Storage/Stability/Compatibility

Pancuronium injection should be stored under refrigeration (2–8°C), but, according to the manufacturer, it is stable for 6 months at room temperature.

Do not store pancuronium in plastic syringes or containers as it may be adsorbed to plastic surfaces. It may be administered in plastic syringes, however.

It is recommended that pancuronium not be mixed with barbiturates, as a precipitate may form, although data conflicts on this point. No precipitate was seen when pancuronium was mixed with succinylcholine, meperidine, neostigmine, gallamine, tubocurarine, or promethazine.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS: None

The ARCI (Racing Commissioners International) has designated this drug as a class 2 substance. See the appendix for more information.

HUMAN-LABELED PRODUCTS:

Pancuronium Bromide for Injection: 1 mg/mL in 10 mL vials; 2 mg/mL in 2 mL and 5 mL amps; generic; (Rx)

PANTOPRAZOLE

(pan-*toe*-prah-zohl) Protonix®, Pantoloc®

PROTON PUMP INHIBITOR

Prescriber Highlights

- Proton pump inhibitor similar to omeprazole; also available in IV dosage form
- May be useful in treating or preventing gastric acid-related pathologies in dogs, cats, foals & camelids
- Relatively limited research & experience in veterinary medicine, particularly when compared with omeprazole
- Appears well tolerated

Uses/Indications

Pantoprazole may be useful in treating or preventing gastric acid-related pathologies in dogs, cats, foals and camelids, particularly when the intravenous route is preferred. Pantoprazole is available in both intravenous and oral tablet (delayed-release) formulations. One study (Bersenas, Mathews et al. 2005) performed in dogs, comparing the gastric pH effects of intravenous pantoprazole with oral omeprazole, intravenous ranitidine, and intravenous famotidine, found at the dosages used, that pantoprazole was more effective than ranitidine, but similar to famotidine, and that oral omeprazole was more effective in maintaining intragastric pH >3 for a longer period than pantoprazole.

Pantoprazole has been shown to directly reduce *in vitro* counts of *H. pylori* and is used in some *H. pylori* treatment protocols for humans.

Pharmacology/Actions

Pantoprazole is a substituted benzimidazole, similar to omeprazole and the other proton pump inhibitors (PPIs). At the secretory surface of gastric parietal cells, pantoprazole forms a covalent bond at two sites of the H^+/K^+ ATPase (proton pump) enzyme system. There it inhibits the transport of hydrogen ions into the stomach. Pantoprazole reduces acid secretion during both basal and stimulated conditions.

Pharmacokinetics

No specific information was located for pantoprazole pharmacokinetics in dogs or cats. In neonatal foals, intragastric (IG) administered pantoprazole bioavailability was 41% and drug was detected in plasma within 5 minutes of administration. Mean hourly gastric pH was increased for 2–24 hours versus untreated foals after either IV or IG administration, but IV administration increased pH significantly greater than IG administration, presumably due to low GI bioavailability (Ryan, Sanchez et al. 2005).

In humans, it is rapidly absorbed after oral administration with an oral bioavailability of 77%. Food can reduce the rate of absorption, but does not appear to affect the extent of absorption. On average, 51% of gastric acid secretion is inhibited at 2.5 hours after a single dose and 85% is inhibited after the seventh day of daily administration. Protein binding is 98%, primarily to albumin. The drug is metabolized in the liver, primarily by CYP2C19 isoenzymes. CYP3A4, 2D6, 2C9, or 1A2 are minor components of pantoprazole biotransformation; pantoprazole does not appear to clinically affect (either induce or inhibit) the metabolism of other drugs using these isoenzymes for biotransformation. Metabolites of pantoprazole do not appear to have pharmacologic activity. Elimination half-life for both oral and IV administration is only about an hour, but the drug's pharmacologic action can persist for 24 hours or more, presumably due to irreversible binding at the receptor site. About 71% of a dose is excreted as metabolites in the urine, with the remainder in the feces as metabolites and unabsorbed drug.

Contraindications/Precautions/Warnings

Pantoprazole is contraindicated in patients known to be hypersensitive to it or other substituted benzimidazole PPIs.

Parenteral pantoprazole must be administered IV; do not give IM or SQ. Reconstituted injection (4 mg/mL) must be administered intravenously over not less than 2 minutes.

Adverse Effects

Use has been limited in small animals and an adverse effect profile is not well established; however, the drug appears to be tolerated well.

In humans, the most commonly reported adverse effects are diarrhea and headache. Hyperglycemia has been reported in about 1% of patients. Proton pump inhibitors have been associated with an increased risk of developing community-acquired pneumonia in humans. Injection site reactions (thrombophlebitis, abscess) have occurred with IV administration.

Reproductive/Nursing Safety

When pantoprazole was dosed in rats (98X human dose) and rabbits (16X), no affects on fertility or teratogenic effects were noted. In humans, the FDA categorizes pantoprazole as category ***B*** for use during pregnancy (*Animal studies have not yet demonstrated risk to the fetus, but there are no adequate studies in pregnant women; or animal studies have shown an adverse effect, but adequate studies in pregnant women have not demonstrated a risk to the fetus in the first trimester of pregnancy, and there is no evidence of risk in later trimesters.*)

Pantoprazole and its metabolites have been detected in milk, but it should be relatively safe to use in nursing veterinary patients.

Overdosage/Acute Toxicity

There is limited information available. A single oral dose of 887 mg/kg was lethal in dogs. Acute toxic signs included ataxia, hypoactivity, and tremor. In humans, single oral overdoses of up to 600 mg have been reported without adversity. In the event of a large overdose, it is recommended to contact an animal poison control center for guidance.

Drug Interactions

The following drug interactions have either been reported or are theoretical in humans or animals receiving pantoprazole and may be of significance in veterinary patients:

- **DRUGS REQUIRING DECREASED GASTRIC PH FOR OPTIMAL ABSORPTION** (*e.g.*, **ketoconazole, itraconazole, iron, ampicillin esters**): Pantoprazole may decrease drug absorption
- **SUCRALFATE**: May decrease bioavailability of orally administered pantoprazole
- **WARFARIN**: Pantoprazole may increase anticoagulant effect

Laboratory Considerations

- Although not likely to be important for veterinary patients, pantoprazole may cause false-positive results for urine screening tests for THC (tetrahydrocannabinol)

Doses

- **DOGS/CATS:**
  a) Dogs: For intravenous treatment of stress-related mucosal disease: 0.7–1 mg/kg IV once daily. (Bateman 2003)
- **HORSES:**
  a) For gastric acid suppression in neonatal foals: 1.5 mg/kg IV once daily. **Note:** From an experimental study evaluating the pharmacokinetics and pharmacodynamics in normal neonatal foals. Further studies are required to investigate the use of this drug in critically ill patients. (Ryan, Sanchez et al. 2005)

Monitoring

- Efficacy
- Adverse effects (vomiting, diarrhea, injection site reactions if used IV)

Client Information

- Tablets must be given whole; do not split or crush
- If patient develops bloody diarrhea, tarry-black stools, or vomits blood, contact veterinarian immediately
- Contact veterinarian if vomiting or diarrhea persist or are severe

Chemistry/Synonyms

Pantoprazole sodium sesquihydrate occurs as a white to off-white crystalline powder and is racemic. It is freely soluble in water and very slightly soluble in phosphate buffer at a pH of 7.4. Stability of aqueous solutions is pH dependent. At room temperature, solutions of pH 5 are stable for about 3 hours; at a pH of 7.8, 220 hours.

Pantoprazole may also be known as BY-1023, or SKF-96022. International trade names include: *Controloc®, Pantoloc®, Zurcal, Pantozol®, Pantop®, Protonix®, Protium®, Somac-MA®,* and many others.

Storage/Stability/Compatibility

Delayed-release tablets should be stored between 15–30°C.

The powder for injection should be stored protected from light at 20–25°C; excursions are permitted to 15– 30°C. For a 2-minute IV infusion; reconstitute with 10 mL of 0.9% sodium chloride injection. To prepare the injection for a 15-minute IV infusion, reconstitute with 10 mL of 0.9% sodium chloride injection, then dilute further with 100 mL of D5W, 0.9% sodium chloride or lactated Ringer's injection to a final concentration of approximately 0.4 mg/mL. Reconstituted solutions (10 mL) are stable for up to 2 hours at room temperature. If further diluted (per 15 minute infusion), it is stable for up to 22 hours at room temperature. Reconstituted solutions do not need to be protected from light. Do not freeze. Do not use the IV solution if discoloration or precipitates are seen; should these be observed during the infusion, stop immediately.

Pantoprazole injection is **not compatible** with midazolam and may not be compatible with solutions containing zinc.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS: None

The ARCI (Racing Commissioners International) has designated this drug as a class 5 substance. See the appendix for more information.

HUMAN-LABELED PRODUCTS:

Pantoprazole Sodium Delayed-Release Tablets: 20 mg (as base) & 40 mg (as base); *Protonix®* (Wyeth-Ayerst); (Rx)

Pantoprazole Powder (freeze-dried) for Injection: 40 mg (as base)/vial; *Protonix I.V.®* (Wyeth-Ayerst); (Rx)

PARAPOX OVIS VIRUS IMMUNOMODULATOR

(pair-ah-***poks oh***-vis) Zylexis®

IMMUNOSTIMULANT

Prescriber Highlights

- **Biologic immunostimulant labeled for use in healthy horses of 4 months of age & older as an aid in reducing upper respiratory disease caused by equine herpesvirus types 1 & 4**
- **Limited published information available on safety & efficacy**

Uses/Indications

Parapox ovis virus immunomodulator is commercially available in the USA labeled for "use in healthy horses of 4 months of age and older as an aid in reducing upper respiratory disease caused by equine herpesvirus types 1 and 4."

A parapoxvirus product (*Baypamun®*) is reportedly available in some European countries for use in small animals.

Pharmacology/Actions

Parapox ovis is the virus responsible for "orf" in sheep, a contagious pustular dermatitis. The virus is inactivated in the commercial product. Parapoxvirus products are so-called "paramunity inducers" and are believed to prevent viral infection by pathogenic viruses via viral interference. By "infecting" host cells with a defective (non-replicating) virus, interference with infection by the pathogenic virus can occur. Postulated mechanisms of action include induction of interferons, cytokines and colony-stimulating factors, and activation of natural killer cells.

Pharmacokinetics

Effects on the immune system are reported to occur 4–6 hours after treating; effects persist for 1–2 weeks.

Contraindications/Precautions/Warnings

Do not be use in patients with prior hypersensitivity to the agent. The manufacturer warns that in the case of an anaphylactic reaction, administer epinephrine or equivalent.

Reproductive/Nursing Safety

No information was located.