



Enroflox[®]

PRODUCT PORTFOLIO



A FLUOROQUINOLONE ANTIBIOTIC DESIGNED TO MANAGE
SUSCEPTIBLE BACTERIAL DISEASE



Enroflox Injection
(enrofloxacin) For Dogs 2.27%



Enroflox Chewable Tablets
(enrofloxacin)

Discover Enroflox[®]

AFFORDABLE, EFFECTIVE ANTIBACTERIAL THERAPY

Enroflox[®] (enrofloxacin) is a fluoroquinolone antibiotic designed to manage susceptible bacteria and treat disease.

Its broad-spectrum activity against both Gram-negative and Gram-positive bacteria makes it an effective treatment against many dermal, respiratory and urinary tract infections. Enroflox[®] comes in two delivery methods, Enroflox[®] (enrofloxacin) Injection for Dogs 2.27% and Enroflox[®] (enrofloxacin) Chewable Tablets for dogs and cats, giving you flexibility to better care for your patients. And it has the same active ingredient as Baytril[®] products, so you get the same indications with increased client savings – and increased clinic profit.

Broad-Spectrum Activity

Enrofloxacin has excellent activity against both Gram (+) and Gram (-) susceptible bacteria

Gram (+) Aerobes

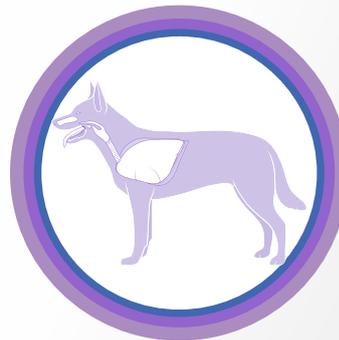
- *Staphylococcus*
- *Streptococcus*

Gram (-) Aerobes

- *E. coli*
- *Bordetella*
- *Brucella*
- *Klebsiella*
- *Pasturella*
- *Pseudomonas*

Most strains of these organisms were found to be susceptible to enrofloxacin *in vitro* but the clinical significance has not been determined for some of the isolates.

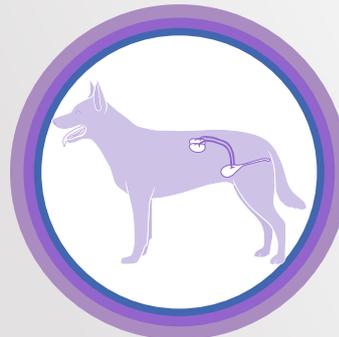
Enroflox[®] attacks susceptible bacteria at the infection site.



Respiratory

- *Staphylococcus aureus*
- *Escherichia coli*

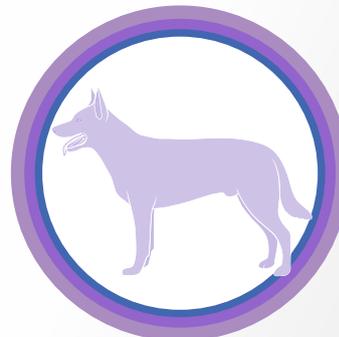
Treatable in dogs with **Enroflox Injection** and **Enroflox Chewable Tablets**



Urinary

- *Escherichia coli*
- *Proteus mirabilis*
- *Staphylococcus aureus*

Treatable in dogs with **Enroflox Injection** and **Enroflox Chewable Tablets**



Dermal

- *Staphylococcus intermedius*
- *Escherichia coli*
- *Klebsiella pneumoniae*
- *Proteus mirabilis*

Treatable in dogs with **Enroflox Injection** and **Enroflox Chewable Tablets**



Dermal

- For wounds and abscesses
- *Pasteurella multocida*
- *Staphylococcus aureus*
- *Staphylococcus epidermidis*

Treatable in cats with **Enroflox Chewable Tablets** only



Lower your costs and pass on the savings.

ENROFLOX[®] (ENROFLOXACIN) CHEWABLE TABLETS PRICING VS. BAYTRIL[®] (ENROFLOXACIN) TASTE TABS^{*}

See how you can save by switching to Enroflox Chewable Tablets.

WEIGHT OF PET	TABLET STRENGTH	BAYTRIL [®] TASTE TABS [*] COST TO TREAT DAILY	ENROFLOX [®] CHEWABLE TABLETS COST TO TREAT DAILY	ENROFLOX [®] SAVINGS
10 lbs	22.7 mg	\$0.57	\$0.40	29%
30 lbs	68 mg	\$1.46	\$1.03	29%
60 lbs	136 mg	\$2.54	\$1.81	29%

*Price comparisons based on 2022 DVM List Price – econo sizes.



ENROFLOX[®] (ENROFLOXACIN) INJECTION FOR DOGS 2.27% PRICING VS. BAYTRIL (ENROFLOXACIN) ANTIBACTERIAL INJECTABLE SOLUTION 2.27%

See the cost savings you can enjoy when you switch to Enroflox Injection.

BAYTRIL [®] INJECTABLE 20 mL	ENROFLOX [®] INJECTION 2.27% 20 mL	ENROFLOX [®] INJECTION 2.27% 50 mL	ENROFLOX [®] INJECTION 2.27% 100 mL
\$39.25 VET PRICE	\$27.75 VET PRICE	\$65.90 VET PRICE	\$125.20 VET PRICE
	Vet saves 29% vs. Baytril Injectable	Save an additional 4% per mL	Save an additional 7% per mL

*Price comparisons based on 2022 DVM List Price.



Enroflox[®] Chewable Tablets

(enrofloxacin)



Impactful antibiotic activity in a liver-flavored chewable tablet

Enroflox[®] (enrofloxacin) Chewable Tablets is a fluoroquinolone that manages a variety of susceptible bacterial infections. The double-scored chewable tablet design allows for easy, flexible dosing with the same efficacy as Baytril[®] (enrofloxacin) Taste Tabs[®] at a better cost, allowing you to boost clinic profits and pass savings on to your clients.

- Indications for both dogs and cats
- Liver-flavored
- Same active ingredient and dosing regimen as pioneer product
- Significant savings versus Baytril Taste Tabs
- Once-daily, flexible dosing for dogs of 5-20 mg/kg (2.27-9.07 mg/lb). Administer once daily for cats at 5 mg/kg (2.27 mg/lb) of body weight
- Double scored with a unique, geometric design for accurate dosing
- Concentration dependent and bactericidal
- Available in 22.7 mg, 68 mg & 136 mg strengths
- Uniform 50 count and 200 count bottles across all 3 strengths



Enroflox[®] Injection

(enrofloxacin) For Dogs 2.27%



The same effective antibiotic in an easy-to-use injection form

Enroflox[®] (enrofloxacin) Injection for Dogs 2.27% offers broad-spectrum antibiotic activity against Gram-negative and Gram-positive bacteria to manage a variety of susceptible bacterial infections in dogs. This injectable form is easily administered as a single dose, followed by Enroflox (enrofloxacin) Chewable Tablet therapy.

- Indicated for dogs only
- Same active ingredient and dosing regimen as Baytril (enrofloxacin) Antibacterial Injectable Solution 2.27%
- Significant savings versus Baytril Injectable
- Each mL of injectable solution contains 22.7 mg of enrofloxacin
- Initial treatment administered intramuscularly as a single dose at 2.5 mg/kg
- Concentration dependent and bactericidal
- Available in 20 mL, 50 mL & economical 100 mL bottles to fit any practice



Get to know Norbrook®

Providing quality, cost-effective animal health products to the veterinary community for over 50 years.

Norbrook was founded in Newry, Northern Ireland, in 1969 and is now a leading global provider of veterinary pharmaceuticals. With world-class manufacturing facilities on four continents and sales and marketing offices in 30 countries, Norbrook exports to over 120 countries worldwide. Their products have been featured in the U.S. for over 30 years.

DID YOU KNOW?

- Norbrook manufactures several of its own active pharmaceutical ingredients (APIs), ensuring control over costs and increased confidence in quality.
- Norbrook is one of the largest manufacturers of veterinary sterile injectables in the world.
- Norbrook manufactures products for other major animal health companies.
- Norbrook is one of the largest manufacturers of companion animal and livestock private-label brands in the U.S.

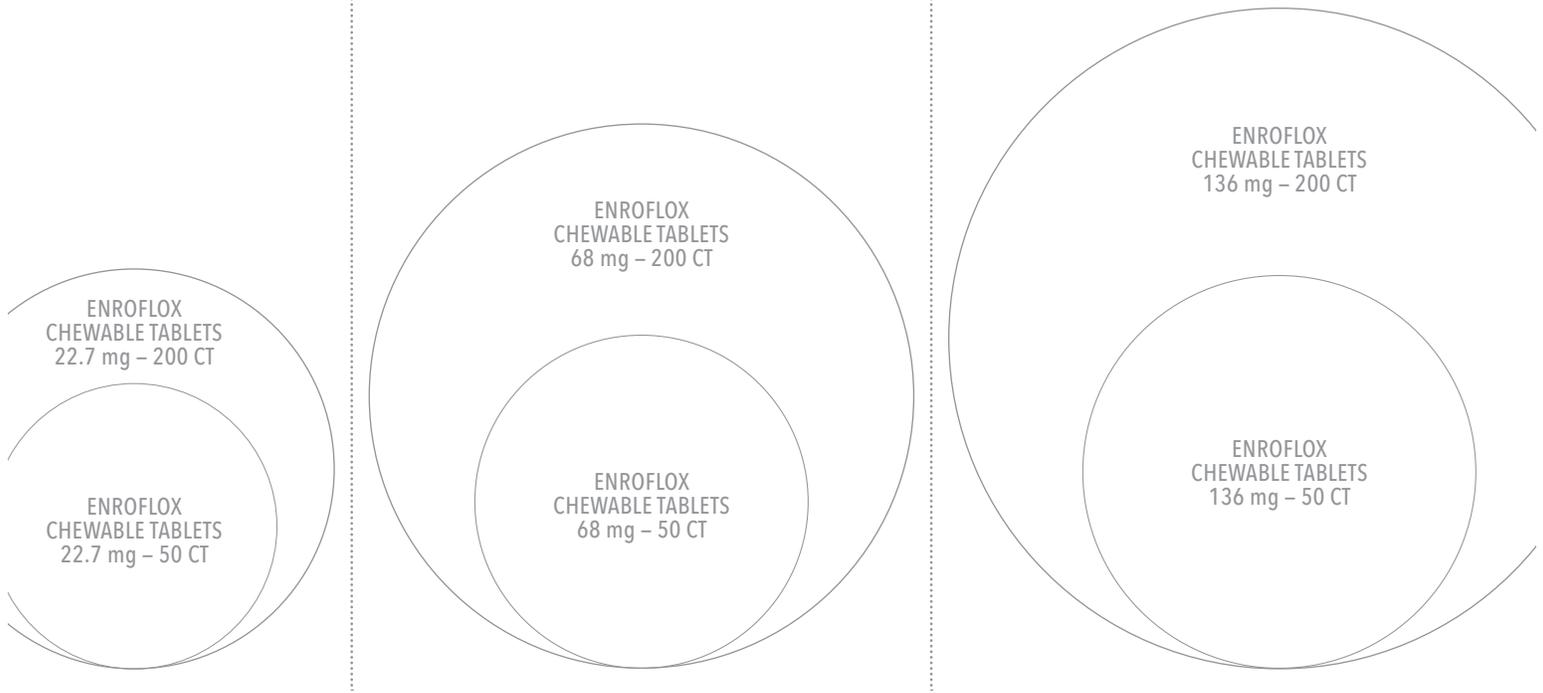
For more information about Norbrook products, visit [Norbrook.com](https://www.norbrook.com) or call 866-591-5777.

ENROFLOX® CHEWABLE TABLETS

CAUTION: Federal (U.S.A.) law restricts this drug to use by or on the order of a licensed veterinarian. In rare instances, use of this product in cats has been associated with retinal toxicity. Do not exceed 2.27 mg/lb. of body weight per day in cats. Observe label directions and see product labeling for full product information.

ENROFLOX® INJECTION FOR DOGS 2.27%

CAUTION: Federal (U.S.A.) law restricts this drug to use by or on the order of a licensed veterinarian. Federal law prohibits the extra label use of this drug in food-producing animals. **CONTRAINDICATIONS:** Enrofloxacin is contraindicated in dogs known to be hypersensitive to quinolones. The safe use of enrofloxacin has not been established in large and giant breeds during the rapid growth phase. The use of enrofloxacin is contraindicated in small and medium breed dogs during the rapid growth phase (between 2 and 8 months of age). **WARNINGS: For use in animals only. The use of this product in cats may result in Retinal Toxicity. Keep out of reach of children.** Observe label directions and see product labeling for full product information.



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Enroflox[®] (enrofloxacin) Chewable Tablets Once-Daily Dosing



5 mg/kg* dose for dogs and cats

Do not exceed 5 mg/kg of body weight per day in cats



22.7 mg tablet
(actual size)

68 mg tablet
(actual size)

136 mg tablet
(actual size)

WEIGHT	22.7 MG TABLET	68 MG TABLET	136 MG TABLET
5 lb (2.27 kg)	½		
10 lb (4.54 kg)	1		
15 lb (6.80 kg)	1½	or ½	
30 lb (13.61 kg)		1	
45 lb (20.41 kg)		1½	
60 lb (27.22 kg)			1
90 lb (40.82 kg)			1½
120 lb (54.43 kg)			2

*Dosing range for dogs is 5-20 mg/kg.

CAUTION: Federal (U.S.A.) law restricts this drug to use by or on the order of a licensed veterinarian. In rare instances, use of this product in cats has been associated with retinal toxicity. Do not exceed 2.27 mg/lb of body weight per day in cats. Observe label directions and see product labeling for full product information.

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ENROFLOX INJECTION
FOR DOGS 2.27%
20 mL

ENROFLOX INJECTION
FOR DOGS 2.27%
50 mL

ENROFLOX INJECTION
FOR DOGS 2.27%
100 mL

▼ FOLD HERE ▼

Enroflox[®] (enrofloxacin) Injection for Dogs 2.27% Dosing



Enroflox[®] Injection may be used as the initial dose at 2.5 mg/kg. It should be administered intramuscularly (IM) as a single dose followed 12 hours later by initiation of Enroflox Chewable Tablets.



WEIGHT	ENROFLOX [®] INJECTION FOR DOGS 2.5 mg/kg
10 lb (4.5 kg)	0.5 mL
15 lb (6.8 kg)	0.75 mL
20 lb (9.1 kg)	1.00 mL
25 lb (11.3 kg)	1.25 mL
30 lb (13.6 kg)	1.50 mL
35 lb (15.9 kg)	1.75 mL
40 lb (18.1 kg)	2.00 mL
45 lb (20.4 kg)	2.25 mL
50 lb (22.7 kg)	2.50 mL

CAUTION: Federal (U.S.A.) law restricts this drug to use by or on the order of a licensed veterinarian. Federal law prohibits the extralabel use of this drug in food-producing animals. **CONTRAINDICATIONS:** Enrofloxacin is contraindicated in dogs known to be hypersensitive to quinolones. The safe use of enrofloxacin has not been established in large and giant breeds during the rapid growth phase. The use of enrofloxacin is contraindicated in small and medium breed dogs during the rapid growth phase (between 2 and 8 months of age).

WARNINGS: For use in animals only. The use of this product in cats may result in Retinal Toxicity. Keep out of reach of children. Observe label directions and see product labeling for full product information.

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0422-ENR-M02C

Enroflox[®] Chewable Tablets (enrofloxacin)

Antibacterial Tablets For Dogs And Cats

CAUTION:

Federal (U.S.A.) law restricts this drug to use by or on the order of a licensed veterinarian.

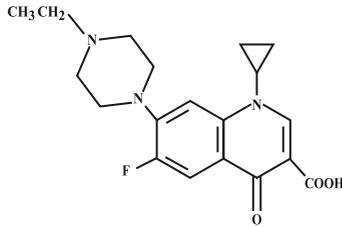
▶ Federal law prohibits the extralabel use of this drug in food-producing animals. ◀

DESCRIPTION

Enrofloxacin is a synthetic chemotherapeutic agent from the class of the quinolone carboxylic acid derivatives. It has antibacterial activity against a broad spectrum of Gram negative and Gram positive bacteria (See Tables I and II). It is rapidly absorbed from the digestive tract, penetrating into all measured body tissues and fluids (See Table III). Tablets are available in three sizes (22.7, 68.0 and 136.0 mg enrofloxacin).

CHEMICAL NOMENCLATURE AND STRUCTURAL FORMULA:

1-cyclopropyl-7-(4-ethyl-1-piperazinyl)-6-fluoro-1,4-dihydro-4-oxo-3-quinolinecarboxylic acid.



ACTIONS:

Microbiology: Quinolone carboxylic acid derivatives are classified as DNA gyrase inhibitors. The mechanism of action of these compounds is very complex and not yet fully understood. The site of action is bacterial gyrase, a synthesis promoting enzyme. The effect on *Escherichia coli* is the inhibition of DNA synthesis through prevention of DNA supercoiling. Among other things, such compounds lead to the cessation of cell respiration and division. They may also interrupt bacterial membrane integrity.¹

Enrofloxacin is bactericidal, with activity against both Gram negative and Gram positive bacteria. The minimum inhibitory concentrations (MICs) were determined for a series of 39 isolates representing 9 genera of bacteria from natural infections in dogs and cats, selected principally because of resistance to one or more of the following antibiotics: ampicillin, cephalothin, colistin, chloramphenicol, erythromycin, gentamicin, kanamycin, penicillin, streptomycin, tetracycline, triple sulfa and sulfa/trimethoprim. The MIC values for enrofloxacin against these isolates are presented in Table I.

Most strains of these organisms were found to be susceptible to enrofloxacin *in vitro* but the clinical significance has not been determined for some of the isolates.

The susceptibility of organisms to enrofloxacin should be determined using enrofloxacin 5 mcg disks. Specimens for susceptibility testing should be collected prior to the initiation of enrofloxacin therapy.

TABLE I — MIC Values for Enrofloxacin Against Canine and Feline Pathogens (Diagnostic laboratory isolates, 1984)

Organisms	Isolates	MIC Range (mcg/mL)
<i>Bacteroides</i> spp.	2	2
<i>Bordetella bronchiseptica</i>	3	0.125-0.5
<i>Brucella canis</i>	2	0.125-0.25
<i>Clostridium perfringens</i>	1	0.5
<i>Escherichia coli</i>	5*	≤0.016-0.031
<i>Klebsiella</i> spp.	11*	0.031-0.5
<i>Proteus mirabilis</i>	6	0.062-0.125
<i>Pseudomonas aeruginosa</i>	4	0.5-8
<i>Staphylococcus</i> spp.	5	0.125

*Includes feline isolates

The inhibitory activity on 120 isolates of seven canine urinary pathogens was also investigated and is listed in Table II.

TABLE II — MIC Values for Enrofloxacin Against Canine Urinary Pathogens (Diagnostic laboratory isolates, 1985)

Organisms	Isolates	MIC Range (mcg/mL)
<i>E. coli</i>	30	0.06-2.0
<i>P. mirabilis</i>	20	0.125-2.0
<i>K. pneumoniae</i>	20	0.06-0.5
<i>P. aeruginosa</i>	10	1.0-8.0
<i>Enterobacter</i> spp.	10	0.06-1.0
<i>Staph. (coag. +)</i>	20	0.125-0.5
<i>Strep. (alpha hemol.)</i>	10	0.5-8.0

Distribution in the Body: Enrofloxacin penetrates into all canine and feline tissues and body fluids. Concentrations of drug equal to or greater than the MIC for many pathogens (See Tables I, II and III) are reached in most tissues by two hours after dosing at 2.5 mg/kg and are maintained for 8-12 hours after dosing. Particularly high levels of enrofloxacin are found in urine. A summary of the body fluid/tissue drug levels at 2 to 12 hours after dosing at 2.5 mg/kg is given in Table III.

Table III — Body Fluid/Tissue distribution of Enrofloxacin in Dogs and Cats Single Oral Dose = 2.5 mg/kg (1.13 mg/lb)

Body Fluids (mcg/mL)	Post-treatment Enrofloxacin Levels			
	Canine (n = 2)		Feline (n = 4)	
	2 Hr.	8 Hr.	2 Hr.	12 Hr.
Bile	—	—	2.13	1.97
Cerebrospinal Fluid	—	—	0.37	0.10
Urine	43.05	55.35	12.81	26.41
Eye Fluids	0.53	0.66	0.45	0.65
Whole Blood	1.01	0.36	—	—
Plasma	0.67	0.33	—	—
Serum	—	—	0.48	0.18

Tissues (mcg/g) Hematopoietic System

Liver	3.02	1.36	1.84	0.37
Spleen	1.45	0.85	1.33	0.52
Bone Marrow	2.10	1.22	1.68	0.64
Lymph Node	1.32	0.91	0.49	0.21

Urogenital System

Kidney	1.87	0.99	1.43	0.37
Bladder Wall	1.36	0.98	1.16	0.55
Testes	1.36	1.10	1.01	0.28
Prostate	1.36	2.20	1.88	0.55
Ovaries	—	—	0.78	0.56
Uterine Wall	1.59	0.29	0.81	1.05

Gastrointestinal and Cardiopulmonary Systems

Lung	1.34	0.82	0.91	0.33
Heart	1.88	0.78	0.84	0.32
Stomach	3.24	2.16	3.26	0.27
Small Intestine	2.10	1.11	2.72	0.40
Large Intestine	—	—	0.94	1.10

Other

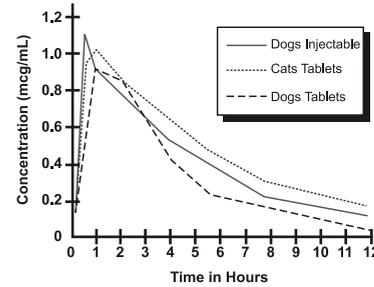
Fat	0.52	0.40	0.24	0.11
Skin	0.66	0.48	0.46	0.17
Muscle	1.62	0.77	0.53	0.29
Brain	0.25	0.24	0.22	0.12
Mammary Gland	0.45	0.21	0.36	0.30
Feces	1.65	9.97	0.37	4.18

Pharmacokinetics: In dogs, the absorption and elimination characteristics of the oral formulation are linear (plasma concentrations increase proportionally with dose) when enrofloxacin is administered at up to 11.5 mg/kg, twice daily². Approximately 80% of the orally administered dose enters the systemic circulation unchanged. The eliminating organs, based on the drug's body clearance time, can readily remove the drug with no indication that the eliminating mechanisms are saturated. The primary route of excretion is via the urine. The absorption and elimination characteristics beyond this point are unknown. In cats, no oral absorption information is available at other than 2.5 mg/kg, administered orally as a single dose. Saturable absorption and/or elimination processes may occur at greater doses. When saturation of the absorption process occurs, the plasma concentration of the active moiety will be less than predicted, based on the concept of dose proportionality.

Following an oral dose in dogs of 2.5 mg/kg (1.13 mg/lb), enrofloxacin reached 50% of its maximum serum concentration in 15 minutes and peak serum level was reached in one hour. The elimination half-life in dogs is approximately 2.5 - 3 hours at that dose, while in cats it is greater than 4 hours. In a study comparing dogs and cats, the peak concentration and the time to peak concentration were not different.

A graph indicating the mean serum levels following a dose of 2.5 mg/kg (1.13 mg/lb) in dogs (oral and intramuscular) and cats (oral) is shown in Figure 1.

Figure 1 - Serum Concentrations of Enrofloxacin Following a Single Oral or Intramuscular Dose at 2.5 mg/kg in Dogs and a Single Oral Dose at 2.5 mg/kg in Cats.



Breakpoint: Based on pharmacokinetic studies of enrofloxacin in dogs and cats after a single oral administration of 2.5 mg enrofloxacin/kg BW (i.e. half of the lowest-end single daily dose range for dogs and half the single daily dose for cats) and the data listed in Tables I and II, the following breakpoints are recommended for canine and feline isolates.

Zone Diameter (mm)	MIC (µg/mL)	Interpretation
≥ 21	≤ 0.5	Susceptible (S)
18 - 20	1	Intermediate (I)
≤ 17	≥ 2	Resistant (R)

A report of "Susceptible" indicates that the pathogen is likely to be inhibited by generally achievable plasma levels. A report of "Intermediate" is a technical buffer and isolates falling into this category should be retested. Alternatively the organism may be successfully treated if the infection is in a body site where drug is physiologically concentrated. A report of "Resistant" indicates that the achievable drug concentrations are unlikely to be inhibitory and other therapy should be selected.

Standardized procedures require the use of laboratory control organisms for both standardized disk diffusion assays and standardized dilution assays. The 5 µg enrofloxacin disk should give the following zone diameters and enrofloxacin powder should provide the following MIC values for reference strains.

QC strain	MIC (µg/mL)	Zone Diameter (mm)
<i>E. coli</i> ATCC 25922	0.008 - 0.03	32 - 40
<i>P. aeruginosa</i> ATCC 27853	1 - 4	15 - 19
<i>S. aureus</i> ATCC 25923	—	27 - 31
<i>S. aureus</i> ATCC 29213	0.03 - 0.12	—

INDICATIONS:

Enroflox[®] Chewable Tablets (enrofloxacin) are indicated for the management of diseases associated with bacteria susceptible to enrofloxacin. Enroflox Chewable Tablets are indicated for use in dogs and cats.

EFFICACY CONFIRMATION:

Dogs : Clinical efficacy was established in dermal infections (wounds and abscesses) associated with susceptible strains of *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, and *Staphylococcus intermedius*; respiratory infections (pneumonia, tonsillitis, rhinitis) associated with susceptible strains of *Escherichia coli* and *Staphylococcus aureus*; and urinary cystitis associated with susceptible strains of *Escherichia coli*, *Proteus mirabilis*, and *Staphylococcus aureus*.

Cats : Clinical efficacy was established in dermal infections (wounds and abscesses) associated with susceptible strains of *Pasteurella multocida*, *Staphylococcus aureus*, and *Staphylococcus epidermidis*.

CONTRAINDICATIONS:

Enrofloxacin is contraindicated in dogs and cats known to be hypersensitive to quinolones.

Dogs : Based on the studies discussed under the section on Animal Safety Summary, the use of enrofloxacin is contraindicated in small and medium breeds of dogs during the rapid growth phase (between 2 and 8 months of age). The safe use of enrofloxacin has not been established in large and giant breeds during the rapid growth phase.

Large breeds may be in this phase for up to one year of age and the giant breeds for up to 18 months. In clinical field trials utilizing a daily oral dose of 5.0 mg/kg, there were no reports of lameness or joint problems in any breed. However, controlled studies with histological examination of the articular cartilage have not been conducted in the large or giant breeds.

ADVERSE REACTIONS:

Dogs : Two of the 270 (0.7%) dogs treated with enrofloxacin tablets at 5.0 mg/kg per day in the clinical field studies exhibited side effects, which were apparently drug-related. These two cases of vomiting were self-limiting.

Post-Approval Experience: The following adverse experiences, although rare, are based on voluntary post-approval adverse drug experience reporting. The categories of reactions are listed in decreasing order of frequency by body system.

Gastrointestinal: anorexia, diarrhea, vomiting, elevated liver enzymes

Neurologic: ataxia, seizures

Behavioral: depression, lethargy, nervousness

Cats : No drug-related side effects were reported in 124 cats treated with enrofloxacin tablets at 5.0 mg/kg per day for 10 days in clinical field studies.

Post-Approval Experience: The following adverse experiences, although rare, are based on voluntary post-approval adverse drug experience reporting. The categories of reactions are listed in decreasing order of frequency by body system.

Ocular: Mydriasis, retinal degeneration (retinal atrophy, attenuated retinal vessels, and hyperreflective tapeta have been reported), loss of vision. Mydriasis may be an indication of impending or existing retinal changes.

Gastrointestinal: vomiting, anorexia, elevated liver enzymes, diarrhea

Neurologic: ataxia, seizures

Behavioral: depression, lethargy, vocalization, aggression

To report suspected adverse drug events, for technical assistance or to obtain a copy of the Safety Data Sheet (SDS), contact Norbrook at 1-866-591-5777. For additional information about adverse drug experience reporting for animal drugs, contact FDA at 1-888-FDA-VETS or online at www.fda.gov/reportanimalae.

ANIMAL SAFETY SUMMARY:

Dogs : Adult dogs receiving enrofloxacin orally at a daily dosage rate of 52 mg/kg for 13 weeks had only isolated incidences of vomiting and inappetence. Adult dogs receiving the tablet formulation for 30 consecutive days at a daily treatment of 25 mg/kg did not exhibit significant clinical signs nor were there effects upon the clinical chemistry, hematological or histological parameters. Daily doses of 125 mg/kg for up to 11 days induced vomiting, inappetence, depression, difficult locomotion and death while adult dogs receiving 50 mg/kg/day for 14 days had clinical signs of vomiting and inappetence.

Adult dogs dosed intramuscularly for three treatments at 12.5 mg/kg followed by 57 oral treatments at 12.5 mg/kg, all at 12 hour intervals, did not exhibit either significant clinical signs or effects upon the clinical chemistry, hematological or histological parameters.

Oral treatment of 15 to 28 week old growing puppies with daily dosage rates of 25 mg/kg has induced abnormal carriage of the carpal joint and weakness in the hindquarters. Significant improvement of clinical signs is observed following drug withdrawal. Microscopic studies have identified lesions of the articular cartilage following 30 day treatments at either 5, 15 or 25 mg/kg in this age group. Clinical signs of difficult ambulation or associated cartilage lesions have not been observed in 29 to 34 week old puppies following daily treatments of 25 mg/kg for 30 consecutive days nor in 2 week old puppies with the same treatment schedule.

Tests indicated no effect on circulating microfilariae or adult heartworms (*Dirofilaria immitis*) when dogs were treated at a daily dosage rate of 15 mg/kg for 30 days. No effect on cholinesterase values was observed.

No adverse effects were observed on reproductive parameters when male dogs received 10 consecutive daily treatments of 15 mg/kg/day at 3 intervals (90, 45 and 14 days) prior to breeding or when female dogs received 10 consecutive daily treatments of 15 mg/kg/day at 4 intervals: between 30 and 0 days prior to breeding, early pregnancy (between 10th & 30th days), late pregnancy (between 40th & 60th days), and during lactation (the first 28 days).

Cats : Cats in age ranges of 3 to 4 months and 7 to 10 months received daily treatments of 25 mg/kg for 30 consecutive days with no adverse effects upon the clinical chemistry, hematological or histological parameters. In cats 7-10 months of age treated daily for 30 consecutive days, 2 of 4 receiving 5 mg/kg, 3 of 4 receiving 15 mg/kg, 2 of 4 receiving 25 mg/kg and 1 of 4 nontreated controls experienced occasional vomiting. Five to 7 month old cats had no side effects with daily treatments of 15 mg/kg for 30 days, but 2 of 4 animals had articular cartilage lesions when administered 25 mg/kg per day for 30 days.

Doses of 125 mg/kg for 5 consecutive days to adult cats induced vomiting, depression, incoordination and death while those receiving 50 mg/kg for 6 days had clinical signs of vomiting, inappetence, incoordination and convulsions, but they returned to normal.

Enrofloxacin was administered to thirty-two (8 per group), six- to eight-month-old cats at doses of 0, 5, 20, and 50 mg/kg of body weight once a day for 21 consecutive days. There were no adverse effects observed in cats that received 5 mg/kg body weight of enrofloxacin. The administration of enrofloxacin at 20 mg/kg body weight or greater caused salivation, vomiting, and depression. Additionally, dosing at 20 mg/kg body weight or greater resulted in mild to severe fundic lesions on ophthalmologic examination (change in color of the fundus, central or generalized retinal degeneration), abnormal electroretinograms (including blindness), and diffuse light microscopic changes in the retina.

DRUG INTERACTIONS:

Compounds that contain metal cations (e.g., aluminum, calcium, iron, magnesium) may reduce the absorption of some quinolone-class drugs from the intestinal tract. Concomitant therapy with other drugs that are metabolized in the liver may reduce the clearance rates of the quinolone and the other drug.

Dogs : Enrofloxacin has been administered to dogs at a daily dosage rate of 10 mg/kg concurrently with a wide variety of other health products including anthelmintics (praziquantel, febantel, sodium disphenol), insecticides (fenthion, pyrethrins), heartworm preventatives (diethylcarbamazine) and other antibiotics (ampicillin, gentamicin sulfate, penicillin, dihydrostreptomycin). No incompatibilities with other drugs are known at this time.

Cats : Enrofloxacin was administered at a daily dosage rate of 5 mg/kg concurrently with anthelmintics (praziquantel, febantel), an insecticide (propoxur) and another antibacterial (ampicillin). No incompatibilities with other drugs are known at this time.

WARNINGS:

For use in animals only. In rare instances, use of this product in cats has been associated with Retinal Toxicity. Do not exceed 5 mg/kg of body weight per day in cats. Safety in breeding or pregnant cats has not been established. Keep out of reach of children.

Avoid contact with eyes. In case of contact, immediately flush eyes with copious amounts of water for 15 minutes. In case of dermal contact, wash skin with soap and water. Consult a physician if irritation persists following ocular or dermal exposure. Individuals with a history of hypersensitivity to quinolones should avoid this product. In humans, there is a risk of user photosensitization within a few hours after excessive exposure to quinolones. If excessive accidental exposure occurs, avoid direct sunlight.

For customer service or to obtain product information, including Safety Data Sheet (SDS), call 1-866-591-5777.

PRECAUTIONS:

Quinolone-class drugs should be used with caution in animals with known or suspected Central Nervous System (CNS) disorders. In such animals, quinolones have, in rare instances, been associated with CNS stimulation which may lead to convulsive seizures.

Quinolone-class drugs have been associated with cartilage erosions in weight-bearing joints and other forms of arthropathy in immature animals of various species.

The use of fluoroquinolones in cats has been reported to adversely affect the retina. Such products should be used with caution in cats.

DOSAGE AND ADMINISTRATION:

Dogs : Administer orally at a rate to provide 5-20 mg/kg (2.27 to 9.07 mg/lb) of body weight. Selection of a dose within the range should be based on clinical experience, the severity of disease, and susceptibility of the pathogen. Animals which receive doses in the upper-end of the dose range should be carefully monitored for clinical signs that may include inappetence, depression, and vomiting.

Weight of Dog	Once Daily Dosing Chart			
	5.0 mg/kg	10.0 mg/kg	15.0 mg/kg	20.0 mg/kg
9.1 kg (20 lb)	2 x 22.7 mg tablets	1 x 22.7 mg plus 1 x 68 mg tablets	1 x 136 mg tablet	1 x 136 mg plus 2 x 22.7 mg tablets
27.2 kg (60 lb)	1 x 136 mg tablet	2 x 136 mg tablets	3 x 136 mg tablets	4 x 136 mg tablets

All tablet sizes are double scored for accurate dosing.

Cats : Administer orally at 5 mg/kg (2.27 mg/lb) of body weight. The dose for dogs and cats may be administered either as a single daily dose or divided into two (2) equal daily doses administered at twelve (12) hour intervals. The dose should be continued for at least 2-3 days beyond cessation of clinical signs, to a maximum of 30 days.

Weight of Cat	Once Daily Dosing Chart (5 mg/kg/day)
5 lb (2.27 kg)	1/2 x 22.7 mg tablet
10 lb (4.5 kg)	1 x 22.7 mg tablet
15 lb (6.8 kg)	1 and 1/2 x 22.7 mg tablets or 1/2 x 68 mg tablet

All tablet sizes are double scored for accurate dosing.

Dogs & Cats: The duration of treatment should be selected based on clinical evidence. Generally, administration of Enroflox Chewable Tablets (enrofloxacin) should continue for at least 2-3 days beyond cessation of clinical signs. For severe and/or complicated infections, more prolonged therapy, up to 30 days, may be required. If no improvement is seen within five days, the diagnosis should be reevaluated and a different course of therapy considered.

The lower limit of the dose range in dogs and the daily dose for cats was based on efficacy studies in dogs and cats where enrofloxacin was administered at 2.5 mg/kg twice daily. Target animal safety and toxicology were used to establish the upper limit of the dose range for dogs and treatment duration for dogs and cats.

STORAGE:

Dispense tablets in tight containers only. Enroflox Chewable Tablets (enrofloxacin) should be stored at or below 77° F (25°C). Use half and quarter tablets within 90 days.

HOW SUPPLIED:

Tablet Size	Tablets/Bottle	Tablet Size	Tablets/Bottle
22.7 mg	50 Double Scored	68.0 mg	200 Double Scored
22.7 mg	200 Double Scored	136.0 mg	50 Double Scored
68.0 mg	50 Double Scored	136.0 mg	200 Double Scored

Norbrook, the Norbrook bull and Enroflox® are registered trademarks of Norbrook Laboratories Limited.

REFERENCES:

- Dougherty, T.J., & Saukkonen, J.J. (1985). Membrane permeability changes associated with DNA gyrase inhibitors in *Escherichia Coli*. *Antimicrob Agents Chemother*, 28 (2), 200-206.
- Walker, R.D., Stein, G.E., Hauptmam, J.G., McDonald, K.H. (1992). Pharmacokinetic evaluation of enrofloxacin administered orally to healthy dogs. *Am J Vet Res*, 53 (12):2315-2319.

Norbrook Laboratories Limited
Newry, Co. Down, BT35 6PU, Northern Ireland
 Made in the UK

December 2021



Enroflox[®]

(enrofloxacin)

Injection For Dogs

2.27%

For Dogs Only**CAUTION:**

Federal (U.S.A.) law restricts this drug to use by or on the order of a licensed veterinarian.

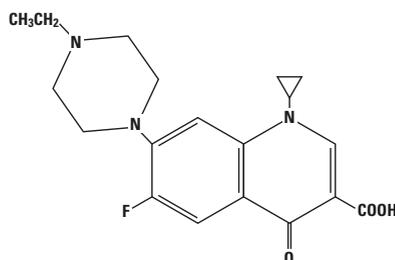
Federal law prohibits the extralabel use of this drug in food-producing animals.

DESCRIPTION:

Enrofloxacin is a synthetic chemotherapeutic agent from the class of the quinolone carboxylic acid derivatives. It has antibacterial activity against a broad spectrum of Gram negative and Gram positive bacteria (See Tables I and II). Each mL of injectable solution contains: enrofloxacin 22.7 mg, n-butyl alcohol 30 mg, potassium hydroxide for pH adjustment and water for injection, q.s.

CHEMICAL NOMENCLATURE AND STRUCTURAL FORMULA:

1-cyclopropyl-7-(4-ethyl-1-piperazinyl)-6-fluoro-1,4-dihydro-4-oxo-3-quinolonecarboxylic acid.

**ACTIONS:**

Microbiology: Quinolone carboxylic acid derivatives are classified as DNA gyrase inhibitors. The mechanism of action of these compounds is very complex and not yet fully understood. The site of action is bacterial gyrase, a synthesis promoting enzyme. The effect of *Escherichia coli* is the inhibition of DNA synthesis through prevention of DNA supercoiling. Among other things, such compounds lead to the cessation of cell respiration and division. They may also interrupt bacterial membrane integrity.¹

Enrofloxacin is bactericidal, with activity against both Gram negative and Gram positive bacteria. The minimum inhibitory concentrations (MICs) were determined for a series of 37 isolates representing 9 genera of bacteria from natural infections in dogs, selected principally because of resistance to one or more of the following antibiotics: ampicillin, cephalothin, colistin, chloramphenicol, erythromycin, gentamicin, kanamycin, penicillin, streptomycin, tetracycline, triple sulfa and sulfa/trimethoprim. The MIC values for enrofloxacin against these isolates are presented in Table I. Most strains of these organisms were found to be susceptible to enrofloxacin *in vitro* but the clinical significance has not been determined for some of the isolates.

The susceptibility of organisms to enrofloxacin should be determined using enrofloxacin 5 mcg disks. Specimens for susceptibility testing should be collected prior to the initiation of enrofloxacin therapy.

TABLE I – MIC Values for Enrofloxacin Against Canine Pathogens (Diagnostic laboratory isolates, 1984)

Organisms	Isolates	MIC Range (mcg/mL)
<i>Bacteroides</i> spp.	2	2
<i>Bordetella bronchiseptica</i>	3	0.125-0.5
<i>Brucella canis</i>	2	0.125-0.25
<i>Clostridium perfringens</i>	1	0.5
<i>Escherichia coli</i>	4	≤0.016-0.031
<i>Klebsiella</i> spp.	10	0.031-0.5
<i>Proteus mirabilis</i>	6	0.062-0.125
<i>Pseudomonas aeruginosa</i>	4	0.5-8
<i>Staphylococcus</i> spp.	5	0.125

The inhibitory activity on 120 isolates of seven canine urinary pathogens was also investigated and is listed in Table II.

TABLE II – MIC Values for Enrofloxacin Against Canine Urinary Pathogens (Diagnostic laboratory isolates, 1985)

Organisms	Isolates	MIC Range (mcg/mL)
<i>E. coli</i>	30	0.06-2.0
<i>P. mirabilis</i>	20	0.125-2.0
<i>K. pneumoniae</i>	20	0.06-0.5
<i>P. aeruginosa</i>	10	1.0-8.0
<i>Enterobacter</i> spp.	10	0.06-1.0
<i>Staph. (coag. +)</i>	20	0.125-0.5
<i>Strep. (alpa hemol.)</i>	10	0.5-8.0

Distribution in the Body: Enrofloxacin penetrates into all canine tissues and body fluids. Concentrations of drug equal to or greater than the MIC for many pathogens (See Tables I, II and III) are reached in most tissues by two hours after dosing at 2.5 mg/kg and are maintained for 8-12 hours after dosing. Particularly high levels of enrofloxacin are found in urine. A summary of the body fluid/tissue drug levels at 2 to 12 hours after dosing at 2.5 mg/kg is given in Table III.

TABLE III – Body Fluid/Tissue distribution of Enrofloxacin in Dogs Single Oral Dose = 2.5 mg/kg (1.13 mg/lb) Post-treatment Enrofloxacin Levels Canine (n=2)

Body Fluids (mcg/mL)	2 Hr.	8 Hr.
Urine	43.05	55.35
Eye Fluids	0.53	0.66
Whole Blood	1.01	0.36
Plasma	0.67	0.33
Tissues (mcg/g) Hematopoietic System		
Liver	3.02	1.36
Spleen	1.45	0.85
Bone Marrow	2.10	1.22
Lymph Node	1.32	0.91
Urogenital System		
Kidney	1.87	0.99
Bladder Wall	1.36	0.98
Testes	1.36	1.10
Prostate	1.36	2.20
Uterine Wall	1.59	0.29
Gastrointestinal and Cardiopulmonary Systems		
Lung	1.34	0.82
Heart	1.88	0.78
Stomach	3.24	2.16
Small Intestine	2.10	1.11
Other		
Fat	0.52	0.40
Skin	0.66	0.48
Muscle	1.62	0.77
Brain	0.25	0.24
Mammary Gland	0.45	0.21
Feces	1.65	9.97

Pharmacokinetics: In dogs, the absorption and elimination characteristics of the oral formulation are linear (plasma concentrations increase proportionally with dose) when enrofloxacin is administered at up to 11.5 mg/kg, twice daily.² Approximately 80% of the orally administered dose enters the systemic circulation unchanged. The eliminating organs, based on the drug's body clearance time, can readily remove the drug with no indication that the eliminating mechanisms are saturated. The primary route of excretion is via the urine. The absorption and elimination characteristics beyond this point are unknown. Saturable absorption and/or elimination processes may occur at greater doses. When saturation of the absorption process occurs, the plasma concentration of the active moiety will be less than predicted, based on the concept of dose proportionality.

Following an oral dose in dogs of 2.5 mg/kg (1.13 mg/lb), enrofloxacin reached 50% of its maximum serum concentration in 15 minutes and peak serum level was reached in one hour. The elimination half-life in dogs is approximately 2 ½ -3 hours at that dose.

A graph indicating the mean serum levels following a dose of 2.5 mg/kg (1.13 mg/lb) in dogs (oral and intramuscular) is shown in Figure 1.

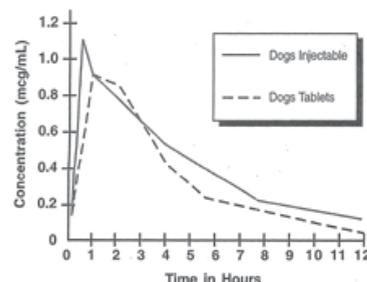


Figure 1 – Serum Concentrations of Enrofloxacin Following a Single Oral or Intramuscular Dose at 2.5 mg/kg in Dogs.

Breakpoint: Based on pharmacokinetic studies of enrofloxacin in dogs after a single oral administration of 2.5 mg enrofloxacin/kg BW (i.e. half of the lowest-end single daily dose range) and the data listed in Tables I and II, the following breakpoints are recommended for canine isolates.

Zone Diameter (mm)	MIC (µg/mL)	Interpretation
≥ 21	≤ 0.5	Susceptible (S)
18-20	1	Intermediate (I)
≤ 17	≥ 2	Resistant (R)

A report of "Susceptible" indicates that the pathogen is likely to be inhibited by generally achievable plasma levels. A report of "Intermediate" is a technical buffer and isolates falling into this category should be retested. Alternatively the organism may be successfully treated if the infection is in a body site where drug is physiologically concentrated. A report of "Resistant" indicates that the achievable drug concentrations are unlikely to be inhibitory and other therapy should be selected.

Standardized procedures require the use of laboratory control organisms for both standardized disk diffusion assays and standardized dilution assays. The 5 µg enrofloxacin disk should give the following zone diameters and enrofloxacin powder should provide the following MIC values for reference strains.

QC Strain	MIC (µg/mL)	Zone Diameter (mm)
<i>E. coli</i> ATCC 25922	0.008 - 0.03	32 - 40
<i>P. aeruginosa</i> ATCC 27853	1 - 4	15 - 19
<i>S. aureus</i> ATCC 25923		27 - 31
<i>S. aureus</i> ATCC 29213	0.03 - 0.12	

INDICATIONS:

Enroflox[®] (brand of enrofloxacin) Injectable Solution is indicated for the management of diseases in dogs associated with bacteria susceptible to enrofloxacin.

EFFICACY CONFIRMATION:

Clinical efficacy was established in dermal infections (wounds and abscesses) associated with susceptible strains of *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, and *Staphylococcus intermedius*; respiratory infections (pneumonia, tonsillitis, rhinitis) associated with susceptible strains of *Escherichia coli* and *Staphylococcus aureus* and urinary cystitis associated with susceptible strains of *Escherichia coli*, *Proteus mirabilis*, and *Staphylococcus aureus*.

CONTRAINDICATIONS:

Enrofloxacin is contraindicated in dogs known to be hypersensitive to quinolones.

Based on the studies discussed under the section on Animal Safety Summary, the use of enrofloxacin is contraindicated in small and medium breeds of dogs during the rapid growth phase (between 2 and 8 months of age). The safe use of enrofloxacin has not been established in large and giant breeds during the rapid growth phase. Large breeds may be in this phase for up to one year of age and the giant breeds for up to 18 months. In clinical field trials utilizing a daily oral dose of 5.0 mg/kg, there were no reports of lameness or joint problems in any breed. However, controlled studies with histological examination of the articular cartilage have not been conducted in the large or giant breeds.

ADVERSE REACTIONS:

No drug-related side effects were reported in 122 clinical cases treated with an enrofloxacin injectable solution followed by enrofloxacin tablets at 5.0 mg/kg per day.

To report adverse reactions, call Norbrook at 1-866-591-5777

ANIMAL SAFETY SUMMARY:

Adult dogs receiving enrofloxacin orally at a daily dosage rate of 52 mg/kg for 13 weeks had only isolated incidences of vomiting and inappetence. Adult dogs receiving the tablet formulation for 30 consecutive days at a daily treatment of 25 mg/kg did not exhibit significant clinical signs nor were there effects upon the clinical chemistry, hematological or histological parameters. Daily doses of 125 mg/kg for up to 11 days induced vomiting, inappetence, depression, difficult locomotion and death while adult dogs receiving 50 mg/kg/day for 14 days had clinical signs of vomiting and inappetence.

Adult dogs dosed intramuscularly for three treatments at 12.5 mg/kg followed by 57 oral treatments at 12.5 mg/kg, all at 12 hour intervals, did not exhibit either significant clinical signs or effects upon the clinical chemistry, hematological or histological parameters.

Oral treatment of 15 to 28 week old growing puppies with daily dosage rates of 25 mg/kg has induced abnormal carriage of the carpal joint and weakness in the hindquarters. Significant improvement of clinical signs is observed following drug withdrawal. Microscopic studies have identified lesions of the articular cartilage following 30 day treatments at either 5, 15 or 25 mg/kg in this age group. Clinical signs of difficult ambulation or associated cartilage lesions have not been observed in 29 to 34 week old puppies following daily treatments of 25 mg/kg for 30 consecutive days nor in 2 week old puppies with the same treatment schedule.

Tests indicated no effect on circulating microfilariae or adult heartworms (*Dirofilaria immitis*) when dogs were treated at a daily dosage rate of 15 mg/kg for 30 days. No effect on cholinesterase values was observed. No adverse effects were observed on reproductive parameters when male dogs received 10 consecutive daily treatments of 15 mg/kg/day at 3 intervals

(90, 45 and 14 days) prior to breeding or when female dogs received 10 consecutive daily treatments of 15 mg/kg/day at 4 intervals; between 30 and 0 days prior to breeding, early pregnancy (between 10th and 30th days), late pregnancy (between 40th and 60th days), and during lactation (the first 28 days).

DRUG INTERACTIONS:

Concomitant therapy with other drugs that are metabolized in the liver may reduce the clearance rates of the quinolone and the other drug.

Enrofloxacin has been administered to dogs at a daily dosage rate of 10 mg/kg concurrently with a wide variety of other health products including anthelmintics (praziquantel, febantel), insecticides (pyrethrins), heartworm preventatives (diethylcarbamazine) and other antibiotics (ampicillin, gentamicin sulfate, penicillin). No incompatibilities are known with other drugs at this time.

WARNINGS:

For use in animals only. The use of this product in cats may result in Retinal Toxicity. Keep out of reach of children.

Avoid contact with eyes. In case of contact, immediately flush eyes with copious amounts of water for 15 minutes. In case of dermal contact, wash skin with soap and water. Consult a physician if irritation persists following ocular or dermal exposure. Individuals with a history of hypersensitivity to quinolones should avoid this product. In humans, there is a risk of user photosensitization within a few hours after excessive exposure to quinolones. If excessive accidental exposure occurs, avoid direct sunlight. For customer service, to obtain a copy of the Safety Data Sheet (SDS) or to report adverse reactions call Norbrook at 1-866-591-5777.

PRECAUTION:

Quinolone-class drugs should be used with caution in animals with known or suspected Central Nervous System (CNS) disorders. In such animals, quinolones have, in rare instances, been associated with CNS stimulation which may lead to convulsive seizures.

Quinolone-class drugs have been associated with cartilage erosions in weight-bearing joints and other forms of arthropathy in immature animals of various species.

The use of fluoroquinolones in cats has been reported to adversely affect the retina. Such products should be used with caution in cats.

DOSAGE AND ADMINISTRATION:

Enroflox Injection for Dogs may be used as the initial dose at 2.5 mg/kg. It should be administered intramuscularly (IM) as a single dose, followed by initiation of enrofloxacin tablet therapy.

Enroflox Injection for Dogs may be administered as follows:

Weight Of Animal	Enroflox [®] Injection for Dogs*
	2.5 mg/kg
9.1 kg (20 lb)	1.00 mL
27.2 kg (60 lb)	3.00 mL

*The initial Enroflox Injection for Dogs administration should be followed 12 hours later by initiation of enrofloxacin tablet therapy.

The lower limit of the dose range was based on efficacy studies in dogs where enrofloxacin was administered at 2.5 mg/kg twice daily. Target animal safety and toxicology studies were used to establish the upper limit of the dose range and treatment duration.

STORAGE:

Store at 59°-77°F (15°-25°C). Excursions permitted up to 86°F (30°C). Brief exposure to temperature up to 104°F (40°C) may be tolerated provided the mean kinetic temperature does not exceed 77°F (25°C); however, such exposure should be minimized. Protect from direct sunlight. Do not freeze. Use within 90 days of first puncture.

HOW SUPPLIED:

Enroflox Injection for Dogs Vial Sizes 20 mL, 50 mL and 100 mL

REFERENCES:

¹ Dougherty, T.J. and Saukkonen, J.J. Membrane Permeability Changes Associated with DNA Gyrase Inhibitors in *Escherichia coli*. Antimicrob. Agents and Chemoth., V. 28, Aug. 1985: 200-206.

² Walker, R.D., et al. Pharmacokinetic Evaluation of Enrofloxacin Administered Orally to Healthy Dogs. Am.J.Res., V. 53, No. 12, Dec. 1992: 2315-2319.

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TAKE TIME

OBSERVE LABEL
DIRECTIONS

Rev. 04/17


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