ANTHRAX

ALL SUSPECT CASES OF ANTHRAX MUST BE REPORTED IMMEDIATELY TO THE HEALTH AND HUMAN SERVICES COMMUNICABLE DISEASE CONTROL:

During business hours: (916) 875-5881
After hours (Health Officer On call): (916) 875-5000

Epidemiology:

- Anthrax can be transmitted by inhalation, ingestion, or inoculation (inhalation is the most likely during a bioterrorist attack)
- The spore form of anthrax is highly resistant to physical and chemical agents; spores can persist in the environment for years
- **Anthrax is not transmitted from person to person**

Clinical:

- Incubation period is 1-5 days (range up to 43 days)
- Inhalation anthrax presents as acute hemorrhagic mediastinitis
- Biphasic illness, with initial phase characterized by nonspecific flu-like illness followed by acute phase characterized by acute respiratory distress and toxemia (sepsis)
- Chest x-ray findings: **Mediastinal widening in a previously healthy patient in the absence of trauma is pathognomonic for anthrax**
- Mortality rate for inhalation anthrax approaches 90%, even with treatment. Shock and death within 24 – 36 hours

Laboratory Diagnosis:

- Laboratory specimens should be handled in a Biosafety Level 2 facility (e.g. California state Microbial Diseases Laboratory)
- Gram stain shows gram positive bacilli, occurring singly or in short chains, often with squared off ends (safety pin appearance). In advanced disease, a gram stain of unspun blood may be positive
- Distinguishing characteristics on culture include: non-hemolytic, non-motile, capsulated bacteria that are susceptible to gamma phage lysis
- ELISA and PCR tests are available at national reference laboratories
- Fluorescent antibody test available through the Laboratory Response Network.
- Contact the Sacramento County Public Health Laboratory for assistance.

Patient Isolation:

- Standard barrier isolation precautions. Patients do not require isolation rooms
- **Anthrax is not transmitted person to person**

Treatment:

- Prompt initiation of antibiotic therapy is essential
- Antibiotic susceptibility testing is KEY to guiding treatment
- Ciprofloxicin (400 mg IV q 12 hr) is the antibiotic of choice for penicillin-resistant anthrax or for empiric therapy while awaiting susceptibility results
- All patients should be treated with anthrax vaccine if available; antibiotic treatment should be continued until 3 doses of vaccine have been administered (day 0, 14 and 28). If vaccine is unavailable, antibiotic treatment should be continued for 60 days.

Prophylaxis:

- If vaccine is available, all exposed persons (as determined by local and state health depts) should be vaccinated with 3 doses of anthrax vaccine (days 0, 14 and 28)
- Start antibiotic prophylaxis immediately after exposure with ciprofloxicin (500 mg po q 12 hrs) or doxycycline (100 mg po q 12 hrs). (If strain is penicillin-susceptible, therapy can be modified to penicillin or amoxicillin.)
- Antibiotic prophylaxis should be continued until 3 doses of vaccine have been administered; if vaccine is unavailable, antibiotics should be continued for 60 days.

SACRAMENTO COUNTY

HEALTH AND HUMAN SERVICES

COMMUNICABLE DISEASE CONTROL

Medical Treatment and Response to Suspected Anthrax: Information for Health Care Providers During Biologic Emergencies

ALL SUSPECT CASES OF ANTHRAX MUST BE REPORTED IMMEDIATELY TO THE SACRAMENTO COUNTY HEALTH AND HUMAN SERVICES, COMMUNICABLE DISEASE CONTROL:

During Business Hours: (916) 875-5881

After Hours (Nights, Weekends and Holidays): Health Officer On call, at (916) 875-5000

I. KEY SUMMARY POINTS

Epidemiology

- Anthrax can be transmitted by inhalation, ingestion, or inoculation (inhalation is the most likely during a bioterrorist attack)
- The spore form of anthrax is highly resistant to physical and chemical agents; spores can persist in the environment for years
- **Anthrax is <u>not</u> transmitted from person to person**

Clinical:

- Incubation period is 1-5 days (range up to 43 days)
- Inhalation anthrax presents as acute hemorrhagic mediastinitis
- Biphasic illness, with initial phase characterized by nonspecific flu-like illness followed by acute phase characterized by acute respiratory distress and toxemia (sepsis)
- Chest x-ray findings: **Mediastinal widening in a previously healthy patient in the absence of trauma is pathognomonic for anthrax**
- Mortality rate for inhalation anthrax approaches 90%, even with treatment. Shock and death within 24 – 36 hours

Laboratory Diagnosis:

- Laboratory specimens should be handled in a Biosafety Level 2 facility (e.g. California state Microbial Diseases Laboratory, Sacramento County Public Health Laboratory)
- Gram stain shows gram positive bacilli, occurring singly or in short chains, often with squared off ends (safety pin appearance). In advanced disease, a gram stain of unspun blood may be positive
- Distinguishing characteristics on culture include: non-hemolytic, non-motile, capsulated bacteria that are susceptible to gamma phage lysis
- ELISA and PCR tests are available at national reference laboratories

Patient Isolation:

- Standard barrier isolation precautions. Patients do <u>not</u> require isolation rooms
- **Anthrax is <u>not</u> transmitted person to person**

Treatment:

- Prompt initiation of antibiotic therapy is essential
- Antibiotic susceptibility testing is KEY to guiding treatment
- Ciprofloxicin (400 mg IV q 12 hr) is the antibiotic of choice for penicillin-resistant anthrax or for empiric therapy while awaiting susceptibility results
- All patients should be treated with anthrax vaccine if available; antibiotic treatment should be continued until 3 doses of vaccine have been administered (day 0, 14 and 28). If vaccine is unavailable, antibiotic treatment should be continued for 60 days.

Prophylaxis:

- If vaccine is available, all exposed persons (as determined by local and state health depts) should be vaccinated with 3 doses of anthrax vaccine (days 0, 14 and 28)
- Start antibiotic prophylaxis immediately after exposure with ciprofloxicin (500 mg po q 12 hrs) or doxycycline (100 mg po q 12 hrs). (If strain is penicillin-susceptible, therapy can be modified to penicillin or amoxicillin.)
- Antibiotic prophylaxis should be continued until 3 doses of vaccine have been administered; if vaccine is unavailable, antibiotics should be continued for 60 days

---

ALL SUSPECT CASES OF ANTHRAX MUST BE REPORTED IMMEDIATELY TO THE SACRAMENTO COUNTY HEALTH AND HUMAN SERVICES, COMMUNICABLE DISEASE CONTROL:

During Business Hours: (916) 875-5881

After Hours (Nights, Weekends and Holidays): Health Officer On call, at (916) 875-5000

II. Introduction/Epidemiology

Anthrax is a disease caused by *Bacillus anthracis* which can infect most warm-blooded animals, including man. Transmission to humans usually occurs through contact with infected animals or contaminated animal products. Humans become infected by inoculation, inhalation, or ingestion of the bacterium. In humans, naturally-occurring

anthrax primarily involves the skin or rarely, the lungs or the gastrointestinal tract. **The bacillus produces a resistant spore which could be dispersed as a small particle aerosol. In the event of a biologic terrorist attack, aerosolization is the most likely mode of transmission, and inhalational anthrax would be the predominant form of disease affecting persons exposed to the aerosol**.

The spore form of *B. anthracis* is highly resistant to physical and chemical agents. The organism has been shown to persist for years in factories contaminated during the processing of infected animal products. Soil, animal feed, and to a lesser extent, ground water are the major reservoirs for anthrax.

Although human anthrax is infrequent and sporadic in the United States and most other industrialized countries, human cases (primarily cutaneous) continue to be reported from Africa, Asia, Europe, and the Americas. Although anthrax-contaminated soil exists in many foci throughout the United States, the number of cases reported annually has declined throughout the last five decades; five human cases (all cutaneous anthrax) were reported between 1981-1996. **A suspected case of anthrax in a patient *without* a clear exposure history (e.g., a traveler returning from an area with known animal cases or a person with exposure to imported animal hides) may be the first clue of a bioterrorist attack. Therefore, even a single, suspect case should prompt immediate notification of the Sacramento County Health and Human Services, Communicable Disease Control, (Business hours: (916) 875-5881; After hours: Health Officer On call, at (916) 875-5000)**

Person to person transmission of anthrax is extremely rare.

III. **Significance as a Potential Bioterrorist Agent**

- Anthrax has been weaponized by many countries during the last 50 years, including the United States (during the 1950's) and Iraq during the Gulf War.
- Anthrax is easy to cultivate and spores are readily produced.
- Anthrax spores are highly resistant to heat and disinfection.

- If aerosolized spores are inhaled, a severe hemorrhagic mediastinitis can occur with mortality rates approaching 90% even with appropriate treatment.

- Currently, anthrax vaccine is in limited supply in the United States and not available to the general public.

IV. **Clinical Manifestations**

During an act of bioterrorism, release of an aerosol will be the most likely route of transmission. Given this, most exposed individuals will present with symptoms of inhalation anthrax with only a few, if any, presenting with the cutaneous form of the disease. Gastrointestinal anthrax would be much less likely.

Inhalation Anthrax presents as acute hemorrhagic mediastinitis after inhalation of airborne particles contaminated with *B. anthracis* spores. Inhalation anthrax does **not** present as an acute pneumonia.

Incubation period - illness usually occurs within 1-5 days of exposure (may be as long as 43 days)
Symptoms - Typically biphasic illness
Initial Phase is characterized by flu-like symptoms:

mild, nonspecific respiratory illness
malaise, fatigue, myalgia
low-grade fever
nonproductive cough
mild chest discomfort (occasionally)
rhonchi may be heard, exam otherwise normal

Acute Phase develops after 2-5 days, it may be briefly preceded by 1-2 days of improvement. Characteristic findings include:

acute severe respiratory distress
dyspnea, cyanosis, stridor and profuse diaphoresis
subcutaneous edema of chest and neck
markedly elevated temperature, pulse, respiratory rate
moist crepitant rales

x-ray findings: **mediastinal widening in an otherwise healthy persons is a pathognomonic sign**; pleural effusion may be present, evidence of pneumonia is often lacking

Shock develops rapidly, sometimes accompanied by evidence of hemorrhagic meningitis, and patients usually die within 24 hours of onset of the acute phase. In prior outbreaks, mortality rates approached 90% despite appropriate antibiotic therapy.

The differential diagnosis of acute mediastinitis includes: esophageal perforation; trauma; contiguous spread from a head, neck or thoracic infection; and post-surgical infections after cardiothoracic procedures. **Anthrax should be strongly considered in any previously healthy patient with acute mediastinitis.**

The diagnosis of inhalation anthrax requires a very high index of suspicion, most often based on epidemiologic evidence of a potential exposure. In the initial stages after a bioterrorist attack, a recognized source of exposure would likely be absent -- clinical suspicion is of utmost importance.

Cutaneous Anthrax: presents as a "malignant pustule or malignant carbuncle" resulting from introduction of the anthrax bacillus beneath the skin by inoculation or contamination of a pre-existent break in the skin.

Incubation period - ranges from 1-7 days but is commonly 2-5 days
Symptoms - an evolving skin lesion, usually located on the exposed parts of the body (face, neck, arms), with a varying degree of associated edema. The skin lesion typically progresses as follows:

Small, painless, pruritic papule **>>>** small ring of vesicles that coalesce into a single large vesicle **>>>** vesicle ruptures to form depressed ulcer **>>>** 1-3 cm eschar develops in center (7-10 days from onset of lesion) **>>>** eschar falls off (after 1-2 weeks) leaving a permanent scar.

Systemic symptoms including fever, headache, myalgias, and regional lymphangitis/lymphadenopathy have been described. Lesions on the face and neck may be associated with significant edema and impingement of the trachea

from neck swelling can occur. "Malignant edema" describes a syndrome with marked edema, induration and multiple bullae at the site of inoculation associated with generalized toxemia. Septicemia is rare. Untreated cutaneous anthrax has a case fatality rate up to 20%, but fatalities are rare (< 1%) with effective antibiotic treatment.

Gastrointestinal Anthrax: occurs after the ingestion of contaminated food, particularly raw or undercooked meat from infected animals.

Incubation period - ranges from 2-7 days

Symptoms - Two clinical presentations, *intestinal* and *oropharyngeal*, have been described. The symptoms of intestinal anthrax are initially nonspecific and include nausea, vomiting, anorexia and fever. As the disease progresses, abdominal pain, hematemesis and bloody diarrhea develop, occasionally accompanied by ascites. The patient may present with the findings of an acute surgical abdomen. Oropharyngeal anthrax is associated with cervical edema and necrosis. A lesion, resembling a cutaneous anthrax lesion, may be seen in the oral cavity on the posterior wall, the hard palate or the tonsils. Patients typically complain of fever, dysphagia and lymphadenopathy. Toxemia, shock and cyanosis characterize the terminal stages of both forms of the disease. The case fatality rate for gastrointestinal anthrax ranges from 25 to 60%.

Meningitis: Meningitis occurs in less than 5% of cases, and may be a complication of any form of anthrax (inhalational, gastrointestinal or cutaneous). Rarely does it occur without a primary focus. It is usually hemorrhagic.

Incubation period - concurrent with or one to several days after the onset of cutaneous, inhalation or gastrointestinal anthrax.

Symptoms - abrupt onset of meningeal symptoms including nausea, vomiting, myalgia, chills and dizziness. Laboratory findings are notable for a hemorrhagic meningitis. Encephalomyelitis and cortical hemorrhages have been reported; death occurs in 1-6 days.

V. Laboratory Diagnosis

Laboratory work with clinical specimens must be done under Biosafety Level 2 conditions. If infection with *Bacillus anthracis* is suspected, please *immediately* call the Sacramento County Health and Human Services, Communicable Disease Control at (916) 875-5881 arrange for submission of specimens to an appropriate reference laboratory for confirmatory testing. After hours call Sacramento County Health Officer On call, at (916) 875-5000.

- **Culture** is the definitive test for anthrax.

  Bacillus anthracis can be isolated from blood, pleural fluid, CSF, ascitic fluid, vesicular fluid or lesion exudate. Sputum cultures are rarely positive. When culturing a lesion, collect either vesicular fluid or exudate from the ulcer. If there is no visible exudate, lift the edge of the eschar with a pair of forceps and collect the fluid near the edge.

  Blood cultures may be positive for bacterial growth in 12-48 hours using standard technology; however, the ability of most clinical microbiology laboratories to definitively identify *B. anthracis* may be limited.

- **Microscopy**

  - **Gram stain**

    - Gram stain should be performed on vesicular fluid or exudate from ulcerative lesions for suspected cutaneous anthrax, pleural fluid for suspected inhalation anthrax, and CSF for suspected meningeal anthrax. **In advanced disease, a gram stain of unspun blood may be positive.** The Gram stain shows gram positive bacilli, usually occurring singly or in short chains, often with squared-off ends (safety-pin appearance).

- **Direct Fluorescent Antibody (DFA) Test**
  - Rapid diagnostic staining technique. This test has been used to examine exudate from cutaneous lesions, CSF and tissue. Not generally helpful for inhalation anthrax because respiratory/pleural fluid specimens are usually negative in the early stages of disease when rapid diagnosis is most critical. Contact the Sacramento County Public Health Laboratory at (916) 874-9231 for assistance.
- **Rapid diagnostic tests**
  - An ELISA assay for protective antigen detection and PCR for detection of nucleic acid can provide a preliminary diagnosis of anthrax within several hours. Currently, these tests are only available at reference laboratories.

o ***Evaluation of a Blood Culture that is Suspicious for Anthrax:*** **The following steps are needed to presumptively identify anthrax in the microbiology laboratory:**

- Overnight incubation on a blood or nutrient agar isolation plate
- Gram stain shows large gram positive rods with square or concave ends
- Blood agar colonies are non-hemolytic, rough, gray-white, tenacious colonies with comma- shaped protrusions
- Subculture to blood agar plates to test for lysis with gamma phage and penicillin susceptibility. (**NOTE: Although naturally-occurring anthrax is penicillin-sensitive, in the event of a bioterrorist event, an anthrax strain resistant to penicillin may have been released.**)
- Test for lack of growth on phenylethyl alcohol blood agar, lack of gelatin hydrolysis, and lack of salicin fermentation
- The bacterial capsule can be demonstrated on nutrient agar containing 0.7% sodium bicarbonate incubated overnight in a candle jar. Examine for capsule with methylene blue or India ink.

  To distinguish *Bacillus anthracis* from other *Bacillus species:* Distinguishing features include that *Bacillus anthracis* is non-hemolytic, non-motile, capsulated and susceptible to gamma phage lysis.

Summary: *Bacillus anthracis* is a gram positive bacillus that is white or gray in color, nonhemolytic or weakly so, nonmotile, gamma phage and usually penicillin susceptible, and able to produce the characteristic capsule.

- **Serology** - not helpful for rapidly establishing the diagnosis during the acute illness.

- **Autopsy Findings** - identifying thoracic hemorrhagic necrotizing lymphadenitis and hemorrhagic necrotizing mediastinitis in a previously healthy patient is essentially pathognomonic for inhalation anthrax. Hemorrhagic meningitis would also be a distinct clue to the diagnosis of anthrax.

****NOTE: In the event of a bioterrorist event, the anthrax strain may be penicillin resistant. There are currently no NCCLS standards for susceptibility testing for *B. anthracis*. Microbiology laboratories must alert the Sacramento County Public Health Laboratory (916-874-9231, after hours 916-875-5000) as soon as *B. anthracis* is identified so that susceptibility testing at a national reference laboratory can be arranged. The results of susceptibility testing are crucial in guiding both therapy and prophylaxis for potentially infected persons.**

VI. Handling Laboratory Specimens

Biosafety Level 2 practices, containment equipment and facilities are recommended for procedures on clinical materials suspected as being positive for anthrax. Laboratory staff handling specimens from persons who might have anthrax must wear surgical gloves, protective gowns and shoe covers. Laboratory tests should be performed in Biological Safety Level 2 cabinets and blood cultures should be maintained in a closed system. Every effort should be made to avoid splashing or creating an aerosol, and protective eye wear and masks should be worn if work cannot be done in a Biological Safety Level 2 cabinet. A full-face mask respirator with a HEPA (high efficiency particulate air) filter is an acceptable alternative to masks and protective eye wear, but use of this equipment is not mandatory.

Accidental spills of potentially contaminated material should be decontaminated immediately by covering liberally with a disinfectant solution (5% hypochlorite or 10% formalin), **left to soak for 30 minutes**, and wiped up with absorbent material soaked in

disinfectant. All biohazardous waste should be decontaminated by autoclaving. Contaminated equipment or instruments may be decontaminated with a hypochlorite solution, hydrogen peroxide, iodine, peracetic acid, 1% glutaraldehyde solution, formaldehyde, ethylene oxide, copper irradiation or other O.S.H.A. approved solutions, or by autoclaving or boiling for 10 minutes.

VII. Treatment

The key to successful treatment is prompt administration of an antimicrobial at the first suspicion of anthrax. During a biologic emergency, before susceptibility is determined (which may take several days), assume penicillin and tetracycline resistance and treat with ciprofloxacin at 400 mg IV every 12 hours. Penicillin is the antibiotic of choice for treating infections with penicillin-sensitive anthrax.

Treatment for Non-Pregnant Adults:

Inhalation anthrax (this regimen also recommended for gastrointestinal and meningeal anthrax)

- For **penicillin resistant anthrax,** administer *ciprofloxacin* at 400 mg IV every 8 to 12 hours (Alternative quinolone options include: ofloxacin 400 mg IV every 12 hours or levofloxacin 500 mg IV every 24 hours). If the isolate is tetracycline susceptible, *doxycycline* 200 mg initially, followed by 100mg IV every 12 hours is equally efficacious.

- For **penicillin susceptible anthrax,** administer *Penicillin G* IV 80,000 units/kg body weight in the first hour followed by a maintenance dose of 320,000 units/kg body weight/day. The average adult dose is 4 million units every 4 hours; can also be administered as 2 million units every 2 hours. (*Amoxicillin* 500 mg IV every 8 hours is an alternative regimen, with a dosing schedule that may be easier to administer in the event of a large-scale outbreak.)

- Supportive therapy is often required (e.g., volume expanders, vasopressor agents and oxygen). A tracheotomy may be needed if cervical edema compromises the airways.

Cutaneous anthrax

- *Mild disease*

  Penicillin susceptible anthrax - Potassium penicillin V orally at 30 mg/kg body weight/day in four equal portions every 6 hours, or amoxicillin 500 mg orally every 8 hours.

  Penicillin resistant anthrax - ciprofloxacin 500 mg orally every 12 hours or (if tetracycline susceptible) doxycycline 100 mg orally every 12 hours.

- *Extensive lesions*

  Penicillin susceptible anthrax - Penicillin G IV 2-4 million units every 4-6 hours or amoxicillin 500 mg IV every 8 hours.

  Penicillin resistant anthrax - Ciprofloxacin 400 mg IV every 12 hours or (if tetracycline susceptible) doxycycline 100 mg IV every 12 hours. When the edema and systemic symptoms have improved, treatment may be completed with the above oral regimens. In the absence of an aerosol exposure, therapy should be continued for 7-10 days. The skin lesions will continue to evolve despite the use of effective antibiotics but severe edema and systemic symptoms will be prevented. Glucosteroids for the first 3-4 days of treatment may reduce morbidity and mortality in severe cutaneous anthrax (malignant edema), particularly in the setting of laryngeal edema.

Alternative Therapies

******* In the event of severe penicillin allergy, documented resistance of *Bacillus anthracis* to penicillin, inability to administer the frequent IV dosing required for penicillin, or the exhaustion of penicillin supplies; **Ciprofloxacin (400 mg IV every 12 hours)**, **Ofloxacin (400 mg IV or orally every 8 to 12 hours)**, **Levofloxacin (500 mg IV or orally every 24 hours)** or **Doxycycline (100 mg IV every 12 hours)** (if proven susceptible) are the preferred alternatives.

In addition, the following drugs have been shown to have *in vitro* activity against anthrax and could potentially be used as alternative agents in the event of an emergency, if the preferred antimicrobials listed above are unavailable or in short supply:

erythromycin	aminoglycosides	vancomycin
imipenem	cephalothin/cefazolin	chloramphenicol
clindamycin	tetracycline	extended-spectrum penicillins

***** In vitro testing suggests that *B. anthracis* is generally resistant to sulfamethoxazole, trimethoprim, cefuroxime, cefotaxime, ceftriaxone, ceftazadime, and aztreonam. Therefore, these antibiotics should not be used for treatment or prophylaxis of anthrax infection.*****

Therapy in pediatric patients and pregnant women

- For **penicillin-resistant anthrax**, although ciprofloxacin is not generally given to children less than 16 years of age due to concerns about the development of arthropathy, the high mortality rate from anthrax infection weighs heavily in favor of using ciprofloxacin in this clinical situation. *Ciprofloxacin* should be given at 20-30 mg/kg/day orally or IV in 2 divided doses, not to exceed 1 gram/day.

- For **penicillin-susceptible anthrax**, *Penicillin G* is the drug of choice. The recommended intravenous dose **for children** with severe cutaneous anthrax, inhalation anthrax, or gastrointestinal anthrax is 250,000 units/kg body weight/day administered every 4 hours. *Amoxicillin* 500 mg IV every 8 hours for children > 20 kg and 40 mg/kg/day IV in divided doses every 8 hours for children < 20 kg, is an alternative antibiotic. Oral formulations can be used for milder disease or when IV therapy is not available.

- If ciprofloxacin supplies are exhausted and the patient is penicillin allergic or the anthrax strain is not susceptible to penicillin, *doxycycline* would be the preferred alternative agent (5 mg/kg/day IV or orally divided every 12 hours). Although doxycycline is not routinely administered to children < 8 years of age because of the risk of discoloration of teeth, the high mortality rate from systemic anthrax makes use of this agent the greater priority.

- *Penicillin G* is the drug of choice for **pregnant women,** if the isolate is penicillin-susceptible. The dosing schedule is as outlined for adults above. *Ciprofloxacin*, although not routinely prescribed during pregnancy, is the preferred alternative drug for penicillin-resistant strains, as tetracyclines can result in rare but serious liver toxicity during pregnancy. If doxycycline is used because of exhaustion of quinolone supplies or severe allergy to either penicillin or ciprofloxacin, liver function tests should be performed.

Vaccination and Duration of Therapy

- All patients treated for inhalational anthrax should also receive anthrax vaccine due to the risk that delayed germination of mediastinal spores can result in disease recurrence. **Three doses of vaccine (Days 0, 14 and 28) should be administered.**

- In the absence of available anthrax vaccine, antibiotic treatment for inhalation anthrax should be continued for 60 days. (Patients should be switched to oral medications, as soon as possible.) If anthrax vaccine is available for post-exposure vaccination, antibiotic therapy can be discontinued after three doses of vaccine (Days 0, 14, and 28) have been administered.

VIII. Isolation of Patients

Inhalation, cutaneous and gastrointestinal anthrax have never been transmitted directly from human-to-human. All staff should observe **Standard Precautions** when caring for patients with suspected or confirmed anthrax. In addition, the following is advised:

- For cutaneous anthrax, cover the lesion with a sterile dressing. Contact Wound and skin precautions should be observed for patients with skin lesions.

- Gloves should be worn for touching potentially infective material; gowns should be worn only if soiling is likely. Masks are not necessary, since patients with inhalation anthrax do not produce small particle aerosols containing sufficient spore counts (8,000 to 10,000 spores) to cause secondary infections.

- **HANDS MUST BE WASHED AFTER TOUCHING THE PATIENT OR POTENTIALLY CONTAMINATED ARTICLES AND BEFORE TAKING CARE OF ANOTHER PATIENT.**

- Patients do not require isolation rooms.

- Articles contaminated with infective material including bandages should be discarded and bagged and labeled before being sent for decontamination and reprocessing.

IX. Disposal of Infectious Waste

Use of tracking forms, containment, storage, packaging, treatment and disposal methods should be based upon the same rules as all other regulated medical wastes.

X. Autopsy and Handling of Corpses

All postmortem procedures should be performed using Universal Precautions.

- All persons performing or assisting in postmortem procedures must wear mandated P.P.E. (personal protective equipment) as delineated by O.S.H.A. guidelines.

- Instruments should be autoclaved or sterilized with a 10% bleach solution or other solutions approved by O.S.H.A. Surfaces contaminated during postmortem procedures should be decontaminated with an appropriate chemical germicide such as iodine, 10% hypochlorite or 5% phenol (carbolic acid).

XI. Management of Exposed Persons

In the event of a bioterrorist release of *Bacillus anthracis* spores, it may be difficult to define who has been exposed. Once the site of the attack is determined, all persons at the site of the release or downwind of the release (assuming an aerosol dispersal) would be considered potentially exposed.

Since inhalation anthrax does not spread from person to person, household and other contacts (such as healthcare workers caring for cases) of exposed persons are not considered exposed and do not require prophylaxis (unless they too were exposed to the aerosolized anthrax spores at the time of the attack).

- **Inhalational exposures:** Initiation of antibiotic therapy quickly after exposure has been shown to markedly reduce the mortality of inhalation anthrax in animal studies. The best available prophylactic regimen is the combination of antibiotic therapy and vaccination. Antibiotic susceptibility information on clinical isolates should guide prophylactic antibiotic choices.

While awaiting antibiotic susceptibility test results, or if susceptibility results confirm ***penicillin resistance***, begin therapy immediately with oral *ciprofloxacin* (500 mg po bid), *levofloxacin* (500 mg po per day), *ofloxacin* (400 mg po per bid), or *doxycycline* (100 mg po bid). If the isolate is ***penicillin susceptible***, *potassium penicillin V* (30 mg/kg/day in 4 divided doses) or *amoxicillin* (500 mg po every 8 hours) are the preferred preventive treatment.

- *Recommendations for prophylactic treatment of children, while awaiting antibiotic susceptibility results or if susceptibility results confirm* ***penicillin resistance****, include:* ciprofloxacin (20-30 mg per kg of body mass per day divided every 12 hours) or doxycycline (5 mg per kg of body mass per day divided every 12 hours). If the isolate is ***penicillin-susceptible***, all children should be treated with a penicillin antibiotic (for children weighing at least 20 kg, amoxicillin 500 mg po every 8 hours; for children < 20 kg, amoxicillin 40 mg per kg per day in divided doses every 8 hours).

- **Duration of antibiotic prophylaxis:** Therapy should be continued for at least 4 weeks, or until **three** doses of anthrax vaccine have been administered (Days 0, 14 and 28). **If vaccine is unavailable**, antibiotic prophylaxis should be continued for at least 60 days, and withdrawn under medical supervision.

- **Exposures through cuts, abrasions or injections:** Immediately wash the infected part, and apply a disinfectant solution such as hypochlorite solution. Promptly begin therapy as outlined under the treatment section for "Cutaneous anthrax-mild disease"; continue therapy for 7-10 days. Anthrax vaccine is not indicated.

- **Ingestional exposures:** Treat as for exposure by cuts or abrasions.

- **All persons exposed to anthrax should be instructed to watch for signs/symptoms of flu-like illness for at least 7 days.** Should such symptoms occur, patients must be immediately evaluated by a physician for the possible institution of intravenous antibiotic therapy.

- **VACCINATION** - An alum-absorbed, cell-free killed vaccine for anthrax has been developed and used primarily by the military and laboratory

workers/veterinarians. The vaccine efficacy against cutaneous anthrax has been documented for humans; evidence for protection against inhalation and gastrointestinal anthrax is limited to animal studies.

For prophylaxis, the vaccine is given parenterally (0.5mL subcutaneously) in three doses 2 weeks apart (Days 0, 14 and 28). Currently, there are limited vaccine supplies in the United States, and distribution is restricted to the military or persons at high-risk due to occupational exposures. (NOTE: Data from animal studies suggest that two doses of anthrax vaccine given two weeks apart may be sufficient, and in the setting of limited vaccine supplies may be a practical alternative).

Adverse reactions to anthrax vaccine are not common. About 6% of patients may develop a local reaction and 2-3% experience mild systemic symptoms. **(NOTE: The FDA has only licensed the vaccine for use in healthy adults aged 18-65 years; the safety and efficacy of the vaccine for children and pregnant women has not been studied).**

For current information about the availability of human anthrax vaccine, call the Sacramento County Health and Human Services, Communicable Disease Control at (916) 875-5881.

XII. Reporting to the Health Department

Human anthrax is a reportable disease in California. Although reporting of animal anthrax is not required by California regulations, we strongly urge reporting of suspect animal cases as they may represent exposure to a bioterrorism attack. *All suspect human cases* should be reported immediately by phone:

- **During business hours**
  - Report suspect cases of *human and animal anthrax* to:
    Sacramento County Health and Human Services, Communicable Disease Control at **(916) 875-5881**
- **After business hours**
  - *Human and animal cases* call
    Sacramento County Health Officer On call, at **(916) 875-5000.**

XIII. References

Benenson AS, ed. *Control of Communicable Diseases Manual*. 16th ed. Washington, DC: American Public Health Association; 1995:18-22.

Brachman PS. Anthrax. In: Hoeprich PD, Jordan MC, Ronald AR., eds. *Infectious Diseases: a treatise of infectious processes*. 5th ed. Philadelphia, PA: J.B. Lippincott Company; 1994:1003-1008.

Edward M. Anthrax. In: Feigin RD, Cherry JD, eds. *Textbook of Pediatric Infectious Diseases*. 3rd ed. Philadelphia, PA; 1992:1053-1056.

Fleming DO, Richardson JH, Tulis JJ, Vesley D, eds. *Laboratory Safety Principles and Practices*. 2nd ed. Washington, DC: American Society for Microbiology;1995:324.

Friedlander AM. Anthrax. In: Sidell FR, Takafuji ET, Franz DR, eds. *Textbook of Military Medicine*. Washington, D.C.: Office of the Surgeon General at TMM Publications; 1997:467-478.

Inglesby TV, Henderson DA, Bartlett JG, et al. Anthrax: Civilian Medical and Public Health Management following use of a Biological Weapon. *JAMA* 1999: (in press).

LaForce FM. Anthrax. *Clin Infect Dis*. 1994;19:1009-1014.

Lew D. Bacillus Anthracis (Anthrax). In: Mandell G, Bennett J, Dolin R, eds. *Principles and Practice of Infectious Diseases*. 4th ed. New York: Churchill Livingstone; 1995:1885-1889.

Meselson M, Guillemin J, Hugh-Jones M, et al. The Sverdlosk anthrax outbreak of 1979. *Science* 1994;226:1202-1208.

Pile JC, Malone JD, Eitzen EM, Friedlander AM. Anthrax as a potential biological warfare agent. *Arch Intern Med*. 1998;158:429-434.

Turnbull PCB, Kramer JM. Bacillus. In: Balows A, Haulser WJ, Herrman KL, Shadomy HJ, eds. *Manual of Clinical Microbiology* 5th ed. Washington, DC: American Society for Microbiology; 1991:298-299.

US Army Medical Research Institute of Infectious Diseases. Medical Management of Biological Casualties. 3rd Edition. Fort Detrick, MD. 1998.

XIV. **Table 1: Inhalational Anthrax Treatment and Prophylaxis**

	Therapy	**Prophylaxis***
	Adult Doses	**Adult Doses**
Susceptibility Results Unknown or Penicillin- Resistant**	Ciprofloxacin 400mg IV q 8- 12h (*Alternative quinolones include:* ofloxacin 400mg IV q 8-12h or levofloxacin (500mg IV q 24h) Doxycycline 200mg IV x 1, then 100mg IV q 12h (*if tetracycline-susceptible*)	Ciprofloxacin 500mg po bid (*Alternative quinolones include:* ofloxacin 400mg po q 8- 12h or levofloxacin (500mg po q 24h Doxycycline 100mg po bid (*if tetracycline susceptible*)
Penicillin Susceptible	Penicillin G 80,000 units per kg in 1st hour followed by 320,000 units/kg/day. (*Average adult dose is 4 million units q 4hr or 2 million units q 2h*) Amoxicillin 500mg IV q 8h	Penicillin VK 30mg/kg/d in 4 divided doses Amoxicillin 500mg po q 8h

	Pediatric Doses	Pediatric Doses
Susceptibility results unknown or penicillin-resistant	Ciprofloxacin 20-30mg/kg/day IV in 2 divided doses (*maximum daily dose not to exceed 1 gram/d*) Doxycycline (*if ciprofloxacin not available*) 4 mg/kg/d IV in 2 divided doses	Ciprofloxacin 20-30mg/kg per day po divided in 2 doses Doxycycline 5mg/kg/per day in 2 divided doses
Penicillin-susceptibility	Penicillin G 250,000 units/kg per day IV administered every 4 hours Amoxacillin 500mg IV q 8h if > 20kg or 40mg/kg per day IV divided into 3 doses if < 20kg	Penicillin VK 30 mg/kg per day po administered in 4 divided doses Amoxicillin 500mg po q 8h if > 20kg or 40mg/kg per day po divided in 3 doses if < 20kg

* Antibiotic prophylaxis should be continued for 60 days if anthrax vaccine is not available (*or if vaccine is available, antibiotics should be continued until 3rd dose of vaccine has been administered*).

** In pregnant women, penicillin-resistant anthrax should be treated with ciprofloxacin. If doxycycline is used, liver function tests should be monitored closely.

October 2001
Used with permission and adapted from the New York City Health Department/Bureau of Communicable Diseases