LEPTOSPIROSIS SPOTLIGHT: STRAINS AFFECTING CATTLE

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Judith Roberts explains how this zoonosis can be diagnosed and managed, and details methods that may prevent spread of infection

LEPTOSPIROSIS is a significant disease affecting cattle worldwide. The disease is a zoonosis, and when exposed to the organism, humans are at risk of contracting severe diseases.

Prevalence of infection is greater than the incidence of clinical disease, with 65 per cent of UK herds demonstrating exposure to leptospires. Infection transmission is predominantly via infected animals' urine (either directly or indirectly). The organisms can persist in ground surface water for up to 200 days.

Strains with significant effects in the cattle population include:

• ***Leptospira borgpetersenii hardjo-bovis.*** The abbreviation of *L hardjo-bovis* will be used in this article. It is found worldwide and is the most common serovar in UK cattle.

• ***Leptospira interrogans hardjo-prajitno.*** The abbreviation of *L hardjo-prajitno* will be used in this article.

Strains where cattle are accidental or incidental hosts include:

• ***Leptospira interrogans pomona.*** The abbreviation of *L pomona* will be used in this article. Maintenance hosts include pigs, skunks, racoons and opossums, and this strain is mostly found in the Americas, New Zealand and Australia. However, it is present in the UK sporadically.

• ***Leptospira grippotyphosa.*** The abbreviation *L grippotyphosa* will be used in this article. It is usually found in squirrels, racoons and opossums.

• ***Leptospira interrogans icterohaemorrhagiae*** The abbreviation *L icterohaemorrhagiae* will be used in this article. It is usually found in rats.

The nomenclature of the various strains affecting cattle can seem confusing, but the importance of the distinction is demonstrated when choosing diagnostic tests or vaccination policies on farm.

The main animal risk factor for infection is the *Leptospira* serovar (which demonstrates species susceptibility). Host-adapted reservoir hosts are susceptible to infection and tend to get more persistent low-grade disease, whereas non-host-adapted incidental hosts are less susceptible, but can develop severe disease.

Disease transmission

An infected animal can transmit spirochaetes via urine, abortion products, uterine discharges or semen. This spread can be within and between species. Susceptible animals gain the infection via cutaneous or mucosal abrasions (occasionally, in-utero transmission may occur).

Urine is the major source of organism spread, with infected animals shedding spirochaetes for more than a month and carrier animals shedding intermittently for life. In the UK, rats are the main source of wildlife contributing to disease transmission. Rat urine contaminates feed supply, water troughs and the environment.

Aborting cows on infected units excrete the agent for eight days after aborting or calving, but the organism can remain in the oviducts and uterus for up to 90 days following infection, thus allowing easy transmission to bulls, as well as potential spread due to poor hygiene at artificial insemination.

Major risk factors for disease in a herd include:

• purchase of infected cattle;

• cograzing with infected cattle or sheep;

• infected or carrier bulls; and

• access to contaminated water supplies.

Zoonotic implication

Leptospirosis is an important occupational zoonosis for farmers, vets and butchers.

The prevalence of disease in humans has grown following an increase in travel to infected areas abroad, and high-risk recreational sports (such as watersports in contaminated lakes or rivers). There is no vaccine available to prevent disease in humans. Leptospirosis encompasses a wide spectrum of clinical disease in humans, with a distinct lack of specific symptoms. The disease can be very severe, resulting in potential multi-organ failure associated with a high mortality rate. The course of the illness is biphasic, with initial pyrexia and “influenza-like” illness as the organism multiplies, and then secondary disease as circulating antibodies develop. Organs are infected and renal excretion occurs. Incubation usually occurs over one to two weeks. Anyone in contact with infected animals who displays pyrexia and fatigue should make their doctor aware of the possibility of exposure to leptospirosis, as early diagnosis and treatment will significantly improve disease outcome of the disease.

The disease’s pathology proceeds thus: the organism penetrates skin/mucosa of susceptible animal; migrates to the liver to multiply; migrates around body in bloodstream; and localises in kidneys and is excreted in urine.

Clinical signs

Cattle can present with disease in the acute, subacute or chronic form. In the UK, disease is usually associated with *L hardjo-bovis* or *L hardjo-prajitno* and, occasionally, *L pomona*.

• ***L hardjo-bovis and L hardjoprajitno.*** These result in milk drop syndrome, abortion and infertility. In general, *L hardjoprajitno* is more pathogenic than *L hardjo-bovis*.

– Milk drop syndrome. Signs include the sudden onset of fever, anorexia, immobility and agalactia, with a flabby udder affecting all four quarters equally and milk that is yellow to orange lasting two to 10 days. Up to 50 per cent of cows may be affected, with a significant production loss to the farm that may last up to eight weeks while infection circulates. It may be followed by high somatic cell count (SCC) until full production returns.

– Infertility. This can be seen with low reproductive performance, most marked in the first year following infection with a low first service conception rate (34 per cent), an increased calving-to-conception interval (40 days) and increased services for each cow conceiving (1.3 more serves per cow).

– Abortion. This may occur several weeks after infection in some cattle, with or without the above syndromes.

Most cases occur in the second half of pregnancy, and infection close to calving can lead to small, weak calves rather than abortion. As immunity develops within the herd, newly infected heifers may continue to abort; this may often be the only sign of the disease.

– Subclinical disease. This mostly occurs in non-pregnant and non-lactating animals. This mild form of the disease is usually only detected by the presence of antibodies or an incidental finding of interstitial nephritis during postmortem.

• ***L pomona***

– Acute. This generally appears in calves less than one month of age with septicaemia, pyrexia, anorexia, depression, petechiae of mucosa, acute haemolytic anaemia (with haemoglobinuria, tachycardia and dyspnoea) and jaundice. The disease is severe, with high mortality or prolonged recovery. In adult cattle, there is abortion, milk drop (a vascular lesion with resultant blood in the milk and high SCC; it is occasionally referred to as “leptospirosis mastitis”), and a soft, limp udder.

– Subacute. This has the same signs as above, but to a less severe degree or not all in one individual.

– Chronic. This is predominantly mild, but with abortions. This can result in groups of cattle at a similar stage of gestation giving rise to “abortion storms”. There are no other fertility effects.

– Immunity is serovar-specific and long term, occurring via both humoral and cell-mediated mechanisms.

Diagnosis

• Clinical signs, likely exposure and vaccination history (susceptibility).

• Bacteriological culture: leptospiraemia (circulating leptospires) occurs only in the first few days of infection and at a low level, thus, making blood culture difficult. Urine only contains leptospires 10 days after the onset of clinical signs, but the culture can be enhanced using frusemide to increase glomerular filtration rate (releasing more bacteria) and to produce more dilute urine (enhancing survival of the organism). Samples for culture should be diluted in one per cent bovine serum albumin transport material and sent to a specialised laboratory that is prepared to carry out culture using specialised media.

• Serology: acute and convalescent sera for microscopic agglutination test (MAT) or enzyme-linked immunosorbent assay (ELISA) screening. MAT measures IgM and IgGl (in effect, acute not chronic) rise, and is specific to individual serovars. Maximal rise is seen at seven to 14 days following infection and can, therefore, be used as paired or single tests. IgM antibody levels decline by six months post-infection. The test should be used in animals with acute disease requesting

MAT levels for both *L hardjobovis* and *L prajitno*, unless the serovar of the organism is already known.

ELISA measures IgG rise over the 14 to 21 days following infection, with levels staying high for years. It detects antibodies for the leptospirosis hardjo serogroup and, therefore, cannot differentiate between *L hardjo-bovis* or *L hardjo-prajitno*. It is useful to indicate chronic infection or historic exposure, but there can be some cross-reaction with *L interrogans saxkoebing* (an incidental finding).

• A fluorescent antibody test (FAT) of urine to demonstrate the presence of an organism.

• ELISA on cervico-vaginal mucus to demonstrate local immunity.

• A polymerase chain reaction (PCR) test to demonstrate the presence of an organism, such as on semen or the products of an abortion.

Bulk milk ELISA tests are used to detect chronic infection and demonstrate the presence or absence of infection in a dairy herd. Antibody persistence is two to three years, but there is significant variation. Therefore, care should be taken with infection timescale interpretation – most laboratories supply comprehensive guidance on interpretation of the results.

Postmortem and histopathology findings

• Cattle: anaemia, jaundice, haemoglobinuria, subserosal haemorrhages, interstitial nephritis, centrolobular hepatic necrosis and haemoglobin-filled renal tubules.

• Aborted foetuses. The placenta is avascular and the foetus may appear jaundiced. However, changes are often rarely visible until histology is performed.

Important differential diagnoses to consider

• **Acute disease.** Diseases causing haemolytic anaemia and/or haemoglobinuria: postparturient haemoglobinuria, bacillary haemoglobinuria, babesiosis, anaplasmosis, chronic copper poisoning, rape and kale poisoning, cold water haemolytic anaemia of calves, and drug-induced and blood transfusion reactions.

• **Chronic disease.** Diseases causing abortion (not discussed further here).

• **Milk drop syndrome.** Alternatives include diet and management changes, and disease outbreaks – such as bovine respiratory disease.

Treatment

Therapy of infected animals is aimed at removing the causal organism. The antibacterial agent of choice is dihydrostreptomycin at 12mg/kg IM bid for three days. Leptospires are also susceptible to ampicillin, amoxicillin, procaine benzylpenicillin, tilmicosin, ceftiofur and oxytetracycline.

To eliminate leptospiruria (in infected or carrier animals), use a single doze of dihydrostreptomycin 25mg/kg IM (this would be off-licence use, so standard withdrawal periods of seven days for milk and 28 days for meat must be followed). Supportive therapy may be required in individual cases; this may include fluid therapy or a blood transfusion in severely affected animals.

Disease control and prevention

Biosecurity is a significant aspect of disease prevention in an individual animal. The main risks to be considered and dealt with adequately are the introduction of carrier or infected animals, rodent control and access to contaminated watercourses.

Herds that do not need to introduce new stock are clearly the safest, providing there are adequate quarantine protocols for animals that may attend shows. Purchased animals should be tested prior to purchase and while in quarantine to ensure they are not carriers or newly infected at purchase.

Additionally, bought-in animals can be treated with antibacterial agents to reduce the likelihood of shedding. They can also be vaccinated if they are potentially naïve and at risk of gaining disease following entry to the herd.

Contaminated water should be fenced off at every location, with all natural watercourses assumed to be infected. Cograzing with sheep should be avoided, and boundary fences should be secure to prevent any contact with neighbouring sheep and cattle.

Vaccination may be the mainstay of preventing the significant spread of disease on newly infected premises. This can be used in conjunction with antimicrobial therapy in the event of a disease outbreak. There is no cross-protection between serovars, so a full diagnosis will be needed before implementing a vaccination protocol.

Vaccination mainly induces IgG antibodies; these peak two weeks postvaccination before decreasing rapidly to levels below that of natural exposure.

Consult the vaccine datasheets for full and up-to-date information, but be aware that vaccines are not fully effective at completely controlling the disease and its effects, and must be used in conjunction with testing procedures and other control methods in most circumstances.

Eradication

Eradication of the disease may be possible and worthwhile in herds where there is a low prevalence of infection. There are two options.

• Removal of all animals that test positive from the herd. Use a frequent testing strategy (there will be a potentially significant number of false-positive animals in this group when significant numbers are infected).

• Segregation of the herd into negative and positive groups with strict testing, quarantine, biosecurity and treatment procedures (streptomycin) until all youngstock entering the herd remain seronegative. Disinfectants suitable for leptospires include iodine or chlorine-based products, and should be used to prevent infection entering a naïve population.

In herds with a higher level of infection, the eradication policy may need to include treatment and vaccination to minimise the financial losses incurred in controlling the disease.

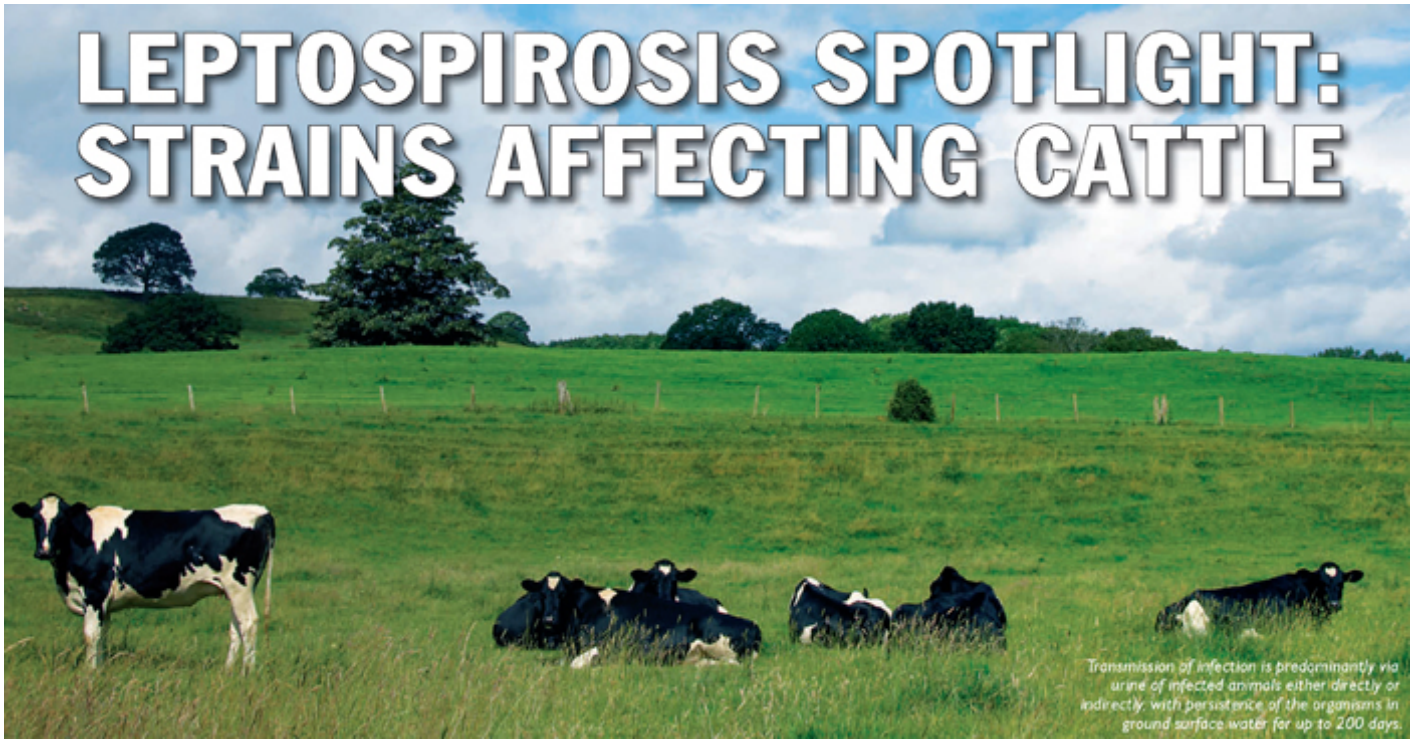
The Netherlands has implemented a national control programme for leptospirosis and more than 98 per cent of dairy herds are free of infection. There is also slow, but steady, progress in the beef herds.

Accreditation for diseasefree status against leptospirosis is available following two herd screening tests, performed six months apart, that demonstrate freedom from disease. This is maintained by the annual testing of a sample of animals aged more than one year.

Summary

Leptospirosis in cattle herds can manifest itself in a variety of ways, with differing clinical signs and with financial implications.

Knowledge of the organism strains affecting cattle helps with the diagnosis of the infectious agent involved, and is useful for implementing a treatment and control programme to reduce the significance and severity of the disease with in a herd.



Transmission of infection is predominantly via urine of infected animals either directly or indirectly, with persistence of the organisms in ground surface water for up to 200 days.

Photo: SXC/MIKE WADE.

In the UK, rats are the main wildlife reservoir; therefore, vermin control aids disease management.

Leptospirosis is a significant zoonotic disease among farmers and vets. The main route of transmission is via infected urine.

Above: cattle may show minor clinical signs, such as abortion or milk drop.

Right (top and bottom): testing can be performed on bulk milk to gain herd status or milk and/or blood for individual animal statuses.

Right (top and bottom): testing can be performed on bulk milk to gain herd status or milk and/or blood for individual animal statuses.

A risk factor for disease is the cograzing of sheep and cattle.

Antibacterial agents can be used to treat infected animals and reduce organism shedding.