

Antibiotics alone, cannot protect a community from an anthrax attack!

Anthrax (*Bacillus anthracis*) has been made to resist every recommended antibiotic available by prescription or stored in the U.S. CDC Strategic National Stockpile:^{1,2,3,4,5}

- ciprofloxacin (Cipro[®])^{2, 3, 6} and ofloxacin (Floxin[®])^{2, 4, 6}
- doxycycline^{3, 4} and tetracycline^{3, 4}
- penicillin G² and amoxicillin (Amoxil[®])²
- ceftriaxone (Rocephin[®])²
- vancomycin (Vancocin[®])² and clindamycin (Cleocin[®])²
- erythromycin^{2,3} and azithromycin³ (Zithromax[®]) and clarithromycin (Biaxin[®])^{2, 3}

A regimen of 60 days of antibiotics is probably not be enough to prevent or cure anthrax.

- Anthrax spores can be detected in the lungs of monkeys (the best model for human disease) for at least 100 days after exposure.⁶ This lingering threat can outlast antibiotic regimens.⁷
- Spores can lay dormant in the host mammal for up to 60 days before germinating and attacking.⁸
- Antibiotics have no effect on anthrax spores or the toxins produced by the organism.⁹
- An antibiotic course of 100 days is necessary to protect against infection induced by lingering spores that germinate later.¹⁰

Patient adherence to long term antibiotic regiments is poor.¹¹

- In the 2001 anthrax attacks, compliance and persistency to the prescribed 60 day course of Cipro[®] ranged from 21% of persons exposed at the Morgan postal facility in New York City to 64% of persons exposed at the Brentwood postal facility in Washington, D.C.

Adverse events associated with antimicrobial prophylaxis in victims of the 2001 anthrax attacks are commonly reported.¹¹

- Of the 5,343 persons who reported taking at least one dose of antibiotic, 57% (n=3,032) reported adverse events during the first 60 days of the prescribed regimen.¹¹
- At the post 60 day follow-up, 16% (n=842) of respondents who took at least one dose of antibiotic reported seeking medical care for adverse events caused by the antibiotic.¹¹

Long term antibiotic therapy, as recommended for the treatment of exposure to anthrax, might induce antimicrobial resistance in *Bacillus anthracis* by the selection of resistant mutants.^{2,12}

CONCLUSION – Pre-attack vaccination is the cornerstone of community preparedness against anthrax.

¹ Athamna et al. Selection of *Bacillus anthracis* isolates resistant to antibiotics. J Antimicrob Chemotherapy(2004) 54, 424-428.

² Brook, I., Elliott, T. B., Pryor, H. I. et al. (2001). In vitro resistance of *Bacillus anthracis* Sterne to doxycycline, macrolides and quinolones. International Journal of Antimicrobial Agents 18, 559-62.

³ Pomerantsev, A. P., Shishkova, N. A. & Marinin, L. I. (1992). Comparison of therapeutic effects of antibiotics of the tetracycline group in the treatment of anthrax caused by a strain inheriting tet-gene of plasmid pBC16. Antibioticki i Khimioterapiia 37, 31-4.

⁴ Price, L. B., Volger, A., Pearson, T. et al. (2003). In vitro selection and characterization of *Bacillus anthracis* mutants with high level resistance to ciprofloxacin. Antimicrobial Agents and Chemotherapy 47, 2362-5.

⁵ Choe, C. H., Bouhauala, S., Brook, I. et al. (2000). In vitro development of resistance to ofloxacin and doxycycline in *Bacillus anthracis*. Antimicrobial Agents and Chemotherapy 44, 1766.

⁶ Henderson D. W., Peacock, S., Belton, F.C. Observations on the prophylaxis of experimental pulmonary anthrax in the monkey. J Hyg (Lond): 1956; Mar;54(1):28-36.

⁷ Brookmeyer R., Johnson, E., Bollinger, R. Modeling the optimum duration of antibiotic prophylaxis in an anthrax outbreak. PNAS (2003) Vol. 100, No. 17; 10129-10132.

⁸ Friedlander A. M. et al. Postexposure prophylaxis against experimental inhalation anthrax. J Infect Disease 1993;167:1239-43.

⁹ Spencer R. C., *Bacillus anthracis*. J Clin Pathol 2003;56:182-197

¹⁰ Brookmeyer R., Johnson E., Barry S. Modelling the incubation period of anthrax. Stat Med. 2005 Feb 28; 24(4):531-42.

¹¹ Shepard CW, Soriano-Gabarro M, Zell ER, et al. Antimicrobial postexposure prophylaxis for anthrax: adverse events and adherence. Emerg Infect Dis 2002;10: 1124-1132.

¹² Levy, SB. Garrod lecture. Factors impacting the problem of antibiotic resistance. J Antimicrob Chemother. 2002 Jan;49(1):25-30.