

ANTHRAX – A ZOOONOTIC DISEASE

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This set of slides is a guideline on surveillance, prevention & control of anthrax, that is issued from the State Surveillance Unit of I.D.S.P., West Bengal. The slides, on one hand, briefly describe the epidemiology and the modes of transmission and outbreak control measures, that may interest a public health manager.

On the other hand, these slides deal with the basics of diagnosis & case management (including prophylaxis), that would be quite relevant for the Medical Officers.

CONTENT

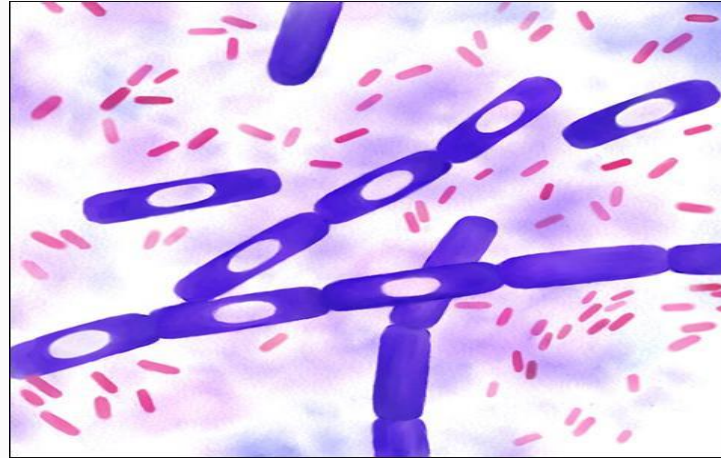
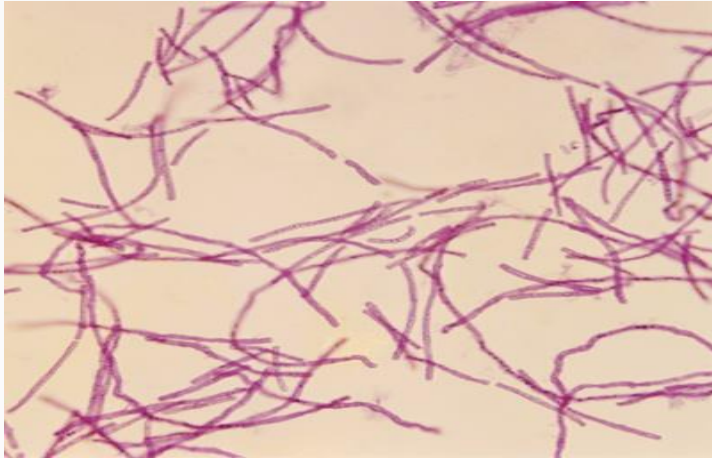
- 1. Causative Agent of Anthrax**
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CAUSATIVE AGENT OF ANTHRAX

WHAT IS ANTHRAX

- Anthrax is also known as Malignant pustule, Malignant oedema, Wool sorter's disease.
- In West Bengal known as 'TARKA' in animal.
- One of the oldest recorded disease of animals.
- Primarily a disease of herbivorous animals (cattle, sheep, goats horses and wild herbivores).
- Occasionally affects human (incidental).
- First disease of humans and other animals in which the causative agent was definitely demonstrated as a specific microorganism by the French biologist Casimir-Joseph Davaine in 1863 and by the German bacteriologist Robert Koch in 1876 who isolated the organism in pure culture.

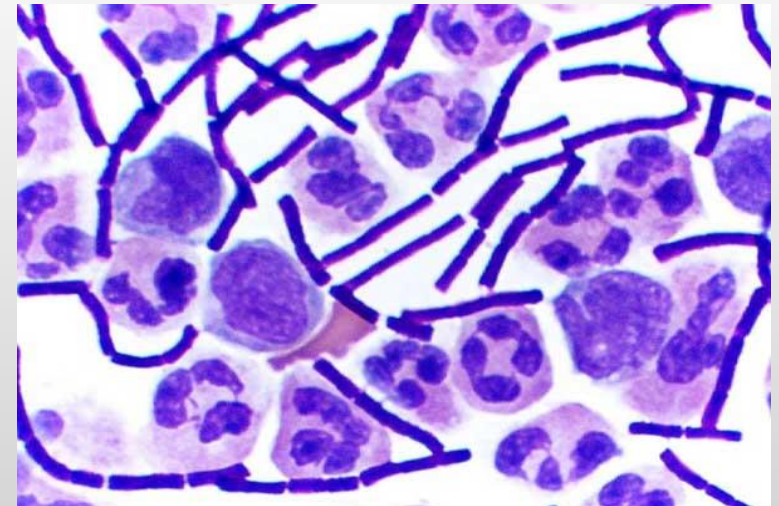
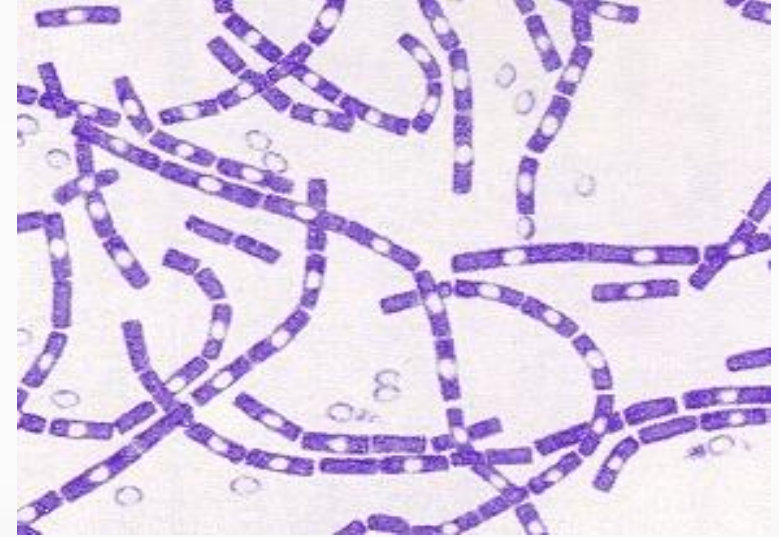
Bacillus anthracis



- First pathogenic bacteria to be observed under microscope
- First bacterium to be shown cause of disease
- First bacilli to be isolated in pure culture
- First bacilli in which spores were demonstrated
- First bacterium that evolved as a potent weapon in bioterrorism

MORPHOLOGY OF *Bacillus anthracis*

- One of the largest of all bacterial pathogens with a width of 1-1.2 μm and a length of 3-5 μm .
- Gram +ve, rod shaped, non motile and non acid fast.
- Bamboo stick appearance of long chain.
- Polypeptide capsule.
- The cells have characteristic squared ends.
- Central or sub terminal oval spores, do not form in animal tissue.
- Spores are resistant to staining.



PHYSICAL PROPERTIES OF *B. anthracis*

Moist heat kills – Vegetative cells at 60 ° C X 30 minutes

Spores at 100 ° C X 10 minutes

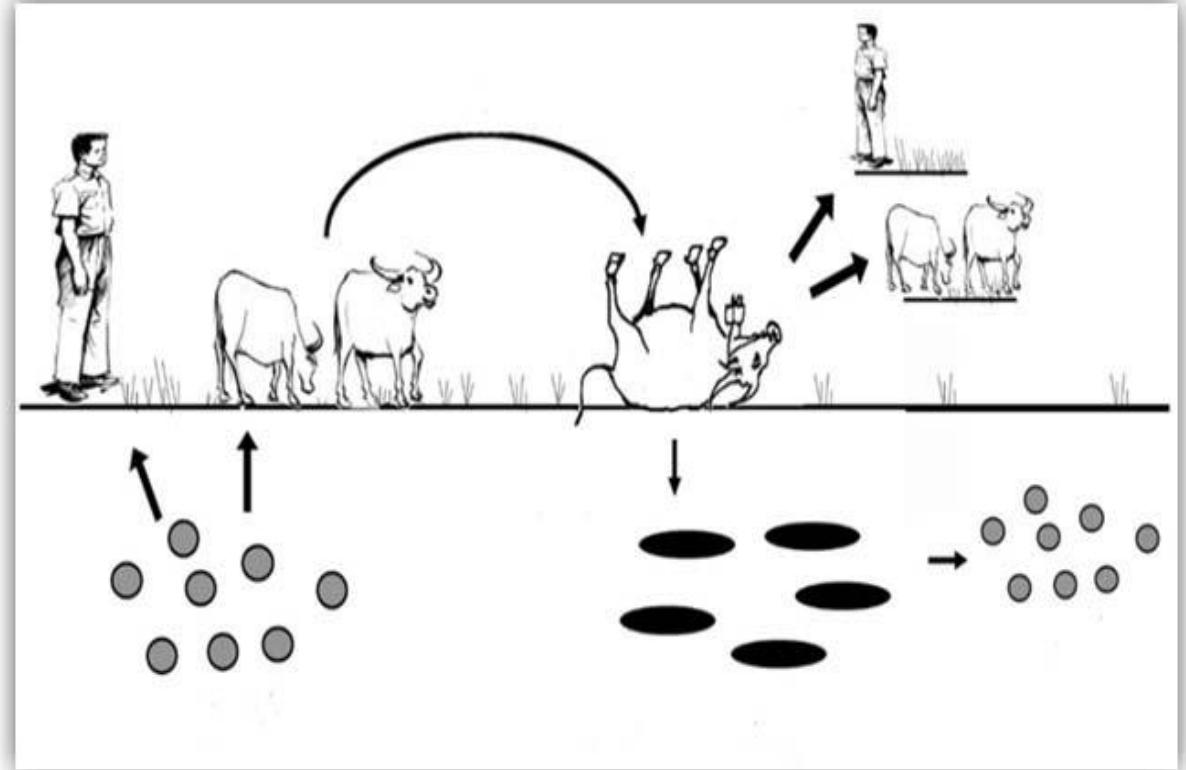
Spores are also killed by - 5% Formaldehyde

- 4% KMnO_4

- Hypochlorite (0.5%)

SOIL SERVES AS A NATURAL RESERVOIR OF ANTHRAX SPORES

- Dried or otherwise processed skins of infected animals may also harbour the spores for years.
- Spore forms are predominant in the environment and it is very largely through the uptake of spores that anthrax is contracted.
- Infected animals shed the bacilli during bleeding from natural orifices, or if the blood of the dead animal is spilled accidentally.
- On exposure to the air the vegetative forms sporulate.
- Spores are resistant to many disinfectants and adverse environmental conditions
- Spores remain viable in the soil for decades.

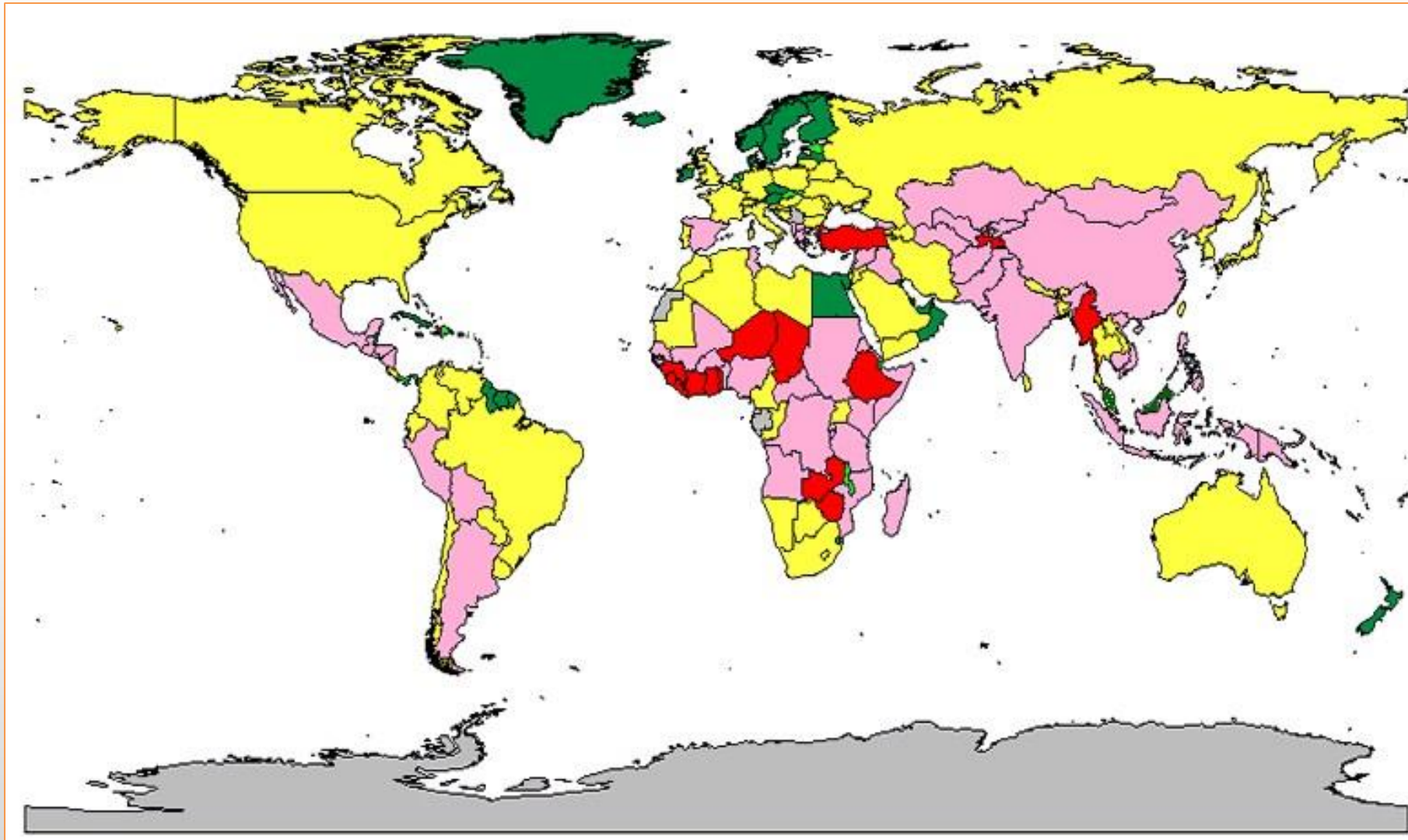


EPIDEMIOLOGY OF ANTHRAX

EPIDEMIOLOGY

- Distribution worldwide.
- Most common in agricultural regions where it occurs in animals.
- These include South and Central Americas, Southern and Eastern Europe, Africa, the Caribbean, Middle East & Asia (China, Pakistan, India).
- Human to human or animal to animal transmission is rare.
- Grazing animals become infected through ingestion of spores in soil (carcasses are usually the source).
- Epidemic : A. Spread to contiguous geographic areas - by infected animal
B. Spread to non-contiguous geographic areas by
 - Biting flies
 - Vultures
 - Contaminated surface water pool

Geographical Distribution of Anthrax

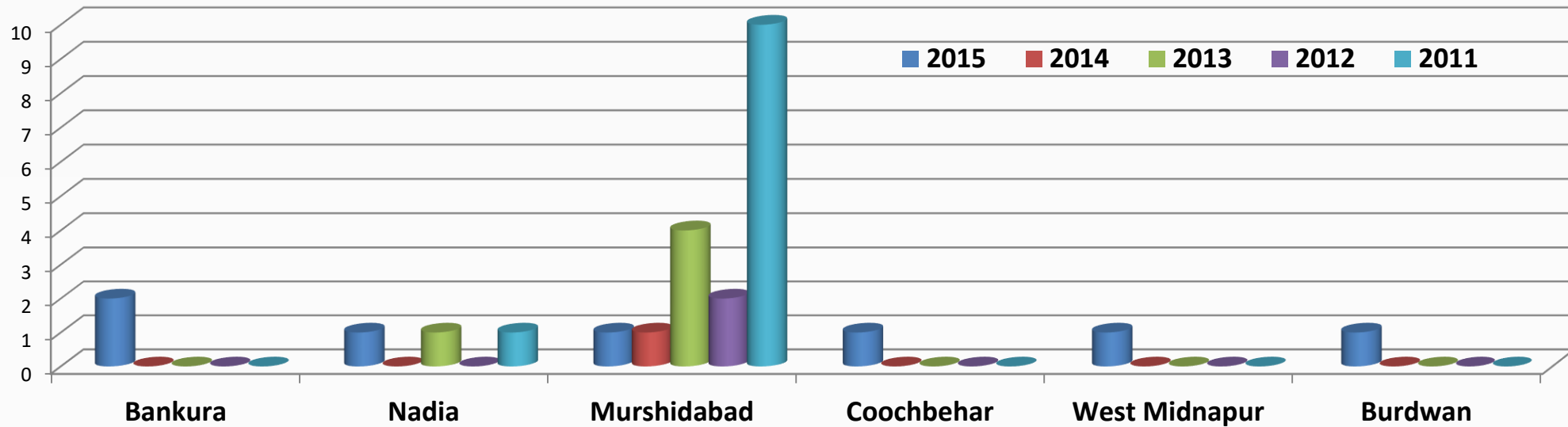


Source : http://www.vetmed.lsu.edu/whocc/mp_world.htm

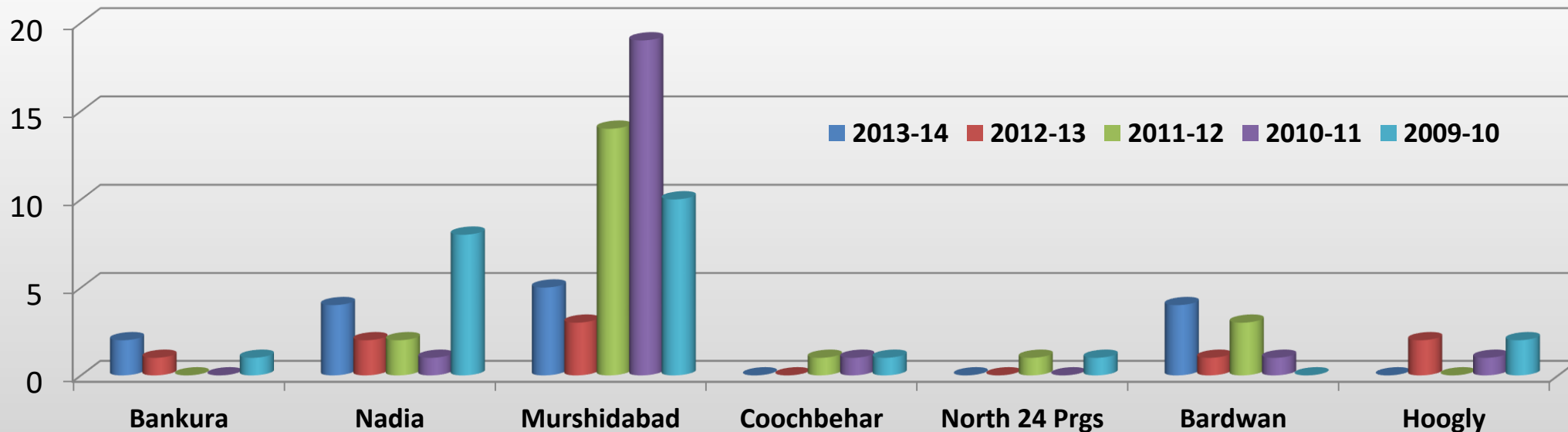
HUMAN ANTHRAX OUTBREAK SCENARIO IN WEST BENGAL FOR LAST 5 YEARS (2011 -2015)

Year	District	No. of outbreak	No. of cases in outbreaks	No. of deaths in outbreaks	C.F.R. (%)
2015	Bankura	2	56	2	3.6
	Nadia	1	10	0	0.0
	Murshidabad	1	14	0	0.0
	Coochbehar	1	6	0	0.0
2014	West Midnapur	1	11	0	0.0
	Murshidabad	1	19	0	0.0
2013	Murshidabad	4	35	0	0.0
	Nadia	1	9	0	0.0
	Burdwan	1	10	1	10.0
2012	Murshidabad	2	8	0	0.0
2011	Murshidabad	10	95	0	0.0
	Nadia	1	7	0	0.0

District wise Anthrax outbreak in human in West Bengal, 2011-2015



District wise Anthrax outbreak in animal in West Bengal, 2009-10 to 2013-14



TRANSMISSION AND PATHOGENESIS

TRANSMISSION

Animal

1. Ingestion – Most common

- Contaminated soil or feeds.
- Heavy rain, drought.
- Omnivores and carnivores through contaminated meat, bone meal and other feeds
- Among wild life from feeding on anthrax carcasses.



2. Inhalation : Least common

3. Cutaneous :

- Mechanical (insect bite)
- Vultures have been reported to spread the organism from one area to another.

Incubation period in the susceptible herbivore ranges from 1 to 14 days.

TRANSMISSION...(Cont'd)

Human

1. Cutaneous anthrax :

- After exposure to infected animals and contaminated animal products such as hair, hides, wool, bones, or skin.
- Biting fly from infected animal.

2. Inhalation anthrax :

- Inhalation of spores. Aerosols of such particles may be created by the agitation of the hair or wool in the industry settings.

3. Intestinal anthrax :

- Results from ingestion of contaminated meat.

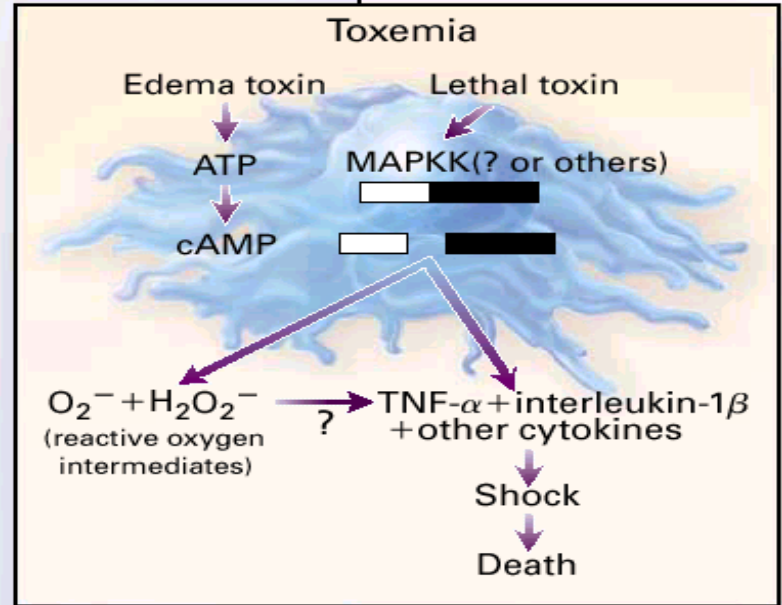
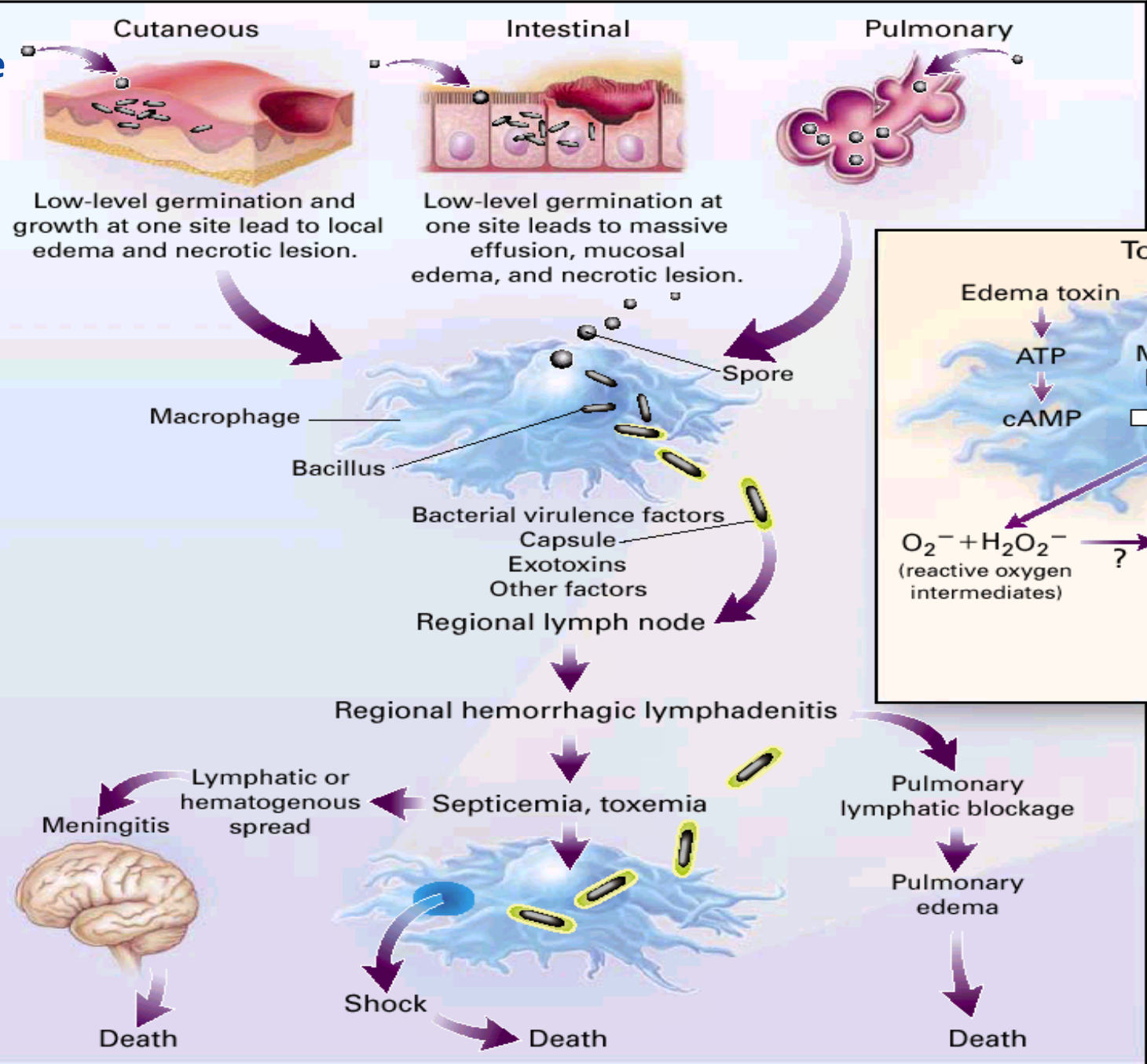
Incubation period - few hours to 7 days.

Most cutaneous anthrax (by biting flies) occur within 48 hours of exposure



PATHOGENESIS OF ANTHRAX

Spore



CLINICAL SIGNS OF ANTHRAX

CLINICAL SIGNS OF ANTHRAX IN ANIMAL

- Many species of animal affected
- Ruminants at greatest risk
- Three forms in animal
 - 1) **Per acute**
Cattle, sheep, goat, antelope
 - 2) **Acute**
Ruminants & equine
 - 3) **Subacute-chronic**
Swine, dogs, cats.



CLINICAL SIGNS OF ANTHRAX IN ANIMAL...(Cont'd)

- First signs of an anthrax is bleeding from natural orifices, subcutaneous haemorrhage, sudden death without prior symptoms or following a brief period of fever in the affected livestock.
- In pigs, carnivores and primates, local oedema and swelling of face and neck or of lymph nodes particularly mandibular and pharyngeal and/or mesenteric nodes may be present.

Other signs are:

- Going off feed or producing less milk than usual.
- During systemic phase, the animal become distress, difficulty in breathing and cease eating and drinking.
- Swelling in the submandibular fossa may be apparent and temperature may rise.
- If the animal fails to respond to the treatment, it lapses into coma followed by death due to shock.



CLINICAL SIGNS OF ANTHRAX IN HUMAN

Clinically three forms of Human anthrax occur

- A. Cutaneous anthrax
- B. Inhalation anthrax
- C. Ingestion anthrax

Broadly can be classified into:

➤ Non Industrial/Agricultural (through infected animals)

- Cutaneous anthrax
- intestinal anthrax

➤ Industrial Anthrax (through animal products)

- Mostly through animal products (wool, hair, hides, bones)
- Likely to develop cutaneous and inhalation anthrax

CLINICAL SIGNS OF ANTHRAX IN HUMAN...(Cont'd)

A. CUTANEOUS ANTHRAX

Incubation period: 2-3 days

Day 0.

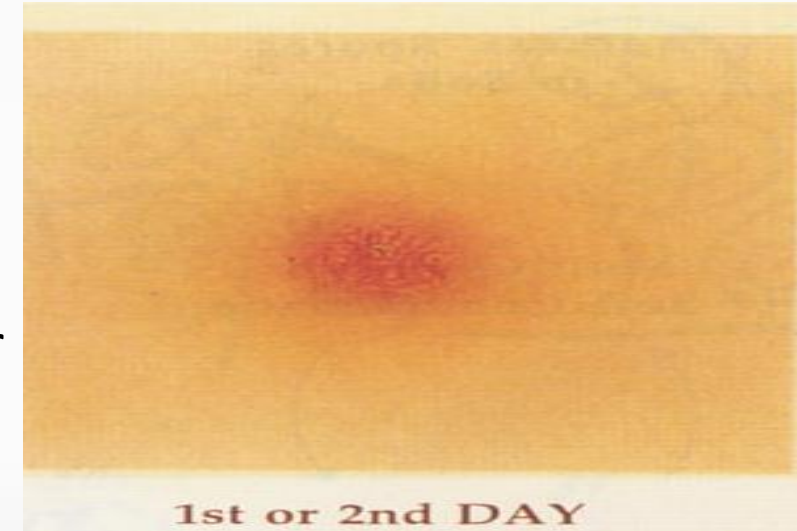
Entry of the infecting *B. anthracis* spores through a skin lesion (cut, abrasion, etc.) or possibly as vegetative forms, or vegetative forms and spores by means of a fly-bite.

Days 2–3.

A small pimple or papule appears

Days 3–4.

- A ring of vesicles develops around the papule.
- Marked oedema starts to develop.
- The lesion is painless.
- The lesion is usually 1–3 cm in diameter and remains round and regular. Occasionally larger and irregularly shaped



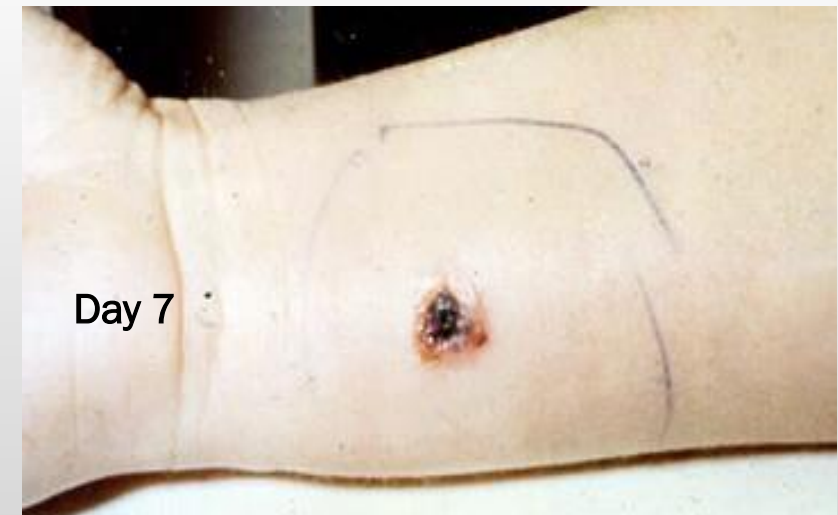
CLINICAL SIGNS OF ANTHRAX IN HUMAN...(Cont'd)

Days 5–7.

- The original papule ulcerates & form the characteristic eschar.
- Oedema extends some distance from the lesion.

Systemic symptoms :

- Low-grade fever, malaise and headache.
- If the cutaneous reaction is more severe, especially if located on the face, neck or chest, clinical symptoms may be more severe with more extensive oedema extending from the lesion.
- Toxemia.
- Change in mental status, high fever, hypotension, regional lymphadenomegaly and inability to eat or drink.

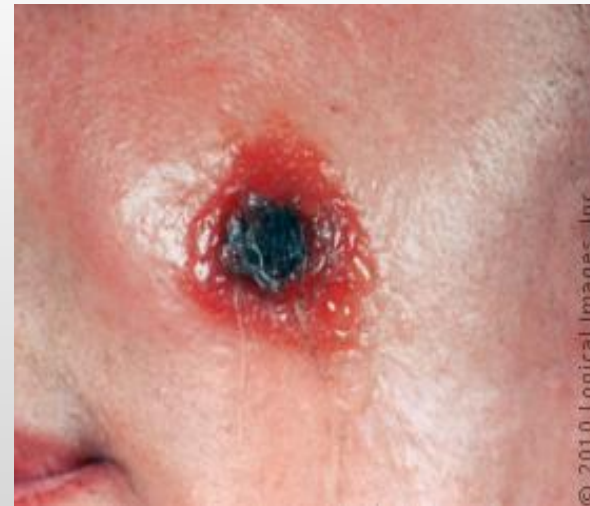


CUTANEOUS ANTHRAX.....(Cont'd)

Day 10 (approx.)

The eschar begins to resolve; resolution takes several weeks and is not hastened by treatment. A small proportion of untreated cases develop sepsis or meningitis with hyperacute symptoms.

About 5-20% of untreated cases of cutaneous anthrax will result in death.

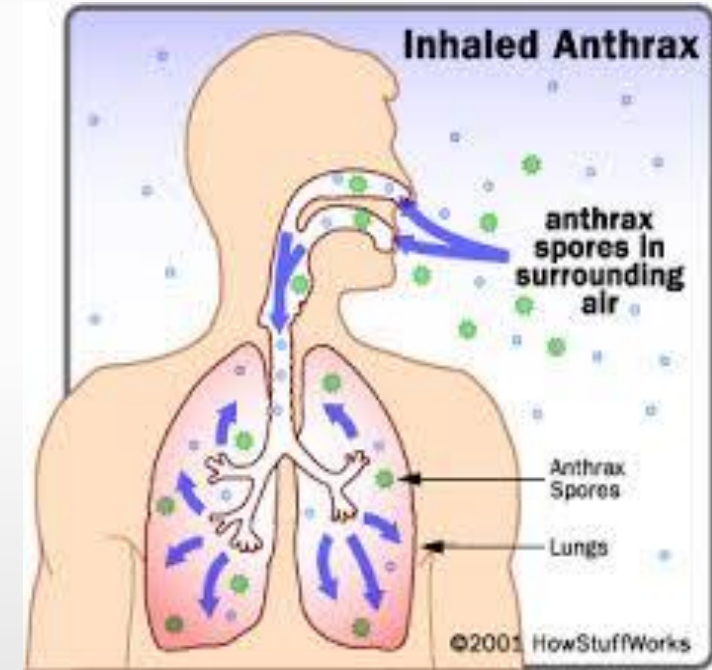


Different locations and types of lesion of cutaneous anthrax

CLINICAL SIGNS OF ANTHRAX IN HUMAN...(Cont'd)

B. INHALATION ANTHRAX:

- **Incubation period 1-7 days.**
- Incubation period up to 60 days is possible.
- Initial symptoms may resemble a common cold.
- May progress to severe breathing problems and hypoxia leading to respiratory failure and shock.
- Death in 1-2 days after onset of the acute symptoms.
Mortality is 75-90% in untreated cases.



CLINICAL SIGNS OF ANTHRAX IN HUMAN...(Cont'd)

C. INGESTION ANTHRAX

Incubation period : 3-7 days

Two clinical forms:

- **Intestinal anthrax:** nausea, vomiting, fever, abdominal pain, haematemesis, bloody diarrhoea and massive ascites.

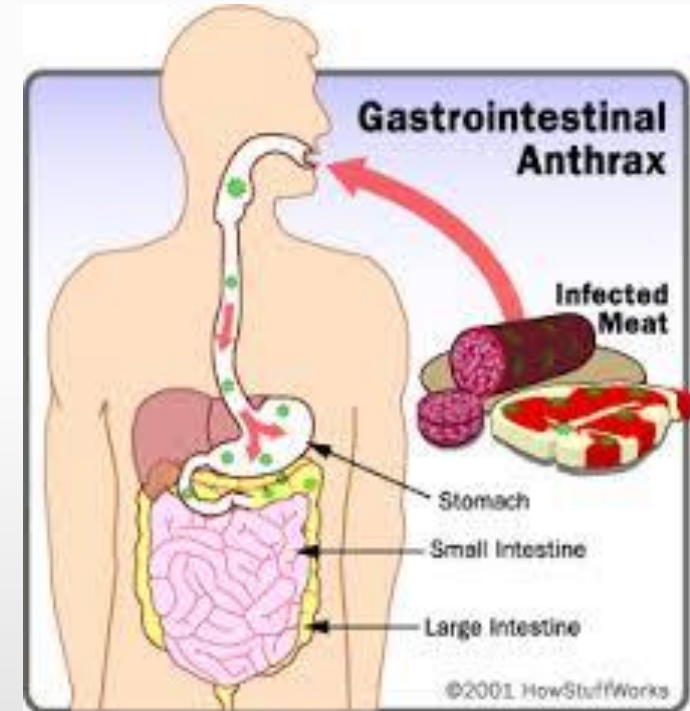
Unless treatment starts early, toxemia and shock develop resulting in death.

Result in death in 25% to 60% of cases.

- **Oropharyngeal anthrax:**

Sore throat, dysphagia, fever, lymphadenopathy in the neck and toxemia.

Even with treatment mortality is high, about 50%.



OTHER FORMS

Anthrax Meningitis :

- Meningitis due to anthrax is a serious clinical development
- **It may follow any of the other three forms of anthrax**
- Intense inflammation of the meninges with accompanying oedema.
- Anthrax meningitis is a haemorrhagic leptomeningitis with symptoms of
 - neck pain with or without flexion
 - headache
 - changes in mental state
 - vomiting and high-grade fever
 - neurological signs include cranial nerve palsies, myoclonus, fasciculation, decerebrate posturing and papilloedema
- The prognosis is extremely poor
- May develop in 30-40% cases
- 100% mortality

CASE DEFINITION

RECOMMENDED CASE DEFINITION FOR HUMAN

- **Suspect:** A case that is compatible with the clinical description and has an epidemiological link to confirmed or suspected animal cases or contaminated animal products.
- **Presumptive:** A suspected case where
 - The clinical specimen in culture shows typical characteristic; or
 - In smear short chain of capsulated bacilli are seen when stained with polychrome methylene blue.
- **Confirmed:** A suspected case that is laboratory confirmed by one or more of the following:
 - Where it shows encapsulated, non-motile, non-haemolytic gram positive bacilli susceptible to penicillin and the isolate is susceptible to gamma phage lysis.
 - PCR confirming presence of toxin and capsule genes.

Source: Guideline for Prevention and Control of Anthrax. Zoonosis Division, NCDC. 2006

SPECIMEN TO COLLECT

SPECIMEN TO COLLECT (HUMAN ANTHRAX)

➤ **Cutaneous anthrax:**

- In early stage vesicular exudate by swabs and capillary tube aspirate
- In later stage swab from underneath the eschar after lifting up the eschar

➤ **Ingestion anthrax:**

- Stool sample – if patient is not severely ill
- Ascitic fluid (peritoneal fluid) –if patient is severely ill

➤ **Inhalation anthrax:**

- Sputum, serum samples for antibody
- Gastric lavage -In severely ill children

CASE MANAGEMENT

CHEMOTHERAPY

Antibiotics are effective if the disease is recognized early and the full recommended dose and course of the antibiotic are completed; otherwise the disease can be fatal.

General measures for treatment of shock are also necessary.

Cutaneous anthrax



1. Ciprofloxacin 500 mg BD orally for 10 days or
Doxycycline 100 mg BD orally for 10 days or
Amoxicillin 500 mg TDS orally for 10 days
2. Oral penicillin V 500 mg 6 hourly or
Procaine penicillin 1 million unit 12 to 24 hourly by IM route
3. Chloramphenicol, Rifampicin, Erythromycin, Clindamycin or
Clarithromycin may also be given.

Source: Guideline for Prevention and Control of Anthrax. Zoonosis Division, NCDC. 2006

CHEMOTHERAPY...(Cont'd)

Inhalation and Ingestion anthrax



Ciprofloxacin 400 mg IV BD till 2 weeks after the clinical response or

Penicillin G- 2million units/day by infusion or by slow IV injection should be administered until the temperature returns to normal.

Thereafter treatment should be continued with Procaine penicillin 1 million units every 12- 24 hrs by IM route.

Streptomycin 1-2 gms/day IM, may act synergistically with penicillin.

Supportive care:

- Oxygen inhalation
- Respiratory support
- Treatment of shock if present

Source: Guideline for Prevention and Control of Anthrax. Zoonosis Division, NCDC. 2006

VACCINE AGAINST ANTHRAX

VACCINE FOR HUMANS *(Source: National Health Portal)*

Anthrax vaccine is recommended for people of 18 to 65 years of age. These people should get 5 doses of vaccine (IM):

- Dose : A. First dose when risk of a potential exposure is identified
- B. Remaining doses at 4 weeks and 6, 12 and 18 months after the first dose
- C. Annual booster doses are recommended for ongoing protection

Who are to be vaccinated (not widely available)

Professionals (Veterinarians, butcher, person working in hide, wool and bone meal industry, Zoo keeper, Wild life workers, Forest guards) should be vaccinated if their exposure is frequent and if the human vaccine is available.

VACCINE FOR ANIMALS: Anthrax spore vaccine (for livestock 1 ml SC). *(Source: IAH &VB, West Bengal)*

- Dose : A. 1st dose at 3rd to 5th month of age - then annual booster dose
- B. Before rainy season

**PREVENTION AND CONTROL /
ACTION TO BE TAKEN DURING ANTHRAX
OUTBREAK**

PREVENTION AND CONTROL OF ANTHRAX

The problem of anthrax continues because of

- Consumption of meat from sudden death animals and utilizing their hair, hides, bones etc.
- Lack of cooperation over reporting sudden deaths in animals.
- Long delays in diagnosis due to poor communication and inadequate local laboratory facilities.
- Failure to implement policies on disposal of carcasses and subsequent disinfection and decontamination.

Control of disease in animals is key to prevent the disease in human.

Control measures aim at

- Breaking the cycle of infection
- If a potential infectious source is known to exist, it should be eliminated without delay.

CONTROL MEASURES TO BE ADOPTED DURING ANTHRAX OUTBREAK

In the event of a case of anthrax outbreak occurring in livestock, control measures consists of:

1. Proper disposal of carcasses
2. Disinfection, decontamination and disposal of contaminated materials
3. Initiation of treatment and/or vaccination of other animals as appropriate
4. Intersectoral coordination

CONTROL MEASURES TO BE ADOPTED DURING ANTHRAX OUTBREAK...(Cont'd)

1. PROPER DISPOSAL OF CARCASS

- **AVOID** performing an autopsy when anthrax is being considered.
- **Prevent** escape of bloody exudates from the carcass
 - Ensure that all body openings (e.g. anus, mouth, nose, etc.) are plugged with an absorbent material (e.g. non-perforated paper towel, cloths, etc.) to prevent leakage of exudates.
 - Ensure that the entire head is covered with a heavy plastic bag that is secured at the neck, behind the ears, and across the poll with duct tape or tied with rope.

The methods of disposal of an anthrax carcass are **incineration, rendering or deep burial.**

PROPER DISPOSAL OF CARCASS...(Cont'd)

A. Incineration :

- The goal is to destroy as many spores as possible, thereby decreasing environmental anthrax contamination.
- Must be done with appropriate care to ensure complete burning so that the carcass should be completely reduced to ash.

General Consideration

- Incinerate or burn by either pit or raised carcass method (pyre), which is the preferred method of disposal.
- Be aware that ventilation and adequate airflow within a pyre or pit are essential.
- Understand that, if the fire burns too quickly, a complete burn will not be achieved, necessitating a secondary burn.
- Avoid using materials that may be environmentally harmful (e.g. rubber tires).
- Ensure that an adequate amount of fuel is available to completely reduce the carcass to ash.
- Burn contaminated materials with the carcass.

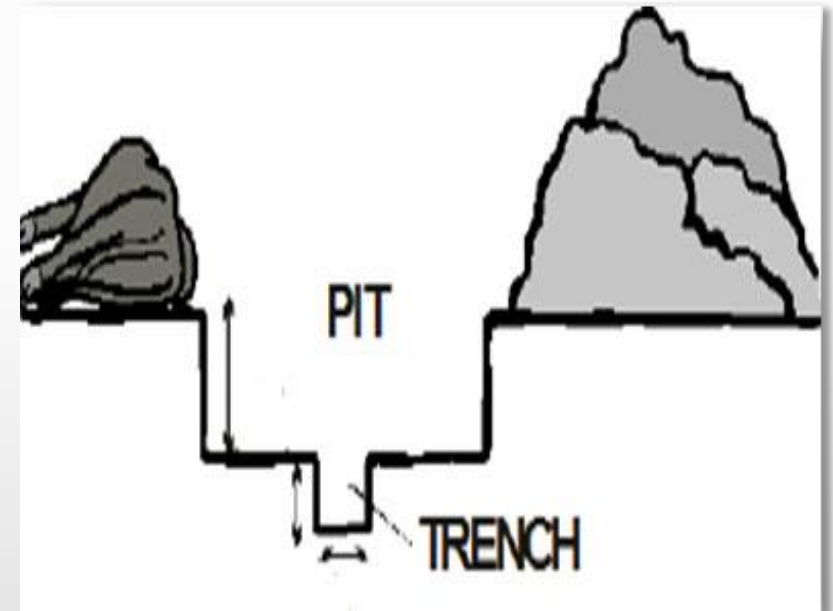


PROPER DISPOSAL OF CARCASS...(Cont'd)

A. Incineration :

i. Pit Method

- For a mature animal, the pit should be 0.5 m (18- 20 inches) deep and should exceed the length and breadth of the carcass by about 0.25m (10 inches) on each side.
- A trench approx. 0.25m wide X 0.25m deep should be dug along the length of the centre of the pit extending beyond the ends by about 0.75m (approx. 30 inches); this serves allowing air for the fire under the carcass.
- The bottom of the pit and trench are then covered with accelerant (kerosene) soaked straw or wood etc., placed in such a way that facilitates airflow.
- Pieces of heavy timber (or other beams) are placed across the pit to support the pyre.
- Then add larger pieces of wood and/or coal if available until the pit is filled upto top ground level.



PROPER DISPOSAL OF CARCASS...(Cont'd)

Pit Method...(Cont'd)

- Saturate all the fuel with kerosene.
- The carcass can be drawn onto the pyre, propping up the carcass to lay it on its back.
- Pour kerosene over the carcass. Set the fire at either end of the longitudinal trench.
- After about first hour, the pyre should be covered with corrugated iron or other metal sheet in such a way as to reduce the heat loss without cutting off the ventilation.
- Approx. quantities of fuel needed for a large domestic animal are
Straw 20kg, kerosene 10 liters and either 2 tonnes of wood or 0.5 tonnes of wood and 0.5 tonnes of coal.

Note: Decontaminate the ground where the carcass lay and from where it was removed to the pit and also the ground, equipment etc. contaminated during this moving process.

Source: Guideline for Prevention and Control of Anthrax. Zoonosis Division, NCDC. 2006

PROPER DISPOSAL OF CARCASS...(Cont'd)

A. Incineration...(cont'd)

ii. Raised Carcass Method (Pyre)

Appropriate when labour is scarce or the ground is unsuitable for construction of a pit.

- Place straw over a 2 x 1.5 metre area.
- Place 2 wooden beams (approx. 2m length) over the straw parallel to each other and about 1.2m apart.
- Soak the straw with kerosene and cover with thin and thick pieces of wood and coal if available.
- Place further cross- pieces of wood or other material across the two main beams to support the carcass.
- Prop up the carcass to lay it on its back.
- The fuel (wood or coal) is banked up on either side of the carcass.
- Fuel and carcass further soaked with kerosene.
- The fire can then be started and when well underway, it should be covered, as in pit method, with metal sheet to retain heat but without inhibiting ventilation.

PROPER DISPOSAL OF CARCASS...(Cont'd)

Raised carcass method...(cont'd)

- More fuel may be required than with pit method.
- For a large domestic animal, an estimate is 0.75 tonnes coal + 0.5 tonnes wood or,
- If coal is unavailable, approximately 3 tonnes of wood, plus 20 kg straw and 20 liters of kerosene.

Note: Decontaminate the ground where the carcass lay and from where it was removed to the pyre and also the ground, equipment etc. contaminated during this movement.

Source: Guideline for Prevention and Control of Anthrax. Zoonosis Division, NCDC. 2006

PROPER DISPOSAL OF CARCASS...(Cont'd)

B. Rendering

- Essentially a cooking process which results in sterilization of raw materials of animal origin such that parts of carcass may be utilized safely for subsequent commercial purposes.
- In general, the raw materials are finely chopped and then passed into a steam heated chamber.
- Temperatures ranging from 100°C to 150°C for 10-60 minutes.

Disadvantage:

There is risk of spreading disease during movement of anthrax infected carcasses to rendering facilities.

Source: Guideline for Prevention and Control of Anthrax. Zoonosis Division, NCDC. 2006

PROPER DISPOSAL OF CARCASS...(Cont'd)

C. Burial Method

If incineration is not feasible or cannot take place immediately, deep burial is the alternative.

- Ensure that the pit is 6 - 8 feet (2m) deep - the bottom of which should be well above the water table (minimum 3 feet or 0.9 m).
- Cover the carcass with lime and soil in 1:3 ratio.
- Use 10% formalin or 5% sodium hydroxide, or another acceptable disinfectant, to decontaminate the carcass and all soil put into the burial pit.



Source: Guideline for Prevention and Control of Anthrax. Zoonosis Division, NCDC. 2006

PROPER DISPOSAL OF CARCASS...(Cont'd)

Burial Method...(cont'd)

General consideration:

- Consider the water table level and soil composition - clay soil is preferable, whereas sand or gravel should be avoided.
- Do not locate burial pit in areas prone to water logging or at risk of flooding.
- Ensure that there is no drinking water supply, river, well or any field drain near the burial site.
- Do not bury carcass in polythene bags or other impervious materials.

Burial should be discouraged in favour of incineration or rendering wherever possible.

Disadvantages

- Disturbance of burial site brings the spores to the soil surface.

PROPER DISPOSAL OF CARCASS...(Cont'd)

D. The last resort

Situations where incineration, rendering or burial may not be feasible. This is the least preferred option.

- Leave the carcass unmoved and adequately closed off from other animals particularly scavengers or people.
- The carcass should be fenced off and covered using branches of trees, corrugated iron sheet or any other available materials, and hazard signs should be posted around the site.
- Cover the carcass and the surrounding area with disinfectants such as 10% formalin or 5% solution of sodium hydroxide, and repeated as needed.
- *B. anthracis* within the animal carcass does not sporulate and is inactivated by the putrefactive process in a few days.
- Environmental contamination due to bloody exudates escaping from natural orifices of the dead animals could be minimized by scorching the site with fire after the carcass has effectively putrefied, though this may be many months later.

CONTROL MEASURES TO BE ADOPTED DURING ANTHRAX OUTBREAK...(Cont'd)

2. Disinfection and Decontamination

- Disinfectants should be available in reasonable quantities.
- Site where the animal died is to be disinfected with 5% formaldehyde after disposal of the carcass.
- Spores resistant to heat, sunlight, drying and many disinfectants.
- Disinfectants
 - Formaldehyde (5%)
 - Glutaraldehyde (2%)
 - Sodium hydroxide (10%)
 - Bleach
- Gas or heat sterilization
- Gamma radiation

Any milk collected from a cow, buffalo or goat showing signs of anthrax within 8 hours of milking is to be destroyed, along with any other milk that may have been mixed with the suspected milk.

CONTROL MEASURES TO BE ADOPTED DURING ANTHRAX OUTBREAK...(Cont'd)

Disinfection and Decontamination...(Cont'd)

- Preliminary disinfection
 - 10% formaldehyde
 - 4% glutaraldehyde (pH 8.0-8.5)
- Cleaning
 - Hot water, scrubbing, protective clothing
- Final disinfection (one of the following)
 - 10% formaldehyde
 - 4% glutaraldehyde (pH 8.0-8.5)
 - 3% hydrogen peroxide
 - 1% peracetic acid

CONTROL MEASURES TO BE ADOPTED DURING ANTHRAX OUTBREAK...(Cont'd)

3. Vaccination

- All symptomatic animals are to be treated.
- All other animals in the affected herd are to be vaccinated.
- All cattle of neighboring premises should be vaccinated.

4. Quarantine

- Affected premises are to be quarantined for at least 3 weeks after the last case.
- A buffer zone, 20-30 Km wide, is to be established around the infected area within which all cattle are to be vaccinated and quarantined.

CONTROL MEASURES TO BE ADOPTED DURING ANTHRAX OUTBREAK...(Cont'd)

Personal Protection For Human

- People entering infected premises are required to wear protective clothing and footwear, which are disinfected before leaving the premises.
- Such persons should avoid any contact with other persons or animals without first changing clothing, washing hands and taking appropriate disinfection measures.
- Where there is a risk of aerosolization of spores, further precautions should be considered such as damping down the material, possibly with 5% formalin, wearing face masks etc.
- **Chemoprophylaxis for exposed person:**
Asymptomatic exposed individuals are to be put on a four week course of doxycycline 100 mg twice daily or ciprofloxacin 500 mg twice daily.

ANTHRAX SURVEILLANCE SYSTEM

ANTHRAX SURVEILLANCE SYSTEM

The primary objectives of any anthrax surveillance system are:

(1) to prevent or reduce livestock losses and (2) to prevent human disease.

- Monitoring the incidence of the disease in both animal and human populations.
- All unexplained livestock deaths or suspected human and animals cases must be investigated with laboratory support.
- In animals, biological samples should be collected with the help of veterinarian.

➤ **Prompt Reporting**

- Mandatory reporting of sudden deaths among livestock.
- Mandatory reporting of all human cases.

➤ **Early and correct diagnosis and prompt treatment (both for human and animal)**

ANTHRAX SURVEILLANCE SYSTEM...(Cont'd)

➤ Implementation Of Control Measures

➤ Intersectoral Coordination

Control of anthrax among humans depends on the integration of veterinary and human health surveillance and control programmes.

- Routine cross-notification between the veterinary and human health surveillance systems is needed.
- Close collaboration between the two health sectors is particularly important during epidemiological and outbreak investigations.
- Intersectoral cooperation is important in areas where wildlife areas abut with livestock areas, or where wildlife and livestock intermingle.



ANTHRAX SURVEILLANCE SYSTEM...(Cont'd)

➤ Education /Awareness Campaign

- Education of both those who will be involved in the surveillance system and those who own or handle livestock, meat, hides and other animal products – about modes of anthrax transmission, care of skin abrasions and personal cleanliness.
 - Control dust and properly ventilate all hazardous industries particularly which handle raw animal materials.
 - Handle of animals properly in slaughter houses, tanning industry etc.
 - Treat properly the effluents from hazardous industries handling animals etc.
- Not to kill sick animals for consumption. Proper cooking of meat products.
- Do not use/sell hide of animals exposed to anthrax nor use their carcasses to make feed supplement.

THANK YOU

