Virginia Department of Health
Anthrax: Guidance for Health Care Providers
Key Medical and Public Health Interventions after Identification of a Suspected Case

Table of Contents

1. Epidemiology

Anthrax is a zoonotic disease caused by the aerobic, gram-positive, encapsulated, spore-forming, nonmotile, nonhemolytic, rod-shaped bacterium *Bacillus anthracis* (*B. anthracis*). *B. anthracis* is designated as a Category A bioterrorism agent (i.e., easily disseminated or transmitted with a higher rate of mortality than Category B agents) and a select agent, which means that it could be developed as a bioterrorism agent and that possession, use or transfer of these organisms requires registration with CDC or USDA. If anthrax is suspected or confirmed, the local health department must be notified immediately so that a public health investigation can be initiated.

B. anthracis primarily affects herbivores such as cattle, sheep, goats, antelope, and deer, which become infected by ingesting contaminated vegetation, water, or soil. Humans are generally incidental hosts. *B. anthracis* is transmitted primarily by direct contact with *B. anthracis*-infected animals or their carcasses or with contaminated products from infected animals, including meat, hides, wool, or items made with those products, such as drums or wool clothing.

Anthrax is found worldwide, but is most common in agricultural regions in Central and South America, sub-Saharan Africa, Central and Southwestern Asia, and southern and Eastern Europe. Human anthrax is rare in the United States with only 0–2 cases per year; sporadic outbreaks might occur in livestock and wild herbivores.

Travelers to endemic areas might acquire anthrax through direct or indirect contact with carcasses of animals that died from anthrax. Cases of cutaneous, gastrointestinal, and inhalation anthrax have been reported among people who have handled or played drums made with contaminated goat hides from countries endemic for anthrax or who have been present at events where those drums have been played. Cases have also been reported among people making drums from contaminated goat hides

imported from countries endemic for anthrax, as well as members of their households exposed to environments contaminated by the drum-making process.

Anthrax in humans normally presents as one of three forms, depending on how the anthrax spores enter the body: cutaneous, gastrointestinal, and inhalation. Introduction of the spores through the skin can result in cutaneous anthrax; abrasion of the skin increases susceptibility. Eating meat from infected animals can result in gastrointestinal anthrax. Inhalation anthrax typically occurs when a person inhales spores aerosolized by industrial processing of contaminated materials, such as hides or wool, or by working with contaminated animal hides or wool in a way that can aerosolize dust and spores; it can also result from bioterrorism. Anthrax in humans is not generally considered to be contagious. Person-to-person transmission is very rare and has only rarely been reported for cutaneous anthrax.

Recently, a fourth type of anthrax has been identified in heroin-injecting drug users in northern Europe and is probably caused by contaminated heroin. Injection anthrax has never been reported in the United States. Symptoms may be similar to those of cutaneous anthrax, but there may be infection deep under the skin or in the muscle where the drug was injected. Injection anthrax can spread throughout the body faster and be harder to recognize and treat compared to other forms of anthrax. Other bacteria are more common causes of skin or injection site infections in drug users and should be considered ahead of *B. anthracis*.

The at-risk population includes those who process hides, wool, hair (especially from goats), bone, and bone products imported from endemic regions; veterinarians and agriculture and wildlife workers who handle infected animals; laboratory workers who work with anthrax; and military personnel who work in areas where anthrax could be used as a bioterrorism weapon.

2. Clinical Manifestations

Cutaneous Anthrax

Incubation period: Usually 1–7 days.

Symptoms: The skin infection begins as a small papule or vesicle that ulcerates with central necrosis and drying. Painless, localized nonpitting edema surrounds the ulcerated area, which progresses to a dark, leathery eschar. Extensive nonpitting edema, regional lymphadenopathy, lymphangitis, fever, and malaise may be present. Lesions tend to occur on exposed areas of the body (e.g., face, hands, arms, neck).

Gastrointestinal Anthrax

Incubation period: Usually 1–7 days.

Symptoms: Gastrointestinal anthrax follows the consumption of raw or undercooked contaminated meat and can present as either oropharyngeal or intestinal forms. Gastrointestinal anthrax is associated with severe abdominal distress followed by fever and severe signs of septicemia. The oropharyngeal form results in lesions at the base of the tongue, sore throat, dysphagia, fever, bilateral neck swelling (caused by regional lymphadenopathy), edema, and sepsis. The intestinal form is characterized with nausea, vomiting, loss of appetite, and fever, progressing rapidly to bloody diarrhea and sepsis. Ulcerations can occur anywhere along the gastrointestinal tract.

Inhalation Anthrax

Incubation period: Usually 1–7 days, but incubation periods up to 60 days are possible.

Symptoms: The first stage of illness is characterized by a nonspecific prodrome of malaise, myalgias, fever, headache, nonproductive cough, nausea, and abdominal pain. Some patients have a brief period of apparent recovery before progressing to the second stage directly. The second stage of illness develops abruptly with sudden fever, dyspnea, diaphoresis and shock, stridor in some cases with massive lymphadenopathy and widening of the mediastinum on X-ray. Cyanosis and hypotension progress rapidly to death in some patients.

Injection Anthrax

Incubation period: Usually 1–4 days

Symptoms: Symptoms may be similar to those of cutaneous anthrax, but there may be infection deep under the skin or in the muscle where the drug was injected. Patients may present with edema around the injection site, often leading to compartment syndrome or necrotizing fasciitis. Classical signs (i.e., papules, vesicles or eschar) are often missing, whereas complications such as septic and cardiovascular shock, meningitis and death despite antibiotic therapy, occur more often than in cases of classic cutaneous anthrax.

3. Specimen Collection and Laboratory Testing

Protocols for sentinel clinical laboratories are no longer posted on the CDC website. The American Society for Microbiology (ASM) has agreed to take the lead in the development and dissemination of sentinel laboratory information. The most current ASM guidelines for specimen collection and laboratory testing for anthrax are available at http://www.asm.org/index.php/guidelines/sentinel-guidelines. For additional laboratory guidance, refer to the CDC Infectious Diseases Test Directory or CDC's Biosafety in Microbiological and Biomedical Laboratories (5th edition) (see References).

CDC recommends that all of the following specimens be collected for testing, if available, based on the form of anthrax. If possible, specimens should be collected before initiation of antibiotics. Methods of testing primarily include the real-time polymerase chain reaction (PCR), culture, and serology on a variety of specimens. The Division of Consolidated Laboratory Services (DCLS) would be doing the initial testing and additional testing can be conducted at CDC as needed. DCLS and the Virginia Department of Health should be consulted if *B. anthracis* is suspected. Please note that DCLS must approve testing before samples will be accepted for testing. Laboratory personnel must be alerted before shipping to ensure safe specimen processing. The DCLS Emergency Services Officer can be reached 24 hours a day/7 days a week at (804) 335-4617.

Below are listed the types of samples to be collected depending on the clinical presentation and Table 1 summarizes sample collection instructions for different types of specimens.

For diagnostic testing of patients with suspected cutaneous anthrax:

- For vesicular lesions, two swabs of vesicular fluid from an unopened vesicle, one for culture and the second for real-time PCR.
- For eschars, the edge should be lifted and two swab samples rotated underneath and submitted, one for culture and the second for real-time PCR.
- For ulcers, the base of the lesion should be sampled with two saline moistened swabs and submitted, one for culture and the second for real-time PCR.

- Blood cultures obtained prior to antimicrobial therapy, if the patient has evidence of systemic symptoms.
- A full thickness punch biopsy of a papule or vesicle including adjacent skin should be obtained from all patients with a lesion being evaluated for cutaneous anthrax, to be submitted in 10% formalin for histopathology, special stains, and immunohistochemistry (IHC).
- In patients not on antibiotic therapy or on therapy for <24 hours, a second biopsy specimen should be submitted for culture and real-time PCR.
- Acute serum samples for testing for anthrax lethal toxin, and acute and convalescent serum samples for serologic testing.

For diagnostic testing of patients with suspected inhalation anthrax

- Blood cultures obtained prior to antimicrobial therapy.
- Pleural fluid, if present, for culture, real-time PCR, and testing for anthrax lethal toxin.
- Pleural and/or bronchial biopsies for IHC.
- CSF, in patients with meningeal signs, for culture and real-time PCR.
- Acute serum samples for testing for anthrax lethal toxin, and acute and convalescent serum samples for serologic testing.
- Autopsy tissues from fatal cases for histopathology, special stains, and IHC.

For diagnostic testing of patients with suspected gastrointestinal anthrax

- Blood cultures obtained prior to antimicrobial therapy.
- Ascites fluid for culture and real-time PCR.
- Stool or rectal swabs for culture and real-time PCR.
- Oropharyngeal lesion, if present, for culture and real-time PCR.
- Acute and convalescent serum samples for serologic testing.
- Autopsy tissues from fatal cases for histopathology, special stains, and IHC.

Table 1. Sample collection for suspected anthrax cases and testing at DCLS*

Samples	Amount	Type of Tests and Anthrax	Instructions
Vesicle or eschar	2 dry swabs; punch biopsy if patient on antibiotics	Gram stain, PCR, and culture for cutaneous anthrax	• Collect eschar material by lifting the eschar's outer edge; insert a sterile dry swab, then slowly rotate for 2-3 seconds beneath the edge of the eschar. • If no vesicle or eschar is present, swab the base of the ulcer using a sterile moist swab. • Specimens for culture, or both culture and PCR, should be shipped using cold packs and stored at 2 to 8°C. • Specimens for PCR testing only may be shipped on dry ice and stored at -70°C.
Ulcer	2 pre-moistened swabs		
Blood	10 mL in EDTA or Sodium Citrate	PCR and culture for inhalation, gastrointestinal, and systemic cutaneous anthrax	• Blood for culture should be collected before antimicrobial therapy. Ship on cold packs.
Serum	5 mL acute sera and 5 mL convalescent sera (10 mL blood yields ~ 5 mL of sera)	Serology and lethal toxin test for inhalation, gastrointestinal, and systemic cutaneous anthrax	Separate serum from clot; serum should be frozen immediately following separation and stored frozen at -20°C or colder, and should be shipped frozen on dry ice, in labeled plastic screw cap vials. Shipping information is available at: http://www.cdc.gov/anthrax/labs/cdcspecimens.html
Pleural fluid	> 1 mL	PCR and culture for inhalation anthrax	Collect in a sterile container and store at 2 to 8°C for no more than 24h and ship using cold packs.
Stool	5-10 grams in an unpreserved, sterile container	PCR and culture for intestinal form of gastrointestinal anthrax	• Specimens for culture, or both culture and PCR, should be stored at 2 to 8°C and shipped using cold packs. • Specimens for PCR only may be stored at -70°C and shipped on dry ice.
Cerebrospinal fluid (CSF)	> 1 mL CSF in a sterile container	PCR and culture for any anthrax with meningeal signs	CSF specimens for culture and PCR should be shipped on cold packs.
Biopsy of papule or vesicle	A full thickness punch	Histopathology, immunohistochemistry (IHC), special stains, PCR, and culture for cutaneous anthrax	• Obtain a full thickness punch biopsy of a papule or vesicle including adjacent skin and place into 10% formalin. Ship formalin fixed samples at room temperature and fresh samples using dry ice. • For PCR and culture, biopsy specimens should be collected no more than 24 hours after initiating antibiotic treatment.
Pleural or bronchial biopsies	Small amount	IHC for inhalation anthrax	Collect in sterile container. Store at 2 to 8°C for no more than 24 hrs. Ship formalin fixed samples at room temperature and fresh samples using dry ice.
Ascites fluid	>1 mL	PCR and culture for gastrointestinal anthrax	Stored at 2 to 8°C for no more than 24 hrs and shipped using cold packs.
Oropharyngeal swab	2 dry swabs	PCR and culture for oropharyngeal anthrax	Using a sterile dry swab, swab surface and edges of suspected lesions in the orophagynx or buccal cavity, or on the tongue, tonsils, or posterior pharyngeal wall.
Rectal swab	2 dry swabs	PCR and culture for intestinal anthrax	Obtain using a sterile dry swab.
Autopsy tissues	≥ 8 blocks of fixed tissue	Histopathology, IHC, and special stains for inhalation anthrax	Ship paraffin-embedded tissue blocks and unprocessed tissues in 10% neutral buffered formalin.

* If anthrax is suspected, notify the local health department immediately to discuss the case and laboratory testing (see www.vdh.virginia.gov/LHD/index.htm). Specimens should be sent to Division of Consolidated Laboratory Services (DCLS) after LHD has been consulted and testing has been approved by LHD/DCLS. The DCLS Emergency Duty Officer can be reached 24/7 at (804) 335-4617.

4. Diagnosis

CDC guidance is available to help with the clinical diagnosis of anthrax, the taking of patient history to determine potential anthrax exposure, and the ordering of necessary laboratory diagnostic tests. If inhalation anthrax is suspected, chest X-rays or CT scans can confirm if the patient has mediastinal widening or pleural effusion, the classic thoracic imaging findings in patients with inhalation anthrax. The only way to confirm a diagnosis of anthrax is to either test directly for *B. anthracis* in a clinical specimen (e.g., blood, skin lesion swab, spinal fluid, or respiratory secretions) or measure antibodies or toxin in blood.

The current CDC case definition for anthrax is available at http://wwwn.cdc.gov/nndss/script/casedefDefault.aspx. Note that a case definition is a set of uniform criteria used to define a disease for public health surveillance. Case definitions enable public health to classify and count cases consistently across reporting jurisdictions, and should not be used by healthcare providers to determine how to meet an individual patient's health needs.

5. Treatment

Primary treatment includes antibiotics and antitoxin with antitoxin added for systemic infections, as described below. All types of anthrax infection are treated with antibiotics, but the production of toxin, potential for antimicrobial drug resistance, frequent occurrence of meningitis, and presence of latent spores must be taken into account in determining treatment regimen. Depending on the situation, hemodynamic support, mechanical ventilation, adjunctive corticosteroids, and surgical interventions can be considered.

Antitoxins

There are currently two antitoxins in the CDC Strategic National Stockpile: raxibacumab and Anthrax Immune Globulin Intravenous (AIGIV). Although raxibacumab has not been given to patients with systemic anthrax, it is approved by the Food and Drug Administration (FDA) for postexposure prophylaxis (PEP) and treatment for anthrax under the Animal Rule Summary. AIGIV is not FDA-approved, but could be made available under an Investigational New Drug protocol or an Emergency Use Authorization during a declared emergency. Given that systemic anthrax has a high case-fatality rate and the risk for antitoxin treatment appears to be low, the potential benefit achieved by adding antitoxin to combination antimicrobial drug treatment outweighs the potential risk. An antitoxin should be added to combination antimicrobial drug treatment for any patient for whom there is a high level of clinical suspicion for systemic anthrax. Although there is some experience with AIGIV use in humans, there are no major medical, operational, or logistical considerations that clearly favor use of 1 antitoxin over another in adults with systemic anthrax.

Antibiotics

Tables 2–4 provide detailed information on drugs, dosage, and duration for antibiotic treatment of anthrax in adults, including pregnant women, and Table 5 describes such information for antibiotic treatment of anthrax in children.

Table 2. Intravenous treatment for systemic anthrax in adults with possible or confirmed meningitis*

Nonpregnant Adults	Modifications for pregnant women
1. Bactericidal agent (fluoroquinolone) **Ciprofloxacin, 400 mg every 8 h;** OR Levofloxacin, 750 mg every 24 h; OR Moxifloxacin, 400 mg every 24 h	Ciprofloxacin is preferred
PLUS	
2. Bactericidal agent (β-lactam) a. For all strains, regardless of penicillin susceptibility or if susceptibility is unknown: **Meropenem, 2 g every 8 h;** OR Imipenem, 1 g every 6 h†; OR Doripenem, 500 mg every 8 h	At least one antibiotic with transplacental passage is recommended: ciprofloxacin, levofloxacin, meropenem, ampicillin, penicillin, clindamycin, rifampin
OR	
b. Alternatives for penicillin-susceptible strains: Penicillin G, 4 million units every 4 h; OR Ampicillin, 3 g every 6 h	
PLUS	
3. Protein synthesis inhibitor: **Linezolid, 600 mg every 12 h‡;** OR Clindamycin, 900 mg every 8 h; OR Rifampin, 600 mg every 12 h§; OR Chloramphenicol, 1 g every 6–8 h¶	
Duration of treatment: ≥2–3 weeks until the patient is clinically stable. See Table 6 for postexposure prophylaxis.	No change in duration

*Patients exposed to aerosolized spores will require prophylaxis to complete an antimicrobial drug course of 60 days from onset of illness. Systemic anthrax includes anthrax meningitis; inhalation, injection, and gastrointestinal anthrax; and cutaneous anthrax with systemic involvement, extensive edema, or lesions of the head or neck. **Preferred drugs are indicated in boldface.** Alternative drugs are listed in order of preference for treatment for patients who cannot take first-line treatment, or if first-line treatment is unavailable. For additional information on dosing, please consult the package inserts.

†Increased risk for seizures associated with imipenem/cilastatin treatment.

‡Linezolid should be used with caution in patients with thrombocytopenia because it might exacerbate it. Linezolid use for >14 days has additional hematopoietic toxicity.

§Rifampin is not a protein synthesis inhibitor. However, it may be used in combination with other antimicrobial drugs on the basis of its in vitro synergy.

¶Should only be used if other options are not available because of toxicity concerns.

Sources: 1) Hendricks KA, et al. 2014. http://dx.doi.org/10.3201/eid2002.130687. 2) Meaney-Delman D, et al. 2014. http://dx.doi.org/10.3201/eid2002.130611

Table 3. Intravenous therapy for systemic anthrax in adults when meningitis has been excluded*

Nonpregnant Adults	Modifications for pregnant women
1. Bactericidal Antimicrobial a. For all strains, regardless of penicillin susceptibility or if susceptibility is unknown: **Ciprofloxacin, 400 mg every 8 h;** OR Levofloxacin, 750 mg every 24 h; OR Moxifloxacin, 400 mg every 24 h; OR Meropenem, 2 g every 8 h; OR Imipenem, 1 g every 6 h†; OR Doripenem, 500 mg every 8 h; OR Vancomycin, 60 mg/kg/d intravenous divided every 8 h (maintain serum trough concentrations of 15–20 µg/mL)	Ciprofloxacin is preferred At least one antibiotic with transplacental passage is recommended: ciprofloxacin, levofloxacin, meropenem, ampicillin, penicillin, clindamycin, rifampin
OR	
b. Alternatives for penicillin-susceptible strains: Penicillin G, 4 million units every 4 h; OR Ampicillin, 3 g every 6 h	
PLUS	
2. Protein synthesis inhibitor: **Clindamycin, 900 mg every 8 h;** OR **Linezolid, 600 mg every 12 h‡;** OR Doxycycline, 200 mg initially, then 100 mg every 12 h§; OR Rifampin, 600 mg every 12h¶	
Duration of treatment: for 2 weeks or the patient is clinically stable. See Table 6 for postexposure prophylaxis.	No change in duration

*Patients exposed to aerosolized spores will require prophylaxis to complete an antimicrobial drug course of 60 days from onset of illness. Systemic anthrax includes anthrax meningitis; inhalation, injection, and gastrointestinal anthrax; and cutaneous anthrax with systemic involvement, extensive edema, or lesions of the head or neck. Preferred drugs are indicated in boldface. Alternative drugs are listed in order of preference for treatment for patients who cannot take first-line treatment, or if first-line treatment is unavailable. For additional information on dosing, please consult the package inserts.

†Increased risk for seizures associated with imipenem/cilastatin treatment.

‡Linezolid should be used with caution in patients with thrombocytopenia because it might exacerbate it. Linezolid use for >14 days has additional hematopoietic toxicity.

§A single 10–14 days course of doxycycline is not routinely associated with tooth staining.

¶Rifampin is not a protein synthesis inhibitor. However, it may be used in combination with other antimicrobials drugs on the basis of its in vitro synergy.

Sources: 1) Hendricks KA, et al. 2014. http://dx.doi.org/10.3201/eid2002.130687. 2) Meaney-Delman D, et al. 2014. http://dx.doi.org/10.3201/eid2002.130611

Table 4. Oral treatment for cutaneous anthrax without systemic involvement*

Nonpregnant Adults	Modifications for pregnant women
a. For all strains, regardless of penicillin susceptibility or if susceptibility is unknown: **Ciprofloxacin, 500 mg every 12 h;** OR **Doxycycline, 100 mg every 12 h;** OR **Levofloxacin, 750 mg every 24 h;** OR **Moxifloxacin, 400 mg every 24 h;** OR Clindamycin, 600 mg every 8 h†	Ciprofloxacin is preferred
OR	
b. Alternatives for penicillin-susceptible strains: Amoxicillin, 1 g every 8 h; OR Penicillin VK, 500 mg every 6 h	
Duration of Treatment: 60 days	No change in duration

*Recommendations are specific to cutaneous anthrax in the setting of bioterrorism. Boldface indicates preferred agent. Alternative selections are listed in order of preference for treatment for patients who cannot take first-line treatment, or if first-line treatment is unavailable. For additional information on dosing, please consult the package inserts.

†Based on in vitro susceptibility data, rather than studies of clinical efficacy.

Sources: 1) Hendricks KA, et al. 2014. http://dx.doi.org/10.3201/eid2002.130687. 2) Meaney-Delman D, et al. 2014. http://dx.doi.org/10.3201/eid2002.130611

Table 5. Antimicrobial treatment of anthrax in children*

Regimens should continue for a total of 60 days.	
Inhalation or Gastrointestinal Anthrax	Cutaneous Anthrax
IV treatment initially[1]: Ciprofloxacin[2], 10-15mg/kg every 12 h OR Doxycycline[3], > 8 y and weight >45kg: 100 mg every 12 h; > 8 y and weight ≤45kg: 2.2 mg/kg every 12 h; ≤ 8 y: 2.2 mg/kg every 12 h AND 1-2 additional antimicrobials[4] Switch to oral therapy when clinically appropriate Ciprofloxacin, 10-15 mg/kg every 12 h (not to exceed 1 g/day) OR Doxycycline, every 12 h: > 8 y and weight >45kg: 100 mg > 8 y and weight ≤45kg: 2.2 mg/kg ≤ 8 y: 2.2 mg/kg	Oral therapy Ciprofloxacin, 10-15mg/kg every 12 h (not to exceed 1 g/day) OR Doxycycline[3], > 8 y and weight >45kg: 100 mg every 12 h; > 8 y and weight <45kg: 2.2 mg/kg every 12 h; < 8 y: 2.2 mg/kg every 12 h Alterative oral therapy if susceptible strain: Amoxicillin[5], ≥20kg: 500 mg every 8 h; <20kg: 80 mg/kg/day divided every 8 h (not to exceed 500mg/dose)

*For additional information on dosing, please consult the package inserts.

[1] Initial therapy may be altered based on clinical course of patient; one or two antimicrobial agents (e.g., ciprofloxacin or doxycycline) may be adequate as patient improves.

[2] 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 is present.

[3] If meningitis is suspected, doxycycline may be less optimal because of poor central nervous system penetration.

[4] Other agents with *in vitro* activity include tetracycline, linezolid, macrolides, aminoglycosides, and cefazolin. *B anthracis* strains are naturally resistant to sulfamethoxazole, trimethoprim, cefuroxime, cefotaxime sodium, aztreonam, and ceftazidime. Because of concerns of constitutive and inducible beta-lactamases in *Bacillus anthracis* isolates, penicillin and ampicillin should not be used alone. Consultation with an infectious disease specialist is advised.

[5] Amoxicillin is not approved by the FDA for postexposure prophylaxis or treatment of anthrax; however, CDC indicated that it could be used for pregnant women or children for postexposure prophylaxis if the isolate is determined to be susceptible. Sources: 1) MMWR. 2001; 50 (42); 909-919.http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5042a1.htm; 2) MMWR. 2001; 50 (45); 1014-1016. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5045a5.htm; 3) MMWR. 2001; 50 (41) 889-892. http://www.cdc.gov/mmwr/PDF/wk/mm5041.pdf

6. Postexposure Prophylaxis

PEP decisions should be made considering the epidemiologic circumstances of release of or exposure to *B. anthracis*. Ongoing case monitoring would be needed to define high-risk groups, to direct follow-up, and to guide PEP in appropriate groups. Ciprofloxacin and doxycycline offer the same protection against anthrax and are two primary antibiotics for preventive treatment of anthrax. People who have been exposed to anthrax should take antibiotics for 60 days for prevention purpose. Tables 6–7 show the recommended PEP regimens for adults (Table 6) and children (Table 7).

Table 6. Oral antimicrobial postexposure prophylaxis for infection with *Bacillus anthracis* in adults*

Nonpregnant Adults	**Modifications for pregnant women**
a. For all strains, regardless of penicillin susceptibility or if susceptibility is unknown: **ciprofloxacin 500 mg every 12h** OR **doxycycline 100 mg every 12h** OR levofloxacin 750 mg every 24h OR moxifloxacin 400 mg every 24h OR clindamycin† 600 mg every 8h	Ciprofloxacin is preferred; no change in dosing
OR	
b. Alternatives for penicillin-susceptible strains amoxicillin 1 g every 8h OR penicillin VK 500 mg every 6h	
Duration of Postexposure Prophylaxis for *Bacillus anthracis*: 60 days	no change in duration

*Boldface indicates preferred agent. Alternative selections are listed in order of preference for treatment for patients who cannot take first-line treatment, or if first-line treatment is unavailable. For additional information on dosing, please consult with the package inserts.

†Based on in vitro susceptibility data, rather than studies of clinical efficacy.

Sources: 1) Hendricks KA, et al. 2014. http://dx.doi.org/10.3201/eid2002.130687. 2) 2) Meaney-Delman D, et al. 2014. http://dx.doi.org/10.3201/eid2002.130611

Table 7. Oral antimicrobial postexposure prophylaxis for infection with *Bacillus anthracis* in children*

Regimens should continue for a total of 60 days.
Ciprofloxacin: 10–15 mg/kg every 12 hrs (Ciprofloxacin dose should not exceed 1 gram per day in children) OR Doxycycline: >8 yrs and >45 kg: 100 mg, twice a day >8 yrs and <45 kg: 2.2 mg/kg, twice a day <8 yrs: 2.2 mg/kg twice a day OR **Amoxicillin**[1] **(preferred if susceptible strain):** 80 mg/kg/day divided every 8 hours (maximum 500 mg/dose).

*For additional information on dosing, please consult with the package inserts.

[1] Amoxicillin is not approved by the FDA for postexposure prophylaxis or treatment of anthrax; however, CDC indicated that it could be used for pregnant women or children for postexposure prophylaxis if the isolate is determined to be susceptible. Sources: 1) MMWR. 2001; 50 (42); 909-919.http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5042a1.htm; 2) MMWR. 2001; 50 (45); 1014-1016. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5045a5.htm; 3) MMWR. 2001; 50 (41) 889-892. http://www.cdc.gov/mmwr/PDF/wk/mm5041.pdf

7. Vaccination

The anthrax vaccine approved by FDA is approved for at-risk adults before exposure to anthrax and is not typically available for the general public. Anthrax Vaccine Adsorbed (AVA) protects against cutaneous and inhalation anthrax, according to limited, but well researched evidence. The vaccine does not contain any anthrax bacteria and does not cause anthrax. The at-risk adults who are eligible to receive anthrax vaccine are those who are 18 to 65 years of age and may be at increased risk of anthrax exposure because of their occupation, including laboratory workers who work with anthrax, certain people who handle animals or animal products, such as some veterinarians, and some members of the United States military. These groups should get 5 shots of anthrax vaccine intramuscularly over 18 months to build up protection. Annual boosters are needed to sustain the immunity. However, certain people should not get the anthrax vaccine. These include people who have had a serious allergic reaction to a previous dose of anthrax vaccine, people who have severe allergies to any component of the anthrax vaccine, people who have a moderate or severe illness (people with mild illness can usually be vaccinated), and pregnant women.

If there were ever an anthrax emergency, people who were exposed might be given anthrax vaccine to prevent disease under an Investigational New Drug protocol or an Emergency Use Authorization in a declared emergency.
In such situations, people who were exposed would get 3 shots of anthrax vaccine over 4 weeks plus a 60-day course of antibiotics to prevent disease. During an emergency, the only people who should not get the vaccine after exposure are those who have had a serious allergic reaction to a previous dose of anthrax vaccine.

8. Infection Control

Transmission from person-to-person is extremely rare. It has not been reported for inhalation or gastrointestinal forms of anthrax, and has only rarely been reported for cutaneous anthrax, where it requires direct contact with skin lesions. Isolation of patients is not indicated. Prophylaxis for patient contacts is not necessary unless the contacts were exposed to the same source of anthrax as the case-patient.

Standard precautions should be followed for hospitalized patients with cutaneous, gastrointestinal or inhalation anthrax. Contact precautions should be implemented when draining cutaneous lesions are present. Nondisposable articles soiled with discharge from lesions should be disinfected. A solution of 1 part household bleach to 9 parts water (0.5% sodium hypochlorite solution) should be used. Hydrogen peroxide, paracetic acid, or glutaraldehyde may be considered as alternatives.

In hazardous industries, especially those handling raw animal materials, dust control procedures should be in place and work areas should be properly ventilated. Maintain medical supervision of employees and provide prompt medical care for all suspicious skin lesions. Workers should use appropriate personal protective equipment (gloves, boots, impermeable gowns, etc.). Thoroughly wash, disinfect, or sterilize hair, wool, bone meal, or other feed of animal origin prior to processing. Use protocols that can eradicate *B. anthracis* spores.

9. Animal-related Illness Considerations

In endemic regions, livestock should be vaccinated. Appropriate measures should be taken in the event of incidents of livestock anthrax, including treatment of symptomatic animals, correct disposal of carcasses and decontamination of carcass sites and items in contact with the carcasses or sites. Symptomatic animals should not be used for food until a few months have passed. Hides of animals exposed to anthrax should not be sold and their carcasses should not be used as food or feed supplements.

If anthrax in an animal is suspected, necropsy should not be performed because of the risk for inducing sporulation and spreading the organism. Instead, aseptically collect a blood sample for smear or culture. If necropsy is inadequately performed, autoclave, incinerate or chemically disinfect or fumigate all instruments or materials used. Carcasses of infected animals should be incinerated at the site of death or moved to an incinerator or rendering plant. As an alternative, carcasses can be buried at the site of death as deeply as possible, without digging below the local water table level. Do not add lye or quicklime to a carcass on burial. Control effluents and wastes from rendering plants that handle potentially infected animals, and from factories that manufacture products from hair, wool, bones or hides that may be contaminated. Decontaminate if appropriate. Vaporized formaldehyde may be used to disinfect contaminated workplaces.

10. Decontamination

In situations of intentional release of *B. anthracis* spores, people who are exposed should wash exposed skin thoroughly with soap and water and shower with soap and shampoo as early as possible. Contaminated clothing should be removed and double bagged. For cutaneous anthrax, clothing and bedding that are soiled with lesion fluid should be disinfected.

For disinfection, hypochlorite is sporicidal and can be used when organic matter is not overwhelming and the item is not corrodible. As an alternative, hydrogen peroxide, peracetic acid or glutaraldehyde can be used. Formaldehyde, ethylene oxide, and cobalt irradiation have also been used. Additional information from Occupational Safety and Health Administration (OSHA) on decontamination of environments and facilities is available at: https://www.osha.gov/SLTC/etools/anthrax/decon.html.

11. Postmortem Practices

If anthrax is suspected as a cause of death, the regional Office of the Chief Medical Examiner should be immediately notified (see http://www.vdh.virginia.gov/medExam/ContactUs.htm). In the event of death, the body fluids of the deceased person should be assumed to have very high concentrations of *B. anthracis.*

Suitable over-clothing and gloves should be worn to place the body in a body bag. Serious consideration should be given to cremation. Bedding should be bagged and disposed of as medical waste rather than simply laundered or disinfected. Fumigation of the room may be needed, depending on the perceived level of contamination beyond bedding. If autopsies are performed, instruments and materials used during the process should be autoclaved or disposed of as medical waste.

12. Public Health Measures

- Suspected or confirmed anthrax cases should be reported immediately to the local health department. See http://www.vdh.virginia.gov/LHD/index.htm.
- Laboratory specimens should be sent to the state public health laboratory (DCLS) for confirmation and other studies after consultation and approval. The DCLS Emergency Services Officer can be reached 24 hours a day/7 days a week at (804) 335-4617.
- Designated public health authority should begin an epidemiologic investigation. The activities include:
  - Collect detailed information from the patient to identify any possible sources of the exposure.
  - Investigate contacts of the case-patient for compatible illness to identify a potential common exposure.
  - Collect suspected food items (e.g., contaminated meat) for potential testing. VDH's Office of Epidemiology will work with Virginia Department of Agriculture and Consumer Services (VDACS), FDA, or USDA as appropriate if commercially prepared food is implicated.
  - Notify VDACS if animal exposures are identified.
  - Implement control measures to prevent disease and additional exposures. For laboratorians or others potentially exposed who might have worked with the agent before identification as *B. anthracis*, postexposure prophylaxis and monitoring might be recommended based on a risk assessment.
  - VDH will work with the CDC, Federal Bureau of Investigation (FBI) and other federal agencies as necessary.

13. References and Resources

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