Chemistry/Synonyms

The esterified compounds, testosterone cypionate, enanthate, and propionate are available commercially as injectable products. Testosterone cypionate occurs as an odorless to having a faint odor, creamy white or white, crystalline powder. It is insoluble in water, soluble in vegetable oils, and freely soluble in alcohol. Testosterone cypionate has a melting range of 98°–104°C. It may also be known as testosterone cyclopentylpropionate.

Testosterone enanthate occurs as an odorless to having a faint odor, creamy white or white, crystalline powder. It is soluble in vegetable oils, insoluble in water and melts between 34–39°C.

Testosterone propionate occurs as odorless, creamy white to white, crystals or crystalline powder. It is insoluble in water, freely soluble in alcohol and soluble in vegetable oils. Testosterone propionate melts between 118–123°C.

Testosterone Cypionate may also be known as: testosterone cyclopentylpropionate, testosterone cypionate, *Deposteron®, Depotrone®, Depo-Testosterone®, Duratest®, Scheinpharm Testone-Cyp®, T-Cypionate®, Testex®, Testiormina®, Testred®, Virilon®,* or *depAndro®*.

Testosterone Propionate may also be known as: NSC-9166, testosteroni propionas, *Malogen in Oil®, Sostenon®, Sustanon®, Testanon 25®, Testex®, Testoviron®, Testoviron Depot®, Testovis®, Tesurene®,* or *Virormone®*.

Storage/Stability/Compatibility

The commercially available injectable preparations of testosterone cypionate, enanthate and propionate should be stored at room temperature; avoid freezing or exposing to temperatures greater than 40°C. If exposed to low temperature a precipitate may form, but should redissolve with shaking and rewarming. If a wet needle or syringe is used to draw up the parenteral solutions, cloudy solutions may result, but will not affect the drug's potency.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS:

No known testosterone products (with the exception of combinations with estradiol as growth promotant implants) approved for use in veterinary species were located. Testosterone propionate (200 mg) is available in combination with estradiol benzoate (20 mg) as a growth promotant. Trade names include *Component E-H®* (VetLife); (OTC) and *Synovex-H®* (Fort Dodge); (OTC). For use in heifers weighing 400 or more pounds.

Testosterone propionate (200 mg) with estradiol benzoate (28 mg); *Synovex-Plus®* (Fort Dodge); (OTC); for steers.

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

HUMAN-LABELED PRODUCTS:

Testosterone Cypionate (in oil) Injection: 100 mg/mL, and 200 mg/mL in 1 mL and 10 mL vials; *Depo-Testosterone®* (Pharmacia); generic (Watson); (Rx, C-III)

Testosterone Enanthate (in oil) Injection: 200 mg/mL in 5 mL multidose vials and 1 mL syringes; *Delatestyl®* (Savient); (Rx, C-III)

Testosterone Propionate Injection (in oil): 100 mg/mL in 10 mL vials; available generically; (Rx, C-III)

Testosterone Pellets: 75 mg (0.2 mg stearic acid, 2 mg polyvinylpyrrolidone) in 1 pellet/vials; *Testopel®* (Bartor Pharmacal); (Rx, C-III)

Testosterone Transdermal System: Release Rates: 5 and 2.5 mg/24 hour, total testosterone contents: 24.3 mg and 12.2 mg (respectively): *Androderm®* (Watson Pharma); (Rx, C-III)

Testosterone Gel: 1% testosterone in 2.5 g or 5 g packets of gel to deliver 25 mg or 50 mg testosterone and metered-dose pumps to deliver 75 g or 60 metered 1.25 g doses; *AndroGel® 1%* (Unimed Pharm.); *Testim®* (Auxilium Pharm); (Rx, C-III)

Testosterone, Buccal System: 30 mg testosterone in blister packs; *Striant®* (Columbia); (Rx, C-III)

TETRACYCLINE HCL

(tet-ra-sye-kleen) Aquadrops®, Panmycin®

TETRACYCLINE ANTIBIOTIC

Prescriber Highlights

- **Prototype tetracycline antibiotic; many bacteria are now resistant, but still may be very useful to treat mycoplasma, rickettsia, spirochetes, & Chlamydia**
- **Dosing frequency may be an issue for small animals**
- **Contraindications: Hypersensitivity**
- **Extreme Caution: Pregnancy**
- **Caution: Liver or renal insufficiency**
- **Adverse Effects: GI distress, staining of developing teeth & bones, superinfections, photosensitivity; long-term use may cause uroliths. CATS: Do not tolerate very well. HORSES: If stressed may break with diarrheas (oral use). RUMINANTS: High oral doses can cause ruminal microflora depression & ruminoreticular stasis; rapid IV of undiluted propylene glycol-based products can cause intravascular hemolysis & cardiodepressant effects; *IM*: local reactions, yellow staining & necrosis may be seen at the injection site**

Uses/Indications

While tetracycline still is used as an antimicrobial, most small animal clinicians prefer doxycycline and large animal clinicians prefer oxytetracycline when a tetracycline is indicated to treat susceptible infections. The most common use of tetracycline HCl today is in combination with niacinamide for the treatment of certain immune-mediated skin conditions in dogs, such as pemphigus.

Pharmacology/Actions

Tetracyclines generally act as bacteriostatic antibiotics and inhibit protein synthesis by reversibly binding to 30S ribosomal subunits of susceptible organisms, thereby preventing binding to those ribosomes of aminoacyl transfer-RNA. Tetracyclines are believed to reversibly bind to 50S ribosomes and additionally alter cytoplasmic membrane permeability in susceptible organisms. In high concentrations, tetracyclines can inhibit protein synthesis by mammalian cells.

As a class, the tetracyclines have activity against most mycoplasma, spirochetes (including the Lyme disease organism), Chlamydia, and Rickettsia. Against gram-positive bacteria, the tetracyclines have activity against some strains of staphylococcus and streptococci, but resistance of these organisms is increasing. Gram-positive bacteria that are usually covered by tetracyclines include *Actinomyces* spp., *Bacillus anthracis*, *Clostridium perfringens* and tetani, *Listeria monocytogenes*, and Nocardia. Among gram-negative bacteria that tetracyclines usually have *in vitro* and *in vivo* activity include

Bordetella spp., Brucella, Bartonella, *Haemophilus* spp., *Pasturella multocida*, Shigella, and Yersinia pestis. Many or most strains of *E. coli*, Klebsiella, Bacteroides, Enterobacter, Proteus and *Pseudomonas aeruginosa* are resistant to the tetracyclines. While most strains of Pseudomonas aeruginosa show *in vitro* resistance to tetracyclines, those compounds attaining high urine levels (*e.g.*, tetracycline, oxytetracycline) have been associated with clinical cures in dogs with UTI secondary to this organism.

Oxytetracycline and tetracycline share nearly identical spectrums of activity and patterns of cross-resistance and a tetracycline susceptibility disk is usually used for *in vitro* testing for oxytetracycline susceptibility.

Tetracyclines have antiinflammatory and immunomodulating effects. They can suppress antibody production and chemotaxis of neutrophils; inhibit lipases, collagenases, prostaglandin synthesis, and activation of complement component 3.

Pharmacokinetics

Both oxytetracycline and tetracycline are readily absorbed after oral administration to fasting animals. Bioavailabilities are approximately 60–80%. The presence of food or dairy products can significantly reduce the amount of tetracycline absorbed, with reductions of 50% or more possible. After IM administration, tetracycline is erratically and poorly absorbed with serum levels usually lower than those attainable with oral therapy.

Tetracyclines as a class, are widely distributed to heart, kidney, lungs, muscle, pleural fluid, bronchial secretions, sputum, bile, saliva, urine, synovial fluid, ascitic fluid, and aqueous and vitreous humor. Only small quantities of tetracycline and oxytetracycline are distributed to the CSF, and therapeutic levels may not be achievable. While all tetracyclines distribute to the prostate and eye, doxycycline or minocycline penetrate better into these and most other tissues. Tetracyclines cross the placenta, enter fetal circulation and are distributed into milk. The volume of distribution of tetracycline is approximately 1.2–1.3 L/kg in small animals. The amount of plasma protein binding is about 20–67% for tetracycline. In cattle, the volume of distribution for oxytetracycline is between 1 and 2.5 L/kg. Milk to plasma ratios for oxytetracycline and tetracycline are 0.75 and 1.2–1.9, respectively.

Both oxytetracycline and tetracycline are eliminated unchanged primarily via glomerular filtration. Patients with impaired renal function can have prolonged elimination half-lives and accumulate the drug with repeated dosing. These drugs apparently are not metabolized, but are excreted into the GI tract via both biliary and nonbiliary routes and may become inactive after chelation with fecal materials. The elimination half-life of tetracycline is approximately 5–6 hours in dogs and cats.

Contraindications/Precautions/Warnings

Tetracycline is contraindicated in patients hypersensitive to it or other tetracyclines. Because tetracyclines can retard fetal skeletal development and discolor deciduous teeth, they should only be used in the last half of pregnancy when the benefits outweigh the fetal risks. Oxytetracycline and tetracycline are considered more likely to cause these abnormalities than either doxycycline or minocycline.

In patients with renal insufficiency or hepatic impairment, tetracycline must be used cautiously; lower than normal dosages are recommended with enhanced monitoring of renal and hepatic function. Avoid concurrent administration of other nephrotoxic or hepatotoxic drugs if tetracyclines are administered to these patients. Monitoring of serum levels should be considered if long-term therapy is required.

Adverse Effects

Oxytetracycline and tetracycline given to young animals can cause discoloration of bones and teeth to a yellow, brown, or gray color. High dosages or chronic administration may delay bone growth and healing.

Tetracyclines in high levels can exert an antianabolic effect that can cause an increase in BUN and/or hepatotoxicity, particularly in patients with preexisting renal dysfunction. As renal function deteriorates secondary to drug accumulation, this effect may be exacerbated.

In ruminants, high oral doses can cause ruminal microflora depression and ruminoreticular stasis. Rapid intravenous injection of undiluted propylene glycol-based products can cause intravascular hemolysis with resultant hemoglobinuria. Propylene glycol based products have also caused cardiodepressant effects when administered to calves. When administered IM, local reactions, yellow staining, and necrosis may be seen at the injection site.

In small animals, tetracyclines can cause nausea, vomiting, anorexia, and diarrhea. Cats do not tolerate oral tetracycline or oxytetracycline very well, and may present with clinical signs of colic, fever, hair loss, and depression. There are reports that long-term tetracycline use may cause urolith formation in dogs.

Horses that are stressed by surgery, anesthesia, trauma, etc., may break with severe diarrheas after receiving tetracyclines (especially with oral administration).

Tetracycline therapy (especially long-term) may result in overgrowth of non-susceptible bacteria or fungi (superinfections).

Tetracyclines have also been associated with photosensitivity reactions and, rarely, hepatotoxicity or blood dyscrasias.

Reproductive/Nursing Safety

In humans, the FDA categorizes this drug as category ***D*** for use during pregnancy (*There is evidence of human fetal risk, but the potential benefits from the use of the drug in pregnant women may be acceptable despite its potential risks.*) In a separate system evaluating the safety of drugs in canine and feline pregnancy (Papich 1989), this drug is categorized as in class: ***D*** (*Contraindicated. These drugs have been shown to cause congenital malformations or embryotoxicity.*)

Tetracyclines are excreted in milk, but because much of the drug will be bound to calcium in milk, it is unlikely to be of significant risk to nursing animals.

Overdosage/Acute Toxicity

Tetracyclines are generally well tolerated after acute overdoses. Dogs given more than 400 mg/kg/day orally or 100 mg/kg/day IM of oxytetracycline did not demonstrate any toxicity. Oral overdoses would most likely be associated with GI disturbances (vomiting, anorexia, and/or diarrhea). Should the patient develop severe emesis or diarrhea, fluids and electrolytes should be monitored and replaced if necessary. Chronic overdoses may lead to drug accumulation and nephrotoxicity.

High oral doses given to ruminants, can cause ruminal microflora depression and ruminoreticular stasis. Rapid intravenous injection of undiluted propylene glycol-based products can cause intravascular hemolysis with resultant hemoglobinuria.

Rapid intravenous injection of tetracyclines has induced transient collapse and cardiac arrhythmias in several species, presumably due to chelation with intravascular calcium ions. Overdose quantities of drug could exacerbate this effect if given too rapidly IV. If the drug must be given rapidly IV (less than 5 minutes), some clinicians recommend pre-treating the animal with intravenous calcium gluconate.

Drug Interactions

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

- **ATOVAQUONE:** Tetracyclines have caused decreased atovaquone levels
- **BETA-LACTAM OR AMINOGLYCOSIDE ANTIBIOTICS:** Bacteriostatic drugs, like the tetracyclines, may interfere with bactericidal activity of the penicillins, cephalosporins, and aminoglycosides; there is some controversy regarding the actual clinical significance of this interaction, however.
- **DIGOXIN:** Tetracyclines have increased the bioavailability of digoxin in a small percentage of human patients and caused digoxin toxicity. These effects may persist for months after discontinuation of the tetracycline.
- **DIVALENT OR TRIVALENT CATIONS (oral antacids, saline cathartics or other GI products containing aluminum, calcium, iron, magnesium, zinc, or bismuth cations):** When orally administered, tetracyclines can chelate divalent or trivalent cations that can decrease the absorption of the tetracycline or the other drug if it contains these cations; it is recommended that all oral tetracyclines be given at least 1–2 hours before or after the cation-containing products.
- **METHOXYFLURANE:** Fatal nephrotoxicity has occurred in humans when used with tetracycline; concomitant use with oxytetracycline not recommended
- **WARFARIN:** Tetracyclines may depress plasma prothrombin activity and patients on anticoagulant therapy may need dosage adjustment

Laboratory Considerations

- Tetracyclines (not minocycline) may cause falsely elevated values of **urine catecholamines** when using fluorometric methods of determination.
- Tetracyclines reportedly can cause false-positive **urine glucose results** if using the cupric sulfate method of determination (Benedict's reagent, *Clinitest®*), but this may be the result of ascorbic acid that is found in some parenteral formulations of tetracyclines. Tetracyclines have also reportedly caused false-negative results in determining urine glucose when using the glucose oxidase method (*Clinistix®*, *Tes-Tape®*).

Doses

- **DOGS:**

  For discoid lupus erythematosus:

  a) For dogs weighing 10 kg or more: 500 mg of niacinamide and 500 mg of tetracycline PO q8h. For dogs weighing from 5–10 kg: 250 mg of each PO q8h. For dogs weighing <5 kg: 100 mg of each PO q8h. Improvement is usually noted within 6 weeks. (White 2000)

  b) Dogs weighing more than 10 kg: 500 mg of niacinamide and 500 mg of tetracycline PO q8h. For dogs weighing less than 10 kg: 250 mg of each PO q8h. May use in combination with corticosteroids and Vitamin E. If adverse effects become a problem, reduce dose of niacinamide first. May also try this regimen for pemphigus foliaceous or pemphigus erythematous. (Campbell 1999)

  c) For various immune-mediated diseases (discoid lupus erythematosus, pemphigus erythematosus, pemphigus foliaceous, vasculitis, sterile pyelogranuloma, dermatomyositis and lupoid onychodystrophy: For dogs less than 10 kg: 250 mg each of niacinamide and tetracycline PO three times daily. For dogs larger than 10 kg: 500 mg each of niacinamide and tetracycline PO three times daily. May substitute doxycycline for tetracycline at 5 mg/kg PO once a day. (Tapp 2002)

  For susceptible infections:

  a) For UTI: 16 mg/kg PO q8h for 7–14 days;
  For Rickettsiosis, Borreliosis: 22 mg/kg PO q8h for 14 days;
  For systemic bacteremia, brucellosis: 22–50 mg/kg PO q8h for 28 days. (Greene, Hartmannn et al. 2006)

  b) For Rocky Mountain Spotted Fever: 22 mg/kg q8h for 14–21 days (Sellon and Breitschwerdt 1995)

  c) 20 mg/kg PO q8–12h; (may give with food if GI upset occurs; avoid or reduce dose in animals with renal or severe liver failure; avoid in young, pregnant or breeding animals) (Vaden and Papich 1995)

  d) 22–33 mg/kg PO q8h (Aronson and Aucoin 1989)

  e) For Lyme disease: 22 mg/kg PO q8h for 14 days (Breitschwerdt 2000)

  f) For small intestinal bacterial overgrowth: 5–10 mg/kg PO q8h for 28 days; has been effective for uncomplicated cases (Ludlow and Davenport 2000)

  g) For rickettsial diseases:
  Ehrlichiosis: 22 mg/kg, PO three times daily for at least 14 days
  Salmon poisoning: 22 mg/kg, PO three times daily for 10–14 days or 7 mg/kg IV three times daily
  Rocky Mountain Spotted Fever: 22 mg/kg, PO three times daily for 10–14 days (Lissman 1988)

  For facial tear staining:

  a) 5–10 mg/kg/day or 50 mg per dog per day. Results are variable. (Kern 1986)

  For pleurodesis:

  a) Using capsules or aqueous solution; mix 20 mg/kg in 4 mL per kg of saline and infuse into pleural space (Morgan 1988)

- **CATS:**

  For susceptible infections:

  a) For soft tissue infections: 20 mg/kg PO q8h for 21 days;
  For Hemotropic mycoplasmosis: 10–25 mg/kg PO q8–12h for 21 days;
  For bacteremia, systemic infections: 7 mg/kg IV, IM q12h as long as necessary. (Greene, Hartmannn et al. 2006)

  b) For rickettsial diseases: 16 mg/kg, PO three times daily for 21 days (Morgan 1988)

  c) 20 mg/kg PO q8–12h; (may give with food if GI upset occurs; avoid or reduce dose in animals with renal or severe liver failure; avoid in young, pregnant or breeding animals) (Vaden and Papich 1995)

  d) 22–33 mg/kg PO q8h (Aronson and Aucoin 1989)

- **FERRETS:**

  For susceptible infections:

  a) 25 mg/kg PO 2–3 times daily (Williams 2000)

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

  a) Rabbits: 50–100 mg/kg PO q8–12h (Ivey and Morrisey 2000)

  b) Chinchillas: 50 mg/kg PO q8–12h (Hayes 2000)

  c) Chinchillas, Guinea Pigs, Rats: 20 mg/kg, PO q12h. Mice: 20 mg/kg, PO q12h or 50–60 mg/liter of drinking water Hamsters: 30 mg/kg, PO q6h or 400 mg/liter, drinking water. Gerbils: 20 mg/kg, PO or IM q24h (Adamcak and Otten 2000)

■ **CATTLE:**

For susceptible infections in calves:

a) 11 mg/kg orally (Howard 1986)

b) 11 mg/kg, PO twice daily for up to 5 days (Label directions; *Polyotic*®—American Cyanamid)

■ **SHEEP:**

For susceptible infections:

a) 11 mg/kg, PO twice daily for up to 5 days (Label directions; *Polyotic*®—American Cyanamid)

■ **HORSES:**

For susceptible infections:

a) 5–7.5 mg/kg IV q12h (Brumbaugh 1987)

■ **SWINE:**

For susceptible infections:

a) 22 mg/kg, PO for 3 to 5 days in drinking water (Label directions; *Polyotic*®—American Cyanamid)

■ **BIRDS:**

For susceptible infections:

a) For treatment of psittacosis in conjunction with *LA-200*® (see oxytetracycline doses) and/or medicated pellets and/or *Keet Life*: Using 25 mg/mL oral suspension, mix 2 teaspoonsful to 1 cup of soft food.

For mild respiratory disease (especially flock treatment): Mix 1 teaspoonful of 10 g/6.4 oz. soluble powder per gallon of drinking water. Used as an adjunct for psittacosis with other tetracycline forms. Will not reach therapeutic levels by itself. Prepare fresh solution twice daily, as potency is rapidly lost. (McDonald 1989)

b) Mix 1 teaspoonful of 10 g/6.4 oz. soluble powder per gallon of drinking water and administer for 5–10 days. Prepare fresh solution 2–3 times daily, as potency is rapidly lost.

For converting regimen to pelleted feeds administer oral suspension by gavage at 200–250 mg/kg once or twice daily until feeds are accepted. Is not an adequate therapy for long-term treatment of chlamydiosis (psittacosis) (Clubb 1986)

Monitoring

■ Adverse effects

■ Clinical efficacy

■ Long-term use or in susceptible patients: periodic renal, hepatic, hematologic evaluations

Client Information

■ Avoid giving this drug orally within 1–2 hours of feeding, giving milk or other dairy products

■ If gastrointestinal upset occurs, giving with a small amount of food may help, but this may also reduce the amount of drug absorbed

Chemistry/Synonyms

An antibiotic obtained from *Streptomyces aureofaciens* or derived semisynthetically from oxytetracycline, tetracycline HCl occurs as a moderately hygroscopic, yellow, crystalline powder. About 100 mg/mL is soluble in water and 10 mg/mL soluble in alcohol. Tetracycline base has a solubility of about 0.4 mg per mL of water and 20 mg per mL of alcohol. Commercially available tetracycline HCl for IM injection also contains magnesium chloride, procaine HCl and ascorbic acid.

Tetracycline may also be known as: tetracyclini hydrochloridum; many trade names are available.

Storage/Stability/Compatibility

Unless otherwise instructed by the manufacturer, tetracycline oral tablets and capsules should be stored in tight, light resistant containers at room temperature (15–30°C). The oral suspension and powder for injection should be stored at room temperature; avoid freezing the oral suspension.

After reconstituting the IM product, it may be stored at room temperature but should be used within 24 hours. After reconstituting the intravenous product with sterile water to a concentration of 50 mg/mL, the preparation is stable for 12 hours at room temperature. If further diluted in an appropriate IV fluid, use immediately.

Tetracycline HCl for intravenous injection is reportedly physically **compatible** with the following IV fluids and drugs: 0.9% sodium chloride, D5W, D5W in normal saline, Ringer's injection, lactated Ringer's injection, 10% invert sugar, dextrose-Ringer's and lactated Ringer's combinations, ascorbic acid, cimetidine HCl, colistimethate sodium, corticotropin, ephedrine sulfate, isoproterenol HCl, kanamycin sulfate, lidocaine HCl, metaraminol bitartrate, norepinephrine bitartrate, oxytetracycline HCl, oxytocin, potassium chloride, prednisolone sodium phosphate, procaine HCl, promazine HCl, and vitamin B complex with C.

Drugs that are reportedly physically **incompatible** with tetracycline, data conflicts, or compatibility is concentration/time dependent, include: amikacin sulfate, aminophylline, ampicillin sodium, amobarbital sodium, amphotericin B, calcium chloride/gluconate, carbenicillin disodium, cephalothin sodium, cephapirin sodium, chloramphenicol sodium succinate, dimenhydrinate, erythromycin gluceptate/lactobionate, heparin sodium, hydrocortisone sodium succinate, meperidine HCl, morphine sulfate, methicillin sodium, methohexital sodium, methyldopate HCl, oxacillin sodium, penicillin G potassium/sodium, phenobarbital sodium, sodium bicarbonate, thiopental sodium, and warfarin sodium. Compatibility is dependent upon factors such as pH, concentration, temperature, and diluent used; consult specialized references or a hospital pharmacist for more specific information.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS:

There are a variety of Tetracycline HCl Soluble Powder (as a water additive) products that are available in various concentrations and sizes. Usual concentrations are either 25 grams/lb or 324 grams/lb and these products may be available in several sizes; may be approved for use in swine, cattle, or poultry. Withdrawal time may vary depending on age of animal and product.

An oral combination product containing tetracycline, novobiocin and prednisone (*Delta Albaplex*®) is also available; see the novobiocin monograph for more information.

HUMAN-LABELED PRODUCTS:

Tetracycline HCl Capsules: 250 mg, and 500 mg; *Sumycin*® *-250* & *-500* (Par); generic; (Rx)

Tetracycline HCl Oral Suspension: 25 mg/mL in 473 mL; *Sumycin*® *Syrup* (Par); (Rx)

Theophylline—see Aminophylline

THIABENDAZOLE

(thye-a-***ben***-da-zole)

ANTHELMINTIC; ANTIFUNGAL

Prescriber Highlights

- Benzimidazole anthelmintic; has antifungal (dermatophytes) activity
- Contraindications: None noted
- Adverse Effects: DOGS: Vomiting, diarrhea, hair loss, & lethargy. Dachshunds may be particularly sensitive to thiabendazole. Toxic epidermal necrolysis (TEN) is rarely seen.
- Parasitic-resistance is an issue
- Many veterinary products no longer available

Uses/Indications

Thiabendazole has been used for the removal of the following parasites in dogs: ascarids (*Toxocara canis, T. leonina*), *Strongyloides stercoralis*, and Filaroides. It has been used systemically as an anti-fungal agent in the treatment of nasal aspergillosis and penicillinosis. Topical and otic use of thiabendazole for the treatment of various fungi is also commonly employed.

Thiabendazole is indicated (labeled) for the removal of the following parasites in cattle: *Haemonchus* spp., *Ostertagia* spp., *Trichostrongylus* spp., *Nematodirus* spp., *Cooperia* spp. and *Oesophagostomum radiatum*.

Thiabendazole is indicated (labeled) for the removal of the following parasites in sheep and goats: Haemonchus spp., *Ostertagia* spp., *Trichostrongylus* spp., *Nematodirus* spp., *Cooperia* spp., *Chabertia* spp., *Bunostomum* spp. and *Oesophagostomum* spp.

Thiabendazole is indicated (labeled) for the removal of the following parasites in horses: *Strongylus* spp., *craterstomum* spp., *Oesphagodontus* spp., *Posteriostomum* spp., *Cyathostomum* spp., *Cylicocylus* spp., *Cylicostephanus* spp., *Oxyuris* spp., and *Parasacaris* spp.

Thiabendazole is indicated (labeled) for the removal or prevention of the following parasites in swine: large roundworms (*Ascaris suum*) (prevention), and in baby pigs infested with *Strongyloides ransomi*.

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

In many geographic areas, significant thiabendazole resistance problems have developed and, for many parasites, other anthelmintics would be a better choice for treatment.

When used topically, thiabendazole has antidermatophytic properties.

Pharmacokinetics

Thiabendazole is relatively well absorbed (for a benzimidazole) and is distributed throughout body tissues. Peak levels occur in approximately 2–7 hours after dosing. Absorbed drug is rapidly metabolized in the liver by hydroxylation, glucuronidation and sulfate formation. Within 48 hours of dosing, 90% of the drug is excreted in the urine (as metabolites) and 5% in the feces. Less than 1% of the drug is excreted in the urine unchanged. Five days after a dose, the drug is virtually eliminated from the body.

Adverse Effects

At recommended doses, thiabendazole is usually well tolerated in approved species. In dogs, vomiting, diarrhea, hair loss, and lethargy are possible side effects, notably with high dose or long-term therapy. Dachshunds have been reported to be particularly sensitive to thiabendazole. Toxic epidermal necrolysis (TEN) has been reported in dogs receiving thiabendazole, but the incidence appears to be very rare.

Reproductive/Nursing Safety

Thiabendazole has not been demonstrated to be a teratogen and is considered generally safe to use during pregnancy. However, in high doses it has been implicated in causing toxemia in ewes. 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 in class: ***B*** (*Safe for use if used cautiously. Studies in laboratory animals may have uncovered some risk, but these drugs appear to be safe in dogs and cats or these drugs are safe if they are not administered when the animal is near term.*)

It is not known whether this drug is excreted in milk, but it is unlikely to be of clinical concern in nursing patients.

Overdosage/Toxicity

Thiabendazole has a safety margin of at least 20 times the recommended dose in horses. Doses of 800–1000 mg/kg are necessary to cause anorexia and depression in sheep. The minimum lethal dose is 700 mg/kg in cattle and 1200 mg/kg in sheep.

It is unlikely that a modest overdose would cause significant problems. If a massive overdose occurs, treat supportively and symptomatically. See the Adverse effects section for more information.

Drug Interactions

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

- **THEOPHYLLINE:** Thiabendazole may compete with xanthines for metabolizing sites in the liver, thereby increasing xanthine blood levels

Doses

Note: There are no veterinary commercial products for systemic use currently being marketed in the USA.

- **DOGS:**

As an antiparasitic agent:

a) For treatment of *Strongyloides stercoralis*: 50–60 mg/kg PO (Todd, Paul, and DiPietro 1985)

b) For treatment of Filaroides (now called Oslerus) infections: 35 mg/kg PO twice daily for 5 days, then 70 mg/kg PO twice daily for 21 days. Prednisone can also be given at 0.55 mg/kg, PO twice daily every other day (Ettinger, Kantrowitz et al. 2000)

As an antifungal agent:

a) For treatment of nasal aspergillosis/penicillinosis infections: 30–70 mg/kg divided q12h PO in food for 20–45 days (Roudebush 1985)

b) For the treatment of aspergillosis: 20 mg/kg PO, once a day or divided twice daily; (with or without ketoconazole: 20 mg/kg PO, once a day or divided twice daily). Maintenance therapy: 10–20 mg/kg PO once a day (Greene, O'Neal, and Barsanti 1984)