Zoonotic Disease

Zoonoses are illnesses and infections that spread spontaneously from animals to people. They account for over 70% of recently developing infectious illnesses. Meat from cattle is one of the main sources of red meat and essential element of human diet.

Meat inspection (MI) is an important aspect to ensure the safety during handling and consuming of meat and meat by-products. Abattoir or modern slaughterhouse is the place where infections are acquired by the workers or veterinary professional as zoonoses. Bacterial zoonotic diseases such as erysipelothricosis, brucella, listeria, and anthrax and viral zoonotic diseases like cow pox, foot and mouth disease, and rift valley fever are causing great economic losses and are important in terms of zoonoses.

These zoonotic diseases are mostly diagnosed at abattoir levels using conventional approaches; however, diagnosis and identification of these diseases using latest methods is an important aspect for ensuring meat safety and hygiene. This semester will discuss the current trends about diagnosis and identification of these zoonotic diseases

Anthrax

Synonyms: Malignant pustule, malignant carbuncle, carbon, hematic anthrax, bacterial anthrax, splenic fever, woolsorters' disease.

Etiology: *Bacillus anthracis*, an aerobic, nonmotile, gram-positive bacillus 3–5 microns long that forms centrally located spores. It should be differentiated from *B. cereus*, which is quite similar. One of the media used to differentiate them is the gamma phage specific for *B. anthracis*. The etiologic agent is found in a vegetative state in man and animals. When exposed to oxygen in the air, it forms spores that are highly resistant to physical and chemical agents.

Source of Infection and Mode of Transmission: Soil is the reservoir for the infectious agent. For man, the source of infection is always infected animals, contaminated animal products, or environmental contamination by spores from these sources.

Cutaneous anthrax is contracted by inoculation during the process of skinning or butchering an animal or by contact with infected leather, pelts, wool, or fur. Broken skin favors transmission. Products made from contaminated hair (e.g., shaving brushes), skins (e.g., drums), and bone meal (e.g., fertilizer) may continue to be sources of infection for many years. Transmission from animals to man is possible by means of insects acting as mechanical vectors, but reliably documented cases are few.

Role of Animals in the Epidemiology of the Disease: Animals are essential. Anthrax is transmitted to humans by animals or animal products. Transmission between humans is exceptional.

Human anthrax is traditionally classified as either nonindustrial or industrial anthrax depends on whether the disease in acquired directly from animal or indirectly during handling of a contaminated animal products.

Nonindustrial anthrax usually affects a person who works with animal or animal carcasses, such as farmers, veterinarians and butchers.and it's almost always coetaneous.

Industrial anthrax, acquired from handling contaminated hair, hides, wool, bone meal or other animal products, has a higher chance of being pulmonary as a result of the inhalation of sporeladen dust.

Occurrence in Man: The infection in humans is correlated with the incidence of the disease in domestic animals. In economically advanced countries, where animal anthrax has been controlled, it occurs only occasionally among humans. Some cases stem from the importation of contaminated animal products. Human anthrax is most common in enzootic areas in developing countries, among people who work with livestock, eat undercooked meat from infected animals, or work in establishments where wool, goatskins, and pelts are stored and processed. The incidence of human illness in developing countries is not well known because those sick with the disease do not always see a doctor, nor do doctors always report the cases; in addition, the diagnosis often is based only on the clinical syndrome.

Occurrence in Animals: Anthrax is common in enzootic areas where no control programs have been established. There is no *antemortem* inspection of animals in that region, thus increasing the risk of human exposure.

The Disease in Man: The incubation period is from two to five days. Three clinical forms are recognized: coetaneous, pulmonary or respiratory, and gastrointestinal. The coetaneous form is the most common and is contracted by contact with infected animals (usually carcasses) or contaminated wool, hides, and fur. The exposed part of the skin begins to itch and a papule appears at the inoculation site. This papule becomes a vesicle and then evolves into a depressed, black scar. Generally, the coetaneous lesion is not painful or is only slightly so; consequently, some patients do not consult a doctor in time. If left untreated, the infection can lead to septicemia and death. The case fatality rate for untreated anthrax is estimated at between 5% to 20%.

The pulmonary form is contracted by inhalation of *B. anthracis* spores. At the

onset of illness, the symptomatology is mild and resembles that of a common upper respiratory tract infection. Thus, many patients do not see a doctor in the early stage of the disease when it would be easily cured. Some three to five days later the symptoms become acute, with fever, shock, and resultant death. The case fatality rate is high.

Gastrointestinal anthrax is contracted by ingesting meat from infected animals and is manifested by violent gastroenteritis with vomiting and bloody stools. Mortality ranges from 25% to 75% .

The Disease in Animals: It takes four forms: apoplectic or peracute, acute and subacute and chronic. The apoplectic form is seen mostly in cattle, sheep, and goats, and occurs most frequently at the beginning of an outbreak. The onset is sudden and death ensues rapidly. The animals show signs of cerebral apoplexy and die. The acute and subacute forms are frequent in cattle, horses, and sheep. The symptomatology consists of fever, a halt to rumination, excitement followed by depression, respiratory difficulty, uncoordinated movements, convulsions, and death. Bloody discharges from natural orifices as well as edemas in different parts of the body are sometimes observed.

Chronic anthrax occurs mainly in less susceptible species, such as pigs, but is also seen in cattle, horses, and dogs. During outbreaks in swine herds, some animals fall victim to the acute form, but most suffer from chronic anthrax. The main symptom of this form is pharyngeal and lingual edema. Frequently, a foamy, sanguinolent discharge from the mouth is observed. The animals die from asphyxiation. Another localized chronic form in pigs is intestinal anthrax.

Diagnosis

- Clinical evaluation
- Laboratory examinations

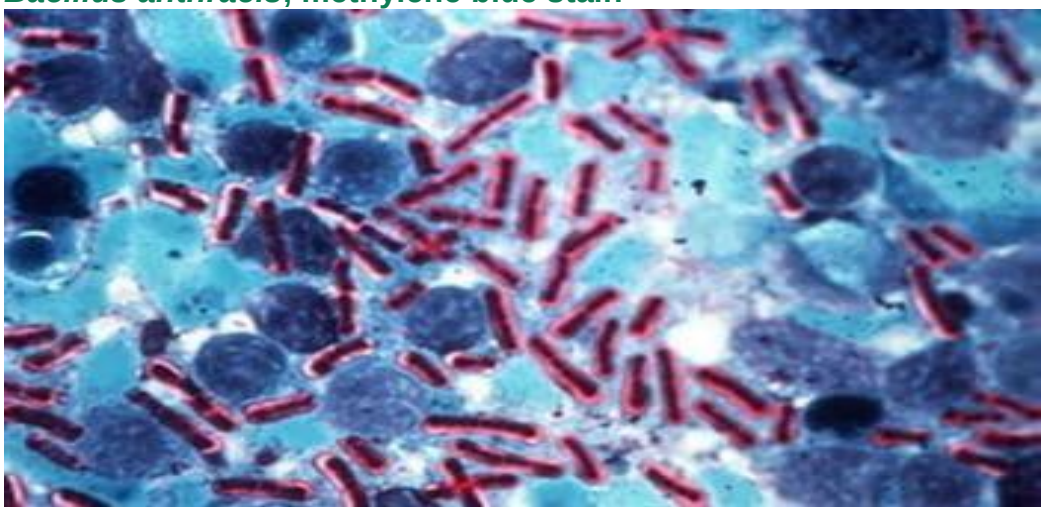
Diagnosis of anthrax based only on clinical signs is difficult. Confirmatory laboratory testing should be attempted if anthrax is suspected. Because the vegetative cell is not robust and will not survive 3 days in transit, the optimal sample is a cotton swab dipped in the blood and allowed to dry. This results in sporulation and the death of

other bacteria and contaminants. For carcasses dead >3 days, either the nasal turbinates should be swabbed or turbinate samples removed. Pigs with localized disease are rarely bacteremic, so a small piece of affected lymphatic tissue that has been collected aseptically should be submitted. Before submission, the receiving reference laboratory should be contacted regarding appropriate specimen labelling, handling, and shipping procedures.

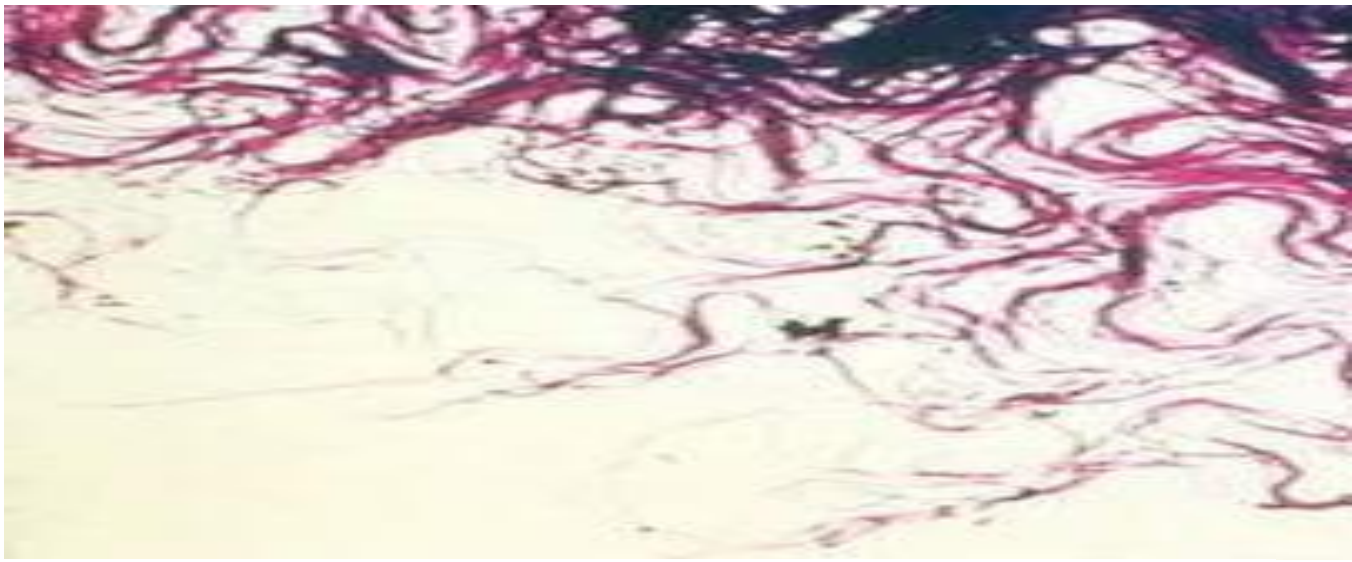
***Bacillus anthracis* colonies**

Specific diagnostic tests include bacterial culture, PCR assay, and fluorescent antibody stains to demonstrate the agent in blood films or tissues. Western blot and ELISA for antibody detection are available at some reference laboratories. Lacking other tests, fixed blood smears stained with Loeffler's or MacFadean stains can be used and the capsule visualized; however, this can result in a false-positive rate of ~20%.

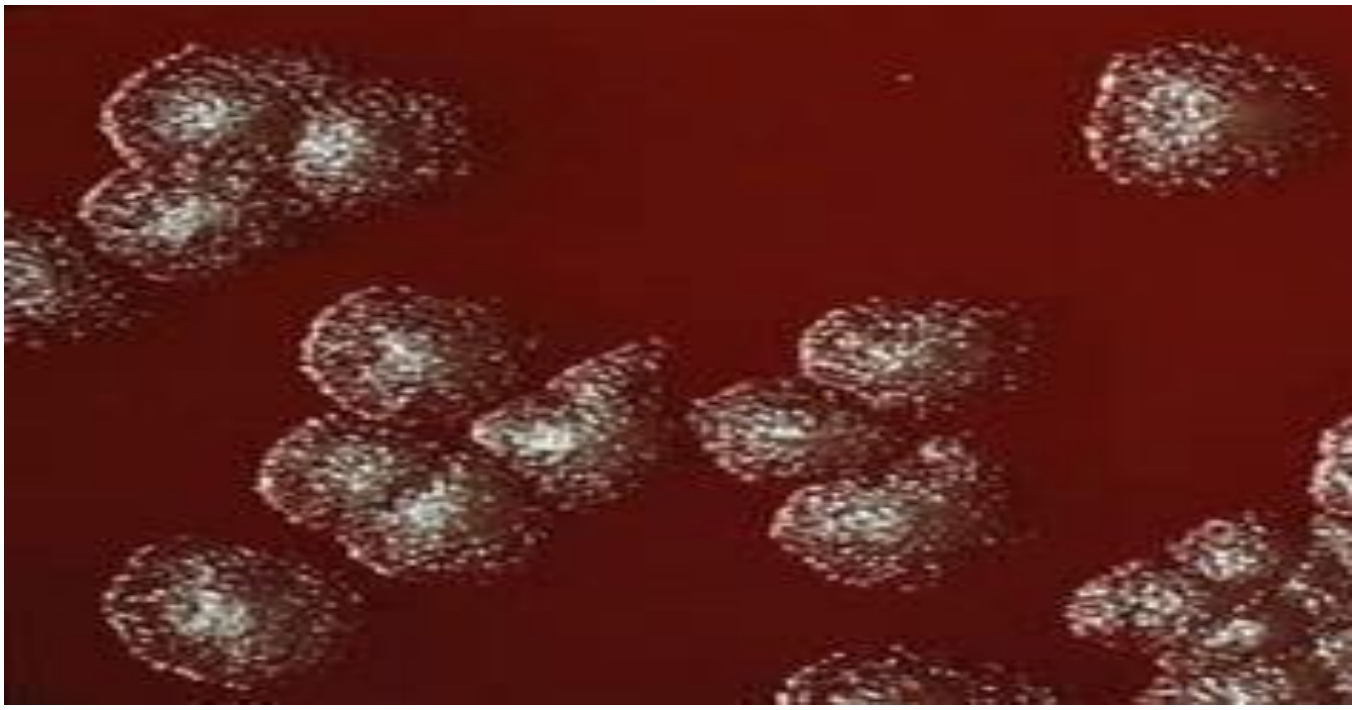
***Bacillus anthracis*, methylene blue stain**



***Bacillus anthracis*, medusa head morphology**



***Bacillus anthracis*, ground glass colonies**



In production animals,
anthrax must be differentiated from other conditions that cause sudden death. In cattle and sheep, clostridial infections, bloat, and lightning strike (or any cause of sudden death) may be confused with anthrax. Also, acute leptospirosis, bacillary hemoglobinuria, anaplasmosis, and acute poisonings by bracken fern, sweet clover, and lead must be considered in cattle. In horses, acute infectious anemia, purpura, colic, lead poisoning, lightning strike, and sunstroke may resemble anthrax. In pigs, acute classical swine fever, African swine fever, and pharyngeal malignant edema are diagnostic considerations. In dogs, acute

systemic infections and pharyngeal swellings due to other causes must be considered.

Control: In man, the prevention of anthrax is based mainly on: (a) control of the infection in animals; (b) prevention of contact with infected animals and contaminated animal products; (c) environmental and personal hygiene in places where products of animal origin are handled (adequate ventilation and work clothing); (d) medical care for cutaneous lesions; and (e) disinfection of fur and wool with hot formaldehyde. Occupational groups at risk may benefit from vaccination with the protective antigen.

The human vaccine used in the US and Great Britain is acellular and consists of a filtrate of *B. anthracis* culture from a nonencapsulated strain that is adsorbed with aluminum hydroxide. This vaccine is not very potent and may not protect against all field strains. In the countries of Eastern Europe and in China, a live attenuated spore vaccine is administered by scarification.

In animals, anthrax control is based on systematic vaccination in enzootic areas. Sterne's avirulent spore vaccine is indicated because of its effectiveness and safety. The vaccine consists of spores from the none capsulated 34F2 strain with an adjuvant usually a saponin and is currently used worldwide, with a few exceptions. It is suitable for all domestic animal species. However, goats sometimes have severe reactions and the recommendation is thus to administer the vaccine in two doses in this species, with a month between doses (administer one-fourth of the dose in the first month and the full dose the following month). Pregnant females of any species should not be vaccinated unless they are at high risk of contracting anthrax. Antibiotics should not be administered a few days before or a few days after vaccination. In general, annual vaccination is sufficient; only in hyper enzootic areas is vaccination at shorter intervals recommended. Immunity is established in approximately one week in cattle, but takes

longer in horses. In regions where anthrax occurs sporadically, mass vaccination is not justified and should be limited to affected herds. Rapid diagnosis, isolation, and treatment of sick animals with antibiotics (penicillin) are important.