



Children and Anthrax: A Fact Sheet for Clinicians

Anthrax is an acute infectious disease caused by the bacterium *Bacillus anthracis*. Children, like adults, may be affected by three clinical forms: cutaneous, inhalational, or gastrointestinal. The symptoms and signs of anthrax infection in children older than 2 months of age are similar to those in adults. The clinical presentation of anthrax in young infants is not well defined. When children become ill and present for treatment, making a diagnosis may be more difficult than in adults because young children have difficulty reporting what has happened to them or telling a doctor exactly how they feel. Because respiratory illnesses are much more common in children than adults, the examining clinician should have an understanding of disease manifestations in children.

The following are clinical descriptions (based on experience with adults) of the three forms of anthrax (*MMWR* 2001;50(41):889-893).

- **Inhalational.** Inhalational anthrax begins with a brief prodrome resembling an influenza-like viral respiratory illness followed by development of dyspnea, systemic symptoms, and shock, with radiographic evidence of mediastinal widening and pleural effusion. Inhalational anthrax is the most lethal form of anthrax. The incubation period of inhalational anthrax among humans typically ranges from 1 to 7 days but may be up to 60 days. Host factors, dose of exposure, and chemoprophylaxis may affect the duration of the incubation period. Patients frequently develop meningitis. Case-fatality estimates for inhalational anthrax are extremely high; the risk for death is high even if patients are provided with supportive care, including appropriate antimicrobial treatment.
- **Cutaneous.** Cutaneous anthrax is characterized by a skin lesion evolving from a papule, through a vesicular stage, to a depressed black eschar. The incubation period ranges from 1 to 12 days. The lesion is usually painless, but patients also may have fever, malaise, headache, and regional lymphadenopathy. The case fatality rate for cutaneous anthrax is 20% without, and <1% with, antimicrobial treatment.
- **Gastrointestinal.** Gastrointestinal anthrax is characterized by severe abdominal pain followed by fever and signs of septicemia. This form of anthrax usually results from eating raw or undercooked meat containing *B. anthracis*, and the incubation period is usually 1 to 7 days. An oropharyngeal and an abdominal form of the disease have been described. Involvement of the pharynx is usually characterized by lesions at the base of the tongue, dysphagia, fever, and regional lymphadenopathy. Lower bowel inflammation typically causes nausea, loss of appetite, and fever followed by abdominal pain, hematemesis, and bloody diarrhea. The case-fatality rate is estimated to be between 25% and 60%. The effect of early antibiotic treatment on the case-fatality rate has not been established.



Neither CDC nor the American Academy of Pediatrics (AAP) recommend dispensing antibiotics for parents to have on hand in case of a possible exposure to *Bacillus anthracis*. CDC and its partner organizations will dispense antibiotics through the National Pharmaceutical Stockpile (NPS) program if exposure occurs. The NPS was designed to ensure the availability of lifesaving pharmaceuticals; antimicrobials; chemical interventions; and medical, surgical, and patient-support supplies, as well as equipment for prompt delivery to disaster sites. Disasters include a possible biological or chemical terrorist event anywhere in the United States. For more detailed information about the NPS, see CDC's Web site at www.bt.cdc.gov.

Vaccination

At this time, anthrax vaccine is not recommended for people younger than 18 years of age. Military personnel and civilians at high risk for repeated exposure (e.g., laboratory workers handling powders containing *Bacillus anthracis* may benefit from the vaccine.

Prophylaxis

Post-exposure prophylaxis is indicated to prevent inhalational anthrax after a confirmed or suspected aerosol exposure to *Bacillus anthracis*. Consultation with public health authorities is strongly encouraged to identify people who should receive prophylaxis. When no information is available about the antimicrobial susceptibility of the implicated strain of *Bacillus anthracis*, CDC recommends initial therapy with either ciprofloxacin or doxycycline for children, as follows:

- **Ciprofloxacin:**
10–15 mg/kg/dose po Q12 hours (not to exceed 1 gram per day) for 60 days.
- **Doxycycline:**
 - ✓ 8 years or older and weighing more than 45 kg: 100 mg po BID for 60 days.
 - ✓ 8 years or older and weighing 45 kg or less: 2.2 mg/kg/dose po BID for 60 days.
 - ✓ 8 years or younger: 2.2 mg/kg/dose po BID for 60 days

Reference: CDC. Update: Investigation of anthrax associated with intentional exposure and interim public health guidelines, October, 2001. *MMWR* 2001;50 (41):889-893.

The National Pharmaceutical Stockpile (NSP) contains oral and liquid types of both drugs for use by children who are too small to tolerate pills. Both tetracyclines and fluoroquinolones can cause adverse health effects in children. These risks must be weighed carefully against the risk of developing a life-threatening disease due to *Bacillus anthracis*. As soon as the penicillin susceptibility of the organism has been confirmed, prophylactic therapy for children should be changed to oral amoxicillin 80 mg/kg of body mass per day divided every 8 hours (not to exceed 500 mg three times daily). The NSP also includes amoxicillin suspension for children.



Bacillus anthracis is not susceptible to cephalosporins or to trimethoprim/sulfamethoxazole, and these agents should not be used for prophylaxis.

Drug Recommendations For Pediatric Anthrax Cases

Some antibiotics and other treatments that have proven effective against anthrax in adults have not been studied as extensively in children. Therefore, CDC provides the following recommendations for treating anthrax in children:

For inhalational anthrax:

Initial Therapy (intravenous)	Duration
Ciprofloxacin* 10–15 mg/kg/dose every 12 hours OR Doxycycline: [¶] > 8 years and > 45 kg: 100 mg every 12 hours > 8 years and 45 kg or less: 2.2 mg/kg/dose every 12 hours 8 years or younger: 2.2 mg/kg/dose every 12 hours AND One or two additional antimicrobials [§]	IV treatment initially. Switch to oral antimicrobial therapy when clinically appropriate: Ciprofloxacin 10–15 mg/kg/dose po every 12 hours OR Doxycycline: [¶] > 8 years and > 45 kg: 100 mg po BID > 8 years and 45 kg or less: 2.2 mg/kg/dose po BID 8 years or younger: 2.2 mg/kg/dose po BID Continue for 60 days (IV and po combined)

Antimicrobial therapy should be continued for 60 days because of the potential persistence of spores after an aerosol exposure. Initial therapy may be altered on the basis of the clinical course of the patient; one or two antimicrobial agents (e.g., ciprofloxacin or doxycycline) may be adequate as the patient improves.

*If intravenous ciprofloxacin is not available, oral ciprofloxacin may be acceptable because it is rapidly and well absorbed from the gastrointestinal tract with no substantial loss by first-pass metabolism. Maximum serum concentrations are attained 1 to 2 hours after oral dosing but may not be achieved if vomiting or ileus is present. In children, ciprofloxacin dosage should not exceed 1 g/day.

[¶] The AAP recommends treatment of young children with tetracyclines for serious infections (e.g., Rocky Mountain spotted fever). If meningitis is suspected, doxycycline may be less optimal because of poor central nervous system penetration.

[§] Other agents with *in vitro* activity include rifampin, vancomycin, penicillin, ampicillin, chloramphenicol, imipenem, clindamycin, and clarithromycin. Because of concerns of constitutive and inducible beta-lactamases in *Bacillus anthracis* isolates involved in the current bioterrorist attack, penicillin and ampicillin should not be used alone. Consultation with an infectious disease specialist is advised.

For cutaneous anthrax, CDC recommends the following treatment:

Initial Therapy (oral)	Duration
Ciprofloxacin: 10–15 mg/kg/dose every 12 hours (not to exceed 1 g/day) OR Doxycycline: > 8 years and > 45 kg: 100 mg every 12 hours > 8 years and 45 kg or less: 2.2 mg/kg/dose every 12 hours	60 days 60 days



8 years or younger: 2.2 mg/kg/dose every 12 hours	
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Cutaneous anthrax with signs of systemic involvement, extensive edema, or lesions on the head or neck requires intravenous therapy, and a multidrug approach is recommended. Ciprofloxacin or doxycycline should be considered first-line therapy. Amoxicillin 80 mg/kg/day divided every 8 hours is an option for completion of therapy after clinical improvement, if the organism is susceptible.

Previous guidelines have suggested treating cutaneous anthrax for 7 to 10 days, but 60 days is recommended in the setting of this attack, given the likelihood of exposure to aerosolized *Bacillus anthracis*.

For gastrointestinal and oropharyngeal anthrax, use regimens recommended for inhalational anthrax.

Children are more likely than adults to suffer side effects from some antibiotics used to prevent or treat the disease. If a child does develop side effects, testing should be done to determine whether the bacteria to which the child was exposed are susceptible to other drugs with fewer side effects, such as amoxicillin.

For additional information

The American Academy of Pediatrics offers more extensive information about children and anthrax at its Web site, <http://www.aap.org/advocacy/releases/smlpoxanthrax.htm>. For information related to preparedness and bioterrorism, see CDC's Web site at <http://www.bt.cdc.gov>.

Sources: *MMWR* 50(41); October 19, 2001; *MMWR* 50(42); October 26, 2001; American Academy of Pediatrics fact sheet at: <http://www.aap.org/advocacy/releases/smlpoxanthrax.htm>.