

insulin, regular (injection, concentrated) (in-su-lin)

HumuLIN R,  Insulin-Toronto, NovoLIN R, HumuLIN R Regular U-500 (Concentrated)

Classification

Therapeutic: antidiabetics, hormones

Pharmacologic: pancreatics

Pregnancy Category B

Indications

Control of hyperglycemia in patients with diabetes mellitus. **Concentrated regular insulin U-500:** Only for use in patients with insulin requirements >200 units/day. **Unlabeled Use:** Treatment of hyperkalemia.

Action

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

Pharmacokinetics

Absorption: Rapidly absorbed from subcutaneous administration sites. U-100 regular insulin is absorbed slightly more quickly than U-500.

Distribution: Identical to endogenous insulin.

Metabolism and Excretion: Metabolized by liver, spleen, kidney, and muscle.

Half-life: 30–60 min.

TIME/ACTION PROFILE (hypoglycemic effect)

ROUTE	ONSET	PEAK	DURATION
Regular insulin IV	10–30 min	15–30 min	30–60 min
Regular insulin subcutaneous	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.

 = Canadian drug name.

 = Genetic Implication.

CAPITALS indicate life-threatening, underlines indicate most frequent.

~~Strikethrough~~ = Discontinued.

Use Cautiously in: Stress or infection—may temporarily ↑ insulin requirements; Renal/hepatic impairment—may ↓ insulin requirements; Concomitant use with pioglitazone or rosiglitazone (↑ risk of fluid retention and worsening HF); **OB:** Pregnancy may temporarily ↑ insulin requirements.

Adverse Reactions/Side Effects

Endo: HYPOGLYCEMIA. **Local:** lipodystrophy, pruritus, erythema, swelling. **Misc:** allergic reactions including ANAPHYLAXIS.

Interactions

Drug-Drug: Beta blockers, clonidine, and reserpine may mask some of the signs and symptoms of hypoglycemia. **Corticosteroids, thyroid supplements, estrogens, isoniazid, niacin, phenothiazines, and rifampin** may ↑ insulin requirements. **Alcohol, ACE inhibitors, MAO inhibitors, octreotide, oral hypoglycemic agents, and salicylates,** may ↓ insulin requirements. Concurrent use with **pioglitazone or rosiglitazone** may ↑ risk of fluid retention and worsening HF.

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

Route/Dosage

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

Ketoacidosis—Regular (100 units/mL) Insulin Only

IV (Adults): 0.1 unit/kg/hr as a continuous infusion.

IV (Children): Loading dose-0.1 unit/kg, then maintenance continuous infusion 0.05–0.2 unit/kg/hr, titrate to optimal rate of decrease of serum glucose of 80–100 mg/dL/hr.

Maintenance Therapy

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

Treatment of Hyperkalemia

Subcut, IV (Adults and Children): dextrose 0.5–1 g/kg combined with insulin 1 unit for every 4–5 g dextrose given.

NURSING IMPLICATIONS

Assessment

● **Assess patient periodically for symptoms of hypoglycemia (anxiety; restlessness; tingling in hands, feet, lips, or tongue; chills; cold sweats; con-**

fusion; cool, pale skin; difficulty in concentration; drowsiness; nightmares or trouble sleeping; excessive hunger; headache; irritability; nausea; nervousness; tachycardia; tremor; weakness; unsteady gait) and hyperglycemia (confusion, drowsiness; flushed, dry skin; fruit-like breath odor; rapid, deep breathing, polyuria; loss of appetite; unusual thirst) during therapy.

- Monitor body weight periodically. Changes in weight may necessitate changes in insulin dose.
- **Lab Test Considerations:** Monitor blood glucose every 6 hr during therapy, more frequently in ketoacidosis and times of stress. A1C may be monitored every 3–6 mo 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:** Medication errors involving insulins have resulted in serious patient harm and death. Clarify all ambiguous orders and do not accept orders using the abbreviation “u” for units, which can be misread as a zero or the numeral 4 and has resulted in tenfold overdoses. Insulins are available in different types and strengths. Check type, dose, and expiration date with another licensed nurse. Do not interchange insulins without consulting health care professional. Do not confuse regular **concentrated (U-500)** insulin with regular insulin. To prevent errors between regular U-100 insulin and concentrated U-500 insulin, concentrated U-500 insulin is marked with a band of diagonal brown strips and “U-500” is highlighted in red on the label and a conversion chart should always be available.
- **Do not confuse Humulin with Humalog. Do not confuse Novolin with Novolog.**
- 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. Prior to withdrawing dose, rotate vial between palms to ensure uniform solution; do not shake.
- When mixing insulins, draw regular insulin into syringe first to avoid contamination of regular insulin vial.

- Insulin should be stored in a cool place but does not need to be refrigerated.
- **Subcut:** Administer regular insulin within 15–30 min before a meal.

IV Administration

- **IV:** Do not use if cloudy, discolored, or unusually viscous. **High Alert:** Do not administer regular (concentrated) insulin U-500 IV.
- **Direct IV: Diluent:** May be administered IV undiluted directly into vein or through Y-site. **Rate:** Administer up to 50 units over 1 min.
- **Continuous Infusion: Diluent:** May be diluted in 0.9% NaCl using polyvinyl chloride infusion bags. **Concentration:** 0.1 unit/mL to 1 unit/mL in infusion systems with the infusion fluids. **Rate:** Rate should be ordered by health care professional, and infusion placed on an IV pump for accurate administration.
- Rate of administration should be decreased when serum glucose level reaches 250 mg/dL.
- **Y-Site Compatibility:** acyclovir, alfentanil, aminophylline, amphotericin B lipid complex, anidulafungin, argatroban, ascorbic acid, atropine, azathoprine, aztreonam, benztropine, bivalirudin, bleomycin, bumetanide, buprenorphine, calcium chloride, calcium gulconate, carboplatin, carmustine, caspofungin, ceftazolin, cefepime, ceftaroline, ceftazidime, ceftriaxone, cefuroxime, chloramphenicol, clindamycin, cyanocobalamin, cyclophosphamide, cytarabine, dactinomycin, daptomycin, dexamethasone, dexmedetomidine, dexrazoxane, docetaxel, doripenem, doxapram, doxorubicin liposomal, doxycycline, enalapril, ephedrine, epirubicin, epoetin alfa, ertapenem, erythromycin, esmolol, etoposide, etoposide phosphate, fenoldopam, fentanyl, fluconazole, fludarabine, folic acid, fosarnet, ganciclovir, gemcitabine, granisetron, hetastarch, hydrocortisone, hydromorphone, ibuprofen, idarubicin, ifosfamide, imipenem-cilastatin, indomethacin, irinotecan, ketorolac, leucovorin calcium, lidocaine, linezolid, lorazepam, magnesium sulfate, mannitol, mechlorethamine, meperidine, meropenem, methotrexate, methylodopate, methylprednisolone, metoclopramide, metoprolol, metronidazole, milrinone, mitoxantrone, moxifloxacin, mycophenolate, nalbuphine, naloxone, nitroglycerin, nitroprusside, octreotide, oxacillin, oxaliplatin, paclitaxel, palonosetron, pamidronate, pancuronium, papaverine, pemetrexed, penicillin G, pentazocine, pentobarbital, phenobarbital, phytonadione, potassium acetate, potassium chloride, procainamide, promethazine, propofol, pyridoxine, remifentanyl, sodium bicarbonate, streptokinase, sufentanil, tacrolimus, teniposide, terbutaline, theophylline, thiamine, thiotepa, ticarcillin/clavulanate, tigecycline, tirofiban, tolazoline, vancomycin, vecuronium, verapamil, vinblastine, vincristine, vinorelbine, vitamin B complex with C, voriconazole, zoledronic acid.

*CONTINUED***insulin, regular (injection, concentrated)**

- **Y-Site Incompatibility:** alemtuzumab, butorphanol, cefoperazone, ceftaxime, chlorpromazine, cisplatin, dantrolene, diazepam, diazoxide, diphenhydramine, hydroxyzine, isoproterenol, ketamine, labetalol, micafungin, nesiritide, pentamidine, phenolamine, phenylephrine, phenytoin, piperacillin/tazobactam, prochlorperazine, propranolol, protamine, quinupristin/dalfopristin, rocuronium, trimethoprim/sulfamethoxazole.
- **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. Opened, unused insulin vials should be discarded 1 mo after opening.
- Demonstrate technique for mixing insulins by drawing up regular insulin 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.
- Instruct patient to notify health care professional of all Rx or OTC medications, vitamins, or herbal products being taken and to consult health care professional before taking other Rx, OTC, herbal products, or alcohol.
- 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.



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- **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 or if breast feeding or planning to breast feed.
- Patients with diabetes mellitus should carry a source of sugar (candy, glucose gel) 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 in diabetic patients without the appearance of hypoglycemic or hyperglycemic episodes.

Why was this drug prescribed for your patient?