

Johne's disease in dairy cattle

Johne's disease is a bacterial disease of ruminants and other (mainly) mammals, for which there is no cure. The organism has been found in wildlife as well as domesticated animals. It is caused by the bacterium *Mycobacterium avium* subspecies *paratuberculosis*, (MAP for short). It can survive in the environment in waterways, slurry, soil, dust, etc., but needs a host animal to multiply in.

The disease has a worldwide prevalence and has important economic implications for farmed livestock. It is estimated that over one third of UK dairy herds are infected to some extent, but within herd prevalence is difficult to ascertain, due to low sensitivity of most available tests, (ability to diagnose presence of the disease). Johne's disease results in financial loss to the farmer in terms of lower milk yields, higher somatic cell counts, increased mastitis, reduced fertility, increased susceptibility to other diseases, increased culling for all the aforementioned reasons, lower cull cow value and eventually death in animals that are in the final stages of the disease. The cost of the disease per unit of livestock is very difficult to ascertain, as it can often be masked in some, or all of the parameters just mentioned.

Implications

Johne's disease has often been associated with Crohn's disease in humans, because of some common symptoms. However, uncertainty remains over what role Johne's disease plays, if any, in Crohn's disease development.

Herd infection with Johne's

The usual entry point of Johne's disease onto a farm is through the purchase of infected animals, which are not usually exhibiting signs of the disease, irrespective of what test(s) were carried out on them before arrival, or in quarantine post arrival, particularly if the animal(s) were young at the time of importation. The disease can consequently spread silently in the herd to the point where the imported animal(s) and other infected animals show clinical signs of the disease, which could be years later.

Other routes of entry include:

- imported colostrum,
- imported slurry,
- shared livestock trailers,
- use of short term conacre, (often for replacement heifers), which may previously have had (Johne's contaminated) slurry spread on it from another farm.

Johne's disease is not always easily recognised in a herd, often because of high culling rates, which are associated with other factors, such as high SCC, poor production, infertility, lameness etc. and also because no testing has been carried out to ascertain the level of prevalence in the herd.

Animal infection with Johne's

The ingestion of faeces is considered to be the main entry point for the organism, with young calves thought to be more susceptible than older animals. Older cattle may become infected from the shedding of Johne's by infectious animals in the herd, but the consensus is that the level of exposure must be very high for this to happen. Mature cows can ingest contaminated faeces, producing a short term immune response and subsequently shed the organism, but may not be truly infected in the long term. A calf can get infected in the womb, which is largely determined by how advanced the disease is in the dam. If the disease is at an advanced stage in the dam, the estimate is ~ 1 in 3 calves get infected this way, if the infection is at an earlier stage in the dam, around 1 in 10 will get infected *in utero*.

Ingestion of the bacterium via colostrum/milk from an infected dam is a primary source of infection, as is infected bedding material in a calving pen, so hygiene in calving pens is extremely important. Replacement heifers that get infected *in utero*, via drinking infected colostrum/milk, or via the ingestion of faeces from their environment can subsequently pass the bacterium on to their herd mates through faecal shedding, (the one to many scenario) and by so doing, ensure that the disease persists in a herd and the cycle from dam to calf continues.

Diagnosing the disease

The main problem with Johne's disease diagnosis is that most infected animals are subclinical, i.e. they are not showing clinical signs of the disease, unless they have progressed to the terminal stage, when they start to waste away and have a profuse diarrhoea. Available tests lack sensitivity, i.e. the ability to show true positive results, particularly in the early stages of infection. Faecal shedding often precedes

the onset of measurable antibody circulation in the blood. Shedding is often intermittent and therefore Johne's is not always detected in faeces, but this does not mean that the animal in question is disease free. Older animals are more likely to test positive for the disease, if they have picked up the bacterium at some earlier stage of their lives, which is usually as a baby calf.

Testing for the disease

Testing for presence of the disease is usually done using milk or blood samples from individual animals, as bulk milk testing is of very limited value in assessing prevalence in a herd. Faecal testing, (culture or PCR), may be used as a follow-up on cows with a positive result from milk or blood, but is not necessarily definitive, due to the often sporadic nature of faecal shedding. Repeat testing by whatever method(s) is recommended, to build a picture of the likelihood of an animal having the disease, due to possible false negative, or false positive results. Veterinary expertise should always be sought, both in deciding what type/frequency of testing to do and in the interpretation of the results.

Additional Information

Stage of lactation and milk yield affect testing results from milk and blood. High yielding cows can dilute Johne's antibodies in their milk, changing what might have been a positive result to a negative result. Equally, 1st lactation animals may not test positive, because of low antibody excretion in their milk, even though they may be subclinical for the disease. Generally, younger animals are less likely to test positive for Johne's, with the odds of testing positive increasing with age/lactation number, (if the animal is infected).

When milk or blood gives positive results in apparently healthy cows and/or low-prevalence herds, it is recommended that a faecal test should be carried out to confirm the result. If the faecal results are negative, the cow(s) should be re-examined in 6-12 months, since it may be that at the time of sampling, the animal was not shedding the Johne's bacterium in the faeces in detectable amounts. Cows can change status between sampling periods, hence the need for repeat testing and/or faecal testing to confirm results and the expertise of a veterinarian to decide on the course of action.

TB testing can generate false positives from milk or blood samples. Blood should not be taken at the second day of the TB test and blood or milk should not be taken for Johne's testing for 3 months after a TB test. For TB restricted herds, sampling should be done as late as possible after the last TB test and just before the next test.

The advice from Animal Health N.I. for a herd of unknown Johne's status is to test the entire herd with either blood or milk samples, to establish prevalence. A number of pooled faecal samples from cows in similar parity, tested for bacterial culture and/or PCR, will give some indication of prevalence in a herd, but is a poor substitute for whole herd testing. Tests should be repeated in 3-6 months to aid confirmation of results.

For non-milk recorded herds, a blood sample can be taken from each cow at the annual TB test and screened for presence of Johne's. Animals that test positive by this method should be further tested before being considered for culling, (repeat blood test, milk sample, PCR, or faecal culture).

For herds that milk record, a quarterly individual cow test for Johne's can be undertaken to build up a picture of herd prevalence and infection status of individual cows. Cows should be at least 2 months post TB test at time sample is taken. Cows should not necessarily be culled on the basis of one positive test result. However, this depends on the history of infection in the herd and the magnitude of the test result reading. Repeat testing and use of metrics such as likelihood ratios, where age/parity and milk yield are considered in relation to current test result and previous test history are useful in deciding what animals to earmark for culling. Animals that are showing clinical signs of the disease should be culled immediately, as they are likely to be shedding large amounts of MAP into their environment and will not improve over time. The interpretation of test results and the actions to take should always be done in conjunction with your veterinary practitioner.

Vaccination

Vaccines are available and have been used in many countries as a control measure. They are effective in limiting signs of the disease and are considered cost effective in these circumstances. However, vaccines do not prevent disease establishment. More generally, vaccination will lead to animals testing positive by milk or blood and so it becomes impossible to distinguish vaccinated from infected animals

and is therefore not a viable option for herd owners wanting to eradicate the disease from their herd/flock. Another big drawback with the vaccine is that it can interfere with TB test results and therefore **vaccination is not permitted in many countries that have a bovine TB testing programme, such as N.I.**

Summary and Recommendations

1. Maintain a closed herd and/or only purchase animals known to be free from the disease. In reality this means that animals should only be purchased from herds with a known low prevalence for Johne's.
2. If high risk animals are in-calf, (as determined by testing), they should be calved in a separate isolated calving pen, with the calf removed immediately post calving and fed colostrum from a known Johne's negative cow. (Ideally all calves should be removed at calving to minimise faecal ingestion).
3. Replacement offspring of cows testing positive should be put on a concentrated repeat testing regime, as they are more likely to be Johne's positive, or to become positive with time.
4. Pooling of colostrum should not be practiced, as it has the potential to infect many calves from one infected dam.
5. Do not import colostrum from other farms, Keep a supply of frozen colostrum from non-infected cows for emergency situations and for calves from possibly infected dams.
6. Do not purchase fodder, particularly grass silage from another farm, unless absolutely necessary, as it could be contaminated with Johne's from manure spread on silage fields.
7. Do not feed waste milk to calves and definitely not to replacement heifers. (They should be reared on their own mothers' milk only initially and then on powdered milk). Pasteurisation of colostrum and milk does kill the organism, but may not eliminate it completely if the contamination load is high. Pasteurisation is a helpful tool to further reduce the risk in feeding low risk milk, but it should not be relied upon for high risk milk, (from test positive animals).
8. Do not breed replacement heifers from high-risk animals, (identified using one or more of the tests mentioned above). Ideally, high risk animals should be culled as soon as they are identified. (They could be what is called 'super shedders', because of the larger number of bacteria excreted in their faeces).
9. Test animals at least yearly and preferably 3 monthly at milk recording, for the presence of antibodies to Johne's, (blood or milk). Categorise animals into risk categories, particularly for the high risk category; animals with 3 consecutive positive tests, or 2 out of the last 4 tests. Consider further testing of these animals, if they have had a positive milk test and/or faecal sampling for organism growth/PCR analysis. The above points should be discussed with your veterinary practitioner.
10. Culling decisions based on only one positive result has serious financial implications, compared to results based on repeated measurements. To achieve a reduction in the prevalence of Johne's in a herd, it is commonly recommended to cull animals that repeatedly test positive, (by whatever test), as they are more likely to be infected and potentially excreting MAP into their environment.
11. Waterways should be fenced off so that animals do not have access to them, as water can be infected with Johne's via slurry runoff from neighbouring farms.
12. Slurry should not be imported from other farms due to the bio-security risk of importing Johne's in the slurry.
13. Slurry/manure particularly from cows, should not be spread on fields where youngstock graze.

14. Cattle trailers and manure spreading equipment should not be shared between farms.

For further information on Johne's disease see <http://www.animalhealthni.com/johnes-disease.aspx>