Small Animal Dosage
- No dose available.

Large Animal Dosage
Horses
- 0.044 mg/kg (or 1 mL/110 lb) PO once per day for 15 days.

Swine
- Administer 6.8 mL (15 mg altrenogest) per gilt once daily for 14 consecutive days by top dressing on a portion of each gilt's daily feed.

Regulatory Information
Do not use in horses intended for food. In pigs, gilts must not be slaughtered for human consumption for 21 days after the last treatment. Do not administer to other food-producing animals.

Aluminum Hydroxide and Aluminum Carbonate
ah-loo´mih-num hye-droks´ide, ah-loo´mih-num kar´boe-nate

Trade and other names: Aluminum hydroxide gel (Amphojel) and aluminum carbonate gel (Basalgel)

Functional classification: Antacid

Pharmacology and Mechanism of Action
Aluminum is an antacid and phosphate binder in intestine. It is used in both the aluminum hydroxide and aluminum carbonate formulations.

Indications and Clinical Uses
Aluminum hydroxide is used for its antacid properties to treat or manage GI ulcers. A more common use in small animals is as a phosphate binder. It is indicated in animals with hyperphosphatemia associated with chronic renal failure, often in combination with phosphorus-restricted diets. Although this was once widely available, because of the decreased availability of products containing aluminum, other drugs are used more commonly to decrease hyperphosphatemia in patients, such as calcium carbonate and calcium citrate. A new oral phosphate binder is available in some countries for cats. This product (Lenziaren) consists of a complex of iron oxide/hydroxide and is administered orally to cats.

Precautionary Information
Adverse Reactions and Side Effects

These aluminum-containing compounds are generally safe. However, there has been some concern expressed that these drugs may increase the systemic levels of aluminum, which may lead to some forms of aluminum toxicoses. The evidence for this as a clinical problem in veterinary medicine is lacking.

Contraindications and Precautions

Aluminum decreases oral absorption of some drugs (e.g., fluoroquinolones, tetracyclines). If fluoroquinolone antimicrobials are used concurrently, separation of oral doses should be considered.

Drug Interactions

Aluminum binds and chelates some drugs and prevents GI absorption. Drugs bound to aluminum include tetracyclines and quinolone antibiotics.

Instructions for Use

Antacid doses are designed to neutralize stomach acid, but duration of acid suppression is short. Although aluminum hydroxide is often used to prevent hyperphosphatemia, this drug may not be available in some pharmacies. A substitute for this indication is calcium citrate or calcium carbonate. An oral product is also available for cats to administer as a phosphate binder (Lenziaren), which is a complex of iron oxide/hydroxide.

Patient Monitoring and Laboratory Tests

Phosphate plasma levels should be monitored to determine success of therapy.

Formulations

- Aluminum hydroxide gel is available in a 64-mg/mL oral suspension and 600-mg tablet.
- Aluminum carbonate gel is available in capsules (equivalent to 500-mg aluminum hydroxide).
- Note: Products containing aluminum may no longer be available from many sources, and other products may be used, such as Lenziaren, which is a complex of iron oxide/hydroxide for cats.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature.

Small Animal Dosage

Dogs

- Aluminum hydroxide gel: 10–30 mg/kg q8h PO (with meals).
- Aluminum carbonate gel: 10–30 mg/kg q8h PO (with meals).

Cats

- Aluminum hydroxide gel: 10–30 mg/kg q8h PO (with meals).
- Aluminum carbonate gel: 10–30 mg/kg q8h PO (with meals).

Large Animal Dosage

Horses

- Antacid: 60 mg/kg q8h PO.

Regulatory Information

No regulatory information is available. Residues from administration to food-producing animals ordinarily are not a concern. However, for extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.

Instructions for Use
Manufacturer's dose should be used initially, but for refractory cases, this dose has been exceeded to produce increased efficacy.

Patient Monitoring and Laboratory Tests
Monitor by performing periodic skin scrapings and examining for presence of mites.

Formulations
- Amitraz is available in 10.6-mL concentrated dip (19.9%).

Stability and Storage
Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage
Dogs
- 10.6 mL/7.5 L water (0.025% solution). Apply three to six topical treatments every 14 days. For refractory cases, this dosage has been exceeded to improve efficacy. Dosages that have been used include 0.025%, 0.05%, and 0.1% concentration applied once or twice per week. For refractory cases, a dose of 0.125% has been used by applying to only half of the dog's body one day, then to the other half of the body the following day. This alternating schedule has been repeated every day for 4 weeks and up to 5 months to achieve cures but should be considered only in extreme cases.

Large Animal Dosage
- No dose has been reported for large animals.

Regulatory Information
No regulatory information is available. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.
RCI Classification: 3

Amitriptyline Hydrochloride
am-ih-trip´tih-leen hye-droe-klor´ide

Trade and other names: Elavil and generic brands

Functional classification: Behavior modification, tricyclic antidepressant

Pharmacology and Mechanism of Action
Tricyclic antidepressant drug (TCA). Amitriptyline, like other TCAs, acts via inhibition of the uptake of serotonin and other transmitters at presynaptic nerve terminals. The action in cats for treating cystitis is unknown but may be through reducing anxiety, behavior modification, or anticholinergic effects. It has no direct effect on the bladder mucosa.

Indications and Clinical Uses
Like other TCAs, amitriptyline is used in animals to treat a variety of behavioral disorders (e.g., anxiety). However, there are few studies documenting efficacy in animals, and much of the use is based on anecdotal evidence. For treatment of some disorders, such as obsessive-compulsive disorder (1 mg/kg q12h up to 2 mg/kg), it

was not as effective in animals as clomipramine. For treatment of aggressive behavior in dogs (2 mg/kg q12h), there was no difference between amitriptyline and placebo.

Amitriptyline has been used in cats for chronic idiopathic cystitis, a condition that is not well understood. However, when used for short-term treatment of idiopathic cystitis (10 mg per cat q24h) it was not effective. In another study, at 5 mg/cat per day for 7 days (0.55–1.2 mg/kg), there was no difference on recovery from hematuria and pollakiuria between amitriptyline and placebo, leading to a conclusion that short-term treatment is not helpful.

Amitriptyline, like other antidepressants, have been considered for treatment of chronic pain in animals, especially pain that may be maladaptive, or neuropathic in origin. Despite some use of this drug for treatment in people, no studies have established efficacy of amitriptyline in animals for this purpose.

Precautionary Information

Adverse Reactions and Side Effects

Amitriptyline has a bitter taste and is difficult to administer orally. Multiple side effects are associated with TCAs, such as antimuscarinic effects (dry mouth and rapid heart rate) and antihistamine effects (sedation). High doses can produce life-threatening cardiotoxicity. In cats, reduced grooming, weight gain, and sedation are possible.

Contraindications and Precautions

Use cautiously in patients with heart disease.

Drug Interactions

Do not use with other behavior modification drugs, such as serotonin reuptake inhibitors. Do not use with MAOIs.

Instructions for Use

Doses are primarily based on empiricism. There are no controlled efficacy trials available for animals. There is evidence for success treating idiopathic cystitis in cats, but more recent studies have been less supportive. Amitriptyline was not effective for treatment of aggressive behavior in dogs, compared with behavior modification alone, and other anti-anxiety drugs for dogs should be considered instead (e.g., fluoxetine, clomipramine). Amitriptyline applied transdermally is not systemically absorbed in cats.

Patient Monitoring and Laboratory Tests

Monitor patient's cardiovascular status during therapy, such as heart rate and rhythm. Like other TCAs, amitriptyline may decrease total T_4 and free T_4 concentrations in dogs.

Formulations

- Amitriptyline is available in 10-, 25-, 50-, 75-, 100-, and 150-mg tablets.
- The injectable formulation is no longer marketed in the United States.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage

Dogs

- 1–2 mg/kg q12–24h PO.

Cats

- 2–4 mg per cat/day PO (0.5–1.0 mg/kg PO per day). The dose for cats may be divided into 12-hour intervals.
- Idiopathic cystitis: 2 mg/kg/day PO or a range of 2.5–7.5 mg/cat/day. (This indication is controversial.)

Large Animal Dosage

- No dose has been reported for large animals.

Regulatory Information

No regulatory information is available. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.
RCI Classification: 2

Amlodipine Besylate

am-loe´dih-peen bess´ih-late

Trade and other names: Norvasc

Functional classification: Calcium-channel blocker

Pharmacology and Mechanism of Action

Calcium-channel blocking drug. Amlodipine is a second-generation calcium-channel blocker of the dihydropyridine class. It decreases calcium influx in cardiac and vascular smooth muscle. However, its greatest effect is on vascular smooth muscle by blocking the L-type calcium channels. Through this mechanism, it acts as a vasodilator for treating hypertension.

Pharmacokinetics: It has a high volume of distribution and slow systemic clearance, resulting in a half-life of approximately 30 hours. It is well-absorbed orally.

Indications and Clinical Uses

In both dogs and cats, amlodipine is effective for lowering systemic blood pressure. Therefore, it is used to treat systemic hypertension (high blood pressure). Amlodipine has been considered the drug of choice for many years by clinicians for treating hypertension in cats. Hypertension in cats has been defined as systolic blood pressure greater than 190 mm Hg and diastolic pressure greater than 120 mm Hg. By comparison, angiotensin-converting enzyme (ACE) inhibitors are less effective in cats, and they respond better to amlodipine than to ACE inhibitors. Amlodipine reduces blood pressure in hypertensive cats and can reduce proteinuria but may not improve survival in cats with hypertensive kidney disease. Beta blockers may be added to therapy for cats (e.g., atenolol) to control the heart rate in hypertensive and hyperthyroid cats, but beta blockers do not have a direct anti-hypertensive effect in cats.

Although amlodipine has traditionally been considered the anti-hypertensive drug of choice for cats, recently, the angiotensin II blocker telmisartan has become a preferred agent because of proof of efficacy and available veterinary formulations (see Telmisartan for more information).

Small Animal Dosage

Dogs

- Conventional formulation (0.3 mg/mL): 0.006–0.02 mg/kg q4–8h IV, IM, or SQ. For analgesia, higher doses are used in the range of 0.03–0.04 mg/kg, IV, IM, or SQ (30–40 mcg/kg).
- Concentrated solution (1.8 mg/mL): 20 mcg/kg, IM or SQ, administered for relief of surgical pain.
- Constant rate infusion (CRI): 20 mcg/kg IV followed by 5 mcg/kg/h infusion.
- Epidural: 0.003–0.006 mg/kg (3–6 mcg/kg).
- Buprenorphine SR: 120–270 mcg/kg (0.12–0.27 mg/kg) SQ (duration of 72 hours).

Cats

- For analgesia, a dose of 0.01–0.02 mg/kg (10–20 mcg/kg) IV or 0.02 mg/kg (20 mcg/kg) IM. Duration is 4–6 hours typically. Additional doses of 0.02 mg/kg may be administered.
- For sedation, often with other sedative agents, the dose of 0.02–0.04 mg/kg IV or IM is used. It is not as effective for sedation as other combinations of agents.
- CRI: 20 mcg/kg IV followed by 12 mcg/kg/h infusion.
- Subcutaneous administration: The concentrated formulation (Simbadol) can be administered SQ once daily for up to 3 days at a dose of 0.24 mg/kg (240 mcg/kg). This formulation may be administered prior to surgery.
- Buccal (transmucosal) administration: 0.02–0.04 mg/kg (20–40 mcg/kg) q8h. 0.02 mg/kg (20 mcg/kg) is equivalent to 0.066 mL/kg. This may be applied to the cat's gingival or oral mucosa (i.e., sublingual).
- Epidural: 12.5 mcg/kg diluted with saline to a volume of 0.3 mL/kg.
- Buprenorphine SR: 120–270 mcg/kg (0.12–0.27 mg/kg) SQ (duration of 72 hours).

Large Animal Dosage

Horses

- 0.005–0.01 mg/kg (5–10 mcg/kg IM); short acting in horses.

Sheep

- 0.01 mg/kg (10 mcg/kg) IM q6h.

Regulatory Information

The drug is controlled by the Drug Enforcement Administration. Do not administer to animals intended for food.
Schedule III controlled drug.
RCI Classification: 2

Buspirone Hydrochloride

byoo-speer′own hye-droe-klor′ide

Trade and other names: BuSpar

Functional classification: Behavior modification

Pharmacology and Mechanism of Action

Antianxiety agent of the azapirone class. Buspirone acts as a direct-acting serotonin ($5\text{-}HT_{1A}$) agonist. By activating $5\text{-}HT_{1A}$ receptors, buspirone and related drugs alter mood and anxiety. Buspirone is used to treat anxiety and other behavior problems. Other related drugs include gepirone and ipsapirone.

Indications and Clinical Uses

In veterinary medicine, buspirone has been primarily used for the treatment of urine spraying (urine marking) in cats. In cats, there are published studies demonstrating efficacy. However, some cats relapse after treatment is discontinued. Buspirone also has been used as an antiemetic in cats (4 mg/kg SQ). In dogs, it has occasionally been used to treat behavior problems, such as anxiety disorders.

Precautionary Information

Adverse Reactions and Side Effects

Few side effects are seen in cats compared with other drugs. Some cats show increased aggression, and some cats show increased affection and friendliness to owners. It may produce mild sedation.

Contraindications and Precautions

Do not use in animals with sensitivity to serotonin agonists.

Drug Interactions

Do not use with other serotonin antagonists, selective serotonin reuptake inhibitors, or MAOIs (e.g., selegiline).

Instructions for Use

Some efficacy trials suggest effectiveness for treating urine spraying in cats. There may be a lower relapse rate compared with other drugs.

Patient Monitoring and Laboratory Tests

No specific monitoring is necessary.

Formulations

- Buspirone is available in 5-, 10-, 15-, and 30-mg tablets.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage

Cats

- 2.5–5 mg/cat q12h PO, which may be increased to 5–7.5 mg per cat twice daily for some cats (0.5–1 mg/kg q12h PO).

Dogs

- 2.5–10 mg/dog q24h or q12h PO.
- 1 mg/kg q12h PO.

Large Animal Dosage

Horses

- 100–250 mg/horse q24h PO (0.5 mg/kg).

Regulatory Information
Do not administer to animals intended for food.
RCI Classification: 2

Busulfan
byoo-sul′fan

Trade and other names: Myleran

Functional classification: Anticancer agent

Pharmacology and Mechanism of Action
Anticancer agent. Busulfan is a bifunctional alkylating agent and acts to disrupt DNA of tumor cells.

Indications and Clinical Uses
Busulfan is used primarily for lymphoreticular neoplasia.

Precautionary Information
Adverse Reactions and Side Effects
Leukopenia is the most severe side effect.

Contraindications and Precautions
Do not use in animals with suppressed bone marrow.

Drug Interactions
No drug interactions are reported in animals.

Instructions for Use
Busulfan is usually used in combination with other anticancer agents. Consult specific protocol for details.

Patient Monitoring and Laboratory Tests
Monitor CBC in animals during treatment.

Formulations
- Busulfan is available in 2-mg tablets and a 6-mg/mL injection under the name Busulfex.

Stability and Storage
Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage
Dogs and Cats
- 3–4 mg/m^2 q24h PO.

Large Animal Dosage
- No dose has been reported for large animals.

Regulatory Information
Withdrawal times are not established for animals that produce food. This drug should not be used in food animals because it is an anticancer agent.

Calcitriol

kal-sih-trye′ole

Trade and other names: Rocaltrol and Calcijex

Functional classification: Calcium supplement

Pharmacology and Mechanism of Action

Vitamin D analogue, also called *1,25-dihydroxycholecalciferol*. Calcitriol is normally formed in the kidneys from 25-hydroxycholecalciferol. Action of calcitriol is to increase calcium absorption from the intestine and facilitate a parathyroid hormone (PTH) effect on bone. Low calcitriol levels in animals can cause decreased intestinal calcium absorption. Animals with chronic kidney disease (CKD) (especially cats) and hyperparathyroidism often have low calcitriol levels that require supplementation with this medication. Calcitriol can also inhibit synthesis and storage of PTH.

Indications and Clinical Uses

Calcitriol is used to treat calcium deficiency and diseases such as hypocalcemia associated with hyperparathyroidism. It is also used to increase calcium in cats that have had parathyroid glands surgically removed. In this use, it is often administered with calcium supplements to the diet. It is used in dogs and cats to manage calcium and phosphorous balance with CKD. Although used by veterinarians to reduce renal secondary PTH concentrations in animals with CKD, this benefit is more controversial and not supported by strong evidence. Supplementation to cats with CKD may help slow progression of disease in some cats, but some cats do not show a benefit. Calcitriol should not be used as a vitamin D supplement.

Precautionary Information

Adverse Reactions and Side Effects

Overdose can result in hypercalcemia. High doses can cause soft tissue mineralization.

Contraindications and Precautions

Do not use in patients that are at risk of hypercalcemia. Capsules made for humans may contain high overdoses for dogs and cats and should be reformulated.

Drug Interactions

Calcitriol may cause hypercalcemia if used with thiazide diuretics.

Instructions for Use

When comparing doses with vitamin D, 1 unit of vitamin D is equivalent to 0.025 mcg of cholecalciferol or ergocalciferol (400 units of vitamin D = 10 mcg of cholecalciferol). Doses should be adjusted in each patient according to response and monitoring calcium plasma concentration; thus, the maintenance dose in animals may vary depending on the adjustment to calcium levels. For example, when used for treating dogs with CKD, the average dosage was 2.5 ng/kg/day, but it ranged from 0.75–5 ng/kg/day based on adjustments from measuring calcium concentrations. When used in CKD, it is often used with intestinal phosphate binders (e.g.,

aluminum hydroxide) and dietary phosphorous restriction. Recommended phosphate concentrations should be maintained at less than 6 mg/dL.

In cats, do not administer simultaneously with a meal to avoid increased calcium absorption. It is best administered in the evening before a meal. If ionized calcium increases above the reference range (above 4.5–5.5 mg/dL), stop treatment and then reintroduce it at a lower dose.

Patient Monitoring and Laboratory Tests

Monitor plasma ionized calcium concentration. Adjust doses as necessary to maintain normal calcium, phosphorous, and PTH concentrations.

Normal total calcium concentrations in dogs and cats are 9–11.5 mg/dL and 8–10.5 mg/dL, respectively, or 1.2–1.5 mmol/L and 1.1–1.4 mmol/L, respectively. Monitor serum PTH concentrations (assays are available in many diagnostic laboratories). Monitor serum creatinine in animals when used to treat CKD.

Formulations

- Calcitriol is available as injection (Calcijex) in a 1- and 2-mcg/mL and in 0.25- and 0.5-mcg capsules.
- Calcitriol oral solution is available as 1 mcg/mL (Rocaltrol). This may be diluted for administration to small animals. See the Stability and Storage section for instructions on dilutions.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature.

Compounded forms: Small animal veterinarians have compounded calcitriol in oil to facilitate dosing to small animals. One such recipe uses 1 part oral solution (Rocaltrol) mixed with 9 parts medium-chain triglyceride (MCT) oil or olive oil. Rocaltrol has been mixed with corn oil (1:10 ratio) to prepare a 100-ng/mL oral formulation.

A more complex compounded formulation prepared by some pharmacies uses a diluent prepared from 400 mg of butylated hydroxyanisole (BHA) and 400 mg of butylated hydroxytoluene (BHT) in 2 mL of 100% ethyl alcohol. This should be mixed thoroughly to dissolve BHA and BHT. This mixture is added to 400 mL of extra-light olive oil and mixed thoroughly. This mixture is used as a diluent. 145.5 mL of this diluent is added to 4.5 mL of oral calcitriol (Rocaltrol) 1-mcg/mL oral solution. This mixture produces a 30-ng/mL (0.030 mcg/mL) oral solution. Store in an amber bottle. Beyond-use-date is 6 months from the time of preparation.

Small Animal Dosage

(Note: To convert from micrograms (mcg) to nanograms (ng) refer to the page facing the inside front cover.)

Dogs

- Renal secondary hyperparathyroidism in chronic renal failure: 2.5 ng/kg PO once daily. Adjust dose with calcium and PTH measurements. If PTH concentrations remain elevated and calcium is not elevated, increase the dosage to 3.5 ng/kg once daily. The dosage may be increased incrementally up to 5 ng/kg once daily. If dogs cannot be medicated once daily, an alternative dosing regimen is a 10 ng/kg twice per week PO.

Cats

- Hypocalcemia (after removal of parathyroid glands): 0.25 mcg/cat q48h PO or 0.01–0.04 mcg/kg/day PO (10–40 ng/kg/day).
- Renal secondary hyperparathyroidism: 2.5 ng/kg PO once daily. Adjust dose with calcium and PTH measurements. If PTH concentrations remain elevated and calcium is not elevated, increase the dose to 3.5 ng/kg once daily and incrementally up to a dose of 5 ng/kg/day. Do not exceed 5 ng/kg/day. An alternative dosing regimen that has been used for cats that cannot be

administered once daily is 10 ng/kg twice per week PO. Because the volumes for dosing cats is low, refer to the Formulation section for compounding a more dilute solution.

Large Animal Dosage

- No dose has been reported for large animals.

Regulatory Information

No regulatory information is available. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.

Calcium Carbonate

Trade and other names: Titralac, Calci-Mix, Tums, and generic brands

Functional classification: Calcium supplement

Pharmacology and Mechanism of Action

Calcium supplement. Calcium is essential for the functional integrity of several body systems. Calcium carbonate is equivalent to 400 mg of calcium ion per gram. Calcium carbonate neutralizes stomach acid for treating and preventing stomach ulcers.

Indications and Clinical Uses

Calcium carbonate is used as an oral calcium supplement for hypocalcemia, sometimes used with vitamin D supplements or calcitriol. It contains 40% elemental calcium. It is used as antacid to treat gastric hyperacidity and GI ulcers and as an intestinal phosphate binder for hyperphosphatemia associated with CKD. Pronefra (calcium carbonate and magnesium carbonate) is administered as a palatable phosphate binder in dogs and cats. It is administered as an oral liquid suspension with meals.

Precautionary Information

Adverse Reactions and Side Effects

Few side effects. High calcium concentrations are possible. With any calcium supplements, constipation and intestinal bloating can occur.

Contraindications and Precautions

Do not administer to animals predisposed to forming calcium-containing renal or cystic calculi. When calcium carbonate or calcium citrate is used as a phosphate binder to prevent hyperphosphatemia, caution is advised to avoid hypercalcemia in patients with kidney disease.

Drug Interactions

Oral administration of calcium supplements may interfere with absorption of other drugs such as fluoroquinolones (e.g., enrofloxacin, orbifloxacin, marbofloxacin, pradofloxacin), bisphosphonates, zinc, iron, and tetracyclines. Use cautiously with thiazide diuretics because this could cause a high increase in calcium concentrations.

Instructions for Use

Calcium carbonate is equivalent to 400 mg of calcium ion per gram. Doses are primarily derived from extrapolation of human doses. When used as a calcium supplement, doses should be adjusted according to serum calcium concentrations. Administer with food to improve oral absorption. Some tablets also contain vitamin

administered once daily is 10 ng/kg twice per week PO. Because the volumes for dosing cats is low, refer to the Formulation section for compounding a more dilute solution.

Large Animal Dosage

- No dose has been reported for large animals.

Regulatory Information

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Instructions for Use

Calcium carbonate is equivalent to 400 mg of calcium ion per gram. Doses are primarily derived from extrapolation of human doses. When used as a calcium supplement, doses should be adjusted according to serum calcium concentrations. Administer with food to improve oral absorption. Some tablets also contain vitamin

D. Doses are based on calcium carbonate, not the ion concentration (e.g., a 650-mg tablet contains 260 mg of calcium ion).

Patient Monitoring and Laboratory Tests

Monitor serum calcium levels, particularly if patients have kidney disease. Normal total calcium concentrations in dogs and cats are 9–11.5 mg/dL and 8–10.5 mg/dL, respectively, or 1.2–1.5 mmol/L and 1.1–1.4 mmol/L, respectively.

Formulations

Calcium carbonate is available in tablets or oral suspension, most of which are available over the counter (OTC). One gram of calcium carbonate is equivalent to 400 mg of calcium ion. Calci-Mix is available in 1.25-g capsules. OTC tablets are available in 500 and 600 mg and 1, 1.25, and 1.5 g. Oral suspension (Titralac) is 1.25 g/5 mL. The formulation Pronefra also is available as calcium carbonate and magnesium carbonate. It is an oral syrup that may be administered as a phosphate binder in cats. Pronefra is preferred by some cats because it is a palatable liquid suspension with poultry liver flavoring.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated. Do not mix with other compounds that may chelate with calcium.

Small Animal Dosage

Dogs and Cats

- Calcium supplementation: 70–185 mg/kg/day given with food PO.
- Treatment of hypoparathyroidism: 30–60 mg/kg per day in divided doses (with meals).
- Phosphate binder: 60–100 mg/kg/day in divided doses, usually given with food PO.
- Pronefra (calcium carbonate and magnesium carbonate) for use as a phosphate binder. Administer with a meal. Cats: 1 mL per 4.4 kg (8.8 lb) twice a day at mealtime. Dogs: 1 mL/5 kg (11 lb) twice a day at mealtime.

Large Animal Dosage

- No dose has been reported for large animals. Usually, other calcium salts are used for supplementation in cattle.

Regulatory Information

No withdrawal times are available. Because this is a normal dietary supplement with little risk from residues, no withdrawal time is suggested for animals intended for food.

Calcium Chloride

Trade and other names: Generic brands

Functional classification: Calcium supplement

Pharmacology and Mechanism of Action

Calcium supplement. Calcium is essential for the functional integrity of several body systems. Injection is 27.2 mg of calcium ion (1.36 mEq) per milliliter.

Patient Monitoring and Laboratory Tests

No specific monitoring is necessary.

Formulations

- Clofazimine is not available in the United States but is available in other countries as 50-mg capsules. Some compounding pharmacies will prepare this drug for use in the United States.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage

Cats

- 1 mg/kg up to a maximum of 4 mg/kg/day PO.

Large Animal Dosage

- Cattle: 600–1000 mg oral to adult cattle per day (2 mg/kg per day).

Regulatory Information

No regulatory information is available. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.

Clomipramine Hydrochloride

kloe-mip′rah-meen hye-droe-klor′ide

Trade and other names: Clomicalm (veterinary preparation) and Anafranil (human preparation)

Functional classification: Behavior modification

Pharmacology and Mechanism of Action

Clomipramine is an antidepressant drug of the tricyclic antidepressant (TCA) class. It is used in people to treat anxiety and depression. The mechanism of action is via inhibition of uptake of serotonin at presynaptic nerve terminals. Beneficial effects may be caused primarily by blocking reuptake of serotonin and modulation of serotonin in areas of the brain that affect anxiety and behavior. Clomipramine has more serotonin-reuptake–blocking effects than other TCA drugs. Side effects result from antimuscarinic effects caused by the active metabolite desmethylclomipramine. However, animals produce less of this metabolite than people do.

Pharmacokinetics: In dogs, the half-life is 5 hours after oral administration, with a peak at 1.5 hours, but the half-life may be shorter (2–4 hours) with repeated dosing. The oral absorption in dogs is 20%.

Indications and Clinical Uses

Like other TCAs, clomipramine is used in animals to treat various behavioral disorders, including obsessive-compulsive disorders (also called canine compulsive disorder) and separation anxiety. In dogs, it has been superior to amitriptyline for treating compulsive disorders; however, it does not appear to be beneficial when used for dominance-related aggression. In cats, with long-term treatment, it has been effective for decreasing urine spraying. It was equally effective as fluoxetine for urine spraying in cats, but treated animals returned to urine marking abruptly after the drug was discontinued. It has not been effective for psychogenic alopecia in cats.

Precautionary Information

Adverse Reactions and Side Effects

Reported adverse effects include sedation and reduced appetite. Vomiting may occur in dogs, which can be reduced if administered with a small amount of food. Clomipramine has a bitter taste and some animals may refuse the medication. Other side effects associated with TCAs are antimuscarinic effects (dry mouth, rapid heart rate, and urine retention) and antihistamine effects (sedation). In cats, sedation and weight gain have been observed. The antimuscarinic effects from clomipramine may be caused by an active metabolite. Clomipramine can decrease total T_4 and free T_4 thyroid concentrations in dogs, but it may still be within normal reference ranges. It has been safe in cats, with no significant adverse effects observed during clinical studies.

Overdoses, especially in dogs that accidentally consume large amounts, can produce life-threatening cardiotoxicity. If an overdose occurs, immediately contact a poison control center.

Contraindications and Precautions

Use cautiously in patients with heart disease.

Drug Interactions

Do not use with other behavior-modifying drugs such as serotonin reuptake inhibitors. Do not use with monoamine oxidase inhibitors, such as selegiline or amitraz. Although tramadol can produce some serotonin effects, there have been no reported interactions from administration of tramadol and clomipramine concurrently.

Instructions for Use

When adjusting doses, one may initiate therapy with a low dose and increase gradually. There may be a delayed onset of 2–4 weeks after initiation of therapy before beneficial effects are observed. After achieving a favorable response, the dose can be gradually lowered in some animals. To reduce incidence of vomiting in dogs, it may be administered with food.

Patient Monitoring and Laboratory Tests

Monitor animal's heart rate and rhythm periodically during treatment. Like other TCAs, clomipramine may decrease total T_4 and free T_4 concentrations in dogs.

Formulations

- Clomipramine is available in 5-, 20-, 40-, and 80-mg tablets (veterinary preparation).
- 25-, 50-, and 75-mg capsules (human preparation).

Stability and Storage

Store at room temperature. Protect from moisture. It has been compounded in a tuna-flavored liquid for cats without a decrease in efficacy.

Small Animal Dosage

Dogs

- 2–4 mg/kg/day, PO, which may be administered as a single dose, or divided into twice-daily doses. Start at lower dose and gradually increase to reach the desired effect. Increases in dose should be made approximately every 14 days until desired effect is observed.

Cats

- 1–5 mg per cat q12–24h PO (0.5 mg/kg per day) and gradually increase.
- Urine spraying in cats: Up to 5 mg per cat once a day.

Large Animal Dosage

- No dose has been reported for large animals.

Regulatory Information

No regulatory information is available. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.
RCI Classification: 2

Clonazepam

kloe-nah′zih-pam

Trade and other names: Klonopin and generic brands

Functional classification: Anticonvulsant

Pharmacology and Mechanism of Action

Clonazepam is a benzodiazepine with action similar to other benzodiazepines, which is to enhance inhibitory effects of gamma-aminobutyric acid (GABA) in the CNS. Through these GABA effects, it has anticonvulsant action, sedative properties, and effects on some behavioral disorders.

Indications and Clinical Uses

Clonazepam has been used as an anticonvulsant in dogs and cats, but this use is not common because there are other more effective anticonvulsant agents available. Tolerance may develop to the anticonvulsant effects with long-term use. Like other benzodiazepines, it also is used to treat behavior problems in dogs and cats, particularly those associated with anxiety.

Precautionary Information

Adverse Reactions and Side Effects

Side effects include sedation and polyphagia. Some animals may experience paradoxical excitement.

Contraindications and Precautions

No contraindications reported for animals. Use of benzodiazepines in early pregnancy has been associated with an increased risk of spontaneous abortions and fetal malformations in people. This incidence in animals is unknown.

Drug Interactions

No drug interactions are reported in animals. However, it potentiates effects from other sedatives and CNS depressants.

Instructions for Use

The doses used clinically in dogs and cats are based primarily on reports from human medicine, empiricism, or experimental studies. No clinical efficacy studies have been performed in dogs or cats. Some dogs are sensitive to the doses listed in the dosing section and lowered to 0.1–0.2 mg/kg in some animals.

Instructions for Use
Doses are derived from extrapolation of human doses or empiricism. No well-controlled clinical studies have been performed in veterinary medicine.

Patient Monitoring and Laboratory Tests
Monitor for signs of hepatic reactions. Monitor CBC occasionally because bone marrow toxicity has occurred in some animals.

Formulations
- Dapsone is available in 25- and 100-mg tablets. Formulations also may be compounded. See Stability and Storage.

Stability and Storage
Store in a tightly sealed container, protected from light, and at room temperature. Dapsone may discolor without change in potency. Compounded suspension formulations have been stable for 21 days when mixed with citric acid.

For dosing smaller patients, a 2-mg/mL oral suspension may be made from the tablets in a 1:1 mixture of Ora-Sweet and Ora-Plus. To prepare this formulation, crush eight 25-mg tablets in a mortar and reduce to a fine powder. Add small portions of vehicle and mix to a uniform paste; mix while adding the vehicle in incremental proportions to almost 100 mL; transfer to a calibrated bottle, rinse mortar with vehicle, and add quantity of vehicle sufficient to make 100 mL. Label "Shake well." Stable for 90 days at room temperature or refrigerated.

Small Animal Dosage
Dogs
- 1.1 mg/kg q8–12h PO.

Cats
- Do not use.

Large Animal Dosage
- No dose has been reported for large animals.

Regulatory Information
No regulatory information is available. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.

Darbepoetin Alfa
dar′be-poe′e-tin al′fa

Trade and other names: Aranesp

Functional classification: Hormone

Pharmacology and Mechanism of Action
Human recombinant erythropoietin. Hematopoietic growth factor that stimulates erythropoiesis. Darbepoetin is a hyperglycosylated recombinant form of human erythropoietin. It differs from epoetin because it has 5 N-carbohydrate chains, thus producing a longer duration. The longer half-life translates to less often administration. In dogs, it has a three times longer half-life than epoetin. Because of the longer duration, epoetin has largely been replaced in veterinary medicine by darbepoetin.

Indications and Clinical Uses

Darbepoetin alfa is used to treat nonregenerative anemia. It has been used to treat myelosuppression caused by disease or chemotherapy. It has been used in people to treat anemia associated with chronic kidney disease (CKD) and has been used for this purpose in dogs and cats with CKD. It has been an effective treatment for anemia secondary to CKD in dogs with most dogs achieving a goal of greater than 30% improvement in the packed cell volume (PCV). It also has been effective for this use in cats, at a dosage of 1 mcg/kg per week or higher. For comparison, the typical dosage in people is 2.25 mcg/kg once every 3 weeks or a dosage of 0.45–0.75 mcg/kg per week. When switching from the use of erythropoietin (epoetin alpha) to darbepoetin, a conversion for treatment is: 400 units/wk of epoetin = 1 mcg/kg darbepoetin.

Precautionary Information

Adverse Reactions and Side Effects

Injection-site pain and headache have occurred in people. Adverse effects have included iron deficiency, hypertension, joint pain (arthralgia), gastrointestinal (GI) disturbance, and polycythemia. Because this product is a human-recombinant product, it may induce local and systemic allergic reactions in animals. Human erythropoietin products can cause red cell aplasia caused by neutralizing anti-erythropoietin antibodies that cross-react with other forms of erythropoietin. This is less likely with darbepoetin than epoetin. The feline erythropoietin is 83% homologous to human erythropoietin. Increased red cell aplasia may occur in animals when there is less than 100% homology. Pure red cell aplasia (PRCA) in cats was 25%–30% with epoetin compared with only 8% with darbepoetin. Reported adverse reactions in cats and dogs included vomiting, hypertension, seizures, fevers, and PRCA. Adverse effects in dogs included hypertension, seizures, hyperkalemia (which may be caused by other drugs), and PRCA.

Contraindications and Precautions

Do not shake vial vigorously. Do not dilute with other fluids or solutions. Do not use if cloudy. Stop therapy if joint pain, fever, anorexia, or cutaneous reactions are observed. Rotate sites of injection to avoid reactions.

Drug Interactions

No interactions are reported.

Instructions for Use

The use of darbepoetin has been primarily in cats and dogs with anemia caused by CKD. It is preferred over epoetin alpha for this use. Iron supplementation is recommended when used in cats and dogs. By improving anemia, it may increase survival in animals with CKD and improve quality of life. An important adverse effect that may limit the use in animals is PRCA, which is described in the Adverse Reaction section. The doses listed in the dosing section are based on initial treatment. This treatment may be initiated with once-weekly injections for 3–4 weeks until the desired PCV has stabilized. Thereafter, the interval between doses may be increased, but this should not be longer than 21 days.

Patient Monitoring and Laboratory Tests

Monitor hematocrit. The dose should be adjusted to maintain hematocrit in a range of 25%–35%. Because darbepoetin can cause hypertension, monitor blood pressure in treated animals. An increase may indicate a need for an increase in the antihypertensive drug dose.

Formulations Available

Darbepoetin alfa is available in a variety of injectable solution concentrations, including: 25, 40, 60, 100, 200, 300, and 500 mcg/mL.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. Do not freeze. Do not mix with other solutions or fluids.

Small Animal Dosage

Dogs

- Start with 0.5 mcg/kg every 7 days injected SQ. After initial evaluation, increase the dosage to 0.8 mcg/kg once per week if needed; then increase or decrease the dosage as needed by monitoring the patient's PCV.

Cats

- Start with 1 mcg/kg once per week, injected SQ, until the target PCV is achieved. Then the frequency can be decreased to every 2- to 3-week intervals. Typically, the expected response is a PCV of 25%–35%.

Large Animal Dosage

No large animal doses are reported.

Regulatory Information

No withdrawal times are established for food animals. Erythropoietin or derivatives in any form are prohibited to be on the premises of racing horses.
RCI Classification: 2

Deferoxamine Mesylate

deh-fer-oks´ah-meen mess´ih-late

Trade and other names: Desferal

Functional classification: Antidote, Chelating agent

Pharmacology and Mechanism of Action

Deferoxamine is a siderophore (iron-binding compound) produced by the bacteria *Streptomyces pilosus*. It is not absorbed well enough from oral administration and must be injected. Because it has strong affinity for trivalent cations, it has chelating properties and is used to treat poisoning from these metal cations. In particular, it is valuable to treat acute iron toxicosis. One molecule of deferoxamine binds to a single atom, forming a complex, referred to as ferrioxamine, that is inactive and can be excreted, primarily through the kidneys. Hepatocytes also can take up deferoxamine and chelate hepatic iron, with the complex excreted in the bile.

There is another similar compound, but it is used less frequently in veterinary medicine. This synthetic chelator, deferasirox, is well absorbed from the GI tract and cleared more slowly, with longer-acting effects.

Indications and Clinical Uses

Deferoxamine is indicated in cases of severe poisoning, especially iron toxicosis. It also has been used to chelate aluminum and facilitate removal.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage

Dogs

- 22–44 mcg/kg IM (total dose not to exceed 1 mg).

Cats

- 250 mcg/cat IM, between 40 hours and 5 days of mating.

Large Animal Dosage

- No large animal doses have been reported.

Regulatory Information

Do not use in food-producing animals.

Estriol

ess-tree-ole

Trade and other names: Incurin and Theelol (previously called Oestriol)

Functional classification: Hormone

Pharmacology and Mechanism of Action

Estriol is a natural estrogen hormone. It differs from diethylstilbestrol (DES) and other estrogens because it is naturally occurring and occupies the receptor for a shorter duration compared with synthetic compounds such as estradiol and DES. When used to treat urinary incontinence, its effects are believed to be caused by increasing sensitivity of alpha-adrenergic receptors in urinary smooth muscle.

Indications and Clinical Uses

Estriol is an estrogen replacement. In small animals, it has most often been used to treat urinary incontinence that is associated with estrogen deficiency in female dogs. This problem is most common in dogs that have undergone ovariohysterectomy. An advantage of estriol is that one tablet can be used to treat all sizes of dogs, and if they respond to initial dosing, the frequency of administration can be tapered to the lowest effective level. Another approved drug for treating urinary incontinence in dogs is phenylpropanolamine (PPA) (see Phenylpropanolamine). It may be used instead of or concurrently with estriol.

Precautionary Information

Adverse Reactions and Side Effects

In field studies, the most common adverse effects were loss of appetite, vomiting, excessive water drinking, and swollen vulva. Estriol has not been associated with pyometra or bone marrow suppression compared with estradiol.

Contraindications and Precautions

Estriol is contraindicated in pregnancy. Do not administer to ferrets.

Drug Interactions

No drug interactions are reported for animals. It should not be used with other drugs that may suppress the bone marrow. In people, it has been recommended that these estrogen compounds not be used with other drugs that may cause hepatotoxicity, but such an interaction has not been shown in dogs for estriol.

Instructions for Use
To treat urinary incontinence, it has been used in combination with PPA; however, the addition of PPA to the treatment regimen may not improve efficacy compared to estrogen drugs used alone.

Patient Monitoring and Laboratory Tests
Monitor CBC for evidence of bone marrow suppression.

Formulations
- Estriol is available as a 1-mg tablet.

Stability and Storage
Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage
Dogs
- 2 mg per dog PO q24h (may be combined with PPA). After starting with 2 mg per dog per day, after 1 week, reduce dose to 1.5 mg per dog per day for 1 week, then 1 mg per dog per day for 1 week, and a gradually tapered regimen and increased interval (every other day, every third day, and so on) until a goal of 0.5 mg per dog once per week is achieved.

Cats
- No dose has been established.

Large Animal Dosage
- No large animal doses have been reported.

Regulatory Information
Do not use in food-producing animals.

Etidronate Disodium
eh-tih-droe´nate dye-soe´dee-um

Trade and other names: Didronel

Functional classification: Antihypercalcemic agent

Pharmacology and Mechanism of Action
Etidronate disodium is a bisphosphonate drug and used to treat bone disorders. This group of drugs is characterized by a germinal bisphosphonate bond. They slow the formation and dissolution of hydroxyapatite crystals. Their clinical use resides in their ability to inhibit bone resorption. These drugs decrease bone turnover by inhibiting osteoclast activity and retard bone resorption and decrease the rate of osteoporosis. Other drugs in this class used in animals are alendronate, zoledronate (Zometa), pamidronate, clodronate (Osphos), and tiludronate (Tildren).

Indications and Clinical Uses
The bisphosphonate group of drugs, which includes etidronate, is used primarily in people to treat osteoporosis and hypercalcemia of malignancy. In animals, they are used to decrease calcium in conditions that cause hypercalcemia, such as cancer and vitamin D toxicosis. Studies in people have shown that bisphosphonates may have

Formulations

- Fenbendazole is available in 22.2% (222 mg/g) (Panacur) granules, 10% oral paste (92 g/32 oz), and 100-mg/mL oral suspension. Some formulations (e.g., Panacur Plus) may contain other ingredients such as ivermectin and praziquantel.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage

Dogs

- 50 mg/kg/day for 3 days PO. Duration may be extended to 5 days for severe parasitic infestations. For pulmonary helminths (lungworms) in dogs, increase the duration of this dosage to 10–14 days.
- *Giardia* treatment: 50 mg/kg q24h for 3–5 days.

Cats

- 50 mg/kg/day for 3 days PO.
- Duration may be extended to 5 days for severe parasitic infestations.

Large Animal Dosage

Horses

- Intestinal parasites, such as strongyles, pinworms, and ascarids: Panacur granules or paste is administered at a dose of 5.1 mg/kg (2.3 mg/lb) PO. Two packets of 1.15 g each will treat a 450-kg (1000-lb) horse. Panacur paste can be administered to horses at a dose of 5 mg/kg PO. Retreatment at 6–8 weeks may be necessary. For treatment of ascarids (*Parascaris equorum*) in horses, a higher dose of 10 mg/kg is recommended.

Sheep and Goats

- 5 mg/kg PO.

Cattle

- 5 mg/kg PO or 5 mg/kg/day provided in feed for 3–6 days.

Regulatory Information

Cattle withdrawal time (meat): 8 days. There is no withdrawal period for milk. Goat withdrawal time: 6 days meat; 0 days milk. For additional withdrawal time information, contact FARAD at www.FARAD.org.

Fenoldopam Mesylate

fe-nol′doe-pam

Trade and other names: Corlopam

Functional classification: Vasodilator

Pharmacology and Mechanism of Action

Fenoldopam is a dopamine agonist. It is specific for the dopamine D_1 receptors, without effects on alpha- or beta-adrenergic receptors, and therefore has been used to produce smooth muscle relaxation and vasodilation in vascular beds that have D_1 receptors (peripheral arteries and kidneys). It has no activity on D_2 receptors and only a small effect on alpha-adrenergic receptors. Because of this activity, fenoldopam has more specificity than dopamine, which has been used for similar indications. The most common use of fenoldopam is for increasing renal perfusion to treat acute renal failure.

Pharmacokinetics: The half-life in animals is very short (1–7 minutes in dogs), with very high clearance (60 mL/min/h); therefore, it is usually administered via CRI.

Indications and Clinical Uses

The use of fenoldopam in veterinary medicine is limited to a few research studies (primarily in cats and dogs), small observational studies, and some anecdotal evidence of efficacy for treating acute kidney injury (AKI). In healthy dogs at a dose of 0.8 mcg/kg/min (CRI), it produced a significant increase in glomerular filtration rate, and renal plasma flow without inducing hypotension. This effect likely is produced through its action as a renal vasodilator and improvement in renal plasma flow. Despite this effect in healthy animals, at this time, there is insufficient evidence to recommend for routine treatment in patients with kidney failure as there has been no demonstrated difference in survival associated with treatment. In people, fenoldopam has replaced dopamine as a treatment of AKI. It is also used in people to treat severe hypertension, to prevent renal ischemia, and to increase gastrointestinal (GI) perfusion, as well as being a treatment for AKI. The use is limited to short-term in-hospital use when rapid treatment of hypertension is needed. These indications in people have not been fully explored for use in animals.

Precautionary Information

Adverse Reactions and Side Effects

It has been generally safe and well-tolerated in dogs and cats, but these studies were in healthy animals. The most common side effect is hypotension. The half-life of fenoldopam is short; therefore, if hypotension is observed, decrease the infusion rate. Other adverse effects described for small animals include reflex tachycardia and mild hypokalemia. Rarely, it has caused facial twitching and hypersalivation in cats. In people, adverse effects can include increased intraocular pressure (risk in glaucoma), low potassium, and tachycardia.

Contraindications and Precautions

No known contraindications.

Drug Interactions

Use cautiously with other vasodilators; excessive hypotension can occur. Do not use with beta blockers.

Instructions for Use

Administer by CRI. There is no need to administer bolus doses because the onset of effects should occur within 15 minutes of starting the CRI. Dose recommendations are based on some limited research studies and anecdotal clinical experience from veterinarians. There have been no well-controlled studies of efficacy in animals, and the use is largely extrapolated from human recommendations. It is recommended that the solution be added to fluids (e.g., 5% dextrose) to make a 40-mcg/mL solution for infusion. For example, add 1 mL (10 mg) to 250 mL.

Patient Monitoring and Laboratory Tests

Monitor patient's heart rate and blood pressure during treatment.

Formulations

- Fenoldopam is available as a 10-mg/mL injection. The pH range is 2.8–3.8.

Stability and Storage

Fenoldopam solution can be mixed with sodium chloride solution (0.9%) or 5% dextrose solution for infusion. After being mixed in fluids, it is stable under normal ambient light and temperature conditions for at least 24 hours. After 24 hours, discard the solution.

Small Animal Dosage

Dogs

- 0.8 mcg/kg/min CRI.

Cats

- 0.5–0.8 mcg/kg/min CRI.

Large Animal Dosage

Foals

- 0.04 mcg/kg/min.

Regulatory Information

There are no withdrawal times established for food animals. Because fenoldopam has a very short half-life, residues in food animals are not expected to be a problem.

Fentanyl Citrate (Note: Transdermal Fentanyl Is Listed Separately in the Next Section)

fen′tah-nil sih′trate

Trade and other names: Sublimaze and generic brands; Fentora buccal tablets

Functional classification: Analgesic, opioid

Pharmacology and Mechanism of Action

Fentanyl is a synthetic opioid analgesic. Fentanyl is approximately 80–100 times more potent than morphine. Fentanyl is an agonist for the mu-opiate receptors on nerves and inhibits release of neurotransmitters involved with transmission of pain stimuli (e.g., substance P). The central sedative and euphoric effects are related to mu-receptor effects in the brain. Fentanyl has a wide safety profile with doses as high as 300 times the recommended dose not being lethal in spontaneously breathing dogs. It is highly lipophilic (approximately 1000 times more lipophilic than morphine) and has low protein binding in dogs (15.6%), which produces rapid diffusion into the CNS.

Pharmacokinetics: In dogs, the half-life is approximately 2–6 hours (depending on the study); in cats, it is approximately 2.5 hours. Clearance is high, approximately equal to hepatic blood flow, and oral absorption is very low. Fentanyl can be absorbed from the skin or oral mucous membrane, but it is not orally bioavailable if swallowed.

Indications and Clinical Uses

Fentanyl citrate is used as an IV bolus or as a CRI in animals for relief of pain, an adjunct for anesthesia, or as a sedative in combination with other CNS sedatives. After administration by the IV route, fentanyl will produce antinociceptive effects for approximately 2 hours. Most of the doses are based on empirical observations, small retrospective observational studies, and experimental studies in research animals. Oral buccal tablets have been used in people for treatment of breakthrough pain, but there has been only anecdotal experience with this use in animals. See Fentanyl, Transdermal for information about the transdermal form. Clinical use is primarily in dogs and cats. In horses at doses needed to produce analgesia, it is associated with a high degree of restlessness, tachycardia, increased locomotor activity, and excitement if sedative drugs are not administered concurrently (see Adverse Reactions and Side Effects). In horses, there has been poor efficacy at lower doses.

Formulations

- Fluorouracil is available in a 50-mg/mL vial. It is also available in topical forms as 0.5%, 1%, 2%, and 5% solutions and 1% and 5% creams. The topical forms are used in people for skin tumors and keratosis.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. Stability of compounded formulations has not been evaluated.

Small Animal Dosage

Dogs

- 150 mg/m^2 once per week IV.

Cats

- Do not use.

Large Animal Dosage

- No large animal doses have been reported.

Regulatory Information

Withdrawal times are not established for animals that produce food. This drug should not be used in food animals because it is an anticancer agent.

Fluoxetine Hydrochloride

floo-oks′eh-teen hye-droe-klor′ide

Trade and other names: Prozac (human formulation) and Reconcile (veterinary formulation)

Functional classification: Behavior modification, selective serotonin reuptake inhibitor

Pharmacology and Mechanism of Action

Fluoxetine is an antidepressant drug and used for behavior problems in animals. Fluoxetine, like other drugs in this class, is a selective serotonin reuptake inhibitor (SSRI). Its mechanism of action is through selective inhibition of serotonin reuptake and downregulation of 5-HT_1 receptors. SSRIs are more selective for inhibiting serotonin reuptake than the TCAs; therefore there may be fewer effects on other receptors compared with other behavior-modifying drugs.

Pharmacokinetics: Fluoxetine is metabolized to norfluoxetine, which is an active metabolite. Oral absorption in dogs is 72% with a half-life of 6–10 hours. The metabolite norfluoxetine has a longer half-life of 48–57 hours. In cats, oral absorption is 100% with a half-life of 34–47 hours; the metabolite norfluoxetine has a half-life of 51–55 hours. Absorption in cats from transdermal administration is only 10%. Another SSRI used in animals is paroxetine (Paxil).

Indications and Clinical Uses

Fluoxetine, like other SSRIs, is used to treat behavioral disorders such as separation anxiety, canine compulsive behaviors, and dominance aggression. In cats, it has been effective for decreasing urine spraying (1 mg/kg/day). In trials comparing fluoxetine with clomipramine for treating urine marking in cats, both drugs were equally effective for long-term use. However, the urine marking returned after discontinuation of

the drug. In both dogs and cats, SSRIs have been used for pain syndromes, such as neuropathic pain, but there are no studies of efficacy published to confirm efficacy for this indication. In horses, fluoxetine has been used for "cribbing behavior" and other behavior disorders, but efficacy is based on small observational studies.

Precautionary Information

Adverse Reactions and Side Effects

Fluoxetine has fewer adverse effects (especially antihistamine and antimuscarinic effects) compared with other antidepressant drugs. During clinical trials in dogs, adverse reactions included vomiting, decreased appetite, lethargy, depression, trembling, and shaking in some dogs; the most common were lethargy and decreased appetite. In rare cases, it may cause seizures. Adverse effects are more common at doses above 8–10 mg/kg, but occasionally, some of these signs may be seen at lower doses. In dogs, at high doses of 10–20 mg/kg, it caused tremors, anorexia, aggressive behavior, nystagmus, emesis, and ataxia. Seizures can occur at doses above 25 mg/kg.

In cats, nervousness or increased anxiousness has been observed. In cats, 5 mg/kg produced tremors, and 3 mg/kg produced anorexia and vomiting. However, in trials used for treating urine spraying, few adverse effects were reported, and cats have tolerated doses up to 50 mg/kg.

Contraindications and Precautions

Use cautiously in animals prone to aggression because it may decrease inhibition. In early pregnancy, it appears to be safe but has caused pulmonary hypertension in experimental animals late in pregnancy. Serotonin reuptake inhibitors can increase the risk of bleeding by inhibiting serotonin uptake by platelets, but this has not been reported in animals.

Drug Interactions

Do not use with other behavior-modifying drugs such as other SSRIs or TCAs. Do not use with monoamine oxidase inhibitors (MAOIs). Administration with selegiline may induce a reaction. Because it is highly metabolized by the liver, it may be subject to interactions caused by cytochrome P450 inhibitors. (See Appendix I.)

Instructions for Use

Always use in conjunction with a comprehensive behavior modification protocol. Clinical efficacy of fluoxetine for separation anxiety in dogs has been established from clinical studies. Because of a long half-life, accumulation in plasma may take several days to weeks. There may be a delay in the onset of action of 2 weeks. Do not apply transdermally; absorption is low, and it may cause skin irritation.

In some animals, paroxetine (Paxil) is preferred, which is a human formulation available in tablets and has been used for smaller-size animals.

Sudden discontinuation of serotonin reuptake inhibitors can produce other behavior problems, such as anxiety, signs of agitation and nervousness. If treatment is discontinued, gradually withdraw the medication.

Patient Monitoring and Laboratory Tests

Use in animals has been relatively safe, and one should only monitor behavior changes.

Formulations

- Fluoxetine is available in human formulations of 10-, 20-, and 40-mg capsules; 10-, 20-, and 60-mg tablets; and 4-mg/mL oral solution. The veterinary formulations have been available in sizes of 8-, 16-, 32-, and 64-mg tablets.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature. It is soluble in water at 14 mg/mL and in alcohol at 100 mg/mL. Fluoxetine hydrochloride solution has been mixed with various juices and flavorings and found to be stable for 8 weeks. In one trial, it was mixed in tuna-flavored water for cats and retained effectiveness.

Small Animal Dosage

Dogs

- 1–2 mg/kg once daily PO.

Cats

- 0.5–4 mg/cat q24h PO (0.5–1 mg/kg/day). Start with 1/4 tablet (2.5 mg) per cat and increase as needed.
- Urine marking: 1 mg/kg q24h PO and increase to 1.5 mg/kg if there has been inadequate response.

Large Animal Dosage

- Horses: 0.25–0.5 mg/kg PO once daily, mixed with grain.

Regulatory Information

Do not administer to animals intended for food.
RCI Classification: 2

Fluralaner

floor ′ah-lan′er

Trade and other names: Bravecto

Functional classification: Antiparasitic, Ectoparasiticide

Pharmacology and Mechanism of Action

Fluralaner belongs to the isooxazolines class of ectoparasiticides. It is effective for treating and preventing infections from fleas, mites, and ticks. It produces selective inhibition of the GABA receptor and L-glutamate–gated chloride channels. This inhibition of the receptor produces changes in chloride channels, hyperexcitement of the parasite, and death. Mammals are not affected because of a lack of binding to mammalian GABA receptors.

Efficacy has been demonstrated against a wide range of ectoparasites, including fleas, various mites (including *Demodex* and *Sarcoptes* spp.), and ticks. The parasite must bite the animal for exposure to the agent. Activity of the isooxazolines has been superior to other ectoparasiticides, including dieldrin, fipronil, deltamethrin, and imidacloprid.

Pharmacokinetics: Fluralaner has a long half-life in dogs. After topical or oral administration, the peak concentration occurs between 2 hours and 3 days. The half-life ranges between 14 and 29 days with a bioavailability from either route of approximately 25%.

Other drugs in this class with similar activity but different pharmacokinetics include afoxolaner, lotilaner, and sarolaner.

Indications and Clinical Uses

Fluralaner, like the other isooxazolines is active against fleas, mites, and ticks. After oral administration or topical application, it can start killing fleas within

Stability and Storage

Phenylephrine is soluble in water and may be mixed in IV solutions. It is also soluble in ethanol. It is subject to oxidation and turns a darker color in some solutions, especially alkaline solutions. Discard formulations that turn a dark color. Store in a tightly sealed container, protected from light, and at room temperature.

Small Animal Dosage

Dogs and Cats

- 10 mcg/kg (0.01 mg/kg) q15min IV as needed or 0.1 mg/kg q15min IM or SQ.
- CRI: 10 mcg/kg (0.01 mg/kg) IV followed by 3 mcg/kg/min IV.

Large Animal Dosage

- Horses: Dilute 10–20 mg in 500 mL of 0.9% saline solution and infuse over 10–15 minutes or dilute 20 mg in 1000 mL of 0.9% saline and infuse over 10 minutes. Note that this use for nephrosplenic entrapment is controversial because of the potential for adverse effects.

Regulatory Information

Withdrawal times are not established for animals that produce food. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.
RCI Classification: 3

Phenylpropanolamine Hydrochloride

fen-ill-proe-pah-nole′ah-meen hye-droe-klor′ide

Trade and other names: PPA, Proin, Proin ER, UriCon, and Propalin (veterinary preparations)

Functional classification: Adrenergic agonist

Pharmacology and Mechanism of Action

Phenylpropanolamine (PPA) is an adrenergic agonist that is used most often to treat urinary incontinence in dogs. PPA is a sympathomimetic and nonselectively acts as an agonist for the alpha-adrenergic and beta-adrenergic receptor. These receptors are found throughout the body, such as on sphincters, blood vessels, smooth muscle, and heart. The most profound effects observed with PPA are on vascular smooth muscle (vasoconstriction) and urethral smooth muscle (increased tone of urethra).

Pharmacokinetics: The half-life of the conventional immediate-release formulation in dogs is 4–7 hours, with a duration of effect may be at least 8–12 hours and as long as 24 hours in some animals. Oral absorption is 94% There is also an extended-release (ER) tablet for dogs with a duration of effectiveness of 24 hours. A longer interval of administration between doses may prevent some downregulation of alpha receptors.

Indications and Clinical Uses

Phenylpropanolamine has been used as a decongestant, as a mild bronchodilator, and to increase tone of the urinary sphincter. Pseudoephedrine and ephedrine are related drugs that produce similar alpha-receptor and beta-receptor effects. The most common use in animals is for treating urinary incontinence. The mechanism for this action appears to be via stimulating receptors on the urethral sphincter. It has also been used to treat priapism (persistent erection) in dogs. Abuse potential and adverse effects have limited the routine use as a decongestant and appetite suppressant in human medicine.

Precautionary Information

Adverse Reactions and Side Effects

Adverse effects are attributed to excess stimulation of adrenergic (alpha and beta) receptors. Side effects include tachycardia (or bradycardia), cardiac effects, CNS excitement, restlessness, and appetite suppression. There are reports of adverse effects caused by PPA in people. In particular, it has caused problems with blood pressure and increased risk of strokes. Such a concern should also apply to animals, but there have been no specific reports of these problems in animals. In animals exposed to high doses (accidental ingestion from the flavored canine tablets), it produces agitation, vomiting, mydriasis, tremors, panting and cardiovascular effects. Prognosis is good after accidental exposure if supportive care is provided.

Contraindications and Precautions

Use cautiously in any animal with cardiovascular disease. For the extended-release (ER) formulations, do not administer to dogs smaller than 4.5 kg because this will produce a dose higher than 4 mg/kg.

Phenylpropanolamine has been abused by people and used as a recreational drug. PPA and a related drug, pseudoephedrine, can be diverted to clandestine laboratories for the manufacture of amphetamines. The Drug Enforcement Administration has issued a notice to inform individuals and businesses handling PPA that this chemical is used in the illicit manufacture of amphetamine. Most of the human preparations have been removed from the market, and the only forms readily available are those marketed for veterinary medicine.

Drug Interactions

Phenylpropanolamine and other sympathomimetic drugs can cause increased vasoconstriction and changes in heart rate. Use cautiously with other vasoactive drugs and alpha$_2$ agonists such as dexmedetomidine and xylazine. Use cautiously with other drugs that may lower the seizure threshold. Use of inhalant anesthetics with PPA may increase cardiovascular risk. Do not use with TCAs or MAOIs. However, studies in dogs have shown that although selegiline is a MAOI, it can be administered safely with PPA.

Instructions for Use

Although frequency of administration has been every 8–12 hours with the conventional product for dogs, an interval of q24h in dogs at a dose of 1.5 mg/kg has been just as effective in some dogs. Alternatively, the ER form can be used once-daily.

In some animals, pseudoephedrine has been substituted for PPA with good success, but these tablets are more tightly regulated because of the potential to divert to the manufacture of methamphetamine.

Patient Monitoring and Laboratory Tests

Monitor heart rate and blood pressure in animals receiving treatment. Animals with urinary incontinence should be checked periodically for presence of UTIs.

Formulations

- PPA is available in 25-, 50-, and 75-mg flavored tablets; 25-mg vanilla-flavored liquid; and 50-mg scored tablets (veterinary preparations). Human formulations of 15-, 25-, 30-, and 50-mg tablets are no longer available.

- PPA ER tablets are available in tablets of 18-, 38-, 74-, and 145-mg. Do not split or crush the tablets
- Human formulations have been removed from the market.

Stability and Storage

The stability and potency of compounded formulations has not been evaluated. The ER tablets should not be broken or crushed.

Small Animal Dosage

Dogs

- Immediate-release formulation: 1 mg/kg q8h PO. Increase dosage to 1.5–2 mg/kg q8h PO if necessary. In some animals, it may be possible to decrease frequency to q12h or q24h PO.
- ER formulation: 2–4 mg/kg PO once daily.

Cats

- No dosage has been determined. A dosage of 1 mg/kg q12h PO has been used (extrapolated from the canine use), and the dosage has been adjusted as needed.

Large Animal Dosage

- No large animal dosage is available.

Regulatory Information

There are no formulations currently marketed in the United States for human use because of abuse potential and adverse cardiovascular events.
RCI Classification: 3

Phenytoin, Phenytoin Sodium

fen′ i toyn soe′dee-um

Trade and other names: Dilantin

Functional classification: Anticonvulsant, antiarrhythmic

Pharmacology and Mechanism of Action

Phenytoin is an older anticonvulsant agent that is used infrequently in veterinary medicine. Phenytoin depresses nerve conduction via blockade of sodium channels. Phenytoin stabilizes neuronal membranes and limits the spread of neuronal or seizure activity from the focus. It blocks inward movement of sodium and stabilizes excitable tissue. Phenytoin also decreases calcium inward flow during depolarization, thus inhibiting Ca^{++}-dependent release of neurotransmitters.

Phenytoin is also classified as a Class I cardiac antiarrhythmic but is not used often for this indication. In cardiac tissue, phenytoin increases the threshold for triggering ventricular arrhythmias. It also decreases conduction velocity and does not shorten the refractory period as much as lidocaine.

Pharmacokinetics: The elimination is very rapid in dogs. In horses, the half-life was approximately 12–13 hours, and oral absorption is variable among horses, ranging from 14% to 85%.

Indications and Clinical Uses

Phenytoin is commonly used as an anticonvulsant in people, but it is not effective in dogs and not used in cats. In dogs, elimination is so rapid that dosing is impractical.

- In combination, it is available as 13.6 mg of praziquantel and 54.3 mg of pyrantel,18.2 mg of praziquantel and 72.6 of mg pyrantel, or 27.2 mg of praziquantel and 108.6 mg of pyrantel. It is combined with emodepside in Profender.
- Praziquantel is available in pastes and gels for horses in combination with other drugs (e.g., ivermectin, moxidectin, febantel).

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature.

Small Animal Dosage

Dogs

- Dogs weighing less than 6.8 kg: 7.5 mg/kg once PO.
- Dogs weighing more than 6.8 kg: 5 mg/kg once PO.
- Dogs weighing less than 2.3 kg: 7.5 mg/kg once IM or SQ.
- Dogs weighing more than 2.7–4.5 kg: 6.3 mg/kg once IM or SQ.
- Dogs weighing more than 5 kg: 5 mg/kg once IM or SQ.
- Paragonimus in dogs (lung worms): 23 mg/kg PO q8h for 3 days.
- *Spirometra* spp. and *Diphyllobothrium* spp. treatment: 25 mg/kg PO once daily for 2 consecutive days.

Cats

All doses are given once.

- Cats weighing less than 1.8 kg: 11.4 mg/cat PO.
- Cats weighing 1.8–2.2 kg: 11.4 mg/cat SQ or IM.
- Cats weighing 2.3–4.5 kg: 22.7 mg/cat SQ or IM.
- Cats weighing 2.3–5 kg: 23 mg/cat PO.
- Cats weighing more than 5 kg: 34.5 mg/cat PO or 34.1 mg/cat SQ or IM.
- *Spirometra* spp. and *Diphyllobothrium* spp. treatment: 25 mg/kg PO once daily for 2 consecutive days.

Large Animal Dosage

Horses

- 1.5–2.5 mg/kg PO.

Regulatory Information

Withdrawal times are not established for animals that produce food. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.

Prazosin

pray′zoe-sin

Trade and other names: Minipress

Functional classification: Vasodilator

Pharmacology and Mechanism of Action

Prazosin is a nonselective alpha$_1$-adrenergic blocker. Prazosin is a vasodilator that is a selective blocker for the alpha$_1$-adrenergic receptor, but it is not selective

for either alpha$_{1a}$ or alpha$_{1b}$. Its action is similar to phenoxybenzamine, but it produces less tachycardia than nonselective alpha-antagonist drugs. Prazosin decreases tension in both arterial and venous vascular smooth muscle to produce vasodilation. In cats, 30% of the proximal urethra is smooth muscle, and the remaining is skeletal muscle. Therefore, it has been used to relax the urethral smooth muscle to treat and prevent urethral obstruction in male cats. The alpha$_{1b}$ adrenoreceptors regulate vascular tone, and the alpha$_{1a}$ adrenoreceptors regulate urethral smooth muscle tone. For specific urinary smooth muscle relaxation, the drugs tamsulosin (Flomax) and silodosin (Rapaflo) are more specific for the alpha$_{1a}$ receptor and can produce a more specific effect on the urethra.

Indications and Clinical Uses

Prazosin has been used in people for vasodilation and the management of hypertension that is not responsive to other drugs. Prazosin has been used to a limited extent in veterinary medicine to produce balanced vasodilation. There are no controlled studies to establish efficacy and dose, and indications are derived from anecdotal use and extrapolation from human medicine. It has been used in cats with urethral obstruction to improve urine flow. There is some evidence that in comparison with phenoxybenzamine, it produced fewer recurrence rates of urethral obstruction (0.5 mg per cat q8h PO), but at lower doses (0.25 mg per cat q12h for 30 days) there was no difference compared with placebo for recurrence rate in cats with urethral obstruction. In dogs, there are no clinical studies that have examined effectiveness to relax the urethra. It has also been used experimentally in horses to improve digital perfusion in the treatment of laminitis. Long-term administration is not common because tolerance may develop with chronic use.

Precautionary Information

Adverse Reactions and Side Effects

High doses cause vasodilation and hypotension. Oral treatment in cats has caused lethargy, ptyalism, and diarrhea.

Contraindications and Precautions

Use cautiously in animals with compromised cardiac function. It may lower blood pressure and decrease cardiac output.

Drug Interactions

No drug interactions have been reported in animals, but when combined with other vasodilators, it may produce severe lowering of blood pressure.

Instructions for Use

Titrate dose to the needs of the individual patient. Results of clinical studies in animals have not been reported; therefore use in animals (and doses) is based on experience in people or anecdotal experience in animals. For a more specific effect on the urethra smooth muscle, consider tamsulosin (Flomax), which is more specific for the alpha$_{1a}$ receptor and can produce a more specific effect on the urethra.

Patient Monitoring and Laboratory Tests

Monitor for hypotension and reflex tachycardia.

Formulations
Prazosin is available in 1-, 2-, and 5-mg capsules.

Stability and Storage
Store in a tightly sealed container, protected from light, and at room temperature.

Small Animal Dosage
Dogs
- 0.5–2 mg per dog q8–24h (as needed).

Cats
- 0.25–1 mg per cat (0.07 mg/kg or approximately 1 mg per 15 kg) q8–12h PO.
- Cats with urethral obstruction: 0.5 mg per cat PO q8h initially; then 0.25–0.5 mg per cat once daily.

Large Animal Dosage
- No doses have been reported for large animals.

Regulatory Information
Withdrawal times are not established for animals that produce food. For extralabel use withdrawal interval estimates, contact FARAD at www.FARAD.org.
RCI Classification: 3

Prednisolone, Prednisolone Acetate
Trade and other names: Delta-Cortef, PrednisTab, and generic brands

Functional classification: Corticosteroid

Pharmacology and Mechanism of Action
Prednisolone is one of the most widely used glucocorticoids. Prednisolone is the active form of prednisone. Prednisolone, like other glucocorticoids, produces anti-inflammatory and immunosuppressive effects. Anti-inflammatory effects are complex, but via binding to cellular glucocorticoid receptors, prednisolone acts to inhibit inflammatory cells and suppresses expression of inflammatory mediators. Prednisolone is approximately four times more potent than cortisol but only one seventh as potent as dexamethasone. Prednisolone is available as the base (usually as a tablet) or as an injectable acetate form, which can be administered intramuscularly or intraarticularly.

Indications and Clinical Uses
Prednisolone, like other corticosteroids, is used to treat a variety of inflammatory and immune-mediated disease. The accompanying dosing section lists a range of doses for replacement therapy, anti-inflammatory therapy, and immunosuppressive therapy. Large animal uses include treatment of inflammatory conditions, especially musculoskeletal disorders. In horses, prednisolone is used for treatment of equine asthma syndrome when recurrent airway obstruction (RAO) occurs. In cattle, corticosteroids have been used in the treatment of ketosis. The prednisolone and trimeprazine formulation (Temaril-P) has been effective for treating pruritus in dogs. (See Trimeprazine for further details.)

Precautionary Information

Adverse Reactions and Side Effects

Adverse effects not reported for animals. However, excessive doses are expected to cause fluid and electrolyte loss.

Contraindications and Precautions

Do not administer to animals with gastrointestinal (GI) obstruction. Do not administer to dehydrated animals.

Drug Interactions

No drug interactions have been reported in animals.

Instructions for Use

Doses and indications are not well established for veterinary medicine. Use is strictly based on anecdotal experience.

Patient Monitoring and Laboratory Tests

No specific monitoring is necessary.

Formulations

- Senna is available in granules in concentrate or syrup.

Stability and Storage

Store in a tightly sealed container, protected from light, and at room temperature.

Small Animal Dosage

Dogs

- Syrup: 5–10 mL/dog/day PO.
- Granules: ½–1 tsp/dog/day PO.

Cats

- Syrup: 5 mL/cat q24h.
- Granules: ½ tsp/cat q24h (with food).

Large Animal Dosage

- No doses have been reported for large animals.

Regulatory Information

Because of a low risk of harmful residues in animals intended for food, no withdrawal time is suggested.

Sevelamer Carbonate

se-vel′a-mer

Trade and other names: generic

Functional classification: Phosphate binder

Pharmacology and Mechanism of Action

Sevelamer is a non-absorbed oral phosphate binder. It is a polymeric amine, anion exchange resin that binds directly to phosphorous. It contains multiple amines in a protonated form in the intestine. These amines bind to phosphate molecules in the intestine and decrease absorption. Sevelamer effectively lowers the phosphate levels in the serum. Phosphate binding capacity: Sevelamer HCl 400 mg binds approximately 32 mg of phosphate, and 800 mg binds approximately 64 mg of phosphate.

Sevelamer also may bind to bile acids in research animals. This effect may lower serum cholesterol.

Indications and Clinical Uses

Sevelamer is used as an oral treatment to bind phosphate in patients with chronic kidney disease. There are two forms, sevelamer carbonate and sevelamer hydrochloride salt. The two forms react similarly and are interchangeable.

Precautionary Information

Adverse Reactions and Side Effects

Adverse effects are not reported for animals. In people, it has had a good safety margin with constipation being the major adverse effect. There is no systemic absorption. Long-term administration can potentially decrease fat-soluble vitamins such as vitamins A, D, and K because of the effect on bile acids and normal fat absorption.

Contraindications and Precautions

There are no specific contraindications or precautions.

Drug Interactions

No drug interactions have been reported for animals. However, it may potentially interfere with oral absorption of other drugs. In people, it decreased oral absorption of fluoroquinolones by 50%.

Instructions for Use

Administer only by the oral route with food. When using the powder form, empty the entire contents of a 0.8- or 2.4-g packet into a container and add 30 mL of water (for the 0.8-g packet) or 60 mL of water (for the 2.4-g packet). If switching from sevelamer hydrochloride to sevelamer carbonate, use the same dose and frequency. Phosphate levels in the blood are better controlled with frequent administration during the day with each meal rather than with one single dose.

Patient Monitoring and Laboratory Tests

Adjust dose based on measuring serum phosphorous.

Formulations

- Sevelamer is available in a film-coated tablet, 800 mg, and sevelamer carbonate powder (citrus flavor).

Stability and Storage

Sevelamer should be stored in a dry place in a tightly sealed container at room temperature.

Small Animal Dosage

- 80–100 mg/kg (approximately) per day. This dose should be divided up equally for each meal fed to the pet (e.g., 25–30 mg/kg PO three times daily).

Large Animal Dosage

- No large animal doses have been identified.

Regulatory Information

No withdrawal times are established for animals intended for food. Because the effects are limited to the intestine, no withdrawal times are anticipated.

Sevoflurane

see-voe-floo′rane

Trade and other names: Ultane

Functional classification: Anesthetic