

# LEVOFLOXACIN- levofloxacin solution/ drops

## BPI LABS LLC

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### HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use LEVOFLOXACIN OPTHALMIC SOLUTION safely and effectively. See full prescribing information for LEVOFLOXACIN OPTHALMIC SOLUTION.

### LEVOFLOXACIN ophthalmic solution 1.5%, sterile topical ophthalmic solution

Initial U.S. Approval: 1996

#### INDICATIONS AND USAGE

Levofloxacin ophthalmic solution is a topical quinolone anti-microbial indicated for the treatment of corneal ulcer caused by susceptible strains of the following bacteria:

*Corynebacterium species* \*

*Staphylococcus aureus*

*Staphylococcus epidermidis*

*Streptococcus pneumonia*

*Viridans group streptococci*\*

*Pseudomonas aeruginosa*

*Serratia marcescens*\*

\*Efficacy for this organism was studied in fewer than 10 infections. (1)

#### DOSAGE AND ADMINISTRATION

Days 1 through 3:

Instill one to two drops in the affected eye(s) every 30 minutes to 2 hours while awake and approximately 4 and 6 hours after retiring.

Day 4 through treatment completion:

Instill one to two drops in the affected eye(s) every 1 to 4 hours while awake. (2)

#### DOSAGE FORMS AND STRENGTHS

5 cc container filled with 5 mL sterile ophthalmic solution of levofloxacin, 1.5% (3)

#### CONTRAINDICATIONS

Levofloxacin ophthalmic solution is contraindicated in patients with a history of hypersensitivity to levofloxacin, to other quinolones, or to any of the components in this medication. (4)

#### WARNINGS AND PRECAUTIONS

- Hypersensitivity and anaphylaxis have been reported with systemic use of levofloxacin. (5.1)
- Prolonged use may result in the overgrowth of non- susceptible organisms, including fungi. (5.2)
- Patients should not wear contact lenses if they have signs or symptoms of corneal ulcer. (5.3)

#### ADVERSE REACTIONS

The most frequently reported adverse reactions in the overall study population were headache and a taste disturbance following instillation. These reactions occurred in approximately 8 to 10% of patients. (6)

**To report SUSPECTED ADVERSE REACTIONS, contact BPI Labs LLC at (727)471-0850 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).**

**See 17 for PATIENT COUNSELING INFORMATION.**

Revised: 7/2020

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\* Sections or subsections omitted from the full prescribing information are not listed.

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## **FULL PRESCRIBING INFORMATION**

### **1 INDICATIONS AND USAGE**

Levofloxacin ophthalmic solution is indicated for the treatment of corneal ulcer caused by susceptible strains of the following bacteria:

#### **Gram-positive bacteria:**

*Corynebacterium species*

*Staphylococcus aureus*

*Staphylococcus epidermidis*

*Streptococcus pneumonia*

*Viridans group streptococci\**

#### **Gram-negative bacteria:**

*Pseudomonas aeruginosa*

*Serratia marcescens*\*

\*Efficacy for this organism was studied in fewer than 10 infections

## **2 DOSAGE AND ADMINISTRATION**

### Days 1 through 3:

Instill one to two drops in the affected eye(s) every 30 minutes to 2 hours while awake and approximately 4 and 6 hours after retiring.

### Day 4 through treatment completion:

Instill one to two drops in the affected eye(s) every 1 to 4 hours while awake.

## **3 DOSAGE FORMS AND STRENGTHS**

5 cc bottle filled with 5 mL sterile ophthalmic solution of levofloxacin, 1.5%.

## **4 CONTRAINDICATIONS**

Levofloxacin ophthalmic solution is contraindicated in patients with a history of hypersensitivity to levofloxacin, to other quinolones, or to any of the components in this medication.

## **5 WARNINGS AND PRECAUTIONS**

### **5.1 Hypersensitivity Reactions**

In patients receiving systemically administered quinolones, including levofloxacin, serious and occasionally fatal hypersensitivity (anaphylactic) reactions have been reported, some following the first dose. Some reactions were accompanied by cardiovascular collapse, loss of consciousness, angioedema, (including laryngeal, pharyngeal or facial edema), airway obstruction, dyspnea, urticaria and itching. If an allergic reaction to levofloxacin occurs, discontinue the drug. Serious acute hypersensitivity reactions may require immediate emergency treatment. Oxygen and airway management should be administered as clinically indicated.

### **5.2 Growth of Resistant Organisms with Prolonged Use**

As with other anti-infectives, prolonged use may result in overgrowth of non-susceptible organisms, including fungi. If superinfection occurs, discontinue use and institute alternative therapy. Whenever clinical judgment dictates, the patient should be examined with the aid of magnification, such as slit-lamp biomicroscopy, and where appropriate, fluorescein staining.

### **5.3 Avoidance of Contact Lens Wear**

Patients should be advised not to wear contact lenses if they have signs and symptoms of corneal ulcer.

## **6 ADVERSE REACTIONS**

The most frequently reported adverse reactions in the overall study population were headache and a taste disturbance following instillation. These reactions occurred in approximately 8 to 10% of patients. Adverse reactions occurring in approximately 1 to 2% of patients included decreased/blurred vision, diarrhea, dyspepsia, fever, infection, instillation site irritation/discomfort, ocular infection, nausea, ocular pain/discomfort, and throat irritation. Other reported ocular reactions occurring in less than 1% of patients included chemosis, corneal erosion, diplopia, floaters, hyperemia, lid edema, and lid erythema.

## **8 USE IN SPECIFIC POPULATIONS**

### **8.1 Pregnancy**

Pregnancy Category C

Teratogenic Effects: Levofloxacin at oral doses of 810 mg/kg/day in rats caused decreased fetal body weight and increased fetal mortality. No teratogenic effect was observed when rabbits were dosed orally as high as 50 mg/kg/day, at which systemic exposure was estimated to be 250 times that observed at the maximum recommended human ophthalmic dose, or when dosed intravenously as high as 25 mg/kg/day, at which systemic exposure was estimated to be 120 times that observed at the maximum recommended human ophthalmic dose.

There are, however, no adequate and well-controlled studies in pregnant women. Levofloxacin should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

### **8.3 Nursing Mothers**

Levofloxacin has not been measured in human milk. Based on data from ofloxacin, it can be presumed that levofloxacin is excreted in human milk. Caution should be exercised when levofloxacin is administered to a nursing mother.

### **8.4 Pediatric Use**

Safety and effectiveness in children below the age of six years have not been established. Oral administration of systemic quinolones has been shown to cause arthropathy in immature animals. There is no evidence that the ophthalmic administration of levofloxacin has any effect on weight bearing joints.

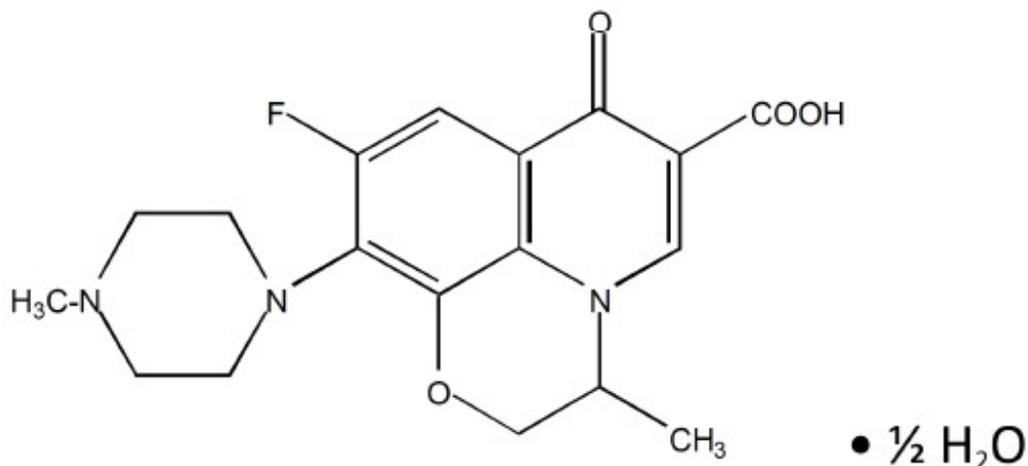
### **8.5 Geriatric Use**

No overall differences in safety or effectiveness have been observed between elderly and other adult patients.

## **10 OVERDOSAGE**

## **11 DESCRIPTION**

Levofloxacin ophthalmic solution 1.5% is a sterile topical ophthalmic solution. Levofloxacin is a fluoroquinolone antibacterial active against a broad spectrum of Gram-positive and Gram-negative ocular pathogens. Levofloxacin is a fluorinated 4-quinolone containing a six-member (pyridobenzoxazine) ring from positions 1 to 8 of the basic ring structure. Levofloxacin is the pure (-)-(S)-enantiomer of the racemic drug substance, ofloxacin. It is more soluble in water at neutral pH than ofloxacin.



C<sub>18</sub>H<sub>20</sub>FN<sub>3</sub>O<sub>4</sub> · ½ H<sub>2</sub>O                      Mol Wt 370.38

Chemical Name: (-)-(S)-9-fluoro-2,3-dihydro-3-methyl-10-(4-methyl-1-piperazinyl)-7-oxo-7H-pyrido[1,2,3-de]-1,4-benzoxazine-6-carboxylic acid hemihydrate. Levofloxacin (hemihydrate) USP is a yellowish-white crystalline powder. Each mL of levofloxacin ophthalmic solution contains 15.36 mg of levofloxacin hemihydrate USP equivalent to 15 mg levofloxacin.

Contains: Active: Levofloxacin (hemihydrate) USP is a light yellowish-white; Inactives: glycerin and water for injection. May also contain hydrochloric acid and/or sodium hydroxide to adjust pH to approximately 6.7. Levofloxacin ophthalmic solution is isotonic with an osmolality of approximately 291 mOsm/kg.

## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

Levofloxacin is a member of the fluoroquinolone class of anti-microbial drug (See 12.4 Microbiology).

### 12.3 Pharmacokinetics

Levofloxacin concentration in plasma was measured in 14 healthy adult volunteers during a 16-day course of treatment with levofloxacin ophthalmic solution. The dosing schedule was 1 to 2 drops per eye once in the morning on Days 1 and 16; 1 to 2 drops per eye every two hours Days 2 through 8; and 1 to 2 per eye every four hours Days 9 through 15. The mean levofloxacin concentration in plasma 1 hour post dose ranged from 3.13 ng/mL on Day 1 to 10.4 ng/mL on Day 16.

Maximum mean levofloxacin concentrations increased from 3.22 ng/mL on Day 1 to 10.9 ng/mL on Day 16, which is more than 400 times lower than those reported after standard oral doses of levofloxacin.

Levofloxacin concentration in tears was measured in 100 healthy adult volunteers at various time points following instillation of 2 drops of levofloxacin ophthalmic solution. Mean tear concentration measured 15 minutes after instillation was 757 mcg/mL.

## 12.4 Microbiology

Levofloxacin is the L-isomer of the racemate, ofloxacin, a quinolone antimicrobial agent. The antibacterial activity of ofloxacin resides primarily in the L-isomer. The mechanism of action of levofloxacin and other fluoroquinolone antimicrobials involves the inhibition of bacterial topoisomerase IV and DNA gyrase (both of which are type II topoisomerases), enzymes required for DNA replication, transcription, repair, and recombination.

Levofloxacin has *in vitro* activity against a wide range of Gram-negative and Gram-positive microorganisms and is often bactericidal at concentrations equal to or slightly greater than inhibitory concentrations.

Fluoroquinolones, including levofloxacin, differ in chemical structure and mode of action from  $\beta$ -lactam antibiotics and aminoglycosides, and therefore may be active against bacteria resistant to  $\beta$ -lactam antibiotics and aminoglycosides. Additionally,  $\beta$ -lactam antibiotics and aminoglycosides may be active against bacteria resistant to levofloxacin. Resistance to levofloxacin due to spontaneous mutation *in vitro* is a rare occurrence (range:  $10^{-9}$  to  $10^{-10}$ ).

Levofloxacin has been shown to be active against most strains of the following microorganisms, both *in vitro* and in clinical infections as described in the INDICATIONS AND USAGE section.

### Aerobic gram-positive microorganisms:

*Corynebacterium species\**

*Staphylococcus aureus*

*Staphylococcus epidermidis*

*Streptococcus pneumoniae*

*Viridans group streptococci\**

### Aerobic gram-negative microorganisms:

*Pseudomonas aeruginosa*

*Serratia marcescens\**

\*Efficacy for this organism was studied in fewer than 10 infections.

The following *in vitro* data are also available, but their clinical significance in ophthalmic infections is unknown. The safety and effectiveness of levofloxacin in treating ophthalmological infections due to these microorganisms have not been established in adequate and well controlled trials.

These organisms are considered susceptible when evaluated using systemic breakpoints. However, a correlation between the *in vitro* systemic breakpoint and

ophthalmological efficacy has not been established. The list of organisms is provided as guidance only in assessing the potential treatment of corneal ulcer. Levofloxacin exhibits *in vitro* minimal inhibitory concentrations (MICs) of 2 mcg/mL or less (systemic susceptible breakpoint) against most ( $\geq 90\%$ ) strains of the following ocular pathogens:

Aerobic gram-positive microorganisms:

*Enterococcus faecalis* (many strains are only moderately susceptible)

*Staphylococcus saprophyticus*

*Streptococcus agalactiae*

*Streptococcus pyogenes*

*Streptococcus* (Group C/F)

*Streptococcus* (Group G)

Aerobic gram-negative microorganisms:

*Acinetobacter baumannii*

*Acinetobacter lwoffii*

*Citrobacter koseri*

*Citrobacter freundii*

*Enterobacter aerogenes*

*Enterobacter cloacae*

*Escherichia coli*

*Haemophilus influenzae*

*Haemophilus parainfluenzae*

*Klebsiella oxytoca*

*Klebsiella pneumoniae*

*Legionella pneumophila*

*Moraxella catarrhalis*

*Morganella morganii*

*Neisseria gonorrhoeae*

*Pantoea agglomerans*

*Proteus mirabilis*

*Proteus vulgaris*

*Providencia rettgeri*

*Providencia stuartii*

*Pseudomonas fluorescens*

## **13 NONCLINICAL TOXICOLOGY**

### **13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility**

In a long term carcinogenicity study in rats, levofloxacin exhibited no carcinogenic or tumorigenic potential following daily dietary administration for 2 years at doses up to 100 mg/kg/day, corresponding to plasma levels that were 245 times maximum clinical exposure, based on C<sub>max</sub>.

Levofloxacin was not mutagenic in the following assays: Ames bacterial mutation assay (*S. typhimurium* and *E. coli*) CHO/HGPRT forward mutation assay, mouse micronucleus test, mouse dominant lethal test, rat unscheduled DNA synthesis assay, and the in vivo mouse sister chromatid exchange assay. It was positive in the in vitro chromosomal aberration (CHL cell line) and in vitro sister chromatid exchange (CHL/IU cell line) assays. Levofloxacin caused no impairment of fertility or reproduction in rats at oral doses as high as 360 mg/kg/day, at which systemic exposure was estimated to be 2,600 times that at the maximum recommended human ophthalmic dose.

## **14 CLINICAL STUDIES**

In two randomized, double-masked, multi-center, controlled clinical trials of 280 patients with positive cultures, subjects were dosed with levofloxacin or ofloxacin 0.3% ophthalmic solution.

Dosing occurred on Days 1 through 3 every two hours while awake and 4 and 6 hours after retiring. Dosing occurred on Day 4 through treatment completion 4 times daily while awake. Clinical cure was defined as complete re-epithelialization and no progression of the infiltrate for two consecutive visits. The levofloxacin treated subjects had an approximately equal mean clinical cure rate of 80% (73% to 87%) compared to 84% (82% to 86%) for the subjects treated with ofloxacin 0.3% ophthalmic solution.

## **16 HOW SUPPLIED/STORAGE HANDLING**

Levofloxacin ophthalmic solution 1.5% is supplied in a sterile with a white opaque cylindrical shaped low density polyethylene bottle with an open white opaque cone shaped low density polyethylene controlled dropper tip and a tan color cone shaped high density polyethylene cap in the following size:

5 mL fill in 5 cc container- NDC 54288-140-01

Storage: Store at 15° to 25°C (59° to 77°F).

## **17 PATIENT COUNSELING INFORMATION**

### **17.1 Avoid Contamination of the Product**

Advise patients to avoid contaminating the applicator tip with material from the eye, finger, or other source.

### **17.2 Avoid Contact Lens Wear**

Advise patients not to wear contact lenses if they have signs and symptoms of corneal

ulcer.

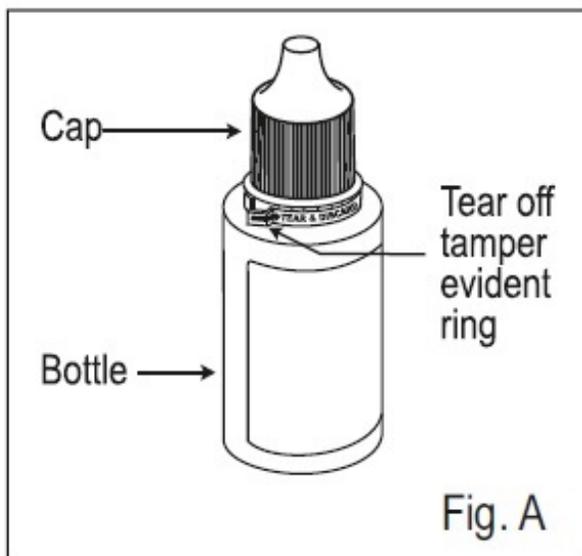
### 17.3 Hypersensitivity Reactions

Systemically administered quinolones, including levofloxacin, have been associated with hypersensitivity reactions, even following a single dose. Advise patients to discontinue use immediately and contact their physician at the first sign of a rash or allergic reactions.

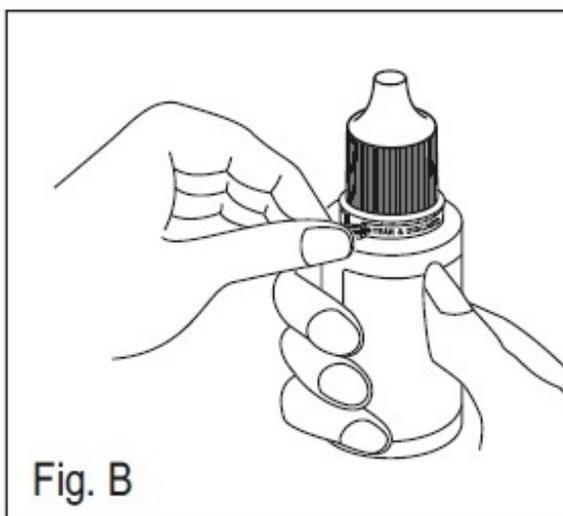
#### INSTRUCTIONS FOR USE

Before you use Levofloxacin Ophthalmic Solution for the first time:

1. Check to make sure that the tamper evident ring between the bottle and the cap is not broken ( See Figure A). If the tamper evident ring is broken or missing, contact your pharmacist.

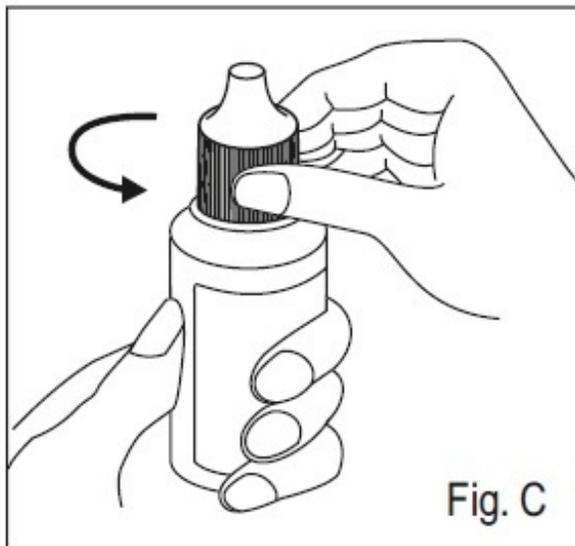


2. Tear off the tamper evident ring ( See Figure B).



3. To open the bottle, remove the cap by turning it in the counterclockwise direction

( See Figure C).



This Instructions for Use has been approved by the U.S. Food and Drug Administration.

Manufactured by:

**Micro Labs Limited**

Banglore-560099. INDIA.

Distributed by:

**BPI Labs, LLC**

Freehold, NJ 07728

LI32I R-2006

**PACKAGE LABEL.PRINCIPAL DISPLAY PANEL**

NDC 54288-140-01

Levofloxacin Ophthalmic Solution 1.5%

FOR TOPICAL APPLICATION IN THE EYE

Rx Only

5 mL

BPI LABS, LLC



Rx Only NDC 54288-140-01

Levofloxacin Ophthalmic Solution 1.5%  
 FOR TOPICAL APPLICATION IN THE EYE  
 5 mL  
 BPI LABS, LLC



Rx Only



USL-041

NDC 54288-140-01

# Levofloxacin

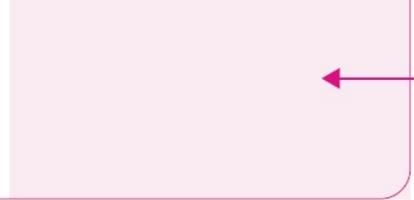
Ophthalmic Solution

1.5%

FOR TOPICAL APPLICATION IN THE EYE  
5 mL



M.L.No: KTK/28/357/2006  
Manufactured by:  
**Micro Labs Limited**  
Bangalore-560 099, INDIA.  
Distributed by:  
**BPI Labs, LLC**  
Freehold, NJ 07728  
Made in India  
LI140L-01 R-2006



## LEVOFLOXACIN

levofloxacin solution/ drops

### Product Information

<b>Product Type</b>	HUMAN PRESCRIPTION DRUG	<b>Item Code (Source)</b>	NDC:54288-140
<b>Route of Administration</b>	OPHTHALMIC		

### Active Ingredient/Active Moiety

Ingredient Name	Basis of Strength	Strength
<b>LEVOFLOXACIN</b> (UNII: 6GNT3Y5LMF) (LEVOFLOXACIN ANHYDROUS - UNII:RIX4E89Y14)	LEVOFLOXACIN ANHYDROUS	15 mg in 1 mL

### Inactive Ingredients

Ingredient Name	Strength
<b>GLYCERIN</b> (UNII: PDC6A3C0OX)	
<b>HYDROCHLORIC ACID</b> (UNII: QTT17582CB)	
<b>SODIUM HYDROXIDE</b> (UNII: 55X04QC32I)	
<b>WATER</b> (UNII: 059QF0KO0R)	

### Product Characteristics

<b>Color</b>	yellow (greenish yellow)	<b>Score</b>	
<b>Shape</b>		<b>Size</b>	
<b>Flavor</b>		<b>Imprint Code</b>	
<b>Contains</b>			

### Packaging

#	Item Code	Package Description	Marketing Start Date	Marketing End Date
1	NDC:54288-140-01	1 in 1 CARTON	07/13/2020	

1	5 mL in 1 CARTON; Type 0: Not a Combination Product		
<b>Marketing Information</b>			
<b>Marketing Category</b>	<b>Application Number or Monograph Citation</b>	<b>Marketing Start Date</b>	<b>Marketing End Date</b>
ANDA	ANDA205600	07/13/2020	

**Labeler -** BPI LABS LLC (078627620)

<b>Establishment</b>			
<b>Name</b>	<b>Address</b>	<b>ID/FEI</b>	<b>Business Operations</b>
Micro Labs Limited		677600482	manufacture(54288-140)

Revised: 10/2023

BPI LABS LLC