Leptospirosis Diagnosis - Part 2:
The Herd or Flock

Part 1 focused on diagnosis in individual animals, Part 2 focuses on diagnosis at the flock or herd level.

Of the 6 endemic serovars in NZ*, cattle, sheep and deer are maintenance hosts for only one – Hardjo. This article will therefore focus primarily on this serovar.

Infection of a maintenance host with Hardjo usually results in subclinical disease, a reduced immune response compared with infection with Pomona, or Copenhageni, and prolonged renal excretion.

Although undistinguishable by MAT, Hardjo has two major genotypes; *Leptospira interrogans* (Hardjo-prajitno) and *L. borgpetersenii* (Hardjo-bovis). The only genotype described in NZ or Australia to date is *L. borgpetersenii*.

**Economic effect**

Globally both genotypes are economically important causes of infertility, early embryonic death, abortion, still or weak births and milk drop. The financial impact of Hardjo in NZ is uncertain. Given the majority of dairy cattle are vaccinated, the focus has shifted to the importance of Hardjo in beef cattle, sheep and deer.

The majority of NZ beef and deer herds are seropositive for Hardjo. In beef, the financial impact of infection has only been investigated once. In this study there was no difference in pregnancy rate in mixed age or 2-year old cattle in seropositive compared with seronegative herds. A 5% difference (p=0.034) was found in 3 year old cows, however. The effect of Hardjo on abortion or infection during mating has not been investigated. In deer Hardjo infection is associated with reduced reproduction and weight gain (i.e. 9% reduction in weaning percentage and a 3.7kg reduction in weight gain between weaning and 12 months of age, respectively).

In sheep infection with Hardjo is reasonably common, however unlike Pomona no economic importance is associated with infection. However, there has been virtually no research on this topic.

Nonetheless Hardjo, like other serovars in NZ, is a very important zoonosis.

**Is infection endemic?**

Generally if Hardjo infection has been established for some time, diagnosis by means of serology is relatively straightforward. Given seroprevalence is usually high; if one or more animals have a titre greater than 1:50 in a random sample of 15 animals per mob infection can be diagnosed with at least 95% confidence. Note as the surface antigens of leptospires are not shared with other organisms MAT false positives are rare.

Given the age at which animals are exposed and the duration of MAT titres, mobs of animals older than about 18 months are the most likely to test positive.

**Interpretation of MAT titres**

Interpretation of individual titres is at best subjective. Following natural infection or vaccination MAT titres peak after 11 to 21 days and range from below the routine cut-off of 1:50 to greater than 1:12,800 in cattle and up to 1:800 in sheep. Titres then decline gradually over time. Titres from natural infection last up to 2 years. Therefore the sensitivity of detecting animals infected for more than two years is low. It is important to note, there is little correlation between MAT titre and being a renal carrier.

*See Leptospirosis in NZ Dairy Herds Technical Bulletin for details.*
There is disagreement as to the minimum Hardjo titre that is considered indicative of recent infection in unvaccinated stock. Any titre above 1:50 is important, but generally a titre of 1:400 or more can be considered strong evidence of recent infection. In vaccinated stock, the age of animals, the number of vaccinations and the time since the last vaccination must be considered.

It is impossible to definitively differentiate if titres were induced by vaccination or infection. Peak post-vaccination titres are lower in sheep and calves (i.e. <1:50 to 1600, with most less than 400) compared to cattle older than 6-8 months (i.e. <1:50 to 12,800, with most between 1:100 to 1600). In animals given a primary vaccination course (2 injections 4-6 weeks apart) nearly all cattle will have non-detectable titres after approximately 8 months. In sheep and deer the period is shorter, probably about 6 months. Following subsequent annual booster vaccinations the peak, and duration, of titres is unknown, however the peak is probably higher and duration is longer.

Note vaccinated cattle may not produce an antibody titre following exposure to leptospires. This has not been shown with sheep.

It is important to remember that there is strong evidence that antibodies other than those detected by MAT (i.e. non-agglutinating) are protective.

Maternally derived antibodies

The concentration of maternally derived antibodies, following either vaccination or natural infection of the dam, varies markedly. If testing to determine infection is occurring in calves, it is expected that all calves will decline to below the cut-off of 1:50 by 3-6 months of age. Note since maternal antibodies cannot cross the placental barrier, the presence of leptospiral antibodies in the foetus is indicative of foetal infection.

Beyond MAT

Serology can only hint at the involvement of Hardjo in disease. As background seroprevalence is high, evidence of seroconversion during critical times and identification of leptospires in tissues by histological staining, culture or PCR are important. For more detail see Part 1.

Summary

This two part series has highlighted that leptospires are a common organism, but definitively diagnosing infection as a cause of production loss in cattle, sheep or deer can be difficult and requires a full understanding of diagnostic tools available.

References