For adjunctive therapy of septic shock:

a) 0.08 mg/kg/hr IV. Low-dose hydrocortisone infusions can reduce the time that vasopressors are required and lead to earlier resolution of sepsis-induced organ dysfunction. (Crowe 2002)

■ **CATTLE:**

For adjunctive treatment of photosensitization reactions:

a) 100–600 mg (salt not specified) in 1000 mL of 10% dextrose saline IV or SC. (Black 1986)

■ **HORSES:** (**Note:** ARCI UCGFS Class 4 Drug)

As a glucocorticoid:

a) Hydrocortisone sodium succinate: 1–4 mg/kg as an IV infusion (Robinson 1987)

Monitoring

Monitoring of glucocorticoid therapy is dependent on its reason for use, dosage, agent used (amount of mineralocorticoid activity), dosage schedule (daily versus alternate day therapy), duration of therapy, and the animal's age and condition. The following list may not be appropriate or complete for all animals; use clinical assessment and judgment should adverse effects be noted:

- Weight, appetite, signs of edema
- Serum and/or urine electrolytes
- Total plasma proteins, albumin
- Blood glucose
- Growth and development in young animals
- ACTH stimulation test if necessary

Client Information

- Clients should carefully follow the dosage instructions and should not discontinue the drug abruptly without consulting with the veterinarian beforehand.
- Clients should be briefed on the potential adverse effects that can be seen with these drugs and instructed to contact the veterinarian should these effects become severe or progress.

Chemistry/Synonyms

Also known as compound F or cortisol, hydrocortisone is secreted by the adrenal gland. Hydrocortisone occurs as an odorless, white to practically white, crystalline powder. It is very slightly soluble in water and sparingly soluble in alcohol. Hydrocortisone is administered orally.

Hydrocortisone sodium succinate occurs as an odorless, white to nearly white, hygroscopic, amorphous solid. It is very soluble in both water and alcohol. Hydrocortisone sodium succinate injection is administered via IM or IV routes.

Hydrocortisone may also be known as: antiinflammatory hormone, compound F, cortisol, hydrocortisonum, 17-hydroxycorticosterone, and NSC-10483; many trade names are available.

Storage/Stability/Compatibility

Hydrocortisone tablets should be stored in well-closed containers. The cypionate oral suspension should be stored in tight, light resistant containers. All products should be stored at room temperature (15–30°C); avoid freezing the suspensions or solutions. After reconstituting solutions, only use products that are clear. Discard unused solutions after 3 days.

Hydrocortisone sodium succinate is reportedly physically **compatible** with the following solutions and drugs: dextrose-Ringer's injection combinations, dextrose-Ringer's lactate injection combinations, dextrose-saline combinations, dextrose injections, Ringer's injection, lactated Ringer's injection, sodium chloride injections, amikacin sulfate, aminophylline, amphotericin B (limited quantities), calcium chloride/gluconate, cephalothin sodium (not in combination with aminophylline), cephapirin sodium, chloramphenicol sodium succinate, clindamycin phosphate, corticotropin, daunorubicin HCl, dopamine HCl, erythromycin gluceptate, erythromycin lactobionate, lidocaine HCl, mephentermine sulfate, metronidazole with sodium bicarbonate, netilmicin sodium, penicillin G potassium/sodium, piperacillin sodium, polymyxin B sulfate, potassium chloride, prochlorperazine edisylate, sodium bicarbonate, thiopental sodium, vancomycin HCl, verapamil HCl, and vitamin B-complex with C.

Hydrocortisone sodium succinate is reportedly physically **incompatible** when mixed with the following solutions and drugs: ampicillin sodium, bleomycin sulfate, colistimethate sodium, dimenhydrinate, diphenhydramine HCl, doxorubicin HCl, ephedrine sulfate, heparin sodium, hydralazine HCl, metaraminol bitartrate, methicillin sodium, nafcillin sodium, oxytetracycline HCl, pentobarbital sodium, phenobarbital sodium, promethazine HCl, secobarbital sodium, and tetracycline HCl. Compatibility is dependent upon factors such as pH, concentration, temperature and diluent used; consult specialized references or a hospital pharmacist for more specific information.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS:

There are no products containing hydrocortisone (or its salts) known for systemic use. There are a variety of hydrocortisone veterinary products for topical use. A 10 ppb tolerance has been established for hydrocortisone (as the succinate or acetate) in milk.

The ARCI (Racing Commissioners International) has designated this drug as a class 4 substance. See the appendix for more information.

HUMAN-LABELED PRODUCTS:

Hydrocortisone Tablets: 5 mg, 10 mg, 20 mg; *Cortef*® (Upjohn); generic; (Rx)

Hydrocortisone Sodium Succinate Injection: 100 mg/vial, 250 mg/vial, 500 mg/vial, 1000 mg/vial (as sodium succinate) in 2 mL, 4 mL and 8 mL *Univials*, fliptop vials, *Act-O-Vials* and vials; *Solu-Cortef*® (Upjohn); *A-Hydrocort*® (Abbott); (Rx)

There are many OTC and Rx topical and anorectal products available in a variety of dosage forms.

HYDROGEN PEROXIDE 3% (ORAL)

(***hye***-droe-jen per-***oks***-ide)

ORAL EMETIC, TOPICAL ANTISEPTIC

Also see the Decontamination information in the appendix

Prescriber Highlights

- **Topical antiseptic that is used orally as an emetic in dogs & sometimes cats particularly when clients cannot transport the patient to a veterinary hospital in a timely manner**
- **Many contraindications to use (for emesis)**

Uses/Indications
Hydrogen peroxide 3% solution can be used as an orally administered emetic in dogs and cats. It is best reserved for those cases when animals cannot be transported to a veterinary hospital in a timely way and immediate emesis is required. Apomorphine for dogs and cats (apomorphine is somewhat controversial for cats), or xylazine for cats are generally preferred emetic agents to be administered in a veterinary practice.

Pharmacology/Actions
Orally administered hydrogen peroxide solution (3%) induces a vomiting reflex via direct irritant effects of the oropharynx and gastric lining. After administering PO to dogs or cats, emesis usually ensues within 10 minutes.

Pharmacokinetics
No pharmacokinetic information located.

Contraindications/Precautions/Warnings
Do not induce emesis in those dogs or cats that are already vomiting, severely lethargic, comatose, debilitated (*e.g.,* respiratory distress, decreased swallowing reflex, bradycardia, etc.), seizuring or hyperactive, have had recent abdominal surgery or with megaesophagus. Emesis is generally contraindicated after ingestions of corrosives/caustics (*e.g.,* acids, alkalis), sharp objects, or bagged illicit drugs. Emesis is usually contraindicated after ingestion of a hydrocarbon or petroleum distillate.

Use caution when attempting to induce emesis in a dog that has ingested a compound that can cause seizures or CNS depression as CNS status may rapidly deteriorate.

Before inducing emesis, obtain a complete history of the ingestion and ensure that vital signs are stable.

Administration and emesis generally must occur within 4 hours (some say 2 hours or 6 hours maximum) of the toxic ingestion.

Do not use emetics in rodents or rabbits.

If home administration of hydrogen peroxide is necessary, be sure that clients use only the 3% medical grade solution and not another more concentrated hydrogen peroxide product.

Because aspiration and/or bradycardia are possible, animals should be closely observed after administration. Suctioning, respiratory and cardiovascular support (*e.g.*, atropine) should be available. Do not allow animal to re-ingest vomitus.

Successful induction of emesis does not ensure that stomach contents have been emptied and significant quantities of the ingested drug/toxin may remain or already been absorbed.

Adverse Effects
Aspiration of hydrogen peroxide solution during administration or stomach contents after inducing emesis is possible. Inducing emesis in animals with cardiovascular compromise may cause a vasovagal (bradycardic) response. Gastric ulceration in cats and gastric-dilatation-volvulus in dogs have been reported.

Reproductive/Nursing Safety
No specific information was located. While orally administered 3% hydrogen peroxide is unlikely to cause reproductive harm, weigh the risks to the dam and offspring of the ingested toxin versus the risks associated with inducing emesis.

Overdosage/Acute Toxicity
Hydrogen peroxide 3% solution is relatively non-toxic (see Adverse Effects) after oral ingestion. Hydrogen peroxide in concentrations of 10% or greater can be very corrosive (severe burns to oral/gastric mucosa) and induce oxygen emboli after oral ingestion.

Drug Interactions
- **ACETYLCYSTEINE** (**oral**): Hydrogen peroxide can oxidize acetylcysteine in the gut and although clinical significance is unclear, alternative emetics (*e.g.,* apomorphine, xylazine) are preferred for acetaminophen overdoses
- **ANTIEMETICS** (*e.g.,* **ondansetron, maropitant,** etc.): Preadministration or ingestion of these products may negate the emetic effects of hydrogen peroxide

Laboratory Considerations
No specific concerns were noted.

Doses
- **DOGS/CATS:**

As an emetic:

a) 1–2 mL/kg PO up to 2–3 times (Rudloff 2006b)

b) 1–5 mL/kg PO; generally not to exceed 50 mL for dogs and 10 mL for cats; may repeat one time if after 10 minutes emesis does not occur. Inducing emesis is most effective if administered after a small meal. (Peterson 2006c)

c) 0.25–0.5 mL/kg PO; may repeat once after 5–15 minutes if vomiting has not occurred. (Cote 2005)

Monitoring
- Efficacy (emesis, signs associated with toxicity of the substance ingested, blood levels of toxicants if applicable)
- Heart rate/respiration rate & auscultation after emesis

Client Information
- Use only under the direct instructions of a veterinarian or a poison control center
- Only use hydrogen peroxide 3%; stronger concentrations can be very toxic
- Carefully administer; do not allow patient to "inhale" the liquid
- Observe animal after administration, do not allow them to re-ingest the vomited material (vomitus)
- Save all vomitus for the veterinarian to examine

Chemistry/Synonyms
Hydrogen peroxide 3% solution is a clear, colorless liquid containing 2.5–3.5% w/v hydrogen peroxide. Up to 0.05% of the liquid may contain preservatives.

Hydrogen peroxide 3% solution may also be known as dilute hydrogen peroxide solution, hydrogen peroxide solution 10-volume (**Note:** NOT 10%), or hydrogen peroxide topical solution.

Storage/Stability
Store 3% solutions in airtight containers at room temperature and protected from light.

Hydrogen peroxide 3% can deteriorate with time; outdated or improperly stored products may not be effective as an emetic.

Dosage Forms/Regulatory Status
VETERINARY-LABELED PRODUCTS:

None as an oral emetic

HUMAN-LABELED PRODUCTS:

None as an oral emetic. Hydrogen Peroxide 3% Solution is readily available over-the-counter from a variety of manufacturers. It is usually sold in pint bottles.

HYDROMORPHONE

(hye-droe-*mor*-fone) Dilaudid®

OPIATE AGONIST

Prescriber Highlights

- Injectable opiate sedative/restraining agent, analgesic, & preanesthetic similar to oxymorphone
- Less expensive than oxymorphone on a per mL basis, but has shorter duration of action
- Contraindications: Hypersensitivity to it, diarrhea caused by a toxic ingestion, prior to GI obstructive surgery (may cause vomiting)
- Extreme caution: Respiratory disease or acute respiratory dysfunction
- Caution: Hypothyroidism, severe renal insufficiency (acute uremia), adrenocortical insufficiency, geriatric or severely debilitated patients, head injuries or increased intracranial pressure & acute abdominal conditions (*e.g.*, colic)
- Adverse Effects: CNS depression, respiratory depression, & bradycardia; decreased GI motility with resultant constipation possible
- CATS: Ataxia, hyperesthesia, hyperthermia, & behavioral changes (without concomitant tranquilization)
- Drug-drug; drug-lab interactions
- C-II controlled substance

Uses/Indications

Like oxymorphone, hydromorphone is used in dogs and cats as a sedative/restraining agent, analgesic and preanesthetic. It may also be useful in other species, but little data or experience is available. Because of expense and availability issues with oxymorphone, hydromorphone is rapidly replacing it in veterinary medicine. In dogs and cats, hydromorphone is generally less sedating that morphine, usually causes minimal histamine release after IV administration, and rarely causes vasodilation and hypotension.

Pharmacology/Actions

Receptors for opiate analgesics are found in high concentrations in the limbic system, spinal cord, thalamus, hypothalamus, striatum, and midbrain. They are also found in tissues such as the gastrointestinal tract, urinary tract, and in other smooth muscle.

The morphine-like agonists (morphine, meperidine, oxymorphone, hydromorphone) have primary activity at the *mu* receptors, with some activity possible at the delta receptor. The primary pharmacologic effects of these agents include: analgesia, antitussive activity, respiratory depression, sedation, emesis, physical dependence, and intestinal effects (constipation/defecation). Secondary pharmacologic effects include: CNS: euphoria, sedation, and confusion. Cardiovascular: bradycardia due to central vagal stimulation, alpha-adrenergic receptors may be depressed resulting in peripheral vasodilation, decreased peripheral resistance, and baroreceptor inhibition. Orthostatic hypotension and syncope may occur. Urinary: Increased bladder sphincter tone can induce urinary retention.

Various species may exhibit contradictory effects from these agents. For example, horses, cattle, swine, and cats may develop excitement and dogs may defecate after morphine injections. These effects are in contrast to the expected effects of sedation and constipation. Dogs and humans may develop miosis, while other species (especially cats) may develop mydriasis.

Hydromorphone is approximately 5 times more potent an analgesic on a per weight basis when compared to morphine and approximately equal in potency to oxymorphone. At the usual doses employed, hydromorphone alone has good sedative qualities in the dog. Respiratory depression can occur especially in debilitated, neonatal, or geriatric patients. Bradycardia, as well as a slight decrease in cardiac contractility and blood pressure, may be seen. Like oxymorphone, hydromorphone does initially increase the respiratory rate (panting in dogs) while actual oxygenation may be decreased and blood CO_2 levels may increase by 10 mmHg or more. Gut motility is decreased with resultant increases in stomach emptying times. Unlike either morphine or meperidine, hydromorphone may only infrequently cause mild histamine release in dogs or cats after IV injection.

Pharmacokinetics

Hydromorphone is absorbed when given by IV, IM, SC, and rectal routes. The onset of analgesic efficacy occurs within 15–30 minutes, depending on route of administration.

The drug is metabolized in the liver, primarily by glucuronidation. Because cats are deficient in this metabolic pathway, half-lives in cats are probably prolonged. The glucuronidated metabolite is excreted by the kidney.

Contraindications/Precautions/Warnings

All opiates should be used with caution in patients with hypothyroidism, severe renal insufficiency, adrenocortical insufficiency (Addison's), and geriatric or severely debilitated patients. Hydromorphone is contraindicated in patients hypersensitive to narcotic analgesics, and those with diarrhea caused by a toxic ingestion (until the toxin is eliminated from the GI tract). All opiates should be used with caution in patients with hypothyroidism, severe renal insufficiency, adrenocortical insufficiency (Addison's), and geriatric or severely debilitated patients.

Because it may cause vomiting, hydromorphone use should be considered contraindicated as a preanesthetic med in animals with suspected gastric dilation, volvulus, or intestinal obstruction.

Hydromorphone should be used with extreme caution in patients with head injuries, increased intracranial pressure, and acute abdominal conditions (*e.g.*, colic) as it may obscure the diagnosis or clinical course of these conditions. It should be used with extreme caution in patients suffering from respiratory disease or acute respiratory dysfunction (*e.g.*, pulmonary edema secondary to smoke inhalation).

Hydromorphone can cause bradycardia and therefore should be used cautiously in patients with preexisting bradyarrhythmias.

Neonatal, debilitated, or geriatric patients may be more susceptible to the effects of hydromorphone and may require lower dosages. Patients with severe hepatic disease may have prolonged duration of action of the drug. If used in cats at high dosages, the drug has been recommended to be given along with a tranquilizing agent, as hydromorphone can produce bizarre behavioral changes in this species. This also is true in cats for the other opiate agents, such as morphine.

Opiate analgesics are contraindicated in patients who have been stung by the scorpion species *Centruroides sculpturatus Ewing* and *C. gertschi Stahnke* as it may potentiate these venoms.

Adverse Effects

Hydromorphone has a similar adverse effect profile to oxymorphone or morphine in dogs and cats. CNS depression may be greater than desired, particularly when treating moderate to severe pain. Dose related respiratory depression is possible, and more

likely during general anesthesia. Panting (may occur more often than with oxymorphone) and cough suppression (may be of benefit) may occur. Cats may be prone to developing hyperthermia. Secondary to enhanced vagal tone, hydromorphone can cause bradycardia. This apparently occurs on par with morphine or oxymorphone. Hydromorphone may cause histamine release which, while generally clinically insignificant, may be significant in critically ill animals. Vomiting and defecation can occur after dosing; use caution when using as a preanesthetic. Constipation is possible with chronic dosing.

Reproductive/Nursing Safety

In humans, the FDA categorizes this drug as category ***C*** for use during pregnancy (*Animal studies have shown an adverse effect on the fetus, but there are no adequate studies in humans; or there are no animal reproduction studies and no adequate studies in humans.*)

Most opiates are excreted into milk, but effects on nursing offspring may not be significant.

Overdosage/Acute Toxicity

Massive overdoses may produce profound respiratory and/or CNS depression in most species. Other effects may include cardiovascular collapse, hypothermia, and skeletal muscle hypotonia. Naloxone is the agent of choice in treating respiratory depression. In massive overdoses, naloxone doses may need to be repeated, and animals should be closely observed as naloxone's effects may diminish before sub-toxic levels of oxymorphone are attained. Mechanical respiratory support should be considered in cases of severe respiratory depression.

In susceptible patients, moderate overdoses may require naloxone and supportive treatment as well.

Drug Interactions

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

- **BUTORPHANOL, NALBUPHINE:** Potentially could antagonize opiate effects
- **CNS DEPRESSANTS, OTHER:** Additive CNS effects possible
- **DIURETICS:** Opiates may decrease efficacy in CHF patients
- **MONOAMINE OXIDASE INHIBITORS** (*e.g.,* **amitraz** and potentially, **selegiline**): Severe and unpredictable opiate potentiation may be seen; not recommended (in humans) if MAO inhibitor has been used within 14 days
- **MUSCLE RELAXANTS, SKELETAL:** Hydromorphone may enhance effects
- **PHENOTHIAZINES:** Some phenothiazines may antagonize analgesic effects and increase risk for hypotension
- **TRICYCLIC ANTIDEPRESSANTS** (**clomipramine, amitriptyline,** etc.): Hydromorphone may exacerbate the effects of tricyclic antidepressants
- **WARFARIN:** Opiates may potentiate anticoagulant activity

Laboratory Considerations

- As they may increase biliary tract pressure, opiates can increase plasma amylase and lipase values up to 24 hours following their administration.

Doses

- **DOGS:**
  a) As an analgesic: 0.05–0.2 mg/kg IM, IV or SC q2–6 hours (Wagner 2002)
  b) For cancer pain: 0.08–0.2 mg/kg IV, IM, or SC (Lester and Gaynor 2000)
  c) For moderate to severe pain: 0.08–0.3+ mg/kg IV, IM or SC q2–6 hours (Mathews 2000)
  d) As an analgesic: 0.05–0.2 mg/kg IV, IM, SC q2–4h (Hansen 2003b), (Hardie 2006)
  e) As an analgesic: 0.2–0.6 mg/kg PO q6–8h; For perioperative pain: 0.1–0.2 mg/kg IV, IM, SC q2–4h (Pascoe 2006)
  f) As a premed prior to moderately painful procedures: 0.1 mg/kg; may be combined with acepromazine (0.02–0.05 mg/kg) in young, healthy patients. As a sedative/restraint agent for fractious or aggressive dogs: 0.1–0.2 mg/kg mixed with acepromazine (0.05 mg/kg) IM. Maximal effect usually reached in about 15 minutes, but an additional wait of another 15 minutes may be necessary in some dogs.

  As an alternate induction method (especially in critical patients): hydromorphone 0.05–0.2 mg/kg IV, slowly to effect followed by diazepam 0.02 mg/kg IV (do not mix two drugs together). Endotracheal intubation may be possible after administration, if not, delivery of an inhalant by facemask will give a greater depth of anesthesia. Positive pressure ventilation likely will be necessary. If bradycardia requires treatment, use either glycopyrrolate (0.01–0.02 mg/kg IV) or atropine (0.02–0.04 mg/kg IV). (Pettifer and Dyson 2000)
- **CATS:**
  a) As an analgesic: 0.05–0.1 mg/kg IM, IV or SC q2–6 hours (Wagner 2002)
  b) For cancer pain: 0.08–0.2 mg/kg IV, IM, or SC (Lester and Gaynor 2000)
  c) As an analgesic: 0.02–0.05 mg/kg IV, IM, SC q2–4h (Hansen 2003b), (Hardie 2006)
  d) For moderate to severe pain: 0.08–0.3+ mg/kg IV, IM or SC q2–6 hours (Mathews 2000)
  e) As a premed prior to moderately painful procedures: 0.1 mg/kg; may be combined with acepromazine (0.05–0.2 mg/kg) in young, healthy patients.

  As an alternate induction method (especially in critical patients): hydromorphone 0.05–0.2 mg/kg IV, slowly to effect followed by diazepam 0.02 mg/kg IV (do not mix two drugs together). Endotracheal intubation may be possible after administration, if not, delivery of an inhalant by facemask will give a greater depth of anesthesia. Positive pressure ventilation likely will be necessary. If bradycardia requires treatment, use either glycopyrrolate (0.01–0.02 mg/kg IV) or atropine (0.02–0.04 mg/kg IV). (Pettifer and Dyson 2000)
- **FERRETS:**
  a) As a pre-op: 0.05–0.1 mg/kg IV; as a CRI post-op: 0.05 mg/kg IV loading dose, then 0.05–0.1 mg/kg/hr (Lichtenberger 2006a)
- **SMALL MAMMALS:**
  a) Rabbits: 0.05–0.1 mg/kg IV; as a CRI post-op: 0.05 mg/kg IV loading dose, then 0.05–0.1 mg/kg/hr (Lichtenberger 2006a)

Monitoring

- Respiratory rate/depth (pulse oximetry highly recommended)
- CNS level of depression/excitation
- Blood pressure (especially with IV use)
- Cardiac rate
- Analgesic efficacy

Client Information
- When given parenterally, this agent should be used in an inpatient setting or with direct professional supervision

Chemistry/Synonyms
A semi-synthetic phenanthrene-derivative opiate related to morphine, hydromorphone HCl occurs as white, fine, crystalline powder. It is freely soluble in water. The commercial injection has a pH of 4–5.5.

Hydromorphone may also be known as: dihydromorphinone hydrochloride, *Dolonovag®, Hydal®, HydroStat IR®, Hydromorph®, Opidol®, Palladon®, Palladone®*, and *Sophidone®*.

Storage/Stability/Compatibility
The injection should be stored at room temperature and protected from light. A slight yellowish tint to the solution may occur, but does not indicate loss of potency. The injection remains stable for at least 24 hours when mixed with commonly used IV fluids if protected from light.

Hydromorphone tablets should be stored at room temperature in tight, light resistant containers. The suppositories should be kept in the refrigerator.

Hydromorphone injection is **compatible** in commonly used IV fluids (for 24 hours when protected from light at 25°C) and with midazolam, ondansetron, potassium chloride, and heparin sodium. Hydromorphone injection mixed in the same syringe with atropine and medetomidine (*Domitor®*) for use as a preop in dogs prior to sevoflurane or propofol anesthesia has been described (Ko 2005). Hydromorphone is **incompatible** with sodium bicarbonate, or thiopental.

Dosage Forms/Regulatory Status
VETERINARY-LABELED PRODUCTS: None

HUMAN-LABELED PRODUCTS:

Hydromorphone HCl Injection: 1 mg/mL in 1 mL amps & syringes, 2 mg/mL in 1 mL amps, 1 mL syringes, 1 mL amps and 20 mL vials & multidose vials; 4 mg/mL in1 mL amps & syringes; and 10 mg/mL in 1 mL, 5 mL, single-dose vials & amps and 50 mL single-dose vials; *Dilaudid®* and *Dilandid-HP®* (Abbott); generic; (Rx, C-II)

Hydromorphone HCl Powder for Injection, lyophilized: 250 mg (10 mg/mL after reconstitution) in single-dose vials; *Dilaudid-HP ®* (Abbott); (Rx, C-II)

Hydromorphone HCl Tablets: 2 mg, 4 mg, and 8 mg; *Dilaudid®* (Abbott); generic, (Rx, C-II)

Hydromorphone HCl Capsules (extended-release): 12 mg, 16 mg, 24 mg, & 32 mg; *Palladone®* (Purdue Pharma); (Rx, C-II)

Hydromorphone HCL Oral Solution: 1 mg/1 mL in 4 mL UD and 8 mL UD patient cups; 250 mL & 473 mL; *Dilaudid-5®* (Abbott); generic; (Rx, C-II)

Hydromorphone Suppositories: 3 mg; Hydromorphone HCl (Paddock); *Dilaudid®* (Abbott); (Rx, C-II)

Hydroxyethyl Starch — See Hetastarch

HYDROXYUREA

(hye-drox-ee-yor-ee-a) Hydrea®, Droxia®, Mylocel®

ANTINEOPLASTIC

Prescriber Highlights
- **Antineoplastic used for treatment of polycythemia vera, mastocytomas, & leukemias in dogs & cats**
- **Caution: Anemia, bone marrow depression, history of urate stones, infection, impaired renal function, or in patients who have received previous chemotherapy or radiotherapy**
- **Adverse Effects: GI effects, stomatitis, sloughing of nails, alopecia, & dysuria; most serious are bone marrow depression & pulmonary fibrosis**
- **Proven teratogen**

Uses/Indications
Hydroxyurea may be useful in the treatment of polycythemia vera, mastocytomas, and leukemias in dogs and cats. It is often used to treat dogs with chronic myelogenous leukemia no longer responsive to busulfan. Hydroxyurea, potentially, may be of benefit in the treatment of feline hypereosinophilic syndrome and in the adjunctive treatment of canine meningiomas. It can also be used in dogs for the adjunctive medical treatment (to reduce hematocrit) of right to left shunting patent ductus arteriosis or tetralogy of Fallot.

Pharmacology/Actions
While the exact mechanism of action for hydroxyurea has not been determined, it appears to interfere with DNA synthesis without interfering with RNA or protein synthesis. Hydroxyurea apparently inhibits thymidine incorporation into DNS and may directly damage DNA. It is an S-phase inhibitor, but may also arrest cells at the G_1-S border.

Hydroxyurea inhibits urease, but is less potent than acetohydroxamic acid. Hydroxyurea can stimulate production of fetal hemoglobin.

Pharmacokinetics
Hydroxyurea is well absorbed after oral administration and crosses the blood-brain barrier. Approximately 50% of an absorbed dose is excreted unchanged in the urine and about 50% is metabolized in the liver and then excreted in the urine.

Contraindications/Precautions/Warnings
Risk versus benefit should be considered before using hydroxyurea in patients with the following conditions: anemia, bone marrow depression, history of urate stones, current infection, impaired renal function, or in patients who have received previous chemotherapy or radiotherapy.

Adverse Effects
Potential adverse effects include GI effects (anorexia, vomiting, diarrhea), stomatitis, sloughing of nails, alopecia, and dysuria. The most serious adverse effects associated with hydroxyurea are bone marrow depression (anemia, thrombocytopenia, leukopenia) and pulmonary fibrosis. If myelotoxicity occurs, it is recommended to halt therapy until values return to normal. Methemoglobinemia has been reported in cats given high dosages (>500 mg).