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">▪ Tualremia
▪ 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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<table>
<tr><th colspan="3">Gastrointestinal Anthrax</th></tr>
<tr><td>Incubation Period</td><td colspan="2">Usually 1-7 days</td></tr>
<tr><td>Typical Signs/Symptoms</td><td>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</td><td>Subsequent Phase
2-4 days after onset of symptoms, ascites develop as abdominal pain decreases
Shock, death within 2-5 days of onset</td></tr>
<tr><td>Laboratory</td><td>Specimens
Obtain specimens appropriate to system affected
Blood (essential)
Ascite fluid</td><td>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</td></tr>
<tr><td>Treatment</td><td colspan="2">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)</td></tr>
<tr><td>Precautions</td><td colspan="2">Standard contact precautions</td></tr>
</table>

<table>
<tr><th colspan="3">Oropharyngeal Anthrax</th></tr>
<tr><td>Incubation Period</td><td colspan="2">▪ Usually 1-7 days</td></tr>
<tr><td>Typical Signs/Symptoms</td><td>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</td><td>Subsequent Phase
▪ Ulcers may progress to necrosis
▪ Swelling can compromise the airway</td></tr>
<tr><td>Laboratory</td><td>Specimens
▪ Obtain specimens appropriate to system affected
o Blood (essential)
o Throat</td><td>Clues to diagnosis
▪ 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
▪ 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)</td></tr>
<tr><td>Precautions</td><td colspan="2">▪ Standard contact precautions</td></tr>
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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.