Overdosage/Acute Toxicity
If administered with sufficient liquid, psyllium overdose should cause only an increased amount of soft or loose stools.

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

- **ASPIRIN** (and other **SALICYLATES**): Potential exists for psyllium to bind and reduce absorption if given at the same time; if possible, separate doses by 3 hours or more
- **DIGOXIN**: Potential exists for psyllium to bind and reduce absorption if given at the same time; if possible, separate doses by 3 hours or more
- **NITROFURANTOIN**: Potential exists for psyllium to bind and reduce absorption if given at the same time; if possible, separate doses by 3 hours or more

Doses
- **DOGS:**
  a) For a trial to treat chronic idiopathic large bowel diarrhea using *Metamucil*®: Median dose is 2 tablespoonsful (1.33 g/kg/day; range: 0.32–4.9 g/kg/day) per day added to a highly digestible diet such as Hill's *i/d*® (Leib 2004a), (Leib 2005)
  b) To increase fiber in dogs with chronic colitis: Add 1–2 tablespoonsful (15–30 mL) per 25 kg body weight to animal's regular diet. (Jergens 2007)
  c) 1 teaspoonful–2 tablespoonsful mixed with food every 12 hours (McConnell and Hughey 1987)
- **CATS:**
  a) For chronic constipation: 1–4 teaspoonsful per meal added to canned cat food. Be sure cat is properly hydrated. (Washabau 2001)
  b) For adjunctive treatment of feline megacolon: 1–4 teaspoonsful mixed with food PO q12–24h (Scherk 2003b)
- **HORSES:**
  a) For treatment of sand colic: 0.5 kg in 6–8 L (1 pound in 1.5–2 gallons) of water via stomach tube. Mix with water just before administration; simultaneously mixing water with psyllium as mixture is being pumped is ideal. May repeat as necessary as long as horse continues to pass feces and fluid does not accumulate in stomach. After initial treatment, may add up to 125 gm with each feeding; best if mixed with grain or sweet feed. Water must be available. (Calahan 1987)
  b) For sand impactions: 8 ounces in water via NG tube q24h. (Blikslager 2006a)

Monitoring
- Stool consistency, frequency

Client Information
- Contact veterinarian if patient begins vomiting
- Be sure animal has free access to water

Chemistry/Synonyms
Psyllium is obtained from the ripe seeds of varieties of Plantago species. The seed coating is high in content of hemicellulose mucilage that absorbs and swells in the presence of water.

Psyllium may also be known as *Metamucil*®; many other trade names are available.

Storage/Stability
Store psyllium products in tightly closed containers; protect from excess moisture or humidity.

Dosage Forms/Regulatory Status
VETERINARY-LABELED PRODUCTS:

Equine Enteric Colloid® (Techmix); *Equi-Phar*® *Sweet Psyllium* (Vedco); (not for horses intended for food); *Sandclear*® (Farnam), *Anipsyll*® *Powder* (AHC), *Purepsyll*® *Powder* (AHC), *Vita-Flex Sand Relief*® (Vita-lex), *Equa Aid Psyllium*® (Equi Aid); (OTC). Products may be available in 28 oz, 56 oz, 1 lb, 10 lb and 30 lb pails and are labeled for use in horses.

Vetasyl Fiber Tablets for Cats® 500 mg, & 1000 mg tablets in bottles of 60 or 180; (Virbac) (OTC); Labeled for use in cats. Also contains barley malt extract powder, acacia and thiamine.

HUMAN-LABELED PRODUCTS:

There are many human-approved products containing psyllium, most products contain approximately 3.4 grams of psyllium per rounded teaspoonful. Dosages of sugar-free products may be different from those containing sugar.

PYRANTEL PAMOATE

(pi-*ran*-tel) Strongid T®, Nemex®

ANTIPARASITIC

Prescriber Highlights
- **Pyrimidine anthelmintic used primarily for ascarids in a variety of species**
- **Contraindications: Severely debilitated animals**
- **Adverse Effects: Unlikely, emesis possible in small animals**

Uses/Indications
Pyrantel has been used for the removal of the following parasites in dogs: ascarids (*Toxocara canis, T. leonina*), hookworms (*Ancylostoma caninum, Uncinaria stenocephala*), and stomach worm (Physaloptera). Although not approved for use in cats, it is useful for similar parasites and is considered safe to use.

Pyrantel is indicated (labeled) for the removal of the following parasites in horses: *Strongylus vulgaris* and *equinus*, *Parasacaris equorum*, and *Probstymayria vivapara*. It has variable activity against *Oxyuris equi, S. edentatus*, and small strongyles. Pyrantel is active against ileocecal tapeworm (*A. perfoliata*) when used at twice the recommended dose, although resistance has been reported.

Although there are apparently no pyrantel products approved for use in cattle, sheep, or goats, the drug is effective (as the tartrate) for the removal of the following parasites: *Haemonchus* spp., *Ostertagia* spp., *Trichostrongylus* spp., *Nematodirus* spp., *Chabertia* spp., *Cooperia* spp. and *Oesophagostomum* spp.

Pyrantel tartrate is indicated (labeled) for the removal or prevention of the following parasites in swine: large roundworms (*Ascaris suum*) and *Oesophagostomum* spp. The drug has activity against the swine stomach worm (*Hyostrongylus rubidus*).

Although not approved, pyrantel has been used in pet birds and llamas. See the Dosage section for more information.

Pharmacology/Actions

Pyrantel acts as a depolarizing, neuromuscular-blocking agent in susceptible parasites, which paralyzes the organism. The drug possesses nicotine-like properties and acts similarly to acetylcholine. It also inhibits cholinesterase.

Pharmacokinetics

Pyrantel pamoate is poorly absorbed from the GI tract, thus allowing it to reach the lower GI in dogs, cats and equines. Pyrantel tartrate is absorbed more readily than the pamoate salt. Pigs and dogs absorb pyrantel tartrate more so than do ruminants, with peak plasma levels occurring 2–3 hours after administration. Peak plasma levels occur at highly variable times in ruminants.

Absorbed drug is rapidly metabolized and excreted into the urine and feces.

Contraindications/Precautions/Warnings

Use with caution in severely debilitated animals. The manufacturers usually recommend not administering the drug to severely debilitated animals.

Adverse Effects

When administered at recommended doses, adverse effects are unlikely. Emesis may possibly occur in small animals receiving pyrantel pamoate.

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.*) In a separate system evaluating the safety of drugs in canine and feline pregnancy (Papich 1989), this drug is categorized as class: ***A*** (*Probably safe. Although specific studies may not have proved he safety of all drugs in dogs and cats, there are no reports of adverse effects in laboratory animals or women.*)

Pyrantel is considered safe to use in nursing veterinary patients.

Overdosage/Acute Toxicity

Pyrantel has a moderate margin of safety. Dosages up to approximately 7 times recommended generally result in no toxic reactions. In horses, doses of 20X yielded no adverse effects. The LD_{50} in mice and rats for pyrantel tartrate is 170 mg/kg; >690 mg/kg for pyrantel pamoate in dogs.

Chronic dosing of pyrantel pamoate in dogs resulted in clinical signs when given at 50 mg/kg/day, but not at 20 mg/kg/day over 3 months. Clinical signs of toxicity that may be seen include increased respiratory rates, profuse sweating (in species with sweat glands), ataxia or other cholinergic effects.

Drug Interactions

- **DIETHYLCARBAMAZINE:** Increased risk for adverse effects
- **LEVAMISOLE:** Because of similar mechanisms of action (and toxicity), do not use concurrently with pyrantel
- **MORANTEL:** Because of similar mechanisms of action (and toxicity), do not use concurrently with pyrantel
- **ORGANOPHOSPHATES:** Increased risk for adverse effects
- **PIPERAZINE:** Pyrantel and piperazine have antagonistic mechanisms of action; do not use together

Doses

All doses are for pyrantel pamoate unless otherwise noted. **CAUTION:** Listed dosages are often not specified as to whether using the salt or base.

- **DOGS:**

  For susceptible parasites:

  a) For hookworms, or roundworms: 5 mg/kg PO after meals; repeat in 7–10 days (Willard 2003a)

  b) 15 mg/kg PO 30 minutes after a light meal. Re-treatment recommendations: For hooks: 2 weeks; every other week for 5–6 weeks (beginning at 1 week old) if bitch previously lost pups due to hookworm anemia. For Ascarids: Every other week for 3–4 treatments beginning at 2 weeks old if pups have heavy infestation; retreatment usually not necessary for mature animals. (Cornelius and Roberson 1986)

  c) Puppies: Can be treated as early as 2–3 weeks of age at 5–10 mg/kg PO; can be repeated every 2–3 weeks until at least 12 weeks of age. (Hoskins 2005d)

  d) For dogs weighing <5 lb: 10 mg/kg (as base) PO; for dogs weighing >5 lbs: 5 mg/kg (as base) PO. Treat puppies at 2, 3, 4, 6, 8, and 10 weeks of age. Treat lactating bitches 2–3 weeks after whelping. Do follow-up fecal 2–4 weeks after treating to determine need for retreatment. (Label directions; *Nemex® Tabs*—Pfizer)

  e) 20 mg/kg PO; be sure that liquid is well mixed before using; tablets may be broken for accurate dosing. Not approved for cats but very safe and effective. (Blagburn 2005b)

- **CATS:**

  For susceptible parasites:

  a) Ascarids, Hookworms, Physaloptera: 5 mg/kg, PO; repeat in 2 weeks (one time only for Physaloptera) (Dimski 1989)

  b) 10 mg/kg PO, repeat in 3 weeks (Kirk 1989)

  c) Kittens: Can be treated as early as 2–3 weeks of age at 5–10 mg/kg PO; can be repeated every 2–3 weeks until at least 12 weeks of age. (Hoskins 2005d)

- **RABBITS, RODENTS, SMALL MAMMALS:**

  a) Rabbits: 15–10 mg/kg PO, repeat in 2–3 weeks (Ivey and Morrisey 2000)

- **HORSES:**

  For susceptible parasites:

  a) 6.6 mg (as base)/kg PO; 13.2 mg (as base)/kg for cestodes (Robinson 1987), (Roberson 1988b)

  b) 19 mg/kg, PO (Brander, Pugh, and Bywater 1982)

  c) Pyrantel tartrate: 12.5 mg/kg, PO (Roberson 1988b)

- **SWINE:**

  For susceptible parasites:

  a) To remove *Ascaris suum* or *Oesophagostomum* spp.: Pyrantel tartrate: 22 mg/kg PO (or in feed at a rate of 800 g/ton) as a single treatment. For *Ascaris suum* only: in feed at a rate of 96 g/ton (2.6 mg/kg) for 3 days (Paul 1986) (Label instructions from several pyrantel tartrate premix products)

  b) Pyrantel tartrate: 22 mg/kg, PO; maximum of 2 grams per animal (Roberson 1988b)

  c) For ascarids and nodular worms in potbellied pigs: 6.6 mg/kg PO (Braun 1995)

- **CATTLE, SHEEP & GOATS:**

  For susceptible parasites:

  a) Pyrantel tartrate: 25 mg/kg, PO (Roberson 1988b)

■ **LLAMAS:**

For susceptible parasites:

a) 18 mg/kg, PO for one day (Cheney and Allen 1989), (Fowler 1989)

■ **BIRDS:**

For intestinal nematodes:

a) 4.5 mg/kg PO once. Repeat in 14 days. Suspension is nontoxic and palatable. (Clubb 1986)

b) For nematodes: 100 mg/kg, PO as a single dose in psittacines and passerines (Marshall 1993)

Client Information

■ Shake suspensions well before administering.

Chemistry/Synonyms

A pyrimidine-derivative anthelmintic, pyrantel pamoate occurs as yellow to tan solid and is practically insoluble in water and alcohol. Each gram of pyrantel pamoate is approximately equivalent to 347 mg (34.7%) of the base.

Pyrantel may also be known as: CP-10423-16, pyrantel embonate, pirantel pamoate, *Anthel®*, *Antiminth®*, *Ascarical®*, *Aut®*, *Bantel®*, *Cobantril®*, *Combantrin®*, *Combantrin®*, *Early Bird®*, *Helmex®*, *Helmintox®*, *Jaa Pyral®*, *Lombriareu®*, *Nemex®*, *Nemocid®*, *Pin-X®*, *Pirantrim®*, *Pyrantin®*, *Pyrantrin®*, *Pyrapam®*, *Reese's® Pinworm*, *Strongid®*, *Trilombrin®*, or *Vertel®*.

Storage/Stability/Compatibility

Pyrantel pamoate products should be stored in tight, light-resistant containers at room temperature (15–30°C) unless otherwise directed by the manufacturer.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS:

Note: Many products available; a partial listing of products follows:

Pyrantel Pamoate Tablets: 22.7 mg (of base), 113.5 mg (of base); (OTC). Approved for use in dogs. A commonly known product is *Nemex® Tabs* (Pfizer).

Pyrantel Pamoate Oral Suspension: 4.54 mg/mL (as base) (for dogs only); in 60 mL, 120 mL 280 mL and 473 mL bottles;) Many products are available; a commonly known trade name is *Nemex-2®* (Pfizer); (OTC)

Pyrantel Pamoate Oral Suspension: 50 mg/mL (of base); Many products are available; a commonly known trade name is *Strongid® T* (Pfizer); (OTC). Approved for use in horses not intended for food.

Pyrantel Pamoate Oral Paste: 43.9% w/w pyrantel base in 23.6 g (20 mL) paste (180 mg pyrantel base/mL); Several products are available; a commonly known trade name is *Strongid® Paste* (Pfizer); (OTC). Approved for use in horses not intended for food.

Pyrantel Tartrate 1.06% (4.8 g/lb) Top Dress: in 25 lb pails: *Strongid C®* (Pfizer); (OTC). Labeled for use in horses (not intended for food).

Combination Products:

Praziquantel 18.2 mg/pyrantel pamoate 72.6 mg (as base); *Drontal® Tablets* (Bayer); (OTC). Approved for use in cats and kittens that are 4 weeks of age or older and weigh 1.5 lb. or greater.

Praziquantel 30 mg/pyrantel pamoate 30 mg; & Praziquantel 114 mg/pyrantel pamoate 114 mg Chewable Tablets: *Virbantel Flavored Chewables®* (Virbac); (OTC). Approved for use in dogs.

Praziquantel/pyrantel pamoate plus febantel Tablets: Small, medium and large dog sizes. *Drontal® Plus Tablets* (Bayer); (Rx); Approved for dogs and puppies 3 weeks of age or older and weighing 2 lb. or greater.

Ivermectin/Pyrantel Oral Chewable Tablets: 68 mcg/57 mg, 136 mcg/114mg, 272 mcg/228 mg; *Heartgard® Plus Chewables* (Merial); *Tri-Heart® Plus Chewable Tablets* (Schering); (Rx). Approved for use in dogs.

HUMAN-LABELED PRODUCTS:

Pyrantel Pamoate Oral Suspension or Liquid: 50 mg/mL pyrantel (as pamoate) in 30 mL and 60 mL; *Antiminth®* (Pfizer Labs); *Reese's® Pinworm* (Reese); *Pin-X®* (Effcon); (OTC)

Pyrantel Soft-gel Capsules: 180 mg (equivalent to 62.5 mg pyrantel base); *Pin-Rid®* (Apothecary); *Reese's® Pinworm* (Reese); (OTC)

PYRIDOSTIGMINE BROMIDE

(peer-i-oh-*stig*-meen) Mestinon®

ANTICHOLINESTERASE AGENT

Prescriber Highlights

- **Anticholinesterase used for treatment of myasthenia gravis**
- **Contraindications: hypersensitivity to this class of compounds or bromides, patients with mechanical or physical obstructions of the urinary or GI tract**
- **Caution: bronchospastic disease, epilepsy, hyperthyroidism, bradycardia or other arrhythmias, vagotonia, or GI ulcer diseases**
- **Adverse Effects: Usually dose related cholinergic effects GI (nausea, vomiting, diarrhea), salivation, sweating, respiratory (increased bronchial secretions, bronchospasm, pulmonary edema, respiratory paralysis), ophthalmic (miosis, blurred vision, lacrimation), cardiovascular (bradycardia or tachycardia, cardiospasm, hypotension, cardiac arrest), muscle cramps, & weakness**

Uses/Indications

Pyridostigmine is used in the treatment of myasthenia gravis (MG) in dogs (and rarely in cats). It is considered to be much more effective in acquired MG, than in congenital MG.

Pharmacology/Actions

Pyridostigmine inhibits the hydrolysis of acetylcholine by directly competing with acetylcholine for attachment to acetylcholinesterase. Because the pyridostigmine-acetylcholinesterase complex is hydrolyzed at a much slower rate than the acetylcholine-acetylcholinesterase complex, acetylcholine tends to accumulate at cholinergic synapses with resultant cholinergic activity.

At usual doses, pyridostigmine does not cross into the CNS (quaternary ammonium structure), but overdoses can cause CNS effects.

Pharmacokinetics

Pyridostigmine is only marginally absorbed from the GI tract and absorption may be more erratic with the sustained-release tablets than the regular tablets. The onset of action after oral dosing is generally within one hour.