



Animal Disease Factsheets

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Bovine Tuberculosis

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Importance

Bovine tuberculosis is a significant zoonosis that can spread to humans through aerosols and by ingestion of raw milk. In developed countries, eradication efforts have significantly reduced the prevalence of this disease, but reservoirs in wildlife make complete eradication difficult. Bovine tuberculosis is still common in less developed countries, and economic losses can occur in cattle and African buffalo from deaths, chronic disease, and trade restrictions. Infections may also be a serious threat to endangered species.

Etiology

Bovine tuberculosis results from infection by *Mycobacterium bovis*, a Gram positive, acid-fast bacterium.

Species affected

Cattle and buffalo are considered to be the maintenance hosts for *M. bovis*. Infections have also been described in numerous other domestic and wild animals including sheep, goats, horses, pigs, deer, antelope, dogs, cats, ferrets, camels, foxes, mink, badgers, rats, primates, llamas, kudus, elands, tapirs, elk, elephants, sitatungas, oryxes, addaxes, rhinoceroses, opossums, ground squirrels, otters, seals, hares, moles, raccoons, coyotes, lions, tigers, leopards, and lynx. Most of these species are considered to be spill-over hosts; however, some can act as wildlife reservoirs. Known reservoir hosts include brush-tailed opossums in New Zealand, badgers in the United Kingdom and Ireland, deer in the United States, bison in Canada, and greater kudu, common duiker, African buffalo, warthogs, and Kafue lechwe in Africa.

Geographic distribution

Tuberculosis has been found worldwide. Eradication programs are in progress or nearing completion in a number of countries in Europe, as well as the United States, Canada, Japan, and New Zealand. A few countries including Australia, Denmark, Sweden, Norway, and Finland are considered to be free of bovine tuberculosis.

Transmission

Tuberculosis can be transmitted either by the respiratory route or ingestion. In cattle, aerosol spread is more common. In pigs, ingestion is frequent. Cutaneous, genital, and congenital infections have been seen but are rare. Infectious bacteria can be shed in the respiratory secretions, feces, milk, and in some individuals in the urine, vaginal secretions, or semen. Not all infected animals transmit the disease. Asymptomatic and anergic carriers occur.

M. bovis can survive for several months in the environment, particularly in cold, dark, and moist conditions.

Incubation period

The clinical signs usually take months to develop. Infections can also remain dormant for years and reactivate during periods of stress or in old age.

Clinical signs

Bovine tuberculosis is usually a chronic debilitating disease, but can occasionally be acute and rapidly progressive. Early infections are often asymptomatic. In the late stages, common symptoms include progressive emaciation, a low-grade fluctuating fever, weakness, and inappetence. Animals with pulmonary involvement usually have a moist cough that is worse in the morning, during cold weather, or exercise, and may have dyspnea or tachypnea. In some animals, the retropharyngeal or other lymph nodes enlarge and may rupture and drain. Greatly enlarged lymph nodes can also obstruct blood vessels, airways, or the digestive tract. If the digestive tract is involved, intermittent diarrhea and constipation may be seen. Lesions are sometimes found on the female genitalia but are rare on the male genitalia. In cats, skin lesions similar to those of feline leprosy may be seen.



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Bovine Tuberculosis

Post mortem lesions [Click to view images](#)

Bovine tuberculosis is characterized by the formation of tuberculous granulomas (tubercles) where bacteria have localized. These granulomas are usually yellowish and caseous, caseo–calcareous, or calcified, and are often encapsulated (tb1). In some species such as deer, lesions resemble abscesses more than typical tubercles. Occasional tubercles may appear purulent. Granulomas are most often found in the mediastinal, retropharyngeal, and portal lymph nodes. They are also common in the lung, spleen, liver, and the surfaces of body cavities. In disseminated cases, multiple small granulomas may be found in numerous organs. Many infected cattle have only a few lesions at necropsy.

Morbidity and Mortality

Bovine tuberculosis is often a sporadic disease, with many infections confined to one or two animals in a herd. In two studies of transmission from naturally infected reactor cattle, 0–40% of susceptible contacts became infected and 0–10% developed gross lesions. The severity of disease varies with the dose of infectious organisms and individual immunity. Infected animals may remain asymptomatic, become ill only after stress or in old age, or develop a fatal, chronically debilitating disease. In developed countries, most reactors are detected during routine testing and mortality from tuberculosis is rare.

Drug treatment can be effective but does not always eliminate the infection and is not available in all countries.

Diagnosis

Clinical

Tuberculosis can be difficult to diagnose based only on the clinical signs. In developed countries, few infections become symptomatic; most are diagnosed by routine testing or found at the slaughterhouse.

Differential diagnosis

The differential diagnosis includes [contagious bovine pleuropneumonia](#), *Pasteurella* or *Corynebacterium pyogenes* pneumonia, aspiration pneumonia (often secondary to Chronic Wasting Disease in cervids), traumatic pericarditis, caseous lymphadenitis or [melioidosis](#) in small ruminants, and chronic aberrant liver fluke infestation.

Laboratory tests

In live cattle, tuberculosis is usually diagnosed in the field with the tuberculin skin test. Occasionally, the sputum and other body fluids may be collected for microbiological examination. Post–mortem, bovine tuberculosis can be diagnosed by histopathology, microscopic demonstration of acid–fast bacilli, isolation of mycobacteria on selective culture media, and identification by biochemical tests. Slides

may be stained with the Ziehl/ Neelsen stain, a fluorescent acid–fast stain, or immunoperoxidase techniques. DNA probe/polymerase chain reaction (PCR) methods have also been described. Very rarely, guinea–pig inoculation may be necessary before isolation and identification of the organism.

New diagnostic blood tests include the lymphocyte proliferation assay, the gamma–interferon assay, and enzyme–linked immunosorbent assays (ELISAs). The gamma interferon test is only useful in members of the Bovidae, but the lymphocyte proliferation test and ELISA may be used in other zoo animals and wildlife. These tests are not used routinely for diagnosis in cattle.

All procedures for bacterial culture should be done in a biological safety cabinet, as the bacteria may survive in heat fixed smears or become aerosolized during specimen preparation.

Samples to collect

Bovine tuberculosis is a zoonotic disease; samples should be collected and handled with all appropriate precautions.

The tuberculin (delayed hypersensitivity) test is the standard method of diagnosis in live cattle and the prescribed test for international trade. The comparative intradermal tuberculin test can be used to distinguish between infections with *M. bovis* and sensitization to other *Mycobacteria* species. Variations such as the thermal test and Stormont test have also been used. False negative reactions may occur in animals that have poor immunity or are anergic, old, or have recently calved. In some cases, blood samples may be taken for diagnostic blood tests. Samples for the gamma interferon test must be transported to the laboratory promptly, as this test must be started within 8 hours of blood collection.

At necropsy, samples for culture should be taken from abnormal lymph nodes and affected organs such as the lungs, liver, and spleen. If an animal reacted on the tuberculin test but there are no gross lesions, samples should be taken from the retropharyngeal, bronchial, mandibular, supramammary, and mediastinal lymph nodes, some of the mesenteric lymph nodes, and the liver. These specimens should be shipped to the laboratory quickly. If shipping must be delayed, the samples can be refrigerated or frozen. If refrigeration or freezing is not feasible, 0.5% (w/v) boric acid may be added for periods of a week or less. Specimens should also be collected for histopathology. All samples must be wrapped securely and comply with all biosafety regulations to prevent human infections.

Bovine Tuberculosis

Recommended actions if bovine tuberculosis is suspected

Notification of authorities

Bovine tuberculosis is a reportable disease. State authorities should be consulted for specific regulations. Federal: Area Veterinarians in Charge (AVICS) http://www.aphis.usda.gov/vs/area_offices.htm

State vets: <http://www.aphis.usda.gov/vs/sregs/official.html>

Quarantine and Disinfection

Control measures usually include early diagnosis with the tuberculin test, segregation or slaughter of infected animals, and tracing and containment of animals that have been in contact with reactors.

M. bovis is relatively resistant to disinfectants and requires long contact times for inactivation. Effective disinfectants include 5% phenol, iodine solutions with a high concentration of available iodine, glutaraldehyde, and formaldehyde. In environments with low concentrations of organic material, 1% sodium hypochlorite with a long contact time is also effective. This organism is also susceptible to moist heat.

Public health

M. bovis can infect humans, primarily by ingestion of raw (unpasteurized) milk or dairy products but also through aerosols and breaks in the skin. Infections in humans may result in asymptomatic infections, pulmonary tuberculosis, or disseminated infections. The symptoms of pulmonary infection can include fever, cough, chest pain, cavitation, hemoptysis, and fibrosis. Untreated infections may be fatal. *M. bovis* is classified as a risk group 3 pathogen.

For More Information

World Organization for Animal Health (OIE)

<http://www.oie.int>

OIE Manual of Standards

http://www.oie.int/eng/normes/mmanual/a_summry.htm

OIE International Animal Health Code

http://www.oie.int/eng/normes/mcode/A_summry.htm

Michigan Bovine Tuberculosis Eradication Project

<http://www.bovinetb.com/>

Manual for the Recognition of Exotic Diseases of Livestock.

FAO/SPC Animal Health Information System

<http://www.spc.int/rahs/>

Material Safety Data Sheet –*Mycobacterium tuberculosis*, *Mycobacterium bovis*

Canadian Laboratory Centre for Disease Control

<http://www.hc-sc.gc.ca/pphb-dgspsp/msds-ftss/msds103e.html>

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