

Anthrax and Zoonosis

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Introduction

Aka Splenic Fever, Wool Sorter's Disease, Anthrax is a zoonotic disease caused by the spore forming bacterium *Bacillus anthracis*, characterized by acute septicemia with a high fatality rate, often accompanied by hemorrhagic lymphadenitis, absence of rigor mortis and presence of unclotted blood in natural orifices, mostly common in wild and domestic herbivores (eg.,cattle, sheep, goats, camels, antelopes) but can also be seen in people exposed to tissue from infected animals.

Etiology

Bacillus anthracis is an aerobic, gram-positive, non-motile spore forming rods arranged in long chains. *B.anthraxis* was used successfully as a weapon of terrorism since 1900s. It has been possible to store bacteria in a viable condition in about 60 years in rubber stoppered bottle (Wilson and Russell, 1964).

Epidemiology

Anthrax has been reported from nearly every continent and is most common in agricultural regions with neutral or alkaline, calcareous soils. i.e., South and Central America, Southern and Eastern Europe, Asia, Africa, the Caribbean, and the Middle East. It is still endemic in Middle-east Asia, Kenya, Zimbabwe, Thailand, Iran, Iraq, turkey, parts of Russia and Yugoslavia. In northern Europe and countries with similar

epidemiological situations, one human cutaneous case per 10 livestock carcasses butchered are seen while in developing countries (Africa, India, and the southern Russian Federation), each affected cow can result in up to 10 human cases because of home slaughter and sanitation issues. The incidence of human anthrax in the world is estimated to be 20,000 to 1,00,000 cases per annum (WHO).

In Nepal, a total of 222 animals were affected during 19 different outbreaks in 1996 (Bhatanagar&Batra, 2001). According to GIDEON Informatics Inc., (Dr. Stephen Berger, 2016), animal anthrax was confirmed for the first time in 1992 in Kathmandu in four cattle near Kathmandu. Number of bovine affected was highest in 2001 reaching to 34 and there were no cases of bovine anthrax during 2005-2007. Latest cases are 40 cattle death in foregone 5 months in Galdha-7, (ekantipur.com; Jan 19, 2016) and 4 oxen death in Atmara, Dhankuta N.P-3 (dhankutakhabar.com; June 6, 2016).

Sources and Transmission

The transmission may occur due to:

- Feed (fodder and meat)
- Direct contact with body secretions or Contaminated fomites
- Inoculation into skin during husbandry practices, surgical operations and mechanical transmission by vectors (Tabanusfly,etc.)

Pathogenesis

Bacillus anthracis produces three type of toxins:

- Factor-I: Oedema Factor (EF) – AdenylateCyclase (causes Oedema)
- Factor-II: Protective Antigen (PA)- transports EF & LF to target cells
- Factor-III: Lethal Factor (LF)- Zn dependantmetaloproteases (Inhibition of signal transduction protein involved in cell division)

The poly-D-glutamate capsule is responsible for the interference of opsonization and thus enhances the function of EF and LF. The pathogenesis is as follows:

Anthrax spore -> Pharynx -> Small Intestine -> Unaffected by gastric juice
-> Vegetative form-> Lymph nodes -> Lymphatic channel (Multiplication)
-> Blood Stream -> Bone Marrow -> Fulminating Septicaemia -> Death due to shock and renal failure (Harris-Smith et. al., 1958) or severe anoxia (Rammele et. al., 1968)

Anthrax bacilli -> Lysis -> Toxin -> Damage of vascular endothelium -> Haemorrhage -> Stasis -> Exudates in body cavities -> Impairment of blood coagulation

The Presence of Antibodies in host can neutralize the toxin and animal may recover.

Disease in Animals

The Incubation period of anthrax bacilli is 3–7 days (range 1–14 days). The disease may be manifested as:

— **Peracute form** (common in cattle and sheep): characterized by sudden onset and a rapidly fatal course, Staggering, dyspnea, trembling, collapse, a few convulsive movements, and death.

— **Acute form-** In cattle and sheep: abrupt fever and a period of excitement followed by depression, stupor, respiratory or cardiac distress, staggering, convulsions, and death; Increased temperature (107°F/41.5°C), Localized, subcutaneous, edematous swelling in ventral neck, thorax, and shoulders.

In horses: fever, chills, severe colic, bloody diarrhea, and swellings of the neck, sternum, lower abdomen, and external genitalia; Death occurs within 2–3 days of onset.

— **Chronic form-** Oropharyngitis is common; anorexia, vomiting, diarrhea (sometimes bloody), or constipation in Pig.

Disease in Humans

The disease is seen several forms in humans,

— **Cutaneous anthrax (malignant pustule/eschar):** Most common form of disease in man. Resembles an insect bite, develops into vesicle and then painless ulcer 1-3cm in dm with a characteristic black necrotic area in the center within 1-2 days. Morbidity 95% and mortality 20%.

— **Pulmonary anthrax (wool sorter's disease):** Characterized by cough, pain in the chest, high fever, septicemia, blood in the sputum, shock and death after 1-2 days. 100% mortality.

— **Gastrointestinal Anthrax:** After 1 to 7 days of infection several abdominal pains, high fever, vomition, watery to bloody diarrhoea. Mortality 25-60%.

— **Meningial anthrax:** Severe head ache, nervous symptoms, high fever, general malaise and death.

PM Lesions

The diagnostic lesions are:

— Rigor mortis is frequently absent or incomplete.

— Dark blood (due to lack of O₂) that fails to clot readily may ooze from the mouth, nostrils, and anus with marked bloating and rapid body decomposition.

— Hemorrhages and ulcers frequently along the GI tract mucosa.

— Splenomegaly and Hepatomegaly.

— Meningitis.

Diagnosis

— Animal that die suddenly with bloody discharges from natural orifices must be suspected for anthrax death. The body should not be opened if anthrax has been suspected. Anthrax is diagnosed by isolating *B. anthracis* from the blood, skin lesions, or respiratory secretions or by measuring specific antibodies in the blood of persons with suspected cases. Once exposed to Anthrax half of all deaths occur within 24 to 48 hours.

— Samples: Blood, Nasal turbinates, Affected lymphoid tissue

— Bacterial culture, PCR tests, and fluorescent antibody stains to demonstrate the agent in blood films or tissues; Western blot and ELISA tests are done for antibody detection.

Treatment

1. Peracute cases cannot be treated because death of the infected animal occurs before the symptoms appear. Treatment at initial stage of disease with Penicillin (V or G) @10000 units/kg bw twice daily for 5-7 days through parenteral route has been found effective (Whitford,1978). Oxytetracycline, amoxicillin, chloramphenicol, ciprofloxacin, doxycycline, erythromycin, gentamicin, streptomycin, and sulfonamides also can be used.
1. Anti-anthrax serum @100-200 cc IV along with a course of penicillin is suggested.

Prevention and Control

The following measures are suggested for control of Anthrax:

— Annual vaccination (Nonencapsulated Sterne-strain vaccine) of all grazing animals in the endemic area at least 2–4 wk before the season when outbreaks may be expected followed by antibiotics administration within 1 wk of vaccination.

— Strict Quarantine and proper disposal of contaminants, disinfection procedures.

— Use of insect repellents.

— People who handle diseased animals should follow sanitation.

— Three S/C injections to be administered at 2 weeks apart and additional 3 injections at 6,12 and 18 months followed by annual booster there after (Bioport Corporation vaccine for veterinarians, lab workers, wool sorters,etc.)

Risks of Anthrax in Nepal:

v The bacilli may be endemic in Nepal because there have been several outbreaks already and still ongoing (as spores remain in soil for decades).

v Unsanitary butchering practices and lack of strict food safety issues.

v Inefficient Quarantine and disposal practices.

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