dose for shortest possible duration; after observing initial response, adjust dose and frequency to meet individual patient's needs. Various OTC ibuprofen products are available; caution patients not to duplicate dosing with multiple ibuprofen products. Medication guide required at dispensing.

# IMIQUIMOD: Zyclara, Various

**Class:** Immune Response Modifier

**Dosage Forms. Topical Cream:** 2.5%, 3.75%, 5%

**Common FDA Label Indication, Dosing, and Titration.**

1. Actinic keratosis: Apply topically to affected treatment area 2 times per week at bedtime for 16 wk
2. Condyloma acuminatum, external: Apply topically to affected area 3 times per week until total clearance or up to a *max* duration of 16 wk
3. Superficial basal cell carcinoma, on trunk, neck, or extremities; when surgical methods are less appropriate and follow-up is assured: Apply topically once daily 5 times per week for 6 wk

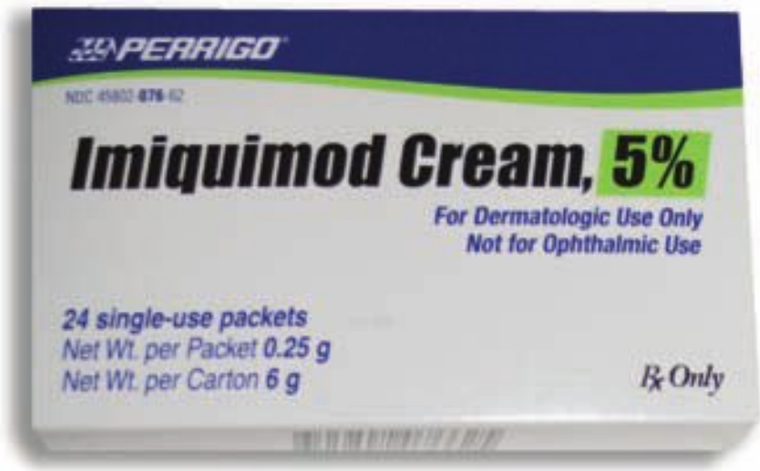
**Off-Label Uses.**

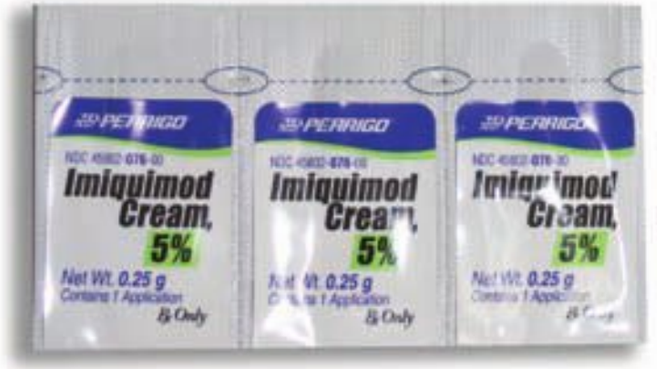
1. Condyloma acuminatum, external-HIV infection: Apply topically to lesion at bedtime 3 times per week on nonconsecutive nights for up to 16 wk; wash with soap and water 6-10 h after each application.

**MOA.** Toll-like receptor 7 agonist that induces cytokines, including interferon-α and others.

**Drug Characteristics: Imiquimod**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | Absorption is dose dependent; 75 mg of cream yielded a Cmax = 3.5 ng/mL |
| **Dose Adjustment Renal** | Not required | **Distribution** | Unknown |
| **Dialyzable** | Not dialyzable | **Metabolism** | Unknown |
| **Pregnancy Category** | C | **Elimination** | Minimal, <1% with a half-life of 20 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | None | **Black Box Warnings** | None |




Perrigo generic 5% cream pictured

**Medication Safety Issues: Imiquimod**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| Zyclara Pump | No | No | No | Alora | No |

**Drug Interactions: Imiquimod.** None known

**Adverse Reactions: Imiquimod**

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Local itching, burning, and pain | Headache, myalgia | Exfoliative dermatitis |

**Efficacy Monitoring Parameters.** Resolution of skin lesions.

**Toxicity Monitoring Parameters.** Seek medical attention if signs/symptoms of severe rash, burning, or itching.

**Key Patient Counseling Points.** Apply at bedtime and leave on skin for 8 h; when you get up, wash the treated skin area with mild soap and water. Do not cover treated skin areas with bandages. Do not use cosmetics or other skin care products on the treated skin areas. Apply on same days of each week. May increase sensitivity to sun.

**Clinical Pearls.** Condyloma acuminata are also known as genital warts and are sexually transmitted. Patients should be advised to abstain from sex while being treated. Imiquimod is not a cure for genital or anal warts; patients may develop new warts or spread warts while using the cream.

# INDOMETHACIN: Indocin, Various

**Class:** NSAID

**Dosage Forms.** **Oral Capsule, Immediate Release:** 25 mg, 50 mg; **Oral Capsule, Extended Release:** 75 mg; **Oral Suspension:** 25 mg/5 mL; **Rectal Suppository:** 50 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Ankylosing spondylitis, osteoarthritis, rheumatoid arthritis: Immediate Release, 25-50 mg po bid-tid, *max* 200 mg/d; Extended Release, 75 mg po daily bid
2. Pain: Immediate Release, 75-150 mg/d in 3-4 divided doses for 7-14 d

Sandoz generic pictured

**Off-Label Uses.**

1. Preterm labor, prevention: 25 mg po q6-12h

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

**Drug Characteristics: Indomethacin**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Severe hepatic failure, use with caution | **Absorption** | F = 90%, no food effect |
| **Dose Adjustment Renal** | CrCl <15 mL/min, use with caution | **Distribution** | Vd = 0.34-1.57 L/kg; 99% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | 40% hepatic |
| **Pregnancy Category** | C | **Elimination** | 60% renal elimination with a half-life of 4.5 h |
| **Lactation** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity, concurrent use with ketorolac or pentoxifylline; asthma, urticaria, or allergic-type reaction following aspirin or other NSAID administration; CABG surgery, treatment of perioperative pain | **Black Box Warnings** | Cardiovascular events, GI toxicity, CABG |

**Medication Safety Issues: Indomethacin**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | ER capsule | No | Imodium, Lincocin, Minocin, Vicodin | Avoid |

### Drug Interactions: Indomethacin

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Aspirin, low-molecular-weight heparins, SSRIs | Additive GI toxicity and increased risk of bleeding | Monitor for GI toxicity |
| ACE-Is, angiotensin II receptor blockers, beta-blockers, loop diuretics, thiazide diuretics | Decreased diuretic and antihypertensive efficacy via decreased renal prostaglandin production | Monitor and consider alternative therapy |
| Cyclosporine, tacrolimus, lithium | Increased risk of cyclosporine, lithium toxicity, unknown mechanism | Monitor cyclosporine, tacrolimus, or lithium levels and consider dose adjustments |
| Ketorolac, pentoxifylline | Additive GI toxicity and increased risk of bleeding | Contraindicated |
| Pemetrexed | Decreased renal clearance and increased toxicity of pemetrexed | Avoid NSAIDs in combination with pemetrexed in patients with renal dysfunction |
| Sulfonylurea antidiabetic agents | Increased risk of hypoglycemia via inhibition of sulfonylurea metabolism | Monitor blood glucose and adjust as necessary |
| Warfarin | Competitive metabolism | Monitor INR and adjust warfarin dose |

### Adverse Reactions: Indomethacin

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

**Efficacy Monitoring Parameters.** Osteoarthritis and rheumatoid arthritis: decreased pain and improved range of motion.

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

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

**Clinical Pearls.** Elderly patients are at increased risk of GI ulceration. NSAIDs are associated with an increased risk of adverse cardiovascular thrombotic events, including fatal MI and stroke. Use lowest effective dose for shortest possible duration; after observing initial response, adjust dose and frequency to meet individual patient's needs. Various OTC NSAID products are available; caution patients not to duplicate dosing with multiple NSAID products. Indomethacin is effective for stopping premature labor and delaying delivery for several weeks, but should be used with caution as it may cause harm to the infant. Medication guide required at dispensing.

# INFLUENZA VIRUS VACCINE, INACTIVATED: Afluria, Flublok, Fluzone, Fluzone High-Dose; Fluzone Intradermal, FluLaval, Fluarix, Fluvirin, Flucelvax, Various

**Class:** Vaccine

**Dosage Forms.** **Suspension for Intramuscular Injection:** 0.5 mL vial (available as trivalent product containing 2 strains of influenza A virus and 1 influenza B virus strain and as a quadrivalent product containing 2 strains of influenza A virus and 2 influenza B virus strains); **Suspension for Intradermal Injection:** 0.1 mL in prefilled intradermal injection system

**Common FDA Label Indication, Dosing, and Titration.**

1. Prevention of influenza infection: Adults, 1 dose annual prior to or during influenza season; Children aged 6 mo to 8 y who have not been vaccinated in the past, 2 doses separated by at least 4 wk during the 1st season they receive influenza vaccine

**Off-Label Uses.** None

**Drug Characteristics: Inf uenza Virus Vaccine, Inactivated**

| | | | |
|---|---|---|---|
| **Pregnancy Category** | C | **ADME** | None known |
| **Lactation** | Infant risk is minimal | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to inf uenza vaccine, egg protein or a component of the vaccine; asthma, chronic medical conditions, immunosuppression | **Black Box Warnings** | None |

**Medication Safety Issues: Inf uenza Virus Vaccine, Inactivated**

| Suf xes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | Flumazenil; vials and syringes often mistaken for tetanus toxoid or tuberculin skin test | No |

Sanofi Pasteur pictured

I

### Drug Interactions: Inf uenza Virus Vaccine, Inactivated

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Moderate- to high-dose corticosteroids | Immunosuppression and increased risk of infection by vaccine | Delay vaccine administration until corticosteroid therapy has been discontinued if possible |
| Immunosuppressing agents, including cyclosporine, cancer chemotherapy | Immunosuppression and increased risk of infection by vaccine | Delay vaccine administration until corticosteroid therapy has been discontinued if possible |

### Adverse Reactions: Inf uenza Virus Vaccine, Inactivated

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, including erythema and soreness. Itching, fatigue, headache, nasal congestion | Fever, myalgia, arthralgia | Anaphylaxis, Guillain-Barré syndrome, febrile seizures |

**Efficacy Monitoring Parameters.** Prevention of influenza infection.

**Toxicity Monitoring Parameters.** Syncope.

**Key Patient Counseling Points.** Annual seasonal immunization is recommended.

**Clinical Pearls.** Choose the vaccine preparation for appropriate age group. Use current year vaccine only (virus strains and vaccine vary year to year). Not all influenza vaccines are licensed for young children. Intradermal influenza vaccine licensed for adults aged 18-64 y. High-dose influenza vaccine licensed for individuals aged ≥65 y. Flublok is a recombinant influenza vaccine for ages 18-49 y and can be used in egg-allergic individuals. Flucelvax vaccine virus is grown in cell culture, but the seed virus is grown in eggs. Afluria is not recommended for children <9 y of age due to risk of febrile seizures. Recommended for pregnant females.

# INFLUENZA VIRUS VACCINE, LIVE: FluMist, Quadrivalent

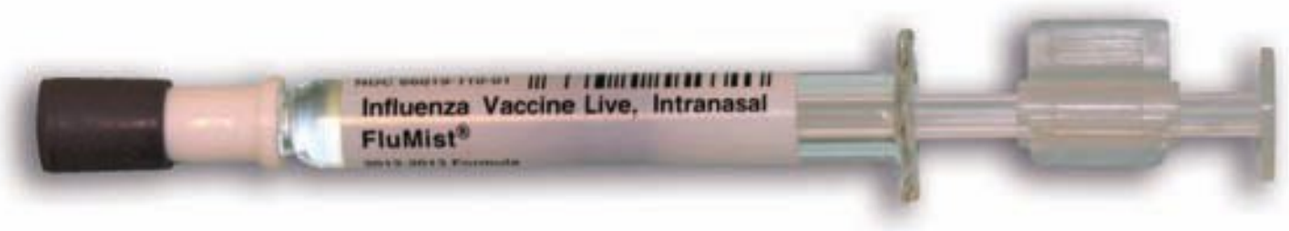
**Class:** Vaccine

**Dosage Forms.** **Intranasal Spray:** 0.2 mL (quadrivalent product containing 2 strains of influenza A virus and 2 influenza B virus strains)

**Common FDA Label Indication, Dosing, and Titration.**

1. Prevention of influenza infection: Adults, healthy, aged 18-49 y, 1 spray each nostril annually; Children, healthy, aged 2-18 y, 1 spray in each nostril annually
2. Preferred influenza vaccine preparation for healthy children aged 2-8 y

**Off-Label Uses.** None




MedImmune pictured

**Drug Characteristics: Inf uenza Virus Vaccine, Live**

| | | | |
|---|---|---|---|
| **Pregnancy Category** | B | **ADME** | None known |
| **Lactation** | Infant risk is minimal | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to inf uenza vaccine, egg protein or a component of the vaccine; asthma, chronic medical conditions, immunosuppression; pregnancy | **Black Box Warnings** | None |

**Medication Safety Issues: Inf uenza Virus Vaccine, Live**

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

## Drug Interactions: Inf uenza Virus Vaccine, Live

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Aspirin, salicylates | Increased risk of Reye syndrome | Avoid giving salicylates to children for the 6 wk following live inf uenza virus vaccine administration |
| Moderate- to high-dose corticosteroids | Immunosuppression and increased risk of infection by vaccine | Delay live inf uenza virus vaccine administration until corticosteroid therapy has been discontinued |
| Immunosuppressing agents, including cyclosporine, cancer chemotherapy | Immunosuppression and increased risk of infection by vaccine | Delay live inf uenza virus vaccine administration until immunosuppressive therapy has been discontinued |
| Inf uenza antiviral medications: adamantanes, neuraminidase inhibitors | Interference with immune response to inf uenza virus vaccine | Hold antiviral agent for at least 2 wk |

## Adverse Reactions: Inf uenza Virus Vaccine, Live

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Headache, nasal congestion | Fever | Anaphylaxis, Guillain-Barré syndrome, Bells palsy |

**Efficacy Monitoring Parameters.** Prevention of influenza infection.

**Toxicity Monitoring Parameters.** Nasal discharge.

**Key Patient Counseling Points.** Annual seasonal immunization is recommended.

**Clinical Pearls.** Use current year vaccine only (virus strains and vaccine vary year to year). LAIV has an 18-wk expiration date so it can expire before the end of the season. Transmission of the vaccine virus to susceptible individuals without clinical consequences has been documented. Avoid administering to contacts of individuals so severely immunocompromised that they require protective isolation. The dose is sprayed into each nostril with no cooperation (active inhalation) required by the individual being vaccinated. Vaccine dosing does not need to be repeated if the individual sneezes following administration.

# INSULIN: Humulin R, Humulin N, Humulin 70/30, Various

**Class:** Insulin, Short-Acting (R); Intermediate-Acting (NPH)

**Dosage Forms.** **Injection Solution:** Humulin R (Regular): 100 units/mL, 500 units/mL; Humulin N (NPH): 100 units/mL; Humulin 70/30 (NPH/Regular): 70 units NPH/30 units Regular/mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Diabetes mellitus, type 1 and 2: Subcutaneous dosing is individualized to patient needs

**Off-Label Uses.** None

**MOA.** Insulin promotes cellular uptake of glucose, fatty acids, and amino acids, and their conversion to glycogen, triglycerides, and proteins.

**Drug Characteristics: Insulin**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | Regular: onset: 30 min, peak effect: 2 h, duration: 4-6 h; NPH: onset: 2 h, peak effect: 4-8 h, duration: 8-12 h |
| **Dose Adjustment Renal** | Not required | **Distribution** | Protein binding 5% |
| **Dialyzable** | Not dialyzable | **Metabolism** | 50% hepatic, 30% renal, 20% adipose tissue |
| **Pregnancy Category** | Not categorized, but used in pregnancy | **Elimination** | Renal elimination is 30% with a half-life of 1-5 h |
| **Lactation** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |


Lilly NPH 100 units/mL pictured

**Medication Safety Issues: Insulin**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| R = Regular, N = NPH, 70/30 = 70% NPH/30% R, U-500 (high concentration) | HumuLIN, NovoLIN | No | Yes | HumaLOG, HumuLIN, NovoLIN, NovoLOG | Avoid sliding scale |

### Drug Interactions: Insulin

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Beta-blockers | Altered glucose metabolism and increased risk of hypoglycemia | Avoid propranol; use others with caution and increased monitoring |
| Fluoroquinolones | Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| MAOIs | Stimulation of insulin secretion, hypoglycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Somatostatin analogues | Altered glucose metabolism and increased risk of hypoglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Psyllium | Psyllium may delay absorption of glucose from meals, leading to less postprandial hyperglycemia and potentially allowing a reduced dosage of the antidiabetic agent | Avoid concurrent use if possible; monitor and consider dose adjustments |

### Adverse Reactions: Insulin

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, weight gain | Hypoglycemia, lipodystrophy | Severe hypersensitivity, insulin resistance, severe hypoglycemia |

**Efficacy Monitoring Parameters.** Preprandial blood glucose between 70 and 130 mg/dL, $HbA_{1c}$ <7%.

**Toxicity Monitoring Parameters.** Symptoms of hypoglycemia include nausea, sweating, and loss of consciousness, tremor.

**Key Patient Counseling Points.** Monitor blood glucose in frequent intervals (2-4 times per day); if <70 mg/dL, eat candy or sugar and contact prescriber. Store in refrigerator. Dispose needles in sharps container. Do not share needles; this increases the risk of transmission of infectious diseases. Rotate injection sites.

**Clinical Pearls.** Beef and pork insulins are extracted and purified from the animal's pancreas. Human insulin is produced by recombinant DNA technology or enzymatic conversion of pork insulin. No differences in side effects or long-term control of diabetes have been observed between human insulin and highly purified pork insulin. Use caution when dispensing 500 units/mL insulin solution, can result in accidental overdose of insulin and hypoglycemia. Regular is short acting; NPH is intermediate acting. Rapid acting inhaled insulin was approved by FDA in June 2014, but is not yet available.

# INSULIN ASPART: NovoLog, NovoLog FlexPen

**Class:** Insulin, Rapid-Acting

**Dosage Forms. Injection Solution:** 100 units/mL; **Pen and Refills (Administration Device)**: 100 units/mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Diabetes mellitus, type 1 and 2: Dosing is individualized to patient needs

**Off-Label Uses.** None

**MOA.** Insulin promotes cellular uptake of glucose, fatty acids, and amino acids, and their conversion to glycogen, triglycerides, and proteins.


Novo Nordisk pictured

## Drug Characteristics: Insulin Aspart

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | Onset: 15-30 min, peak: 1-2 h, duration: 3-5 h |
| **Dose Adjustment Renal** | Not required | **Distribution** | Protein binding 5% |
| **Dialyzable** | Not dialyzable | **Metabolism** | 50% hepatically metabolized |
| **Pregnancy Category** | B | **Elimination** | Renal elimination is 30% with a half-life of 1.5 h |
| **Lactation** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

## Medication Safety Issues: Insulin Aspart

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| FlexPen, FlexFill | NovoLOG | No | Yes | HumaLOG, HumuLIN, Nimbex, NovoLIN, NovoLOG Mix 70/30 | Avoid sliding scale |

### Drug Interactions: Insulin Aspart

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Beta-blockers | Altered glucose metabolism and increased risk of hypoglycemia | Avoid propranol; use others with caution and increased monitoring |
| Fluoroquinolones | Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| MAOIs | Stimulation of insulin secretion, hypoglycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Somatostatin analogues | Altered glucose metabolism and increased risk of hypoglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Psyllium | Psyllium may delay absorption of glucose from meals, leading to less postprandial hyperglycemia and potentially allowing a reduced dosage of the antidiabetic agent | Avoid concurrent use if possible; monitor and consider dose adjustments |

### Adverse Reactions: Insulin Aspart

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, weight gain, hypoglycemia | Pruritus, rash, lipodystrophy | Severe hypersensitivity, insulin resistance |

**Efficacy Monitoring Parameters.** Preprandial blood glucose between 70 and 130 mg/dL, $HbA_{1c}$ <7%.

**Toxicity Monitoring Parameters.** Symptoms of hypoglycemia include nausea, sweating, and loss of consciousness, tremor

**Key Patient Counseling Points.** Monitor blood glucose in frequent intervals (2-4 times per day); if <70 mg/dL, eat candy or sugar and contact prescriber. Store in refrigerator. Dispose needles in sharps container. Do not share needles; this increases the risk of transmission of infectious diseases. Rotate injection sites.

**Clinical Pearls.** Insulin requirements may change during periods of stress (illness) or with increased activity; monitor and adjust. This is the fastest acting insulin.

# INSULIN DETEMIR: Levemir

**Class:** Insulin, Long-Acting

**Dosage Forms. Injection Solution:** 100 units/mL; **Pen (Administration Device):** 100 units/mL

**Common FDA Label Indication and Dosing.**

1. Diabetes mellitus, type 1 and 2: Dosing is individualized to patient needs

**Off-Label Uses.** Not required

**MOA.** Insulin promotes cellular uptake of glucose, fatty acids, and amino acids, and their conversion to glycogen, triglycerides, and proteins.

**Drug Characteristics: Insulin Detemir**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | Onset: 2 h, no peak, duration: 14-24 h (dose dependant) |
| **Dose Adjustment Renal** | Not required | **Distribution** | 98% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | 50% hepatically metabolized |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 30% with a half-life of 5-7 h |
| **Lactation** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

**Medication Safety Issues: Insulin Detemir**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| FlexPen, FlexTouch | No | No | Yes | FlexFill | Avoid sliding scale |


Novo Nordisk 100 units/mL pictured

### Drug Interactions: Insulin Detemir

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Beta-blockers | Altered glucose metabolism and increased risk of hypoglycemia | Avoid propranol; use others with caution and increased monitoring |
| Fluoroquinolones | Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| MAOIs | Stimulation of insulin secretion, hypoglycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Somatostatin analogues | Altered glucose metabolism and increased risk of hypoglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Psyllium | Psyllium may delay absorption of glucose from meals, leading to less postprandial hyperglycemia and potentially allowing a reduced dosage of the antidiabetic agent | Avoid concurrent use if possible; monitor and consider dose adjustments |

### Adverse Reactions: Insulin Detemir

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, weight gain, hypoglycemia | Pruritus, rash | Severe hypersensitivity, insulin resistance |

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

**Toxicity Monitoring Parameters.** Symptoms of hypoglycemia include nausea, sweating, and loss of consciousness, tremor.

**Key Patient Counseling Points.** Monitor blood glucose in frequent intervals (2-4 times per day); if <70 mg/dL, eat candy or sugar and contact prescriber. Store in refrigerator. Dispose needles in sharps container. Do not share needles; this increases the risk of transmission of infectious diseases. Rotate injection sites. Not for IV or IM use. Do not share pens, even if needles are changed.

**Clinical Pearls.** Insulin requirements may change during periods of stress (illness) or with increased activity; monitor and adjust.

# INSULIN GLARGINE: Lantus

**Class:** Insulin, Long-Acting

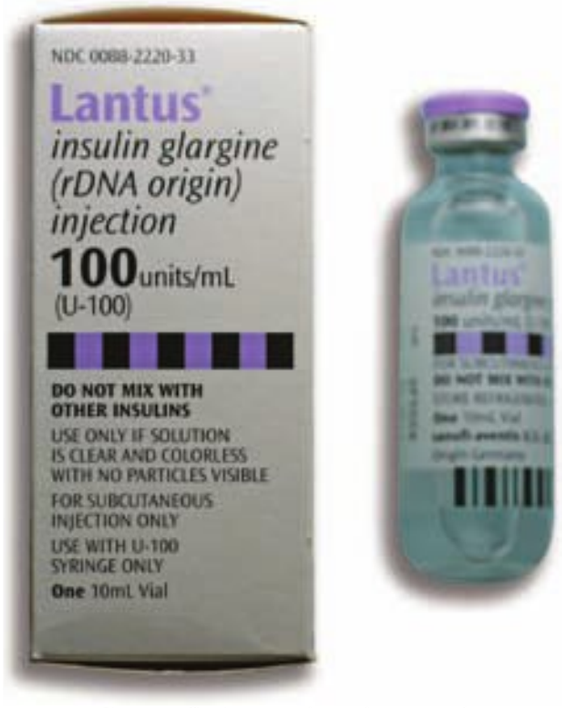
**Dosage Forms. Injection Solution:** 100 units/mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Diabetes mellitus, type 1 and 2: Dosing is individualized to patient needs

**Off-Label Uses.** None

**MOA.** Insulin promotes cellular uptake of glucose, fatty acids, and amino acids, and their conversion to glycogen, triglycerides, and proteins.



Sanofi-Aventis pictured

**Drug Characteristics: Insulin Glargine**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | Onset: 4-5 h, peak: none, duration: 22-24 h |
| **Dose Adjustment Renal** | Not required | **Distribution** | Unknown |
| **Dialyzable** | Not dialyzable | **Metabolism** | Metabolized to form active metabolites: M1 (21A-Gly-insulin) and M2 (21A-Gly-des-30B-Thr-insulin) 50% |
| **Pregnancy Category** | C | **Elimination** | Duration of effect 10-24 h |
| **Lactation** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

**Medication Safety Issues: Insulin Glargine**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| SoloStar | No | No | Yes | Latanoprost, Latuda, Xalatan | Avoid sliding scale |

### Drug Interactions: Insulin Glargine

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Beta-blockers | Altered glucose metabolism and increased risk of hypoglycemia | Avoid propranol; use others with caution and increased monitoring |
| Fluoroquinolones | Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| MAOIs | Stimulation of insulin secretion, hypoglycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Somatostatin analogues | Altered glucose metabolism and increased risk of hypoglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Psyllium | Psyllium may delay absorption of glucose from meals, leading to less postprandial hyperglycemia and potentially allowing a reduced dosage of the antidiabetic agent | Avoid concurrent use if possible, monitor and consider dose adjustments |

### Adverse Reactions: Insulin Glargine

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, weight gain, hypoglycemia | Pruritus, rash, lipodystrophy | Severe hypersensitivity, insulin resistance |

**Efficacy Monitoring Parameters.** Preprandial blood glucose between 70 and 130 mg/dL, $HbA_{1c}$ <7%.

**Toxicity Monitoring Parameters.** Symptoms of hypoglycemia include nausea, sweating, and loss of consciousness, tremor

**Key Patient Counseling Points.** Monitor blood glucose in frequent intervals (2-4 times per day); if <70 mg/dL, eat candy or sugar and contact prescriber. Store in refrigerator. Dispose needles in sharps container. Do not share needles; this increases the risk of transmission of infectious diseases. Rotate injection sites.

**Clinical Pearls.** Insulin requirements may change during periods of stress (illness) or with increased activity; monitor and adjust. Following subcutaneous administration, insulin glargine forms a microprecipitate in the fatty tissue from which small amounts of insulin are released slowly, resulting in a relatively constant concentration/time profile over 24 h with no pronounced peak.

# INSULIN LISPRO: Humalog, Humalog KwikPen

**Class:** Insulin, Rapid-Acting

**Dosage Forms.** **Injection Solution:** 100 units/mL; **Pen (Administration Device):** 100 units/mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Diabetes mellitus, type 1 and 2: Dosing is individualized to patient needs

**Off-Label Uses.** None

**MOA.** Insulin promotes cellular uptake of glucose, fatty acids, and amino acids, and their conversion to glycogen, triglycerides, and proteins.


Lilly pictured 100 units/mL

**Drug Characteristics: Insulin Lispro**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | Onset: 15-30 min, peak: 1-2 h, duration 3-4 h |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 0.26 L/kg |
| **Dialyzable** | Not dialyzable | **Metabolism** | 50% hepatically metabolized |
| **Pregnancy Category** | C | **Elimination** | Half-life of 0.5-1 h |
| **Lactation** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

**Medication Safety Issues: Insulin Lispro**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| Mix 50/50, KwikPen | HumaLOG | No | Yes | Humira, HumaLIN N, HumaLIN R, NovoLOG | Avoid sliding scale |

### Drug Interactions: Insulin Lispro

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Beta-blockers | Altered glucose metabolism and increased risk of hypoglycemia | Avoid propranol; use others with caution and increased monitoring |
| Fluoroquinolones | Altered glucose metabolism and increased risk of hypoglycemia and hyperglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| MAOIs | Stimulation of insulin secretion, hypoglycemic effects | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Somatostatin analogues | Altered glucose metabolism and increased risk of hypoglycemia | Avoid concurrent use if possible; monitor and consider dose adjustments |
| Psyllium | Psyllium may delay absorption of glucose from meals, leading to less postprandial hyperglycemia and potentially allowing a reduced dosage of the antidiabetic agent | Avoid concurrent use if possible, monitor and consider dose adjustments |

### Adverse Reactions: Insulin Lispro

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Injection site reactions, weight gain, hypoglycemia | Hypokalemia, lipodystrophy | Severe hypersensitivity, insulin resistance |

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

**Toxicity Monitoring Parameters.** Symptoms of hypoglycemia include nausea, sweating, and loss of consciousness, tremor

**Key Patient Counseling Points.** Monitor blood glucose in frequent intervals (2-4 times per day); if <70 mg/dL, eat candy or sugar and contact prescriber. Store in refrigerator. Dispose needles in sharps container. Do not share needles; this increases the risk of transmission of infectious diseases. Rotate injection sites.

**Clinical Pearls.** Insulin requirements may change during periods of stress (illness) or with increased activity; monitor and adjust. Injection of insulin lispro into an abdominal versus posterior upper arm or lateral thigh area site results in more rapid absorption. Faster acting than regular insulin.

# IPRATROPIUM/ALBUTEROL: Combivent, Various

**Class:** Anticholinergic/Selective $\beta_2$-Agonist Combination

**Dosage Forms.** **Metered-Dose Inhaler (MDI):** 18 mcg/90 mcg ipratropium/albuterol per actuation; **Inhalation Solution:** 0.5 mg/2.5 mg ipratropium/albuterol per 3 mL; **Spray:** 20 mcg/100 mcg ipratropium/albuterol per inhalation

**Common FDA Label Indication, Dosing, and Titration.**

1. Chronic obstructive pulmonary disease: Adults, 2 inhalations qid (*max* 12 inhalations/d) or 3 mL via nebulizer qid (*max* 6 doses/d)

**Off-Label Uses.**

1. Asthma exacerbation: Adults, ipratropium 0.5 mg with albuterol 2.5 mg via nebulized usually given once

**MOA.** Albuterol is a selective $\beta_2$-adrenergic agonist that produces bronchodilation, vasodilation, uterine relaxation, skeletal muscle stimulation, peripheral vasodilation, and tachycardia. Ipratropium is a competitive antagonist of acetylcholine at peripheral, but not central, muscarinic receptors. It appears to produce bronchodilation by inhibition of cholinergic receptors on bronchial smooth muscle.


Boehringer Ingelheim pictured

**Drug Characteristics: Ipratropium/Albuterol**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | About 90% of an inhaled dose is swallowed; F = 6.9% following inhalation |
| **Dose Adjustment Renal** | Not required | **Distribution** | Albuterol protein binding 10% |
| **Dialyzable** | Not dialyzable | **Metabolism** | Albuterol is conjugatively metabolized to an active metabolite; ipratropium is partially metabolized to 8 inactive metabolites |
| **Pregnancy Category** | C | **Elimination** | Albuterol renal elimination is 80-100% with a half-life of 4 h; ipratropium has minimal renal elimination, 48% in feces, with a half-life of 2 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to albuterol, ipratropium, or any other components of the product, or to atropine or its derivatives, or levalbuterol; hypersensitivity to soya lecithin or related food products (eg, soybean, peanut products) | **Black Box Warnings** | None |

### Medication Safety Issues: Ipratropium/Albuterol

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | Combivir, Serevent | No |

### Drug Interactions: Ipratropium/Albuterol

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Other anticholinergic agents | Additive effect with ipratropium | Avoid concurrent use |
| Other short-acting sympathomimetics | Additive effect with albuterol | Avoid concurrent use |
| Beta-blockers | May decrease effectiveness of albuterol and produce bronchospasms | Avoid use of nonselective beta-blocker in patients with asthma; monitor PFTs if cardioselective beta-blockers are clinically indicated |
| 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: Ipratropium/Albuterol

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Bronchitis, upper respiratory tract infections | Angina, tachycardia, nausea, cough, headache, dyspnea, tremor, nervousness, insomnia, urinary retention, blurred vision | Angle-closure glaucoma, pneumonia, hypersensitivity reactions, paradoxical bronchospasm |

**Efficacy Monitoring Parameters.** Resolution of COPD symptoms, improved PFTs.

**Toxicity Monitoring Parameters.** Use alternative therapy or seek emergency treatment if paradoxical bronchospasms occur.

**Key Patient Counseling Points.** Instruct patient on appropriate inhaler technique. Wash the mouthpiece in warm water and air dry thoroughly daily (may cease to deliver medication if mouthpiece becomes blocked). Store the inhaler at room temperature; avoid excessive humidity; do not freeze. Each canister contains 200 inhalations. Keep track of number of inhalations administered and discard canister after 200 inhalations have been used. Nebulizer technique: use entire vial of inhalation solution immediately after opening to avoid contamination; deliver over 5-15 min. Seek medical attention if the prescribed dose does not provide relief or if symptoms worsen.

**Clinical Pearls.** Because of anticholinergic effect of ipratropium, use with caution in patients with bladder neck obstruction, narrow-angle glaucoma, or BPH.

# IRBESARTAN: Avapro, Various

**Class:** Angiotensin II Receptor Antagonist

**Dosage Forms. Oral Tablet:** 75 mg, 150 mg, and 300 mg

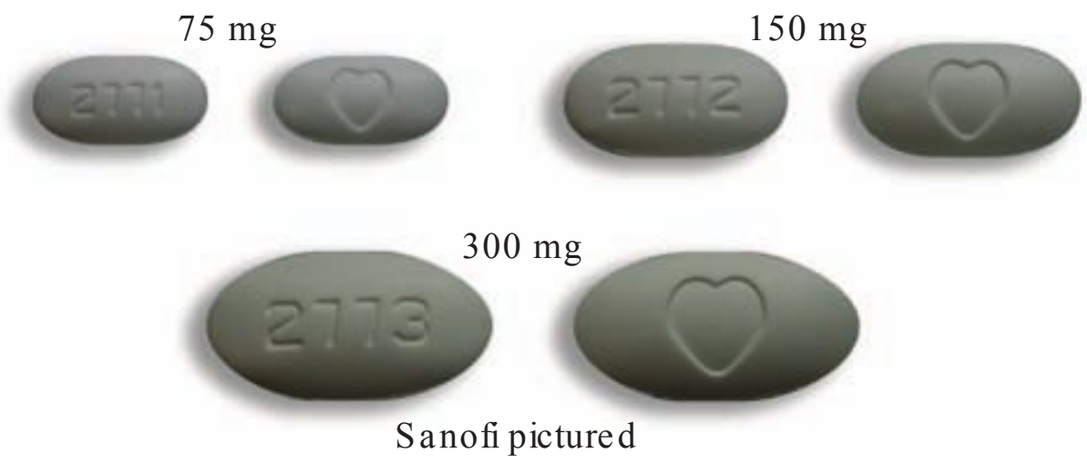
**Common FDA Label Indication, Dosing, and Titration.**

1. Diabetic nephropathy in patients with type 2 diabetes and hypertension: Adults, 75-300 mg po daily; titrate to target dose of 300 mg daily
2. Hypertension: Adults, initial, 150-300 mg po daily

**Off-Label Uses.**

1. Left ventricular hypertrophy: Adults, 150-300 mg po daily
2. Hypertension, renal impairment: Adults, 150-300 mg po daily

**MOA.** Irbesartan is a selective, reversible, competitive antagonist of the angiotensin II receptor (AT1), which is responsible for the physiologic effects of angiotensin II including vasoconstriction, aldosterone secretion, sympathetic outflow, and stimulation of renal sodium reabsorption.



Sanofi pictured

**Drug Characteristics: Irbesartan**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 80%, food does not affect absorption |
| **Dose Adjustment Renal** | Patients receiving hemodialysis, initial dose 75 mg po daily | **Distribution** | Vd = 53-93 L; 90% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | Minor CYP2C9 substrate. Moderate inhibitor of CYP2C8 and CYP2C9 |
| **Pregnancy Category** | C (1st trimester), D (2nd and 3rd trimesters) | **Elimination** | Renal elimination is 20% and fecal elimination is 80% with a half-life 11-15 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity or pregnancy | **Black Box Warnings** | Pregnancy |

**Medication Safety Issues: Irbesartan**

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

## Drug Interactions: Irbesartan

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Potassium-sparing diuretics | Increased risk of hypotension, hyperkalemia | Avoid concurrent use or monitor BP and serum potassium levels |
| CYP2C8 and 2C9 substrates | Decreased metabolism of substrates and increased toxicity of substrates | Avoid concurrent use or consider substrate dose reduction |
| ACE-Is | 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 levels |
| NSAIDs | Decreased antihypertensive and natriuretic effect of irbesartan, increased risk of nephrotoxicity | Avoid concurrent use or monitor BP and SCr levels |
| Diuretics | Increased risk of postural hypotension due to hypovolemia | Monitor BP; rise from seated position slowly |
| Lithium | Increased risk of lithium toxicity | Monitor serum lithium levels |

## Adverse Reactions: Irbesartan

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Headache | Diarrhea, dizziness, fatigue, heartburn, hyperkalemia, hypotension, nephrotoxicity, tachycardia | Angioedema, birth defects, hepatotoxicity, rhabdomyolysis |

**Efficacy Monitoring Parameters.** Decreased BP. Monitor BP weekly; may require 2-4 wk for full effect.

**Toxicity Monitoring Parameters.** Report signs/symptoms of hypotension, tachycardia. Baseline and periodic electrolyte panel, renal function tests, and urine protein are recommended.

**Key Patient Counseling Points.** Seek medical attention if angioedema (swelling of the face, eyes, lips, tongue, or throat), excessive fluid loss (vomiting, diarrhea, or excessive perspiration), hyperkalemia (confusion, body weakness, uneven heartbeat, or numbness/tingling in hands or feet), reduction in urination, jaundice, or skin rash occurs. Avoid pregnancy. Avoid abrupt discontinuation. Use potassium supplements or salt substitutes only under medical supervision. This medicine may cause dizziness. Avoid alcohol or driving.

**Clinical Pearls.** Safety and efficacy have not been established in children.

# ISOSORBIDE MONONITRATE: Imdur, ISMO, Monoket, Various

**Class:** Long-Acting Nitrate, Anti-anginal

**Dosage Forms.** **Oral Tablet, Extended Release:** 30 mg, 60 mg, 120 mg; **Oral Tablet, Immediate Release:** 10 mg, 20 mg

Kremers Urban generic 20 mg pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Angina, prophylaxis: Adults, Extended Release, initial, 30-60 mg po daily, may titrate to maintenance of 120-240 mg po daily; Immediate Release, 20 mg bid separated 7 h apart to decrease tolerance development

**Off Label Uses**. None

**MOA.** Isosorbide mononitrate (ISMN) is the active 5-mononitrate metabolite of isosorbide dinitrate. Nitroglycerin and other organic nitrates are converted to nitric oxide (NO) by vascular endothelium. NO activates guanylate cyclase, increasing cyclic GMP that in turn decreases intracellular calcium, resulting in direct relaxation of vascular smooth muscle.

**Drug Characteristics: Isosorbide Mononitrate**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 93%, food slows rate (but not extent) of absorption |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 0.6L; <5% protein bound |
| **Dialyzable** | Yes (hemodialysis) | **Metabolism** | >95% hepatic, CYP3A4/5 substrate |
| **Pregnancy Category** | C | **Elimination** | Renal elimination of metabolites is 96% with a half-life of 6 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to nitrates, concurrent use with erectile dysfunction meds | **Black Box Warnings** | None |

**Medication Safety Issues: Isosorbide Mononitrate**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | XR formulation | No | Imuran, Inderal LA, K-Dur | No |

### Drug Interactions: Isosorbide Mononitrate

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| CYP3A4/5 inducers | Increased metabolism of isosorbide mononitrate decreases isosorbide efficacy | Monitor for toxicity and consider dose increases of isosorbide mononitrate |
| CYP3A4/5 inhibitors | Decreased metabolism of isosorbide mononitrate increases risk of isosorbide mononitrate toxicity | Monitor for efficacy and consider dose decreases of isosorbide mononitrate |
| Phosphodiesterase inhibitors (erectile dysfunction medications) | Excessive hypotension | Concurrent use contraindicated; separate sildenafil and vardenafil from nitrates by 24 h; tardenafil from nitrates by 48 h |

### Adverse Reactions: Isosorbide Mononitrate

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Dizziness, headache | Bradycardia, f ushing, hypotension, nausea, orthostatic hypotension, tachycardia, vomiting | Severe hypotension, syncope |

**Efficacy Monitoring Parameters.** Decreased use of sublingual nitroglycerin, reduction in angina episodes.

**Toxicity Monitoring Parameters.** Report signs/symptoms of hypotension, problematic headaches, or decreasing efficacy (drug tolerance) to prescriber.

**Key Patient Counseling Points.** It is best to take this medicine on an empty stomach with at least half a glass of water. Swallow the extended-release tablet whole. Do not break, crush, or chew it. This medicine can cause headaches, which is a sign that the medicine is working. Acetaminophen may be used to relieve the headache. Talk with your doctor if the headache is severe. This medicine can cause dizziness. Avoid driving, using machines, or doing anything else that could be dangerous if not alert. Stand up slowly if this medicine causes light-headedness from orthostatic hypotension. Do not stop using this medicine suddenly without asking a health-care provider. The dose may need to be slowly decreased before stopping it completely. Avoid concomitant use of erectile dysfunction medications as this may increase risk of severe hypotension. Avoid drinking alcohol while taking this drug.

**Clinical Pearls.** Safety and efficacy have not established in children. Combining long-acting nitrates with antihypertensive medications can increase risk of hypotension. To avoid tolerance, include an 8-h nitrate-free interval in every 24-h period.

# KETOCONAZOLE TOPICAL: Nizoral, Various


Teva generic 2% cream pictured

**Class:** Imidazole Antifungal

**Dosage Forms.** **Topical Cream:** 2%, **Topical Foam:** 2%, **Topical Gel:** 2%, **Topical Shampoo:** 1% (OTC), 2% (by prescription)

**Common FDA Label Indication, Dosing, and Titration.**

1. Candidiasis of skin: Apply 2% cream topically once daily for 2 wk
2. Dandruff: Apply 1% shampoo topically to wet hair, lather, rinse thoroughly, and repeat; use every 3-4 d for up to 8 wk; then as needed to control dandruff
3. Pityriasis versicolor: Apply 2% shampoo topically to damp skin and a wide surrounding margin, lather, leave on skin for 5 min, then rinse, *or* apply 2% cream to affected areas once daily × 2 wk
4. Seborrheic dermatitis: Apply cream, gel, and foam topically to the affected area bid for 4 wk or until clinical clearing
5. Tinea corporis: Apply 2% cream topically once daily for 2 wk
6. Tinea cruris: Apply 2% cream topically once daily for 2 wk
7. Tinea pedis: Apply 2% cream topically once daily for 6 wk

**Off-Label Uses.** None

**MOA.** Ketoconazole inhibits biosynthesis of ergosterol or other sterols, damaging the fungal cell wall membrane and altering its permeability.

### Drug Characteristics: Ketoconazole Topical

| | | | |
|---|---|---|---|
| **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** | Usually compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

### Medication Safety Issues: Ketoconazole Topical

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| A-D | No | No | No | Nasarel, Neoral, Nitrol | No |

**Drug Interactions: Ketoconazole Topical.** None known with topical product; many interactions with oral formulation

### Adverse Reactions: Ketoconazole Topical

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Application site reaction with foam | Dry skin, burning, stinging at site of application | Rash, hair loss |

**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.

**Key Patient Counseling Points.** Apply thin layer to affected area of skin. Skin should be intact. Do not get it in your eyes, nose, mouth, or vagina. Do not wash the areas where you applied this medicine for at least 3 h after application. Cosmetics (makeup or sunscreens) may be put on the affected areas 20 min after application. Topical products are alcohol based and flammable immediately after application.

**Clinical Pearls.** Topical products typically not effective in toenail onychomycosis. Resistant infections typically require oral therapy.

# LABETALOL: Normodyne, Various

**Class:** α/β-Adrenergic Blocker

**Dosage Forms. Oral Tablet:** 100 mg, 200 mg, 300 mg

Sandoz generic pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Hypertension: Adults, initial, 100 mg po bid; may titrate in 100 mg increments po bid every 2-3 d to maintenance dose of 200-400 mg po bid, *max* dose 2400 mg daily

**Off-Label Uses.**

1. Hypertension: Children, initial, 1-3 mg/kg/d po in 2 divided doses; *max* 10-12 mg/kg/d or 600 mg po bid
2. Hypertension, urgency: 200-400 mg po depending on initial BP

**MOA.** Labetalol is an adrenergic receptor blocking drug that has selective $\alpha_1$- and nonselective β-adrenergic receptor blocking actions.

**Drug Characteristics: Labetalol**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Reduce dose by 50% if hepatic failure | **Absorption** | F = 25%; food increases absorption |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 3-16 L/kg; 50% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | >90% hepatic and primarily via glucuronide conjugation |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 55-60% (5% unchanged) and 50% in feces, with a half-life of 5-8 h |
| **Lactation** | Compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity; bronchial asthma or related bronchospastic condition; severe sinus bradycardia, 2nd- or 3rd-degree AV block; overt heart failure; cardiogenic shock, conditions associated with severe and prolonged hypotension | **Black Box Warnings** | None |

**Medication Safety Issues: Labetalol**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | Yes (IV only) | Betaxolol, lamoTRIgine, Lipitor | No |

## Drug Interactions: Labetalol

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Alpha-/Beta-agonists | Labetalol may enhance the vasopressor effect of alpha-/beta-agonist | Avoid concurrent use or monitor BP |
| Alpha1-blockers, fentanyl | Additive orthostatic hypotension | Avoid concurrent use or monitor BP |
| Beta-blockers, amiodarone, dronedarone | Increased risk of bradycardia, heart block, sinus arrest | Avoid concurrent use in patients with sick sinus syndrome or AV block |
| Antidiabetic drugs | Decreased glycemic control | Monitor blood glucose levels |
| Calcium channel blockers | Increased risk of hypotension and/or bradycardia and AV block | Avoid concurrent use |

## Adverse Reactions: Labetalol

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Dizziness, fatigue, nausea | Bradyarrhythmias, constipation, diaphoresis, diarrhea, disorder of glucose regulation, dyspnea, headache, impotence, increased liver enzymes, orthostatic hypotension, somnolence, wheezing | Hepatotoxicity, bronchospasm |

**Efficacy Monitoring Parameters.** Decreased BP.

**Toxicity Monitoring Parameters.** Signs/symptoms of peripheral edema, increased HR, signs/symptoms of liver damage.

**Key Patient Counseling Points.** Report signs/symptoms of hypotension with initial dosing and dose changes. Avoid alcohol while taking drug. May cause dizziness. Avoid driving, using machinery, or doing anything else that could be dangerous if not alert. Instruct patient to rise slowly from a sitting/supine position, as labetalol may cause orthostatic hypotension. Report signs/symptoms of bronchospasm, slow HR, hepatotoxicity, or syncope. Advise diabetic patients to carefully follow blood sugar levels as beta-blockers may mask symptoms of hypoglycemia. Advise patients against sudden discontinuation of drug as this may cause rebound hypertension.

**Clinical Pearls.** Safety and efficacy not established in pediatric patients <6 y of age. Is not a first-line agent for managing hypertension, thiazides, calcium channel blockers are preferred for initial management

# LACOSAMIDE: Vimpat

**Class:** Anticonvulsant, Miscellaneous. C-V

**Dosage Forms.** **Oral Tablet:** 50 mg, 100 mg, 150 mg, 200 mg; **Oral Solution:** 10 mg/mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Partial onset seizure: Initial, 100 mg po bid, may titrate by 50 mg increments to *max* of 200 mg po bid

**Off-Label Uses.** None

**MOA.** Lacosamide stabilizes hyperexcitable neuronal membranes and inhibits neuronal firing


**Drug Characteristics: Lacosamide**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | *Max* dose 300 mg in mild to moderate hepatic dysfunction, avoid in severe hepatic dysfunction | **Absorption** | F = 100% |
| **Dose Adjustment Renal** | CrCl ≤30 ml/min, *max* dose is 300 mg | **Distribution** | Vd = 0.6 L/kg |
| **Dialyzable** | Removed by hemodialysis | **Metabolism** | Hepatic, CYP3A4/5, 2C9 and 2C19 substrate |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 95% (40% unchanged) with a half-life of 13 h |
| **Lactation** | Excretion into breast milk unknown, weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

**Medication Safety Issues: Lacosamide**

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

### Drug Interactions: Lacosamide

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| CYP2C9, CYP3A4/5 inhibitors | Decreased lacosamide metabolism increases risk of lacosamide toxicity | Consider dose decreases of lacosamide if concurrent strong CYP3A4/5 or CYP2C9 inhibitors or poor renal or hepatic function, monitor and consider dose reduction if concurrent moderate inhibitors |
| CYP2C9, CYP3A4/5 inducers | Increased lacosamide metabolism decreases lacosamide efficacy | Consider dose increases of lacosamide if concurrent strong CYP3A4/5 or CYP2C9 inhibitors, monitor and consider dose increase if concurrent moderate inhibitors |

### Adverse Reactions: Lacosamide

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Dizziness, fatigue, ataxia, nausea, tremor, diplopia | Syncope, drowsiness, diarrhea, pruritus, nystagmus, increased liver enzymes | Acute psychosis, bradycardia, hepatotoxicity, agranulocytosis, suicidiality |

**Efficacy Monitoring Parameters.** Decreased seizures.

**Toxicity Monitoring Parameters.** Obtain ECG prior to initiating therapy in patients with underlying risk of conduction disorders. CBC, LFTs and SCr at initiation and periodically during therapy.

**Key Patient Counseling Points.** May be taken without regard to food but at same time of day. Take with food if GI distress. For the oral solution, measure carefully with oral syringe. Seek medical attention if seizure frequency increases or seizures worsen, abnormal heartbeat or extreme dizziness.

**Clinical Pearls.** May be used as monotherapy or added to other antiseizure medications for patients with resistant epilepsy. Start at 50 mg when used in combination.

# LAMOTRIGINE: Lamictal, Various

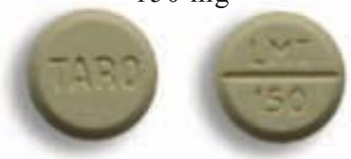
**Class:** Phenyltriazine Anticonvulsant

**Dosage Forms.** **Oral Chewable Tablet:** 2 mg, 5 mg, 25 mg; **Oral Tablet:** 25 mg, 100 mg, 150 mg, 200 mg; **Oral Tablet, Extended Release:** 25 mg, 50 mg, 100 mg, 200 mg, 250 mg, 300 mg; **Oral Dispersible Tablet:** 25 mg, 50 mg, 100 mg, 200 mg

200 mg


Teva generic pictured

150 mg




Taro generic pictured

100 mg


Taro generic pictured

25 mg

Teva generic pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Bipolar I disorder: Adults, 100-400 mg po daily
2. Partial seizure, adjunct or monotherapy, tonic-clonic seizure, Lennox-Gastaut syndrome, adjunctive: Adults and Children ≥12 y of age, Immediate Release, 100-500 mg/d po in 2 divided doses, Extended Release, 200-600 mg po daily; Children 2-12 y of age: Immediate Release, 1-15 mg/kg/d po in 1 or 2 divided doses, *max* 400 mg/d

**Off-Label Uses.** None

**MOA.** Lamotrigine is a phenyltriazine derivative unrelated to other marketed antiepileptic drugs (AEDs). Lamotrigine inhibits voltage-dependent sodium channels, thereby stabilizing neuronal membranes and reducing the release of excitatory neurotransmitters such as glutamate and aspartate.

**Drug Characteristics: Lamotrigine**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Moderate-severe without ascites, reduce dose by 25%; severe with ascites, reduce dose by 50% | **Absorption** | F = 98%, no effect of food on absorption |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 0.9-1.3 L; 55% protein bound |
| **Dialyzable** | Yes (hemodialysis), 20% removed | **Metabolism** | 90% hepatic and occurs by glucuronidation |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 94% with a half-life of 25-70 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | Skin reactions |

### Medication Safety Issues: Lamotrigine

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| ODT, XR | LamoTRIgine, LaMICtal | Extended-release formulation, oral dispersible tablet | No | Labetalol, LamISIL, lamiVUDine, levothyroxine, Lomotil | No |

### Drug Interactions: Lamotrigine

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Enzyme inducers, rifampin, carbamazepine | Increased lamotrigine metabolism decreases lamotrigine efficacy | Monitor seizure control and consider dose increase of lamotrigine |
| Escitalopram | Increased risk of myoclonus through additive effect on calcium channels | Caution with concurrent use |
| Ethinyl estradiol and other estrogen-based birth control products | Decreased lamotrigine concentrations via increased metabolism | Use an alternative form of birth control or consider dose increase of lamotrigine |
| Risperidone | Increased risperidone plasma concentrations and risk of adverse effects via unknown mechanism | Monitor and use with caution |

### Adverse Reactions: Lamotrigine

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Rash, ataxia, somnolence, headache, diplopia, rhinitis, nausea, vomiting, insomnia | Vertigo, anxiety, depression, dysmenorrhea | Stevens-Johnson syndrome, anemia, leukopenia, disseminated intravascular coagulation, thrombocytopenia, liver failure, aseptic meningitis, suicidal thoughts |

**Efficacy Monitoring Parameters.** Seizure severity and frequency if taken for seizures. Decrease in manic or depressive symptoms if for bipolar disorder.

**Toxicity Monitoring Parameters.** Seek medical attention if yellowing of skin or eyes, unusual bruising or bleeding, blistering skin rash, or shortness of breath.

**Key Patient Counseling Points.** Seek medical attention if rash develops. Slow titration necessary to minimize side effects. Avoid alcohol. Talk to your health-care provider if you become or plan to become pregnant. Review driving restrictions for patients with seizures. Place oral disintegrating tablet formulation on tongue and allow to dissolve.

**Clinical Pearls.** Rash is more common in children, when quickly titrated and with high starting doses. Rash usually occurs 2-8 wk after start of therapy. Extended-release products are not approved for use in children <13 y of age. Bipolar patients have an increased risk of suicide during first 24 wk of therapy. Avoid abrupt discontinuation, increases risk of seizures. Medication guide required at dispensing.

# LANSOPRAZOLE: Prevacid, Various

**Class:** Proton Pump Inhibitor

**Dosage Forms. Oral Capsule, Delayed Release:** 15 mg, 30 mg; **Oral Disintegrating Tablet:** 15 mg, 30 mg; **Powder for Oral Suspension:** 3 mg/mL

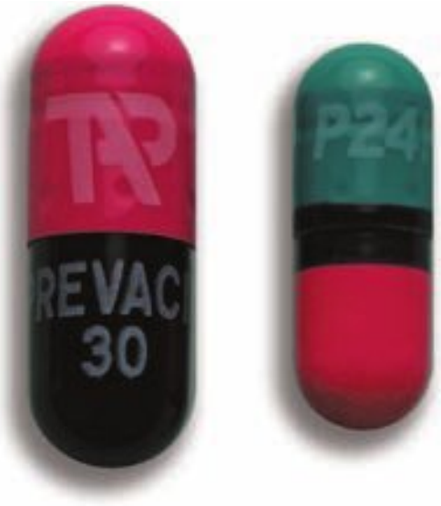
**Common FDA Label Indication, Dosing, and Titration.**

1. Duodenal ulcer disease: 15 mg po daily × up to 4 wk
2. Gastric ulcer disease, treatment: 30 mg po daily × up to 8 wk
3. *Helicobacter pylori* GI tract infection, triple therapy: 30 mg po bid × 10-14 d in combination with amoxicillin 1000 mg and clarithromycin 500 mg po bid
4. Erosive esophagitis, GERD, treatment: Children 1-11 y of age and ≤30 kg, 15 mg po daily × 12 wk; Children >30 kg, 30 mg po daily × 12 wk; Children ≥12 y of age and Adults, 30 mg po daily × 8-16 wk
5. Zollinger-Ellison syndrome: 60 mg po bid up to 180 mg/d

**Off-Label Uses.**

1. Heartburn ≥2 d/wk: 15 mg po daily for up to 14 d (OTC labeling)
2. Drug-induced GI disturbance: 15 mg po daily

Takeda generic 30 mg pictured




Novartis 15 mg pictured

**MOA.** Lansoprazole is a proton pump inhibitor (PPI) that, when protonated in the secretory canaliculi of the parietal cells, covalently binds to $H^{++}$/K+-ATPase (proton pump), which is the final pathway for acid secretion.

**Drug Characteristics: Lansoprazole**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Consider dose adjustments in severe liver disease | **Absorption** | F = 80%, brief delay in reaching peak if taken with food, but no effect of food on overall absorption |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 14-18 L; 97% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | 70-75% hepatic, CYP2C19 and CYP3A4/5 substrate |
| **Pregnancy Category** | B | **Elimination** | Renal elimination is 15-25% with a half-life of 90 min |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | Caution with CYP2C19 poor metabolizers |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

**Medication Safety Issues: Lansoprazole**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| 24 HR; SoluTab | No | Do not crush, chew, or open delayed release capsule or SoluTab | No | Aripiprazole, dexlansoprazole | No |

### Drug Interactions: Lansoprazole

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Antacids | Increase gastric pH and prevent dissolution of lansoprazole granules, reducing bioavailability of lansoprazole | Administer lansoprazole at least 1 h after antacid therapy |
| Clopidogrel | May decrease the effect of clopidogrel on platelet inhibition, resulting in cardiovascular events (MI, stroke, death) | Avoid concurrent use; consider alternative acid-reducing agent such as $H_2$ inhibitor |
| CYP2C19 and CYP3A4/5 inducers | Increased metabolism of lansoprazole, decreased efficacy | Avoid concurrent use or increase dose of lansoprazole |
| CYP2C19 and CYP3A4/5 inhibitors | Decreased metabolism of lansoprazole and increased risk of lansoprazole toxicity | Avoid concurrent use or decrease dose of lansoprazole |
| pH-dependent drugs (erlotinib, mycophenolate, etc) | As lansoprazole lowers gastric pH, absorption of drugs that require acid environment is reduced | Avoid concurrent use |

### Adverse Reactions: Lansoprazole

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| | Diarrhea, headache | Stevens-Johnson syndrome, rhabdomyolysis, acute interstitial nephritis, *Clostridium diff cle* diarrhea, hypomagnesemia |

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

**Toxicity Monitoring Parameters.** Seek medical attention if severe headache or blistering skin rash occurs.

**Key Patient Counseling Points.** Should be taken on an empty stomach 1 h before eating. Should not be taken with antacids. For those unable to swallow capsules, capsules may be opened and sprinkled on 1 tablespoon of applesauce if intact granules swallowed immediately.

**Clinical Pearls.** Multiple *H. pylori* regimens exist that include different combinations of PPIs and antibiotics; counsel patient to complete full regimen if prescribed for *H. pylori* management. Other PPI and $H_2$ antagonists available OTC; warn patients not to take multiple products concurrently to avoid additive risk of adverse effects. Increased risk of bone fracture with long-term use, use with caution in those with osteoporosis. Medication guide required at dispensing.

# LATANOPROST: Xalatan, Various

**Class:** Prostaglandin, Antiglaucoma Agent

**Dosage Forms. Ophthalmic Solution:** 0.005%

**Common FDA Label Indication, Dosing, and Titration.**

1. Ocular hypertension, open-angle glaucoma: 1 drop in affected eye(s) daily in the evening

**Off-Label Uses.** None

**MOA.** Latanoprost is a prostaglandin F2-alpha analog. It is believed to reduce IOP by increasing the outflow of aqueous humor. Studies suggest that the main mechanism of action is increased uveoscleral outflow, but the exact mechanism is unknown.

**Drug Characteristics: Latanoprost**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | Absorbed through the cornea where the isopropyl ester prodrug is hydrolyzed to the acid form to become biologically active. Systemic absorption following ocular instillation is very low |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 0.16 L/kg |
| **Dialyzable** | Not dialyzable | **Metabolism** | Metabolized within the cornea; any entering systemic circulation is metabolized in the liver, extent unknown |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 88-98% with a half-life of 17 min |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |


Pfizer 0.005% solution pictured

### Medication Safety Issues: Latanoprost

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | Lantus, Travatan, Xalacom | No |

### Drug Interactions: Latanoprost

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Pilocarpine | Coadministration decreases access of latanoprost to the receptor and increases resistance to flow through the uveoscleral pathway | Bedtime dose of pilocarpine should be given at least 10 min (preferably 1 h) after latanoprost |

### Adverse Reactions: Latanoprost

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Blurred vision, itching, sensation of foreign body in eye, hyperpigmentation of eyelid, iris pigmentation | Dry eye, eyelid edema | Macular retinal edema, diplopia, keratitis |

**Efficacy Monitoring Parameters.** Reduction in IOP.

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

**Key Patient Counseling Points.** Wash hands and remove contact lenses before using the medicine. For administration, lie down or tilt your head back. With your index finger, pull down the lower lid of your eye to form a pocket. Hold the dropper close to your eye with the other hand. Drop the correct number of drops into the pocket made between your lower lid and eyeball. Gently close your eyes. Place your index finger over the inner corner of your eye for 1 min. Do not rinse or wipe the dropper or allow it to touch anything, including your eye. Put the cap on the bottle right away.

**Clinical Pearls.** If used concurrently with pilocarpine, separate dose by 1 h if possible. Separate administration from other ophthalmic products by at least 5 min. Advise patients that there is a risk of permanent increased iris pigmentation associated with instillation of this product. Do not administer more than once daily to avoid loss of therapeutic effect. Store intact bottles under refrigeration. Opened bottles may be stored at room temperature for 6 wk.

# LEVALBUTEROL: Xopenex HFA

**Class:** Selective $\beta_2$-Agonist; Bronchodilator

**Dosage Forms. Metered Dose Inhaler:** 0.045 mg/actuation; **Nebulization Solution:** 0.31 mg/3 mL, 0.63 mg/3 mL, 1.25 mg/3 mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Asthma, bronchospasm: Adults and Children ≥4 y of age, MDI, 2 inhalations q4-6h prn (*max* 2 inhalations q4h); by nebulizer, 0.63 mg TID (*max* 1.25 mg TID)

**Off-Label Uses.**

1. Asthma, acute exacerbation: Children ≥4 y of age, MDI, 4-8 inhalations q20min × 3 doses, then q1-4h prn; Adults, MDI, 4-8 inhalations po q20min up to 4 h, then q1-4h prn; by nebulizer, 1.25-2.5 mg q20min × 3 doses, then q1-4h prn

**MOA.** Activation of $\beta_2$-adrenergic receptors on airway smooth muscle leads to the activation of adenylate cyclase and to an increase in the intracellular concentration of cyclic-3′, 5′-adenosine monophosphate (cyclic AMP). The increase in cyclic AMP is associated with the activation of protein kinase A, which in turn inhibits the phosphorylation of myosin and lowers intracellular ionic calcium concentrations, resulting in muscle relaxation. Levalbuterol relaxes the smooth muscles of all airways, from the trachea to the terminal bronchioles.

Sepracor pictured

## Drug Characteristics: Levalbuterol

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 30% after oral administration |
| **Dose Adjustment Renal** | Not required | **Distribution** | After inhalation, Vd is ~1900 L |
| **Dialyzable** | Not dialyzable | **Metabolism** | Oral doses undergo rapid metabolism in the GI tract; hepatic metabolism of inhaled doses |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 80-100% with a half-life of 5-7 min |
| **Lactation** | Compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

## Medication Safety Issues: Levalbuterol

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| HFA | No | No | No | Xanax | No |

### Drug Interactions: Levalbuterol

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Other short-acting sympathomimetics | May potentiate levalbuterol effect | Avoid concurrent use |
| Beta-blockers | May decrease effectiveness of levalbuterol and produce bronchospasm | Avoid use of nonselective beta-blockers in patients with asthma; monitor PFTs if cardioselective beta-blockers clinically indicated |

### Adverse Reactions: Levalbuterol

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Vomiting | Chest pain, palpitations, tachyarrhythmia, tremor, pharyngitis, rhinitis | Paradoxical bronchospasm, anaphylaxis, cardiac dysrhythmias |

**Efficacy Monitoring Parameters.** Resolution of asthma symptoms and improvement in PFTs.

**Toxicity Monitoring Parameters.** BP, HR.

**Key Patient Counseling Points.** Instruct patient on proper inhaler technique. Wash the mouthpiece and air dry thoroughly at least once a week (may cease to deliver medication if mouthpiece becomes blocked). Store the inhaler at room temperature, away from heat and direct light. Do not freeze. Do not keep this medicine inside a car where it could be exposed to extreme heat or cold. Contact prescriber if the need to use more levalbuterol to control symptoms than usual as this may indicate asthma deterioration.

**Clinical Pearls.** The National Heart, Lung and Blood Institute asthma guidelines recommend SABA as the drug of choice for treating acute asthma symptoms and exacerbations. SABA are not recommended for regularly scheduled, daily, long-term use.

# LEVETIRACETAM: Keppra, Keppra XR, Various


Mylan generic
250 mg pictured


Mylan generic
500 mg pictured


Teva generic
1000 mg pictured

**Class:** Anticonvulsant

**Dosage Forms.** **Tablet:** 250 mg, 500 mg, 750 mg, 1000 mg; **Tablet, Extended Release:** 500 mg, 750 mg; **Oral Solution:** 100 mg/mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Myoclonic seizure, adjunct: Children ≥12 y of age and Adults, initial, 500 mg po bid, titrate to target dose of 3000 mg/d
2. Partial seizure, adjunct: Children ≥16 y of age and Adults, immediate release, initial, 500 mg po bid, *max* 3000 mg/d; extended release, initial, 1000 mg po qd, *max* 3000 mg/d; Children 4-15 y of age, immediate release, initial, 10 mg/kg po bid, *max* 60 mg/kg/d
3. Tonic-clonic seizure, primary generalized, adjunct: Children ≥16 y of age and Adults, initial, 500 mg po bid, titrate to target dose of 3000 mg/d; Children 6-15 y of age, initial, 10 mg/kg po bid, titrate to target dose of 60 mg/kg/d

**Off-Label Uses.** None

**MOA.** Levetiracetam is a pyrrolidine derivative that is structurally unrelated to other AEDs. Its mechanism of action is unclear and does not relate to any known mechanisms of neuronal excitation or inhibition. The action of levetiracetam in animal models of seizures and epilepsy is unique from other AEDs.

**Drug Characteristics: Levetiracetam**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 100%; minor effect of food on absorption |
| **Dose Adjustment Renal** | CrCl <30 mL/min, reduce dose by 67%;<br>CrCl = 30-50 mL/min, reduce dose by 50% | **Distribution** | <10% protein bound |
| **Dialyzable** | CrCl <30 mL/min, reduce dose by 67%;<br>CrCl = 30-50 mL/min, reduce dose by 50% | **Metabolism** | Minimal and via hydrolysis |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 66% unchanged and 20-25% in feces, with a half-life of 6-8 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

### Medication Safety Issues: Levetiracetam

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| Keppra Keppra XR | LevETIRAcetam | Do not crush ER tablets | No | LevOCARNitine, levofoxacin | No |

### Drug Interactions: Levetiracetam

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Carbamazepine | Increased risk of carbamazepine toxicity | Use caution with concomitant therapy; monitor for side effects |

### Adverse Reactions: Levetiracetam

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Asthenia, fatigue, headache, somnolence, vomiting | Abnormal behavior, agitation, depression, diarrhea, dizziness, hostile behavior, irritability, loss of appetite, mood swings, nausea, nasopharyngitis, neck pain | Pancytopenia, hepatotoxicity, suicidal thoughts, suicide |

**Efficacy Monitoring Parameters.** Reduction in the frequency and severity of seizures.

**Toxicity Monitoring Parameters.** Emergence or worsening of depression, suicidal behavior or ideation, or unusual changes in behavior, WBC, LFTs.

**Key Patient Counseling Points.** Instruct patient to swallow extended-release tablet whole; do not chew, break, or crush. Avoid activities requiring mental alertness or coordination until drug effects are realized. Report mood swings, agitation, hostile behavior, suicidal ideation, or unusual changes in behavior. Avoid sudden discontinuation of drug, may increase seizure activity.

**Clinical Pearls.** Safety and efficacy of tablets and solution not established in children <4 y of age. Safety and efficacy of extended-release tablet not established in children <16 y of age. Patients weighing <20 kg should be dosed with the oral solution. Data suggest an increased risk of suicidal behavior or ideation may exist in patients receiving therapy with AEDs. Pregnancy: up to a 50% dose increase during 3rd trimester with subsequent dose reduction after delivery may be necessary. Do not stop abruptly, increased risk of seizures. Dispense with medication safety guideline.

# LEVOCETIRIZINE: Xyzal

**Class:** Antihistamine

**Dosage Forms.** **Oral Solution:** 2.5 mg/5 mL; **Oral Tablet:** 5 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Idiopathic urticaria, perennial or seasonal allergic rhinitis: Children 6 mo to 5 y of age, 1.25 mg po daily; Children 6-11 y of age, 2.5 mg po daily; Children ≥12 y of age and Adults, 5 mg po daily; doses should be given in the evening


Sanofi-Aventis 5 mg pictured

**Off-Label Uses.** None

**MOA.** Levocetirizine, an enantiomer of cetirizine, is a low-sedating, long-acting $H_1$-receptor antagonist that is a metabolite of hydroxyzine. It competitively inhibits the interaction of histamine with $H_1$ receptors, thereby preventing the allergic response.

**Drug Characteristics: Levocetirizine**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 85%, limited effect of food on absorption |
| **Dose Adjustment Renal** | CrCl = 30-50 mL/min, 2.5 mg po every other day; CrCl = 10-29 mL/min, 2.5 mg po twice per wk; CrCl <10 mL/min, avoid | **Distribution** | Vd = 0.4 L/kg with 95% protein binding |
| **Dialyzable** | Not dialyzable | **Metabolism** | Hepatic metabolism, <14% |
| **Pregnancy Category** | B | **Elimination** | Renal elimination is 85% (80% unchanged) with a half-life of 7-8 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to cetirizine, levocetirizine, hydroxyzine, patients with CrCl <10 mL/min, children <12 y with any renal impairment, any patient on hemodialysis | **Black Box Warnings** | None |

**Medication Safety Issues: Levocetirizine**

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

### Drug Interactions: Levocetirizine

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

### Adverse Reactions: Levocetirizine

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Diarrhea in children | Sedation, headache, dry mouth, fatigue, and nausea | Agitation, seizures |

**Efficacy Monitoring Parameters.** Improvement in rhinitis or urticaria symptoms.

**Toxicity Monitoring Parameters.** Seek medical attention for signs of severe CNS toxicity; monitor SCr.

**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.** An expensive alternative to racemic version (cetirizine) which is available generically and over the counter. Limited evidence suggesting any advantage over racemic compound.

# LEVOFLOXACIN: Levaquin, Various

**Class:** Fluoroquinolone Antibiotic

**Dosage Forms. Oral Solution:** 25 mg/mL; **Oral Tablet:** 250 mg, 500 mg, 750 mg

Ortho-McNeil-Janssen pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Bacterial prostatitis, chronic: 500 mg po daily × 28 d
2. Bacterial sinusitis, acute: 750 mg po daily × 5 d
3. Bronchitis, chronic, acute bacterial exacerbation: 500 mg po daily × 7 d
4. Community acquired pneumonia: 500-750 mg po daily × 7-14 d
5. Infection of skin and/or subcutaneous tissue: (uncomplicated) 500 mg po daily × 7-14 d
6. Pyelonephritis, acute: 250 mg po daily × 10 d

**Off-Label Uses.**

1. Chlamydial infection: 500 mg po daily × 7 d
2. Traveler's diarrhea: 500 mg po daily × 1-3 d

**MOA.** Levofloxacin 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.

## Drug Characteristics: Levofloxacin

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 99%, no food effect, take without regard to meals |
| **Dose Adjustment Renal** | CrCl 20-50 mL/min, reduce dose by 50%; CrCl 5-19 mL/min, extend interval to 48 h | **Distribution** | Bile, blister, CSF, gynecologic tissues, lung, prostate, synovial fluid, sputum, tonsils |
| **Dialyzable** | Not dialyzable | **Metabolism** | Not metabolized |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 87% with a half-life of 6-8 h |
| **Lactation** | Avoid | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to ciprofloxacin or other quinolones; concomitant tizanidine administration | **Black Box Warnings** | Myasthenia gravis; tendon rupture |

## Medication Safety Issues: Levofloxacin

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

### Drug Interactions: Levofoxacin

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Antidiabetics | Hypogycemic or hyperglycemic episodes, mechanism unknown | Caution with concurrent use, monitor plasma glucose and consider dose adjustments of antidiabetic agent |
| Aluminum, calcium, and calcium-fortified foods, didanosine, iron | Decreased absorption of fluoroquinolones caused by chelation | Separate administration by 2 h before or 6 h after |
| Class III antiarrhythmic agents or other agents that effect the QTc interval | Additive potential for QTc prolongation | Contraindicated |
| Corticosteroids | Increased risk if tendon rupture | Counsel patients to discontinue levofoxacin and seek medical attention if tendon pain or rupture |
| NSAIDs | Increased risk of seizures via inhibition of GABA resulting in CNS stimulation | Avoid NSAIDs if possible |
| Warfarin | Increased risk of bleeding | Increased monitoring of INR and warfarin adjustments |

### Adverse Reactions: Levofoxacin

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Photosensitivity | Nausea and vomiting, rash, myalgia, arthralgia, tendinitis, headache | Stevens-Johnson syndrome, renal failure, severe hypersensitivity, anemia, neutropenia, thrombocytopenia, seizure, cardiac arrest, cardiac arrhythmias, liver failure, tendon rupture, psychosis, glucose abnormalities, *C. diffcile* colitis |

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

**Toxicity Monitoring Parameters.** Baseline SCr.

**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, or tendon pain. Take with or without food, but not with milk, yogurt, or other dairy products or calcium-fortified products (some juices and breads). If using antacids, sucralfate, or mineral supplements and multivitamins with calcium, iron, or zinc, take levofloxacin at least 2 h before or 6 h after these medicines.

**Clinical Pearls.** Not approved in children <18 y of age. Oral and IV dosing is interchangeable. Increased risk of tendon rupture in patients >60 y of age. Medication guide required at dispensing.

# LEVOTHYROXINE: Synthroid, Various

**Class:** Thyroid Supplement

**Dosage Forms.** **Oral Tablet:** 25 mcg, 50 mcg, 75 mcg, 88 mcg, 100 mcg, 112 mcg, 125 mcg, 137 mcg, 150 mcg, 175 mcg, 200 mcg, 300 mcg; **Oral Capsule:** 13 mcg, 25 mcg, 50 mcg, 75 mcg, 100 mcg, 112 mcg, 125 mcg, 137 mcg, 150 mcg

Mylan generic pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Hypothyroidism: Oral, maintenance, individualized based on clinical response and serum TSH levels; Adults, 25-300 mcg po daily; Infants 0-3 mo of age, 10-15 mcg/kg/d po daily, Infants 3-6 mo of age, 8-10 mcg/kg/d po daily, Infants 6-12 mo of age, 6-8 mcg/kg/d po daily, Children 1-5 y of age, 5-6 mcg/kg/d po daily, Children 6-12 y of age, 4-5 mcg/kg/d po daily, Children ≥12 y of age, growth and puberty incomplete) 2-3 mcg/kg/d po daily, Children ≥12 y of age, growth and puberty complete, 1.7 mcg/kg/d
2. Thyroid-stimulating hormone suppression, pituitary: Thyroid cancer, doses >2 mcg/kg/d po are usually required to suppress TSH <0.1 milliunits/L

**Off-Label Uses.**

1. Toxicity due to radiotherapy; use same age-based dosing as hypothyroidism

**MOA.** Levothyroxine sodium is a synthetic thyroid hormone. The endogenous thyroid hormones, T3 and T4, diffuse into the cell nucleus and bind to thyroid receptor proteins attached to DNA. This hormone nuclear receptor complex activates gene transcription and synthesis of messenger RNA and cytoplasmic proteins.

**Drug Characteristics: Levothyroxine**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 40-80%, increases with fasting |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 8.7-9.7 L; >99% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | Approximately 80% of levothyroxine sodium is deiodinated into T3 in the liver, kidney, and other tissues. It can also be metabolized by conjugation with glucuronides and sulfates and then enter into enterohepatic recirculation |
| **Pregnancy Category** | A | **Elimination** | Renal excretion is 50% with a half-life of 7 d |
| **Lactation** | Compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity, nontoxic diffuse goiter or nodular thyroid disease, thyrotoxicosis, acute MI, treatment of obesity or weight loss, uncorrected adrenal insufficiency; may precipitate acute adrenal crisis | **Black Box Warnings** | Not for weight reduction |

## Medication Safety Issues: Levothyroxine

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | LamoTRIgine, Lanoxin, levofloxacin, liothyronine | No |

## Drug Interactions: Levothyroxine

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Aluminum, calcium- and magnesium-containing antacids, iron, sucralfate, orlistat, etc | Decreased absorption of levothyroxine | Separate administration by 4 h |
| Estrogens | Estrogen-induced increases in serum thyroxine-binding globulin concentration | Monitor and consider increasing dose of levothyroxine |
| Eltrombopag | Inhibition of OATP1B1-mediated elimination of levothyroxine by eltrombopag | Monitor and consider decreasing dose of levothyroxine |
| Imatinib | Decreased levothyroxine effectiveness and worsening of hypothyroidism | Monitor and consider increasing dose of levothyroxine |
| Phenytoin, rifampin, simvastatin | Increased levothyroxine clearance | Monitor and consider increasing dose of levothyroxine |
| Warfarin | Enhanced anticoagulant effect | Monitor and consider warfarin dose adjustment |

## Adverse Reactions: Levothyroxine

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| | Appetite decreased, anxiety, diarrhea, insomnia | Aggravation of preexisting cardiovascular disease, hyperthyroidism |

**Efficacy Monitoring Parameters.** Serum TSH, T(3), and T(4) levels. T(3) normal range is 100-200 ng/dL. T(4) normal range is 4.5-11.2 mcg/dL. Free T4 normal range is 0.7-1.8 ng/dL. TSH level should be between 0.5 and 3.0 mIU/L in those treated for a thyroid disorder. Resolution of symptoms of hypothyroidism, fatigue, edema, hair loss, cold intolerance, and lethargy.

**Toxicity Monitoring Parameters.** Monitor patients with preexisting cardiovascular disease for exacerbation of symptoms.

**Key Patient Counseling Points.** May require 6-8 wk for symptomatic improvement. Avoid abrupt discontinuation. Take on an empty stomach, with water at least 30 min before food. Avoid antacids and iron within 4 h of dose.

**Clinical Pearls.** Not recommended for weight loss. May cause serious adverse effects and death in euthymic patients using it for weight loss.

# LIDOCAINE TOPICAL PATCH: Lidoderm


Endo 5% patch pictured

**Class:** Local Anesthetic

**Dosage Forms. Topical Patch:** 5%

**Common FDA Label Indication, Dosing, and Titration.**

1. Postherpetic neuralgia and localized pain: 1-3 patches topically simultaneously for up to 12 h within a 24-h period

**Off-Label Uses.** None

**MOA.** Lidocaine is an amide-type local anesthetic agent and is suggested to stabilize neuronal membranes by inhibiting the ionic fluxes required for the initiation and conduction of impulses. The penetration of lidocaine in patch form into intact skin is sufficient to produce an analgesic effect, but less than the amount necessary to produce a complete sensory block.

## Drug Characteristics: Lidocaine Topical Patch

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Severe hepatic dysfunction, use fewer patches, for shorter periods of time, and/or with longer treatment-free intervals | **Absorption** | Only 3% of administered dose is absorbed systemically when applied to intact skin |
| **Dose Adjustment Renal** | Not required | **Distribution** | Not absorbed |
| **Dialyzable** | Yes | **Metabolism** | Not absorbed |
| **Pregnancy Category** | B | **Elimination** | Not absorbed |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

## Medication Safety Issues: Lidocaine Topical Patch

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

**Drug Interactions: Lidocaine Topical Patch.** Minimal systemic absorption, none known.

## Adverse Reactions: Lidocaine Topical Patch

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Skin irritation, somnolence | Hypotension, nausea, vomiting, confusion, dizziness, headache, paresthesia, constipation, tremor | Cardiac arrest, cardiac dysrhythmia, seizure, methemoglobinemia |

**Efficacy Monitoring Parameters.** Relief from pain.

**Toxicity Monitoring Parameters.** Application of too many patches, for too long a period of time, and/or without adequate drug-free period may increase toxicity; application to broken skin or covering with occlusive dressing may lead to toxicity, particularly cardiac dysrhythmia.

**Key Patient Counseling Points.** Instruct patients on the appropriate application process. Leave patches on skin for no more than12 h within a 24-h period. Caution patients to administer only as directed, to intact skin, without covering with occlusive dressing or tight clothes.

**Clinical Pearls.** Patches may be cut into smaller sizes prior to removal of release liner to refine dose to meet patients' needs. Patients should be instructed to fold used patches after removal so that the adhesive side sticks to itself and safely discard used patches or pieces of cut patches where children and pets cannot get to them. Accidental ingestion of used patches can lead to serious adverse effects.

# LINAGLIPTIN: Tradjenta

**Class:** Dipeptidyl peptidase IV inhibitor

**Dosage Forms. Oral Tablet:** 5 mg


**Common FDA Label Indication, Dosing, and Titration.**

1. Diabetes, type 2: 5mg po daily

**Off-Label Uses.** None

**MOA.** Binds to and inhibits the dipeptidyl peptidase IV enzyme, resulting in prolonged incretin levels. Incretin hormones regulate glucose metabolism by increasing insulin secretion and release.

**Drug Characteristics: Linagliptin**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 30% |
| **Dose Adjustment Renal** | Not required | **Distribution** | Protein binding 70-80% |
| **Dialyzable** | Unknown | **Metabolism** | Hepatic, CYP3A4/5 substrate, P-glycoprotein substrate |
| **Pregnancy Category** | B | **Elimination** | 80% in the feces unchanged. Half-life is 12 h, enzyme binding can persist >100 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity | **Black Box Warnings** | None |

**Medication Safety Issues: Linagliptin**

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

### Drug Interactions: Linagliptin

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| CYP3A4/5 inhibitors | Decreased linagliptin metabolism increases risk of linagliptin toxicity | Avoid strong CYP3A4/5 inhibitors, moderate inhibitors, monitor carefully and consider linagliptin dose reduction |
| CYP3A4/5 inducers | Increased linagliptin metabolism decreases linagliptin efficacy | Avoid strong CYP3A4/5 inducers, monitor carefully and consider linagliptin dose increases |
| P-glycoprotein inhibitors | Decreased linagliptin transport increases risk of linagliptin toxicity | Monitor carefully and consider linagliptin dose reduction |
| P-glycoprotein inducers | Increased linagliptin transport decreases linagliptin efficacy | Monitor carefully and consider linagliptin dose increases |
| Corticosteroids, thiazide diuretics | May decrease the hypoglycemic effect of linagliptin | Monitor and consider dose adjustments of linagliptin |

### Adverse Reactions: Linagliptin

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Hypoglycemia | Headache, weight gain, diarrhea, arthralgia | Acute pancreatitis, anaphylaxis, angioedema, hypersensitivity |

**Efficacy Monitoring Parameters.** Preprandial blood glucose between 70 and 130 mg/dL, $HbA_{1c}$ <7%

**Toxicity Monitoring Parameters.** Severe abdominal pain, hypoglycemia

**Key Patient Counseling Points.** Monitor blood glucose frequently (2-4 times per day); if <70 mg/dL eat candy or juice and contact prescriber. Take with or without food, but at same time each day.

**Clinical Pearls.** Metformin is first-line therapy for type 2 diabetes and has been shown to be more effective than DPP-4 monotherapy. Linagliptin may be added as a 2nd agent in patients not controlled on metformin or as first-line therapy in patients with contraindications for metformin, such as renal dysfunction.

# LIRAGLUTIDE: Victoza

**Class:** Glucagon-Like Peptide-1-Receptor Agonist

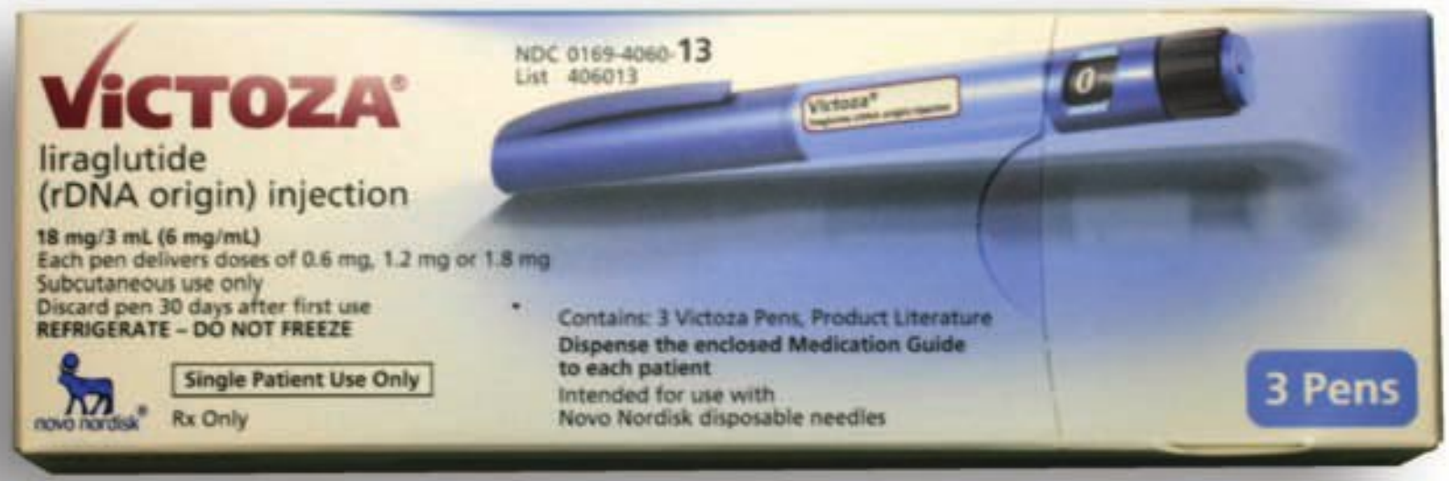
**Dosage Forms. Solution, Pen Injector:** 18 mg/3 mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Diabetes, type 2: 0.6 mg sq once daily for 1 wk, then increase to 1.2 mg sq once daily

**Off-Label Uses.** None

**MOA.** Analog of glucagon-like peptide-1, which increases glucose-dependent insulin secretion, decreases inappropriate glucagon secretion, slows gastric emptying, and decreased food intake.




## Drug Characteristics: Liraglutide

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Use with caution in patients with severe hepatic dysfunction | **Absorption** | F = 55% |
| **Dose Adjustment Renal** | Use with caution in patients with severe renal dysfunction | **Distribution** | Vd = 13L, protein binding >98% |
| **Dialyzable** | Unknown | **Metabolism** | Metabolized by dipeptidyl peptidase IV |
| **Pregnancy Category** | C | **Elimination** | 5% in the feces, 6% in urine, Half-life is 13 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity, multiple endocrine neoplasia syndrome type 2, history or family history of medullary thyroid carcinoma | **Black Box Warnings** | Increased risk of thyroid cancer |

### Medication Safety Issues: Liraglutide

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

### Drug Interactions: Liraglutide

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Corticosteroids, thiazide diuretics | May decrease the hypoglycemic effect of liraglutide | Monitor and consider dose adjustments of liraglutide |

### Adverse Reactions: Liraglutide

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Nausea, diarrhea, vomiting | Headache, hyperbilirubinemia, antibody development, injection site reactions | Acute renal failure, thyroid carcinoma, exacerbation of chronic renal failure, hypoglycemia, pancreatitis, hypersensitivity |

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

**Toxicity Monitoring Parameters.** Severe abdominal pain, SCr, LFTs

**Key Patient Counseling Points.** Monitor blood glucose frequently (2-4 times per day); if <70 mg/dL eat candy or juice and contact prescriber. Administer in upper arm, thigh, or abdomen. Change needle for each injection, do not share pens, even if needle is changed. If also using insulin, administer with separate injection in a non-adjacent area. Can be injected without regard to meals.

**Clinical Pearls.** Metformin is first-line therapy for type 2 diabetes. Liraglutide may be added as a 2nd agent in patients not controlled on metformin. An advantage of liraglutide over other therapies is lack of weight gain and no hypoglycemia.

# LISDEXAMFETAMINE: Vyvanse

**Class:** Amphetamine, CNS Stimulant. C-II

**Dosage Forms. Oral Capsule:** 20 mg, 30 mg, 40 mg, 50 mg, 60 mg, 70 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Attention-deficit hyperactivity disorder (ADHD): 30 mg po daily in the morning, may titrate in 10-20 mg/d increments at weekly intervals to *max* dose of 70 mg po daily; discontinue if improvement not observed after 1 mo of dosage titration.

30 mg 40 mg 50 mg 60 mg


Shire generic pictured

**Off-Label Uses.** None

**MOA.** Lisdexamfetamine is converted to dextroamphetamine. The mechanism of action of dextroamphetamine in the treatment of ADHD is unknown. Amphetamines may block the reuptake of norepinephrine and dopamine at the presynaptic neuron and thus increase the release of norepinephrine and dopamine into the extraneuronal space.

**Drug Characteristics: Lisdexamphetamine**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 100%, food has no effect on absorption |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 3.5-4.6 L/kg; 60% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | Extensive metabolism in the blood by hydrolytic activity of red blood cells to dextroamphetamine and l -lysine |
| **Pregnancy Category** | C | **Elimination** | Renal elimination is 96% and 0.3% in feces, with a half-life of <1 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity/idiosyncrasy to sympathomimetic amines; MAOIs; symptomatic cardiovascular disease or advanced arteriosclerosis; moderate-severe hypertension; hyperthyroidism; glaucoma; agitated states; history of drug dependence | **Black Box Warnings** | Risk of abuse, misuse, diversion |

### Medication Safety Issues: Lisdexamphetamine

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | Do not chew capsule, but may be opened and dissolved in water | No | Visanne, ViVAXIM | No |

### Drug Interactions: Lisdexamphetamine

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Tricyclic antidepressants | Increased risk of hypertension, other cardiac effects, and CNS stimulation | Use caution with concomitant therapy; monitor BP and for side effects |
| MAOIs | Increased risk of hypertensive crisis (headache, hyperpyrexia, hypertension) | Concomitant use contraindicated |

### Adverse Reactions: Lisdexamphetamine

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Dystonia, insomnia, hallucinations, irritability, loss of appetite, upper abdominal pain, xerostomia | Agitation, anxiety, decreased growth and development, diarrhea, dizziness, headache, increased BP, increased HR, nausea, rash, vomiting, weight loss | Chest pain, new onset or worsening of existing psychotic disorders, stroke, sudden cardiac death, tachycardia |

**Efficacy Monitoring Parameters.** Improvement of mental and behavioral symptoms of ADHD (inappropriate inattention, impulsivity, hyperactivity, and cognitive performance).

**Toxicity Monitoring Parameters.** Palpitations, near syncope, or syncope; may be indicative of a cardiac condition. BP and HR should be evaluated at baseline, during routine follow-up within 1-3 mo, and at follow-up visits every 6-12 mo.

**Key Patient Counseling Points.** Take dose in the morning with or without food. Growth rate and weight may need to be monitored more frequently for children using this drug. Report new or worsened psychiatric problems (behavior and thought problems, bipolar illness, aggressive behavior or hostility). Also report chest pain, palpitations, dyspnea, or signs/symptoms of cardiac dysrhythmia, myocardial infarction, or cerebrovascular accident. Capsule may be opened and the entire contents dissolved in a glass of water, stirring until dispersed completely and consuming entire mixture immediately.

**Clinical Pearls.** Amphetamines have a high potential for abuse, and administration for prolonged periods of time may lead to drug dependence and must be avoided. Misuse of amphetamines may cause sudden death and serious cardiovascular adverse events. A complete family and patient history for conditions associated with sudden cardiac death is required and current use of any other prescription or over-the-counter medications needs to be determined. A complete physical evaluation of the patient for hypertension, cardiac murmurs, physical findings associated with Marfan syndrome, and signs of irregular cardiac rhythms should be conducted. Medication guide required at dispensing.

# LISINOPRIL: Prinivil, Zestril, Various

**Class:** ACE-I, Antihypertensive

**Dosage Forms.** **Oral Tablet:** 2.5 mg, 5 mg, 10 mg, 20 mg, 30 mg, 40 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Acute myocardial infarction: 5-10 mg po daily × 6 wk
2. Heart failure: 2.5-5 mg po daily, may titrate to 40 mg/d
3. Hypertension: Adults, 10 mg po daily, may titrate to 80 mg/d; Children 6-16 y of age, 0.07 mg/kg (*max* 5 mg/d) po daily, may titrate to 0.61 mg/kg/d (*max* 40 mg/d)

**Off-Label Uses.** None

**MOA.** Lisinopril 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: Lisinopril**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 25% (F = 16% in heart failure), no effect of food on absorption |
| **Dose Adjustment Renal** | CrCl 10-30 mL/min: initial dose 5 mg/d; CrCl <10 mL/min: initial dose is 2.5 mg/d; dialysis patients: initial dose is 2.5 mg/d, supplemental dose equivalent to 20% of daily dose after hemodialysis | **Distribution** | 25% protein bound |
| **Dialyzable** | Yes (hemodialysis and peritoneal) | **Metabolism** | Not metabolized |
| **Pregnancy Category** | C (1st trimester), D (2nd and 3rd trimesters) | **Elimination** | Renal elimination is 50-70% with a half-life of 12 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to lisinopril or other ACE-Is, history of ACE-I-induced angioedema, and hereditary or idiopathic angioedema, concurrent use with aliskerin in diabetic patients | **Black Box Warnings** | Pregnancy |

Teva generic pictured

### Medication Safety Issues: Lisinopril

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | Fosinopril, Lioresal, ZyPREXA, RisperDAL | No |

### Drug Interactions: Lisinopril

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

### Adverse Reactions: Lisinopril

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

**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, and 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.

**Clinical Pearls.** Observe patients who are volume depleted for at least 2 h after taking the initial dose of lisinopril. As effective as atenolol in the treatment of hypertension. Recommended as first line therapy with HCTZ for HTN.

# LITHIUM CARBONATE: Eskalith, Eskalith-CR, Lithobid, Various

**Class:** Antimanic

**Dosage Forms.** **Oral Capsule:** 150 mg, 300 mg, 600 mg; **Oral Tablet:** 300 mg; **Oral Tablet, Extended Release:** 300 mg, 450 mg; **Oral Solution**: 300 mg/5 mL (as a citrate)

Roxane generic pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Bipolar disorder, maintenance therapy: Adults and Children >12 y of age, extended release, 900-1800 mg/d po in 2-3 divided doses; immediate release, initial 300 mg po daily, may titrate to 900-1800 mg po in 3-4 divided doses
2. Bipolar disorder, manic episode: Adults and Children >12 y of age, extended release, 1800 mg/d po in 2-3 divided doses; immediate release, 600 mg po tid

**Off-Label Uses.**

1. Depression: Adults and Children >12 y of age, extended release, 600-1200 mg/d po in 2-3 divided doses; immediate release, 300 mg po bid-qid

**MOA.** Lithium's mechanism of anti-manic effect is unknown; it alters the actions of several second-messenger systems (eg, adenylate cyclase and phosphoinositol). Alters cation transport across cell membrane in nerve and muscle cells and influences reuptake of serotonin and/or norepinephrine; second-messenger systems involving the phosphatidylinositol cycle are inhibited

**Drug Characteristics: Lithium**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 90-100%, food has no effect on absorption |
| **Dose Adjustment Renal** | CrCl 10-50 mL/min, give 50-75% of the usual dose; CrCL <10 mL/min, give 25-50% of usual dose at the normal dosing interval | **Distribution** | Vd = 1.4 L/kg, no protein binding |
| **Dialyzable** | Yes, a maintenance dose should be given following hemodialysis | **Metabolism** | Not metabolized |
| **Pregnancy Category** | D | **Elimination** | Renal elimination is 89-98% and <1% fecal elimination, with a half-life of 14-24 h (up to 2.43 d with long-term therapy) |
| **Lactation** | Avoid | **Pharmacogenetics** | None known |
| **Contraindications** | Severe debilitation, dehydration, or sodium depletion; significant cardiovascular disease; significant renal impairment; concomitant diuretic therapy | **Black Box Warnings** | Lithium levels required |

**Medication Safety Issues: Lithium**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| CR | No | Do not chew or crush ER formulations | No | Estratest | No |

### Drug Interactions: Lithium

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Acetazolamide, sodium bicarbonate | Decreased lithium concentrations and effectiveness | Monitor lithium efficacy and serum concentrations |
| ACE-Is, ARBs, diuretics | Increased risk of lithium toxicity and/or nephrotoxicity | Avoid concomitant use of ACI-Is and ARBs; diuretics are contraindicated |
| Agents that prolong QT interval | Additive cardiotoxicity | Avoid concurrent use or monitor ECGs |
| Antipsychotic drugs, clozapine | Increased risk of adverse effects and extrapyramidal symptoms | Monitor for adverse effects |
| MAOIs | Increased risk of malignant hyperpyrexia | Avoid concomitant use; allow 2 wk to elapse between discontinuation of MAOIs and initiation of lithium |
| SSRIs, linezolid | Increased lithium concentrations and/or an increased risk of serotonin syndrome | Monitor for adverse effects and lithium serum concentrations |

### Adverse Reactions: Lithium

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Cardiac dysrhythmias, fine tremor, hypothyroidism, leukocytosis, thrombocytosis, xerostomia | Ataxia, blurred vision, diarrhea, EEG changes, ECG changes, headache, muscle weakness, nausea, oliguria, polyuria, somnolence, tinnitus, vomiting | Hypotension, nephrotoxicity, seizure, hypercalcemia, hyperparathyroidism |

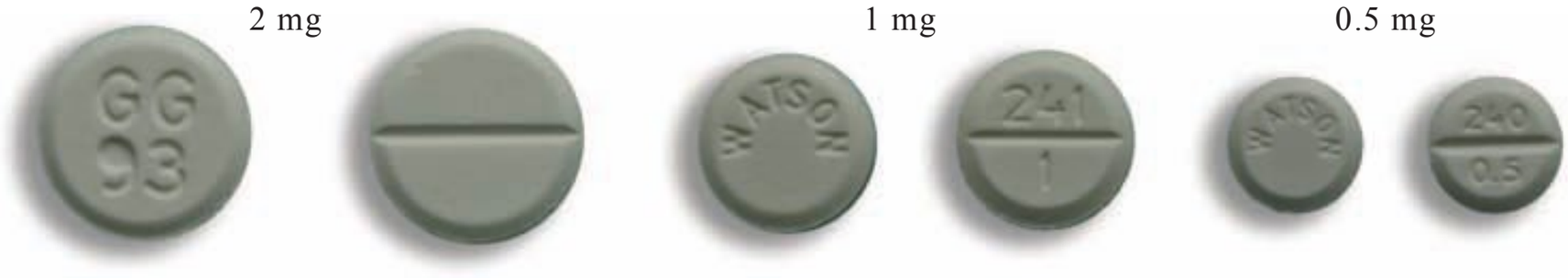
**Efficacy Monitoring Parameters.** Reduction in manic symptoms, prevention of manic and depressive episodes. Drug levels: between 1 and 1.5 mEq/L for acute mania and 0.6 and 1.2 mEq/L for long-term control; serum concentrations should not exceed 2.0 mEq/L during acute therapy. Drug levels should be drawn just prior to the next dose.

**Toxicity Monitoring Parameters.** Kidney and thyroid function, hydration status, sodium levels. Periodic EEG and ECG exams if medically warranted.

**Key Patient Counseling Points.** Swallow extended-release tablets whole; do not crush or chew. Avoid activities requiring mental alertness or coordination until drug effects are realized. Report signs/symptoms of toxicity, which may vary depending on the degree of toxicity. These may include diarrhea, vomiting, tremor, ataxia, drowsiness, muscle weakness, lack of coordination, giddiness, blurred vision, tinnitus, or large volumes of dilute urine. Maintain adequate fluid intake and normal salt intake.

**Clinical Pearls.** Safety and effectiveness in patients <12 y of age have not been established. Lithium toxicity is closely related to serum lithium levels and can occur at doses close to therapeutic levels. Ability to tolerate lithium is greater during the acute manic phase and decreases when manic symptoms subside. Do not confuse dosing in mEq versus mg. Doses should be in mg (300 mg = 8 mEq).

# LORAZEPAM: Ativan, Various




Sandoz generic pictured

Watson generic pictured

**Class:** Benzodiazepine, Short or Intermediate Acting. C-IV

**Dosage Forms.** **Oral Tablet:** 0.5 mg, 1 mg, 2 mg; **Oral Solution:** 2 mg/mL, 4 mg/mL

**Common FDA Label Indication, Dosing, and Titration.**

1. Anxiety: Adults, 1 mg po bid-tid
2. Insomnia, due to anxiety or situational stress: Adults and Children >12 y of age, 2-4 mg po hs

**Off-Label Uses**

1. Alcohol withdrawal syndrome: Initial, 2 mg po qid, then 1 mg qid × 8 doses

**MOA.** Enhance the postsynaptic effect of the inhibitory neurotransmitter, GABA.

**Drug Characteristics: Lorazepam**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | F = 90-93%, no effect of food on absorption |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 1.3 L/kg; 85% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | Extensively metabolized via glucuronidation |
| **Pregnancy Category** | D | **Elimination** | Renal elimination is 88% with a half-life of 12 h in adults; increased half-life in other age groups |
| **Lactation** | Compatible | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to benzodiaz-epines, narrow-angle glaucoma | **Black Box Warnings** | None |

### Medication Safety Issues: Lorazepam

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

### Drug Interactions: Lorazepam

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Alfentanil, opioids, and other respiratory depressants | Additive respiratory depression | Avoid if possible and consider dose reductions of both agents |
| Amitriptyline | Additive psychomotor defects | Monitor and advise patient |
| Ethinyl estradiol and other estrogen-based birth control products | Increased lorazepam metabolism and decreased effectiveness | May require higher dose of lorazepam |
| Valproic acid | Decreased metabolism of lorazepam | Reduce lorazepam dose by 50% |

### Adverse Reactions: Lorazepam

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Drowsiness, impaired motor coordination, retrograde amnesia | Asthenia, dizziness, blurred vision, depression | Seizures, mania, depression, withdrawal symptoms |

**Efficacy Monitoring Parameters.** Reduction in anxiety symptoms, alcohol withdrawal symptoms (BP, tremor), onset of sleep.

**Toxicity Monitoring Parameters.** Seek medical attention if severe drowsiness, thoughts of suicide, or seizures; monitor BP, HR.

**Key Patient Counseling Points.** May cause drowsiness; avoid driving or other tasks requiring motor coordination. Avoid alcohol.

**Clinical Pearls.** May be benzodiazepine of choice in impaired liver function and for nursing mothers. Use caution in elderly, appear more sensitive to the effects; dose reductions of 50% have been recommended. Avoid abrupt discontinuation after chronic use, may cause seizures. Safety not established for children <12 y of age.

# LOSARTAN: Cozaar, Various

**Class:** Angiotensin II Receptor Antagonist, Antihypertensive

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

Merck 100 mg pictured

**Common FDA Label Indication, Dosing, and Titration.**

1. Hypertension: Adults, initial 50 mg po daily, may titrate to 25-100 mg po daily or bid; Children ≥6 y of age, 0.7 mg/kg po daily, *max* 50 mg po daily
2. Heart failure: Initial, 12.5 mg po daily, maintenance 50 mg po daily
3. Reduce risk of cerebrovascular accident, in hypertensive patients with left ventricular hypertrophy; prophylaxis, diabetic nephropathy: Initial, 50 mg po daily, may titrate to 100 mg podaily
4. Diabetic nephropathy: Initial, 50 mg daily, may titrate based on BP up to 100 mg po daily

**Off-Label Uses.**

1. Cardiovascular event risk, reduction: Adults, 50-100 mg po daily
2. Isolated systolic hypertension, left ventricular hypertension, nondiabetic kidney disease: 50 mg po daily

**MOA.** Losartan is a selective, reversible, competitive antagonist of the angiotensin II receptor (AT1), which is responsible for the physiologic effects of angiotensin II including vasoconstriction, aldosterone secretion, sympathetic outflow, and stimulation of renal sodium reabsorption.

## Drug Characteristics: Losartan

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Starting dose, 25 mg po daily, *max* 100 mg/d | **Absorption** | F = 33%, food slows absorption and decreases Cmax by 10% |
| **Dose Adjustment Renal** | Not required | **Distribution** | Vd = 34 L; 99% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | 14% hepatic, CYP2C9 and CYP3A4/5 substrate |
| **Pregnancy Category** | C (1st trimester), D (2nd and 3rd trimesters) | **Elimination** | Renal elimination is 35% and fecal elimination is 60% with a half-life 2 h (6-9 h for active metabolite, 5-carboxylic acid) |
| **Lactation** | Not recommended | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to losartan or other angiotensin II receptor antagonists, pregnancy | **Black Box Warnings** | Pregnancy |

## Medication Safety Issues: Losartan

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | No | No | Colace, Coreg | No |

### Drug Interactions: Losartan

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| ACE-Is, potassium-sparing diuretics | Increased risk of hypotension, hyperkalemia, nephrotoxicity | Avoid concurrent use or monitor BP, SCr, and potassium levels |
| Aliskiren | Increased risk of hyperkalemia | Monitor serum potassium level |
| CYP2C9 and CYP3A4/5 inhibitors | Decreased losartan metabolism and increased risk of losartan toxicity | Monitor BP; consider dose reductions of losartan |
| CYP2C9 and CYP3A4/5 inducers | Increased losartan metabolism and decreased losartan efficacy | Monitor BP; consider dose increases of losartan |
| Diuretics | Increased risk of postural hypotension due to hypovolemia | Monitor BP; rise from seated position slowly |
| Potassium supplements, salt substitutes | Increased risk of hyperkalemia and cardiac arrhythmias | Avoid concurrent use or monitor serum potassium level |
| Nonsteroidal anti-inf ammatory drugs | Decreased antihypertensive and natriuretic effect of losartan, increased risk of nephrotoxicity | Avoid concurrent use or monitor BP and SCr levels |

### Adverse Reactions: Losartan

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Headache | Anorexia, back pain, constipation, dizziness, dyspepsia, hypotension, hyperkalemia, leg pain, muscle cramps, myalgia, nausea, nephrotoxicity, rash, tachycardia | Angioedema, birth defects, hepatotoxicity, rhabdomyolysis |

**Efficacy Monitoring Parameters.** Decreased BP.

**Toxicity Monitoring Parameters.** Signs/symptoms of peripheral edema. Baseline and periodic electrolyte panel, renal function tests, and urine protein are recommended.

**Key Patient Counseling Points.** Avoid pregnancy. Avoid sudden discontinuation; rebound hypertension can occur. Use potassium supplements or salt substitutes only under medical supervision. May cause dizziness that may worsen if dehydrated. Seek medical attention if angioedema, excessive fluid loss, hyperkalemia, reduction in urination, or jaundice occurs.

**Clinical Pearls.** Observe patients who are volume depleted for at least 2 h after taking the initial dose and consider a lower starting dose.

# LOTEPREDNOL: Alrex, Lotemax


**Class:** Corticosteroid, Ophthalmic

**Dosage Forms.** **Suspension, Ophthalmic:** 0.2%, 0.5%; **Ointment, Ophthalmic:** 0.5%; **Gel, Ophthalmic:** 0.5%

**Common FDA Label Indication, Dosing, and Titration.**

1. Temporary relief of seasonal allergic conjunctivitis: Instill 1 drop of 0.2% suspension qid
2. Inflammatory conditions: Instill 1-2 drops of 0.5% suspension in conjunctival sac of affected eye qid
3. Postoperative inflammation: Apply 1/2 inch of gel or 1-2 drops of 0.5% gel or suspension into conjunctival sac of affected eye qid continuing 24 h before surgery and for 2 wk after surgery

**Off-Label Uses.** None

**MOA.** Corticosteroids inhibit the inflammatory response including edema, capillary dilation, leukocyte migration, and scar formation

**Drug Characteristics: Loteprednol**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Not required | **Absorption** | Minimal |
| **Dose Adjustment Renal** | Not required | **Distribution** | Not absorbed |
| **Dialyzable** | Unknown | **Metabolism** | Not absorbed |
| **Pregnancy Category** | C | **Elimination** | Not absorbed |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity, active eye infection | **Black Box Warnings** | None |

**Medication Safety Issues: Loteprednol**

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

**Drug Interactions: Loteprednol:** None known

**Adverse Reactions: Loteprednol**

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Headache, burning on instillation, discharge, dry eyes, itching, photophobia, abnormal vision/blurring | Irritation, corneal abnormalities, eyelid erythema, increased IOP | Cataract formation, changes in visual acuity, optic nerve damage, secondary eye infection |

**Efficacy Monitoring Parameters.** Relief or prevention of redness, irritation and other inflammatory symptoms

**Toxicity Monitoring Parameters.** Assess for increased IOP if >10 d of treatment, signs and symptoms of infection

**Key Patient Counseling Points.** Suspension: Shake well before use. Take out contact before use, may put contacts back in 10 min after using suspension. Tilt head and drop into eye. Keep eyes closed after use and put pressure on inside corner of the eye. Ointment: Do not use contacts while using this product. To administer, gently pull down lower lid, and squeeze in gel. Let go of eyelid, but keep eye closed for 1-2 min. Gel: Turn upside down and shake once. Do not use contacts while using this product. Tilt head and drop into eye. Keep eyes closed after use and put pressure on inside corner of the eye. If using for both eyes, do not use same bottle in both eyes.

**Clinical Pearls.** Patients with allergic conjunctivitis should be advised to avoid triggers, rubbing their eyes, and reduce contact use. Cool compresses and refrigerated artificial tears can also reduce redness and irritation.

# LOVASTATIN: Altoprev, Mevacor, Various

**Class:** HMG-CoA Reductase Inhibitor

**Dosage Forms. Oral Tablet:** 10 mg, 20 mg, 40 mg; **Oral Tablet, Extended Release:** 20 mg, 40 mg, 60 mg

**Common FDA Label Indication, Dosing, and Titration.**

1. Coronary arteriosclerosis, hypercholesterolemia, primary and mixed: Initial, 20 mg po daily, maintenance 10-80 mg po daily or in 2 divided doses; *max* 80 mg/d; Extended-release tablet: 20-60 mg po qhs
2. Familial hypercholesterolemia, heterozygous: Children 10-17 y of age, initial, 10 po daily, maintenance 10-40 mg po daily; *max* 40 mg/d

Sandoz generic pictured

**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.

**Drug Characteristics: Lovastatin**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Active liver disease or unexplained persistent elevation of liver enzymes, avoid use | **Absorption** | F = <5% with immediate release, improved to 30% with ER, food decreases absorption |
| **Dose Adjustment Renal** | CrCl <30mL/min, use caution if giving doses >20 mg/d | **Distribution** | >95% protein bound |
| **Dialyzable** | Not dialyzable | **Metabolism** | 80-85% hepatic, CYP3A4/5 substrate |
| **Pregnancy Category** | X | **Elimination** | Renal elimination is <10% with a half-life of 2 h |
| **Lactation** | Contraindicated | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity to lovastatin, active liver disease, pregnancy and lactation, concomitant use with HIV protease inhibitors, and unexplained persistent elevation of liver enzymes | **Black Box Warnings** | None |

**Medication Safety Issues: Lovastatin**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | Do not crush or chew ER formulations | No | AtorvaSTATin | No |

### Drug Interactions: Lovastatin

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| CYP3A4/5 inhibitors | Decreased lovastatin metabolism increase risk of lovastatin toxicity | Avoid concurrent use or monitor for myopathy and measure creatine kinase levels, *max* dose of lovastatin 20 mg/d for strong inhibitors (40 mg/d with verapamil, a moderate inhibitor). Protease inhibitors are contraindicated |
| CYP3A4/5 inducers | Increased lovastatin metabolism decreases lovastatin efficacy | Avoid concurrent use, or monitor lipids and consider dose increases of lovastatin |
| Fibrates, niacin | Increased risk of myopathy or rhabdomyolysis | Avoid concurrent use or monitor for myopathy and measure creatine kinase levels. Use lower doses of statins |

### Adverse Reactions: Lovastatin

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| | Abdominal pain, constipation, diarrhea, headache, increased liver enzymes, myalgia, nausea, rash, hyperglycemia | Rhabdomyolysis, hepatotoxicity, increased risk of diabetes |

**Efficacy Monitoring Parameters.** Reduction in total cholesterol, LDL-cholesterol, and triglyceride levels; increase in HDL-cholesterol levels. Assess at baseline and periodically during treatment.

**Toxicity Monitoring Parameters.** Signs/symptoms of rhabdomyolysis (myalgias, dark urine, arthralgias, fatigue) or hepatotoxicity. LFTs, blood glucose, and $HbA_{1c}$ should be performed at baseline, 6-12 wk after initiation of therapy, and periodically 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.** Immediate-release tablets should be taken with the evening meal. Extended-release tablets should be taken at bedtime. Swallow extended-release tablets whole; do not chew, crush, or cut. Avoid alcohol, grapefruit, and grapefruit juice. Report signs/symptoms of rhabdomyolysis, jaundice (yellowing of skin or eyes), or renal failure. There are multiple significant drug-drug interactions with lovastatin. Consult a health-care professional prior to starting any new prescription or OTC medications. Lovastatin does not take the place of lifestyle changes (diet, exercise) to lower cholesterol levels.

**Clinical Pearls.** Safety and efficacy of extended-release tablets not established in pediatric patients. Use increases risk of diabetes, especially in the elderly.

# LUBIPROSTONE: Amitiza

**Class:** Chloride Channel Activator

**Dosage Forms. Oral Capsule:** 8 mcg, 24 mcg


**Common FDA Label Indication, Dosing, and Titration.**

1. Chronic idiopathic constipation: 24 mcg po bid
2. Irritable bowel syndrome with constipation: Females >18 y of age, 8 mcg po bid
3. Opioid induced constipation: 24 mcg po bid

**Off-Label Uses.** None

**MOA.** Lubiprostone is a bicyclic fatty acid that acts at the apical portion of the intestine as a chloride channel activator, which increases intestinal fluid secretion. When used for opioid-induced constipation activation of the chloride channel bypasses the antisecretory effects of opioids

**Drug Characteristics: Lubiprostone**

| | | | |
|---|---|---|---|
| **Dose Adjustment Hepatic** | Moderate, reduce dose to 16 mcg bid; Severe, reduce dose to 8 mcg bid | **Absorption** | Poorly absorbed |
| **Dose Adjustment Renal** | Not required | **Distribution** | >94% protein bound |
| **Dialyzable** | Unknown | **Metabolism** | Rapid and extensive in stomach and jejunum by carbonyl reductase to active metabolite |
| **Pregnancy Category** | C | **Elimination** | Half-life of 0.9 -1.4 h |
| **Lactation** | Weigh risks and benefits | **Pharmacogenetics** | None known |
| **Contraindications** | Hypersensitivity, bowel obstruction | **Black Box Warnings** | None |

**Medication Safety Issues: Lubiprostone**

| Suffixes | Tall Man Letters | Do Not Crush | High Alert | Confused Names | Beers Criteria |
|---|---|---|---|---|---|
| No | No | Do not crush or chew | No | No | No |

**Drug Interactions: Lubiprostone**

| Typical Agents | Mechanism | Clinical Management |
|---|---|---|
| Methadone | May decreases lubiprostone activation of chloride channels resulting in decreased lubiprostone efficacy | Monitor therapy and consider alternative constipation treatments |

**Adverse Reactions: Lubiprostone**

| Common (>10%) | Less Common (1-10%) | Rare but Serious (<1%) |
|---|---|---|
| Headache, nausea, diarrhea | Edema, dizziness, dyspnea, fatigue, abdominal pain, f atulence, vomiting, xerostomia | Anorexia, GERD, tachycardia |

**Efficacy Monitoring Parameters.** Relief of constipation.

**Toxicity Monitoring Parameters.** Baseline LFTs, physical exam and history to rule out bowel obstruction.

**Key Patient Counseling Points.** Take with food and water to reduce risk of nausea. Seek medical attention chest pain, shortness of breath or severe GI symptoms. Dyspnea, described as chest tightness, has been reported and generally occurs with the 1st dose and resolves after a few hours without intervention.

**Clinical Pearls.** Not approved for males with irritable bowel syndrome, despite what you may see advertised directly to consumers.