Bovine Tuberculosis

TB in cattle is caused by the bacterium *Mycobacterium bovis*. TB was once a common disease in humans and there are still between 5-6000 cases annually in the UK. It is spread via the air, after the carrier coughs, sneezes or spits and usually infects the lungs. It can infect the lymph glands and, very rarely, the brain. Normally prolonged exposure to the disease is required for infection to take place. The most common cause of TB in humans is *Mycobacterium tuberculosis*, though infection by *M bovis* does occur in about 40 cases a year, though normally through people being infected whilst abroad and/or drinking contaminated or unpasteurised milk. There is very limited evidence that it can be caught direct from cattle, and the bacterium is killed by pasteurization.

The incidence of bovine TB

Data on TB incidents are collected regularly, though this was interrupted during the foot and mouth crisis in 2001. Data are presented as new herd incidents i.e. herds which were previously free of TB but had a reactor (see below); many of these may be confirmed following post mortem examinations. Prior to 2001 the number of cases in the UK had been growing by 16% per annum and the number of animals compulsorily slaughtered as a result of TB controls rose from 921 in 1978, to 6,890 in 1999. The latest figures show that the incidence of bovine TB increased 18% faster in the first six months of 2007 compared to the same period in 2006. The number of animals slaughtered rose 25% to 18,101 (half yearly figures) whilst the number of herds under movement restrictions rose by almost 13% to 6,610. The west of England continues to be the worst affected area but the disease has spread northwards and is now firmly established in west Wales where the incidence increased by 49% during the same period.

Monitoring TB in herds

Regular testing is carried out on farms to try and assess the incidence of TB. Normally cattle are tested every four years, but in high risk areas the testing is more frequent and may be annual. The usual test is the skin test, where a sterile extract of tuberculin is injected into the skin of the animal on the neck. In most cattle which are already infected with TB this will cause an immune response leading to swelling where the injection took place. However, because some other types of mycobacteria may cause a similar response a second injection, about 13cm away from the first, is made from a different tuberculin derived from *Mycobacterium avium*. The comparison between the two injections leads to identification of TB reactors.

If the swelling due to *M bovis* is more than 4mm larger than the swelling due to *M avium*, the animal is considered to be infected and is termed a “reactor”. If the swelling is between 1 and 4 mm greater the animal is an “inconclusive reactor” and will be tested again after 42 to 60 days. If an animal is subsequently confirmed as having TB through a post mortem examination the test results for the rest of the herd are re-examined and a more stringent test (a “severe interpretation” test) is applied. In this case a swelling that is 2mm or more larger will be considered to be a positive reactor.

All reactors must be isolated from the rest of the herd, they are valued and slaughtered. The rest of the herd is placed under movement restrictions and any Official Tuberculosis Free (OTF) status is removed. Animals from these herds can not be sold at market and OTF status is a precondition for any untreated milk to be sold to the public. Movement restrictions can only be lifted, and OTF status restored, after all animals have passed through two consecutive tests, 60 days apart – or one test if TB was not confirmed in the reactor following post mortem examination.

Monitoring TB in the environment

How TB is spread is still not fully understood, including how agricultural or husbandry practices make a difference, and where the main reservoirs of bovine TB occur in the wild. Badgers are the most likely reservoir and research was begun prior to FMD which attempted to answer these questions. Field trials were

planned in 30 trial areas, each of about 100 square km. Each trial was grouped into a set of three ("triplets") and in each treatment the same three treatments applied:

- Reactive culling – badgers were culled on and around all farms following a TB outbreak, but not elsewhere within the trial area.
- Proactive culling – as many badgers as possible were culled and steps taken to keep the badger population as low as possible within the trial area.
- Survey – no culling took place but the badger population was extensively monitored.

There were significant protests from animal rights groups, and some disruption to culls. However, out of a total estimated badger population of 300,000 it was estimated that the culls would account for about 12,500 animals. There was a three-month close season on culling from February to April, to protect female badgers with dependent cubs. In conjunction with the culls, detailed questionnaires were sent out to all farms with a confirmed outbreak asking about farm type, farming and husbandry practices, climate etc. Control questionnaires were sent to other farms in the trial area which had not had an outbreak. The results were to be collected and analysed over 5 years.

The analysis was conducted by the Independent Scientific Group on cattle TB which published its report in June 2007. This concluded that whilst badgers made a significant contribution to TB in cattle in high risk areas it would require their virtual elimination to make a contribution to reducing the incidence of the disease, it questioned the social and practical hurdles to achieving this and whether it would be cost effective. Instead it recommended tougher controls to prevent cattle-to-cattle spread and movement restrictions to be imposed between high and low risk areas. However, in contrast, the government's Chief Scientific Adviser publicly acknowledged in October 2007 that culling badgers in the areas worst affected by bovine TB would be beneficial in tackling the prevalence of the disease.

Vaccination

Two types of vaccination have been under consideration:

- DNA vaccines, where a small part of the DNA from the mycobacterium is injected into the animal, allowing antigens and an immune response to develop
- Attenuated (weakened) mycobacterial vaccines which also cause an immune response.

The most common vaccine in humans, BCG (the **B**acterium named after Drs **C**almette and **G**uerin) has very limited applicability in cattle. A further problem is that tests often fail to distinguish which animals have contracted TB in the wild and which have been vaccinated, so that under current legislation a vaccinated animal might lose its OTF status. The possibility of vaccinating badgers to reduce their capacity to carry TB has also been considered.

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