

# Recommended antimicrobial treatment for plague

**Begin appropriate therapy as soon as plague is suspected.** Gentamicin and fluoroquinolones are first-line treatments in the U.S. Treatment duration is 10-14 days but can be extended for patients with ongoing fever or other concerning signs. Patients can be treated with IV or oral antimicrobials, depending on illness severity and other clinical factors.

The regimens listed below may need to be adjusted depending on a patient's age, medical history, underlying health conditions, or allergies. Please use clinical judgment and, if needed, consult an infectious disease specialist regarding individual patient treatment decisions.

## Recommended antimicrobial treatment of **ADULTS AND CHILDREN** with **PNEUMONIC OR SEPTICEMIC PLAGUE**

Pediatric regimens are for children aged  $\geq 1$  month to  $\leq 17$  years.

Antimicrobial	Dose	Route of administration	Notes
Ciprofloxacin	Adults: 400 mg every 8 hrs	IV	FDA approved based on animal studies and clinical data. <sup>1</sup>
	Children: 10 mg/kg every 8 or 12 hrs (maximum 400 mg/dose)		
	Adults: 750 mg every 12 hrs	PO	
	Children: 15 mg/kg every 8 or 12 hrs (maximum 500 mg/dose every 8 hrs or 750 mg/dose every 12 hrs)		
Levofloxacin	Adults: 750 mg every 24 hrs	IV or PO	FDA approved based on animal studies; clinical data for human plague is limited.
	Children: Weight <50 kg: 8 mg/kg every 12 hrs (maximum 250 mg/dose) Weight $\geq 50$ kg: 500-750 mg every 24 hrs		
Moxifloxacin	Adults: 400 mg every 24 hrs	IV or PO	FDA approved based on animal studies; clinical data for human plague is limited. Moxifloxacin is a first-line treatment for adults but an alternative for children, since it is not FDA approved for use in children aged $\leq 17$ years.
	Children: See notes		
Gentamicin	Adults: 5 mg/kg every 24 hrs	IV or IM	Not FDA approved but considered an effective alternative to streptomycin. <sup>2,3</sup>
	Children: 4.5-7.5 mg/kg every 24 hrs		
Streptomycin	Adults: 1 g every 12 hrs	IV or IM	FDA approved based on clinical experience. Not widely available in the US. The IV formulation is not approved by FDA; however, the IM formulation has been given IV as an off-label use. <sup>4</sup>
	Children: 15 mg/kg every 12 hrs (maximum 1 g/dose)		

<sup>1</sup>Apangu T, Griffith K, Abaru J, et al. Successful treatment of human plague with oral ciprofloxacin. *Emerg Infect Dis.* 2017;23:553-5.

<sup>2</sup>Boulanger LL, Ettestad P, Fogarty JD, Dennis DT, Romig D, Mertz G. Gentamicin and tetracyclines for the treatment of human plague: Review of 75 cases in New Mexico, 1985–1999. *Clin Infect Dis.* 2004 38(5):663-669.

<sup>3</sup>Mwengee W, Butler T, Mgema S, Mhina G, Almasi Y, Bradley C, Formanik JB, Rochester CG. Treatment of plague with gentamicin or doxycycline in a randomized clinical trial in Tanzania. *Clin Infect Dis.* 2006 42(5):614-21.

<sup>4</sup>Morris JT, Cooper RH. Intravenous streptomycin: a useful route of administration. *Clin Infect Dis.* 1994;19:1150–1.

## Recommended antimicrobial treatment of **ADULTS AND CHILDREN** with **BUBONIC OR PHARYNGEAL PLAGUE**

Begin appropriate therapy as soon as plague is suspected. Pediatric regimens are for children aged ≥1 month to ≤17 years.

Antimicrobial	Dose	Route of administration	Notes
Ciprofloxacin	Adults: 400 mg every 8 hrs	IV	FDA approved based on animal studies and clinical data. <sup>1</sup>
	Children: 10 mg/kg every 8 or 12 hrs (maximum 400 mg/dose)		
	Adults: 750 mg every 12 hrs	PO	
	Children: 15 mg/kg every 8 or 12 hrs (maximum 500 mg/dose every 8 hrs or 750 mg/dose every 12 hrs)		
Levofloxacin	Adults: 750 mg every 24 hrs	IV or PO	FDA approved based on animal studies; clinical data for human plague is limited.
	Children: Weight <50 kg: 8 mg/kg every 12 hrs (maximum 250 mg/dose) Weight ≥50 kg: 500-750 mg every 24 hrs.		
Moxifloxacin	Adults: 400 mg every 24 hrs	IV or PO	FDA approved based on animal studies; clinical data for human plague is limited. Moxifloxacin is a first-line treatment for adults but an alternative for children, since it is not FDA approved for use in children aged ≤17 years.
	Children: See notes		
Doxycycline	Adults: 200 mg loading dose, then 100 mg every 12 hrs	IV or PO	Bacteriostatic, but FDA approved and effective in a randomized trial when compared to gentamicin. <sup>2</sup> No evidence of tooth staining after multiple short courses. <sup>3</sup>
	Children: Weight <45 kg: 4.4 mg/kg loading dose, then 2.2 mg/kg every 12 hrs (maximum 100 mg/dose) Weight ≥45 kg: same as adult dose		
Gentamicin	Adults: 5 mg/kg every 24 hrs	IM or IV	Not FDA approved but considered an effective alternative to streptomycin. <sup>2,4,5</sup>
	Children: 4.5-7.5 mg/kg every 24 hrs		
Streptomycin	Adults: 1 g every 12 hrs	IM or IV	FDA approved based on clinical experience. Not widely available in the US. The IV formulation is not approved by FDA; however, the IM formulation has been given IV as an off-label use. <sup>5,6</sup>
	Children: 15 mg/kg every 12 hrs (maximum 1 g/dose)		

<sup>1</sup>Apangu T, Griffith K, Abaru J, et al. Successful treatment of human plague with oral ciprofloxacin. *Emerg Infect Dis.* 2017;23:553-5.

<sup>2</sup>Mwenge W, Butler T, Mgema S, Mhina G, Almasi Y, Bradley C, Formanik JB, Rochester CG. Treatment of plague with gentamicin or doxycycline in a randomized clinical trial in Tanzania. *Clin Infect Dis.* 2006 42(5):614-21.

<sup>3</sup>Todd SR, Dahlgren FS, Traeger MS, Beltrán-Aguilar ED, Marianos DW, Hamilton C, McQuiston JH, Regan JJ. No visible dental staining in children treated with doxycycline for suspected Rocky Mountain spotted fever. *J Pediatr.* 2015 May;166(5):1246-51.

<sup>4</sup>Boulanger LL, Ettestad P, Fogarty JD, Dennis DT, Romig D, Mertz G. Gentamicin and tetracyclines for the treatment of human plague: Review of 75 cases in New Mexico, 1985–1999. *Clin Infect Dis.* 2004 38(5):663-669.

<sup>5</sup> Since abscesses such as buboes have lower pH than most human tissues, transport of aminoglycosides into the bacterial cell may be reduced. Clinicians may consider alternative or dual therapy for patients with large buboes.

<sup>6</sup>Morris JT, Cooper RH. Intravenous streptomycin: a useful route of administration. *Clin Infect Dis.* 1994;19:1150–1.

Recommended antimicrobial treatment of **PREGNANT WOMEN** with **PNEUMONIC, SEPTICEMIC, BUBONIC, OR PHARYNGEAL PLAGUE**

Begin appropriate therapy as soon as plague is suspected.

Antimicrobial	Dose	Route of administration	Notes
<b>Gentamicin PLUS</b>	Same as adult dose	IM or IV	Not FDA approved but considered an effective alternative to streptomycin. <sup>1,2,3</sup>
<b>Ciprofloxacin OR</b>	400 mg every 8 hrs	IV	FDA approved based on animal studies and clinical data. <sup>4</sup>
	500 mg every 8 hrs	PO	
<b>Levofloxacin</b>	Same as adult dose	IV or PO	FDA approved based on animal studies; clinical data for human plague is limited.

<sup>1</sup>Mwengee W, Butler T, Mgema S, Mhina G, Almasi Y, Bradley C, Formanik JB, Rochester CG. Treatment of plague with gentamicin or doxycycline in a randomized clinical trial in Tanzania. *Clin Infect Dis*. 2006 42(5):614-21.

<sup>2</sup>Boulanger LL, Ettestad P, Fogarty JD, Dennis DT, Romig D, Mertz G. Gentamicin and tetracyclines for the treatment of human plague: Review of 75 cases in New Mexico, 1985–1999. *Clin Infect Dis*. 2004 38(5):663-669.

<sup>3</sup>Since abscesses such as buboes have lower pH than most human tissues, transport of aminoglycosides into the bacterial cell may be reduced. Clinicians may consider alternative or dual therapy for patients with large buboes.

<sup>4</sup>Apangu T, Griffith K, Abaru J, et al. Successful treatment of human plague with oral ciprofloxacin. *Emerg Infect Dis*. 2017;23:553-5.

**For more information, please contact:**

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