Contract session: Caprine arthritis encephalitis in New Zealand dairy goat farms

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Introduction

Caprine arthritis-encephalitis (CAE) is a widespread disease in goats that was first reported in New Zealand in 1981 (Oliver 1982; Oliver et al. 1983). The disease is caused by a lentivirus (CAEV) which, like all retroviruses, inserts its genome into the DNA of the cell it infects. CAEV infects and replicates within monocytes and macrophages and these immune cells then carry the virus throughout the body. Seroconversion typically occurs slowly (months rather than weeks) and there is no simple relationship between the initial infection and moment of conversion.

All breeds and ages of goats are susceptible to infection and, once established, it persists throughout the animal's life. Progression of the disease can take months to years and it is unusual to observe gross clinical signs prior to two years of age. Not all goats that are infected with CAEV will develop the disease and these asymptomatic carriers may spread the disease within the herd. The most common symptom of CAE is chronic arthritis in adult animals. Bilateral or unilateral swelling of the carpal region is common, hence the lay term 'big knees'. Infection can also lead to weight loss and/or impaired milk production (Greenwood 1995).

The major transmission route of CAEV is through the ingestion of virus-infected colostrum by kids, although lateral transmission through prolonged close contact with infected animals is also thought to occur (Adams et al. 1983) and, more recently, evidence suggests that vertical transmission from the reproductive tract of infected females to their offspring is possible (Hasegawa et al. 2017). CAEV has been found in semen, so it is also possible that a doe may get the disease from an infected buck (Souza et al. 2013).

Diagnostic testing

Serum CAEV antibody enzyme-linked immunosorbent assay (ELISA) is routinely used to test goats for past exposure to this virus. More than 90% of serology-positive goats may be free of any clinical signs but remain potentially infectious. However, single negative results must be regarded with caution as some goats may take a long time to develop antibodies against CAEV and the levels of these antibodies can fluctuate. Sometimes an infected animal may be positive at one test and negative at a later test (Balco et al. 1985). Another serum test for CAE diagnosis is agar gel immunodiffusion (AGID); however, this test has been found to lack sensitivity compared with ELISA and tends to be quite time consuming (Merrall & MacDiarmid 1987).

As an alternative to antibody testing, polymerase chain reaction (PCR) detection of CAEV has been evaluated and can be performed on samples other than serum, such as milk, semen or other bodily secretions (Brajon et al. 2012; Brinkhof et al. 2010; Reddy et al. 1993; Wagner et al. 2004). The main advantage of a PCR test is the ability to detect early infection, before seroconversion takes place. When a PCR test was first developed for CAEV it tended to lack sensitivity due to the high degree of genetic variability of lentiviruses and often low viral load (Pasick 1998; Zhang et al. 2000). More recently, CAEV PCR tests have shown some improvement in sensitivity (Brajon et al. 2012).

No gold standard diagnostic test has been identified for CAE, instead it has been noted that a combination of diagnostic techniques and sample types leads to optimal diagnosis of CAE positive animals within the herd (Hasegawa et al. 2017).

Prevalence and control of the disease

After the first identification of CAEV-infected animals in NZ, prevalence of the disease was investigated and was found to be relatively low and concentrated in herds containing genetically superior imported animals (Merrall & MacDiarmid 1987). At that time it was noted that as the industry expanded there was a possibility that CAEV may be spread by trade of stud animals. Indeed, prevalence of CAE has increased since the initial investigation in the 1980s but no publications have been found to identify CAE prevalence in NZ herds in recent years. A final report to MPI Sustainable farming fund (Anonymous, 2013) aimed to identify the prevalence of CAE (among other diseases) in NZ dairy goat farms. Results indicated that of the 20,834 animals tested in the 2011/12 season, 37% were positive for CAEV.

Control of CAE spread is targeted through management strategies and many NZ goat farms now operate closed herds and employ strict control measures, such as separating mobs of positive and negative animals. The order of milking infected and uninfected mobs, vaccination, hoof trimming and use of drench equipment are required to be carefully monitored. Kids from positive does that are to be kept are removed from the doe straight after birth before any licking or drinking can occur (lay term 'snatching'). Routine testing of the herd and culling of positive animals to limit disease spread is fundamental

to eradication of disease from the herd. For a viral disease such as CAE, herd accreditation is the only means of providing a firm assurance that goats from a particular herd are not carriers of CAEV (Merrall & MacDiarmid 1987).

During the 1980s other countries had over 80 % prevalence of CAE in the dairy goat population (Merrall & MacDiarmid 1987; Nord et al. 1998); however, the application of national eradication schemes over the past couple of decades has reduced overall herd level prevalence. For example, Switzerland and Norway have both successfully reduced prevalence through CAE control schemes involving culling of any CAEV-positive animals and implementation of management techniques to minimise spread of the disease (Thomann et al. 2017; Anonymous, 2016).

Although voluntary accreditation schemes have been and are in place in NZ (Merrall & MacDiarmid 1987; Anonymous, 2015) a lot of further work is required to reduce prevalence of CAE. Given such successful outcomes in other countries, eradication schemes can be beneficial. An increased uptake in diagnostic testing for screening whole herds, in combination with careful management of CAEV-infected animals, may minimise spread and prevalence of this disease.

Screening for CAEV antibodies using routine herd-test milk samples

Serum CAE antibody ELISA is the most common test currently used for NZ dairy goat herds, with most farms testing their whole herd once per season, usually before mating. The majority of commercial ELISA kits available have only been validated for serum, although research has shown that milk samples can be effectively used with these kits with some modifications (Brinkhof et al. 2010; Plaza et al. 2009).

CAEV antibody testing using routinely collected herd-test milk samples would provide a convenient, non-invasive alternative to serum testing. Also a large portion of the current CAE testing cost consists of collection of blood samples, which would be eliminated by use of routine herd-test milk samples. Given the convenience of herd test milk CAE testing, screening of the herd could be performed more than once per season, allowing detection of additional animals that may have seroconverted since the initial test.

LIC Diagnostics is currently evaluating the accuracy of a CAEV antibody ELISA test (IDEXX Laboratories Inc., USA) for use with herd test milk samples. Four Waikato farms (approximately 3000 animals) with a known history of CAE in the herds were enrolled in the trial, with milk samples obtained via routine herd testing between August 2016 and April 2017. Results of the herd test milk CAE ELISA were compared with ELISA testing of serum samples collected as part of the farms normal CAE testing regime. Should the herd-test milk ELISA prove to have sufficient sensitivity and specificity, the test could be released for convenient screening of goat herds from late 2017.

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