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ANTHRAX

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BASICS

DESCRIPTION

- Anthrax is a highly infectious disease of animals, especially ruminants (hooved animals such as cows, goats, sheep, etc.) that is caused by the bacteria *Bacillus anthracis*. Cutaneous (95% of US cases), inhalational, and gastrointestinal forms can be transmitted to man by contact with the animals or their products (typically hair or hides).
- Synonym(s) for cutaneous anthrax: Charbon; Malignant pustule; Siberian ulcer; Malignant edema; Splenic fever; Milzbrand.
- Synonym(s) for inhalational anthrax: Ragpicker's disease; Woollsorter's disease

GENERAL PREVENTION

- Anthrax vaccine protects against all forms of anthrax and is as safe as other vaccines, according to the Food and Drug Administration, the Centers for Disease Control and Prevention, and the National Academy of Sciences. A 2005 review by the Cochrane Infectious Disease Group concluded that the anthrax vaccine is effective in reducing the risk of contracting anthrax and has a low rate of adverse effects (1)[A].
- Anthrax vaccine should be effective against all known strains of *B. anthracis*, as well as against any strains that might be bioengineered by terrorists or others.
- Vaccine is given subcutaneously in 6 doses (0, 2, and 4 weeks, and 6, 12, and 18 months) plus annual boosters.
 - If you get behind schedule, don't start the series over; begin where you left off (delays don't reduce the resulting protection).
 - Redness up to 1 inch (2.5 cm) in diameter occurs in 30% of men and 60% of women, and redness or other reactions >5 inches (12.7 cm) occur in ~1% of people (both male and female).
 - Fever and malaise can occur within hours to days after vaccine administration; the rates at which they occur are comparable to those observed with other adult vaccines.
 - Anthrax vaccine often causes a nodule under the skin where the vaccine is injected; this can last from 2–3 months. These nodules eventually resolve.
 - The Advisory Committee on Immunization Practices recommends vaccination for the following groups
 - o Persons who work directly with the organism in the laboratory
 - o Persons who work with imported animal hides or furs in areas where standards are insufficient to prevent exposure to anthrax spores
 - o Persons who handle potentially infected animal products in high-incidence areas
 - o Military personnel deployed to areas with high risk for exposure to organisms (when used as a biologic warfare weapon)

- o Pregnant women should be vaccinated for anthrax only if absolutely necessary.

- Patients with a likely exposure history but no symptoms are candidates for post-exposure prophylaxis with either ciprofloxacin 500 mg PO b.i.d. or doxycycline 100 mg PO b.i.d.

EPIDEMIOLOGY

- There were a total of 235 Anthrax cases (224 cutaneous and 11 inhalational) in the US between 1955-1994, resulting in 20 fatalities.
- Cutaneous: 95% of cases in the US; cases of cutaneous anthrax without occupational risk should raise concern for a terrorist attack. About 5–20% of untreated cases result in death.
- Gastrointestinal (GI): Very rare in the US (no documented case in the 20th century).
- Inhalational anthrax is very rare in US; must be considered a bioterrorist event in US until proven otherwise (the last US occupational case occurred in 1976). Death results in 99% of untreated cases, and in 45–80% of patients with severe symptoms who are treated in a state-of-the-art facility.
- Anthrax is most common in agricultural regions, where it occurs in animals. These regions include the Middle East, Asia, Southern and Eastern Europe, Africa, South and Central America, and the Caribbean.

Incidence

Prevalence

RISK FACTORS

- Contact with infected animals or their products
- Bioterrorist event

Genetics

PATHOPHYSIOLOGY

- *Bacillus anthracis* is a spore-forming, gram-positive bacterium found in the soil worldwide. The word *anthracis* is derived from a Greek word meaning "coal," which is used to describe the cutaneous form of the disease that leads to a characteristic black lesion.
- *B. anthracis* has 3 known virulence factors: An antiphagocytic capsule and 2 protein toxins (known as edema factor and lethal factor).
 - The capsule provides resistance to phagocytosis.
 - Lethal factor and edema factor are named for the effects they induce when injected into experimental animals.
 - A protein called protective antigen binds to the host cell's surface; when cleaved by a protease on the cell surface it creates a binding site to which the lethal factor and edema factor can bind; protective antigen is required for the action of the 2 protein toxins.
- *B. anthracis* spores introduced into the host are ingested at the exposed site by macrophages and then germinate into vegetative forms that produce the virulence factors.

ETIOLOGY

- Cutaneous: Occurs when *B. anthracis* enters the skin through a cut or abrasion during the handling of animal products (such as meat, wool, or hides infected with *B. anthracis*)
- GI: Ingestion of bacillus-contaminated meat
- Inhalational: Inhalation of aerosolized *B. anthracis* spores

ASSOCIATED CONDITIONS

DIAGNOSIS

PRE-HOSPITAL

SIGNS AND SYMPTOMS

- Cutaneous: Begins as a pruritic red-brown papule that enlarges with peripheral erythema, vesiculation, and induration, followed by black eschar formation within 7–10 days of the initial lesion. The papule, blister, and eschar are painless, and cutaneous symptoms may be accompanied by fever, malaise, and headache. A black eschar with massive edema is nearly pathognomonic for cutaneous anthrax.
- GI: Presents as 1 of 2 distinct syndromes— oropharyngeal and abdominal. Oropharyngeal syndrome presentation can include fever, edema, ulcer, severe sore throat, and lymphadenopathy resulting in marked unilateral or bilateral neck swelling. Abdominal syndrome may present with fever, malaise, hematemesis, anorexia, severe abdominal pain, and hematochezia or melena.
- Inhalational: Biphasic presentation, with initial phase featuring nonspecific influenza-like symptoms such as low-grade fever, chills, headache, nonproductive cough, diaphoresis, malaise, chest discomfort, nausea, vomiting, diarrhea, and abdominal pain. This initial phase is followed by the 2nd fulminant phase that includes abrupt onset of high fever, severe dyspnea, hypoxia, hypotension, and death.

History

- Cutaneous: Crucial clinical clues are rapid evolution of symptoms, lack of pain, occasional massive edema, and the near pathognomonic black eschar. Incubation period is usually immediate but may last up to 1 day.
- GI: Incubation period usually 1–7 days; 2–4 days after onset of symptoms, ascites develop as abdominal pain decreases. Shock and death occur within 2–5 days after onset of symptoms.
- Inhalational: Incubation period is usually <1 week, but may be as long as 2 months. 2nd portion of the biphasic presentation begins 1–5 days after onset of initial symptoms. There may be a 1–3 day period of improvement after the 1st phase and before the 2nd phase begins. Shock and death occur within 24–36 hours after onset of the 2nd phase.

Physical Exam

- Cutaneous: Red-brown papule, vesicles, or black eschar
- GI: Acute abdomen with rebound tenderness may occur. Ascites present later in course

- Inhalational: Rhonchi may be present.

TESTS

Lab

Gram stain and culture. *B anthracis* is easily isolated from blood cultures in <24 h. A presumptive diagnosis can be made if Gram-positive rods are present that are nonmotile, nonhemolytic, and encapsulated (usually seen with India ink). If antibiotics have been given for >24 hours, perform immunohistochemical staining and/or polymerase chain reaction.

Imaging

- Inhalational: Widened mediastinum on chest radiograph may be present; pleural effusions frequently present; infiltrates are rare.
- GI: Mesenteric adenopathy on CT scan likely.

Diagnostic Procedures/Surgery

Pathological Findings

DIFFERENTIAL DIAGNOSIS

Skin Cellulitis; Brown recluse spider bite; Cat-scratch disease; Rat bite fever; Rickettsial spotted fever; Carbuncle; Cowpox; Bullous erysipelas; Tularemia vasculitides; Ecthyma gangrenosum; Orf (a transmissible viral disease of goats and sheep)

TREATMENT

PRE HOSPITAL

INITIAL STABILIZATION

GENERAL MEASURES

Inhalational and GI anthrax are not known to spread from person to person, so communicability concerns are not an issue during management of the patient. While cutaneous anthrax is also considered non-contagious, avoidance of contact with the wound or wound drainage seems prudent.

Diet

Activity

Nursing

SPECIAL THERAPY

Radiotherapy

Physical Therapy

IV Fluids

Complementary and Alternative Medicine

MEDICATION (DRUGS)

First Line

- Cutaneous: Ciprofloxacin 500 mg PO b.i.d. for 60 days or doxycycline 100 mg PO b.i.d. for 60 days. If systemic involvement, massive edema, or

lesions on the head or neck, follow treatment recommendation per inhalational anthrax (2)[C].

- Inhalational and GI: IV ciprofloxacin 400 mg q12h or doxycycline 100 mg q12h AND 1 or 2 additional antimicrobials such as rifampin, vancomycin, penicillin, ampicillin, chloramphenicol, imipenem, clindamycin, and clarithromycin. May switch to PO when clinically appropriate. Must complete 60-day course (combined PO and IV) (2)[C].

Second Line

Patients being treated for anthrax may also benefit from vaccination as part of their regimen (3)[C].

SURGERY

FOLLOW-UP

DISPOSITION

Admission Criteria

Discharge Criteria

Issues For Referral

PROGNOSIS

- Cutaneous: Death in 5–20% of untreated cases.
- GI: Mortality rates as high as 50% reported.
- Inhalational: Death in 99% of untreated cases.

COMPLICATIONS

PATIENT MONITORING

Must monitor patient for 60 days to ensure completion of the treatment course

REFERENCES

1. Jefferson T, Demicheli V, Deeks J, et al. Vaccines for preventing anthrax. [Systematic Review] Cochrane Infectious Diseases Group. Cochrane Database of Systematic Rev. 1,2006.
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3. Centers for Disease Control and Prevention. Use of anthrax vaccine in the United States, ACIP Recommendations. MMWR Recommendations & Reports. 2000;49(RR-15):1–20.

ADDITIONAL READING

- The anthrax vaccine immunization program. <http://www.anthrax.mil>
- Centers for Disease Control and Prevention, Emergency Preparedness and Response. <http://www.bt.cdc.gov/agent/anthrax/>
- Durning SJ, Roy MJ. Anthrax. In: Roy MJ, ed. Physician's Guide to Terrorist Attack. Totowa, NJ: Humana Press Inc.; 2003.

- Schwartz MN. Recognition and management of anthrax—an update. N Engl J Med 2001;345:1621–6.

MISCELLANEOUS

CODES

ICD9-CM

- 022.0 Cutaneous Anthrax
- 022.1 Pulmonary Anthrax
- 022.2 Gastrointestinal Anthrax

ICD10

- A22.0 Cutaneous Anthrax
- A22.1 Pulmonary Anthrax
- A22.2 Gastrointestinal Anthrax

Snomed

CPT

PATIENT TEACHING

PATIENT TEACHING: DIET

PATIENT TEACHING: ACTIVITY

PATIENT TEACHING: PREVENTION

FAQ

- Q: Is anthrax vaccination safe?
 - A: Anthrax vaccination is as safe as other vaccinations according to the FDA, CDC, and the National Academy of Sciences.
- Q: What is the likelihood that a case of inhalational anthrax is naturally occurring?
 - A: The last case of occupationally related inhalational anthrax in the US was in 1976. Therefore, a case of inhalational anthrax should be considered a bioterrorist event until proven otherwise.
- Q: Is inhalational anthrax communicable?
 - A: Inhalational and GI anthrax are not known to spread from person to person.
- Q: How long must a person with inhalational anthrax be treated?
 - A: 60 days. This recommendation is based on studies done in monkeys, where relapse after therapy was noted when medications were discontinued after 30 days.