Cefoxitin may also be known as: MK-306, L-620-388, cefoxitinum, cefoxitina, cefoxitine, *Mefoxin®*, *Mefoxitin®*, *Cefociclin®*, or *Cefoxin®*.

Storage/Stability/Compatibility

Cefoxitin sodium powder for injection should be stored at temperatures less than 30°C and should not be exposed to temperatures greater than 50°C. The frozen solution for injection should be stored at temperatures no higher than -20°C.

After reconstitution, the solution is stable for 24 hours when kept at room temperature and from 48 hours to 1 week if refrigerated. If after reconstitution the solution is immediately frozen in the original container, the preparation is stable up to 30 weeks when stored at -20°C. Stability is dependent on the diluent used and the reader should refer to the package insert or other specialized references for more information. The powder or reconstituted solution may darken but this apparently does not affect the potency of the product.

All commonly used IV fluids and the following drugs are reportedly **compatible** with cefoxitin: amikacin sulfate, cimetidine HCl, gentamicin sulfate, kanamycin sulfate, mannitol, metronidazole, multivitamin infusion concentrate, sodium bicarbonate, tobramycin sulfate and vitamin B-complex with C. 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: None

HUMAN-LABELED PRODUCTS:

Cefoxitin Sodium Powder for Injection: 1 g (of cefoxitin), 2 g, & 10 g in vials, infusion bottles, bulk bottles, or duplex bags; *Mefoxin®* (Merck); generic; (Rx)

Cefoxitin Sodium Injection: 1 g & 2 g premixed, frozen in 50 mL; *Mefoxin®* (Merck); (Rx)

CEFPODOXIME PROXETIL

(sef-poe-***docks***-eem) Simplicef®, Vantin®

3rd GENERATION CEPHALOSPORIN

Prescriber Highlights

- Oral 3rd generation cephalosporin that may be useful in dogs or cats
- Contraindications: Hypersensitivity to it or other cephalosporins
- May need to adjust dose if patient has renal disease
- Adverse Effects: Primarily GI, but hypersensitivity possible

Uses/Indications

In dogs, cefpodoxime is indicated for the treatment of skin infections caused by *Staphylococcus intermedius, Staphylococcus aureus, Streptococcus canis, E. coli, Proteus mirabilis,* and *Pasteurella multocida*. Although not currently approved for cats, it may also be useful as well.

Pharmacology/Actions

Like other cephalosporins, cefpodoxime inhibits bacterial cell wall synthesis. It is considered bactericidal and relatively resistant to bacterial beta-lactamases.

Cefpodoxime's main spectrum of activity is against gram-negative bacteria in the family *Enterobacteriaceae* (excluding Pseudomonas) including Escherichia, Proteus, and Klebsiella, and gram-positive streptococci (not enterococcus) and Staphylococci.

Cefpodoxime is not efficacious against *Pseudomonas aeruginosa,* Enterococcus, anaerobes, and methicillin-resistant Staphylococcus strains.

Because sensitivity of various bacteria to the 3rd generation cephalosporin antibiotics is unique to a given agent, cefpodoxime specific disks or dilutions must be used to determine susceptibility.

Pharmacokinetics

Cefpodoxime proxetil is not active as an antibiotic. Cefpodoxime is active after the proxetil ester is cleaved *in vivo*. After single oral doses (10 mg/kg) to fasted dogs, bioavailability is approximately 63%; volume of distribution 150 mL/kg; peak concentrations about 16 mg/mL; time to peak was 2.2 hours; and terminal elimination half-life of approximately 5–6 hours.

In humans, cefpodoxime proxetil is about 40–50% absorbed from the GI tract. Food can alter the rate, but not the extent, of absorption. Cefpodoxime penetrates most tissues well; it is unknown if it penetrates into the CSF. The drug is eliminated in both the urine and feces. Serum half-life may be prolonged in patients with impaired renal function.

In foals after an oral dose (suspension) of 10 mg/kg, peak levels occur in about 100 minutes and peak at about 0.8 mcg/mL. Elimination half-life is about 7 hours in foals. Levels in synovial and peritoneal fluids were similar to those found in the serum, but no drug was detected in the CSF.

Contraindications/Precautions/Warnings

Cefpodoxime is contraindicated in patients hypersensitive to it or other cephalosporins. Because cefpodoxime is excreted by the kidneys, dosages and/or dosage frequency may need to be adjusted in patients with significantly diminished renal function. Use with caution in patients with seizure disorders.

Adverse Effects

Although usage of this drug in veterinary patients remains limited to date, it appears to be tolerated very well. The most likely adverse effects seen with this medication have been inappetence, diarrhea, and vomiting. Hypersensitivity reactions are a possibility.

Cefpodoxime may occasionally induce a positive direct Coombs' test. Rarely, blood dyscrasias may be seen following high doses of cephalosporins.

Reproductive/Nursing Safety

Cefpodoxime has not shown to be teratogenic but should only be used during pregnancy when clearly indicated. The veterinary product is labeled: "The safety of cefpodoxime proxetil in dogs used for breeding, pregnant dogs, or lactating bitches has not been demonstrated." In humans, the FDA categorizes this drug as category ***B*** for use during pregnancy (*Animal studies have not yet demonstrated risk to the fetus, but there are no adequate studies in pregnant women; or animal studies have shown an adverse effect, but adequate studies in pregnant women have not demonstrated a risk to the fetus in the first trimester of pregnancy, and there is no evidence of risk in later trimesters.*)

The drug enters maternal milk in low concentrations. Modification/alteration of bowel flora with resultant diarrhea is theoretically possible.

Overdosage/Acute Toxicity

Cephalosporin overdoses are unlikely to cause significant problems but other effects are possible (see Adverse effects section).

Drug Interactions

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

- **AMINOGLYCOSIDES/NEPHROTOXIC DRUGS**: The concurrent use of parenteral aminoglycosides or other nephrotoxic drugs (*e.g.*, amphotericin B) with cephalosporins is somewhat controversial. Potentially, cephalosporins could cause additive nephrotoxicity when used with these drugs, but this interaction has only been well documented with cephaloridine (no longer marketed). *In vitro* studies have demonstrated that cephalosporins can have synergistic or additive activity against certain bacteria when used with aminoglycosides, but they should not be mixed together (administer separately).
- **ANTACIDS**: Drugs that can increase stomach pH may decrease the absorption of the drug
- **H-2 ANTAGONISTS** (**ranitidine, famotidine,** etc.): Drugs that can increase stomach pH may decrease the absorption of the drug
- **PROBENECID**: Competitively blocks the tubular secretion of most cephalosporins thereby increasing serum levels and serum half-lives
- **PROTON PUMP INHIBITORS** (*e.g.*, **omeprazole**): Drugs that can increase stomach pH may decrease the absorption of the drug

Laboratory Considerations

- Cefpodoxime may cause false-positive **urine glucose determinations** when using cupric sulfate solution (Benedict's Solution, *Clinitest®*). Tests utilizing glucose oxidase (*Tes-Tape®*, *Clinistix®*) are not affected by cephalosporins.
- If using the nitroprusside test for determining **urinary ketones,** cefpodoxime may cause false-positive results.

Doses

- **DOGS:**
  a) For susceptible skin infections: 5–10 mg/kg PO once daily. Should be administered for 5–7 days or 2–3 days beyond cessation of clinical signs, up to a maximum of 28 days. Treatment of acute infections should not be continued for more than 3–4 days if no response to therapy is seen. May be given with or without food. (Label information; *Simplicef®*—Pfizer)
  b) For staphylococcal skin infections: 5–10 mg/kg PO q12h (Campbell 1999); (MacDonald 2002b)
  c) For susceptible infections: 5–10 mg/kg PO twice daily (Boothe 1999)
- **CATS:**
  a) For susceptible skin and soft tissue infections: 5 mg/kg PO q12h or 10 mg/kg PO once daily (**Note**: Extrapolated from human dosage) (Greene and Watson 1998)

Monitoring

- Clinical efficacy

Client Information

- Can be given without regard to meals (in humans presence of food enhances absorption).
- Give as directed for as long as veterinarian recommends, even if patient appears well.

Chemistry/Synonyms

An orally administered semisynthetic 3rd generation cephalosporin, cefpodoxime proxetil is a prodrug that is hydrolyzed *in vivo* to cefpodoxime. The esterified form (proxetil) enhances lipid solubility and oral absorption.

Cefpodoxime proxetil may also be known as: CS-807; R-3763, U-76252, U-76253, *Banan®*, *Biocef®*, *Cefodox®*, *Cepodem®*, *Garia®*, *Instana®*, *Kelbium®*, *Orelox®*, *Otreon®*, *Podomexef®*, *Simplicef®*, or *Vantin®*.

Storage/Stability/Compatibility

Tablets and unreconstituted powder should be stored at 20–25°C in well-closed containers. After reconstitution, the oral suspension should be stored in the refrigerator and discarded after 14 days.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS:

Cefpodoxime Proxetil Tablets: 100 mg & 200 mg; *Simplicef®* (Pfizer); (Rx). Approved for use in dogs.

HUMAN-LABELED PRODUCTS:

Cefpodoxime Proxetil Tablets: 100 mg & 200 mg; *Vantin®* (Pharmacia & Upjohn), generic (Putney); (Rx)

Cefpodoxime Proxetil Granules for Suspension: 50 mg/5 mL & 100 mg/5 mL in 50 mL, 75 mL & 100 mL bottles; *Vantin®* (Pharmacia & Upjohn), generic (Putney); (Rx)

CEFTAZIDIME

(sef-***taz***-i-deem) Ceptaz®, Fortaz®, Tazicef®

3rd GENERATION CEPHALOSPORIN

Prescriber Highlights

- 3rd generation cephalosporin used parenterally for gram-negative infections
- Particularly useful in reptiles
- Could cause hypersensitivity reactions, granulocytopenia/thrombocytopenia, diarrhea, mild azotemia
- May cause pain on IM injection; SC injection probably less painful
- May need to reduce dose in renal failure; use with caution
- Check drug-lab interactions

Uses/Indications

Ceftazidime is potentially useful in treating serious gram-negative bacterial infections particularly against susceptible Enterobacteriaceae including *Pseudomonas aeruginosa*, that are not susceptible to other, less-expensive agents, or when aminoglycosides are not indicated (due to their potential toxicity). It is of particular interest for treating gram-negative infections in reptiles due to a very long half-life.

Pharmacology/Actions

Ceftazidime is a third generation injectable cephalosporin agent. It is bactericidal and acts via its inhibition of enzymes responsible for bacterial cell wall synthesis. The third generation cephalosporins retain much of the gram-positive activity of the first and second generation agents, but, have much expanded gram-negative activity. As with the 2nd generation agents, enough variability exists with individual bacterial sensitivities that susceptibility testing is necessary for most bacteria. Ceftazidime is considered an anti-pseudomonal