CONTINUED

HYPOGLYCEMIC AGENTS, ORAL

- To convert from other oral hypoglycemic agents, gradual conversion is not required. For insulin dosage of less than 20 units/day, change to oral hypoglycemic agents can be made without gradual dose adjustment. Patients taking 20 or more units/day should convert gradually by receiving oral agent and a 25–30% reduction in insulin dose every day or every 2nd day with gradual insulin dose reduction as tolerated. Monitor serum or urine glucose and ketones at least 3 times/day during conversion.
- **PO:** May be administered once in the morning or divided into 2 doses. Administer most sulfonylureas with meals to ensure best diabetic control and to minimize gastric irritation. Do not administer after last meal of the day.
- Administer *glipizide* 30 min before a meal.
- *Do not administer nonmicronized glyburide* with a meal high in fat. *Micronized glyburide* cannot be substituted for *nonmicronized glyburide* Preparations are not equivalent.
- Tablets may be crushed and taken with fluids if patient has difficulty swallowing.

Patient/Family Teaching

- Instruct patient to take medication at same time each day. Take missed doses as soon as remembered unless almost time for next dose. Do not take if unable to eat.
- Explain to patient that this medication controls hyperglycemia but does not cure diabetes. Therapy is long term.
- Review signs of hypoglycemia and hyperglycemia with patient. If hypoglycemia occurs, advise patient to take a glass of orange juice or 2–3 tsp of sugar, honey, or corn syrup dissolved in water and notify health care professional.
- Encourage patient to follow prescribed diet, medication, and exercise regimen to prevent hypoglycemic or hyperglycemic episodes.
- Instruct patient in proper testing of serum glucose and ketones. These tests should be closely monitored during periods of stress or illness and health care professional notified if significant changes occur.
- May occasionally cause dizziness or drowsiness. Caution patient to avoid driving or other activities requiring alertness until response to medication is known.
- Caution patient to avoid other medications, especially aspirin and alcohol, while on this therapy without consulting health care professional.
- Concurrent use of alcohol may cause a disulfiram-like reaction (abdominal cramps, nausea, flushing, headaches, and hypoglycemia).
- Insulin is the recommended method of controlling blood glucose during pregnancy. Counsel female patients to use a form of contraception other than oral contraceptives and to notify health care professional promptly if pregnancy is planned or suspected.
- Caution patient to use sunscreen and protective clothing to prevent photosensitivity reactions.
- Advise patient to inform health care professional of medication regimen before treatment or surgery.
- Advise patient to carry a form of sugar (sugar packets, candy) and identification describing disease process and medication regimen at all times.
- Advise patient to notify health care professional promptly if unusual weight gain, swelling of ankles, drowsiness, shortness of breath, muscle cramps, weakness, sore throat, rash, or unusual bleeding or bruising occurs.
- Emphasize the importance of routine follow-up exams.

Evaluation/Desired Outcomes

- Control of blood glucose levels without the appearance of hypoglycemic or hyperglycemic episodes.

ibuprofen (eye-byoo-**proe**-fen)

♣Actiprofen, Advil, Advil Migraine Liqui-Gels, ♣Apo-Ibuprofen, Children's Advil, Children's Motrin, Dolgesic, Genpril, Haltran, Junior Strength Advil, Menadol, Medipren, Midol Maximum Strength Cramp Formula, Motrin, Motrin Drops, Motrin IB, Motrin Junior Strength, Motrin Migraine Pain, ♣Novo-Profen, Nuprin, PediaCare Children's Fever

Classification

Therapeutic: antipyretics, antirheumatics, nonopioid analgesics, nonsteroidal anti-inflammatory agents
Pharmacologic: nonopioid analgesics

Pregnancy Category B (first trimester)

Indications

Mild/moderate dysmenorrhea. Rheumatoid arthritis. Osteoarthritis.

Action

Inhibits prostaglandin synthesis. **Therapeutic Effects:** Decreased pain and inflammation. Reduction of fever.

Pharmacokinetics

Absorption: Well absorbed from the GI tract.
Distribution: Does not enter breast milk in significant amounts.
Metabolism and Excretion: Mostly metabolized by the liver.
Half-life: 2–4 hr.

TIME/ACTION PROFILE

ROUTE	ONSET	PEAK	DURATION
PO (analgesic)	30 min	1–2 hr	4–6 hr
PO (anti-inflammatory)	7 days	1–2 wk	unknown

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Cross-sensitivity may exist with other NSAIDs, including aspirin. Active GI bleeding/ulcer disease. Phenylketonuria (chewables only). Peri-operative pain from coronary artery bypass graft (CABG) surgery.
Use Cautiously in: Cardiovascular/renal/hepatic disease (may ↑ risk of cardiovascular events); Geriatric patients (lower initial dose recommended); Chronic alcohol use/abuse; History of ulcer disease (may ↑ risk of GI bleeding); Pregnancy (use during second half of pregnancy not recommended); Lactation (has been used safely).

Adverse Reactions/Side Effects

CNS: headache, dizziness, drowsiness, psychic disturbances. **EENT:** amblyopia, blurred vision, tinnitus. **CV:** arrhythmias, edema. **GI:** GI BLEEDING, HEPATITIS, constipation, dyspepsia, nausea, vomiting, discomfort. **GU:** cystitis, hematuria, renal failure. **Derm:** EXFOLIATIVE DERMATITIS, STEVENS-JOHNSON SYNDROME, TOXIC EPIDERMAL NECROLYSIS, rashes. **Hemat:** blood dyscrasias, prolonged bleeding time. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: May limit the cardioprotective effects of low-dose **aspirin**. Concurrent use with **aspirin** may ↓ effectiveness of ibuprofen. Additive adverse GI side effects with **aspirin**, other **NSAIDs**, **corticosteroids**, or **alcohol**. Chronic use with **acetaminophen** may ↑ risk of adverse renal reactions. May ↓ effectiveness of **diuretics** or **antihypertensives**. May ↑ hypoglycemic effects of **insulin** or **oral hypoglycemic agents**. May slightly ↑ serum **digoxin** levels. May ↑ serum **lithium** levels and risk of toxicity. ↑ risk of toxicity from **methotrexate**. **Probenecid** ↑ risk of toxicity from ibuprofen. ↑ risk of bleeding with **cefotetan**, **cefoperazone**, **valproic acid**, **thrombolytics**, **warfarin**, and **drugs affecting platelet function** including **clopidogrel**, **ticlopidine**, **abciximab**, **eptifibatide**, or **tirofiban**. ↑ risk of adverse hematologic reactions with **antineoplastics** or **radiation therapy**. ↑ risk of nephrotoxicity with **cyclosporine**.

Why was this drug prescribed for your patient?

Drug-Natural Products: ↑ bleeding risk with *anise*, *arnica*, *chamomile*, *clove*, *dong quai*, *fenugreek*, *feverfew*, *garlic*, *ginger*, *ginkgo*, *Panax ginseng*, *licorice*, and others.

Route/Dosage

Analgesia

PO (Adults): *Anti-inflammatory*—400–800 mg 3–4 times daily (not >3600 mg/day). *Analgesic/antidysmenorrheal/antipyretic*—200–400 mg q 4–6 hr (not >1200 mg/day).

PO (Children 6 mo–12 yr): *Anti-inflammatory*—20–40 mg/kg/day in 3–4 divided doses (not >50 mg/kg/day). *Antipyretic*—5 mg/kg for temperature <102.5°F (39.17°C) or 10 mg/kg for higher temperatures (not >40 mg/kg/day); may repeat q 4–6 hr. OTC dosing appears on product label.

NURSING IMPLICATIONS

Assessment

- Patients who have asthma, aspirin-induced allergy, and nasal polyps are at increased risk for developing hypersensitivity reactions. Assess for rhinitis, asthma, and urticaria.
- **Pain:** Assess pain (note type, location, and intensity) prior to and 1–2 hr following administration.
- **Arthritis:** Assess pain and range of motion prior to and 1–2 hr following administration.
- **Fever:** Monitor temperature; note signs associated with fever (diaphoresis, tachycardia, malaise).
- ***Lab Test Considerations:*** BUN, serum creatinine, CBC, and liver function tests should be evaluated periodically in patients receiving prolonged therapy.
- Serum potassium, BUN, serum creatinine, alkaline phosphatase, LDH, AST, and ALT may show ↑ levels. Blood glucose, hemoglobin, and hematocrit concentrations, leukocyte and platelet counts, and CCr may be ↓.
- May cause prolonged bleeding time; may persist for <1 day following discontinuation.

Potential Nursing Diagnoses

Acute pain (Indications)
Impaired physical mobility (Indications)

Implementation

- Administration in higher than recommended doses does not provide increased effectiveness but may cause increased side effects. Use lowest effective dose for shortest period of time.
- Coadministration with opioid analgesics may have additive analgesic effects and may permit lower opioid doses.
- Available in combination with hydrocodone (Vicoprofen) and oxycodone (Combunox) and various decongestants (Appendix A).
- **PO:** For rapid initial effect, administer 30 min before or 2 hr after meals. May be administered with food, milk, or antacids to decrease GI irritation. Tablets may be crushed and mixed with fluids or food; 800-mg tablet can be dissolved in water.
- **Dysmenorrhea:** Administer as soon as possible after the onset of menses. Prophylactic treatment has not been shown to be effective.

Patient/Family Teaching

- Advise patients to take ibuprofen with a full glass of water and to remain in an upright position for 15–30 min after administration.
- Instruct patient to take medication as directed. Take missed doses as soon as remembered but not if almost time for next dose. Do not double doses.
- May cause drowsiness or dizziness. Advise patient to avoid driving or other activities requiring alertness until response to medication is known.
- Caution patient to avoid the concurrent use of alcohol, aspirin, acetaminophen, or other OTC or herbal products without consulting health care professional.

CONTINUED

CONTINUED

ibuprofen

- Advise patient to inform health care professional of medication regimen prior to treatment or surgery.
- Caution patient to wear sunscreen and protective clothing to prevent photosensitivity reactions.
- Instruct patients not to take OTC ibuprofen preparations for more than 10 days for pain or more than 3 days for fever, and to consult health care professional if symptoms persist or worsen.
- Caution patient that use of ibuprofen with 3 or more glasses of alcohol per day may increase the risk of GI bleeding.
- Advise patient to consult health care professional if rash, itching, visual disturbances, tinnitus, weight gain, edema, black stools, persistent headache, or influenza-like syndrome (chills, fever, muscle aches, pain) occurs.

Evaluation/Desired Outcomes

- Decrease in severity of pain.
- Improved joint mobility. Partial arthritic relief is usually seen within 7 days, but maximum effectiveness may require 1–2 wk of continuous therapy. Patients who do not respond to one NSAID may respond to another.
- Reduction in fever.

Why was this drug prescribed for your patient?

imipenem/cilastatin (i-me-**pen**-em/sye-la-**stat**-in)

Primaxin

Classification

Therapeutic: anti-infectives
Pharmacologic: carbapenems

Pregnancy Category C

Indications

Lower respiratory tract infections. Urinary tract infections. Abdominal infections. Gynecologic infections. Skin/skin structure infections. Bone/joint infections. Bacteremia/endocarditis. Polymicrobic infections.

Action

Binds to bacterial cell wall. Combination with cilastatin prevents renal inactivation of imipenem, allowing high urinary concentrations. Resists the actions of enzymes that degrade other penicillins. **Therapeutic Effects:** Bactericidal action against most susceptible bacteria. Bacteriostatic against *Enterococcus*. **Spectrum:** Also active against: *Streptococcus pneumoniae*, Group A beta-hemolytic streptococci, *Staphylococcus aureus*, *Enterococcus*. Active against most gram-negative bacillary organisms, including: *Escherichia coli*, *Klebsiella*, *Acinetobacter*, *Proteus*, *Serratia*, *Pseudomonas aeruginosa*. Also displays activity against: *Salmonella*, *Shigella*, *Neisseria gonorrhoeae*, Numerous anaerobes.

Pharmacokinetics

Absorption: Well absorbed following IM administration. IV administration results in complete bioavailability.
Distribution: Widely distributed. Crosses the placenta; enters breast milk.
Metabolism and Excretion: 70% excreted unchanged by the kidneys.
Half-life: *Imipenem/cilastatin*—1 hr (prolonged in renal impairment).

TIME/ACTION PROFILE (blood levels)

ROUTE	ONSET	PEAK	DURATION
IM	rapid	1–2 hr	12 hr
IV	rapid	end of infusion	6–8 hr

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Cross-sensitivity may occur with penicillins and cephalosporins.
Use Cautiously in: History of hypersensitivities; Seizures; Geriatric patients; Renal impairment (dosage reduction required if CCr ≤70 ml/min/1.73 m^2); Pregnancy, lactation, or children (safety not established).

Adverse Reactions/Side Effects

CNS: SEIZURES, dizziness, somnolence. **CV:** hypotension. **GI:** PSEUDOMEMBRANOUS COLITIS, diarrhea, nausea, vomiting. **Derm:** rash, pruritus, sweating, urticaria. **Hemat:** eosinophilia. **Local:** phlebitis at IV site. **Misc:** allergic reactions including ANAPHYLAXIS, fever, superinfection.

Interactions

Drug-Drug: Do not admix with **aminoglycosides** (inactivation may occur). **Probenecid** ↓ renal excretion and ↑ blood levels. ↑ risk of seizures with **ganciclovir** or **cyclosporine** (avoid concurrent use of ganciclovir).

Route/Dosage

IV (Adults): *Mild infections*—250–500 mg q 6 hr. *Moderate infections*—500 mg q 6–8 hr *or* 1 g q 8 hr. *Serious infections*—500 mg q 6 hr to 1 g q 6–8 hr.
IV (Children ≥3 mo): *non-CNS infections*—15–25 mg/kg q 6 hr; higher doses have been used in older children with cystic fibrosis.
IV (Children 4 wk–3 mo): *non-CNS infections*—25 mg/kg q 6 hr.
IV (Children 1–4 wk): *non-CNS infections*—25 mg/kg q 8 hr.
IV (Children <1 wk): *non-CNS infections*—25 mg/kg q 12 hr.

IM (Adults): 500–750 mg q 12 hr.
IM (Children): 10–15 mg/kg q 6 hr.

NURSING IMPLICATIONS

Assessment

- Assess patient for infection (vital signs; wound appearance, sputum, urine, and stool; WBC) at beginning and throughout course of therapy.
- Obtain a history before initiating therapy to determine previous use of and reactions to penicillins. Persons with a negative history of penicillin sensitivity may still have an allergic response.
- Obtain specimens for culture and sensitivity before initiating therapy. First dose may be given before receiving results.
- **Observe patient for signs and symptoms of anaphylaxis (rash, pruritus, laryngeal edema, wheezing). Discontinue drug and notify physician immediately if these signs occur. Have epinephrine, an antihistamine, and resuscitative equipment close by in case of an anaphylactic reaction.**
- ***Lab Test Considerations:*** BUN, AST, ALT, LDH, serum alkaline phosphatase, bilirubin, and creatinine levels may be transiently increased.

Implementation

- **Do not confuse imipenem with omnipen.**
- **IM:** Reconstitute 500-mg vial with 2 ml and 750-mg vial with 3 ml of lidocaine without epinephrine. Shake well to form a suspension. Withdraw and inject entire contents of vial IM.
- **Intermittent Infusion:** Reconstitute each 250- or 500-mg vial with 10 ml of compatible diluent, shake well. Transfer resulting solution to at least 100 ml of compatible diluent. Add an additional 10 ml to each reconstituted vial; shake well to ensure all medication is used. Transfer remaining contents of the vial to the infusion container. Reconstitute 120-ml infusion bottles with 100 ml of a compatible diluent. Shake well until clear.
- *Compatible diluents* include 0.9% NaCl, D5W, D10W, D5/0.9% NaCl, D5/0.45% NaCl, or D5/0.225% NaCl. Solution may range from clear to yellow in color. Do not administer cloudy solutions. Solution is stable for 4 hr at room temperature and 24 hr if refrigerated. ***Rate:*** Administer each 250- or 500-mg dose over 20–30 min and each 1-g dose over 40–60 min. Administer over 20–30 min for pediatric patients. Do not administer direct IV. Rapid infusion may cause nausea, vomiting, unusual tiredness or weakness, dizziness, or sweating. If these symptoms develop, slow infusion. Discontinuation of medication may be necessary.

Patient/Family Teaching

- Advise patient to report the signs of superinfection (black, furry overgrowth on the tongue, vaginal itching or discharge, loose or foul-smelling stools) and allergy.
- **Caution patient to notify health care professional if fever and diarrhea occur, especially if stool contains blood, pus, or mucus. Advise patient not to treat diarrhea without consulting health care professional. May occur up to several weeks after discontinuation of medication.**

Evaluation/Desired Outcomes

- Resolution of the signs and symptoms of infection. Length of time for complete resolution depends on the organism and site of infection.

Why was this drug prescribed for your patient?

imipramine (im-ip-ra-meen)

♣Apo-Imipramine, ♣Impril, Norfranil, ♣Novopramine, Tipramine, Tofranil, Tofranil PM

Classification

Therapeutic: antidepressants
Pharmacologic: tricyclic antidepressants

Pregnancy Category C

Indications

Depression. Enuresis (children).

Action

Potentiates the effect of serotonin and norepinephrine. Has significant anticholinergic properties. **Therapeutic Effects:** Antidepressant action.

Pharmacokinetics

Absorption: Well absorbed from the GI tract.
Distribution: Widely distributed. Crosses the placenta/enters breast milk.
Metabolism and Excretion: Extensively metabolized by the liver. Some conversion to active compounds. Undergoes enterohepatic recirculation.
Half-life: 8–16 hr.

TIME/ACTION PROFILE (antidepressant effect)

ROUTE	ONSET	PEAK	DURATION
PO, IM	hours	2–6 wk	weeks

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Cross-sensitivity with other antidepressants may occur. Narrow-angle glaucoma. Hypersensitivity to tartrazine or sulfites (in some preparations).
Use Cautiously in: Geriatric patients (more susceptible to adverse reactions); Pre-existing cardiovascular disease; Geriatric men with prostatic hyperplasia (more susceptible to urinary retention); Seizures or history of seizure disorder; May ↑ risk of suicide attempt/ideation especially during dose early treatment or dose adjustment; risk may be greater in children or adolescents; Pregnancy; use only if clearly needed and maternal benefits outweigh risk to fetusLactation (may result in sedation in infant); Children <6 yr (safety not established).

Adverse Reactions/Side Effects

CNS: drowsiness, fatigue, agitation, confusion, hallucinations, insomnia. **EENT:** blurred vision, dry eyes. **CV:** ARRHYTHMIAS, hypotension, ECG changes. **GI:** constipation, dry mouth, nausea, paralytic ileus. **GU:** urinary retention. **Derm:** photosensitivity. **Endo:** gynecomastia. **Hemat:** blood dyscrasias.

Interactions

Drug-Drug: May cause hypotension, tachycardia, and potentially fatal reactions with **MAO inhibitors** (avoid concurrent use—discontinue 2 wk before imipramine). Concurrent use with **SSRIs** may result in toxicity and should be avoided (**fluoxetine** should be stopped 5 wk before). **Clonidine** may cause hypertensive crisis and should be avoided. Action may be affected by drugs that compete for metabolism including other **antidepressants**, **phenothiazines**, **carbamazepine**, **propafenone**, **flecainide**; when used concurrently, dosage reduction of one or the other or both may be necessary. Concurrent use of **cimetidine**, **quinidine**, **amiodarone**, and **ritonavir** may result in ↑ effects of imipramine. Concurrent **levodopa** may result in delayed/↓ absorption of levodopa or hypertension. Blood levels and effects may be ↓ by **rifamycins**. ↑ CNS depression with other **CNS depressants** including **alcohol**, **antihistamines**, **clonidine**, **opioids**, and **sedative/hypnotics**. **Barbiturates** may alter blood levels and effects. **Adrenergic** and **anticholinergic** side effects may be ↑ with other **agents having these properties**. **Phenothiazines** or **hormonal contraceptives** ↑ levels and may cause toxicity. **Cigarette smoking** may increase metabolism and alter effects.
Drug-Natural Products: Concomitant use of **kava, valerian, skullcap, chamomile,** or **hops** can increase CNS depression. Increased anticholinergic effects with **angel's trumpet, jimson weed,** and **scopolia.**

indapamide (in-dap-a-mide)

♣Lozide, Lozol

Classification

Therapeutic: antihypertensives, diuretics
Pharmacologic: thiazide-like diuretics

Pregnancy Category B

Indications

Used alone or in combination with other agents in the management of mild or moderate hypertension. Edema associated with congestive heart failure (CHF).

Action

Increases excretion of sodium and water by inhibiting sodium reabsorption in the distal tubule. Promotes excretion of chloride, potassium, magnesium, and bicarbonate. May produce arteriolar dilation. **Therapeutic Effects:** Lowering of blood pressure in hypertensive patients. Diuresis with subsequent mobilization of edema.

Pharmacokinetics

Absorption: Well absorbed from the GI tract after oral administration.
Distribution: Widely distributed.
Metabolism and Excretion: Mostly metabolized by the liver. Small amounts (7%) excreted unchanged by the kidneys.
Half-life: 14–18 hr.

TIME/ACTION PROFILE (antihypertensive effect)

ROUTE	ONSET	PEAK	DURATION
PO (single dose)	unknown	2-4 hr	unknown
PO (multiple dose)	1–2 wk	8–12 wk	up to 8 wk

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Cross-sensitivity with other sulfonamides may occur. Anuria. Lactation.
Use Cautiously in: Renal or severe hepatic impairment; Geriatric patients (increased sensitivity); Pregnancy or children (safety not established).

Adverse Reactions/Side Effects

CNS: dizziness, drowsiness, lethargy. **CV:** arrhythmias, hypotension. **GI:** anorexia, cramping, nausea, vomiting. **Derm:** photosensitivity, rashes. **Endo:** hyperglycemia. **F and E:** hypokalemia, dehydration, hypochloremic alkalosis, hyponatremia, hypovolemia. **Metab:** hyperuricemia. **MS:** muscle cramps.

Interactions

Drug-Drug: Additive hypotension with other **antihypertensives**, **nitrates**, or acute ingestion of **alcohol**. Additive hypokalemia with **corticosteroids**, **amphotericin B**, **piperacillin**, or **ticarcillin**. Decreases the excretion of **lithium;** may cause toxicity. Hypokalemia may increase risk of **digoxin** toxicity.
Drug-Natural Products: Licorice and **stimulant laxative** herbs (**aloe, cascara sagrada, senna**) may increase risk of potassium depletion.

Route/Dosage

PO (Adults): *Hypertension*—1.25–5 mg daily in the morning; may be increased at 4-wk intervals up to 5 mg/day. *Edema secondary to CHF*—2.5 mg daily in the morning; may be increased after 1 wk to 5 mg/day.

NURSING IMPLICATIONS

Assessment

- Monitor blood pressure, intake and output, and daily weight; assess feet, legs, and sacral area for edema daily.
- Assess patient, especially if taking digoxin, for anorexia, nausea, vomiting, muscle cramps, paresthesia, and confusion; report signs of electrolyte

Route/Dosage

PO (Adults): 25–50 mg 3–4 times daily (not to exceed 300 mg/day); total daily dose may be given at bedtime.
PO (Geriatric Patients): 25 mg at bedtime initially (up to 100 mg/day).
PO (Children >12 yr): *Antidepressant*—25–50 mg/day in divided doses (not to exceed 100 mg/day).
PO (Children 6–12 yr): *Antidepressant*—5–15 mg twice daily.
PO (Children >6 yr): *Enuresis*—25 mg once daily 1 hr before bedtime; increase by 25 mg weekly to 50 mg in children <12 yr, up to 75 mg in children >12 yr.
IM (Adults): up to 100 mg/day in divided doses.

NURSING IMPLICATIONS

Assessment

- Monitor BP and pulse rate before and during initial therapy.
- Monitor periodic ECGs in geriatric patients or patients with heart disease and before increasing dosage with children treated for enuresis.
- **Depression:** Assess mental status frequently. Confusion, agitation, and hallucinations may occur during initiation of therapy and may necessitate dosage reduction. Monitor mood changes. Assess for suicidal tendencies, especially during early therapy. Restrict amount of drug available to patient.
- **Enuresis:** Assess frequency of bed-wetting throughout therapy.

Implementation

- **Do not confuse imipramine with desipramine.**
- **PO:** Administer with or after a meal to minimize irritation.
- **IM:** May be slightly yellow or red. Crystals may develop if solution is cool; place ampule under warm running water for 1 min to dissolve.

Patient/Family Teaching

- Instruct patient to take medication exactly as directed. If a dose is missed, take as soon as possible unless almost time for next dose; if regimen is a single dose at bedtime, do not take in the morning because of side effects. Advise patient that drug effects may not be noticed for at least 2 wk. Abrupt discontinuation may cause nausea, vomiting, diarrhea, headache, trouble sleeping with vivid dreams, and irritability.
- May cause drowsiness and blurred vision. Caution patient to avoid driving and other activities requiring alertness until response to drug is known.
- Instruct patient to notify health care professional if visual changes occur.
- Change position slowly to minimize orthostatic hypotension.
- Advise patient to avoid alcohol or other CNS-depressant drugs during therapy and for at least 3–7 days after therapy has been discontinued.
- Instruct patient to notify health care professional if urinary retention occurs or if dry mouth or constipation persists.
- Caution patient to use sunscreen and protective clothing to prevent photosensitivity reactions.
- Inform patient of need to monitor dietary intake; increased appetite may lead to undesired weight gain.
- Advise patient to notify health care professional of medication regimen before treatment or surgery.
- **Children:** Inform parents that side effects include nervousness, insomnia, unusual tiredness, and nausea and vomiting. Notify health care professional if symptoms become pronounced. Advise parents to keep medication out of reach of children to prevent inadvertent overdose.

Evaluation/Desired Outcomes

- Increased sense of well-being
- Renewed interest in surroundings.
- Increased appetite.
- Improved energy level.
- Improved sleep in patients treated for depression. May require 2–6 wk of therapy before full effects are noticeable.
- Control of bed-wetting in children >6 yr.

Why was this drug prescribed for your patient?

imbalance. Patients taking digoxin have an increased risk of digitalis toxicity because of the potassium-depleting effect of the diuretic.
- Assess patient for allergy to sulfonamides.
- ***Lab Test Considerations:*** Monitor electrolytes (especially potassium), blood glucose, BUN, and serum creatinine and uric acid levels before and periodically throughout therapy. May cause decreased potassium, sodium, and chloride concentrations. May increase serum glucose; diabetic patients may require increased oral hypoglycemic or insulin dosage. Increases uric acid level an average of 1.0 mg/100 ml; may precipitate an episode of gout.

Potential Nursing Diagnoses

Excess fluid volume (Indications)
Risk for deficient fluid volume (Side Effects)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- Administer in the morning to prevent disruption of sleep cycle.
- **PO:** May give with food or milk to minimize GI irritation.

Patient/Family Teaching

- Instruct patient to take this medication at the same time each day. If a dose is missed, take as soon as remembered, but not just before next dose is due. Do not double doses. Advise patient using indapamide for hypertension to continue taking the medication even if feeling well. Indapamide controls but does not cure hypertension.
- Caution patient to change positions slowly to minimize orthostatic hypotension. This may be potentiated by alcohol.
- Advise patient to use sunscreen (avoid those containing PABA) and protective clothing when in the sun to prevent photosensitivity reactions.
- Instruct patient to follow a diet high in potassium.
- Advise patient to report muscle weakness, cramps, nausea, or dizziness to health care professional.
- Advise patient to consult health care professional before taking OTC medication concurrently with this therapy.
- Emphasize the importance of routine follow-up exams.
- **Hypertension:** Instruct patient and family on proper technique of blood pressure monitoring. Advise them to check blood pressure at least weekly and to report significant changes.
- Encourage patient to comply with additional interventions for hypertension (weight reduction, low-sodium diet, regular exercise, smoking cessation, moderation of alcohol consumption, and stress management).

Evaluation/Desired Outcomes

- Control of hypertension.
- Decrease in edema secondary to CHF.

Why was this drug prescribed for your patient?

indomethacin (in-doe-**meth**-a-sin)

♣Apo-Indomethacin, ♣Indameth, ♣Indocid, Indocin, Indocin SR, ♣Novo-Methacin, ♣Nu-Indo

Classification

Therapeutic: antirheumatics, ductus arteriosus patency adjuncts (IV only), nonsteroidal anti-inflammatory agents

Pregnancy Category B (first trimester)

Indications

PO, Rect: Inflammatory disorders including Rheumatoid arthritis, Gouty arthritis, Osteoarthritis, Ankylosing spondylitis. Generally reserved for patients who do not respond to less toxic agents.

Action

Inhibits prostaglandin synthesis. **Therapeutic Effects:** Suppression of pain and inflammation.

Pharmacokinetics

Absorption: Well absorbed following PO/rectal administration.
Distribution: Crosses the blood-brain barrier and the placenta. Enters breast milk.
Metabolism and Excretion: Mostly metabolized by the liver.
Half-life: 2.6–11 hr.

TIME/ACTION PROFILE

ROUTE	ONSET	PEAK	DURATION
PO (analgesic)	30 min	0.5–2 hr	4–6 hr
PO-ER (analgesic)	30 min	unknown	4–6 hr
PO (anti-inflammatory)	up to 7 days	1–2 wk	unknown
PO-ER (anti-inflammatory)	up to 7 days	1–2 wk	unknown

♣ = Canadian drug name.

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Known alcohol intolerance (suspension). Cross-sensitivity may exist with other NSAIDs. Active GI bleeding, proctitis, ulcer disease.
Use Cautiously in: Severe cardiovascular, renal, or hepatic disease; History of ulcer disease; Geriatric patient (increased risk of adverse reactions); Pregnancy or lactation (not recommended during second half of pregnancy); Lactation (safety not established).

Adverse Reactions/Side Effects

CNS: dizziness, drowsiness, headache, psychic disturbances. **EENT:** blurred vision, tinnitus. **CV:** arrhythmias, edema. **GI:** *PO*— GI BLEEDING, DRUG-INDUCED HEPATITIS, constipation, dyspepsia, nausea, vomiting; *Rect*— rectal irritation, tenesmus. **GU:** cystitis, hematuria, renal failure. **Derm:** rashes. **F and E:** hyperkalemia. **Hemat:** blood dyscrasias, prolonged bleeding time. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: Concurrent use with **aspirin** may ↓ effectiveness. ↑ adverse GI effects with **aspirin**, other **NSAIDs**, **potassium supplements**, **corticosteroids**, or **alcohol**. Chronic use of **acetaminophen** ↑ the risk of adverse renal reactions. May ↓ effectiveness of **diuretics** or **antihypertensives**. May ↑ hypoglycemia from **insulin** or **oral hypoglycemic agents**. May ↑ risk of toxicity from **lithium** or **zidovudine** (avoid concurrent use with zidovudine). ↑ the risk of toxicity from **methotrexate**. **Probenecid** ↑ risk of toxicity from indomethacin. ↑ risk of bleeding with some **cephalosporins**, **valproates**, **thrombolytics**, or **warfarin**. ↑ risk of hematologic reactions with **antineoplastics** or **radiation therapy**. ↑ risk of nephrotoxicity with **cyclosporine**.
Drug-Natural Products: Increased bleeding risk with **anise, arnica, chamomile, clove, dong quai, feverfew, garlic, ginger, ginkgo, Panax ginseng.**

Route/Dosage

PO (Adults): *Antiarthritic*—25–50 mg 2–4 times daily or 75-mg SR capsule 1–2 times daily (not to exceed 150–200 mg/day). Single bedtime dose

* CAPITALS indicates life-threatening, underlines indicate most frequent.

High Alert

INSULINS (mixtures) (in-su-lin)

insulin lispro/protamine insulin lispro mixture, rDNA origin

Humalog 75/25,

NPH/regular insulin mixtures

Humulin 50/50, Humulin 70/30, Novolin 70/30

Classification

Therapeutic: antidiabetics, hormones
Pharmacologic: pancreatics

Pregnancy Category B

Indications

Treatment of diabetes mellitus. Due to time/action profile, cannot be used for the acute treatment of diabetic ketoacidosis.

Action

Lower blood glucose by stimulating glucose uptake in skeletal muscle and fat, inhibiting hepatic glucose production. Other actions: inhibition of lypolysis and proteolysis, enhanced protein synthesis. **Therapeutic Effects:** Control of blood glucose in diabetic patients.

Pharmacokinetics

Absorption: Well absorbed from subcutaneous administration sites. Absorption rate is determined by type of insulin, injection site, volume of injectate, and other factors.
Distribution: Widely distributed.
Metabolism and Excretion: Metabolized by liver, spleen, kidney, and muscle.

♣ = Canadian drug name.

Half-life: 5–6 min (prolonged in patients with diabetes; biologic half-life is 1–1.5 hr;).

TIME/ACTION PROFILE (hypoglycemic effect)

ROUTE	ONSET	PEAK	DURATION
insulin lispro protamine suspension/ insulin lispro mixture subcutaneous	15–30 min	2.8 hr	24 hr
NPH/Regular Insulin mixture subcutaneous	30 min	4–8 hr	24 hr

Contraindications/Precautions

Contraindicated in: Hypoglycemia. Allergy or hypersensitivity to a particular type of insulin, preservatives, or other additives.
Use Cautiously in: Stress, pregnancy, and infection (may temporarily alter insulin requirements); Children < 18 yr (safety of Humalog not established).

Adverse Reactions/Side Effects

Derm: urticaria. **Endo:** HYPOGLYCEMIA, rebound hyperglycemia (Somogyi effect). **Local:** lipodystrophy (lipoatrophy, lipohypertropy), itching, redness, swelling. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: Glucose lowering effects may be ↓ by **corticosteroids**, **danazol**, **diazoxide**, **diuretics**, **sympathomimetic (adrenergic) agents**, **phenothaizines**, **somatropin**, **thyoroid preparations**, **estrogens**, **progestins**, **protease inhibitor antiretrovirals**, and **atypical antipsychotics** including **olanzapine**, **quetiapine**, **clozapine**, **risperidone**, **aripiprazole** and **ziprasidone**. Blood glucose lowering effects and the risk of hypoglycemia may be ↑ by **oral antidiabetic agents**, **ACE inhibitors**, **disopyramide**, **fibrates**, **salicylates**, **fluoxetine**, **MAO inhibitors**, **pentoxiphylline**, **propoxyphene** and **sulfonamides**. **Beta block-**

* CAPITALS indicates life threatening, underlines indicate most frequent.

of 100 mg may be used. *Antigout*—100 mg, then 50 mg 3 times daily, tapered as pain decreases.
Rect (Adults): 50 mg up to 4 times daily (not to exceed 200 mg/day).
PO, Rect (Children): 1.5–2.5 mg/kg/day in 3–4 divided doses (not to exceed 4 mg/kg/day or 150–200 mg/day).

NURSING IMPLICATIONS

Assessment

- Patients who have asthma, aspirin-induced allergy, and nasal polyps are at increased risk for developing hypersensitivity reactions. Monitor for rhinitis, asthma, and urticaria.
- **Arthritis:** Assess limitation of movement and pain—note type, location, and intensity prior to and 1–2 hr following administration.
- ***Lab Test Considerations:*** BUN, serum creatinine, CBC, serum potassium levels, and liver function tests should be evaluated periodically in patients receiving prolonged therapy.
- Serum potassium, BUN, serum creatinine, AST, and ALT tests may show increased levels. Blood glucose concentrations may be altered. Hemoglobin and hematocrit concentrations, leukocyte and platelet counts, and creatinine clearance may be decreased.
- Urine glucose and urine protein concentrations may be increased.
- Leukocyte and platelet count may be decreased. Bleeding time may be prolonged for several days after discontinuation.

Potential Nursing Diagnoses

Acute pain (Indications)
Impaired physical mobility (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- Also available in an IV formulation for closure of patent ductus arteriosus.
- **PO:** Administer after meals or with food or antacids to decrease GI irritation. Shake suspension before administration. Do not mix with antacid or any other liquid. **Do not crush, break, or chew sustained-release capsules.**
- **Rect:** Encourage patient to retain suppository for 1 hr.

Patient/Family Teaching

- Advise patient to take this medication with a full glass of water and to remain in an upright position for 15–30 min after administration.
- Instruct patient to take medication exactly as directed. Missed doses should be taken as soon as remembered if not almost time for next dose. Do not double doses.
- May cause drowsiness or dizziness. Advise patient to avoid driving or other activities requiring alertness until response to medication is known.
- Caution patient to avoid the concurrent use of alcohol, aspirin, other NSAIDs, acetaminophen, or other OTC medications without consulting health care professional.
- Caution patient to wear sunscreen and protective clothing to prevent photosensitivity reactions.
- Advise patient to inform health care professional of medication regimen prior to treatment or surgery.
- Instruct patient to notify health care professional if rash, itching, chills, fever, muscle aches, visual disturbances, weight gain, edema, abdominal pain, black stools, or persistent headache occurs.

Evaluation/Desired Outcomes

- Decrease in severity of moderate pain
- Improved joint mobility. Partial arthritic relief is usually seen within 2 wk, but maximum effect may require up to 1 mo of continuous therapy. Patients who do not respond to one NSAID may respond to another.

Why was this drug prescribed for your patient?

[illegible] hypoglycemia.
Drug-Natural Products: Glucosamine may worsen blood glucose control. **Chromium**, and **coenzyme Q-10** may produce additive hypoglycemic effects.

Route/Dosage

Dose depends on blood glucose, response, and many other factors.
Subcut: (Adults and Children): 0.5–1 unit/kg/day. *Adolescents during rapid growth*—0.8–1.2 units/kg/day.

NURSING IMPLICATIONS

Assessment

- Assess patient for signs and symptoms of hypoglycemia (anxiety; restlessness; mood changes; tingling in hands, feet, lips, or tongue; chills; cold sweats; confusion; cool, pale skin; difficulty in concentration; drowsiness; excessive hunger; headache; irritability; nausea; nervousness; rapid pulse; shakiness; unusual tiredness or weakness) and hyperglycemia (confusion, drowsiness; flushed, dry skin; fruit-like breath odor; rapid, deep breathing, frequent urination; loss of appetite; tiredness; unusual thirst) periodically during therapy.
- Monitor body weight periodically. Changes in weight may necessitate changes in insulin dose.
- ***Lab Test Considerations:*** May cause ↓ serum inorganic phosphate, magnesium, and potassium levels.
- Monitor blood glucose and ketones every 6 hr during therapy, more frequently in ketoacidosis and times of stress. Glycosylated hemoglobin may also be monitored to determine effectiveness.
- ***Toxicity and Overdose:*** Overdose is manifested by symptoms of hypoglycemia. Mild hypoglycemia may be treated by ingestion of oral glucose. Severe hypoglycemia is a life-threatening emergency; treatment consists of IV glucose, glucagon, or epinephrine.

Potential Nursing Diagnoses

Noncompliance (Patient/Family Teaching)

Implementation

- ***High Alert:*** Insulin-related medication errors have resulted in patient harm and death. Clarify ambiguous orders; do not accept orders using the abbreviation "u" for units, (can be misread as a zero or the numeral 4; has resulted in tenfold overdoses).
- Insulins are available in different types, strengths and from different species. Check type, species source, dose, and expiration date with another licensed nurse. Do not interchange insulins without consulting physician or other health care professional.
- Use *only* insulin syringes to draw up dose. The unit markings on the insulin syringe must match the insulin's units/ml.
- Insulin should be stored in a cool place but does not need to be refrigerated. Do not use if cloudy, discolored, or unusually viscous.
- NPH, lente and ultralente insulins should not be used in the management of ketoacidosis.
- **Subcut:** Rotate injection sites.
- Administer into abdominal wall, thigh, or upper arm subcutaneously. Pinch skin, inject insulin, leave needle in skin for 10 seconds and remove. Gently press on spot injected for several seconds; do not rub area.

Patient/Family Teaching

- Instruct patient on proper technique for administration. Include type of insulin, equipment (syringe, cartridge pens, alcohol swabs), storage, and place to discard syringes. Discuss the importance of not changing brands of insulin or syringes, selection and rotation of injection sites, and compliance with therapeutic regimen.
- Explain to patient that this medication controls hyperglycemia but does not cure diabetes. Therapy is long term.
- Instruct patient in proper testing of serum glucose and ketones. These tests should be closely monitored during periods of stress or illness and health care professional notified of significant changes.

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INSULINS (mixtures)

- Emphasize the importance of compliance with nutritional guidelines and regular exercise as directed by health care professional.
- Advise patient to consult health care professional prior to using alcohol or other Rx, OTC, or herbal products concurrently with insulin.
- Advise patient to notify health care professional of medication regimen prior to treatment or surgery.
- Advise patient to notify health care professional if nausea, vomiting, or fever develops, if unable to eat regular diet, or if blood glucose levels are not controlled.
- Instruct patient on signs and symptoms of hypoglycemia and hyperglycemia and what to do if they occur.
- Advise patient to notify health care professional if pregnancy is planned or suspected.
- Patients with diabetes mellitus should carry a source of sugar (candy, sugar packets) and identification describing their disease and treatment regimen at all times.
- Emphasize the importance of regular follow-up, especially during first few weeks of therapy.

Evaluation/Desired Outcomes

- Control of blood glucose levels without the appearance of hypoglycemic or hyperglycemic episodes.

Why was this drug prescribed for your patient?

High Alert

INSULINS (short acting) (in-su-lin)

regular insulin (insulin injection)

Humulin R, 🍁Insulin-Toronto, Novolin R, Iletin II Regular, Velosulin BR

concentrated regular insulin

Classification

Therapeutic: antidiabetics, hormones
Pharmacologic: pancreatics

Pregnancy Category B

Indications

Treatment of diabetes mellitus; can be used to treat diabetic ketoacidosis.
Concentrated insulin U-500: Only for use in patients with insulin requirements >200 units/day.

Action

Lower blood glucose by stimulating glucose uptake in skeletal muscle and fat, inhibiting hepatic glucose production. Other actions: inhibition of lypolysis and proteolysis, enhanced protein synthesis. Sources may be pork (Iletin II) or biosynthetic. **Therapeutic Effects:** Control of blood glucose in diabetic patients.

Pharmacokinetics

Absorption: Rapidly absorbed from subcutaneous administration sites.
Distribution: Widely distributed.
Metabolism and Excretion: Metabolized by liver, spleen, kidney, and muscle.
Half-life: 5–6 min (prolonged in patients with diabetes; biologic half-life is 1–1.5 hr;).

TIME/ACTION PROFILE (hypoglycemic effect)

ROUTE	ONSET	PEAK	DURATION
Regular insulin IV	10–30 min	15–30 min	30–60 min
Regular insulin subcut	30–60 min	2–4 hr	5–7 hr

Contraindications/Precautions

Contraindicated in: Hypoglycemia. Allergy or hypersensitivity to a particular type of insulin, preservatives, or other additives.
Use Cautiously in: Stress, pregnancy, and infection (may temporarily alter insulin requirements).

Adverse Reactions/Side Effects

Derm: urticaria. **Endo:** HYPOGLYCEMIA, rebound hyperglycemia (Somogyi effect). **Local:** lipodystrophy (lipoatrophy, lipohypertropy), itching, redness, swelling. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: Glucose lowering effects may be ↓ by **corticosteroids, danazol, diazoxide, diuretics, sympathomimetic (adrenergic) agents, phenothaizines, somatropin, thyoroid preparations, estrogens, progestins, protease inhibitor antiretrovirals,** and **atypical antipsychotics** including **olanzapine, quetiapine, clozapine, risperidone, aripiprazole** and **ziprasidone**. Blood glucose lowering effects and the risk of hypoglycemia may be ↑ by **oral antidiabetic agents, ACE inhibitors, disopyramide, fibrates, salicylates, fluoxetine, MAO inhibitors, pentoxiphylline, propoxyphene** and **sulfonamides. Beta blockers,** and **reserpine** may block some signs of and delay recovery from hypoglycemia.
Drug-Natural Products: Glucosamine may worsen blood glucose control. **Chromium** and **coenzyme Q-10** may produce additive hypoglycemic effects.

Route/Dosage

Dose depends on blood glucose, response, and many other factors.

IV (Children): Individualized on the basis of patient's weight.

Maintenance Therapy

Subcut: (Adults and Children): 0.5–1 unit/kg/day. *Adolescents during rapid growth*—0.8–1.2 units/kg/day.

NURSING IMPLICATIONS

Assessment

- Assess patient for signs and symptoms of hypoglycemia (anxiety;restlessness; mood changes; tingling in hands, feet, lips, or tongue; chills; cold sweats; confusion; cool, pale skin; difficulty in concentration; drowsiness; excessive hunger; headache; irritability; nausea; nervousness; rapid pulse; shakiness; unusual tiredness or weakness) and hyperglycemia (confusion, drowsiness; flushed, dry skin; fruit-like breath odor; rapid, deep breathing, frequent urination; loss of appetite; tiredness; unusual thirst) periodically during therapy.
- Monitor body weight periodically. Changes in weight may necessitate changes in insulin dose.
- ***Lab Test Considerations:*** May cause ↓ serum inorganic phosphate, magnesium, and potassium levels.
- Monitor blood glucose and ketones every 6 hr during therapy, more frequently in ketoacidosis and times of stress. Glycosylated hemoglobin may also be monitored to determine effectiveness.
- ***Toxicity and Overdose:*** Overdose is manifested by symptoms of hypoglycemia. Mild hypoglycemia may be treated by ingestion of oral glucose. Severe hypoglycemia is a life-threatening emergency; treatment consists of IV glucose, glucagon, or epinephrine.

Potential Nursing Diagnoses

Noncompliance (Patient/Family Teaching)

- ***High Alert:*** Insulin-related medication errors have resulted in patient harm and death. Clarify ambiguous orders; do not accept orders using the abbreviation "u" for units, (can be misread as a zero or the numeral 4; has resulted in tenfold overdoses). Insulins are available in different types, strengths and from different species. Check type, species source, dose, and expiration date with another licensed nurse. Do not interchange insulins without consulting physician or other health care professional. Do not confuse regular **concentrated (U-500)** insulin with regular insulin.
- Use *only* insulin syringes to draw up dose. The unit markings on the insulin syringe must match the insulin's units/ml. Special syringes for doses <50 units are available.
- When mixing insulins, draw regular insulin into syringe first to avoid contamination of regular insulin vial. Mixed insulins should never be used in a pump or for IV infusion. ***High Alert:*** Do not mix *insulin glargine (Lantus)* with any other insulin or solution, or use syringes containing any other medicinal product or residue. If giving with a short acting insulin, use separate syringes and different injection sites. Solution should be clear and colorless with no particulate matter.
- Insulin should be stored in a cool place but does not need to be refrigerated. Do not use if cloudy, discolored, or unusually viscous.
- **Subcut:** Rotate injection sites.
- Administer into abdominal wall, thigh, or upper arm subcutaneously. Pinch skin, inject insulin, leave needle in skin for 10 seconds and remove. Gently press on spot injected for several seconds; do not rub area.
- Administer *regular insulin* within 15–30 min before a meal.
- **IV:** Regular insulin is the *only* insulin that can be administered IV. ***High Alert:*** Regular (concentrated) insulin U-500 should not be given IV.
- **Direct IV:** May be administered IV undiluted directly into vein or through Y-site. ***Rate:*** Administer up to 50 units over 1 min.
- **Continuous Infusion:** May be diluted in commonly used IV solutions as an infusion; however, insulin potency may be reduced by at least 20–80%

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INSULINS (short acting)

by the plastic or glass container or tubing before reaching the venous system. ***Rate:*** Rate should be ordered by physician, and infusion should be placed on an IV pump for accurate administration.

- Rate of administration should be decreased when serum glucose level reaches 250 mg/100 ml.
- **Y-Site Compatibility:** amiodarone, ampicillin, ampicillin-sulbactam, aztreonam, cefazolin, cefotetan, dobutamine, doxapram, esmolol, famotadine, gentamicin, heparin, imipenem-cilastatin, indomethacin, magnesium sulfate, meperidine, meropenem, midazolam, milrinone, morphine, nitroglycerin, nitroprusside, oxytocin, potassium chloride, propofol, ritodrine, sodium bicarbonate, tacrolimus, terbutaline, ticarcillin, ticarcillin/clavulanate, tobramycin, vancomycin, vitamin B complex with C.
- **Y-Site Incompatibility:**, dopamine, nafcillin, norepinephrine, ranitidine.
- **Additive Compatibility:** May be added to total parenteral nutrition (TPN) solutions.

Patient/Family Teaching

- Instruct patient on proper technique for administration. Include type of insulin, equipment (syringe, cartridge pens, alcohol swabs), storage, and place to discard syringes. Discuss the importance of not changing brands of insulin or syringes, selection and rotation of injection sites, and compliance with therapeutic regimen.
- Demonstrate technique for mixing insulins by drawing up regular insulin and rolling intermediate-acting insulin vial between palms to mix, rather than shaking (may cause inaccurate dose).
- Explain to patient that this medication controls hyperglycemia but does not cure diabetes. Therapy is long term.
- Instruct patient in proper testing of serum glucose and ketones. These tests should be closely monitored during periods of stress or illness and health care professional notified of significant changes.
- Emphasize the importance of compliance with nutritional guidelines and regular exercise as directed by health care professional.
- Advise patient to consult health care professional prior to using alcohol or other Rx, OTC, or herbal products concurrently with insulin.
- Advise patient to notify health care professional of medication regimen prior to treatment or surgery.
- Advise patient to notify health care professional if nausea, vomiting, or fever develops, if unable to eat regular diet, or if blood glucose levels are not controlled.
- Instruct patient on signs and symptoms of hypoglycemia and hyperglycemia and what to do if they occur.
- Advise patient to notify health care professional if pregnancy is planned or suspected.
- Patients with diabetes mellitus should carry a source of sugar (candy, sugar packets) and identification describing their disease and treatment regimen at all times.
- Emphasize the importance of regular follow-up, especially during first few weeks of therapy.

Evaluation/Desired Outcomes

- Control of blood glucose levels without the appearance of hypoglycemic or hyperglycemic episodes.

Why was this drug prescribed for your patient?

INSULINS (intermediate-acting) (in-su-lin)

NPH insulin (isophane insulin suspension)

Humulin N, NPH Iletin II, 🍁Novolin ge NPH, Novolin N

insulin zinc suspension (lente insulin)

Humulin L, Lente Iletin II, 🍁Novolin ge Lente

Classification

Therapeutic: antidiabetics, hormones
Pharmacologic: pancreatics

Pregnancy Category B

Indications

Treatment of diabetes mellitus. Intemediate-acting insulins cannot be used for the acute treatment of diabetic ketoacidosis.

Action

Lower blood glucose by stimulating glucose uptake in skeletal muscle and fat, inhibiting hepatic glucose production. Other actions: inhibition of lypolysis and proteolysis, enhanced protein synthesis. Sources may be pork (Iletin II products) or biosynthetic. **Therapeutic Effects:** Control of blood glucose in diabetic patients.

Pharmacokinetics

Absorption: Well absorbed from subcutaneous administration sites; rate of absorption may vary by site or volume of injection and other factors.
Distribution: Widely distributed.
Metabolism and Excretion: Metabolized by liver, spleen, kidney, and muscle.
Half-life: 5–6 min (prolonged in patients with diabetes; biologic half-life is 1–1.5 hr.

ROUTE	ONSET	PEAK	DURATION
NPH	1–2 hr	4–12 hr	18–24 hr
Lente	1–3 hr	8–12 hr	18–28 hr

Contraindications/Precautions

Contraindicated in: Hypoglycemia. Allergy or hypersensitivity to a particular type of insulin, preservatives, or other additives.
Use Cautiously in: Stress, pregnancy, and infection (may temporarily alter insulin requirements).

Adverse Reactions/Side Effects

Derm: urticaria. **Endo:** HYPOGLYCEMIA, rebound hyperglycemia (Somogyi effect). **Local:** lipodystrophy (lipoatrophy, lipohypertropy), itching, redness, swelling. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: Glucose lowering effects may be ↓ by **corticosteroids, danazol, diazoxide, diuretics, sympathomimetic (adrenergic) agents, phenothaizines, somatropin, thyoroid preparations, estrogens, progestins, protease inhibitor antiretrovirals,** and **atypical antipsychotics** including **olanzapine, quetiapine, clozapine, risperidone, aripiprazole** and **ziprasidone**. Blood glucose lowering effects and the risk of hypoglycemia may be ↑ by **oral antidiabetic agents, ACE inhibitors, disopyramide, fibrates, salicylates, fluoxetine, MAO inhibitors, pentoxiphylline, propoxyphene** and **sulfonamides. Beta blockers,** and **reserpine** may block some signs of and delay recovery from hypoglycemia.
Drug-Natural Products: Glucosamine may worsen blood glucose control; **chromium** and **coenzyme Q-10** may produce additive hypoglycemic effects.

Route/Dosage

Dose depends on blood glucose, response, and many other factors.

Subcut: (Adults and Children): 0.5–1 unit/kg/day. *Adolescents during rapid growth*—0.8–1.2 units/kg/day.

NURSING IMPLICATIONS

Assessment

- Assess patient for signs and symptoms of hypoglycemia (anxiety; restlessness; mood changes; tingling in hands, feet, lips, or tongue; chills; cold sweats; confusion; cool, pale skin; difficulty in concentration; drowsiness; excessive hunger; headache; irritability; nausea; nervousness; rapid pulse; shakiness; unusual tiredness or weakness) and hyperglycemia (confusion, drowsiness; flushed, dry skin; fruit-like breath odor; rapid, deep breathing, frequent urination; loss of appetite; tiredness; unusual thirst) periodically during therapy.
- Monitor body weight periodically. Changes in weight may necessitate changes in insulin dose.
- ***Lab Test Considerations:*** May cause ↓ serum inorganic phosphate, magnesium, and potassium levels.
- Monitor blood glucose and ketones every 6 hr during therapy, more frequently in ketoacidosis and times of stress. Glycosylated hemoglobin may also be monitored to determine effectiveness.
- ***Toxicity and Overdose:*** Overdose is manifested by symptoms of hypoglycemia. Mild hypoglycemia may be treated by ingestion of oral glucose. Severe hypoglycemia is a life-threatening emergency; treatment consists of IV glucose, glucagon, or epinephrine.

Potential Nursing Diagnoses

Noncompliance (Patient/Family Teaching)

Implementation

- ***High Alert:*** Insulin-related medication errors have resulted in patient harm and death. Clarify ambiguous orders; do not accept orders using the abbreviation "u" for units, (can be misread as a zero or the numeral 4; has resulted in tenfold overdoses).
- Insulins are available in different types, strengths and from different species. Check type, species source, dose, and expiration date with another licensed nurse. Do not interchange insulins without consulting physician or other health care professional.
- Do not confuse Lantus insulin with Lente insulin. Do not confuse regular concentrated (U-500) insulin with regular insulin.
- Use *only* insulin syringes to draw up dose. The unit markings on the insulin syringe must match the insulin's units/ml.
- When mixing insulins, draw regular insulin, insulin aspart, insulin glulisine, or insulin lispro into syringe first to avoid contamination of regular insulin vial. Mix insulin glulisine *only* with NPH insulin. Mixed insulins should never be used in a pump or for IV infusion.
- Insulin should be stored in a cool place but does not need to be refrigerated. Do not use if cloudy, discolored, or unusually viscous.
- Because of short duration of *insulin lispro insulin glulisine* and *insulin aspart*, supplementation with longer-acting insulin may be necessary to control blood glucose levels.
- When transferring from once-daily NPH human insulin or ultralente insulin to *insulin glargine*, the dose usually remains unchanged. When transferring from twice-daily NPH human insulin to insulin glargine, the initial dose of insulin glargine is usually reduced by 20%.
- NPH, lente and ultralente insulins should not be used in the management of ketoacidosis.
- **Subcut:** Rotate injection sites.
- Administer into abdominal wall, thigh, or upper arm subcutaneously. Pinch skin, inject insulin, leave needle in skin for 10 seconds and remove. Gently press on spot injected for several seconds; do not rub area.
- Administer *lente insulin* within 30 min before a meal.
- Administer *NPH insulin* and *ultralente insulin* within 30–60 min before a meal.

Patient/Family Teaching

- Instruct patient on proper technique for administration. Include type of insulin, equipment (syringe, cartridge pens, alcohol swabs), storage, and

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INSULINS (intermediate-acting)

place to discard syringes. Discuss the importance of not changing brands of insulin or syringes, selection and rotation of injection sites, and compliance with therapeutic regimen.
- Demonstrate technique for mixing insulins by drawing up regular insulin, insulin aspart, or insulin lispro first and rolling intermediate-acting insulin vial between palms to mix, rather than shaking (may cause inaccurate dose).
- Explain to patient that this medication controls hyperglycemia but does not cure diabetes. Therapy is long term.
- Instruct patient in proper testing of serum glucose and ketones. These tests should be closely monitored during periods of stress or illness and health care professional notified of significant changes.
- Emphasize the importance of compliance with nutritional guidelines and regular exercise as directed by health care professional.
- Advise patient to consult health care professional prior to using alcohol or other Rx, OTC, or herbal products concurrently with insulin.
- Advise patient to notify health care professional of medication regimen prior to treatment or surgery.
- Advise patient to notify health care professional if nausea, vomiting, or fever develops, if unable to eat regular diet, or if blood glucose levels are not controlled.
- Instruct patient on signs and symptoms of hypoglycemia and hyperglycemia and what to do if they occur.
- Advise patient to notify health care professional if pregnancy is planned or suspected.
- Patients with diabetes mellitus should carry a source of sugar (candy, sugar packets) and identification describing their disease and treatment regimen at all times.
- Emphasize the importance of regular follow-up, especially during first few weeks of therapy.

Evaluation/Desired Outcomes
- Control of blood glucose levels without the appearance of hypoglycemic or hyperglycemic episodes.

Why was this drug prescribed for your patient?

High Alert

INSULINS (long-acting) (in-su-lin)

insulin detemir
Levemir

insulin zinc suspension, extended (ultralente insulin)
Humulin U Ultralente, ♣Novolin de Ultralente, Novolin U, Ultralente U

insulin glargine
Lantus

Classification
Therapeutic: antidiabetics, hormones
Pharmacologic: pancreatics

Pregnancy Category B (insulin zinc suspension), C (insulin detemir, insulin glargine)

Indications
Treatment of diabetes mellitus; due to delayed and prolonged duration, cannot be used in the acute treatment of diabetic ketoacidosis.

Action
Lower blood glucose by stimulating glucose uptake in skeletal muscle and fat, inhibiting hepatic glucose production. Other actions: inhibition of lypolysis and proteolysis, enhanced protein synthesis. **Therapeutic Effects:** Control of blood glucose in diabetic patients.

Pharmacokinetics
Absorption: Physiochemical characteristics of long-acting insulins result in delayed and prolonged absorption.
Distribution: Widely distributed.
Metabolism and Excretion: Metabolized by liver, spleen, kidney, and muscle.
Half-life: 5–6 min (prolonged in patients with diabetes); biologic half-life is 1–1.5 hr; *insulin detemir* 5–7 hr (dose-dependent).

TIME/ACTION PROFILE (hypoglycemic effect)

ROUTE	ONSET	PEAK	DURATION
Insulin detemir	within 2 hr	3–14 hr	24 hr
Insulin glargine	1.1 hr	5 hr‡	24 hr
Ultralente insulin	4–6 hr	18–24 hr	36 hr

‡Small amounts of insulins glargine and detemir are slowly released resulting in a relatively constant effect over time

Contraindications/Precautions
Contraindicated in: Hypoglycemia. Allergy or hypersensitivity to a particular type of insulin, preservatives, or other additives.
Use Cautiously in: Stress, pregnancy, and infection (may temporarily alter insulin requirements).

Adverse Reactions/Side Effects
Derm: urticaria. **Endo:** HYPOGLYCEMIA, rebound hyperglycemia (Somogyi effect). **Local:** lipodystrophy (lipoatrophy, lipohypertropy), itching, redness, swelling. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions
Drug-Drug: Glucose lowering effects may be ↓ by **corticosteroids, danazol, diazoxide, diuretics, sympathomimetic (adrenergic) agents, phenothaizines, somatropin, thyoroid preparations, estrogens, progestins, protease inhibitor antiretrovirals,** and **atypical antipsychotics** including **olanzapine, quetiapine, clozapine, risperidone, aripiprazole** and **ziprasidone**. Blood glucose lowering effects and the risk of hypoglycemia may be ↑ by **oral antidiabetic agents, ACE inhibitors, disopyramide, fibrates, salicylates, fluoxetine, MAO inhibitors, pentoxiphylline, propoxyphene** and **sulfonamides. Beta block-**

ers, and **reserpine** may block some signs of and delay recovery from hypoglycemia.
Drug-Natural Products: Glucosamine may worsen blood glucose control. **Chromium**, and **coenzyme Q-10** may produce additive hypoglycemic effects.

Route/Dosage

Dose depends on blood glucose, response, and many other factors.
Subcut: (Adults and Children): 0.5–1 unit/kg/day. *Adolescents during rapid growth*—0.8–1.2 units/kg/day.

NURSING IMPLICATIONS

Assessment

- Assess patient for signs and symptoms of hypoglycemia (anxiety; restlessness; mood changes; tingling in hands, feet, lips, or tongue; chills; cold sweats; confusion; cool, pale skin; difficulty in concentration; drowsiness; excessive hunger; headache; irritability; nausea; nervousness; rapid pulse; shakiness; unusual tiredness or weakness) and hyperglycemia (confusion, drowsiness; flushed, dry skin; fruit-like breath odor; rapid, deep breathing, frequent urination; loss of appetite; tiredness; unusual thirst) periodically during therapy.
- Monitor body weight periodically. Changes in weight may necessitate changes in insulin dose.
- ***Lab Test Considerations:*** May cause ↓ serum inorganic phosphate, magnesium, and potassium levels.
- Monitor blood glucose and ketones every 6 hr during therapy, more frequently in ketoacidosis and times of stress. Glycosylated hemoglobin may also be monitored to determine effectiveness.
- ***Toxicity and Overdose:*** Overdose is manifested by symptoms of hypoglycemia. Mild hypoglycemia may be treated by ingestion of oral glucose. Severe hypoglycemia is a life-threatening emergency; treatment consists of IV glucose, glucagon, or epinephrine. Recovery from hypoglycemia may be delayed due to the prolonged effect of subcutaneous *insulin glargine*.

Potential Nursing Diagnoses

Noncompliance (Patient/Family Teaching)

Implementation

- ***High Alert:*** Insulin-related medication errors have resulted in patient harm and death. Clarify ambiguous orders; do not accept orders using the abbreviation "u" for units, (can be misread as a zero or the numeral 4; has resulted in tenfold overdoses).
- Insulins are available in different types, strengths and from different species. Check type, species source, dose, and expiration date with another licensed nurse. Do not interchange insulins without consulting physician or other health care professional.
- Do not confuse Lantus insulin with Lente insulin. Do not confuse regular concentrated (U-500) insulin with regular insulin.
- Use *only* insulin syringes to draw up dose. The unit markings on the insulin syringe must match the insulin's units/ml. Special syringes for doses <50 units are available. Insulin syringe or OptiPen One can be used for administration of *insulin glargine*. Prior to withdrawing dose, rotate vial between palms to ensure uniform solution; do not shake.
- ***High Alert:*** Do not mix *insulin glargine (Lantus) or detemir (Levemir)* with any other insulin or solution, or use syringes containing any other medicinal product or residue. If giving with a short acting insulin, use separate syringes and different injection sites. Solution should be clear and colorless with no particulate matter.
- Insulin should be stored in a cool place but does not need to be refrigerated. Do not use if cloudy, discolored, or unusually viscous. Store unopened vials and cartridges of *insulin glargine and insulin detemir* in the refrigerator; do not freeze. If unable to refrigerate, the 10-ml vial of insulin glargine can be kept in a cool place unrefrigerated for up to 28 days, and the 5-ml vial, up to 14 days. Once the cartridge is placed in an OptiPen One, do not refrigerate. After initial use vials of insulin detemir.

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INSULINS (long-acting)

cartridges *(PenFill)* or a prefilled syringe may be stored in a cool place for 42 days. Do not store in-use cartridges and pre-filled syringes in refrigerator or with needle in place. Keep away from direct heat and sunlight.

- When transferring from once-daily NPH human insulin or ultralente insulin to *insulin glargine*, the dose usually remains unchanged. When transferring from twice-daily NPH human insulin to insulin glargine, the initial dose of insulin glargine is usually reduced by 20%.
- NPH, lente and ultralente insulins should not be used in the management of ketoacidosis.
- **Subcut:** Rotate injection sites.
- Administer *ultralente insulin* within 30–60 min before a meal.
- Administer *insulin glargine* once daily at the same time each day.
- Administer *daily insulin detemir* with evening meal or at bedtime. Administer *twice daily insulin detemir* evening dose with evening meal, at bedtime, or 12 hrs after morning dose.

Patient/Family Teaching

- Instruct patient on proper technique for administration. Include type of insulin, equipment (syringe, cartridge pens, alcohol swabs), storage, and place to discard syringes. Discuss the importance of not changing brands of insulin or syringes, selection and rotation of injection sites, and compliance with therapeutic regimen. Patients taking insulin detemir should be given the *Patient Information* circular for this product.
- Explain to patient that this medication controls hyperglycemia but does not cure diabetes. Therapy is long term.
- Instruct patient in proper testing of serum glucose and ketones. These tests should be closely monitored during periods of stress or illness and health care professional notified of significant changes.
- Emphasize the importance of compliance with nutritional guidelines and regular exercise as directed by health care professional.
- Advise patient to consult health care professional prior to using alcohol or other Rx, OTC, or herbal products concurrently with insulin.
- Advise patient to notify health care professional of medication regimen prior to treatment or surgery.
- Advise patient to notify health care professional if nausea, vomiting, or fever develops, if unable to eat regular diet, or if blood glucose levels are not controlled.
- Instruct patient on signs and symptoms of hypoglycemia and hyperglycemia and what to do if they occur.
- Advise patient to notify health care professional if pregnancy is planned or suspected.
- Patients with diabetes mellitus should carry a source of sugar (candy, sugar packets) and identification describing their disease and treatment regimen at all times.
- Emphasize the importance of regular follow-up, especially during first few weeks of therapy.

Evaluation/Desired Outcomes

- Control of blood glucose levels without the appearance of hypoglycemic or hyperglycemic episodes.

Why was this drug prescribed for your patient?

High Alert

INSULINS (rapid acting) (in-su-lin)

insulin aspart, rDNA origin

Novolog

insulin lispro, rDNA origin

Humalog

insulin glulisine

Apidra

Classification

Therapeutic: antidiabetics, hormones
Pharmacologic: pancreatics

Pregnancy Category B

Indications

Treatment of diabetes mellitus. These subcutaneous insulins have a more rapid onset and shorter duration than regular insulin.

Action

Lower blood glucose by stimulating glucose uptake in skeletal muscle and fat, inhibiting hepatic glucose production. Other actions: inhibition of lypolysis and proteolysis, enhanced protein synthesis. **Therapeutic Effects:** Control of blood glucose in diabetic patients.

Pharmacokinetics

Absorption: Rapidly absorbed.
Distribution: Widely distributed.
Metabolism and Excretion: Metabolized by liver, spleen, kidney, and muscle.
Half-life: 5–6 min (prolonged in patients with diabetes; biologic half-life is 1–1.5 hr; *insulin glulisine—42 min*).

TIME/ACTION PROFILE (hypoglycemic effect)

ROUTE	ONSET	PEAK	DURATION
Insulin aspart subcutaneous	15 min	1–3 hr	3–5 hr
Insulin glulisine subcutaneous	within 15 min	1 hr	2 hr
Insulin lispro subcutaneous	15–30 min	0.5–2.5 hr	3–6.5 hr

Contraindications/Precautions

Contraindicated in: Hypoglycemia. Allergy or hypersensitivity to a particular type of insulin, preservatives, or other additives.
Use Cautiously in: Stress, pregnancy, and infection (may temporarily alter insulin requirements).

Adverse Reactions/Side Effects

Derm: urticaria. **Endo:** HYPOGLYCEMIA, rebound hyperglycemia (Somogyi effect). **Local:** lipodystrophy (lipoatrophy, lipohypertropy), itching, redness, swelling. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: Glucose lowering effects may be ↓ by **corticosteroids**, **danazol**, **diazoxide**, **diuretics**, **sympathomimetic (adrenergic) agents**, **phenothaizines**, **somatropin**, **thyoroid preparations**, **estrogens**, **progestins**, **protease inhibitor antiretrovirals**, and **atypical antipsychotics** including **olanzapine**, **quetiapine**, **clozapine**, **risperidone**, **aripiprazole** and **ziprasidone**. Blood glucose lowering effects and the risk of hypoglycemia may be ↑ by **oral antidiabetic agents**, **ACE inhibitors**, **disopyramide**, **fibrates**, **salicylates**, **fluoxetine**, **MAO inhibitors**, **pentoxiphylline**, **propoxyphene** and **sulfonamides**. **Beta blockers** and **reserpine** may block some signs of and delay recovery from hypoglycemia.

Drug-Natural Products: Glucosamine may worsen blood glucose control. **Chromium** and **coenzyme Q-10** may produce additive hypoglycemic effects.

Route/Dosage

Dose depends on blood glucose, response, and many other factors.
Subcut: (Adults and Children): 0.5–1 unit/kg/day. *Adolescents during rapid growth*—0.8–1.2 units/kg/day.

NURSING IMPLICATIONS

Assessment

- Assess patient for signs and symptoms of hypoglycemia (anxiety; restlessness; mood changes; tingling in hands, feet, lips, or tongue; chills; cold sweats; confusion; cool, pale skin; difficulty in concentration; drowsiness; excessive hunger; headache; irritability; nausea; nervousness; rapid pulse; shakiness; unusual tiredness or weakness) and hyperglycemia (confusion, drowsiness; flushed, dry skin; fruit-like breath odor; rapid, deep breathing, frequent urination; loss of appetite; tiredness; unusual thirst) periodically during therapy.
- Monitor body weight periodically. Changes in weight may necessitate changes in insulin dose.
- **Insulin glulisine:** Assess patient for signs of allergic reactions (rash, shortness of breath, wheezing, rapid pulse, sweating, low blood pressure) during therapy.
- ***Lab Test Considerations:*** May cause ↓ serum inorganic phosphate, magnesium, and potassium levels.
- Monitor blood glucose and ketones every 6 hr during therapy, more frequently in ketoacidosis and times of stress. Glycosylated hemoglobin may also be monitored to determine effectiveness.
- ***Toxicity and Overdose:*** Overdose is manifested by symptoms of hypoglycemia. Mild hypoglycemia may be treated by ingestion of oral glucose. Severe hypoglycemia is a life-threatening emergency; treatment consists of IV glucose, glucagon, or epinephrine.

Potential Nursing Diagnoses

Noncompliance (Patient/Family Teaching)

Implementation

- ***High Alert:*** Insulin-related medication errors have resulted in patient harm and death. Clarify ambiguous orders; do not accept orders using the abbreviation "u" for units, (can be misread as a zero or the numeral 4; has resulted in tenfold overdoses).
- Insulins are available in different types, strengths and from different species. Check type, species source, dose, and expiration date with another licensed nurse. Do not interchange insulins without consulting physician or other health care professional.
- Use *only* insulin syringes to draw up dose. The unit markings on the insulin syringe must match the insulin's units/ml. Special syringes for doses <50 units are available. Use *only* U-100 insulin syringes to draw up *insulin lispro* and *insulin glulisine* doses.
- When mixing insulins, draw insulin aspart, insulin glulisine, or insulin lispro into syringe first to avoid contamination of rapid-acting insulin vial. Mix insulin glulisine *only* with NPH insulin. Mixed insulins should never be used in a pump or for IV infusion.
- Insulin should be stored in a cool place but does not need to be refrigerated. Do not use if cloudy, discolored, or unusually viscous.Cartridges or vials of *insulin aspart* may be kept at room temperature for up to 28 days if kept from excessive heat and sunlight.
- Because of short duration of *insulin lispro insulin glulisine* and *insulin aspart*, supplementation with longer-acting insulin may be necessary to control blood glucose levels.
- **Subcut:** Rotate injection sites. Administer *insulin aspart* in the abdominal wall, thigh, or upper arm within 5–10 min before a meal.
- When used as meal time insulin, administer *insulin glulisine* 15 min before or within 20 min after starting a meal. Administer into abdominal wall, thigh, or upper arm subcutaneously. Pinch skin, inject insulin, leave needle in skin for 10 seconds and remove. Gently press on spot injected

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INSULINS (rapid acting)

for several seconds; do not rub area. Administer *insulin lispro* within 15 min before a meal.

- For administration via infusion pump, administer *insulin glulisine* as a subcutaneous infusion into abdominal wall. Solution is stable for 48 hr and at temperatures not higher than 98.6°F. Discard infusion sets (reservoirs, tubing, catheters) after no more than 48 hr. Infusion sites that are erythematous, pruritic or thickened should be reported to health care professional and a new site selected; continued infusion may increase skin reaction and alter absorption of insulin glulisine. Do not dilute or mix insulin glulisine with any other insulin.

Patient/Family Teaching

- Instruct patient on proper technique for administration. Include type of insulin, equipment (syringe, cartridge pens, alcohol swabs), storage, and place to discard syringes. Discuss the importance of not changing brands of insulin or syringes, selection and rotation of injection sites, and compliance with therapeutic regimen.
- Caution patient taking *insulin glulisine* not to make any changes in type of insulin or dose without consulting health care professional. Advise patient to read the Patient Information prior to use and each time prescription is refilled.
- Demonstrate technique for mixing insulins by drawing up regular insulin, insulin aspart, or insulin lispro first and rolling intermediate-acting insulin vial between palms to mix, rather than shaking (may cause inaccurate dose).
- Explain to patient that this medication controls hyperglycemia but does not cure diabetes. Therapy is long term.
- Instruct patient in proper testing of serum glucose and ketones. These tests should be closely monitored during periods of stress or illness and health care professional notified of significant changes.
- Emphasize the importance of compliance with nutritional guidelines and regular exercise as directed by health care professional.
- Advise patient to consult health care professional prior to using alcohol or other Rx, OTC, or herbal products concurrently with insulin.
- Advise patient to notify health care professional of medication regimen prior to treatment or surgery.
- Advise patient to notify health care professional if nausea, vomiting, or fever develops, if unable to eat regular diet, or if blood glucose levels are not controlled.
- Instruct patient on signs and symptoms of hypoglycemia and hyperglycemia and what to do if they occur.
- Advise patient to notify health care professional if pregnancy is planned or suspected.
- Patients with diabetes mellitus should carry a source of sugar (candy, sugar packets) and identification describing their disease and treatment regimen at all times.
- Emphasize the importance of regular follow-up, especially during first few weeks of therapy.

Evaluation/Desired Outcomes

- Control of blood glucose levels without the appearance of hypoglycemic or hyperglycemic episodes.

Why was this drug prescribed for your patient?

ipratropium (i-pra-**troe**-pee-um)

Atrovent HFA

Classification

Therapeutic: allergy, cold, and cough remedies, bronchodilators
Pharmacologic: anticholinergics

Pregnancy Category B

Indications

Inhaln: Maintenance therapy of reversible airway obstruction caused by COPD. **Intranasal:** Management of rhinorrhea associated with allergic and nonallergic perennial rhinitis (0.03% solution) or the common cold (0.06% solution).

Action

Inhaln: Inhibits cholinergic receptors in bronchial smooth muscle, resulting in decreased concentrations of cyclic guanosine monophosphate (cGMP). Decreased levels of cGMP produce local bronchodilation. **Intranasal:** Local application inhibits secretions from glands lining the nasal mucosa. **Therapeutic Effects: Inhaln:** Bronchodilation without systemic anticholinergic effects. **Intranasal:** Decreased rhinorrhea.

Pharmacokinetics

Absorption: Minimal systemic absorption (2% for inhalation solution; 20% for inhalation aerosol; <20% after nasal use).
Distribution: Does not appear to cross the blood-brain barrier.
Metabolism and Excretion: Small amounts absorbed are metabolized by the liver.
Half-life: 2 hr.

TIME/ACTION PROFILE (relief of symptoms)

ROUTE	ONSET	PEAK	DURATION
Inhalation	5–15 min	1–2 hr	3–4 hr (up to 8 hr)
Intranasal	15 min	within 1 hr	6–12 hr

Contraindications/Precautions

Contraindicated in: Hypersensitivity to ipratropium, atropine, belladonna alkaloids, or fluorocarbons. Acute bronchospasm. Peanut or soy allergy (inhaler contains soy lecithin).
Use Cautiously in: Bladder neck obstruction; Prostatic hypertrophy; Glaucoma; Urinary retention; Geriatric patients (may be more sensitive to effects); Pregnancy, lactation, or children <5 yr (safety not established).

Adverse Reactions/Side Effects

CNS: dizziness, headache, nervousness. **EENT:** blurred vision, epistaxis, nasal dryness/irritation, sore throat. **Resp:** bronchospasm, cough. **CV:** hypotension, palpitations. **GI:** GI irritation, nausea. **Derm:** rash. **Misc:** allergic reactions.

Interactions

Drug-Drug: Potential ↑ fluorocarbon toxicity when used with other **inhalation bronchodilators having a fluorocarbon propellant.** ↑ anticholinergic properties with other **drugs having anticholinergic properties (antihistamines, phenothiazines, disopyramide).**

Route/Dosage

Inhaln (Adults): *Metered-dose inhaler*—1–4 inhalations 3–4 times daily (not to exceed 24 inhalations/24 hr or more frequent than q 4 hr). During initial therapy, up to 8 inhalations may be repeated. During acute exacerbations 6–8 inhalations q 3–4 hr using a spacer device may be needed. *Via nebulization*—250–500 mcg 3–4 times daily given q 6–8 hr as needed (up to 500 mcg q 4 hr).
Inhaln (Children 5–12 yr): *Via nebulization*—125–250 mcg 3–4 times daily given q 4–6 hr as needed. *Metered dose inhaler*—1–2 inhalations q 6–8 hr as needed.
Intranasal (Adults and Children ≥12 yr): *Perennial rhinitis*—2 sprays of 0.03% solution in each nostril 2–3 times daily (21 mcg/spray); *common cold*—2 sprays of 0.06% solution in each nostril 3–4 times daily (42 mcg/spray) for up to 4 days.

Intranasal (Children 5–11 yr): *Perennial rhinitis*—2 sprays of 0.03% solution in each nostril 2–3 times daily (21 mcg/spray); *common cold*—2 sprays of 0.06% solution in each nostril 3 times daily (42 mcg/spray).

NURSING IMPLICATIONS

Assessment

- Assess for allergy to atropine and belladonna alkaloids; patients with these allergies may also be sensitive to ipratropium. Assess for peanut or soy allergy (inhaler contains soy lecithin).
- **Inhaln:** Assess respiratory status (rate, breath sounds, degree of dyspnea, pulse) before administration and at peak of medication. Consult physician or other health care professional about alternative medication if severe bronchospasm is present; onset of action is too slow for patients in acute distress. If paradoxical bronchospasm (wheezing) occurs, withhold medication and notify physician or other health care professional immediately.
- **Nasal Spray:** Assess patient for rhinorrhea.

Potential Nursing Diagnoses

Ineffective airway clearance (Indications)
Activity intolerance (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- Do not confuse Atrovent (ipratropium) with Alupent (metaproterenol).
- **Inhaln:** When ipratropium is administered concurrently with other inhalation medications, administer adrenergic bronchodilators first, followed by ipratropium, then corticosteroids. Wait 5 min between medications.
- Solution for *nebulization* can be mixed with albuterol or metaproterenol if used within 1 hr of mixing.

Patient/Family Teaching

- Instruct patient in proper use of inhaler, nebulizer, or nasal spray and to take medication as directed. Take missed doses as soon as remembered unless almost time for the next dose; space remaining doses evenly during day. Do not double doses.
- Advise patient that rinsing mouth after using inhaler, good oral hygiene, and sugarless gum or candy may minimize dry mouth. Health care professional should be notified if stomatitis occurs or if dry mouth persists for more than 2 wk.
- **Inhalation:** Caution patient not to exceed 12 doses within 24 hr. Patient should notify health care professional if symptoms do not improve within 30 min after administration of medication or if condition worsens.
- Explain need for pulmonary function tests prior to and periodically during therapy to determine effectiveness of medication.
- Caution patient to avoid spraying medication in eyes; may cause blurring of vision or irritation.
- Advise patient to inform health care professional if cough, nervousness, headache, dizziness, nausea, or GI distress occurs.
- **Nasal Spray:** Instruct patient in proper use of nasal spray. Clear nasal passages gently before administration. Do not inhale during administration, so medication remains in nasal passages. Prime pump initially with 7 actuations. If used regularly, no further priming is needed. If not used in 24 hr, prime with 2 actuations. If not used for >7 days, prime with 7 actuations.
- Advise patient to contact health care professional if symptoms do not improve within 1–2 wk or if condition worsens.

Evaluation/Desired Outcomes

- Decreased dyspnea
- Improved lung sounds.
- Decrease in rhinorrhea from perennial rhinitis or the common cold.

Why was this drug prescribed for your patient?

irinotecan (eye-ri-noe-**tee**-kan)

Camptosar

Classification

Therapeutic: antineoplastics
Pharmacologic: enzyme inhibitors

Pregnancy Category D

Indications

Metastatic colorectal cancer (with 5-fluorouracil and leucovorin).

Action

Interferes with DNA synthesis by inhibiting topoisomerase. **Therapeutic Effects:** Death of rapidly replicating cells, particularly malignant ones.

Pharmacokinetics

Absorption: IV administration results in complete bioavailability.
Distribution: Unknown.
Protein Binding: *Irinotecan*—30–68%; *SN–38 (active metabolite)*—95%.
Metabolism and Excretion: Converted by liver to SN-38, its active metabolite, which is also liver metabolized. Small amounts renally excreted.
Half-life: 6 hr.

TIME/ACTION PROFILE (hematologic effects)

	ONSET	PEAK	DURATION
IV	unknown	21–29 days	27–34 days

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Pregnancy or lactation.
Use Cautiously in: Previous pelvic or abdominal irradiation or age ≥65 yr (increased risk of myelosuppression); Presence of infection, underlying bone marrow depression, or concurrent chronic illness; History of prior pelvic/abdominal irradiation and serum bilirubin >1–2 mg/dl (initial dosage reduction recommended); ↑ sensitivity to adverse effects (myelosuppression); initiate at lower dose; Previous severe myelosuppression or diarrhea (reinstitute at lower dose following resolution); Patients with genetically reduced UGT1A1 activity (↑ risk of neutropenia); Patients with childbearing potential; Children (safety not established).

Adverse Reactions/Side Effects

CNS: dizziness, headache, insomnia, weakness. **EENT:** rhinitis. **Resp:** coughing, dyspnea. **CV:** edema, vasodilation. **GI:** DIARRHEA, ELEVATED LIVER ENZYMES, abdominal pain/cramping, anorexia, constipation, dyspepsia, flatulence, nausea, stomatitis, vomiting, abdominal enlargement, colonic ulceration. **Derm:** alopecia, rash, sweating. **F and E:** dehydration. **Hemat:** anemia, leukopenia, thrombocytopenia. **Local:** injection site reactions. **Metab:** weight loss. **MS:** back pain. **Misc:** chills, fever.

Interactions

Drug-Drug: Combination with **fluorouracil** may result in serious toxicity (dehydration, neutropenia, sepsis). ↑ bone marrow depression may occur with other **antineoplastics** or **radiation therapy. Laxatives** should be avoided (diarrhea may be ↑). **Diuretics** ↑ risk of dehydration (may discontinue during therapy). **Dexamethasone** used as an antiemetic ↑ risk of hyperglycemia and lymphocytopenia. **Prochlorperazine** given on the same day as irinotecan ↑ risk of akathisia.
Drug-Natural Products: St. John's wort ↑ increases levels and risk of toxicity.

Route/Dosage

Other regimens are used; careful modification required for all levels of toxicity/tolerance.

Single Agent

IV (Adults): *Weekly dosage schedule*—125 mg/m² once weekly for 4 wk, followed by a 2-wk rest. *Once-every-3-wk schedule*—350 mg/m² once every 3 wk.
IV (Geriatric Patients >70 yr): Start at300 mg/m² every 3 wk.

CONTINUED

irinotecan

Patient/Family Teaching

- Instruct patient to report occurrence of diarrhea to health care professional immediately, especially if it occurs more than 24 hr after dose. **Diarrhea may be accompanied by severe dehydration and electrolyte imbalance. It may be life-threatening and should be treated promptly.**
- Instruct patient to notify health care professional promptly if fever; chills; sore throat; signs of infection; bleeding gums; bruising; petechiae; blood in urine, stool, or emesis occurs. Caution patient to avoid crowds and persons with known infections. Instruct patient to use soft toothbrush and electric razor. Caution patient not to drink alcoholic beverages or take products containing aspirin or NSAIDs.
- Instruct patient to notify nurse of pain at injection site immediately.
- Instruct patient to notify health care professional if vomiting, fainting, or dizziness occurs.
- Discuss with patient possibility of hair loss. Explore methods of coping.
- Advise patient that this medication may have teratogenic effects. Contraception should be used during therapy.
- Instruct patient not to receive any vaccinations without consulting health care professional.
- Emphasize the need for periodic lab tests to monitor for side effects.

Evaluation/Desired Outcomes

- Decrease in size and spread of malignancy.

Why was this drug prescribed for your patient?

Hepatic Impairment

IV (Adults): *Bilirubin 1–2 mg/dl and history of prior pelvic/abdominal irradiation—Weekly dosage schedule*—Start at lower dose (100 mg/m²); once weekly for 4 wk, followed by a 2-wk rest. *Once-every-3-wk schedule*—300 mg/m² once every 3 wk, dose adjusted toas low as 200 mg/m² and further adjusted in 50-mg increments.

With Leucovorin and 5-Fluorouracil

IV (Adults): *Regimen 1 (Bolus regimen)*—125 mg/m² once/wk for 4 wk, followed by 2-wk rest.; *Regimen 2(Infusional regimen)*—180 mg/m² every 2 wk for 3 doses, followed by a 3-wk rest.

NURSING IMPLICATIONS

Assessment

- Monitor vital signs frequently during administration.
- Monitor for bone marrow depression. Assess for bleeding (bleeding gums, bruising, petechiae, guaiac stools, urine, and emesis) and avoid IM injections and taking rectal temperatures if platelet count is low. Apply pressure to venipuncture sites for 10 min. Assess for signs of infection during neutropenia. Anemia may occur. Monitor for increased fatigue, dyspnea, and orthostatic hypotension.
- Monitor closely for the development of diarrhea. Two types may occur. The early type occurs within 24 hr of administration and may be preceded by cramps and sweating. Atropine 0.25–1 mg IV may be given to decrease symptoms. **Potentially life-threatening diarrhea may occur more than 24 hr after a dose and may be accompanied by severe dehydration and electrolyte imbalance. Loperamide 4 mg initially, followed by 2 mg every 2 hr until diarrhea ceases for at least 12 hr (or 4 mg every 4 hr if given during sleeping hours) should be administered promptly to treat late-occurring diarrhea. Careful fluid and electrolyte replacement should be instituted to prevent complications. Subsequent doses should be delayed in patients with active diarrhea until diarrhea is resolved for 24 hr. If diarrhea is grade 2, 3, or 4, decrease subsequent doses of irinotecan.**
- Nausea and vomiting are common. Pretreatment with dexamethasone 10 mg along with agents such as ondansetron or granisetron should be started on the same day as irinotecan at least 30 min before administration. Prochlorperazine may be used on subsequent days but may increase risk of akathisia if given on the same day as irinotecan.
- Assess IV site frequently for inflammation. Avoid extravasation. If extravasation occurs, infusion must be stopped and restarted in another vein to avoid damage to subcut tissue. Flushing site with sterile water and application of ice over the extravasated site are recommended.
- ***Lab Test Considerations:*** Monitor CBC with differential and platelet count prior to each dose. Temporarily discontinue irinotecan if absolute neutrophil count is <500 cells/mm³ or if neutropenic fever occurs. Administration of a colony-stimulating factor may be considered if clinically significant decreases in WBC (<2000/mm³), neutrophil count (<1000/mm³), hemoglobin (<9 g/dl), or platelet count (<100,000 cells/mm³) occur.
- May cause ↑ serum alkaline phosphatase and AST concentrations.

Potential Nursing Diagnoses

Risk for infection (Adverse Reactions)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- Solution should be prepared in a biologic cabinet. Wear gloves, gown, and mask while handling IV medication. Discard IV equipment in specially designated containers.
- **Intermittent Infusion:** Dilute before infusion with D5W or 0.9% NaCl for a concentration of 0.12–1.1 mg/ml. Usual diluent is 500 ml of D5W. Solution is pale yellow. Do not administer solutions that are cloudy or contain particulate matter. Solution is stable for 24 hr at room temperature or 48 hr if refrigerated. To prevent microbial contamination, solutions should be used within 24 hr of dilution if refrigerated or 6 hr at room temperature. Do not refrigerate solutions diluted with 0.9% NaCl. ***Rate:*** Administer dose over 90 min.
- **Y-Site Incompatibility:** gemcitabine.
- **Additive Incompatibility:** Information unavailable. Do not admix with other solutions or medications.

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IRON SUPPLEMENTS

carbonyl iron (100%) (**kar**-bo-nil**eye**-ern)
Feosol, Icar

ferrous fumarate (33% elemental iron)
(**fer**-us**fyoo**-ma-rate)
Femiron, Feostat, Fumasorb, Fumerin, Hemocyte, Neo-Fer, ♣Nephro-Fer, ♣Novofumar, ♣Palafer, Span-FF

ferrous gluconate (12% elemental iron)
(**fer**-us**gloo**-koe-nate)
♣Apo-Ferrous Gluconate, Fergon, Ferralet, ♣Fertinic, ♣Novoferrogluc, Simron

ferrous sulfate (30% elemental iron) (**fer**-us**sul**-fate)
♣Apo-Ferrous Sulfate, ED-IN-SOL, Fe50, Feosol, Feratab, Fer-gen-sol, Fer-In-Sol, Fer-Iron, ♣Fero-Grad, ♣Novoferrosulfa, ♣PMS Ferrous Sulfate, Slow FE

iron dextran (**eye**-ern**dex**-tran)
DexFerrum, InFeD

iron polysaccharide (**eye**-ern poll-ee-**sak**-a-ride)
Hytinic, Niferex, Nu-Iron

iron sucrose (**eye**-ern**su**-krose)
Venofer

sodium ferric gluconate complex
(**so**-dee-yum**ferr**-ic**gloo**-ko-nate)
Ferrlecit

Classification
Therapeutic: antianemics
Pharmacologic: iron supplements

Pregnancy Category B (sodium ferric gluconate, iron sucrose), C (iron dextran)

Indications

PO: Prevention/treatment of iron-deficiency anemia. **IM, IV:** *Iron dextran*—Treatment/prevention of iron-deficiency anemia in patients who cannot tolerate oral iron. *Sodium ferric gluconate complex, iron sucrose*—Treatment of iron deficiency in patients undergoing chronic hemodialysis who are concurrently receiving erythropoietin.

Action

An essential mineral found in hemoglobin, myoglobin, and many enzymes. Parenteral iron enters the bloodstream and reticuloendothelial system (liver, spleen, bone marrow), where it is separated out and becomes part of iron stores. **Therapeutic Effects:** Prevention/treatment of iron deficiency.

Pharmacokinetics

Absorption: 5–10% of dietary iron is absorbed. In deficiency states, this increases up to 30%. Therapeutically administered PO iron may be 60% absorbed; absorption is an active and passive transport process. Well absorbed following IM administration.
Distribution: Remains in the body for many months. Crosses the placenta; enters breast milk.
Metabolism and Excretion: Mostly recycled, small daily losses occurring via desquamation, sweat, urine, and bile.
Half-life: *Iron dextran, iron sucrose*—6 hr.

TIME/ACTION PROFILE (effects on erythropoiesis)

ROUTE	ONSET	PEAK	DURATION
PO	4 days	7–10 days	2–4 mo
IM, IV	4 days	1–2 wk	wk–mos

Contraindications/Precautions

Contraindicated in: Primary hemochromatosis. Hemolytic anemias and other anemias not due to iron deficiency. Some products contain alcohol, tartrazine, or sulfites and should be avoided in patients with known intolerance or hypersensitivity.

♣ = Canadian drug name.

* CAPITALS indicates life threatening, underlines indicate most frequent.

CONTINUED

IRON SUPPLEMENTS

- Assess bowel function for constipation or diarrhea. Notify physician or other health care professional and use appropriate nursing measures should these occur.
- **Iron Dextran, Iron Sucrose, and Sodium Ferric Gluconate Complex:** Monitor blood pressure and heart rate frequently following IV administration until stable. Rapid infusion rate may cause hypotension and flushing.
- **Assess patient for signs and symptoms of anaphylaxis (rash, pruritus, laryngeal edema, wheezing). Notify physician immediately if these occur. Keep epinephrine and resuscitation equipment close by in the event of an anaphylactic reaction.**
- ***Lab Test Considerations:*** Monitor hemoglobin, hematocrit, and reticulocyte values prior to and every 3 wk during the first 2 mo of therapy and periodically thereafter. Serum ferritin and iron levels may also be monitored to assess effectiveness of therapy.
- Occult blood in stools may be obscured by black coloration of iron in stool. Guaiac test results may occasionally be false-positive. Benzidine test results are not affected by iron preparations.
- **Iron Dextran:** Monitor hemoglobin, hematocrit, reticulocyte values, transferrin, ferritin, total iron-binding capacity, and plasma iron concentrations periodically during therapy. Serum ferritin levels peak in 7–9 days and return to normal in 3 wk. Serum iron determinations may be inaccurate for 1–2 wk after therapy with large doses; therefore, hemoglobin and hematocrit are used to gauge initial response. Normal hemoglobin concentrations of 14.8 g/100 ml should be used for patients weighing >15 kg, while 12 g/100 ml should be used for patients weighing 15 kg or less.
- May impart a brownish hue to blood drawn within 4 hr of administration. May cause false ↑ in serum bilirubin and false decrease in serum calcium values.
- Prolonged PTT may be calculated when blood sample is anticoagulated with citrate dextrose solution; use sodium citrate instead.
- **Iron Sucrose:** Monitor hemoglobin, hematocrit, serum ferritin, and transferritin saturation prior to and periodically during therapy. Transferrin saturation values increase rapidly after IV administration; therefore, serum iron values may be reliably obtained 48 hr after IV administration. Withhold iron therapy if evidence of iron overload occurs.
- May cause ↑ liver enzymes.
- ***Toxicity and Overdose:*** Early symptoms of overdose include stomach pain, fever, nausea, vomiting (may contain blood), and diarrhea. Late symptoms include bluish lips, fingernails, and palms; drowsiness; weakness; tachycardia; seizures; metabolic acidosis; hepatic injury; and cardiovascular collapse. Patient may appear to recover prior to the onset of late symptoms. Therefore, hospitalization continues for 24 hr after patient becomes asymptomatic to monitor for delayed onset of shock or GI bleeding. Late complications of overdose include intestinal obstruction, pyloric stenosis, and gastric scarring. Treatment includes inducing emesis with syrup of ipecac. If patient is comatose or seizing, gastric lavage with sodium bicarbonate is performed. Deferoxamine is the antidote. Additional supportive treatments to maintain fluid and electrolyte balance and correction of metabolic acidosis are also indicated. If signs of overdose occur during IV administration of iron sucrose, administration at a slower rate usually relieves symptoms.

Implementation

- Oral iron preparations should be discontinued prior to parenteral administration.
- Ferrlecit is for IV use only.

♣ = Canadian drug name.

* CAPITALS indicates life threatening, underlines indicate most frequent.

Use Cautiously in: PO: Peptic ulcer; Ulcerative colitis; regional enteritis (may aggravate condition); Indiscriminate chronic use; Autoimmune disorders/arthritis (↑ risk of allergic reactions—IM, IV only)
Exercise Extreme Caution in: Patients with severe liver impairment (IM, IV only).

Adverse Reactions/Side Effects

CNS: IM, IV: SEIZURES, dizziness, headache, syncope. **CV: IM, IV:** hypotension, tachycardia. **GI:** nausea. **PO:** constipation, dark stools, diarrhea, epigastric pain, GI bleeding. **IM, IV:** taste disorder, vomiting. **Derm: IM, IV:** flushing, urticaria. **Local:** pain at IM site (iron dextran), phlebitis at IV site, staining at IM site (iron dextran). **MS: IM, IV:** arthralgia, myalgia. **Misc: PO:** staining of teeth (liquid preparations). **IM, IV:** allergic reactions including ANAPHYLAXIS, fever, lymphadenopathy.

Interactions

Drug-Drug: Tetracycline and **antacids** ↑ oral absorption of iron by forming insoluble compounds. Oral iron supplements ↓ absorption of **Tetracyclines**, **fluoroquinolones**, and **penicillamine** (simultaneous administration should be avoided). ↓ absorption of and may ↓ effects of **levodopa** and **methyldopa**. May ↓ efficacy of **levothyroxine** (concurrent administration should be avoided). Concurrent administration of **cimetidine** may ↓ absorption. Doses of **ascorbic acid** ≥200 mg may ↑ absorption by ≥30%. **Chloramphenicol** and **vitamin E** may ↓ hematologic response to iron therapy.
Drug-Food: Iron absorption is ↓ 33–50% by concurrent administration of food.

Route/Dosage

Iron Replacement Therapy in Deficiency States

PO (Adults): 100–200 mg (2–3 mg/kg) elemental iron/day in 3 divided doses. *Pregnancy*—15–30 mg/day.
PO (Children 2–12 yr or 15–30 kg): 50–100 mg (1–1.5 mg/kg) elemental iron/day in 3–4 divided doses.
PO (Children 6 mo–2 yr): up to 6 mg/kg elemental iron/day in 3–4 divided doses.
PO (Infants): 10–25 mg elemental iron/day in 3–4 divided doses.

Iron Dextran

Test dose of 0.5 ml (25 mg) is given prior to therapy.
IM, IV (Adults and Children >15 kg): *Iron deficiency*—Total dose (ml) = 0.0442 (desired Hgb–actual Hgb)× lean body weight (kg) + (0.26 × lean body weight). Divided up and given in small daily doses until total is reached; not to exceed 100 mg/day. *Total dose IV infusion*—Total dose may be diluted and infused over 4–5 hr following a test dose of 10 drops (unlabeled).
IM, IV (Children 5–15 kg): *Iron deficiency*—Total dose (ml) = 0.0442 (desired Hgb–actual Hgb) × weight (kg) + (0.26 × weight) (not to exceed 25 mg/day in children <5 kg; 50 mg/day in children <10 kg; or 100 mg/day in others).
IM, IV (Adults): *Blood loss*—Dose (ml) = (Blood loss [ml] × hematocrit) ÷ 50.

Sodium Ferric Gluconate Complex

IV (Adults): 10 ml (125 mg elemental iron) repeated during 8 sequential dialysis treatments to a total cumulative dose of 1 g.

Iron Sucrose

IV (Adults): *Dialysis dependent patients*— 100 mg (5 ml) during each dialysis session for 10 doses (total of 1000 mg) additional smaller doses may be necessary; *Non-dialysis dependent patients*— 200 mg (10 ml) on 5 different days within a 14 day period to a total of 1000 mg, may also be given as infusion of 500 mg on day 1 and day 14.

NURSING IMPLICATIONS

Assessment

- Assess nutritional status and dietary history to determine possible cause of anemia and need for patient teaching.

CONTINUED

- **PO:** Oral preparations are most effectively absorbed if administered 1 hr before or 2 hr after meals. If gastric irritation occurs, administer with meals. Tablets and capsules should be taken with a full glass of water or juice. **Do not crush or chew enteric-coated tablets and do not open capsules.**
- Liquid preparations may stain teeth. Dilute in water or fruit juice, full glass (240 ml) for adults and ½ glass (120 ml) for children, and administer with a straw or place drops at back of throat. Feosol elixir should be diluted in water only. Fer-In-Sol liquid or syrup may be diluted in water or fruit juice.
- Avoid using antacids, coffee, tea, dairy products, eggs, or whole-grain breads with or within 1 hr after administration of ferrous salts. Iron absorption is decreased by 33% if iron and calcium are given with meals. If calcium supplementation is needed, calcium carbonate does not decrease absorption of iron salts if supplements are administered between meals.
- **Iron Dextran:** The 2-ml ampule may be used for IM or IV administration; the 10-ml multidose vial may be used only for IM administration.
- Prior to initial IM or IV dose, give a test dose of 25 mg by the same route as the dose, to determine reaction. The IV test dose should be administered over 5 min. The IM dose should be administered in the same injection site and by same technique as the therapeutic dose. The remaining portion may be administered after 1 hr, if no adverse symptoms have occurred.
- **IM:** Inject deeply via Z-track technique into upper outer quadrant of buttock, never into arm or other exposed areas. Use a 2–3 in., 19- or 20-gauge needle. Change needles between withdrawal from container and injection to minimize staining of subcut tissues. Stains are usually permanent.
- **IV:** Following IV administration, patient should remain recumbent for at least 30 min to prevent orthostatic hypotension.
- **Direct IV:** Administer undiluted. ***Rate:*** Administer slowly at a rate of 50 mg (1 ml) over at least 1 min.
- **Continuous Infusion:** May be diluted in 200–1000 ml of 0.9% NaCl or D5W; 0.9% NaCl is the preferred diluent; dilution in D5W increases incidence of pain and phlebitis. ***Rate:*** Administer over 1–8 hr following a test dose of 10 drops/min for 10 min. Flush line with 10 ml of 0.9% NaCl at completion of infusion.
- **Y-Site Incompatibility:** Discontinue other IV solutions during infusion.
- **Sodium Ferric Gluconate Complex:** Before initiating therapeutic doses, a test dose of 2 ml (25 mg of elemental iron) should be administered. Dilute test dose in 50 ml of 0.9% NaCl and administer IV over 60 min.
- For a dose of 10 ml (125 mg of elemental iron) dilute in 100 ml of 0.9% NaCl. Dialysis patients frequently require a cumulative dose of 1 g of elemental iron, administered over 8 sessions of sequential dialysis. ***Rate:*** Administer over 1 hr.
- **Iron Sucrose:** Do not administer iron sucrose concurrently with oral iron, as the absorption of oral iron is reduced.
- Each 5–ml vial contains 100 mg of elemental iron. Most patients require a minimum cumulative dose of 1000 mg of elemental iron, administered over 10 sequential dialysis sessions, to achieve a favorable hemoglobin or hematocrit response.
- Iron sucrose must only be administered IV directly into dialysis line, either by slow injection or by infusion. Solution is brown. Inspect for particulate matter or discoloration. Do not administer solutions that contain particulate matter or are discolored.
- **Direct IV:** May be administered undiluted by slow injection into dialysis line. ***Rate:*** Administer at a rate of 1 ml undiluted solution per minute, not to exceed one vial per injection. Discard any unused portion.
- **Intermittent Infusion:** May also be administered via infusion, into dialysis line for hemodialysis patients. May reduce risk of hypotensive episodes. Each vial must be diluted in a maximum of 100 ml of 0.9% NaCl immediately prior to infusion. Unused diluted solution should be discarded. ***Rate:*** Infuse at a rate of 100 mg of iron over at least 15 min.

CONTINUED

CONTINUED

IRON SUPPLEMENTS

Patient/Family Teaching

- Encourage patient to comply with medication regimen. Take missed doses as soon as remembered within 12 hr; otherwise, return to regular dosing schedule. Do not double doses.
- Advise patient that stools may become dark green or black and that this change is harmless.
- Instruct patient to follow a diet high in iron.
- Discuss with parents the risk of children's overdosing on iron. Medication should be stored in the original childproof container and kept out of reach of children. Do not refer to vitamins as candy. Medical help should be sought immediately if overdose is suspected, as death may occur. Parents should have syrup of ipecac at home but call pediatrician, emergency department, or poison control center for instructions before administering.
- **Iron Dextran:** Delayed reaction may occur 1–2 days after administration and last 3–4 days if IV route used, 3–7 days with IM route. Instruct patient to contact physician if fever, chills, malaise, muscle and joint aches, nausea, vomiting, dizziness, and backache occur.

Evaluation/Desired Outcomes

- Increase in hemoglobin, which may reach normal parameters after 1–2 mo of therapy. May require 3–6 mo for normalization of body iron stores.
- Increase in hemoglobin, hematocrit, and plasma iron levels with iron dextran. The diagnosis of iron-deficiency anemia should be reconfirmed if hemoglobin has not increased by 1 g/100 ml in 2 wk.
- Improvement in anemia of chronic renal failure.

Why was this drug prescribed for your patient?

isoniazid (eye-soe-**nye**-a-zid)

INH, ♣Isotamine, Laniazid, ♣PMS Isoniazid, Nydrazid

Classification

Therapeutic: antituberculars

Pregnancy Category C

Indications

First-line therapy of active tuberculosis, in combination with other agents. Prevention of tuberculosis in patients exposed to active disease (alone).

Action

Inhibits mycobacterial cell wall synthesis and interferes with metabolism.
Therapeutic Effects: Bacteriostatic or bactericidal action against susceptible mycobacteria.

Pharmacokinetics

Absorption: Well absorbed following PO/IM administration.
Distribution: Widely distributed; readily crosses the blood-brain barrier. Crosses the placenta; enters breast milk in concentrations equal to plasma.
Metabolism and Excretion: 50% metabolized by the liver at rates that vary widely among individuals; 50% excreted unchanged by the kidneys.
Half-life: 1–4 hr.

TIME/ACTION PROFILE (blood levels)

ROUTE	ONSET	PEAK	DURATION
PO, IM	rapid	1–2 hr	up to 24 hr

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Acute liver disease. Previous hepatitis from isoniazid.

Use Cautiously in: History of liver damage or chronic alcohol ingestion; Black and Hispanic women, women in postpartum period, or patients >50 yr (increased risk of drug-induced hepatitis); Severe renal impairment (dosage reduction may be necessary); Malnourished patients, patients with diabetes, or chronic alcoholics (increased risk of neuropathy); Pregnancy and lactation (although safety is not established, isoniazid has been used with ethambutol to treat tuberculosis in pregnant women without harm to the fetus).

Adverse Reactions/Side Effects

CNS: psychosis, seizures. **EENT:** visual disturbances. **GI:** DRUG-INDUCED HEPATITIS, nausea, vomiting. **Derm:** rashes. **Endo:** gynecomastia. **Hemat:** blood dyscrasias. **Neuro:** peripheral neuropathy. **Misc:** fever.

Interactions

Drug-Drug: Additive CNS toxicity with other **antituberculars. BCG vaccine** may not be effective during isoniazid therapy. Isoniazid inhibits the metabolism of **phenytoin. Aluminum-containing antacids** may decrease absorption. Psychotic reactions and coordination difficulties may result with **disulfiram.** Concurrent administration of **pyridoxine** may prevent neuropathy. Increased risk of hepatotoxicity with other **hepatotoxic agents** including **alcohol** and **rifampin**. Isoniazid may decrease blood levels and effectiveness of **ketoconazole**. Increases **carbamazepine** blood levels and risk of hepatotoxicity.
Drug-Food: Severe reactions may occur with ingestion of foods containing high concentrations of **tyramine.**

Route/Dosage

PO, IM (Adults): 300 mg/day or 15 mg/kg (up to 900 mg) 2–3 times weekly.

PO, IM (Children): 10–20 mg/kg/day (up to 300 mg/day) or 20–40 mg/kg (up to 900 mg) 2–3 times weekly.

NURSING IMPLICATIONS

Assessment

- Mycobacterial studies and susceptibility tests should be performed before and periodically throughout therapy to detect possible resistance.
- ***Lab Test Considerations:*** Hepatic function should be evaluated before and monthly throughout therapy. Increased AST, ALT, and serum bilirubin may indicate drug-induced hepatitis. Black and Hispanic women, postpartal women, and patients >50 yr are at highest risk. The risk is lower in children; therefore liver function tests are usually ordered less frequently for children.
- ***Toxicity and Overdose:*** If isoniazid overdose occurs, treatment with pyridoxine (vitamin B) is instituted.

Potential Nursing Diagnoses

Risk for infection (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)
Noncompliance (Patient/Family Teaching)

Implementation

- Available in tablet, syrup, and injectable forms.
- Also available in combination with rifampin (Rifamate) and with rifampin and pyrazinamide (Rifater)—see Appendix A.
- **PO:** May be administered with food or antacids if GI irritation occurs, although antacids containing aluminum should not be taken within 1 hr of administration.
- **IM:** Medication may cause discomfort at injection site. Massage site after administration and rotate injection sites.
- Solution may form crystals at low temperatures; crystals will redissolve on warming to room temperature.

Patient/Family Teaching

- Advise patient to take medication exactly as directed. If a dose is missed, take as soon as possible unless it is almost time for next dose; do not double up on missed doses. Emphasize the importance of continuing therapy even after symptoms have subsided. Therapy may be continued for 6 mo–2 years.
- **Advise patient to notify health care professional promptly if signs and symptoms of hepatitis (yellow eyes and skin, nausea, vomiting, anorexia, dark urine, unusual tiredness, or weakness)** or peripheral neuritis (numbness, tingling, paresthesia) occurs. Pyridoxine may be used concurrently to prevent neuropathy. Any changes in visual acuity, eye pain, or blurred vision should also be reported immediately.
- **Caution patient to avoid the use of alcohol during this therapy, as this may increase the risk of hepatotoxicity** Ingestion of Swiss or Cheshire cheeses, fish (tuna, skipjack, and sardinella), and possibly tyramine-containing foods should also be avoided, as they may result in redness or itching of the skin, hot feeling, rapid or pounding heartbeat, sweating, chills, cold clammy feeling, headache, or light-headedness.
- Emphasize the importance of regular follow-up physical and ophthalmologic exams to monitor progress and to check for side effects.

Evaluation/Desired Outcomes

- Resolution of signs and symptoms of tuberculosis
- Negative sputum cultures.
- Prevention of activation of tuberculosis in persons known to be exposed.

Why was this drug prescribed for your patient?

ISOSORBIDE

isosorbide dinitrate (eye-soe-**sor**-bide dye-**nye**-trate)
♣Apo-ISDN, ♣Cedocard-SR, ♣Coronex, Dilatrate-SR, ISDN, Iso-Bid, Isochron, Isonate, Isorbid, Isordil, Isotrate, ♣Novosorbide, Sorbitrate, Sorbitrate SA

isosorbide mononitrate (eye-soe-**sor**-bide mo-noe-**nye**-trate)
Imdur, Isotrate ER, ISMO, Monoket

Classification
Therapeutic: antianginals
Pharmacologic: nitrates

Pregnancy Category C

Indications
Acute treatment of anginal attacks (SL nitroglycerin preferred only). Prophylactic management of angina pectoris (dinitrate and mononitrate). Treatment of chronic congestive heart failure (dinitrate).

Action
Produces vasodilation (venous greater than arterial). Decreases left ventricular end-diastolic pressure and left ventricular end-diastolic volume (preload); net effect is reduced myocardial oxygen consumption. Increases coronary blood flow by dilating coronary arteries and improving collateral flow to ischemic regions. **Therapeutic Effects:** Relief of anginal attacks and increased cardiac output.

Pharmacokinetics
Absorption: Well absorbed after buccal PO and SL administration.
Distribution: Unknown.
Metabolism and Excretion: Mostly metabolized by the liver.
Half-life: *Isosorbide dinitrate*—50 min; *isosorbide mononitrate*—5 hr.

TIME/ACTION PROFILE (cardiovascular effects)

ROUTE	ONSET	PEAK	DURATION
ISDN—SL, Chew	2–5 min	unknown	1–2 hr
ISDN—PO	15–40 min	unknown	4 hr
ISDN—PO-ER	30 min	unknown	up to 12 hr
ISMN—PO	30–60 min	unknown	7 hr
ISMN—ER	unknown	unknown	12 hr

ISDN=isosorbide dinitrate; ISMN=isosorbide mononitrate

Contraindications/Precautions
Contraindicated in: Hypersensitivity. Severe anemia. Concurrent use of sildenafil, vardenalfil or tadalafil.
Use Cautiously in: Head trauma or cerebral hemorrhage; Older patients may be more sensitive to hypotension (start with lower doses); Pregnancy (may compromise maternal/fetal circulation)or lactation; Children (safety not established).

Adverse Reactions/Side Effects
CNS: dizziness, headache, apprehension, weakness. **CV:** hypotension, tachycardia, paradoxical bradycardia, syncope. **GI:** abdominal pain, nausea, vomiting. **Misc:** cross-tolerance, flushing, tolerance.

Interactions
Drug-Drug: Serious, life-threatening hypotension may occur with concurrent use of **sildenafil**, **vardenafil** or **tadalafil**. Additive hypotension with acute ingestion of **alcohol** and with **antihypertensives**, **beta blockers**, **calcium channel blockers**, and **phenothiazines**.

Route/Dosage

Isosorbide Dinitrate
SL, Buccal (Adults): *Acute attack of angina pectoris*—2.5–5 mg may be repeated q 5–10 min for 3 doses in 15–30 min. *Prophylaxis of angina pectoris*—2.5–10 mg may be repeated q 2–3 hr or 15 min prior to activities known to provoke angina.

♣ = Canadian drug name.

* CAPITALS indicates life-threatening, underlines indicate most frequent

itraconazole (it-tra-**kon**-a-zole)
Sporanox

Classification
Therapeutic: antifungals (systemic)

Pregnancy Category C

Indications
IV, PO: Histoplasmosis, Blastomycosis, Aspergillosis, Onychomycosis of the fingernail or toenail caused by *tinea unguium* in nonimmunocompromised patients (oral capsules only), Oropharyngeal lesophageal candidiasis. **IV:** Suspected fungal infections in febrile neutropenic patients.

Action
Inhibits enzymes necessary for integrity of the fungal cell membrane. **Therapeutic Effects:** Fungistatic effects against susceptible organisms. **Spectrum:** Active against *Histoplasma capsulatum*, *Blastomyces dermatitidis*, *Cryptococcus neoformans*, *Aspergillus fumigatus*, *Trichophyton* spp., *Candida*, and *tinea unguium*.

Pharmacokinetics
Absorption: Absorption after oral administration is enhanced by food; IV administration results in complete bioavailability.
Distribution: Tissue concentrations are higher than plasma concentrations. Does not enter CSF; enters breast milk.
Metabolism and Excretion: Mostly metabolized by the liver and excreted in feces. Hydroxyitraconazole, the major metabolite, has antifungal activity.
Half-life: 21 hr.

TIME/ACTION PROFILE (blood levels)

ROUTE	ONSET	PEAK	DURATION
PO	rapid	4 hr	12–24 hr
IV	unknown	end of infusion	12–24 hr

Contraindications/Precautions
Contraindicated in: Hypersensitivity; cross-sensitivity with other azole antifungals (miconazole, ketoconazole) may occur. Concurrent pimozide, dofetilide, quinidine, midazolam, triazolam, ergot alkaloimds, simvastatin, or lovastatin. Severe renal impairment (CCr<30 ml/min). Lactation. Congestive heart failure.
Use Cautiously in: Patients with hepatic impairment (dosage reduction may be required); Patients with achlorhydria or hypochlorhydria (absorption will be decreased); Pregnancy or children (safety not established).

Adverse Reactions/Side Effects
CNS: dizziness, drowsiness, fatigue, headache, malaise. **EENT:** tinnitus. **CV:** CHF, edema, hypertension. **GI:** HEPATOXICITY, nausea, abdominal pain, anorexia, diarrhea, flatulence, vomiting. **GU:** albuminuria, decreased libido, impotence. **Derm:** TOXIC EPIDERMAL NECROLYSIS, photosensitivity, pruritus, rash. **Endo:** adrenal insufficiency. **F and E:** hypokalemia. **MS:** rhabdomyolysis. **Misc:** allergic reactions including ANAPHYLAXIS, fever.

Interactions
Drug-Drug: Itraconazole is a potent inhibitor of the P450 3A hepatic enzyme, which can result in increased blood levels and effects of other drugs which are metabolized by this system. ↑ risk of potentially fatal arrhythmias with **quinidine**, **dofetilide**, or **pimozide** (concurrent use is contraindicated and may result in QTc prolongation, torsades de pointes, ventricular arrthythmias, and sudden death). ↑ risk of excessive sedation with oral **midazolam** or **triazolam**, ↑ risk of adverse CNS reactions with **pimozide**, and ↑ risk of myopathy with **simvastatin** or **lovastatin** (concurrent use contraindicated). Concurrent use with **ergot alkaloids (dihydroergotamine ergonovine ergotamine methylergonovine)** ↑ risk of vasoconstriction and is contraindicated. May also ↑ blood levels and the risk of toxicity from **warfarin**, **ritonavir**, **indinavir**, **saquinavir**, **vinca alkaloids**, **busulfan**, **cilostazol diazepam**, **eletriptan felodipine**, **isradipine**, **nicardipine**, **nifedipine**, **nimodipine**, **cyclosporine**, **sildenafil vardenafil tacrolimus**, **methylprednisolone**, **digoxin**, and **quinidine**.

♣ = Canadian drug name.

* CAPITALS indicates life-threatening, underlines indicate most frequent

PO (Adults): *Prophylaxis of angina pectoris*—5–20 mg initially. Usual maintenance dose is 10–40 mg q 6 hr or 40–80 mg q 8–12 hr as sustained-release form.

Isosorbide Mononitrate

PO (Adults): *ISMO, Monoket*—20 mg twice daily (may start with 5 mg twice daily), 7 hr apart. *Imdur*—30–60 mg once daily, may increase to 120 mg once daily (up to 240 mg/day).

NURSING IMPLICATIONS

Assessment

- Assess location, duration, intensity, and precipitating factors of anginal pain.
- Monitor blood pressure and pulse routinely during period of dosage adjustment.

Potential Nursing Diagnoses

Ineffective tissue perfusion (Indications)
Activity intolerance (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

Isosorbide Dinitrate

- **PO:** Administer 1 hr before or 2 hr after meals with a full glass of water for faster absorption.
- Chewable tablets should be chewed well before swallowing and held in mouth for 2 min. Do not swallow whole.
- **Extended-release tablets and capsules should be swallowed whole. Do not crush, break, or chew. SL:** tablets should be held under tongue until dissolved. Avoid eating, drinking, or smoking until tablet is dissolved. Replace tablet if inadvertently swallowed.

Isosorbide Mononitrate

- **Do not confuse Imdur with imuran, inderal, or K-Dur. Do not confuse Monoket with monopril (fosinopril).**
- **PO:** Medication should be taken on an empty stomach with a full glass of water.

Patient/Family Teaching

- Instruct patient to take medication exactly as directed, even if feeling better. If a dose is missed, take as soon as remembered; doses of isosorbide dinitrate should be taken at least 2 hr apart (6 hr with extended-release preparations); daily doses of isosorbide mononitrate should be taken 7 hr apart. Do not double doses. Do not discontinue abruptly.
- Caution patient to change position slowly to minimize orthostatic hypotension.
- May cause dizziness. Caution patient to avoid driving or other activities requiring alertness until response to medication is known.
- Advise patient to avoid concurrent use of alcohol with this medication. Patient should also consult health care professional before taking Rx, OTC, or herbal products while taking isosorbide.
- Inform patient that headache is a common side effect that should decrease with continuing therapy. Aspirin or acetaminophen may be ordered to treat headache. Notify health care professional if headache is persistent or severe. Do not alter dose to avoid headache.
- Advise patient to notify health care professional if dry mouth or blurred vision occurs, or if undigested extended-release isosorbide dinitrate tablets are found in stool.

Evaluation/Desired Outcomes

- Decrease in frequency and severity of anginal attacks
- Increase in activity tolerance.

Why was this drug prescribed for your patient?

May also ↓ metbolism and ↑ effects of **budesoinide dexamethasone** and **methylprednisolone**. Absorption ↓ by **antacids, histamine H_2 blockers, sucralfate, gastric acid-pump inhibitors,** or other **agents that increase gastric pH**, including the buffer in **didanosine** (take 2 hr after itraconazole). **Phenytoin, phenobarbital, isoniazid, rifampin, rifabutin**, and **carbamazepine** ↑ metabolism and ↓ blood levels of itraconazole (↑ dosage may be necessary). Itraconazole ↓ metabolism and may ↑ effects of **phenytoin** and **oral hypoglycemic agents**. If hypokalemia occurs, the risk of **digoxin** toxicity is ↑. Blood levels of itraconazole may be ↑ by **clarithromycin, erythromycin ritonavir**, and **indinavir**.
Drug-Food: Food increases absorption.

Route/Dosage

Aspergillosis

PO (Adults): 200 mg once or twice daily for a minimum of 3 mo.
IV (Adults): 200 mg twice daily for 4 doses, then 200 mg once daily.

Blastomycosis, Histoplasmosis

PO (Adults): 200 mg once daily; may be increased by 100 mg/day up to 200 mg twice daily.
IV (Adults): 200 mg twice daily for 4 doses, then 200 mg once daily.

Onychomycosis

PO (Adults): *Toenail fungus with or without fingernail fungus*—200 mg/day for 12 consecutive wk. *Fingernail fungus*—200 mg twice daily for 1 wk, then 3 wk without therapy, then 200 mg twice daily an additional wk–6 mo.

Empiric Therapy for Suspected Fungal Infections in Febrile Neutropenic Patients

IV (Adults): 200 mg twice daily for 4 doses, then 200 mg once daily for 14 days.

Candidiasis

PO (Adults): *Oropharyngeal candidiasis*—200 mg (20 ml) daily for 1–2 wk. *Oropharyngeal candidiasis unresponsive to fluconazole*—100 mg (10 ml) twice daily for at least 2–4 wk. *Esophageal candidiasis*—100 mg (10 ml) once daily for at least 3 wk.

NURSING IMPLICATIONS

Assessment

- Assess for signs and symptoms of infection (vital signs, lung sounds, sputum, WBC, oral and pharyngeal mucosa, nail beds) before and periodically during therapy.
- Obtain specimens for culture before instituting therapy. Therapy may be started before results are obtained.
- ***Lab Test Considerations:*** Monitor hepatic function tests before and periodically during therapy, especially in patients with pre-existing hepatic function abnormalities. Discontinue itraconazole if abnormal values persist or worsen.
- Monitor serum potassium. May cause hypokalemia.

Potential Nursing Diagnoses

Risk for infection (Indications)
Noncompliance (Patient/Family Teaching)

Implementation

- Do not interchange capsules and oral solution. Only oral solution is effective for oropharyngeal candidiasis. Oral solution is not recommended for initial treatment of patients at risk for systemic candidiasis.
- **Capsules:** Administer with a full meal to minimize nausea and vomiting and to increase absorption.
- Do not administer with antacids or other medications that may increase gastric pH; may decrease absorption of itraconazole.
- **Oral Solution:** Administer without food if possible. Swish solution in mouth vigorously, 10 ml at a time, for several seconds, then swallow.

CONTINUED

CONTINUED

itraconazole

- **Intermittent Infusion:** Add contents of 25–ml vial to 50–ml bag of 0.9% NaCl provided and mix gently. Do not use other diluents. Diluted solution is stable for 48 hr if refrigerated or at room temperature. Protect from light during storage; no protection is needed during administration. ***Rate:*** Using an infusion control device, administer 60 ml over 60 min. After infusion, flush line with 15-20 ml of 0.9% NaCl over 30 seconds to 15 min.

Patient/Family Teaching

- Instruct patient to take medication as directed, even if feeling better. Doses should be taken at the same time each day.
- May occasionally cause drowsiness. Caution patient to avoid driving or other activities requiring alertness until response to medication is known.
- Instruct patient to notify health care professional if signs and symptoms of liver dysfunction (unusual fatigue, anorexia, nausea, vomiting, jaundice, dark urine, or pale stools) or CHF (dyspnea, peripheral edema, weight gain) occur. If signs of CHF occur, discontinue itraconazole and notify health care professional immediately.
- Advise patient to consult health care professional before taking any Rx, OTC, or herbal medications concurrently with itraconazole.
- Advise patient to use sunscreen and wear protective clothing to prevent photosensitivity reactions.

Evaluation/Desired Outcomes

- Resolution of clinical and laboratory indications of fungal infections. Minimal treatment for systemic fungal infections is 3 mo. Inadequate period of treatment may lead to recurrence of active infection.

Why was this drug prescribed for your patient?

KETOCONAZOLE (kee-toe-**kone**-na-zole)

Nizoral

Classification

Therapeutic: antifungals (systemic)

Pregnancy Category C

Indications

Treatment of: Candidiasis (disseminated and mucocutaneous), Chromoblastomycosis, Coccidioidomycosis, Histoplasmosis, Paracoccidioidomycosis. **Unlabeled uses:** Treatment of advanced prostate cancer. Treatment of Cushing's syndrome.

Action

Disrupts fungal cell membrane. Interferes with fungal metabolism. Also inhibits the production of adrenal steroids. **Therapeutic Effects:** Fungistatic or fungicidal action against susceptible organisms, depending on organism and site of infection. **Spectrum:** Active against many pathogenic fungi, including: *Blastomyces*, *Candida*, *Coccidioides*, *Cryptococcus* and *Histoplasma*, Many dermatophytes.

Pharmacokinetics

Absorption: Absorption from the GI tract is pH-dependent; increasing pH decreases absorption.
Distribution: Widely distributed. Minimal CNS penetration. Crosses the placenta and enters breast milk.
Metabolism and Excretion: Partially metabolized by the liver. Excreted in feces via biliary excretion.
Half-life: 8 hr.

TIME/ACTION PROFILE (blood levels)

ROUTE	ONSET	PEAK	DURATION
PO	rapid	1–4 hr	24 hr

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Concurrent astemizole. Pregnancy or lactation.
Use Cautiously in: History of liver disease; Achlorhydria or hypochlorhydria; Alcoholism.

Adverse Reactions/Side Effects

CNS: dizziness, drowsiness. **EENT:** photophobia. **GI:** DRUG-INDUCED HEPATITIS, nausea, vomiting, abdominal pain, constipation, diarrhea, flatulence. **GU:** azoospermia, decreased male libido, menstrual irregularities, oligospermia. **Derm:** rashes. **Endo:** gynecomastia.

Interactions

Drug-Drug: Ketoconazole inhibits the hepatic P450 3A4 enzyme system, which results in ↓ metabolism and possibly ↑ effects and/or toxicity from **cyclosporine**, **tacrolimus**, **corticosteroids** (dosage reduction may be necessary), **calcium channel blockers,** sulfonylurea **oral hypoglycemic agents**, **quinidine**, **buspirone**, **clarithromycin**, **troleandomycin**, **erythromycin**, **cyclophosphamide**, **phenytoin**, **warfarin** (↑ risk of bleeding), **tamoxifen**, **tricyclic antidepressants**, **carbamazepine**, **nisoldipine**, **zolpidem**, **vinca alkaloids**, **ifosfamide**, some **benzodiazepines** (effect may persist for several days; use of triazolam is contraindicated), **alfentanil**, **fentanyl**, **sufentanil**, **donepezil**, **atorvastatin**, **lovastatin**, **simvastatin**, **amprenavir**, **indinavir** (dosage ↓ of indinavir recommended), **nelfinavir**, **ritonavir**, **saquinavir**, **quinidine**, **sildenafil** and **vardenafil** (dosage adjustments may be necessary). May alter the effectiveness of **hormonal contraceptives** (alternative method of contraception recommended). Drugs that ↑ gastric pH, including **antacids, histamine H_2 antagonists, didanosine** (chewable tablets, because of buffer), and **gastric acid–pump inhibitors** ↓ absorption (wait 2 hr before administration of ketoconazole). **Sucralfate** and **isoniazid** also ↓ bioavailability. ↑ hepatotoxicity with other **hepatotoxic agents,** including **alcohol.** Disulfiram-like reaction may occur with **alcohol. Rifampin** or **isoniazid** may ↓ levels and effectiveness. May ↓ absorption and effectiveness of **theophylline**.

Route/Dosage

PO (Adults): 200–400 mg/day, single dose (up to 1 g/day).
PO (Children >2 yr): 3.3–6.6 mg/kg/day, single dose.

NURSING IMPLICATIONS

Assessment

- Assess patient for symptoms of infection prior to and periodically during therapy.
- Specimens for culture should be taken prior to instituting therapy. Therapy may be started before results are obtained.
- ***Lab Test Considerations:*** **Monitor hepatic function tests prior to and monthly for 3–4 mo and then periodically during therapy. May cause ↑ AST, ALT, serum alkaline phosphatase, and bilirubin concentrations. Ketoconazole should be discontinued if even minor abnormalities occur.**
- May cause ↓ serum testosterone concentrations.

Potential Nursing Diagnoses

Risk for infection (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)
Noncompliance (Patient/Family Teaching)

Implementation

- **Do not confuse Nizoral (ketoconazole) with Neoral (cyclosporine).**
- **PO:** Administer with meals or snacks to minimize nausea and vomiting.
- Shake suspension well prior to administration.
- Do not administer histamine H_2 antagonists or antacids within 2 hr of ketoconazole.
- For patients with achlorhydria, dissolve each tablet in 4 ml of aqueous solution of 0.2 N hydrochloric acid. Use a glass or plastic straw to avoid contact with teeth and follow with a glass of water, swished in mouth and swallowed.

Patient/Family Teaching

- Instruct patient to take medication as directed, at the same time each day,even if feeling better. Take missed doses as soon as remembered; if almost time for next dose, space missed dose and next dose 10–12 hr apart.
- May cause dizziness or drowsiness. Caution patient to avoid driving or other activities requiring alertness until response to medication is known.
- Advise patient to avoid taking OTC antacids within 2 hr of ketoconazole.
- Caution patient to wear sunglasses and to avoid prolonged exposure to bright light to prevent photophobic reactions.
- Advise patient to use a nonhormonal form of contraception during ketoconazole therapy.
- Advise patient to avoid concurrent use of alcohol while taking ketoconazole; may cause a disulfiram-like reaction (flushing, rash, peripheral edema, nausea, headache) and increase the risk of hepatotoxicity.
- **Instruct patient to notify health care professional if abdominal pain, fever, or diarrhea becomes pronounced or if signs and symptoms of liver dysfunction (unusual fatigue, anorexia, nausea, vomiting, jaundice, dark urine, or pale stools) occur.**

Evaluation/Desired Outcomes

- Resolution of clinical and laboratory indications of fungal infections.
- Minimal treatment for candidiasis is 1–2 wk and for other systemic mycoses is 6 mo
- Chronic mucocutaneous candidiasis usually requires maintenance therapy.

Why was this drug prescribed for your patient?

KETOROLAC (kee-toe-role-ak)

Toradol

Classification

Therapeutic: nonsteroidal anti-inflammatory agents, nonopioid analgesics
Pharmacologic: nonopioid analgesics

Pregnancy Category C

Indications

PO, IM, IV: Short-term management of pain (not to exceed 5 days total for all routes combined).

Action

Inhibits prostaglandin synthesis, producing peripherally mediated analgesia. Also has antipyretic and anti-inflammatory properties. **Therapeutic Effects:** Decreased pain.

Pharmacokinetics

Absorption: Rapidly and completely absorbed following administration by all routes.
Distribution: Enters breast milk in low concentrations.
Metabolism and Excretion: <50% metabolized by the liver. Ketorolac and metabolites excreted mostly by the kidneys (91%); 6% excreted in feces.
Half-life: 4.5 hr (range 3.8–6.3 hr; increased in geriatric patients and patients with impaired renal function).

TIME/ACTION PROFILE (analgesic effects)

ROUTE	ONSET	PEAK	DURATION
PO	unknown	2–3 hr	4–6 hr or longer
IM, IV	10 min	1–2 hr	6 hr or longer

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Cross-sensitivity with other NSAIDs may exist. Lactation. Pre- or perioperative use. Known alcohol intolerance (injection only). Peri-operative pain from coronary artery bypass graft (CABG) surgery.
Use Cautiously in: Cardiovascular disease or risk factors for cardiovascular disease (may ↑ risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, especially with prolonged use); Pregnancy and children (use not recommended during second half of pregnancy); Geriatric patients (increased risk of GI bleeding); History of GI bleeding; Renal impairment (dosage reduction may be required).

Adverse Reactions/Side Effects

CNS: drowsiness, abnormal thinking, dizziness, euphoria, headache. **Resp:** asthma, dyspnea. **CV:** edema, vasodilation, pallor. **GI:** GI BLEEDING, abnormal taste, dry mouth, diarrhea, dyspepsia, GI pain, nausea. **GU:** oliguria, renal toxicity, urinary frequency. **Derm:** EXFOLIATIVE DERMATITIS, STEVENS-JOHNSON SYNDROME, TOXIC EPIDERMAL NECROLYSIS, pruritus, purpura, sweating, urticaria. **Hemat:** prolonged bleeding time. **Local:** injection site pain. **Neuro:** paresthesia. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: Concurrent use with **aspirin** may ↓ effectiveness. ↑ adverse GI effects with **aspirin**, other **NSAIDs**, **potassium supplements**, **corticosteroids**, or **alcohol.** Chronic use with **acetaminophen** may ↑ the risk of adverse renal reactions. May decrease the effectiveness of **diuretics** or **antihypertensives.** May ↑ serum **lithium** levels and ↑ the risk of toxicity. ↑ the risk of toxicity from **methotrexate**. ↑ risk of bleeding with **cefotetan**, **cefoperazone**, **valproic acid**, **clopidogrel**, **ticlopidine**, **tirofiban**, **eptifibatide**, **thrombolytics**, or **anticoagulants.** ↑ risk of adverse hematologic reactions with **antineoplastics** or **radiation therapy.** May ↑ the risk of nephrotoxicity from **cyclosporine**. **Probenecid** ↑ ketorolac blood levels and the risk of adverse reactions (concurrent use should be avoided).
Drug-Natural Products: ↑ bleeding risk with **anise, arnica, chamomile, clove, dong quai, feverfew, garlic, ginger, ginkgo, Panax ginseng.**

Route/Dosage

Oral therapy used only as a continuation of IM/IV therapy; total duration of therapy by all routes should not exceed 5 days.

lactulose (lak-tyoo-lose)

Cephulac, Cholac, Chronulac, Constilac, Constulose, Duphalac, Enulose, Evalose, Heptalac, Kristalose, ♣Lactulax, Lactulose PSE, Portalac

Classification

Therapeutic: laxatives
Pharmacologic: osmotics

Pregnancy Category B

Indications

Treatment of chronic constipation in adult and geriatric patients. Adjunct in the management of portal-systemic (hepatic) encephalopathy (PSE).

Action

Increases water content and softens the stool. Lowers pH of the colon, which inhibits the diffusion of ammonia from the colon into the blood, thereby reducing blood ammonia levels. **Therapeutic Effects:** Relief of constipation. Decreased blood ammonia levels with improved mental status in PSE.

Pharmacokinetics

Absorption: Less than 3% absorbed following oral administration.
Distribution: Unknown.
Metabolism and Excretion: Absorbed lactulose is excreted unchanged in the urine. Unabsorbed lactulose is metabolized by colonic bacteria to lactic, acetic, and formic acids.
Half-life: Unknown.

TIME/ACTION PROFILE (relief of constipation)

ROUTE	ONSET	PEAK	DURATION
PO	24–48 hr	unknown	unknown

Contraindications/Precautions

Contraindicated in: Patients on low-galactose diets.
Use Cautiously in: Diabetes mellitus; Excessive or prolonged use (may lead to dependence); Pregnancy, lactation, or children (safety not established).

Adverse Reactions/Side Effects

GI: cramps, belching, distention, flatulence, diarrhea. **Endo:** hyperglycemia (diabetic patients).

Interactions

Drug-Drug: Should not be used with **other laxatives** in the treatment of hepatic encephalopathy (leads to inability to determine optimal dose of lactulose). **Anti-infectives** may diminish effectiveness in treatment of hepatic encephalopathy.

Route/Dosage

Constipation

PO (Adults): 15–30 ml/day up to 60 ml/dayas liquid or 10–20 g as powder for oral solution (up to 40 g/day has been used).
PO (Children): 7.5 ml daily (unlabeled).

Portal-Systemic Encephalopathy

PO (Adults): 30–45 ml 3–4 times/day; may be given q 1–2 hr initially to induce laxation.
PO (Infants): 2.5–10 ml daily in divided doses (unlabeled).
PO (Children and Adolescents): 40–90 ml daily in divided doses (unlabeled).
Rect (Adults): 300 ml diluted and administered as a retention enema q 4–6 hr.

NURSING IMPLICATIONS

Assessment

- Assess patient for abdominal distention, presence of bowel sounds, and usual pattern of bowel function.

PO (Adults <65 yr): 20 mg initially, then 10 mg q 4–6 hr as needed (not to exceed 40 mg/day).
PO (Adults ≥65 yr, <50 kg, or with renal impairment): 10 mg q 4–6 hr as needed (not to exceed 40 mg/day).
IM (Adults <65 yr): *Single dose*—60 mg. *Multiple dosing*—30 mg q 6 hr (not to exceed 120 mg/day).
IM (Adults ≥65 yr, <50 kg, or with renal impairment): *Single dose*—30 mg. *Multiple dosing*—15 mg q 6 hr (not to exceed 60 mg/day).
IV (Adults <65 yr): *Single dose*—30 mg. *Multiple dosing*—30 mg q 6 hr (not to exceed 120 mg/day).
IV (Adults ≥65 yr, <50 kg, or with renal impairment): *Single dose*—15 mg. *Multiple dosing*—15 mg q 6 hr (not to exceed 60 mg/day).

NURSING IMPLICATIONS

Assessment

- **Patients who have asthma, aspirin-induced allergy, and nasal polyps are at increased risk for developing hypersensitivity reactions. Assess for rhinitis, asthma, and urticaria.**
- **Pain:** Assess pain (note type, location, and intensity) prior to and 1–2 hr following administration.
- ***Lab Test Considerations:*** Evaluate liver function tests, especially AST and ALT, periodically in patients receiving prolonged therapy. May cause ↑ levels.
- May cause prolonged bleeding time that may persist for 24–48 hr following discontinuation of therapy.
- May cause ↑ BUN, serum creatinine, or potassium concentrations.

Potential Nursing Diagnoses

Acute pain (Indications)

Implementation

- **Do not confuse Toradol (ketorolac) with Torecan (thiethylperazine) or tramadol (Ultram).**
- Administration in higher-than-recommended doses does not provide increased effectiveness but may cause increased side effects. **Duration of ketorolac therapy, by all routes combined, should not exceed 5 days** Use lowest effective dose for shortest period of time.
- Coadministration with opioid analgesics may have additive analgesic effects and may permit lower opioid doses.
- **PO:** Ketorolac therapy should always be given initially by the IM or IV route. Use oral therapy *only* as a continuation of parenteral therapy.
- **Direct IV:** Administer undiluted. ***Rate:*** Administer over at least 15 sec.
- **Syringe Compatibility:** sufentanil.
- **Syringe Incompatibility:** haloperidol, hydroxyzine, meperidine, morphine, nalbuphine, prochlorperazine, promethazine, thiethylperazine.
- **Y-Site Compatibility:** dexmedetomidine, fentanyl, hydromorphone, morphine, remifentanil, sufentanil.
- **Y-Site Incompatibility:** azithromycin, fenoldopam.
- **Solution Compatibility:** D5/0.9% NaCl, D5W, Ringer's injection, lactated Ringer's injection, 0.9% NaCl.

Patient/Family Teaching

- Instruct patient on how and when to ask for pain medication.
- Instruct patient to take medication exactly as directed. Take missed doses as soon as remembered if not almost time for next dose. Do not double doses.
- May cause drowsiness or dizziness. Advise patient to avoid driving or other activities requiring alertness until response to the medication is known.
- Caution patient to avoid the concurrent use of alcohol, aspirin, NSAIDs, acetaminophen, or other OTC medications without consulting health care professional.
- Advise patient to inform health care professional of medication regimen prior to treatment or surgery.
- Advise patient to consult health care professional if rash, itching, visual disturbances, tinnitus, weight gain, edema, black stools, persistent headache, or influenza-like syndrome (chills, fever, muscle aches, pain) occurs.

Evaluation/Desired Outcomes

- Decrease in severity of pain. Patients who do not respond to one NSAID may respond to another.

Why was this drug prescribed for your patient?

- Assess color, consistency, and amount of stool produced.
- **Portal-Systemic Encephalopathy:** Assess mental status (orientation, level of consciousness) before and periodically throughout course of therapy.
- ***Lab Test Considerations:*** Decreases blood ammonia concentrations by 25–50%.
- May cause increased blood glucose levels in diabetic patients.
- Monitor serum electrolytes periodically when used chronically. May cause diarrhea with resulting hypokalemia and hypernatremia.

Potential Nursing Diagnoses

Constipation (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- When used in hepatic encephalopathy, dosage should be adjusted until patient averages 2–3 soft bowel movements per day. During initial therapy, 30–45 ml may be given hourly to induce rapid laxation.
- Darkening of solution does not alter potency.
- **PO:** Mix with fruit juice, water, milk, or carbonated citrus beverage to improve flavor. Administer with a full glass (240 ml) of water or juice. May be administered on an empty stomach for more rapid results.
- Dissolve single dose packets (Kristalose) in 4 oz of water. Solution should be colorless to slightly pale yellow.
- **Rect:** To administer enema, use rectal balloon catheter. Mix 300 ml of lactulose with 700 ml of water or 0.9% NaCl. Enema should be retained for 30–60 min. If inadvertently evacuated, may repeat administration.

Patient/Family Teaching

- Encourage patient to use other forms of bowel regulation, such as increasing bulk in the diet, increasing fluid intake, and increasing mobility. Normal bowel habits are individualized; frequency of bowel movement may vary from 3 times/day to 3 times/wk.
- Caution patient that this medication may cause belching, flatulence, or abdominal cramping. Health care professional should be notified if this becomes bothersome or if diarrhea occurs.

Evaluation/Desired Outcomes

- Passage of a soft, formed stool, usually within 24–48 hr.
- Clearing of confusion, apathy, and irritation and improved mental status in portal-systemic encephalopathy. Improvement may occur within 2 hr following enema and 24–48 hr following oral administration.

Why was this drug prescribed for your patient?

lamivudine (la-**mi**-vyoo-deen)

Epivir

Classification

Therapeutic: antiretrovirals, antivirals
Pharmacologic: nucleoside reverse transcriptase inhibitors

Pregnancy Category C

Indications

HIV infection (with other antiretrovirals). Chronic hepatitis B infection. **Unlabeled uses:** Part of HIV-postexposure prophylaxis with zidovudine and indinavir.

Action

Following intracellular conversion to its active form (lamivudine-5-triphosphate), inhibits viral DNA synthesis, by inhibiting the enzyme reverse transcriptase. **Therapeutic Effects:** Slows the progression of HIV infection and decreases the occurrence of its sequelae. Increases CD4 cell counts and decreases viral load. Protection from liver damage due to chronic hepatitis B infection; decreases viral load.

Pharmacokinetics

Absorption: Well absorbed following oral administration (86% in adults, 66% in infants and children).
Distribution: Distributes into the extravascular space. Some penetration into CSF; remainder of distribution unknown.
Metabolism and Excretion: Mostly excreted unchanged in urine.
Half-life: *Adults*—3.7 hr; *children*—2 hr.

TIME/ACTION PROFILE (blood levels)

ROUTE	ONSET	PEAK	DURATION
PO	unknown	0.9 hr†	12 hr

†On an empty stomach; peak levels occur at 3.2 hr if lamivudine is taken with food. Food does not affect total amount of drug absorbed

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Lactation.
Use Cautiously in: Impaired renal function (increased dosing interval/decreased dose recommended if CCr <50 ml/min); Geriatric patients (dosage reduction may be necessary); Pregnancy or children <3 mo (safety not established)
Exercise Extreme Caution in: Pediatric patients with a history of pancreatitis (use only if no alternative); Coinfection with hepatitis B (hepatitis may recur after discontinuation of lamivudine).

Adverse Reactions/Side Effects

Noted for combination of lamivudine plus zidovudine **CNS:** SEIZURES, fatigue, headache, insomnia, malaise, depression, dizziness. **Resp:** cough. **GI:** HEPATOMEGALY WITH STEATOSIS, PANCREATITIS (increased in pediatric patients), anorexia, diarrhea, nausea, vomiting, abdominal discomfort, abnormal liver function studies, dyspepsia. **Derm:** alopecia, erythema multiforme, rashes, urticaria. **Endo:** hyperglycemia. **F and E:** LACTIC ACIDOSIS. **Hemat:** anemia, neutropenia. **MS:** musculoskeletal pain, arthralgia, muscle weakness, myalgia, rhabdomyolysis. **Neuro:** neuropathy. **Misc:** hypersensitivity reactions including ANAPHYLAXIS and STEVENS-JOHNSON SYNDROME.

Interactions

Drug-Drug: Trimethoprim/sulfamethoxazole ↑ lamivudine blood levels (dosage alteration may be necessary in renal impairment). ↑ risk of pancreatitis with other **drugs causing pancreatitis.** ↑ risk of neuropathy with other **drugs causing neuropathy.** Combination therapy with **tenofovir** and **abacavir** may lead to virologic nonresponse and should not be used.

Route/Dosage

HIV Infection

PO (Adults and Children >12 yr and ≥50 kg): 150 mg twice daily.
PO (Adults <50 kg): 2 mg/kg twice daily.
PO (Children 3 mo–12 yr): 4 mg/kg twice daily (up to 300 mg/day).

Chronic Hepatitis B

PO (Adults): 100 mg once daily.
PO (Children 2–17 yr): 3 mg/kg once daily (up to 100 mg/day).

lansoprazole (lan-**soe**-pra-zole)

Prevacid

Classification

Therapeutic: antiulcer agents
Pharmacologic: proton-pump inhibitors

Pregnancy Category B

Indications

Erosive esophagitis. Duodenal ulcers (with or without anti-infectives for *Helicobacter pylori*). Active benign gastric ulcer. Short-term treatment of symptomatic GERD. Healing and risk reduction of NSAID-associated gastric ulcer. Pathologic hypersecretory conditions, including Zollinger-Ellison syndrome.

Action

Binds to an enzyme in the presence of acidic gastric pH, preventing the final transport of hydrogen ions into the gastric lumen. **Therapeutic Effects:** Diminished accumulation of acid in the gastric lumen, with lessened acid reflux. Healing of duodenal ulcers and esophagitis.

Pharmacokinetics

Absorption: Well absorbed (80%) after oral administration.
Distribution: Unknown.
Metabolism and Excretion: Extensively metabolized by the liver to inactive compounds. Converted intracellularly to at least two other antisecretory compounds.
Half-life: Less than 2 hr (increased in geriatric patients and patients with impaired hepatic function).

TIME/ACTION PROFILE (acid suppression)

ROUTE	ONSET	PEAK	DURATION
PO	rapid	unknown	more than 24 hr

Contraindications/Precautions

Contraindicated in: Hypersensitivity.
Use Cautiously in: Geriatric patients (maintenance dose should not exceed 30 mg/day unless additional acid suppression is required); Severe hepatic impairment (not to exceed 30 mg/day in these patients); Pregnancy, lactation, or children <1 yr (safety not established).

Adverse Reactions/Side Effects

CNS: dizziness, headache. **GI:** abdominal pain, diarrhea, nausea. **Derm:** rash.

Interactions

Drug-Drug: Sucralfate ↓ absorption of lansoprazole (take 30 min before sucralfate). May ↓ absorption of drugs requiring acid pH, including **ketoconazole, itraconazole, ampicillin esters, iron salts,** and **digoxin.** May ↑ risk of bleeding with warfarin (monitor INR/PT).

Route/Dosage

PO (Adults and children ≥ 12 yr): *Short-term treatment of duodenal ulcer*—15 mg once daily for 4 wk; *H. pylori eradication to reduce the risk of duodenal ulcer recurrence*—30 mg twice daily with clarithromycin 500 mg twice daily and amoxicillin 1000 mg twice daily for 10–14 days (triple therapy) or 30 mg three times daily with 1000 mg amoxicillin three times daily for 14 days (dual therapy); *maintenance of healed duodenal ulcers*—15 mg once daily; *short-term treatment of gastric ulcers/healing of NSAID-associated gastric ulcer*—30 mg once daily for up to 8 wk; *risk reduction of NSAID-associated gastric ulcer*—15 mg once daily for up to 12 wk; *short-term treatment of symptomatic GERD*—15 mg once daily for up to 8 wk; *short-term treatment of erosive esophagitis*—30 mg once

NURSING IMPLICATIONS

Assessment

- **HIV:** Assess patient for change in severity of symptoms of HIV infection and for symptoms of opportunistic infection during therapy.
- Monitor patient for signs and symptoms of peripheral neuropathy (tingling, burning, numbness, or pain in hands or feet); may be difficult to differentiate from peripheral neuropathy of severe HIV disease. May require discontinuation of therapy.
- Assess patient, especially pediatric patients, for signs of pancreatitis (nausea, vomiting, abdominal pain) periodically during therapy. May require discontinuation of therapy.
- **Chronic Hepatitis B Infection:** Monitor signs of hepatitis (jaundice, fatigue, anorexia, pruritus) during therapy.

Lab Test Considerations:

- Monitor viral load and CD4 levels before and periodically during therapy.
- Monitor serum amylase, lipase, and triglycerides periodically during therapy. Elevated serum levels may indicate pancreatitis and require discontinuation.
- Monitor liver function. May cause elevated levels of AST, ALT, CPK, bilirubin, and alkaline phosphatase, which usually resolve after interruption of therapy. Lactic acidosis may occur with hepatic toxicity causing hepatic steatosis; may be fatal, especially in women.
- May rarely cause neutropenia and anemia.

Potential Nursing Diagnoses

Risk for infection (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- Do not confuse lamivudine with lamotrigine. Do not confuse Epivir tablets and oral solution with Epivir-HBV tablets and oral solutions. Epivir Tablets and Oral Solution contain a higher dose of the same active ingredient (lamivudine) than in Epivir-HBV Tablets and Oral Solution. Epivir-HBV was developed for patients with hepatitis B and should not be used for patients dually infected with HIV and hepatitis B; use may lead to lamivudine-resistant HIV due to sub-therapeutic dose.
- Available in combination with zidovudine (Combivir). See Appendix A.
- **PO:** May be administered without regard to food.

Patient/Family Teaching

- Instruct patient to take lamivudine as directed, every 12 hr. Explain the difference between Epivir and Epivir-HBV to patients. Emphasize the importance of compliance with full course of therapy, not taking more than the prescribed amount, and not discontinuing without consulting health care professional. Take missed doses as soon as possible unless almost time for next dose. Do not double doses. Caution patient not to share medication with others.
- Inform patient that lamivudine does not cure HIV disease or prevent associated or opportunistic infections. Lamivudine does not reduce the risk of transmission of HIV to others through sexual contact or blood contamination. Caution patient to use a condom during sexual contact and avoid sharing needles or donating blood to prevent spreading HIV to others. Advise patient that the long-term effects of lamivudine are unknown at this time.
- Instruct patient to notify health care professional promptly if signs of peripheral neuropathy or pancreatitis occur.
- Advise patient not to take other OTC or prescription medications or herbal products without consulting health care professional.
- Emphasize the importance of regular follow-up exams and blood tests to determine progress and monitor for side effects.

Evaluation/Desired Outcomes

- Slowing of the progression of HIV infection and its sequelae.
- Decrease in viral load and improvement in CD4 levels in patients with advanced HIV infection.
- Protection from liver damage due to chronic hepatitis B infection.
- Protection from liver damage caused by chronic hepatitis B infection; decreases viral load.

Why was this drug prescribed for your patient?

daily for up to 8 wk (8 additional weeks may be necessary); *maintenance of healing of erosive esophagitis*—15 mg once daily; *pathologic hypersecretory conditions*—60 mg once daily intially, up to 90 mg twice daily (daily dose >120 mg should be given in divided doses).
IV (Adults): 30 mg/day for up to 7 days.

NURSING IMPLICATIONS

Assessment

- Assess patient routinely for epigastric or abdominal pain and for frank or occult blood in stool, emesis, or gastric aspirate.
- ***Lab Test Considerations:*** May cause abnormal liver function tests, including increased AST, ALT, alkaline phosphatase, LDH, and bilirubin.
- May cause ↑ serum creatinine and ↑ or ↓ electrolyte levels.
- May alter RBC, WBC, and platelet levels.
- May also cause ↑ gastrin levels, abnormal A/G ratio, hyperlipidemia, and ↑ or ↓ cholesterol.
- Monitor INR and prothrombin time in patients taking warfarin.

Potential Nursing Diagnoses

Acute pain (Indications)

Implementation

- **Do not confuse Prevacid (lansoprazole) with Pravachol (pravastatin).**
- **PO:** Administer before meals. Capsules may be opened and sprinkled on 1 tbsp of applesauce, pudding, cottage cheese, or yogurt and swallowed immediately for patients with difficulty swallowing. **Do not crush or chew capsule contents.**
- For patients with an NG tube, capsules may be opened and intact granules may be mixed in 40 ml of apple, cranberry, grape, orange, pineapple, prune, or V8 vegetable juice and injected through the NG tube into stomach. Flush NG tube with additional apple juice to clear tube. If administered via jejunostomy tube, lansoprazole should be prepared as a suspension with 2.5 ml of 4.2% sodium bicarbonate and 2.5 ml water.
- *Orally disintegrating tablets* may be placed on tongue, allowed to disintegrate and swallowed with or without water. For administration via oral syringe or nasogastric tube, *Prevacid SoluTab* can be administered by placing a 15 mg tablet in oral syringe and drawing up 4 mL of water, or a 30 mg tablet in oral syringe and drawing up 10 mL of water. Shake gently to allow for a quick dispersal. After tablet has dispersed, administer the contents within 15 minutes. Refill syringe with 2 mL (5 mL for the 30 mg tablet) of water, shake gently, and administer any remaining contents and flush nasogastric tube.To be determined.
- *Oral suspension* may be prepared by emptying packet into 2 tbsp of water. Do not use other liquids or foods. Stir well and drink immediately. If material remains in glass, add water and drink immediately. Do not administer oral suspension through enteral tubes.
- Antacids may be used concurrently.
- **Intermittent Infusion:** There are 2 methods of preparing IV lansoprazole.
- *Reconstitution in vial and preparation of admixture:* Inject 5 ml of ONLY Sterile Water for injection into 30 mg vial of lansoprazole for a concentration of 6 mg/mL. Other diluents will cause precipitation. Mix gently until powder dissolves. Reconstituted solution is stable for 1 hr at room temperature. Dilute reconstituted solution in 50 mL of 0.9% NaCl, LR, or D5W. Solutions diluted in 0.9% NaCl or LR are stable for 24 hr and solutions diluted in D5W are stable for 12 hr at room temperature.
- *Reconstitution with Baxter MINI-BAG plus container:* May be reconstituted directly into 50 mL of 0.9% NaCl or D5W utilizing the Baxter MINI-BAG plus container. Follow instructions provided with Baxter system. Solution is stable at room temperature for 24 hr or 8 hr if diluted with 0.9% NaCl or D5W, respectively. ***Rate:*** Administer via the in-line filter provided. Prime administration set as usual and close clamp. Connect luer adaptor of administration set to filter inlet using twisting motion; avoid overtightening. Hold filter below level of solution container. Open administration set clamp and slowly prime filter. Close clamp and verify no air bubbles are present on patient side of filter. If air bubbles are present,

CONTINUED

Why was this drug prescribed for your patient?

CONTINUED

lansoprazole

open clamp slightly to re-establish flow, then gently tap filter housing until no bubbles are present and close clamp. Connect to patient and regulate flow. Filter may be primed with a syringe and saline. Administration set can then be connected to inlet of filter. Filter is for single use only; change filter every 24 hr. Do not use pumps downstream of filter.

- Administer over 30 min. Flush line with 0.9% NaCl, LR, or D5W before and after admnistration.
- **Y-Site Incompatibility:** Do not administer with other drugs or diluents.

Patient/Family Teaching

- Instruct patient to take medication as directed for the full course of therapy, even if feeling better.
- Advise patient to avoid alcohol, products containing aspirin or NSAIDs, and foods that may cause an increase in GI irritation.
- May occasionally cause dizziness. Caution patient to avoid driving and other activities that require alertness until response to medication is known.
- Advise patient to report onset of black, tarry stools; diarrhea; or abdominal pain to health care professional promptly.

Evaluation/Desired Outcomes

- Decrease in abdominal pain or prevention of gastric irritation and bleeding. Healing of duodenal ulcers can be seen on x-ray examination or endoscopy. Therapy is continued for at least 2–4 wk. Therapy for pathologic hypersecretory conditions may be long term.
- Healing in patients with erosive esophagitis. Therapy is continued for up to 8 wk, and an additional 8-wk course may be used for patients who do not heal in 8 wk or whose ulcer recurs.

leucovorin calcium (loo-koe-**vor**-in)

citrovorum factor, folinic acid, Wellcovorin

Classification

Therapeutic: antidotes (for methotrexate), vitamins
Pharmacologic: folic acid analogues

Pregnancy Category C

Indications

Minimizes hematologic effects of high-dose methotrexate therapy (leucovorin rescue). Advanced colorectal carcinoma with 5–fluorouracil. Management of overdoses/prevention of toxicity from folic acid antagonists (pyrimethamine, trimethoprim, trimetrexate). Folic acid deficiency (megaloblastic anemia) unresponsive to oral replacement.

Action

Is a cofactor in DNA and RNA synthesis. **Therapeutic Effects:** Reverses folic acid antagonist toxicity. Reverses folic acid deficiency.

Pharmacokinetics

Absorption: Rapidly absorbed (38%)after oral administration.
Distribution: Widely distributed. Concentrates in CNS and liver.
Metabolism and Excretion: Largely converted to tetrahydrofolic derivatives, including 5-methyltetrahydrofolate, a major storage form.
Half-life: 3.5 hr.

TIME/ACTION PROFILE (serum folate levels)

ROUTE	ONSET	PEAK	DURATION
PO	20–30 min	unknown	3–6 hr
IM	10–20 min	unknown	3–6 hr
IV	<5 min	unknown	>3–6 hr

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Prroducts containing benzyl alcohol should not be used in neonates.

Use Cautiously in: Undiagnosed anemia; Ascites; Renal failure; Dehydration; Pleural effusions; Urine pH <7; Pregnancy or lactation (may be used for megaloblastic anemia).

Adverse Reactions/Side Effects

Misc: allergic reactions.

Interactions

Drug-Drug: May ↓ anticonvulsant effect of **barbiturates, phenytoin**, or **primidone**. High doses of the liquid contain significant **alcohol** and may cause ↑ CNS depression when used with **CNS depressants.** Concurrent use with **trimethoprim/sulfamethoxazole** may result in ↓ anti-infective efficacy and poor therapeutic outcome when used to treat *Pneumocystis carinii* pneumonia in HIV patients. May ↑ therapeutic effects and toxicity of **fluorouracil**; therapy may be combined for this purpose.

Route/Dosage

High-Dose Methotrexate—Leucovorin Rescue

PO, IM, IV (Adults and Children): *Normal methotrexate elimination*—10 mg/m² q 6 hr (first dose IV/IM, then change to PO) until methotrexate level is $<10^{-8}$ M. *CCr has increased to 50% above previous value or methotrexate level is* $>5 \times 10^{-8}$ *M at 24 hr*—increase leucovorin to 100 mg/m² q 3 hr IM/IV until methotrexate level is appropriate.

Advanced Colorectal Cancer

IV (Adults): 200 mg/m² followed by 5-fluorouracil 370 mg/m² or leucovorin 20 mg/m² is followed by 5-fluorouracil 425 mg/m². Regimen is given daily for 5 days q 4–5 wk.

Prevention of Hematologic Toxicity from Trimetrexate

PO, IV (Adults and Children): 20 mg/m² q 6 hr for 72 hr after last trimetrexate dose (round PO doses to the next 25 mg).

Prevention of Hematologic Toxicity from Pyrimethamine

PO, IV (Adults and Children): 5–15 mg/day.

Inadvertent Overdose of Folic Acid Antagonists

IM, IV (Adults and Children): *Methotrexate (large doses)*—75 mg IV followed by 12 mg IM q 6 hr for 4 doses. *Methotrexate (average doses)*—6–12 mg IM q 6 hr for 4 doses.

Megaloblastic Anemia

PO, IM, IV (Adults and Children): up to 1 mg/day (up to 6 mg/day).

NURSING IMPLICATIONS

Assessment

- Assess patient for nausea and vomiting secondary to methotrexate therapy or folic acid antagonists (pyrimethamine and trimethoprim) overdose. Parenteral route may be necessary to ensure that patient receives dose.
- Monitor for development of allergic reactions (rash, urticaria, wheezing). Notify physician if these occur.
- **Megaloblastic Anemia:** Assess degree of weakness and fatigue. **Leucovorin rescue:** Monitor serum methotrexate levels to determine dosage and effectiveness of therapy. Leucovorin calcium levels should be equal to or greater than methotrexate level. Rescue continues until serum methotrexate level is $<5 \times 10M$.
- Monitor CCr and serum creatinine prior to and every 24 hr during therapy to detect methotrexate toxicity. An increase >50% over the pretreatment concentration at 24 hr is associated with severe renal toxicity.
- Monitor urine pH every 6 hr during therapy; pH should be maintained >7 to decrease nephrotoxic effects of high-dose methotrexate. Sodium bicarbonate or acetazolamide may be ordered to alkalinize urine.
- *Megaloblastic anemia*—Monitor plasma folic acid levels, hemoglobin, hematocrit, and reticulocyte count prior to and periodically during therapy.

Implementation

- **Do not confuse folinic acid (leucovorin calcium) with folic acid. Do not confuse leucovorin with leukeran (chlorambucil) or leukine (sargramostim).**
- Make sure leucovorin calcium is available before administering high-dose methotrexate. **Administration must be initiated within 24 hr of methotrexate therapy.**
- Administer as soon as possible after toxic dose of folic acid antagonists (pyrimethamine and trimethoprim). Effectiveness of therapy begins to decrease 1 hr after overdose.
- **PO:** Parenteral therapy should be used in patients with GI toxicity, nausea, and vomiting, or with doses >25 mg.
- **IM:** IM route is preferred for treatment of megaloblastic anemia. Ampules of leucovorin calcium injection for IM use do not require reconstitution.
- **Direct IV:** To reconstitute 50-mg vial of leucovorin calcium for injection, add 5 ml of bacteriostatic water or sterile water for injection, for a concentration of 10 mg/ml. Use 10-ml diluent for 100-mg vial. The 350-mg vial should be reconstituted with 17 ml of diluent for a concentration of 20 mg/ml. If dose is >10 mg/m^2, do not use product containing benzyl alcohol. Use immediately if reconstituted with sterile water for injection. Stable for 7 days when reconstituted with bacteriostatic water. ***Rate:*** Do not exceed 160 mg/min (16 ml of 10 mg/ml solution per min).
- **Intermittent Infusion:** May be diluted in 100–500 ml of D5W, D10W, 0.9% NaCl, Ringer's or LR. Stable for 24 hr.

Patient/Family Teaching

- Explain purpose of medication. Emphasize need to take as directed and contact health care professional if a dose is missed.
- **Leucovorin Rescue:** Instruct patient to drink 3000 ml of fluid/day.
- **Folic Acid Deficiency:** Encourage patient to eat a diet high in folic acid (meat proteins, bran, dried beans, and green leafy vegetables).

Evaluation/Desired Outcomes

- Reversal of bone marrow and GI toxicity in patients receiving methotrexate or other folic acid antagonists.
- Increased sense of well-being and increased production of normoblasts in patients with megaloblastic anemia.

Why was this drug prescribed for your patient?

High Alert

LIDOCAINE

lidocaine (parenteral) (lye-doe-kane)

LidoPen, Xylocaine, ♣Xylocard

lidocaine (local anesthetic)

Dilocaine, Lidoject, Nervocaine, Octocaine, Xylocaine

lidocaine (mucosal)

Anestacon, Xylocaine Viscous

Classification

Therapeutic: anesthetics—topical/local, antiarrhythmics (class IB)

Pregnancy Category B

Indications

IV: Ventricular arrhythmias. **IM:** Self-injected or when IV is unavailable (during transport to hospital facilities). **Local:** Infiltration/mucosal anesthetic.

Action

IV, IM: Suppresses automaticity and spontaneous depolarization of the ventricles during diastole by altering the flux of sodium ions across cell membranes with little or no effect on heart rate. **Local:** Produces local anesthesia by inhibiting transport of ions across neuronal membranes, thereby preventing initiation and conduction of normal nerve impulses. **Therapeutic Effects:** Control of ventricular arrhythmias. Local anesthesia.

Pharmacokinetics

Absorption: Well absorbed following IM administration into the deltoid muscle; some absorption follows local use.
Distribution: Widely distributed. Concentrates in adipose tissue. Crosses the blood-brain barrier and placenta.

Metabolism and Excretion: Mostly metabolized by the liver.
Half-life: Biphasic—initial phase 7–30 min, terminal phase 90–120 min.

TIME/ACTION PROFILE (IV, IM = antiarrhythmic effects; Local = anesthetic effects)

ROUTE	ONSET	PEAK	DURATION
IV	immediate	immediate	10–20 min (up to several hours after continuous infusion)
IM	5–15 min	20–30 min	60–90 min
Local	rapid	unknown	1–3 hr

Contraindications/Precautions

Applies mainly to systemic use **Contraindicated in:** Hypersensitivity. Advanced AV block.
Use Cautiously in: Liver disease, CHF, patients weighing < 50 kg, and geriatric patients (reduce bolus and/or maintenance dose); Respiratory depression, shock, or heart block; Pregnancy or lactation (safety not established).

Adverse Reactions/Side Effects

Applies mainly to systemic use **CNS:** SEIZURES, confusion, drowsiness, dizziness, nervousness, tremor. **EENT:** *mucosal use*— decreased or absent gag reflex. **CV:** CARDIAC ARREST, arrhythmias, bradycardia, hypotension. **GI:** nausea, vomiting. **Local:** stinging, burning, contact dermatitis, erythema. **Misc:** allergic reactions, including ANAPHYLAXIS.

Interactions

Applies mainly to systemic use.
Drug-Drug: ↑ cardiac depression and toxicity with **phenytoin**, amiodarone, **quinidine**, **procainamide**, or **propranolol**. **Cimetidine** and **beta blockers** may ↓ metabolism and ↑ risk of toxicity.

CONTINUED

LIDOCAINE

side, potassium chloride, propofol, remifentanil, streptokinase, theophylline, tirofiban, vitamin B complex with C, warfarin.

- **Y-Site Incompatibility:** amphotericin B cholesteryl sulfate, thiopental.
- **Infiltration:** Lidocaine with epinephrine may be used to minimize systemic absorption and prolong local anesthesia.
- **Topical:** Apply *ELA-Max* 30 min. prior to a needlestick.

Patient/Family Teaching

- May cause drowsiness and dizziness. Advise patient to call for assistance during ambulation and transfer.
- **IM:** Available in LidoPen Auto-Injector for use outside the hospital setting. Advise patient to telephone health care professional immediately if symptoms of a heart attack occur. Do not administer unless instructed by health care professional. To administer, remove safety cap and place back end on thickest part of thigh or deltoid muscle. Press hard until needle prick is felt. Hold in place for 10 sec, then massage area for 10 sec. Do not drive after administration unless absolutely necessary.

Evaluation/Desired Outcomes

- Decrease in ventricular arrhythmias.
- Local anesthesia.

Why was this drug prescribed for your patient?

Route/Dosage

IV (Adults): 50–100 mg (1 mg/kg) bolus (may be repeated in 5 min), then 1–4 mg/min (20–50 mcg/kg/min) infusion (up to 4.5 mg/kg or 300 mg in 1 hr).
IV (Children): 1 mg/kg bolus; may be repeated after 5 min (not to exceed 3 mg/kg) followed by 30 mcg/kg/min infusion (range 20–50 mcg/kg/min).
IM (Adults and Children ≥50 kg): 300 mg (4.5 mg/kg), may be repeated in 60–90 min.
Infiltration: (Adults and Children): Infiltrate affected area as needed (increased amount and frequency of use increases likelihood of systemic absorption and adverse reactions).
Mucosal: (Adults): *For anesthetizing oral surfaces*—20 mg as 2 sprays/quadrant (not to exceed 30 mg/quadrant) may be used; 15 ml of the viscous solution may be used q 3 hr for oral/pharyngeal pain. *For anesthetizing the female urethra*—3–5 ml of the jelly or 20 mg as 2% solution may be used. *For anesthetizing the male urethra*—5–10 ml of the jelly or 5–15 ml of 2% solution may be used before catheterization or 30 ml of jelly before cystoscopy or similar procedures. Topical solutions may be used to anesthetize mucous membranes of larynx/trachea/esophagus.

NURSING IMPLICATIONS

Assessment

- **Antiarrhythmic:** Monitor ECG continuously and blood pressure and respiratory status frequently during administration.
- **Anesthetic:** Assess degree of numbness of affected part.
- ***Lab Test Considerations:*** Serum electrolyte levels should be monitored periodically during prolonged therapy.
- IM administration may cause increased CPK levels.
- ***Toxicity and Overdose:*** Serum lidocaine levels should be monitored periodically during prolonged or high-dose therapy. Therapeutic serum lidocaine levels range from 1.5 to 5 mcg/ml: Signs and symptoms of toxicity include confusion, excitation, blurred or double vision, nausea, vomiting, ringing in ears, tremors, twitching, seizures, difficulty breathing, severe dizziness or fainting, and unusually slow heart rate. If symptoms of overdose occur, stop infusion and monitor patient closely.

Potential Nursing Diagnoses

Decreased cardiac output (Indications)
Acute pain (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- ***High Alert:*** Lidocaine is readily absorbed through mucous membranes. Inadvertent overdosage of lidocaine jelly and spray has resulted in patient harm or death from neurologic and/or cardiac toxicity. Do not exceed recommended dosages.
- **Throat Spray:** Ensure that gag reflex is intact before allowing patient to drink or eat.
- **IM:** IM injections are recommended only when ECG monitoring is not available and benefits outweigh risks. Administer IM injections only into deltoid muscle while frequently aspirating to prevent IV injection.
- **IV:** Only 1% and 2% solutions are used for direct IV injection.
- **Direct IV:** Administer undiluted IV loading dose of 1 mg/kg at a rate of 25–50 mg over 1 min. May repeat dose after 5 min. Follow by IV infusion. Do not use lidocaine with preservatives or other medications, such as epinephrine, for IV injection.
- **Continuous Infusion:** To prepare for IV infusion, add 1 g lidocaine to 250, 500, or 1000 ml of D5W. Solution is stable for 24 hr. Other compatible solutions include D5/LR, D5/0.45% NaCl, D5/0.9% NaCl, 0.45% NaCl, 0.9% NaCl, and LR. ***Rate:*** Administer via infusion pump for accurate dose at a rate of 1–4 mg/min.
- **Y-Site Compatibility:** alteplase, amiodarone, cefazolin, ciprofloxacin, cisatracurium, diltiazem, dobutamine, dopamine, enalaprilat, etomidate, famotidine, gatifloxacin, haloperidol, heparin, inamrinone, labetalol, levofloxacin, linezolid, meperidine, morphine, nitroglycerin, nitropruss-

CONTINUED

lidocaine/prilocaine (lye-doe-kane/pri-loe-kane)

EMLA

Classification

Therapeutic: anesthetics—topical/local

Pregnancy Category B

Indications

Produces local anesthesia before painful dermal procedures including Insertion of cannulae or needles, Arterial/venous/lumbar puncture, IM injections, Subcutaneous injections, Dermal procedures, Laser treatments, Circumcision.

Action

Produces local anesthesia by inhibiting transport of ions across neuronal membranes, thereby preventing initiation and conduction of normal nerve impulses. The two anesthetics are applied as a system that consists of a cream under an occlusive dressing. Active drug is released into the dermal and epidermal skin layers, resulting in accumulation of local anesthetic in the regions of dermal pain receptors and nerve endings. **Therapeutic Effects:** Anesthetic action localized to the area of the application.

Pharmacokinetics

Absorption: Small amounts are systemically absorbed during 4-hr placement of EMLA system.
Distribution: Small amounts absorbed are widely distributed; cross the placenta and blood-brain barrier.
Metabolism and Excretion: *Lidocaine*—mostly metabolized by the liver. *Prilocaine*—metabolized by the liver and kidneys.
Half-life: *Lidocaine*—7–30 min first phase, 90–120 min terminal phase; *prilocaine*—10–50 min.

TIME/ACTION PROFILE (local anesthesia)

ROUTE	ONSET	PEAK	DURATION†
Topical	15 min	3 hr	1–2 hr

†Following removal of occlusive dressing

Contraindications/Precautions

Contraindicated in: Hypersensitivity to lidocaine, prilocaine, or any other amide-type local anesthetics. Hypersensitivity to ingredients in the formulation. Congenital/idiopathic methemoglobinemia. Infants <6 mo who are receiving methemoglobin-inducing agents.
Use Cautiously in: Repeated use or use on large areas of skin; Geriatric, acutely ill, or debilitated patients; Severe liver disease; Conditions associated with methemoglobinemia (including glucose-6-phosphate dehydrogenase deficiency); Children <20 kg; Lactation.

Adverse Reactions/Side Effects

Local: blanching, redness, alteration in temperature sensation, edema, itching, rash. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: Concurrent use with **class I antiarrhythmics (mexiletine, tocainide)** may result in adverse cardiovascular effects. Concurrent use with **other local anesthetics** may result in ↑ toxicity. Concurrent use with **sulfonamides** in children ↑ the risk of methemoglobinemia (avoid concurrent use in children <12 mo).

Route/Dosage

Topical (Adults and Children): *Minor dermal procedures including venipuncture and IV cannulation*—2.5 g (½ of the 5-g tube) applied to 20–25 cm² (2 in. by 2 in.) area of skin, covered with an occlusive dressing applied for at least 1 hr. *Major dermal procedures*—2 g/10 cm² area of skin, covered with an occlusive dressing for at least 2 hr. *Adult male genital skin*—as an adjunct prior to local anesthetic infiltration, apply a thick

♣ = Canadian drug name.

* CAPITALS indicates life-threatening, underlines indicate most frequent.

lithium (lith-ee-um)

♣Carbolith, ♣Duralith, Eskalith, Eskalith CR, ♣Lithizine, Lithonate, Lithotabs

Classification

Therapeutic: antimanics

Pregnancy Category D

Indications

Bipolar affective disorders (treatment of acute manic episodes and prophylaxis against recurrence).

Action

Alters cation transport in nerve and muscle. May also influence re-uptake of neurotransmitters. **Therapeutic Effects:** Prevents/decreases incidence of acute manic episodes.

Pharmacokinetics

Absorption: 100% absorbed.
Distribution: Widely distributed; CSF levels are 50% of plasma levels. Crosses the placenta; enters breast milk.
Metabolism and Excretion: Mostly renal excretion.
Half-life: 20–27 hr.

TIME/ACTION PROFILE (antimanic effects)

ROUTE	ONSET	PEAK	DURATION
PO, PO-ER	5–7 days	10–21 days	days

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Severe cardiovascular/renal disease. Dehydrated/debilitated patients. Products containing alcohol or tartrazine should be avoided in known hypersensitivity/intolerance. Pregnancy or lactation.

Use Cautiously in: Geriatric patients; Cardiac/renal/thyroid disease; Diabetes; Children (safety not established).

Adverse Reactions/Side Effects

CNS: SEIZURES, fatigue, headache, impaired memory, ataxia, confusion, dizziness, drowsiness, psychomotor retardation, restlessness, stupor. **EENT:** aphasia, blurred vision, dysarthria, tinnitus. **CV:** ARRHYTHMIAS, ECG changes, edema, hypotension. **GI:** pain, anorexia, bloating, diarrhea, nausea, dry mouth, metallic taste. **GU:** polyuria, glycosuria, nephrogenic diabetes insipidus, renal toxicity. **Derm:** acneiform eruption, folliculitis, alopecia, diminished sensation, pruritus. **Endo:** hypothyroidism, goiter, hyperglycemia, hyperthyroidism. **F and E:** hyponatremia. **Hemat:** leukocytosis. **Metab:** weight gain. **MS:** muscle weakness, hyperirritability, rigidity. **Neuro:** tremors.

Interactions

Drug-Drug: May prolong the action of **neuromuscular blocking agents.** ↑ risk of neurologic toxicity with **haloperidol** or **molindone**. **Diuretics, methyldopa, probenecid, fluoxetine,** and **NSAIDs** may ↑ risk of toxicity. Blood levels may be ↑ by **ACE inhibitors.** Lithium may ↓ effects of **chlorpromazine. Chlorpromazine** may mask early signs of lithium toxicity. Hypothyroid effects may be additive with **potassium iodide** or **antithyroid agents. Aminophylline, phenothiazines,** and **drugs containing large amounts of sodium** ↑ renal elimination and ↓ effectiveness. **Psyllium** can ↓ **lithium** levels.
Drug-Natural Products: Caffeine-containing herbs (**cola nut, guarana, mate, tea, coffee**) may ↓ **lithium** serum levels and efficacy.
Drug-Food: Large changes in **sodium** intake may alter the renal elimination of lithium. ↑ sodium intake will ↑ renal excretion.

Route/Dosage

PO (Adults): *Tablets/capsules*—300–600 mg 3 times daily; maintenance dose. *Slow-release capsules*—200–300 mg 3 times daily; increased up to 1800 mg/day in divided doses. *Extended-release tablets*—450–900 mg twice daily or 300–600 mg 3 times daily. Maintenance dose is 900–1200 mg/day.

♣ = Canadian drug name.

* CAPITALS indicates life-threatening, underlines indicate most frequent.

layer (1 g/10 cm^2) to skin surface for 15 min, local infiltration anesthesia should be performed immediately after removal of cream. *Adult female genital mucous membranes*—apply a thick layer (5–10 g) for 5–10 min.
Topical (Children 7–12 yr and >20 kg): Dose should not exceed 20 g over more than 200 cm^2 for more than 4 hr.
Topical (Children 1–6 yr and >10 kg): Dose should not exceed 10 g over more than 100 cm^2 for more than 4 hr.
Topical (Children 3 mo–12 mo and >5 kg): Dose should not exceed 2 g over more than 20 cm^2 for more than 4 hr.
Topical (Children 0–3 mo or <5 kg): Dose should not exceed 1 g over more than 10 cm^2 for more than 1 hr.

NURSING IMPLICATIONS

Assessment

- Assess application site for open wounds. Apply only to intact skin.
- Assess application site for anesthesia following removal of system and before procedure.

Potential Nursing Diagnoses

Acute pain, acute (Indications)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- **Topical:** When used for minor dermal procedures (venipuncture, IV cannulation, arterial puncture, lumbar puncture), apply the 2.5-g tube of cream (½ of the 5-g tube) to each 2 in. by 2 in. area of skin in a *thick* layer at the site of the impending procedure. Remove the center cutout piece from an occlusive dressing (supplied with the 5-g tube) and peel the paper liner from the paper-framed dressing. Cover the lidocaine/prilocaine cream so that there is a *thick* layer of cream underneath the occlusive dressing. Do not spread out or rub in the cream. Smooth the dressing edges carefully and ensure it is secure to avoid leakage. Remove the paper frame and mark the time of application on the occlusive dressing. Lidocaine/prilocaine cream must be applied *at least 1 hr* before the start of a minor dermal procedure (venipuncture, IV cannulation). Anesthesia may be more profound with 90 min-2 hr application. Remove the occlusive dressing and wipe off the lidocaine/prilocaine cream. Clean the entire area with antiseptic solution and prepare the patient for the procedure.
- For major dermal procedures (skin graft harvesting), follow the same procedure using larger amounts of lidocaine/prilocaine cream and the appropriate size occlusive dressing. Lidocaine/prilocaine cream must be applied *at least 2 hr* before major dermal procedures.

Patient/Family Teaching

- Explain purpose of cream and occlusive dressing to patient and parents. Inform patient that lidocaine/prilocaine cream may block all sensations in treated skin. Caution patient to avoid trauma to the area from scratching, rubbing, or exposure to extreme heat or cold until all sensation has returned.
- **Home Care Issues:** Instruct patient or parent in proper application. Provide a diagram of location for application.

Evaluation/Desired Outcomes

- Anesthesia in the area of application.

Why was this drug prescribed for your patient?

PO (Children <12 yr): 15–20 mg (0.4–0.5 mEq)/kg/day in 2–3 divided doses; dosage may be adjusted weekly.

NURSING IMPLICATIONS

Assessment

- Assess mood, ideation, and behaviors frequently. Initiate suicide precautions if indicated.
- Monitor intake and output ratios. Report significant changes in totals. Unless contraindicated, fluid intake of at least 2000–3000 ml/day should be maintained. Weight should also be monitored at least every 3 mo.
- ***Lab Test Considerations:*** Evaluate renal and thyroid function, WBC with differential, serum electrolytes, and glucose periodically during therapy.
- ***Toxicity and Overdose:*** Monitor serum lithium levels twice weekly during initiation of therapy and every 2–3 mo during chronic therapy. Draw blood samples in the morning immediately before next dose. Therapeutic levels range from 0.5 to 1.5 mEq/L: Assess patient for signs and symptoms of lithium toxicity (vomiting, diarrhea, slurred speech, decreased coordination, drowsiness, muscle weakness, or twitching). If these occur, report before administering next dose.

Potential Nursing Diagnoses

Disturbed thought process (Indications)
Risk for self-directed violence (Indications)
Risk for other-directed violence (Indications)
Noncompliance (Patient/Family Teaching)

Implementation

- **Do not confuse Lithobid (lithium) with Levbid (hyoscyamine).**
- **PO:** Administer with food or milk to minimize GI irritation. Swallow extended-release preparations whole; **do not break, crush, or chew.**

Patient/Family Teaching

- Instruct patient to take medication as directed, even if feeling well. Take missed doses as soon as remembered unless within 2 hr of next dose (6 hr if extended release).
- Lithium may cause dizziness or drowsiness. Caution patient to avoid driving or other activities requiring alertness until response to medication is known.
- Low sodium levels may predispose patient to toxicity. Advise patient to drink 2000–3000 ml fluid each day and eat a diet with consistent and moderate sodium intake. Excessive amounts of coffee, tea, and cola should be avoided because of diuretic effect. Avoid activities that cause excess sodium loss (heavy exertion, exercise in hot weather, saunas). Notify health care professional of fever, vomiting, and diarrhea, which also cause sodium loss.
- Advise patient that weight gain may occur. Review principles of a low-calorie diet.
- Instruct patient to consult health care professional before taking OTC medications or herbal products concurrently with this therapy.
- Advise patient to use contraception and to consult health care professional if pregnancy is suspected.
- Review side effects and symptoms of toxicity with patient. Instruct patient to stop medication and report signs of toxicity to health care professional promptly.
- **Explain to patients with cardiovascular disease or over 40 yr of age the need for ECG evaluation before and periodically during therapy. Patient should inform health care professional if fainting, irregular pulse, or difficulty breathing occurs.**
- Emphasize the importance of periodic lab tests to monitor for lithium toxicity.

Evaluation/Desired Outcomes

- Resolution of the symptoms of mania (hyperactivity, pressured speech, poor judgment, need for little sleep).
- Decreased incidence of mood swings in bipolar disorders.
- Improved affect in unipolar disorders. May require 1–3 wk.

Why was this drug prescribed for your patient?

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loperamide (loe-**per**-a-mide)

Diar-aid Caplets, Imodium, Imodium A-D, Kaopectate II Caplets, Maalox Antidiarrheal Caplets, Neo-Diaral, Pepto Diarrhea Control

Classification

Therapeutic: antidiarrheals

Pregnancy Category B

Indications

Adjunctive therapy in acute diarrhea. Treatment of chronic diarrhea associated with inflammatory bowel disease. Decreases the volume of ileostomy drainage.

Action

Inhibits peristalsis and prolongs transit time by a direct effect on nerves in the intestinal muscle wall. Reduces fecal volume and increases fecal viscosity and bulk while diminishing loss of fluid and electrolytes. **Therapeutic Effects:** Relief of diarrhea.

Pharmacokinetics

Absorption: 40% absorbed following oral administration.
Distribution: Unknown. Does not cross the blood-brain barrier.
Metabolism and Excretion: Metabolized partially by the liver, undergoes enterohepatic recirculation; 30% eliminated in the feces. Minimal excretion in the urine.
Half-life: 10.8 hr.

TIME/ACTION PROFILE (relief of diarrhea)

ROUTE	ONSET	PEAK	DURATION
PO	1 hr	2.5–5 hr	10 hr

♣ = Canadian drug name.

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Patients in whom constipation must be avoided. Abdominal pain of unknown cause, especially if associated with fever. Alcohol intolerance (solution only).
Use Cautiously in: Hepatic dysfunction; Geriatric patients; Pregnancy, lactation, or children <2 yr (safety not established).

Adverse Reactions/Side Effects

CNS: drowsiness, dizziness. **GI:** constipation, abdominal pain/distention/discomfort, dry mouth, nausea, vomiting. **Misc:** allergic reactions.

Interactions

Drug-Drug: ↑ CNS depression with other **CNS depressants**, including **alcohol, antihistamines, opioid analgesics,** and **sedative/hypnotics.** ↑ anticholinergic properties with other **drugs having anticholinergic properties**, including **antidepressants** and **antihistamines.**
Drug-Natural Products: Kava, valerian, skullcap, chamomile, or **hops** can ↑ CNS depression.

Route/Dosage

PO (Adults): 4 mg initially, then 2 mg after each loose stool. Maintenance dose usually 4–8 mg/day in divided doses (not to exceed 8 mg/day OTC use or 16 mg/day for Rx use).
PO (Children 9–11 yr or 30–47 kg): 2 mg initially; then 1 mg with each loose stool (not to exceed 6 mg/24 hr; OTC use should not exceed 2 days).
PO (Children 6–8 yr or 24–30 kg): 1 mg initially, then 1 mg with each loose stool (not to exceed 4 mg/24 hr; OTC use should not exceed 2 days).

NURSING IMPLICATIONS

Assessment

- Assess frequency and consistency of stools and bowel sounds before and throughout therapy.
- Assess fluid and electrolyte balance and skin turgor for dehydration.

*CAPITALS indicates life-threatening; underlines indicate most frequent.

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lopinavir/ritonavir (loe-**pin**-a-veer/ri-**toe**-na-veer)

Kaletra

Classification

Therapeutic: antiretrovirals
Pharmacologic: protease inhibitors, metabolic inhibitors

Pregnancy Category C

Indications

HIV infection (with other antiretrovirals).

Action

Lopinavir: Inhibits HIV viral protease. **Ritonavir:** Although ritonavir has antiretroviral activity of its own (inhibits the action of HIV protease and prevents the cleavage of viral polyproteins), it is combined with lopinavir to inhibit the metabolism of lopinavir thus increasing its plasma levels. **Therapeutic Effects:** Increased CD4 cell counts and decreased viral load with subsequent slowed progression of HIV infection and its sequelae.

Pharmacokinetics

Absorption: Well absorbed following oral administration; food enhances absorption.
Distribution: *Ritonavir*—poor CNS penetration.
Protein Binding: *Lopinavir*—98–99 % bound to plasma proteins.
Metabolism and Excretion: *Lopinavir*—completey metabolized in the liver by cytochrome P450 P3A (CY P450 P3A); ritonavir is a potent inhibitor of this enzyme. *Ritonavir*—highly metabolized by the liver (by CY P450 P3A and CY P2D6 enzymes); one metabolite has antiretroviral activity; 3.5% excreted unchanged in urine.
Half-life: *Lopinavir*—5–6 hr *Ritonavir*—3–5 hr.

TIME/ACTION PROFILE (blood levels)

	ONSET	PEAK	DURATION
Lopinavir PO	rapid	4 hr	12 hr
Ritonavir PO	rapid	4 hr*	12 hr

*Non-fasting

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Concurrent use of dihydroergotamine, ergotamine, ergonovine, flecainide, methylergonovine, midazolam, pimozide, propafenone, amiodaroneand triazolam, which are highly dependent on CY P3A or CY P2D6 for metabolism and for which increased blood levels may result in serious and/or life-threatening events. Concurrent use with simastatin, lovastatin, St. John's wort (hypericum perforatum) is not recommended. Hypersensitivity or intolerance to alcohol or castor oil (present in capsules and liquid).
Use Cautiously in: Known alcohol intolerance (oral solution contains alcohol); Concurrent use with atorvastatin (may ↑ risk of rhabdomyolysis); Concurrent use of antiarrhythmics including lidocaine and quinidine (therapeutic blood level monitoring recommended); Concurrent use of anticonvulsants including carbamazepine, phenobarbital or phenytoin (may ↓ effectiveness of lopinavir); Concurrent use of dihydropyridine calcium channel blockers including felodipine, nifedipine and nicardipine (clinical monitoring recommended due to ↑ levels of calcium channel blocker); Impaired hepatic function, history of hepatitis (for ritonavir content); Pregnancy or lactation (safety not established; breastfeeding not recommended in HIV-infected patients)
Exercise Extreme Caution in: Concurrent use with sildenafil should be undertaken with extreme caution and may result in hypotension, syncope, visual changes, and prolonged erection.

♣ = Canadian drug name.

*CAPITALS indicates life-threatening; underlines indicate most frequent.

Potential Nursing Diagnoses

Diarrhea (Indications)
Risk for injury (Side Effects)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- **PO:** Available in tablet, capsule, chewable tablet, and liquid forms.
- Administer with clear fluids to help prevent dehydration that may accompany diarrhea.

Patient/Family Teaching

- Instruct patient to take medication exactly as directed. Do not take missed doses, and do not double doses. In acute diarrhea, medication may be ordered after each unformed stool. Advise patient not to exceed the maximum number of doses.
- May cause drowsiness. Advise patient to avoid driving or other activities requiring alertness until response to drug is known.
- Advise patient that frequent mouth rinses, good oral hygiene, and sugarless gum or candy may relieve dry mouth.
- Caution patient to avoid using alcohol and other CNS depressants concurrently with this medication.
- Instruct patient to notify health care professional if diarrhea persists or if fever, abdominal pain, or distention occurs.

Evaluation/Desired Outcomes

- Decrease in diarrhea
- In patients with acute diarrhea, treatment should be discontinued if no improvement is seen in 48 hr.
- In patients with chronic diarrhea, if no improvement has occurred after at least 10 days of treatment with maximum dose, loperamide is unlikely to be effective.

Why was this drug prescribed for your patient?

Adverse Reactions/Side Effects

CNS: headache, insomnia, weakness. **GI:** diarrhea(↑ in children), abdominal pain, nausea, pancreatitis, taste aversion (in children), vomiting (↑ in children). **Derm:** rash.

Interactions

Drug-Drug: Concurrent use of **flecainide**, **amiodarone**, **propafenone**, **dihydroergotamine**, **ergonovine**, **ergotamine**, **methylergonovine**, **pimozide**, **midazolam**, and **triazolam**, is contraindicated because of the risk of potentially serious, life-threatening drug interactions. Concurrent use with **sildenafil**, **vardenafil**, or **tadalafil** should be undertaken with extreme caution and may result in hypotension, syncope, visual changes, and prolonged erection (dosage reduction of sildenafil to 25 mg every 48 hr with monitoring recommended). Concurrent use with **rifampin** ↓ effectiveness of antiretroviral therapy and should not be undertaken. Should not be used concurrently with **simvastatin** or **lovastatin** due to ↑ risk of rhabdomyolysis; similar risk exists for **atorvastatin** (use lowest possible dose with careful monitoring). Concurrent use with **efavirenz** or **nevirapine** ↓ lopinavir/ritonavir levels and effectiveness; dosage increase may be necessary. **Delavirdine** ↑ lopinavir levels. ↑ levels of **lidocaine** and **quinidine** (blood level monitoring recommended). Concurrent use of anticonvulsants including **carbamazepine**, **phenobarbital**, or **phenytoin** may ↓ effectiveness of lopinavir. ↑ levels of dihydropyridine calcium channel blockers including **felodipine**, **nifedipine**, and **nicardipine** (clinical monitoring recommended). May alter levels and effectiveness of **warfarin**. ↑ levels of **clarithromycin** (dosage reduction recommended for patients with CCr ≤60 ml/min. ↑ blood levels of **itraconazole** and **ketoconazole** (high antifungal doses not recommended). ↑ levels of **rifabutin** (dosage reduction recommended). ↓ blood levels of **atovaquone** (may require dosage increase). **Dexamethasone** ↓ blood levels and may ↓ effectiveness of lopinavir. Oral solution contains alcohol and may produce intolerance when administered with **disulfiram** or **metronidazole**. May ↑ levels and risk of toxicity with immunosuppressant including **cyclosporine** or **tacrolimus** (blood level monitoring recommended). May ↓ levels and effects of **methadone** (dosage of **methadone** may need to be ↑). May ↓ levels and contraceptive efficacy of some estrogen-based **hormonal contraceptives** including **ethinyl estradiol** (alternative or additional methods of contraception recommended). ↑ levels of **fluticasone** by inhalation; avoid concurrent use.

Drug-Natural Products: Concurrent use with **St. John's wort** may ↓ levels and beneficial effect of lopinavir/ritonavir.

Route/Dosage

PO (Adults and Children >40 kg): 400/100 mg (3 capsules or 5 ml oral solution) twice daily *or* may be given as a single daily dose of 800/200 mg (6 capsules or 10 ml oral solution); single dose approved for adults only.
PO (Children 15–40 kg): 10 mg/kg lopinavir content twice daily.
PO (Children 7–15 kg): 12 mg/kg lopinavir content twice daily.

With concurrent efavirenz or nevirapine

PO (Adults and Children >40 kg): 533/133 mg (4 capsules or 6.5 ml oral solution) twice daily.
PO (Children 15–50 kg): 11 mg/kg lopinavir content twice daily.
PO (Children 7–15 kg): 13 mg/kg lopinavir content twice daily.

NURSING IMPLICATIONS

Assessment

- Assess for change in severity of HIV symptoms and for symptoms of opportunistic infections during therapy.
- Assess patient for signs of pancreatitis (nausea, vomiting, abdominal pain, increased serum lipase or amylase) periodically during therapy. May require discontinuation of therapy.
- ***Lab Test Considerations:*** Monitor viral load and CD4 counts regularly during therapy.
- Monitor triglyceride and cholesterol levels prior to initiating therapy and periodically during therapy.
- May cause hyperglycemia.

CONTINUED

CONTINUED

lopinavir/ritonavir

- May cause ↑ serum AST, ALT, GGT, and total bilirubin concentrations.

Potential Nursing Diagnoses

Risk for infection (Indications)
Noncompliance (Patient/Family Teaching)

Implementation

- Do not confuse with Kaletra (lopinavir/ritonavir) with Keppra (levetiracetam).
- Patients taking concurrent didanosine should take didanosine 1 hr before or 2 hr after taking lopinavir/ritonavir.
- **PO:** Administer with food to enhance absorption.
- Oral solution is light yellow to orange.
- Capsules and oral solution are stable if refrigerated until expiration date on label or 2 months at room temperature.

Patient/Family Teaching

- Emphasize the importance of taking lopinavir/ritonavir as directed, at evenly spaced times throughout day. Do not take more than prescribed amount, and do not stop taking this or other antiretrovirals without consulting health care professional. Take missed doses as soon as remembered; do not double doses.
- Instruct patient that lopinavir/ritonavir should not be shared with others.
- Advise patient to avoid taking other medications, RX, OTC, or herbal products, especially St. John's wort, without consulting health care professional.
- Inform patient that lopinavir/ritonavir does not cure AIDS or prevent associated or opportunistic infections. Lopinavir/ritonavir does not reduce the risk of transmission of HIV to others through sexual contact or blood contamination. Caution patient to use a condom during sexual contact and to avoid sharing needles or donating blood to prevent spreading the AIDS virus to others. Advise patient that the long-term effects of lopinavir/ritonavir are unknown at this time.
- Inform patient that lopinavir/ritonavir may cause hyperglycemia. Advise patient to notify health care professional if increased thirst or hunger; unexplained weight loss; or increased urination occurs.
- Advise patients taking oral contraceptives to use a nonhormonal method of birth control during lopinavir/ritonavir therapy.
- Caution patients taking sildenafil of increased risk of sildenafil-associated side effects (hypotension, visual changes, sustained erection). Notify health care professional promptly if these occur.
- Inform patient that redistribution and accumulation of body fat may occur causing central obesity, dorsocervical fat enlargement (buffalo hump), peripheral wasting, breast enlargement, and cushingoid appearance. The cause and long-term effects are not known.
- Instruct patient to notify health care professional if pregnancy is planned or suspected of if breastfeeding an infant.
- Emphasize the importance of regular follow-up exams and blood counts to determine progress and monitor for side effects.

Evaluation/Desired Outcomes

- Delayed progression of AIDS and decreased opportunistic infections in patients with HIV.
- Decrease in viral load and improvement in CD4 cell counts.

Why was this drug prescribed for your patient?

lorazepam (lor-az-e-pam)

♣Apo-Lorazepam, Ativan, ♣Novo-Lorazem, ♣Nu-Loraz

Classification

Therapeutic: anesthetic adjuncts, antianxiety agents, sedative/hypnotics
Pharmacologic: benzodiazepines

Schedule IV

Pregnancy Category D

Indications

Management of anxiety or insomnia. Preoperative sedation. Decreases preoperative anxiety and provides amnesia. **Unlabeled uses: IV:** Antiemetic prior to chemotherapy. Status epilepticus.

Action

Depresses the CNS, probably by potentiating gamma-aminobutyric acid, an inhibitory neurotransmitter. **Therapeutic Effects:** Sedation. Decreased anxiety. Decreased seizures.

Pharmacokinetics

Absorption: Well absorbed following PO/IM administration. Sublingual absorption is more rapid than PO and is similar to IM.
Distribution: Widely distributed. Crosses the blood-brain barrier and placenta; enters breast milk.
Metabolism and Excretion: Highly metabolized by the liver.
Half-life: 10–20 hr.

TIME/ACTION PROFILE (sedation)

ROUTE	ONSET	PEAK	DURATION
PO	15–45 min	1–6 hr	up to 48 hr
IM	15–30 min	1–2 hr†	up to 48 hr
IV	rapid	15–20 min	up to 48 hr

†Amnestic response

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Cross-sensitivity with other benzodiazepines may exist. Comatose patients or those with pre-existing CNS depression. Uncontrolled severe pain. Narrow-angle glaucoma. Pregnancy and lactation.
Use Cautiously in: Severe hepatic/renal/pulmonary impairment; Myasthenia gravis; History of suicide attempt or drug abuse; Geriatric/debilitated patients (dosage reduction recommended); Hypnotic use should be short term.

Adverse Reactions/Side Effects

CNS: dizziness, drowsiness, lethargy, hangover, headache, mental depression, paradoxical excitation. **EENT:** blurred vision. **Resp:** respiratory depression. **CV:** *rapid IV use only*— APNEA, CARDIAC ARREST, bradycardia, hypotension. **GI:** constipation, diarrhea, nausea, vomiting. **Derm:** rashes. **Misc:** physical dependence, psychological dependence, tolerance.

Interactions

Drug-Drug: ↑ CNS depression with other **CNS depressants** including **alcohol, antihistamines, antidepressants, opioid analgesics,** and other **sedative/hypnotics.** May ↓ the efficacy of **levodopa. Smoking** may ↑ metabolism and ↓ effectiveness. **Probenecid** may ↓ metabolism of lorazepam, ↑ its actions.
Drug-Natural Products: Concomitant use of **kava, valerian, skullcap, chamomile,** or **hops** can increase CNS depression.

Route/Dosage

PO (Adults): *Anxiety*—1–3 mg 2–3 times daily (up to 10 mg/day). *Insomnia*—2–4 mg at bedtime.
PO (Geriatric Patients or Debilitated Patients): *Anxiety*—0.5–2 mg/day in divided doses initially. *Insomnia*—0.25–1 mg initially, increased as needed.
IM (Adults): *Preoperative sedation*—50 mcg (0.05 mg)/kg 2 hr before surgery (not to exceed 4 mg).
IV (Adults): *Preoperative sedation*—44 mcg (0.044 mg)/kg (not to exceed 2 mg) 15–20 min before surgery. *Operative amnesia*—up to 50 mcg/kg (not to exceed 4 mg). *Antiemetic*—2 mg 30 min prior to chemo-

therapy; may repeat q 4 hr as needed (unlabeled). *Anticonvulsant*—50 mcg (0.05 mg)/kg, up to 4 mg; may repeat after 10–15 min (not to exceed 8 mg/12 hr; unlabeled).

NURSING IMPLICATIONS

Assessment

- **Anxiety:** Assess degree and manifestations of anxiety prior to and periodically throughout therapy.
- Prolonged high-dose therapy may lead to psychological or physical dependence. Restrict amount of drug available to patient.
- **Status Epilepticus:** Assess location, duration, characteristics, and frequency of seizures.

Potential Nursing Diagnoses

Anxiety (Indications)
Risk for injury (Indications, Side Effects)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- Do not confuse lorazepam with alprazolam or diazepam Do not confuse Ativan (lorazepam) with Atarax (hydroxyzine).
- Following parenteral administration, keep patient supine for at least 8 hr and observe closely.
- **PO:** Tablet may also be given sublingually (unlabeled) for more rapid onset.
- **IM:** Administer IM doses deep into muscle mass at least 2 hr before surgery for optimum effect.
- **Direct IV:** Dilute immediately before use with an equal amount of sterile water, D5W, or 0.9% NaCl for injection. Do not use if solution is colored or contains a precipitate. ***Rate:*** Administer at a rate of 2 mg over 1 min. Rapid IV administration may result in apnea, hypotension, bradycardia, or cardiac arrest.

Patient/Family Teaching

- Instruct patient to take medication exactly as directed and not to skip or double up on missed doses. If medication is less effective after a few weeks, check with health care professional; do not increase dose. Abrupt withdrawal may cause tremors, nausea, vomiting, and abdominal and muscle cramps.
- May cause drowsiness or dizziness. Advise patient to avoid driving or other activities requiring alertness until response to medication is known.
- Caution patient to avoid taking alcohol or other CNS depressants concurrently with this medication.
- Instruct patient to contact health care professional immediately if pregnancy is planned or suspected.
- Emphasize the importance of follow-up exams to determine effectiveness of the medication.

Evaluation/Desired Outcomes

- Increase in sense of well-being
- Decrease in subjective feelings of anxiety without excessive sedation.
- Reduction of preoperative anxiety.
- Postoperative amnesia.
- Improvement in sleep patterns. Need for continued therapy should be re-evaluated regularly. Minimum effective dose should be used.

Why was this drug prescribed for your patient?

memantine (me-man-teen)

Namenda

Classification

Therapeutic: anti-Alzheimer's agents
Pharmacologic:

Pregnancy Category B

Indications

Moderate to severe Alzheimer's dementia.

Action

Binds to CNS N-methyl-D-aspartate (NMDA) receptor sites, preventing binding of glutamate, an excitatory neurotransmitter. **Therapeutic Effects:** Decreased symptoms of dementia. Does not slow progression.

Pharmacokinetics

Absorption: Well absorbed after oral administration.
Distribution: Unknown.
Metabolism and Excretion: 57–82% excreted unchanged in urine by active tubular secretion moderated by pH dependent tubular reabsorption. Remainder metabolized; metabolites are not pharmacologically active.
Half-life: 60–80 hr.

TIME/ACTION PROFILE (blood levels)

ROUTE	ONSET	PEAK	DURATION
PO	unknown	3–7 hr	12 hr

Contraindications/Precautions

Contraindicated in: Severe renal impairment.
Use Cautiously in: Moderate renal impairment (consider ↓ dose); Concurrent use of other NMDA antagonists (amantadine, rimantadine, ketamine, dextromethorphan); Concurrent use of drugs or diets that cause alkaline urine; Pregnancy, lactation, or children (safety not established); Conditions that ↑ urine pH including severe urinary tract infections or renal tubular acidosis (lead to ↓ excretion and ↑ levels).

Adverse Reactions/Side Effects

CNS: dizziness, fatigue, headache. **CV:** hypertension. **Derm:** rash. **GU:** urinary frequency. **Hemat:** anemia.

Interactions

Drug-Drug: Medications that ↑ urine pH lead to ↓ excretion and ↑ blood levels (**carbonic anhydrase inhibitors, sodium bicarbonate**).

Route/Dosage

PO (Adults): 5 mg once daily initially, increased at weekly intervals to 10 mg/day (5 mg twice daily), then 15 mg/day (5 mg once daily, 10 mg once daily as separate doses, then to target dose of 20 mg/day (as 10 mg twice daily).

NURSING IMPLICATIONS

Assessment

- Assess cognitive function (memory, attention, reasoning, language, ability to perform simple tasks) periodically during therapy.
- ***Lab Test Considerations:*** May cause anemia.

Potential Nursing Diagnoses

Disturbed thought process (Indications)
Risk for injury (Side Effects)

Implementation

- Dose increases should occur no more frequently than weekly.
- **PO:** May be administered without regard to food.
- Administer oral solution using syringe provided. Do not dilute or mix with other fluids.

High Alert

meperidine (me-per-i-deen)

Demerol, Pethidine

Classification

Therapeutic: opioid analgesics
Pharmacologic: opioid agonists

Schedule II

Pregnancy Category B

Indications

Moderate or severe pain (alone or with nonopioid agents). Anesthesia adjunct. Analgesic during labor. Preoperative sedation. **Unlabeled uses:** Rigors.

Action

Binds to opiate receptors. Alters perception of and response to painful stimuli, while causing CNS depression. **Therapeutic Effects:** Decreased pain.

Pharmacokinetics

Absorption: 50% absorbed from the GI tract; well absorbed from IM sites.
Distribution: Widely distributed; crosses placenta; enters breast milk.
Metabolism and Excretion: Mostly metabolized by the liver; some converted to normeperidine, which may accumulate and cause seizures.
Half-life: 3–8 hr (prolonged in impaired renal/hepatic function).

TIME/ACTION PROFILE (analgesia)

ROUTE	ONSET	PEAK	DURATION
PO	15 min	60 min	2–4 hr
IM	10–15 min	30–50 min	2–4 hr
Subcut	10–15 min	40–60 min	2–4 hr
IV	immediate	5–7 min	2–4 hr

Contraindications/Precautions

Contraindicated in: Hypersensitivity to meperidine/bisulfites. Recent (14–21 days) MAO inhibitor therapy. Pregnancy/lactation (chronic use).
Use Cautiously in: Head trauma; Increased intracranial pressure; Severe renal, hepatic, or pulmonary disease; Hypothyroidism; Adrenal insufficiency; Alcoholism; Geriatric/debilitated patients (lower doses suggested); Renal impairment; Undiagnosed abdominal pain; Prostatic hyperplasia; Extensive burns; Labor (respiratory depression may occur in the newborn).

Adverse Reactions/Side Effects

CNS: SEIZURES, confusion, sedation, dysphoria, euphoria, floating feeling, hallucinations, headache, unusual dreams. **EENT:** blurred vision, diplopia, miosis. **Resp:** respiratory depression. **CV:** hypotension, bradycardia. **GI:** constipation, nausea, vomiting. **GU:** urinary retention. **Derm:** flushing, sweating. **Misc:** physical dependence, psychological dependence, tolerance.

Interactions

Drug-Drug: Use with extreme caution in patients receiving **MAO inhibitors** or **procarbazine** (may cause fatal reaction—contraindicated within 14–21 days of MAO inhibitor therapy). ↑ CNS depression with **alcohol, antihistamines**, and **sedative/hypnotics.** Administration of **agonist/antagonist opioid analgesics** may precipitate opioid withdrawal in physically dependent patients. **Nalbuphine** or **pentazocine** may ↓ analgesia. **Protease inhibitor antiretrovirals** may ↑ effects and adverse reactions (concurrent use should be avoided. **Phenytoin** ↑ metabolism and may ↓ effects. **Chlorpromazine** and **thioridazine** may ↑ the risk of adverse reactions (concurrent use should be avoided.).
Drug-Natural Products: Concomitant use of **kava, valerian** or **chamomile** can ↓ CNS depression.

Route/Dosage

PO, IM, Subcut: (Adults): *Analgesia*—50–150 mg q 3–4 hr. *Analgesia during labor*—50–100 mg IM or subcut when contractions become regu-

Patient/Family Teaching

- Instruct caregivers on how and when to administer memantine and how to titrate dose. Provide caregiver with *Patient Instructions* sheet.
- Caution patient and caregiver that memantine may cause dizziness.

Evaluation/Desired Outcomes

- Improvement in cognitive function (memory, attention, reasoning, language, ability to perform simple tasks) in patients with Alzheimer's disease.

Why was this drug prescribed for your patient?

lar; may repeat q 1–3 hr. *Preoperative sedation*—50–100 mg IM or subcut 30–90 min before anesthesia.

PO, IM, Subcut: (Children): *Analgesia*—1–1.8 mg/kg q 3–4 hr (should not exceed 100 mg/dose). *Preoperative sedation*—1–2.2 mg/kg 30–90 min before anesthesia (not to exceed adult dose).

IV (Adults): 15–35 mg/hr as a continuous infusion; *PCA*—10 mg initially; with a range of 1–5 mg/incremental dose, recommended lockout interval is 6–10 min (minimum 5 min).

NURSING IMPLICATIONS

Assessment

- Assess type, location, and intensity of pain before and 1 hr after PO, subcut, and IM doses and 5 min (peak) following IV administration. When titrating opioid doses, increases of 25–50% should be administered until there is either a 50% reduction in the patient's pain rating or the patient reports satisfactory pain relief. A repeat dose can be safely administered at the time of the peak if previous dose is ineffective and side effects are minimal.
- An equianalgesic chart (see Appendix B) should be used when changing routes or when changing from one opioid to another.
- Assess BP, pulse, and respirations before and periodically during administration. If respiratory rate is <10/min, assess level of sedation. Dose may need to be decreased by 25–50%. Initial drowsiness will diminish with continued use.
- Assess bowel function routinely. Prevention of constipation should be instituted with increased intake of fluids and bulk, and laxatives to minimize constipating effects. Stimulant laxatives should be administered routinely if opioid use exceeds 2–3 days, unless contraindicated.
- Prolonged use may lead to physical and psychological dependence and tolerance. This should not prevent patient from receiving adequate analgesia. Most patients who receive meperidine for pain do not develop psychological dependence. Progressively higher doses may be required to relieve pain with long-term therapy.
- **Monitor patients on chronic or high-dose therapy for CNS stimulation (restlessness, irritability, seizures) caused by accumulation of normeperidine metabolite** Risk of toxicity increases with doses >600 mg/24 hr, chronic administration (>2 days), and renal impairment.
- ***Toxicity and Overdose:*** If an opioid antagonist is required to reverse respiratory depression or coma, naloxone (Narcan) is the antidote. Dilute the 0.4-mg ampule of naloxone in 10 ml of 0.9% NaCl and administer 0.5 ml (0.02 mg) by direct IV push every 2 min. For children and patients weighing <40 kg, dilute 0.1 mg of naloxone in 10 ml of 0.9% NaCl for a concentration of 10 mcg/ml and administer 0.5 mcg/kg every 2 min. Titrate dose to avoid withdrawal, seizures, and severe pain. In patients receiving meperidine chronically, naloxone may precipitate seizures by eliminating the effects of meperidine, allowing the convulsant activity of normeperidine to predominate. Monitor patient closely.

Potential Nursing Diagnoses

Acute pain (Indications)
Disturbed sensory perception (visual, auditory) (Side Effects)
Risk for injury (Side Effects)

Implementation

- ***High Alert:*** Accidental overdosage of opioid analgesics has resulted in fatalities. Before administering, clarify all ambiguous orders; have second practitioner independently check original order, dose calculations, and infusion pump settings. Do not confuse with morphine or hydromorphone; fatalities have occurred.
- Explain therapeutic value of medication prior to administration to enhance the analgesic effect.
- Regularly administered doses may be more effective than prn administration. Analgesic is more effective if given before pain becomes severe.
- Coadministration with nonopioid analgesics may have additive analgesic effects and permit lower doses.

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CONTINUED

meperidine

- Oral dose is <50% as effective as parenteral. When changing to oral administration, dose may need to be increased (see Appendix B).
- Medication should be discontinued gradually after long-term use to prevent withdrawal symptoms.
- May be administered via PCA pump.
- **PO:** Doses may be administered with food or milk to minimize GI irritation. Syrup should be diluted in half-full glass of water.
- **IM:** Administration of repeated subcut doses may cause local irritation.
- **Direct IV:** Dilute to a concentration of 10 mg/ml with sterile water or 0.9% NaCl for injection. ***Rate: High Alert:*** Administer slowly. Rapid administration may lead to increased respiratory depression, hypotension, and circulatory collapse.
- **Continuous Infusion:** Dilute to a concentration of 1 mg/ml with D5W, D10W, dextrose/saline combinations, dextrose/Ringer's or lactated Ringer's injection combinations, 0.45% NaCl, 0.9% NaCl, or Ringer's or LR. Administer via infusion pump.
- **Syringe Compatibility:** atropine, chlorpromazine, cimetidine, dimenhydrinate, diphenhydramine, droperidol, glycopyrrolate, hydroxyzine, ketamine, metoclopramide, midazolam, ondansetron, perphenazine, prochlorperazine, promethazine, ranitidine, scopolamine.
- **Syringe Incompatibility:** heparin, pentobarbital.
- **Y-Site Compatibility:** amifostine, amikacin, ampicillin, ampicillin/sulbactam, atenolol, aztreonam, bumetanide, cefazolin, cefotaxime, cefotetan, cefoxitin, ceftazidime, ceftizoxime, ceftriaxone, cefuroxime, chloramphenicol, cisatracurium, cladribine, clindamycin, dexamethasone, diltiazem, diphenhydramine, dobutamine, docetaxel, dopamine, doxycycline, droperidol, erythromycin lactobionate, etoposide phosphate, famotidine, filgrastim, fluconazole, fludarabine, gatifloxacin, gemcitabine, gentamicin, granisetron, heparin, hydrocortisone sodium succinate, insulin, kanamycin, labetalol, lidocaine, linezolid, magnesium sulfate, melphalan, methyldopate, methylprednisolone, metoclopramide, metoprolol, metronidazole, ondansetron, oxacillin, oxytocin, paclitaxel, penicillin G potassium, piperacillin, piperacillin/tazobactam, potassium chloride, propofol, propranolol, ranitidine, remifentanil, sargramostim, teniposide, thiotepa, ticarcillin, ticarcillin/clavulanate, tobramycin, trimethoprim/sulfamethoxazole, vancomycin, verapamil, vinorelbine.
- **Y-Site Incompatibility:** allopurinol, amphotericin B cholesteryl sulfate, cefepime, cefoperazone, doxorubicin liposome, idarubicin, imipenem/cilastatin, minocycline.

Patient/Family Teaching

- Instruct patient on how and when to ask for pain medication.
- Medication may cause drowsiness or dizziness. Advise patient to call for assistance when ambulating or smoking. Caution patient to avoid driving and other activities requiring alertness until response to medication is known.
- Advise patient to change position slowly to minimize orthostatic hypotension.
- Advise patient to avoid alcohol or other CNS depressants concurrently.

Evaluation/Desired Outcomes

- Decrease in severity of pain without significant change in level of consciousness or respiratory status.

Why was this drug prescribed for your patient?

metformin (met-**for**-min)

Fortamet, Glucophage, Glucophage XR, Riomet, ♣Novo-Metformin

Classification

Therapeutic: antidiabetics
Pharmacologic: biguanides

Pregnancy Category B

Indications

Management of type 2 diabetes mellitus. May be used with diet, insulin, or sulfonylurea oral hypoglycemic agents.

Action

↓ hepatic production of glucose. ↓ intestinal absorption of glucose. ↑ sensitivity to insulin. **Therapeutic Effects:** Maintenance of blood glucose.

Pharmacokinetics

Absorption: 50–60% absorbed after oral administration.
Distribution: Enters breast milk in concentrations similar to those of plasma.
Metabolism and Excretion: Eliminated mostly unchanged in urine.
Half-life: 17.6 hr.

TIME/ACTION PROFILE (control of blood glucose)

ROUTE	ONSET	PEAK	DURATION
PO	several days	2–4 wk	12 hr (24 hr for extended release tablets)

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Metabolic acidosis. Dehydration, sepsis, hypoxemia, hepatic impairment, excessive alcohol use (acute or chronic). Renal dysfunction (serum creatinine >1.5 mg/dl in men or >1.4 mg/dl in women). Radiographic studies requiring IV iodinated contrast media (withhold metformin). CHF.
Use Cautiously in: Concurrent renal disease; Geriatric/debilitated patients (↓ doses may be required; avoid in patients >80 yr unless renal function is normal); Chronic alcohol use/abuse; Serious medical conditions (MI, stroke); Patients undergoing stress (infection, surgical procedures); Hypoxia; Pituitary deficiency or hyperthyroidism; Pregnancy, lactation, or children <10 yr (safety not established; extended release for use in patients >17 yr only).

Adverse Reactions/Side Effects

GI: bloating, diarrhea, nausea, vomiting, unpleasant metallic taste. **Endo:** hypoglycemia. **F and E:** LACTIC ACIDOSIS. **Misc:** ↓ vitamin B_{12} levels.

Interactions

Drug-Drug: Acute or chronic **alcohol** consumption or **iodinated contrast media** increases the risk of lactic acidosis. **Amiloride**, **calcium channel blockers**, **digoxin**, **morphine**, **procainamide**, **quinidine**, **ranitidine**, **triamterene**, **trimethoprim**, and **vancomycin** may compete for elimination pathways with metformin. Altered responses may occur. **Cimetidine** and **furosemide** may ↑ the effects of metformin. **Nifedipine** ↑ absorption and may ↑ the effects.
Drug-Natural Products: Glucosamine may worsen blood glucose control. **Chromium**, and **coenzyme Q-10** may produce additive hypoglycemic effects.

Route/Dosage

PO (Adults and children >17 yr): 500 mg twice daily; may increase by 500 mg at weekly intervals up to 2000 mg/day. If doses >2000 mg/day are required, give in 3 divided doses (not to exceed 2500 mg/day) or 850 mg once daily; may increase by 850 mg at 2-wk intervals (in divided doses) up to 2550 mg/day in divided doses (up to 850 mg 3 times daily); *Extended-release tablets*—500–1000 mg once daily with evening meal, may increase

by 500 mg at weekly intervals up to 2500 mg once daily. If 2000 mg once daily is inadequate, 1000 mg twice daily may be used.
PO (Children ≥10 yr): 500 mg twice daily, may be increased by 500 mg/day at 1–wk intervals, up to 2000 mg/day in 2 divided doses.

NURSING IMPLICATIONS

Assessment

- Observe for signs and symptoms of hypoglycemic reactions (abdominal pain, sweating, hunger, weakness, dizziness, headache, tremor, tachycardia, anxiety) when combined with oral sulfonylureas.
- **Patients who have been well controlled on metformin who develop illness or laboratory abnormalities should be assessed for ketoacidosis or lactic acidosis. Assess serum electrolytes, ketones, glucose, and, if indicated, blood pH, lactate, pyruvate, and metformin levels. If either form of acidosis is present, discontinue metformin immediately and treat acidosis.**
- ***Lab Test Considerations:*** Monitor serum glucose and glycosylated hemoglobin periodically during therapy to evaluate effectiveness of therapy. May cause false-positive results for urine ketones.
- Moniotor blood glucose concentrations routinely by patient and every 3 mo by health care professional to determine effectiveness of therapy.
- Assess renal function before initiating and at least annually during therapy. Discontinue metformin if renal impairment occurs.
- Monitor serum folic acid and vitamin B_{12} every 1–2 yr in long-term therapy. Metformin may interfere with absorption.

Potential Nursing Diagnoses

Imbalanced nutrition: more than body requirements (Indications)
Noncompliance (Patient/Family Teaching)

Implementation

- Patients stabilized on a diabetic regimen who are exposed to stress, fever, trauma, infection, or surgery may require administration of insulin. Withhold metformin and reinstitute after resolution of acute episode.
- Metformin therapy should be temporarily discontinued in patients requiring surgery involving restricted intake of food and fluids. Resume metformin when oral intake has resumed and renal function is normal.
- Withhold metformin before or at the time of studies requiring IV administration of iodinated contrast media and for 48 hr after study.
- **PO:** Administer metformin with meals to minimize GI effects.
- **XR tablets must be swallowed whole; do not crush or chew.**

Patient/Family Teaching

- Instruct patient to take metformin at the same time each day, exactly as directed. If a dose is missed, take as soon as possible unless almost time for next dose. Do not double doses.
- Explain to patient that metformin helps control hyperglycemia but does not cure diabetes. Therapy is usually long term.
- Encourage patient to follow prescribed diet, medication, and exercise regimen to prevent hyperglycemic or hypoglycemic episodes.
- Review signs of hypoglycemia and hyperglycemia with patient. If hypoglycemia occurs, advise patient to take a glass of orange juice or 2–3 tsp of sugar, honey, or corn syrup dissolved in water, and notify health care professional.
- Instruct patient in proper testing of blood glucose and urine ketones. These tests should be monitored closely during periods of stress or illness and health care professional notified if significant changes occur.
- **Explain to patient the risk of lactic acidosis and the potential need for discontinuation of metformin therapy if a severe infection, dehydration, or severe or continuing diarrhea occurs or if medical tests or surgery is required. Symptoms of lactic acidosis (chills, diarrhea, dizziness, low blood pressure, muscle pain, sleepiness, slow heartbeat or pulse, dyspnea, or weakness) should be reported to health care professional immediately.**
- Caution patient to avoid taking other Rx, OTC, herbal products, or alcohol during metformin therapy without consulting health care professional.

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metformin

- Insulin is the recommended method of controlling blood glucose during pregnancy. Counsel female patients to use a form of contraception other than oral contraceptives and to notify health care professional promptly if pregnancy is planned or suspected.
- Inform patient that metformin may cause an unpleasant or metallic taste that usually resolves spontaneously.
- Inform patients taking XR tablets that inactive ingredients resembling XR tablet may appear in stools.
- Advise patient to inform health care professional of medication regimen before treatment or surgery.
- Advise patient to carry a form of sugar (sugar packets, candy) and identification describing disease process and medication regimen at all times.
- Advise patient to report the occurrence of diarrhea, nausea, vomiting, and stomach pain or fullness to health care professional.
- Emphasize the importance of routine follow-up exams and regular testing of blood glucose, glycosylated hemoglobin, renal function, and hematologic parameters.

Evaluation/Desired Outcomes

- Control of blood glucose levels without the appearance of hypoglycemic or hyperglycemic episodes. Control may be achieved within a few days, but full effect of therapy may be delayed for up to 2 wk. If patient has not responded to metformin after 4 wk of maximum dose therapy, an oral sulfonylurea may be added. If satisfactory results are not obtained with 1–3 months of concurrent therapy, oral agents may be discontinued and insulin therapy instituted.

Why was this drug prescribed for your patient?

High Alert

methotrexate (meth-o-**trex**-ate)

amethopterin, Folex, Folex PFS, Rheumatrex, Trexall

Classification

Therapeutic: antineoplastics, antirheumatics (DMARDs), immunosuppressants
Pharmacologic: antimetabolites

Pregnancy Category X

Indications

Alone or in combination with other treatment modalities (other antineoplastics, surgery, or radiation therapy) in the treatment of Trophoblastic neoplasms (choriocarcinoma, chorioadenoma destruens, hydatidiform mole), Leukemias, Lymphomas, Breast, head, neck, and lung carcinomas. Severe psoriasis. Rheumatoid arthritis. Mycosis fungoides (cutaneous T-cell lymphoma).

Action

Interferes with folic acid metabolism. Result is inhibition of DNA synthesis and cell reproduction (cell-cycle—S phase–specific). Also has immunosuppressive activity. **Therapeutic Effects:** Death of rapidly replicating cells, particularly malignant ones. Immunosuppression.

Pharmacokinetics

Absorption: Small doses are well absorbed from the GI tract. Larger doses incompletely absorbed.
Distribution: Actively transported across cell membranes, widely distributed. Does not reach therapeutic concentrations in the CSF. Crosses the placenta; enters breast milk in low concentrations.
Metabolism and Excretion: Excreted mostly unchanged by the kidneys.
Half-life: 2–4 hr (increased in renal impairment).

TIME/ACTION PROFILE (effects on blood counts)

ROUTE	ONSET	PEAK	DURATION
PO, IM, IV	4–7 days	7–14 days	21 days

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Pregnancy or lactation.
Use Cautiously in: Renal impairment (CCr must be ≥60 ml/min before therapy); Active infections; Decreased bone marrow reserve; Geriatric patients or patients with other chronic debilitating illnesses; Patients with childbearing potential.

Adverse Reactions/Side Effects

CNS: arachnoiditis (IT use only) , dizziness, drowsiness, headaches, malaise. **EENT:** blurred vision, dysarthria transient blindness. **Resp:** PULMONARY FIBROSIS, intestitial pneumonitis. **GI:** anorexia, hepatotoxicity, nausea, stomatitis, vomiting. **GU:** infertility. **Derm:** alopecia, painful plaque erosions (during psoriasis treatment), photosensitivity, pruritus, rashes, skin ulceration, urticaria. **Hemat:** APLASTIC ANEMIA, anemia, leukopenia, thrombocytopenia. **Metab:** hyperuricemia. **MS:** osteonecrosis, stress fracture. **Misc:** nephropathy, chills, fever, soft tissue necrosis.

Interactions

Drug-Drug: The following drugs may ↑ hematologic toxicity of methotrexate: high-dose **salicylates**, **NSAIDs**, **oral hypoglycemic agents (sulfonylureas)**, **phenytoin**, **tetracyclines**, **probenecid**, **trimethoprim/sulfamethoxazole**, **pyrimethamine**, and **chloramphenicol**. ↑ hepatotoxicity with other **hepatotoxic drugs** including **azathioprine**, **sulfasalazine**, and **retinoids.** ↑ nephrotoxicity with other **nephrotoxic drugs.** ↑ bone marrow depression with other **antineoplastics** or **radiation therapy. Radiation therapy** ↑ risk of soft tissue necrosis and osteonecrosis. May ↓ antibody response to **live-virus vaccines** and ↑ risk of adverse reactions. ↑ risk of neurologic reactions with **acyclovir** (IT methotrexate only). **Asparaginase** may ↓ effects of methotrexate.

Drug-Natural Products: Concomitant use with **echinacea,** and **melatonin** may interfere with immunosuppression. **Caffeine** may ↓ efficacy of methotrexate, similar effect may occur with **guarana**.

Route/Dosage

Trophoblastic Neoplasms

PO, IM (Adults): 15–30 mg/day for 5 days, repeat after 1 or more wk for 3–5 courses.

Breast Cancer

IV (Adults): 40 mg/m^2 on days 1 and 8 (with other agents; many regimens are used).

Leukemia

PO (Adults): *Induction*—3.3 mg/m^2/day, usually with prednisone.
PO, IM (Adults): *Maintenance*—20–30 mg/m^2 twice weekly.
IV (Adults): 2.5 mg/kg q 2 wk.
IT (Adults): 12 mg/m^2 or 15 mg.
IT (Children ≥3 yr): 12 mg.
IT (Children 2 yr): 10 mg.
IT (Children 1 yr): 8 mg.
IT (Children <1 yr): 6 mg.

Osteosarcoma

IV (Adults): 12 g/m^2 as a 4-hr infusion followed by leucovorin rescue, usually as part of a combination chemotherapeutic regimen (or increase dose until peak serum methotrexate level is 1×10^{-5} M/L, but not to exceed 15 g/m^2; 12 courses are given starting 4 wk after surgery and repeated at scheduled intervals.

Psoriasis

Therapy may be preceded by a 5–10 mg test dose.
PO (Adults): 2.5–5 mg q 12 hr for 3 doses or q 8 hr for 4 doses once weekly (not to exceed 30 mg/wk).
PO, IM, IV (Adults): 10–25 mg/weekly (not to exceed 30 mg/wk).

Arthritis

Therapy may be preceded by a 5–10 mg test dose.
PO (Adults): 7.5 mg weekly (2.5 mg q 12 hr for 3 doses or single dose; not to exceed 20 mg/wk); when response is obtained, dosage should be decreased.
PO (Children): 10 mg/m^2 once weekly initially, may be increased up to 20–30 mg/m^2, however response may be better if doses >20 mg/m^2 are given IM or subcut.

Mycosis Fungoides

PO, IM, Subcut: (Adults): 5–50 mg once weekly, if response is poor, dose may be changed to 15–37.5 mg twice weekly.

NURSING IMPLICATIONS

Assessment

- Monitor blood pressure, pulse, and respiratory rate periodically during administration. Report significant changes.
- Monitor for abdominal pain, diarrhea, or stomatitis. Report occurrence; therapy may need to be discontinued.
- Monitor for bone marrow depression. Assess for bleeding (bleeding gums, bruising, petechiae, guaiac stools, urine, and emesis) and avoid IM injections and taking rectal temperatures if platelet count is low. Apply pressure to venipuncture sites for 10 min. Assess for signs of infection during neutropenia. Anemia may occur. Monitor for increased fatigue, dyspnea, and orthostatic hypotension.
- Monitor intake and output ratios and daily weights. Report significant changes in totals.
- Monitor for symptoms of pulmonary toxicity, which may manifest early as a dry, nonproductive cough.
- Monitor for symptoms of gout (increased uric acid, joint pain, edema). Encourage patient to drink at least 2 L of fluid each day. Allopurinol and alkalinization of urine may be used to decrease uric acid levels.
- Assess nutritional status. Administering an antiemetic prior to and periodically during therapy and adjusting diet as tolerated may help maintain fluid and electrolyte balance and nutritional status.
- **IT:** Assess for development of nuchal rigidity, headache, fever, confusion, drowsiness, dizziness, weakness, or seizures.

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methotrexate

- **Rheumatoid Arthritis:** Assess patient for pain and range of motion prior to and periodically during therapy.
- **Psoriasis:** Assess skin lesions prior to and periodically during therapy.
- ***Lab Test Considerations:*** Monitor CBC and differential prior to and frequently during therapy. The nadir of leukopenia and thrombocytopenia occurs in 7–14 days. Leukocyte and thrombocyte counts usually recover 7 days after the nadirs. Notify physician of any sudden drop in values.
- Monitor renal (BUN and creatinine) and hepatic function (AST, ALT, bilirubin, and LDH) prior to and routinely during therapy. Urine pH should be monitored prior to high-dose methotrexate therapy and every 6 hr during leucovorin rescue. Urine pH should be kept above 7.0 to prevent renal damage.
- May cause ↑ serum uric acid concentrations, especially during initial treatment of leukemia and lymphoma.
- ***Toxicity and Overdose:*** Monitor serum methotrexate levels every 12–24 hr during high-dose therapy until levels are $<5 \times 10$ M. This monitoring is essential to plan correct leucovorin dose and determine duration of rescue therapy. With high-dose therapy, patient must receive leucovorin rescue within 24–48 hr to prevent fatal toxicity. In cases of massive overdose, hydration and urinary alkalization may be required to prevent renal tubule damage. Monitor fluid and electrolyte status. Intermittent hemodialysis using a high-flux dialyzer may be used for clearance until levels are <0.05 micromolar.

Potential Nursing Diagnoses

Risk for infection (Adverse Reactions)
Imbalanced nutrition: less than body requirements (Adverse Reactions)
Deficient knowledge, related to medication regimen (Patient/Family Teaching)

Implementation

- ***High Alert:*** Fatalities have occurred with chemotherapeutic agents. Before administering, clarify all ambiguous orders; double check single, daily, and course-of-therapy dose limits; have second practitioner independently double check original order, calculations, and infusion pump settings. Methotrexate for non-oncologic use is given at a much lower dose and frequency—often just once a week. Do not confuse non-oncologic dosing regimens with dosing regimens for cancer patients.
- Solutions for injection should be prepared in a biologic cabinet. Wear gloves, gown, and mask while handling medication. Discard equipment in specially designated containers.
- **Direct IV:** Reconstitute each vial with 25 ml of 0.9% NaCl for a concentration no greater than 25 mg/ml. Use sterile preservative-free diluents for high-dose regimens to prevent complications from large amounts of benzyl alcohol. Do not use preparations that are discolored or that contain a precipitate. Reconstitute immediately before use. Discard unused portion. ***Rate:*** Administer at a rate of 10 mg/min into Y-site of a free-flowing IV.
- **Intermittent/Continuous Infusion:** May also be diluted in D5W, D5/0.9% NaCl, or 0.9% NaCl and infused as intermittent or continuous infusion. ***Rate:*** Administration rates of 4–20 mg/hr have been used.
- **Syringe Compatibility:** bleomycin, cisplatin, cyclophosphamide, doxapram, doxorubicin, fluorouracil, furosemide, heparin, leucovorin, mitomycin, vinblastine, vincristine.
- **Syringe Incompatibility:** droperidol.
- **Y-Site Compatibility:** allopurinol, amifostine, amphotericin B cholesteryl sulfate, asparaginase, aztreonam, bleomycin, cefepime, ceftriaxone, cimetidine, cisplatin, cyclophosphamide, cytarabine, daunorubicin, diphenhydramine, doxorubicin, doxorubicin liposome, etoposide, etoposide phosphate, famotidine, filgrastim, fludarabine, fluorouracil, furosemide, ganciclovir, gatifloxacin, granisetron, heparin, hydromorphone, imipenem/cilastatin, leucovorin, linezolid, lorazepam, melphalan, mes-

methylphenidate (meth-ill-fen-i-date)

Concerta, Metadate CD, Metadate ER, Methylin, Methylin SR, ♣PMS-Methylphenidate, ♣Riphenidate, Ritalin, Ritalin LA, Ritalin-SR

Classification

Therapeutic: central nervous system stimulants

Schedule II

Pregnancy Category C

Indications

Attention deficit hyperactivity disorder (ADHD). Symptomatic treatment of narcolepsy.

Action

Produces CNS and respiratory stimulation with weak sympathomimetic activity. **Therapeutic Effects:** Increased attention span in ADHD. Increased motor activity/mental alertness/decreased fatigue in narcoleptic patients.

Pharmacokinetics

Absorption: Well absorbed.
Distribution: Unknown.
Metabolism and Excretion: 80% metabolized by the liver.
Half-life: 1–3 hr.

TIME/ACTION PROFILE (CNS stimulation)

ROUTE	ONSET	PEAK	DURATION
PO	unknown	1–3 hr	4–6 hr
PO-ER	unknown	unknown	up to 8 hr
Concerta	unknown	6-8 hr	up to 24 hr

Contraindications/Precautions

Contraindicated in: Hypersensitivity. Hyperexcitable states. Hyperthyroidism. Patients with psychotic personalities or suicidal or homicidal tendencies. Glaucoma. Motor tics. Concurrent use or use within 14 days of MAO inhibitors.

Use Cautiously in: History of cardiovascular disease; Hypertension; Diabetes mellitus; Continual use (may result in psychological dependence or addiction); Seizure disorders (may lower seizure threshold); Geriatric or debilitated patients; Concerta product should be used cautiously in patients with esophageal motility disorders (may increase the risk of obstruction); Pregnancy or lactation (safety not established).

Adverse Reactions/Side Effects

CNS: hyperactivity, insomnia, restlessness, tremor, dizziness, headache, irritability. **EENT:** blurred vision. **CV:** palpitations, tachycardia, hypertension, hypotension. **GI:** anorexia, constipation, cramps, diarrhea, dry mouth, metallic taste, nausea, vomiting. **Derm:** rashes. **Neuro:** akathisia, dyskinesia. **Misc:** fever, hypersensitivity reactions, physical dependence, psychological dependence, suppression of weight gain (children), tolerance.

Interactions

Drug-Drug: ↑ sympathomimetic effects with **adrenergics, vasoconstrictors,** and **decongestants.** Use with **MAO inhibitors** or **vasopressors** may result in hypertensive crisis (concurrent use or use within 14 days of MAO inhibitors is contraindicated). May ↑ the effects of **warfarin, anticonvulsants,** and **tricyclic antidepressants.** Avoid concurrent **pimozide** (may mask cause of tics). Concurrent use with intrathecal **clonidine** may result in serious adverse reactions.

Drug-Natural Products: Use with caffeine-containing herbs (**cola nut, guarana, mate**) ↑ stimulant effect.

Drug-Food: Excessive use of **caffeine**-containing foods or beverages (**coffee, cola, tea**) may cause ↑ CNS stimulation.

na, methylprednisolone sodium succinate, metoclopramide, mitomycin, morphine, ondansetron, oxacillin, paclitaxel, piperacillin/tazobactam, prochlorperazine, ranitidine, sargramostim, teniposide, thiotepa, vinblastine, vincristine, vinorelbine.

- **Y-Site Incompatibility:** chlorpromazine, gemcitabine, idarubicin, ifosfamide, midazolam, nalbuphine, promethazine, propofol.
- **Additive Compatibility:** cyclophosphamide, cytarabine, fluorouracil, mercaptopurine, ondansetron, sodium bicarbonate, vincristine. **IT:** Reconstitute preservative-free methotrexate with preservative-free 0.9% NaCl, Elliot's B solution, or patient's CSF to a concentration of 1 mg/ml. May be administered via lumbar puncture or Ommaya reservoir. To prevent bacterial contamination, use immediately.

Patient/Family Teaching

- Instruct patient to take medication as directed. If a dose is missed, it should be omitted. Consult health care professional if vomiting occurs shortly after a dose is taken.
- Instruct patient to notify health care professional promptly if fever; chills; cough; hoarseness; sore throat; signs of infection; lower back or side pain; painful or difficult urination; bleeding gums; bruising; petechiae; blood in stools, urine, or emesis; increased fatigue; dyspnea; or orthostatic hypotension occurs. Caution patient to avoid crowds and persons with known infections. Instruct patient to use soft toothbrush and electric razor and to avoid falls. Caution patient not to drink alcoholic beverages or take medication containing aspirin or other NSAIDs; may precipitate gastric bleeding.
- Instruct patient to inspect oral mucosa for erythema and ulceration. If ulceration occurs, advise patient to use sponge brush and to rinse mouth with water after eating and drinking. Topical therapy may be used if mouth pain interferes with eating. Stomatitis pain may require treatment with opioid analgesics.
- Instruct patient to avoid the use of OTC drugs or herbal products without first consulting health care professional.
- Advise patient that this medication may have teratogenic effects. Contraception should be used during therapy and for at least 3 mo for men and 1 ovulatory cycle for women after completion of therapy.
- Discuss the possibility of hair loss with patient. Explore methods of coping.
- Instruct patient not to receive any vaccinations without advice of health care professional.
- Caution patient to use sunscreen and protective clothing to prevent photosensitivity reactions.
- Emphasize the need for periodic lab tests to monitor for side effects.

Evaluation/Desired Outcomes

- Improvement of hematopoietic values in leukemia
- Decrease in symptoms of meningeal involvement in leukemia.
- Decrease in size and spread of non-Hodgkin's lymphomas and other solid cancers.
- Resolution of skin lesions in severe psoriasis.
- Decreased joint pain and swelling
- Improved mobility in patients with rheumatoid arthritis.
- Regression of lesions in mycosis fungoides.

Why was this drug prescribed for your patient?

Route/Dosage

PO (Adults): 5–20 mg 2–3 times daily as prompt-release tablets. When maintenance dose is determined, may change to extended-release formulation.

PO (Children >6 yr): *Prompt release tablets*—0.3 mg/kg/dose or 2.5–5 mg before breakfast and lunch; increase by 5–10 mg at weekly intervals (not to exceed 60 mg/day or 2 mg/kg/day). When maintenance dose is determined, may change to extended-release formulation. *Ritalin SR, Metadate ER*—may be used in place of the Prompt-release tablets when the 8-hour dosage corresponds to the titrated 8-hour dosage of the Prompt-release tablets; *Ritalin LA*—can be used in place of twice daily regimen given once daily at same total dose, or in place of SR product at same dose; *Concerta (patients who have not taken methylphenidate previously)*—18 mg once daily in the morning initially, may be titrated as needed up to 54 mg/day. *Concerta (patients are currently taking other forms of methylphenidate)*—18 mg once daily in the morning if previous dose was 5 mg 2–3 times daily or 20 mg daily as SR product, 36 mg once daily in the morning if previous dose was 10 mg 2–3 times daily or 40 mg daily as SR product, 54 mg once daily in the morning if previous dose was 15 mg 2–3 times daily or 60 mg once daily as SR product. *Metadate CD*—20 mg once daily. Dosage may be adjusted in weekly 20 mg increments to a maximum of 60 mg/day taken once daily in the morning.

NURSING IMPLICATIONS

Assessment

- Monitor blood pressure, pulse, and respiration before administering and periodically during therapy.
- Monitor growth, both height and weight, in children undergoing long-term therapy.
- May produce a false sense of euphoria and well-being. Provide frequent rest periods and observe patient for rebound depression after the effects of the medication have worn off.
- Methylphenidate has high dependence and abuse potential. Tolerance to medication occurs rapidly; do not increase dose.
- **ADHD:** Assess children for attention span, impulse control, and interactions with others. Therapy may be interrupted at intervals to determine whether symptoms are sufficient to continue therapy.
- **Narcolepsy:** Observe and document frequency of episodes.
- ***Lab Test Considerations:*** Monitor CBC, differential, and platelet count periodically in patients receiving prolonged therapy.

Potential Nursing Diagnoses

Disturbed thought process (Side Effects)

Deficient knowledge, related to diet and medication regimen (Patient/Family Teaching)

Implementation

- **PO:** Administer with or after a meal. **Sustained-release tablets should be swallowed whole; do not crush, break, or chew** Metadate CD and Ritalin LA capsules may be opened and sprinkled on cool applesauce, entire mixture should be ingested immediately and followed by a drink of water. Do not store for future use.

Patient/Family Teaching

- Instruct patient to take medication as directed. If a dose is missed, take the remaining doses for that day at regularly spaced intervals; do not double doses. Take the last dose before 6 PM to minimize the risk of insomnia. Instruct patient not to alter dose without consulting health care professional. Abrupt cessation with high doses may cause extreme fatigue and mental depression.
- Advise patient to check weight 2–3 times weekly and report weight loss to health care professional.
- May cause dizziness or blurred vision. Caution patient to avoid driving or activities requiring alertness until response to medication is known.
- Inform patient and/or parents that shell of Concerta tablet may appear in the stool. This is no cause for concern.

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