Case Definition

Anthrax (*Bacillus anthracis*)
(Notifiable)

February 2024

1. **Disease Information**
   - **1.1 General Disease and Pathogen Information:** Anthrax is a serious zoonotic disease caused by the spore-forming bacterium *Bacillus anthracis* that affects mammals and rarely birds. *B. anthracis* is found worldwide; in North America naturally occurring anthrax spores found in the soil can cause sporadic outbreaks in U.S. States west of the Mississippi River and in parts of Canada. Anthrax spores can be found in soil for many years after exposure and pose a risk to grazing animals that may forage down to the soil level. Flies may act as a mechanical vector for *B. anthracis* spores and animal hides, hair, and wool may act as fomites. Animals become infected after wound inoculation, ingestion, or inhalation of spores, which then infect macrophages, germinate, and proliferate systemically. Anthrax is mediated primarily by exotoxins and their enzymatic effects. The exotoxins, lethal toxin and edema toxin, are produced by *B. anthracis* and respectively cause local necrosis, extensive edema, and septicemia, which are frequent characteristics of the disease.
   - **1.2 Clinical Signs:** Peracute, acute, subacute, and rare chronic forms of the disease are reported. Ante-mortem clinical signs may be virtually absent in peracute and acute forms of the disease, with animals found dead, with or without hemorrhage from orifices. Subacute disease may be characterized by progressive fever, depression, inappetence, weakness, prostration, and death. Acute, subacute, and chronic disease may show localized swelling and fever. In the rare cases of chronic disease, the only sign may be enlarged lymph nodes. Domestic ruminants are the most severely affected.
     - **1.2.1** Cattle, small ruminants, most wild herbivores: Most often peracute, with death preceding any clinical signs. Some animals may briefly exhibit gait abnormalities and dyspnea for less than 2 hours before collapsing and entering terminal convulsions. Acute infections are rare, but ruminants will become abruptly febrile (up to 107°F/41.5°C) and excited, followed by disorientation, stupor, depression, respiratory and/or cardiac distress, staggering, convulsions, and death. Dark bloody discharge from orifices may be a presenting sign, reflecting an inability of the blood in the body to clot, including hematuria, hematochezia, and peripheral edema. Behavioral changes and seizures, reflecting central nervous system (CNS) edema and hemorrhage, are common. Localized, subcutaneous, edematous swelling may be present on the ventral neck, thorax, and shoulders. Subacute anthrax can also occur in cattle and small ruminants. Death generally follows within 2 to 4 days of clinical signs. Pregnant cattle may abort, and their milk production may drop suddenly. Chronic infections with clinical signs observed for 6 or more days are rarely observed. Rigor mortis is often absent or incomplete.

1.2.2 Horses: Fever, severe colic, anorexia, depression, weakness, bloody diarrhea, and/or swellings of the neck, sternum, lower abdomen, and external genitalia. Death usually occurs within 2 to 3 days of onset of clinical signs. Acute pharyngitis may cause dyspnea, difficulty swallowing, suffocation, and death.

1.2.3 Swine, dogs, and carnivores: Gastroenteritis, fever, lymphadenopathy, and/or pharyngeal edema. The pharyngeal edema may cause dyspnea, difficulty swallowing, suffocation, and death. Acute septicemia characterized by sudden death may also occur. Intestinal involvement is rare, but anorexia, vomiting, diarrhea (with or without blood), or constipation are possible.

1.2.4 New-world and old-world camelids: Cases have been reported but camelids are not considered major carriers or hosts of the disease. Fever, lack of coordination, tremors, blood in urine, diarrhea, colic, respiratory distress, and sudden death with failure to achieve rigor mortis.

1.2.5 Birds: Considered naturally resistant due to high body temperatures. Some cases have been reported in commercial and wild ostrich flocks, ostensibly because of their lower body temperatures.

2. Laboratory Criteria

2.1 Agent Isolation and Identification: Whole blood collected via venipuncture from a recently dead animal is the sample of choice for identification of *B. anthracis*. From older carcasses, nasal turbinate swabs or a section of lymph node may be collected. From cases of extreme decomposition, submit a swab of the nostrils or eye sockets, or a sample of the soil that has been contaminated with blood. A necropsy is not recommended in suspect anthrax cases as it causes significant environmental contamination due to dispersal of spores and presents a risk of inhalational exposure; however, if a necropsy is done, a section of the spleen or lymph nodes may be submitted. Visualization of the large encapsulated Gram-positive bacilli, usually in large numbers, in a blood smear stained with polychrome methylene blue (M'Fadyean reaction) is fully diagnostic. *B. anthracis* can be isolated with standard aerobic bacteriological culture, but culture from environmental samples and animal products can be challenging. *B. anthracis* grows rapidly with a distinctive appearance of square ends, which is not common for bacilli. Identification is by biochemical tests, diagnostic gamma phage, or polymerase chain reaction (PCR).

2.2 Agent Characterization: A test specific for capsule production, via either growth under special conditions with polychrome methylene blue staining of the capsule or PCR with detection of toxin and capsule genes is necessary to differentiate the acapsular live Sterne vaccine strain from virulent strains of *B. anthracis*.

2.3 Serology: Rarely used for diagnostic purposes.

3. Case Classification

3.1 Suspect Case: A susceptible animal species that

3.1.1 is recently deceased; **AND**

3.1.2 has clinical evidence and history consistent with anthrax; **OR**

3.1.3 is linked to a plausible or confirmed environmental exposure.

3.2 Presumptive Positive Case: A suspect case with

3.2.1 demonstration of typical *B. anthracis* organisms on direct microscopic examination of blood smears; **OR**

3.2.2 identification of *B. anthracis* without confirmation of toxin and capsule production.

3.3 Confirmed Positive Case: Suspect case with

3.3.1 confirmation of encapsulated and virulent *B. anthracis* by PCR; **OR**

3.3.2 confirmation of encapsulated and virulent *B. anthracis* by culture methods.

4. Reporting Criteria: Anthrax is a U.S. Notifiable disease that is immediately reportable under the APHIS National List of Reportable Animal Diseases (NLRAD).

4.1 NLRAD reporting in accordance with the NLRAD Standards for Notifiable diseases; and by APHIS to the World Organisation for Animal Health (WOAH); **AND**

4.2 Federal Select Agent Program reporting using Form 4.