Paratuberculosis

Paratuberculosis, or paratbc is an infectious disease caused by the bacterium Mycobacterium avium subsp. Paratuberculosis. After an infection in cattle with this bacterium, an incurable intestinal inflammation will occur. Paratuberculosis is rather common in ruminants.
In many countries of e.g. Europe, the disease is frequently recorded in cattle and goats. Cattle can be infected also without showing clinical signs. Only a small proportion of infected animals show symptoms, which moreover are not very clear and rather broad. The main tool to control the disease is prevention.

Symptoms
Cattle infected with paratuberculosis (paratbc) develop an incurable intestinal infection. The development of symptoms is very slow, and often only being noticed at the age of three to six years after infection.

These symptoms are successively:

- Drop in milk yield by ten to twenty percent
- Decline of physical condition, despite of a good appetite
- Low birth weight of calves
- Ultimately persistent diarrhea, often with gas bubbles and a further decline in milk production, and
- Mortality.

It is striking that there is no fever recorded in cattle with paratbc. Due to this phenomenon and clinical signs that are also noticed in other diseases, paratbc often remains unnoticed for a long time.

Cause
Paratbc is caused by the bacterium Mycobacterium avium subsp. paratuberculosis. This bacterium belongs to the group of tuberculosis bacteria.
These bacteria have a very long incubation period (the time between infection and the first symptoms). The paratbc incubation period varies from one half to more than ten years. The paratbc bacterium contains a solid wax. This wax makes it possible to survive a period of more than a year, for example in silage, manure, water and soil. Under the influence of UV radiation, such as sunlight, the bacteria will die soon.

Infection Route
Infected cattle excrete the bacterium mainly through manure and also through milk and colostrum. Infection occurs through the uptake of bacteria via the mouth of manure, colostrum, milk, food and drinking water. The unborn calf can become infected via the uterus. Calves are especially prone to infection during the first year of age. Older cattle are less susceptible.
When paratbc bacteria infect cattle, they are not sick during he first phase after the infection, and they will no transmit the bacterium. An infected cow can spread the paratbc bacterium after two years of age. Based on the non-clinical phase of the infection, it is never certain whether a cow is free from the paratbc bacterium or not. So in principle, any bovine animal over the age of two years can transmit the disease. Goats are known to be able to transmit the disease in cattle. Many goats may be infected with paratbc.

Damage and economic losses
Infected animals will develop an incurable intestinal infection. As a result they produce less milk and the physical condition will decline. Paratbc is non-curable, so it is important that these cattle will be discharged as soon as possible after infection, which means lower price at disposal. There will be an increase in costs for veterinary treatments. And the clinical diagnosis of paratbc

means in general that more animals are infected in the meanwhile. Usually there are (much) more infected cattle on that farm.

Economic assessment calculations of Wageningen UR (the Netherlands) show that the average damage due to paratbc in Netherlands on farms with 50 dairy cows is about 770 euros. The damage due to paratbc includes loss of milk yield, losses by discharge of animals, treatment costs of sick animals, and loss of slaughter value. On farms with clinically sick animals, the damage is estimated to be 908 euro per clinically affected cow.

Effects on humans and zoonotic aspects
In humans, a disease known Crohn's disease, closely resembles paratuberculosis in cattle. In some patients with Crohn's disease, the paratuberculosis bacteria has been detected. However, there is still no clear evidence that the paratuberculosis bacteria is involved in the cause of Crohn's disease.

Diagnosis paratuberculosis
There are different laboratory tests to demonstrate the presence of paratbc bacteria. Tests have been developed to detect antibodies against paratbc bacteria in milk or blood, or in manure. When cattle become infected, it takes several months to several years before the paratuberculosis bacteria or antibodies against the bacterium can be detected. A favourable outcome after the examination of samples (with negative test results), does not always mean that the cow is not infected. Investigation on herd level does provide a more reliable picture of the situation on the farm. If these test results are still negative, than it is unlikely that the farm is heavily contaminated.

Test methods
The paratbc ELISA detects antibodies against the paratbc bacterium in milk and blood. The paratbc bacterium, in manure, can be detected by a PCR test or by Ziehl Neelsen staining method.

ELISA assay to understand the paratbc situation
The paratbc ELISA is used to get a first impression on farm-level. This can be done on individually level by milk or blood tests. The blood test can be used to examine all cattle at the age of 3 years and older. The investigation of milk samples takes place to examine all lactating cattle (in case at least thirty percent of the herd is lactating). These results give a good impression of paratbc status of a farm, and therefore form the basis for determining the status of the paratuberculosis control program.
Based on the obtained results, a plan of action, to prevent the disease problems in the future, can be developed.

Possible results and follow-up actions.
The prevention of transmission of the bacterium to calves is an effective and absolute basis for controlling the disease. On heavily contaminated farms, the diagnosis and control of paratbc can be supported by identifying the animals that are spreading the paratbc bacterium. This to stop spreading of the bacterium via the manure. Examination of the manure must be done from all cattle aged 2 years and older. The PCR test in manure usually detects an infection earlier than blood analyses (antibody screening).
By discharging cattle with paratbc bacteria for slaughter, the risk of getting the disease will drop and the occurrence of new infections may be more limited. Animals on the same infected farm, and below one year of age, might probably develop and transmit the disease in the future. The best is to fatten these animals and kill them before they can spread the disease (from about the age of two).
The faecal examination can be repeated every two years, until there are no cattle anymore found positive for paratbc bacteria.

Examination of cattle with symptoms of paratbc
Cattle with a low milk production, which lose weight and have diarrhea (persistent or recurrent) are suspected of having paratbc. Do not take any risk and examine these animals for paratbc. We advise you to examine blood and / or faecal droppings. Are antibodies found in the blood or paratbc bacteria detected in the manure, it is wise to discharge positive animal to slaughter. It is recommended that calves of this cow, younger than one year of age, should be fattened and sold.

Research of purchased cattle
A favourable test result (negative test results) of an individual cow gives no absolute guaranty about the absence of a paratbc infection. An unfavourable result, however, is definitely a reason not to mix the animal to other cattle of the herd. The best is to buy cattle from farms with the highest possible paratbc status, or from farms that are free from paratbc
So status A, or status unsuspected, offers the highest guarantee on the absence of paratbc.

Risk factors paratuberculosis
To prevent infection with the paratbc bacterium, it is important to take measures against the introduction and spread of bacteria within the farm. Rearing of the young animals, limited purchase of animals, and the reduction in the supply of manure forms the main attention. Measures to prevent the introduction and spread of paratuberculosis, also reduce the risk of introducing other transferable diseases, such as salmonella.

Farm operational action
Especially in the first year of life, bovine animal are susceptible to paratbc bacterium infection. Farm preventative measures are mainly focussed on this period. Performing all measures simultaneously is in practice usually not feasible. A stepwise approach is a practical manner to rear calves on a hygienic manner. The following measurement steps are relevant:
Step 1: Measures around calving
Step 2: Measures during colostrum and milk intake
Step 3: Measures after weaning

By applying these measures, the infection cycle will be blocked (stopped).

A summary of measures of each step:

<u>Step 1: Calving period</u>
- Provide the calving cow a clean calving shed and separated from other cows. A calf may even be infected by the uptake of a small amount of manure.
- Catch the calf clean and hygienic during calving, and remove it immediately after birth from the cow. This prevents the calf to become infected by the uptake of manure particles during lactation.

<u>Step 2: Calf rearing to wean</u>
- Give the calf only colostrum from its own mother, and after the colostrum period only powder milk.
- The breeding calves should be housed in individual pens (or igloo) for at least the first three weeks, which is separate from the elder (milk) cattle.
- Do not allow goats to contact calves. Goats are often contaminated with paratbc and can transmit the infection to cattle (especially calves).

<u>Step 3: Calf rearing after weaning</u>
- Breeding calves, to the age of 12 months, should be housed apart from the cattle of two years of age and older. Although the resistance to paratbc increases sharply after the weaning period of calves, preventive measures are still needed.

- Prevent the transfer of manure from the older animals to enter the barn of the young cattle (through food, clothing, tools). Working strategy should be; from young to old cattle, and use separate clothing and tools for these two age groups.
- Avoid contamination of drinking water of young cattle by manure of older cattle (separate water circuit, no surface water).
- Keep the calves during the first year inside, and give them good, not-contaminated roughage (corn, hay or dried grass). Meadowland and silage can be infected by manure from grazing cattle positive for paratbc.

The supply of animals and manure
The greatest risk of introducing paratbc, and other infections on your farm, is the purchase of cattle from another farms. “Do not purchase” is the best way to prevent disease introduction. If cattle are purchased, ask about the health status of the farm of origin, and verify the status.

The following measures can reduce the risk of introduction:
- Buy cattle from a farm with the same or a higher health status
- Use a transport company that strictly follows the hygiene rule (recognized transporter) Even safer is to use own transport trucks.
- Avoid contact with other livestock (neighbouring businesses, exhibition events).

Bacteria can enter the company through agricultural equipment, manure injectors, transport trucks, etc. Even professional visitors, like veterinarians, and equipment pose a risk. Take care for a dressing room, working clothes and boots.

Do not use or supply your farm with manure from other farms. Would you still argue the supply of manure, you can only use it for arable land, this to prevent the contamination of pasture, silage and roughage with paratbc or salmonella bacteria.

Approach paratuberculosis control
The approach of paratuberculosis control can be divided into 'doing nothing', the exclusive use of taking preventive measures, and taking measures in combination with doing investigations of cattle.

<u>Only preventive measures</u>
In combating paratbc, preventing (new) infections is of great importance. The focus of prevention is on prevention of infection during the first year of life, as this period is the most sensitive period for a paratbc infection. Preventive measures focus on breaking the infection cycle by allowing the calves to grow at a paratbc-free environment. The risk preventive measures can be divided into three stages: 1) measures around calving, 2) measures during colostrum and milk intake, and 3) measures after weaning (see above for more information).

<u>Combination prevention and investigation of cattle</u>
On infected farms, the most effective approach to combat paratbc is the combination of preventing new infections and detection and removal of infected cattle. Farmers who want to understand the paratbc situation on their farms, can participate in the Paratuberculosis Program

This program is based on the screening of individual milk or blood samples on antibodies against paratbc, removal of infected cattle and control of introduced and purchased animals. The program starts with identifying the paratbc status based on individual milk or blood tests. This is also a good indicator for the farmer to select which measures should be taken to avoid spreading of the infection. After this start, a periodic monitoring system will follow the paratbc status of the farm.

<u>Doing nothing</u>

Doing nothing on a paratbc infected farm, means that the animals having the disease, will spread the bacterium if no measures are taken. Ultimately, this will lead to significant damage and economic losses.