ANTHRAX

1. **Agent**: *Bacillus anthracis*, a Gram-positive, encapsulated, nonmotile rod; spore-forming bacillus.

2. **Identification**:

   a. **Symptoms**:

   Cutaneous anthrax: Initially a painless, usually pruritic papule progresses to vesicle then develops into a painless black eschar. Edema or erythema can occur in the surrounding area; fever, malaise and lymphadenopathy may occur with the lesion. Progresses to systemic anthrax in 10-20% of cases; systemic anthrax, if untreated, has a fatality rate up to 20%. Fatalities for cutaneous anthrax are <1% if effective antibiotics are given.

   Inhalational anthrax: Early symptoms include fever, chills, and fatigue. Localized thoracic symptoms such as cough, chest pain and dyspnea follow, as well as non-thoracic symptoms of nausea, vomiting, abdominal pain, headache, diaphoresis, and altered mental status. The fulminant phase is characterized by rapidly progressive respiratory symptoms, including severe dyspnea and hypoxemia, and shock. Radiologic evidence of mediastinal widening and pleural effusion is common. Fatality rate can be as high as 67-88%.

   Welder's anthrax: A rare and serious anthrax-like pneumonia caused by *Bacillus* species other than *B. anthracis* that produce anthrax toxin. Cases have been found in several people who are welders or metalworkers. Fever, chills with sudden cough, chest pain, difficulty breathing or coughing up blood. Suspect if welder or metalworker has severe, rapid progressive pneumonia.

   Gastrointestinal (GI) anthrax: Acute vomiting, abdominal distention, GI bleeding, and peritonitis; fever and septicemia can occur; fatality rate high.

   Oropharyngeal anthrax: Painless mucosal lesion in the oral cavity or oropharynx may be observed. Symptoms include sore throat, difficulty swallowing, neck edema. Less specific symptoms include fever, fatigue, shortness of breath, abdominal pain, and nausea/vomiting. Cervical lymphadenopathy, ascites, and altered mental status may be observed.

   Anthrax meningitis: Altered mental status, fever, headache, nausea/vomiting, seizures, focal neurologic deficits, and meningeal signs such as nuchal rigidity and Kernig and Brudzinski signs. Can develop hemorrhagic meningitis with cerebrospinal fluid analysis showing elevated protein, low glucose, and a positive Gram stain and culture. Seventy-five percent of patients can die within 24 hours of presentation.

   Injection anthrax: Injection anthrax cases were reported in northern Europe in heroin-injecting drug users. Symptoms include fever, chills, a group of small blisters or bumps that may itch (appearing where the drug was injected), a painless skin sore with a black center that appears after the blisters or bumps, swelling around the sore, abscesses deep under the skin or in the muscle where the drug was injected.

   b. **Differential Diagnosis**:
   Cutaneous anthrax- includes staphylococcal and streptococcal skin and lymph node infection, erysipelas, spider bite, Orf, syphilitic chancre, cutaneous tuberculosis, ulceroglandular tularemia, scrub typhus, ecthyma gangrenosum, cutaneous leishmaniasis, rickettsial infection, and glanders.
   Inhalational anthrax- includes pneumonic plague, tularemia, community acquired pneumonia, influenza, respiratory syncytial virus, Q- fever.

   c. **Diagnosis**:
      i. Culture and identification from clinical specimens by Laboratory Response Network (LRN)[5,6].

ii. Demonstration of *B. anthracis* antigens in tissues by immunohistochemical staining using both *B. anthracis* cell wall and capsule monoclonal antibodies.
iii. Evidence of a four-fold rise in antibodies to protective antigen between acute and convalescent sera or a fourfold change in antibodies to protective antigen in paired convalescent sera using Centers for Disease Control and Prevention (CDC) quantitative anti-PA immunoglobulin G (IgG) ELISA testing in an unvaccinated person.
iv. Detection of *B. anthracis* or anthrax toxin genes by the LRN-validated polymerase chain reaction and/ or sequencing in clinical specimens collected from a normally sterile site (such as blood or CSF) or lesion of other affected tissue (skin, pulmonary, reticuloendothelial, or gastrointestinal).
v. Detection of lethal factor (LF) in clinical serum specimens by LF mass spectrometry.

1. **Incubation**:
   a. Cutaneous: usually 1-7 days, up to 17 days
   b. Inhalation: usually 1-7 days, up to 2 months
   c. Ingestion: usually 1-7 days, up to 16 days
   d. Injection: 1-4 days

2. **Reservoir**: Soil; infected animals (cattle, sheep, goats, horses, pigs, etc.).

3. **Source**: Spores from soil or contaminated animal products (hides, hair, meat, bones).

4. **Transmission**: Handling infected animals or their carcasses, meat, hides, or wool. Inhalation of aerosolized spores while working with contaminated animal products such as wool, hair or hides. Inhalation of weaponized and intentionally released spore preparations. Inhalation of metal fumes containing Bacillus bacteria. Consumption of undercooked, contaminated meat.

5. **Communicability**: Inhalational Anthrax: No evidence of transmission from person to person. Contaminated products and soil remain infective for years. Cutaneous Anthrax: Transmission through non-intact skin contact with draining lesions possible, therefore use Contact Precaution if large amount of uncontained drainage. Handwashing with soap and water preferable to use of waterless alcohol-based antiseptics since alcohol does not have sporicidal activity. Environmental: Aerosolizable spore-containing powder or other substance: Until decontamination of environment is complete, wear respirator (N95 mask or PAPRs), protective clothing; decontaminate persons.

6. **Specific Treatment**:
   - Antimicrobial therapy. Antitoxins are available but must be used with other treatment options.
   - CDC Guidelines for the Prevention and Treatment of Anthrax provides detailed treatment regimen for different age groups and special considerations.

Vaccine:
- Pre-exposure: 5 doses of a cell-free vaccine containing protective antigen (US trade name: Biothrax) is recommended for the following persons:
  - Certain laboratory workers who work with anthrax
  - Some people who handle animals or animal products
  - Some members of the United States military
- Post-exposure: 3-doses in combination with appropriate antimicrobial prophylaxis may be recommended after exposure to aerosolized Bacillus anthracis spores.
  - CDC recommends a post-exposure regimen of 42-60 days of appropriate antimicrobial prophylaxis depending on anthrax vaccine status and immunocompetence. Refer to CDC guidance for details: CDC: ACIP Recommendations: Anthrax and CDC Guidelines for the Prevention and Treatment of Anthrax
  - Refer to EPRD plan for PEP distribution.

7. **Immunity**: Uncertain.

REPORTING PROCEDURES

1. **Report any case or suspect case by telephone immediately** (Title 17, Section 2500. *California Code of Regulations*).

   a. Call Morbidity Unit (888-397-3993 or 213-240-7821) during working hours.

   b. Call ACDC; after working hours, contact Administrative Officer of the Day (AOD) through County Operator (213-974-1234).

   c. Any laboratory that receives a specimen for anthrax testing is required to report to the State Microbial Diseases Laboratory immediately (Title 17, Section 2505, *California Code of Regulations).*

   d. ACDC must notify the State Division of Communicable Disease Control (DCDC) immediately upon receiving notice of a case of suspected anthrax. ACDC will supervise investigation and control measures.

2. **Report Form**:
   Anthrax Case Investigation Form (For Individual Case)

   Anthrax Case Report Form (For Known Anthrax event or Outbreak Only)

3. **Epidemiologic Data**:

   a. Specify type (cutaneous, inhalational, or gastrointestinal).

   b. Occupation: Farmer, dairyman, veterinarian, wool processor, weaver, butcher, slaughterhouse employee, tanner, taxidermist, hunter, or laboratory worker. Welder or metalworker. Also, postal workers, politicians and their staff, and members of news media as in the 2001 anthrax letter attacks.

   c. Organism can be part of normal soil flora and with favorable conditions can multiply, which increases the risk of infection in grazing animals. Humans can accidently be exposed through contact with infected animals or animal products. Determine if veterinary diagnosis was made.

   d. Ingestion of raw or undercooked meat.

   e. Exposure to animal products (e.g., hair, skins or animal hides, paint brushes, bongo drums, leather, and wool); especially imported animal products from highly endemic areas, such as Iran, Iraq, Turkey, Pakistan, and sub-Saharan Africa, agricultural regions of South and Central America, central and southwestern Asia and southern and eastern Europe.

   f. Inhalation of fumes generated during welding, particularly those containing Bacillus species that produce anthrax toxins, and potentially iron, which bacteria like B. cereus use for growth.

   g. Bioterrorism: *B. anthracis* has been listed by the CDC as one of the agents most likely to be used in a bioterrorist attack because of the devastating physical and psychological effects of inhalational anthrax and the ability to be weaponized and effectively delivered to a target area.

CONTROL OF CASE, CONTACTS & CARRIERS

Investigate on the Day of Report:

CASE:

Precautions:

1. **Cutaneous**: Contact precautions until lesions are completely healed.

2. **Gastrointestinal:** Contact precautions if diarrhea uncontrolled.

3. **Inhalational**: Standard precautions as in Title 17, Section 2500, *California Code of Regulations*. Section 2518 is recommended until patient recovers.

CONTACTS: No restrictions.

CARRIER: Not applicable.

ANIMAL: Veterinary Public Health will investigate potential animal sources.

PREVENTION-EDUCATION

1. Avoid eating raw or undercooked meat and avoid contact with livestock, animal products,

and animal carcasses when visiting to areas where anthrax is common or where an outbreak is occurring. Refer to CDC website for more information: CDC Anthrax: People at Increased Risk for Anthrax

2. Disinfect animal products prior to processing.

3. Educate workers in high-risk occupations.

4. Wear gloves when you have contact with the sick person's blood and other body fluids (urine, feces, vomit, wound drainage, mucous or saliva). Keep cuts and abrasions covered with bandages to prevent anthrax spores from entering wounds. Wash your hands after removing the gloves.

5. Wear gloves when handle or dispose of infectious waste and wash your hands with soap and water afterwards.

6. If anthrax is suspected, necropsy must not be done on the animal.

7. Infected animal carcasses should be burned or deeply buried (at least 6 feet).

8. Maintain proper ventilation in high-risk industries.

9. Ensure proper disposal of wastes from rendering plants and factories that process potentially contaminated animal products.

10. A vaccine is available for veterinary and other high-risk occupations.

11. Any possible bioterrorist exposures should be reported immediately to local law enforcement and public health officials for evaluation.

DIAGNOSTIC PROCEDURES

Specimens: Blood, CSF, pleural fluid, ascitic fluid, vesicular fluid, lesion exudates or other materials for direct examination or culture. Consult the Public Health Laboratory.

REFERENCE

People at Increased Risk for Anthrax
https://www.cdc.gov/anthrax/prevention/occupational-exposure.html

MMWR: CDC Guidelines for the Prevention and Treatment of Anthrax, 2023

CDC MMWR: Use of Anthrax Vaccine in the United States: Recommendations of the Advisory Committee on Immunization Practices

CDPH California Hospital Bioterrorism Response Planning Guide
https://emsa.ca.gov/wp-content/uploads/sites/71/2017/07/ca_hosp_guide.pdf

CDC: ACIP Recommendations: Anthrax Vaccine