

Bovine tuberculosis



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What is bovine tuberculosis?

Bovine tuberculosis, caused by *Mycobacterium (M.) bovis* / *M. caprae* is a chronic infectious disease characterized by specific organ lesions (granulomas, tubercles). Tuberculosis can be transmitted from cattle to humans or vice versa and is therefore classified as a zoonosis.

The course of bovine tuberculosis is similar to that of human tuberculosis. As a rule, it manifests as unspecific symptoms such as loss of productivity, emaciation, sometimes coughing. The infection may remain asymptomatic for a long time (months to years) and may be transmitted during this period to other animals or humans in the immediate vicinity. In immunosuppressed animals / humans infection may lead to severe disease and death.

In addition to cattle, other homeothermic domestic, wild and zoo animals are susceptible to the pathogen and may develop severe disease.

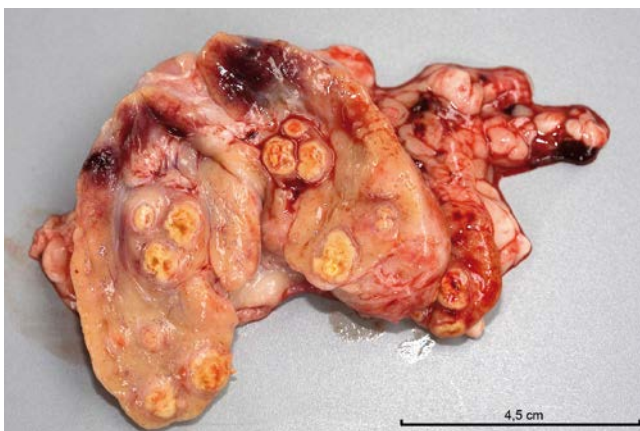


Fig. 1: Multiple smaller granulomas in a retropharyngeal lymph node showing caseation and calcification

Distribution of bovine tuberculosis

In principle, bovine tuberculosis is distributed world-wide. However, many European countries (including Germany) and highly developed countries in other parts of the world are approved officially tuberculosis-free (OTF). Pursuant to the definition of the European Union this means that every year in more than 99.9 % of a country's or region's cattle holdings bovine tuberculosis has not been detected.

Germany has obtained the OTF status effective from July 1, 1996. However, cattle infected with tuberculosis have been detected in a small number of holdings every year since 1996. Within the first ten years up to ten holdings were affected each year. Since 2007, a slight increase has been observed. Thus, in 2008 and 2009 23 holdings and in 2012 again 23 holdings with tuberculosis-infected cattle were detected, mainly in the foothills of the Alps.

It is assumed that the red deer population in the border area between Bavaria and Austria plays an important but so far insufficiently assessed role in this development. In other countries, a permanent pathogen

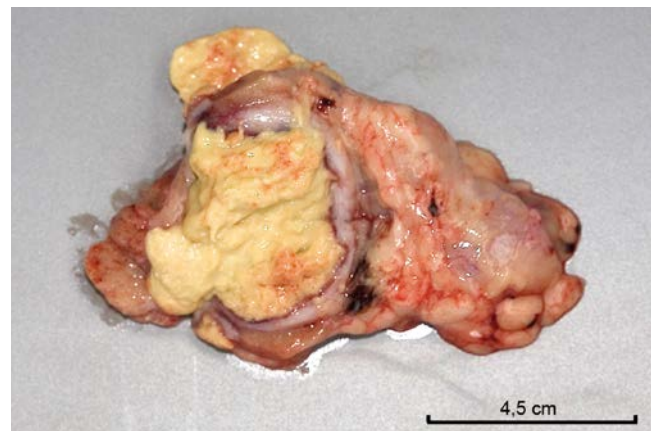


Fig. 2: Significantly enlarged retropharyngeal lymph node with granulomas filled with a creamy, yellow-green content

Bovine tuberculosis

reservoir in the wildlife population is regarded as a central obstacle to sustainable tuberculosis control in livestock (e.g. England, Ireland, New Zealand).

Which animals are affected?

Cattle are the primary hosts, but also other homeothermic domestic animals, zoo animals and wildlife, such as goats, pigs, cats, lynxes, badgers, tapirs and others may become infected via food or infectious aerosols and develop the disease.



Fig. 3: Multifocal granulomatous peritonitis, hepatic granuloma

Which symptoms are seen in infected animals?

Frequently, the infection will remain asymptomatic for a long time, so that the disease is only diagnosed *post mortem* based on gross pathological organ lesions and laboratory-based confirmation. However, the pathogen can be excreted unnoticed. If symptoms occur, they usually are unspecific:

- loss of productivity
- fatigue
- emaciation
- sometimes respiratory symptoms.

Only at a progressed stage of disease (breakdown of resistance) the animal begins to show signs of illness, so that the veterinarian is often consulted very late. If untreated, the disease outcome is usually fatal. However, as life expectancy of high performance cows today is limited to a few years only, fatal outcomes are rarely seen. This calls for an increasingly intensive monitoring of animal holdings.

Diagnostics

For live animals, two test methods are available; one of them is the tuberculin skin test which measures the skin reaction after intra-cutaneous administration of tuberculin. In infected animals, local swelling due to inflammation occurs at the injection site within three days post injection. Based on the increase in skin thickness conclusions can be drawn with regard to TB infection. The second test is the gamma interferon release assay. Similarly to the tuberculin test, this assay is used to investigate the host's immune reaction, in this case however by means of a blood sample. These immunological (syn. allergologic) methods are indirect detection methods.

In slaughtered cattle and fallen stock the causative agents of tuberculosis can be isolated from tissue samples, cultivated and identified by molecular biological methods in the laboratory. Furthermore, molecular biological detection of the pathogen's genetic material in organ samples is possible. In these cases, the causative agents of tuberculosis or their genetic material are detected directly.

Bovine tuberculosis

Is the disease dangerous for humans?

Humans can also become infected with the causative agents of bovine tuberculosis and particularly immunologically compromised persons are at risk of developing severe disease. This applies to both pathogens *M. bovis* and *M. caprae*. In many cases, however, human tuberculosis will also remain undetected for many years and will only be discovered in patients at a higher age.

When the pathogen is ingested with food (e. g. non-pasteurized raw milk), patients will more often develop extrapulmonary manifestations (= outside of the lung), e. g. changes in the gastro-intestinal tract; in case of airborne infection (droplet infection) pulmonary tuberculosis will occur. Human-to-human transmission of the pathogen is also possible, but has rarely been proven so far.



Fig. 4: Several pulmonary granulomas

How is tuberculosis transmitted and spread?

Infected cows may excrete the causative agent unnoticed via the respiratory tract, feces or milk.

Milk intended for sale is generally subjected to heat treatment (pasteurization, ultra heat treatment). However, when raw milk or raw milk products are consumed, infectious pathogens can be ingested.

The infectious dose of *M. tuberculosis*, the causative agent of human tuberculosis, for humans is claimed to be < 10 pathogens. In a cattle holding with unnoticed infection the pathogen concentration in the animal house air may be high enough for the staff to become infected by the respiratory route.

As tuberculosis often remains asymptomatic for many months and years, it may be spread by sale / purchase of animals with unnoticed infection. Dogs, cats, wildlife or humans may also spread the pathogen to other animal holdings.

Similar clinical signs

As tuberculosis usually does not cause specific symptoms, any chronic impairment of the general condition, loss of productivity, weight loss may be a sign of infection with tuberculosis-causing pathogens.

How to react?

Tuberculosis is a notifiable animal disease in the European Union. Any attempts to cure the disease or immunize cattle are prohibited. After official confirmation of tuberculosis, the public veterinary health officer will initiate appropriate control measures, such as movement restrictions for the affected holding, diagnostic investigation of the holding's livestock, diagnostic culling of suspect animals and decontamination measures. The responsible local health authority will also be notified, so that medical supervision of all persons in danger of infection is ensured.

Smaller domestic animals such as dogs or cats should not be fed raw milk and should not have access to animal houses. Horses and other farm animals should be kept separately from cattle in separate animal houses. In case of an outbreak, all animals of the affected holding should be included into the investigations.

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