Revised August 2004

Anthrax *(Bacillus anthracis)*

Information for Health Care Providers

Cause	*Bacillus anthracis* ▪ Encapsulated, aerobic, gram-positive, spore-forming rod-shaped bacterium (bacillus)	
Systems Affected	▪ Skin or cutaneous (most common) ▪ Respiratory tract or inhalation (rare) ▪ Gastrointestinal (GI) tract (rare) ▪ Oropharyngeal (least common)	
Transmission	▪ Skin: direct skin contact with spores. In nature, contact with infected animal or animal product, usually an occupational exposure ▪ Respiratory: inhalation of aerosolized spores ▪ GI: consumption of undercooked or raw meats or dairy products from infected animals ▪ No person-to-person transmission of respiratory or GI anthrax	
Reporting	▪ Immediately report any suspected or confirmed case of anthrax to your local or state health department	
Cutaneous Anthrax		
Incubation Period	▪ Immediate response up to one (1) day	
Typical Signs/Symptoms	▪ Local skin involvement after direct contact with spores or bacilli ▪ Localized itching followed by papular lesion that turns vesicular and subsequently develops black eschar within 7-10 days after initial lesion	
Laboratory	Specimen ▪ Obtain specimens appropriate to the system affected: o Vesicle fluid	Clues to diagnosis ▪ Gram-positive bacilli on smear of vesicle fluid or upon culture provides preliminary identification of *Bacillus* species
Treatment	▪ Obtain specimen for culture **before** initiating antimicrobial treatment ▪ Do **not** use extended-spectrum cephalosporins or trimethoprim sulfamethoxazole because anthrax may be resistant to these drugs ▪ See CDC cutaneous treatment protocol (Table 2)	
Precautions	▪ Standard contact precautions. Avoid direct contact with wound or wound drainage	

<table>
<tr><th colspan="3">Inhalation Anthrax</th></tr>
<tr><td>Incubation Period</td><td colspan="2">▪ Usually <1 week; may be prolonged up to 2 months</td></tr>
<tr><td>Typical Signs/Symptoms</td><td>Initial Phase
▪ Non-specific symptoms such as low-grade fever, nonproductive cough, malaise, fatigue, myalgias, profound sweats, chest discomfort.
▪ Upper respiratory tract symptoms are rare
▪ Maybe rhonchi on exam, otherwise normal
▪ Chest X-ray
o Mediastinal widening
o Pleural effusion (often)
o Infiltrates (rare)</td><td>Subsequent Phase
▪ 1-5 days after onset of initial symptoms
▪ May be preceded by 1-3 days of improvement
▪ Abrupt onset of high fever and severe respiratory distress (dyspnea, stridor, cyanosis)
▪ Shock, death within 24-36 hours</td></tr>
<tr><td>Differential Diagnosis</td><td colspan="2">▪ Tularemia
▪ Plague
▪ Diphtheria</td></tr>
<tr><td>Laboratory</td><td>Specimens
▪ Obtain specimens appropriate to the system affected:
o Blood (essential)
o Pleural fluid
o Cerebral spinal fluid (CSF)
o Skin lesions</td><td>Clues to diagnosis
▪ Gram-positive bacilli on unspun peripheral blood smear or CSF
▪ Aerobic blood culture growth of large, gram-positive bacilli provides preliminary identification of Bacillus species</td></tr>
<tr><td>Treatment</td><td colspan="2">▪ Obtain specimen for culture before initiating antimicrobial treatment
▪ Initiate antimicrobial therapy immediately upon suspicion
▪ Do not use extended-spectrum cephalosporins or trimethoprim sulfamethoxazole because anthrax may be resistant to these drugs
▪ Supportive therapy including controlling pleural effusions
▪ See CDC inhalation treatment protocol (Table 1)</td></tr>
<tr><td>Precautions</td><td colspan="2">▪ Standard contact precautions</td></tr>
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Gastrointestinal Anthrax		
Incubation Period	▪ Usually 1-7 days	
Typical Signs/Symptoms	Initial Phase ▪ Nausea, anorexia, vomiting and fever, progressing to severe abdominal pain, hematemesis and diarrhea that is usually bloody ▪ Acute abdomen picture with rebound tenderness may develop ▪ Mesenteric adenopathy on computed tomography (CT) scan likely. Mediastinal widening on X-ray has been reported	Subsequent Phase ▪ 2-4 days after onset of symptoms, ascites develop as abdominal pain decreases ▪ Shock, death within 2-5 days of onset
Laboratory	Specimens ▪ Obtain specimens appropriate to system affected o Blood (essential) o Ascite fluid	Clues to diagnosis ▪ Gram-positive bacilli on unspun peripheral blood smear or ascite fluid ▪ Aerobic blood culture growth of large, gram-positive bacilli provides preliminary identification of *Bacillus* species
Treatment	▪ Obtain specimen for culture **before** initiating antimicrobial treatment ▪ Early (during initial phase) antimicrobial therapy is critical ▪ Do **not** use extended-spectrum cephalosporins or trimethoprim sulfamethoxazole because anthrax may be resistant to these drugs ▪ See CDC inhalation treatment protocol (Table 1)	
Precautions	▪ Standard contact precautions	

Oropharyngeal Anthrax		
Incubation Period	▪ Usually 1-7 days	
Typical Signs/Symptoms	Initial Phase ▪ Fever and marked unilateral or bilateral neck swelling caused by regional lymphadenopathy ▪ Severe throat pain and dysphagia ▪ Ulcers at the base of the tongue, initially edematous and hyperemic	Subsequent Phase ▪ Ulcers may progress to necrosis ▪ Swelling can compromise the airway
Laboratory	Specimens ▪ Obtain specimens appropriate to system affected o Blood (essential) o Throat	Clues to diagnosis ▪ Aerobic blood culture growth of large, gram-positive bacilli provides preliminary identification of *Bacillus* species
Treatment	▪ Obtain specimen for culture **before** initiating antimicrobial treatment ▪ Do **not** use extended-spectrum cephalosporins or trimethoprim sulfamethoxazole because anthrax may be resistant to these drugs ▪ Supportive care including controlling ascites ▪ See CDC inhalation treatment protocol (Table 1)	
Precautions	▪ Standard contact precautions	

TABLE 1. Inhalational anthrax treatment protocol[*,†] for cases associated with this bioterrorism attack

Category	Initial therapy (intravenous)[§,¶]	Duration
Adults	Ciprofloxacin 400 mg every 12 hrs[*] **or** Doxycycline 100 mg every 12 hrs[††] **and** One or two additional antimicrobials[¶]	IV treatment initially[**]. Switch to oral antimicrobial therapy when clinically appropriate: Ciprofloxacin 500 mg po BID **or** Doxycycline 100 mg po BID Continue for 60 days (IV and po combined)[§§]
Children	Ciprofloxacin 10–15 mg/kg every 12hrs[¶¶,***] **or** Doxycycline:[†††,‡‡] >8 yrs and >45 kg: 100 mg every 12 hrs >8 yrs and ≤45 kg: 2.2 mg/kg every 12 hrs ≤8 yrs: 2.2 mg/kg every 12 hrs **and** One or two additional antimicrobials[¶]	IV treatment initially[**]. Switch to oral antimicrobial therapy when clinically appropriate: Ciprofloxacin 10–15 mg/kg po every 12 hrs[***] **or** Doxycycline:[†††] >8 yrs and >45 kg: 100 mg po BID >8 yrs and ≤45 kg: 2.2 mg/kg po BID ≤8 yrs: 2.2 mg/kg po BID Continue for 60 days (IV and po combined)[§§]
Pregnant women[§§§]	Same for nonpregnant adults (the high death rate from the infection outweighs the risk posed by the antimicrobial agent)	IV treatment initially. Switch to oral antimicrobial therapy when clinically appropriate.[†] Oral therapy regimens same for nonpregnant adults
Immunocompromised persons	Same for nonimmunocompromised persons and children	Same for nonimmunocompromised persons and children

[*] For gastrointestinal and oropharyngeal anthrax, use regimens recommended for inhalational anthrax.
[†] Ciprofloxacin or doxycycline should be considered an essential part of first-line therapy for inhalational anthrax.
[§] Steroids may be considered as an adjunct therapy for patients with severe edema and for meningitis based on experience with bacterial meningitis of other etiologies.
[¶] 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*, penicillin and ampicillin should not be used alone. Consultation with an infectious disease specialist is advised.
[**] Initial therapy may be altered based on clinical course of the patient; one or two antimicrobial agents (e.g., ciprofloxacin or doxycycline) may be adequate as the patient improves.
[††] If meningitis is suspected, doxycycline may be less optimal because of poor central nervous system penetration.
[§§] Because of the potential persistence of spores after an aerosol exposure, antimicrobial therapy should be continued for 60 days.
[¶¶] 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 1–2 hours after oral dosing but may not be achieved if vomiting or ileus are present.
[***] In children, ciprofloxacin dosage should not exceed 1 g/day.
[†††] The American Academy of Pediatrics recommends treatment of young children with tetracyclines for serious infections (e.g., Rocky Mountain spotted fever).
[§§§] Although tetracyclines are not recommended during pregnancy, their use may be indicated for life-threatening illness. Adverse effects on developing teeth and bones are dose related; therefore, doxycycline might be used for a short time (7–14 days) before 6 months of gestation.

TABLE 2. Cutaneous anthrax treatment protocol* for cases associated with this bioterrorism attack

Category	Initial therapy (oral)†	Duration
Adults*	Ciprofloxacin 500 mg BID or Doxycycline 100 mg BID	60 days§
Children*	Ciprofloxacin 10–15 mg/kg every 12 hrs (not to exceed 1 g/day)† or Doxycycline:¶ >8 yrs and >45 kg: 100 mg every 12 hrs >8 yrs and ≤45 kg: 2.2 mg/kg every 12 hrs ≤8 yrs: 2.2 mg/kg every 12 hrs	60 days§
Pregnant women*,**	Ciprofloxacin 500 mg BID or Doxycycline 100 mg BID	60 days§
Immunocompromised persons*	Same for nonimmunocompromised persons and children	60 days§

* Cutaneous anthrax with signs of systemic involvement, extensive edema, or lesions on the head or neck require intravenous therapy, and a multidrug approach is recommended. Table 1.

† Ciprofloxacin or doxycycline should be considered first-line therapy. Amoxicillin 500 mg po TID for adults or 80 mg/kg/day divided every 8 hours for children is an option for completion of therapy after clinical improvement. Oral amoxicillin dose is based on the need to achieve appropriate minimum inhibitory concentration levels.

§ Previous guidelines have suggested treating cutaneous anthrax for 7–10 days, but 60 days is recommended in the setting of this attack, given the likelihood of exposure to aerosolized *B. anthracis* (*6*).

¶ The American Academy of Pediatrics recommends treatment of young children with tetracyclines for serious infections (e.g., Rocky Mountain spotted fever).

** Although tetracyclines or ciprofloxacin are not recommended during pregnancy, their use may be indicated for life-threatening illness. Adverse effects on developing teeth and bones are dose related; therefore, doxycycline might be used for a short time (7–14 days) before 6 months of gestation.